NEC

NARASARAOPETA ENGINEERING COLLEGE

(AUTONOMOUS)

NAAC 'A' GRADE

NBA NATIONAL BOARD of ACCREDITATION

PROCEEDINGS

INTERNATIONAL CONFERENCE

EMERGING TRENDS IN MECHANICAL ENGINEERING AND INDUSTRIAL AUTOMATION

NEC-ICETMEIA-2K21

30th & 31st July, 2021

Editors-in-Chief

Dr. M.Sreenivasa Kumar
Principal & Professor, Dept. of Mechnical Engineering

Dr. D.Jagadish
Professor, Dept. of Mechnical Engineering

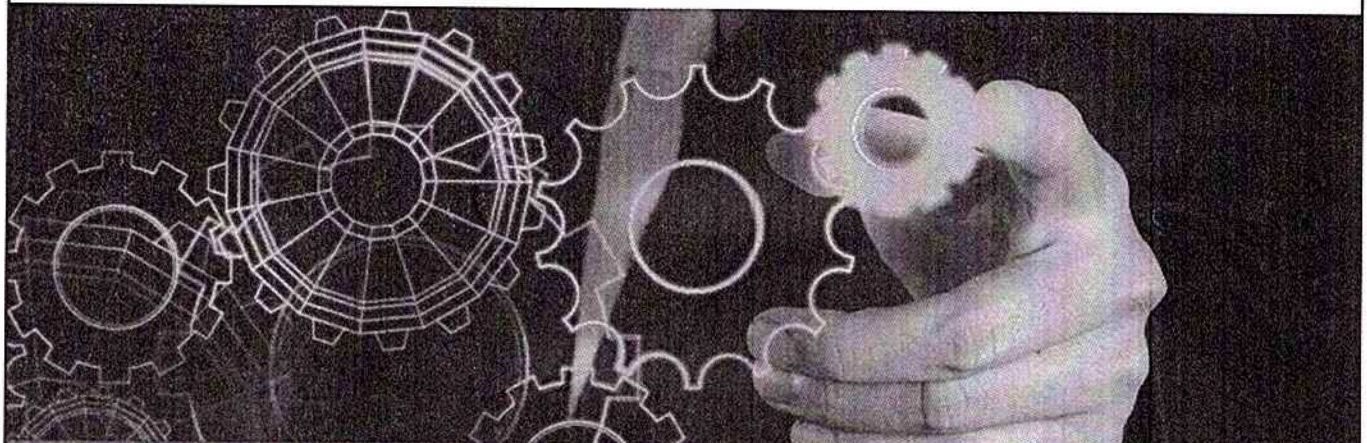
Editors

Dr. D.Suneel
Vice-Principal & Professor, Dept. of ME

Dr. P.Suresh Babu
Professor, Dept. of ME

Dr. B.Venkata Siva
Professor & HoD Dept. of ME

Mr. M.Venkanna Babu
Associate Professor, Dept. of ME



Organized by

Department of **Mechanical Engineering**

In Association with **The Institution of Engineers (India)**

ISBN : 978-93-91420-02-4

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

LIST OF FULL LENGTH PAPERS SELECTED FOR PROCEEDINGS

International Conference on Emerging Trends in Mechanical Engineering and Industrial Automation

NEC-ICETMEIA- 2K21

S.No.	TITLE OF THE PAPER	Page No.
1.	Effectiveness of Compression Ignition Engine Fuelled with Pond Water Algae Biodiesel	01
2.	Design And Analysis of Disc Brake of an Electric Go-Kart	04
3.	A Comprehensive Review on Recent Research on Semi Solid Processed Aluminum 7 Series Alloys	08
4.	A Study on Microstructure and Mechanical Properties A7075 Reinforced with Flyash/Sic Hybrid Metal Matrix Composite	15
5.	Establishment of SCR Test Facility and Evaluation of 8mm Pitch Honeycomb Type Catalyst in a 20 Liter capacity SCR Test facility	19
6.	A Review on NVH Issues and Technological Challenges in Electric Vehicle and Hybrid Electric Vehicle Power Train	25
7.	Design and Analysis of Cantilever Beam	29
8.	Analysis of Static and Fatigue Strength of Aluminium Alloy Wheel	32
9.	Design of Automated Braking System Based on Vehicle Over Speed Using PLC Ladder Method	35
10.	The Analysis on Concentric Pipe Heat Exchanger	39
11.	Design and Finite Element Analysis of Gas Turbine Blade	45
12.	Investigation on Mechanical Properties of Glass Fiber and Carbon Nano Tubes Sandwich Composite Material	47
13.	CFD Analysis of Super Utility Vehicle to Determine Aerodynamic Behavior	54
14.	Devlopment of Code for Automated HVAC System using Digital Controller	60
15.	Performance and Emission Characteristics Of Diesel Engine with Linseed Oil-Diesel Blends as Fuel With VCR	65
16.	Experimental Investigation in Single Cylinder VCR Multifuel Engine Using Bio-Diesel as Linseed Oil	69

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

IQAC

17.	Tribological Properties of Textured Surface	72
18.	Thermal Analysis and Experimental Investigation of Pin Fin made of Brass	76
19.	Experimental and Simulation of Wear Test on GPR material	79
20.	CFD Analysis of Two Pass Double Pipe Heat Exchanger with TiO_2/Ethylene Glycol Nano Fluid	83
21.	Simulation and Optimization of Extrusion Process Parameters of Aluminium 2A12T4Alloy	87
22.	Importance of Ice Jet machining - A Review	91
23.	Performance Investigation of a Battery Powered Peltier Cooler	94
24.	Analysis of Disc Brake Rotor using ANSYS Workbench	98
25.	Modelling and Optimization of Two Wheeler Disk Brake Using ANSYS -Review	101
26.	Fabrication of Sewage Waste Cleaner	105
27.	Manufacturing of Hyperboliodal Gear Model Using Ultimaker S5 3D Printing Machine	109
28.	Arc Welding Process Selection Through Quality and Cost Analysis	113
29.	Li-Br H2O VAR System Analysis by Applying Magnetic Field to Liquid Line	117
30.	Heat Transfer Enhancement on Shell and Coil Type of Heat Exchanger Using SiO_2 and CuO Nano-Fluids	121
31.	Study of Rheological Characteristics of Nano Suspensions	126
32.	Design And Fabrication of Loop Wheel System	129
33.	Performance of Solar Vapour Absorption system and its Dependence on Generator Temperature	131
34.	Design and Analysis Of Handicapped Steering Tricycle	134
35.	Machining Characteristics and Microbiological Growth of Stir Casted A356-SiC MMCs and Pure Metals	136
36.	Design and Analysis of Connecting Rod	141

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

37.	Pressure Vessel Optimum Design using Particle Swarm Optimization	145
38.	Design and Analysis of Wheel Rim on Radial Loads	149
39.	COP Enhancement of VCR System using Diffusers	154
40.	Design and Fabrication of Radiant Cooling System	157
41.	Comparative Performance Analysis of Engine Fuelled with Diesel Biodiesel Iron Oxide Nano Particles	162
42.	Performance analysis of a CI Engine fuelled with olive oil and soybean oil mixture as a biofuels	166
43.	Design and Analysis of Landing Gear	170
44.	A Review on Parameters of Composite Materials	173
45.	Optimisation in WEDM of HCHCR Steel using Taughi Method	177
46.	Automated Pneumatic Sheet Metal Cutting Machine	184
47.	Cylindrical Panel's Numerical And Analytical Investigations Subjected To Different Loads	187
48.	Application of a Thermoplastic Polyurethane/Polylactic Acid Composite Filament For 3D-Printed Personalized Orthosis	192
49.	Design and Analysis of a Connecting Rod	196
50.	A Study and Synthesis of 8 Bar One Degree of Freedom Walking Mechanism	200
51.	Mechanical properties and machining of Al-7075 SiC Composite	204
52.	Characterization of Tungsten carbide reinforced Al7075 matrix Composites.	208
53.	3D Printing of Prototype Through Image Processing using Autodesk Recap Photo Software	212
54.	Fabrication and Testing Mechanical Behaviour of Hemp Fibre, Chopped E Glass and Hybrid with Nano Particle	216
55.	Optical characterization of V_2O_5 doped Na_2O-SiO_2-ZrO_2 glasses	218
56.	Determination of Efficient Location of Split Air Conditioner using CFD	221

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

57.	Frictionless Electromagnetic Braking System	225
58.	Performance Evaluation of Vegetable oils as Cutting fluid under MQL Condition in Turning	228
59.	A novel hybrid Fuzzy AHP and VIKOR methodology for Reclaimer Selection in GSCM	236
60.	Design of Eco-Friendly Road Cleaner	240
61.	Mechanical and Microstructural Characterization of Jute Hybrid Composite with Alkali Treatment	244
62.	Experimental Investigation and Optimization of Process Parameters in Wire Cut EDM of EN31 Steel	248
63.	Design and Analysis of Differential Gear Box	252

***

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

Mech MSK-2024

 ISBN: 978-93-91420-02-4

3D Printing of Prototype through Image Processing Using Autodesk Recap Photo Software

Chandra Bose Boyapati, M. Sreenivasa Kumar and B.Venkata Siva
Department of Mechanical Engineering (Student), Narasaraopeta Engineering College, Guntur, Andhra Pradesh, India.

***Abstract*— Autodesk Recap Pro 3D scanning software to transform the physical world into a digital asset. With reality capture data you can better understand and verify existing and as-built conditions to gain insights and make better decisions. Recap Photo, a cloud-based service of Recap Pro, processes drone, camera photography to create digital representations of current conditions. These representations can be used to create 3D conception models based on real-world context. 3D printing, or additive manufacturing, is the construction of a three-dimensional object from a CAD model or a digital 3D model. The term "3D printing" can refer to a variety of processes in which material is deposited, joined and solidified under computer control to create a three-dimensional object, with material being added together (such as plastics, liquids or powder grains being fused together), typically layer by layer. The part file should be in. STL format.**

Keywords—component, formatting, style, styling, insert (key words)

I. Introduction

A. Autodesk Recap Photo

Autodesk Recap Photo processes photographs that are taken from drones, camera to create 3D representations of current conditions of sites, objects, and more. In this process we collect the photos with different angles of the same object and upload in the software and follow the steps regarding to the steps for creation of object.

B. Photography Tips

- The following tips will help you take quality photos for photogrammetry:
- If you can, take photos in a location where lighting is consistent and doesn't cast shadows.
- Try to keep your own shadow out of the picture.
- Make sure that there are no moving objects in the background when you take the photos.
- If the camera that you're using has a high dynamic range (HDR) setting, turn the feature off, and try not to adjust the exposure of your photographs while you capture images.
- Take pictures about one meter apart while you circle the object.
- If you can, maintain a perpendicular location relative to the object while you take photos.
- If the object is large, move in a lateral motion from one end of the object to the other. Change the height at each pass until you've captured all surfaces.

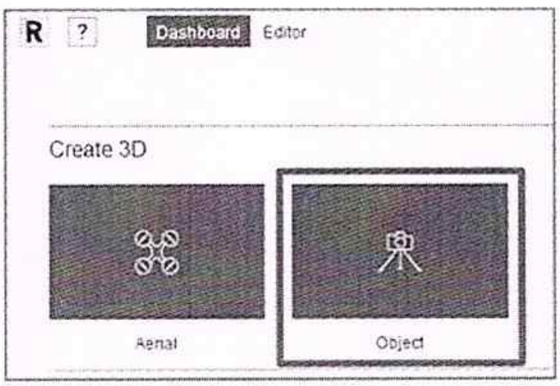
With the impact of digital technology development and the continuous expansion of its application direction, there are a lot of applications be employed in the heritage protection area. It has become a development direction. This article explores the potential of digital technology in heritage protection in the context of increasingly sophisticated digital methods. The primary goal is to design a digital restoration plan for the rooster-shaped statue of Notre Dame damaged in the fire [1]. This plan includes steps of data acquisition and processing, digital modelling and surface repairing, and digital demonstration. In this paper, a large number of successful cases from digital project cases and literature references in recent years were collected. Similarly there are selected potential cases and technical means to analyze their reference to the virtual restoration of the target sample (Rooster-shaped statue of Notre Dame Cathedral). Through the analysis and comparison of digital technology, the virtual restoration plan most suitable for the restoration of rooster-shaped statues is obtained. The plan is not fixed and has reference significance for the protection and restoration of other statues, buildings, and various cultural heritages [2]. It can provide sustainable and promising concrete methods for protecting cultural heritage. A research paper submitted to the University of Dublin, in partial fulfilment of the requirements for the degree of Master of Science Interactive Digital Media.

II. Experimental Work

A. Methodology: Image Processing Using Autodrsk Recap Photo

Open Autodesk Recap Photo. When you first open Autodesk Recap Photo, you'll see the dashboard. On the dashboard, you can select either Aerial or Object to create a new 3D project. This tutorial covers the Object workflow.

Under Create 3D, select Object.



Click anywhere on the page that appears, according to the prompt, and then add the photos that you want to use to create your 3D model. After you've finished importing the photos, select Create.

NEC NARASARAOPETA ENGINEERING COLLEGE (AUTONOMOUS)

NAAC 'A' GRADE

NBA NATIONAL BOARD OF ACCREDITATION

PROCEEDINGS

INTERNATIONAL CONFERENCE

EMERGING TRENDS IN MECHANICAL ENGINEERING AND INDUSTRIAL AUTOMATION

NEC-ICETMEIA-2K21

30th & 31st July, 2021

Editors-in-Chief

Dr. M.Sreenivasa Kumar
Principal & Professor, Dept. of Mechnical Engineering

Dr. D.Jagadish
Professor, Dept. of Mechnical Engineering

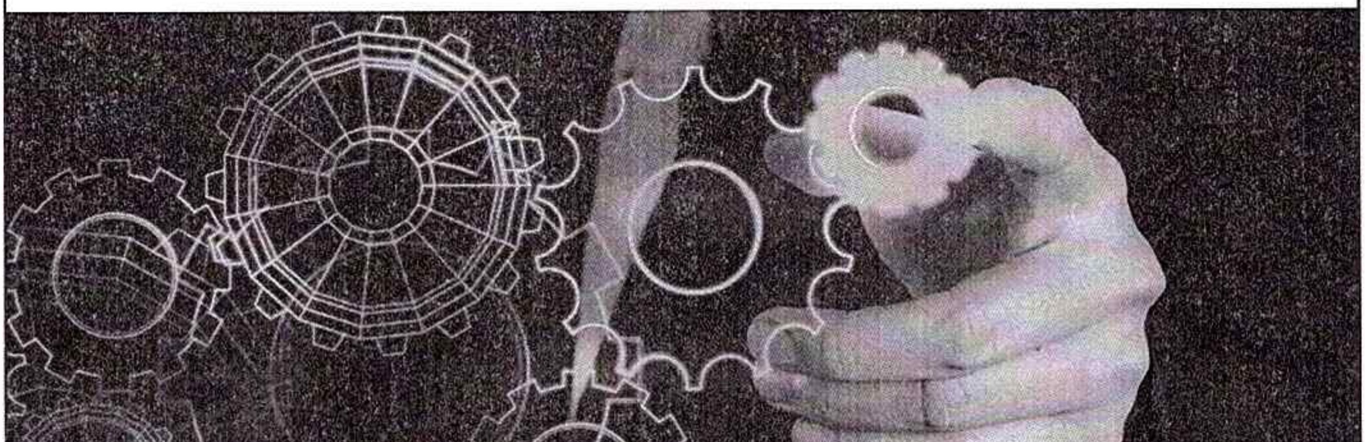
Editors

Dr. D.Suneel
Vice-Principal & Professor, Dept. of ME

Dr. B.Venkata Siva
Professor & HoD Dept. of ME

Dr. P.Suresh Babu
Professor, Dept. of ME

Mr. M.Venkanna Babu
Associate Professor, Dept. of ME



Organized by

Department of **Mechanical Engineering**

In Association with *The Institution of Engineers (India)*

ISBN : 978-93-91420-02-4

LIST OF FULL LENGTH PAPERS SELECTED FOR PROCEEDINGS

International Conference on Emerging Trends in Mechanical Engineering and Industrial Automation

NEC-ICETMEIA- 2K21

S.No.	TITLE OF THE PAPER	Page No.
1.	Effectiveness of Compression Ignition Engine Fuelled with Pond Water Algae Biodiesel	01
2.	Design And Analysis of Disc Brake of an Electric Go-Kart	04
3.	A Comprehensive Review on Recent Research on Semi Solid Processed Aluminum 7 Series Alloys	08
4.	A Study on Microstructure and Mechanical Properties A7075 Reinforced with Flyash/Sic Hybrid Metal Matrix Composite	15
5.	Establishment of SCR Test Facility and Evaluation of 8mm Pitch Honeycomb Type Catalyst in a 20 Liter capacity SCR Test facility	19
6.	A Review on NVH Issues and Technological Challenges in Electric Vehicle and Hybrid Electric Vehicle Power Train	25
7.	Design and Analysis of Cantilever Beam	29
8.	Analysis of Static and Fatigue Strength of Aluminium Alloy Wheel	32
9.	Design of Automated Braking System Based on Vehicle Over Speed Using PLC Ladder Method	35
10.	The Analysis on Concentric Pipe Heat Exchanger	39
11.	Design and Finite Element Analysis of Gas Turbine Blade	45
12.	Investigation on Mechanical Properties of Glass Fiber and Carbon Nano Tubes Sandwich Composite Material	47
13.	CFD Analysis of Super Utility Vehicle to Determine Aerodynamic Behavior	54
14.	Devlopment of Code for Automated HVAC System using Digital Controller	60
15.	Performance and Emission Characteristics Of Diesel Engine with Linseed Oil-Diesel Blends as Fuel With VCR	65
16.	Experimental Investigation in Single Cylinder VCR Multifuel Engine Using Bio-Diesel as Linseed Oil	69

17.	Tribological Properties of Textured Surface	72
18.	Thermal Analysis and Experimental Investigation of Pin Fin made of Brass	76
19.	Experimental and Simulation of Wear Test on GPR material	79
20.	CFD Analysis of Two Pass Double Pipe Heat Exchanger with TiO_2/Ethylene Glycol Nano Fluid	83
21.	Simulation and Optimization of Extrusion Process Parameters of Aluminium 2A12T4Alloy	87
22.	Importance of Ice Jet machining - A Review	91
23.	Performance Investigation of a Battery Powered Peltier Cooler	94
24.	Analysis of Disc Brake Rotor using ANSYS Workbench	98
25.	Modelling and Optimization of Two Wheeler Disk Brake Using ANSYS -Review	101
26.	Fabrication of Sewage Waste Cleaner	105
27.	Manufacturing of Hyperboliodal Gear Model Using Ultimaker S5 3D Printing Machine	109
28.	Arc Welding Process Selection Through Quality and Cost Analysis	113
29.	Li-Br H2O VAR System Analysis by Applying Magnetic Field to Liquid Line	117
30.	Heat Transfer Enhancement on Shell and Coil Type of Heat Exchanger Using SiO_2 and CuO Nano-Fluids	121
31.	Study of Rheological Characteristics of Nano Suspensions	126
32.	Design And Fabrication of Loop Wheel System	129
33.	Performance of Solar Vapour Absorption system and its Dependence on Generator Temperature	131
34.	Design and Analysis Of Handicapped Steering Tricycle	134
35.	Machining Characteristics and Microbiological Growth of Stir Casted A356-SiC MMCs and Pure Metals	136
36.	Design and Analysis of Connecting Rod	141

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

37.	Pressure Vessel Optimum Design using Particle Swarm Optimization	145
38.	Design and Analysis of Wheel Rim on Radial Loads	149
39.	COP Enhancement of VCR System using Diffusers	154
40.	Design and Fabrication of Radiant Cooling System	157
41.	Comparative Performance Analysis of Engine Fuelled with Diesel Biodiesel Iron Oxide Nano Particles	162
42.	Performance analysis of a CI Engine fuelled with olive oil and soybean oil mixture as a biofuels	166
43.	Design and Analysis of Landing Gear	170
44.	A Review on Parameters of Composite Materials	173
45.	Optimisation in WEDM of HCHCR Steel using Taughi Method	177
46.	Automated Pneumatic Sheet Metal Cutting Machine	184
47.	Cylindrical Panel's Numerical And Analytical Investigations Subjected To Different Loads	187
48.	Application of a Thermoplastic Polyurethane/Polylactic Acid Composite Filament For 3D-Printed Personalized Orthosis	192
49.	Design and Analysis of a Connecting Rod	196
50.	A Study and Synthesis of 8 Bar One Degree of Freedom Walking Mechanism	200
51.	Mechanical properties and machining of Al-7075 SiC Composite	204
52.	Characterization of Tungsten carbide reinforced Al7075 matrix Composites.	208
53.	3D Printing of Prototype Through Image Processing using Autodesk Recap Photo Software	212
54.	Fabrication and Testing Mechanical Behaviour of Hemp Fibre, Chopped E Glass and Hybrid with Nano Particle	216
55.	Optical characterization of V_2O_5 doped Na_2O-SiO_2-ZrO_2 glasses	218
56.	Determination of Efficient Location of Split Air Conditioner using CFD	221

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

57.	Frictionless Electromagnetic Braking System	225
58.	Performance Evaluation of Vegetable oils as Cutting fluid under MQL Condition in Turning	228
59.	A novel hybrid Fuzzy AHP and VIKOR methodology for Reclaimer Selection in GSCM	236
60.	Design of Eco-Friendly Road Cleaner	240
61.	Mechanical and Microstructural Characterization of Jute Hybrid Composite with Alkali Treatment	244
62.	Experimental Investigation and Optimization of Process Parameters in Wire Cut EDM of EN31 Steel	248
63.	Design and Analysis of Differential Gear Box	252

***

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

Ds 2021

ISBN: 978-93-91420-02-4

Machining Characteristics and Micro-biological Growth of Stir Casted A356-SiC MMCs and Pure Metals

Suneel Donthamsetty and Penugonda Suresh Babu
Department of Mechanical Engineering, Narasaraopeta Engineering College (Autonomous), Narasaraopet, India

Abstract-- Because of the good properties like light weight, durability, high strength, corrosion resistance etc. the need of Metal Matrix Composites (MMCs) are increasing day by day. In the present work A356 is taken as main base material due to due to proximity with reference to density. Meanwhile silicon carbide (SiC) and A356 are close in terms of density, SiC is chosen as reinforcement material. Machining by changing machining parameters with cutting fluids is done with and without cutting oil by using automatic feed lathe machine by varying the speed and depth of cuts to find out the cutting forces, cutting tool temperatures and surface roughness. It is found that these values are gradually increased in many cases. Microbiological check also done and found that the colony count is gradually increased from fresh oil usage to used cutting oil after machining. These tests also done on MMCs, pure brass and pure aluminium and compared the results with MMCs.

Keywords-- **A356; SiC; Machining; Composites; Bacterial Count**

I. INTRODUCTION

A metal matrix composite (MMC) is a composite in which two or more reinforced materials are added to the metal matrix in order to improve the properties of the composite. MMCs are made by scattering a reinforced material into a base material or matrix which is a monolithic material and is completely continuous [1].

The composites strength, stiffness and density is depends on its constituent materials properties, the reinforced material's size, shape, quantity & distribution and the bond between base and reinforced material. [2]. The composite materials are classified into Metal Matrix Composites of metals based, Ceramic Matrix Composites of ceramic materials based and Polymer Matrix Composites of plastic materials based [3].

Al-MMCs have much importance for aerospace, automobile, agriculture farm machinery industries etc., due to their good properties such as high strength, low density, good wear resistance compared to any other metal [4]. The cutting fluids reduces the cutting temperature by minimizing the friction between work piece and cutting tool. [5].

In the current work the silicon carbide is used as reinforcing material and Al 356 as base material synthesized by using stir casting machine.

2. MATERIALS

2.1 A356 Alloy

A356 alloy is used as a matrix for obtaining composites, which have an enhanced wear resistance, favourable mechanical properties at room temperature and enhanced mechanical properties at elevated temperatures. This is used in the field of application in the automotive and avionics industries [6] and selected as matrix material owing to good and readily castable [7, 8]. The chemical composition of Al 356 alloy is given in Table 1 [6].

Table 1. Chemical composition of Al 356 Alloy

Element	Si	Cu	Mg	Mn	Fe	Zn	Ni	Ti	Al
Wt. (%)	7.20	0.02	0.29	0.01	0.18	0.01	0.02	0.11	Balance

2.2 Fortifying material (Silicon carbide)

Recently lot of research is being done in to incorporate the silicon carbide on aluminum and its alloys to improve their mechanical and tribological properties. Silicon carbide particulates have proven to increase mechanical strength of aluminum and its alloys with increasing content and reduced particle size [9].

2.3 Cutting fluid

The advantages of cutting fluids includes cooling, lubrication, flushing away the chips, reduce the wear, extended tool life etc. The water based cutting oils are fully contaminated with the microorganisms, which deteriorate the cutting fluids properties, causes corrosion of work pieces, choking of fluid flow lines etc. And also chances of getting skin deceases and health issues to the workers who are exposed to these contaminated oil [10]. Emulsions can be prepared at water-to-oil ratios ranging from 5:1 to 100:1 [11]. In this work, taken this ratio as 20:1 and used for machining.

After machining, the used oils were taken and stored in sterilized bottles and tested to study the microbial contamination.

3. EQUIPMENT

3.1 Surface Roughness Tester

The Surf test SJ-210 Portable Surface Roughness Tester shown in Figure 1, is used for testing the surface roughness of the work pieces in microns (μm) after machining on the lathe machine.

NEC NARASARAOPETA ENGINEERING COLLEGE (AUTONOMOUS)

NAAC 'A' GRADE

NATIONAL BOARD of ACCREDITATION

PROCEEDINGS

INTERNATIONAL CONFERENCE

EMERGING TRENDS IN MECHANICAL ENGINEERING AND INDUSTRIAL AUTOMATION

NEC-ICETMEIA-2K21

30th & 31st July, 2021

Editors-in-Chief

Dr. M.Sreenivasa Kumar
Principal & Professor, Dept. of Mechnical Engineering

Dr. D.Jagadish
Professor, Dept. of Mechnical Engineering

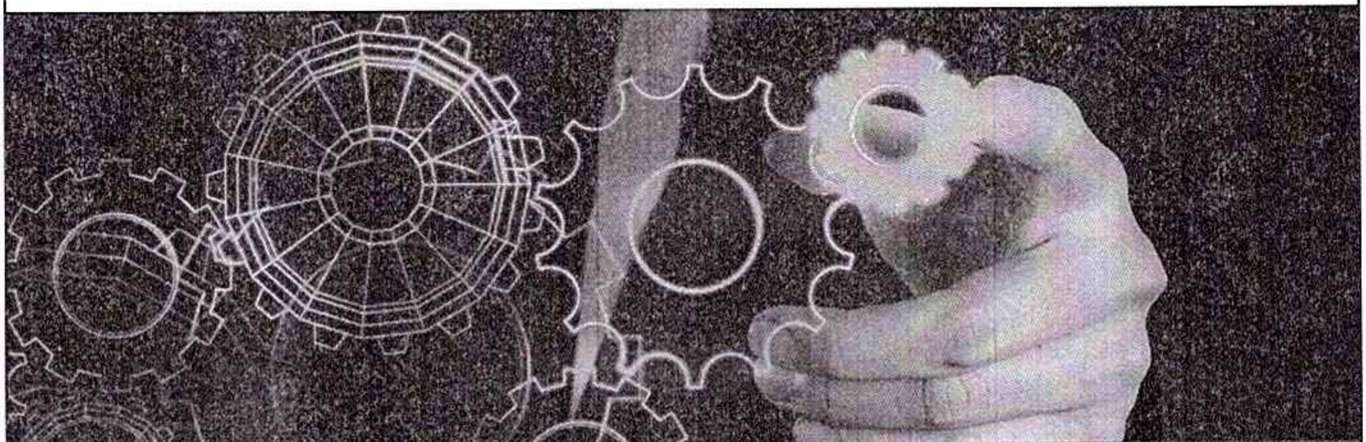
Editors

Dr. D.Suneel
Vice-Principal & Professor, Dept. of ME

Dr. P.Suresh Babu
Professor, Dept. of ME

Dr. B.Venkata Siva
Professor & HoD Dept. of ME

Mr. M.Venkanna Babu
Associate Professor, Dept. of ME



Organized by

Department of **Mechanical Engineering**

In Association with *The Institution of Engineers (India)*

ISBN : 978-93-91420-02-4

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

LIST OF FULL LENGTH PAPERS SELECTED FOR PROCEEDINGS

International Conference on Emerging Trends in Mechanical Engineering and Industrial Automation

NEC-ICETMEIA- 2K21

S.No.	TITLE OF THE PAPER	Page No.
1.	Effectiveness of Compression Ignition Engine Fuelled with Pond Water Algae Biodiesel	01
2.	Design And Analysis of Disc Brake of an Electric Go-Kart	04
3.	A Comprehensive Review on Recent Research on Semi Solid Processed Aluminum 7 Series Alloys	08
4.	A Study on Microstructure and Mechanical Properties A7075 Reinforced with Flyash/Sic Hybrid Metal Matrix Composite	15
5.	Establishment of SCR Test Facility and Evaluation of 8mm Pitch Honeycomb Type Catalyst in a 20 Liter capacity SCR Test facility	19
6.	A Review on NVH Issues and Technological Challenges in Electric Vehicle and Hybrid Electric Vehicle Power Train	25
7.	Design and Analysis of Cantilever Beam	29
8.	Analysis of Static and Fatigue Strength of Aluminium Alloy Wheel	32
9.	Design of Automated Braking System Based on Vehicle Over Speed Using PLC Ladder Method	35
10.	The Analysis on Concentric Pipe Heat Exchanger	39
11.	Design and Finite Element Analysis of Gas Turbine Blade	45
12.	Investigation on Mechanical Properties of Glass Fiber and Carbon Nano Tubes Sandwich Composite Material	47
13.	CFD Analysis of Super Utility Vehicle to Determine Aerodynamic Behavior	54
14.	Devlopment of Code for Automated HVAC System using Digital Controller	60
15.	Performance and Emission Characteristics Of Diesel Engine with Linseed Oil-Diesel Blends as Fuel With VCR	65
16.	Experimental Investigation in Single Cylinder VCR Multifuel Engine Using Bio-Diesel as Linseed Oil	69

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

17.	Tribological Properties of Textured Surface	72
18.	Thermal Analysis and Experimental Investigation of Pin Fin made of Brass	76
19.	Experimental and Simulation of Wear Test on GPR material	79
20.	CFD Analysis of Two Pass Double Pipe Heat Exchanger with TiO_2/Ethylene Glycol Nano Fluid	83
21.	Simulation and Optimization of Extrusion Process Parameters of Aluminium 2A12T4Alloy	87
22.	Importance of Ice Jet machining - A Review	91
23.	Performance Investigation of a Battery Powered Peltier Cooler	94
24.	Analysis of Disc Brake Rotor using ANSYS Workbench	98
25.	Modelling and Optimization of Two Wheeler Disk Brake Using ANSYS -Review	101
26.	Fabrication of Sewage Waste Cleaner	105
27.	Manufacturing of Hyperboliodal Gear Model Using Ultimaker S5 3D Printing Machine	109
28.	Arc Welding Process Selection Through Quality and Cost Analysis	113
29.	Li-Br H2O VAR System Analysis by Applying Magnetic Field to Liquid Line	117
30.	Heat Transfer Enhancement on Shell and Coil Type of Heat Exchanger Using SiO_2 and CuO Nano-Fluids	121
31.	Study of Rheological Characteristics of Nano Suspensions	126
32.	Design And Fabrication of Loop Wheel System	129
33.	Performance of Solar Vapour Absorption system and its Dependence on Generator Temperature	131
34.	Design and Analysis Of Handicapped Steering Tricycle	134
35.	Machining Characteristics and Microbiological Growth of Stir Casted A356-SiC MMCs and Pure Metals	136
36.	Design and Analysis of Connecting Rod	[illegible]

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

37.	Pressure Vessel Optimum Design using Particle Swarm Optimization	145
38.	Design and Analysis of Wheel Rim on Radial Loads	149
39.	COP Enhancement of VCR System using Diffusers	154
40.	Design and Fabrication of Radiant Cooling System	157
41.	Comparative Performance Analysis of Engine Fuelled with Diesel Biodiesel Iron Oxide Nano Particles	162
42.	Performance analysis of a CI Engine fuelled with olive oil and soybean oil mixture as a biofuels	166
43.	Design and Analysis of Landing Gear	170
44.	A Review on Parameters of Composite Materials	173
45.	Optimisation in WEDM of HCHCR Steel using Taughi Method	177
46.	Automated Pneumatic Sheet Metal Cutting Machine	184
47.	Cylindrical Panel's Numerical And Analytical Investigations Subjected To Different Loads	187
48.	Application of a Thermoplastic Polyurethane/Polylactic Acid Composite Filament For 3D-Printed Personalized Orthosis	192
49.	Design and Analysis of a Connecting Rod	196
50.	A Study and Synthesis of 8 Bar One Degree of Freedom Walking Mechanism	200
51.	Mechanical properties and machining of Al-7075 SiC Composite	204
52.	Characterization of Tungsten carbide reinforced Al7075 matrix Composites.	208
53.	3D Printing of Prototype Through Image Processing using Autodesk Recap Photo Software	212
54.	Fabrication and Testing Mechanical Behaviour of Hemp Fibre, Chopped E Glass and Hybrid with Nano Particle	216
55.	Optical characterization of V_2O_5 doped Na_2O-SiO_2-ZrO_2 glasses	218
56.	Determination of Efficient Location of Split Air Conditioner using CFD	

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

57.	Frictionless Electromagnetic Braking System	225
58.	Performance Evaluation of Vegetable oils as Cutting fluid under MQL Condition in Turning	228
59.	A novel hybrid Fuzzy AHP and VIKOR methodology for Reclaimer Selection in GSCM	236
60.	Design of Eco-Friendly Road Cleaner	240
61.	Mechanical and Microstructural Characterization of Jute Hybrid Composite with Alkali Treatment	244
62.	Experimental Investigation and Optimization of Process Parameters in Wire Cut EDM of EN31 Steel	248
63.	Design and Analysis of Differential Gear Box	252

***

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

PSB - 2021

ISBN: 978-93-91420-02-4

Machining Characteristics and Micro-biological Growth of Stir Casted A356-SiC MMCs and Pure Metals

Suneel Donthamsetty and Penugonda Suresh Babu

Department of Mechanical Engineering, Narasaraopeta Engineering College (Autonomous), Narasaraopet, India

Abstract-- Because of the good properties like light weight, durability, high strength, corrosion resistance etc. the need of Metal Matrix Composites (MMCs) are increasing day by day. In the present work A356 is taken as main base material due to due to proximity with reference to density. Meanwhile silicon carbide (SiC) and A356 are close in terms of density, SiC is chosen as reinforcement material. Machining by changing machining parameters with cutting fluids is done with and without cutting oil by using automatic feed lathe machine by varying the speed and depth of cuts to find out the cutting forces, cutting tool temperatures and surface roughness. It is found that these values are gradually increased in many cases. Microbiological check also done and found that the colony count is gradually increased from fresh oil usage to used cutting oil after machining. These tests also done on MMCs, pure brass and pure aluminium and compared the results with MMCs.

Keywords-- **A356; SiC; Machining; Composites; Bacterial Count**

1. INTRODUCTION

A metal matrix composite (MMC) is a composite in which two or more reinforced materials are added to the metal matrix in order to improve the properties of the composite. MMCs are made by scattering a reinforced material into a base material or matrix which is a monolithic material and is completely continuous [1].

The composites strength, stiffness and density is depends on its constituent materials properties, the reinforced material's size, shape, quantity & distribution and the bond between base and reinforced material. [2]. The composite materials are classified into Metal Matrix Composites of metals based, Ceramic Matrix Composites of ceramic materials based and Polymer Matrix Composites of plastic materials based [3].

Al-MMCs have much importance for aerospace, automobile, agriculture farm machinery industries etc., due to their good properties such as high strength, low density, good wear resistance compared to any other metal [4]. The cutting fluids reduces the cutting temperature by minimizing the friction between work piece and cutting tool, [5].

In the current work the silicon carbide is used as reinforcing material and Al 356 as base material synthesized by using stir casting machine.

2. MATERIALS

2.1 A356 Alloy

A356 alloy is used as a matrix for obtaining composites, which have an enhanced wear resistance, favourable mechanical properties at room temperature and enhanced mechanical properties at elevated temperatures. This is used in the field of application in the automotive and avionics industries [6] and selected as matrix material owing to good and readily castable [7, 8]. The chemical composition of Al 356 alloy is given in Table 1 [6].

Table 1. Chemical composition of Al 356 Alloy

Element	Si	Cu	Mg	Mn	Fe	Zn	Ni	Ti	Al
Wt. (%)	7.20	0.02	0.29	0.01	0.18	0.01	0.02	0.11	Balance

2.2 Fortifying material (Silicon carbide)

Recently lot of research is being done in to incorporate the silicon carbide on aluminum and its alloys to improve their mechanical and tribological properties. Silicon carbide particulates have proven to increase mechanical strength of aluminum and its alloys with increasing content and reduced particle size [9].

2.3 Cutting fluid

The advantages of cutting fluids includes cooling, lubrication, flushing away the chips, reduce the wear, extended tool life etc. The water based cutting oils are fully contaminated with the microorganisms, which deteriorate the cutting fluids properties, causes corrosion of work pieces, choking of fluid flow lines etc. And also chances of getting skin deceases and health issues to the workers who are exposed to these contaminated oil [10]. Emulsions can be prepared at water-to-oil ratios ranging from 5:1 to 100:1 [11]. In this work, taken this ratio as 20:1 and used for machining.

After machining, the used oils were taken and stored in sterilized bottles and tested to study the microbial contamination.

3. EQUIPMENT

3.1 Surface Roughness Tester

The Surf test SJ-210 Portable Surface Roughness Tester shown in Figure 1, is used for testing the surface roughness of the work pieces in microns (μm) after machining on the lathe machine.

NEC NARASARAOPETA ENGINEERING COLLEGE (AUTONOMOUS)

NAAC A GRADE

NATIONAL BOARD of ACCREDITATION

RANKED 5

PROCEEDINGS

INTERNATIONAL CONFERENCE

EMERGING TRENDS IN MECHANICAL ENGINEERING AND INDUSTRIAL AUTOMATION

NEC-ICETMEIA-2K21

30th & 31st July, 2021

Editors-in-Chief

Dr. M.Sreenivasa Kumar
Principal & Professor, Dept. of Mechnical Engineering

Dr. D.Jagadish
Professor, Dept. of Mechnical Engineering

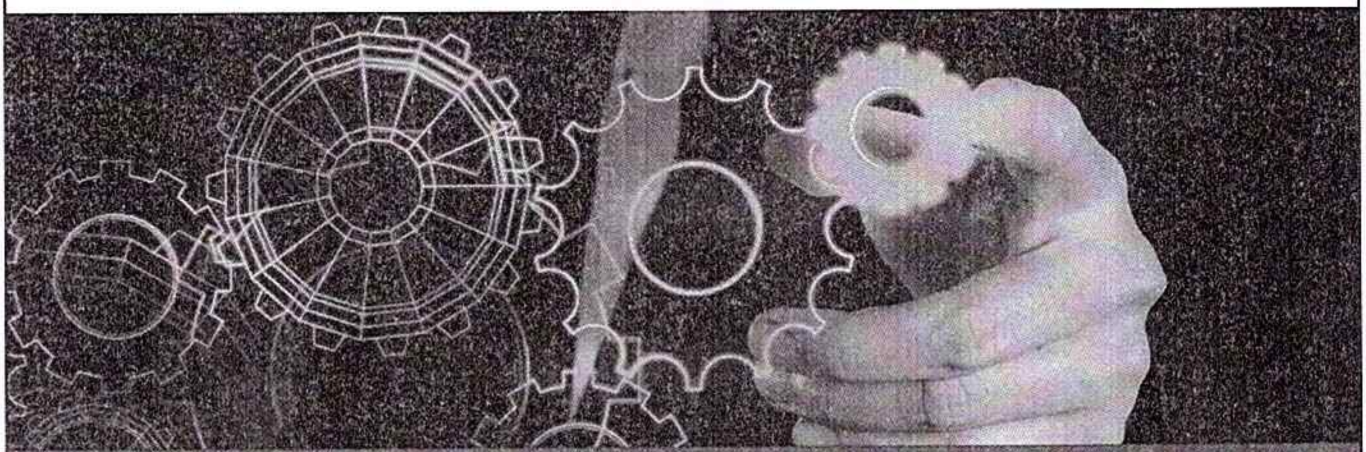
Editors

Dr. D.Suneel
Vice-Principal & Professor, Dept. of ME

Dr. B.Venkata Siva
Professor & HoD Dept. of ME

Dr. P.Suresh Babu
Professor, Dept. of ME

Mr. M.Venkanna Babu
Associate Professor, Dept. of ME



Organized by

Department of Mechanical Engineering

In Association with The Institution of Engineers (India)

ISBN : 978-93-91420-02-4

IQAC

NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

LIST OF FULL LENGTH PAPERS SELECTED FOR PROCEEDINGS

International Conference on Emerging Trends in Mechanical Engineering and Industrial Automation

NEC-ICETMEIA- 2K21

S.No.	TITLE OF THE PAPER	Page No.
1.	Effectiveness of Compression Ignition Engine Fuelled with Pond Water Algae Biodiesel	01
2.	Design And Analysis of Disc Brake of an Electric Go-Kart	04
3.	A Comprehensive Review on Recent Research on Semi Solid Processed Aluminum 7 Series Alloys	08
4.	A Study on Microstructure and Mechanical Properties A7075 Reinforced with Flyash/Sic Hybrid Metal Matrix Composite	15
5.	Establishment of SCR Test Facility and Evaluation of 8mm Pitch Honeycomb Type Catalyst in a 20 Liter capacity SCR Test facility	19
6.	A Review on NVH Issues and Technological Challenges in Electric Vehicle and Hybrid Electric Vehicle Power Train	25
7.	Design and Analysis of Cantilever Beam	29
8.	Analysis of Static and Fatigue Strength of Aluminium Alloy Wheel	32
9.	Design of Automated Braking System Based on Vehicle Over Speed Using PLC Ladder Method	35
10.	The Analysis on Concentric Pipe Heat Exchanger	39
11.	Design and Finite Element Analysis of Gas Turbine Blade	45
12.	Investigation on Mechanical Properties of Glass Fiber and Carbon Nano Tubes Sandwich Composite Material	47
13.	CFD Analysis of Super Utility Vehicle to Determine Aerodynamic Behavior	54
14.	Devlopment of Code for Automated HVAC System using Digital Controller	60
15.	Performance and Emission Characteristics Of Diesel Engine with Linseed Oil-Diesel Blends as Fuel With VCR	65
16.	Experimental Investigation in Single Cylinder VCR Multifuel Engine Using Bio-Diesel as Linseed Oil	69

17.	Tribological Properties of Textured Surface	72
18.	Thermal Analysis and Experimental Investigation of Pin Fin made of Brass	76
19.	Experimental and Simulation of Wear Test on GPR material	79
20.	CFD Analysis of Two Pass Double Pipe Heat Exchanger with TiO_2/Ethylene Glycol Nano Fluid	83
21.	Simulation and Optimization of Extrusion Process Parameters of Aluminium 2A12T4Alloy	87
22.	Importance of Ice Jet machining - A Review	91
23.	Performance Investigation of a Battery Powered Peltier Cooler	94
24.	Analysis of Disc Brake Rotor using ANSYS Workbench	98
25.	Modelling and Optimization of Two Wheeler Disk Brake Using ANSYS -Review	101
26.	Fabrication of Sewage Waste Cleaner	105
27.	Manufacturing of Hyperboliodal Gear Model Using Ultimaker S5 3D Printing Machine	109
28.	Arc Welding Process Selection Through Quality and Cost Analysis	113
29.	Li-Br H2O VAR System Analysis by Applying Magnetic Field to Liquid Line	117
30.	Heat Transfer Enhancement on Shell and Coil Type of Heat Exchanger Using SiO_2 and CuO Nano-Fluids	121
31.	Study of Rheological Characteristics of Nano Suspensions	126
32.	Design And Fabrication of Loop Wheel System	129
33.	Performance of Solar Vapour Absorption system and its Dependence on Generator Temperature	131
34.	Design and Analysis Of Handicapped Steering Tricycle	134
35.	Machining Characteristics and Microbiological Growth of Stir Casted A356-SiC MMCs and Pure Metals	136
36.	Design and Analysis of Connecting Rod	141

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

37.	Pressure Vessel Optimum Design using Particle Swarm Optimization	145
38.	Design and Analysis of Wheel Rim on Radial Loads	149
39.	COP Enhancement of VCR System using Diffusers	154
40.	Design and Fabrication of Radiant Cooling System	157
41.	Comparative Performance Analysis of Engine Fuelled with Diesel Biodiesel Iron Oxide Nano Particles	162
42.	Performance analysis of a CI Engine fuelled with olive oil and soybean oil mixture as a biofuels	166
43.	Design and Analysis of Landing Gear	170
44.	A Review on Parameters of Composite Materials	173
45.	Optimisation in WEDM of HCHCR Steel using Taughi Method	177
46.	Automated Pneumatic Sheet Metal Cutting Machine	184
47.	Cylindrical Panel's Numerical And Analytical Investigations Subjected To Different Loads	187
48.	Application of a Thermoplastic Polyurethane/Polylactic Acid Composite Filament For 3D-Printed Personalized Orthosis	192
49.	Design and Analysis of a Connecting Rod	196
50.	A Study and Synthesis of 8 Bar One Degree of Freedom Walking Mechanism	200
51.	Mechanical properties and machining of Al-7075 SiC Composite	204
52.	Characterization of Tungsten carbide reinforced Al7075 matrix Composites.	208
53.	3D Printing of Prototype Through Image Processing using Autodesk Recap Photo Software	212
54.	Fabrication and Testing Mechanical Behaviour of Hemp Fibre, Chopped E Glass and Hybrid with Nano Particle	216
55.	Optical characterization of V_2O_5 doped Na_2O-SiO_2-ZrO_2 glasses	218
56.	Determination of Efficient Location of Split Air Conditioner using CFD	221

57.	Frictionless Electromagnetic Braking System	225
58.	Performance Evaluation of Vegetable oils as Cutting fluid under MQL Condition in Turning	228
59.	A novel hybrid Fuzzy AHP and VIKOR methodology for Reclaimer Selection in GSCM	236
60.	Design of Eco-Friendly Road Cleaner	240
61.	Mechanical and Microstructural Characterization of Jute Hybrid Composite with Alkali Treatment	244
62.	Experimental Investigation and Optimization of Process Parameters in Wire Cut EDM of EN31 Steel	248
63.	Design and Analysis of Differential Gear Box	252

***

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

SBV 2021

ISBN: 978-93-91420-02-4

CFD Analysis of Super Utiliy Vehicle to Determine Aerodynamic Behaviour

Peruopgu Manoj Kumar and Dr. B. Venkata Siva
Department of Mechanical Engineering, Narasaraopeta Engineering College (A), Narasaraopet, India

***Abstract*— a steady increase in global energy demand has a direct influence on the fuel prices. This together with the environmental problems caused by the exhaust gases of cars is the main motives behind needs to reduce fuel consumption of roads vehicles. Reducing aerodynamic drag can lead to reduction in fuel consumption leading to less environment problems.**

Keywords—Aerodynamics, CFD analysis, Super Utility Vehicle.

I.INTRODUCTION

Aerodynamic, the study of the motion of air, partially it interaction with a solid object such as an airplane wing. Aerodynamic is a sub-field of fluid dynamic and gas dynamics, is often used synonymously with gas dynamics, the difference being that "gas dynamics" applies to study of the motion of all gases, and is not limited to air. The formal study of aerodynamic began in the modern sense in the eighteen century, although observations of fundamental concepts such as aerodynamic drag were recorded much earlier. Most of the early efforts in aerodynamic were directed towards achieving behavior-than-air flight, which was first demonstrated by Wilbur & Orville Wright in 1903. Since then, the use of aerodynamics through mathematical analysis, empirical approximations, wind tunnel experimentation, and computer simulation has formed a rational basis for the development of heavier-than-air flight & a number of other technologies. Recent work in aerodynamics has focused on issues related to compressible flow, turbulence, & boundary layers and has become increasingly computational in nature.

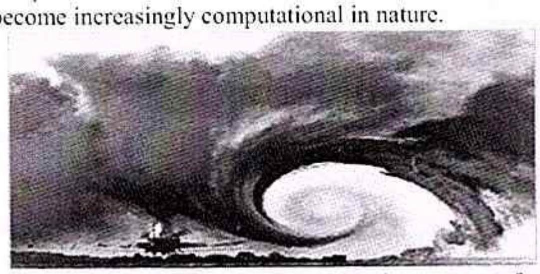


Fig1.A vortex is created by the passage of an aircraft wing, revealed by smoke. Vortices are one of the many phenomena associated with the study of aerodynamics

II.MODELING OF EXTERNAL BODY OF SUV

The external body models of SUV's Brezza & Eco sport are modelled. The model are modified by adding lip kits to the front bumper the analyses are carried out using a commercial CFD solver, ANSYS Fluent. The solver is based on finite volume method with second order discretization. The convergence criteria for continuity, momentum and other parameters were set to 10^{-3}, while the convergence of energy equation was set to 10^{-6}. In most

Cases, the momentum and other residuals were less than 10^{-5} and the highest residual was $7*10^{-4}$.

Fig2. Layout of Steam Power Plant

III.CFD ANALYSIS ON SUV MODELS

CFD analysis is performed on all the models of SUV and compared for the better model by observing results of pressure, velocity, lift and drag.

Turbulence models are known to replace the time-dependent Navier–Stokes equations by averaging them and simplifying the equations to reduce the complexities in calculation of the required quantities. Though these turbulence models are simplified and averaged, these models are able to predict the effects of turbulence accurately in many applications that are developed and implemented within commercial CFD software. The 'two-equation' models are most common and widely used models. These two equations represent two transport equations to solve for turbulent properties of the flow. Generally, one of the turbulent properties is the mean turbulent kinetic energy 'k' and the second property depends on the type of turbulence model. It is either dissipation rate 'e', for k-e turbulence model or the specific dissipation, 'x', which is a measure of the inverse time scale of the eddies, for k-x turbulence model.

3.1 .Boundary Conditions:

Analysis is performed by varying the speed of air
speed of air -80km/hr, 120kmlhr & 160km/hr
3.2 .Brezza original model
→→Ansys → workbench→ select analysis system → fluid flow fluent → double click
→→Select geometry → right click → import geometry → select browse →open part → ok→

Select Tools – Select Enclosure and enter dimensions

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist), A.P.

NEC NARASARAOPETA ENGINEERING COLLEGE (AUTONOMOUS)

NAAC NATIONAL ASSESSMENT AND ACCREDITATION COUNCIL 'A' GRADE

NBA NATIONAL BOARD of ACCREDITATION

PROCEEDINGS

INTERNATIONAL CONFERENCE

EMERGING TRENDS IN MECHANICAL ENGINEERING AND INDUSTRIAL AUTOMATION

NEC-ICETMEIA-2K21

30th & 31st July, 2021

Editors-in-Chief

Dr. M.Sreenivasa Kumar
Principal & Professor, Dept. of Mechnical Engineering

Dr. D.Jagadish
Professor, Dept. of Mechnical Engineering

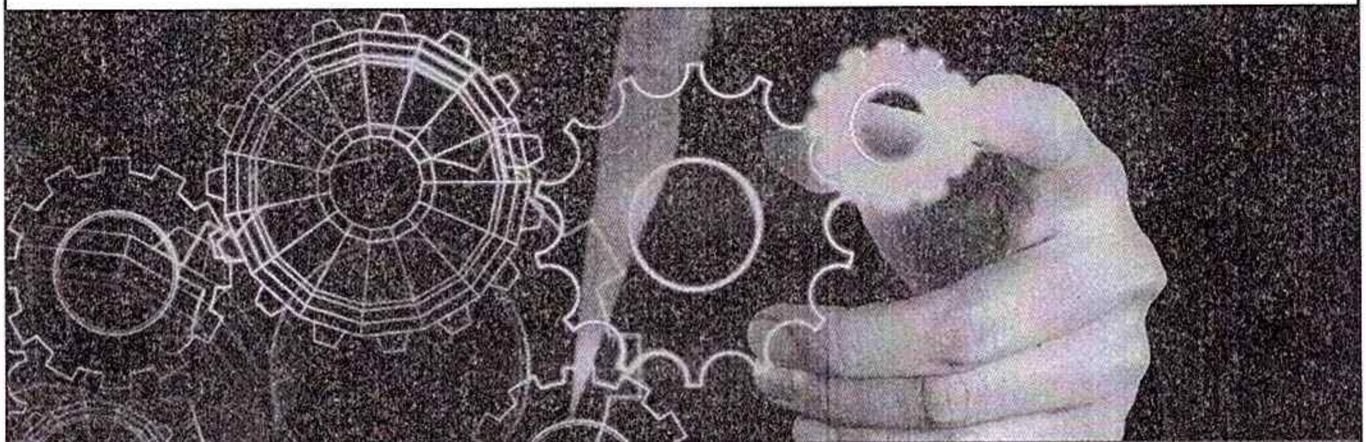
Editors

Dr. D.Suneel
Vice-Principal & Professor, Dept. of ME

Dr. P.Suresh Babu
Professor, Dept. of ME

Dr. B.Venkata Siva
Professor & HoD Dept. of ME

Mr. M.Venkanna Babu
Associate Professor, Dept. of ME



Organized by

Department of **Mechanical Engineering**

In Association with The Institution of Engineers (India)

ISBN: 978-93-91420-02-4

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE (AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

LIST OF FULL LENGTH PAPERS SELECTED FOR PROCEEDINGS

International Conference on Emerging Trends in Mechanical Engineering and Industrial Automation

NEC-ICETMEIA- 2K21

S.No.	TITLE OF THE PAPER	Page No.
1.	Effectiveness of Compression Ignition Engine Fuelled with Pond Water Algae Biodiesel	01
2.	Design And Analysis of Disc Brake of an Electric Go-Kart	04
3.	A Comprehensive Review on Recent Research on Semi Solid Processed Aluminum 7 Series Alloys	08
4.	A Study on Microstructure and Mechanical Properties A7075 Reinforced with Flyash/Sic Hybrid Metal Matrix Composite	15
5.	Establishment of SCR Test Facility and Evaluation of 8mm Pitch Honeycomb Type Catalyst in a 20 Liter capacity SCR Test facility	19
6.	A Review on NVH Issues and Technological Challenges in Electric Vehicle and Hybrid Electric Vehicle Power Train	25
7.	Design and Analysis of Cantilever Beam	29
8.	Analysis of Static and Fatigue Strength of Aluminium Alloy Wheel	32
9.	Design of Automated Braking System Based on Vehicle Over Speed Using PLC Ladder Method	35
10.	The Analysis on Concentric Pipe Heat Exchanger	39
11.	Design and Finite Element Analysis of Gas Turbine Blade	45
12.	Investigation on Mechanical Properties of Glass Fiber and Carbon Nano Tubes Sandwich Composite Material	47
13.	CFD Analysis of Super Utility Vehicle to Determine Aerodynamic Behavior	54
14.	Devlopment of Code for Automated HVAC System using Digital Controller	60
15.	Performance and Emission Characteristics Of Diesel Engine with Linseed Oil-Diesel Blends as Fuel With VCR	65
16.	Experimental Investigation in Single Cylinder VCR Multifuel Engine Using Bio-Diesel as Linseed Oil	69

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

17.	Tribological Properties of Textured Surface	72
18.	Thermal Analysis and Experimental Investigation of Pin Fin made of Brass	76
19.	Experimental and Simulation of Wear Test on GPR material	79
20.	CFD Analysis of Two Pass Double Pipe Heat Exchanger with TiO_2/Ethylene Glycol Nano Fluid	83
21.	Simulation and Optimization of Extrusion Process Parameters of Aluminium 2A12T4Alloy	87
22.	Importance of Ice Jet machining - A Review	91
23.	Performance Investigation of a Battery Powered Peltier Cooler	94
24.	Analysis of Disc Brake Rotor using ANSYS Workbench	98
25.	Modelling and Optimization of Two Wheeler Disk Brake Using ANSYS -Review	101
26.	Fabrication of Sewage Waste Cleaner	105
27.	Manufacturing of Hyperboliodal Gear Model Using Ultimaker S5 3D Printing Machine	109
28.	Arc Welding Process Selection Through Quality and Cost Analysis	113
29.	Li-Br H2O VAR System Analysis by Applying Magnetic Field to Liquid Line	117
30.	Heat Transfer Enhancement on Shell and Coil Type of Heat Exchanger Using SiO_2 and CuO Nano-Fluids	121
31.	Study of Rheological Characteristics of Nano Suspensions	126
32.	Design And Fabrication of Loop Wheel System	129
33.	Performance of Solar Vapour Absorption system and its Dependence on Generator Temperature	131
34.	Design and Analysis Of Handicapped Steering Tricycle	134
35.	Machining Characteristics and Microbiological Growth of Stir Casted A356-SiC MMCs and Pure Metals	136
36.	Design and Analysis of Connecting Rod	141

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

37.	Pressure Vessel Optimum Design using Particle Swarm Optimization	145
38.	Design and Analysis of Wheel Rim on Radial Loads	149
39.	COP Enhancement of VCR System using Diffusers	154
40.	Design and Fabrication of Radiant Cooling System	157
41.	Comparative Performance Analysis of Engine Fuelled with Diesel Biodiesel Iron Oxide Nano Particles	162
42.	Performance analysis of a CI Engine fuelled with olive oil and soybean oil mixture as a biofuels	166
43.	Design and Analysis of Landing Gear	170
44.	A Review on Parameters of Composite Materials	173
45.	Optimisation in WEDM of HCHCR Steel using Taughi Method	177
46.	Automated Pneumatic Sheet Metal Cutting Machine	184
47.	Cylindrical Panel's Numerical And Analytical Investigations Subjected To Different Loads	187
48.	Application of a Thermoplastic Polyurethane/Polylactic Acid Composite Filament For 3D-Printed Personalized Orthosis	192
49.	Design and Analysis of a Connecting Rod	196
50.	A Study and Synthesis of 8 Bar One Degree of Freedom Walking Mechanism	200
51.	Mechanical properties and machining of Al-7075 SiC Composite	204
52.	Characterization of Tungsten carbide reinforced Al7075 matrix Composites.	208
53.	3D Printing of Prototype Through Image Processing using Autodesk Recap Photo Software	212
54.	Fabrication and Testing Mechanical Behaviour of Hemp Fibre, Chopped E Glass and Hybrid with Nano Particle	216
55.	Optical characterization of V_2O_5 doped Na_2O-SiO_2-ZrO_2 glasses	218
56.	Determination of Efficient Location of Split Air Conditioner using CFD	221

57.	Frictionless Electromagnetic Braking System	225
58.	Performance Evaluation of Vegetable oils as Cutting fluid under MQL Condition in Turning	228
59.	A novel hybrid Fuzzy AHP and VIKOR methodology for Reclaimer Selection in GSCM	236
60.	Design of Eco-Friendly Road Cleaner	240
61.	Mechanical and Microstructural Characterization of Jute Hybrid Composite with Alkali Treatment	244
62.	Experimental Investigation and Optimization of Process Parameters in Wire Cut EDM of EN31 Steel	248
63.	Design and Analysis of Differential Gear Box	252

***

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

SBV 2021

ISBN: 978-93-91420-02-4

A Study and Synthesis of 8 Bar one Degree of Freedom Walking Mechanism

D. Samson and B.Venkata Siva
Department of Mechanical Engineering, Narasaraopeta Engineering College (A), Narasaraopet, India.

***Abstract*—With the advent of robotics the researchers are thriving to achieve animal like walking creatures for obvious advantages but all the walking like robots have their own disadvantages, use of multiple actuators and coordination between these actuators among these research. Theo Jansen [6] proposed a mechanism which has single degree of freedom varying a single actuator can produce walking like mechanisms without the use of complex coding required in above said mechanisms.**

Present study is to analyze the Theo Jansen walking mechanism and study its advantages and disadvantages and second part of thesis a new mechanism is synthesis using random sampling and basic mechanisms, which would be more stable and efficient over the existing mechanisms.

Keywords*— *Walking Robot, Mechanisms, Kinematic analysis, SolidWorks.

I. Introduction

Many animals in nature have adopted legs for various environmental conditions. Centipedes, spiders, cockroaches, cats, camels, kangaroos, and human are among those, either with different number of legs or with different kind of walking. It is understandable that people turned their attention to those walking animals, after it was recognized that the human invented wheeled and tracked systems did not satisfy all the needs. In this sense, legged systems have a peculiarity of imitating the nature.

It introduces more flexibility and terrain adaptability at the cost of low speed and increased control complexity. In order to develop dynamic model and control algorithm of legged robots, it is important to have good models describing the kinematic behavior of the complex multi-legged robotic mechanism as walking machines are increasingly gaining importance in space for planetary exploration, where the terrain is rugged thus reducing the expensive and dangerous extra vehicular Activities by Astronauts. Walking machines find wide range of applications like in military logistic support where there are no highways.

Legged locomotion is a proper solution for movements on loose-rough-uneven terrains. This advantage of legged locomotion is mostly due to the fact that legged systems use isolated footholds. Wheeled and tracked systems follow the surface in a continuous manner; therefore their performance is limited by the worst parts on the terrain. A legged system, on the other hand, can choose the best places for foot placement. These footholds are isolated from the remaining parts; hence the performance of the legged system is limited by the best footholds. Besides using isolated footholds, the legged system can provide active suspension, which does not exist in wheeled or tracked systems. This means that the system can have control on the force distribution through the foothold points. In this way an efficient utilization of the footholds provides further improvement of the vehicle-ground interaction. A legged system is well adaptive to uneven terrains, namely the legs can be arranged (lengthened and shortened according to the level changes, and they can jump over obstacles or holes. Therefore, the body can be moved in a desired orientation.

The sensible control of swimming [Tan et al.2011], muscle-driven biped recreation [Geijtenbeek et al.2013], step revelation for quadrupeds [Lee et al.2013], or learning bike stunts [Tan et al. 2014].Translating virtual walk recreations into this present reality is non-insignificant. For people and creatures, many muscles need to act as one by means of a focal sensory system for steady and productive walks. In a robot, the arrangement of actuators as muscles requires numerous sensors and a mind boggling controller. In this setting it is hard to manufacture as, regardless of whether one could discover physical actuators and joints for every single virtual engine, the subsequent cost would surpass what is satisfactory for most applications, and particularly for the basic automata that we consider: for toy and instructive utilize, they have one engine for each appendage, no sensors, and no abnormal state controller; yet, they can walk effectively once created.

Strolling Motions Control in Animation and Robotics An assortment of cutting edge control techniques have been proposed for human physically-mimicked people [Geijtenbeek et al.2013; Lee et al 2010] and creatures [Wampler and Popovic 2009; Coros et al 2011].Such strategies have been connected to modern legged robots to produce controllers [Gehring et al 2013], or to build the dexterity of headway controllers [Gehring et al 2014]. Nonetheless, complex control techniques require muddled mechanics, sensors, and actuators, and the StarlETH robot is well past the intricacy and cost of our objective of automata as toys, in their plans are essentially more straightforward in nature, yet are as yet ready to perform strolling movements. As such, the work is substantially nearer to late work in computational outline than to the general field of mechanical technology.

Computational Design and Fabrication This field lessens the trouble of plan and assembling issues by making devices which forego or decrease the requirement for master space information. For example, late works display specially formed articles that can fly [Umetani et al 2014], remain without anyone else [Prevost et al.2013],or turn steadily [Bacher et al.2014]. A few techniques intend to convey virtual characters to this present reality, and it is currently conceivable to make 3D printable portrayals of virtual characters with joints [Bacher et al 2012; Calı et al.2012], to plan mechanical toys fit for intriguing (non-strolling) movements [Coros et al.2013; Ceylan et al.2013; Thomaszewski et al.2014], or to produce physical characters utilizing flexible materials with the end goal that their twisting affected by outer powers can be controlled.

Coros et al. [2013] take note of that regardless of whether the movement of a mechanical character at first look takes after strolling, this does not imply that the robot would really walk if manufactured. In beginning tests, they were not ready to make any automata along these lines that were fit for strolling steadily, unless we utilized an expansive number of legs (i.e., hexapod). This features the requirement for mechanized techniques. As far as anyone is concerned, work is first to

NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)

NEC

NAAC 'A' GRADE

NATIONAL BOARD OF ACCREDITATION

PROCEEDINGS

INTERNATIONAL CONFERENCE

EMERGING TRENDS IN MECHANICAL ENGINEERING AND INDUSTRIAL AUTOMATION

NEC-ICETMEIA-2K21

30th & 31st July, 2021

Editors-in-Chief

Dr. M.Sreenivasa Kumar
Principal & Professor, Dept. of Mechnical Engineering

Dr. D.Jagadish
Professor, Dept. of Mechnical Engineering

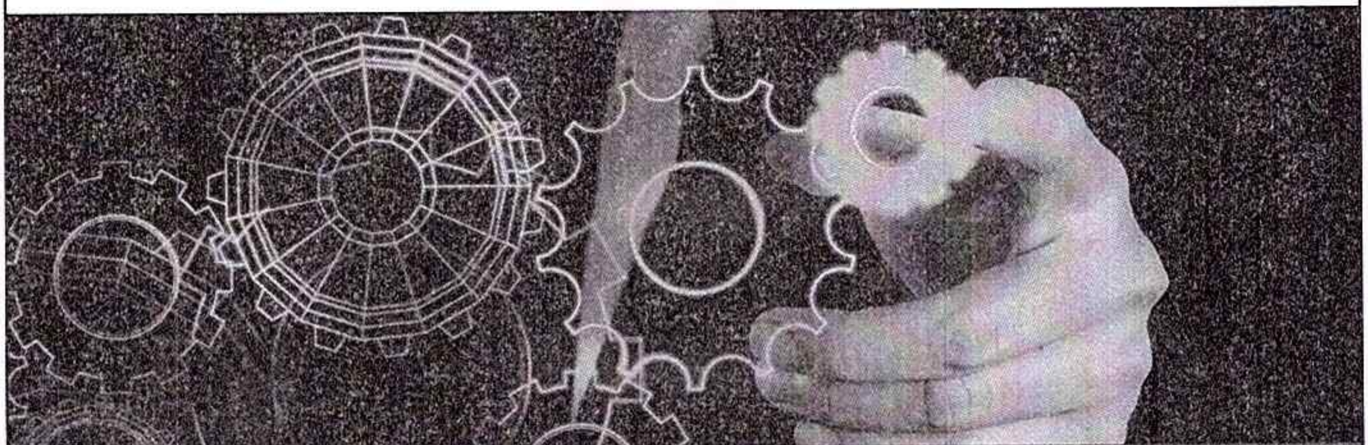
Editors

Dr. D.Suneel
Vice-Principal & Professor, Dept. of ME

Dr. P.Suresh Babu
Professor, Dept. of ME

Dr. B.Venkata Siva
Professor & HoD Dept. of ME

Mr. M.Venkanna Babu
Associate Professor, Dept. of ME



Organized by

Department of **Mechanical Engineering**

In Association with *The Institution of Engineers (India)*

ISBN : 978-93-91420-02-4

LIST OF FULL LENGTH PAPERS SELECTED FOR PROCEEDINGS

International Conference on Emerging Trends in Mechanical Engineering and Industrial Automation

NEC-ICETMEIA- 2K21

S.No.	TITLE OF THE PAPER	Page No.
1.	Effectiveness of Compression Ignition Engine Fuelled with Pond Water Algae Biodiesel	01
2.	Design And Analysis of Disc Brake of an Electric Go-Kart	04
3.	A Comprehensive Review on Recent Research on Semi Solid Processed Aluminum 7 Series Alloys	08
4.	A Study on Microstructure and Mechanical Properties A7075 Reinforced with Flyash/Sic Hybrid Metal Matrix Composite	15
5.	Establishment of SCR Test Facility and Evaluation of 8mm Pitch Honeycomb Type Catalyst in a 20 Liter capacity SCR Test facility	19
6.	A Review on NVH Issues and Technological Challenges in Electric Vehicle and Hybrid Electric Vehicle Power Train	25
7.	Design and Analysis of Cantilever Beam	29
8.	Analysis of Static and Fatigue Strength of Aluminium Alloy Wheel	32
9.	Design of Automated Braking System Based on Vehicle Over Speed Using PLC Ladder Method	35
10.	The Analysis on Concentric Pipe Heat Exchanger	39
11.	Design and Finite Element Analysis of Gas Turbine Blade	45
12.	Investigation on Mechanical Properties of Glass Fiber and Carbon Nano Tubes Sandwich Composite Material	47
13.	CFD Analysis of Super Utility Vehicle to Determine Aerodynamic Behavior	54
14.	Devlopment of Code for Automated HVAC System using Digital Controller	60
15.	Performance and Emission Characteristics Of Diesel Engine with Linseed Oil-Diesel Blends as Fuel With VCR	65
16.	Experimental Investigation in Single Cylinder VCR Multifuel Engine Using Bio-Diesel as Linseed Oil	69

17.	Tribological Properties of Textured Surface	72
18.	Thermal Analysis and Experimental Investigation of Pin Fin made of Brass	76
19.	Experimental and Simulation of Wear Test on GPR material	79
20.	CFD Analysis of Two Pass Double Pipe Heat Exchanger with TiO_2/Ethylene Glycol Nano Fluid	83
21.	Simulation and Optimization of Extrusion Process Parameters of Aluminium 2A12T4Alloy	87
22.	Importance of Ice Jet machining - A Review	91
23.	Performance Investigation of a Battery Powered Peltier Cooler	94
24.	Analysis of Disc Brake Rotor using ANSYS Workbench	98
25.	Modelling and Optimization of Two Wheeler Disk Brake Using ANSYS -Review	101
26.	Fabrication of Sewage Waste Cleaner	105
27.	Manufacturing of Hyperboliodal Gear Model Using Ultimaker S5 3D Printing Machine	109
28.	Arc Welding Process Selection Through Quality and Cost Analysis	113
29.	Li-Br H2O VAR System Analysis by Applying Magnetic Field to Liquid Line	117
30.	Heat Transfer Enhancement on Shell and Coil Type of Heat Exchanger Using SiO_2 and CuO Nano-Fluids	121
31.	Study of Rheological Characteristics of Nano Suspensions	126
32.	Design And Fabrication of Loop Wheel System	129
33.	Performance of Solar Vapour Absorption system and its Dependence on Generator Temperature	131
34.	Design and Analysis Of Handicapped Steering Tricycle	134
35.	Machining Characteristics and Microbiological Growth of Stir Casted A356-SiC MMCs and Pure Metals	136
36.	Design and Analysis of Connecting Rod	141

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

37.	Pressure Vessel Optimum Design using Particle Swarm Optimization	145
38.	Design and Analysis of Wheel Rim on Radial Loads	149
39.	COP Enhancement of VCR System using Diffusers	154
40.	Design and Fabrication of Radiant Cooling System	157
41.	Comparative Performance Analysis of Engine Fuelled with Diesel Biodiesel Iron Oxide Nano Particles	162
42.	Performance analysis of a CI Engine fuelled with olive oil and soybean oil mixture as a biofuels	166
43.	Design and Analysis of Landing Gear	170
44.	A Review on Parameters of Composite Materials	173
45.	Optimisation in WEDM of HCHCR Steel using Taughi Method	177
46.	Automated Pneumatic Sheet Metal Cutting Machine	184
47.	Cylindrical Panel's Numerical And Analytical Investigations Subjected To Different Loads	187
48.	Application of a Thermoplastic Polyurethane/Polylactic Acid Composite Filament For 3D-Printed Personalized Orthosis	192
49.	Design and Analysis of a Connecting Rod	196
50.	A Study and Synthesis of 8 Bar One Degree of Freedom Walking Mechanism	200
51.	Mechanical properties and machining of Al-7075 SiC Composite	204
52.	Characterization of Tungsten carbide reinforced Al7075 matrix Composites.	208
53.	3D Printing of Prototype Through Image Processing using Autodesk Recap Photo Software	212
54.	Fabrication and Testing Mechanical Behaviour of Hemp Fibre, Chopped E Glass and Hybrid with Nano Particle	216
55.	Optical characterization of V_2O_5 doped Na_2O-SiO_2-ZrO_2 glasses	218
56.	Determination of Efficient Location of Split Air Conditioner using CFD	221

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

57.	Frictionless Electromagnetic Braking System	225
58.	Performance Evaluation of Vegetable oils as Cutting fluid under MQL Condition in Turning	228
59.	A novel hybrid Fuzzy AHP and VIKOR methodology for Reclaimer Selection in GSCM	236
60.	Design of Eco-Friendly Road Cleaner	240
61.	Mechanical and Microstructural Characterization of Jute Hybrid Composite with Alkali Treatment	244
62.	Experimental Investigation and Optimization of Process Parameters in Wire Cut EDM of EN31 Steel	248
63.	Design and Analysis of Differential Gear Box	252

***

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET
Guntur (Dist.), A.P.

SB V - 2021

ISBN: 978-93-91420-02-4

3D Printing of Prototype through Image Processing Using Autodesk Recap Photo Software

Chandra Bose Boyapati, M. Sreenivasa Kumar and B.Venkata Siva
Department of Mechanical Engineering (Student), Narasaraopeta Engineering College, Guntur, Andhra Pradesh, India.

***Abstract*— Autodesk Recap Pro 3D scanning software to transform the physical world into a digital asset. With reality capture data you can better understand and verify existing and as-built conditions to gain insights and make better decisions. Recap Photo, a cloud-based service of Recap Pro, processes drone, camera photography to create digital representations of current conditions. These representations can be used to create 3D conception models based on real-world context. 3D printing, or additive manufacturing, is the construction of a three-dimensional object from a CAD model or a digital 3D model. The term "3D printing" can refer to a variety of processes in which material is deposited, joined and solidified under computer control to create a three-dimensional object, with material being added together (such as plastics, liquids or powder grains being fused together), typically layer by layer. The part file should be in. STL format.**

Keywords—component, formatting, style, styling, insert (key words)

I. INTRODUCTION

A. Autodesk Recap Photo

Autodesk Recap Photo processes photographs that are taken from drones, camera to create 3D representations of current conditions of sites, objects, and more. In this process we collect the photos with different angles of the same object and upload in the software and follow the steps regarding to the steps for creation of object.

B. Photography Tips

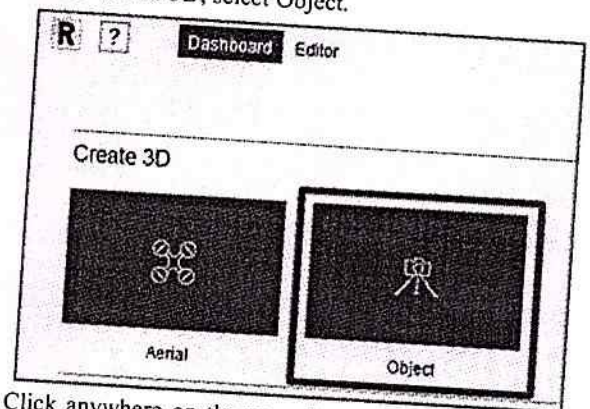
- The following tips will help you take quality photos for photogrammetry:
- If you can, take photos in a location where lighting is consistent and doesn't cast shadows.
- Try to keep your own shadow out of the picture.
- Make sure that there are no moving objects in the background when you take the photos.
- If the camera that you're using has a high dynamic range (HDR) setting, turn the feature off, and try not to adjust the exposure of your photographs while you capture images.
- Take pictures about one meter apart while you circle the object.
- If you can, maintain a perpendicular location relative to the object while you take photos.
- If the object is large, move in a lateral motion from one end of the object to the other. Change the height at each pass until you've captured all surfaces.

With the impact of digital technology development and the continuous expansion of its application direction, there are a lot of applications be employed in the heritage protection area. It has become a development direction. This article explores the potential of digital technology in heritage protection in the context of increasingly sophisticated digital methods. The primary goal is to design a digital restoration plan for the rooster-shaped statue of Notre Dame damaged in the fire [1]. This plan includes steps of data acquisition and processing, digital modelling and surface repairing, and digital demonstration. In this paper, a large number of successful cases from digital project cases and literature references in recent years were collected. Similarly there are selected potential cases and technical means to analyze their reference to the virtual restoration of the target sample (Rooster-shaped statue of Notre Dame Cathedral). Through the analysis and comparison of digital technology, the virtual restoration plan most suitable for the restoration of rooster-shaped statues is obtained. The plan is not fixed and has reference significance for the protection and restoration of other statues, buildings, and various cultural heritages [2]. It can provide sustainable and promising concrete methods for protecting cultural heritage. A research paper submitted to the University of Dublin, in partial fulfilment of the requirements for the degree of Master of Science Interactive Digital Media.

II. EXPERIMENTAL WORK

A. Methodology: Image Processing Using Autodrsk Recap Photo

Open Autodesk Recap Photo. When you first open Autodesk Recap Photo, you'll see the dashboard. On the dashboard, you can select either Aerial or Object to create a new 3D project. This tutorial covers the Object workflow.
Under Create 3D, select Object.



Click anywhere on the page that appears, according to the prompt, and then add the photos that you want to use to create your 3D model. After you've finished importing the photos, select Create.

NEC NARASARAOPETA ENGINEERING COLLEGE (AUTONOMOUS)

NAAC 'A' GRADE

NBA NATIONAL BOARD of ACCREDITATION

RANKED 5

PROCEEDINGS

INTERNATIONAL CONFERENCE

EMERGING TRENDS IN MECHANICAL ENGINEERING AND INDUSTRIAL AUTOMATION

NEC-ICETMEIA-2K21

30th & 31st July, 2021

Editors-in-Chief

Dr. M.Sreenivasa Kumar
Principal & Professor, Dept. of Mechnical Engineering

Dr. D.Jagadish
Professor, Dept. of Mechnical Engineering

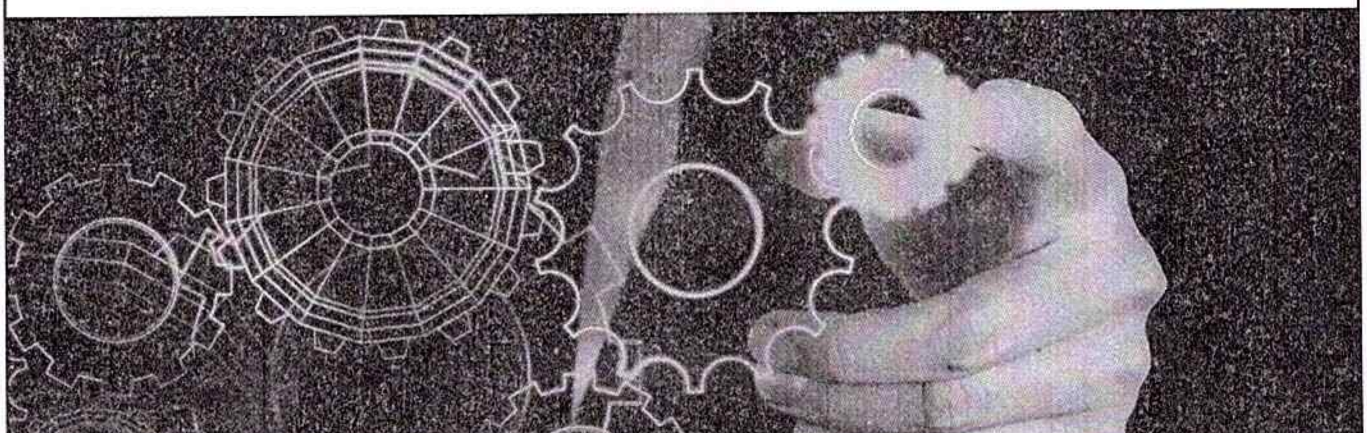
Editors

Dr. D.Suneel
Vice-Principal & Professor, Dept. of ME

Dr. P.Suresh Babu
Professor, Dept. of ME

Dr. B.Venkata Siva
Professor & HoD Dept. of ME

Mr. M.Venkanna Babu
Associate Professor, Dept. of ME



Organized by

Department of Mechanical Engineering

In Association with The Institution of Engineers (India)

ISBN : 978-93-91420-02-4

LIST OF FULL LENGTH PAPERS SELECTED FOR PROCEEDINGS

International Conference on Emerging Trends in Mechanical Engineering and Industrial Automation

NEC-ICETMEIA- 2K21

S.No.	TITLE OF THE PAPER	Page No.
1.	Effectiveness of Compression Ignition Engine Fuelled with Pond Water Algae Biodiesel	01
2.	Design And Analysis of Disc Brake of an Electric Go-Kart	04
3.	A Comprehensive Review on Recent Research on Semi Solid Processed Aluminum 7 Series Alloys	08
4.	A Study on Microstructure and Mechanical Properties A7075 Reinforced with Flyash/Sic Hybrid Metal Matrix Composite	15
5.	Establishment of SCR Test Facility and Evaluation of 8mm Pitch Honeycomb Type Catalyst in a 20 Liter capacity SCR Test facility	19
6.	A Review on NVH Issues and Technological Challenges in Electric Vehicle and Hybrid Electric Vehicle Power Train	25
7.	Design and Analysis of Cantilever Beam	29
8.	Analysis of Static and Fatigue Strength of Aluminium Alloy Wheel	32
9.	Design of Automated Braking System Based on Vehicle Over Speed Using PLC Ladder Method	35
10.	The Analysis on Concentric Pipe Heat Exchanger	39
11.	Design and Finite Element Analysis of Gas Turbine Blade	45
12.	Investigation on Mechanical Properties of Glass Fiber and Carbon Nano Tubes Sandwich Composite Material	47
13.	CFD Analysis of Super Utility Vehicle to Determine Aerodynamic Behavior	54
14.	Devlopment of Code for Automated HVAC System using Digital Controller	60
15.	Performance and Emission Characteristics Of Diesel Engine with Linseed Oil-Diesel Blends as Fuel With VCR	65
16.	Experimental Investigation in Single Cylinder VCR Multifuel Engine Using Bio-Diesel as Linseed Oil	69

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

17.	Tribological Properties of Textured Surface	72
18.	Thermal Analysis and Experimental Investigation of Pin Fin made of Brass	76
19.	Experimental and Simulation of Wear Test on GPR material	79
20.	CFD Analysis of Two Pass Double Pipe Heat Exchanger with TiO_2/Ethylene Glycol Nano Fluid	83
21.	Simulation and Optimization of Extrusion Process Parameters of Aluminium 2A12T4Alloy	87
22.	Importance of Ice Jet machining - A Review	91
23.	Performance Investigation of a Battery Powered Peltier Cooler	94
24.	Analysis of Disc Brake Rotor using ANSYS Workbench	98
25.	Modelling and Optimization of Two Wheeler Disk Brake Using ANSYS -Review	101
26.	Fabrication of Sewage Waste Cleaner	105
27.	Manufacturing of Hyperboliodal Gear Model Using Ultimaker S5 3D Printing Machine	109
28.	Arc Welding Process Selection Through Quality and Cost Analysis	113
29.	Li-Br H2O VAR System Analysis by Applying Magnetic Field to Liquid Line	117
30.	Heat Transfer Enhancement on Shell and Coil Type of Heat Exchanger Using SiO_2 and CuO Nano-Fluids	121
31.	Study of Rheological Characteristics of Nano Suspensions	126
32.	Design And Fabrication of Loop Wheel System	129
33.	Performance of Solar Vapour Absorption system and its Dependence on Generator Temperature	131
34.	Design and Analysis Of Handicapped Steering Tricycle	134
35.	Machining Characteristics and Microbiological Growth of Stir Casted A356-SiC MMCs and Pure Metals	136
36.	Design and Analysis of Connecting Rod	141

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

37.	Pressure Vessel Optimum Design using Particle Swarm Optimization	145
38.	Design and Analysis of Wheel Rim on Radial Loads	149
39.	COP Enhancement of VCR System using Diffusers	154
40.	Design and Fabrication of Radiant Cooling System	157
41.	Comparative Performance Analysis of Engine Fuelled with Diesel Biodiesel Iron Oxide Nano Particles	162
42.	Performance analysis of a CI Engine fuelled with olive oil and soybean oil mixture as a biofuels	166
43.	Design and Analysis of Landing Gear	170
44.	A Review on Parameters of Composite Materials	173
45.	Optimisation in WEDM of HCHCR Steel using Taughi Method	177
46.	Automated Pneumatic Sheet Metal Cutting Machine	184
47.	Cylindrical Panel's Numerical And Analytical Investigations Subjected To Different Loads	187
48.	Application of a Thermoplastic Polyurethane/Polylactic Acid Composite Filament For 3D-Printed Personalized Orthosis	192
49.	Design and Analysis of a Connecting Rod	196
50.	A Study and Synthesis of 8 Bar One Degree of Freedom Walking Mechanism	200
51.	Mechanical properties and machining of Al-7075 SiC Composite	204
52.	Characterization of Tungsten carbide reinforced Al7075 matrix Composites.	208
53.	3D Printing of Prototype Through Image Processing using Autodesk Recap Photo Software	212
54.	Fabrication and Testing Mechanical Behaviour of Hemp Fibre, Chopped E Glass and Hybrid with Nano Particle	216
55.	Optical characterization of V_2O_5 doped Na_2O-SiO_2-ZrO_2 glasses	218
56.	Determination of Efficient Location of Split Air Conditioner using CFD	221

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET
Guntur

57.	Frictionless Electromagnetic Braking System	225
58.	Performance Evaluation of Vegetable oils as Cutting fluid under MQL Condition in Turning	228
59.	A novel hybrid Fuzzy AHP and VIKOR methodology for Reclaimer Selection in GSCM	236
60.	Design of Eco-Friendly Road Cleaner	240
61.	Mechanical and Microstructural Characterization of Jute Hybrid Composite with Alkali Treatment	244
62.	Experimental Investigation and Optimization of Process Parameters in Wire Cut EDM of EN31 Steel	248
63.	Design and Analysis of Differential Gear Box	252

***

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

DJ - 2021

ISBN: 978-93-91420-02-4

Establishment of SCR Test facility and Evaluation of 8mm pitch Honeycomb Type Catalyst in a 20 Liter capacity SCR Test facility

Tellamekala Anitha, Donepudi Jagadish and M.Sreenivasa Kumar
Department of Mechanical Engineering, Narasaraopeta Engineering College, Narasaraopet, India

***Abstract*—The objective of this project was to establish the 20 litre capacity SCR test facility and generate the data required for evaluating the performance of in-house developed 8mm pitch honeycomb type SCR catalyst with dust concentration of about 30 to 52 g/nm^3 in coal based flue gas. SCR test facility is capable to process up to 60 Nm^3/hr of flue gas generated from coal combustion process with 30-60 grams /Nm^3 of dust concentration. The NOx removal efficiency, ammonia slip and differential pressure across honeycomb catalyst was investigated with dust concentration of 30-52 grams/Nm^3 in flue gas by varying the space velocities (2500-1500 per hr.) and flue gas temperatures (300–350^{0}C) using anhydrous ammonia as reducing agent and the ratio of ammonia (NH_3) to Oxides of Nitrogen (NOx) was maintained as 0.9 to 1.0 for all the experiments. The result shows that the NOx reduction efficiency achieved with honeycomb was 81.89 – 86.75% at 2500-1500 per hr. space velocities and the ratio of ammonia (NH3) to oxides of nitrogen (NOx) was maintained at 0.9. NOx reduction efficiency achieved with honeycomb was 82.72–88.23% at 2500-1500 per hr. space velocities and the ratio of ammonia (NH_3) to oxides of nitrogen (NOx) was maintained at 1.0.Ammonia slip measured was in the range of 1.3 to 1.9 ppm for honeycomb catalyst at 0.9 for ammonia to oxides of nitrogen.The total Differential Pressure (DP) across Honeycomb SCR catalyst was 28-38 mmWc over a 2250mm length.**

Keywords—Selective catalytic reactor, honeycomb, catalyst, space velocity, Nox conversion efficiency, ammonia slip.

I. INTRODUCTION

Fossil fuels play a crucial role in the energy mix, and will continue to play a major role in decades to come. Coal is the most common source for heat and power production, and the role of coal will continue to be very important in the near future. According to EIA statistics for 2016, coal remains the second largest energy source worldwide until 2030 and from 2030 through 2040, it is the third-largest energy source. World coal consumption increases from 2012 to 2040 at an average rate of 0.6%/year [1]. The coal combustion generates solid and gaseous combustion products and is inevitably associated with environmental pollutants among which Oxides of Nitrogen (NOx) are major ones. The nitrogen monoxide (NO), nitrogen dioxide (NO2) and nitrous oxide (N_2O) molecule belongs to the family of nitrogen oxides (NOx) compounds. NOx is used to refer to the total amount of nitrogen oxides. About 95 % of oxides of nitrogen from industrial activities come from combustion processes. NOx can cause severe health problems and have strong environmental impacts. The main effects are: Formation of ground-level ozone, formation of acid aerosols, formation of acid rain, deterioration of water quality, formation of toxic chemicals and global warming. In view of severe health issues and strong environmental impacts, the Ministry of Environment and Forest (MOEF), GOI issued notification for implementation of emission norms for particulate matter (PM), sulphur di-oxide (SO2), oxides of nitrogen (NOx) and mercury (Hg). The final emission limits under Title IV, promulgated in February 1998, are shown in Table 1, 2 & 3.

Table 01:TPPs (units) regulatory norms installed before 31st December, 2003

Parameter	Standards
Particulate Matter	100 mg/Nm3
Sulphur Dioxide (SO2)	600 mg/ Nm3 (Units Smaller than 500 MW capacity units) 200mg /Nm3 (for units having capacity of 500MW and above)
Oxides of Nitrogen (NOx)	600 mg/ Nm3
Mercury (Hg)	0.03 mg/ Nm3 (for units having capacity of 500 MW and above)

Table 02: TPPs regulatory norms installed after 1st Jan, 2003, up to 31st Dec, 2016

Parameter	Standards
Particulate Matter	50 mg/Nm3
Sulphur Dioxide (SO2)	600 mg/ Nm3 (Units Smaller than 500 MW capacity units). 200 mg /Nm3 (for units having capacity of 500MW and above).
Oxides of Nitrogen (NOx)	300 mg/ Nm3
Mercury (Hg)	0.03 mg/ Nm3

Table 03: TPPs (units) regulatory norms to be installed form 1st January, 2017

Parameter	Standards
Particulate Matter	30 mg/ Nm3
Sulphur Dioxide (SO2)	100 mg/ Nm3
Oxides of Nitrogen (NOx)	100 mg/ Nm3
Mercury (Hg)	0.03 mg/ Nm3

To maintain stringent regulatory norms imposed by the Ministry of Environment and Forest (MOEF), GOI for Oxides of Nitrogen (NOx), BHEL has formed CFT committee and identified the solution.

NOx Removal techniques: Oxides of Nitrogen (NOX) can be controlled by using the following methods:

- Combustion controls; and
- Post-combustion controls;

Combustion controls: The NOX emissions are reduced by changing the process parameters while combustion process. The combustion process parameters are air, coal and residence time. Under this method the maximum conversion efficiency less than 50% and also this method is least expensive.

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

NEC

NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)

NAAC 'A' GRADE

NATIONAL BOARD of ACCREDITATION

PROCEEDINGS

INTERNATIONAL CONFERENCE

EMERGING TRENDS IN MECHANICAL ENGINEERING AND INDUSTRIAL AUTOMATION

NEC-ICETMEIA-2K21

30th & 31st July, 2021

Editors-in-Chief

Dr. M.Sreenivasa Kumar
Principal & Professor, Dept. of Mechnical Engineering

Dr. D.Jagadish
Professor, Dept. of Mechnical Engineering

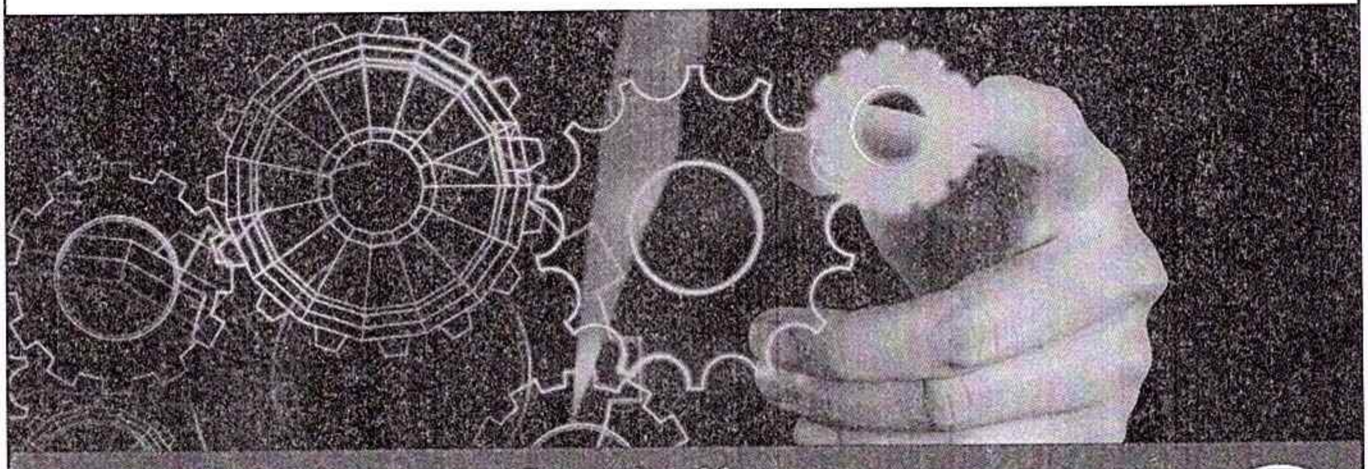
Editors

Dr. D.Suneel
Vice-Principal & Professor, Dept. of ME

Dr. P.Suresh Babu
Professor, Dept. of ME

Dr. B.Venkata Siva
Professor & HoD Dept. of ME

Mr. M.Venkanna Babu
Associate Professor, Dept. of ME



Organized by

Department of **Mechanical Engineering**

In Association with **The Institution of Engineers (India)**

ISBN : 978-93-91420-02-4

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

IQAC

LIST OF FULL LENGTH PAPERS SELECTED FOR PROCEEDINGS

International Conference on Emerging Trends in Mechanical Engineering and Industrial Automation

NEC-ICETMEIA- 2K21

S.No.	TITLE OF THE PAPER	Page No.
1.	Effectiveness of Compression Ignition Engine Fuelled with Pond Water Algae Biodiesel	01
2.	Design And Analysis of Disc Brake of an Electric Go-Kart	04
3.	A Comprehensive Review on Recent Research on Semi Solid Processed Aluminum 7 Series Alloys	08
4.	A Study on Microstructure and Mechanical Properties A7075 Reinforced with Flyash/Sic Hybrid Metal Matrix Composite	15
5.	Establishment of SCR Test Facility and Evaluation of 8mm Pitch Honeycomb Type Catalyst in a 20 Liter capacity SCR Test facility	19
6.	A Review on NVH Issues and Technological Challenges in Electric Vehicle and Hybrid Electric Vehicle Power Train	25
7.	Design and Analysis of Cantilever Beam	29
8.	Analysis of Static and Fatigue Strength of Aluminium Alloy Wheel	32
9.	Design of Automated Braking System Based on Vehicle Over Speed Using PLC Ladder Method	35
10.	The Analysis on Concentric Pipe Heat Exchanger	39
11.	Design and Finite Element Analysis of Gas Turbine Blade	45
12.	Investigation on Mechanical Properties of Glass Fiber and Carbon Nano Tubes Sandwich Composite Material	47
13.	CFD Analysis of Super Utility Vehicle to Determine Aerodynamic Behavior	54
14.	Devlopment of Code for Automated HVAC System using Digital Controller	60
15.	Performance and Emission Characteristics Of Diesel Engine with Linseed Oil-Diesel Blends as Fuel With VCR	65
16.	Experimental Investigation in Single Cylinder VCR Multifuel Engine using Diesel as Linseed Oil	

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

17.	Tribological Properties of Textured Surface	72
18.	Thermal Analysis and Experimental Investigation of Pin Fin made of Brass	76
19.	Experimental and Simulation of Wear Test on GPR material	79
20.	CFD Analysis of Two Pass Double Pipe Heat Exchanger with TiO_2/Ethylene Glycol Nano Fluid	83
21.	Simulation and Optimization of Extrusion Process Parameters of Aluminium 2A12T4Alloy	87
22.	Importance of Ice Jet machining - A Review	91
23.	Performance Investigation of a Battery Powered Peltier Cooler	94
24.	Analysis of Disc Brake Rotor using ANSYS Workbench	98
25.	Modelling and Optimization of Two Wheeler Disk Brake Using ANSYS -Review	101
26.	Fabrication of Sewage Waste Cleaner	105
27.	Manufacturing of Hyperboliodal Gear Model Using Ultimaker S5 3D Printing Machine	109
28.	Arc Welding Process Selection Through Quality and Cost Analysis	113
29.	Li-Br H2O VAR System Analysis by Applying Magnetic Field to Liquid Line	117
30.	Heat Transfer Enhancement on Shell and Coil Type of Heat Exchanger Using SiO_2 and CuO Nano-Fluids	121
31.	Study of Rheological Characteristics of Nano Suspensions	126
32.	Design And Fabrication of Loop Wheel System	129
33.	Performance of Solar Vapour Absorption system and its Dependence on Generator Temperature	131
34.	Design and Analysis Of Handicapped Steering Tricycle	134
35.	Machining Characteristics and Microbiological Growth of Stir Casted A356-SiC MMCs and Pure Metals	136
36.	Design and Analysis of Connecting Rod	141

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

37.	Pressure Vessel Optimum Design using Particle Swarm Optimization	145
38.	Design and Analysis of Wheel Rim on Radial Loads	149
39.	COP Enhancement of VCR System using Diffusers	154
40.	Design and Fabrication of Radiant Cooling System	157
41.	Comparative Performance Analysis of Engine Fuelled with Diesel Biodiesel Iron Oxide Nano Particles	162
42.	Performance analysis of a CI Engine fuelled with olive oil and soybean oil mixture as a biofuels	166
43.	Design and Analysis of Landing Gear	170
44.	A Review on Parameters of Composite Materials	173
45.	Optimisation in WEDM of HCHCR Steel using Taughi Method	177
46.	Automated Pneumatic Sheet Metal Cutting Machine	184
47.	Cylindrical Panel's Numerical And Analytical Investigations Subjected To Different Loads	187
48.	Application of a Thermoplastic Polyurethane/Polylactic Acid Composite Filament For 3D-Printed Personalized Orthosis	192
49.	Design and Analysis of a Connecting Rod	196
50.	A Study and Synthesis of 8 Bar One Degree of Freedom Walking Mechanism	200
51.	Mechanical properties and machining of Al-7075 SiC Composite	204
52.	Characterization of Tungsten carbide reinforced Al7075 matrix Composites.	208
53.	3D Printing of Prototype Through Image Processing using Autodesk Recap Photo Software	212
54.	Fabrication and Testing Mechanical Behaviour of Hemp Fibre, Chopped E Glass and Hybrid with Nano Particle	216
55.	Optical characterization of V_2O_5 doped Na_2O-SiO_2-ZrO_2 glasses	218
56.	Determination of Efficient Location of Split Air Conditioner using CFD	221

57.	Frictionless Electromagnetic Braking System	225
58.	Performance Evaluation of Vegetable oils as Cutting fluid under MQL Condition in Turning	228
59.	A novel hybrid Fuzzy AHP and VIKOR methodology for Reclaimer Selection in GSCM	236
60.	Design of Eco-Friendly Road Cleaner	240
61.	Mechanical and Microstructural Characterization of Jute Hybrid Composite with Alkali Treatment	244
62.	Experimental Investigation and Optimization of Process Parameters in Wire Cut EDM of EN31 Steel	248
63.	Design and Analysis of Differential Gear Box	252

***

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

DJ - 2021

ISBN: 978-93-91420-02-4

Comparative Performance Analysis of Engine Fuelled with Diesel Biodiesel Iron Oxide Nano Particles

Donepudi Jagadish, Ch. Sekhar, P. Srinivasa Rao, Sk Bajan
Department of Mechanical Engineering, Narasaraopet Engineering College (A), Narasaraopet, Guntur, A.P. India.

Abstract: Energy demand is the hot topic of all developing and developed countries. Energy demand has been increasing day by day at a high rate. So, it is necessary to find an alternative solution that is eco-friendly. Biodiesel can be the alternative solution for this problem. The main purpose of this paper is to test the engine performance and emission parameters of a diesel engine using animal fat biodiesel (fatty acid methyl esters) with diesel and using iron oxide Nano particles as additive. The parameters measured are volumetric efficiency, brake thermal efficiency, specific fuel consumption, mass fuel consumption and emission parameters are CO2, CO, NOx, and O2andHC.

I.INTRODUCTION

The need of diesel fuel is increasing in the current situations from several industries and vehicles. Simultaneously, because of its high compression ratio it increases the pollution to the environment. The demand for petroleum products and the cost is increasing day by day, so considering into current and future requirements for the usage of petroleum products there is a need of alternative fuels. The addition of biodiesel to diesel fuel improves the performance and emission characteristics of the diesel engine. The optimized biodiesel mix can Reduce some important portion of fuel dependency and surroundings from pollution with none modification to the diesel engine. The oxygen content presence in biodiesel reduces the carbon monoxide and hydrocarbons emissions and it increases the NOx formation at the exhaust. It leads to incomplete combustion due to poor atomization and to reduce the viscosity, pouring point and increasing the calorific value of biodiesel many researches have been carried out by researchers on different types of additives. The additives, metal and platinum based blended biodiesel improve the diesel engine performance and emission characteristics, but increases the size of the particles and accumulate less. Iron oxide has high level of purity in water and release hydrogen which provides more surface area helps in the combustion process. The optimum fuel with iron oxide brake thermal efficiency (Bth%) increased and specific fuel consumption minimized as related to neat diesel. The emissions carbon monoxide (CO) and hydrocarbons (HC) reduced respectively however increase in NOX were observed. Improved hydrocarbon and carbon monoxide with addition of nanoparticles blended biodiesel compared to biodiesel. Reduced NOx with iron oxide nanoparticles due to sufficient fuel accumulation made early combustion and reduced ignition delay. Increase in brake thermal efficiency for biodiesel-ethanol blend was observed due to better mixing abilities of nanoparticles in the presence of oxygen and significant reduction in unburnt hydrocarbon sand carbon monoxide as compared to diesel at 1/4th and 1/2nd percentage load. Brake thermal efficiency increased as compared to biodiesel and exhaust emissions hydrocarbons, carbon monoxide and NOx were reduced with nanoparticles compared to biodiesel. The higher dosage of alumina nanoparticles to diesel increased brake thermal efficiency compared to diesel and reduced carbon monoxide, hydrocarbons and NOx with iron oxide nanoparticles in comparison with diesel. The addition of Fe2O3 nano particles to biodiesel (B20) in compression ignition engine were improved performance and reduced emissions hydrocarbon, carbon monoxide and NOx with nano additives in diesel engine as compared to biodiesel.

The nanoparticles by mass fraction 50ppm, 100ppm and 150 ppm were added to diesel fuel and compared the results with diesel. Observed that average brake thermal efficiency increased with nanoparticle dosages compared to diesel fuel. Exhaust emissions were decreased after 25% of the load than the diesel fuel. Bio-diesel with iron metal oxide nanoparticles added on the diesel engine with various dosages of nanoparticles resulted in lower BTE, BSFC and exhaust emissions compared to diesel. However, increase in NOx was noted with nanoparticles Investigations from researchers were carried out on iron oxide nanoparticles to see the effect of additions on performance and emission characteristics of the diesel engine. In the literature review most of the researchers established the addition of varying dosages of iron oxide nanoparticles in biodiesel blends and in diesel increases the calorific value of the fuel and found improvement in specific fuel consumption and brake thermal efficiency. Results also showed iron oxide nanoparticles to diesel and biodiesel. Also, with lower dosage levels of iron nano particle as additive in B10 and B20, the BTE, BSFC and emissions characteristics were comparable with the diesel. The objectives of the present paper are to see the influence of addition of iron oxide nanoparticles blended with animal fat-based biodiesel on the CI engine for understanding the performance and emissions characteristics. The outcome of this study is improvement in the engine performance and exhaust emissions

MATERIALS AND METHODS

Some of the paper mentioned here are the works done on implementation of biodiesel in the present engines. Most of the results are in favour of biodiesel showing improvement in performance and emissions.

D. Jagadish et al. [1] mentioned that usage of biofuels received much attention in the current situation of depleting fossil-fuel reserves and in-creased emission legislation. Many ideas have been implemented upon usage of biofuels for energy production to achieve low-emission levels. Internal combustion engines are the basic prime movers for power generation as well as for transportation purpose, which are basically run on fossil petroleum.

NEC

NARASARAOPETA ENGINEERING COLLEGE

(AUTONOMOUS)

NAAC 'A' GRADE

NBA NATIONAL BOARD OF ACCREDITATION

5

PROCEEDINGS

INTERNATIONAL CONFERENCE

EMERGING TRENDS IN MECHANICAL ENGINEERING AND INDUSTRIAL AUTOMATION

NEC-ICETMEIA-2K21

30th & 31st July, 2021

Editors-in-Chief

Dr. M.Sreenivasa Kumar
Principal & Professor, Dept. of Mechnical Engineering

Dr. D.Jagadish
Professor, Dept. of Mechnical Engineering

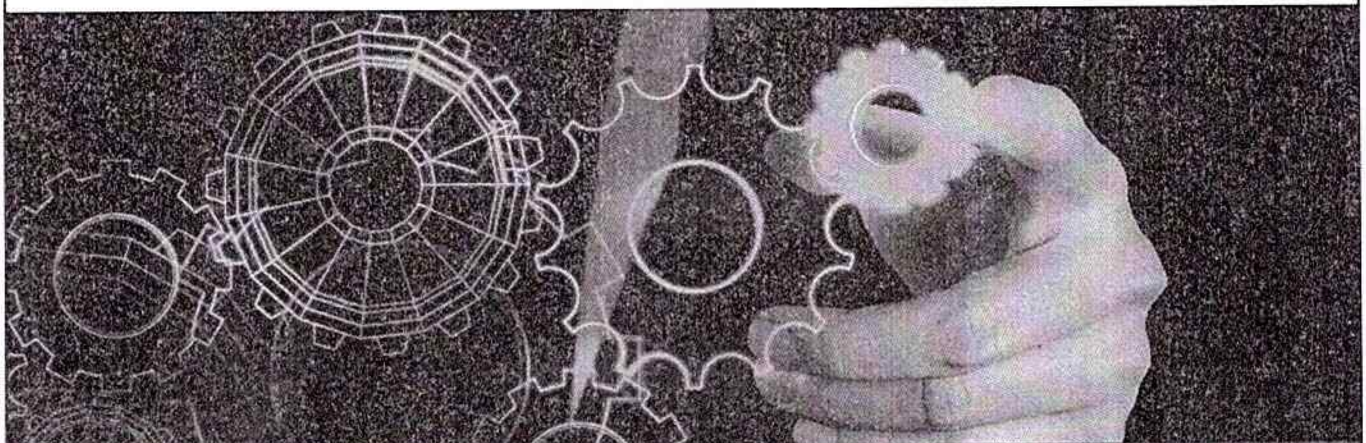
Editors

Dr. D.Suneel
Vice-Principal & Professor, Dept. of ME

Dr. P.Suresh Babu
Professor, Dept. of ME

Dr. B.Venkata Siva
Professor & HoD Dept. of ME

Mr. M.Venkanna Babu
Associate Professor, Dept. of ME



Organized by

Department of **Mechanical Engineering**

In Association with **The Institution of Engineers (India)**

ISBN : 978-93-91420-02-4

LIST OF FULL LENGTH PAPERS SELECTED FOR PROCEEDINGS

International Conference on Emerging Trends in Mechanical Engineering and Industrial Automation

NEC-ICETMEIA- 2K21

S.No.	TITLE OF THE PAPER	Page No.
1.	Effectiveness of Compression Ignition Engine Fuelled with Pond Water Algae Biodiesel	01
2.	Design And Analysis of Disc Brake of an Electric Go-Kart	04
3.	A Comprehensive Review on Recent Research on Semi Solid Processed Aluminum 7 Series Alloys	08
4.	A Study on Microstructure and Mechanical Properties A7075 Reinforced with Flyash/Sic Hybrid Metal Matrix Composite	15
5.	Establishment of SCR Test Facility and Evaluation of 8mm Pitch Honeycomb Type Catalyst in a 20 Liter capacity SCR Test facility	19
6.	A Review on NVH Issues and Technological Challenges in Electric Vehicle and Hybrid Electric Vehicle Power Train	25
7.	Design and Analysis of Cantilever Beam	29
8.	Analysis of Static and Fatigue Strength of Aluminium Alloy Wheel	32
9.	Design of Automated Braking System Based on Vehicle Over Speed Using PLC Ladder Method	35
10.	The Analysis on Concentric Pipe Heat Exchanger	39
11.	Design and Finite Element Analysis of Gas Turbine Blade	45
12.	Investigation on Mechanical Properties of Glass Fiber and Carbon Nano Tubes Sandwich Composite Material	47
13.	CFD Analysis of Super Utility Vehicle to Determine Aerodynamic Behavior	54
14.	Devlopment of Code for Automated HVAC System using Digital Controller	60
15.	Performance and Emission Characteristics Of Diesel Engine with Linseed Oil-Diesel Blends as Fuel With VCR	65
16.	Experimental Investigation in Single Cylinder VCR Multifuel Engine Using Bio-Diesel as Linseed Oil	69

17.	Tribological Properties of Textured Surface	72
18.	Thermal Analysis and Experimental Investigation of Pin Fin made of Brass	76
19.	Experimental and Simulation of Wear Test on GPR material	79
20.	CFD Analysis of Two Pass Double Pipe Heat Exchanger with TiO_2/Ethylene Glycol Nano Fluid	83
21.	Simulation and Optimization of Extrusion Process Parameters of Aluminium 2A12T4Alloy	87
22.	Importance of Ice Jet machining - A Review	91
23.	Performance Investigation of a Battery Powered Peltier Cooler	94
24.	Analysis of Disc Brake Rotor using ANSYS Workbench	98
25.	Modelling and Optimization of Two Wheeler Disk Brake Using ANSYS -Review	101
26.	Fabrication of Sewage Waste Cleaner	105
27.	Manufacturing of Hyperboliodal Gear Model Using Ultimaker S5 3D Printing Machine	109
28.	Arc Welding Process Selection Through Quality and Cost Analysis	113
29.	Li-Br H2O VAR System Analysis by Applying Magnetic Field to Liquid Line	117
30.	Heat Transfer Enhancement on Shell and Coil Type of Heat Exchanger Using SiO_2 and CuO Nano-Fluids	121
31.	Study of Rheological Characteristics of Nano Suspensions	126
32.	Design And Fabrication of Loop Wheel System	129
33.	Performance of Solar Vapour Absorption system and its Dependence on Generator Temperature	131
34.	Design and Analysis Of Handicapped Steering Tricycle	134
35.	Machining Characteristics and Microbiological Growth of Stir Casted A356-SiC MMCs and Pure Metals	136
36.	Design and Analysis of Connecting Rod	141

37.	Pressure Vessel Optimum Design using Particle Swarm Optimization	145
38.	Design and Analysis of Wheel Rim on Radial Loads	149
39.	COP Enhancement of VCR System using Diffusers	154
40.	Design and Fabrication of Radiant Cooling System	157
41.	Comparative Performance Analysis of Engine Fuelled with Diesel Biodiesel Iron Oxide Nano Particles	162
42.	Performance analysis of a CI Engine fuelled with olive oil and soybean oil mixture as a biofuels	166
43.	Design and Analysis of Landing Gear	170
44.	A Review on Parameters of Composite Materials	173
45.	Optimisation in WEDM of HCHCR Steel using Taughi Method	177
46.	Automated Pneumatic Sheet Metal Cutting Machine	184
47.	Cylindrical Panel's Numerical And Analytical Investigations Subjected To Different Loads	187
48.	Application of a Thermoplastic Polyurethane/Polylactic Acid Composite Filament For 3D-Printed Personalized Orthosis	192
49.	Design and Analysis of a Connecting Rod	196
50.	A Study and Synthesis of 8 Bar One Degree of Freedom Walking Mechanism	200
51.	Mechanical properties and machining of Al-7075 SiC Composite	204
52.	Characterization of Tungsten carbide reinforced Al7075 matrix Composites.	208
53.	3D Printing of Prototype Through Image Processing using Autodesk Recap Photo Software	212
54.	Fabrication and Testing Mechanical Behaviour of Hemp Fibre, Chopped E Glass and Hybrid with Nano Particle	216
55.	Optical characterization of V_2O_5 doped Na_2O-SiO_2-ZrO_2 glasses	218
56.	Determination of Efficient Location of Split Air Conditioner using CFD	221

57.	Frictionless Electromagnetic Braking System	225
58.	Performance Evaluation of Vegetable oils as Cutting fluid under MQL Condition in Turning	228
59.	A novel hybrid Fuzzy AHP and VIKOR methodology for Reclaimer Selection in GSCM	236
60.	Design of Eco-Friendly Road Cleaner	240
61.	Mechanical and Microstructural Characterization of Jute Hybrid Composite with Alkali Treatment	244
62.	Experimental Investigation and Optimization of Process Parameters in Wire Cut EDM of EN31 Steel	248
63.	Design and Analysis of Differential Gear Box	252

***

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

CHS - 2021

ISBN: 978-93-91420-02-4

Comparative Performance Analysis of Engine Fuelled with Diesel Biodiesel Iron Oxide Nano Particles

Donepudi Jagadish, Ch. Sekhar, P. Srinivasa Rao, Sk Bajan
Department of Mechanical Engineering, Narasaraopet Engineering College (A), Narasaraopet, Guntur, A.P, India.

Abstract: Energy demand is the hot topic of all developing and developed countries. Energy demand has been increasing day by day at a high rate. So, it is necessary to find an alternative solution that is eco-friendly. Biodiesel can be the alternative solution for this problem. The main purpose of this paper is to test the engine performance and emission parameters of a diesel engine using animal fat biodiesel (fatty acid methyl esters) with diesel and using iron oxide Nano particles as additive. The parameters measured are volumetric efficiency, brake thermal efficiency, specific fuel consumption, mass fuel consumption and emission parameters are CO2, CO, NOx, and O2andHC.

I.INTRODUCTION

The need of diesel fuel is increasing in the current situations from several industries and vehicles. Simultaneously, because of its high compression ratio it increases the pollution to the environment. The demand for petroleum products and the cost is increasing day by day, so considering into current and future requirements for the usage of petroleum products there is a need of alternative fuels. The addition of biodiesel to diesel fuel improves the performance and emission characteristics of the diesel engine. The optimized biodiesel mix can Reduce some important portion of fuel dependency and surroundings from pollution with none modification to the diesel engine. The oxygen content presence in biodiesel reduces the carbon monoxide and hydrocarbons emissions and it increases the NOx formation at the exhaust. It leads to incomplete combustion due to poor atomization and to reduce the viscosity, pouring point and increasing the calorific value of biodiesel many researches have been carried out by researchers on different types of additives. The additives, metal and platinum based blended biodiesel improve the diesel engine performance and emission characteristics, but increases the size of the particles and accumulate less. Iron oxide has high level of purity in water and release hydrogen which provides more surface area helps in the combustion process. The optimum fuel with iron oxide brake thermal efficiency (Bth%) increased and specific fuel consumption minimized as related to neat diesel. The emissions carbon monoxide (CO) and hydrocarbons (HC) reduced respectively however increase in NOX were observed. Improved hydrocarbon and carbon monoxide with addition of nanoparticles blended biodiesel compared to biodiesel. Reduced NOx with iron oxide nanoparticles due to sufficient fuel accumulation made early combustion and reduced ignition delay. Increase in brake thermal efficiency for biodiesel-ethanol blend was observed due to better mixing abilities of nanoparticles in the presence of oxygen and significant reduction in unburnt hydrocarbon sand carbon monoxide as compared to diesel at 1/4th and 1/2nd percentage load. Brake thermal efficiency increased as compared to biodiesel and exhaust emissions hydrocarbons, carbon monoxide and NOx were reduced with nanoparticles compared to biodiesel. The higher dosage of alumina nanoparticles to diesel increased brake thermal efficiency compared to diesel and reduced carbon monoxide, hydrocarbons and NOx with iron oxide nanoparticles in comparison with diesel. The addition of Fe2O3 nano particles to biodiesel (B20) in compression ignition engine were improved performance and reduced emissions hydrocarbon, carbon monoxide and NOx with nano additives in diesel engine as compared to biodiesel.

The nanoparticles by mass fraction 50ppm, 100ppm and 150 ppm were added to diesel fuel and compared the results with diesel. Observed that average brake thermal efficiency increased with nanoparticle dosages compared to diesel fuel. Exhaust emissions were decreased after 25% of the load than the diesel fuel. Bio-diesel with iron metal oxide nanoparticles added on the diesel engine with various dosages of nanoparticles resulted in lower BTE, BSFC and exhaust emissions compared to diesel. However, increase in NOx was noted with nanoparticles Investigations from researchers were carried out on iron oxide nanoparticles to see the effect of additions on performance and emission characteristics of the diesel engine. In the literature review most of the researchers established the addition of varying dosages of iron oxide nanoparticles in biodiesel blends and in diesel increases the calorific value of the fuel and found improvement in specific fuel consumption and brake thermal efficiency. Results also showed iron oxide nanoparticles to diesel and biodiesel. Also, with lower dosage levels of iron nano particle as additive in B10 and B20, the BTE, BSFC and emissions characteristics were comparable with the diesel. The objectives of the present paper are to see the influence of addition of iron oxide nanoparticles blended with animal fat-based biodiesel on the CI engine for understanding the performance and emissions characteristics. The outcome of this study is improvement in the engine performance and exhaust emissions

MATERIALS AND METHODS

Some of the paper mentioned here are the works done on implementation of biodiesel in the present engines. Most of the results are in favour of biodiesel showing improvement in performance and emissions.

D. Jagadish et al. [1] mentioned that usage of biofuels received much attention in the current situation of depleting fossil-fuel reserves and in-creased emission legislation. Many ideas have been implemented upon usage of biofuels for energy production to achieve low-emission levels. Internal combustion engines are the basic prime movers for power generation as well as for transportation purpose, which are basically run on fossil petroleum.

NEC NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)

NAAC A GRADE

NATIONAL BOARD OF ACCREDITATION

PROCEEDINGS

INTERNATIONAL CONFERENCE

EMERGING TRENDS IN MECHANICAL ENGINEERING AND INDUSTRIAL AUTOMATION

NEC-ICETMEIA-2K21

30th & 31st July, 2021

Editors-in-Chief

Dr. M.Sreenivasa Kumar
Principal & Professor, Dept. of Mechnical Engineering

Dr. D.Jagadish
Professor, Dept. of Mechnical Engineering

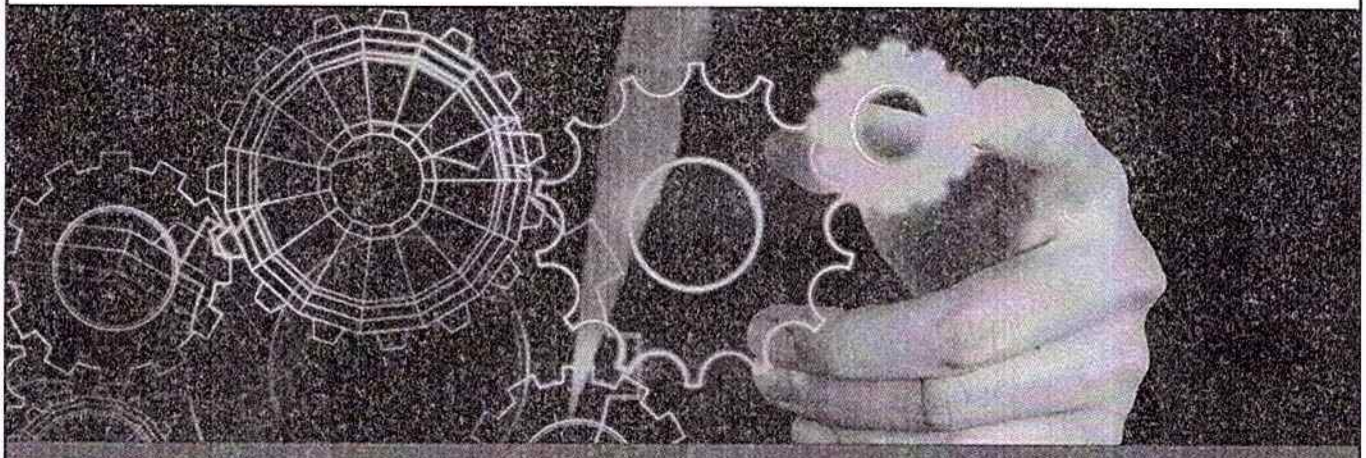
Editors

Dr. D.Suneel
Vice-Principal & Professor, Dept. of ME

Dr. P.Suresh Babu
Professor, Dept. of ME

Dr. B.Venkata Siva
Professor & HoD Dept. of ME

Mr. M.Venkanna Babu
Associate Professor, Dept. of ME



Organized by

Department of **Mechanical Engineering**

In Association with **The Institution of Engineers (India)**

ISBN : 978-93-91420-02-4

LIST OF FULL LENGTH PAPERS SELECTED FOR PROCEEDINGS

International Conference on Emerging Trends in Mechanical Engineering and Industrial Automation

NEC-ICETMEIA- 2K21

S.No.	TITLE OF THE PAPER	Page No.
1.	Effectiveness of Compression Ignition Engine Fuelled with Pond Water Algae Biodiesel	01
2.	Design And Analysis of Disc Brake of an Electric Go-Kart	04
3.	A Comprehensive Review on Recent Research on Semi Solid Processed Aluminum 7 Series Alloys	08
4.	A Study on Microstructure and Mechanical Properties A7075 Reinforced with Flyash/Sic Hybrid Metal Matrix Composite	15
5.	Establishment of SCR Test Facility and Evaluation of 8mm Pitch Honeycomb Type Catalyst in a 20 Liter capacity SCR Test facility	19
6.	A Review on NVH Issues and Technological Challenges in Electric Vehicle and Hybrid Electric Vehicle Power Train	25
7.	Design and Analysis of Cantilever Beam	29
8.	Analysis of Static and Fatigue Strength of Aluminium Alloy Wheel	32
9.	Design of Automated Braking System Based on Vehicle Over Speed Using PLC Ladder Method	35
10.	The Analysis on Concentric Pipe Heat Exchanger	39
11.	Design and Finite Element Analysis of Gas Turbine Blade	45
12.	Investigation on Mechanical Properties of Glass Fiber and Carbon Nano Tubes Sandwich Composite Material	47
13.	CFD Analysis of Super Utility Vehicle to Determine Aerodynamic Behavior	54
14.	Devlopment of Code for Automated HVAC System using Digital Controller	60
15.	Performance and Emission Characteristics Of Diesel Engine with Linseed Oil-Diesel Blends as Fuel With VCR	65
16.	Experimental Investigation in Single Cylinder VCR Multifuel Engine Using Bio Diesel as Linseed Oil	69

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

17.	Tribological Properties of Textured Surface	72
18.	Thermal Analysis and Experimental Investigation of Pin Fin made of Brass	76
19.	Experimental and Simulation of Wear Test on GPR material	79
20.	CFD Analysis of Two Pass Double Pipe Heat Exchanger with TiO_2/Ethylene Glycol Nano Fluid	83
21.	Simulation and Optimization of Extrusion Process Parameters of Aluminium 2A12T4Alloy	87
22.	Importance of Ice Jet machining - A Review	91
23.	Performance Investigation of a Battery Powered Peltier Cooler	94
24.	Analysis of Disc Brake Rotor using ANSYS Workbench	98
25.	Modelling and Optimization of Two Wheeler Disk Brake Using ANSYS -Review	101
26.	Fabrication of Sewage Waste Cleaner	105
27.	Manufacturing of Hyperboliodal Gear Model Using Ultimaker S5 3D Printing Machine	109
28.	Arc Welding Process Selection Through Quality and Cost Analysis	113
29.	Li-Br H2O VAR System Analysis by Applying Magnetic Field to Liquid Line	117
30.	Heat Transfer Enhancement on Shell and Coil Type of Heat Exchanger Using SiO_2 and CuO Nano-Fluids	121
31.	Study of Rheological Characteristics of Nano Suspensions	126
32.	Design And Fabrication of Loop Wheel System	129
33.	Performance of Solar Vapour Absorption system and its Dependence on Generator Temperature	131
34.	Design and Analysis Of Handicapped Steering Tricycle	134
35.	Machining Characteristics and Microbiological Growth of Stir Casted A356-SiC MMCs and Pure Metals	136
36.	Design and Analysis of Connecting Rod	141

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

37.	Pressure Vessel Optimum Design using Particle Swarm Optimization	145
38.	Design and Analysis of Wheel Rim on Radial Loads	149
39.	COP Enhancement of VCR System using Diffusers	154
40.	Design and Fabrication of Radiant Cooling System	157
41.	Comparative Performance Analysis of Engine Fuelled with Diesel Biodiesel Iron Oxide Nano Particles	162
42.	Performance analysis of a CI Engine fuelled with olive oil and soybean oil mixture as a biofuels	166
43.	Design and Analysis of Landing Gear	170
44.	A Review on Parameters of Composite Materials	173
45.	Optimisation in WEDM of HCHCR Steel using Taughi Method	177
46.	Automated Pneumatic Sheet Metal Cutting Machine	184
47.	Cylindrical Panel's Numerical And Analytical Investigations Subjected To Different Loads	187
48.	Application of a Thermoplastic Polyurethane/Polylactic Acid Composite Filament For 3D-Printed Personalized Orthosis	192
49.	Design and Analysis of a Connecting Rod	196
50.	A Study and Synthesis of 8 Bar One Degree of Freedom Walking Mechanism	200
51.	Mechanical properties and machining of Al-7075 SiC Composite	204
52.	Characterization of Tungsten carbide reinforced Al7075 matrix Composites.	208
53.	3D Printing of Prototype Through Image Processing using Autodesk Recap Photo Software	212
54.	Fabrication and Testing Mechanical Behaviour of Hemp Fibre, Chopped E Glass and Hybrid with Nano Particle	216
55.	Optical characterization of V_2O_5 doped Na_2O-SiO_2-ZrO_2 glasses	218
56.	Determination of Efficient Location of Split Air Conditioner	221

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

57.	Frictionless Electromagnetic Braking System	225
58.	Performance Evaluation of Vegetable oils as Cutting fluid under MQL Condition in Turning	228
59.	A novel hybrid Fuzzy AHP and VIKOR methodology for Reclaimer Selection in GSCM	236
60.	Design of Eco-Friendly Road Cleaner	240
61.	Mechanical and Microstructural Characterization of Jute Hybrid Composite with Alkali Treatment	244
62.	Experimental Investigation and Optimization of Process Parameters in Wire Cut EDM of EN31 Steel	248
63.	Design and Analysis of Differential Gear Box	252

***

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

CHS - 2021

ISBN: 978-93-91420-02-4

A Comprehensive Review on Recent Research on Semi Solid Processed Aluminum 7 Series Alloys

Devarapalli Raviteja[1], I Veeranjaneyulu[2], V.Venkata.Kamesh[3]and Sekhar chinthamreddy[4]
[1,2,3] Department of Mechanical Engineering , Aditya Engineering College (A), Surampalem, India
[4]Department of Mechanical Engineering, Narasaraopeta Engineering College (A), Narasaraopet, India

Abstract – At present for industries it is a challenge to produce products of good quality and should have high durability. In this engineering world there is great a great need of various engineering materials to satisfy these engineering needs. The material usage mainly depends on the material strength and properties. Aluminium 7 series alloy has good mechanical properties and low density; it is mainly used in transportation applications like aerospace, marine and automobile manufacturing. The aim of this work is to discuss the manufacturing process for different 7075 alloys required to obtain the spheroidal grain structure suitable for thixoforging. A literature review the semi-solid processed Al 7 series alloys is displayed. Application of the compo casting process led to a transformation of a dendritic to a no dendritic structure of the base alloy. The mechanical properties of the composite are improved in relation to the base alloy.

Keywords: Aluminum-7075, Thixoforging, Casting, Semi Solid

Abbreviations

Al -	Aluminium
SSM -	Semi Solid Metal
RC -	Rheocast
USV -	Ultrasonic Vibrations
dT -	temperature difference
dfs -	composition
GISS -	Gas Induced Semi – Solid
SSR -	Semi Solid Rheocasting
SSD -	Semi Solid Processing
SST -	Semi Solid Temperature
SIMA-	Strain Induced Melt Activated
MMC-	Metal Matrix Composite
Mg -	Magnesium
Si -	Silicon
TRT -	Technique – Thermal Rate Treatment

I. Introduction

A lot of researches have been focused on the semi-solid metal (SSM) processing since it was invented in 1970s at Massachusetts Institute of Technology. Components produced by this unique technique have various advantages compared with the conventional liquid casting, such as low porosity, heat treatability and superior mechanical properties. The Rheocasting process becomes popular in recent years, because it possesses several advantages over thixoforming process, including increasing mould life, low cost, enhancing casting precision and qualities. Rheocasting involves stirring the melt during solidification to produce a non-dendritic semi-solid slurry, then injecting the slurry directly into a mould or die to give a final product. The ultrasonic vibration (USV) for making semi-solid slurry is a relatively new method in rheocasting process. This novel technology requires less expensive equipment for production and it is easy to be introduced into the melt. The alloys commonly used for SSM processing are certain cast Al alloys, and some wrought Al alloys of 2000 or 7000 series. However, little study has been conducted to process 5000 series Al alloys by SSM processing. The 5000 alloys have been found a large variety of applications including architectural, household appliances, marine craft, and automotive structures due to its excellent combination of weldability and corrosion resistance. They are generally classified as a non-heat treatable aluminium alloys, and their strength are not high enough to be used as structural components. Therefore, it is necessary to adopt proper processing to obtain higher mechanical properties for these series alloys. Compared with conventional casting and forging processes, semi-solid forming offers significant advantages, such as increased die life, reduced micro-segregation, and improved mechanical properties.

A new method named Semi-solid metal casting (SSM) is a near net shape variant of die casting. The process is used today with non-ferrous metals, such as aluminum, copper, and magnesium, but also can work with higher temperature alloys for which no currently suitable die materials are available. The process combines the advantages of casting and forging. The potential for this type of process was first recognized in the early 1970s.

SSM is done at a temperature that puts the metal between its liquids and solidus temperature. Ideally, the metal should be 30 to 65% solid. The semi-solid mixture must have a low viscosity to be usable, and to reach this low viscosity the material needs a globular primary surrounded by the liquid phase. The temperature range possible depends on the material and for aluminum alloys can be as much as 50 °C.

Semi-solid casting is typically used for high-end applications. For aluminum alloys, typical parts include structural medical and aerospace parts, pressure containing parts, defense parts, engine mounts, air manifold sensor harnesses, engine blocks, and oil pump filter housings. The below flow chart gives a clear idea of semi-solid processing of metals.

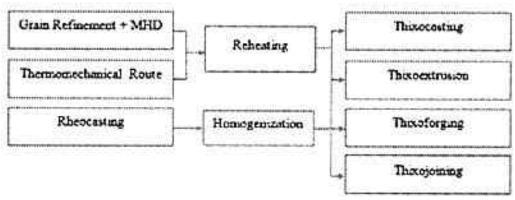


Fig 1.1 Semi Solid Processing of Metals

NEC

NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)

NAAC 'A' GRADE

NBA NATIONAL BOARD OF ACCREDITATION

5

PROCEEDINGS
INTERNATIONAL CONFERENCE
EMERGING TRENDS IN MECHANICAL ENGINEERING AND INDUSTRIAL AUTOMATION
NEC-ICETMEIA-2K21

30th & 31st July, 2021

Editors-in-Chief

Dr. M.Sreenivasa Kumar
Principal & Professor, Dept. of Mechnical Engineering

Dr. D.Jagadish
Professor, Dept. of Mechnical Engineering

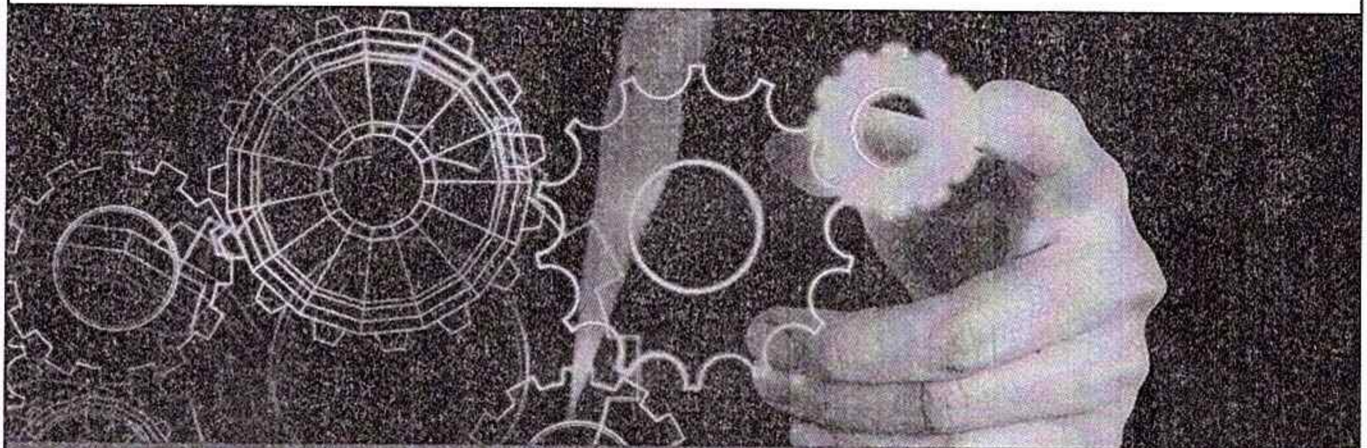
Editors

Dr. D.Suneel
Vice-Principal & Professor, Dept. of ME

Dr. P.Suresh Babu
Professor, Dept. of ME

Dr. B.Venkata Siva
Professor & HoD Dept. of ME

Mr. M.Venkanna Babu
Associate Professor, Dept. of ME



Organized by

Department of Mechanical Engineering

In Association with The Institution of Engineers (India)

ISBN: 978-93-91420-02-4

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

IQAC

LIST OF FULL LENGTH PAPERS SELECTED FOR PROCEEDINGS

International Conference on Emerging Trends in Mechanical Engineering and Industrial Automation

NEC-ICETMEIA- 2K21

S.No.	TITLE OF THE PAPER	Page No.
1.	Effectiveness of Compression Ignition Engine Fuelled with Pond Water Algae Biodiesel	01
2.	Design And Analysis of Disc Brake of an Electric Go-Kart	04
3.	A Comprehensive Review on Recent Research on Semi Solid Processed Aluminum 7 Series Alloys	08
4.	A Study on Microstructure and Mechanical Properties A7075 Reinforced with Flyash/Sic Hybrid Metal Matrix Composite	15
5.	Establishment of SCR Test Facility and Evaluation of 8mm Pitch Honeycomb Type Catalyst in a 20 Liter capacity SCR Test facility	19
6.	A Review on NVH Issues and Technological Challenges in Electric Vehicle and Hybrid Electric Vehicle Power Train	25
7.	Design and Analysis of Cantilever Beam	29
8.	Analysis of Static and Fatigue Strength of Aluminium Alloy Wheel	32
9.	Design of Automated Braking System Based on Vehicle Over Speed Using PLC Ladder Method	35
10.	The Analysis on Concentric Pipe Heat Exchanger	39
11.	Design and Finite Element Analysis of Gas Turbine Blade	45
12.	Investigation on Mechanical Properties of Glass Fiber and Carbon Nano Tubes Sandwich Composite Material	47
13.	CFD Analysis of Super Utility Vehicle to Determine Aerodynamic Behavior	54
14.	Devlopment of Code for Automated HVAC System using Digital Controller	60
15.	Performance and Emission Characteristics Of Diesel Engine with Linseed Oil-Diesel Blends as Fuel With VCR	65
16.	Experimental Investigation in Single Cylinder VCR Multifuel [illegible] Bio-Diesel as Linseed Oil	69

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - [illegible]
Guntur (Dist.), [illegible]

17.	Tribological Properties of Textured Surface	72
18.	Thermal Analysis and Experimental Investigation of Pin Fin made of Brass	76
19.	Experimental and Simulation of Wear Test on GPR material	79
20.	CFD Analysis of Two Pass Double Pipe Heat Exchanger with TiO_2/Ethylene Glycol Nano Fluid	83
21.	Simulation and Optimization of Extrusion Process Parameters of Aluminium 2A12T4Alloy	87
22.	Importance of Ice Jet machining - A Review	91
23.	Performance Investigation of a Battery Powered Peltier Cooler	94
24.	Analysis of Disc Brake Rotor using ANSYS Workbench	98
25.	Modelling and Optimization of Two Wheeler Disk Brake Using ANSYS -Review	101
26.	Fabrication of Sewage Waste Cleaner	105
27.	Manufacturing of Hyperboliodal Gear Model Using Ultimaker S5 3D Printing Machine	109
28.	Arc Welding Process Selection Through Quality and Cost Analysis	113
29.	Li-Br H2O VAR System Analysis by Applying Magnetic Field to Liquid Line	117
30.	Heat Transfer Enhancement on Shell and Coil Type of Heat Exchanger Using SiO_2 and CuO Nano-Fluids	121
31.	Study of Rheological Characteristics of Nano Suspensions	126
32.	Design And Fabrication of Loop Wheel System	129
33.	Performance of Solar Vapour Absorption system and its Dependence on Generator Temperature	131
34.	Design and Analysis Of Handicapped Steering Tricycle	134
35.	Machining Characteristics and Microbiological Growth of Stir Casted A356-SiC MMCs and Pure Metals	136
36.	Design and Analysis of Connecting Rod	141

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

37.	Pressure Vessel Optimum Design using Particle Swarm Optimization	145
38.	Design and Analysis of Wheel Rim on Radial Loads	149
39.	COP Enhancement of VCR System using Diffusers	154
40.	Design and Fabrication of Radiant Cooling System	157
41.	Comparative Performance Analysis of Engine Fuelled with Diesel Biodiesel Iron Oxide Nano Particles	162
42.	Performance analysis of a CI Engine fuelled with olive oil and soybean oil mixture as a biofuels	166
43.	Design and Analysis of Landing Gear	170
44.	A Review on Parameters of Composite Materials	173
45.	Optimisation in WEDM of HCHCR Steel using Taughi Method	177
46.	Automated Pneumatic Sheet Metal Cutting Machine	184
47.	Cylindrical Panel's Numerical And Analytical Investigations Subjected To Different Loads	187
48.	Application of a Thermoplastic Polyurethane/Polylactic Acid Composite Filament For 3D-Printed Personalized Orthosis	192
49.	Design and Analysis of a Connecting Rod	196
50.	A Study and Synthesis of 8 Bar One Degree of Freedom Walking Mechanism	200
51.	Mechanical properties and machining of Al-7075 SiC Composite	204
52.	Characterization of Tungsten carbide reinforced Al7075 matrix Composites.	208
53.	3D Printing of Prototype Through Image Processing using Autodesk Recap Photo Software	212
54.	Fabrication and Testing Mechanical Behaviour of Hemp Fibre, Chopped E Glass and Hybrid with Nano Particle	216
55.	Optical characterization of V_2O_5 doped Na_2O-SiO_2-ZrO_2 glasses	218
56.	Determination of Efficient Location of Split Air Conditioner using CFD	221

57.	Frictionless Electromagnetic Braking System	225
58.	Performance Evaluation of Vegetable oils as Cutting fluid under MQL Condition in Turning	228
59.	A novel hybrid Fuzzy AHP and VIKOR methodology for Reclaimer Selection in GSCM	236
60.	Design of Eco-Friendly Road Cleaner	240
61.	Mechanical and Microstructural Characterization of Jute Hybrid Composite with Alkali Treatment	244
62.	Experimental Investigation and Optimization of Process Parameters in Wire Cut EDM of EN31 Steel	248
63.	Design and Analysis of Differential Gear Box	252

***

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

CHS 2021

 ISBN: 978-93-91420-02-4

A study on microstructure and mechanical Properties A7075 Reinforced with Fly ash/Sic hybrid metal matrix composite

Devarapalli Raviteja[1], I Veeranjaneyulu[2], V.Venkata.Kamesh[3]and Sekhar chinthamreddy[4]
[1,2,3] Department of Mechanical Engineering (A), Aditya Engineering College (A), Surampalem, India
[4]*Department of Mechanical Engineering (A), Narasaraopeta Engineering College (Autonomous), Narasaraopet*, India

***Abstract*—An experiments have been performed under laboratory condition to study the mechanical behavior and microstructure of the hybrid composite with aluminium matrix A7075 alloy, reinforced with silicon carbide (Sic) and Flyash. The fabricating the samples has been done by using stir casting technique. Scanning electron microscopy (SEM) was used for microstructure analysis. Mechanical properties were carried out on both the base alloy and composite. Enhanced hardness was observed for the composite. Interestingly improved tensile results were obtained for the composite than alloy. The hardness of the composite is increased due to dispersion of (Sic) and Flyash particles in aluminium matrix.**

Keywords -- A7075 alloy, (Sic) and Fly ash, (SEM) Scanning electron microscopy, (XRD) X-ray diffraction.

Nomenclature

ρ_{MMC} = density of composite
m= mass of the composite
m_1= mass of the composite in distilled water
ρ_{H2O}= density of distilled water
Vr = weight ratio of reinforcement
ρ_r = density of reinforcement
ρ_c = density of composite
ρ_m is the density of the unreinforced alloy

I. INTRODUCTION

Composites have wide variety of application in aerospace, defense and it in automotive industries because of its unique properties such as high specific strength, wear resistance, strength-to-weight, strength-to-cost, etc. (1). By introduce hard ceramic particulates like SiC, Al_2O_3 and B_4C into aluminium based matrix, results in to enhanced the various properties. From the literature study reveals that among the reinforcements SiC is chemically compatible with aluminium and forms an adequate bond with the matrix without developing inter- metallic phase and has other advantages such as excellent thermal conductivity, good workability and low cost (2). In order to attain high strength to low weight ratios in materials the usage of Aluminium metal matrix composites (AMMCs) are used very extensively which can be used for sophisticated aerospace and automobile structures because of their properties which can be customized in the course of the accumulation of preferred reinforcements . Al_2O_3 is one of the widely used second reinforcement. But it has its own demerits like poor wetting behavior with aluminium and more weight percentage leads to increase in porosity (3). They share a good fraction in automobile and aerospace applications (4-6). Among these particles reinforced metal matrix composites have found unique interest due to their elevated specific stiffness and specific strength at normal or elevated temperature. Normally micron sized ceramic particles are used as reinforcement to improve the properties of the MMCs.

Due to their high heat resistant properties, ceramic particles are mainly used as reinforcements. Out of various ceramics used fly ash is one of the economic as well as low density reinforcement which is available in plenty as waste derivative during incineration of charcoal at thermal power plants. Ibrahim et al. (7) in his review observed that the properties of material obtained by means of metal matrix. A composites with varying reinforcement percentage up to 20% in increment of five, by considering dissimilar alloys A6061, A2014, and A356. It is concluded that by rising reinforcement percentage the tensile properties like yield, and ultimate strengths has been increased whereas the elongation of alloy found to be decreased. Lloyd et al. (8) W.H et al. (9) and D Silva et al. (10), particle induced damage in MMCs has been studied, with Metal matrix composites with a size superior to 10 μm. The cracking of particles has been observed which indicate the dominant damage mechanism. Accordingly properties of metal matrix composites will depend on the particulate size. An attempt has been made to fabricate $Al/TiB_2/Al_2O_3$ composite in our previous work. In this present work an attempt has been made to introduce SiC an outstanding reinforcement among all the other reinforcements.

This present work analyses the various mechanical properties on both base alloy and hybrid composite.

II. EXPERIMENTAL

A. Fabrication of composites

Aluminium based hybrid MMC having Sic and Fly ash particles of 53μm and 3% weight was fabricated by eddy process. A7075 was used as base material and chemical composition is shown in table1.

TABLE I. Elemental analysis of A 7075 alloy by wt. %.

Elemental analysis of A 7075 alloy by wt. %.										
Zn	Cu	Mg	Si	Cr	Mn	Fe	Pb	Sn	Ti	Al
5.1	1.2	2.1	0.4	0.18	0.3	0.5	0.029	0.012	0.2	balance

Fig. 1 Stir casting

NEC NARASARAOPETA ENGINEERING COLLEGE (AUTONOMOUS)

NAAC 'A' GRADE | NATIONAL BOARD OF ACCREDITATION

PROCEEDINGS

INTERNATIONAL CONFERENCE

EMERGING TRENDS IN MECHANICAL ENGINEERING AND INDUSTRIAL AUTOMATION

NEC-ICETMEIA-2K21

30th & 31st July, 2021

Editors-in-Chief

Dr. M.Sreenivasa Kumar
Principal & Professor, Dept. of Mechnical Engineering

Dr. D.Jagadish
Professor, Dept. of Mechnical Engineering

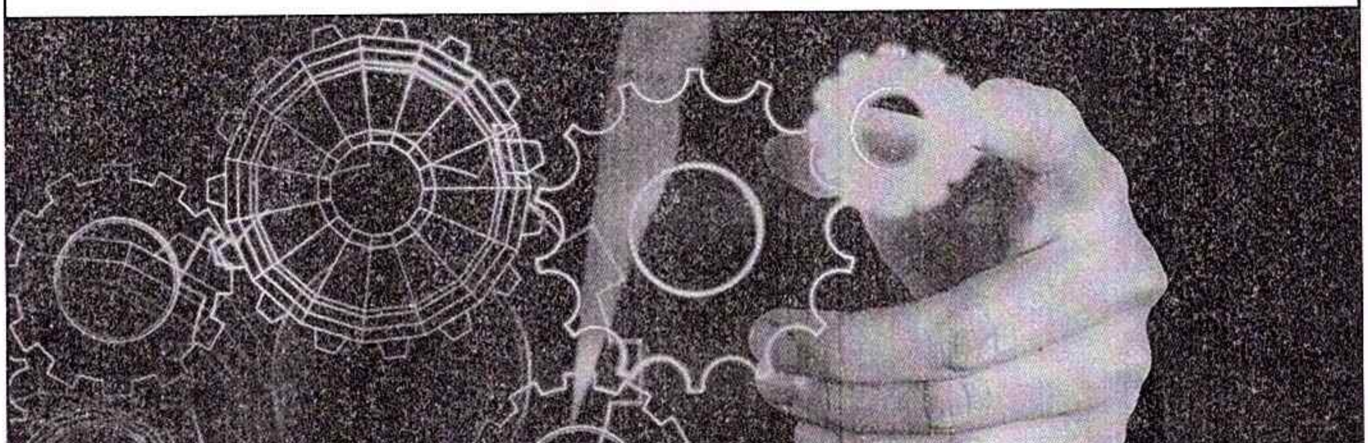
Editors

Dr. D.Suneel
Vice-Principal & Professor, Dept. of ME

Dr. P.Suresh Babu
Professor, Dept. of ME

Dr. B.Venkata Siva
Professor & HoD Dept. of ME

Mr. M.Venkanna Babu
Associate Professor, Dept. of ME



Organized by

Department of Mechanical Engineering

In Association with The Institution of Engineers (India)

ISBN : 978-93-91420-02-4

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

LIST OF FULL LENGTH PAPERS SELECTED FOR PROCEEDINGS

International Conference on Emerging Trends in Mechanical Engineering and Industrial Automation

NEC-ICETMEIA- 2K21

S.No.	TITLE OF THE PAPER	Page No.
1.	Effectiveness of Compression Ignition Engine Fuelled with Pond Water Algae Biodiesel	01
2.	Design And Analysis of Disc Brake of an Electric Go-Kart	04
3.	A Comprehensive Review on Recent Research on Semi Solid Processed Aluminum 7 Series Alloys	08
4.	A Study on Microstructure and Mechanical Properties A7075 Reinforced with Flyash/Sic Hybrid Metal Matrix Composite	15
5.	Establishment of SCR Test Facility and Evaluation of 8mm Pitch Honeycomb Type Catalyst in a 20 Liter capacity SCR Test facility	19
6.	A Review on NVH Issues and Technological Challenges in Electric Vehicle and Hybrid Electric Vehicle Power Train	25
7.	Design and Analysis of Cantilever Beam	29
8.	Analysis of Static and Fatigue Strength of Aluminium Alloy Wheel	32
9.	Design of Automated Braking System Based on Vehicle Over Speed Using PLC Ladder Method	35
10.	The Analysis on Concentric Pipe Heat Exchanger	39
11.	Design and Finite Element Analysis of Gas Turbine Blade	45
12.	Investigation on Mechanical Properties of Glass Fiber and Carbon Nano Tubes Sandwich Composite Material	47
13.	CFD Analysis of Super Utility Vehicle to Determine Aerodynamic Behavior	54
14.	Devlopment of Code for Automated HVAC System using Digital Controller	60
15.	Performance and Emission Characteristics Of Diesel Engine with Linseed Oil-Diesel Blends as Fuel With VCR	65
16.	Experimental Investigation in Single Cylinder VCR Multifuel Engine Using Bio-Diesel as Linseed Oil	69

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

17.	Tribological Properties of Textured Surface	72
18.	Thermal Analysis and Experimental Investigation of Pin Fin made of Brass	76
19.	Experimental and Simulation of Wear Test on GPR material	79
20.	CFD Analysis of Two Pass Double Pipe Heat Exchanger with TiO_2/Ethylene Glycol Nano Fluid	83
21.	Simulation and Optimization of Extrusion Process Parameters of Aluminium 2A12T4Alloy	87
22.	Importance of Ice Jet machining - A Review	91
23.	Performance Investigation of a Battery Powered Peltier Cooler	94
24.	Analysis of Disc Brake Rotor using ANSYS Workbench	98
25.	Modelling and Optimization of Two Wheeler Disk Brake Using ANSYS -Review	101
26.	Fabrication of Sewage Waste Cleaner	105
27.	Manufacturing of Hyperboliodal Gear Model Using Ultimaker S5 3D Printing Machine	109
28.	Arc Welding Process Selection Through Quality and Cost Analysis	113
29.	Li-Br H2O VAR System Analysis by Applying Magnetic Field to Liquid Line	117
30.	Heat Transfer Enhancement on Shell and Coil Type of Heat Exchanger Using SiO_2 and CuO Nano-Fluids	121
31.	Study of Rheological Characteristics of Nano Suspensions	126
32.	Design And Fabrication of Loop Wheel System	129
33.	Performance of Solar Vapour Absorption system and its Dependence on Generator Temperature	131
34.	Design and Analysis Of Handicapped Steering Tricycle	134
35.	Machining Characteristics and Microbiological Growth of Stir Casted A356-SiC MMCs and Pure Metals	136
36.	Design and Analysis of Connecting Rod	141

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

37.	Pressure Vessel Optimum Design using Particle Swarm Optimization	145
38.	Design and Analysis of Wheel Rim on Radial Loads	149
39.	COP Enhancement of VCR System using Diffusers	154
40.	Design and Fabrication of Radiant Cooling System	157
41.	Comparative Performance Analysis of Engine Fuelled with Diesel Biodiesel Iron Oxide Nano Particles	162
42.	Performance analysis of a CI Engine fuelled with olive oil and soybean oil mixture as a biofuels	166
43.	Design and Analysis of Landing Gear	170
44.	A Review on Parameters of Composite Materials	173
45.	Optimisation in WEDM of HCHCR Steel using Taughi Method	177
46.	Automated Pneumatic Sheet Metal Cutting Machine	184
47.	Cylindrical Panel's Numerical And Analytical Investigations Subjected To Different Loads	187
48.	Application of a Thermoplastic Polyurethane/Polylactic Acid Composite Filament For 3D-Printed Personalized Orthosis	192
49.	Design and Analysis of a Connecting Rod	196
50.	A Study and Synthesis of 8 Bar One Degree of Freedom Walking Mechanism	200
51.	Mechanical properties and machining of Al-7075 SiC Composite	204
52.	Characterization of Tungsten carbide reinforced Al7075 matrix Composites.	208
53.	3D Printing of Prototype Through Image Processing using Autodesk Recap Photo Software	212
54.	Fabrication and Testing Mechanical Behaviour of Hemp Fibre, Chopped E Glass and Hybrid with Nano Particle	216
55.	Optical characterization of V_2O_5 doped Na_2O-SiO_2-ZrO_2 glasses	218
56.	Determination of Efficient Location of Split Air Conditioner using CFD	221

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

57.	Frictionless Electromagnetic Braking System	225
58.	Performance Evaluation of Vegetable oils as Cutting fluid under MQL Condition in Turning	228
59.	A novel hybrid Fuzzy AHP and VIKOR methodology for Reclaimer Selection in GSCM	236
60.	Design of Eco-Friendly Road Cleaner	240
61.	Mechanical and Microstructural Characterization of Jute Hybrid Composite with Alkali Treatment	244
62.	Experimental Investigation and Optimization of Process Parameters in Wire Cut EDM of EN31 Steel	248
63.	Design and Analysis of Differential Gear Box	252

***

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

Proceedings of NEC-ICETMEIA- 2K21

ISBN: 978-93-91420-02-4

Experimental Investigation in Single Cylinder VCR Multifuel Engine Using Bio-Diesel as Linseed Oil

[1]Donepudi Jagadish, [2]M.Venkaiah, [3]Ch. Shekar and [4]Jyothu Naik
[1,2,3]Department of Mechanical Engineering, Narasaraopeta Engineering College (A), Narasaraopet, India.
[4]Department of Mechanical Engineering, Rayalaseema University College of Engineering, Kurnool, A.P. India

***Abstract*— The linseed oil is characterized for engine performance, combustion and emission analysis at various compression ratios (CR-14, 16, and 18) and fuel blends (B9, B18, B27, B36%, and Diesel). The brake thermal efficiency (BTHE) at CR18 is higher at full load condition for all blend ratios that may be due to lower brake specific fuel consumption (BSFC) and complete combustion of mixture with excess oxygen in the biodiesel. The BSFC is decreased on increasing brake power (BP) and CR. The exhaust gas temperature is decreased (3%) on increase in CR from 14 to 18. The cylinder peak pressures and net heat release rate are lower than that of diesel because of lower heating value. The hydro carbon (HC), carbon monoxide (CO), and carbon dioxide (CO2) emissions decreases while increasing the compression ratio, however, nitrogen oxide (NOx) emission is increased with CR for all fuel blends and these properties were progressively lower for higher concentration of biodiesel. Overall engine performance is optimum at CR of 18 for B18 fuel blend.**

Keywords*— *VCR Engine, Multi Fuel, Fuel Efficiency.

I. INTRODUCTION

A VCR engine has been widely tested these days to bring out the best fuel efficiency and also to minimize the pollutants[1-2]. Various tests have been made these days by the researchers using this VCR engines to bring out the comparison results using petrol or diesel. This works investigates on a single cylinder multi fuel VCR Engine at 2 compression ratios 16:1 and 18:1 respectively. Petrol engines have the tendency to limit the max pressure during a compression stroke which would result in detonation rather than burning, and hence to achieve this max

Power output along with its same speed, more amount of fuel is to be burnt. This would result in the requirement of more amount of air for burning the fuel[3-7]. This brings in the use of the turbochargers and superchargers for increasing the pressure at the inlet. This would result in decrease in the compression ratio of the detonation in the fuel or air mixture i.e. the volume above the piston is made greater. This can be done to a greater or lesser extent with a very massive increase in power being possible.

Variable Compression Ratio is becoming very much desirable as the oil cost increase and car owners have an interest in fuel economy[12]. In addition to this, the Global Climate Warming may require some measures from the international community. In this Automobile industry, it has stricter limits in the case of car emissions, especially the emission of carbon di oxide. VCR is one cost effective way of to achieve these targets of pollutants. In addition, VCR permits the use of blended diesel with ethanol[8-11]. The cylinder head of an VCR engine is varied by the hydraulic system that is connected to the crank shaft and it could also provide some potential in order to control the temperature of the emitted exhaust gas, contributing to protecting component temperatures. A VCR Engine's efficiency and its performance can be continuously varied by the compression ratio by changing the combustion chamber volume..

• MATERIALS AND METHODOLOGY

The VCR engine which is capable of varying the compression ratio has been used to test the performance of diesel at two compression ratios (16:1 and 18:1). This test is then compared with one another to obtain the best performance results. Compression Ratio can be changed in a number of ways:

- Changing the piston head design.
- Changing the stroke length of the cylinder
- Changing cylinder diameter
- Changing the air fuel ratio.

Table 1 Engine Specification

Parameter	Specification
Compression Ratio	Variable from 5:1 to 20:1
No of Cylinder	Single Cylinder
Cooling	Water Cooling
Spark Timing	Variable from 0 to 70 Deg.
Fuel	Petrol / Diesel
Speed	1400 to 1500 RPM
Lubrication	Forced
Ignition Type	Spark Ignition or Compression Ignition

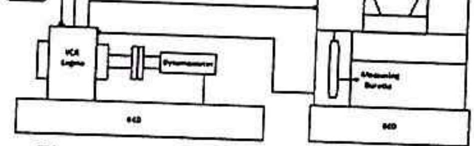


Figure 1 Set up of the VCR Engine

NEC NARASARAOPETA ENGINEERING COLLEGE

(AUTONOMOUS)

NAAC 'A' GRADE

NATIONAL BOARD OF ACCREDITATION

PROCEEDINGS

INTERNATIONAL CONFERENCE

EMERGING TRENDS IN MECHANICAL ENGINEERING AND INDUSTRIAL AUTOMATION

NEC-ICETMEIA-2K21

30th & 31st July, 2021

Editors-in-Chief

Dr. M.Sreenivasa Kumar
Principal & Professor, Dept. of Mechnical Engineering

Dr. D.Jagadish
Professor, Dept. of Mechnical Engineering

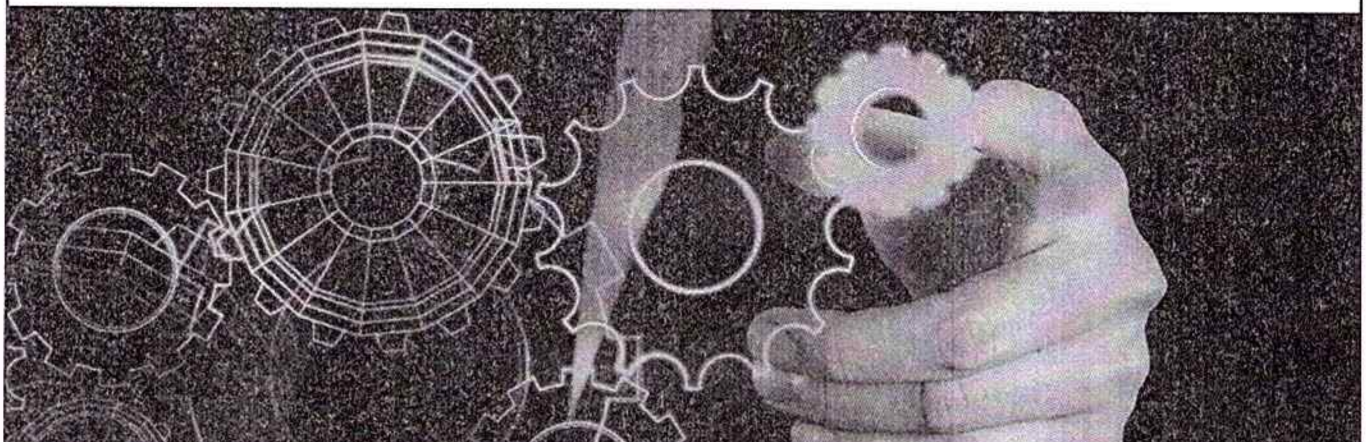
Editors

Dr. D.Suneel
Vice-Principal & Professor, Dept. of ME

Dr. P.Suresh Babu
Professor, Dept. of ME

Dr. B.Venkata Siva
Professor & HoD Dept. of ME

Mr. M.Venkanna Babu
Associate Professor, Dept. of ME



Organized by

Department of **Mechanical Engineering**

In Association with *The Institution of Engineers (India)*

ISBN : 978-93-91420-02-4

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

LIST OF FULL LENGTH PAPERS SELECTED FOR PROCEEDINGS

International Conference on Emerging Trends in Mechanical Engineering and Industrial Automation

NEC-ICETMEIA- 2K21

S.No.	TITLE OF THE PAPER	Page No.
1.	Effectiveness of Compression Ignition Engine Fuelled with Pond Water Algae Biodiesel	01
2.	Design And Analysis of Disc Brake of an Electric Go-Kart	04
3.	A Comprehensive Review on Recent Research on Semi Solid Processed Aluminum 7 Series Alloys	08
4.	A Study on Microstructure and Mechanical Properties A7075 Reinforced with Flyash/Sic Hybrid Metal Matrix Composite	15
5.	Establishment of SCR Test Facility and Evaluation of 8mm Pitch Honeycomb Type Catalyst in a 20 Liter capacity SCR Test facility	19
6.	A Review on NVH Issues and Technological Challenges in Electric Vehicle and Hybrid Electric Vehicle Power Train	25
7.	Design and Analysis of Cantilever Beam	29
8.	Analysis of Static and Fatigue Strength of Aluminium Alloy Wheel	32
9.	Design of Automated Braking System Based on Vehicle Over Speed Using PLC Ladder Method	35
10.	The Analysis on Concentric Pipe Heat Exchanger	39
11.	Design and Finite Element Analysis of Gas Turbine Blade	45
12.	Investigation on Mechanical Properties of Glass Fiber and Carbon Nano Tubes Sandwich Composite Material	47
13.	CFD Analysis of Super Utility Vehicle to Determine Aerodynamic Behavior	54
14.	Devlopment of Code for Automated HVAC System using Digital Controller	60
15.	Performance and Emission Characteristics Of Diesel Engine with Linseed Oil-Diesel Blends as Fuel With VCR	65
16.	Experimental Investigation in Single Cylinder VCR Multifuel Engine Using Bio-Diesel as Linseed Oil	69

17.	Tribological Properties of Textured Surface	72
18.	Thermal Analysis and Experimental Investigation of Pin Fin made of Brass	76
19.	Experimental and Simulation of Wear Test on GPR material	79
20.	CFD Analysis of Two Pass Double Pipe Heat Exchanger with TiO_2/Ethylene Glycol Nano Fluid	83
21.	Simulation and Optimization of Extrusion Process Parameters of Aluminium 2A12T4Alloy	87
22.	Importance of Ice Jet machining - A Review	91
23.	Performance Investigation of a Battery Powered Peltier Cooler	94
24.	Analysis of Disc Brake Rotor using ANSYS Workbench	98
25.	Modelling and Optimization of Two Wheeler Disk Brake Using ANSYS -Review	101
26.	Fabrication of Sewage Waste Cleaner	105
27.	Manufacturing of Hyperboliodal Gear Model Using Ultimaker S5 3D Printing Machine	109
28.	Arc Welding Process Selection Through Quality and Cost Analysis	113
29.	Li-Br H2O VAR System Analysis by Applying Magnetic Field to Liquid Line	117
30.	Heat Transfer Enhancement on Shell and Coil Type of Heat Exchanger Using SiO_2 and CuO Nano-Fluids	121
31.	Study of Rheological Characteristics of Nano Suspensions	126
32.	Design And Fabrication of Loop Wheel System	129
33.	Performance of Solar Vapour Absorption system and its Dependence on Generator Temperature	131
34.	Design and Analysis Of Handicapped Steering Tricycle	134
35.	Machining Characteristics and Microbiological Growth of Stir Casted A356-SiC MMCs and Pure Metals	136
36.	Design and Analysis of Connecting Rod	141

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

37.	Pressure Vessel Optimum Design using Particle Swarm Optimization	145
38.	Design and Analysis of Wheel Rim on Radial Loads	149
39.	COP Enhancement of VCR System using Diffusers	154
40.	Design and Fabrication of Radiant Cooling System	157
41.	Comparative Performance Analysis of Engine Fuelled with Diesel Biodiesel Iron Oxide Nano Particles	162
42.	Performance analysis of a CI Engine fuelled with olive oil and soybean oil mixture as a biofuels	166
43.	Design and Analysis of Landing Gear	170
44.	A Review on Parameters of Composite Materials	173
45.	Optimisation in WEDM of HCHCR Steel using Taughi Method	177
46.	Automated Pneumatic Sheet Metal Cutting Machine	184
47.	Cylindrical Panel`s Numerical And Analytical Investigations Subjected To Different Loads	187
48.	Application of a Thermoplastic Polyurethane/Polylactic Acid Composite Filament For 3D-Printed Personalized Orthosis	192
49.	Design and Analysis of a Connecting Rod	196
50.	A Study and Synthesis of 8 Bar One Degree of Freedom Walking Mechanism	200
51.	Mechanical properties and machining of Al-7075 SiC Composite	204
52.	Characterization of Tungsten carbide reinforced Al7075 matrix Composites.	208
53.	3D Printing of Prototype Through Image Processing using Autodesk Recap Photo Software	212
54.	Fabrication and Testing Mechanical Behaviour of Hemp Fibre, Chopped E Glass and Hybrid with Nano Particle	216
55.	Optical characterization of V_2O_5 doped Na_2O-SiO_2-ZrO_2 glasses	218
56.	Determination of Efficient Location of Split Air Conditioner using CFD	221

57.	Frictionless Electromagnetic Braking System	225
58.	Performance Evaluation of Vegetable oils as Cutting fluid under MQL Condition in Turning	228
59.	A novel hybrid Fuzzy AHP and VIKOR methodology for Reclaimer Selection in GSCM	236
60.	Design of Eco-Friendly Road Cleaner	240
61.	Mechanical and Microstructural Characterization of Jute Hybrid Composite with Alkali Treatment	244
62.	Experimental Investigation and Optimization of Process Parameters in Wire Cut EDM of EN31 Steel	248
63.	Design and Analysis of Differential Gear Box	252

***

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

MV 2021

ISBN: 978-93-91420-02-4

Devlopment of Code for Automated HVAC System using Digital Controller

Venkaiah Mandula
Department of Mechanical Engineering, Narasaraopeta Engineering College (AUTONUMOUS), Narasaraopet, A.P.

Abstract—the present work is intended to develop a code to automate the HVAC System. To achieve that, advanced industrial controller (PLC) software called WPL soft is used, which is the most widely used tool in industries. This software requires a dedicated programming language called Ladder diagram. By using WPL soft, a program in Ladder diagram is developed to automate the HVAC system, also this program will take care the different requirements of industries such as controlling temperature, selection of proper compressor based on the requirement.

Keywords—HVAC, Ladder diagram, PLC.

I.INTRODUCTION TO HVAC

Heating, Ventilating and Air Conditioning, HVAC, is a huge field. HVAC systems include a range from the simplest hand-stoked **stove**, used for comfort heating, to the extremely reliable total air-conditioning systems found in submarines and space shuttles. Cooling equipment varies from the small domestic unit to refrigeration machines that are 10,000 times the size, which is used in industrial processes

Depending on the complexity of the requirements, the HVAC designer must consider many more issues than simply keeping temperatures comfortable. This chapter will introduce **you** to the fundamental concepts that are used by designers to make decisions about system design, operation, and maintenance.

II.HVAC OBJECTIVE & ITS COMPONENTS

A. *Objective of HVAC*

Before starting to design a system, it is critical that you know what your system is to achieve. Often, the objective is to provide a comfortable environment for the human occupants, but there are many other possible objectives: creating a suitable environment for farm animals; regulating a hospital operating room; maintaining cold temperatures for frozen food storage; or maintaining temperature and humidity to preserve wood and fibre works of art.

Whatever the situation, it is important that the objective criteria for system success are clearly identified at the start of the project, because different requirements need different design considerations.

B.Components of HVAC

The components of HVAC system are shown in below figure:

1.Air Conditioner Equipment

Evaporator Coil: In a system with a furnace, the evaporator coils sit on top of the furnace and is the critical component that cools the air inside a home. The furnace blower passes air across the evaporator coil. During this process, the air cools as it comes in contact With the cold coil and heat transfers from the air to the refrigerant.

Condenser Coil: This part of the air conditioning system **cools** (removes heat) from refrigerant and is located in the outdoor condenser unit.

Compressor: A machine used to supply air or other **gas** at increased pressure, located in the outdoor condenser unit.

Fan: A mechanical device that creates a current of air.

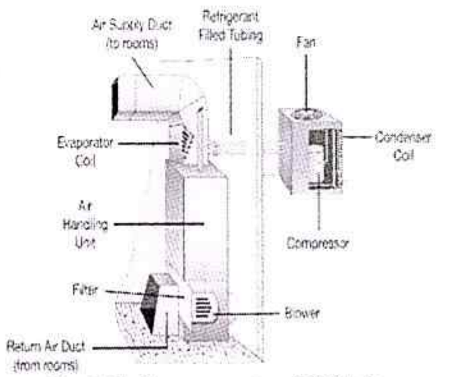


Fig: II.I Components of HVAC

Refrigerant Filled Tubing: Circulates refrigerant **between** outdoor condenser unit and indoor evaporator coil

Gas Forced Air Furnace **Equipment**

Return Air Duct: A duct carrying air from a conditioned space to the mixing air duct or plenum unit.

Filter: A porous device for removing impurities or solid particles from the air that passes through it.

Blower: a mechanical device that creates a current of air. See the fan also.

Air Handling Unit (AHU): a device used to **condition** and circulate air as part of a heating, ventilating, and air-conditioning (HVAC) system. An air handler is usually a large metal box containing a blower, heating or cooling elements, filter racks or chambers, sound attenuators, and dampers. Air handlers usually connect to a ductwork ventilation system that distributes the conditioned air through the building and return it to the AHU.

Air Supply Duct: A **duct** that carries conditioned air from air supply units to room diffusers or grilles.

NEC NARASARAOPETA ENGINEERING COLLEGE (AUTONOMOUS)

NAAC NATIONAL ASSESSMENT AND ACCREDITATION COUNCIL 'A' GRADE

NATIONAL BOARD OF ACCREDITATION

PROCEEDINGS

INTERNATIONAL CONFERENCE

EMERGING TRENDS IN MECHANICAL ENGINEERING AND INDUSTRIAL AUTOMATION

NEC-ICETMEIA-2K21

30th & 31st July, 2021

Editors-in-Chief

Dr. M.Sreenivasa Kumar
Principal & Professor, Dept. of Mechnical Engineering

Dr. D.Jagadish
Professor, Dept. of Mechnical Engineering

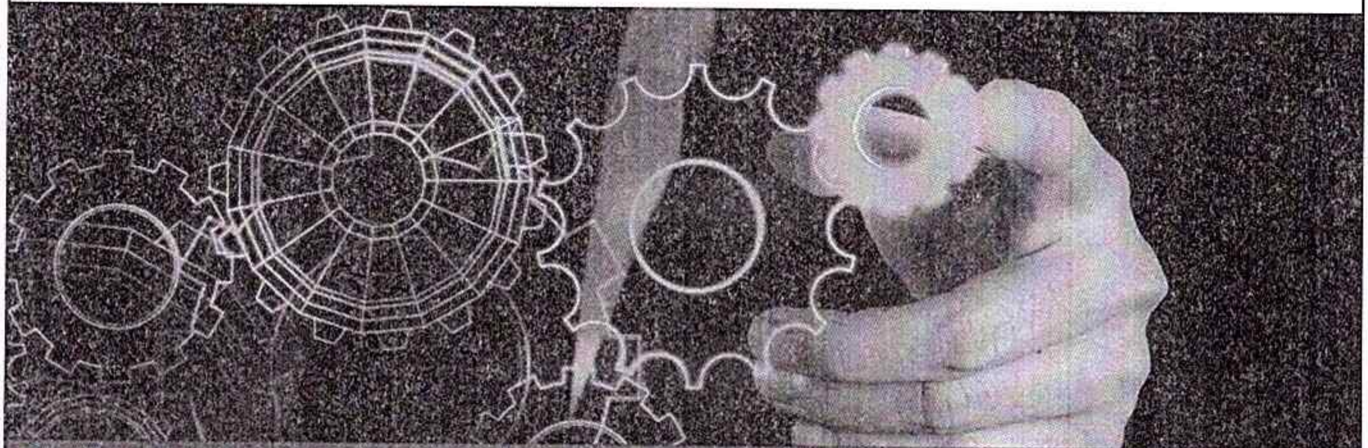
Editors

Dr. D.Suneel
Vice-Principal & Professor, Dept. of ME

Dr. P.Suresh Babu
Professor, Dept. of ME

Dr. B.Venkata Siva
Professor & HoD Dept. of ME

Mr. M.Venkanna Babu
Associate Professor, Dept. of ME



Organized by

Department of **Mechanical Engineering**

In Association with *The Institution of Engineers (India)*

ISBN : 978-93-91420-02-4

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

LIST OF FULL LENGTH PAPERS SELECTED FOR PROCEEDINGS

International Conference on Emerging Trends in Mechanical Engineering and Industrial Automation

NEC-ICETMEIA- 2K21

S.No.	TITLE OF THE PAPER	Page No.
1.	Effectiveness of Compression Ignition Engine Fuelled with Pond Water Algae Biodiesel	01
2.	Design And Analysis of Disc Brake of an Electric Go-Kart	04
3.	A Comprehensive Review on Recent Research on Semi Solid Processed Aluminum 7 Series Alloys	08
4.	A Study on Microstructure and Mechanical Properties A7075 Reinforced with Flyash/Sic Hybrid Metal Matrix Composite	15
5.	Establishment of SCR Test Facility and Evaluation of 8mm Pitch Honeycomb Type Catalyst in a 20 Liter capacity SCR Test facility	19
6.	A Review on NVH Issues and Technological Challenges in Electric Vehicle and Hybrid Electric Vehicle Power Train	25
7.	Design and Analysis of Cantilever Beam	29
8.	Analysis of Static and Fatigue Strength of Aluminium Alloy Wheel	32
9.	Design of Automated Braking System Based on Vehicle Over Speed Using PLC Ladder Method	35
10.	The Analysis on Concentric Pipe Heat Exchanger	39
11.	Design and Finite Element Analysis of Gas Turbine Blade	45
12.	Investigation on Mechanical Properties of Glass Fiber and Carbon Nano Tubes Sandwich Composite Material	47
13.	CFD Analysis of Super Utility Vehicle to Determine Aerodynamic Behavior	54
14.	Devlopment of Code for Automated HVAC System using Digital Controller	60
15.	Performance and Emission Characteristics Of Diesel Engine with Linseed Oil-Diesel Blends as Fuel With VCR	65
16.	Experimental Investigation in Single Cylinder VCR Multifuel Engine Using Bio-Diesel as Linseed Oil	69

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

17.	Tribological Properties of Textured Surface	72
18.	Thermal Analysis and Experimental Investigation of Pin Fin made of Brass	76
19.	Experimental and Simulation of Wear Test on GPR material	79
20.	CFD Analysis of Two Pass Double Pipe Heat Exchanger with TiO_2/Ethylene Glycol Nano Fluid	83
21.	Simulation and Optimization of Extrusion Process Parameters of Aluminium 2A12T4Alloy	87
22.	Importance of Ice Jet machining - A Review	91
23.	Performance Investigation of a Battery Powered Peltier Cooler	94
24.	Analysis of Disc Brake Rotor using ANSYS Workbench	98
25.	Modelling and Optimization of Two Wheeler Disk Brake Using ANSYS -Review	101
26.	Fabrication of Sewage Waste Cleaner	105
27.	Manufacturing of Hyperboliodal Gear Model Using Ultimaker S5 3D Printing Machine	109
28.	Arc Welding Process Selection Through Quality and Cost Analysis	113
29.	Li-Br H2O VAR System Analysis by Applying Magnetic Field to Liquid Line	117
30.	Heat Transfer Enhancement on Shell and Coil Type of Heat Exchanger Using SiO_2 and CuO Nano-Fluids	121
31.	Study of Rheological Characteristics of Nano Suspensions	126
32.	Design And Fabrication of Loop Wheel System	129
33.	Performance of Solar Vapour Absorption system and its Dependence on Generator Temperature	131
34.	Design and Analysis Of Handicapped Steering Tricycle	134
35.	Machining Characteristics and Microbiological Growth of Stir Casted A356-SiC MMCs and Pure Metals	136
36.	Design and Analysis of Connecting Rod	141

37.	Pressure Vessel Optimum Design using Particle Swarm Optimization	145
38.	Design and Analysis of Wheel Rim on Radial Loads	149
39.	COP Enhancement of VCR System using Diffusers	154
40.	Design and Fabrication of Radiant Cooling System	157
41.	Comparative Performance Analysis of Engine Fuelled with Diesel Biodiesel Iron Oxide Nano Particles	162
42.	Performance analysis of a CI Engine fuelled with olive oil and soybean oil mixture as a biofuels	166
43.	Design and Analysis of Landing Gear	170
44.	A Review on Parameters of Composite Materials	173
45.	Optimisation in WEDM of HCHCR Steel using Taughi Method	177
46.	Automated Pneumatic Sheet Metal Cutting Machine	184
47.	Cylindrical Panel's Numerical And Analytical Investigations Subjected To Different Loads	187
48.	Application of a Thermoplastic Polyurethane/Polylactic Acid Composite Filament For 3D-Printed Personalized Orthosis	192
49.	Design and Analysis of a Connecting Rod	196
50.	A Study and Synthesis of 8 Bar One Degree of Freedom Walking Mechanism	200
51.	Mechanical properties and machining of Al-7075 SiC Composite	204
52.	Characterization of Tungsten carbide reinforced Al7075 matrix Composites.	208
53.	3D Printing of Prototype Through Image Processing using Autodesk Recap Photo Software	212
54.	Fabrication and Testing Mechanical Behaviour of Hemp Fibre, Chopped E Glass and Hybrid with Nano Particle	216
55.	Optical characterization of V_2O_5 doped Na_2O-SiO_2-ZrO_2 glasses	218
56.	Determination of Efficient Location of Split Air Conditioner using CFD	221

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

57.	Frictionless Electromagnetic Braking System	225
58.	Performance Evaluation of Vegetable oils as Cutting fluid under MQL Condition in Turning	228
59.	A novel hybrid Fuzzy AHP and VIKOR methodology for Reclaimer Selection in GSCM	236
60.	Design of Eco-Friendly Road Cleaner	240
61.	Mechanical and Microstructural Characterization of Jute Hybrid Composite with Alkali Treatment	244
62.	Experimental Investigation and Optimization of Process Parameters in Wire Cut EDM of EN31 Steel	248
63.	Design and Analysis of Differential Gear Box	252

***

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

MV 2021

ISBN: 978-93-91420-02-4

Experimental Investigation in Single Cylinder VCR Multifuel Engine Using Bio-Diesel as Linseed Oil

[1]Donepudi Jagadish, [2]M.Venkaiah, [3]Ch. Shekar and [4]Jyothu Naik
[1,2,3]Department of Mechanical Engineering, Narasaraopeta Engineering College (A), Narasaraopet, India.
[4]Department of Mechanical Engineering, Rayalaseema University College of Engineering, Kurnool, A.P. India

Abstract— **The linseed oil is characterized for engine performance, combustion and emission analysis at various compression ratios (CR-14, 16, and 18) and fuel blends (B9, B18, B27, B36%, and Diesel). The brake thermal efficiency (BTHE) at CR18 is higher at full load condition for all blend ratios that may be due to lower brake specific fuel consumption (BSFC) and complete combustion of mixture with excess oxygen in the biodiesel. The BSFC is decreased on increasing brake power (BP) and CR. The exhaust gas temperature is decreased (3%) on increase in CR from 14 to 18. The cylinder peak pressures and net heat release rate are lower than that of diesel because of lower heating value. The hydro carbon (HC), carbon monoxide (CO), and carbon dioxide (CO2) emissions decreases while increasing the compression ratio, however, nitrogen oxide (NOx) emission is increased with CR for all fuel blends and these properties were progressively lower for higher concentration of biodiesel. Overall engine performance is optimum at CR of 18 for B18 fuel blend.**

Keywords— VCR Engine, Multi Fuel, Fuel Efficiency.

I. INTRODUCTION

A VCR engine has been widely tested these days to bring out the best fuel efficiency and also to minimize the pollutants[1-2]. Various tests have been made these days by the researchers using this VCR engines to bring out the comparison results using petrol or diesel. This works investigates on a single cylinder multi fuel VCR Engine at 2 compression ratios 16:1 and 18:1 respectively. Petrol engines have the tendency to limit the max pressure during a compression stroke which would result in detonation rather than burning, and hence to achieve this max

Power output along with its same speed, more amount of fuel is to be burnt. This would result in the requirement of more amount of air for burning the fuel[3-7]. This brings in the use of the turbochargers and superchargers for increasing the pressure at the inlet. This would result in decrease in the compression ratio of the detonation in the fuel or air mixture i.e. the volume above the piston is made greater. This can be done to a greater or lesser extent with a very massive increase in power being possible.

Variable Compression Ratio is becoming very much desirable as the oil cost increase and car owners have an interest in fuel economy[12]. In addition to this, the Global Climate Warming may require some measures from the international community. In this Automobile industry, it has stricter limits in the case of car emissions, especially the emission of carbon di oxide. VCR is one cost effective way of to achieve these targets of pollutants. In addition, VCR permits the use of blended diesel with ethanol[8-11]. The cylinder head of an VCR engine is varied by the hydraulic system that is connected to the crank shaft and it could also provide some potential in order to control the temperature of the emitted exhaust gas, contributing to protecting component temperatures. A VCR Engine's efficiency and its performance can be continuously varied by the compression ratio by changing the combustion chamber volume..

• MATERIALS AND METHODOLOGY

The VCR engine which is capable of varying the compression ratio has been used to test the performance of diesel at two compression ratios (16:1 and 18:1). This test is then compared with one another to obtain the best performance results. Compression Ratio can be changed in a number of ways:

- Changing the piston head design.
- Changing the stroke length of the cylinder
- Changing cylinder diameter
- Changing the air fuel ratio.

Table 1 Engine Specification

Parameter	Specification
Compression Ratio	Variable from 5:1 to 20:1
No of Cylinder	Single Cylinder
Cooling	Water Cooling
Spark Timing	Variable from 0 to 70 Deg.
Fuel	Petrol / Diesel
Speed	1400 to 1500 RPM
Lubrication	Forced
Ignition Type	Spark Ignition or Compression Ignition

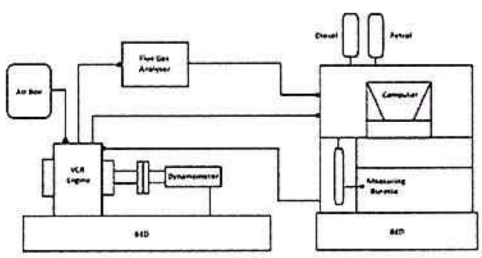


Figure 1 Set up of the VCR Engine

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)

NEC

NAAC 'A' GRADE

NATIONAL BOARD OF ACCREDITATION

RANKED 5

PROCEEDINGS
INTERNATIONAL CONFERENCE

EMERGING TRENDS IN MECHANICAL ENGINEERING AND INDUSTRIAL AUTOMATION

NEC-ICETMEIA-2K21

30th & 31st July, 2021

Editors-in-Chief

Dr. M.Sreenivasa Kumar
Principal & Professor, Dept. of Mechnical Engineering

Dr. D.Jagadish
Professor, Dept. of Mechnical Engineering

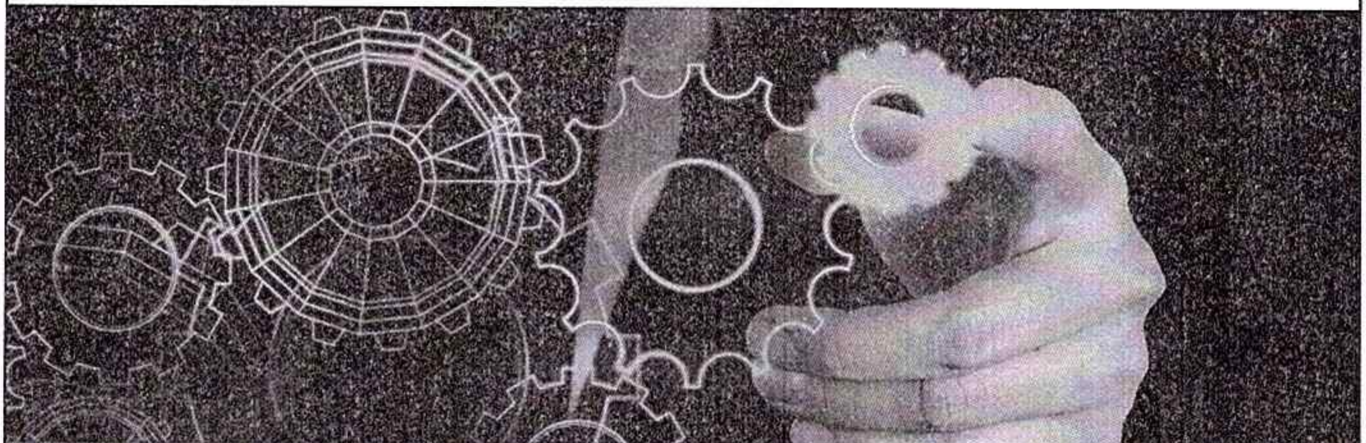
Editors

Dr. D.Suneel
Vice-Principal & Professor, Dept. of ME

Dr. P.Suresh Babu
Professor, Dept. of ME

Dr. B.Venkata Siva
Professor & HoD Dept. of ME

Mr. M.Venkanna Babu
Associate Professor, Dept. of ME



Organized by

Department of **Mechanical Engineering**

In Association with *The Institution of Engineers (India)*

ISBN : 978-93-91420-02-4

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

LIST OF FULL LENGTH PAPERS SELECTED FOR PROCEEDINGS

International Conference on Emerging Trends in Mechanical Engineering and Industrial Automation

NEC-ICETMEIA- 2K21

S.No.	TITLE OF THE PAPER	Page No.
1.	Effectiveness of Compression Ignition Engine Fuelled with Pond Water Algae Biodiesel	01
2.	Design And Analysis of Disc Brake of an Electric Go-Kart	04
3.	A Comprehensive Review on Recent Research on Semi Solid Processed Aluminum 7 Series Alloys	08
4.	A Study on Microstructure and Mechanical Properties A7075 Reinforced with Flyash/Sic Hybrid Metal Matrix Composite	15
5.	Establishment of SCR Test Facility and Evaluation of 8mm Pitch Honeycomb Type Catalyst in a 20 Liter capacity SCR Test facility	19
6.	A Review on NVH Issues and Technological Challenges in Electric Vehicle and Hybrid Electric Vehicle Power Train	25
7.	Design and Analysis of Cantilever Beam	29
8.	Analysis of Static and Fatigue Strength of Aluminium Alloy Wheel	32
9.	Design of Automated Braking System Based on Vehicle Over Speed Using PLC Ladder Method	35
10.	The Analysis on Concentric Pipe Heat Exchanger	39
11.	Design and Finite Element Analysis of Gas Turbine Blade	45
12.	Investigation on Mechanical Properties of Glass Fiber and Carbon Nano Tubes Sandwich Composite Material	47
13.	CFD Analysis of Super Utility Vehicle to Determine Aerodynamic Behavior	54
14.	Devlopment of Code for Automated HVAC System using Digital Controller	60
15.	Performance and Emission Characteristics Of Diesel Engine with Linseed Oil-Diesel Blends as Fuel With VCR	65
16.	Experimental Investigation in Single Cylinder VCR Multifuel Engine Using Bio Diesel as Linseed Oil	69

17.	Tribological Properties of Textured Surface	72
18.	Thermal Analysis and Experimental Investigation of Pin Fin made of Brass	76
19.	Experimental and Simulation of Wear Test on GPR material	79
20.	CFD Analysis of Two Pass Double Pipe Heat Exchanger with TiO_2/Ethylene Glycol Nano Fluid	83
21.	Simulation and Optimization of Extrusion Process Parameters of Aluminium 2A12T4Alloy	87
22.	Importance of Ice Jet machining - A Review	91
23.	Performance Investigation of a Battery Powered Peltier Cooler	94
24.	Analysis of Disc Brake Rotor using ANSYS Workbench	98
25.	Modelling and Optimization of Two Wheeler Disk Brake Using ANSYS -Review	101
26.	Fabrication of Sewage Waste Cleaner	105
27.	Manufacturing of Hyperboliodal Gear Model Using Ultimaker S5 3D Printing Machine	109
28.	Arc Welding Process Selection Through Quality and Cost Analysis	113
29.	Li-Br H2O VAR System Analysis by Applying Magnetic Field to Liquid Line	117
30.	Heat Transfer Enhancement on Shell and Coil Type of Heat Exchanger Using SiO_2 and CuO Nano-Fluids	121
31.	Study of Rheological Characteristics of Nano Suspensions	126
32.	Design And Fabrication of Loop Wheel System	129
33.	Performance of Solar Vapour Absorption system and its Dependence on Generator Temperature	131
34.	Design and Analysis Of Handicapped Steering Tricycle	134
35.	Machining Characteristics and Microbiological Growth of Stir Casted A356-SiC MMCs and Pure Metals	136
36.	Design and Analysis of Connecting Rod	141

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601,
Guntur (Dist.), A.P.

37.	Pressure Vessel Optimum Design using Particle Swarm Optimization	145
38.	Design and Analysis of Wheel Rim on Radial Loads	149
39.	COP Enhancement of VCR System using Diffusers	154
40.	Design and Fabrication of Radiant Cooling System	157
41.	Comparative Performance Analysis of Engine Fuelled with Diesel Biodiesel Iron Oxide Nano Particles	162
42.	Performance analysis of a CI Engine fuelled with olive oil and soybean oil mixture as a biofuels	166
43.	Design and Analysis of Landing Gear	170
44.	A Review on Parameters of Composite Materials	173
45.	Optimisation in WEDM of HCHCR Steel using Taughi Method	177
46.	Automated Pneumatic Sheet Metal Cutting Machine	184
47.	Cylindrical Panel's Numerical And Analytical Investigations Subjected To Different Loads	187
48.	Application of a Thermoplastic Polyurethane/Polylactic Acid Composite Filament For 3D-Printed Personalized Orthosis	192
49.	Design and Analysis of a Connecting Rod	196
50.	A Study and Synthesis of 8 Bar One Degree of Freedom Walking Mechanism	200
51.	Mechanical properties and machining of Al-7075 SiC Composite	204
52.	Characterization of Tungsten carbide reinforced Al7075 matrix Composites.	208
53.	3D Printing of Prototype Through Image Processing using Autodesk Recap Photo Software	212
54.	Fabrication and Testing Mechanical Behaviour of Hemp Fibre, Chopped E Glass and Hybrid with Nano Particle	216
55.	Optical characterization of V_2O_5 doped Na_2O-SiO_2-ZrO_2 glasses	218
56.	Determination of Efficient Location of Split Air Conditioner using CFD	221

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dt.), A.P.

57.	Frictionless Electromagnetic Braking System	225
58.	Performance Evaluation of Vegetable oils as Cutting fluid under MQL Condition in Turning	228
59.	A novel hybrid Fuzzy AHP and VIKOR methodology for Reclaimer Selection in GSCM	236
60.	Design of Eco-Friendly Road Cleaner	240
61.	Mechanical and Microstructural Characterization of Jute Hybrid Composite with Alkali Treatment	244
62.	Experimental Investigation and Optimization of Process Parameters in Wire Cut EDM of EN31 Steel	248
63.	Design and Analysis of Differential Gear Box	252

***

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

MV 2021

ISBN: 978-93-91420-02-4

Study of Rheological Characteristics of Nano Suspensions

Vidya Chaparala[1] and Venkaiah Mandula[2]
[1]Department of Mechanical Engineering, P.V.P.Siddhartha Institute of Technology, Vijayawada,India.
[2]Department of Mechanical Engineering, Narasaraopeta Engineering College,Narasaraopet,India.

***Abstract*— Nano suspensions serve as best candidate in variety of industrial and engineering applications. One such sector is heat transfer agent. Nano fluids enhance the heat transfer rate by many folds than conventional cooling media while making the system compact. Present study aims to explore the role of PH on rheological behavior of SiO2 nano fluids. Present investigation reports a drop in viscosity of fluid by around 9% for a volume concentration of 0.07% with surfactant concentration of 0.05%.**

Keywords— rheology, dynamic viscosity, PH value, nano fluid

INTRODUCTION

Nano materials are tiny particles of which at least one dimension is in the order of nm which contributes to surprising enhancement in thermo physical properties of the same [1,2]. Evaluation and control of dispersion stability by the way of electrostatic and electrostatic modification is of major concern from various scientific applications [3]. Stirred media milling technique can be adopted to produce various popular nano particles in which PH value can be controlled easily to promote stability of suspension [4].

The rheology of CaP suspensions is used to predict the inject ability of this generation of biomaterial. In 1965, one of the first studies related to CaP suspension rheology investigated the viscosity of dicalcium phosphate suspensions (Bujake, 1965). Results demonstrated appreciable shear thinning behavior and suggested significant particle–particle interaction in these suspensions. Over most regions of the shear rate (γ'), the empirical power-law equation $\tau = K\gamma' n$ was proposed to describe flow curve of CaP suspensions, where τ is the shear stress, K is the consistency factor and n is the flow index. Rao and Kannan examined the yield stress and viscosity of hydroxyapatite suspensions (Rao and Kannan, 2001).

For all suspensions, the researchers observed a yield stress and a shear-thinning followed by shear-thickening behavior. Generally, shear thickening appears to occur at high particle loading (Knowles *et al.*, 2000). Friberg *et al.* (2001) measured the viscosity of βTCP suspension by varying the liquid-to-powder ratio (LPR), employing powders of two medium particle sizes, and adding three different modifiers. More recently, Baroud *et al.* (2005) have studied the rheological properties of concentrated aqueous βTCP suspensions. This study has reported measurements of the yield stress and the viscosity as a function of LPR and milling time of the powder.

The LPR clearly affected the rheological properties of CaP suspensions. Increasing LPR results in a more dilute solution with less particle–particle interaction, and hence lower viscosity and yield stress. The effect of milling time was significant, viscosity and yield stress increased as a function of the milling time (Bujake, 1965; Knowles *et al.*, 2000). Liu *et al.* (2006) studied rheological properties of concentrated aqueous injectable CaP cement. Their investigations showed that CaP cement presented visco plasticity and thixotropy. Results of this study confirmed the dependence of the technological parameters such as LPR, temperature and particles size on the rheological behavior of CPC (Liu *et al.*, 2006).

Nanoparticles with their unique and unpredictable properties have recently attracted much attention in several branches of the petroleum industry. This paper is aimed at studying hydrophilic silica-alumina and slightly hydrophobic silica nanoparticle behaviors to see if they have enough feasibility to be used as an appropriate agent in enhanced oil recovery, especially polymer flooding. The main focus is on the rheological behavior of these nanomaterials in aqueous and polymeric media. Viscosity measurements showed that both nanoparticles had a great ability in rheology modification of aqueous solution.

The solution viscosity was studied as a function of nanoparticle concentration and shear rate. The stability improvement of nanoparticle suspensions was also investigated by dissolving fixed amounts of hydrolyzed and sulfonated polyacrylamides. The stability of slightly hydrophobic silica suspensions was significantly improved by low molecular weight polymers. Instead, nanoparticles considerably enhanced polymer solution viscosity. Finally, sand-pack flow experiments, conducted in optimum conditions, revealed how nanoparticles may uniquely enhance polymer flooding performance.

Methodolgy of sample preperation

In the present investigation nano suspension samples prepared by dispersing SiO2 nano particles in distilled water. SiO2 nano particles of average diameter 20nm was purchased from Sisco Research Laboratories, India. Nano particles were used as received without any further processing. Various nano fluids samples were prepared with different surfactants in order to understand the compatibility of surfactant with the chosen nano material. Experimental trails revealed C-TAB as best compatible one as compared to other surfactants. Hence, C-TAB was used as surfactant in the present experimentation. Nano fluid samples were prepared by two step method. Initially surfactant dispersed in to distilled water and stirred with magnetic stirrer. After ensuring the surfactant particles dispersed uniformly in the base fluid then nano particles

NARASARAOPETA ENGINEERING COLLEGE (AUTONOMOUS)

NAAC 'A' GRADE

NATIONAL BOARD OF ACCREDITATION

PROCEEDINGS

INTERNATIONAL CONFERENCE

EMERGING TRENDS IN MECHANICAL ENGINEERING AND INDUSTRIAL AUTOMATION

NEC-ICETMEIA-2K21

30th & 31st July, 2021

Editors-in-Chief

Dr. M.Sreenivasa Kumar
Principal & Professor, Dept. of Mechnical Engineering

Dr. D.Jagadish
Professor, Dept. of Mechnical Engineering

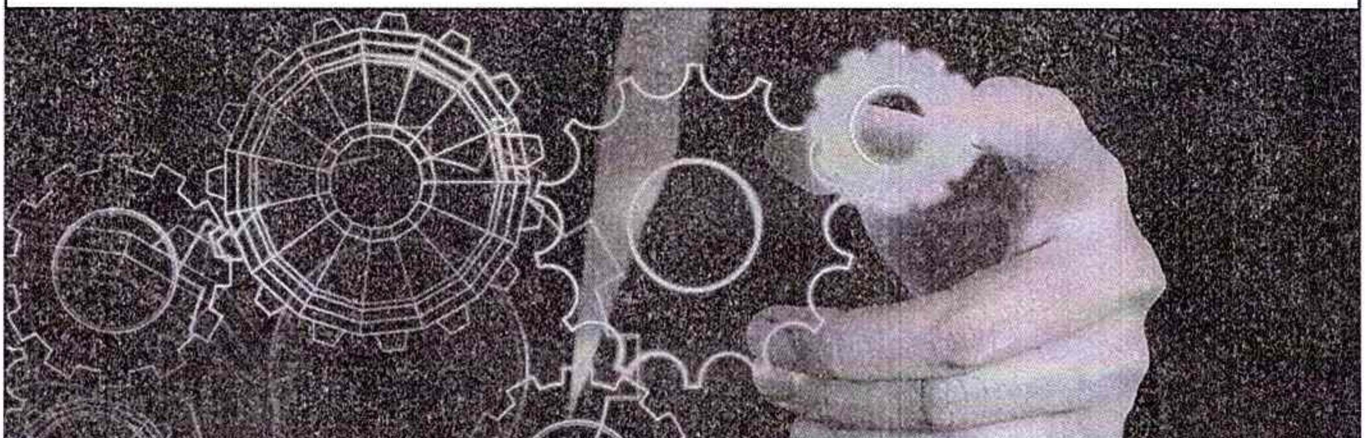
Editors

Dr. D.Suneel
Vice-Principal & Professor, Dept. of ME

Dr. P.Suresh Babu
Professor, Dept. of ME

Dr. B.Venkata Siva
Professor & HoD Dept. of ME

Mr. M.Venkanna Babu
Associate Professor, Dept. of ME



Organized by

Department of **Mechanical Engineering**

In Association with *The Institution of Engineers (India)*

ISBN : 978-93-91420-02-4

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

LIST OF FULL LENGTH PAPERS SELECTED FOR PROCEEDINGS

International Conference on Emerging Trends in Mechanical Engineering and Industrial Automation

NEC-ICETMEIA- 2K21

S.No.	TITLE OF THE PAPER	Page No.
1.	Effectiveness of Compression Ignition Engine Fuelled with Pond Water Algae Biodiesel	01
2.	Design And Analysis of Disc Brake of an Electric Go-Kart	04
3.	A Comprehensive Review on Recent Research on Semi Solid Processed Aluminum 7 Series Alloys	08
4.	A Study on Microstructure and Mechanical Properties A7075 Reinforced with Flyash/Sic Hybrid Metal Matrix Composite	15
5.	Establishment of SCR Test Facility and Evaluation of 8mm Pitch Honeycomb Type Catalyst in a 20 Liter capacity SCR Test facility	19
6.	A Review on NVH Issues and Technological Challenges in Electric Vehicle and Hybrid Electric Vehicle Power Train	25
7.	Design and Analysis of Cantilever Beam	29
8.	Analysis of Static and Fatigue Strength of Aluminium Alloy Wheel	32
9.	Design of Automated Braking System Based on Vehicle Over Speed Using PLC Ladder Method	35
10.	The Analysis on Concentric Pipe Heat Exchanger	39
11.	Design and Finite Element Analysis of Gas Turbine Blade	45
12.	Investigation on Mechanical Properties of Glass Fiber and Carbon Nano Tubes Sandwich Composite Material	47
13.	CFD Analysis of Super Utility Vehicle to Determine Aerodynamic Behavior	54
14.	Devlopment of Code for Automated HVAC System using Digital Controller	60
15.	Performance and Emission Characteristics Of Diesel Engine with Linseed Oil-Diesel Blends as Fuel With VCR	65
16.	Experimental Investigation in Single Cylinder VCR Multifuel Engine Using Bio-Diesel as Linseed Oil	69

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

17.	Tribological Properties of Textured Surface	72
18.	Thermal Analysis and Experimental Investigation of Pin Fin made of Brass	76
19.	Experimental and Simulation of Wear Test on GPR material	79
20.	CFD Analysis of Two Pass Double Pipe Heat Exchanger with TiO_2/Ethylene Glycol Nano Fluid	83
21.	Simulation and Optimization of Extrusion Process Parameters of Aluminium 2A12T4Alloy	87
22.	Importance of Ice Jet machining - A Review	91
23.	Performance Investigation of a Battery Powered Peltier Cooler	94
24.	Analysis of Disc Brake Rotor using ANSYS Workbench	98
25.	Modelling and Optimization of Two Wheeler Disk Brake Using ANSYS -Review	101
26.	Fabrication of Sewage Waste Cleaner	105
27.	Manufacturing of Hyperboliodal Gear Model Using Ultimaker S5 3D Printing Machine	109
28.	Arc Welding Process Selection Through Quality and Cost Analysis	113
29.	Li-Br H2O VAR System Analysis by Applying Magnetic Field to Liquid Line	117
30.	Heat Transfer Enhancement on Shell and Coil Type of Heat Exchanger Using SiO_2 and CuO Nano-Fluids	121
31.	Study of Rheological Characteristics of Nano Suspensions	126
32.	Design And Fabrication of Loop Wheel System	129
33.	Performance of Solar Vapour Absorption system and its Dependence on Generator Temperature	131
34.	Design and Analysis Of Handicapped Steering Tricycle	134
35.	Machining Characteristics and Microbiological Growth of Stir Casted A356-SiC MMCs and Pure Metals	136
36.	Design and Analysis of Connecting Rod	141

37.	Pressure Vessel Optimum Design using Particle Swarm Optimization	145
38.	Design and Analysis of Wheel Rim on Radial Loads	149
39.	COP Enhancement of VCR System using Diffusers	154
40.	Design and Fabrication of Radiant Cooling System	157
41.	Comparative Performance Analysis of Engine Fuelled with Diesel Biodiesel Iron Oxide Nano Particles	162
42.	Performance analysis of a CI Engine fuelled with olive oil and soybean oil mixture as a biofuels	166
43.	Design and Analysis of Landing Gear	170
44.	A Review on Parameters of Composite Materials	173
45.	Optimisation in WEDM of HCHCR Steel using Taughi Method	177
46.	Automated Pneumatic Sheet Metal Cutting Machine	184
47.	Cylindrical Panel's Numerical And Analytical Investigations Subjected To Different Loads	187
48.	Application of a Thermoplastic Polyurethane/Polylactic Acid Composite Filament For 3D-Printed Personalized Orthosis	192
49.	Design and Analysis of a Connecting Rod	196
50.	A Study and Synthesis of 8 Bar One Degree of Freedom Walking Mechanism	200
51.	Mechanical properties and machining of Al-7075 SiC Composite	204
52.	Characterization of Tungsten carbide reinforced Al7075 matrix Composites.	208
53.	3D Printing of Prototype Through Image Processing using Autodesk Recap Photo Software	212
54.	Fabrication and Testing Mechanical Behaviour of Hemp Fibre, Chopped E Glass and Hybrid with Nano Particle	216
55.	Optical characterization of V_2O_5 doped Na_2O-SiO_2-ZrO_2 glasses	218
56.	Determination of Efficient Location of Split Air Conditioner using CFD	221

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

57.	Frictionless Electromagnetic Braking System	225
58.	Performance Evaluation of Vegetable oils as Cutting fluid under MQL Condition in Turning	228
59.	A novel hybrid Fuzzy AHP and VIKOR methodology for Reclaimer Selection in GSCM	236
60.	Design of Eco-Friendly Road Cleaner	240
61.	Mechanical and Microstructural Characterization of Jute Hybrid Composite with Alkali Treatment	244
62.	Experimental Investigation and Optimization of Process Parameters in Wire Cut EDM of EN31 Steel	248
63.	Design and Analysis of Differential Gear Box	252

***

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

MV 2021

 ISBN: 978-93-91420-02-4

Optimization in WEDM of HCHCR Steel Using Taughi Method

[1]P Gopalakrishnaiah and [2]Mandula Venkaiah
[1]Department of Mechanical Engineering, PVP Siddhartha institute of Technology, Vijayawada, India.
[2]Department of Mechanical Engineering, Narasaraopet Engineering College (A), Narasaraopet, Guntur, A.P, India.

Abstract—The purpose of this study aims to obtain excellent products, consistent investigation and manufacturing process control which are the preconditions that organizations have to consider In this paper, process capability analysis was applied during wire electrical discharge machining (WEDM) to study the process performance within specific limits. The purpose of the experimentation is to identify the factors which have strong effects on the machining performance. From mean of S/N ratios for MRR, it is found that pulse-on time has highest rank '1'. Therefore, it has most significant effect on MRR. The wire feed has least effect on MRR. The order of other influencing parameters for MRR: pulse-off time, upper flush, lower flush and wire tension.

Keywords- WEDM, MRR, S/N ratios, pulse-off time, upper flush, lower flush and wire tension

I. INTRODUCTION

1.1 Evolution of EDM Process

Electrical Discharge Machining (EDM) is one of the most extensively used non-conventional material removal processes. The basis of EDM can be traced back to 1770, when English chemist Joseph Priestly discovered the erosive effect of chemical discharges or sparks. However, it was only in 1943 at Moscow University where Lazarenko and Lazarenko exploited for constructive use. They developed a controlled process for machining difficult-to-machine metals by vaporizing materials from the Surface of metal. The Lazarenko EDM system used resistance – capacitance type of power supply, which was used by EDM machine in 1950s and later served as a model for successive development in EDM.In 1980s the advent of Computer Numerical Control (CNC) in EDM brought about tremendous advances in improving the efficiency of the machining operation. CNC has facilitated total EDM, which implied an automatic and unattended machining from inserting the electrodes in the tool changer to a finished polished cavity or cavities. These growing merits of EDM have since then been intensively sought by the manufacturing industries yielding enormous benefits and generating research interests.

1.2 About Alloys and Super Alloys:

Alloys are metallic materials consisting of two or more elements combined in metals used are in the form of alloys. Such a way that they cannot be readily separated by physical means. More than 90% of family of engineering. Materials that provide a wide range of products with useful properties.

Stainless steel alloys are a combination of iron, chromium and nickel frequently modified by the presence of other elements. This family of alloys is particularly resistant to corrosion, in contrast to the rusting phenomenon that consumes ordinary steel.

Super alloys of nickel and cobalt are used in aircraft engines due to their corrosion- and heat-resistance.

Super alloys are heat-resisting alloys based on nickel, nickel-iron, or chromium that exhibit a combination of mechanical strength and resistance to surface degradation. Alloys and Super Alloys used in Aircrafts, Power Plants, Nuclear Plants, Gas turbines, Space Vehicles.

II. LITERATURE REVIEW

[1] Ms. Shalaka Kulkarni and Manik Rodge , Process Parameters Optimization In WEDM of HCHCR Steel Using Taughi Method and Utility Concept Research Scholar, Associate Professor Production Engineering Dept., SGGSIE&T, Nanded (India) international journal of mechanical engineering and technology (ijmet)

[2] Kashid D.V., S.G. Bhatwadekar ,S.B. Sangale , P.R. Kubade Investigations of Effect of Process Parameters on Material Removal Rate in Wire-cut Electrical Discharge Machining of Steel Grade EN 9.

[3] P. Abinesh1, Dr. K. Varatharajan, Dr. G. Satheesh Kumar Research Scholar, Velammal Engineering College, Chennai Optimization of Process Parameters Influencing MRR, Surface Roughness and Electrode Wear During Machining of Titanium Alloys by WEDM

III. Wire EDM Set-Up and Working

3.1 Construction of Wired:

The wire-cut EDM is a discharge machine that uses CNC movement to produce the desired contour or shape. It does not require a special shaped electrode; instead it uses a continuous-travelling vertical wire under tension as the electrode. The electrode in wire-cut EDM is about as thick as a small diameter needle whose path is controlled by the machine computer to produce the shape required.

Wire Electric Discharge Machine at Experimentation

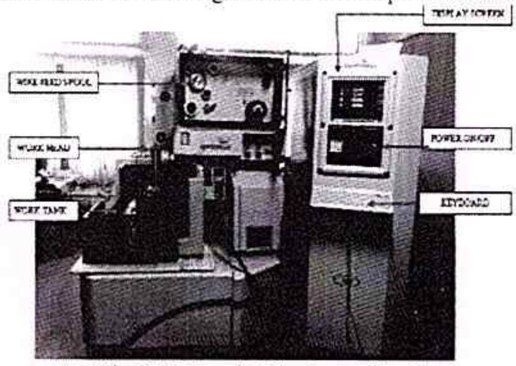


Fig:3.1:Electric Discharge Machine

1) In wire electrical discharge machining (WEDM), also known as wire-cut EDM and wire cutting thin single-strand metal wire, usually brass, is fed through the work piece, submerged in a tank of dielectric fluid, typically de ionised water.

2) Wire-cut EDM is typically used to cut plates as thick as 300mm and to make punches, tools, and dies from hard metals that are difficult to machine with other methods. The wire, which is constantly fed from a spool, is held between upper and lower diamond guides.

NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)

NAAC 'A' GRADE

NATIONAL BOARD OF ACCREDITATION

PROCEEDINGS

INTERNATIONAL CONFERENCE

EMERGING TRENDS IN MECHANICAL ENGINEERING AND INDUSTRIAL AUTOMATION

NEC-ICETMEIA-2K21

30th & 31st July, 2021

Editors-in-Chief

Dr. M.Sreenivasa Kumar
Principal & Professor, Dept. of Mechnical Engineering

Dr. D.Jagadish
Professor, Dept. of Mechnical Engineering

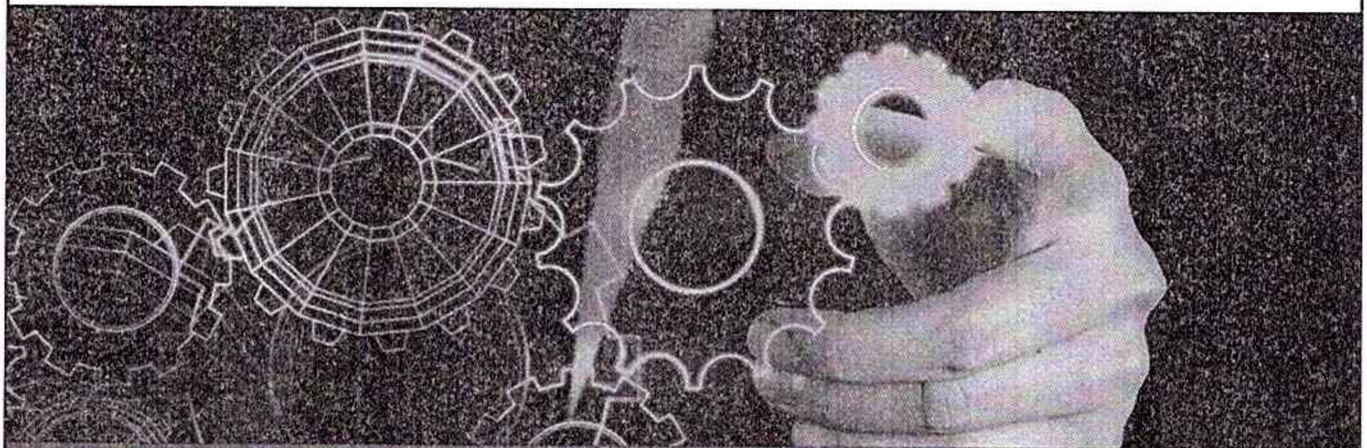
Editors

Dr. D.Suneel
Vice-Principal & Professor, Dept. of ME

Dr. B.Venkata Siva
Professor & HoD Dept. of ME

Dr. P.Suresh Babu
Professor, Dept. of ME

Mr. M.Venkanna Babu
Associate Professor, Dept. of ME



Organized by

Department of Mechanical Engineering

In Association with The Institution of Engineers (India)

ISBN : 978-93-91420-02-4

IQAC

Principal
(AUTONOMOUS)

LIST OF FULL LENGTH PAPERS SELECTED FOR PROCEEDINGS

International Conference on Emerging Trends in Mechanical Engineering and Industrial Automation

NEC-ICETMEIA- 2K21

S.No.	TITLE OF THE PAPER	Page No.
1.	Effectiveness of Compression Ignition Engine Fuelled with Pond Water Algae Biodiesel	01
2.	Design And Analysis of Disc Brake of an Electric Go-Kart	04
3.	A Comprehensive Review on Recent Research on Semi Solid Processed Aluminum 7 Series Alloys	08
4.	A Study on Microstructure and Mechanical Properties A7075 Reinforced with Flyash/Sic Hybrid Metal Matrix Composite	15
5.	Establishment of SCR Test Facility and Evaluation of 8mm Pitch Honeycomb Type Catalyst in a 20 Liter capacity SCR Test facility	19
6.	A Review on NVH Issues and Technological Challenges in Electric Vehicle and Hybrid Electric Vehicle Power Train	25
7.	Design and Analysis of Cantilever Beam	29
8.	Analysis of Static and Fatigue Strength of Aluminium Alloy Wheel	32
9.	Design of Automated Braking System Based on Vehicle Over Speed Using PLC Ladder Method	35
10.	The Analysis on Concentric Pipe Heat Exchanger	39
11.	Design and Finite Element Analysis of Gas Turbine Blade	45
12.	Investigation on Mechanical Properties of Glass Fiber and Carbon Nano Tubes Sandwich Composite Material	47
13.	CFD Analysis of Super Utility Vehicle to Determine Aerodynamic Behavior	54
14.	Devlopment of Code for Automated HVAC System using Digital Controller	60
15.	Performance and Emission Characteristics Of Diesel Engine with Linseed Oil-Diesel Blends as Fuel With VCR	65
16.	Experimental Investigation in Single Cylinder VCR Multifuel Engine Using Bio-Diesel as Linseed Oil	69

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

IQAC

17.	Tribological Properties of Textured Surface	72
18.	Thermal Analysis and Experimental Investigation of Pin Fin made of Brass	76
19.	Experimental and Simulation of Wear Test on GPR material	79
20.	CFD Analysis of Two Pass Double Pipe Heat Exchanger with TiO_2/Ethylene Glycol Nano Fluid	83
21.	Simulation and Optimization of Extrusion Process Parameters of Aluminium 2A12T4Alloy	87
22.	Importance of Ice Jet machining - A Review	91
23.	Performance Investigation of a Battery Powered Peltier Cooler	94
24.	Analysis of Disc Brake Rotor using ANSYS Workbench	98
25.	Modelling and Optimization of Two Wheeler Disk Brake Using ANSYS -Review	101
26.	Fabrication of Sewage Waste Cleaner	105
27.	Manufacturing of Hyperboliodal Gear Model Using Ultimaker S5 3D Printing Machine	109
28.	Arc Welding Process Selection Through Quality and Cost Analysis	113
29.	Li-Br H2O VAR System Analysis by Applying Magnetic Field to Liquid Line	117
30.	Heat Transfer Enhancement on Shell and Coil Type of Heat Exchanger Using SiO_2 and CuO Nano-Fluids	121
31.	Study of Rheological Characteristics of Nano Suspensions	126
32.	Design And Fabrication of Loop Wheel System	129
33.	Performance of Solar Vapour Absorption system and its Dependence on Generator Temperature	131
34.	Design and Analysis Of Handicapped Steering Tricycle	134
35.	Machining Characteristics and Microbiological Growth of Stir Casted A356-SiC MMCs and Pure Metals	136
36.	Design and Analysis of Connecting Rod	141

37.	Pressure Vessel Optimum Design using Particle Swarm Optimization	145
38.	Design and Analysis of Wheel Rim on Radial Loads	149
39.	COP Enhancement of VCR System using Diffusers	154
40.	Design and Fabrication of Radiant Cooling System	157
41.	Comparative Performance Analysis of Engine Fuelled with Diesel Biodiesel Iron Oxide Nano Particles	162
42.	Performance analysis of a CI Engine fuelled with olive oil and soybean oil mixture as a biofuels	166
43.	Design and Analysis of Landing Gear	170
44.	A Review on Parameters of Composite Materials	173
45.	Optimisation in WEDM of HCHCR Steel using Taughi Method	177
46.	Automated Pneumatic Sheet Metal Cutting Machine	184
47.	Cylindrical Panel's Numerical And Analytical Investigations Subjected To Different Loads	187
48.	Application of a Thermoplastic Polyurethane/Polylactic Acid Composite Filament For 3D-Printed Personalized Orthosis	192
49.	Design and Analysis of a Connecting Rod	196
50.	A Study and Synthesis of 8 Bar One Degree of Freedom Walking Mechanism	200
51.	Mechanical properties and machining of Al-7075 SiC Composite	204
52.	Characterization of Tungsten carbide reinforced Al7075 matrix Composites.	208
53.	3D Printing of Prototype Through Image Processing using Autodesk Recap Photo Software	212
54.	Fabrication and Testing Mechanical Behaviour of Hemp Fibre, Chopped E Glass and Hybrid with Nano Particle	216
55.	Optical characterization of V_2O_5 doped Na_2O-SiO_2-ZrO_2 glasses	218
56.	Determination of Efficient Location of Split Air Conditioner using CFD	221

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

57.	Frictionless Electromagnetic Braking System	225
58.	Performance Evaluation of Vegetable oils as Cutting fluid under MQL Condition in Turning	228
59.	A novel hybrid Fuzzy AHP and VIKOR methodology for Reclaimer Selection in GSCM	236
60.	Design of Eco-Friendly Road Cleaner	240
61.	Mechanical and Microstructural Characterization of Jute Hybrid Composite with Alkali Treatment	244
62.	Experimental Investigation and Optimization of Process Parameters in Wire Cut EDM of EN31 Steel	248
63.	Design and Analysis of Differential Gear Box	252

***

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

SBJ 2021

ISBN: 978-93-91420-02-4

Li-Br H_2O VAR System Analysis by Applying Magnetic Field to Liquid Line

Shaik Bajan
Department of Mechanical Engineering, Narasaraopeta Engineering College (A), Narasaraopet, AP, India.

Abstract - **Process of industries and automobile vehicles, there is usually a great amount of waste heat available at different temperatures and at the same time, there are cooling or refrigeration demands at different temperatures. In this work, a single effect vapour absorption refrigeration system is to be fabricated. And to perform the optimal matches between heat source temperatures and refrigeration levels of the vapour absorption refrigeration cycle are determined in terms of two indicators, coefficient of performance (COP) and efficiency of the cycle**

The results shows that the theoretical COP of an VAR system is maximum for the system operated with two pairs of magnets.

Keywords: Fabrication of Vapour absorption Refrigeration System, VAR, LiBr-H2O absorption refrigerator, waste heat VAR system.

I. Introduction

In the early years of the twentieth century, the vapour absorption cycle using water-ammonia systems was popular and widely used. After the development of the vapour compression cycle, the vapour absorption cycle lost much of its importance because of its low coefficient of performance (about one fifth of that of the vapour compression cycle). Today, the vapour absorption cycle is used mainly where fuel for heating is available but electricity is not, such as in recreational vehicles that carry LP gas. It is also used in industrial environments where plentiful waste heat overcomes it's inefficiency. The absorption cycle is similar to the compression cycle, except for the method of raising the pressure of the refrigerant vapour. In the absorption system, the compressor is replaced by an absorber which dissolves the refrigerant in a suitable liquid, a liquid Pump which raises the pressure and a generator which, on heat addition, drives off the refrigerant vapour from the high-pressure liquid. Some work is needed by the liquid pump but, for a given quantity of refrigerant, it is much smaller than needed by the compressor in the vapour compression cycle. Side = 0.625 inches. Each column measures 3.5 inches wide, with a 0.25-inch gap between the two columns.

In an absorption refrigerator, a suitable combination of refrigerant and absorbent is used. The existing review works on heat transformers confirm that water-lithium bromide the most investigated couple for heat transformers. Despite that, they also report many studies researching alternative fluids, due to the high corrosiveness, viscosity and crystallization risk in some operating ranges of the water-lithium bromide pair. Improvements can be achieved by adding additives as ethylene glycol or using mixtures of various salts rather than (Li-Br) alone, but none of the proposed alternatives succeeded in solving all the drawbacks.

METHADOLOGY

In this experiment the exhaust pipe of the engine is connected to the generator shell by using a pipe. Inside this generator shell a generator tank is placed. This generator tank is made up of copper. The generator tank is connected to the condenser.

The condenser is of air flow type condenser. The air is supplied by the fan which is powered by a motor. The condenser is connected to an expansion valve, this expansion valve is connected to evaporator by using copper wire and copper L-bend connectors. The evaporator is bent and wound in a spiral around an eternal sheet. The outlet of the eternal pipe is connected to the absorber tank.

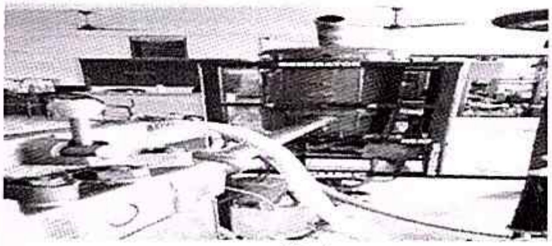


Fig.1

Fig.1: Generator is connected to engine exhaust manifold pipe

One outlet of the absorber is connected to evaporator outlet, another is connected to a pump, and last outlet is connected to the generator which is connected to the heat exchanger. There is a pipe connecting the generator and pump. Generator second outlet pipe is connected to the heat exchanger which is in connection to a regulating valve which connects the absorber tank. This total equipment is fixed on a frame. A pipe is welded to the absorber for adding absorber Absorber and the refrigerant is filled into the absorber tank in the ratio of 25% (refrigerant) and 75 %(absorber). The engine exhaust pipe is mounted on the generator shell. When the engine is started and run for a while the hot exhaust gases of temperature above 1500C enters the generator shell. The heat from the exhaust gases is absorbed by the generator tank. Inside the generator tank water which is the refrigerant absorbs this heat. The refrigerant evaporates and enters the condenser in the form of vapor

NEC NARASARAOPETA ENGINEERING COLLEGE (AUTONOMOUS)

NAAC 'A' GRADE | NATIONAL BOARD OF ACCREDITATION | 5

PROCEEDINGS

INTERNATIONAL CONFERENCE

EMERGING TRENDS IN MECHANICAL ENGINEERING AND INDUSTRIAL AUTOMATION

NEC-ICETMEIA-2K21

30th & 31st July, 2021

Editors-in-Chief

Dr. M.Sreenivasa Kumar
Principal & Professor, Dept. of Mechnical Engineering

Dr. D.Jagadish
Professor, Dept. of Mechnical Engineering

Editors

Dr. D.Suneel
Vice-Principal & Professor, Dept. of ME

Dr. P.Suresh Babu
Professor, Dept. of ME

Dr. B.Venkata Siva
Professor & HoD Dept. of ME

Mr. M.Venkanna Babu
Associate Professor, Dept. of ME

Organized by

Department of **Mechanical Engineering**

In Association with *The Institution of Engineers (India)*

ISBN : 978-93-91420-02-4

IQAC

NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601
Guntur (Dist.), A.P.

LIST OF FULL LENGTH PAPERS SELECTED FOR PROCEEDINGS

International Conference on Emerging Trends in Mechanical Engineering and Industrial Automation

NEC-ICETMEIA- 2K21

S.No.	TITLE OF THE PAPER	Page No.
1.	Effectiveness of Compression Ignition Engine Fuelled with Pond Water Algae Biodiesel	01
2.	Design And Analysis of Disc Brake of an Electric Go-Kart	04
3.	A Comprehensive Review on Recent Research on Semi Solid Processed Aluminum 7 Series Alloys	08
4.	A Study on Microstructure and Mechanical Properties A7075 Reinforced with Flyash/Sic Hybrid Metal Matrix Composite	15
5.	Establishment of SCR Test Facility and Evaluation of 8mm Pitch Honeycomb Type Catalyst in a 20 Liter capacity SCR Test facility	19
6.	A Review on NVH Issues and Technological Challenges in Electric Vehicle and Hybrid Electric Vehicle Power Train	25
7.	Design and Analysis of Cantilever Beam	29
8.	Analysis of Static and Fatigue Strength of Aluminium Alloy Wheel	32
9.	Design of Automated Braking System Based on Vehicle Over Speed Using PLC Ladder Method	35
10.	The Analysis on Concentric Pipe Heat Exchanger	39
11.	Design and Finite Element Analysis of Gas Turbine Blade	45
12.	Investigation on Mechanical Properties of Glass Fiber and Carbon Nano Tubes Sandwich Composite Material	47
13.	CFD Analysis of Super Utility Vehicle to Determine Aerodynamic Behavior	54
14.	Devlopment of Code for Automated HVAC System using Digital Controller	60
15.	Performance and Emission Characteristics Of Diesel Engine with Linseed Oil-Diesel Blends as Fuel With VCR	65
16.	Experimental Investigation in Single Cylinder VCR Multifuel Engine Using Bio-Diesel as Linseed Oil	69

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

17.	Tribological Properties of Textured Surface	72
18.	Thermal Analysis and Experimental Investigation of Pin Fin made of Brass	76
19.	Experimental and Simulation of Wear Test on GPR material	79
20.	CFD Analysis of Two Pass Double Pipe Heat Exchanger with TiO_2/Ethylene Glycol Nano Fluid	83
21.	Simulation and Optimization of Extrusion Process Parameters of Aluminium 2A12T4Alloy	87
22.	Importance of Ice Jet machining - A Review	91
23.	Performance Investigation of a Battery Powered Peltier Cooler	94
24.	Analysis of Disc Brake Rotor using ANSYS Workbench	98
25.	Modelling and Optimization of Two Wheeler Disk Brake Using ANSYS -Review	101
26.	Fabrication of Sewage Waste Cleaner	105
27.	Manufacturing of Hyperboliodal Gear Model Using Ultimaker S5 3D Printing Machine	109
28.	Arc Welding Process Selection Through Quality and Cost Analysis	113
29.	Li-Br H2O VAR System Analysis by Applying Magnetic Field to Liquid Line	117
30.	Heat Transfer Enhancement on Shell and Coil Type of Heat Exchanger Using SiO_2 and CuO Nano-Fluids	121
31.	Study of Rheological Characteristics of Nano Suspensions	126
32.	Design And Fabrication of Loop Wheel System	129
33.	Performance of Solar Vapour Absorption system and its Dependence on Generator Temperature	131
34.	Design and Analysis Of Handicapped Steering Tricycle	134
35.	Machining Characteristics and Microbiological Growth of Stir Casted A356-SiC MMCs and Pure Metals	136
36.	Design and Analysis of Connecting Rod	141

37.	Pressure Vessel Optimum Design using Particle Swarm Optimization	145
38.	Design and Analysis of Wheel Rim on Radial Loads	149
39.	COP Enhancement of VCR System using Diffusers	154
40.	Design and Fabrication of Radiant Cooling System	157
41.	Comparative Performance Analysis of Engine Fuelled with Diesel Biodiesel Iron Oxide Nano Particles	162
42.	Performance analysis of a CI Engine fuelled with olive oil and soybean oil mixture as a biofuels	166
43.	Design and Analysis of Landing Gear	170
44.	A Review on Parameters of Composite Materials	173
45.	Optimisation in WEDM of HCHCR Steel using Taughi Method	177
46.	Automated Pneumatic Sheet Metal Cutting Machine	184
47.	Cylindrical Panel's Numerical And Analytical Investigations Subjected To Different Loads	187
48.	Application of a Thermoplastic Polyurethane/Polylactic Acid Composite Filament For 3D-Printed Personalized Orthosis	192
49.	Design and Analysis of a Connecting Rod	196
50.	A Study and Synthesis of 8 Bar One Degree of Freedom Walking Mechanism	200
51.	Mechanical properties and machining of Al-7075 SiC Composite	204
52.	Characterization of Tungsten carbide reinforced Al7075 matrix Composites.	208
53.	3D Printing of Prototype Through Image Processing using Autodesk Recap Photo Software	212
54.	Fabrication and Testing Mechanical Behaviour of Hemp Fibre, Chopped E Glass and Hybrid with Nano Particle	216
55.	Optical characterization of V_2O_5 doped Na_2O-SiO_2-ZrO_2 glasses	218
56.	Determination of Efficient Location of Split Air Conditioner using CFD	221

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

57.	Frictionless Electromagnetic Braking System	225
58.	Performance Evaluation of Vegetable oils as Cutting fluid under MQL Condition in Turning	228
59.	A novel hybrid Fuzzy AHP and VIKOR methodology for Reclaimer Selection in GSCM	236
60.	Design of Eco-Friendly Road Cleaner	240
61.	Mechanical and Microstructural Characterization of Jute Hybrid Composite with Alkali Treatment	244
62.	Experimental Investigation and Optimization of Process Parameters in Wire Cut EDM of EN31 Steel	248
63.	Design and Analysis of Differential Gear Box	252

***

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

SBJ 2021

Performance Analysis of a CI Engine Fueled With Olive Oil and Soybean Oil Mixture as Biofuels

Nagul Meeravali Shai and Bajan Shaik,
Department of Mechanical Engineering, Narasaraopet Engineering College (A), Narasaraopet, Guntur, A.P, India.

Abstract—**The aim of this research is to evaluate the performance of a CI diesel engine at various loads when it is fueled with a combination of olive oil and soybean biodiesel. All of the tests were conducted on a constant speed. Olive oil and soyabean oil mixtures are used as fuel in the diesel engine.in this research we use a combination two biofuels as a single fuel. When the engine was run with DSO-I, DSO -II, and DSO-III blends at full load, the engine generated brake thermal efficiency of 33.54%, 32.06% and 30.4% respectively, and the conventional fuel efficiency is 34.25%. NOx emissions were reduced greatly in DSO-II blend comparatively diesel and we observe slightly decrease in CO emissions in all blends. Based on the plots DSO-II biofuel is suitable for the fuel in diesel engine without any engine modifications.**

Keywords— pollution, Bio diesels, IC Engines, Brake Thermal Efficiency.

I. Introduction

India is the most important changeover and developing economy on the planet. India's utilization growth of non-renewable energy sources will be most elevated by 2035. The rapid development in economy means expanding air pollution and energy consumption. India energy consumption increases 4% per year. There is a link between the transport industry and the country's economic growth, which directly affects the demand for portable energy sources. The tremendous growth of vehicular pollution and industrialization of the world has led to steep rise in the demand for petroleum products. This has given rise to frequent disturbance and uncertainties and uncertainties in the supply of petroleum and its prices. This situation is likely in the long run a lead to diesel scarcity and ultimately its depletion. The rapid depletion of petroleum fuels and their ever increasing costs have led to an intensive search for alternative fuels. Also there was need to reduce consumption of conventional fuels in the developing countries. Urban air quality management continues to pitch through the development of two wheelers and light engine passenger cars on road transport. Newly licensed cars in India contribute 70-80% of domestic emissions of carbon dioxide and oxides of nitrogen. Abnormal automotive traffic circumstances contributed 31% to 57% of oxides of nitrogen and carbon dioxide respectively [1]. It is estimated that the contribution of the transport industry to carbon dioxide air pollution increases by 4-6% per year, leading to approximately seven times by 2050 [2]. Blends of Karanja and castor biodiesel with standard diesel in an unmodified single-cylinder DI diesel engine have been researched in multiple ratios directly in lowering emissions, whereas slight decreases in thermal efficiency have been observed and the concentration of blends rises the Brake specific fuel consumption, as well as the increased concentration of castor biodiesel, has resulted in increased HC, soot emissions, particulate matter NOX has been discovered to boost for all biodiesel mixtures [3]. Results acquired from light-duty diesel engine provided with used cooking sunflower oil and new sunflower oil biodiesel blends under steady speed and variable load conditions showed decreased emissions except NOX were higher than diesel at lower load circumstances. Waste cooking oil is suggested from the results [4]. Research on diesel engines with Jatropha and fish waste biodiesel mixtures resulted in lower carbon monoxide, HC and soot emissions, but exhaust gas temperatures and NOX were higher than diesel fuel [5]. The analytical validation of various biofuel blends in which average emissions were reduced by 4%, 15.6%, 43.3%, 3% and 37% for soya bean, jojoba curcas, veal oil, grease oil and pentanol respectively [6]. A single cylinder four-stroke DI diesel engine powered by Jatropha as alternative fuel delivered smooth performance with mildly enhanced BTE and decreased carbon oxides [7]. Adding Jamun seed powder and Jackfruit seed powder directly injected into a four-stroke single-cylinder computerized water-cooled diesel engine has resulted in enhanced efficiency up to certain limits and reduced oxides of nitrogen levels [8]. The combined impact of the injection timing and EGR method on a single cylinder four-stroke diesel engine possessively affected by a 10% reduction in NOX emissions from the motor operating waste plastic based oil and elevated performance compared to diesel fuel [9]. Black solder fly is used as alternative fuel in DI diesel engine to analyse the exhaust emissions it increases the oxides of nitrogen emissions as an alternative fuel. Higher oxides of nitrogen recorded in blends under 10% and 20% comparative to diesel [10]. Tyre pyrolitic oil used in a CRDI diesel engine of different proportions as an alternative fuel. From the outcomes it was concluded that the formation of carbon deposits was discovered, which also showed an enhanced Brake Thermal Efficiency of 30% [11]. Animal fat is used in alternative fuel in a single cylinder diesel engine have given remarkable reductions in emissions except oxides of nitrogen [12]. Common single-cylinder rail direct injection DI diesel engine running at higher fuel injection pressures and higher fuel injection times showed enhanced BTE with lower HC and NOX [13]. Mahua methyl esters used as biodiesel on CRDI engines at higher FIP have revealed improved combustion characteristics resulting in enhanced brake thermal efficiency with reduced oxides of carbon, oxides of nitrogen and unburnt hydrocarbons [14]. Honge biodiesel as an alternative fuel on Common rail diesel injection is coupled with Exhaust gas recirculation setup operating with multi injection at 900 bar and 15% EGR has resulted in higher Brake thermal efficiency and decreased CO, CO2, particulate matter, unburnt hydrocarbons and nitrogen oxides [15]. Lemon peel oil is used as a biodiesel in common rail diesel injection system couples with exhaust gas recirculation. The EGR mass flow rate were 10% shows the decreases in SFC and reduction in soot emissions, oxides of carbon and oxides of nitrogen [16]. Higher Exhaust gas recirculation flow rates shown adverse effects on Brake thermal efficiency of light duty diesel engine whereas 5%

NEC NARASARAOPETA ENGINEERING COLLEGE (AUTONOMOUS)

NAAC 'A' GRADE

NATIONAL BOARD OF ACCREDITATION

PROCEEDINGS

INTERNATIONAL CONFERENCE

EMERGING TRENDS IN MECHANICAL ENGINEERING AND INDUSTRIAL AUTOMATION

NEC-ICETMEIA-2K21

30th & 31st July, 2021

Editors-in-Chief

Dr. M.Sreenivasa Kumar
Principal & Professor, Dept. of Mechnical Engineering

Dr. D.Jagadish
Professor, Dept. of Mechnical Engineering

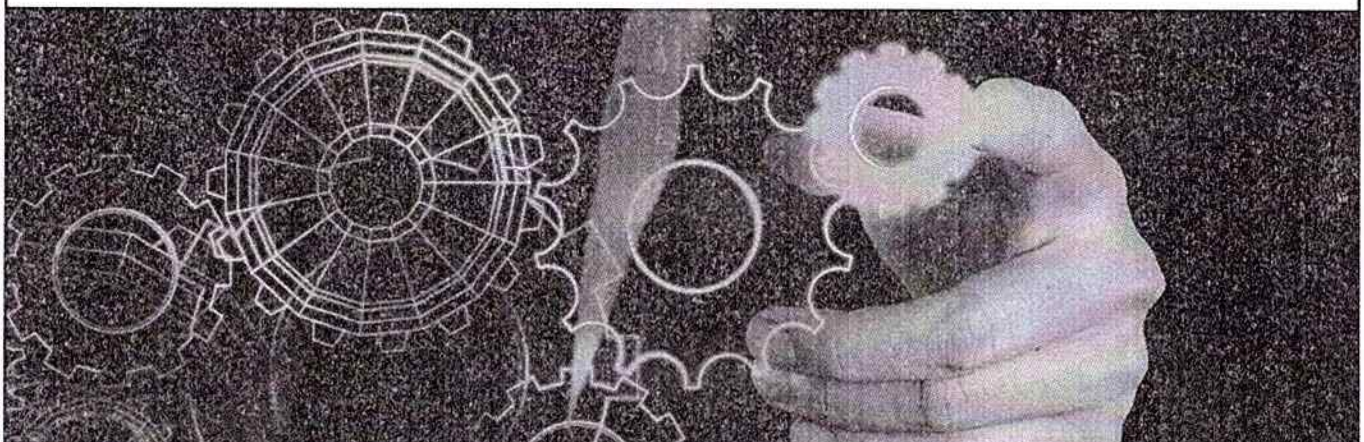
Editors

Dr. D.Suneel
Vice-Principal & Professor, Dept. of ME

Dr. P.Suresh Babu
Professor, Dept. of ME

Dr. B.Venkata Siva
Professor & HoD Dept. of ME

Mr. M.Venkanna Babu
Associate Professor, Dept. of ME



Organized by

Department of **Mechanical Engineering**

In Association with *The Institution of Engineers (India)*

ISBN : 978-93-91420-02-4

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

LIST OF FULL LENGTH PAPERS SELECTED FOR PROCEEDINGS

International Conference on Emerging Trends in Mechanical Engineering and Industrial Automation

NEC-ICETMEIA- 2K21

S.No.	TITLE OF THE PAPER	Page No.
1.	Effectiveness of Compression Ignition Engine Fuelled with Pond Water Algae Biodiesel	01
2.	Design And Analysis of Disc Brake of an Electric Go-Kart	04
3.	A Comprehensive Review on Recent Research on Semi Solid Processed Aluminum 7 Series Alloys	08
4.	A Study on Microstructure and Mechanical Properties A7075 Reinforced with Flyash/Sic Hybrid Metal Matrix Composite	15
5.	Establishment of SCR Test Facility and Evaluation of 8mm Pitch Honeycomb Type Catalyst in a 20 Liter capacity SCR Test facility	19
6.	A Review on NVH Issues and Technological Challenges in Electric Vehicle and Hybrid Electric Vehicle Power Train	25
7.	Design and Analysis of Cantilever Beam	29
8.	Analysis of Static and Fatigue Strength of Aluminium Alloy Wheel	32
9.	Design of Automated Braking System Based on Vehicle Over Speed Using PLC Ladder Method	35
10.	The Analysis on Concentric Pipe Heat Exchanger	39
11.	Design and Finite Element Analysis of Gas Turbine Blade	45
12.	Investigation on Mechanical Properties of Glass Fiber and Carbon Nano Tubes Sandwich Composite Material	47
13.	CFD Analysis of Super Utility Vehicle to Determine Aerodynamic Behavior	54
14.	Devlopment of Code for Automated HVAC System using Digital Controller	60
15.	Performance and Emission Characteristics Of Diesel Engine with Linseed Oil-Diesel Blends as Fuel With VCR	65
16.	Experimental Investigation in Single Cylinder VCR Multifuel Engine Using Bio-Diesel as Linseed Oil	69

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET
Guntur (Dist.),

17.	Tribological Properties of Textured Surface	72
18.	Thermal Analysis and Experimental Investigation of Pin Fin made of Brass	76
19.	Experimental and Simulation of Wear Test on GPR material	79
20.	CFD Analysis of Two Pass Double Pipe Heat Exchanger with TiO_2/Ethylene Glycol Nano Fluid	83
21.	Simulation and Optimization of Extrusion Process Parameters of Aluminium 2A12T4Alloy	87
22.	Importance of Ice Jet machining - A Review	91
23.	Performance Investigation of a Battery Powered Peltier Cooler	94
24.	Analysis of Disc Brake Rotor using ANSYS Workbench	98
25.	Modelling and Optimization of Two Wheeler Disk Brake Using ANSYS -Review	101
26.	Fabrication of Sewage Waste Cleaner	105
27.	Manufacturing of Hyperboliodal Gear Model Using Ultimaker S5 3D Printing Machine	109
28.	Arc Welding Process Selection Through Quality and Cost Analysis	113
29.	Li-Br H2O VAR System Analysis by Applying Magnetic Field to Liquid Line	117
30.	Heat Transfer Enhancement on Shell and Coil Type of Heat Exchanger Using SiO_2 and CuO Nano-Fluids	121
31.	Study of Rheological Characteristics of Nano Suspensions	126
32.	Design And Fabrication of Loop Wheel System	129
33.	Performance of Solar Vapour Absorption system and its Dependence on Generator Temperature	131
34.	Design and Analysis Of Handicapped Steering Tricycle	134
35.	Machining Characteristics and Microbiological Growth of Stir Casted A356-SiC MMCs and Pure Metals	136
36.	Design and Analysis of Connecting Rod	141

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

37.	Pressure Vessel Optimum Design using Particle Swarm Optimization	145
38.	Design and Analysis of Wheel Rim on Radial Loads	149
39.	COP Enhancement of VCR System using Diffusers	154
40.	Design and Fabrication of Radiant Cooling System	157
41.	Comparative Performance Analysis of Engine Fuelled with Diesel Biodiesel Iron Oxide Nano Particles	162
42.	Performance analysis of a CI Engine fuelled with olive oil and soybean oil mixture as a biofuels	166
43.	Design and Analysis of Landing Gear	170
44.	A Review on Parameters of Composite Materials	173
45.	Optimisation in WEDM of HCHCR Steel using Taughi Method	177
46.	Automated Pneumatic Sheet Metal Cutting Machine,	184
47.	Cylindrical Panel's Numerical And Analytical Investigations Subjected To Different Loads	187
48.	Application of a Thermoplastic Polyurethane/Polylactic Acid Composite Filament For 3D-Printed Personalized Orthosis	192
49.	Design and Analysis of a Connecting Rod	196
50.	A Study and Synthesis of 8 Bar One Degree of Freedom Walking Mechanism	200
51.	Mechanical properties and machining of Al-7075 SiC Composite	204
52.	Characterization of Tungsten carbide reinforced Al7075 matrix Composites.	208
53.	3D Printing of Prototype Through Image Processing using Autodesk Recap Photo Software	212
54.	Fabrication and Testing Mechanical Behaviour of Hemp Fibre, Chopped E Glass and Hybrid with Nano Particle	216
55.	Optical characterization of V_2O_5 doped Na_2O-SiO_2-ZrO_2 glasses	218
56.	Determination of Efficient Location of Split Air Conditioner using CFD	221

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

57.	Frictionless Electromagnetic Braking System	225
58.	Performance Evaluation of Vegetable oils as Cutting fluid under MQL Condition in Turning	228
59.	A novel hybrid Fuzzy AHP and VIKOR methodology for Reclaimer Selection in GSCM	236
60.	Design of Eco-Friendly Road Cleaner	240
61.	Mechanical and Microstructural Characterization of Jute Hybrid Composite with Alkali Treatment	244
62.	Experimental Investigation and Optimization of Process Parameters in Wire Cut EDM of EN31 Steel	248
63.	Design and Analysis of Differential Gear Box	252

***

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET -
Guntur (Dist.),

MVB 2021

ISBN: 978-93-91420-02-4

Design and Fabrication of Radiant Cooling System

Kasukurthi Prakash babu[1], Kukkala Haribalakrishna[2] and Venkannababu Mendi[3]

[1,2] Department of Mechanical Engineering Azad College of Engineering and Technology, Hyderabad, India

[3] Department of Mechanical EngineeringNarasaraopeta Engineering College (A).Narasaraopeta, India

***Abstract*: A radiant cooling system refers to a temperature-controlled surface that cools indoor temperatures by removing sensible heat and where more than half of heat transfer occurs through thermal radiation. This project includes the fabrication of air conditioning (HVAC) systems for commercial building by using radiant cooling systems. The two main benefits of radiant cooling systems include the potential to save energy and improvement of indoor thermal comfort. The radiant cooling panels can work more efficiently especially when proper control strategies are employed to avoid condensation. In this project we are studying about two primary types of radiant cooling systems. The first type is systems that deliver cooling through the building structure, usually slabs, these systems are also named thermally activated building systems (TABS).The second type is systems that deliver cooling through specialized panels. We are fabricating the working model of radiant cooling system and its pipe system.Radiant cooling panels are generally attached to ceilings, but can be attached to walls also. They are usually suspended from the ceiling, but can also be directly integrated with continuous dropped ceilings. Radiant cooling cools a floor or ceiling by absorbing the heat radiated from the rest of the room. When the floor is cooled, it is often referred to as radiant floor cooling; cooling the ceiling is usually done in homes with radiant panels.**

I. INTRODUCTION

1.1 RADIANT COOLING: Radiant cooling systems are generally chilled ceiling beams or panels, to take advantage of convective air cooling as well as mean radiant temperature. Because cool air sinks, a chilled ceiling beam will cool air that will sink and distribute itself through the space. Convection is more important for radiant ceiling panels and beams because, unlike radiant floors, no one will touch these surfaces. Because of this, they are sometimes simply called "chilled beams". However, radiant cooling systems can be located in floors as well.

1.2 ADVANTAGES OF RADIANT COOLING SYSTEMS: There are several good reasons designers should consider including radiant cooling systems in new buildings in any climate zones. Commercial buildings primarily cooled by radiant means are more comfortable than buildings cooled by traditional HVAC systems. The first costs for radiant systems are comparable with those for traditional variable-air-volume (VAV) systems, but their lifetime energy savings over VAV systems are routinely 25% or even more. With radiant systems, people are cooled by radiant heat transfer from their bodies to adjacent surfaces ceilings, walls, or floors whose temperatures are held a few degrees cooler than ambient.

Space conditioning energy is usually moved from chillers or boilers to radiant panels or concrete slab using water as a medium. This produces impressive savings, since water has roughly 3,500 times the energy transport capacity of air. Even accounting for the pressure drop involved in pumping water throughout a building, a hydronic system can transport a given amount of cooling with less than 5% of the energy required to deliver cool air with fans.

1.3 TYPES OF RADIANT COOLING SYSTEMS:

CHILLED SLABS: These deliver cooling through the building structure, usually slabs, and is also known as thermally activated building systems (TABS). Radiant cooling from a slab can be delivered to a space from the floor or ceiling. Floor cooling is similar to floor heating that has been used in Europe since last few decades.

CEILING PANELS: These deliver cooling through specialized panels. Systems using concrete slabs are generally cheaper than panel systems and offer the advantage of thermal mass while panel systems offer faster temperature control and flexibility.

2. LITERATURE SURVEY

2.1 LITERATURE SURVEY: Numerous specialists talked about the thermal comfort with in surfaces with a brilliant radiant cooling some of them are: Kulpmann in 1993 exhibited his analyzed result about the radiant cooling system with a decent thermal comfort and an air superiority in a zone where this system present. Kulpmann utilized some heat gain for showing the condition surface. Loveday in 2003 talked about the estimations done by him on thermal comfort on human related in a working space with brilliant radiant cooling with no modifications the thermal comfort by the radiant cooling is conceivable. In 2002 Mariel has built up a specific model with simulation application TRNSYS, utilizing the analyzed study, the execution of thermal comfort and energy utilization comes about for verification.

In fact, instead of using boilers or chillers that consume high-grade fossil fuels and electricity for low-grade needs (space heating and cooling), a more dramatic reduction in loss in terms of exergy would be the use of alternative low-grade cooling/heating sources. Examples are night cooling with ventilation, solar heating/cooling, evaporative processes, and ground heat exchange (Florides et al. 2002,

NEC NARASARAOPETA ENGINEERING COLLEGE (AUTONOMOUS)

NAAC 'A' GRADE

NATIONAL BOARD OF ACCREDITATION

RANKED 5

PROCEEDINGS

INTERNATIONAL CONFERENCE

EMERGING TRENDS IN MECHANICAL ENGINEERING AND INDUSTRIAL AUTOMATION

NEC-ICETMEIA-2K21

30th & 31st July, 2021

Editors-in-Chief

Dr. M.Sreenivasa Kumar
Principal & Professor, Dept. of Mechnical Engineering

Dr. D.Jagadish
Professor, Dept. of Mechnical Engineering

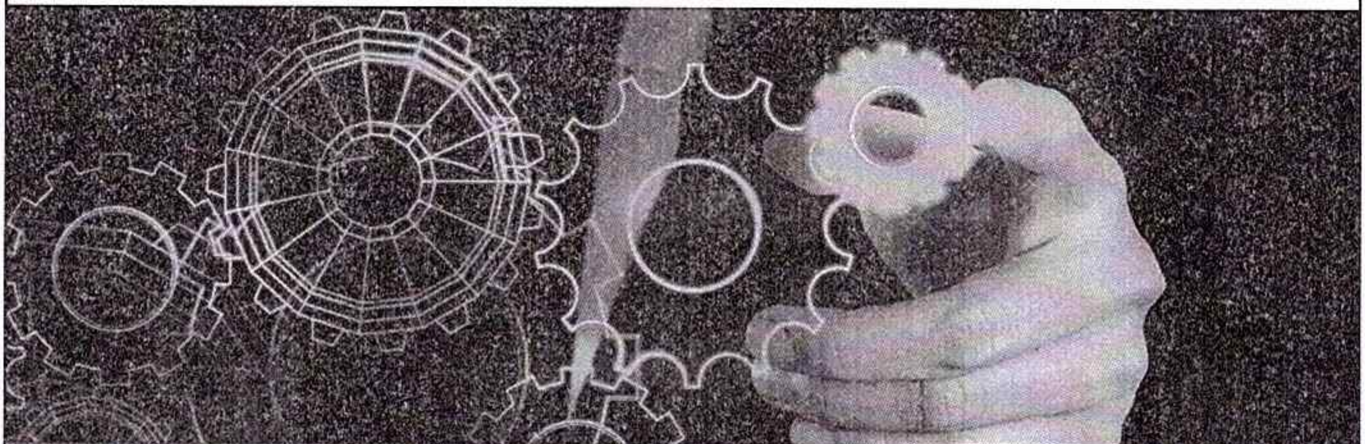
Editors

Dr. D.Suneel
Vice-Principal & Professor, Dept. of ME

Dr. P.Suresh Babu
Professor, Dept. of ME

Dr. B.Venkata Siva
Professor & HoD Dept. of ME

Mr. M.Venkanna Babu
Associate Professor, Dept. of ME



Organized by

Department of Mechanical Engineering

In Association with The Institution of Engineers (India)

ISBN : 978-93-91420-02-4

LIST OF FULL LENGTH PAPERS SELECTED FOR PROCEEDINGS

International Conference on Emerging Trends in Mechanical Engineering and Industrial Automation

NEC-ICETMEIA- 2K21

S.No.	TITLE OF THE PAPER	Page No.
1.	Effectiveness of Compression Ignition Engine Fuelled with Pond Water Algae Biodiesel	01
2.	Design And Analysis of Disc Brake of an Electric Go-Kart	04
3.	A Comprehensive Review on Recent Research on Semi Solid Processed Aluminum 7 Series Alloys	08
4.	A Study on Microstructure and Mechanical Properties A7075 Reinforced with Flyash/Sic Hybrid Metal Matrix Composite	15
5.	Establishment of SCR Test Facility and Evaluation of 8mm Pitch Honeycomb Type Catalyst in a 20 Liter capacity SCR Test facility	19
6.	A Review on NVH Issues and Technological Challenges in Electric Vehicle and Hybrid Electric Vehicle Power Train	25
7.	Design and Analysis of Cantilever Beam	29
8.	Analysis of Static and Fatigue Strength of Aluminium Alloy Wheel	32
9.	Design of Automated Braking System Based on Vehicle Over Speed Using PLC Ladder Method	35
10.	The Analysis on Concentric Pipe Heat Exchanger	39
11.	Design and Finite Element Analysis of Gas Turbine Blade	45
12.	Investigation on Mechanical Properties of Glass Fiber and Carbon Nano Tubes Sandwich Composite Material	47
13.	CFD Analysis of Super Utility Vehicle to Determine Aerodynamic Behavior	54
14.	Devlopment of Code for Automated HVAC System using Digital Controller	60
15.	Performance and Emission Characteristics Of Diesel Engine with Linseed Oil-Diesel Blends as Fuel With VCR	65
16.	Experimental Investigation in Single Cylinder VCR Multifuel Engine Using Bio-Diesel as Linseed Oil	69

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

17.	Tribological Properties of Textured Surface	72
18.	Thermal Analysis and Experimental Investigation of Pin Fin made of Brass	76
19.	Experimental and Simulation of Wear Test on GPR material	79
20.	CFD Analysis of Two Pass Double Pipe Heat Exchanger with TiO_2/Ethylene Glycol Nano Fluid	83
21.	Simulation and Optimization of Extrusion Process Parameters of Aluminium 2A12T4Alloy	87
22.	Importance of Ice Jet machining - A Review	91
23.	Performance Investigation of a Battery Powered Peltier Cooler	94
24.	Analysis of Disc Brake Rotor using ANSYS Workbench	98
25.	Modelling and Optimization of Two Wheeler Disk Brake Using ANSYS -Review	101
26.	Fabrication of Sewage Waste Cleaner	105
27.	Manufacturing of Hyperboliodal Gear Model Using Ultimaker S5 3D Printing Machine	109
28.	Arc Welding Process Selection Through Quality and Cost Analysis	113
29.	Li-Br H2O VAR System Analysis by Applying Magnetic Field to Liquid Line	117
30.	Heat Transfer Enhancement on Shell and Coil Type of Heat Exchanger Using SiO_2 and CuO Nano-Fluids	121
31.	Study of Rheological Characteristics of Nano Suspensions	126
32.	Design And Fabrication of Loop Wheel System	129
33.	Performance of Solar Vapour Absorption system and its Dependence on Generator Temperature	131
34.	Design and Analysis Of Handicapped Steering Tricycle	134
35.	Machining Characteristics and Microbiological Growth of Stir Casted A356-SiC MMCs and Pure Metals	136
36.	Design and Analysis of Connecting Rod	

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

IQAC

37.	Pressure Vessel Optimum Design using Particle Swarm Optimization	145
38.	Design and Analysis of Wheel Rim on Radial Loads	149
39.	COP Enhancement of VCR System using Diffusers	154
40.	Design and Fabrication of Radiant Cooling System	157
41.	Comparative Performance Analysis of Engine Fuelled with Diesel Biodiesel Iron Oxide Nano Particles	162
42.	Performance analysis of a CI Engine fuelled with olive oil and soybean oil mixture as a biofuels	166
43.	Design and Analysis of Landing Gear	170
44.	A Review on Parameters of Composite Materials	173
45.	Optimisation in WEDM of HCHCR Steel using Taughi Method	177
46.	Automated Pneumatic Sheet Metal Cutting Machine	184
47.	Cylindrical Panel's Numerical And Analytical Investigations Subjected To Different Loads	187
48.	Application of a Thermoplastic Polyurethane/Polylactic Acid Composite Filament For 3D-Printed Personalized Orthosis	192
49.	Design and Analysis of a Connecting Rod	196
50.	A Study and Synthesis of 8 Bar One Degree of Freedom Walking Mechanism	200
51.	Mechanical properties and machining of Al-7075 SiC Composite	204
52.	Characterization of Tungsten carbide reinforced Al7075 matrix Composites.	208
53.	3D Printing of Prototype Through Image Processing using Autodesk Recap Photo Software	212
54.	Fabrication and Testing Mechanical Behaviour of Hemp Fibre, Chopped E Glass and Hybrid with Nano Particle	216
55.	Optical characterization of V_2O_5 doped Na_2O-SiO_2-ZrO_2 glasses	218
56.	Determination of Efficient Location of Split Air Conditioner using CFD	221

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

57.	Frictionless Electromagnetic Braking System	225
58.	Performance Evaluation of Vegetable oils as Cutting fluid under MQL Condition in Turning	228
59.	A novel hybrid Fuzzy AHP and VIKOR methodology for Reclaimer Selection in GSCM	236
60.	Design of Eco-Friendly Road Cleaner	240
61.	Mechanical and Microstructural Characterization of Jute Hybrid Composite with Alkali Treatment	244
62.	Experimental Investigation and Optimization of Process Parameters in Wire Cut EDM of EN31 Steel	248
63.	Design and Analysis of Differential Gear Box	252

***

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

MVB 2021

ISBN: 978-93-91420-02-4

Determination of Efficient Location of Split Air Conditioner Using CFD

Venkannababu Mendi [1], Kasukurthi Prakash Babu[2] and Kukkala Haribalakrishna[3]

[1]Associate Professor, Department of Mechanical Engineering,Narasaraopeta Engineering College (Autonomous), Andhra Pradesh

[2,3]Associate Professor, Department of Mechanical Engineering, Azad College of Engineering and Technology,Hyderabad, Telangana

Abstract: **Air conditioning deals with conditioning of air for maintaining specific conditions of temperature, relative humidity and air movement inside an enclosed space. The working performance and efficiency of the air conditioner mainly depends on the location inside the room where it was installed. If the air conditioner was installed correctly, it will perform efficiently and economically. Proper distribution of air in a ventilated room is important in order to achieve satisfactory temperature and air velocity. The inlet location and the conditions of air at the inlet can affect the airflow pattern significantly. Experimentally determining the efficient location for air conditioner is very difficult and tedious. The technique of Computational Fluid Dynamics (CFD) with the help of computers is used for solving fluid problems and spans a wide range of non - industrial and industrial application areas. This technique was applied for the present analysis. In room air conditioning, temperature of the air in human comfort region is the main parameter. This parameter depends on the input parameters such as inlet temperature of the air, wall temperature and velocity of the inlet air. In the above analysis, the efficient location of air conditioner for good performance was found out to be 2.1 m above the floor. Keeping the inlet location at this efficient location, simulation was carried out with in the range of input parameters.**

I. INTRODUCTION

Human beings feel comfort and work efficiently with in a restricted set of physical conditions of temperature, humidity, draught and fresh air requirements. Fresh air is generally required to dilute the pollution levels and CO2 levels. Lack of environmental control in buildings may affect the health of human beings apart from reduction in efficiency and comfort level. In excessively hot climates. It is necessary to reduce temperature and humidity of supply air and in excessively cold climates it is necessary to increase them. Energy efficient buildings with good thermal insulation require low volume flow rates of supply air. This may lead to non-uniform velocity and temperature distribution apart from stagnation zones and accumulation of pollutants and odour due to poor recirculation. Architects and air conditioning engineers have to consider all these facts apart from providing better ambience and aesthetics. The velocity and temperature distribution in the room plays a vital role from this point of view. The need of precise determination of air flow pattern and temperature distribution in room was realized first by air-conditioning engineers so as to provide comfort throughout the occupied zone. The cooling load of an office air condition have increase significantly because of an increase in various types of heat sources such as electric machinery. In particular, the increased no. of personal computers, engineering work stations, main frames etc., generates a large amount of heat, cause serious air conducting problems. In room air conditioning, temperature of the air in human comfort region is the main parameter. This parameter depends on the input parameters such as inlet temperature of the air, wall temperature and velocity of the inlet air. In the above analysis, an attempt was made to find the efficient location of the air conditioner. Considering this model as basis, simulation is done within the range of input parameters.

II. LITERATURE SURVEY

In 1963, a new long-range study on human comfort was initiated by the American society of heating, refrigerating, and air-conditioning engineers (ASHRAE) [1], which was conducted by the institute for environmental Research at Kansas State University under contract to ASHRAE. On the basis of results obtained from that research, a New Effective Temperature scale has been developed. Its comfort Envelope (ABCD) is depicted in Fig. 2.8, which is adapted from data provided in ASHRAE standard 55-74, thermal environment conditions for Human Occupancy, published in 1974, and from ASHRAE handbook, 1977 Fundamentals [1]. It is evident that the comfort envelope has on its lower boundary a line that approximates the 20% RH line. Along this boundary, the "comfort" condition lies between about 72 0F DBT. The upper boundary of the comfort envelope straddles the 65 percent RH line, and here "comfort" exists between about 70 0F DBT and 77 0F DBT.

Mr. Kwok [2] examined the comfort criteria of ASHRAE standard 55-1992 for their applicability in typical classrooms. A file study conducted in Hawaii used a variety of methods to collect the data: survey questionnaires, physical measurements, interviews and behavioral observations. A total of 3,544 students and teachers completed questionnaires in 29 naturally ventilated air-conditioned classrooms in six schools during two seasons. The majority of classrooms failed to meet the physical specification of the standard 55 comfort zone. Thermal neutrality, preference and acceptability votes by occupants of both naturally ventilated and air- conditioned classrooms exceeded the standard's 805 acceptability criteria, regardless of whether physical conditions were in or out of the comfort zone. Responses from these two school populations suggested not only a basis for separate comfort standard but also energy conservation opportunities through raising thermostat set points.

The National Appliance Energy Conservation act (NAECA) of 1987 established minimum energy-efficiency standards for room air-conditioners, which became effective on January 1, 1990 [3]. The 1990 minimum energy-efficiency ratios (EER) range from 8.0 to 9.0 (Btu/h)/W (2.34 to 2.64 W/W). As required by NAECA, the department of energy (DOE) must also consider amending the room air conditioner standards and affected it in 1990. As a result, the DOE issued a notice of proposed rulemaking (NOPR) in March 1994 proposing new energy-efficiency standards for several

IQAC

NEC NARASARAOPETA ENGINEERING COLLEGE (AUTONOMOUS)

NAAC 'A' GRADE

NBA NATIONAL BOARD OF ACCREDITATION

PROCEEDINGS

INTERNATIONAL CONFERENCE

EMERGING TRENDS IN MECHANICAL ENGINEERING AND INDUSTRIAL AUTOMATION

NEC-ICETMEIA-2K21

30th & 31st July, 2021

Editors-in-Chief

Dr. M.Sreenivasa Kumar
Principal & Professor, Dept. of Mechnical Engineering

Dr. D.Jagadish
Professor, Dept. of Mechnical Engineering

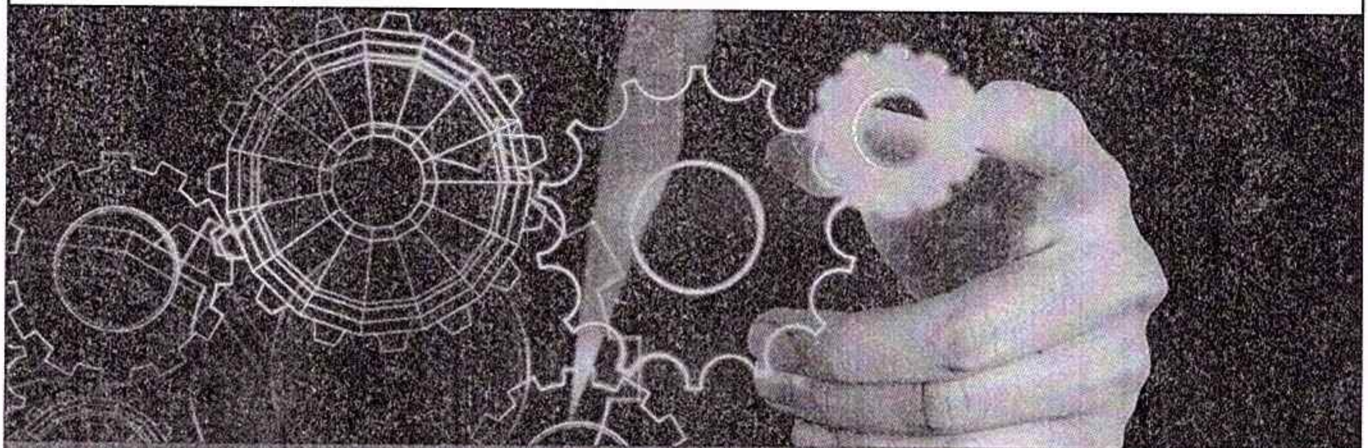
Editors

Dr. D.Suneel
Vice-Principal & Professor, Dept. of ME

Dr. P.Suresh Babu
Professor, Dept. of ME

Dr. B.Venkata Siva
Professor & HoD Dept. of ME

Mr. M.Venkanna Babu
Associate Professor, Dept. of ME



Organized by

Department of **Mechanical Engineering**

In Association with *The Institution of Engineers (India)*

ISBN : 978-93-91420-02-4

LIST OF FULL LENGTH PAPERS SELECTED FOR PROCEEDINGS

International Conference on Emerging Trends in Mechanical Engineering and Industrial Automation

NEC-ICETMEIA- 2K21

S.No.	TITLE OF THE PAPER	Page No.
1.	Effectiveness of Compression Ignition Engine Fuelled with Pond Water Algae Biodiesel	01
2.	Design And Analysis of Disc Brake of an Electric Go-Kart	04
3.	A Comprehensive Review on Recent Research on Semi Solid Processed Aluminum 7 Series Alloys	08
4.	A Study on Microstructure and Mechanical Properties A7075 Reinforced with Flyash/Sic Hybrid Metal Matrix Composite	15
5.	Establishment of SCR Test Facility and Evaluation of 8mm Pitch Honeycomb Type Catalyst in a 20 Liter capacity SCR Test facility	19
6.	A Review on NVH Issues and Technological Challenges in Electric Vehicle and Hybrid Electric Vehicle Power Train	25
7.	Design and Analysis of Cantilever Beam	29
8.	Analysis of Static and Fatigue Strength of Aluminium Alloy Wheel	32
9.	Design of Automated Braking System Based on Vehicle Over Speed Using PLC Ladder Method	35
10.	The Analysis on Concentric Pipe Heat Exchanger	39
11.	Design and Finite Element Analysis of Gas Turbine Blade	45
12.	Investigation on Mechanical Properties of Glass Fiber and Carbon Nano Tubes Sandwich Composite Material	47
13.	CFD Analysis of Super Utility Vehicle to Determine Aerodynamic Behavior	54
14.	Devlopment of Code for Automated HVAC System using Digital Controller	60
15.	Performance and Emission Characteristics Of Diesel Engine with Linseed Oil-Diesel Blends as Fuel With VCR	65
16.	Experimental Investigation in Single Cylinder VCR Multifuel Engine Using Bio-Diesel as Linseed Oil	69

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

17.	Tribological Properties of Textured Surface	72
18.	Thermal Analysis and Experimental Investigation of Pin Fin made of Brass	76
19.	Experimental and Simulation of Wear Test on GPR material	79
20.	CFD Analysis of Two Pass Double Pipe Heat Exchanger with TiO_2/Ethylene Glycol Nano Fluid	83
21.	Simulation and Optimization of Extrusion Process Parameters of Aluminium 2A12T4Alloy	87
22.	Importance of Ice Jet machining - A Review	91
23.	Performance Investigation of a Battery Powered Peltier Cooler	94
24.	Analysis of Disc Brake Rotor using ANSYS Workbench	98
25.	Modelling and Optimization of Two Wheeler Disk Brake Using ANSYS -Review	101
26.	Fabrication of Sewage Waste Cleaner	105
27.	Manufacturing of Hyperboliodal Gear Model Using Ultimaker S5 3D Printing Machine	109
28.	Arc Welding Process Selection Through Quality and Cost Analysis	113
29.	Li-Br H2O VAR System Analysis by Applying Magnetic Field to Liquid Line	117
30.	Heat Transfer Enhancement on Shell and Coil Type of Heat Exchanger Using SiO_2 and CuO Nano-Fluids	121
31.	Study of Rheological Characteristics of Nano Suspensions	126
32.	Design And Fabrication of Loop Wheel System	129
33.	Performance of Solar Vapour Absorption system and its Dependence on Generator Temperature	131
34.	Design and Analysis Of Handicapped Steering Tricycle	134
35.	Machining Characteristics and Microbiological Growth of Stir Casted A356-SiC MMCs and Pure Metals	136
36.	Design and Analysis of Connecting Rod	141

37.	Pressure Vessel Optimum Design using Particle Swarm Optimization	145
38.	Design and Analysis of Wheel Rim on Radial Loads	149
39.	COP Enhancement of VCR System using Diffusers	154
40.	Design and Fabrication of Radiant Cooling System	157
41.	Comparative Performance Analysis of Engine Fuelled with Diesel Biodiesel Iron Oxide Nano Particles	162
42.	Performance analysis of a CI Engine fuelled with olive oil and soybean oil mixture as a biofuels	166
43.	Design and Analysis of Landing Gear	170
44.	A Review on Parameters of Composite Materials	173
45.	Optimisation in WEDM of HCHCR Steel using Taughi Method	177
46.	Automated Pneumatic Sheet Metal Cutting Machine	184
47.	Cylindrical Panel's Numerical And Analytical Investigations Subjected To Different Loads	187
48.	Application of a Thermoplastic Polyurethane/Polylactic Acid Composite Filament For 3D-Printed Personalized Orthosis	192
49.	Design and Analysis of a Connecting Rod	196
50.	A Study and Synthesis of 8 Bar One Degree of Freedom Walking Mechanism	200
51.	Mechanical properties and machining of Al-7075 SiC Composite	204
52.	Characterization of Tungsten carbide reinforced Al7075 matrix Composites.	208
53.	3D Printing of Prototype Through Image Processing using Autodesk Recap Photo Software	212
54.	Fabrication and Testing Mechanical Behaviour of Hemp Fibre, Chopped E Glass and Hybrid with Nano Particle	216
55.	Optical characterization of V_2O_5 doped Na_2O-SiO_2-ZrO_2 glasses	218
56.	Determination of Efficient Location of Split Air Conditioner using CFD	221

57.	Frictionless Electromagnetic Braking System	225
58.	Performance Evaluation of Vegetable oils as Cutting fluid under MQL Condition in Turning	228
59.	A novel hybrid Fuzzy AHP and VIKOR methodology for Reclaimer Selection in GSCM	236
60.	Design of Eco-Friendly Road Cleaner	240
61.	Mechanical and Microstructural Characterization of Jute Hybrid Composite with Alkali Treatment	244
62.	Experimental Investigation and Optimization of Process Parameters in Wire Cut EDM of EN31 Steel	248
63.	Design and Analysis of Differential Gear Box	252

***

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

PS 2021

ISBN: 978-93-91420-02-4

Effectiveness of Compression-Ignition Engine Fuelled with Pond Water Algae Biodiesel

Katta Murali Krishna Prasad and P. Sravani
Department of Mechanical Engineering, Narasaraopeta Engineering College (AUTONUMOUS), Narasaraopet, A.P.

***Abstract*—Algae are the fast-growing florae around the globe. Microalgae are largely a diverse group of microorganisms comprising eukaryotic photoautotrophic protists and prokaryotic cyanobacteria (sometimes called blue-green algae). These microbes contribute to half of global photosynthetic activity and are virtually found in euphotic niches. The viability of biodiesel from pond water algae (PWA) as a third-generation biodiesel feedstock is examined in current investigation. Primarily, the oil is extracted from the algal biomass and then it is subjected to two stage trans-esterification technique. Ethanol is mixed up with the attained algal bio oil in order to reduce its viscosity. The processed algal oil is blended with diesel in various proportions. Later, by direct-injection into compression-ignition, the engine's performance and emission characteristics are assessed at varying loads (25, 50 and 100%) and CRs (15.5, 16.5, 17.5 and 18.5) using these prepared blends. Results have depicted that performance indices of engine are enhanced and emission parameters are reduced with the increase of algal biodiesel proportion in diesel fossil fuel.**

Keywords: Selective catalytic reactor, honeycomb, catalyst, space velocity, NOx conversion efficiency, ammonia slip.

I. INTRODUCTION

Energy executes a noteworthy role in development. The fiscal development of any nation relies on its energy consumption. It is vital in every sector around the world, i.e. transportation, manufacturing, agriculture sector etc. BP Statistical Review reported that primary energy consumption by fuel is 13276.3 M toe. However, total proven oil reserves are 1706.7 thousand million barrels in the world till the end of 2016, which is sufficient to meet 5to6 decades of world energy demand [1].The world energy consumption is drastically increased from ~1687.7 kg in 2003 to 1873.7 kg in2010 (per capita kg of oil equivalent). However, diesel fuel consumption per capita increased by ~ 37% between 2003 and 2010 for the automotive diesel engine [2,3]. It has been found 900 million vehicles (except two-wheelers) throughout the world that produces almost 26% greenhouse gases (GHGs) emissions [4]. Nearly all types of automobiles operated by diesel and petrol play a vital role in air pollution. To curbs out pollution hazards, many countries adopted and implemented the updated emission standards, and made a policy to use alternative energy sources. In India, Bharat Stage VI (BS-VI) standards are going to be implemented from 2020, surpassing BS-V to control the continuous increasing pollution hazards from automobiles. Various worldwide emission standards (Bharat Stage, China, and Euro) for cars and light trucks (diesel vehicles) for the last decade are shown in Fig.1[5]. A flow chart of transportation activities and their emission are presented in Fig. 2, and the vehicle population growth (commercial~29.6%and passenger~34.9) from 2010t o 2020 are shown in Fig. 3 [6].

II. REVIEW OF LITERATURE

Saharetal. [19] Studied the technique for biodiesel production and analysis from used cooking oil with feedstock pretreatment method, transesterification process, whereas Mohadesi et al. [20] examined the impact of KOH/Cl inoptilolite as a catalyst to produce biodiesel using used cooking oil. Kassaby and Allah[21] examined the effect of varying compression ratios (CR14, CR16, CR18) at different speeds (1000, 1250,1500, 1750, and 2000 rpm) on CI engine fueled with different blends (B0, B10, B20,B30, B50) and ensured that the 20% biodiesel blended safely with diesel fuel and delivered almost the same performance and exhaust emissions when compared with diesel.

III. EXPERIMENTALINVESTIGATION

A. Biodiesel preparation

Blends of fossil fuel diesel, PWA oil and ethanol are employed in CI engine as fuels. Initially, Algae was collected from local pond (PWA) present in Krishna district of Andhra Pradesh state, India. Preparation of PWA biodiesel is depicted through Fig. 6.Collected PWA were ground with motor as much as possible. The ground PWA were dried for 20 min at 80°C in an incubator for releasing water. Hexane and ether solution (20 and 20 mL) were mixed with the dried PWA to extract oil. Then the mixture was kept for24 h for settling. The biomass was collected after filtration and weighted.

The extracted oil was evaporated in vacuum to release hexane and ether solutions using rotary evaporator. 0.25 g NaOH was mixed with 24 mL methanol and stirred properly for 20 min. The mixture of catalyst and methanol was poured into the algal oil in a conical flask in order to lessen its viscosity. Later, transesterification reaction process is carried out. The conical flask containing solution was stirred for 3h by electric shaker at 300rpm. The reaction process step is indicated in Fig. 1.

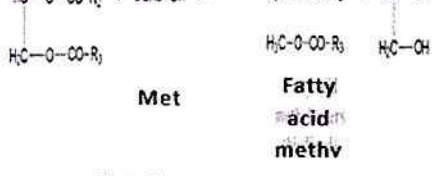


Fig.1. Transesterification reaction

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

NEC NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)

NAAC 'A' GRADE | NATIONAL BOARD OF ACCREDITATION | RANKED 5

PROCEEDINGS

INTERNATIONAL CONFERENCE

EMERGING TRENDS IN MECHANICAL ENGINEERING AND INDUSTRIAL AUTOMATION

NEC-ICETMEIA-2K21

30th & 31st July, 2021

Editors-in-Chief

Dr. M.Sreenivasa Kumar
Principal & Professor, Dept. of Mechnical Engineering

Dr. D.Jagadish
Professor, Dept. of Mechnical Engineering

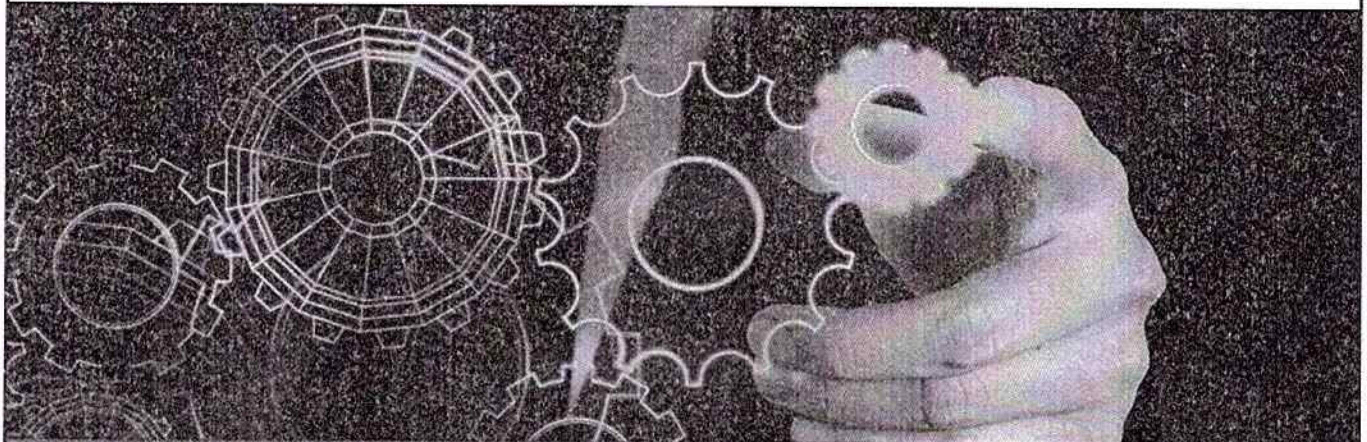
Editors

Dr. D.Suneel
Vice-Principal & Professor, Dept. of ME

Dr. P.Suresh Babu
Professor, Dept. of ME

Dr. B.Venkata Siva
Professor & HoD Dept. of ME

Mr. M.Venkanna Babu
Associate Professor, Dept. of ME



Organized by

Department of Mechanical Engineering

In Association with The Institution of Engineers (India)

ISBN : 978-93-91420-02-4

LIST OF FULL LENGTH PAPERS SELECTED FOR PROCEEDINGS

International Conference on Emerging Trends in Mechanical Engineering and Industrial Automation

NEC-ICETMEIA- 2K21

S.No.	TITLE OF THE PAPER	Page No.
1.	Effectiveness of Compression Ignition Engine Fuelled with Pond Water Algae Biodiesel	01
2.	Design And Analysis of Disc Brake of an Electric Go-Kart	04
3.	A Comprehensive Review on Recent Research on Semi Solid Processed Aluminum 7 Series Alloys	08
4.	A Study on Microstructure and Mechanical Properties A7075 Reinforced with Flyash/Sic Hybrid Metal Matrix Composite	15
5.	Establishment of SCR Test Facility and Evaluation of 8mm Pitch Honeycomb Type Catalyst in a 20 Liter capacity SCR Test facility	19
6.	A Review on NVH Issues and Technological Challenges in Electric Vehicle and Hybrid Electric Vehicle Power Train	25
7.	Design and Analysis of Cantilever Beam	29
8.	Analysis of Static and Fatigue Strength of Aluminium Alloy Wheel	32
9.	Design of Automated Braking System Based on Vehicle Over Speed Using PLC Ladder Method	35
10.	The Analysis on Concentric Pipe Heat Exchanger	39
11.	Design and Finite Element Analysis of Gas Turbine Blade	45
12.	Investigation on Mechanical Properties of Glass Fiber and Carbon Nano Tubes Sandwich Composite Material	47
13.	CFD Analysis of Super Utility Vehicle to Determine Aerodynamic Behavior	54
14.	Devlopment of Code for Automated HVAC System using Digital Controller	60
15.	Performance and Emission Characteristics Of Diesel Engine with Linseed Oil-Diesel Blends as Fuel With VCR	65
16.	Experimental Investigation in Single Cylinder VCR Multifuel Engine Using Bio-Diesel as Linseed Oil	69

17.	Tribological Properties of Textured Surface	72
18.	Thermal Analysis and Experimental Investigation of Pin Fin made of Brass	76
19.	Experimental and Simulation of Wear Test on GPR material	79
20.	CFD Analysis of Two Pass Double Pipe Heat Exchanger with TiO_2/Ethylene Glycol Nano Fluid	83
21.	Simulation and Optimization of Extrusion Process Parameters of Aluminium 2A12T4Alloy	87
22.	Importance of Ice Jet machining - A Review	91
23.	Performance Investigation of a Battery Powered Peltier Cooler	94
24.	Analysis of Disc Brake Rotor using ANSYS Workbench	98
25.	Modelling and Optimization of Two Wheeler Disk Brake Using ANSYS -Review	101
26.	Fabrication of Sewage Waste Cleaner	105
27.	Manufacturing of Hyperboliodal Gear Model Using Ultimaker S5 3D Printing Machine	109
28.	Arc Welding Process Selection Through Quality and Cost Analysis	113
29.	Li-Br H2O VAR System Analysis by Applying Magnetic Field to Liquid Line	117
30.	Heat Transfer Enhancement on Shell and Coil Type of Heat Exchanger Using SiO_2 and CuO Nano-Fluids	121
31.	Study of Rheological Characteristics of Nano Suspensions	126
32.	Design And Fabrication of Loop Wheel System	129
33.	Performance of Solar Vapour Absorption system and its Dependence on Generator Temperature	131
34.	Design and Analysis Of Handicapped Steering Tricycle	134
35.	Machining Characteristics and Microbiological Growth of Stir Casted A356-SiC MMCs and Pure Metals	136
36.	Design and Analysis of Connecting Rod	141

37.	Pressure Vessel Optimum Design using Particle Swarm Optimization	145
38.	Design and Analysis of Wheel Rim on Radial Loads	149
39.	COP Enhancement of VCR System using Diffusers	154
40.	Design and Fabrication of Radiant Cooling System	157
41.	Comparative Performance Analysis of Engine Fuelled with Diesel Biodiesel Iron Oxide Nano Particles	162
42.	Performance analysis of a CI Engine fuelled with olive oil and soybean oil mixture as a biofuels	166
43.	Design and Analysis of Landing Gear	170
44.	A Review on Parameters of Composite Materials	173
45.	Optimisation in WEDM of HCHCR Steel using Taughi Method	177
46.	Automated Pneumatic Sheet Metal Cutting Machine	184
47.	Cylindrical Panel's Numerical And Analytical Investigations Subjected To Different Loads	187
48.	Application of a Thermoplastic Polyurethane/Polylactic Acid Composite Filament For 3D-Printed Personalized Orthosis	192
49.	Design and Analysis of a Connecting Rod	196
50.	A Study and Synthesis of 8 Bar One Degree of Freedom Walking Mechanism	200
51.	Mechanical properties and machining of Al-7075 SiC Composite	204
52.	Characterization of Tungsten carbide reinforced Al7075 matrix Composites.	208
53.	3D Printing of Prototype Through Image Processing using Autodesk Recap Photo Software	212
54.	Fabrication and Testing Mechanical Behaviour of Hemp Fibre, Chopped E Glass and Hybrid with Nano Particle	216
55.	Optical characterization of V_2O_5 doped Na_2O-SiO_2-ZrO_2 glasses	218
56.	Determination of Efficient Location of Split Air Conditioner using CFD	221

57.	Frictionless Electromagnetic Braking System	225
58.	Performance Evaluation of Vegetable oils as Cutting fluid under MQL Condition in Turning	228
59.	A novel hybrid Fuzzy AHP and VIKOR methodology for Reclaimer Selection in GSCM	236
60.	Design of Eco-Friendly Road Cleaner	240
61.	Mechanical and Microstructural Characterization of Jute Hybrid Composite with Alkali Treatment	244
62.	Experimental Investigation and Optimization of Process Parameters in Wire Cut EDM of EN31 Steel	248
63.	Design and Analysis of Differential Gear Box	252

***

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

PS 2021

ISBN: 978-93-91420-02-4

The Analysis on Concentric Pipe Heat Exchanger

Shaik Chand Mabhu Subhani and Pilli Sravani
Department of Mechanical Engineering, Narasaraopeta engineering college (Autonomous),Narasaraopet, Guntur, A.P.

***Abstract*—A Heat Exchanger is a device which is used to transfer heat from one fluid to another, whether the fluids are separated by a solid wall so that they never mix, or the fluids are directly in contact. Every year Heat exchanger technology is growing to develop efficient, compact and economical heat exchangers, all over the world. Updating the community for this development needs an interaction. These days concentric tube heat exchangers are used with forced convection for lowering the working fluid's temperature by raising the cooling medium's temperature.**

The purpose of this project is to use ANSYS FLUENT software and practical calculations to analyze the temperature drops as a function of both inlet velocity and inlet temperature and how each varies with the other. Each heat exchanger model was designed and simulated for both parallel flow and counter flow heat exchanger models. The results were compared between parallel and counter flow heat exchangers. CFD analysis was utilized to find the outlet temperatures of parallel and counter flow heat exchangers for the inlet velocity and inlet temperature of the fluid medium used. "Computational Fluid Dynamics (CFD) is a science of predicting fluid flow, heat transfer, mass transfer, and related phenomena by solving the mathematical equations which govern these processes using a numerical processes". These outlet temperature values obtained were used to determine the overall heat transfer coefficient. Theoretical calculations are done by the values obtained through the experiment conducted on the heat exchanger setup for both parallel and counter flow

Keywords— Heat Exchangers, Parallel flow, Counter flow, temperature , CFD Analysis , ansys

I. Introduction

Today's demand of higher energy consumption and reduced availability of fossil fuel resources increase the impact of thermal performance of heat exchanger day by day. Heat exchangers are very effective for the transfer of heat from one medium to another without even intermixing one fluid with another. One of the most promising devices for heat transfer is the counter flow heat exchanger mostly adapted by the chemical plants, petrochemical plants, oil refineries etc. Reducing the temperature of hot outlet fluid without affecting the cost is a big task for various industries that could be only possible by the proper selection of input. Typically, in a heat exchanger two segregated fluids at different temperature with a solid boundary, exchange thermal energy from one fluid to another via surface without even intermixing. There are numerous configurations of classifying heat exchanger. In context with the flow configuration, there exists three primary types for heat transfer: parallel flow, counter flow and, cross flow. According to Fourier for the conduction states the more the area of heat exchanger, the more will be the heat transfer rate.

By second law of thermodynamics only transfer of sensible heat occurs in the heat exchanger. One of the greatest advantages of the counter flow heat exchanger is higher uniform temperature difference as well as that the mass flow rate and time for the interaction of one fluid with other increases, the heat transfer also goes up as compared to parallel flow heat exchanger. Maximization of surface area and minimization of flow resistance lead to better effectiveness of heat exchanger, which is the main focus for designing. On the contrary, the increase in area increases the space for the installation and correspondingly manufacturing cost will get increased. On the other hand, reduction in flow resistance can be achieved by improving the surface finishing of the heat exchanger. Many experiments have been carried out on the counter flow heat exchanger citing the flow in either laminar or turbulent manner, for achieving its better configuration. However, very limited CFD simulation has been done on the counter flow heat exchanger at different flow configuration to verify the thermo-hydraulic performance or to check the heat transfer and velocity distribution inside the flow domain.

Direction of Flow: According to the relative direction of two fluid streams the heat exchangers are classified into the following three categories:

1. Parallel flow
2. Counter flow
3. Cross – flow

A. Parallel flow heat exchangers:

In parallel flow heat exchangers the fluids both hot and cold travel in same direction. The flow arrangement for hot and cold fluids from inlet to outlet is shown in fig 1.1. In parallel flow heat exchangers the temperature difference from hot to clod fluid decreases. This type of heat exchangers requires large space and hence it is rarely used in practical applications. Eg: Oil coolers, oil heaters, water heaters etc. are examples of parallel flow heat exchanger.

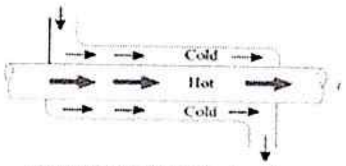


Fig 1.1. Parallel flow heat exchanger

B. Counter flow heat exchangers

In a counter flow heat exchanger, the two hot and cold fluids enter at opposite ends. The flow arrangement and temperature distribution for such a heat exchanger are shown schematically in fig. 1.2. the temperature difference between the two fluids remains more or less nearly constant. This type of heat exchanger, due to counter flow, gives maximum rate of heat transfer f or a given surface area. Hence such a heat exchangers are most favored for heating and cooling of fluids.

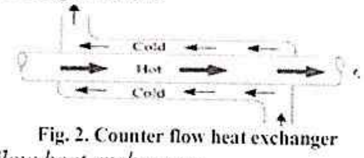


Fig. 2. Counter flow heat exchanger

C. Cross - flow heat exchanger

When two fluids crosses one another in space at right angles such type of heat exchanger is known as cross flow heat exchanger. In cross flow heat exchanger there is no mixing of fluid streams and hot fluid flows in spate tubes and cold fluid is mixes perfectly as it flows through the

NEC NARASARAOPETA ENGINEERING COLLEGE (AUTONOMOUS)

NAAC 'A' GRADE

NATIONAL BOARD of ACCREDITATION

PROCEEDINGS

INTERNATIONAL CONFERENCE

EMERGING TRENDS IN MECHANICAL ENGINEERING AND INDUSTRIAL AUTOMATION

NEC-ICETMEIA-2K21

30th & 31st July, 2021

Editors-in-Chief

Dr. M.Sreenivasa Kumar
Principal & Professor, Dept. of Mechnical Engineering

Dr. D.Jagadish
Professor, Dept. of Mechnical Engineering

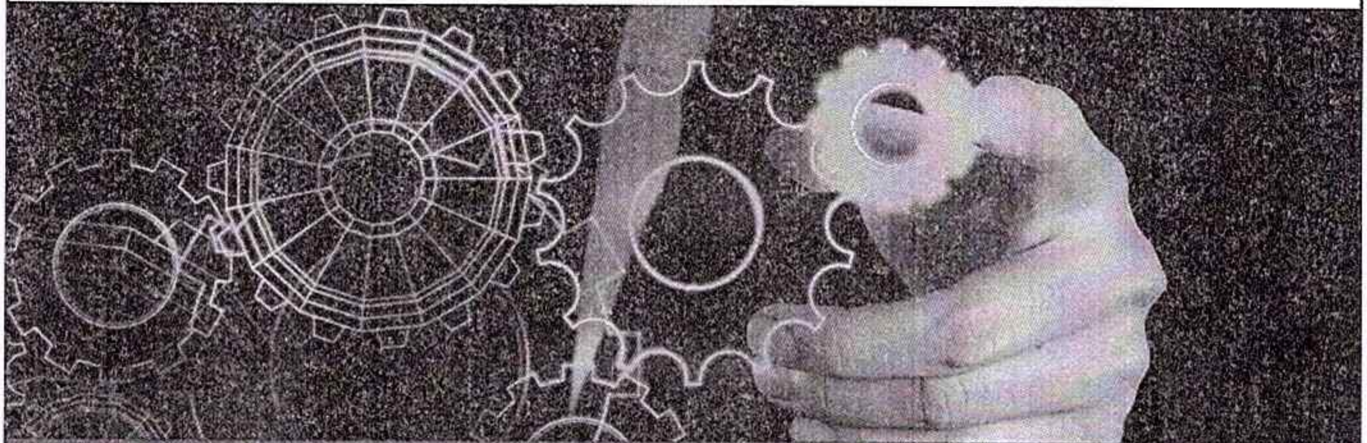
Editors

Dr. D.Suneel
Vice-Principal & Professor, Dept. of ME

Dr. P.Suresh Babu
Professor, Dept. of ME

Dr. B.Venkata Siva
Professor & HoD Dept. of ME

Mr. M.Venkanna Babu
Associate Professor, Dept. of ME



Organized by

Department of Mechanical Engineering

In Association with The Institution of Engineers (India)

ISBN: 978-93-91420-02-4

LIST OF FULL LENGTH PAPERS SELECTED FOR PROCEEDINGS

International Conference on Emerging Trends in Mechanical Engineering and Industrial Automation

NEC-ICETMEIA- 2K21

S.No.	TITLE OF THE PAPER	Page No.
1.	Effectiveness of Compression Ignition Engine Fuelled with Pond Water Algae Biodiesel	01
2.	Design And Analysis of Disc Brake of an Electric Go-Kart	04
3.	A Comprehensive Review on Recent Research on Semi Solid Processed Aluminum 7 Series Alloys	08
4.	A Study on Microstructure and Mechanical Properties A7075 Reinforced with Flyash/Sic Hybrid Metal Matrix Composite	15
5.	Establishment of SCR Test Facility and Evaluation of 8mm Pitch Honeycomb Type Catalyst in a 20 Liter capacity SCR Test facility	19
6.	A Review on NVH Issues and Technological Challenges in Electric Vehicle and Hybrid Electric Vehicle Power Train	25
7.	Design and Analysis of Cantilever Beam	29
8.	Analysis of Static and Fatigue Strength of Aluminium Alloy Wheel	32
9.	Design of Automated Braking System Based on Vehicle Over Speed Using PLC Ladder Method	35
10.	The Analysis on Concentric Pipe Heat Exchanger	39
11.	Design and Finite Element Analysis of Gas Turbine Blade	45
12.	Investigation on Mechanical Properties of Glass Fiber and Carbon Nano Tubes Sandwich Composite Material	47
13.	CFD Analysis of Super Utility Vehicle to Determine Aerodynamic Behavior	54
14.	Devlopment of Code for Automated HVAC System using Digital Controller	60
15.	Performance and Emission Characteristics Of Diesel Engine with Linseed Oil-Diesel Blends as Fuel With VCR	65
16.	Experimental Investigation in Single Cylinder VCR Multifuel Engine Using Bio Diesel as Linseed Oil	

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

IQAC

17.	Tribological Properties of Textured Surface	72
18.	Thermal Analysis and Experimental Investigation of Pin Fin made of Brass	76
19.	Experimental and Simulation of Wear Test on GPR material	79
20.	CFD Analysis of Two Pass Double Pipe Heat Exchanger with TiO_2/Ethylene Glycol Nano Fluid	83
21.	Simulation and Optimization of Extrusion Process Parameters of Aluminium 2A12T4Alloy	87
22.	Importance of Ice Jet machining - A Review	91
23.	Performance Investigation of a Battery Powered Peltier Cooler	94
24.	Analysis of Disc Brake Rotor using ANSYS Workbench	98
25.	Modelling and Optimization of Two Wheeler Disk Brake Using ANSYS -Review	101
26.	Fabrication of Sewage Waste Cleaner	105
27.	Manufacturing of Hyperboliodal Gear Model Using Ultimaker S5 3D Printing Machine	109
28.	Arc Welding Process Selection Through Quality and Cost Analysis	113
29.	Li-Br H2O VAR System Analysis by Applying Magnetic Field to Liquid Line	117
30.	Heat Transfer Enhancement on Shell and Coil Type of Heat Exchanger Using SiO_2 and CuO Nano-Fluids	121
31.	Study of Rheological Characteristics of Nano Suspensions	126
32.	Design And Fabrication of Loop Wheel System	129
33.	Performance of Solar Vapour Absorption system and its Dependence on Generator Temperature	131
34.	Design and Analysis Of Handicapped Steering Tricycle	134
35.	Machining Characteristics and Microbiological Growth of Stir Casted A356-SiC MMCs and Pure Metals	136
36.	Design and Analysis of Connecting Rod	141

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

IQAC

37.	Pressure Vessel Optimum Design using Particle Swarm Optimization	145
38.	Design and Analysis of Wheel Rim on Radial Loads	149
39.	COP Enhancement of VCR System using Diffusers	154
40.	Design and Fabrication of Radiant Cooling System	157
41.	Comparative Performance Analysis of Engine Fuelled with Diesel Biodiesel Iron Oxide Nano Particles	162
42.	Performance analysis of a CI Engine fuelled with olive oil and soybean oil mixture as a biofuels	166
43.	Design and Analysis of Landing Gear	170
44.	A Review on Parameters of Composite Materials	173
45.	Optimisation in WEDM of HCHCR Steel using Taughi Method	177
46.	Automated Pneumatic Sheet Metal Cutting Machine	184
47.	Cylindrical Panel's Numerical And Analytical Investigations Subjected To Different Loads	187
48.	Application of a Thermoplastic Polyurethane/Polylactic Acid Composite Filament For 3D-Printed Personalized Orthosis	192
49.	Design and Analysis of a Connecting Rod	196
50.	A Study and Synthesis of 8 Bar One Degree of Freedom Walking Mechanism	200
51.	Mechanical properties and machining of Al-7075 SiC Composite	204
52.	Characterization of Tungsten carbide reinforced Al7075 matrix Composites.	208
53.	3D Printing of Prototype Through Image Processing using Autodesk Recap Photo Software	212
54.	Fabrication and Testing Mechanical Behaviour of Hemp Fibre, Chopped E Glass and Hybrid with Nano Particle	216
55.	Optical characterization of V_2O_5 doped Na_2O-SiO_2-ZrO_2 glasses	218
56.	Determination of Efficient Location of Split Air Conditioner using CFD	221

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

57.	Frictionless Electromagnetic Braking System	225
58.	Performance Evaluation of Vegetable oils as Cutting fluid under MQL Condition in Turning	228
59.	A novel hybrid Fuzzy AHP and VIKOR methodology for Reclaimer Selection in GSCM	236
60.	Design of Eco-Friendly Road Cleaner	240
61.	Mechanical and Microstructural Characterization of Jute Hybrid Composite with Alkali Treatment	244
62.	Experimental Investigation and Optimization of Process Parameters in Wire Cut EDM of EN31 Steel	248
63.	Design and Analysis of Differential Gear Box	252

***

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

PSR 2021

Proceedings of NEC-ICETMEIA- 2K21

ISBN: 978-93-91420-02-4

Performance and Emission Characteristics of Diesel Engine with Linseed Oil –Diesel blends as Fuel with VCR

[1]K.Kiran chand, [2]P.Srinivasa Rao, [3]Thirupathi Reddy.K and [4]Jyothu Naik
[1,2] Department of Mechanical Engineering, Narasaraopeta Engineering College (A).Narasaraopet, India
[3]Department of Mechanical Engineering, RGM College of Enginering and Technology, Nandhyal, India.
[4]Department of Mechanical Engineering, Rayalaseema University College of Engineering, Kurnool, India

Abstract— this paper investigates the performance and emission characteristics of a diesel engine with Linseed oil and its diesel blends. The Linseed oil-diesel blends C5 (5% Linseed l oil and 95% diesel), C10 (10% Linseed oil and 90% diesel), L15 (15% Linseed oil and 85% diesel), and L20 (20% Linseed oil and 80% diesel) was prepared to test in diesel engines. The present experimental results were obtained on the performance and the emissions of CO, HC and NOx in diesel engine. The results showed that the brake thermal efficiency was decreased as the blend increased, and the brake specific fuel consumption was slightly higher than the diesel fuel. The CO and HC emissions are higher than diesel. However, NOx emissions of the blends were found to be decreased significantly compared to diesel as blend ratio increased. Smoke emission was found to be increased slightly when compared to diesel.

Keywords— Diesel engine, Linseed oil, Diesel blend.

Introduction

The energy demand increases day by day in India due to increase in population as well as increase in modernization of the world. Today India is much dependent on petrochemical reserve (*i.e.* coal, gasoline, crude oil etc.) to satisfy our energy demand. In our country we have a very limited crude oil reserve. So to satisfy our demand we are fully dependent on crude oil import from foreign countries. Among various gasoline fuels, diesel fuel is most widely used as it proves higher energy density (*i.e.* more energy can be extracted from diesel as compared with the same volume of gasoline fuel) than other gasoline. Therefore diesel engines have versatile uses in heavy-duty transportation, power generation and also in agricultural sectors. That's why the consumption of diesel is much higher than other gasoline. As the underground crude oil reserve is non-renewable, so its reserve is decreasing rapidly due to gradual increase in its consumption. This phenomenon drives us to search for an alternative and renewable substitute of diesel fuel.

The use of vegetable oils as an alternative fuel for diesel engines dates back to around a century. Due to rapid decline of crude oil reserve and increase in price, the use of vegetable oils is again prompted in many countries. Depending upon soil condition and climate, different nations are looking for different vegetable oils- for example, soybean oil in U.S.A., rapeseed and sunflower oil in Europe, palm oil in Malaysia and

Problems associated with using straight vegetable oil (SVO) in diesel engine can be classified in two groups, namely: operational and durability problems. Operational problems are related to starting ability, ignition, combustion and performance. Durability problems are related to deposit formation, carbonization of injection tip, ring sticking and lubrication oil dilution [2,3]. Various researchers have shown that the use of vegetable oil and their derivatives is competitive compared to mineral diesel [4,5]. Many researchers have tried to use biodiesel derived from mahua oil as fuel for diesel engine. In most of the countries including India, biodiesel is expensive than the diesel and also biodiesel is not available commercially in the market. Most of the work reported in the literature involves only the laboratory studies [6-8]. Pramanik *et al.* Have studied the performance and emissions of a diesel engine with Jatropha methyl ester at various blends. It has been reported that 50% of Jatropha oil blends can be substituted for diesel fuel in a C.I. engine. It has been reported that the Jatropha oil exhibited higher specific fuel consumption and lower exhaust gas temperatures compared with diesel fuel. Etherification is one of the methods to convert the vegetable oil into its methyl ester, known as biodiesel. Several researchers have used biodiesel as an alternate fuel in the existing CI engines without any modifications the objectives of this experimental study are to assess the performance and emission characteristics of a diesel engine with Castrol oil diesel blends and compared with diesel fuel.

Experimental setup and procedure:

The engine test was conducted on a four stroke, single cylinder, water-cooled direct injection, Kirloskar Engine diesel engine. The specifications of the test engine are given in Table 2. The schematic of the experimental set up is shown in Fig. 1 A three whole injector nozzle was located at the center of the combustion chamber with high pressure fuel pump and has an operating pressure of 180 bar. The engine was coupled to an electrical dynamometer and loaded by electrical resistance to apply different engine brake loads. AVL DI 444 exhaust gas analyzer was used for this experiment is to measure the exhaust emissions like CO, HC, NO. The measuring method is based on the principle of light absorption in the infrared region, known as "non-dispersive infrared absorption". The broadband infrared radiation produced by the light source passes through a chamber filled with gas, generally methane or carbon dioxide. Smoke opacity was measured by AVL 437C model. The

NEC NARASARAOPETA ENGINEERING COLLEGE (AUTONOMOUS)

NAAC 'A' GRADE

NATIONAL BOARD OF ACCREDITATION

PROCEEDINGS

INTERNATIONAL CONFERENCE

EMERGING TRENDS IN MECHANICAL ENGINEERING AND INDUSTRIAL AUTOMATION

NEC-ICETMEIA-2K21

30th & 31st July, 2021

Editors-in-Chief

Dr. M.Sreenivasa Kumar
Principal & Professor, Dept. of Mechnical Engineering

Dr. D.Jagadish
Professor, Dept. of Mechnical Engineering

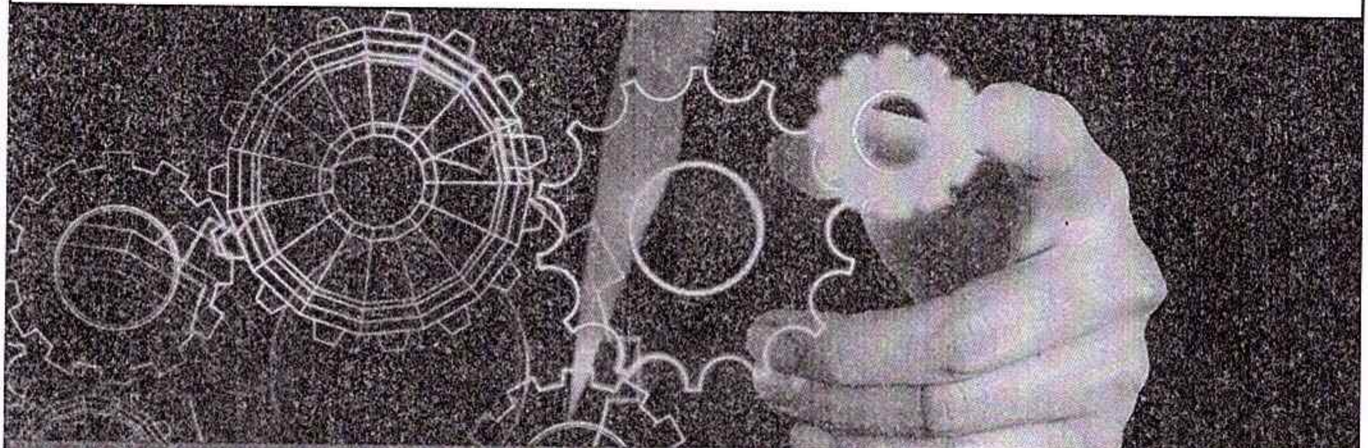
Editors

Dr. D.Suneel
Vice-Principal & Professor, Dept. of ME

Dr. P.Suresh Babu
Professor, Dept. of ME

Dr. B.Venkata Siva
Professor & HoD Dept. of ME

Mr. M.Venkanna Babu
Associate Professor, Dept. of ME



Organized by

Department of Mechanical Engineering

In Association with The Institution of Engineers (India)

ISBN : 978-93-91420-02-4

IQAC

NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522601.
Guntur (Dist.), A.P.

LIST OF FULL LENGTH PAPERS SELECTED FOR PROCEEDINGS

International Conference on Emerging Trends in Mechanical Engineering and Industrial Automation

NEC-ICETMEIA- 2K21

S.No.	TITLE OF THE PAPER	Page No.
1.	Effectiveness of Compression Ignition Engine Fuelled with Pond Water Algae Biodiesel	01
2.	Design And Analysis of Disc Brake of an Electric Go-Kart	04
3.	A Comprehensive Review on Recent Research on Semi Solid Processed Aluminum 7 Series Alloys	08
4.	A Study on Microstructure and Mechanical Properties A7075 Reinforced with Flyash/Sic Hybrid Metal Matrix Composite	15
5.	Establishment of SCR Test Facility and Evaluation of 8mm Pitch Honeycomb Type Catalyst in a 20 Liter capacity SCR Test facility	19
6.	A Review on NVH Issues and Technological Challenges in Electric Vehicle and Hybrid Electric Vehicle Power Train	25
7.	Design and Analysis of Cantilever Beam	29
8.	Analysis of Static and Fatigue Strength of Aluminium Alloy Wheel	32
9.	Design of Automated Braking System Based on Vehicle Over Speed Using PLC Ladder Method	35
10.	The Analysis on Concentric Pipe Heat Exchanger	39
11.	Design and Finite Element Analysis of Gas Turbine Blade	45
12.	Investigation on Mechanical Properties of Glass Fiber and Carbon Nano Tubes Sandwich Composite Material	47
13.	CFD Analysis of Super Utility Vehicle to Determine Aerodynamic Behavior	54
14.	Devlopment of Code for Automated HVAC System using Digital Controller	60
15.	Performance and Emission Characteristics Of Diesel Engine with Linseed Oil-Diesel Blends as Fuel With VCR	65
16.	Experimental Investigation in Single Cylinder VCR Multifuel Engine Using Bio-Diesel as Linseed Oil	69

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

17.	Tribological Properties of Textured Surface	72
18.	Thermal Analysis and Experimental Investigation of Pin Fin made of Brass	76
19.	Experimental and Simulation of Wear Test on GPR material	79
20.	CFD Analysis of Two Pass Double Pipe Heat Exchanger with TiO_2/Ethylene Glycol Nano Fluid	83
21.	Simulation and Optimization of Extrusion Process Parameters of Aluminium 2A12T4Alloy	87
22.	Importance of Ice Jet machining - A Review	91
23.	Performance Investigation of a Battery Powered Peltier Cooler	94
24.	Analysis of Disc Brake Rotor using ANSYS Workbench	98
25.	Modelling and Optimization of Two Wheeler Disk Brake Using ANSYS -Review	101
26.	Fabrication of Sewage Waste Cleaner	105
27.	Manufacturing of Hyperboliodal Gear Model Using Ultimaker S5 3D Printing Machine	109
28.	Arc Welding Process Selection Through Quality and Cost Analysis	113
29.	Li-Br H2O VAR System Analysis by Applying Magnetic Field to Liquid Line	117
30.	Heat Transfer Enhancement on Shell and Coil Type of Heat Exchanger Using SiO_2 and CuO Nano-Fluids	121
31.	Study of Rheological Characteristics of Nano Suspensions	126
32.	Design And Fabrication of Loop Wheel System	129
33.	Performance of Solar Vapour Absorption system and its Dependence on Generator Temperature	131
34.	Design and Analysis Of Handicapped Steering Tricycle	134
35.	Machining Characteristics and Microbiological Growth of Stir Casted A356-SiC MMCs and Pure Metals	136
36.	Design and Analysis of Connecting Rod	141

37.	Pressure Vessel Optimum Design using Particle Swarm Optimization	145
38.	Design and Analysis of Wheel Rim on Radial Loads	149
39.	COP Enhancement of VCR System using Diffusers	154
40.	Design and Fabrication of Radiant Cooling System	157
41.	Comparative Performance Analysis of Engine Fuelled with Diesel Biodiesel Iron Oxide Nano Particles	162
42.	Performance analysis of a CI Engine fuelled with olive oil and soybean oil mixture as a biofuels	166
43.	Design and Analysis of Landing Gear	170
44.	A Review on Parameters of Composite Materials	173
45.	Optimisation in WEDM of HCHCR Steel using Taughi Method	177
46.	Automated Pneumatic Sheet Metal Cutting Machine	184
47.	Cylindrical Panel's Numerical And Analytical Investigations Subjected To Different Loads	187
48.	Application of a Thermoplastic Polyurethane/Polylactic Acid Composite Filament For 3D-Printed Personalized Orthosis	192
49.	Design and Analysis of a Connecting Rod	196
50.	A Study and Synthesis of 8 Bar One Degree of Freedom Walking Mechanism	200
51.	Mechanical properties and machining of Al-7075 SiC Composite	204
52.	Characterization of Tungsten carbide reinforced Al7075 matrix Composites.	208
53.	3D Printing of Prototype Through Image Processing using Autodesk Recap Photo Software	212
54.	Fabrication and Testing Mechanical Behaviour of Hemp Fibre, Chopped E Glass and Hybrid with Nano Particle	216
55.	Optical characterization of V_2O_5 doped Na_2O-SiO_2-ZrO_2 glasses	218
56.	Determination of Efficient Location of Split Air Conditioner using CFD	221

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

57.	Frictionless Electromagnetic Braking System	225
58.	Performance Evaluation of Vegetable oils as Cutting fluid under MQL Condition in Turning	228
59.	A novel hybrid Fuzzy AHP and VIKOR methodology for Reclaimer Selection in GSCM	236
60.	Design of Eco-Friendly Road Cleaner	240
61.	Mechanical and Microstructural Characterization of Jute Hybrid Composite with Alkali Treatment	244
62.	Experimental Investigation and Optimization of Process Parameters in Wire Cut EDM of EN31 Steel	248
63.	Design and Analysis of Differential Gear Box	252

***

PSR 2021

CFD Analysis of Two Pass Double Pipe Heat Exchanger with TiO_2/Ethylene Glycol Nano Fluid

Gopi Nerusu and Pathuri Srinivasa Rao
Department of Mechanical Engineering, Narasaraopeta Engineering College (A), Narasaraopet, India.

***Abstract*- This paper deals with the numerical simulation of cold fluid forced convection heat transfer under turbulent flow condition with different flow rates of 8, 10, 12, 14, 16 lpm and at various Nano fluid volume-fractions of 0.03%, 0.1%, 0.2%, 0.3% and 0.4% with constant hot fluid flow rate of 8 lpm. In this study, TiO2/Ethylene Glycol Nano fluid is used as cold fluid and pure water is used as hot fluid around initial temperatures of 27 °C and 60 °C, respectively. The objective is to augment the heat transfer coefficient and friction-factor of 2 pass Double pipe heat exchanger at various Reynolds numbers range of 9,000 to 25,000 using Computational Fluid Dynamics (CFD). The present study explored that the effect of volume concentration in 2 pass Double pipe counter flow heat exchanger on convective heat transfer and friction characteristics in a tube. The simulations were done for these flow rates at different volume concentrations. The results showed that an enhancement in heat transfer coefficient is increased by 34.93% at 0.4% volume concentration at Reynolds number range of 9000 to 24,000 when compared to water. The maximum friction factor obtained is 1.34 times at 0.3% volume-fraction of TiO2/Ethylene Glycol Nano fluid at Reynolds number of 10,833, when compared to water.**

Keywords: Heat Pipe, Nano fluid, CFD Analysis, Double pipe heat pipe.

I INTRODUCTION

Heat exchangers are essential engineering devices in several process industries as the efficiency and economy of the process largely depends on the performance of the heat exchangers and other important engineering applications in heat exchangers such as power plants, air-conditioning, petrochemical industry, natural gas processing, refrigeration, solar water heater, chemical reactors, sewage treatment, shell and tube heat exchangers in nuclear reactors. The design method for heat exchangers is very critical, as it needs perfect analysis on rate of heat transfer and pressure drop estimations. The rate of heat transfer can be enriched by producing a disturbance in the flow of fluid by breaking the viscous boundary and thermal boundary layers, this problem can be rectified in the other type as there exists a fairly constant difference in temperature. Double pie heat exchanger is a simple exchanger which consists of two pairs of pipes are arranged in the hairpin alignment, for noticeable causes. Butteries of this type of heat exchangers are connected in series-parallel or series in arrangements in order to obtain grater area of surface for heat transfer. The working fluids that are transmitting heat energy from one fluid to another fluid depending up on our requirement in the inner and outer pipes. The increase of heating and cooling systems in a factories or industrial aspects will create a saving the energy, reducing the process-time, raising the temperature and increasing the life of apparatus. The improvement of high operation of thermal processes for augmentation of heat transfer will become trendy now-a-days. There are

Various methods to develop the efficiency heat transfer by use of extended surfaces that are Passive methods and aspect of vibration to the heat transfer parts that are Active methods etc. Efficiency of heat transfer can be developed by raising the thermal conductivity of the base fluids. Generally water, ethylene glycol, and engine oil etc., are having low thermal conductivity and used as base fluids, when compared to solid particles. To raise the thermal conductivity of these fluids, solid particles, generally having higher thermal conductivity, are used to mix with these fluids with a certain concentrations.
These are having following drawbacks represented below:

A. The particles are settled down rapidly and form a small layer on the surface and dropping the heat transfer rate.

B. Whenever rate of circulation increases, sedimentation is diminished, but increasing the erosion rapidly of the heat exchanger parts such as pipe walls, etc.

C. Particles are of large size tends to block the flow loops.

D. The pressure drop increases hastily in the fluid.

E. Finally, development of conductivity based on particle-concentration is reached. That is the higher the particle volume-fraction is, higher the improvement and having major problems.

II OBJECTIVE AND METHODOLOGY

Several research works have been done in the tube flow recently on heat transfer aspects. Convective heat transfer improvement with different types of Nano fluid in a plain tube is clarified by several researchers.
A closer observation at experi0mental and numerical results reveals that most of the convective heat transfer studies in the tube flow have been done with Al_2O_3, CuO, SiC, CNT and Fe_3O_4 etc., Nano fluids itself. So in the present work, TiO2/Ethylene Glycol is considered as a Nano fluid because of the advantage with this, there is a possibility of separation of magnetic Nanoparticles (Fe_3O_4)

NEC NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)

NAAC 'A' GRADE | NATIONAL BOARD OF ACCREDITATION

PROCEEDINGS

INTERNATIONAL CONFERENCE

EMERGING TRENDS IN MECHANICAL ENGINEERING AND INDUSTRIAL AUTOMATION

NEC-ICETMEIA-2K21

30th & 31st July, 2021

Editors-in-Chief

Dr. M.Sreenivasa Kumar
Principal & Professor, Dept. of Mechnical Engineering

Dr. D.Jagadish
Professor, Dept. of Mechnical Engineering

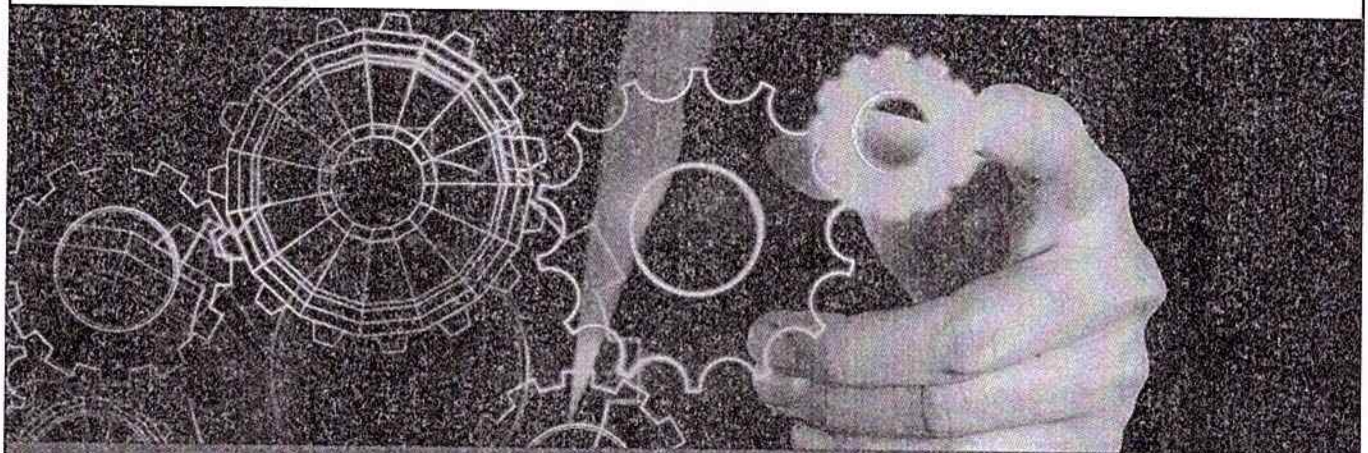
Editors

Dr. D.Suneel
Vice-Principal & Professor, Dept. of ME

Dr. P.Suresh Babu
Professor, Dept. of ME

Dr. B.Venkata Siva
Professor & HoD Dept. of ME

Mr. M.Venkanna Babu
Associate Professor, Dept. of ME



Organized by

Department of **Mechanical Engineering**

In Association with **The Institution of Engineers (India)**

ISBN : 978-93-91420-02-4

LIST OF FULL LENGTH PAPERS SELECTED FOR PROCEEDINGS

International Conference on Emerging Trends in Mechanical Engineering and Industrial Automation

NEC-ICETMEIA- 2K21

S.No.	TITLE OF THE PAPER	Page No.
1.	Effectiveness of Compression Ignition Engine Fuelled with Pond Water Algae Biodiesel	01
2.	Design And Analysis of Disc Brake of an Electric Go-Kart	04
3.	A Comprehensive Review on Recent Research on Semi Solid Processed Aluminum 7 Series Alloys	08
4.	A Study on Microstructure and Mechanical Properties A7075 Reinforced with Flyash/Sic Hybrid Metal Matrix Composite	15
5.	Establishment of SCR Test Facility and Evaluation of 8mm Pitch Honeycomb Type Catalyst in a 20 Liter capacity SCR Test facility	19
6.	A Review on NVH Issues and Technological Challenges in Electric Vehicle and Hybrid Electric Vehicle Power Train	25
7.	Design and Analysis of Cantilever Beam	29
8.	Analysis of Static and Fatigue Strength of Aluminium Alloy Wheel	32
9.	Design of Automated Braking System Based on Vehicle Over Speed Using PLC Ladder Method	35
10.	The Analysis on Concentric Pipe Heat Exchanger	39
11.	Design and Finite Element Analysis of Gas Turbine Blade	45
12.	Investigation on Mechanical Properties of Glass Fiber and Carbon Nano Tubes Sandwich Composite Material	47
13.	CFD Analysis of Super Utility Vehicle to Determine Aerodynamic Behavior	54
14.	Devlopment of Code for Automated HVAC System using Digital Controller	60
15.	Performance and Emission Characteristics Of Diesel Engine with Linseed Oil-Diesel Blends as Fuel With VCR	65
16.	Experimental Investigation in Single Cylinder VCR Multifuel Engine Using Bio-Diesel as Linseed Oil	69

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601,
Guntur (Dist.), A.P.

17.	Tribological Properties of Textured Surface	72
18.	Thermal Analysis and Experimental Investigation of Pin Fin made of Brass	76
19.	Experimental and Simulation of Wear Test on GPR material	79
20.	CFD Analysis of Two Pass Double Pipe Heat Exchanger with TiO_2/Ethylene Glycol Nano Fluid	83
21.	Simulation and Optimization of Extrusion Process Parameters of Aluminium 2A12T4Alloy	87
22.	Importance of Ice Jet machining - A Review	91
23.	Performance Investigation of a Battery Powered Peltier Cooler	94
24.	Analysis of Disc Brake Rotor using ANSYS Workbench	98
25.	Modelling and Optimization of Two Wheeler Disk Brake Using ANSYS -Review	101
26.	Fabrication of Sewage Waste Cleaner	105
27.	Manufacturing of Hyperboliodal Gear Model Using Ultimaker S5 3D Printing Machine	109
28.	Arc Welding Process Selection Through Quality and Cost Analysis	113
29.	Li-Br H2O VAR System Analysis by Applying Magnetic Field to Liquid Line	117
30.	Heat Transfer Enhancement on Shell and Coil Type of Heat Exchanger Using SiO_2 and CuO Nano-Fluids	121
31.	Study of Rheological Characteristics of Nano Suspensions	126
32.	Design And Fabrication of Loop Wheel System	129
33.	Performance of Solar Vapour Absorption system and its Dependence on Generator Temperature	131
34.	Design and Analysis Of Handicapped Steering Tricycle	134
35.	Machining Characteristics and Microbiological Growth of Stir Casted A356-SiC MMCs and Pure Metals	136
36.	Design and Analysis of Connecting Rod	141

37.	Pressure Vessel Optimum Design using Particle Swarm Optimization	145
38.	Design and Analysis of Wheel Rim on Radial Loads	149
39.	COP Enhancement of VCR System using Diffusers	154
40.	Design and Fabrication of Radiant Cooling System	157
41.	Comparative Performance Analysis of Engine Fuelled with Diesel Biodiesel Iron Oxide Nano Particles	162
42.	Performance analysis of a CI Engine fuelled with olive oil and soybean oil mixture as a biofuels	166
43.	Design and Analysis of Landing Gear	170
44.	A Review on Parameters of Composite Materials	173
45.	Optimisation in WEDM of HCHCR Steel using Taughi Method	177
46.	Automated Pneumatic Sheet Metal Cutting Machine	184
47.	Cylindrical Panel's Numerical And Analytical Investigations Subjected To Different Loads	187
48.	Application of a Thermoplastic Polyurethane/Polylactic Acid Composite Filament For 3D-Printed Personalized Orthosis	192
49.	Design and Analysis of a Connecting Rod	196
50.	A Study and Synthesis of 8 Bar One Degree of Freedom Walking Mechanism	200
51.	Mechanical properties and machining of Al-7075 SiC Composite	204
52.	Characterization of Tungsten carbide reinforced Al7075 matrix Composites.	208
53.	3D Printing of Prototype Through Image Processing using Autodesk Recap Photo Software	212
54.	Fabrication and Testing Mechanical Behaviour of Hemp Fibre, Chopped E Glass and Hybrid with Nano Particle	216
55.	Optical characterization of V_2O_5 doped Na_2O-SiO_2-ZrO_2 glasses	218
56.	Determination of Efficient Location of Split Air Conditioner using CFD	221

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

57.	Frictionless Electromagnetic Braking System	225
58.	Performance Evaluation of Vegetable oils as Cutting fluid under MQL Condition in Turning	228
59.	A novel hybrid Fuzzy AHP and VIKOR methodology for Reclaimer Selection in GSCM	236
60.	Design of Eco-Friendly Road Cleaner	240
61.	Mechanical and Microstructural Characterization of Jute Hybrid Composite with Alkali Treatment	244
62.	Experimental Investigation and Optimization of Process Parameters in Wire Cut EDM of EN31 Steel	248
63.	Design and Analysis of Differential Gear Box	252

***

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET
Guntur (Dist.)

PSR 2021

ISBN: 978-93-91420-02-4

COP Enhancement of VCR System Using Diffusers

P. Srinivasarao[1] and G. Nagaraju[2]

Department of Mechanical Engineering, Narasaraopeta Engineering College (A), Narasaraopet, India

Department of Mechanical Engineering, VITAP, Amaravathi, India

Abstract: In This paper the performance of the vapor compression refrigeration system with diffusers at compressor inlet was studied by using R134a refrigerant. Initially to making the four diffusers with the divergence angles of 10°,12°,14°,16°. The experiment is carried to testing of diffusers at inlet of the compressor. When diffuser placed at compressor inlet the outlet tube diameter of evaporator is equal to inlet diameter of the diffuser and outlet tube diameter of the diffuser is equal to the suction tube diameter of the compressor. The system performance is analyze by using of thermodynamic first and second law, to calculate the coefficient of performance.

Key Words: Diffuser, Refrigerating effect, cop.

I. INTRODUCTION

In vapour compression system, mainly the refrigerant under goes phase changes from vapor to liquid state and then liquid to vapor state. In the refrigeration system reject the heat in condenser and heat will be absorbed in evaporator. The cop is the ratio of the heat transfer rate in the evaporator to work of the compressor. The system performance is mainly increases by increasing the refrigeration effect or by decreasing the work of the compressor. Different type of techniques are find on the way to improve the cop of the system, as reported in literature.

M. Yohanet al., [1] to study the use of diffuser in refrigeration system at condenser inlet. The performance can be enhanced by reducing the compressor work by using of diffuser. The system cop was increased by 6% and work of the compressor was reduced by 6.10%.

P. Pranitha et al., [2] in this study to analysis the performance of vcr system by placing the nozzle and diffuser. Nozzle is incorporated at inlet of the evaporator and diffuser is incorporated at inlet of the condenser.

B.Sandhya Rani et al.,[4] In this paper study the experiment was successfully completed by incorporate the nozzle in the cycle at outlet of the condenser. The exta pressure droped in the nozzle, these additional help to achieve the more performance of the refrigeration system. The convergent angle of nozzle is increases from 10° to 14°. The 14° convergent angle of nozzle is got the better cop of the system.

K.Jaya Sudheer Kumar et al.,[5] to study this paper to evaluate the performance of the vcr system without and with nozzle at inlet of the expansion valve. By using the nozzle in the system again decreasing of refrigerant pressure before entering the evaporator. It improve the refrigeration effect and increase the cop of the system increases.

From the above literature survey I can understand the use of diffuser. None of the literature survey studied the effect of the diffuser in VCR system, it will rise the same amount of pressure before entering the compressor of the refrigerant. It will reduce the work of compressor. Due to these reduction, the system performance will increase.

II. EXPERIMENTAL SETUP AND METHODOLOGY

Manufacturing of Diffusers:

The flow of the refrigerant in the VCR system is subsonic. The diffuser is increases the pressure of the refrigerant without any work input. The diffusers are shown in figure2.

Diffuser length (L) = 10 mm

Outlet diameter of diffuser inlet (d_1) = 11 mm

Inner diameter of diffuser inlet (d_2) = 6 mm

Outlet diameter of diffuser outlet (D_1) = 15 mm

Inner diameter of diffuser outlet (D_2) = 10 mm

Divergence angles (θ) =10°, 12°, 14° and 16°.

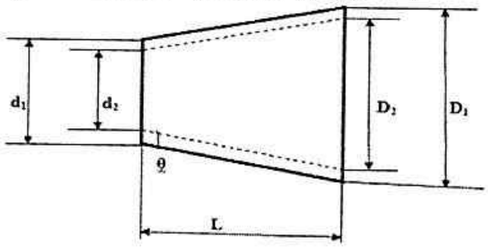


Fig.1 line diagram

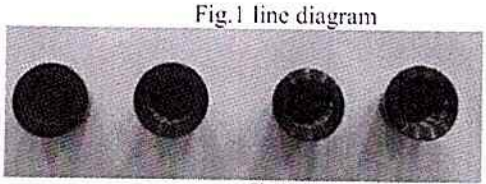


Fig.2 Diffuser

III. EXPERIMENTAL SETUP

It mainly consists of the main loop of system. The main loop is consists of a compressor, condenser, capillary tube valve (expansion valve) and evaporator. The compressor used in this one is hermetically sealed reciprocating type compressor and capacity is 1/8th TOR. The condenser and evaporator both are the coppered single tube. In this single flow tube condenser, inner side refrigerant flows and air is flows out side of the tube. The refrigerant then flows in to the evaporator through expansion valve. The capillary tube is used to control the flow rate of the refrigerant in to the evaporator coil and also to set the difference pressure. In the one flow tube evaporator, the refrigerant flow through the inner side of the tube and water is in storage tank outside of the tubes. To minimize the heat losses, the tube is insulated. The four

NEC NARASARAOPETA ENGINEERING COLLEGE (AUTONOMOUS)

NAAC 'A' GRADE

NATIONAL BOARD of ACCREDITATION

PROCEEDINGS

INTERNATIONAL CONFERENCE

EMERGING TRENDS IN MECHANICAL ENGINEERING AND INDUSTRIAL AUTOMATION

NEC-ICETMEIA-2K21

30th & 31st July, 2021

Editors-in-Chief

Dr. M.Sreenivasa Kumar
Principal & Professor, Dept. of Mechnical Engineering

Dr. D.Jagadish
Professor, Dept. of Mechnical Engineering

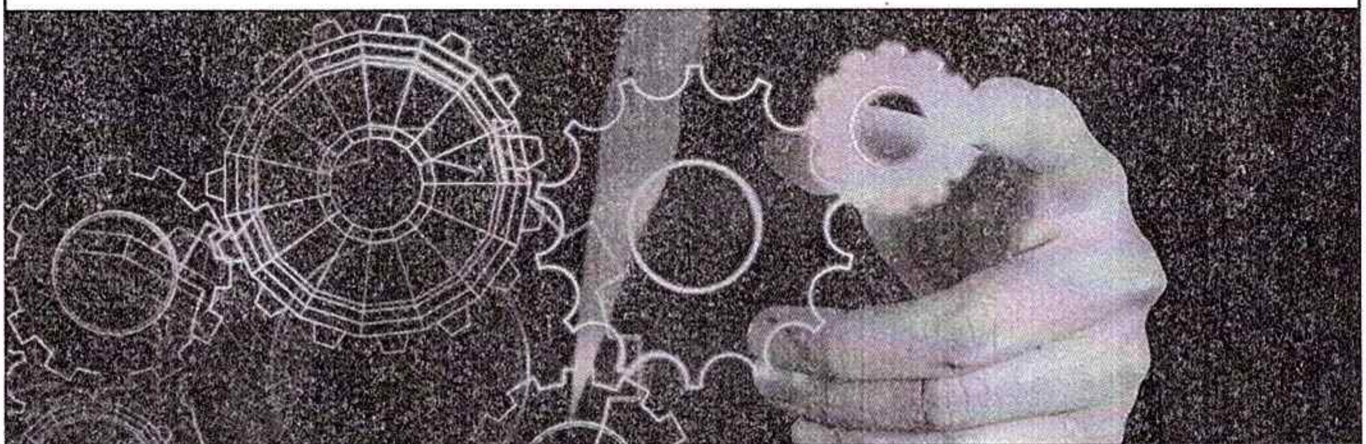
Editors

Dr. D.Suneel
Vice-Principal & Professor, Dept. of ME

Dr. P.Suresh Babu
Professor, Dept. of ME

Dr. B.Venkata Siva
Professor & HoD Dept. of ME

Mr. M.Venkanna Babu
Associate Professor, Dept. of ME



Organized by

Department of **Mechanical Engineering**

In Association with **The Institution of Engineers (India)**

ISBN : 978-93-91420-02-4

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

LIST OF FULL LENGTH PAPERS SELECTED FOR PROCEEDINGS

International Conference on Emerging Trends in Mechanical Engineering and Industrial Automation

NEC-ICETMEIA- 2K21

S.No.	TITLE OF THE PAPER	Page No.
1.	Effectiveness of Compression Ignition Engine Fuelled with Pond Water Algae Biodiesel	01
2.	Design And Analysis of Disc Brake of an Electric Go-Kart	04
3.	A Comprehensive Review on Recent Research on Semi Solid Processed Aluminum 7 Series Alloys	08
4.	A Study on Microstructure and Mechanical Properties A7075 Reinforced with Flyash/Sic Hybrid Metal Matrix Composite	15
5.	Establishment of SCR Test Facility and Evaluation of 8mm Pitch Honeycomb Type Catalyst in a 20 Liter capacity SCR Test facility	19
6.	A Review on NVH Issues and Technological Challenges in Electric Vehicle and Hybrid Electric Vehicle Power Train	25
7.	Design and Analysis of Cantilever Beam	29
8.	Analysis of Static and Fatigue Strength of Aluminium Alloy Wheel	32
9.	Design of Automated Braking System Based on Vehicle Over Speed Using PLC Ladder Method	35
10.	The Analysis on Concentric Pipe Heat Exchanger	39
11.	Design and Finite Element Analysis of Gas Turbine Blade	45
12.	Investigation on Mechanical Properties of Glass Fiber and Carbon Nano Tubes Sandwich Composite Material	47
13.	CFD Analysis of Super Utility Vehicle to Determine Aerodynamic Behavior	54
14.	Devlopment of Code for Automated HVAC System using Digital Controller	60
15.	Performance and Emission Characteristics Of Diesel Engine with Linseed Oil-Diesel Blends as Fuel With VCR	65
16.	Experimental Investigation in Single Cylinder VCR Multifuel Engine Using Bio-Diesel as Linseed Oil	69

IQAC

Principal

NARASARAOPETA ENGINEERING COLLEGE

(AUTONOMOUS)

NARASARAOPET - 522 601.

Guntur (D.t.), A.P.

17.	Tribological Properties of Textured Surface	72
18.	Thermal Analysis and Experimental Investigation of Pin Fin made of Brass	76
19.	Experimental and Simulation of Wear Test on GPR material	79
20.	CFD Analysis of Two Pass Double Pipe Heat Exchanger with TiO_2/Ethylene Glycol Nano Fluid	83
21.	Simulation and Optimization of Extrusion Process Parameters of Aluminium 2A12T4Alloy	87
22.	Importance of Ice Jet machining - A Review	91
23.	Performance Investigation of a Battery Powered Peltier Cooler	94
24.	Analysis of Disc Brake Rotor using ANSYS Workbench	98
25.	Modelling and Optimization of Two Wheeler Disk Brake Using ANSYS -Review	101
26.	Fabrication of Sewage Waste Cleaner	105
27.	Manufacturing of Hyperboliodal Gear Model Using Ultimaker S5 3D Printing Machine	109
28.	Arc Welding Process Selection Through Quality and Cost Analysis	113
29.	Li-Br H2O VAR System Analysis by Applying Magnetic Field to Liquid Line	117
30.	Heat Transfer Enhancement on Shell and Coil Type of Heat Exchanger Using SiO_2 and CuO Nano-Fluids	121
31.	Study of Rheological Characteristics of Nano Suspensions	126
32.	Design And Fabrication of Loop Wheel System	129
33.	Performance of Solar Vapour Absorption system and its Dependence on Generator Temperature	131
34.	Design and Analysis Of Handicapped Steering Tricycle	134
35.	Machining Characteristics and Microbiological Growth of Stir Casted A356-SiC MMCs and Pure Metals	136
36.	Design and Analysis of Connecting Rod	141

37.	Pressure Vessel Optimum Design using Particle Swarm Optimization	145
38.	Design and Analysis of Wheel Rim on Radial Loads	149
39.	COP Enhancement of VCR System using Diffusers	154
40.	Design and Fabrication of Radiant Cooling System	157
41.	Comparative Performance Analysis of Engine Fuelled with Diesel Biodiesel Iron Oxide Nano Particles	162
42.	Performance analysis of a CI Engine fuelled with olive oil and soybean oil mixture as a biofuels	166
43.	Design and Analysis of Landing Gear	170
44.	A Review on Parameters of Composite Materials	173
45.	Optimisation in WEDM of HCHCR Steel using Taughi Method	177
46.	Automated Pneumatic Sheet Metal Cutting Machine	184
47.	Cylindrical Panel's Numerical And Analytical Investigations Subjected To Different Loads	187
48.	Application of a Thermoplastic Polyurethane/Polylactic Acid Composite Filament For 3D-Printed Personalized Orthosis	192
49.	Design and Analysis of a Connecting Rod	196
50.	A Study and Synthesis of 8 Bar One Degree of Freedom Walking Mechanism	200
51.	Mechanical properties and machining of Al-7075 SiC Composite	204
52.	Characterization of Tungsten carbide reinforced Al7075 matrix Composites.	208
53.	3D Printing of Prototype Through Image Processing using Autodesk Recap Photo Software	212
54.	Fabrication and Testing Mechanical Behaviour of Hemp Fibre, Chopped E Glass and Hybrid with Nano Particle	216
55.	Optical characterization of V_2O_5 doped Na_2O-SiO_2-ZrO_2 glasses	218
56.	Determination of Efficient Location of Split Air Conditioner using CFD	221

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

57.	Frictionless Electromagnetic Braking System	225
58.	Performance Evaluation of Vegetable oils as Cutting fluid under MQL Condition in Turning	228
59.	A novel hybrid Fuzzy AHP and VIKOR methodology for Reclaimer Selection in GSCM	236
60.	Design of Eco-Friendly Road Cleaner	240
61.	Mechanical and Microstructural Characterization of Jute Hybrid Composite with Alkali Treatment	244
62.	Experimental Investigation and Optimization of Process Parameters in Wire Cut EDM of EN31 Steel	248
63.	Design and Analysis of Differential Gear Box	252

***

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

k lcc 2021

ISBN: 978-93-91420-02-4

Performance and Emission Characteristics of Diesel Engine with Linseed Oil –Diesel blends as Fuel with VCR

[1]K.Kiran chand, [2]P.Srinivasa Rao, [3]Thirupathi Reddy.K and [4]Jyothu Naik
[1,2] *Department of Mechanical Engineering*, Narasaraopeta Engineering College (A),Narasaraopet, India
[3]*Department of Mechanical Engineering*, RGM College of Enginering and Technology, Nandhyal, India.
[4]*Department of Mechanical Engineering*, Rayalaseema University College of Engineering, Kurnool, India

Abstract— **this paper investigates the performance and emission characteristics of a diesel engine with Linseed oil and its diesel blends. The Linseed oil-diesel blends C5 (5% Linseed l oil and 95% diesel), C10 (10% Linseed oil and 90% diesel), L15 (15% Linseed oil and 85% diesel), and L20 (20% Linseed oil and 80% diesel) was prepared to test in diesel engines. The present experimental results were obtained on the performance and the emissions of CO, HC and NOx in diesel engine. The results showed that the brake thermal efficiency was decreased as the blend increased, and the brake specific fuel consumption was slightly higher than the diesel fuel. The CO and HC emissions are higher than diesel. However, NOx emissions of the blends were found to be decreased significantly compared to diesel as blend ratio increased. Smoke emission was found to be increased slightly when compared to diesel.**

Keywords— **Diesel engine, Linseed oil, Diesel blend.**

Introduction

The energy demand increases day by day in India due to increase in population as well as increase in modernization of the world. Today India is much dependent on petrochemical reserve (*i.e.* coal, gasoline, crude oil etc.) to satisfy our energy demand. In our country we have a very limited crude oil reserve. So to satisfy our demand we are fully dependent on crude oil import from foreign countries. Among various gasoline fuels, diesel fuel is most widely used as it proves higher energy density (*i.e.* more energy can be extracted from diesel as compared with the same volume of gasoline fuel) than other gasoline. Therefore diesel engines have versatile uses in heavy-duty transportation, power generation and also in agricultural sectors. That's why the consumption of diesel is much higher than other gasoline. As the underground crude oil reserve is non-renewable, so its reserve is decreasing rapidly due to gradual increase in its consumption. This phenomenon drives us to search for an alternative and renewable substitute of diesel fuel.

The use of vegetable oils as an alternative fuel for diesel engines dates back to around a century. Due to rapid decline of crude oil reserve and increase in price, the use of vegetable oils is again prompted in many countries. Depending upon soil condition and climate, different nations are looking for different vegetable oils- for example, soybean oil in U.S.A., rapeseed and sunflower oil in Europe, palm oil in Malaysia and

Problems associated with using straight vegetable oil (SVO) in diesel engine can be classified in two groups, namely: operational and durability problems. Operational problems are related to starting ability, ignition, combustion and performance. Durability problems are related to deposit formation, carbonization of injection tip, ring sticking and lubrication oil dilution [2, 3]. Various researchers have shown that the use of vegetable oil and their derivatives is competitive compared to mineral diesel [4, 5]. Many researchers have tried to use biodiesel derived from mahua oil as fuel for diesel engine. In most of the countries including India, biodiesel is expensive than the diesel and also biodiesel is not available commercially in the market. Most of the work reported in the literature involves only the laboratory studies [6-8]. Pramanik *et al.* Have studied the performance and emissions of a diesel engine with Jatropha methyl ester at various blends. It has been reported that 50% of Jatropha oil blends can be substituted for diesel fuel in a C.I. engine. It has been reported that the Jatropha oil exhibited higher specific fuel consumption and lower exhaust gas temperatures compared with diesel fuel. Etherification is one of the methods to convert the vegetable oil into its methyl ester, known as biodiesel. Several researchers have used biodiesel as an alternate fuel in the existing CI engines without any modifications the objectives of this experimental study are to assess the performance and emission characteristics of a diesel engine with Castrol oil diesel blends and compared with diesel fuel.

Experimental setup and procedure:

The engine test was conducted on a four stroke, single cylinder, water-cooled direct injection, Kirloskar Engine diesel engine. The specifications of the test engine are given in Table 2. The schematic of the experimental set up is shown in Fig. 1 A three whole injector nozzle was located at the center of the combustion chamber with high pressure fuel pump and has an operating pressure of 180 bar. The engine was coupled to an electrical dynamometer and loaded by electrical resistance to apply different engine brake loads. AVL DI 444 exhaust gas analyzer was used for this experiment is to measure the exhaust emissions like CO, HC, NO. The measuring method is based on the principle of light absorption in the infrared region, known as "non-dispersive infrared absorption". The broadband infrared radiation produced by the light source passes through a chamber filled with gas, generally methane or carbon dioxide. Smoke opacity was measured by AVL 437C model. The

NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)

NEC

NAAC 'A' GRADE

NBA NATIONAL BOARD of ACCREDITATION

PROCEEDINGS

INTERNATIONAL CONFERENCE

EMERGING TRENDS IN MECHANICAL ENGINEERING AND INDUSTRIAL AUTOMATION

NEC-ICETMEIA-2K21

30th & 31st July, 2021

Editors-in-Chief

Dr. M.Sreenivasa Kumar
Principal & Professor, Dept. of Mechnical Engineering

Dr. D.Jagadish
Professor, Dept. of Mechnical Engineering

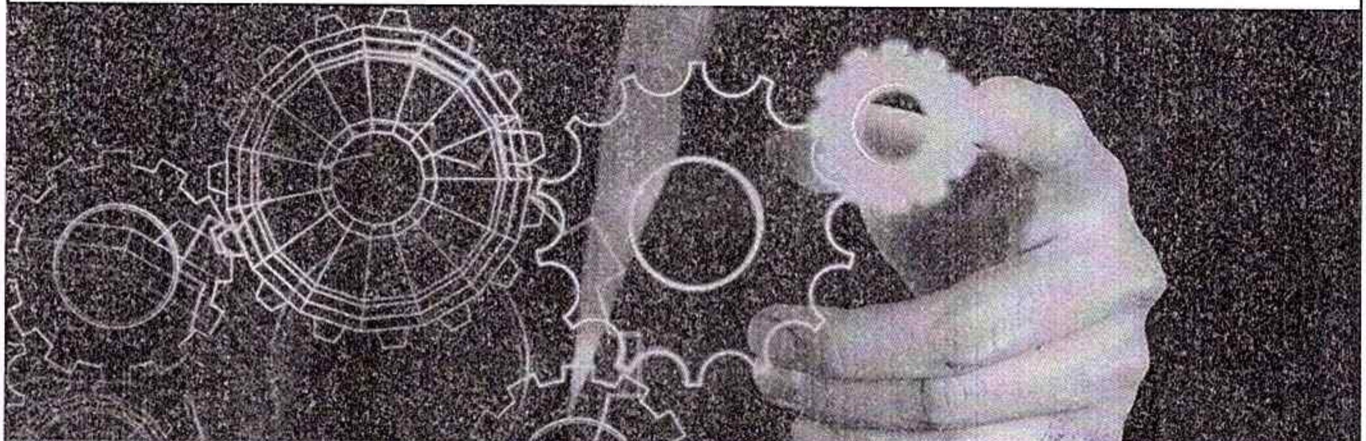
Editors

Dr. D.Suneel
Vice-Principal & Professor, Dept. of ME

Dr. P.Suresh Babu
Professor, Dept. of ME

Dr. B.Venkata Siva
Professor & HoD Dept. of ME

Mr. M.Venkanna Babu
Associate Professor, Dept. of ME



Organized by

Department of **Mechanical Engineering**

In Association with *The Institution of Engineers (India)*

ISBN : 978-93-91420-02-4

LIST OF FULL LENGTH PAPERS SELECTED FOR PROCEEDINGS

International Conference on Emerging Trends in Mechanical Engineering and Industrial Automation

NEC-ICETMEIA- 2K21

S.No.	TITLE OF THE PAPER	Page No.
1.	Effectiveness of Compression Ignition Engine Fuelled with Pond Water Algae Biodiesel	01
2.	Design And Analysis of Disc Brake of an Electric Go-Kart	04
3.	A Comprehensive Review on Recent Research on Semi Solid Processed Aluminum 7 Series Alloys	08
4.	A Study on Microstructure and Mechanical Properties A7075 Reinforced with Flyash/Sic Hybrid Metal Matrix Composite	15
5.	Establishment of SCR Test Facility and Evaluation of 8mm Pitch Honeycomb Type Catalyst in a 20 Liter capacity SCR Test facility	19
6.	A Review on NVH Issues and Technological Challenges in Electric Vehicle and Hybrid Electric Vehicle Power Train	25
7.	Design and Analysis of Cantilever Beam	29
8.	Analysis of Static and Fatigue Strength of Aluminium Alloy Wheel	32
9.	Design of Automated Braking System Based on Vehicle Over Speed Using PLC Ladder Method	35
10.	The Analysis on Concentric Pipe Heat Exchanger	39
11.	Design and Finite Element Analysis of Gas Turbine Blade	45
12.	Investigation on Mechanical Properties of Glass Fiber and Carbon Nano Tubes Sandwich Composite Material	47
13.	CFD Analysis of Super Utility Vehicle to Determine Aerodynamic Behavior	54
14.	Devlopment of Code for Automated HVAC System using Digital Controller	60
15.	Performance and Emission Characteristics Of Diesel Engine with Linseed Oil-Diesel Blends as Fuel With VCR	65
16.	Experimental Investigation in Single Cylinder VCR Multifuel Engine Using Bio-Diesel as Linseed Oil	69

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

17.	Tribological Properties of Textured Surface	72
18.	Thermal Analysis and Experimental Investigation of Pin Fin made of Brass	76
19.	Experimental and Simulation of Wear Test on GPR material	79
20.	CFD Analysis of Two Pass Double Pipe Heat Exchanger with TiO_2/Ethylene Glycol Nano Fluid	83
21.	Simulation and Optimization of Extrusion Process Parameters of Aluminium 2A12T4Alloy	87
22.	Importance of Ice Jet machining - A Review	91
23.	Performance Investigation of a Battery Powered Peltier Cooler	94
24.	Analysis of Disc Brake Rotor using ANSYS Workbench	98
25.	Modelling and Optimization of Two Wheeler Disk Brake Using ANSYS -Review	101
26.	Fabrication of Sewage Waste Cleaner	105
27.	Manufacturing of Hyperboliodal Gear Model Using Ultimaker S5 3D Printing Machine	109
28.	Arc Welding Process Selection Through Quality and Cost Analysis	113
29.	Li-Br H2O VAR System Analysis by Applying Magnetic Field to Liquid Line	117
30.	Heat Transfer Enhancement on Shell and Coil Type of Heat Exchanger Using SiO_2 and CuO Nano-Fluids	121
31.	Study of Rheological Characteristics of Nano Suspensions	126
32.	Design And Fabrication of Loop Wheel System	129
33.	Performance of Solar Vapour Absorption system and its Dependence on Generator Temperature	131
34.	Design and Analysis Of Handicapped Steering Tricycle	134
35.	Machining Characteristics and Microbiological Growth of Stir Casted A356-SiC MMCs and Pure Metals	136
36.	Design and Analysis of Connecting Rod	141

37.	Pressure Vessel Optimum Design using Particle Swarm Optimization	145
38.	Design and Analysis of Wheel Rim on Radial Loads	149
39.	COP Enhancement of VCR System using Diffusers	154
40.	Design and Fabrication of Radiant Cooling System	157
41.	Comparative Performance Analysis of Engine Fuelled with Diesel Biodiesel Iron Oxide Nano Particles	162
42.	Performance analysis of a CI Engine fuelled with olive oil and soybean oil mixture as a biofuels	166
43.	Design and Analysis of Landing Gear	170
44.	A Review on Parameters of Composite Materials	173
45.	Optimisation in WEDM of HCHCR Steel using Taughi Method	177
46.	Automated Pneumatic Sheet Metal Cutting Machine	184
47.	Cylindrical Panel's Numerical And Analytical Investigations Subjected To Different Loads	187
48.	Application of a Thermoplastic Polyurethane/Polylactic Acid Composite Filament For 3D-Printed Personalized Orthosis	192
49.	Design and Analysis of a Connecting Rod	196
50.	A Study and Synthesis of 8 Bar One Degree of Freedom Walking Mechanism	200
51.	Mechanical properties and machining of Al-7075 SiC Composite	204
52.	Characterization of Tungsten carbide reinforced Al7075 matrix Composites.	208
53.	3D Printing of Prototype Through Image Processing using Autodesk Recap Photo Software	212
54.	Fabrication and Testing Mechanical Behaviour of Hemp Fibre, Chopped E Glass and Hybrid with Nano Particle	216
55.	Optical characterization of V_2O_5 doped Na_2O-SiO_2-ZrO_2 glasses	218
56.	Determination of Efficient Location of Split Air Conditioner using CFD	221

57.	Frictionless Electromagnetic Braking System	225
58.	Performance Evaluation of Vegetable oils as Cutting fluid under MQL Condition in Turning	228
59.	A novel hybrid Fuzzy AHP and VIKOR methodology for Reclaimer Selection in GSCM	236
60.	Design of Eco-Friendly Road Cleaner	240
61.	Mechanical and Microstructural Characterization of Jute Hybrid Composite with Alkali Treatment	244
62.	Experimental Investigation and Optimization of Process Parameters in Wire Cut EDM of EN31 Steel	248
63.	Design and Analysis of Differential Gear Box	252

***

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

Klcc 2021

ISBN: 978-93-91420-02-4

Modelling and Optimization of Two Wheeler Disk Brake Using ANSYS –Review

Kadru John Babu and Kiran Chand Kopila
Department of Mechanical Engineering, Narasaraopeta Engineering College (Autonomous), Narasaraopet, India.

Abstract— Each single system has been studied and developed in order to meet safety requirement. Instead of having air bag, good suspension systems, good handling and safe cornering, there is one most critical system in the vehicle which is brake systems. Without brake system in the vehicle will put a passenger in unsafe position. Therefore, it is must for all vehicles to have proper brake system. In this paper carbon ceramic matrix disc brake material use for calculating normal force, shear force and piston force. And also calculating the brake distance of disc brake. The standard disc brake two wheelers model using in Ansys and done the Thermal analysis and Modal analysis also calculate the deflection and Heat flux, Temperature of disc brake model. This is important to understand action force and friction force on the disc brake new material, how disc brake works more efficiently, which can help to reduce the accident that may happen in each day.

Keywords— Disc Brake, Thermal Analysis, Modal Analysis, Ansys

I. INTRODUCTION

The disc brake is a wheel brake which slows rotation of the wheel by the friction caused by pushing brake pads against a brake disc with a set of callipers. The brake disc (or rotor in American English) is usually made of cast iron, but may in some cases be made of composites such as reinforced carbon– carbon or ceramic matrix composites. This is connected to the wheel and/or the axle. To stop the wheel, friction material in the form of brake pads, mounted on a device called a brake calliper, is forced mechanically, hydraulically, pneumatically or electromagnetically against both sides of the disc. Friction causes the disc and attached wheel to slow or stop. Brakes convert motion to heat, and if the brakes get too hot, they become less effective, a phenomenon known as brake fade.

Disc-style brakes development and use began in England in the 1890s. The first calliper-type automobile disc brake was patented by Frederick William Lanchester in his Birmingham, UK factory in 1902 and used successfully on Lanchester cars. Compared to drum brakes, disc brakes offer better stopping performance, because the disc is more readily cooled. A disc brake consists of a cast iron disc bolted to the wheel hub and a stationary housing called calliper. The calliper is connected to some stationary part of the vehicle like the axle casing or the stub axle as is cast in two parts each part containing a piston. In between each piston and the disc there is a friction pad held in position by retaining pins, spring plates etc. passages are drilled in the calliper for the fluid to enter or leave each housing. The passages are also connected to another one for bleeding. Each cylinder contains rubber-sealing ring between

The cylinder and piston. A schematic diagram is shown in the figure 1

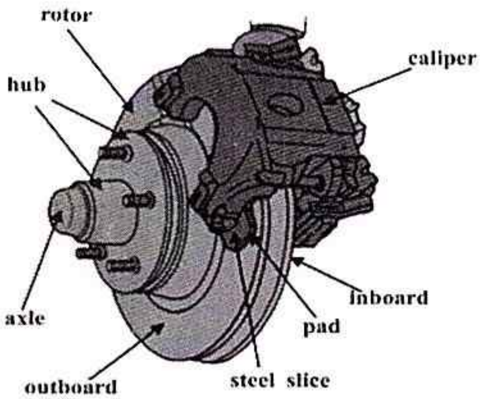


Fig 1 Disc Brake

II. PROBLEM OCCURRED IN DISC BRAKE

Discs are made up mainly gray cast iron, so discs are damaged in one of three ways: scarring, cracking, warping or excessive rusting. Service shops will sometimes respond to any disc problem by changing out the discs entirely. This is done mainly where the cost of a new disc may actually be lower than the cost of workers to resurface the original disc. Mechanically this is unnecessary unless the discs have reached manufacturer's minimum recommended thickness, which would make it unsafe to use them, or vane rusting. Severe (ventilated discs only). Most leading vehicle manufacturers recommend brake disc skimming (US: turning) as a solution for lateral run-out, vibration issues and brake noises.

The machining process is performed in a brake lathe, which removes a very thin layer off the disc surface to clean off minor damage and restore uniform thickness. Machining the disc as necessary will maximize the mileage out of the current discs on the vehicle. Braking systems rely on friction to bring the vehicle to a halt – hydraulic pressure pushes brake pads against a cast iron disc or brake shoes against the inside of a cast iron drum. When a vehicle is decelerated, load is transferred to the front wheels – this means that the front

Brakes do most of the work in stopping the vehicle. Scarring can occur if brake pads are not changed promptly when they reach the end of their service life and are considered worn out.

Cracking is limited mostly to drilled discs, which may develop small cracks around edges of holes drilled near the edge of the disc due to the disc's uneven rate of expansion in severe duty environments. The discs are commonly made from cast iron and a certain amount of what is known as "surface rust" is normal. Sometimes a loud noise or high pitched squeal occurs when the brakes are applied. Most brake squeal is produced by vibration (resonance instability) of the brake

NEC NARASARAOPETA ENGINEERING COLLEGE (AUTONOMOUS)

NAAC 'A' GRADE

NBA NATIONAL BOARD OF ACCREDITATION

PROCEEDINGS

INTERNATIONAL CONFERENCE

EMERGING TRENDS IN MECHANICAL ENGINEERING AND INDUSTRIAL AUTOMATION

NEC-ICETMEIA-2K21

30th & 31st July, 2021

Editors-in-Chief

Dr. M.Sreenivasa Kumar
Principal & Professor, Dept. of Mechnical Engineering

Dr. D.Jagadish
Professor, Dept. of Mechnical Engineering

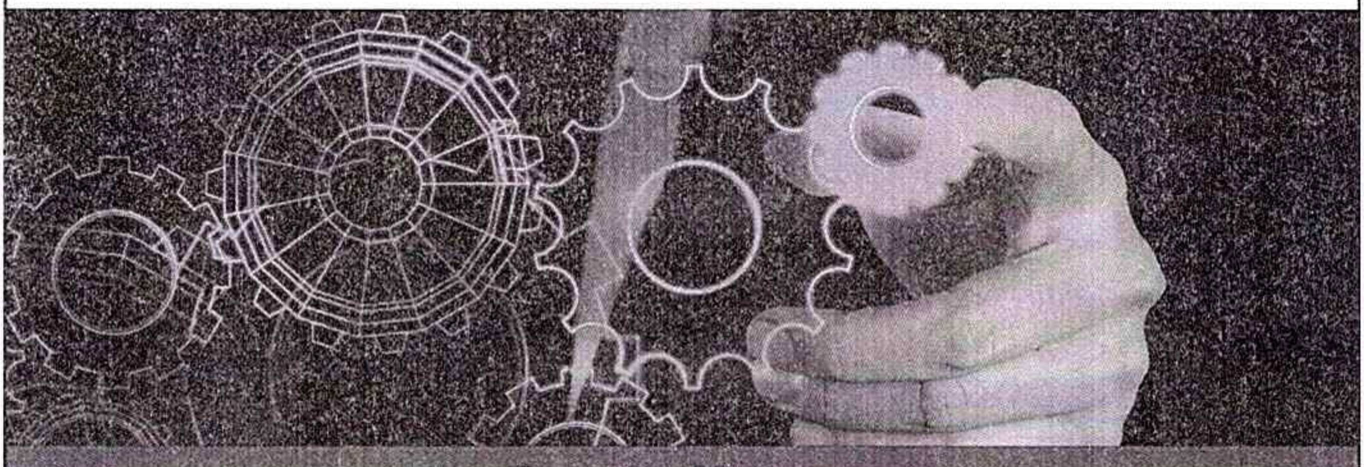
Editors

Dr. D.Suneel
Vice-Principal & Professor, Dept. of ME

Dr. P.Suresh Babu
Professor, Dept. of ME

Dr. B.Venkata Siva
Professor & HoD Dept. of ME

Mr. M.Venkanna Babu
Associate Professor, Dept. of ME



Organized by

Department of **Mechanical Engineering**

In Association with *The Institution of Engineers (India)*

ISBN : 978-93-91420-02-4

LIST OF FULL LENGTH PAPERS SELECTED FOR PROCEEDINGS

International Conference on Emerging Trends in Mechanical Engineering and Industrial Automation

NEC-ICETMEIA- 2K21

S.No.	TITLE OF THE PAPER	Page No.
1.	Effectiveness of Compression Ignition Engine Fuelled with Pond Water Algae Biodiesel	01
2.	Design And Analysis of Disc Brake of an Electric Go-Kart	04
3.	A Comprehensive Review on Recent Research on Semi Solid Processed Aluminum 7 Series Alloys	08
4.	A Study on Microstructure and Mechanical Properties A7075 Reinforced with Flyash/Sic Hybrid Metal Matrix Composite	15
5.	Establishment of SCR Test Facility and Evaluation of 8mm Pitch Honeycomb Type Catalyst in a 20 Liter capacity SCR Test facility	19
6.	A Review on NVH Issues and Technological Challenges in Electric Vehicle and Hybrid Electric Vehicle Power Train	25
7.	Design and Analysis of Cantilever Beam	29
8.	Analysis of Static and Fatigue Strength of Aluminium Alloy Wheel	32
9.	Design of Automated Braking System Based on Vehicle Over Speed Using PLC Ladder Method	35
10.	The Analysis on Concentric Pipe Heat Exchanger	39
11.	Design and Finite Element Analysis of Gas Turbine Blade	45
12.	Investigation on Mechanical Properties of Glass Fiber and Carbon Nano Tubes Sandwich Composite Material	47
13.	CFD Analysis of Super Utility Vehicle to Determine Aerodynamic Behavior	54
14.	Devlopment of Code for Automated HVAC System using Digital Controller	60
15.	Performance and Emission Characteristics Of Diesel Engine with Linseed Oil-Diesel Blends as Fuel With VCR	65
16.	Experimental Investigation in Single Cylinder VCR Multifuel Engine Using Bio-Diesel as Linseed Oil	69

Principal
NARASARAOPETA ENGINEERING
(AUTONOMOUS)
NARASARAOPET
Guntur (Dist.),

IQAC

17.	Tribological Properties of Textured Surface	72
18.	Thermal Analysis and Experimental Investigation of Pin Fin made of Brass	76
19.	Experimental and Simulation of Wear Test on GPR material	79
20.	CFD Analysis of Two Pass Double Pipe Heat Exchanger with TiO_2/Ethylene Glycol Nano Fluid	83
21.	Simulation and Optimization of Extrusion Process Parameters of Aluminium 2A12T4Alloy	87
22.	Importance of Ice Jet machining - A Review	91
23.	Performance Investigation of a Battery Powered Peltier Cooler	94
24.	Analysis of Disc Brake Rotor using ANSYS Workbench	98
25.	Modelling and Optimization of Two Wheeler Disk Brake Using ANSYS -Review	101
26.	Fabrication of Sewage Waste Cleaner	105
27.	Manufacturing of Hyperboliodal Gear Model Using Ultimaker S5 3D Printing Machine	109
28.	Arc Welding Process Selection Through Quality and Cost Analysis	113
29.	Li-Br H2O VAR System Analysis by Applying Magnetic Field to Liquid Line	117
30.	Heat Transfer Enhancement on Shell and Coil Type of Heat Exchanger Using SiO_2 and CuO Nano-Fluids	121
31.	Study of Rheological Characteristics of Nano Suspensions	126
32.	Design And Fabrication of Loop Wheel System	129
33.	Performance of Solar Vapour Absorption system and its Dependence on Generator Temperature	131
34.	Design and Analysis Of Handicapped Steering Tricycle	134
35.	Machining Characteristics and Microbiological Growth of Stir Casted A356-SiC MMCs and Pure Metals	136
36.	Design and Analysis of Connecting Rod	141

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

37.	Pressure Vessel Optimum Design using Particle Swarm Optimization	145
38.	Design and Analysis of Wheel Rim on Radial Loads	149
39.	COP Enhancement of VCR System using Diffusers	154
40.	Design and Fabrication of Radiant Cooling System	157
41.	Comparative Performance Analysis of Engine Fuelled with Diesel Biodiesel Iron Oxide Nano Particles	162
42.	Performance analysis of a CI Engine fuelled with olive oil and soybean oil mixture as a biofuels	166
43.	Design and Analysis of Landing Gear	170
44.	A Review on Parameters of Composite Materials	173
45.	Optimisation in WEDM of HCHCR Steel using Taughi Method	177
46.	Automated Pneumatic Sheet Metal Cutting Machine	184
47.	Cylindrical Panel's Numerical And Analytical Investigations Subjected To Different Loads	187
48.	Application of a Thermoplastic Polyurethane/Polylactic Acid Composite Filament For 3D-Printed Personalized Orthosis	192
49.	Design and Analysis of a Connecting Rod	196
50.	A Study and Synthesis of 8 Bar One Degree of Freedom Walking Mechanism	200
51.	Mechanical properties and machining of Al-7075 SiC Composite	204
52.	Characterization of Tungsten carbide reinforced Al7075 matrix Composites.	208
53.	3D Printing of Prototype Through Image Processing using Autodesk Recap Photo Software	212
54.	Fabrication and Testing Mechanical Behaviour of Hemp Fibre, Chopped E Glass and Hybrid with Nano Particle	216
55.	Optical characterization of V_2O_5 doped Na_2O-SiO_2-ZrO_2 glasses	218
56.	Determination of Efficient Location of Split Air Conditioner using CFD	221

57.	Frictionless Electromagnetic Braking System	225
58.	Performance Evaluation of Vegetable oils as Cutting fluid under MQL Condition in Turning	228
59.	A novel hybrid Fuzzy AHP and VIKOR methodology for Reclaimer Selection in GSCM	236
60.	Design of Eco-Friendly Road Cleaner	240
61.	Mechanical and Microstructural Characterization of Jute Hybrid Composite with Alkali Treatment	244
62.	Experimental Investigation and Optimization of Process Parameters in Wire Cut EDM of EN31 Steel	248
63.	Design and Analysis of Differential Gear Box	252

***

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

ISBN: 978-93-91420-02-4

Design and Analysis of Wheel Rim on Radial Loads

Kiran Chand Kopila[1], Kandru John Babu[2]
Narasaraopeta engineering College (Autonomous), Andhra Pradesh, Guntur, India

***Abstract*—Wheels are one of the important components in the vehicle. The two-wheeler, there are two types of wheels used. One is alloy wheel and another one is spokes wheel. Mostly alloy materials are used for fabricate the wheel rim. The main reason used for the alloy material is increase the efficiency of the two-wheeler by reducing the weight.**
In this study a tire of car wheel rim belonging to the disc wheel category is considered. Design in an important industrial activity which influences the quality of the product. The wheel rim is designed by using modelling software CATIAv5R19. ANSYS software used for simulating the different forces, pressure acting on the component and also for calculating and viewing the results. In the present work a detailed static analysis - displacement, maximum and minimum von-misses stresses and fatigue analysis of wheel rim under radial loads has been done. The application of finite element method for analyzing stress distribution and fatigue life of wheel rim was summarized.

Keywords—Wheel rim, static analysis, fatigue analysis of wheel rim

I. INTRODUCTION

Archaeologists and historians of today see the introduction of the wheel as the real genesis of any old civilization. The wheel is perhaps the most important discovery of old times. This discovery capitulated commerce to heights unknown before. The wheel has developed from nothing more than an oversize bearing to a fully integral part of any modern transportation vehicle. The modern vehicle is also seen today a fashion item to complement people's individual tastes. Motor vehicles are produced according to very strict rules to ensure the safety of the passengers. Every component is therefore designed according to the criticality of the component. Wheels are classified as a safety critical component and international cods and criteria are used to design a wheel.

II. FUNCTIONS OF A WHEEL RIM.

In its basic form a wheel rim is a transfer element between the tyre and the vehicle. The following are the main functions of a wheel rim:

- ✓ Transfers torque (braking and acceleration).
- ✓ Support mass
- ✓ Adds mass (damped mass for driving comfort).
- ✓ Dissipates heat (from braking).
- ✓ Adds value.
- ✓ Absorbs impact (road hazards).
- ✓ Conserves energy

III. CLASSIFICATION OF CAR WHEELS

Car wheels are divided in to two main categories, steel wheels and alloy wheels. Alloy wheels are often fitted standard during the manufacturing of modern vehicles.

Steel Wheels:

All steel wheels consist of two pressed Components, the rim and the wheel disc, which are welded together. The rim is the part on which tyre is mounted. Its dimensions shape and condition must suitable to satisfactorily accommodate the particular tyre required for the vehicle. The wheel disc is the supporting member between the vehicles hub and the rim. Its dimensions shape and location in the rim must be suited to the design of the wheel hub and the suspension geometry of the vehicle to which it has to be mounted. The purpose of the rim is to provide a firm base on which to fit the tire. Four vital dimensions are involved. The different parts developed in the PART module of CATIA are assembled in the ASSEMBLY module of CATIA. The components developed are assembled using the placement constraints available from the list in the component placement dialogue box. On to the rim, it would be impossible for the inside diameter of the tire to pass over the large diameter of the tire rim without causing damage to the beads. Forcing the tire bead into the rim well opposite to the fitting head of the machine tire bead. Steel disc

Alloy Wheels:

Alloy wheels are often incorrectly referred to as magnesium or "Mag" wheels. Magnesium is used in alloys. However, they are almost found only in racing rims meant for the track. Its brittle and highly flammable qualities make it unsuited as a road rim. Low pressure, die-casted aluminum alloy wheels are used and offer certain benefits over steel wheels. It is possible to design alloy wheels that alloy for the better air flow over the brakes and that are also slightly lighter and visually more appealing than steel wheels. Because alloy is lighter than steel, wider rims can be used without sacrificing unsprang weight.

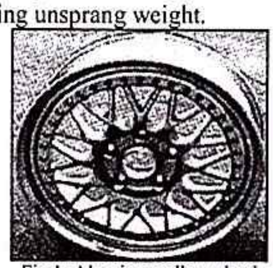


Fig 1: Aluminum alloy wheel

IV. STEPS INVOLVED IN PROJECT WORK

Gathering all relative data for the design of wheel rim.
Generation of model using CATIAV5. Importing the generated model to ANSYS for analysis work Static analysis is carried out on the wheel rim to evaluate the performance. Modal analysis is carried out on the wheel rim.

NEC NARASARAOPETA ENGINEERING COLLEGE (AUTONOMOUS)

NAAC 'A' GRADE | NBA NATIONAL BOARD OF ACCREDITATION | RANKED 5

PROCEEDINGS

INTERNATIONAL CONFERENCE

EMERGING TRENDS IN MECHANICAL ENGINEERING AND INDUSTRIAL AUTOMATION

NEC-ICETMEIA-2K21

30th & 31st July, 2021

Editors-in-Chief

Dr. M.Sreenivasa Kumar
Principal & Professor, Dept. of Mechnical Engineering

Dr. D.Jagadish
Professor, Dept. of Mechnical Engineering

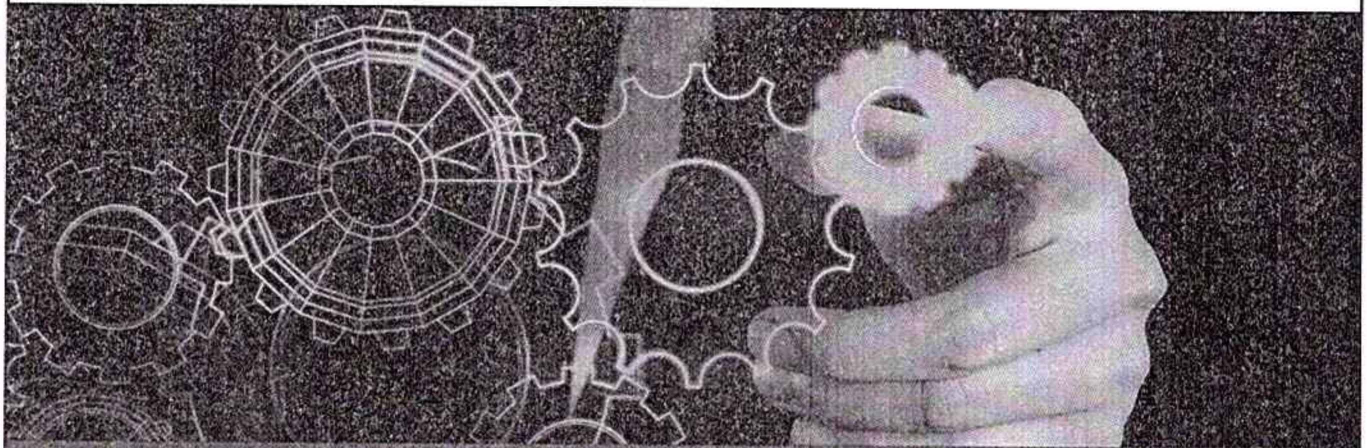
Editors

Dr. D.Suneel
Vice-Principal & Professor, Dept. of ME

Dr. P.Suresh Babu
Professor, Dept. of ME

Dr. B.Venkata Siva
Professor & HoD Dept. of ME

Mr. M.Venkanna Babu
Associate Professor, Dept. of ME



Organized by

Department of **Mechanical Engineering**

In Association with *The Institution of Engineers (India)*

ISBN : 978-93-91420-02-4

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

LIST OF FULL LENGTH PAPERS SELECTED FOR PROCEEDINGS

International Conference on Emerging Trends in Mechanical Engineering and Industrial Automation

NEC-ICETMEIA- 2K21

S.No.	TITLE OF THE PAPER	Page No.
1.	Effectiveness of Compression Ignition Engine Fuelled with Pond Water Algae Biodiesel	01
2.	Design And Analysis of Disc Brake of an Electric Go-Kart	04
3.	A Comprehensive Review on Recent Research on Semi Solid Processed Aluminum 7 Series Alloys	08
4.	A Study on Microstructure and Mechanical Properties A7075 Reinforced with Flyash/Sic Hybrid Metal Matrix Composite	15
5.	Establishment of SCR Test Facility and Evaluation of 8mm Pitch Honeycomb Type Catalyst in a 20 Liter capacity SCR Test facility	19
6.	A Review on NVH Issues and Technological Challenges in Electric Vehicle and Hybrid Electric Vehicle Power Train	25
7.	Design and Analysis of Cantilever Beam	29
8.	Analysis of Static and Fatigue Strength of Aluminium Alloy Wheel	32
9.	Design of Automated Braking System Based on Vehicle Over Speed Using PLC Ladder Method	35
10.	The Analysis on Concentric Pipe Heat Exchanger	39
11.	Design and Finite Element Analysis of Gas Turbine Blade	45
12.	Investigation on Mechanical Properties of Glass Fiber and Carbon Nano Tubes Sandwich Composite Material	47
13.	CFD Analysis of Super Utility Vehicle to Determine Aerodynamic Behavior	54
14.	Devlopment of Code for Automated HVAC System using Digital Controller	60
15.	Performance and Emission Characteristics Of Diesel Engine with Linseed Oil-Diesel Blends as Fuel With VCR	65
16.	Experimental Investigation in Single Cylinder VCR Multifuel Engine Using Bio-Diesel as Linseed Oil	69

17.	Tribological Properties of Textured Surface	72
18.	Thermal Analysis and Experimental Investigation of Pin Fin made of Brass	76
19.	Experimental and Simulation of Wear Test on GPR material	79
20.	CFD Analysis of Two Pass Double Pipe Heat Exchanger with TiO_2/Ethylene Glycol Nano Fluid	83
21.	Simulation and Optimization of Extrusion Process Parameters of Aluminium 2A12T4Alloy	87
22.	Importance of Ice Jet machining - A Review	91
23.	Performance Investigation of a Battery Powered Peltier Cooler	94
24.	Analysis of Disc Brake Rotor using ANSYS Workbench	98
25.	Modelling and Optimization of Two Wheeler Disk Brake Using ANSYS -Review	101
26.	Fabrication of Sewage Waste Cleaner	105
27.	Manufacturing of Hyperboliodal Gear Model Using Ultimaker S5 3D Printing Machine	109
28.	Arc Welding Process Selection Through Quality and Cost Analysis	113
29.	Li-Br H2O VAR System Analysis by Applying Magnetic Field to Liquid Line	117
30.	Heat Transfer Enhancement on Shell and Coil Type of Heat Exchanger Using SiO_2 and CuO Nano-Fluids	121
31.	Study of Rheological Characteristics of Nano Suspensions	126
32.	Design And Fabrication of Loop Wheel System	129
33.	Performance of Solar Vapour Absorption system and its Dependence on Generator Temperature	131
34.	Design and Analysis Of Handicapped Steering Tricycle	134
35.	Machining Characteristics and Microbiological Growth of Stir Casted A356-SiC MMCs and Pure Metals	136
36.	Design and Analysis of Connecting Rod	

37.	Pressure Vessel Optimum Design using Particle Swarm Optimization	145
38.	Design and Analysis of Wheel Rim on Radial Loads	149
39.	COP Enhancement of VCR System using Diffusers	154
40.	Design and Fabrication of Radiant Cooling System	157
41.	Comparative Performance Analysis of Engine Fuelled with Diesel Biodiesel Iron Oxide Nano Particles	162
42.	Performance analysis of a CI Engine fuelled with olive oil and soybean oil mixture as a biofuels	166
43.	Design and Analysis of Landing Gear	170
44.	A Review on Parameters of Composite Materials	173
45.	Optimisation in WEDM of HCHCR Steel using Taughi Method	177
46.	Automated Pneumatic Sheet Metal Cutting Machine	184
47.	Cylindrical Panel's Numerical And Analytical Investigations Subjected To Different Loads	187
48.	Application of a Thermoplastic Polyurethane/Polylactic Acid Composite Filament For 3D-Printed Personalized Orthosis	192
49.	Design and Analysis of a Connecting Rod	196
50.	A Study and Synthesis of 8 Bar One Degree of Freedom Walking Mechanism	200
51.	Mechanical properties and machining of Al-7075 SiC Composite	204
52.	Characterization of Tungsten carbide reinforced Al7075 matrix Composites.	208
53.	3D Printing of Prototype Through Image Processing using Autodesk Recap Photo Software	212
54.	Fabrication and Testing Mechanical Behaviour of Hemp Fibre, Chopped E Glass and Hybrid with Nano Particle	216
55.	Optical characterization of V_2O_5 doped Na_2O-SiO_2-ZrO_2 glasses	218
56.	Determination of Efficient Location of Split Air Conditioner using CFD	221

57.	Frictionless Electromagnetic Braking System	225
58.	Performance Evaluation of Vegetable oils as Cutting fluid under MQL Condition in Turning	228
59.	A novel hybrid Fuzzy AHP and VIKOR methodology for Reclaimer Selection in GSCM	236
60.	Design of Eco-Friendly Road Cleaner	240
61.	Mechanical and Microstructural Characterization of Jute Hybrid Composite with Alkali Treatment	244
62.	Experimental Investigation and Optimization of Process Parameters in Wire Cut EDM of EN31 Steel	248
63.	Design and Analysis of Differential Gear Box	252

***

Klc 2021

ISBN: 978-93-91420-02-4

Automated Pneumatic Sheet Metal Cutting Machine

Venkateswarlu Sampathi, Kiran Chand Kopila and Kadru John Babu
Department of Mechanical Engineering., SKN Sinhgad Institute of Technology & Science (SKNSITS)
Savitribai pune university, pune, India
[2]Department of Mechanical Engineering, Narasaraopet Engineering College (A), Narasaraopet, Guntur, A.P. India.

Abstract—**One of the major challenges in innovating manufacturing process is to make an equipment or system affordable and as well as compatible for small industries and large scale businesses. Already existing traditional machinery is bulky and expensive which small scale industries can neither accommodate and nor can afford. Traditional machinery requires large capital investment and work force. This machineries have some basic flaws like to increase the production you either need more machines or skilled work force (or both). In this paper, we propose a small but efficient pneumatic metal cutting machines that can be automated using simple microcontrollers. Our machines uses simple fabrication and easily available but good quality parts which makes or machinery efficient and easily affordable for small industries or home based businesses.**

Keywords—Automated, Pneumatic, Sheet metal cutting machine.

I.INTRODUCTION

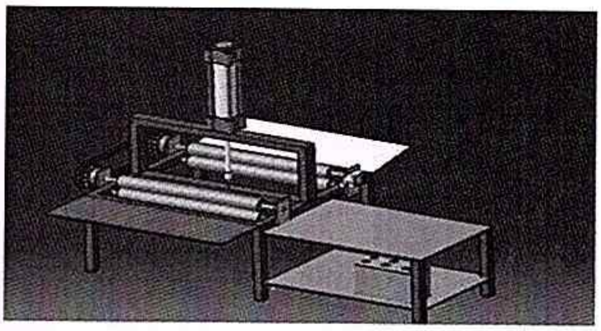
Today is world is more practical and thinks more of cost reduction, so the punching process for sheet-metal has to be done in economical way of operation, easier implementation for mass- production, as well as greater control on the other technical parameters. In most of the sheet metal operations punching is the main operation in the process sequence. Automating this operation results in reduced time and also can reduce human effort. Automation is a process in which combination of mechanical work, electronic work is carried out. Automation systems to operate and control production with help of computer and commanding software. The reason for automating this process may be to reduce manufacturing lead time, to increase labor productivity or to improve the worker safe. In these unit high-pressure air is used to move piston with required pressure and piston consist of punch with modified design to punch sheet metal into required shape and size. Thin and flat pieces of sheet metal are then obtained. It is one of the fundamental forms used in metal working and can be cut and bent into variety of different shapes. Sheet metals are available in flat pieces or as a coiled strip. Sheet metals has wide range of applications in car bodies, airplane wings, medical tables, roofs of buildings and many other things.

PROBLEM STATEMENT

In traditional pneumatic punching machine all operation is controlled manually and due to this the production rate is reduced and due to this the accuracy of the product may be reduced. In traditional pneumatic punching machine, the lot of time is wasted in to change the setting of the machine for new pitch distance. To overcome the above problem then the solution is to use the CNC Punching machine but the cost of the CNC Punching is high and the small-scale industries cannot afford the cost of the CNC Machine

II.LITERATURE REVIEW

A lot of researchers have worked on pneumatic sys-tems as well as on sheet metal experiments. The work done by various authors are explained below.Pneumatics was first documented by Hero of Alexan-dria in 60 A.D., but the concept had existed before then .Vallance and Matlock (1992) studied the friction be-havior of zinc-based coated sheet steels and laboratory scale friction analysis techniques that involve sheet sliding over cylindrical dies.Sanchez et al. (1999) has focused on systematic analy-sis of testing equipment as a measurement system of the friction phenomenon on sheet metal under plain strain. It has also provided experimental reference in order to optimize the usage of sheet metal and lubricants. Mutoh et al. proposed that the exhaust pressure of the cylinder hold middle level is 0.2-0.5 MPa. If the ex-haust flow is used effectively, losses can be reduced in pneumatic systems. If the exhaust pressure is set near 0.2 MPa, it reduces the losses by 15% of total con-sumption .



A. WORKING PRINCIPLE:

The sheet metal will be fed through feed rollers. The gear arrangement on the rollers is meshed with the DC motor, which feeds the sheet. The inductive proximity switch/sensor will be used, it detects the metal sheet and also records the sheet length as the sheet passes over it. After detection, these information are sent as a input to the microcontroller circuit containing series of relays. The microcontroller carries out the computations according to the coding done on it.

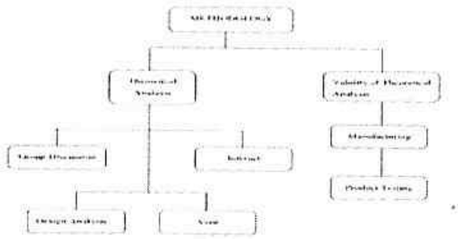


Fig 1: Flowchart of methodology

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

NEC NARASARAOPETA ENGINEERING COLLEGE (AUTONOMOUS)

NAAC 'A' GRADE

NATIONAL BOARD of ACCREDITATION

PROCEEDINGS

INTERNATIONAL CONFERENCE

EMERGING TRENDS IN MECHANICAL ENGINEERING AND INDUSTRIAL AUTOMATION

NEC-ICETMEIA-2K21

30th & 31st July, 2021

Editors-in-Chief

Dr. M.Sreenivasa Kumar
Principal & Professor, Dept. of Mechnical Engineering

Dr. D.Jagadish
Professor, Dept. of Mechnical Engineering

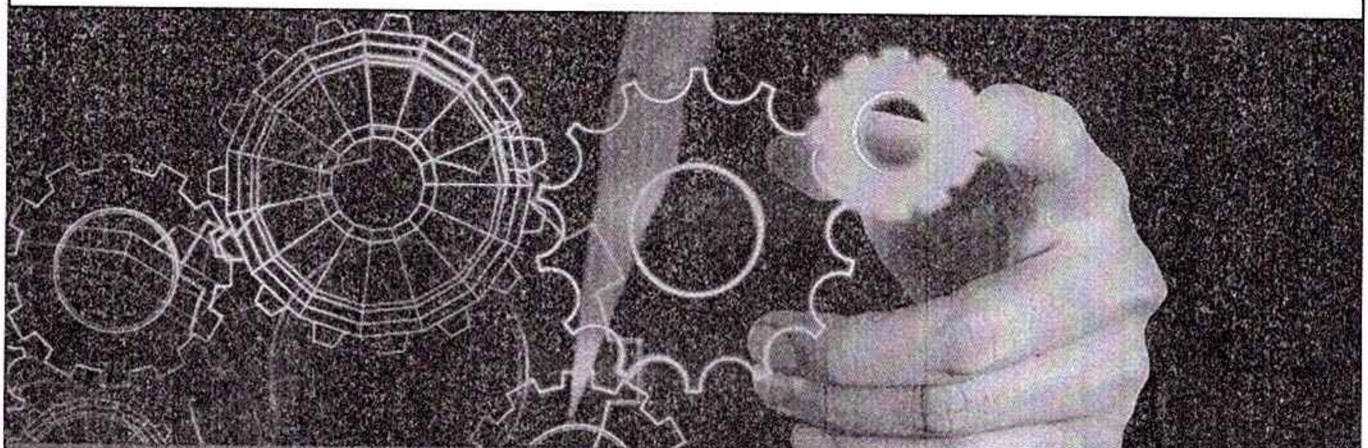
Editors

Dr. D.Suneel
Vice-Principal & Professor, Dept. of ME

Dr. B.Venkata Siva
Professor & HoD Dept. of ME

Dr. P.Suresh Babu
Professor, Dept. of ME

Mr. M.Venkanna Babu
Associate Professor, Dept. of ME



Organized by

Department of **Mechanical Engineering**

In Association with *The Institution of Engineers (India)*

ISBN : 978-93-91420-02-4

LIST OF FULL LENGTH PAPERS SELECTED FOR PROCEEDINGS

International Conference on Emerging Trends in Mechanical Engineering and Industrial Automation

NEC-ICETMEIA- 2K21

S.No.	TITLE OF THE PAPER	Page No.
1.	Effectiveness of Compression Ignition Engine Fuelled with Pond Water Algae Biodiesel	01
2.	Design And Analysis of Disc Brake of an Electric Go-Kart	04
3.	A Comprehensive Review on Recent Research on Semi Solid Processed Aluminum 7 Series Alloys	08
4.	A Study on Microstructure and Mechanical Properties A7075 Reinforced with Flyash/Sic Hybrid Metal Matrix Composite	15
5.	Establishment of SCR Test Facility and Evaluation of 8mm Pitch Honeycomb Type Catalyst in a 20 Liter capacity SCR Test facility	19
6.	A Review on NVH Issues and Technological Challenges in Electric Vehicle and Hybrid Electric Vehicle Power Train	25
7.	Design and Analysis of Cantilever Beam	29
8.	Analysis of Static and Fatigue Strength of Aluminium Alloy Wheel	32
9.	Design of Automated Braking System Based on Vehicle Over Speed Using PLC Ladder Method	35
10.	The Analysis on Concentric Pipe Heat Exchanger	39
11.	Design and Finite Element Analysis of Gas Turbine Blade	45
12.	Investigation on Mechanical Properties of Glass Fiber and Carbon Nano Tubes Sandwich Composite Material	47
13.	CFD Analysis of Super Utility Vehicle to Determine Aerodynamic Behavior	54
14.	Devlopment of Code for Automated HVAC System using Digital Controller	60
15.	Performance and Emission Characteristics Of Diesel Engine with Linseed Oil-Diesel Blends as Fuel With VCR	65
16.	Experimental Investigation in Single Cylinder VCR Multifuel Engine Using Bio-Diesel as Linseed Oil	69

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

17.	Tribological Properties of Textured Surface	72
18.	Thermal Analysis and Experimental Investigation of Pin Fin made of Brass	76
19.	Experimental and Simulation of Wear Test on GPR material	79
20.	CFD Analysis of Two Pass Double Pipe Heat Exchanger with TiO_2/Ethylene Glycol Nano Fluid	83
21.	Simulation and Optimization of Extrusion Process Parameters of Aluminium 2A12T4Alloy	87
22.	Importance of Ice Jet machining - A Review	91
23.	Performance Investigation of a Battery Powered Peltier Cooler	94
24.	Analysis of Disc Brake Rotor using ANSYS Workbench	98
25.	Modelling and Optimization of Two Wheeler Disk Brake Using ANSYS -Review	101
26.	Fabrication of Sewage Waste Cleaner	105
27.	Manufacturing of Hyperboliodal Gear Model Using Ultimaker S5 3D Printing Machine	109
28.	Arc Welding Process Selection Through Quality and Cost Analysis	113
29.	Li-Br H2O VAR System Analysis by Applying Magnetic Field to Liquid Line	117
30.	Heat Transfer Enhancement on Shell and Coil Type of Heat Exchanger Using SiO_2 and CuO Nano-Fluids	121
31.	Study of Rheological Characteristics of Nano Suspensions	126
32.	Design And Fabrication of Loop Wheel System	129
33.	Performance of Solar Vapour Absorption system and its Dependence on Generator Temperature	131
34.	Design and Analysis Of Handicapped Steering Tricycle	134
35.	Machining Characteristics and Microbiological Growth of Stir Casted A356-SiC MMCs and Pure Metals	136
36.	Design and Analysis of Connecting Rod	141

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

IQAC

37.	Pressure Vessel Optimum Design using Particle Swarm Optimization	145
38.	Design and Analysis of Wheel Rim on Radial Loads	149
39.	COP Enhancement of VCR System using Diffusers	154
40.	Design and Fabrication of Radiant Cooling System	157
41.	Comparative Performance Analysis of Engine Fuelled with Diesel Biodiesel Iron Oxide Nano Particles	162
42.	Performance analysis of a CI Engine fuelled with olive oil and soybean oil mixture as a biofuels	166
43.	Design and Analysis of Landing Gear	170
44.	A Review on Parameters of Composite Materials	173
45.	Optimisation in WEDM of HCHCR Steel using Taughi Method	177
46.	Automated Pneumatic Sheet Metal Cutting Machine	184
47.	Cylindrical Panel's Numerical And Analytical Investigations Subjected To Different Loads	187
48.	Application of a Thermoplastic Polyurethane/Polylactic Acid Composite Filament For 3D-Printed Personalized Orthosis	192
49.	Design and Analysis of a Connecting Rod	196
50.	A Study and Synthesis of 8 Bar One Degree of Freedom Walking Mechanism	200
51.	Mechanical properties and machining of Al-7075 SiC Composite	204
52.	Characterization of Tungsten carbide reinforced Al7075 matrix Composites.	208
53.	3D Printing of Prototype Through Image Processing using Autodesk Recap Photo Software	212
54.	Fabrication and Testing Mechanical Behaviour of Hemp Fibre, Chopped E Glass and Hybrid with Nano Particle	216
55.	Optical characterization of V_2O_5 doped Na_2O-SiO_2-ZrO_2 glasses	218
56.	Determination of Efficient Location of Split Air Conditioner using	221

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

IQAC

57.	Frictionless Electromagnetic Braking System	225
58.	Performance Evaluation of Vegetable oils as Cutting fluid under MQL Condition in Turning	228
59.	A novel hybrid Fuzzy AHP and VIKOR methodology for Reclaimer Selection in GSCM	236
60.	Design of Eco-Friendly Road Cleaner	240
61.	Mechanical and Microstructural Characterization of Jute Hybrid Composite with Alkali Treatment	244
62.	Experimental Investigation and Optimization of Process Parameters in Wire Cut EDM of EN31 Steel	248
63.	Design and Analysis of Differential Gear Box	252

***

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET
Guntur (Dist.), A.P.

KJB 2021

ISBN: 978-93-91420-02-4

Automated Pneumatic Sheet Metal Cutting Machine

Venkateswarlu Sampathi, Kiran Chand Kopila and Kadru John Babu
Department of Mechanical Engineering., SKN Sinhgad Institute of Technology & Science (SKNSITS)
Savitribai pune university, pune, India
[2]Department of Mechanical Engineering, Narasaraopet Engineering College (A), Narasaraopet, Guntur, A.P. India.

Abstract—**One of the major challenges in innovating manufacturing process is to make an equipment or system affordable and as well as compatible for small industries and large scale businesses. Already existing traditional machinery is bulky and expensive which small scale industries can neither accommodate and nor can afford. Traditional machinery requires large capital investment and work force. This machineries have some basic flaws like to increase the production you either need more machines or skilled work force (or both). In this paper, we propose a small but efficient pneumatic metal cutting machines that can be automated using simple microcontrollers. Our machines uses simple fabrication and easily available but good quality parts which makes or machinery efficient and easily affordable for small industries or home based businesses.**

Keywords—Automated, Pneumatic, Sheet metal cutting machine.

I.INTRODUCTION

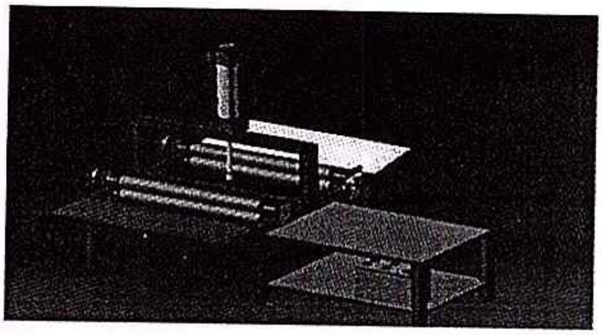
Today is world is more practical and thinks more of cost reduction, so the punching process for sheet-metal has to be done in economical way of operation, easier implementation for mass- production, as well as greater control on the other technical parameters. In most of the sheet metal operations punching is the main operation in the process sequence. Automating this operation results in reduced time and also can reduce human effort. Automation is a process in which combination of mechanical work, electronic work is carried out. Automation systems to operate and control production with help of computer and commanding software. The reason for automating this process may be to reduce manufacturing lead time, to increase labor productivity or to improve the worker safe. In these unit high-pressure air is used to move piston with required pressure and piston consist of punch with modified design to punch sheet metal into required shape and size. Thin and flat pieces of sheet metal are then obtained. It is one of the fundamental forms used in metal working and can be cut and bent into variety of different shapes. Sheet metals are available in flat pieces or as a coiled strip. Sheet metals has wide range of applications in car bodies, airplane wings, medical tables, roofs of buildings and many other things.

PROBLEM STATEMENT

In traditional pneumatic punching machine all operation is controlled manually and due to this the production rate is reduced and due to this the accuracy of the product may be reduced. In traditional pneumatic punching machine, the lot of time is wasted in to change the setting of the machine for new pitch distance. To overcome the above problem then the solution is to use the CNC Punching machine but the cost of the CNC Punching is high and the small-scale industries cannot afford the cost of the CNC Machine

II.LITERATURE REVIEW

A lot of researchers have worked on pneumatic sys-tems as well as on sheet metal experiments. The work done by various authors are explained below.Pneumatics was first documented by Hero of Alexan-dria in 60 A.D., but the concept had existed before then .Vallance and Matlock (1992) studied the friction be-havior of zinc-based coated sheet steels and laboratory scale friction analysis techniques that involve sheet sliding over cylindrical dies.Sanchez et al. (1999) has focused on systematic analy-sis of testing equipment as a measurement system of the friction phenomenon on sheet metal under plain strain. It has also provided experimental reference in order to optimize the usage of sheet metal and lubricants. Mutoh et al. proposed that the exhaust pressure of the cylinder hold middle level is 0.2-0.5 MPa. If the ex-haust flow is used effectively, losses can be reduced in pneumatic systems. If the exhaust pressure is set near 0.2 MPa, it reduces the losses by 15% of total con-sumption .



A. WORKING PRINCIPLE:

The sheet metal will be fed through feed rollers. The gear arrangement on the rollers is meshed with the DC motor, which feeds the sheet. The inductive proximity switch/sensor will be used, it detects the metal sheet and also records the sheet length as the sheet passes over it. After detection, these information are sent as a input to the microcontroller circuit containing series of relays. The microcontroller carries out the computations according to the coding done on it.

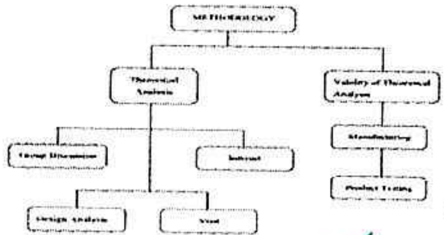


Fig 1: Flowchart of methodology

NEC

NARASARAOPETA
ENGINEERING COLLEGE
(AUTONOMOUS)

NAAC 'A' GRADE

NATIONAL BOARD OF ACCREDITATION

PROCEEDINGS

INTERNATIONAL CONFERENCE

EMERGING TRENDS IN MECHANICAL ENGINEERING AND INDUSTRIAL AUTOMATION

NEC-ICETMEIA-2K21

30th & 31st July, 2021

Editors-in-Chief

Dr. M.Sreenivasa Kumar
Principal & Professor, Dept. of Mechnical Engineering

Dr. D.Jagadish
Professor, Dept. of Mechnical Engineering

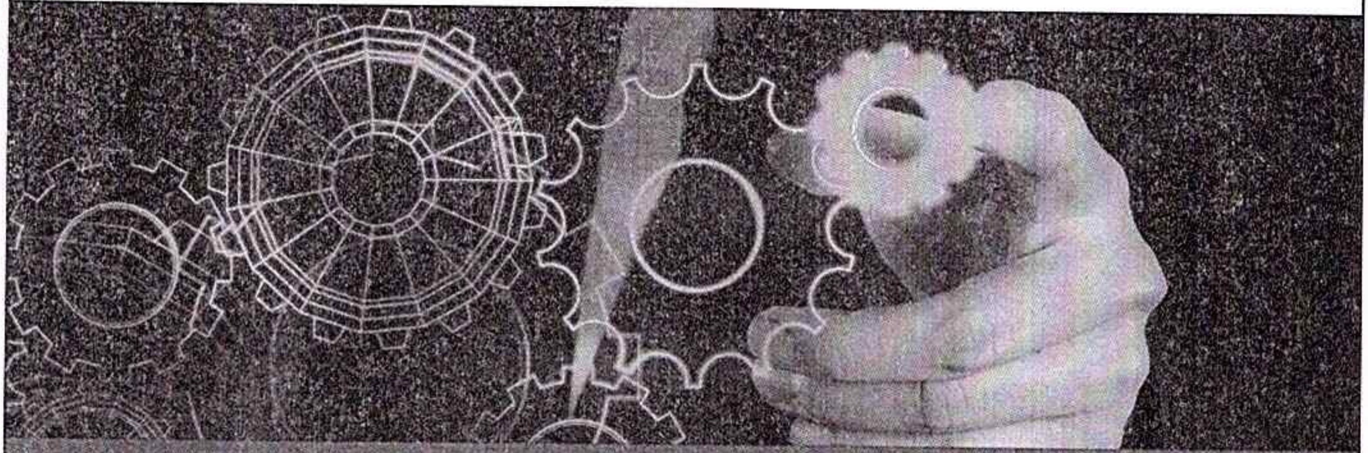
Editors

Dr. D.Suneel
Vice-Principal & Professor, Dept. of ME

Dr. P.Suresh Babu
Professor, Dept. of ME

Dr. B.Venkata Siva
Professor & HoD Dept. of ME

Mr. M.Venkanna Babu
Associate Professor, Dept. of ME



Organized by

Department of **Mechanical Engineering**

In Association with *The Institution of Engineers (India)*

ISBN : 978-93-91420-02-4

LIST OF FULL LENGTH PAPERS SELECTED FOR PROCEEDINGS

International Conference on Emerging Trends in Mechanical Engineering and Industrial Automation

NEC-ICETMEIA- 2K21

S.No.	TITLE OF THE PAPER	Page No.
1.	Effectiveness of Compression Ignition Engine Fuelled with Pond Water Algae Biodiesel	01
2.	Design And Analysis of Disc Brake of an Electric Go-Kart	04
3.	A Comprehensive Review on Recent Research on Semi Solid Processed Aluminum 7 Series Alloys	08
4.	A Study on Microstructure and Mechanical Properties A7075 Reinforced with Flyash/Sic Hybrid Metal Matrix Composite	15
5.	Establishment of SCR Test Facility and Evaluation of 8mm Pitch Honeycomb Type Catalyst in a 20 Liter capacity SCR Test facility	19
6.	A Review on NVH Issues and Technological Challenges in Electric Vehicle and Hybrid Electric Vehicle Power Train	25
7.	Design and Analysis of Cantilever Beam	29
8.	Analysis of Static and Fatigue Strength of Aluminium Alloy Wheel	32
9.	Design of Automated Braking System Based on Vehicle Over Speed Using PLC Ladder Method	35
10.	The Analysis on Concentric Pipe Heat Exchanger	39
11.	Design and Finite Element Analysis of Gas Turbine Blade	45
12.	Investigation on Mechanical Properties of Glass Fiber and Carbon Nano Tubes Sandwich Composite Material	47
13.	CFD Analysis of Super Utility Vehicle to Determine Aerodynamic Behavior	54
14.	Devlopment of Code for Automated HVAC System using Digital Controller	60
15.	Performance and Emission Characteristics Of Diesel Engine with Linseed Oil-Diesel Blends as Fuel With VCR	65
16.	Experimental Investigation in Single Cylinder VCR Multifuel Engine Using Diesel as Linseed Oil	69

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

17.	Tribological Properties of Textured Surface	72
18.	Thermal Analysis and Experimental Investigation of Pin Fin made of Brass	76
19.	Experimental and Simulation of Wear Test on GPR material	79
20.	CFD Analysis of Two Pass Double Pipe Heat Exchanger with TiO_2/Ethylene Glycol Nano Fluid	83
21.	Simulation and Optimization of Extrusion Process Parameters of Aluminium 2A12T4Alloy	87
22.	Importance of Ice Jet machining - A Review	91
23.	Performance Investigation of a Battery Powered Peltier Cooler	94
24.	Analysis of Disc Brake Rotor using ANSYS Workbench	98
25.	Modelling and Optimization of Two Wheeler Disk Brake Using ANSYS -Review	101
26.	Fabrication of Sewage Waste Cleaner	105
27.	Manufacturing of Hyperboliodal Gear Model Using Ultimaker S5 3D Printing Machine	109
28.	Arc Welding Process Selection Through Quality and Cost Analysis	113
29.	Li-Br H2O VAR System Analysis by Applying Magnetic Field to Liquid Line	117
30.	Heat Transfer Enhancement on Shell and Coil Type of Heat Exchanger Using SiO_2 and CuO Nano-Fluids	121
31.	Study of Rheological Characteristics of Nano Suspensions	126
32.	Design And Fabrication of Loop Wheel System	129
33.	Performance of Solar Vapour Absorption system and its Dependence on Generator Temperature	131
34.	Design and Analysis Of Handicapped Steering Tricycle	134
35.	Machining Characteristics and Microbiological Growth of Stir Casted A356-SiC MMCs and Pure Metals	136
36.	Design and Analysis of Connecting Rod	141

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

37.	Pressure Vessel Optimum Design using Particle Swarm Optimization	145
38.	Design and Analysis of Wheel Rim on Radial Loads	149
39.	COP Enhancement of VCR System using Diffusers	154
40.	Design and Fabrication of Radiant Cooling System	157
41.	Comparative Performance Analysis of Engine Fuelled with Diesel Biodiesel Iron Oxide Nano Particles	162
42.	Performance analysis of a CI Engine fuelled with olive oil and soybean oil mixture as a biofuels	166
43.	Design and Analysis of Landing Gear	170
44.	A Review on Parameters of Composite Materials	173
45.	Optimisation in WEDM of HCHCR Steel using Taughi Method	177
46.	Automated Pneumatic Sheet Metal Cutting Machine	184
47.	Cylindrical Panel's Numerical And Analytical Investigations Subjected To Different Loads	187
48.	Application of a Thermoplastic Polyurethane/Polylactic Acid Composite Filament For 3D-Printed Personalized Orthosis	192
49.	Design and Analysis of a Connecting Rod	196
50.	A Study and Synthesis of 8 Bar One Degree of Freedom Walking Mechanism	200
51.	Mechanical properties and machining of Al-7075 SiC Composite	204
52.	Characterization of Tungsten carbide reinforced Al7075 matrix Composites.	208
53.	3D Printing of Prototype Through Image Processing using Autodesk Recap Photo Software	212
54.	Fabrication and Testing Mechanical Behaviour of Hemp Fibre, Chopped E Glass and Hybrid with Nano Particle	216
55.	Optical characterization of V_2O_5 doped Na_2O-SiO_2-ZrO_2 glasses	218
56.	Determination of Efficient Location of Split Air Conditioner usi[illegible]	221

57.	Frictionless Electromagnetic Braking System	225
58.	Performance Evaluation of Vegetable oils as Cutting fluid under MQL Condition in Turning	228
59.	A novel hybrid Fuzzy AHP and VIKOR methodology for Reclaimer Selection in GSCM	236
60.	Design of Eco-Friendly Road Cleaner	240
61.	Mechanical and Microstructural Characterization of Jute Hybrid Composite with Alkali Treatment	244
62.	Experimental Investigation and Optimization of Process Parameters in Wire Cut EDM of EN31 Steel	248
63.	Design and Analysis of Differential Gear Box	252

***

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

IcJB - 2021

ISBN: 978-93-91420-02-4

Design and Analysis of Wheel Rim on Radial Loads

Kiran Chand Kopila[1], Kandru John Babu[2]
Narasaraopeta engineering College (Autonomous), Andhra Pradesh, Guntur, India

***Abstract*—Wheels are one of the important components in the vehicle. The two-wheeler, there are two types of wheels used. One is alloy wheel and another one is spokes wheel. Mostly alloy materials are used for fabricate the wheel rim. The main reason used for the alloy material is increase the efficiency of the two-wheeler by reducing the weight.**

In this study a tire of car wheel rim belonging to the disc wheel category is considered. Design in an important industrial activity which influences the quality of the product. The wheel rim is designed by using modelling software CATIAv5R19. ANSYS software used for simulating the different forces, pressure acting on the component and also for calculating and viewing the results. In the present work a detailed static analysis - displacement, maximum and minimum von-misses stresses and fatigue analysis of wheel rim under radial loads has been done. The application of finite element method for analyzing stress distribution and fatigue life of wheel rim was summarized.

Keywords—Wheel rim, static analysis, fatigue analysis of wheel rim

I. INTRODUCTION

Archaeologists and historians of today see the introduction of the wheel as the real genesis of any old civilization. The wheel is perhaps the most important discovery of old times. This discovery capitulated commerce to heights unknown before. The wheel has developed from nothing more than an oversize bearing to a fully integral part of any modern transportation vehicle. The modern vehicle is also seen today a fashion item to complement people's individual tastes. Motor vehicles are produced according to very strict rules to ensure the safety of the passengers. Every component is therefore designed according to the criticality of the component. Wheels are classified as a safety critical component and international cods and criteria are used to design a wheel.

II. FUNCTIONS OF A WHEEL RIM.

In its basic form a wheel rim is a transfer element between the tyre and the vehicle. The following are the main functions of a wheel rim:

- ✓ Transfers torque (braking and acceleration).
- ✓ Support mass
- ✓ Adds mass (damped mass for driving comfort).
- ✓ Dissipates heat (from braking).
- ✓ Adds value.
- ✓ Absorbs impact (road hazards).
- ✓ Conserves energy

III. CLASSIFICATION OF CAR WHEELS

Car wheels are divided in to two main categories, steel wheels and alloy wheels. Alloy wheels are often fitted standard during the manufacturing of modern vehicles.

Steel Wheels:

All steel wheels consist of two pressed Components, the rim and the wheel disc, which are welded together. The rim is the part on which tyre is mounted. Its dimensions shape and condition must suitable to satisfactorily accommodate the particular tyre required for the vehicle. The wheel disc is the supporting member between the vehicles hub and the rim. Its dimensions shape and location in the rim must be suited to the design of the wheel hub and the suspension geometry of the vehicle to which it has to be mounted. The purpose of the rim is to provide a firm base on which to fit the tire. Four vital dimensions are involved. The different parts developed in the PART module of CATIA are assembled in the ASSEMBLY module of CATIA. The components developed are assembled using the placement constraints available from the list in the component placement dialogue box. On to the rim, it would be impossible for the inside diameter of the tire to pass over the large diameter of the tire rim without causing damage to the beads. Forcing the tire bead into the rim well opposite to the fitting head of the machine tire bead. Steel disc

Alloy Wheels:

Alloy wheels are often incorrectly referred to as magnesium or "Mag" wheels. Magnesium is used in alloys. However, they are almost found only in racing rims meant for the track. Its brittle and highly flammable qualities make it unsuited as a road rim. Low pressure, die-casted aluminum alloy wheels are used and offer certain benefits over steel wheels. It is possible to design alloy wheels that alloy for the better air flow over the brakes and that are also slightly lighter and visually more appealing than steel wheels. Because alloy is lighter than steel, wider rims can be used without sacrificing unsprang weight.

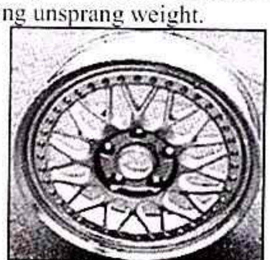


Fig 1: Aluminum alloy wheel

IV. STEPS INVOLVED IN PROJECT WORK

Gathering all relative data for the design of wheel rim.
Generation of model using CATIAV5. Importing the generated model to ANSYS for analysis work Static analysis is carried out on the wheel rim to evaluate the performance. Modal analysis is carried out on the wheel rim.

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.

NEC

NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)

NAAC 'A' GRADE

NATIONAL BOARD OF ACCREDITATION

PROCEEDINGS

INTERNATIONAL CONFERENCE

EMERGING TRENDS IN MECHANICAL ENGINEERING AND INDUSTRIAL AUTOMATION

NEC-ICETMEIA-2K21

30th & 31st July, 2021

Editors-in-Chief

Dr. M.Sreenivasa Kumar
Principal & Professor, Dept. of Mechnical Engineering

Dr. D.Jagadish
Professor, Dept. of Mechnical Engineering

Editors

Dr. D.Suneel
Vice-Principal & Professor, Dept. of ME

Dr. P.Suresh Babu
Professor, Dept. of ME

Dr. B.Venkata Siva
Professor & HoD Dept. of ME

Mr. M.Venkanna Babu
Associate Professor, Dept. of ME

Organized by

Department of **Mechanical Engineering**

In Association with *The Institution of Engineers (India)*

ISBN : 978-93-91420-02-4

LIST OF FULL LENGTH PAPERS SELECTED FOR PROCEEDINGS

International Conference on Emerging Trends in Mechanical Engineering and Industrial Automation

NEC-ICETMEIA- 2K21

S.No.	TITLE OF THE PAPER	Page No.
1.	Effectiveness of Compression Ignition Engine Fuelled with Pond Water Algae Biodiesel	01
2.	Design And Analysis of Disc Brake of an Electric Go-Kart	04
3.	A Comprehensive Review on Recent Research on Semi Solid Processed Aluminum 7 Series Alloys	08
4.	A Study on Microstructure and Mechanical Properties A7075 Reinforced with Flyash/Sic Hybrid Metal Matrix Composite	15
5.	Establishment of SCR Test Facility and Evaluation of 8mm Pitch Honeycomb Type Catalyst in a 20 Liter capacity SCR Test facility	19
6.	A Review on NVH Issues and Technological Challenges in Electric Vehicle and Hybrid Electric Vehicle Power Train	25
7.	Design and Analysis of Cantilever Beam	29
8.	Analysis of Static and Fatigue Strength of Aluminium Alloy Wheel	32
9.	Design of Automated Braking System Based on Vehicle Over Speed Using PLC Ladder Method	35
10.	The Analysis on Concentric Pipe Heat Exchanger	39
11.	Design and Finite Element Analysis of Gas Turbine Blade	45
12.	Investigation on Mechanical Properties of Glass Fiber and Carbon Nano Tubes Sandwich Composite Material	47
13.	CFD Analysis of Super Utility Vehicle to Determine Aerodynamic Behavior	54
14.	Devlopment of Code for Automated HVAC System using Digital Controller	60
15.	Performance and Emission Characteristics Of Diesel Engine with Linseed Oil-Diesel Blends as Fuel With VCR	65
16.	Experimental Investigation in Single Cylinder VCR Multifuel Engine Using Bio-Diesel as Linseed Oil	69

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

17.	Tribological Properties of Textured Surface	72
18.	Thermal Analysis and Experimental Investigation of Pin Fin made of Brass	76
19.	Experimental and Simulation of Wear Test on GPR material	79
20.	CFD Analysis of Two Pass Double Pipe Heat Exchanger with TiO_2/Ethylene Glycol Nano Fluid	83
21.	Simulation and Optimization of Extrusion Process Parameters of Aluminium 2A12T4Alloy	87
22.	Importance of Ice Jet machining - A Review	91
23.	Performance Investigation of a Battery Powered Peltier Cooler	94
24.	Analysis of Disc Brake Rotor using ANSYS Workbench	98
25.	Modelling and Optimization of Two Wheeler Disk Brake Using ANSYS -Review	101
26.	Fabrication of Sewage Waste Cleaner	105
27.	Manufacturing of Hyperboliodal Gear Model Using Ultimaker S5 3D Printing Machine	109
28.	Arc Welding Process Selection Through Quality and Cost Analysis	113
29.	Li-Br H2O VAR System Analysis by Applying Magnetic Field to Liquid Line	117
30.	Heat Transfer Enhancement on Shell and Coil Type of Heat Exchanger Using SiO_2 and CuO Nano-Fluids	121
31.	Study of Rheological Characteristics of Nano Suspensions	126
32.	Design And Fabrication of Loop Wheel System	129
33.	Performance of Solar Vapour Absorption system and its Dependence on Generator Temperature	131
34.	Design and Analysis Of Handicapped Steering Tricycle	134
35.	Machining Characteristics and Microbiological Growth of Stir Casted A356-SiC MMCs and Pure Metals	136
36.	Design and Analysis of Connecting Rod	

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

37.	Pressure Vessel Optimum Design using Particle Swarm Optimization	145
38.	Design and Analysis of Wheel Rim on Radial Loads	149
39.	COP Enhancement of VCR System using Diffusers	154
40.	Design and Fabrication of Radiant Cooling System	157
41.	Comparative Performance Analysis of Engine Fuelled with Diesel Biodiesel Iron Oxide Nano Particles	162
42.	Performance analysis of a CI Engine fuelled with olive oil and soybean oil mixture as a biofuels	166
43.	Design and Analysis of Landing Gear	170
44.	A Review on Parameters of Composite Materials	173
45.	Optimisation in WEDM of HCHCR Steel using Taughi Method	177
46.	Automated Pneumatic Sheet Metal Cutting Machine	184
47.	Cylindrical Panel's Numerical And Analytical Investigations Subjected To Different Loads	187
48.	Application of a Thermoplastic Polyurethane/Polylactic Acid Composite Filament For 3D-Printed Personalized Orthosis	192
49.	Design and Analysis of a Connecting Rod	196
50.	A Study and Synthesis of 8 Bar One Degree of Freedom Walking Mechanism	200
51.	Mechanical properties and machining of Al-7075 SiC Composite	204
52.	Characterization of Tungsten carbide reinforced Al7075 matrix Composites.	208
53.	3D Printing of Prototype Through Image Processing using Autodesk Recap Photo Software	212
54.	Fabrication and Testing Mechanical Behaviour of Hemp Fibre, Chopped E Glass and Hybrid with Nano Particle	216
55.	Optical characterization of V_2O_5 doped Na_2O-SiO_2-ZrO_2 glasses	218
56.	Determination of Efficient Location of Split Air Conditioner using CFD	221

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

57.	Frictionless Electromagnetic Braking System	225
58.	Performance Evaluation of Vegetable oils as Cutting fluid under MQL Condition in Turning	228
59.	A novel hybrid Fuzzy AHP and VIKOR methodology for Reclaimer Selection in GSCM	236
60.	Design of Eco-Friendly Road Cleaner	240
61.	Mechanical and Microstructural Characterization of Jute Hybrid Composite with Alkali Treatment	244
62.	Experimental Investigation and Optimization of Process Parameters in Wire Cut EDM of EN31 Steel	248
63.	Design and Analysis of Differential Gear Box	252

***

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

ICJB 2021

ISBN: 978-93-91420-02-4

Modelling and Optimization of Two Wheeler Disk Brake Using ANSYS –Review

Kadru John Babu and Kiran Chand Kopila
Department of Mechanical Engineering, Narasaraopeta Engineering College (Autonomous), Narasaraopet, India.

Abstract— Each single system has been studied and developed in order to meet safety requirement. Instead of having air bag, good suspension systems, good handling and safe cornering, there is one most critical system in the vehicle which is brake systems. Without brake system in the vehicle will put a passenger in unsafe position. Therefore, it is must for all vehicles to have proper brake system. In this paper carbon ceramic matrix disc brake material use for calculating normal force, shear force and piston force. And also calculating the brake distance of disc brake. The standard disc brake two wheelers model using in Ansys and done the Thermal analysis and Modal analysis also calculate the deflection and Heat flux, Temperature of disc brake model. This is important to understand action force and friction force on the disc brake new material, how disc brake works more efficiently, which can help to reduce the accident that may happen in each day.

Keywords— Disc Brake, Thermal Analysis, Modal Analysis, Ansys

I. INTRODUCTION

The disc brake is a wheel brake which slows rotation of the wheel by the friction caused by pushing brake pads against a brake disc with a set of callipers. The brake disc (or rotor in American English) is usually made of cast iron, but may in some cases be made of composites such as reinforced carbon– carbon or ceramic matrix composites. This is connected to the wheel and/or the axle. To stop the wheel, friction material in the form of brake pads, mounted on a device called a brake calliper, is forced mechanically, hydraulically, pneumatically or electromagnetically against both sides of the disc. Friction causes the disc and attached wheel to slow or stop. Brakes convert motion to heat, and if the brakes get too hot, they become less effective, a phenomenon known as brake fade.

Disc-style brakes development and use began in England in the 1890s. The first calliper-type automobile disc brake was patented by Frederick William Lanchester in his Birmingham, UK factory in 1902 and used successfully on Lanchester cars. Compared to drum brakes, disc brakes offer better stopping performance, because the disc is more readily cooled. A disc brake consists of a cast iron disc bolted to the wheel hub and a stationary housing called calliper. The calliper is connected to some stationary part of the vehicle like the axle casing or the stub axle as is cast in two parts each part containing a piston. In between each piston and the disc there is a friction pad held in position by retaining pins, spring plates etc. passages are drilled in the calliper for the fluid to enter or leave each housing. The passages are also connected to another one for bleeding. Each cylinder contains rubber-sealing ring between

The cylinder and piston. A schematic diagram is shown in the figure 1

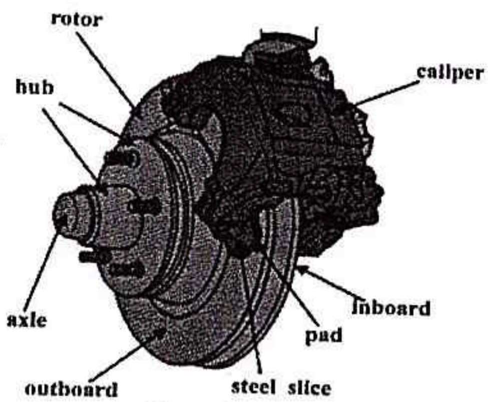


Fig 1 Disc Brake

II. PROBLEM OCCURRED IN DISC BRAKE

Discs are made up mainly gray cast iron, so discs are damaged in one of three ways: scarring, cracking, warping or excessive rusting. Service shops will sometimes respond to any disc problem by changing out the discs entirely. This is done mainly where the cost of a new disc may actually be lower than the cost of workers to resurface the original disc. Mechanically this is unnecessary unless the discs have reached manufacturer's minimum recommended thickness, which would make it unsafe to use them, or vane rusting. Severe (ventilated discs only). Most leading vehicle manufacturers recommend brake disc skimming (US: turning) as a solution for lateral run-out, vibration issues and brake noises.

The machining process is performed in a brake lathe, which removes a very thin layer off the disc surface to clean off minor damage and restore uniform thickness. Machining the disc as necessary will maximize the mileage out of the current discs on the vehicle. Braking systems rely on friction to bring the vehicle to a halt – hydraulic pressure pushes brake pads against a cast iron disc or brake shoes against the inside of a cast iron drum. When a vehicle is decelerated, load is transferred to the front wheels – this means that the front

Brakes do most of the work in stopping the vehicle. Scarring can occur if brake pads are not changed promptly when they reach the end of their service life and are considered worn out.

Cracking is limited mostly to drilled discs, which may develop small cracks around edges of holes drilled near the edge of the disc due to the disc's uneven rate of expansion in severe duty environments. The discs are commonly made from cast iron and a certain amount of what is known as "surface rust" is normal. Sometimes a loud noise or high pitched squeal occurs when the brakes are applied. Most brake squeal is produced by vibration (resonance instability) of the brake

NEC

NARASARAOPETA ENGINEERING COLLEGE

(AUTONOMOUS)

NAAC 'A' GRADE

NBA NATIONAL BOARD of ACCREDITATION

PROCEEDINGS

INTERNATIONAL CONFERENCE

EMERGING TRENDS IN MECHANICAL ENGINEERING AND INDUSTRIAL AUTOMATION

NEC-ICETMEIA-2K21

30th & 31st July, 2021

Editors-in-Chief

Dr. M.Sreenivasa Kumar
Principal & Professor, Dept. of Mechnical Engineering

Dr. D.Jagadish
Professor, Dept. of Mechnical Engineering

Editors

Dr. D.Suneel
Vice-Principal & Professor, Dept. of ME

Dr. P.Suresh Babu
Professor, Dept. of ME

Dr. B.Venkata Siva
Professor & HoD Dept. of ME

Mr. M.Venkanna Babu
Associate Professor, Dept. of ME

Organized by

Department of **Mechanical Engineering**

In Association with *The Institution of Engineers (India)*

ISBN : 978-93-91420-02-4

IQAC

NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET
Guntur (Dist.), A.P.

LIST OF FULL LENGTH PAPERS SELECTED FOR PROCEEDINGS

International Conference on Emerging Trends in Mechanical Engineering and Industrial Automation

NEC-ICETMEIA- 2K21

S.No.	TITLE OF THE PAPER	Page No.
1.	Effectiveness of Compression Ignition Engine Fuelled with Pond Water Algae Biodiesel	01
2.	Design And Analysis of Disc Brake of an Electric Go-Kart	04
3.	A Comprehensive Review on Recent Research on Semi Solid Processed Aluminum 7 Series Alloys	08
4.	A Study on Microstructure and Mechanical Properties A7075 Reinforced with Flyash/Sic Hybrid Metal Matrix Composite	15
5.	Establishment of SCR Test Facility and Evaluation of 8mm Pitch Honeycomb Type Catalyst in a 20 Liter capacity SCR Test facility	19
6.	A Review on NVH Issues and Technological Challenges in Electric Vehicle and Hybrid Electric Vehicle Power Train	25
7.	Design and Analysis of Cantilever Beam	29
8.	Analysis of Static and Fatigue Strength of Aluminium Alloy Wheel	32
9.	Design of Automated Braking System Based on Vehicle Over Speed Using PLC Ladder Method	35
10.	The Analysis on Concentric Pipe Heat Exchanger	39
11.	Design and Finite Element Analysis of Gas Turbine Blade	45
12.	Investigation on Mechanical Properties of Glass Fiber and Carbon Nano Tubes Sandwich Composite Material	47
13.	CFD Analysis of Super Utility Vehicle to Determine Aerodynamic Behavior	54
14.	Devlopment of Code for Automated HVAC System using Digital Controller	60
15.	Performance and Emission Characteristics Of Diesel Engine with Linseed Oil-Diesel Blends as Fuel With VCR	65
16.	Experimental Investigation in Single Cylinder VCR Multifuel Engine Using Biodiesel as Linseed Oil	69

17.	Tribological Properties of Textured Surface	72
18.	Thermal Analysis and Experimental Investigation of Pin Fin made of Brass	76
19.	Experimental and Simulation of Wear Test on GPR material	79
20.	CFD Analysis of Two Pass Double Pipe Heat Exchanger with TiO_2/Ethylene Glycol Nano Fluid	83
21.	Simulation and Optimization of Extrusion Process Parameters of Aluminium 2A12T4Alloy	87
22.	Importance of Ice Jet machining - A Review	91
23.	Performance Investigation of a Battery Powered Peltier Cooler	94
24.	Analysis of Disc Brake Rotor using ANSYS Workbench	98
25.	Modelling and Optimization of Two Wheeler Disk Brake Using ANSYS -Review	101
26.	Fabrication of Sewage Waste Cleaner	105
27.	Manufacturing of Hyperboliodal Gear Model Using Ultimaker S5 3D Printing Machine	109
28.	Arc Welding Process Selection Through Quality and Cost Analysis	113
29.	Li-Br H2O VAR System Analysis by Applying Magnetic Field to Liquid Line	117
30.	Heat Transfer Enhancement on Shell and Coil Type of Heat Exchanger Using SiO_2 and CuO Nano-Fluids	121
31.	Study of Rheological Characteristics of Nano Suspensions	126
32.	Design And Fabrication of Loop Wheel System	129
33.	Performance of Solar Vapour Absorption system and its Dependence on Generator Temperature	131
34.	Design and Analysis Of Handicapped Steering Tricycle	134
35.	Machining Characteristics and Microbiological Growth of Stir Casted A356-SiC MMCs and Pure Metals	136
36.	Design and Analysis of Connecting Rod	

37.	Pressure Vessel Optimum Design using Particle Swarm Optimization	145
38.	Design and Analysis of Wheel Rim on Radial Loads	149
39.	COP Enhancement of VCR System using Diffusers	154
40.	Design and Fabrication of Radiant Cooling System	157
41.	Comparative Performance Analysis of Engine Fuelled with Diesel Biodiesel Iron Oxide Nano Particles	162
42.	Performance analysis of a CI Engine fuelled with olive oil and soybean oil mixture as a biofuels	166
43.	Design and Analysis of Landing Gear	170
44.	A Review on Parameters of Composite Materials	173
45.	Optimisation in WEDM of HCHCR Steel using Taughi Method	177
46.	Automated Pneumatic Sheet Metal Cutting Machine	184
47.	Cylindrical Panel's Numerical And Analytical Investigations Subjected To Different Loads	187
48.	Application of a Thermoplastic Polyurethane/Polylactic Acid Composite Filament For 3D-Printed Personalized Orthosis	192
49.	Design and Analysis of a Connecting Rod	196
50.	A Study and Synthesis of 8 Bar One Degree of Freedom Walking Mechanism	200
51.	Mechanical properties and machining of Al-7075 SiC Composite	204
52.	Characterization of Tungsten carbide reinforced Al7075 matrix Composites.	208
53.	3D Printing of Prototype Through Image Processing using Autodesk Recap Photo Software	212
54.	Fabrication and Testing Mechanical Behaviour of Hemp Fibre, Chopped E Glass and Hybrid with Nano Particle	216
55.	Optical characterization of V_2O_5 doped Na_2O-SiO_2-ZrO_2 glasses	218
56.	Determination of Efficient Location of Split Air Conditioner using CFD	[illegible]

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

57.	Frictionless Electromagnetic Braking System	225
58.	Performance Evaluation of Vegetable oils as Cutting fluid under MQL Condition in Turning	228
59.	A novel hybrid Fuzzy AHP and VIKOR methodology for Reclaimer Selection in GSCM	236
60.	Design of Eco-Friendly Road Cleaner	240
61.	Mechanical and Microstructural Characterization of Jute Hybrid Composite with Alkali Treatment	244
62.	Experimental Investigation and Optimization of Process Parameters in Wire Cut EDM of EN31 Steel	248
63.	Design and Analysis of Differential Gear Box	252

***

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

BRB2024

ISBN: 978-93-91420-02-4

Design and Finite Element Analysis of Gas Turbine Blade

Mojeswararao Duduku and B.Rambabu
Department of Mechanical Engineering, Narasaraopeta Engineering College (A), Narasaraopet, India

***Abstract*— Gas turbines are extensively used for air craft propulsion, land based power generation and industrial applications. Thermal efficiency of gas turbine improved by increasing turbine rotor inlet temperature. The current rotor inlet temperature in advanced gas turbine is for above the melting point of blade material. A sophisticated cooling scheme must be developed for continuous safe operation of gas turbines with high performance.**

Gas turbines are cooled externally and internally. Several methods have been suggested for the cooling of blades and vanes. The techniques that involve cooling the blades and vanes by using cooling methods is to have radial holes to pass high velocity cooling air along the blade span.

In this thesis a turbine blade is designed and modeled in CREO parametric software. The turbine blades are designed using film cooling. The turbine blade with film cooling for no holes, 3 holes, 7 holes, 13 holes is modeled.

CFD, Thermal analysis is done to determine the heat transfer rates, heat transfer coefficients of the blade. The present used material for blade is chromium steel. In this thesis, it is replaced with Nickel alloys. CFD analysis, Thermal analysis is done in ANSYS.

Keywords: Gas turbine blade, Vanes, CREO, nickel alloy.

INTRODUCTION

A gas turbine, also called a combustion turbine, is a type of internal combustion engine. It has an upstream rotating compressor coupled to a downstream turbine, and a combustion chamber in-between.Gas turbines are sometimes referred to as turbine engines. Such engines usually feature an inlet, fan, compressor, combustor and nozzle (possibly other assemblies) in addition to one or more turbines.

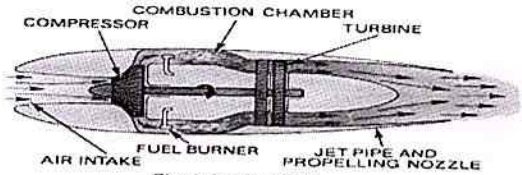


Fig: 1 Gas Turbine

I. SELECTION OF MATERIAL

Chromium Steel Thermal conductivity = 24.38W/m-k
Nickel Alloy 617 Thermal conductivity = 13.6W/m-k

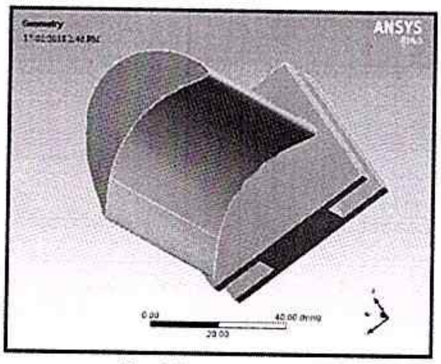


Fig: 2 Imported Model

II.FINITE ELEMENT ANALYSIS

FEA consists of a computer model of a material or design that is stressed and analyzed for specific results. It is used in new product design, and existing product refinement. A company is able to verify a proposed design will be able to perform to the client's specifications prior to manufacturing or construction. Modifying an existing product or structure is utilized to qualify the product or structure for a new service condition. In case of structural failure, FEA may be used to help determine the design modifications to meet the new condition.

There are generally two types of analysis that are used in industry: 2-D modeling, and 3-D modeling. While 2-D modeling conserves simplicity and allows the analysis to be run on a relatively normal computer, it tends to yield less accurate results. 3-D modeling, however, produces more accurate results while sacrificing the ability to run on all but the fastest computers effectively. Within each of these modeling schemes, the programmer can insert numerous algorithms (functions) which may make the system behave linearly or non-linearly. Linear systems are far less complex and generally do not take into account plastic deformation. Non-linear systems do account for plastic deformation, and many also are capable of testing a material all the way to fracture. Points of interest may consist of: fracture point of previously tested material, fillets, corners, complex detail, and high stress areas. The mesh acts like a spider web in that from each node, there extends a mesh element to each of the adjacent nodes.

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

NEC

NARASARAOPETA ENGINEERING COLLEGE

(AUTONOMOUS)

NAAC 'A' GRADE

NBA NATIONAL BOARD OF ACCREDITATION

PROCEEDINGS

INTERNATIONAL CONFERENCE

EMERGING TRENDS IN MECHANICAL ENGINEERING AND INDUSTRIAL AUTOMATION

NEC-ICETMEIA-2K21

30th & 31st July, 2021

Editors-in-Chief

Dr. M.Sreenivasa Kumar
Principal & Professor, Dept. of Mechnical Engineering

Dr. D.Jagadish
Professor, Dept. of Mechnical Engineering

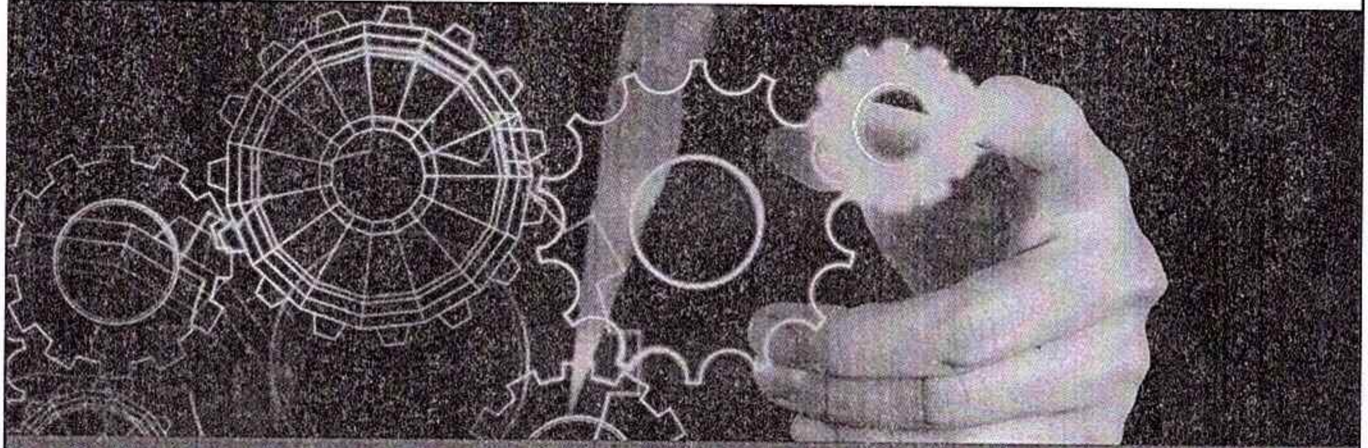
Editors

Dr. D.Suneel
Vice-Principal & Professor, Dept. of ME

Dr. B.Venkata Siva
Professor & HoD Dept. of ME

Dr. P.Suresh Babu
Professor, Dept. of ME

Mr. M.Venkanna Babu
Associate Professor, Dept. of ME



Organized by

Department of **Mechanical Engineering**

In Association with *The Institution of Engineers (India)*

ISBN : 978-93-91420-02-4

LIST OF FULL LENGTH PAPERS SELECTED FOR PROCEEDINGS

International Conference on Emerging Trends in Mechanical Engineering and Industrial Automation

NEC-ICETMEIA- 2K21

S.No.	TITLE OF THE PAPER	Page No.
1.	Effectiveness of Compression Ignition Engine Fuelled with Pond Water Algae Biodiesel	01
2.	Design And Analysis of Disc Brake of an Electric Go-Kart	04
3.	A Comprehensive Review on Recent Research on Semi Solid Processed Aluminum 7 Series Alloys	08
4.	A Study on Microstructure and Mechanical Properties A7075 Reinforced with Flyash/Sic Hybrid Metal Matrix Composite	15
5.	Establishment of SCR Test Facility and Evaluation of 8mm Pitch Honeycomb Type Catalyst in a 20 Liter capacity SCR Test facility	19
6.	A Review on NVH Issues and Technological Challenges in Electric Vehicle and Hybrid Electric Vehicle Power Train	25
7.	Design and Analysis of Cantilever Beam	29
8.	Analysis of Static and Fatigue Strength of Aluminium Alloy Wheel	32
9.	Design of Automated Braking System Based on Vehicle Over Speed Using PLC Ladder Method	35
10.	The Analysis on Concentric Pipe Heat Exchanger	39
11.	Design and Finite Element Analysis of Gas Turbine Blade	45
12.	Investigation on Mechanical Properties of Glass Fiber and Carbon Nano Tubes Sandwich Composite Material	47
13.	CFD Analysis of Super Utility Vehicle to Determine Aerodynamic Behavior	54
14.	Devlopment of Code for Automated HVAC System using Digital Controller	60
15.	Performance and Emission Characteristics Of Diesel Engine with Linseed Oil-Diesel Blends as Fuel With VCR	65
16.	Experimental Investigation in Single Cylinder VCR Multifuel Engine Using Bio-Diesel as Linseed Oil	69

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

17.	Tribological Properties of Textured Surface	72
18.	Thermal Analysis and Experimental Investigation of Pin Fin made of Brass	76
19.	Experimental and Simulation of Wear Test on GPR material	79
20.	CFD Analysis of Two Pass Double Pipe Heat Exchanger with TiO_2/Ethylene Glycol Nano Fluid	83
21.	Simulation and Optimization of Extrusion Process Parameters of Aluminium 2A12T4Alloy	87
22.	Importance of Ice Jet machining - A Review	91
23.	Performance Investigation of a Battery Powered Peltier Cooler	94
24.	Analysis of Disc Brake Rotor using ANSYS Workbench	98
25.	Modelling and Optimization of Two Wheeler Disk Brake Using ANSYS -Review	101
26.	Fabrication of Sewage Waste Cleaner	105
27.	Manufacturing of Hyperboliodal Gear Model Using Ultimaker S5 3D Printing Machine	109
28.	Arc Welding Process Selection Through Quality and Cost Analysis	113
29.	Li-Br H2O VAR System Analysis by Applying Magnetic Field to Liquid Line	117
30.	Heat Transfer Enhancement on Shell and Coil Type of Heat Exchanger Using SiO_2 and CuO Nano-Fluids	121
31.	Study of Rheological Characteristics of Nano Suspensions	126
32.	Design And Fabrication of Loop Wheel System	129
33.	Performance of Solar Vapour Absorption system and its Dependence on Generator Temperature	131
34.	Design and Analysis Of Handicapped Steering Tricycle	134
35.	Machining Characteristics and Microbiological Growth of Stir Casted A356-SiC MMCs and Pure Metals	136
36.	Design and Analysis of Connecting Rod	141

37.	Pressure Vessel Optimum Design using Particle Swarm Optimization	145
38.	Design and Analysis of Wheel Rim on Radial Loads	149
39.	COP Enhancement of VCR System using Diffusers	154
40.	Design and Fabrication of Radiant Cooling System	157
41.	Comparative Performance Analysis of Engine Fuelled with Diesel Biodiesel Iron Oxide Nano Particles	162
42.	Performance analysis of a CI Engine fuelled with olive oil and soybean oil mixture as a biofuels	166
43.	Design and Analysis of Landing Gear	170
44.	A Review on Parameters of Composite Materials	173
45.	Optimisation in WEDM of HCHCR Steel using Taughi Method	177
46.	Automated Pneumatic Sheet Metal Cutting Machine	184
47.	Cylindrical Panel's Numerical And Analytical Investigations Subjected To Different Loads	187
48.	Application of a Thermoplastic Polyurethane/Polylactic Acid Composite Filament For 3D-Printed Personalized Orthosis	192
49.	Design and Analysis of a Connecting Rod	196
50.	A Study and Synthesis of 8 Bar One Degree of Freedom Walking Mechanism	200
51.	Mechanical properties and machining of Al-7075 SiC Composite	204
52.	Characterization of Tungsten carbide reinforced Al7075 matrix Composites.	208
53.	3D Printing of Prototype Through Image Processing using Autodesk Recap Photo Software	212
54.	Fabrication and Testing Mechanical Behaviour of Hemp Fibre, Chopped E Glass and Hybrid with Nano Particle	216
55.	Optical characterization of V_2O_5 doped Na_2O-SiO_2-ZrO_2 glasses	218
56.	Determination of Efficient Location of Split Air Conditioner using CFD	221

57.	Frictionless Electromagnetic Braking System	225
58.	Performance Evaluation of Vegetable oils as Cutting fluid under MQL Condition in Turning	228
59.	A novel hybrid Fuzzy AHP and VIKOR methodology for Reclaimer Selection in GSCM	236
60.	Design of Eco-Friendly Road Cleaner	240
61.	Mechanical and Microstructural Characterization of Jute Hybrid Composite with Alkali Treatment	244
62.	Experimental Investigation and Optimization of Process Parameters in Wire Cut EDM of EN31 Steel	248
63.	Design and Analysis of Differential Gear Box	252

***

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

BR 2021

ISBN: 978-93-91420-02-4

MANUFACTURING OF HYPERBOLOIDAL GEAR MODEL USING ULTIMAKER S5 3D PRINTING MACHINE

Bachali.Rambabu
Deaprtment of Mechanical Engineering, Narasaraopeta Engineering College(A), Narasaraopet, AP,India.

Abstract- **Hyperboloidal gears are extensively used in power transmission. The manufacturing of the gear components with complex geometry involves a tedious procedure. Additive manufacturing/Rapid prototyping is a technique used for producing complex geometry. 3D printing is one of the techniques of RPP. Present work focus on the manufacturing of hyperboloidal gear of given dimension in an Ultimaker S5 3D printing Machine. The gear components were initially prepared using CURA software which is followed by Slicing methods in order to facilitate the smooth addition of the molten material. The total gear assembly is of seven parts which are made separately to form a set of hyperboloidal gear. The total time required for the components is 30 hours.**

I. INTRODUCTION TO MANUFACTURING OF HYPERBOLIODAL GEAR MODEL

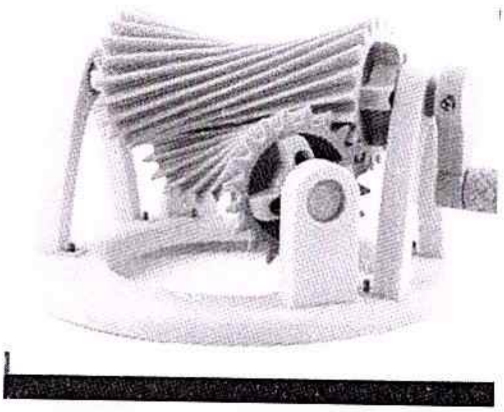
3-D printing is an additive manufacturing (am) technique for fabricating a wide range of structures and complex geometries from three dimensional (3d) model data. the process consists of printing successive layers of materials that are formed on top of each other. this technology has been developed by charles hull in 1986 in a process known as stereolithography (sla), which was followed by subsequent developments such as powder bed fusion, fused deposition modelling (fdm), inkjet printing and contour crafting (cc). 3d-printing,which involves various methods, materials and equipment, has evolved over the years and has the ability to transform manufacturing and logistics processes. additive manufacturing has been widely applied in different industries, including construction, prototyping and biomechanical. the uptake of 3d printing in the construction industry, in particular, was very slow and limited despite the advantages e.g. less waste, freedom of design and automation.

A. Objective of HGM

New applications are emerging as novel materials and AM methods are continuously being developed. One of the main drivers for this technology to become more accessible is attributed to the expiry of earlier patents, which has given manufacturers the ability to develop new 3D printing devices. Recent developments have reduced the cost of 3D printers, thereby expanding its applications in schools, homes, libraries and laboratories. Initially, 3D printing has been extensively used by architects and designers to produce aesthetic and functional prototypes due to its rapid and cost-effective prototyping capability.the situation, it is important that the objective criteria for system success are clearly identified at the start of the project, because different requirements need different design considerations.

B.Components of HGM

The component of HGM system are shown in below figure:



Program for Optimization Geometric and Technological Synthesis of Spired Gears upon a Pitch Contact Point This program includes solving of the following tasks: ¬ Synthesis of geometric pitch circles. ¬ Synthesis of the active tooth surfaces of the spired pinion and of the cutting tool for generation of the Spiroid crown (Spiroid hob). Verification if that the accepted quality criteria of the gear drive are fulfilled. From the formulation of the defined tasks, it can be seen that the algorithm of this program corresponds to the approach to mathematical modeling for synthesis upon a pitch contact point. In this sense, when designing the spired gears, it is of particular importance to select the location of the pitch contact point in the fixed space. The placement of the pitch contact point (as a common point of the pitch circles and conjugated active tooth surfaces) effects on one hand on the common geometry of the designed gear system (overall dimensions of the gear pair) and on the other- on the geometry and proportions of the gears teeth, as well as on the gears quality (through the geometric, kinematic and strength characteristics of the conjugated gear pair)

C. Software Program for a Preliminary Synthesis

The aim of the preliminary synthesis is to be calculated the main geometric parameters of the special case of Spiroid gear, when the angle, at which the rotations axes are crossed, is 90o, and pinion is of cylindrical form. With other words, the preliminary synthesis of the Spiroid gears is essentially oriented to the geometric dimensioning (without an optimization) of hyperboloid drive of type Helicon. The

NEC

NARASARAOPETA ENGINEERING COLLEGE

(AUTONOMOUS)

NAAC A GRADE

NATIONAL BOARD OF ACCREDITATION

PROCEEDINGS

INTERNATIONAL CONFERENCE

EMERGING TRENDS IN MECHANICAL ENGINEERING AND INDUSTRIAL AUTOMATION

NEC-ICETMEIA-2K21

30th & 31st July, 2021

Editors-in-Chief

Dr. M.Sreenivasa Kumar
Principal & Professor, Dept. of Mechnical Engineering

Dr. D.Jagadish
Professor, Dept. of Mechnical Engineering

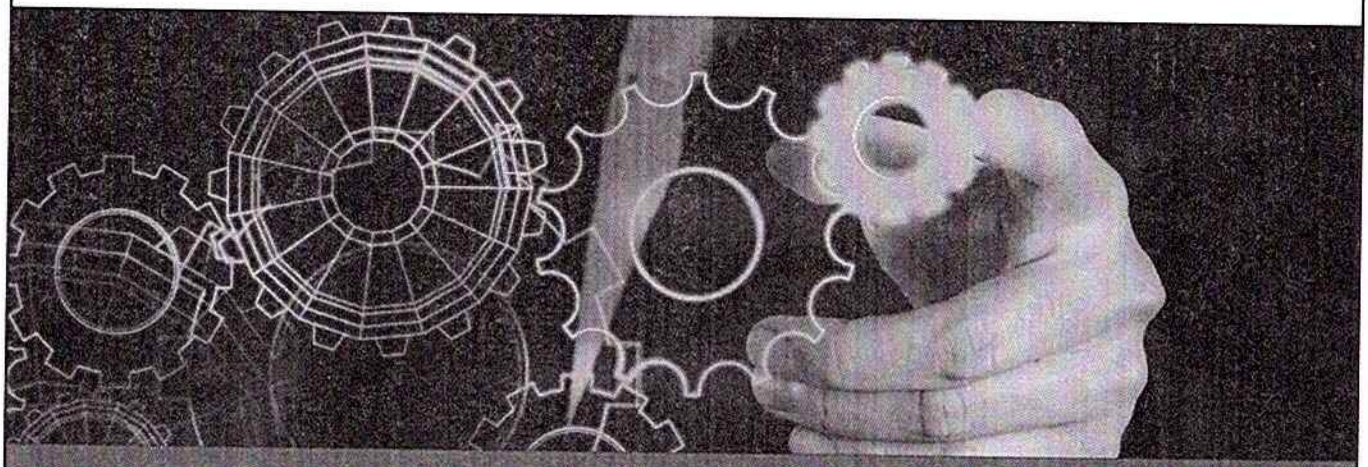
Editors

Dr. D.Suneel
Vice-Principal & Professor, Dept. of ME

Dr. P.Suresh Babu
Professor, Dept. of ME

Dr. B.Venkata Siva
Professor & HoD Dept. of ME

Mr. M.Venkanna Babu
Associate Professor, Dept. of ME



Organized by

Department of **Mechanical Engineering**

In Association with *The Institution of Engineers (India)*

ISBN : 978-93-91420-02-4

LIST OF FULL LENGTH PAPERS SELECTED FOR PROCEEDINGS

International Conference on Emerging Trends in Mechanical Engineering and Industrial Automation

NEC-ICETMEIA- 2K21

S.No.	TITLE OF THE PAPER	Page No.
1.	Effectiveness of Compression Ignition Engine Fuelled with Pond Water Algae Biodiesel	01
2.	Design And Analysis of Disc Brake of an Electric Go-Kart	04
3.	A Comprehensive Review on Recent Research on Semi Solid Processed Aluminum 7 Series Alloys	08
4.	A Study on Microstructure and Mechanical Properties A7075 Reinforced with Flyash/Sic Hybrid Metal Matrix Composite	15
5.	Establishment of SCR Test Facility and Evaluation of 8mm Pitch Honeycomb Type Catalyst in a 20 Liter capacity SCR Test facility	19
6.	A Review on NVH Issues and Technological Challenges in Electric Vehicle and Hybrid Electric Vehicle Power Train	25
7.	Design and Analysis of Cantilever Beam	29
8.	Analysis of Static and Fatigue Strength of Aluminium Alloy Wheel	32
9.	Design of Automated Braking System Based on Vehicle Over Speed Using PLC Ladder Method	35
10.	The Analysis on Concentric Pipe Heat Exchanger	39
11.	Design and Finite Element Analysis of Gas Turbine Blade	45
12.	Investigation on Mechanical Properties of Glass Fiber and Carbon Nano Tubes Sandwich Composite Material	47
13.	CFD Analysis of Super Utility Vehicle to Determine Aerodynamic Behavior	54
14.	Devlopment of Code for Automated HVAC System using Digital Controller	60
15.	Performance and Emission Characteristics Of Diesel Engine with Linseed Oil-Diesel Blends as Fuel With VCR	65
16.	Experimental Investigation in Single Cylinder VCR Multifuel Engine Using Bio-Diesel as Linseed Oil	69

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET
Guntur (Dist.),

17.	Tribological Properties of Textured Surface	72
18.	Thermal Analysis and Experimental Investigation of Pin Fin made of Brass	76
19.	Experimental and Simulation of Wear Test on GPR material	79
20.	CFD Analysis of Two Pass Double Pipe Heat Exchanger with TiO_2/Ethylene Glycol Nano Fluid	83
21.	Simulation and Optimization of Extrusion Process Parameters of Aluminium 2A12T4Alloy	87
22.	Importance of Ice Jet machining - A Review	91
23.	Performance Investigation of a Battery Powered Peltier Cooler	94
24.	Analysis of Disc Brake Rotor using ANSYS Workbench	98
25.	Modelling and Optimization of Two Wheeler Disk Brake Using ANSYS -Review	101
26.	Fabrication of Sewage Waste Cleaner	105
27.	Manufacturing of Hyperboliodal Gear Model Using Ultimaker S5 3D Printing Machine	109
28.	Arc Welding Process Selection Through Quality and Cost Analysis	113
29.	Li-Br H2O VAR System Analysis by Applying Magnetic Field to Liquid Line	117
30.	Heat Transfer Enhancement on Shell and Coil Type of Heat Exchanger Using SiO_2 and CuO Nano-Fluids	121
31.	Study of Rheological Characteristics of Nano Suspensions	126
32.	Design And Fabrication of Loop Wheel System	129
33.	Performance of Solar Vapour Absorption system and its Dependence on Generator Temperature	131
34.	Design and Analysis Of Handicapped Steering Tricycle	134
35.	Machining Characteristics and Microbiological Growth of Stir Casted A356-SiC MMCs and Pure Metals	136
36.	Design and Analysis of Connecting Rod	

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

37.	Pressure Vessel Optimum Design using Particle Swarm Optimization	145
38.	Design and Analysis of Wheel Rim on Radial Loads	149
39.	COP Enhancement of VCR System using Diffusers	154
40.	Design and Fabrication of Radiant Cooling System	157
41.	Comparative Performance Analysis of Engine Fuelled with Diesel Biodiesel Iron Oxide Nano Particles	162
42.	Performance analysis of a CI Engine fuelled with olive oil and soybean oil mixture as a biofuels	166
43.	Design and Analysis of Landing Gear	170
44.	A Review on Parameters of Composite Materials	173
45.	Optimisation in WEDM of HCHCR Steel using Taughi Method	177
46.	Automated Pneumatic Sheet Metal Cutting Machine	184
47.	Cylindrical Panel's Numerical And Analytical Investigations Subjected To Different Loads	187
48.	Application of a Thermoplastic Polyurethane/Polylactic Acid Composite Filament For 3D-Printed Personalized Orthosis	192
49.	Design and Analysis of a Connecting Rod	196
50.	A Study and Synthesis of 8 Bar One Degree of Freedom Walking Mechanism	200
51.	Mechanical properties and machining of Al-7075 SiC Composite	204
52.	Characterization of Tungsten carbide reinforced Al7075 matrix Composites.	208
53.	3D Printing of Prototype Through Image Processing using Autodesk Recap Photo Software	212
54.	Fabrication and Testing Mechanical Behaviour of Hemp Fibre, Chopped E Glass and Hybrid with Nano Particle	216
55.	Optical characterization of V_2O_5 doped Na_2O-SiO_2-ZrO_2 glasses	218
56.	Determination of Efficient Location of Split Air Conditioner using CFD	221

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET
Guntur (Dist.), A.P.

57.	Frictionless Electromagnetic Braking System	225
58.	Performance Evaluation of Vegetable oils as Cutting fluid under MQL Condition in Turning	228
59.	A novel hybrid Fuzzy AHP and VIKOR methodology for Reclaimer Selection in GSCM	236
60.	Design of Eco-Friendly Road Cleaner	240
61.	Mechanical and Microstructural Characterization of Jute Hybrid Composite with Alkali Treatment	244
62.	Experimental Investigation and Optimization of Process Parameters in Wire Cut EDM of EN31 Steel	248
63.	Design and Analysis of Differential Gear Box	252

***

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET
Guntur (Dist.)

BR $\bar{B}$ 2021

ISBN: 978-93-91420-02-4

Design and Analysis of Landing Gear

[1]Banavathu.Gopala Krishna Naik and [2]Bachali Rambabu
[1]Central Institute of Tool Design, Hyderabad, India
[2] Department of Mechanical Engineering, Narasaraopet Engineering College (A), Narasaraopet, Guntur, A.P, India.

***Abstract*- Landing gear is a vital structural unit of an aircraft which enables to take off and land safely main landing gear units. Even during a normal landing operation heavy loads (equal to the weight of an aircraft) are to be absorbed by the landing gear. In turn joints are to be provided such that heavy concentrated loads are first received by the airframe and subsequently diffused to the surrounding areas. Normally heavy concentrated loads are received through a lug joint. Therefore design of a lug joint against failure under static and fatigue loading conditions assumes importance in the development of an aircraft structure.**

Keywords- Landing Gear types and Arrangement.

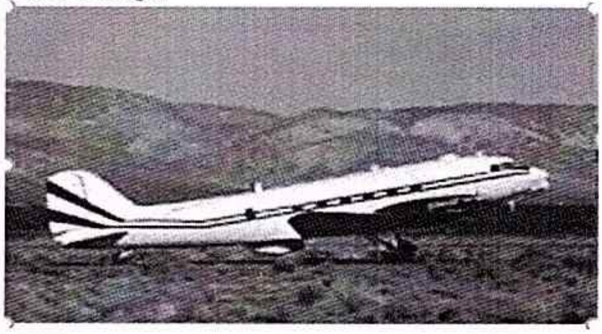
I. Introduction

Aircraft is machine that is able to fly from one place to another place. Many researches were made to fly the machine since from mythology, many had lost their life during their experiments, and many failed to fly their machine. But finally in 1910 Wright Brothers build machine which is able to fly for 59 seconds, which is very short duration but it is first milestone for development of aviation. Further many researches were made to transport the goods and passengers. Then it is brought into business for transportation. And also used in military for air support, thus many fighter planes are developed. An aircraft is a machine that is able to fly by gaining support from the air, or, in general, the atmosphere of a planet. It counters the force of gravity by using either static lift or by using the dynamic lift of an aerofoil, or in a few cases the downward thrust from jet engines. The human activity that surrounds aircraft is called aviation. Landing gear is one of the critical subsystem of an aircraft and is often configured along with aircraft structure.

II. TYPES OF LANDING GEAR

A. Tail wheel-type Landing Gear

Tail wheel-type landing gear is also known as conventional gear because many early aircraft use this type of arrangement. The main gear are located forward of the centre of gravity, causing the tail to require support from a third wheel assembly. A few early aircraft designs use a skid rather than a tail wheel. This helps slow the aircraft upon landing and provides directional stability. The resulting angle of the aircraft fuselage, when fitted with conventional gear, allows the use of a long propeller that compensates for older, underpowered engine design. The increased clearance of the forward fuselage offered by tail wheel-type landing gear is also advantageous when operating in and out of non-paved runways. Today, aircraft are manufactured with conventional gear for this reason and for the weight savings accompanying the relatively light tail wheel assembly. The proliferation of hard surface runways has rendered the tail skid obsolete in favor of the tail wheel. Directional control is maintained through differential braking until the speed of the aircraft enables control with the rudder. A steerable tail wheel, connected by cables to the rudder or rudder pedals, is also a common design.



B.Tandem Landing Gear

Few aircraft are designed with tandem landing gear. As the name implies, this type of landing gear has the main gear and tail gear aligned on the longitudinal axis of the aircraft. Sailplanes commonly use tandem gear, although many only have one actual gear forward on the fuselage with a skid under the tail. A few military bombers, such as the B-47 and the B-52, have tandem gear, as does the U2 spy plane. The VTOL Harrier has tandem gear but uses small outrigger gear under the wings for support. Generally, placing the gear only under the fuselage facilitates the use of very flexible wings. The tail wheel aircraft also sits with its nose higher than tricycle gear airplane, lowering forward visibility for the pilot during ground operations. It's more difficult to taxi without being able to see directly in front of you, which is why you'll often see pilots of tail wheel aircraft do S-turns while taxiing. And steering a tail wheel aircraft is different than steering a nose wheel aircraft since steering is accomplished from behind the pilot instead of in front. There are certainly benefits to a tail dragger, as well. The nose-high attitude on the ground means that the propellers on tail wheel aircraft often have more clearance from the ground, making them better suited for grass or dirt runways. And they're often designed and configured for slow flight, making them easier to land on short runways. Many are high-design and are better suited for backcountry flying than nose wheel aircraft are. Tail wheel airplanes are without a doubt the favorite airplane among bush pilots.

C. Tri-Cycle Type Landing Gear

NEC NARASARAOPETA ENGINEERING COLLEGE (AUTONOMOUS)

NAAC 'A' GRADE

NBA NATIONAL BOARD OF ACCREDITATION

RANKED 5

PROCEEDINGS

INTERNATIONAL CONFERENCE

EMERGING TRENDS IN MECHANICAL ENGINEERING AND INDUSTRIAL AUTOMATION

NEC-ICETMEIA-2K21

30th & 31st July, 2021

Editors-in-Chief

Dr. M.Sreenivasa Kumar
Principal & Professor, Dept. of Mechnical Engineering

Dr. D.Jagadish
Professor, Dept. of Mechnical Engineering

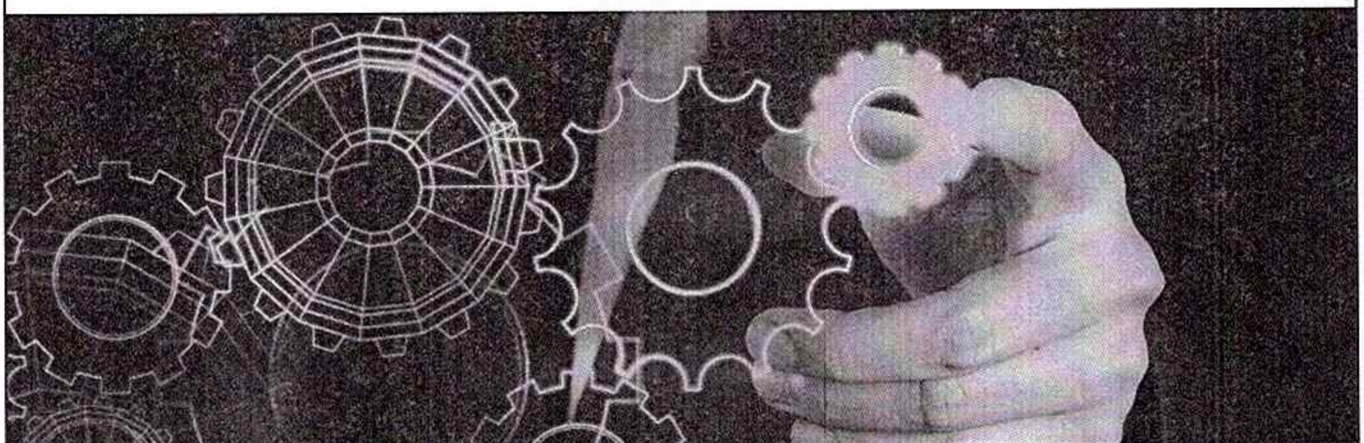
Editors

Dr. D.Suneel
Vice-Principal & Professor, Dept. of ME

Dr. P.Suresh Babu
Professor, Dept. of ME

Dr. B.Venkata Siva
Professor & HoD Dept. of ME

Mr. M.Venkanna Babu
Associate Professor, Dept. of ME



Organized by

Department of Mechanical Engineering

In Association with The Institution of Engineers (India)

ISBN : 978-93-91420-02-4

IQAC

LIST OF FULL LENGTH PAPERS SELECTED FOR PROCEEDINGS

International Conference on Emerging Trends in Mechanical Engineering and Industrial Automation

NEC-ICETMEIA- 2K21

S.No.	TITLE OF THE PAPER	Page No.
1.	Effectiveness of Compression Ignition Engine Fuelled with Pond Water Algae Biodiesel	01
2.	Design And Analysis of Disc Brake of an Electric Go-Kart	04
3.	A Comprehensive Review on Recent Research on Semi Solid Processed Aluminum 7 Series Alloys	08
4.	A Study on Microstructure and Mechanical Properties A7075 Reinforced with Flyash/Sic Hybrid Metal Matrix Composite	15
5.	Establishment of SCR Test Facility and Evaluation of 8mm Pitch Honeycomb Type Catalyst in a 20 Liter capacity SCR Test facility	19
6.	A Review on NVH Issues and Technological Challenges in Electric Vehicle and Hybrid Electric Vehicle Power Train	25
7.	Design and Analysis of Cantilever Beam	29
8.	Analysis of Static and Fatigue Strength of Aluminium Alloy Wheel	32
9.	Design of Automated Braking System Based on Vehicle Over Speed Using PLC Ladder Method	35
10.	The Analysis on Concentric Pipe Heat Exchanger	39
11.	Design and Finite Element Analysis of Gas Turbine Blade	45
12.	Investigation on Mechanical Properties of Glass Fiber and Carbon Nano Tubes Sandwich Composite Material	47
13.	CFD Analysis of Super Utility Vehicle to Determine Aerodynamic Behavior	54
14.	Devlopment of Code for Automated HVAC System using Digital Controller	60
15.	Performance and Emission Characteristics Of Diesel Engine with Linseed Oil-Diesel Blends as Fuel With VCR	65
16.	Experimental Investigation in Single Cylinder VCR Multifuel Engine Using Bio-Diesel as Linseed Oil	69

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET
Guntur (Dist.)

IQAC

17.	Tribological Properties of Textured Surface	72
18.	Thermal Analysis and Experimental Investigation of Pin Fin made of Brass	76
19.	Experimental and Simulation of Wear Test on GPR material	79
20.	CFD Analysis of Two Pass Double Pipe Heat Exchanger with TiO_2/Ethylene Glycol Nano Fluid	83
21.	Simulation and Optimization of Extrusion Process Parameters of Aluminium 2A12T4Alloy	87
22.	Importance of Ice Jet machining - A Review	91
23.	Performance Investigation of a Battery Powered Peltier Cooler	94
24.	Analysis of Disc Brake Rotor using ANSYS Workbench	98
25.	Modelling and Optimization of Two Wheeler Disk Brake Using ANSYS -Review	101
26.	Fabrication of Sewage Waste Cleaner	105
27.	Manufacturing of Hyperboliodal Gear Model Using Ultimaker S5 3D Printing Machine	109
28.	Arc Welding Process Selection Through Quality and Cost Analysis	113
29.	Li-Br H2O VAR System Analysis by Applying Magnetic Field to Liquid Line	117
30.	Heat Transfer Enhancement on Shell and Coil Type of Heat Exchanger Using SiO_2 and CuO Nano-Fluids	121
31.	Study of Rheological Characteristics of Nano Suspensions	126
32.	Design And Fabrication of Loop Wheel System	129
33.	Performance of Solar Vapour Absorption system and its Dependence on Generator Temperature	131
34.	Design and Analysis Of Handicapped Steering Tricycle	134
35.	Machining Characteristics and Microbiological Growth of Stir Casted A356-SiC MMCs and Pure Metals	136
36.	Design and Analysis of Connecting Rod	141

37.	Pressure Vessel Optimum Design using Particle Swarm Optimization	145
38.	Design and Analysis of Wheel Rim on Radial Loads	149
39.	COP Enhancement of VCR System using Diffusers	154
40.	Design and Fabrication of Radiant Cooling System	157
41.	Comparative Performance Analysis of Engine Fuelled with Diesel Biodiesel Iron Oxide Nano Particles	162
42.	Performance analysis of a CI Engine fuelled with olive oil and soybean oil mixture as a biofuels	166
43.	Design and Analysis of Landing Gear	170
44.	A Review on Parameters of Composite Materials	173
45.	Optimisation in WEDM of HCHCR Steel using Taughi Method	177
46.	Automated Pneumatic Sheet Metal Cutting Machine	184
47.	Cylindrical Panel's Numerical And Analytical Investigations Subjected To Different Loads	187
48.	Application of a Thermoplastic Polyurethane/Polylactic Acid Composite Filament For 3D-Printed Personalized Orthosis	192
49.	Design and Analysis of a Connecting Rod	196
50.	A Study and Synthesis of 8 Bar One Degree of Freedom Walking Mechanism	200
51.	Mechanical properties and machining of Al-7075 SiC Composite	204
52.	Characterization of Tungsten carbide reinforced Al7075 matrix Composites.	208
53.	3D Printing of Prototype Through Image Processing using Autodesk Recap Photo Software	212
54.	Fabrication and Testing Mechanical Behaviour of Hemp Fibre, Chopped E Glass and Hybrid with Nano Particle	216
55.	Optical characterization of V_2O_5 doped Na_2O-SiO_2-ZrO_2 glasses	218
56.	Determination of Efficient Location of Split Air Conditioner [illegible]	224

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

IQAC

57.	Frictionless Electromagnetic Braking System	225
58.	Performance Evaluation of Vegetable oils as Cutting fluid under MQL Condition in Turning	228
59.	A novel hybrid Fuzzy AHP and VIKOR methodology for Reclaimer Selection in GSCM	236
60.	Design of Eco-Friendly Road Cleaner	240
61.	Mechanical and Microstructural Characterization of Jute Hybrid Composite with Alkali Treatment	244
62.	Experimental Investigation and Optimization of Process Parameters in Wire Cut EDM of EN31 Steel	248
63.	Design and Analysis of Differential Gear Box	252

***

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

NVS 2021

ISBN: 978-93-91420-02-4

Design and Analysis of Cantilever Beam

K.L.N. Murthy and N. Vijaya Sekhar
Department of Mechanical Engineering, A.M. Reddy College of Engineering College, Guntur, Andhra Pradesh, INDIA,
Department of Mechanical Engineering, Narasaraopeta Engineering College, Guntur, Andhra Pradesh, INDIA

Abstract: In this project static and Modal analysis is a process to detect project, statics, strain and deformation. Vibration characteristics (natural frequencies and mode shapes) of a structure or a machine component while it is being designed. It has become a major alternative to provide a helpful contribution in understanding control of many vibration phenomena which encountered in practice.

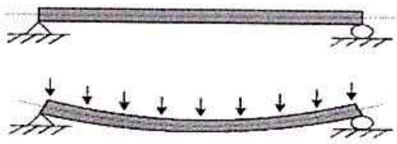
In this work we compared the stress and natural frequency for different material having same I, C and T cross- sectional beam. The cantilever beam is designed and analyzed in ANSYS. The cantilever beam which is fixed at one end is vibrated to obtain the natural frequency, mode shapes and deflection with different sections and materials.

Key words: Finite element analysis, cantilever beam, static and model analysis.

1. INTRODUCTION

1.1 BEAM

A **beam** is a structural element that is capable of withstanding load primarily by resisting against bending. The bending force induced into the material of the beam as a result of the external loads, own weight, span and external reactions to these loads is called a bending moment. Beams are characterized by their profile (shape of cross-section), their length, and their material. Beams are traditionally descriptions of building or civil engineering structural elements, but smaller structures such as truck or automobile frames, machine frames, and other mechanical or structural systems contain beam structures that are designed and analyzed in a similar fashion.



A statically determinate beam, bending (sagging) under a uniformly distributed load.

2. LITERATURE REVIEW

The dynamic analysis of a beam with multiple degree of freedom (MDOF) are studied in this paper. Due to the destructive effects of vibration in machines and structures due to resonance. In multiple degree of freedom system, there are n natural frequencies and the concept of resonance is complicated by the effect of mode shapes. In the present work cantilever beam of different materials and dimensions is considered for the dynamic analysis of free vibration at no load condition as well as comparison between materials. The modelling, simulation and analysis of cantilever beam is done by using ANSYS and theoretically by finite element method (FEM) for the evaluation of natural frequency and mode shape.

3. PROBLEM DESCRIPTION:

The objective of this project is to make a 3D model of the cantilever beam and study the static and model behavior of the cantilever beam by performing the finite element analysis.3D modeling software(PRO-Engineer) was used for designing and analysis software (ANSYS) was used for static and modal analysis.

The methodology followed in the project is as follows:

- Create a 3D model of the cantilever beam assembly using parametric software pro-engineer.
- Convert the surface model into Para solid file and import the model into ANSYS to do analysis.
- Perform static analysis on the cantilever beam.
- Perform model analysis on the existing model of the cantilever beam.

4. INTRODUCTION TO CAD/CAE:

Computer-aided design (CAD), also known as **computer-aided design and drafting (CADD)**, is the use of computer technology for the process of design and design-documentation.

4.1. INTRODUCTION TO PRO-ENGINEER

Pro/ENGINEER Wildfire is the standard in 3D product design, featuring industry-leading productivity tools that promote best practices in design while ensuring compliance with your industry and company standards. Integrated Pro/ENGINEER CAD/CAM/CAE solutions allow you to design faster than ever, while maximizing innovation and quality to ultimately create exceptional products.

Different modules in pro/engineer

Part design, Assembly, Drawing&Sheet metal.

4.2. INTRODUCTION TO FINITE ELEMENT METHOD:

Finite Element Method (FEM) is also called as Finite Element Analysis (FEA). Finite Element Method is a basic analysis technique for resolving and substituting complicated problems by simpler ones, obtaining approximate solutions Finite element method being a flexible tool is used in various industries to solve several practical engineering problems. In finite element method it is feasible to generate the relative results.

5. RESULTS AND DISCUSSIONS:

5.1. Models of cantilever beam using pro-e wildfire 5.0:
The cantilever beam is modeled using the given specifications and design formula from data book. The cantilever beam outer casing body profile is sketched in sketcher and then it is extruded using extrude option.

NEC NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)

NAAC NATIONAL ASSESSMENT AND ACCREDITATION COUNCIL 'A' GRADE

NBA NATIONAL BOARD OF ACCREDITATION

RANKED 5

PROCEEDINGS

INTERNATIONAL CONFERENCE

EMERGING TRENDS IN MECHANICAL ENGINEERING AND INDUSTRIAL AUTOMATION

NEC-ICETMEIA-2K21

30th & 31st July, 2021

Editors-in-Chief

Dr. M.Sreenivasa Kumar
Principal & Professor, Dept. of Mechnical Engineering

Dr. D.Jagadish
Professor, Dept. of Mechnical Engineering

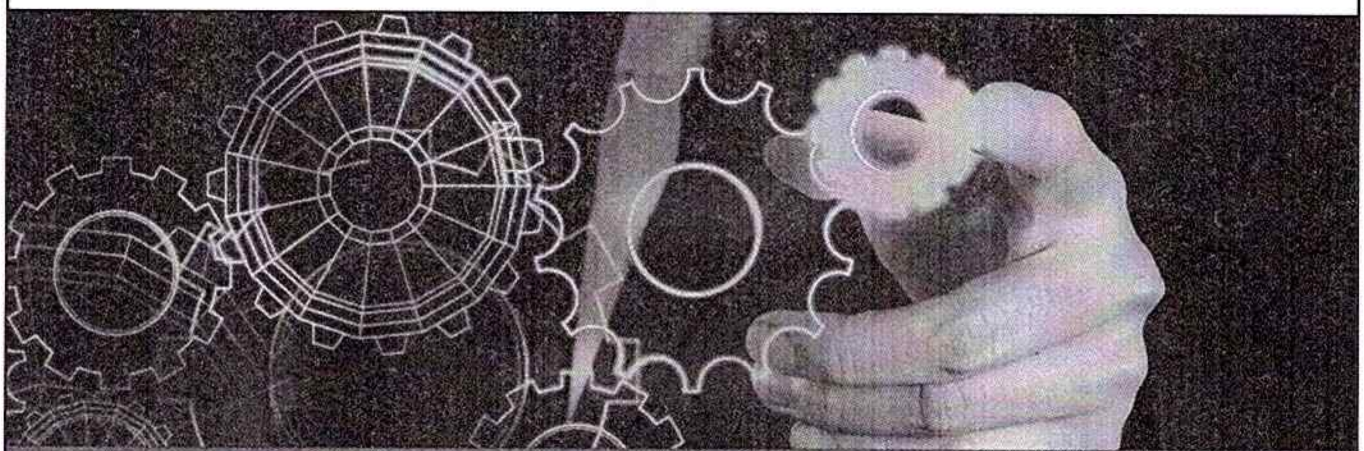
Editors

Dr. D.Suneel
Vice-Principal & Professor, Dept. of ME

Dr. P.Suresh Babu
Professor, Dept. of ME

Dr. B.Venkata Siva
Professor & HoD Dept. of ME

Mr. M.Venkanna Babu
Associate Professor, Dept. of ME



Organized by

Department of **Mechanical Engineering**

In Association with *The Institution of Engineers (India)*

ISBN : 978-93-91420-02-4

LIST OF FULL LENGTH PAPERS SELECTED FOR PROCEEDINGS

International Conference on Emerging Trends in Mechanical Engineering and Industrial Automation

NEC-ICETMEIA- 2K21

S.No.	TITLE OF THE PAPER	Page No.
1.	Effectiveness of Compression Ignition Engine Fuelled with Pond Water Algae Biodiesel	01
2.	Design And Analysis of Disc Brake of an Electric Go-Kart	04
3.	A Comprehensive Review on Recent Research on Semi Solid Processed Aluminum 7 Series Alloys	08
4.	A Study on Microstructure and Mechanical Properties A7075 Reinforced with Flyash/Sic Hybrid Metal Matrix Composite	15
5.	Establishment of SCR Test Facility and Evaluation of 8mm Pitch Honeycomb Type Catalyst in a 20 Liter capacity SCR Test facility	19
6.	A Review on NVH Issues and Technological Challenges in Electric Vehicle and Hybrid Electric Vehicle Power Train	25
7.	Design and Analysis of Cantilever Beam	29
8.	Analysis of Static and Fatigue Strength of Aluminium Alloy Wheel	32
9.	Design of Automated Braking System Based on Vehicle Over Speed Using PLC Ladder Method	35
10.	The Analysis on Concentric Pipe Heat Exchanger	39
11.	Design and Finite Element Analysis of Gas Turbine Blade	45
12.	Investigation on Mechanical Properties of Glass Fiber and Carbon Nano Tubes Sandwich Composite Material	47
13.	CFD Analysis of Super Utility Vehicle to Determine Aerodynamic Behavior	54
14.	Devlopment of Code for Automated HVAC System using Digital Controller	60
15.	Performance and Emission Characteristics Of Diesel Engine with Linseed Oil-Diesel Blends as Fuel With VCR	65
16.	Experimental Investigation in Single Cylinder VCR Multifuel Engine Using Bio-Diesel as Linseed Oil	69

17.	Tribological Properties of Textured Surface	72
18.	Thermal Analysis and Experimental Investigation of Pin Fin made of Brass	76
19.	Experimental and Simulation of Wear Test on GPR material	79
20.	CFD Analysis of Two Pass Double Pipe Heat Exchanger with TiO_2/Ethylene Glycol Nano Fluid	83
21.	Simulation and Optimization of Extrusion Process Parameters of Aluminium 2A12T4Alloy	87
22.	Importance of Ice Jet machining - A Review	91
23.	Performance Investigation of a Battery Powered Peltier Cooler	94
24.	Analysis of Disc Brake Rotor using ANSYS Workbench	98
25.	Modelling and Optimization of Two Wheeler Disk Brake Using ANSYS -Review	101
26.	Fabrication of Sewage Waste Cleaner	105
27.	Manufacturing of Hyperboliodal Gear Model Using Ultimaker S5 3D Printing Machine	109
28.	Arc Welding Process Selection Through Quality and Cost Analysis	113
29.	Li-Br H2O VAR System Analysis by Applying Magnetic Field to Liquid Line	117
30.	Heat Transfer Enhancement on Shell and Coil Type of Heat Exchanger Using SiO_2 and CuO Nano-Fluids	121
31.	Study of Rheological Characteristics of Nano Suspensions	126
32.	Design And Fabrication of Loop Wheel System	129
33.	Performance of Solar Vapour Absorption system and its Dependence on Generator Temperature	131
34.	Design and Analysis Of Handicapped Steering Tricycle	134
35.	Machining Characteristics and Microbiological Growth of Stir Casted A356-SiC MMCs and Pure Metals	136
36.	Design and Analysis of Connecting Rod	141

37.	Pressure Vessel Optimum Design using Particle Swarm Optimization	145
38.	Design and Analysis of Wheel Rim on Radial Loads	149
39.	COP Enhancement of VCR System using Diffusers	154
40.	Design and Fabrication of Radiant Cooling System	157
41.	Comparative Performance Analysis of Engine Fuelled with Diesel Biodiesel Iron Oxide Nano Particles	162
42.	Performance analysis of a CI Engine fuelled with olive oil and soybean oil mixture as a biofuels	166
43.	Design and Analysis of Landing Gear	170
44.	A Review on Parameters of Composite Materials	173
45.	Optimisation in WEDM of HCHCR Steel using Taughi Method	177
46.	Automated Pneumatic Sheet Metal Cutting Machine	184
47.	Cylindrical Panel's Numerical And Analytical Investigations Subjected To Different Loads	187
48.	Application of a Thermoplastic Polyurethane/Polylactic Acid Composite Filament For 3D-Printed Personalized Orthosis	192
49.	Design and Analysis of a Connecting Rod	196
50.	A Study and Synthesis of 8 Bar One Degree of Freedom Walking Mechanism	200
51.	Mechanical properties and machining of Al-7075 SiC Composite	204
52.	Characterization of Tungsten carbide reinforced Al7075 matrix Composites.	208
53.	3D Printing of Prototype Through Image Processing using Autodesk Recap Photo Software	212
54.	Fabrication and Testing Mechanical Behaviour of Hemp Fibre, Chopped E Glass and Hybrid with Nano Particle	216
55.	Optical characterization of V_2O_5 doped Na_2O-SiO_2-ZrO_2 glasses	218
56.	Determination of Efficient Location of Split Air Conditioner using CFD	221

57.	Frictionless Electromagnetic Braking System	225
58.	Performance Evaluation of Vegetable oils as Cutting fluid under MQL Condition in Turning	228
59.	A novel hybrid Fuzzy AHP and VIKOR methodology for Reclaimer Selection in GSCM	236
60.	Design of Eco-Friendly Road Cleaner	240
61.	Mechanical and Microstructural Characterization of Jute Hybrid Composite with Alkali Treatment	244
62.	Experimental Investigation and Optimization of Process Parameters in Wire Cut EDM of EN31 Steel	248
63.	Design and Analysis of Differential Gear Box	252

***

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

NV 5 2021

ISBN: 978-93-91420-02-4

Analysis of Static and Fatigue Strength of Aluminum Alloy Wheel

K.L.N. Murthy and N. Vijaya Sekhar
Department of Mechanical Engineering, A.M. Reddy College of Engineering College, Guntur, Andhra Pradesh, INDIA,
Department of Mechanical Engineering, Narasaraopeta Engineering College, Narasaraopet, INDIA

Abstract—The present thesis summarizes the application of Finite Element Analysis technique for analysing stress distribution and fatigue life of Aluminium alloy wheels subject to radial loads. Alloy wheels intended for use on passenger cars stipulate two types of fatigue tests, the Dynamic cornering fatigue test and the Dynamic radial fatigue test. As wheels undergo inconsistent, varying loads during their service life, fatigue behaviour is a key consideration in the design and performance evaluation. But, alloy wheels have more complex shapes than regular steel wheels, so it is difficult to assess fatigue life by analytical methods. Hence, Finite Element Analysis has been used to evaluate the performance of wheels over their life. The deflection for Alloy wheel Al 2024-T351 of this project is found to be around 0.164 mm which is much less than that of Aluminium A356.2 alloy wheel which is 0.2833mm.This shows that Al 2024-T351 is stiffer than Aluminium A356.2 alloy wheel. Static analysis results showed that the maximum shear stress and von- Mises stresses of A356.2 alloy wheel are 78.6% and 50% higher than the Al 2024-T351 alloy wheel.

Keywords—Alloy wheel, Fatigue life, Fatigue tests

I. INTRODUCTION

Wheel is an important structural member of the vehicular suspension system that supports the static and dynamic loads encountered during vehicle operation. Since the rims, on which cars move, are the most vital elements in a vehicle, they must be designed carefully. Safety and economy are particularly of major concerns when designing a mechanical structure so that the people could use them safely and economically. Style, weight, manufacturability and performance are the four major technical issues related to the design of a new wheel and/or its optimization. The wheels are made of either steel or cast/forge Aluminum alloys. Aluminum is the metal with features of excellent lightness, corrosion resistance, etc. In particular, the rims, which are made of Aluminum casting alloys, are more preferable because of their weight and cost. In the real service conditions, the determination of mechanical behavior of the wheel is important, but the testing and inspection of the wheels during their development process is time consuming and costly.

II. LITERATURE SURVEY

Fatigue analysis as we know it today has come a long way. 178 years ago, in 1837, Wilhelm Albert published the first article on fatigue, establishing a correlation between applied loads and durability. Two years later, in 1839, Jean-Victor Poncelet, designer of cast iron axles for mill wheels, officially used the term "fatigue" for the first time in a book on mechanics.In19th century, it was considered to be mysterious that fatigue fracture did not show a visible plastic deformation. Systematic fatigue fractures tests were done in laboratories notable by August Wohler. Fatigue was considered to be an engineering problem. Fatigue is also the initiation and growth of a crack, or growth from a pre-existing defect, which progresses until a critical size is reached. In narrow sense, the term fatigue of materials and structural components means damage and damage due to cyclic, repeatedly applied stresses.

III FATIGUE ANALYSIS

It has been observed that material fail under fluctuating stresses. It is a stress magnitude which is lower than the ultimate tensile strength of the material the decreased resistance of the materials to fluctuating stresses is called FATIGUE. There is a basic difference between failure due to static load and that due to fatigue. The failure due to static load is illustrated by the simple tension test. And there is sufficient time for elongation of fibres. In this case the load is gradually applied. The fatigue failure begins with a crack at some point in the material. The crack is more likely to occur in the regions of discontinuity, such as oil holes, key ways, screw threads and regions in machining operations, such as scratches on the surface, stamp mark, inspection marks, internal crack due to defects in materials like holes etc. These regions are subjected to stress concentration due to the crack. The crack spreads due to fluctuating stresses, until the cross section of the component is so reduced that the remaining portion is subjected sudden fracture.

A. FATIGUE LIMIT (ENDURANCE LIMIT)

The problem with Aluminium is it doesn't have a typical 'fatigue limit'. The more stress cycles that are imposed on Aluminium, the lower the stress cycles need to be to eventually result in failure. This is different than steel which has some distinct endurance limit. If a plot is drawn between peak alternating bending stress on y- axis against a log scale of life cycle on x- axis a knee in the curve at around 10^7 cycles is appeared as shown in Fig.1, so by 10^8cycles, the graph is almost flat. For Aluminium it isn't flat though, it continues to decline, meaning that as it continue to impose more cycles on test specimen, the peak alternating bending stress needed to result in failure continues to drop.

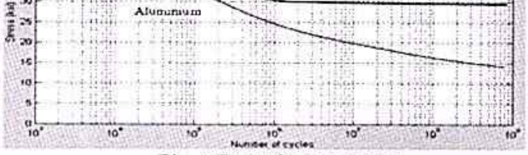


Fig.1 FATIGUE LIMIT

NEC NARASARAOPETA ENGINEERING COLLEGE (AUTONOMOUS)

NAAC 'A' GRADE

NBA NATIONAL BOARD OF ACCREDITATION

PROCEEDINGS

INTERNATIONAL CONFERENCE

EMERGING TRENDS IN MECHANICAL ENGINEERING AND INDUSTRIAL AUTOMATION

NEC-ICETMEIA-2K21

30th & 31st July, 2021

Editors-in-Chief

Dr. M.Sreenivasa Kumar
Principal & Professor, Dept. of Mechnical Engineering

Dr. D.Jagadish
Professor, Dept. of Mechnical Engineering

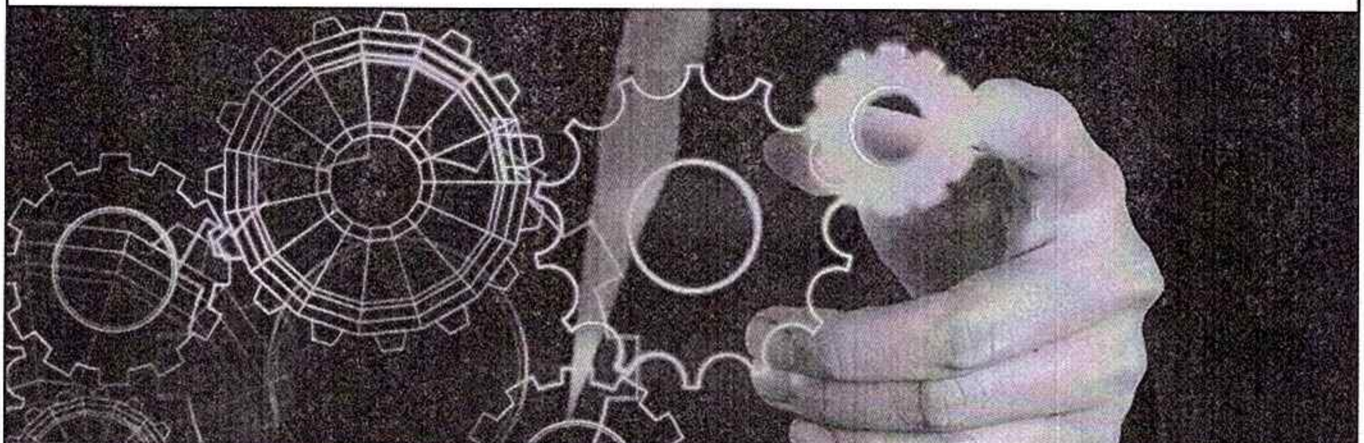
Editors

Dr. D.Suneel
Vice-Principal & Professor, Dept. of ME

Dr. P.Suresh Babu
Professor, Dept. of ME

Dr. B.Venkata Siva
Professor & HoD Dept. of ME

Mr. M.Venkanna Babu
Associate Professor, Dept. of ME



Organized by

Department of **Mechanical Engineering**

In Association with *The Institution of Engineers (India)*

ISBN : 978-93-91420-02-4

LIST OF FULL LENGTH PAPERS SELECTED FOR PROCEEDINGS

International Conference on Emerging Trends in Mechanical Engineering and Industrial Automation

NEC-ICETMEIA- 2K21

S.No.	TITLE OF THE PAPER	Page No.
1.	Effectiveness of Compression Ignition Engine Fuelled with Pond Water Algae Biodiesel	01
2.	Design And Analysis of Disc Brake of an Electric Go-Kart	04
3.	A Comprehensive Review on Recent Research on Semi Solid Processed Aluminum 7 Series Alloys	08
4.	A Study on Microstructure and Mechanical Properties A7075 Reinforced with Flyash/Sic Hybrid Metal Matrix Composite	15
5.	Establishment of SCR Test Facility and Evaluation of 8mm Pitch Honeycomb Type Catalyst in a 20 Liter capacity SCR Test facility	19
6.	A Review on NVH Issues and Technological Challenges in Electric Vehicle and Hybrid Electric Vehicle Power Train	25
7.	Design and Analysis of Cantilever Beam	29
8.	Analysis of Static and Fatigue Strength of Aluminium Alloy Wheel	32
9.	Design of Automated Braking System Based on Vehicle Over Speed Using PLC Ladder Method	35
10.	The Analysis on Concentric Pipe Heat Exchanger	39
11.	Design and Finite Element Analysis of Gas Turbine Blade	45
12.	Investigation on Mechanical Properties of Glass Fiber and Carbon Nano Tubes Sandwich Composite Material	47
13.	CFD Analysis of Super Utility Vehicle to Determine Aerodynamic Behavior	54
14.	Devlopment of Code for Automated HVAC System using Digital Controller	60
15.	Performance and Emission Characteristics Of Diesel Engine with Linseed Oil-Diesel Blends as Fuel With VCR	65
16.	Experimental Investigation in Single Cylinder VCR Multifuel Engine Using Bio-Diesel as Linseed Oil	69

17.	Tribological Properties of Textured Surface	72
18.	Thermal Analysis and Experimental Investigation of Pin Fin made of Brass	76
19.	Experimental and Simulation of Wear Test on GPR material	79
20.	CFD Analysis of Two Pass Double Pipe Heat Exchanger with TiO_2/Ethylene Glycol Nano Fluid	83
21.	Simulation and Optimization of Extrusion Process Parameters of Aluminium 2A12T4Alloy	87
22.	Importance of Ice Jet machining - A Review	91
23.	Performance Investigation of a Battery Powered Peltier Cooler	94
24.	Analysis of Disc Brake Rotor using ANSYS Workbench	98
25.	Modelling and Optimization of Two Wheeler Disk Brake Using ANSYS -Review	101
26.	Fabrication of Sewage Waste Cleaner	105
27.	Manufacturing of Hyperboliodal Gear Model Using Ultimaker S5 3D Printing Machine	109
28.	Arc Welding Process Selection Through Quality and Cost Analysis	113
29.	Li-Br H2O VAR System Analysis by Applying Magnetic Field to Liquid Line	117
30.	Heat Transfer Enhancement on Shell and Coil Type of Heat Exchanger Using SiO_2 and CuO Nano-Fluids	121
31.	Study of Rheological Characteristics of Nano Suspensions	126
32.	Design And Fabrication of Loop Wheel System	129
33.	Performance of Solar Vapour Absorption system and its Dependence on Generator Temperature	131
34.	Design and Analysis Of Handicapped Steering Tricycle	134
35.	Machining Characteristics and Microbiological Growth of Stir Casted A356-SiC MMCs and Pure Metals	136
36.	Design and Analysis of Connecting Rod	141

37.	Pressure Vessel Optimum Design using Particle Swarm Optimization	145
38.	Design and Analysis of Wheel Rim on Radial Loads	149
39.	COP Enhancement of VCR System using Diffusers	154
40.	Design and Fabrication of Radiant Cooling System	157
41.	Comparative Performance Analysis of Engine Fuelled with Diesel Biodiesel Iron Oxide Nano Particles	162
42.	Performance analysis of a CI Engine fuelled with olive oil and soybean oil mixture as a biofuels	166
43.	Design and Analysis of Landing Gear	170
44.	A Review on Parameters of Composite Materials	173
45.	Optimisation in WEDM of HCHCR Steel using Taughi Method	177
46.	Automated Pneumatic Sheet Metal Cutting Machine	184
47.	Cylindrical Panel's Numerical And Analytical Investigations Subjected To Different Loads	187
48.	Application of a Thermoplastic Polyurethane/Polylactic Acid Composite Filament For 3D-Printed Personalized Orthosis	192
49.	Design and Analysis of a Connecting Rod	196
50.	A Study and Synthesis of 8 Bar One Degree of Freedom Walking Mechanism	200
51.	Mechanical properties and machining of Al-7075 SiC Composite	204
52.	Characterization of Tungsten carbide reinforced Al7075 matrix Composites.	208
53.	3D Printing of Prototype Through Image Processing using Autodesk Recap Photo Software	212
54.	Fabrication and Testing Mechanical Behaviour of Hemp Fibre, Chopped E Glass and Hybrid with Nano Particle	216
55.	Optical characterization of V_2O_5 doped Na_2O-SiO_2-ZrO_2 glasses	218
56.	Determination of Efficient Location of Split Air Conditioner using CFD	221

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

57.	Frictionless Electromagnetic Braking System	225
58.	Performance Evaluation of Vegetable oils as Cutting fluid under MQL Condition in Turning	228
59.	A novel hybrid Fuzzy AHP and VIKOR methodology for Reclaimer Selection in GSCM	236
60.	Design of Eco-Friendly Road Cleaner	240
61.	Mechanical and Microstructural Characterization of Jute Hybrid Composite with Alkali Treatment	244
62.	Experimental Investigation and Optimization of Process Parameters in Wire Cut EDM of EN31 Steel	248
63.	Design and Analysis of Differential Gear Box	252

***

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

BRK 2021

Investigation on Mechanical Properties of Glass fiber and Carbon Nano Tubes Sandwich Composite Material

Rajiv Kumar Busa
Department of Mechanical Engineering, Narasaraopeta Engineering College(A), Narasaraopeta, India

Abstract—Sandwich epoxy composite material is a combination of two or more different materials which consists of three layers i.e. two face sheets and one core material as in the form of layer. These Composites are widely used because of their light weight and good strength which are suitable for the applications like aerospace, marine, automobile, architecture panel etc. In order to improve the properties of the sandwich epoxy composites several particulate and fiber based fillers/reinforcing materials are used.

This research work involves in improving the mechanical properties of Epoxy /Glass Fiber composite by adding Multi Walled Carbon Nano Tubes (MWCNT) and thus reducing the cost of the hybrid nano composite.

In this research work high magnesium content and low weight aluminum sheet of 0.5mm thickness sheet is used as face material and Carbon nanotubes which is low weight material and glass fiber of woven type is used as core material in order to improve mechanical properties. In addition to this, Carbon nanotubes have high electrical conductivity than copper by adding Carbon nanotubes electrical properties can also be improved.

Formability analysis is done to find out forming parameters by using Erickson cupping test. .Experimental investigation helps in identifying the some of the parameters such as density, Poisson's ratio, yield strength, ultimate tensile stress, total elongation, strain hardening coefficient, plastic strain ratio, etc. of materials.

Keywords—Epoxy, Carbon Nano Tubes, Glass Fiber.

I. Introduction

Sandwich composite material is a combination of two or more different materials which consists of three layers i.e. two face sheets and one core material as in the form of layer. These materials have great advantages such as low weight and considerably higher shear stiffness to weight ratio than an equivalent beam made of only the core material or the face-sheet material and also high tensile strength to weight ratio. The high stiffness of the face-sheet leads to a high bending stiffness to weight ratio for the composite.

There are different manufacturing processes for sandwich composite materials .They are cold working and hot working process. In cold working process there in no external heat is used in hot working process external heat is supplied to the material to improve its properties and also to minimize curing time.

Materials used for manufacturing are as in the form of sheets and some- times core materials are in the form of granulated powder. Mostly aluminum is used in manufacturing of sandwich composite material due to its low weight and easy deformation on applying of load. Depending up on the requirement number of layers are increased in general it is a three layer composite

II. Sandwich Structure

Sandwich structures can be classed as composite materials in that they consist of two or more individual components of differing properties which when combined result in a high performance material. In contrast to monolithic composites - which consist of an intimate mixture of fibres (glass, kevlar, carbon, metal, etc.) supported within a continuous matrix (e.g. thermoplastic or thermoset resin) - sandwich structures have a discrete structure in which a core material is bonded to, and faced with, a skin material.

The skin material usually has a high stiffness, whereas the core typically has high compressive and shear strength. When these are bonded together, this combination gives the sandwich structure a high flexural modulus.

Skin material can vary but common forms include:

FRP (fibre reinforced polymer - thermoplastic and thermoset).

Polymer

Wood

Aramid sheet

Metals (aluminium, titanium, steel, etc.)

Ceramic

Stone

The core can exist in a number of structures and materials:

Expanded/extruded foam (polymer - polyurethane, epoxy; metal - aluminium)

Honeycomb structure (metal - aluminium, steel; Nomex - aramid fibre dipped in resin (epoxy, phenolic or polyamide) to form a paper-like material)

Solid (wood - balsa; polymer - epoxy)

The skins are bonded to the core with film, liquid or paste adhesives and normally cured using heat and pressure, although some adhesives can cure at room temperature. It is important to note that the chosen adhesive needs to have the appropriate mechanical and thermal properties to achieve compatibility between the skin and

NEC NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)

NAAC 'A' GRADE

NATIONAL BOARD OF ACCREDITATION

PROCEEDINGS

INTERNATIONAL CONFERENCE

EMERGING TRENDS IN MECHANICAL ENGINEERING AND INDUSTRIAL AUTOMATION

NEC-ICETMEIA-2K21

30th & 31st July, 2021

Editors-in-Chief

Dr. M.Sreenivasa Kumar
Principal & Professor, Dept. of Mechnical Engineering

Dr. D.Jagadish
Professor, Dept. of Mechnical Engineering

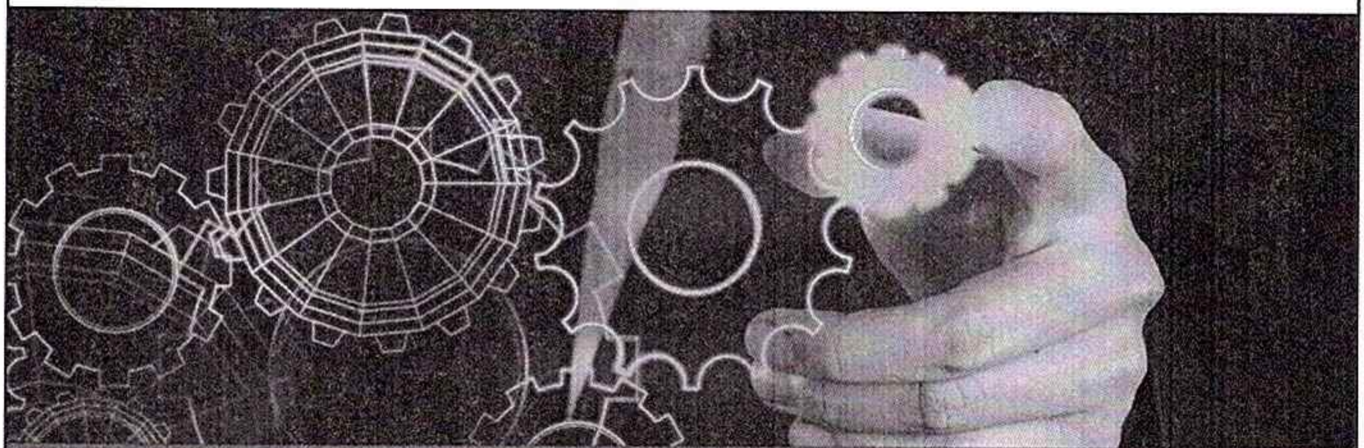
Editors

Dr. D.Suneel
Vice-Principal & Professor, Dept. of ME

Dr. P.Suresh Babu
Professor, Dept. of ME

Dr. B.Venkata Siva
Professor & HoD Dept. of ME

Mr. M.Venkanna Babu
Associate Professor, Dept. of ME



Organized by

Department of **Mechanical Engineering**

In Association with *The Institution of Engineers (India)*

ISBN : 978-93-91420-02-4

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

IQAC

LIST OF FULL LENGTH PAPERS SELECTED FOR PROCEEDINGS

International Conference on Emerging Trends in Mechanical Engineering and Industrial Automation

NEC-ICETMEIA- 2K21

S.No.	TITLE OF THE PAPER	Page No.
1.	Effectiveness of Compression Ignition Engine Fuelled with Pond Water Algae Biodiesel	01
2.	Design And Analysis of Disc Brake of an Electric Go-Kart	04
3.	A Comprehensive Review on Recent Research on Semi Solid Processed Aluminum 7 Series Alloys	08
4.	A Study on Microstructure and Mechanical Properties A7075 Reinforced with Flyash/Sic Hybrid Metal Matrix Composite	15
5.	Establishment of SCR Test Facility and Evaluation of 8mm Pitch Honeycomb Type Catalyst in a 20 Liter capacity SCR Test facility	19
6.	A Review on NVH Issues and Technological Challenges in Electric Vehicle and Hybrid Electric Vehicle Power Train	25
7.	Design and Analysis of Cantilever Beam	29
8.	Analysis of Static and Fatigue Strength of Aluminium Alloy Wheel	32
9.	Design of Automated Braking System Based on Vehicle Over Speed Using PLC Ladder Method	35
10.	The Analysis on Concentric Pipe Heat Exchanger	39
11.	Design and Finite Element Analysis of Gas Turbine Blade	45
12.	Investigation on Mechanical Properties of Glass Fiber and Carbon Nano Tubes Sandwich Composite Material	47
13.	CFD Analysis of Super Utility Vehicle to Determine Aerodynamic Behavior	54
14.	Devlopment of Code for Automated HVAC System using Digital Controller	60
15.	Performance and Emission Characteristics Of Diesel Engine with Linseed Oil-Diesel Blends as Fuel With VCR	65
16.	Experimental Investigation in Single Cylinder VCR Multifuel Engine Using Bio-Diesel as Linseed Oil	69

17.	Tribological Properties of Textured Surface	72
18.	Thermal Analysis and Experimental Investigation of Pin Fin made of Brass	76
19.	Experimental and Simulation of Wear Test on GPR material	79
20.	CFD Analysis of Two Pass Double Pipe Heat Exchanger with TiO_2/Ethylene Glycol Nano Fluid	83
21.	Simulation and Optimization of Extrusion Process Parameters of Aluminium 2A12T4Alloy	87
22.	Importance of Ice Jet machining - A Review	91
23.	Performance Investigation of a Battery Powered Peltier Cooler	94
24.	Analysis of Disc Brake Rotor using ANSYS Workbench	98
25.	Modelling and Optimization of Two Wheeler Disk Brake Using ANSYS -Review	101
26.	Fabrication of Sewage Waste Cleaner	105
27.	Manufacturing of Hyperboliodal Gear Model Using Ultimaker S5 3D Printing Machine	109
28.	Arc Welding Process Selection Through Quality and Cost Analysis	113
29.	Li-Br H2O VAR System Analysis by Applying Magnetic Field to Liquid Line	117
30.	Heat Transfer Enhancement on Shell and Coil Type of Heat Exchanger Using SiO_2 and CuO Nano-Fluids	121
31.	Study of Rheological Characteristics of Nano Suspensions	126
32.	Design And Fabrication of Loop Wheel System	129
33.	Performance of Solar Vapour Absorption system and its Dependence on Generator Temperature	131
34.	Design and Analysis Of Handicapped Steering Tricycle	134
35.	Machining Characteristics and Microbiological Growth of Stir Casted A356-SiC MMCs and Pure Metals	136
36.	Design and Analysis of Connecting Rod	141

37.	Pressure Vessel Optimum Design using Particle Swarm Optimization	145
38.	Design and Analysis of Wheel Rim on Radial Loads	149
39.	COP Enhancement of VCR System using Diffusers	154
40.	Design and Fabrication of Radiant Cooling System	157
41.	Comparative Performance Analysis of Engine Fuelled with Diesel Biodiesel Iron Oxide Nano Particles	162
42.	Performance analysis of a CI Engine fuelled with olive oil and soybean oil mixture as a biofuels	166
43.	Design and Analysis of Landing Gear	170
44.	A Review on Parameters of Composite Materials	173
45.	Optimisation in WEDM of HCHCR Steel using Taughi Method	177
46.	Automated Pneumatic Sheet Metal Cutting Machine	184
47.	Cylindrical Panel's Numerical And Analytical Investigations Subjected To Different Loads	187
48.	Application of a Thermoplastic Polyurethane/Polylactic Acid Composite Filament For 3D-Printed Personalized Orthosis	192
49.	Design and Analysis of a Connecting Rod	196
50.	A Study and Synthesis of 8 Bar One Degree of Freedom Walking Mechanism	200
51.	Mechanical properties and machining of Al-7075 SiC Composite	204
52.	Characterization of Tungsten carbide reinforced Al7075 matrix Composites.	208
53.	3D Printing of Prototype Through Image Processing using Autodesk Recap Photo Software	212
54.	Fabrication and Testing Mechanical Behaviour of Hemp Fibre, Chopped E Glass and Hybrid with Nano Particle	216
55.	Optical characterization of V_2O_5 doped Na_2O-SiO_2-ZrO_2 glasses	218
56.	Determination of Efficient Location of Split Air Conditioner using CFD	221

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

IQAC

57.	Frictionless Electromagnetic Braking System	225
58.	Performance Evaluation of Vegetable oils as Cutting fluid under MQL Condition in Turning	228
59.	A novel hybrid Fuzzy AHP and VIKOR methodology for Reclaimer Selection in GSCM	236
60.	Design of Eco-Friendly Road Cleaner	240
61.	Mechanical and Microstructural Characterization of Jute Hybrid Composite with Alkali Treatment	244
62.	Experimental Investigation and Optimization of Process Parameters in Wire Cut EDM of EN31 Steel	248
63.	Design and Analysis of Differential Gear Box	252

***

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

TAK - 2021

ISBN: 978-93-91420-02-4

Design and Analytics of Differential Gear Box

T.Ashok Kumar and P.Mokthar Bhasha
Department of Mechanical Engineering, Narasaraopeta Engineering College (A), Narasaraopet, India

***Abstract-* Gears are the most important component in a power transmission system. Advances in engineering technology in recent years have brought demands for gear teeth, which can operate at ever increasing load capacities and speeds. The gears generally fail when tooth stress exceeds the safe limit. Therefore it is essential to explore alternate gear material. The important considerations while selecting a gear material is the ability of the gear material to withstand high frictional temperature and less abrasive wear. Weight, manufacturability and cost are also important factors those are need to be considered during the design phase. Moreover, the gear must have enough thermal storage capacity to prevent distortion or cracking from thermal stress until the heat can be dissipated. It must have well anti-fade characteristics i.e. their effectiveness should not decrease with constant prolonged application and should have well anti-wear properties.**

The main objective of this project is to developed parametric model of differential Gearbox by using CATIA-V5 under various design stages. It is observed that composite material is best material for differential gearbox and is found to suitable for different revolutions (2500 rpm, 5000 rpm and 7500 rpm) under static loading conditions. Comparisons of various stress and strain results using ANSYS-19.2 with Glass filled polyamide composite and metallic materials (Aluminium alloy, Alloy Steel and Cast Iron) are also being performed and found to be lower for composite material.

I. INTRODUCTION

Gearboxes are used in almost every industry right from power to marine, and also include agriculture, textile, automobiles, aerospace, shipping etc. There are different types of gearboxes available for varying uses. These gearboxes are constructed from a variety of materials depending on their end use and the kind of industry they are being used in. The product has numerous industrial applications for providing high torque and smooth speed reductions. These gearboxes are also manufactured keeping certain specifications in mind, which will also vary depending on the application.

The upcoming requirement of power saving and efficiency of mechanical parts during the past few years increased the use of composite materials. Moreover the use of composite materials have also increased due to their properties such as weight reduction property with enough strength , high specific stiffness, corrosion free, ability to produce complex shapes, high specific strength, high impact energy absorption and many more. Product development has changed from the traditional serial process of design, followed by prototype testing and manufacturing but to more on computer aids. CAE (Computer Aided Engineering) has greatly influenced. The chain of processes between the initial design and the final realization of a product CAE software helps in product designing, 3-D visualization, analysis, simulation and impacted a lot on time and cost saving to the industry. A Gear box is one of the important mechanical components of transmission system used in variety of machines. Differential Gear box increases effective weight of vehicle which in turn directly affects the performance and efficiency of the vehicle. So there is a requirement to make light and effective gears. Therefore, in the present work composite materials are used to make light weight gears in order to perform such duty efficiently.

A. Importance of differential gear box

A differential is a device, usually but not necessarily employing gears, capable of transmitting torque and rotation through three shafts, almost always used in one of two ways: in one way, it receives one input and provides two outputs this is found in most automobiles and in the other way, it combines two inputs to create an output that is the sum, difference, or average, of the inputs. In automobiles and other wheeled vehicles, the differential allows each of the driving road wheels to rotate at different speeds, while for most vehicles supplying equal torque to each of them. A vehicle's wheels rotate at different speeds, mainly when turning corners. The differential is designed to drive a pair of wheels with equal torque while allowing them to rotate at different speeds. In vehicles without a differential, such as karts, both driving wheels are forced to rotate at the same speed, usually on a common axle driven by a simple chain-drive mechanism. When cornering, the inner wheel needs to travel a shorter distance than the outer wheel, so with no differential, the result is the inner wheel spinning and/or the outer wheel dragging, and this results in difficult and unpredictable handling, damage to tires and roads, and strain on (or possible failure of) the entire drive train.

B. Definition

- A gearbox, also known as a gear case or gearhead, is a gear or a hydraulic system responsible for transmitting mechanical power from a prime mover (an engine or electric motor) into some form of useful output. It is referred to the metal casing in which a number of gears are sealed.
- A gearbox is also a set of gears for transmitting power from one rotating shaft to another. They are used in a wide range of industrial, automotive and home machinery application.
- Gearheads are available in different sizes, capacities and speed ratios. Their main function is to convert the input provided by an electric motor into an output of lower RPM and higher torque.

C. Functions of Gear box

- A gearbox is precisely bored to control gear and shaft alignment.
- It is used as a housing/container for gear oil.

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

NEC

NARASARAOPETA
ENGINEERING COLLEGE
(AUTONOMOUS)

NAAC
'A' GRADE

NATIONAL BOARD OF ACCREDITATION

PROCEEDINGS

INTERNATIONAL CONFERENCE

EMERGING TRENDS IN MECHANICAL ENGINEERING AND INDUSTRIAL AUTOMATION

NEC-ICETMEIA-2K21

30th & 31st July, 2021

Editors-in-Chief

Dr. M.Sreenivasa Kumar
Principal & Professor, Dept. of Mechnical Engineering

Dr. D.Jagadish
Professor, Dept. of Mechnical Engineering

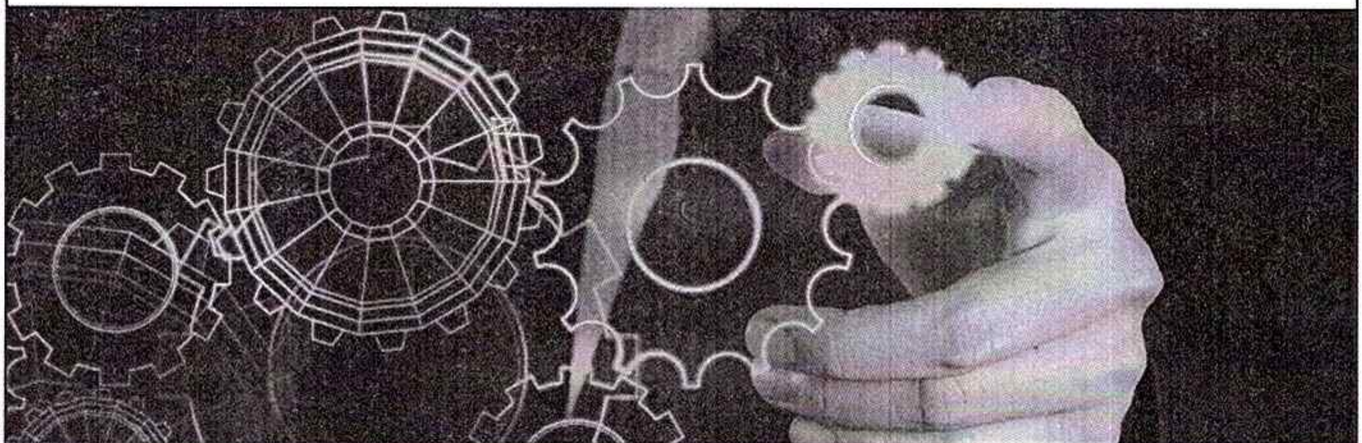
Editors

Dr. D.Suneel
Vice-Principal & Professor, Dept. of ME

Dr. P.Suresh Babu
Professor, Dept. of ME

Dr. B.Venkata Siva
Professor & HoD Dept. of ME

Mr. M.Venkanna Babu
Associate Professor, Dept. of ME



Organized by

Department of **Mechanical Engineering**

In Association with *The Institution of Engineers (India)*

ISBN : 978-93-91420-02-4

LIST OF FULL LENGTH PAPERS SELECTED FOR PROCEEDINGS

International Conference on Emerging Trends in Mechanical Engineering and Industrial Automation

NEC-ICETMEIA- 2K21

S.No.	TITLE OF THE PAPER	Page No.
1.	Effectiveness of Compression Ignition Engine Fuelled with Pond Water Algae Biodiesel	01
2.	Design And Analysis of Disc Brake of an Electric Go-Kart	04
3.	A Comprehensive Review on Recent Research on Semi Solid Processed Aluminum 7 Series Alloys	08
4.	A Study on Microstructure and Mechanical Properties A7075 Reinforced with Flyash/Sic Hybrid Metal Matrix Composite	15
5.	Establishment of SCR Test Facility and Evaluation of 8mm Pitch Honeycomb Type Catalyst in a 20 Liter capacity SCR Test facility	19
6.	A Review on NVH Issues and Technological Challenges in Electric Vehicle and Hybrid Electric Vehicle Power Train	25
7.	Design and Analysis of Cantilever Beam	29
8.	Analysis of Static and Fatigue Strength of Aluminium Alloy Wheel	32
9.	Design of Automated Braking System Based on Vehicle Over Speed Using PLC Ladder Method	35
10.	The Analysis on Concentric Pipe Heat Exchanger	39
11.	Design and Finite Element Analysis of Gas Turbine Blade	45
12.	Investigation on Mechanical Properties of Glass Fiber and Carbon Nano Tubes Sandwich Composite Material	47
13.	CFD Analysis of Super Utility Vehicle to Determine Aerodynamic Behavior	54
14.	Devlopment of Code for Automated HVAC System using Digital Controller	60
15.	Performance and Emission Characteristics Of Diesel Engine with Linseed Oil-Diesel Blends as Fuel With VCR	65
16.	Experimental Investigation in Single Cylinder VCR Multifuel Engine Using Bio-Diesel as Linseed Oil	69

17.	Tribological Properties of Textured Surface	72
18.	Thermal Analysis and Experimental Investigation of Pin Fin made of Brass	76
19.	Experimental and Simulation of Wear Test on GPR material	79
20.	CFD Analysis of Two Pass Double Pipe Heat Exchanger with TiO_2/Ethylene Glycol Nano Fluid	83
21.	Simulation and Optimization of Extrusion Process Parameters of Aluminium 2A12T4Alloy	87
22.	Importance of Ice Jet machining - A Review	91
23.	Performance Investigation of a Battery Powered Peltier Cooler	94
24.	Analysis of Disc Brake Rotor using ANSYS Workbench	98
25.	Modelling and Optimization of Two Wheeler Disk Brake Using ANSYS -Review	101
26.	Fabrication of Sewage Waste Cleaner	105
27.	Manufacturing of Hyperboliodal Gear Model Using Ultimaker S5 3D Printing Machine	109
28.	Arc Welding Process Selection Through Quality and Cost Analysis	113
29.	Li-Br H2O VAR System Analysis by Applying Magnetic Field to Liquid Line	117
30.	Heat Transfer Enhancement on Shell and Coil Type of Heat Exchanger Using SiO_2 and CuO Nano-Fluids	121
31.	Study of Rheological Characteristics of Nano Suspensions	126
32.	Design And Fabrication of Loop Wheel System	129
33.	Performance of Solar Vapour Absorption system and its Dependence on Generator Temperature	131
34.	Design and Analysis Of Handicapped Steering Tricycle	134
35.	Machining Characteristics and Microbiological Growth of Stir Casted A356-SiC MMCs and Pure Metals	136
36.	Design and Analysis of Connecting Rod	141

37.	Pressure Vessel Optimum Design using Particle Swarm Optimization	145
38.	Design and Analysis of Wheel Rim on Radial Loads	149
39.	COP Enhancement of VCR System using Diffusers	154
40.	Design and Fabrication of Radiant Cooling System	157
41.	Comparative Performance Analysis of Engine Fuelled with Diesel Biodiesel Iron Oxide Nano Particles	162
42.	Performance analysis of a CI Engine fuelled with olive oil and soybean oil mixture as a biofuels	166
43.	Design and Analysis of Landing Gear	170
44.	A Review on Parameters of Composite Materials	173
45.	Optimisation in WEDM of HCHCR Steel using Taughi Method	177
46.	Automated Pneumatic Sheet Metal Cutting Machine	184
47.	Cylindrical Panel's Numerical And Analytical Investigations Subjected To Different Loads	187
48.	Application of a Thermoplastic Polyurethane/Polylactic Acid Composite Filament For 3D-Printed Personalized Orthosis	192
49.	Design and Analysis of a Connecting Rod	196
50.	A Study and Synthesis of 8 Bar One Degree of Freedom Walking Mechanism	200
51.	Mechanical properties and machining of Al-7075 SiC Composite	204
52.	Characterization of Tungsten carbide reinforced Al7075 matrix Composites.	208
53.	3D Printing of Prototype Through Image Processing using Autodesk Recap Photo Software	212
54.	Fabrication and Testing Mechanical Behaviour of Hemp Fibre, Chopped E Glass and Hybrid with Nano Particle	216
55.	Optical characterization of V_2O_5 doped Na_2O-SiO_2-ZrO_2 glasses	218
56.	Determination of Efficient Location of Split Air Conditioner using CFD	221

57.	Frictionless Electromagnetic Braking System	225
58.	Performance Evaluation of Vegetable oils as Cutting fluid under MQL Condition in Turning	228
59.	A novel hybrid Fuzzy AHP and VIKOR methodology for Reclaimer Selection in GSCM	236
60.	Design of Eco-Friendly Road Cleaner	240
61.	Mechanical and Microstructural Characterization of Jute Hybrid Composite with Alkali Treatment	244
62.	Experimental Investigation and Optimization of Process Parameters in Wire Cut EDM of EN31 Steel	248
63.	Design and Analysis of Differential Gear Box	252

***

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

TAK-2021

ISBN: 978-93-91420-02-4

Application of a Thermoplastic Polyurethane/Polylactic Acid Composite Filament for 3d-Printed Personalized Orthosis

[1]V.Vana Kiran Kumar and [2]T.Ashok Kumar
[1]Department of Mechanical Engineering, Sree Rama Engineering College Tirupathi, Andha Pradesh, India.
[2]Department of Mechanical Engineering, Narasaraopeta Engineering College (A), Andha Pradesh, India.

Abstract:
For designing and fabricating personalized, cost-effective and bio-degradable orthoses, a finger orthosis was chosen as an example to explore a suitable material, personalized design method, and fabrication with a fuse-deposition-modeling (FDM) open-source 3D printer. Thermoplastic polyurethane (TPU)/polylactic acid (PLA) composite filaments were explored for 3D printing. The polymer composite compositions were TPU/PLA: 0 %/100 % (TP0), 25 %/75 % (TP25), and 50 %/50 % (TP50) by weight, respectively. The mechanical performance, thermal properties, and structure of the TPU/PLA composite filaments were assessed by tensile tests, thermal gravimetric analysis (TGA), differential scanning calorimetry (DSC), and powder X-ray diffraction (XRD) measurements. Compared to the neat PLA, the TP25 specimens exhibited almost the same tensile strength, but its higher elongation at the break indicates that TP25 is more suitable for the material of orthoses. However, a further increase of the TPU ratio to 50 % resulted in a sharp decrease of the tensile strength. The addition of TPU had little effect on the starting thermal decomposition temperature, glass-transition temperature, and melting temperature of the composites. The com- posite filaments can be printed through the normal 3D printing procedure. 3D scanning and open-source 3D printers can be used to complete the design and fabrication of personalized orthoses.

Keywords: 3D printing, 3D scanning; orthosis, thermoplastic polyurethane, polylactic acid

I.INTRODUCTION

In the medical field, orthoses are used for many purposes. Depending on the patient's impairment, they might be used as braces for the rehabilitation of peripheral nerves' dysfunctions, the improvement of gait performance for people with an impaired lower-limb function, or the optimization of the support of a limb used in rheumatology, traumatology, or other articulations inflammatory processes. 3D printing (3DP), also known as additive manufacturing (AM) technology, can be defined as a technique for creating three-dimensional objects in a layer-by-layer manner. Over the past few years, 3DP has extended to areas of aerospace, auto-motive, architecture, medical, education, and fashion. Nowadays, 3DP is spreading in the orthosis field. Given its low-cost and continuous materials evolution, its diffusion is expected to rapidly increase in the near future.3

Fused deposition modelling (FDM) is one of the most commonly used techniques in 3DP. The expiration of early FDM patents has led to the growth of relatively low-cost, open-source 3D printers. In essence, an FDM printer consists of an engine, gear wheels, an extrusion nozzle, and a building plate. The filament with a well- defined and consistent diameter is loaded and pushed towards the extrusion nozzle (Which is set at an elevated temperature) to be melted and deposited onto a building plate. Dictated by the slicing software, the extrusion nozzle can be moved in different XY directions. Once each individual cross-section of the desired object is completed, the building plate can be moved down (Z direction) to deposit different layers.4

Polylactic acid (PLA) filaments are widely used as bio-based feedstock for FDM. Although PLA filaments are degradable and exhibit outstanding properties, its brittleness restricts their suitability for orthosis applications. Preparing PLA composites by mixing PLA with an elastomer offers a solution for ameliorating the tough- ness of PLA.5 Thermoplastic polyurethane (TPU) elastomers are excellent biocompatible materials for many applications in the medical field, such as blood bags and surgical gloves, catheters, synthetic veins, and wound dressings.6 Based on the chemical structure of PLA and TPU, it is possible to achieve better compatibility between both polymers. PLA is compatible with the soft polyester segments of TPU and can form hydrogen bonds with the carbonates from hard segments of TPU.7. 83DP's most distinguishing feature is its ability to construct complex spatial objects rapidly from a digital model file. The design and production of personalized products in the pharmaceutical field, such as medicines, oral dosage forms, and medical devices, has benefitted from the advantages of 3DP.9,10 Computer-aided design (CAD) and 3D scanning technology are commonly used to generate 3D models. For personalized orthoses, 3D scanning technology offers an ideal technique for obtaining patient-specific 3D models.

In this paper, a finger orthosis was chosen as an example to explore the design and fabrication of a personalized orthosis. The TPU/PLA composite filaments were developed for FDM 3DP. The properties of the TPU/PLA composite were investigated. The feasibility of making personalized orthoses using 3D scanning and an open-source 3D printer was explored.

II.EXPERIMENTAL PART

Preparation Of TPU/PLA Polymer Composite Filaments: Virgin PLA (4032D) pellets were purchased from Nature Works LLC, USA. The density is 1.24 g cm–3 and the melting temperature is about 160 °C. TPU (1170A Elastonllan) pellets were obtained from the BASF Company, Germany. This is a polyether TPU with high toughness and elongation at the break, and a density of 1.08 g cm–3.The PLA and TPU pellets were initially dehydrated (103 °C) for 4 hours to eliminate the moisture. After drying, the TPU and PLA pellets were then blended with different ratios of TPU/PLA (0 %/100 %(TP0), 25 %/75 % (TP25), and 50 %/50 % (TP50) by weight and extruded using a single screw extruder (C2 model, Well zoom

NEC NARASARAOPETA ENGINEERING COLLEGE (AUTONOMOUS)

NAAC 'A' GRADE | NATIONAL BOARD OF ACCREDITATION | RANKED 5

PROCEEDINGS

INTERNATIONAL CONFERENCE

EMERGING TRENDS IN MECHANICAL ENGINEERING AND INDUSTRIAL AUTOMATION

NEC-ICETMEIA-2K21

30th & 31st July, 2021

Editors-in-Chief

Dr. M.Sreenivasa Kumar
Principal & Professor, Dept. of Mechnical Engineering

Dr. D.Jagadish
Professor, Dept. of Mechnical Engineering

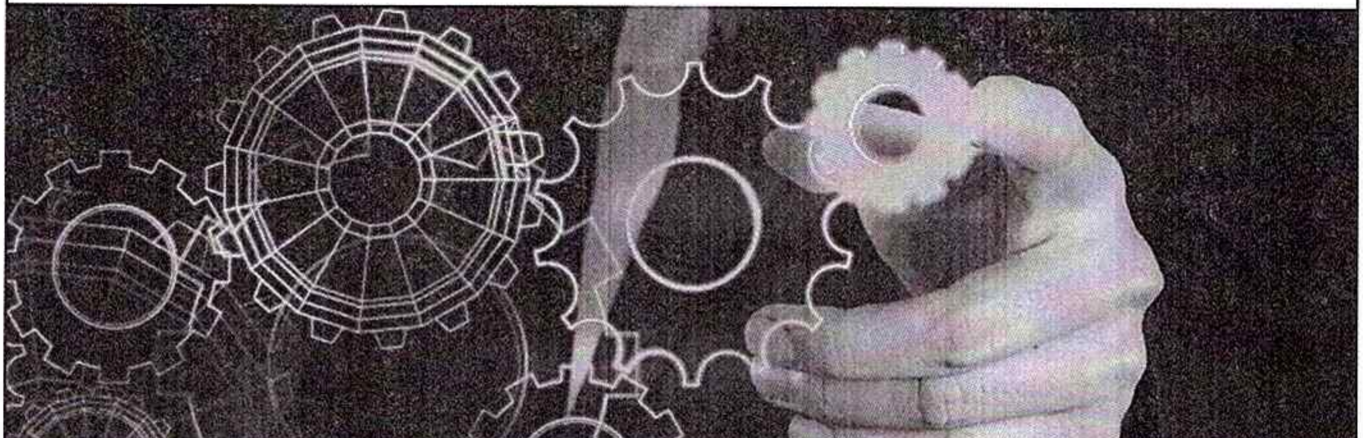
Editors

Dr. D.Suneel
Vice-Principal & Professor, Dept. of ME

Dr. P.Suresh Babu
Professor, Dept. of ME

Dr. B.Venkata Siva
Professor & HoD Dept. of ME

Mr. M.Venkanna Babu
Associate Professor, Dept. of ME



Organized by

Department of **Mechanical Engineering**

In Association with *The Institution of Engineers (India)*

ISBN : 978-93-91420-02-4

LIST OF FULL LENGTH PAPERS SELECTED FOR PROCEEDINGS

International Conference on Emerging Trends in Mechanical Engineering and Industrial Automation

NEC-ICETMEIA- 2K21

S.No.	TITLE OF THE PAPER	Page No.
1.	Effectiveness of Compression Ignition Engine Fuelled with Pond Water Algae Biodiesel	01
2.	Design And Analysis of Disc Brake of an Electric Go-Kart	04
3.	A Comprehensive Review on Recent Research on Semi Solid Processed Aluminum 7 Series Alloys	08
4.	A Study on Microstructure and Mechanical Properties A7075 Reinforced with Flyash/Sic Hybrid Metal Matrix Composite	15
5.	Establishment of SCR Test Facility and Evaluation of 8mm Pitch Honeycomb Type Catalyst in a 20 Liter capacity SCR Test facility	19
6.	A Review on NVH Issues and Technological Challenges in Electric Vehicle and Hybrid Electric Vehicle Power Train	25
7.	Design and Analysis of Cantilever Beam	29
8.	Analysis of Static and Fatigue Strength of Aluminium Alloy Wheel	32
9.	Design of Automated Braking System Based on Vehicle Over Speed Using PLC Ladder Method	35
10.	The Analysis on Concentric Pipe Heat Exchanger	39
11.	Design and Finite Element Analysis of Gas Turbine Blade	45
12.	Investigation on Mechanical Properties of Glass Fiber and Carbon Nano Tubes Sandwich Composite Material	47
13.	CFD Analysis of Super Utility Vehicle to Determine Aerodynamic Behavior	54
14.	Devlopment of Code for Automated HVAC System using Digital Controller	60
15.	Performance and Emission Characteristics Of Diesel Engine with Linseed Oil-Diesel Blends as Fuel With VCR	65
16.	Experimental Investigation in Single Cylinder VCR Multifuel Engine Using Bio-Diesel as Linseed Oil	69

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

17.	Tribological Properties of Textured Surface	72
18.	Thermal Analysis and Experimental Investigation of Pin Fin made of Brass	76
19.	Experimental and Simulation of Wear Test on GPR material	79
20.	CFD Analysis of Two Pass Double Pipe Heat Exchanger with TiO_2/Ethylene Glycol Nano Fluid	83
21.	Simulation and Optimization of Extrusion Process Parameters of Aluminium 2A12T4Alloy	87
22.	Importance of Ice Jet machining - A Review	91
23.	Performance Investigation of a Battery Powered Peltier Cooler	94
24.	Analysis of Disc Brake Rotor using ANSYS Workbench	98
25.	Modelling and Optimization of Two Wheeler Disk Brake Using ANSYS -Review	101
26.	Fabrication of Sewage Waste Cleaner	105
27.	Manufacturing of Hyperboliodal Gear Model Using Ultimaker S5 3D Printing Machine	109
28.	Arc Welding Process Selection Through Quality and Cost Analysis	113
29.	Li-Br H2O VAR System Analysis by Applying Magnetic Field to Liquid Line	117
30.	Heat Transfer Enhancement on Shell and Coil Type of Heat Exchanger Using SiO_2 and CuO Nano-Fluids	121
31.	Study of Rheological Characteristics of Nano Suspensions	126
32.	Design And Fabrication of Loop Wheel System	129
33.	Performance of Solar Vapour Absorption system and its Dependence on Generator Temperature	131
34.	Design and Analysis Of Handicapped Steering Tricycle	134
35.	Machining Characteristics and Microbiological Growth of Stir Casted A356-SiC MMCs and Pure Metals	136
36.	Design and Analysis of Connecting Rod	141

37.	Pressure Vessel Optimum Design using Particle Swarm Optimization	145
38.	Design and Analysis of Wheel Rim on Radial Loads	149
39.	COP Enhancement of VCR System using Diffusers	154
40.	Design and Fabrication of Radiant Cooling System	157
41.	Comparative Performance Analysis of Engine Fuelled with Diesel Biodiesel Iron Oxide Nano Particles	162
42.	Performance analysis of a CI Engine fuelled with olive oil and soybean oil mixture as a biofuels	166
43.	Design and Analysis of Landing Gear	170
44.	A Review on Parameters of Composite Materials	173
45.	Optimisation in WEDM of HCHCR Steel using Taughi Method	177
46.	Automated Pneumatic Sheet Metal Cutting Machine	184
47.	Cylindrical Panel's Numerical And Analytical Investigations Subjected To Different Loads	187
48.	Application of a Thermoplastic Polyurethane/Polylactic Acid Composite Filament For 3D-Printed Personalized Orthosis	192
49.	Design and Analysis of a Connecting Rod	196
50.	A Study and Synthesis of 8 Bar One Degree of Freedom Walking Mechanism	200
51.	Mechanical properties and machining of Al-7075 SiC Composite	204
52.	Characterization of Tungsten carbide reinforced Al7075 matrix Composites.	208
53.	3D Printing of Prototype Through Image Processing using Autodesk Recap Photo Software	212
54.	Fabrication and Testing Mechanical Behaviour of Hemp Fibre, Chopped E Glass and Hybrid with Nano Particle	216
55.	Optical characterization of V_2O_5 doped Na_2O-SiO_2-ZrO_2 glasses	218
56.	Determination of Efficient Location of Split Air Conditioner using CFD	221

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

57.	Frictionless Electromagnetic Braking System	225
58.	Performance Evaluation of Vegetable oils as Cutting fluid under MQL Condition in Turning	228
59.	A novel hybrid Fuzzy AHP and VIKOR methodology for Reclaimer Selection in GSCM	236
60.	Design of Eco-Friendly Road Cleaner	240
61.	Mechanical and Microstructural Characterization of Jute Hybrid Composite with Alkali Treatment	244
62.	Experimental Investigation and Optimization of Process Parameters in Wire Cut EDM of EN31 Steel	248
63.	Design and Analysis of Differential Gear Box	252

***

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

FAK 2021

ISBN: 978-93-91420-02-4

Design and Analysis of a Connecting Rod

[1]G. Raju and [2]T. Ashok Kumar,
[1]Department Of Mechanical Engineering, JNTUN, Narasaraopet, Andha Pradesh, Guntur District
[2]Department of Mechanical Engineering, Narasaraopeta Engineering College (A), Narasaraopeta
Andha Pradesh, India.

Abstract: The main function of a connecting rod is to convert linear motion of piston to rotary motion of crank. It is the main component of an internal combustion (IC) engine and is the most heavily stressed part in the engine. During its operation various stresses are acting on connecting rod. The influence of compressive stress is more in connecting rod due to gas pressure and whipping stress. The objective of this study is to carry out a FEA analysis of a connecting rod and obtain its stress distribution on application of the force. Geometry of connecting rod used for FEA, its generation, simplifications and accuracy is done by using CATIA. Mesh generation, the load application, particularly the distribution at the contact area, factors that decide application of the restraints and validation of the FEA model are also discussed. FEM was used to determine structural behavior under static load condition (static FEA).
Keywords: Connecting Rod, Catia, Ansys, FEA

I. INTRODUCTION

In modern automotive internal combustion engines, the connecting rods are most usually made of steel for production engines, but can be made of aluminium (for lightness and the ability to absorb high impact at the expense of durability) or titanium (for a combination of strength and lightness at the expense of affordability) for high performance engines. They are not rigidly fixed at either end, hence the angle between the connecting rod and the piston changes as the rod moves up and down and rotates around the crankshaft. Connecting rods are manufactured by means of forging. Being one of the most integral parts in an engine's design, the connecting rod must be able to withstand tremendous loads and transmit a great deal of power. In a reciprocating piston engines, connecting rod connects the piston to the crank or crankshaft. Together with the crank, they form a simple mechanism that converts reciprocating motion into rotating motion. As the connecting rod is rigid, it may transmit either a push or a pull and so the rod may rotate the crank through both halves of a revolution, i.e., piston pushing and piston pulling. The small end is attached to the piston pin and the big end connects to the bearing journal on the crank. Typically, there is a pinhole bored through the bearing and the big end of the connecting rod so that pressurized lubricating motor oil squirts out onto the thrust side of the cylinder wall to lubricate the travel of the pistons and piston rings.

II.FINITEELEMENTANALYSIS

Design

The connecting rod is designed using CATIA V5 6R 2014accordingtothespecificationsgivenbelow.

Parameter	Value
Length of connecting rod	150
Outer diameter of big end	56
Inner diameter of big end	48
Outer diameter of small end	32
Inner diameter of small end	24

Table1: Dimensions of Connecting Rod

Meshing

The connecting rod model is imported to the ANSYS(mechanical APDL 14.5) by converting the Catia file into .anf extension file format. The element type selected is solid185.After successful import of model material property is defined. The materials and their properties used and necessary for the analysis is given in table2.

Material	Young's modulus(GPa)	Poisson's ratio	Density(Kg mm3)
Steel	200	.303	8050
Aluminium	69	.334	2700

Table2:Material Properties

After defining the element type and material property, meshing is done. Meshing is probably the most important part in analysis. Meshing means to create a mesh of some grid-points called 'nodes'. It's done with a variety of tools & options available in the software. The results are calculated by solving the relevant governing equations numerically at each of the nodes of the mesh. For the design under consideration, finite element mesh is generated using tetrahedral mesh type taking fine size to 1mm and minimum edge length as 0.1mm with 50730 nodes

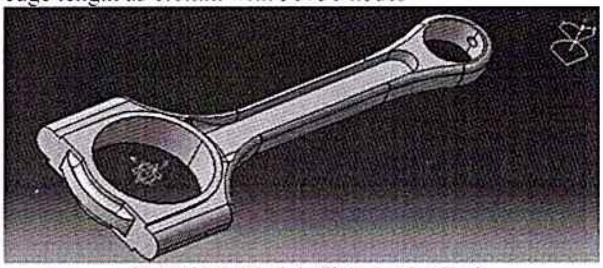
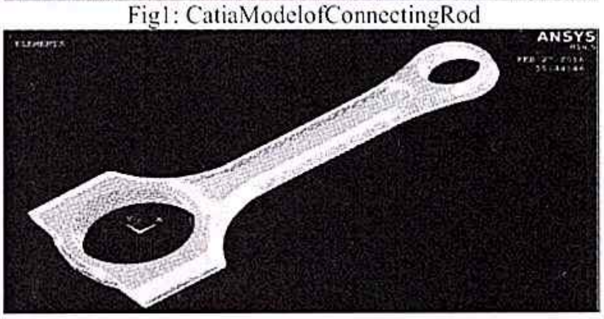


Fig1: CatiaModelofConnectingRod



Load Analysis

Compressive Loading:

Crank End: p = 37.66 MPa Piston pin End: p=69.98MPa

Tensile Loading:

Crank End: p = 41.5 MPa Piston pin End: p=77.17MPa

Since the analysis is linear and elastic, for static analysis the stress, displacement and strain are proportional to the magnitude of the load. Therefore, the result obtained from FEA is applied to several elastic load carries in a proportional manner.

NEC NARASARAOPETA ENGINEERING COLLEGE (AUTONOMOUS)

NAAC 'A' GRADE

NBA NATIONAL BOARD OF ACCREDITATION

PROCEEDINGS

INTERNATIONAL CONFERENCE

EMERGING TRENDS IN MECHANICAL ENGINEERING AND INDUSTRIAL AUTOMATION

NEC-ICETMEIA-2K21

30th & 31st July, 2021

Editors-in-Chief

Dr. M.Sreenivasa Kumar
Principal & Professor, Dept. of Mechnical Engineering

Dr. D.Jagadish
Professor, Dept. of Mechnical Engineering

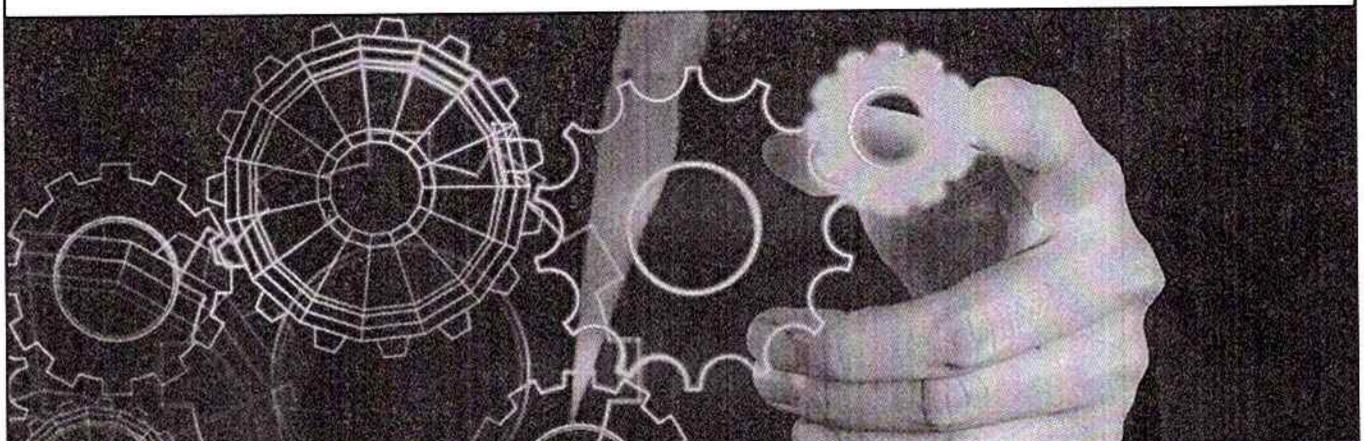
Editors

Dr. D.Suneel
Vice-Principal & Professor, Dept. of ME

Dr. P.Suresh Babu
Professor, Dept. of ME

Dr. B.Venkata Siva
Professor & HoD Dept. of ME

Mr. M.Venkanna Babu
Associate Professor, Dept. of ME



Organized by

Department of Mechanical Engineering

In Association with The Institution of Engineers (India)

ISBN : 978-93-91420-02-4

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

LIST OF FULL LENGTH PAPERS SELECTED FOR PROCEEDINGS

International Conference on Emerging Trends in Mechanical Engineering and Industrial Automation

NEC-ICETMEIA- 2K21

S.No.	TITLE OF THE PAPER	Page No.
1.	Effectiveness of Compression Ignition Engine Fuelled with Pond Water Algae Biodiesel	01
2.	Design And Analysis of Disc Brake of an Electric Go-Kart	04
3.	A Comprehensive Review on Recent Research on Semi Solid Processed Aluminum 7 Series Alloys	08
4.	A Study on Microstructure and Mechanical Properties A7075 Reinforced with Flyash/Sic Hybrid Metal Matrix Composite	15
5.	Establishment of SCR Test Facility and Evaluation of 8mm Pitch Honeycomb Type Catalyst in a 20 Liter capacity SCR Test facility	19
6.	A Review on NVH Issues and Technological Challenges in Electric Vehicle and Hybrid Electric Vehicle Power Train	25
7.	Design and Analysis of Cantilever Beam	29
8.	Analysis of Static and Fatigue Strength of Aluminium Alloy Wheel	32
9.	Design of Automated Braking System Based on Vehicle Over Speed Using PLC Ladder Method	35
10.	The Analysis on Concentric Pipe Heat Exchanger	39
11.	Design and Finite Element Analysis of Gas Turbine Blade	45
12.	Investigation on Mechanical Properties of Glass Fiber and Carbon Nano Tubes Sandwich Composite Material	47
13.	CFD Analysis of Super Utility Vehicle to Determine Aerodynamic Behavior	54
14.	Devlopment of Code for Automated HVAC System using Digital Controller	60
15.	Performance and Emission Characteristics Of Diesel Engine with Linseed Oil-Diesel Blends as Fuel With VCR	65
16.	Experimental Investigation in Single Cylinder VCR Multifuel Engine Using Bio-Diesel as Linseed Oil	69

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

17.	Tribological Properties of Textured Surface	72
18.	Thermal Analysis and Experimental Investigation of Pin Fin made of Brass	76
19.	Experimental and Simulation of Wear Test on GPR material	79
20.	CFD Analysis of Two Pass Double Pipe Heat Exchanger with TiO_2/Ethylene Glycol Nano Fluid	83
21.	Simulation and Optimization of Extrusion Process Parameters of Aluminium 2A12T4Alloy	87
22.	Importance of Ice Jet machining - A Review	91
23.	Performance Investigation of a Battery Powered Peltier Cooler	94
24.	Analysis of Disc Brake Rotor using ANSYS Workbench	98
25.	Modelling and Optimization of Two Wheeler Disk Brake Using ANSYS -Review	101
26.	Fabrication of Sewage Waste Cleaner	105
27.	Manufacturing of Hyperboliodal Gear Model Using Ultimaker S5 3D Printing Machine	109
28.	Arc Welding Process Selection Through Quality and Cost Analysis	113
29.	Li-Br H2O VAR System Analysis by Applying Magnetic Field to Liquid Line	117
30.	Heat Transfer Enhancement on Shell and Coil Type of Heat Exchanger Using SiO_2 and CuO Nano-Fluids	121
31.	Study of Rheological Characteristics of Nano Suspensions	126
32.	Design And Fabrication of Loop Wheel System	129
33.	Performance of Solar Vapour Absorption system and its Dependence on Generator Temperature	131
34.	Design and Analysis Of Handicapped Steering Tricycle	134
35.	Machining Characteristics and Microbiological Growth of Stir Casted A356-SiC MMCs and Pure Metals	136
36.	Design and Analysis of Connecting Rod	141

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

37.	Pressure Vessel Optimum Design using Particle Swarm Optimization	145
38.	Design and Analysis of Wheel Rim on Radial Loads	149
39.	COP Enhancement of VCR System using Diffusers	154
40.	Design and Fabrication of Radiant Cooling System	157
41.	Comparative Performance Analysis of Engine Fuelled with Diesel Biodiesel Iron Oxide Nano Particles	162
42.	Performance analysis of a CI Engine fuelled with olive oil and soybean oil mixture as a biofuels	166
43.	Design and Analysis of Landing Gear	170
44.	A Review on Parameters of Composite Materials	173
45.	Optimisation in WEDM of HCHCR Steel using Taughi Method	177
46.	Automated Pneumatic Sheet Metal Cutting Machine	184
47.	Cylindrical Panel's Numerical And Analytical Investigations Subjected To Different Loads	187
48.	Application of a Thermoplastic Polyurethane/Polylactic Acid Composite Filament For 3D-Printed Personalized Orthosis	192
49.	Design and Analysis of a Connecting Rod	196
50.	A Study and Synthesis of 8 Bar One Degree of Freedom Walking Mechanism	200
51.	Mechanical properties and machining of Al-7075 SiC Composite	204
52.	Characterization of Tungsten carbide reinforced Al7075 matrix Composites.	208
53.	3D Printing of Prototype Through Image Processing using Autodesk Recap Photo Software	212
54.	Fabrication and Testing Mechanical Behaviour of Hemp Fibre, Chopped E Glass and Hybrid with Nano Particle	216
55.	Optical characterization of V_2O_5 doped Na_2O-SiO_2-ZrO_2 glasses	218
56.	Determination of Efficient Location of Split Air Conditioner using CFD	221

57.	Frictionless Electromagnetic Braking System	225
58.	Performance Evaluation of Vegetable oils as Cutting fluid under MQL Condition in Turning	228
59.	A novel hybrid Fuzzy AHP and VIKOR methodology for Reclaimer Selection in GSCM	236
60.	Design of Eco-Friendly Road Cleaner	240
61.	Mechanical and Microstructural Characterization of Jute Hybrid Composite with Alkali Treatment	244
62.	Experimental Investigation and Optimization of Process Parameters in Wire Cut EDM of EN31 Steel	248
63.	Design and Analysis of Differential Gear Box	252

***

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

SMV ~~2025~~ 2021

ISBN: 978-93-91420-02-4

Performance Analysis of a CI Engine Fueled With Olive Oil and Soybean Oil Mixture as Biofuels

Nagul Meeravali Shai and Bajan Shaik.
Department of Mechanical Engineering, Narasaraopet Engineering College (A), Narasaraopet, Guntur, A.P. India.

***Abstract*—The aim of this research is to evaluate the performance of a CI diesel engine at various loads when it is fueled with a combination of olive oil and soybean biodiesel. All of the tests were conducted on a constant speed. Olive oil and soyabean oil mixtures are used as fuel in the diesel engine.in this research we use a combination two biofuels as a single fuel. When the engine was run with DSO-I, DSO -II, and DSO-III blends at full load, the engine generated brake thermal efficiency of 33.54%, 32.06% and 30.4% respectively, and the conventional fuel efficiency is 34.25%. NOx emissions were reduced greatly in DSO-II blend comparatively diesel and we observe slightly decrease in CO emissions in all blends. Based on the plots DSO-II biofuel is suitable for the fuel in diesel engine without any engine modifications.**

Keywords*— *pollution, Bio diesels, IC Engines, Brake Thermal Efficiency.

I. Introduction

India is the most important changeover and developing economy on the planet. India's utilization growth of non-renewable energy sources will be most elevated by 2035. The rapid development in economy means expanding air pollution and energy consumption. India energy consumption increases 4% per year. There is a link between the transport industry and the country's economic growth, which directly affects the demand for portable energy sources. The tremendous growth of vehicular pollution and industrialization of the world has led to steep rise in the demand for petroleum products. This has given rise to frequent disturbance and uncertainties and uncertainties in the supply of petroleum and its prices. This situation is likely in the long run a lead to diesel scarcity and ultimately its depletion. The rapid depletion of petroleum fuels and their ever increasing costs have led to an intensive search for alternative fuels. Also there was need to reduce consumption of conventional fuels in the developing countries. Urban air quality management continues to pitch through the development of two wheelers and light engine passenger cars on road transport. Newly licensed cars in India contribute 70-80% of domestic emissions of carbon dioxide and oxides of nitrogen. Abnormal automotive traffic circumstances contributed 31% to 57% of oxides of nitrogen and carbon dioxide respectively [1]. It is estimated that the contribution of the transport industry to carbon dioxide air pollution increases by 4-6% per year, leading to approximately seven times by 2050 [2]. Blends of Karanja and castor biodiesel with standard diesel in an unmodified single-cylinder DI diesel engine have been researched in multiple ratios directly in lowering emissions, whereas slight decreases in thermal efficiency have been observed and the concentration of blends rises the Brake specific fuel consumption, as well as the increased concentration of castor biodiesel, has resulted in increased HC, soot emissions, particulate matter NOX has been discovered to boost for all biodiesel mixtures [3]. Results acquired from light-duty diesel engine provided with used cooking sunflower oil and new sunflower oil biodiesel blends under steady speed and variable load conditions showed decreased emissions except NOX were higher than diesel at lower load circumstances. Waste cooking oil is suggested from the results [4]. Research on diesel engines with Jatropha and fish waste biodiesel mixtures resulted in lower carbon monoxide, HC and soot emissions, but exhaust gas temperatures and NOX were higher than diesel fuel [5]. The analytical validation of various biofuel blends in which average emissions were reduced by 4%, 15.6%, 43.3%, 3% and 37% for soya bean, jojoba curcas, veal oil, grease oil and pentanol respectively [6]. A single cylinder four-stroke DI diesel engine powered by Jatropha as alternative fuel delivered smooth performance with mildly enhanced BTE and decreased carbon oxides [7]. Adding Jamun seed powder and Jackfruit seed powder directly injected into a four-stroke single-cylinder computerized water-cooled diesel engine has resulted in enhanced efficiency up to certain limits and reduced oxides of nitrogen levels [8]. The combined impact of the injection timing and EGR method on a single cylinder four-stroke diesel engine possessively affected by a 10% reduction in NOX emissions from the motor operating waste plastic based oil and elevated performance compared to diesel fuel [9]. Black solder fly is used as alternative fuel in DI diesel engine to analyse the exhaust emissions it increases the oxides of nitrogen emissions as an alternative fuel. Higher oxides of nitrogen recorded in blends under 10% and 20% comparative to diesel [10]. Tyre pyrolitic oil used in a CRDI diesel engine of different proportions as an alternative fuel. From the outcomes it was concluded that the formation of carbon deposits was discovered, which also showed an enhanced Brake Thermal Efficiency of 30% [11]. Animal fat is used in alternative fuel in a single cylinder diesel engine have given remarkable reductions in emissions except oxides of nitrogen [12]. Common single-cylinder rail direct injection DI diesel engine running at higher fuel injection pressures and higher fuel injection times showed enhanced BTE with lower HC and NOX [13]. Mahua methyl esters used as biodiesel on CRDI engines at higher FIP have revealed improved combustion characteristics resulting in enhanced brake thermal efficiency with reduced oxides of carbon, oxides of nitrogen and unburnt hydrocarbons [14]. Honge biodiesel as an alternative fuel on Common rail diesel injection is coupled with Exhaust gas recirculation setup operating with multi injection at 900 bar and 15% EGR has resulted in higher Brake thermal efficiency and decreased CO, CO2, particulate matter, unburnt hydrocarbons and nitrogen oxides [15]. Lemon peel oil is used as a biodiesel in common rail diesel injection system couples with exhaust gas recirculation. The EGR mass flow rate were 10% shows the decreases in SFC and reduction in soot emissions, oxides of carbon and oxides of nitrogen [16]. Higher Exhaust gas recirculation flow rates shown adverse effects on Brake thermal efficiency of light duty diesel engine whereas 5%

NEC NARASARAOPETA ENGINEERING COLLEGE (AUTONOMOUS)

NAAC 'A' GRADE | NBA NATIONAL BOARD OF ACCREDITATION | RANKED 5

PROCEEDINGS

INTERNATIONAL CONFERENCE

EMERGING TRENDS IN MECHANICAL ENGINEERING AND INDUSTRIAL AUTOMATION

NEC-ICETMEIA-2K21

30th & 31st July, 2021

Editors-in-Chief

Dr. M.Sreenivasa Kumar
Principal & Professor, Dept. of Mechnical Engineering

Dr. D.Jagadish
Professor, Dept. of Mechnical Engineering

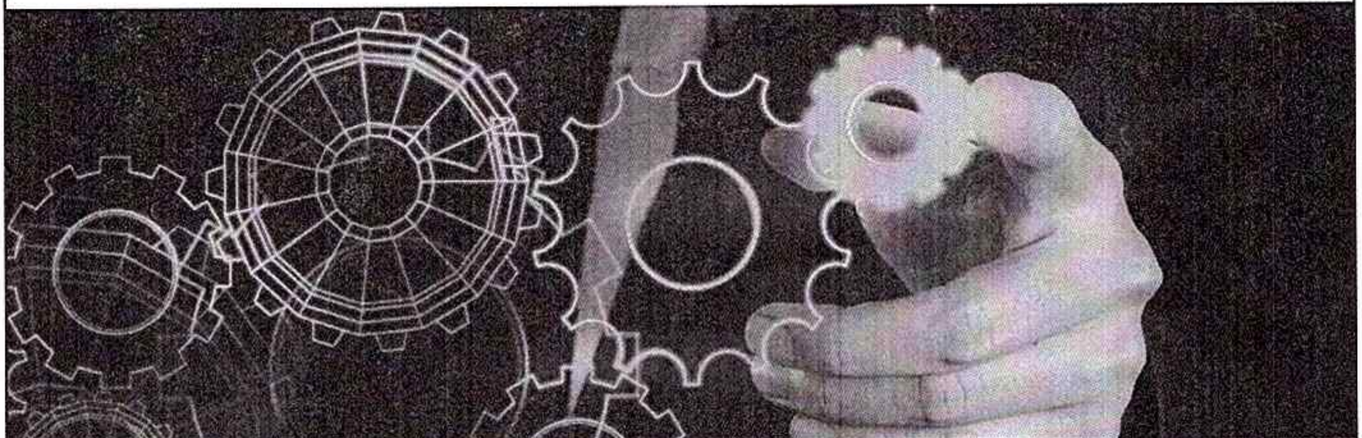
Editors

Dr. D.Suneel
Vice-Principal & Professor, Dept. of ME

Dr. P.Suresh Babu
Professor, Dept. of ME

Dr. B.Venkata Siva
Professor & HoD Dept. of ME

Mr. M.Venkanna Babu
Associate Professor, Dept. of ME



Organized by

Department of **Mechanical Engineering**

In Association with **The Institution of Engineers (India)**

ISBN : 978-93-91420-02-4

LIST OF FULL LENGTH PAPERS SELECTED FOR PROCEEDINGS

International Conference on Emerging Trends in Mechanical Engineering and Industrial Automation

NEC-ICETMEIA- 2K21

S.No.	TITLE OF THE PAPER	Page No.
1.	Effectiveness of Compression Ignition Engine Fuelled with Pond Water Algae Biodiesel	01
2.	Design And Analysis of Disc Brake of an Electric Go-Kart	04
3.	A Comprehensive Review on Recent Research on Semi Solid Processed Aluminum 7 Series Alloys	08
4.	A Study on Microstructure and Mechanical Properties A7075 Reinforced with Flyash/Sic Hybrid Metal Matrix Composite	15
5.	Establishment of SCR Test Facility and Evaluation of 8mm Pitch Honeycomb Type Catalyst in a 20 Liter capacity SCR Test facility	19
6.	A Review on NVH Issues and Technological Challenges in Electric Vehicle and Hybrid Electric Vehicle Power Train	25
7.	Design and Analysis of Cantilever Beam	29
8.	Analysis of Static and Fatigue Strength of Aluminium Alloy Wheel	32
9.	Design of Automated Braking System Based on Vehicle Over Speed Using PLC Ladder Method	35
10.	The Analysis on Concentric Pipe Heat Exchanger	39
11.	Design and Finite Element Analysis of Gas Turbine Blade	45
12.	Investigation on Mechanical Properties of Glass Fiber and Carbon Nano Tubes Sandwich Composite Material	47
13.	CFD Analysis of Super Utility Vehicle to Determine Aerodynamic Behavior	54
14.	Devlopment of Code for Automated HVAC System using Digital Controller	60
15.	Performance and Emission Characteristics Of Diesel Engine with Linseed Oil-Diesel Blends as Fuel With VCR	65
16.	Experimental Investigation in Single Cylinder VCR Multifuel Engine Using Bio-Diesel as Linseed Oil	69

17.	Tribological Properties of Textured Surface	72
18.	Thermal Analysis and Experimental Investigation of Pin Fin made of Brass	76
19.	Experimental and Simulation of Wear Test on GPR material	79
20.	CFD Analysis of Two Pass Double Pipe Heat Exchanger with TiO_2/Ethylene Glycol Nano Fluid	83
21.	Simulation and Optimization of Extrusion Process Parameters of Aluminium 2A12T4Alloy	87
22.	Importance of Ice Jet machining - A Review	91
23.	Performance Investigation of a Battery Powered Peltier Cooler	94
24.	Analysis of Disc Brake Rotor using ANSYS Workbench	98
25.	Modelling and Optimization of Two Wheeler Disk Brake Using ANSYS -Review	101
26.	Fabrication of Sewage Waste Cleaner	105
27.	Manufacturing of Hyperboliodal Gear Model Using Ultimaker S5 3D Printing Machine	109
28.	Arc Welding Process Selection Through Quality and Cost Analysis	113
29.	Li-Br H2O VAR System Analysis by Applying Magnetic Field to Liquid Line	117
30.	Heat Transfer Enhancement on Shell and Coil Type of Heat Exchanger Using SiO_2 and CuO Nano-Fluids	121
31.	Study of Rheological Characteristics of Nano Suspensions	126
32.	Design And Fabrication of Loop Wheel System	129
33.	Performance of Solar Vapour Absorption system and its Dependence on Generator Temperature	131
34.	Design and Analysis Of Handicapped Steering Tricycle	134
35.	Machining Characteristics and Microbiological Growth of Stir Casted A356-SiC MMCs and Pure Metals	136
36.	Design and Analysis of Connecting Rod	141

37.	Pressure Vessel Optimum Design using Particle Swarm Optimization	145
38.	Design and Analysis of Wheel Rim on Radial Loads	149
39.	COP Enhancement of VCR System using Diffusers	154
40.	Design and Fabrication of Radiant Cooling System	157
41.	Comparative Performance Analysis of Engine Fuelled with Diesel Biodiesel Iron Oxide Nano Particles	162
42.	Performance analysis of a CI Engine fuelled with olive oil and soybean oil mixture as a biofuels	166
43.	Design and Analysis of Landing Gear	170
44.	A Review on Parameters of Composite Materials	173
45.	Optimisation in WEDM of HCHCR Steel using Taughi Method	177
46.	Automated Pneumatic Sheet Metal Cutting Machine	184
47.	Cylindrical Panel's Numerical And Analytical Investigations Subjected To Different Loads	187
48.	Application of a Thermoplastic Polyurethane/Polylactic Acid Composite Filament For 3D-Printed Personalized Orthosis	192
49.	Design and Analysis of a Connecting Rod	196
50.	A Study and Synthesis of 8 Bar One Degree of Freedom Walking Mechanism	200
51.	Mechanical properties and machining of Al-7075 SiC Composite	204
52.	Characterization of Tungsten carbide reinforced Al7075 matrix Composites.	208
53.	3D Printing of Prototype Through Image Processing using Autodesk Recap Photo Software	212
54.	Fabrication and Testing Mechanical Behaviour of Hemp Fibre, Chopped E Glass and Hybrid with Nano Particle	216
55.	Optical characterization of V_2O_5 doped Na_2O-SiO_2-ZrO_2 glasses	218
56.	Determination of Efficient Location of Split Air Conditioner using CFD	221

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

57.	Frictionless Electromagnetic Braking System	225
58.	Performance Evaluation of Vegetable oils as Cutting fluid under MQL Condition in Turning	228
59.	A novel hybrid Fuzzy AHP and VIKOR methodology for Reclaimer Selection in GSCM	236
60.	Design of Eco-Friendly Road Cleaner	240
61.	Mechanical and Microstructural Characterization of Jute Hybrid Composite with Alkali Treatment	244
62.	Experimental Investigation and Optimization of Process Parameters in Wire Cut EDM of EN31 Steel	248
63.	Design and Analysis of Differential Gear Box	252

***

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

APIC 2021

 ISBN: 978-93-91420-02-4

A Review on Parameters of Composite Materials

A.Pavan Kumar and Shaik Chand Mabhu Subhani
Department of Mechanical Engineering, Narasaraopet Engineering College (A), Narasaraopet, Guntur, A.P. India.

***Abstract*— In the present work Taguchi method is used to optimize tensile strength and hardness of the stir casted LM 26 Al/RHA/RM hybrid composites. Taguchi's L_9 orthogonal array is used for experimental design. Overall performance of the stir casting method is improved significantly by combining the experimental and analytical concepts and the most important parameter is determined on the result response. Hybrid composites are prepared by stir casting technique using three different parameters, stirring time, stirring speed, and weight fraction of the reinforcement particles. Better parameters for highest tensile strength and hardness to the castings are predicted by Taguchi technique and then composites are prepared at these parameters. The experimental and analytical results proved that the Taguchi method was successful in predicting the parameters that give the highest properties. From analysis of variance (ANOVA) test weight fraction is the most influential parameter on the tensile strength and hardness results of castings.**

Keywords: LM 26 Al/RHA/RM hybrid Composites; Taguchi method; ANOVA; Tensile strength; Hardness.

I. Introduction

Aluminium-based composite exhibit many attractive material properties such as increased stiffness, wear resistance, specific strength and vibration damping and decreased coefficient of thermal expansion compared with the conventional aluminium alloys [Donnell and Looney (2001)]. Al–Si alloys are widely used for various automobile applications owing to their high corrosion resistance, good castability and low density [Hemanth (2005)]. Taguchi technique is a powerful tool for the design of high quality systems [Luangvaranunt *et al.* (2010); Siva Prasad and Rama Krishna (2011)].It provides a simple efficient and systematic approach to optimize design for performance, quality and cost. The methodology is valuable when design parameters are qualitative and discrete. Taguchi parameter design can optimize the performance characteristic through the setting of design parameters and reduce the sensitivity of the system performance to source of variation [Taguchi and Konishi (1997)]. Dingal *et al.* [2004] used Taguchi method to find out the significant factors influencing density, porosity and hardness on selective laser sintering of iron powder. Guharaja *et al.* [2006] made an attempt to obtain optimal settings of green sand casting parameters using Taguchi method. Rama Rao and padmanabhan [2012] used Taguchi method and ANOVA in optimization of process parameters for material removal rate in electrochemical machining of Al/5% SiC composites. Nataraj *et al.* [2005] used risk analysis Taguchi method to find optimum conditions of design parameters. Barua *et al.* [1997] used the Taguchi Method to optimize the mechanical properties of V (Vacuum) casting process. In this paper they consider the effects of the selected process parameters on the mechanical properties of alloy casting and subsequent optimal settings of the parameters, which are accomplished using Taguchi's Parameter Design Approach.

In the present study, the Taguchi method is used to obtain optimum tensile strength and hardness in the casting process of LM 26 Al/RHA/RM hybrid Composites. Finally, ANOVA and confirmation test have been conducted to validate the test result.

II. Materials and Methods

A. Experimental work

Fabrication of LM 26 Al, rice husk ash and red mud (LM 26 Al/RHA/RM) hybrid composites were carried out by stir casting equipment as shown in Fig. 1. In the present work red mud was maintained constant at 5 wt% and rice husk ash was varied at 5, 10 and 15 wt% while preparing the hybrid composites.

Fig.1. Stir casting equipment

Based on the literature available, the experimental conditions shown in Table 1 are selected as input casting parameters to study the influence of theses parameters on tensile strength and hardness of the fabricated composites. A measured amount of LM 26 aluminium alloy was taken into a graphite crucible and melted in an electric furnace. A measured amount of RHA and RM powder was preheated at 150^{0}C for 20 minutes and then added to the melt. After that, the melt was stirred inside the furnace at different speed and times to make a vortex in order to disperse the particles in the melt. The melt temperature was controlled around 700^{0}C and poured into an EN8 steel die. The dimensions of the resulted castings are 30 mm diameter and 120mm length cylindrical rod. The fabricated composites were observed with scanning electron microscope (SEM). The SEM picture shows the uniform distribution of the RHA and RM particles in the LM 26 Al alloy as shown in Fig. 2. Tensile specimens of hybrid composites were prepared according to ASTM E-8 specification. The tensile test was performed at room temperature on a Universal Testing Machine of 10T (model Dak UTB9103). The hardness of each specimen is measured by using Vickers hardness apparatus type Zwick & Co., Germany.

TABLE I. Control Factors and Levels

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

NEC NARASARAOPETA ENGINEERING COLLEGE (AUTONOMOUS)

NAAC A GRADE

NBA NATIONAL BOARD of ACCREDITATION

RANKED 5

PROCEEDINGS

INTERNATIONAL CONFERENCE

EMERGING TRENDS IN MECHANICAL ENGINEERING AND INDUSTRIAL AUTOMATION

NEC-ICETMEIA-2K21

30th & 31st July, 2021

Editors-in-Chief

Dr. M.Sreenivasa Kumar
Principal & Professor, Dept. of Mechnical Engineering

Dr. D.Jagadish
Professor, Dept. of Mechnical Engineering

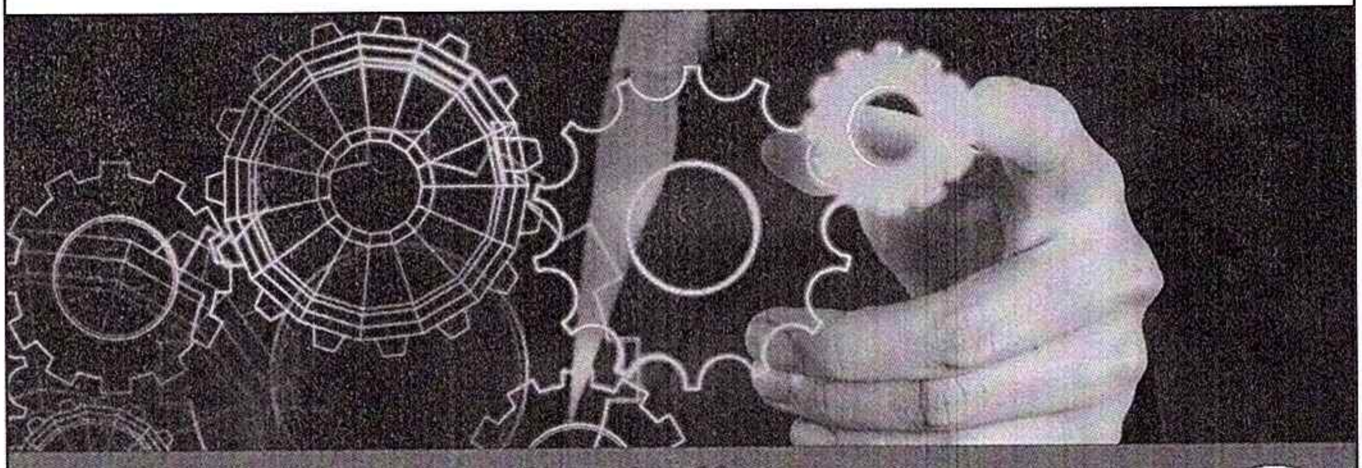
Editors

Dr. D.Suneel
Vice-Principal & Professor, Dept. of ME

Dr. B.Venkata Siva
Professor & HoD Dept. of ME

Dr. P.Suresh Babu
Professor, Dept. of ME

Mr. M.Venkanna Babu
Associate Professor, Dept. of ME



Organized by

Department of Mechanical Engineering

In Association with The Institution of Engineers (India)

ISBN : 978-93-91420-02-4

LIST OF FULL LENGTH PAPERS SELECTED FOR PROCEEDINGS

International Conference on Emerging Trends in Mechanical Engineering and Industrial Automation

NEC-ICETMEIA- 2K21

S.No.	TITLE OF THE PAPER	Page No.
1.	Effectiveness of Compression Ignition Engine Fuelled with Pond Water Algae Biodiesel	01
2.	Design And Analysis of Disc Brake of an Electric Go-Kart	04
3.	A Comprehensive Review on Recent Research on Semi Solid Processed Aluminum 7 Series Alloys	08
4.	A Study on Microstructure and Mechanical Properties A7075 Reinforced with Flyash/Sic Hybrid Metal Matrix Composite	15
5.	Establishment of SCR Test Facility and Evaluation of 8mm Pitch Honeycomb Type Catalyst in a 20 Liter capacity SCR Test facility	19
6.	A Review on NVH Issues and Technological Challenges in Electric Vehicle and Hybrid Electric Vehicle Power Train	25
7.	Design and Analysis of Cantilever Beam	29
8.	Analysis of Static and Fatigue Strength of Aluminium Alloy Wheel	32
9.	Design of Automated Braking System Based on Vehicle Over Speed Using PLC Ladder Method	35
10.	The Analysis on Concentric Pipe Heat Exchanger	39
11.	Design and Finite Element Analysis of Gas Turbine Blade	45
12.	Investigation on Mechanical Properties of Glass Fiber and Carbon Nano Tubes Sandwich Composite Material	47
13.	CFD Analysis of Super Utility Vehicle to Determine Aerodynamic Behavior	54
14.	Devlopment of Code for Automated HVAC System using Digital Controller	60
15.	Performance and Emission Characteristics Of Diesel Engine with Linseed Oil-Diesel Blends as Fuel With VCR	65
16.	Experimental Investigation in Single Cylinder VCR Multifuel Engine Using Bio-Diesel as Linseed Oil	69

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

17.	Tribological Properties of Textured Surface	72
18.	Thermal Analysis and Experimental Investigation of Pin Fin made of Brass	76
19.	Experimental and Simulation of Wear Test on GPR material	79
20.	CFD Analysis of Two Pass Double Pipe Heat Exchanger with TiO_2/Ethylene Glycol Nano Fluid	83
21.	Simulation and Optimization of Extrusion Process Parameters of Aluminium 2A12T4Alloy	87
22.	Importance of Ice Jet machining - A Review	91
23.	Performance Investigation of a Battery Powered Peltier Cooler	94
24.	Analysis of Disc Brake Rotor using ANSYS Workbench	98
25.	Modelling and Optimization of Two Wheeler Disk Brake Using ANSYS -Review	101
26.	Fabrication of Sewage Waste Cleaner	105
27.	Manufacturing of Hyperboliodal Gear Model Using Ultimaker S5 3D Printing Machine	109
28.	Arc Welding Process Selection Through Quality and Cost Analysis	113
29.	Li-Br H2O VAR System Analysis by Applying Magnetic Field to Liquid Line	117
30.	Heat Transfer Enhancement on Shell and Coil Type of Heat Exchanger Using SiO_2 and CuO Nano-Fluids	121
31.	Study of Rheological Characteristics of Nano Suspensions	126
32.	Design And Fabrication of Loop Wheel System	129
33.	Performance of Solar Vapour Absorption system and its Dependence on Generator Temperature	131
34.	Design and Analysis Of Handicapped Steering Tricycle	134
35.	Machining Characteristics and Microbiological Growth of Stir Casted A356-SiC MMCs and Pure Metals	136
36.	Design and Analysis of Connecting Rod	141

37.	Pressure Vessel Optimum Design using Particle Swarm Optimization	145
38.	Design and Analysis of Wheel Rim on Radial Loads	149
39.	COP Enhancement of VCR System using Diffusers	154
40.	Design and Fabrication of Radiant Cooling System	157
41.	Comparative Performance Analysis of Engine Fuelled with Diesel Biodiesel Iron Oxide Nano Particles	162
42.	Performance analysis of a CI Engine fuelled with olive oil and soybean oil mixture as a biofuels	166
43.	Design and Analysis of Landing Gear	170
44.	A Review on Parameters of Composite Materials	173
45.	Optimisation in WEDM of HCHCR Steel using Taughi Method	177
46.	Automated Pneumatic Sheet Metal Cutting Machine	184
47.	Cylindrical Panel's Numerical And Analytical Investigations Subjected To Different Loads	187
48.	Application of a Thermoplastic Polyurethane/Polylactic Acid Composite Filament For 3D-Printed Personalized Orthosis	192
49.	Design and Analysis of a Connecting Rod	196
50.	A Study and Synthesis of 8 Bar One Degree of Freedom Walking Mechanism	200
51.	Mechanical properties and machining of Al-7075 SiC Composite	204
52.	Characterization of Tungsten carbide reinforced Al7075 matrix Composites.	208
53.	3D Printing of Prototype Through Image Processing using Autodesk Recap Photo Software	212
54.	Fabrication and Testing Mechanical Behaviour of Hemp Fibre, Chopped E Glass and Hybrid with Nano Particle	216
55.	Optical characterization of V_2O_5 doped Na_2O-SiO_2-ZrO_2 glasses	218
56.	Determination of Efficient Location of Split Air Conditioner using	221

57.	Frictionless Electromagnetic Braking System	225
58.	Performance Evaluation of Vegetable oils as Cutting fluid under MQL Condition in Turning	228
59.	A novel hybrid Fuzzy AHP and VIKOR methodology for Reclaimer Selection in GSCM	236
60.	Design of Eco-Friendly Road Cleaner	240
61.	Mechanical and Microstructural Characterization of Jute Hybrid Composite with Alkali Treatment	244
62.	Experimental Investigation and Optimization of Process Parameters in Wire Cut EDM of EN31 Steel	248
63.	Design and Analysis of Differential Gear Box	252

***

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET
Guntur (Dist.)

DJ-2021

ISBN: 978-93-91420-02-4

Experimental Investigation in Single Cylinder VCR Multifuel Engine Using Bio-Diesel as Linseed Oil

[1]Donepudi Jagadish, [2]M.Venkaiah, [3]Ch. Shekar and [4]Jyothu Naik
[1,2,3]Department of Mechanical Engineering, Narasaraopeta Engineering College (A), Narasaraopet, India.
[4]Department of Mechanical Engineering, Rayalaseema University College of Engineering, Kurnool, A.P. India

Abstract— **The linseed oil is characterized for engine performance, combustion and emission analysis at various compression ratios (CR-14, 16, and 18) and fuel blends (B9, B18, B27, B36%, and Diesel). The brake thermal efficiency (BTHE) at CR18 is higher at full load condition for all blend ratios that may be due to lower brake specific fuel consumption (BSFC) and complete combustion of mixture with excess oxygen in the biodiesel. The BSFC is decreased on increasing brake power (BP) and CR. The exhaust gas temperature is decreased (3%) on increase in CR from 14 to 18. The cylinder peak pressures and net heat release rate are lower than that of diesel because of lower heating value. The hydro carbon (HC), carbon monoxide (CO), and carbon dioxide (CO2) emissions decreases while increasing the compression ratio, however, nitrogen oxide (NOx) emission is increased with CR for all fuel blends and these properties were progressively lower for higher concentration of biodiesel. Overall engine performance is optimum at CR of 18 for B18 fuel blend.**

Keywords— VCR Engine, Multi Fuel, Fuel Efficiency.

I. Introduction

A VCR engine has been widely tested these days to bring out the best fuel efficiency and also to minimize the pollutants[1-2]. Various tests have been made these days by the researchers using this VCR engines to bring out the comparison results using petrol or diesel. This works investigates on a single cylinder multi fuel VCR Engine at 2 compression ratios 16:1 and 18:1 respectively. Petrol engines have the tendency to limit the max pressure during a compression stroke which would result in detonation rather than burning, and hence to achieve this max

Power output along with its same speed, more amount of fuel is to be burnt. This would result in the requirement of more amount of air for burning the fuel[3-7]. This brings in the use of the turbochargers and superchargers for increasing the pressure at the inlet. This would result in decrease in the compression ratio of the detonation in the fuel or air mixture i.e. the volume above the piston is made greater. This can be done to a greater or lesser extent with a very massive increase in power being possible.

Variable Compression Ratio is becoming very much desirable as the oil cost increase and car owners have an interest in fuel economy[12]. In addition to this, the Global Climate Warming may require some measures from the international community. In this Automobile industry, it has stricter limits in the case of car emissions, especially the emission of carbon di oxide. VCR is one cost effective way of to achieve these targets of pollutants. In addition, VCR permits the use of blended diesel with ethanol[8-11]. The cylinder head of an VCR engine is varied by the hydraulic system that is connected to the crank shaft and it could also provide some potential in order to control the temperature of the emitted exhaust gas, contributing to protecting component temperatures. A VCR Engine's efficiency and its performance can be continuously varied by the compression ratio by changing the combustion chamber volume..

• MATERIALS AND METHODOLOGY

The VCR engine which is capable of varying the compression ratio has been used to test the performance of diesel at two compression ratios (16:1 and 18:1). This test is then compared with one another to obtain the best performance results. Compression Ratio can be changed in a number of ways:

- Changing the piston head design.
- Changing the stroke length of the cylinder
- Changing cylinder diameter
- Changing the air fuel ratio.

Table 1 Engine Specification

Parameter	Specification
Compression Ratio	Variable from 5:1 to 20:1
No of Cylinder	Single Cylinder
Cooling	Water Cooling
Spark Timing	Variable from 0 to 70 Deg.
Fuel	Petrol / Diesel
Speed	1400 to 1500 RPM
Lubrication	Forced
Ignition Type	Spark Ignition or Compression Ignition

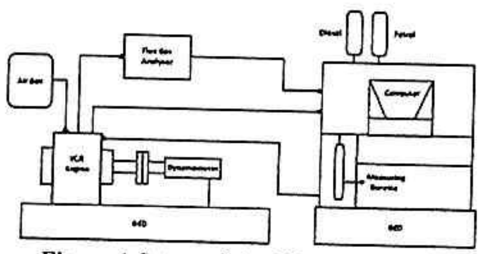


Figure 1 Set up of the VCR Engine

NEC NARASARAOPETA ENGINEERING COLLEGE (AUTONOMOUS)

NAAC 'A' GRADE

NBA NATIONAL BOARD OF ACCREDITATION

PROCEEDINGS

INTERNATIONAL CONFERENCE

EMERGING TRENDS IN MECHANICAL ENGINEERING AND INDUSTRIAL AUTOMATION

NEC-ICETMEIA-2K21

30th & 31st July, 2021

Editors-in-Chief

Dr. M.Sreenivasa Kumar
Principal & Professor, Dept. of Mechnical Engineering

Dr. D.Jagadish
Professor, Dept. of Mechnical Engineering

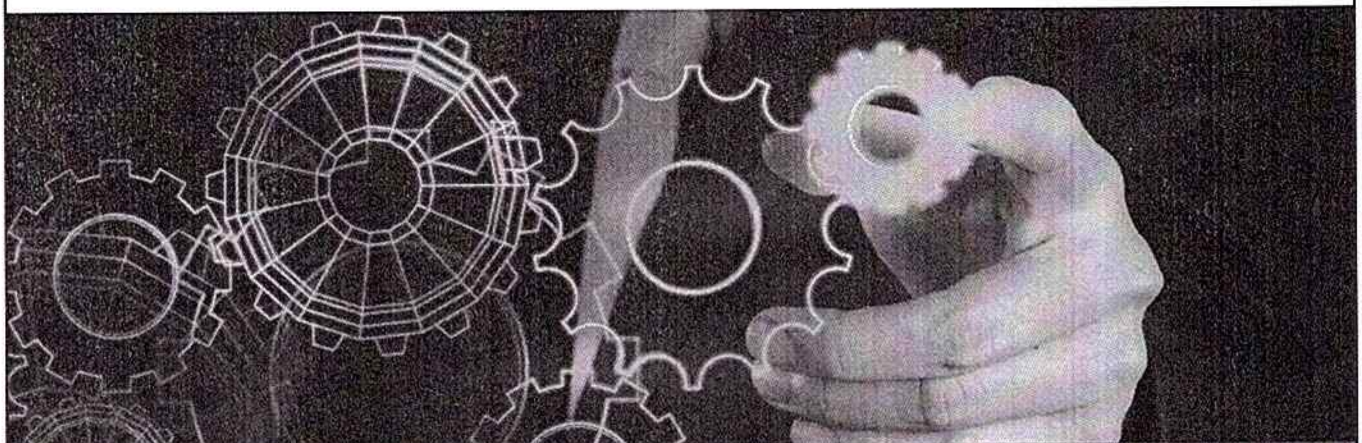
Editors

Dr. D.Suneel
Vice-Principal & Professor, Dept. of ME

Dr. B.Venkata Siva
Professor & HoD Dept. of ME

Dr. P.Suresh Babu
Professor, Dept. of ME

Mr. M.Venkanna Babu
Associate Professor, Dept. of ME



Organized by

Department of **Mechanical Engineering**

In Association with *The Institution of Engineers (India)*

ISBN : 978-93-91420-02-4

LIST OF FULL LENGTH PAPERS SELECTED FOR PROCEEDINGS

International Conference on Emerging Trends in Mechanical Engineering and Industrial Automation

NEC-ICETMEIA- 2K21

S.No.	TITLE OF THE PAPER	Page No.
1.	Effectiveness of Compression Ignition Engine Fuelled with Pond Water Algae Biodiesel	01
2.	Design And Analysis of Disc Brake of an Electric Go-Kart	04
3.	A Comprehensive Review on Recent Research on Semi Solid Processed Aluminum 7 Series Alloys	08
4.	A Study on Microstructure and Mechanical Properties A7075 Reinforced with Flyash/Sic Hybrid Metal Matrix Composite	15
5.	Establishment of SCR Test Facility and Evaluation of 8mm Pitch Honeycomb Type Catalyst in a 20 Liter capacity SCR Test facility	19
6.	A Review on NVH Issues and Technological Challenges in Electric Vehicle and Hybrid Electric Vehicle Power Train	25
7.	Design and Analysis of Cantilever Beam	29
8.	Analysis of Static and Fatigue Strength of Aluminium Alloy Wheel	32
9.	Design of Automated Braking System Based on Vehicle Over Speed Using PLC Ladder Method	35
10.	The Analysis on Concentric Pipe Heat Exchanger	39
11.	Design and Finite Element Analysis of Gas Turbine Blade	45
12.	Investigation on Mechanical Properties of Glass Fiber and Carbon Nano Tubes Sandwich Composite Material	47
13.	CFD Analysis of Super Utility Vehicle to Determine Aerodynamic Behavior	54
14.	Devlopment of Code for Automated HVAC System using Digital Controller	60
15.	Performance and Emission Characteristics Of Diesel Engine with Linseed Oil-Diesel Blends as Fuel With VCR	65
16.	Experimental Investigation in Single Cylinder VCR Multifuel Engine Using Bio-Diesel as Linseed Oil	69

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

17.	Tribological Properties of Textured Surface	72
18.	Thermal Analysis and Experimental Investigation of Pin Fin made of Brass	76
19.	Experimental and Simulation of Wear Test on GPR material	79
20.	CFD Analysis of Two Pass Double Pipe Heat Exchanger with TiO_2/Ethylene Glycol Nano Fluid	83
21.	Simulation and Optimization of Extrusion Process Parameters of Aluminium 2A12T4Alloy	87
22.	Importance of Ice Jet machining - A Review	91
23.	Performance Investigation of a Battery Powered Peltier Cooler	94
24.	Analysis of Disc Brake Rotor using ANSYS Workbench	98
25.	Modelling and Optimization of Two Wheeler Disk Brake Using ANSYS -Review	101
26.	Fabrication of Sewage Waste Cleaner	105
27.	Manufacturing of Hyperboliodal Gear Model Using Ultimaker S5 3D Printing Machine	109
28.	Arc Welding Process Selection Through Quality and Cost Analysis	113
29.	Li-Br H2O VAR System Analysis by Applying Magnetic Field to Liquid Line	117
30.	Heat Transfer Enhancement on Shell and Coil Type of Heat Exchanger Using SiO_2 and CuO Nano-Fluids	121
31.	Study of Rheological Characteristics of Nano Suspensions	126
32.	Design And Fabrication of Loop Wheel System	129
33.	Performance of Solar Vapour Absorption system and its Dependence on Generator Temperature	131
34.	Design and Analysis Of Handicapped Steering Tricycle	134
35.	Machining Characteristics and Microbiological Growth of Stir Casted A356-SiC MMCs and Pure Metals	136
36.	Design and Analysis of Connecting Rod	141

37.	Pressure Vessel Optimum Design using Particle Swarm Optimization	145
38.	Design and Analysis of Wheel Rim on Radial Loads	149
39.	COP Enhancement of VCR System using Diffusers	154
40.	Design and Fabrication of Radiant Cooling System	157
41.	Comparative Performance Analysis of Engine Fuelled with Diesel Biodiesel Iron Oxide Nano Particles	162
42.	Performance analysis of a CI Engine fuelled with olive oil and soybean oil mixture as a biofuels	166
43.	Design and Analysis of Landing Gear	170
44.	A Review on Parameters of Composite Materials	173
45.	Optimisation in WEDM of HCHCR Steel using Taughi Method	177
46.	Automated Pneumatic Sheet Metal Cutting Machine	184
47.	Cylindrical Panel's Numerical And Analytical Investigations Subjected To Different Loads	187
48.	Application of a Thermoplastic Polyurethane/Polylactic Acid Composite Filament For 3D-Printed Personalized Orthosis	192
49.	Design and Analysis of a Connecting Rod	196
50.	A Study and Synthesis of 8 Bar One Degree of Freedom Walking Mechanism	200
51.	Mechanical properties and machining of Al-7075 SiC Composite	204
52.	Characterization of Tungsten carbide reinforced Al7075 matrix Composites.	208
53.	3D Printing of Prototype Through Image Processing using Autodesk Recap Photo Software	212
54.	Fabrication and Testing Mechanical Behaviour of Hemp Fibre, Chopped E Glass and Hybrid with Nano Particle	216
55.	Optical characterization of V_2O_5 doped Na_2O-SiO_2-ZrO_2 glasses	218
56.	Determination of Efficient Location of Split Air Conditioner using CFD	221

57.	Frictionless Electromagnetic Braking System	225
58.	Performance Evaluation of Vegetable oils as Cutting fluid under MQL Condition in Turning	228
59.	A novel hybrid Fuzzy AHP and VIKOR methodology for Reclaimer Selection in GSCM	236
60.	Design of Eco-Friendly Road Cleaner	240
61.	Mechanical and Microstructural Characterization of Jute Hybrid Composite with Alkali Treatment	244
62.	Experimental Investigation and Optimization of Process Parameters in Wire Cut EDM of EN31 Steel	248
63.	Design and Analysis of Differential Gear Box	252

***

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

PSR -2021

ISBN: 978-93-91420-02-4

Comparative Performance Analysis of Engine Fuelled with Diesel Biodiesel Iron Oxide Nano Particles

Donepudi Jagadish, Ch. Sekhar, P. Srinivasa Rao, Sk Bajan
Department of Mechanical Engineering, Narasaraopet Engineering College (A), Narasaraopet, Guntur, A.P. India.

Abstract: Energy demand is the hot topic of all developing and developed countries. Energy demand has been increasing day by day at a high rate. So, it is necessary to find an alternative solution that is eco-friendly. Biodiesel can be the alternative solution for this problem. The main purpose of this paper is to test the engine performance and emission parameters of a diesel engine using animal fat biodiesel (fatty acid methyl esters) with diesel and using iron oxide Nano particles as additive. The parameters measured are volumetric efficiency, brake thermal efficiency, specific fuel consumption, mass fuel consumption and emission parameters are CO2, CO, NOx, and O2andHC.

I.INTRODUCTION

The need of diesel fuel is increasing in the current situations from several industries and vehicles. Simultaneously, because of its high compression ratio it increases the pollution to the environment. The demand for petroleum products and the cost is increasing day by day, so considering into current and future requirements for the usage of petroleum products there is a need of alternative fuels. The addition of biodiesel to diesel fuel improves the performance and emission characteristics of the diesel engine. The optimized biodiesel mix can Reduce some important portion of fuel dependency and surroundings from pollution with none modification to the diesel engine. The oxygen content presence in biodiesel reduces the carbon monoxide and hydrocarbons emissions and it increases the NOx formation at the exhaust. It leads to incomplete combustion due to poor atomization and to reduce the viscosity, pouring point and increasing the calorific value of biodiesel many researches have been carried out by researchers on different types of additives. The additives, metal and platinum based blended biodiesel improve the diesel engine performance and emission characteristics, but increases the size of the particles and accumulate less. Iron oxide has high level of purity in water and release hydrogen which provides more surface area helps in the combustion process. The optimum fuel with iron oxide brake thermal efficiency (Bth%) increased and specific fuel consumption minimized as related to neat diesel. The emissions carbon monoxide (CO) and hydrocarbons (HC) reduced respectively however increase in NOX were observed. Improved hydrocarbon and carbon monoxide with addition of nanoparticles blended biodiesel compared to biodiesel. Reduced NOx with iron oxide nanoparticles due to sufficient fuel accumulation made early combustion and reduced ignition delay. Increase in brake thermal efficiency for biodiesel-ethanol blend was observed due to better mixing abilities of nanoparticles in the presence of oxygen and significant reduction in unburnt hydrocarbon sand carbon monoxide as compared to diesel at 1/4th and 1/2nd percentage load. Brake thermal efficiency increased as compared to biodiesel and exhaust emissions hydrocarbons, carbon monoxide and NOx were reduced with nanoparticles compared to biodiesel. The higher dosage of alumina nanoparticles to diesel increased brake thermal efficiency compared to diesel and reduced carbon monoxide, hydrocarbons and NOx with iron oxide nanoparticles in comparison with diesel. The addition of Fe_2O_3 nano particles to biodiesel (B20) in compression ignition engine were improved performance and reduced emissions hydrocarbon, carbon monoxide and NOx with nano additives in diesel engine as compared to biodiesel.

The nanoparticles by mass fraction 50ppm, 100ppm and 150 ppm were added to diesel fuel and compared the results with diesel. Observed that average brake thermal efficiency increased with nanoparticle dosages compared to diesel fuel. Exhaust emissions were decreased after 25% of the load than the diesel fuel. Bio-diesel with iron metal oxide nanoparticles added on the diesel engine with various dosages of nanoparticles resulted in lower BTE, BSFC and exhaust emissions compared to diesel. However, increase in NOx was noted with nanoparticles Investigations from researchers were carried out on iron oxide nanoparticles to see the effect of additions on performance and emission characteristics of the diesel engine. In the literature review most of the researchers established the addition of varying dosages of iron oxide nanoparticles in biodiesel blends and in diesel increases the calorific value of the fuel and found improvement in specific fuel consumption and brake thermal efficiency. Results also showed iron oxide nanoparticles to diesel and biodiesel. Also, with lower dosage levels of iron nano particle as additive in B10 and B20, the BTE, BSFC and emissions characteristics were comparable with the diesel. The objectives of the present paper are to see the influence of addition of iron oxide nanoparticles blended with animal fat-based biodiesel on the CI engine for understanding the performance and emissions characteristics. The outcome of this study is improvement in the engine performance and exhaust emissions

MATERIALS AND METHODS

Some of the paper mentioned here are the works done on implementation of biodiesel in the present engines. Most of the results are in favour of biodiesel showing improvement in performance and emissions.

D. Jagadish et al. [1] mentioned that usage of biofuels received much attention in the current situation of depleting fossil-fuel reserves and in-creased emission legislation. Many ideas have been implemented upon usage of biofuels for energy production to achieve low-emission levels. Internal combustion engines are the basic prime movers for power generation as well as for transportation purpose, which are basically run on fossil petroleum.

NEC NARASARAOPETA ENGINEERING COLLEGE (AUTONOMOUS)

NAAC 'A' GRADE

NATIONAL BOARD OF ACCREDITATION

PROCEEDINGS

INTERNATIONAL CONFERENCE

EMERGING TRENDS IN MECHANICAL ENGINEERING AND INDUSTRIAL AUTOMATION

NEC-ICETMEIA-2K21

30th & 31st July, 2021

Editors-in-Chief

Dr. M.Sreenivasa Kumar
Principal & Professor, Dept. of Mechnical Engineering

Dr. D.Jagadish
Professor, Dept. of Mechnical Engineering

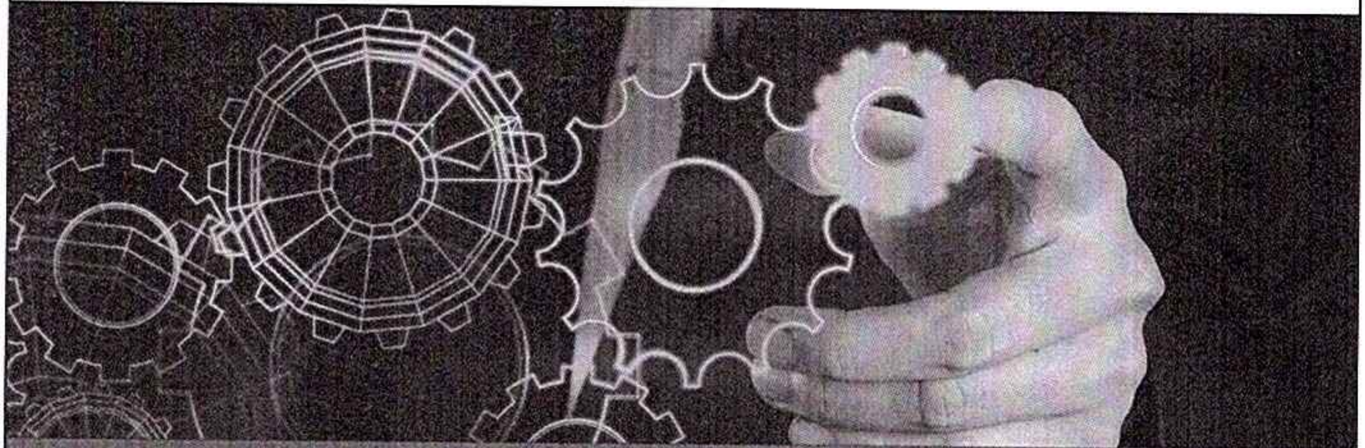
Editors

Dr. D.Suneel
Vice-Principal & Professor, Dept. of ME

Dr. P.Suresh Babu
Professor, Dept. of ME

Dr. B.Venkata Siva
Professor & HoD Dept. of ME

Mr. M.Venkanna Babu
Associate Professor, Dept. of ME



Organized by

Department of **Mechanical Engineering**

In Association with *The Institution of Engineers (India)*

ISBN : 978-93-91420-02-4

LIST OF FULL LENGTH PAPERS SELECTED FOR PROCEEDINGS

International Conference on Emerging Trends in Mechanical Engineering and Industrial Automation

NEC-ICETMEIA- 2K21

S.No.	TITLE OF THE PAPER	Page No.
1.	Effectiveness of Compression Ignition Engine Fuelled with Pond Water Algae Biodiesel	01
2.	Design And Analysis of Disc Brake of an Electric Go-Kart	04
3.	A Comprehensive Review on Recent Research on Semi Solid Processed Aluminum 7 Series Alloys	08
4.	A Study on Microstructure and Mechanical Properties A7075 Reinforced with Flyash/Sic Hybrid Metal Matrix Composite	15
5.	Establishment of SCR Test Facility and Evaluation of 8mm Pitch Honeycomb Type Catalyst in a 20 Liter capacity SCR Test facility	19
6.	A Review on NVH Issues and Technological Challenges in Electric Vehicle and Hybrid Electric Vehicle Power Train	25
7.	Design and Analysis of Cantilever Beam	29
8.	Analysis of Static and Fatigue Strength of Aluminium Alloy Wheel	32
9.	Design of Automated Braking System Based on Vehicle Over Speed Using PLC Ladder Method	35
10.	The Analysis on Concentric Pipe Heat Exchanger	39
11.	Design and Finite Element Analysis of Gas Turbine Blade	45
12.	Investigation on Mechanical Properties of Glass Fiber and Carbon Nano Tubes Sandwich Composite Material	47
13.	CFD Analysis of Super Utility Vehicle to Determine Aerodynamic Behavior	54
14.	Devlopment of Code for Automated HVAC System using Digital Controller	60
15.	Performance and Emission Characteristics Of Diesel Engine with Linseed Oil-Diesel Blends as Fuel With VCR	65
16.	Experimental Investigation in Single Cylinder VCR Multifuel Engine Using Bio-Diesel as Linseed Oil	69

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

17.	Tribological Properties of Textured Surface	72
18.	Thermal Analysis and Experimental Investigation of Pin Fin made of Brass	76
19.	Experimental and Simulation of Wear Test on GPR material	79
20.	CFD Analysis of Two Pass Double Pipe Heat Exchanger with TiO_2/Ethylene Glycol Nano Fluid	83
21.	Simulation and Optimization of Extrusion Process Parameters of Aluminium 2A12T4Alloy	87
22.	Importance of Ice Jet machining - A Review	91
23.	Performance Investigation of a Battery Powered Peltier Cooler	94
24.	Analysis of Disc Brake Rotor using ANSYS Workbench	98
25.	Modelling and Optimization of Two Wheeler Disk Brake Using ANSYS -Review	101
26.	Fabrication of Sewage Waste Cleaner	105
27.	Manufacturing of Hyperboliodal Gear Model Using Ultimaker S5 3D Printing Machine	109
28.	Arc Welding Process Selection Through Quality and Cost Analysis	113
29.	Li-Br H2O VAR System Analysis by Applying Magnetic Field to Liquid Line	117
30.	Heat Transfer Enhancement on Shell and Coil Type of Heat Exchanger Using SiO_2 and CuO Nano-Fluids	121
31.	Study of Rheological Characteristics of Nano Suspensions	126
32.	Design And Fabrication of Loop Wheel System	129
33.	Performance of Solar Vapour Absorption system and its Dependence on Generator Temperature	131
34.	Design and Analysis Of Handicapped Steering Tricycle	134
35.	Machining Characteristics and Microbiological Growth of Stir Casted A356-SiC MMCs and Pure Metals	136
36.	Design and Analysis of Connecting Rod	141

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

37.	Pressure Vessel Optimum Design using Particle Swarm Optimization	145
38.	Design and Analysis of Wheel Rim on Radial Loads	149
39.	COP Enhancement of VCR System using Diffusers	154
40.	Design and Fabrication of Radiant Cooling System	157
41.	Comparative Performance Analysis of Engine Fuelled with Diesel Biodiesel Iron Oxide Nano Particles	162
42.	Performance analysis of a CI Engine fuelled with olive oil and soybean oil mixture as a biofuels	166
43.	Design and Analysis of Landing Gear	170
44.	A Review on Parameters of Composite Materials	173
45.	Optimisation in WEDM of HCHCR Steel using Taughi Method	177
46.	Automated Pneumatic Sheet Metal Cutting Machine	184
47.	Cylindrical Panel's Numerical And Analytical Investigations Subjected To Different Loads	187
48.	Application of a Thermoplastic Polyurethane/Polylactic Acid Composite Filament For 3D-Printed Personalized Orthosis	192
49.	Design and Analysis of a Connecting Rod	196
50.	A Study and Synthesis of 8 Bar One Degree of Freedom Walking Mechanism	200
51.	Mechanical properties and machining of Al-7075 SiC Composite	204
52.	Characterization of Tungsten carbide reinforced Al7075 matrix Composites.	208
53.	3D Printing of Prototype Through Image Processing using Autodesk Recap Photo Software	212
54.	Fabrication and Testing Mechanical Behaviour of Hemp Fibre, Chopped E Glass and Hybrid with Nano Particle	216
55.	Optical characterization of V_2O_5 doped Na_2O-SiO_2-ZrO_2 glasses	218
56.	Determination of Efficient Location of Split Air Conditioner using CFD	221

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - [illegible]
Guntur (Dt.), A.P.

57.	Frictionless Electromagnetic Braking System	225
58.	Performance Evaluation of Vegetable oils as Cutting fluid under MQL Condition in Turning	228
59.	A novel hybrid Fuzzy AHP and VIKOR methodology for Reclaimer Selection in GSCM	236
60.	Design of Eco-Friendly Road Cleaner	240
61.	Mechanical and Microstructural Characterization of Jute Hybrid Composite with Alkali Treatment	244
62.	Experimental Investigation and Optimization of Process Parameters in Wire Cut EDM of EN31 Steel	248
63.	Design and Analysis of Differential Gear Box	252

***

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

9kB2021

ISBN: 978-93-91420-02-4

Comparative Performance Analysis of Engine Fuelled with Diesel Biodiesel Iron Oxide Nano Particles

Donepudi Jagadish, Ch. Sekhar, P. Srinivasa Rao, Sk Bajan
Department of Mechanical Engineering, Narasaraopet Engineering College (A), Narasaraopet, Guntur, A.P, India.

Abstract: Energy demand is the hot topic of all developing and developed countries. Energy demand has been increasing day by day at a high rate. So, it is necessary to find an alternative solution that is eco-friendly. Biodiesel can be the alternative solution for this problem. The main purpose of this paper is to test the engine performance and emission parameters of a diesel engine using animal fat biodiesel (fatty acid methyl esters) with diesel and using iron oxide Nano particles as additive. The parameters measured are volumetric efficiency, brake thermal efficiency, specific fuel consumption, mass fuel consumption and emission parameters are CO2, CO, NOx, and O2andHC.

I.INTRODUCTION

The need of diesel fuel is increasing in the current situations from several industries and vehicles. Simultaneously, because of its high compression ratio it increases the pollution to the environment. The demand for petroleum products and the cost is increasing day by day, so considering into current and future requirements for the usage of petroleum products there is a need of alternative fuels. The addition of biodiesel to diesel fuel improves the performance and emission characteristics of the diesel engine. The optimized biodiesel mix can Reduce some important portion of fuel dependency and surroundings from pollution with none modification to the diesel engine. The oxygen content presence in biodiesel reduces the carbon monoxide and hydrocarbons emissions and it increases the NOx formation at the exhaust. It leads to incomplete combustion due to poor atomization and to reduce the viscosity, pouring point and increasing the calorific value of biodiesel many researches have been carried out by researchers on different types of additives. The additives, metal and platinum based blended biodiesel improve the diesel engine performance and emission characteristics, but increases the size of the particles and accumulate less. Iron oxide has high level of purity in water and release hydrogen which provides more surface area helps in the combustion process. The optimum fuel with iron oxide brake thermal efficiency (Bth%) increased and specific fuel consumption minimized as related to neat diesel. The emissions carbon monoxide (CO) and hydrocarbons (HC) reduced respectively however increase in NOX were observed. Improved hydrocarbon and carbon monoxide with addition of nanoparticles blended biodiesel compared to biodiesel. Reduced NOx with iron oxide nanoparticles due to sufficient fuel accumulation made early combustion and reduced ignition delay. Increase in brake thermal efficiency for biodiesel-ethanol blend was observed due to better mixing abilities of nanoparticles in the presence of oxygen and significant reduction in unburnt hydrocarbon sand carbon monoxide as compared to diesel at 1/4th and 1/2nd percentage load. Brake thermal efficiency increased as compared to biodiesel and exhaust emissions hydrocarbons, carbon monoxide and NOx were reduced with nanoparticles compared to biodiesel. The higher dosage of alumina nanoparticles to diesel increased brake thermal efficiency compared to diesel and reduced carbon monoxide, hydrocarbons and NOx with iron oxide nanoparticles in comparison with diesel. The addition of Fe2O3 nano particles to biodiesel (B20) in compression ignition engine were improved performance and reduced emissions hydrocarbon, carbon monoxide and NOx with nano additives in diesel engine as compared to biodiesel.

The nanoparticles by mass fraction 50ppm, 100ppm and 150 ppm were added to diesel fuel and compared the results with diesel. Observed that average brake thermal efficiency increased with nanoparticle dosages compared to diesel fuel. Exhaust emissions were decreased after 25% of the load than the diesel fuel. Bio-diesel with iron metal oxide nanoparticles added on the diesel engine with various dosages of nanoparticles resulted in lower BTE, BSFC and exhaust emissions compared to diesel. However, increase in NOx was noted with nanoparticles Investigations from researchers were carried out on iron oxide nanoparticles to see the effect of additions on performance and emission characteristics of the diesel engine. In the literature review most of the researchers established the addition of varying dosages of iron oxide nanoparticles in biodiesel blends and in diesel increases the calorific value of the fuel and found improvement in specific fuel consumption and brake thermal efficiency. Results also showed iron oxide nanoparticles to diesel and biodiesel. Also, with lower dosage levels of iron nano particle as additive in B10 and B20, the BTE, BSFC and emissions characteristics were comparable with the diesel. The objectives of the present paper are to see the influence of addition of iron oxide nanoparticles blended with animal fat-based biodiesel on the CI engine for understanding the performance and emissions characteristics. The outcome of this study is improvement in the engine performance and exhaust emissions

MATERIALS AND METHODS

Some of the paper mentioned here are the works done on implementation of biodiesel in the present engines. Most of the results are in favour of biodiesel showing improvement in performance and emissions.

D. Jagadish et al. [1] mentioned that usage of biofuels received much attention in the current situation of depleting fossil-fuel reserves and in-creased emission legislation. Many ideas have been implemented upon usage of biofuels for energy production to achieve low-emission levels. Internal combustion engines are the basic prime movers for power generation as well as for transportation purpose, which are basically run on fossil petroleum.

NEC

NARASARAOPETA
ENGINEERING COLLEGE
(AUTONOMOUS)

NAAC 'A' GRADE

NBA NATIONAL BOARD OF ACCREDITATION

PROCEEDINGS

INTERNATIONAL CONFERENCE

EMERGING TRENDS IN MECHANICAL ENGINEERING AND INDUSTRIAL AUTOMATION

NEC-ICETMEIA-2K21

30th & 31st July, 2021

Editors-in-Chief

Dr. M.Sreenivasa Kumar
Principal & Professor, Dept. of Mechnical Engineering

Dr. D.Jagadish
Professor, Dept. of Mechnical Engineering

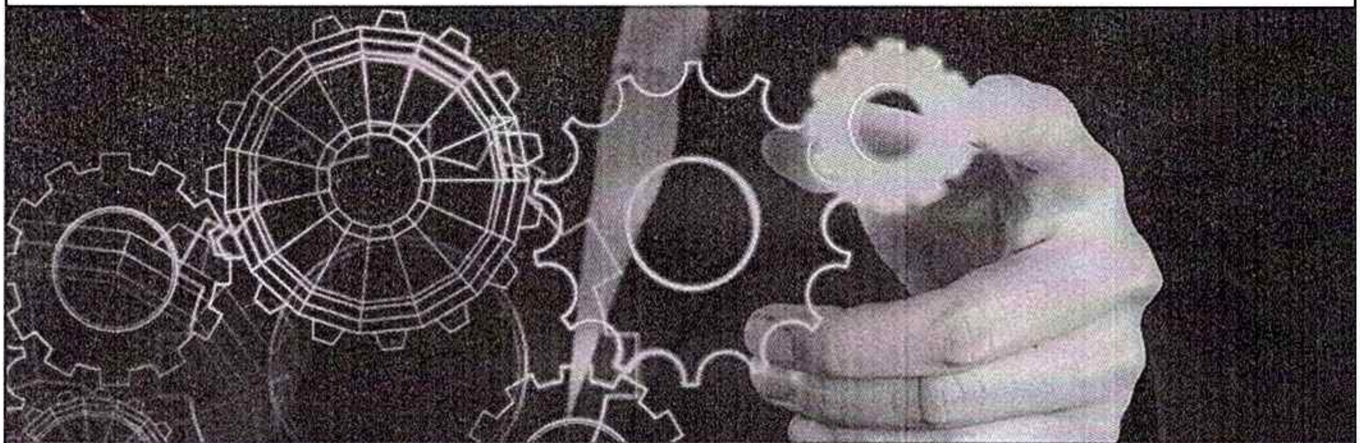
Editors

Dr. D.Suneel
Vice-Principal & Professor, Dept. of ME

Dr. P.Suresh Babu
Professor, Dept. of ME

Dr. B.Venkata Siva
Professor & HoD Dept. of ME

Mr. M.Venkanna Babu
Associate Professor, Dept. of ME



Organized by

Department of **Mechanical Engineering**

In Association with *The Institution of Engineers (India)*

ISBN : 978-93-91420-02-4

LIST OF FULL LENGTH PAPERS SELECTED FOR PROCEEDINGS

International Conference on Emerging Trends in Mechanical Engineering and Industrial Automation

NEC-ICETMEIA- 2K21

S.No.	TITLE OF THE PAPER	Page No.
1.	Effectiveness of Compression Ignition Engine Fuelled with Pond Water Algae Biodiesel	01
2.	Design And Analysis of Disc Brake of an Electric Go-Kart	04
3.	A Comprehensive Review on Recent Research on Semi Solid Processed Aluminum 7 Series Alloys	08
4.	A Study on Microstructure and Mechanical Properties A7075 Reinforced with Flyash/Sic Hybrid Metal Matrix Composite	15
5.	Establishment of SCR Test Facility and Evaluation of 8mm Pitch Honeycomb Type Catalyst in a 20 Liter capacity SCR Test facility	19
6.	A Review on NVH Issues and Technological Challenges in Electric Vehicle and Hybrid Electric Vehicle Power Train	25
7.	Design and Analysis of Cantilever Beam	29
8.	Analysis of Static and Fatigue Strength of Aluminium Alloy Wheel	32
9.	Design of Automated Braking System Based on Vehicle Over Speed Using PLC Ladder Method	35
10.	The Analysis on Concentric Pipe Heat Exchanger	39
11.	Design and Finite Element Analysis of Gas Turbine Blade	45
12.	Investigation on Mechanical Properties of Glass Fiber and Carbon Nano Tubes Sandwich Composite Material	47
13.	CFD Analysis of Super Utility Vehicle to Determine Aerodynamic Behavior	54
14.	Devlopment of Code for Automated HVAC System using Digital Controller	60
15.	Performance and Emission Characteristics Of Diesel Engine with Linseed Oil-Diesel Blends as Fuel With VCR	65
16.	Experimental Investigation in Single Cylinder VCR Multifuel Engine Using Bio-Diesel as Linseed Oil	69

17.	Tribological Properties of Textured Surface	72
18.	Thermal Analysis and Experimental Investigation of Pin Fin made of Brass	76
19.	Experimental and Simulation of Wear Test on GPR material	79
20.	CFD Analysis of Two Pass Double Pipe Heat Exchanger with TiO_2/Ethylene Glycol Nano Fluid	83
21.	Simulation and Optimization of Extrusion Process Parameters of Aluminium 2A12T4Alloy	87
22.	Importance of Ice Jet machining - A Review	91
23.	Performance Investigation of a Battery Powered Peltier Cooler	94
24.	Analysis of Disc Brake Rotor using ANSYS Workbench	98
25.	Modelling and Optimization of Two Wheeler Disk Brake Using ANSYS -Review	101
26.	Fabrication of Sewage Waste Cleaner	105
27.	Manufacturing of Hyperboliodal Gear Model Using Ultimaker S5 3D Printing Machine	109
28.	Arc Welding Process Selection Through Quality and Cost Analysis	113
29.	Li-Br H2O VAR System Analysis by Applying Magnetic Field to Liquid Line	117
30.	Heat Transfer Enhancement on Shell and Coil Type of Heat Exchanger Using SiO_2 and CuO Nano-Fluids	121
31.	Study of Rheological Characteristics of Nano Suspensions	126
32.	Design And Fabrication of Loop Wheel System	129
33.	Performance of Solar Vapour Absorption system and its Dependence on Generator Temperature	131
34.	Design and Analysis Of Handicapped Steering Tricycle	134
35.	Machining Characteristics and Microbiological Growth of Stir Casted A356-SiC MMCs and Pure Metals	136
36.	Design and Analysis of Connecting Rod	141

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dt.), A.P.

57.	Frictionless Electromagnetic Braking System	225
58.	Performance Evaluation of Vegetable oils as Cutting fluid under MQL Condition in Turning	228
59.	A novel hybrid Fuzzy AHP and VIKOR methodology for Reclaimer Selection in GSCM	236
60.	Design of Eco-Friendly Road Cleaner	240
61.	Mechanical and Microstructural Characterization of Jute Hybrid Composite with Alkali Treatment	244
62.	Experimental Investigation and Optimization of Process Parameters in Wire Cut EDM of EN31 Steel	248
63.	Design and Analysis of Differential Gear Box	252

***

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

MSIC 2021

ISBN: 978-93-91420-02-4

Establishment of SCR Test facility and Evaluation of 8mm pitch Honeycomb Type Catalyst in a 20 Liter capacity SCR Test facility

Tellamekala Anitha, Donepudi Jagadish and M.Sreenivasa Kumar
Department of Mechanical Engineering, Narasaraopeta Engineering College, Narasaraopet, India

***Abstract*—The objective of this project was to establish the 20 litre capacity SCR test facility and generate the data required for evaluating the performance of in-house developed 8mm pitch honeycomb type SCR catalyst with dust concentration of about 30 to 52 g/nm^3 in coal based flue gas. SCR test facility is capable to process up to 60 Nm^3/hr of flue gas generated from coal combustion process with 30-60 grams /Nm^3 of dust concentration. The NOx removal efficiency, ammonia slip and differential pressure across honeycomb catalyst was investigated with dust concentration of 30-52 grams/Nm^3 in flue gas by varying the space velocities (2500-1500 per hr.) and flue gas temperatures (300–350^{0}C) using anhydrous ammonia as reducing agent and the ratio of ammonia (NH_3) to Oxides of Nitrogen (NOx) was maintained as 0.9 to 1.0 for all the experiments. The result shows that the NOx reduction efficiency achieved with honeycomb was 81.89 – 86.75% at 2500-1500 per hr. space velocities and the ratio of ammonia (NH3) to oxides of nitrogen (NOx) was maintained at 0.9. NOx reduction efficiency achieved with honeycomb was 82.72–88.23% at 2500-1500 per hr. space velocities and the ratio of ammonia (NH_3) to oxides of nitrogen (NOx) was maintained at 1.0.Ammonia slip measured was in the range of 1.3 to 1.9 ppm for honeycomb catalyst at 0.9 for ammonia to oxides of nitrogen.The total Differential Pressure (DP) across Honeycomb SCR catalyst was 28-38 mmWc over a 2250mm length.**

Keywords*—*Selective catalytic reactor, honeycomb, catalyst, space velocity, Nox conversion efficiency, ammonia slip.

I. Introduction

Fossil fuels play a crucial role in the energy mix, and will continue to play a major role in decades to come. Coal is the most common source for heat and power production, and the role of coal will continue to be very important in the near future. According to EIA statistics for 2016, coal remains the second largest energy source worldwide until 2030 and from 2030 through 2040, it is the third-largest energy source. World coal consumption increases from 2012 to 2040 at an average rate of 0.6%/year [1]. The coal combustion generates solid and gaseous combustion products and is inevitably associated with environmental pollutants among which Oxides of Nitrogen (NOx) are major ones. The nitrogen monoxide (NO), nitrogen dioxide (NO2) and nitrous oxide (N_2O) molecule belongs to the family of nitrogen oxides (NOx) compounds. NOx is used to refer to the total amount of nitrogen oxides. About 95 % of oxides of nitrogen from industrial activities come from combustion processes. NOx can cause severe health problems and have strong environmental impacts. The main effects are: Formation of ground-level ozone, formation of acid aerosols, formation of acid rain, deterioration of water quality, formation of toxic chemicals and global warming. In view of severe health issues and strong environmental impacts, the Ministry of Environment and Forest (MOEF), GOI issued notification for implementation of emission norms for particulate matter (PM), sulphur di-oxide (SO2), oxides of nitrogen (NOx) and mercury (Hg). The final emission limits under Title IV, promulgated in February 1998, are shown in Table 1, 2 & 3.

Table 01:TPPs (units) regulatory norms installed before 31st December, 2003

Parameter	Standards
Particulate Matter	100 mg/Nm3
Sulphur Dioxide (SO2)	600 mg/ Nm3 (Units Smaller than 500 MW capacity units) 200mg/Nm3 (for units having capacity of 500MW and above)
Oxides of Nitrogen (NOx)	600 mg/ Nm3
Mercury (Hg)	0.03 mg/ Nm3 (for units having capacity of 500 MW and above)

Table 02: TPPs regulatory norms installed after 1st Jan. 2003, up to 31st Dec. 2016

Parameter	Standards
Particulate Matter	50 mg/Nm3
Sulphur Dioxide (SO2)	600 mg/ Nm3 (Units Smaller than 500 MW capacity units). 200 mg /Nm3 (for units having capacity of 500MW and above).
Oxides of Nitrogen (NOx)	300 mg/ Nm3
Mercury (Hg)	0.03 mg/ Nm3

Table 03: TPPs (units) regulatory norms to be installed form 1st January, 2017

Parameter	Standards
Particulate Matter	30 mg/ Nm3
Sulphur Dioxide (SO2)	100 mg/ Nm3
Oxides of Nitrogen (NOx)	100 mg/ Nm3
Mercury (Hg)	0.03 mg/ Nm3

To maintain stringent regulatory norms imposed by the Ministry of Environment and Forest (MOEF), GOI for Oxides of Nitrogen (NOx), BHEL has formed CFT committee and identified the solution.

NOx Removal techniques: Oxides of Nitrogen (NOX) can be controlled by using the following methods:

- Combustion controls; and
- Post-combustion controls;

Combustion controls: The NOX emissions are reduced by changing the process parameters while combustion process. The combustion process parameters are air, coal and residence time. Under this method the maximum conversion efficiency less than 50% and also this method is least expensive.

IQAC

PRINCIPAL
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

INTERNATIONAL CONFERENCE ON ADVANCES IN MATERIAL SCIENCE AND MECHANICAL ENGINEERING

[ICAMSME - 2020]

7-9, February 2020

Souvenir

Organised by

Department of Mechanical Engineering
N.B.K.R. Institute of Science & Technology
(Autonomous)
Vidyanagar, SPSR Nellore (Dist.)
Andhra Pradesh – 524 413, India
(Affiliated to JNTUA, Ananthapuramu)

Supported by

ANDHRA PRADESH STATE COUNCIL OF HIGHER EDUCATION

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

AMARA RAJA
Gotta be a better way

IQAC

ELIXON Technologies

Change for better
RAM CADDSYS

RATHNA'S Herbals

List of Technical Papers

S.No	Title& Author (s)	Page
	MATERIAL SCIENCE	
1	**Mechanical & Metallurgical Characterization of Al-6061 HMMC with SiCp & Graphite as an Reinforcement** G.Srinivas Kumar, Y.Venkata Mohana Reddy, B.Chandra Mohana Reddy	1
2	**Wear Characteristics of Al7075/Al_2O_3/ SiC Hybrid Metal Matrix Nano Composites** N.Sreedhar, S.Balaguru	1
3	**Mechanical behavior of Al7075/Al_2O_3/SiC Hybrid Metal Matrix Nano Composites** N.Sreedhar, S.Balaguru	2
4	**Effect of Heat Treatment on Mechanical properties ofAluminium Metal Matrix Composite (AA6061/MoS2)** Manda Chandra Sekhar, B. Surendra Babu, N. Ramaniah	2
5	**Wear characteristics optimization of Al6061- sugarcane bagasse ashmetal matrix composite using Taguchi Method** Anwesh K. Virkunwar, Shouvik Ghosh, Ranjan Basak	3
6	**Coatings for Improving Tribological and Hot Corrosion Properties** Sowri Subhash, Bandaru Kiran, G.Rajyalakshmi, Srinivas Viswanath, K.Jayakrishna	3
7	**Effect of hybrid resin system on mechanical properties of carbon fiber composites for aerospace applications** C.Venkateshwar Reddy, P.RameshBabu, R.RamNarayanan	4
8	**Assimilation of Mechanical properties of reinforced Aluminum, Stainless steel wire mesh with Glass fiber epoxy hybrid composites for Aircraft application** A.Naga Phaneendra, R.Meenakshi Reddy, G.Sankaraiah, V.Diwakar Reddy	4
9	**Modelling of Flow Behaviour and Rheology Properties of M2 Steel in Semisolid State** Sudip Simlandi, Nilkanta Barman	5
10	**Mechanical and Rheology properties of PLA /ABS/TCS polymer Blends** B. Ramanjaneyulu, N. Venkatachalapathi, G. Prasanthi	5
11	**Manufacturing, microstructural and mechanical characterization of stir cast aluminum 7075/SiC metal matrix composite** Mulugundam Siva Surya, G. Prasanthi, Chidwilas I	6
12	**Study on mechanical properties of AA6061/SiC/B4C hybrid nano metal matrix composites** Shubhajit Das, M. Chandrasekaran, Sutanu Samanta	6
13	**Mechanical Characterization of Areca Fiber and Coconut Shell Powder Reinforced Hybrid Composites** G. Kishore Chowdari, D.V.V. Krishna Prasad	7
14	**Morphology and Corrosion Performance of Aluminium Matrix Nano composites Fabricated through Stir Casting Process** Md Tanwir Alam	7
15	**Effect of Silicon Carbide Boron Carbide and Fly-Ash Particles on Aluminium Metal Matrix Composite** C. Thirupathaiah, Sanjeev Reddy K Hudgikar	8

16	**Mechanical and Tribological Behavior of Al 5083- Gr /SiO_2/B4c Hybrid Composites** T.Hariprasad, L.Shakeel Ahmed, K.Srinivasan, S.V.Suresh Babu	8
17	**Sliding Wear Characteristics of Carbon Filled Polytetrafluoroethylene (PTFE) Composite Against AISI 304Stainless Steel Counter face** Amol Barade, Satish Chinchanikar, Abhijeet Deshpande	9
18	**Influence of Heat treatment on Microstructure and Mechanical Behaviour of hot rolled Al-Mg-Si alloy** R.Vasanth Kumar, R.Keshavamurthy, Chandra S.Perugu, Siddaraju C	9
19	**Fracture Toughness Properties of Al/SiC/Al2O3/B4C MMC's: A Review** RajeshGandasi Lakshmikantha, Virupaxi Auradi	10
20	**Influence of Walnut (Juglans L.) Shell Particles Addition on the Mechanical Properties of Epoxy Composites** Mohit Mittal, Kanchan Phutela, Rajiv Chaudhary	10
21	**Effect of Fiber Length and Content on the Mechanical Properties ofPineapple Leaf Fiber Reinforced-Epoxy Composites** Mohit Mittal, Rajiv Chaudhary	11
22	**Mechanical Behavior of Jute/ Banana Hybrid Composites** K. Balu Narendra, A.K. Chaitanya, K.V.N. Girish Kumar T. Vijay Sriharsha	11
23	**Tribological performance of 1.5 wt% B4C particulate reinforced Al-12Si alloy nanocomposite fabricated by ultrasonic stir casting** Deepak M Shinde, Suswagata Poria, Prasanta Sahoo	12
24	**Mechanical Characterisation of UV Photo-Polymerised PMMA with different Photo-Initiator Concentration** M A Manjunath, K Naveen, P Vinod, N Balashanmugam, M R Sankar	12
25	**State of Art on Development of Diamond Reinforced Tungsten Carbide based Cutting Tool by Powder Metallurgy Routes** M. M. Basha, S. M. Basha, M. R. Sankar	13
26	**Optimization of Process Parameters for Plasma Sprayed Lanthanum Zirconate TBCson Nickel Based Super Alloy** R Keshavamurthy, Naveena BE, Ramesh T, Shashikumara N K	13
27	**Effect of electrolyte composition and heat treatment on corrosion resistance of coatings developed on Cp-Ti by anodization** Saikiran A, Sai Venkata Gayathri A, M. Narayanan, Nirusha N, Rameshbabu N	14
28	**Optimization of Tensile Strength and Hardness of Aluminium Based Metal Matrix Composites- A GRA Approach** Banavath Haritha Bai, Podaralla Nanda Kumar	14
29	**Effect of Oxygen Flow Rate on Surface Morphology and Optical Properties of Reactive DC Magnetron SputteredTiO_2 Thin Films** M. Lavanya,S. Sunitha Ratnam, B. Rajesh Kumar, T. Subba Rao	15
30	**An Experimental Study on the Effect of Reverse Two-Step Sintering onAluminum– Silicon Carbide Metal Matrix Composite** R. Raj Mohan, Dr. S. Raghuraman, B.G.Chidambaram, S. Balakrishnan, S.Vishnuram	15
31	**Mechanical Characterization of Epoxy Resin Polymer Matrix HybridComposite Reinforced with Kenaf and Flax Laminates** V.S.S Venkatesh	16
32	**Comparative Studies on Medium Carbon Low Alloy Steels and Maraging Steels**	16

	Nikhil kumar, C. M. Ramesha, Anilkumar T, Rajendra P, Chandan. B. R	
33	**Analysis of Tungsten-Alumina Nanocomposite Thin Films on SS304 Substrate** Sahas, Krupashankara M S, P V Srihari, Mohan Kumar T R	17
34	**Effect of volume fraction and micro structural characterization ofannealed AA6082 plates by Friction Stir Processing** N. Srimath, A. Murugarajan	17
35	**X-ray Diffraction Analysis by Williamson-Hall, Size-Strain, Halder-Wagner Plot Methods for Ni Doped CdS Nanoparticles** V. Krishna Bharath, Sashank Viswanadha, B. Hymavathi, B.Rajesh Kumar	18
36	**Optical analysis of KCl doped Poly vinyl pyrollidene (PVP)/Poly methyl methacrylate (PMMA) polymer electrolyte films** V. Raja, R. Padma Suvarna, K. Vasanth Kumar, Y. Madhava Kumar	18
37	**Experimental Determination of Anisotropic Properties and Evaluation of FLD for Sheet Metal Operations** A C Sekhara Reddy, B Sandeep, J Sandeep Kumar, B.Sanjanna	19
38	**Effect of Pre Heat Treatment of Boron Carbide Reinforcements on Mechanical Properties of AA7075/B_4C Composite Fabricated by Powder Metallurgy Techniques** Guttikonda Manohar, K M Pandey, S R Maity	19
39	**A Study on Mechanical Properties of ZrO_2, C and AA6061 Metal Matrix Composites** R Pandiyarajan, P Maran, S Marimuthu, S Sabarish	20
40	**Synthesis and Characterization of Nano Tio2 Film for Enhancing AntiReflection Properties** Natarajan Purushothaman, R Elansezhian, A V Ravi Prakash	20
41	**Air-water mist cooling characteristics of an MS plate in a Laboratoryscale ROT- an Experimental Observation** Rajdeep Sardar, Prishat Bachhar, Sounak Majumder, PranibeshMandal	21
42	**A Gaussian Process based model for air jet-cooling of MS plate in ROT** Prishat Bachhar, AbhishekKundu, Pranibesh Mandal	21
43	**Effect of Spin Speed on Structural and Optical Properties of Zn Doped CdS Thin Films Prepared by Sol-Gel Spin Coating Method** M. Venkata Veera Prasad, K. Thyagarajan, B. Rajesh Kumar	22
44	**Structural and Dielectric Properties of Calcium Bismuth Titanate(CaBi4Ti4O15) Ceramics** B. Hymavathi, T. Gopal Reddy, B. Rajesh Kumar, T. Subba Rao	22
45	**A Review – Black Oxide Coating on Metal Substrates of Steels, Aluminium, Magnesium and Copper** A Manoj,M M Basha, S M Basha, M R Sankar	23
46	**Simulation Modelling and Analysis of Residual Stresses and Temperature Distribution of Haste Alloy C-276 in GTAW** Bandaru Kiran, Dega Nagaraju, S. Narayanan	23
47	**Scrapped Cigarette Filter and Coconut Coir Filled Polymer Composite** R. Balaji, Mukesh Nadarajan, Ashish Selokar, Nilesh Ugemuge	24
48	**Effect of Oxygen flow rate on the characteristics of RF sputtered ZnOthin films** Pathan Parhana, M.V.Lakshmaiah	24
49	**Experimental Investigation On Mechanical Properties of Magnesium Based**	25

	Metal Matrix Composites Jaya Krishna Nagallapati, Nagaraju Dega	
50	**Fabrication and Testing of Functionally Graded Hybrid PV panel** P.S.Ravi Kumar,P. Nanda Kumar, G. Ranga Janardhana	25
51	**Experimental Investigation of Mechanical and Machining Characteristics of Aramid-Natural Fiber Composite** S.Rajesh, B.VijayaRamnath, Obuliei PraveenK, Paveen K.M	26
52	**Green Synthesis and Production of Copper / Silver Nano particles by using Plant Leaves** J. Subramanyam, G. Bhanodaya Reddy, B. G. Vijayasimha Reddy	26
53	**Studies on Tribological Behaviour of ZnO Nano rods Suspended in SAE 20w40 Engine Oil** R. Melvin Rajkumar, K. Kiruthiga S. Induja, P.S. Raghavan, Mohammed Shafee, Ravishankar Sathyamurthy, S.Chandra Sekhar	27
54	**Exploration of properties of Al 6060/CNT Metal Matrix Nano Composites** B. Madhusudhana Reddy, P. Anand, S.P. Akbar Hussain, K. Raja Sekhar	27
55	**Multi Objective Optimization of Wire EDM Process Parameters of Al7075-SiC Composites using Genetic Algorithm** M.Gouthama Kranthi, R.Vishnuvardhan Reddy,S.Indumathi	28
56	**Behaviour of Heat Treated Aluminium Alloy under Hardness Test.** Domadal Pranan, Sruthi Sivaram, Nidheesh S Prakash, Mukesh Nadarajan, Ashish Selokar	28
57	**Experimental Investigation on Al5083-SiCp AMMC using Cooling Slope Technique** Chandra Sekhar Macha, G. Ranga janardhana, P. Nanda kumar	29
58	**Investigations of Tensile Behaviour of Graphene composites** B. Vijaya Ramnath, N.Abishek, J.Melvin Antony, D.Kumaran, C.Nikhil Kumar	29
59	**Analysis of Control Factors Effecton FlexuralProperty of Tamarind Seed Particles/MWCNT Hybrid Nanocomposites** Muzzammil A. Annigeri,G. U. Raju	30
60	**Experimental and Numerical Analysis of Woven Glass-Epoxy Composite Laminates with Single Lap Joints** Shabbir Ahmed R. M., Mohammed Haneef, N.K.Shashikumara	30
61	**Investigations of Compression and Impact Behaviour of Hemp - Graphene Composites** B. Vijaya Ramnath,A.Manivasagam,R.Rohit,V.Sudharsan,S.Sheshathri	31
62	**Surface Analysis and Mechanical Behavior of Polysiloxane Coating on Steel Substrate** J. Rajasekar,R. Elansezhian	31
63	**Fabrication of Hybrid Aluminum Metal Matrix Composite** Ch. Venkatarao, T. Raviteja, S.Srikiran	32
64	**Equal Channel Angular Pressing of Mechanically Milled Al5083 Nano Composites** K. Chandra Sekhar, B. Ravisankar, S. Kumaran	32
65	**Solidification in Selective Laser Melting (SLM) of Nickel Alloy IN625** Boddu Pavan,Gajji Sai Kiran, Pappuri Hazarathaiah	33
66	**A Review on Improvement of Mechanical Properties on AISI409 Ferritic Stainless Steel by Nitriding Process**	33

	P.Rohith, K.Aishwarya, E.Nirmala Devi, R.Srilatha, Ram Subbiah	
67	**An Overview on AISI430 Ferritic Stainless Steel by Nitriding Process** A.Rohit Sai Krishna, B.Vamshi Krishna, T.Sashank, D.Harshith, Ram Subbiah	34
68	**Assessment of Properties on Duplex Stainless Steel by Carburizing Process - A Review** P.N.V.Krishna Chaitanya,K.Manjith Srinivas, M.Pramod, S.Bharath,Ram Subbiah	34
69	**Experimental and Phenomenological Study of the Effects of Input Setting Variables for Chip Deformation and Ignition Mapping in High Speed Machining of Mg Alloy for the Benefits of Industries Ergonomics** S.P. Sundar Singh Sivam, Ganesh Babu Loganathan, K.Saravanan D.Kumaran, N. Harshavardhana	35
70	**The Effect of Alkali Treatments on Vinyl Ester Hybrid Composites Stuffed with Sansevieria Cylindrical Fiber and Carbon Fiber** B.Amara Babu, V. Pandu Rangadu	35
71	**Preparation and Analysis of Silicon Carbide and Graphite Particulate Reinforcements in Aluminium Matrix** S. Raja Kumar, CH. Ramakrishnaiah	36
72	**Numerical Analysis of Al-6063/Tungsten Carbide (WC) Hybrid metal matrix composite (HMMC) as a Thermally Conducting Materials for higher temperature heat-transfer applications using ANSYS 14.0** Shubham Sharma, S.P.Akbar Hussian, J.Guru Sai, B.Satheesh Kumar	36
	THERMAL ENGINEERING	
73	**Theoretical Investigation of a Combined Cycle Power Plant** Mude Murali Mohan Naik, V. S. S. Murty, B. Durga Prasad	37
74	**Condensation Heat Transfer and Pressure Drop During R134a Saturated Vapour Inside a Brazed Plate-Fin Heat Exchanger with Wavy Fin** K.V. Ramana Murthy, C. Ranganayakulu, Sankaraiah Mada	37
75	**CFD Studies on A Centrifugal Compressor Stage with Twisted Vanes of a Low Solidity Diffuser** Venkateswara Rao Pothuri, Venkata Ramana Murty Govindaraju, Y. Ashok Kumar Reddy, M. Sreenivasulu	38
76	**Effect of Aluminium Oxide Nano Additive on Gasoline Fumigated SingleCylinder Diesel Engine** Tamilvanan A, Bharathiraja M, Balamurugan K, Mitun S Naveen Kumar CB, Chanduru R	38
77	**Hydro Magnetic Visco Elastic Fluid Flow Past a Vertical Porous Plate Under the Influence of Radiation Absorption and Heat Source** Ananda Reddy N, Uma Maheswar M	39
78	**Performance Study on the C.I.Engine using LHR and LTC in Combination with Biodiesel Blends** R.T. Sarathbabu, M. Kannan	39
79	**Physiological Jeffery fluid model under the Impact of Rotation and Hall Current with Porous Medium through an Inclined Vertical Tapered Channel with Slip Boundary Conditions** S. Ravikumar, Sk Abzal, Y. Harinath, N. Ameer Ahamme	40
80	**Assemble of Pyrolysis Machine for Plastic WastesConversion into Liquid Hydrocarbon Fuel** M. Venkata Subbaiah, S. Sunil Kumar Reddy, B. Durga Prasad	40
81	**Preparation of Fleshing Oil Methyl Ester from leather industry fleshings,**	41

	performance and emission studies in standard diesel engine K.V. Sandhya, V. Brindha, S. Chandra Sekharand K.Karuppasamy, N. Vedaraman, K.C. Velappan	
82	**Experimental exploration on the potentiality of fuel blends microalgae biodiesel –additive diethyl ether with a diesel engine coupled by supercharger and EGR** Vamsi Krishna K, Sastry GRK, John Deb Barma, G. Santosh Kumar	41
83	**Optimal ternary blend for diesel engine- diesel, diethyl ether & canola oil** K. Venkata Akash, V. Srikar Reddy, B.Hari,M. Sreenivasulu, S. Suresh	42
84	**Experimental investigatation on computerised VCR engine Operating with ternary blend** K. Venkata Akash, V. SrikarReddy, B.Hari,M. Sreenivasulu, S. Suresh	42
85	**Performance of Evacuated Stepped Basin Solar still with PCM and Intermittent Water Collector** P. Tejendra, P. Sumanth, B.Hari, P. Kesavulu, S. Suresh	43
86	**Moderate Temperature Waste Heat Recovery Using Kalina Cycle** M Subba Reddy, Mude Murali Mohan Naik	43
87	**Experimental Investigation on a PCM based Thermal Energy Storage System for a VCR System** Shaik Riyaz Basha	44
88	**Failure Analysis of IC Engine Valves and its Performance Evaluation for Various Titanium based Composite Coatings using FE Analysis** R. SundarRao, K. Hemachandra Reddy, Ch R. Vikram Kumar	44
89	**Thermal Radiation and Velocity Second Order Slip effects on Peristaltic flow under the influence of Hall current through a channel** S. Ravikumar, M. Sreenivasulu, D. Vijaya Sekhar, S.Kiranmaiye N. Ameer Ahammed	45
90	**Solar Thermal Energy Storage Using Sensible and Latent Heat a Future Generation Energy Utilization Technology** P. Narasimha Siva Teja, P. Badari Narayana, K. Hemachandra Reddy	45
91	**Thermal performance and optimization of Paraffin wax as a Phase changing materials (PCM)-based heat sink with internal fins using ANSYS: An experimental approach** Shubham Sharma, M.Sreenivasulu, Y.Ashok Kumar Reddy, Venkateswara Rao Pothuri	46
92	**Gps And Gis Tools And Applications In Energy Sector Towards Enhanced Energy Efficiency** A. G. Matani	46
	DESIGN ENGINEERING	
93	**Vibration Analysis of Gearbox Fault Diagnosis using DWT and Statistical Features** Setti Suresh, M. Srinivas, V.P.S. Naidu	47
94	**Design and Analysis of a Pressure Relief Valve – Case Study** Amarnath J. M,Sudhir Nair, Rajyalakshmi G, Srinivas Viswanath V	48
95	**Bearing Health Condition Monitoring Using Time DomainFeaturesand LDA Classifier** Y. Chandukrishna, V.P.S. Naidu	48

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

96	**Fabrication and simulation of Bladeless Turbine** M.Sivaramakrishaniah, P.Nanda Kumar	49
97	**Finite Element Simulation of Temperature Distribution, Distortion and Residual Stresses of Similar Welded Joints** K. Venkateswarlu, P. Nanda Kumar, P.S. Ravi Kumar	49
98	**Modeling and Simulation of a Passive Suspension System forQuarter Car and Half Car Models using MATLAB Simulink** Harsha Kamatham, P. Srihari Reddy, Bharath Kumar	50
99	**Damping Performance of Polychloroprene Rubber for Unconstrained Damping Applications** Prasanth Kumar Mallipudi, P.Jyothi, N.Ramanaiah, V.V.S. Bhaskara Raju	50
100	**Simulation Modelling and Analysis of Startup India Initiative procedures** Dega Nagaraju, Sai Krishna Pabba, R. Inder Raj Singh, Paul Satwik	51
101	**Numerical Analysis of a Submarine Hull Drag and Open-Water Propeller Performance** Pritam Ghosh, Pranibesh Mandal	51
102	**Experimental Modal Analysis of a Linear Reciprocating Tribometer for Maximum Reciprocating Frequency** Harish Thetanikkal Viswanathan, Prem Kumar J, Rajeev V R	52
103	**Finite Element Analysis of Friction Stir Welding of Copper** Keshavamurthy R, Shiva Prasad R, M.C. Jeevan,Pradeep Kumar G.S, Shashi kumara N.K	52
104	**Structural and Thermal Analysis of Brake Drum** Shaik.Chand Mabhu Subhani, A.Pavan Kumar, D.Venkata Rao, K.Anna Purnaiah	53
105	**Leaf Spring Model for Heavy Load Vehicle Using Solid Works and ANSYS Analysis** Chirag D. Bhatt, Mukesh Nadarajan, R.Balaji, Ashish Selokar	53
106	**Review on Condition Monitoring of Bearings Using Vibrations** M. SaiKoushik, G.Sai Ravi Teja, P. Santosh kumar, R.Balaji, K.Viswanathan,Ashish Selokar	54
107	**Computer Aided Modeling of Helical Springs with Different Cross Section Using CATIA V5 R-19 Software** Reddy Sreenivasulu, N. Yaswanth Krishna, M.Sukumar, O.N.Gouse Basha, N. ArunKumar, K. Heamanth, M.Vamsi Krishna	54
108	**Design evaluation of a four wheeler suspension system for variable load conditions** Kiran Sunkara,Muchakala Suresh,K.Venkateswarlu	55
109	**A Novel Experimental Study & Design Study on Systematic Designed Sea Water Purifier Machine using Activated Carbon** R. Balaji, S. Gowtham, Kelam Meghana, Ankush Sarkar, Ijas Ahamed	55
110	**Development of Model for Investigation of Temperature effect in Radial Ball Bearing Using Matrix Method of Dimensional Analysis** G.Maheedhara Reddy, V. Diwakar Reddy, B. Satheesh Kumar	56
111	**Performance Evaluation and Energy Augmentation of Wind Turbine System: An overview** K. Ramesh Kumar, M. Selvaraj	56
112	**Modal and Frequncy Response Analysis of Four-Wheeled Passenger Car**	57

	Vehicle Under Harmonic Input Excitation P.Srihari Reddy, Ramji Koona	
113	**Design and Analysis of Convertible Bench** S.B. Mohan, B.OmPrakash	57
114	**Experimental Characterization of Stiffness and Damping of Assemblies with Bolted Lap Joints** A.T. Ananthakrishna, D.S. Srinivasu, Mohit Law	58
115	**Enhanced Bicycle model and Complex Multi Body Dynamics model – A Comparative Study** Balaramakrishna.N	58
116	**Dynamic model of a Polymer Electrolyte Membrane Fuel Cell System** A Sri Harha, Gajji Sai kiran and Sri Harsha Arigela	59
	MANUFACTURING ENGINEERING	
117	**Experimental Investigation on Electrochemical Micro Machining Process Parameters of Al7075 T6 Alloy** K. Samson Praveen Kumar, G. Jaya Chandra Reddy	59
118	**Eigenvalue Analysis of a Spindle Bracket of a Miniaturized Machine Tool by Discrete Numerical Methods** K. Rajesh Babu	60
119	**Study on Viscoelastic Properties of Poly Ethylene Terephthalate Glycol (PETG) Material Processed by Fused Deposition Modeling** Gorrimuchu Vishal, V. Srinivasa Reddy, M. Indra Reddy	60
120	**Taguchi Analysis of MRR and PC for Sustainable Machining of Ti6Al4Valloy using WEDM Process** D. Devarasiddappa, M. Chandrasekaran, K. Palanikumar	61
121	**Prediction of Cutting forces in heat assisted turning of super alloy** A. Kiran Kumar, P. V. Ramaiah, B. Sreenivasulu	61
122	**Optimization of cutting temperature and tool wear in machining AISI4140 at different cooling conditions** Amrita M, Rukmini Srikant Revuru, VenkataRamana V.S.N.	62
123	**Experimental Investigations on the Surface Waviness in Abrasive Waterjet Milling of Aluminum 6061-T6 Alloy** Sourabh Adsul, D.S. Srinivasu	62
124	**Investigation of Tool Forces, Weld Bead Micro-hardness and Surface Roughness during Friction Stir Welding of Aluminum 6063 Alloy** Satish Chinchanikar,Swaroop Gharde, Mahendra Gadge	63
125	**Investigating the Effect of TiAlSiN Ultra Hard Coated Solid Carbide Tool on Surface Roughness in Dry End Milling of Inconel 625** Ramesh Rajguru,Hari Vasudevan	63
126	**Surface Roughness investigation of a Chemical assisted Rotary ultrasonic drilling of Float glass: A Novel approach** Ankit Sharma, Vivek Jain	64
127	**Some experimental investigations of powder mixed electric discharge machining (PMEDM): A Review** Sovan Bhowmick, Gautam Majumdar, Asish Bandyopadhyay	64
128	**Optimization of drilling process parameters on herringbone sisal fabric reinforced vinyl ester with polyurethane foam sandwich composites using grey relational analysis** Rajath Upadhya, Nagamadhu M, Samuel Sehgal, Vijay Kumar S	65

129	**Effect of process parameters on surface finish for pulsed electrochemical machining of Aluminium 6082** B. N. Manjunath, A.R.Vinod, S. K. Verma, M. R. Sankar	65
130	**State of Art on Vapour Smoothing of Fused Deposition Modelling Components** S. M. Basha, M. M. Basha,N. Venkaiah, M. R. Sankar	66
131	**Effect of spindle speed and feed rate on surface roughness of microchannels by micromilling process** M. S. Karthik, V. R. Raju, K. N. Reddy,N. Balashanmugam, M. R. Sankar	66
132	**Effect of FSW Parameters for Modified AA5083 alloy with Sc-Zr on Hardness, Tensile Strength and %Elongation** Srinivasa Rao Mallipudi, Ramanaiah Nallu	67
133	**Investigations on Hardness, Machinability and Electrical Conductivity of A356 Nanocomposites Reinforced with Sic Nanoparticles (Synthesized through Stir casting allied Ultrasonic Assisted Cavitation)** Suneel Donthamsetty, Penugonda Suresh Babu	67
134	**Review on Weldability prospects of Super Austenitic Stainless Steels** ArunkumarSrirangan,SeshadriSridharan	68
135	**A Comparative Study on CCGTAW and CCGTAW with Superimposed HF Current of Super Duplex Stainless Steel** Rajeev Kumar,Somnath Chattopadhyaya, Sanjeev Kumar, B.P. Agarwal	68
136	**Modelling Studies on Surface Roughness of Laminated Glass Cut by Abrasive Water Jet** Balasubramanya H. S, D. Venkatesh, Nishanth R Acharya	69
137	**Comparative Study of Electrical Discharge Machining, Electrical Discharge Drilling and Electrical Discharge Diamond Drilling process of Nimonic75** Rajeev Kumar, Somnath Chattopadhyaya, G.K. Singh, Sanjeev Kumar, U.K. Vates	69
138	**Response Surface Modeling and Optimisation of Cutting Temperature in Turning of AISI 52100 Hardened Alloy Steel under Minimal Cutting Fluid Application** Sandip. Mane, Sanjay Kumar	70
139	**An approximate analysis of crushing forces in the analytical models under quasi-static and dynamic compression of thin-walled aluminium tubes** Mujeeb Pasha, Edgar VivekMendonca, B.G. Vijayasimha Reddy	70
140	**Study on the influence of heat input on mechanical property and microstructure of weld in GMAW of AISI 201LN Stainless steel** Vivek Singh, M. Chandrasekaran, Sutanu Samanta	71
141	**Experimental investigations on surface roughness in drilling of AZ91D Magnesium Alloy** G.Satheesh,N.Naga Jayadeep, R.Purna Chandra Rao, M.Murali Mohan Balaji, P.Umamaheswarrao,B.Ravi Sankar	71
142	**Analysis of Surface Roughness during Turning of AISI 52100 Hardened Alloy Steel using Minimal Cutting Fluid Application** Sandip. Mane, Sanjay Kumar	72
143	**Experimental investigations on the effect of tool rotational speed on Mechanical properties of friction stir welded AZ 91 Mg Alloy**	72

	M.Sucharitha, B.Ravi Sankar, P.Umamaheswarrao	
144	**Prediction of Optimum Parameters of Hole Geometrical Features in Laser Drilling of Ti-6Al-4V Superalloy Sheet** Satish Namdev, Anand Pandey, Arun Kumar Pandey	73
145	**On-Machine Measurement of Geometric Tolerances on a Five-axis CNC Machining Centre** G. Rajamohan, Sangeeth P	73
146	**Nano Coatings for Development of Wear Properties on ToolMaterials during Machining of Nickel Alloys** Bandaru Kiran, U. Sowri Subhash, Rajyalakshmi G, SrinivasViswanath V, Jayakrishna K	74
147	**Laser Welding Using SPI Fibre Laser** Arava David Brainard,Chandra Neeraj Babu,Gajji Sai kiran	74
148	**Blind Pocket Micro Milling, Raster Mode and 18-W CO2 Pulse laser** Chitoor Damodhar Sai Singh, Bhumi Reddy Praveen Reddy,Chadalawada Vineeth	75
149	**Macro segregation in Casting** K. Manoj Babu, Chandra Niraj Babu, Arava David Brainard	75
150	**Experimental and Numerical Analysis of Friction Stir Welding of 6063 Aluminum Alloy** Srinivas Viswanath V, Sowri Subhash U,Rajyalakshmi G	76
151	**Response Optimization on Wire Electrical Discharge Machining of Monel 400** Srinivas Viswanath V,Sowri Subhash U, Rajyalakshmi G	76
152	**Comparison of Traditional Manufacturing and Current Manufacturing Trends - A Review** Sudarshan B, J.Suresh Babu	77
153	**Novel studies on Thermo-Mechanical Properties of Structural Glass with and without Coating** Nagamadhu M, S. B. Kivade	77
154	**Multi-Objective Optimization of Machining Parameters in Turning of EN8 Steel using Particle Swarm Optimization** S.Indumathi, M.Venkata Kishor Kumar, M. Gouthama Kranthi	78
155	**Effect of process parameters in plasma arc cutting on D2 steel & Optimization parameter with Non-linear regression analysis and TLBO algorithm** Darshan S. Viroliya, Dhruv gosani, M.V.Tadvi, A.B.Pandey	78
156	**Optimisation of Keyhole Plasma Arc Welding Process Using Grey-Based Taguchi Method for Dissimilar Welding of P91-SS316H** S.Indumathi,B. Anil Kumar, M.Gouthama Kranthi	79
157	**Experimental Investigation on Micro Electro Discharge Machining process using Tungsten Carbide and Titanium Nitride coated micro tool electrode for machining of Ti-6Al-4V** Shailesh S. Shirguppikar, Maharudra S. Patil	79
158	**Optimization of fused deposition modelling technique parameters for production of shrinkage in ABS object** Ravi Datt, Rakesh Kuma, Vijay Gautam	80
159	**A Review on Warm formed Tailor Welded Blanks (TWBs)**	80

	Rakesh Kumar, Vijay Gautam	
160	**Design and Analysis of Fixtures for Friction Stir Welding** Sambit K Muduli, Santanu Satpathy, Sanjog Behera, Tejasweeni Acharya, Purusottam Pattnaik, Kanchan Kumari	81
161	**Experimental Investigation on Similar and Dissimilar Alloy of Stainless Steel joints by LBW** B. Narayana Reddy, P. Hema, G. Padmanabhan	81
162	**Simulation of Deep Drawing Process using Abaqus with Johnson-Cook Model** Md.Sabiha Tamkeen, Sainath Nunna, P.S. Ravi Kumar, P. Nanda Kumar	82
163	**Effects of Welding Speed on Microstructure and Mechanical Properties of CO_2 Laser Welded Dissimilar Butt Joints between Low Carbon Steel and Austenitic Stainless Steel** M.P.Prabakaran, G.R.Kannan	82
164	**Experimental Investigations on Inconel 625 Alloy using Plasma ArcMachining** Pothur Hema, Ram Prasad Ganesan, K. Aruna	83
165	**Development and Process Parameter Assessment and Selection in Sheet Metal Spinning through Copra's and ANOVA Approach** S.P. Sundar Singh Sivam, Ganesh Babu Loganathan, K.saravanan, D.Kumaran, N. Harshavardhana	83
166	**Influence of EDM Process Parameters on Machining Characteristics of B_4C and Graphene Reinforced Al 6061 nano-Composites** Saikiran Ammisetty, CH. R. Vikram Kumar,K. Hemachandra Reddy	84
167	**Design and Optimization of gating system to eradicate scabbing defects in manifold casting in Foundry industries using L_9 Taguchi orthogonal array in MINITAB 17.0** Shubham Sharma, P.Vijaya Bhaskara Reddy, K. Raja Sekhar	84
	INDUSTRIAL ENGINEERING	
168	**Modeling and Analysis of Surface Roughness withStatistical and Soft Computing Approach** L.B. Abhang, M. Hameedullah	85
169	**Modified Genetic Algorithm for the Multi-Objective Scheduling of a Flow Shop with Sequence Dependent Setup Times** V. Anjana, V.V. Muhammed Anees, R. Sridharan, P.N. Ram Kumar	85
170	**Simulation modelling and analysis of due date assignment methods and scheduling decision rules in a flexible manufacturing system** V.V. Muhammed Anees, R. Sridharan	86
171	**Parameter Optimization of Assembly Line Balancing using Genetic Approach** Chandra Neeraj Babu,Gajji Sai kiran, Pappuri Hazarathaiah	86
172	**A Comparative Analysis of Vehicle Routing Problem in APSRTC Firm** G. R. PavanKarthik, K. Dharma Reddy	87
173	**Evaluation model of Code price estimation strategies supported by Fuzzy Theory** Aleem Basha Shaik	87
174	**Optimization of inventory using response surface methodology, correlation, simplex techniques and a comparative analysis ofinventory by using ABC-**	88

	XYZ-FSN quantitative analysis in APSRTC organization B. Venkata subbaiah, K. Dharma Reddy	
175	**Optimization of CNC-VTM Parameters for Material Removal Rate & Surface Roughness of Maraging Steel** S. Jayakrishna, P. Nanda Kumar	88
	INTERDISCIPLINARY	
176	**The Flywheel Energy Storage System (FESS)** ChitoorDamodhar Sai Singh,Gajji Sai kiran, Ch.Venkata Purushotham Sai	89
177	**Real Time Remote Monitoring, Control and Reporting Dashboard System to avoid Industrial Disasters using IIOT** L. Guru Kumar, G. Harinatha Reddy, P. Venkata Sai, Sk. Irfan, Mdk. Shabana Asmin	89
178	**A Robust Machine Learning Approach for Multiclass Alzheimer's Disease Detection using 3D Brain Magnetic Resonance Images** G. Nagarjuna Reddy, K. Nagireddy	90
179	**Experimental Investigation on Smart Solar Grass Cutter with Lawn Coverage** S. Satish, Chirag D Bhatt, R. Rahul Kothari, R.Balaji, Ashish Selokar	90
180	**An Experimental Study on Advanced Lane Changing Signal Assist Technology with Smart Helmet** Sourav Dubey, R.Balaji, K.Meghana, S.Seenu, Shivnandan Khatri	91
181	**A Potent based image watermarking using DWT-YIQ with probabilistic neural system** B.Lakshmana Rao, G. RoselineNesa Kumari, S. Maruthu Perumal	91
182	**A novel approach to control the Jointed Arm Robot to track the moving object on a conveyor using Integrated Computer Vision system** Pramod Kumar Thotapalli,CH. R. Vikram Kumar, B.ChandraMohana Reddy	92
183	**Multi-Plane Fused Deposition using Six Axis Industrial Robot** A. Sri Harsha, Ch. R. Vikram Kumar	92
184	**3-Domination Number of a Butterfly Graph** P.Vijaya Jyothi, B. Maheswari	93
185	**Trajectory planning of cooperative crane robots using trigonometric spline techniques and Robot Dynamics** S. Vijaya Bhaskar, L.V.V. Gopala Rao, A. and Gopala Krishna	93
186	**High Efficiency Video Coding: An Approach with Hybrid Wavelet Transform and Content Split Block Search Algorithm** Anitha Perla, P. Sudhakara Reddy, M.N.Giri Prasad	94
	POSTER PRESENTATION	
187	**Working of Spacecraft by Using Nuclear Powered Energy** Patibandla Akash Chowdary, M.Doondiram Chowdary	95
188	**Multi Objective Optimization of Machining Using Topsis and Deng's Similarity Based Approach** D.Lohitha Gayathri, Ch. Gokul Charan, D. Jagadeesh,	95

	P. Vijay Bhaskara Reddy	
189	**Automated Car Braking System Using Neural Network System in Lab View Environment** V.Yamini, N.Srigiri	96
190	**ANN-Based Fuzzy-Pid Controller for Estimating the Throttle Angle in SI Engine** Muttineni Sandeep, Nanga Kusal, Patchineela Srinivasulu	96
191	**Customization of Disposable Bottle Design** P.Thanmayi, Y.Ashok Kumar Reddy, P.Nanda Kumar	97
192	**Finite Element Analysis of Pin Fin** B.Chenchumohan	97
193	**Modeling and 3D Printing of Compound Gear Train used in Lathe Machine** T.Sucharitha, B.Nandini	98
194	**Smart Materials used in Aviation Industry: A Future Scope** Sk. Arshad, Sk. Abbas Ali, B.Hari, M. Sreenivasulu	98
195	**Design and Development of a Low Cost Single Wheeled Self Propelled Pesticides Sprayer for Indian Middle Class Farmers** Sk.Rahaman, V.Hari Krishna, V.Karthik	99
196	**Solar Powered Thermoelectric Cooler** SK.Vali Khan, Nanga Kusal, P. Sai Prudhvi, B. Satheesh Kumar	99
197	**Hydraulic Internal Combustion Engine** S. Kalyan,L. Damodhar, B. Sundarkiran, B. Hari	100
198	**Cloud Computing Applications in Core Engineering** K. Krishnakanth	100
199	**Exergy Analysis with Phase Change Material** G. Sumanth,D. Sujeevan,V. Sai Sumanth, B.Hari	101
200	**Preparation of Sugar Fuel as a Substitute for Traditional Black Powder to Reduce Emission** P.Himavanth,K.Jagadeesh, M. Jyothiswaroop Reddy	101
201	**An Intelligent Braking System** V. Sreekanth,D.Sumanth Reddy,M.Doondi Ram Chowdary, P.Vijaya Bhaskara Reddy	102
202	**NC Manufacturing** G.Anil kumar, P.Nanda Kumar	102
203	**Fabrication of Mini Air Cooler** P.Mahesh	103
204	**Evolving an Era of graphene** K. Abhishek,P. Sumanth, D.Lakshmi Narayana	103
205	**Dynamic data exchange interface between MATLAB and robot controller through socket programming to control the industrial robot based on visual feedback** K. Tharun,Sk. Iliyaz, T. PramodKumar, M. Chandra Sekhar	104
206	**Theo Jansen Mechanism 8 Legs Spider Bot** T.V. Praveen Kumar, P.V. Arudra, T. Pramod Kumar	104
207	**Plastic Drainage System with Waste Plastic** S. Bramhananda Reddy, G.V.S.K.Karthik	105
208	**Water Fuelled Vehicle** D.Mohith babu,D.Lakshmi Narayana,A.Gowtham Kumar G.CharanTeja	105

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

209	**Artificial Intelligence in Nano Technology** K. VamsiKrishna	106
210	**Stephen Nicolas Vehicle for Handicap People** K.Srihari	106
211	**Comparision of Ride Dynamic Analysis of a Passive and Active Suspesion System Using Matlab Simulink** K.Ravi Kumar, P.Jagadeesh	107
212	**Introduction to LPG Engine** Jalli Venkata Jaswanth Kumar	107
213	**Piezo-Electric Rail** Thatapudi Vishal, V. Yogesh Reddy	108
214	**Case Study e-Examinations** Vanja Aniket	108
215	**Simulation and Control of Vision assisted Robot arm using LabVIEW and Raspberry pie** K. Saisunil, Y. Ashok Kumar Reddy, Sk. Abbhas Ali, K. Baharath Kumar Reddy	109
216	**Selective and Ensemble Learning based Image Retrieval for High Dimensional Features** Gurukumar Lokku, Swathi A, Ganeh K, Madhuri M, Sharabhi A	109

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601
Guntur (Dist.), A.P.

204

Applied Mechanics and Materials
ISSN: 1662-7482, Vol. 903, pp 107-115
doi:10.4028/www.scientific.net/AMM.903.107

Submitted: 2020-04-26
Revised: 2020-09-28
Accepted: 2020-09-28
Online: 2021-04-15

Investigations on Hardness, Machinability and Electrical Conductivity of Stir Casted A356 Nanocomposites Reinforced with SiC Nanoparticles with Ultrasonic Assisted Cavitation

Dr. Suneel Donthamsetty[1,a*], Penugonda Suresh Babu[2,b]

[1]Dean (Academics) & Head of the Dept., Department of Mechanical Engineering, Narasaraopeta Engineering College (Autonomous), Narasaraopet, Guntur District, Andhra Pradesh, India, 522601. Mobile No: 91-9441895535

[2]Associate Professor, Department of Mechanical Engineering, Narasaraopeta Engineering College (Autonomous), Narasaraopet, Guntur District, Andhra Pradesh, India, 522601

[a]deanacademics@nrtec.ac.in, [b]sureshbabudevi.p@gmail.com

Keywords: SiC; A356; Nanocomposites; Hardness; Machinability; Electrical Conductivity

Abstract. The mechanical properties like hardness, machinability and electrical conductivity of nanocomposites are analysed in current work. Inferable from its good castable property, A356 has been picked as matrix material and due to proximity with reference to density; Nano silicon carbide (SiC) is chosen as reinforcement material. A novel technique "Ultrasonic assisted cavitation" is followed for the synthesis of nancomposites for uniform dispersion and better properties. By keeping the size of reinforcement as 50 nm and varying the quantity from 0.1 to 0.5 by wt%; it is perceived that the hardness & drill thrust forces are increased and electrical conductivity is decreased when equated to pure alloy.

1. Introduction

In recent past, researchers are inclined towards Nanocomposites owing to their excellent properties. The matrix material with reinforcing of any type like particle, fiber or whiskers (example-SiC, $CaCo_3$ etc.) of sizes less than 100 nanometers are called Metal Matrix Nanocomposites (MMNCs). They exhibit high strength, stiffness and resistance to corrosion and wear contrasted with regular Metal Matrix Composites (MMCs). Subsequently these are by and large widely utilized in automotive, aeronautical industries, biomedical areas etc., In MMNCs, material properties increases because of more interaction between very small size (nano) reinforcements and matrix phase. This aspect (Orowan strengthening mechanism) also discussed in present research work. The biggest hurdle before researchers is uniform dispersion of nanoparticles in melt. Author of this paper is recipient of funding for a major research project sponsored by University Grants Commission (UGC)-New Delhi and successfully developed A356 Metal Matrix Nanocomposites reinforced with SiC nanoparticles through stir casting allied ultrasonic assisted cavitation and established mechanical properties also. But in previous research works, except Hardness, Machinability and Electrical Conductivity were not presented [1, 2]. Present paper focuses on above properties in detail.

2. Literature Review

There has been an extraordinary improvement in utilizing aluminum composites for auxiliary uses, especially in aviation and car enterprises, attributable to their high conductivity nature, low density and strength, which prompts the weight decrease causes lot of savings. But still their usage is being restricted due to poor wear resistance and low hardness [3]. By reinforcing the SiC particles into A356 Al alloy, the hardness is increased [4].

VIDYANAGAR
N.B.K.R. INSTITUTE OF SCIENCE AND TECHNOLOGY
WORK IS WORSHIP

Celebrating 40 Years of Excellence

INTERNATIONAL CONFERENCE ON ADVANCES IN MATERIAL SCIENCE AND MECHANICAL ENGINEERING
ICAMSME 2020
NBKRIST

INTERNATIONAL CONFERENCE ON
ADVANCES IN MATERIAL SCIENCE AND MECHANICAL ENGINEERING
(ICAMSME - 2020)

7-9, February 2020

Souvenir

Organised by

Department of Mechanical Engineering
N.B.K.R. Institute of Science & Technology
(Autonomous)
Vidyanagar, SPSR Nellore (Dist.)
Andhra Pradesh – 524 413, India
(Affiliated to JNTUA, Ananthapuramu)

Supported by

ANDHRA PRADESH STATE COUNCIL OF HIGHER EDUCATION
జిజ్ఞాస కార్యవాహిక

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

AMARA RAJA
Gotta be a better way

ELIXON Technologies

IQAC

Change for better
RAM CADDSYS

RATHNA'S Herbals

List of Technical Papers

S.No	Title& Author (s)	Page
	MATERIAL SCIENCE	
1	**Mechanical & Metallurgical Characterization of Al-6061 HMMC with SiCp & Graphite as an Reinforcement** G.Srinivas Kumar, Y.Venkata Mohana Reddy, B.Chandra Mohana Reddy	1
2	**Wear Characteristics of Al7075/Al_2O_3/ SiC Hybrid Metal Matrix Nano Composites** N.Sreedhar, S.Balaguru	1
3	**Mechanical behavior of Al7075/Al_2O_3/SiC Hybrid Metal Matrix Nano Composites** N.Sreedhar, S.Balaguru	2
4	**Effect of Heat Treatment on Mechanical properties ofAluminium Metal Matrix Composite (AA6061/MoS2)** Manda Chandra Sekhar, B. Surendra Babu, N. Ramaniah	2
5	**Wear characteristics optimization of Al6061- sugarcane bagasse ashmetal matrix composite using Taguchi Method** Anwesh K. Virkunwar, Shouvik Ghosh, Ranjan Basak	3
6	**Coatings for Improving Tribological and Hot Corrosion Properties** Sowri Subhash, Bandaru Kiran, G.Rajyalakshmi, Srinivas Viswanath, K.Jayakrishna	3
7	**Effect of hybrid resin system on mechanical properties of carbon fiber composites for aerospace applications** C.Venkateshwar Reddy, P.RameshBabu, R.RamNarayanan	4
8	**Assimilation of Mechanical properties of reinforced Aluminum, Stainless steel wire mesh with Glass fiber epoxy hybrid composites for Aircraft application** A.Naga Phaneendra, R.Meenakshi Reddy, G.Sankaraiah, V.Diwakar Reddy	4
9	**Modelling of Flow Behaviour and Rheology Properties of M2 Steel in Semisolid State** Sudip Simlandi, Nilkanta Barman	5
10	**Mechanical and Rheology properties of PLA /ABS/TCS polymer Blends** B. Ramanjaneyulu, N. Venkatachalapathi, G. Prasanthi	5
11	**Manufacturing, microstructural and mechanical characterization of stir cast aluminum 7075/SiC metal matrix composite** Mulugundam Siva Surya, G. Prasanthi, Chidwilas I	6
12	**Study on mechanical properties of AA6061/SiC/B4C hybrid nano metal matrix composites** Shubhajit Das, M. Chandrasekaran, Sutanu Samanta	6
13	**Mechanical Characterization of Areca Fiber and Coconut Shell Powder Reinforced Hybrid Composites** G. Kishore Chowdari, D.V.V. Krishna Prasad	7
14	**Morphology and Corrosion Performance of Aluminium Matrix Nano composites Fabricated through Stir Casting Process** Md Tanwir Alam	7
15	**Effect of Silicon Carbide Boron Carbide and Fly-Ash Particles on Aluminium Metal Matrix Composite** C. Thirupathaiah, Sanjeev Reddy K Hudgikar	8

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

IQAC

16	**Mechanical and Tribological Behavior of Al 5083- Gr /SiO_2/B4c Hybrid Composites** T.Hariprasad, L.Shakeel Ahmed, K.Srinivasan, S.V.Suresh Babu	8
17	**Sliding Wear Characteristics of Carbon Filled Polytetrafluoroethylene (PTFE) Composite Against AISI 304Stainless Steel Counter face** Amol Barade, Satish Chinchanikar, Abhijeet Deshpande	9
18	**Influence of Heat treatment on Microstructure and Mechanical Behaviour of hot rolled Al-Mg-Si alloy** R.Vasanth Kumar, R.Keshavamurthy, Chandra S.Perugu, Siddaraju C	9
19	**Fracture Toughness Properties of Al/SiC/Al2O3/B4C MMC's: A Review** RajeshGandasi Lakshmikantha, Virupaxi Auradi	10
20	**Influence of Walnut (Juglans L.) Shell Particles Addition on the Mechanical Properties of Epoxy Composites** Mohit Mittal, Kanchan Phutela, Rajiv Chaudhary	10
21	**Effect of Fiber Length and Content on the Mechanical Properties ofPineapple Leaf Fiber Reinforced-Epoxy Composites** Mohit Mittal, Rajiv Chaudhary	11
22	**Mechanical Behavior of Jute/ Banana Hybrid Composites** K. Balu Narendra, A.K. Chaitanya, K.V.N. Girish Kumar T. Vijay Sriharsha	11
23	**Tribological performance of 1.5 wt% B4C particulate reinforced Al-12Si alloy nanocomposite fabricated by ultrasonic stir casting** Deepak M Shinde, Suswagata Poria, Prasanta Sahoo	12
24	**Mechanical Characterisation of UV Photo-Polymerised PMMA with different Photo-Initiator Concentration** M A Manjunath, K Naveen, P Vinod, N Balashanmugam, M R Sankar	12
25	**State of Art on Development of Diamond Reinforced Tungsten Carbide based Cutting Tool by Powder Metallurgy Routes** M. M. Basha, S. M. Basha, M. R. Sankar	13
26	**Optimization of Process Parameters for Plasma Sprayed Lanthanum Zirconate TBCson Nickel Based Super Alloy** R Keshavamurthy, Naveena BE, Ramesh T, Shashikumara N K	13
27	**Effect of electrolyte composition and heat treatment on corrosion resistance of coatings developed on Cp-Ti by anodization** Saikiran A, Sai Venkata Gayathri A, M. Narayanan, Nirusha N, Rameshbabu N	14
28	**Optimization of Tensile Strength and Hardness of Aluminium Based Metal Matrix Composites- A GRA Approach** Banavath Haritha Bai, Podaralla Nanda Kumar	14
29	**Effect of Oxygen Flow Rate on Surface Morphology and Optical Properties of Reactive DC Magnetron SputteredTiO_2 Thin Films** M. Lavanya,S. Sunitha Ratnam, B. Rajesh Kumar, T. Subba Rao	15
30	**An Experimental Study on the Effect of Reverse Two-Step Sintering onAluminum– Silicon Carbide Metal Matrix Composite** R. Raj Mohan, Dr. S. Raghuraman, B.G.Chidambaram, S. Balakrishnan, S.Vishnuram	15
31	**Mechanical Characterization of Epoxy Resin Polymer Matrix HybridComposite Reinforced with Kenaf and Flax Laminates** V.S.S Venkatesh	16
32	**Comparative Studies on Medium Carbon Low Alloy Steels and Maraging Steels**	16

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

	Nikhil kumar, C. M. Ramesha, Anilkumar T, Rajendra P, Chandan. B. R	
33	**Analysis of Tungsten-Alumina Nanocomposite Thin Films on SS304 Substrate** Sahas, Krupashankara M S, P V Srihari, Mohan Kumar T R	17
34	**Effect of volume fraction and micro structural characterization ofannealed AA6082 plates by Friction Stir Processing** N. Srimath, A. Murugarajan	17
35	**X-ray Diffraction Analysis by Williamson-Hall, Size-Strain, Halder-Wagner Plot Methods for Ni Doped CdS Nanoparticles** V. Krishna Bharath, Sashank Viswanadha, B. Hymavathi, B.Rajesh Kumar	18
36	**Optical analysis of KCl doped Poly vinyl pyrollidene (PVP)/Poly methyl methacrylate (PMMA) polymer electrolyte films** V. Raja, R. Padma Suvarna, K. Vasanth Kumar, Y. Madhava Kumar	18
37	**Experimental Determination of Anisotropic Properties and Evaluation of FLD for Sheet Metal Operations** A C Sekhara Reddy, B Sandeep, J Sandeep Kumar, B.Sanjanna	19
38	**Effect of Pre Heat Treatment of Boron Carbide Reinforcements on Mechanical Properties of AA7075/B_4C Composite Fabricated by Powder Metallurgy Techniques** Guttikonda Manohar, K M Pandey, S R Maity	19
39	**A Study on Mechanical Properties of ZrO_2, C and AA6061 Metal Matrix Composites** R Pandiyarajan, P Maran, S Marimuthu, S Sabarish	20
40	**Synthesis and Characterization of Nano Tio2 Film for Enhancing AntiReflection Properties** Natarajan Purushothaman, R Elansezhian, A V Ravi Prakash	20
41	**Air-water mist cooling characteristics of an MS plate in a Laboratoryscale ROT- an Experimental Observation** Rajdeep Sardar, Prishat Bachhar, Sounak Majumder, PranibeshMandal	21
42	**A Gaussian Process based model for air jet-cooling of MS plate in ROT** Prishat Bachhar, AbhishekKundu, Pranibesh Mandal	21
43	**Effect of Spin Speed on Structural and Optical Properties of Zn Doped CdS Thin Films Prepared by Sol-Gel Spin Coating Method** M. Venkata Veera Prasad, K. Thyagarajan, B. Rajesh Kumar	22
44	**Structural and Dielectric Properties of Calcium Bismuth Titanate(CaBi4Ti4O15) Ceramics** B. Hymavathi, T. Gopal Reddy, B. Rajesh Kumar, T. Subba Rao	22
45	**A Review – Black Oxide Coating on Metal Substrates of Steels, Aluminium, Magnesium and Copper** A Manoj,M M Basha, S M Basha, M R Sankar	23
46	**Simulation Modelling and Analysis of Residual Stresses and Temperature Distribution of Haste Alloy C-276 in GTAW** Bandaru Kiran, Dega Nagaraju, S. Narayanan	23
47	**Scrapped Cigarette Filter and Coconut Coir Filled Polymer Composite** R. Balaji, Mukesh Nadarajan, Ashish Selokar, Nilesh Ugemuge	24
48	**Effect of Oxygen flow rate on the characteristics of RF sputtered ZnOthin films** Pathan Parhana, M.V.Lakshmaiah	24
49	**Experimental Investigation On Mechanical Properties of Magnesium Based**	25

	Metal Matrix Composites Jaya Krishna Nagallapati, Nagaraju Dega	
50	**Fabrication and Testing of Functionally Graded Hybrid PV panel** P.S.Ravi Kumar,P. Nanda Kumar, G. Ranga Janardhana	25
51	**Experimental Investigation of Mechanical and Machining Characteristics of Aramid-Natural Fiber Composite** S.Rajesh, B.VijayaRamnath, Obuliei PraveenK, Paveen K.M	26
52	**Green Synthesis and Production of Copper / Silver Nano particles by using Plant Leaves** J. Subramanyam, G. Bhanodaya Reddy, B. G. Vijayasimha Reddy	26
53	**Studies on Tribological Behaviour of ZnO Nano rods Suspended in SAE 20w40 Engine Oil** R. Melvin Rajkumar, K. Kiruthiga S. Induja, P.S. Raghavan, Mohammed Shafee, Ravishankar Sathyamurthy, S.Chandra Sekhar	27
54	**Exploration of properties of Al 6060/CNT Metal Matrix Nano Composites** B. Madhusudhana Reddy, P. Anand, S.P. Akbar Hussain, K. Raja Sekhar	27
55	**Multi Objective Optimization of Wire EDM Process Parameters of Al7075-SiC Composites using Genetic Algorithm** M.Gouthama Kranthi, R.Vishnuvardhan Reddy,S.Indumathi	28
56	**Behaviour of Heat Treated Aluminium Alloy under Hardness Test.** Domadal Pranan, Sruthi Sivaram, Nidheesh S Prakash, Mukesh Nadarajan, Ashish Selokar	28
57	**Experimental Investigation on Al5083-SiCp AMMC using Cooling Slope Technique** Chandra Sekhar Macha, G. Ranga janardhana, P. Nanda kumar	29
58	**Investigations of Tensile Behaviour of Graphene composites** B. Vijaya Ramnath, N.Abishek, J.Melvin Antony, D.Kumaran, C.Nikhil Kumar	29
59	**Analysis of Control Factors Effecton FlexuralProperty of Tamarind Seed Particles/MWCNT Hybrid Nanocomposites** Muzzammil A. Annigeri,G. U. Raju	30
60	**Experimental and Numerical Analysis of Woven Glass-Epoxy Composite Laminates with Single Lap Joints** Shabbir Ahmed R. M., Mohammed Haneef, N.K.Shashikumara	30
61	**Investigations of Compression and Impact Behaviour of Hemp - Graphene Composites** B. Vijaya Ramnath,A.Manivasagam,R.Rohit,V.Sudharsan,S.Sheshathri	31
62	**Surface Analysis and Mechanical Behavior of Polysiloxane Coating on Steel Substrate** J. Rajasekar,R. Elansezhian	31
63	**Fabrication of Hybrid Aluminum Metal Matrix Composite** Ch. Venkatarao, T. Raviteja, S.Srikiran	32
64	**Equal Channel Angular Pressing of Mechanically Milled Al5083 Nano Composites** K. Chandra Sekhar, B. Ravisankar, S. Kumaran	32
65	**Solidification in Selective Laser Melting (SLM) of Nickel Alloy IN625** Boddu Pavan,Gajji Sai Kiran, Pappuri Hazarathaiah	33
66	**A Review on Improvement of Mechanical Properties on AISI409 Ferritic Stainless Steel by Nitriding Process**	33

	P.Rohith, K.Aishwarya, E.Nirmala Devi, R.Srilatha, Ram Subbiah	
67	**An Overview on AISI430 Ferritic Stainless Steel by Nitriding Process** A.Rohit Sai Krishna, B.Vamshi Krishna, T.Sashank, D.Harshith, Ram Subbiah	34
68	**Assessment of Properties on Duplex Stainless Steel by Carburizing Process - A Review** P.N.V.Krishna Chaitanya,K.Manjith Srinivas, M.Pramod, S.Bharath,Ram Subbiah	34
69	**Experimental and Phenomenological Study of the Effects of Input Setting Variables for Chip Deformation and Ignition Mapping in High Speed Machining of Mg Alloy for the Benefits of Industries Ergonomics** S.P. Sundar Singh Sivam, Ganesh Babu Loganathan, K.Saravanan D.Kumaran, N. Harshavardhana	35
70	**The Effect of Alkali Treatments on Vinyl Ester Hybrid Composites Stuffed with Sansevieria Cylindrical Fiber and Carbon Fiber** B.Amara Babu, V. Pandu Rangadu	35
71	**Preparation and Analysis of Silicon Carbide and Graphite Particulate Reinforcements in Aluminium Matrix** S. Raja Kumar, CH. Ramakrishnaiah	36
72	**Numerical Analysis of Al-6063/Tungsten Carbide (WC) Hybrid metal matrix composite (HMMC) as a Thermally Conducting Materials for higher temperature heat-transfer applications using ANSYS 14.0** Shubham Sharma, S.P.Akbar Hussian, J.Guru Sai, B.Satheesh Kumar	36
	THERMAL ENGINEERING	
73	**Theoretical Investigation of a Combined Cycle Power Plant** Mude Murali Mohan Naik, V. S. S. Murty, B. Durga Prasad	37
74	**Condensation Heat Transfer and Pressure Drop During R134a Saturated Vapour Inside a Brazed Plate-Fin Heat Exchanger with Wavy Fin** K.V. Ramana Murthy, C. Ranganayakulu, Sankaraiah Mada	37
75	**CFD Studies on A Centrifugal Compressor Stage with Twisted Vanes of a Low Solidity Diffuser** Venkateswara Rao Pothuri, Venkata Ramana Murty Govindaraju, Y. Ashok Kumar Reddy, M. Sreenivasulu	38
76	**Effect of Aluminium Oxide Nano Additive on Gasoline Fumigated SingleCylinder Diesel Engine** Tamilvanan A, Bharathiraja M, Balamurugan K, Mitun S Naveen Kumar CB, Chanduru R	38
77	**Hydro Magnetic Visco Elastic Fluid Flow Past a Vertical Porous Plate Under the Influence of Radiation Absorption and Heat Source** Ananda Reddy N, Uma Maheswar M	39
78	**Performance Study on the C.I.Engine using LHR and LTC in Combination with Biodiesel Blends** R.T. Sarathbabu, M. Kannan	39
79	**Physiological Jeffery fluid model under the Impact of Rotation and Hall Current with Porous Medium through an Inclined Vertical Tapered Channel with Slip Boundary Conditions** S. Ravikumar, Sk Abzal, Y. Harinath, N. Ameer Ahamme	40
80	**Assemble of Pyrolysis Machine for Plastic WastesConversion into Liquid Hydrocarbon Fuel** M. Venkata Subbaiah, S. Sunil Kumar Reddy, B. Durga Prasad	40
81	**Preparation of Fleshing Oil Methyl Ester from leather industry fleshings,**	41

	performance and emission studies in standard diesel engine K.V. Sandhya, V. Brindha, S. Chandra Sekharand K.Karuppasamy, N. Vedaraman, K.C. Velappan	
82	**Experimental exploration on the potentiality of fuel blends microalgae biodiesel –additive diethyl ether with a diesel engine coupled by supercharger and EGR** Vamsi Krishna K, Sastry GRK, John Deb Barma, G. Santosh Kumar	41
83	**Optimal ternary blend for diesel engine- diesel, diethyl ether & canola oil** K. Venkata Akash, V. Srikar Reddy, B.Hari,M. Sreenivasulu, S. Suresh	42
84	**Experimental investigatation on computerised VCR engine Operating with ternary blend** K. Venkata Akash, V. SrikarReddy, B.Hari,M. Sreenivasulu, S. Suresh	42
85	**Performance of Evacuated Stepped Basin Solar still with PCM and Intermittent Water Collector** P. Tejendra, P. Sumanth, B.Hari, P. Kesavulu, S. Suresh	43
86	**Moderate Temperature Waste Heat Recovery Using Kalina Cycle** M Subba Reddy, Mude Murali Mohan Naik	43
87	**Experimental Investigation on a PCM based Thermal Energy Storage System for a VCR System** Shaik Riyaz Basha	44
88	**Failure Analysis of IC Engine Valves and its Performance Evaluation for Various Titanium based Composite Coatings using FE Analysis** R. SundarRao, K. Hemachandra Reddy, Ch R. Vikram Kumar	44
89	**Thermal Radiation and Velocity Second Order Slip effects on Peristaltic flow under the influence of Hall current through a channel** S. Ravikumar, M. Sreenivasulu, D. Vijaya Sekhar, S.Kiranmaiye N. Ameer Ahammed	45
90	**Solar Thermal Energy Storage Using Sensible and Latent Heat a Future Generation Energy Utilization Technology** P. Narasimha Siva Teja, P. Badari Narayana, K. Hemachandra Reddy	45
91	**Thermal performance and optimization of Paraffin wax as a Phase changing materials (PCM)-based heat sink with internal fins using ANSYS: An experimental approach** Shubham Sharma, M.Sreenivasulu, Y.Ashok Kumar Reddy, Venkateswara Rao Pothuri	46
92	**Gps And Gis Tools And Applications In Energy Sector Towards Enhanced Energy Efficiency** A. G. Matani	46
	DESIGN ENGINEERING	
93	**Vibration Analysis of Gearbox Fault Diagnosis using DWT and Statistical Features** Setti Suresh, M. Srinivas, V.P.S. Naidu	47
94	**Design and Analysis of a Pressure Relief Valve – Case Study** Amarnath J. M,Sudhir Nair, Rajyalakshmi G, Srinivas Viswanath V	48
95	**Bearing Health Condition Monitoring Using Time DomainFeaturesand LDA Classifier** Y. Chandukrishna, V.P.S. Naidu	48

96	**Fabrication and simulation of Bladeless Turbine** M.Sivaramakrishaniah, P.Nanda Kumar	49
97	**Finite Element Simulation of Temperature Distribution, Distortion and Residual Stresses of Similar Welded Joints** K. Venkateswarlu, P. Nanda Kumar, P.S. Ravi Kumar	49
98	**Modeling and Simulation of a Passive Suspension System forQuarter Car and Half Car Models using MATLAB Simulink** Harsha Kamatham, P. Srihari Reddy, Bharath Kumar	50
99	**Damping Performance of Polychloroprene Rubber for Unconstrained Damping Applications** Prasanth Kumar Mallipudi, P.Jyothi, N.Ramanaiah, V.V.S. Bhaskara Raju	50
100	**Simulation Modelling and Analysis of Startup India Initiative procedures** Dega Nagaraju, Sai Krishna Pabba, R. Inder Raj Singh, Paul Satwik	51
101	**Numerical Analysis of a Submarine Hull Drag and Open-Water Propeller Performance** Pritam Ghosh, Pranibesh Mandal	51
102	**Experimental Modal Analysis of a Linear Reciprocating Tribometer for Maximum Reciprocating Frequency** Harish Thetanikkal Viswanathan, Prem Kumar J, Rajeev V R	52
103	**Finite Element Analysis of Friction Stir Welding of Copper** Keshavamurthy R, Shiva Prasad R, M.C. Jeevan,Pradeep Kumar G.S, Shashi kumara N.K	52
104	**Structural and Thermal Analysis of Brake Drum** Shaik.Chand Mabhu Subhani, A.Pavan Kumar, D.Venkata Rao, K.Anna Purnaiah	53
105	**Leaf Spring Model for Heavy Load Vehicle Using Solid Works and ANSYS Analysis** Chirag D. Bhatt, Mukesh Nadarajan, R.Balaji, Ashish Selokar	53
106	**Review on Condition Monitoring of Bearings Using Vibrations** M. SaiKoushik, G.Sai Ravi Teja, P. Santosh kumar, R.Balaji, K.Viswanathan,Ashish Selokar	54
107	**Computer Aided Modeling of Helical Springs with Different Cross Section Using CATIA V5 R-19 Software** Reddy Sreenivasulu, N. Yaswanth Krishna, M.Sukumar, O.N.Gouse Basha, N. ArunKumar, K. Heamanth, M.Vamsi Krishna	54
108	**Design evaluation of a four wheeler suspension system for variable load conditions** Kiran Sunkara,Muchakala Suresh,K.Venkateswarlu	55
109	**A Novel Experimental Study & Design Study on Systematic Designed Sea Water Purifier Machine using Activated Carbon** R. Balaji, S. Gowtham, Kelam Meghana, Ankush Sarkar, Ijas Ahamed	55
110	**Development of Model for Investigation of Temperature effect in Radial Ball Bearing Using Matrix Method of Dimensional Analysis** G.Maheedhara Reddy, V. Diwakar Reddy, B. Satheesh Kumar	56
111	**Performance Evaluation and Energy Augmentation of Wind Turbine System: An overview** K. Ramesh Kumar, M. Selvaraj	56
112	**Modal and Frequncy Response Analysis of Four-Wheeled Passenger Car.**	57

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

IQAC

	Vehicle Under Harmonic Input Excitation P.Srihari Reddy, Ramji Koona	
113	**Design and Analysis of Convertible Bench** S.B. Mohan, B.OmPrakash	57
114	**Experimental Characterization of Stiffness and Damping of Assemblies with Bolted Lap Joints** A.T. Ananthakrishna, D.S. Srinivasu, Mohit Law	58
115	**Enhanced Bicycle model and Complex Multi Body Dynamics model – A Comparative Study** Balaramakrishna.N	58
116	**Dynamic model of a Polymer Electrolyte Membrane Fuel Cell System** A Sri Harha, Gajji Sai kiran and Sri Harsha Arigela	59
	MANUFACTURING ENGINEERING	
117	**Experimental Investigation on Electrochemical Micro Machining Process Parameters of Al7075 T6 Alloy** K. Samson Praveen Kumar, G. Jaya Chandra Reddy	59
118	**Eigenvalue Analysis of a Spindle Bracket of a Miniaturized Machine Tool by Discrete Numerical Methods** K. Rajesh Babu	60
119	**Study on Viscoelastic Properties of Poly Ethylene Terephthalate Glycol (PETG) Material Processed by Fused Deposition Modeling** Gorrimuchu Vishal, V. Srinivasa Reddy, M. Indra Reddy	60
120	**Taguchi Analysis of MRR and PC for Sustainable Machining of Ti6Al4Valloy using WEDM Process** D. Devarasiddappa, M. Chandrasekaran, K. Palanikumar	61
121	**Prediction of Cutting forces in heat assisted turning of super alloy** A. Kiran Kumar, P. V. Ramaiah, B. Sreenivasulu	61
122	**Optimization of cutting temperature and tool wear in machining AISI4140 at different cooling conditions** Amrita M, Rukmini Srikant Revuru, VenkataRamana V.S.N.	62
123	**Experimental Investigations on the Surface Waviness in Abrasive Waterjet Milling of Aluminum 6061-T6 Alloy** Sourabh Adsul, D.S. Srinivasu	62
124	**Investigation of Tool Forces, Weld Bead Micro-hardness and Surface Roughness during Friction Stir Welding of Aluminum 6063 Alloy** Satish Chinchanikar,Swaroop Gharde, Mahendra Gadge	63
125	**Investigating the Effect of TiAlSiN Ultra Hard Coated Solid Carbide Tool on Surface Roughness in Dry End Milling of Inconel 625** Ramesh Rajguru,Hari Vasudevan	63
126	**Surface Roughness investigation of a Chemical assisted Rotary ultrasonic drilling of Float glass: A Novel approach** Ankit Sharma, Vivek Jain	64
127	**Some experimental investigations of powder mixed electric discharge machining (PMEDM): A Review** Sovan Bhowmick, Gautam Majumdar, Asish Bandyopadhyay	64
128	**Optimization of drilling process parameters on herringbone sisal fabric reinforced vinyl ester with polyurethane foam sandwich composites using grey relational analysis** Rajath Upadhya, Nagamadhu M, Samuel Sehgal, Vijay Kumar S	65

129	**Effect of process parameters on surface finish for pulsed electrochemical machining of Aluminium 6082** B. N. Manjunath, A.R.Vinod, S. K. Verma, M. R. Sankar	65
130	**State of Art on Vapour Smoothing of Fused Deposition Modelling Components** S. M. Basha, M. M. Basha,N. Venkaiah, M. R. Sankar	66
131	**Effect of spindle speed and feed rate on surface roughness of microchannels by micromilling process** M. S. Karthik, V. R. Raju, K. N. Reddy,N. Balashanmugam, M. R. Sankar	66
132	**Effect of FSW Parameters for Modified AA5083 alloy with Sc-Zr on Hardness, Tensile Strength and %Elongation** Srinivasa Rao Mallipudi, Ramanaiah Nallu	67
133	**Investigations on Hardness, Machinability and Electrical Conductivity of A356 Nanocomposites Reinforced with Sic Nanoparticles (Synthesized through Stir casting allied Ultrasonic Assisted Cavitation)** Suneel Donthamsetty, Penugonda Suresh Babu	67
134	**Review on Weldability prospects of Super Austenitic Stainless Steels** ArunkumarSrirangan,SeshadriSridharan	68
135	**A Comparative Study on CCGTAW and CCGTAW with Superimposed HF Current of Super Duplex Stainless Steel** Rajeev Kumar,Somnath Chattopadhyaya, Sanjeev Kumar, B.P. Agarwal	68
136	**Modelling Studies on Surface Roughness of Laminated Glass Cut by Abrasive Water Jet** Balasubramanya H. S, D. Venkatesh, Nishanth R Acharya	69
137	**Comparative Study of Electrical Discharge Machining, Electrical Discharge Drilling and Electrical Discharge Diamond Drilling process of Nimonic75** Rajeev Kumar, Somnath Chattopadhyaya, G.K. Singh, Sanjeev Kumar, U.K. Vates	69
138	**Response Surface Modeling and Optimisation of Cutting Temperature in Turning of AISI 52100 Hardened Alloy Steel under Minimal Cutting Fluid Application** Sandip. Mane, Sanjay Kumar	70
139	**An approximate analysis of crushing forces in the analytical models under quasi-static and dynamic compression of thin-walled aluminium tubes** Mujeeb Pasha, Edgar VivekMendonca, B.G. Vijayasimha Reddy	70
140	**Study on the influence of heat input on mechanical property and microstructure of weld in GMAW of AISI 201LN Stainless steel** Vivek Singh, M. Chandrasekaran, Sutanu Samanta	71
141	**Experimental investigations on surface roughness in drilling of AZ91D Magnesium Alloy** G.Satheesh,N.Naga Jayadeep, R.Purna Chandra Rao, M.Murali Mohan Balaji, P.Umamaheswarrao,B.Ravi Sankar	71
142	**Analysis of Surface Roughness during Turning of AISI 52100 Hardened Alloy Steel using Minimal Cutting Fluid Application** Sandip. Mane, Sanjay Kumar	72
143	**Experimental investigations on the effect of tool rotational speed on Mechanical properties of friction stir welded AZ 91 Mg Alloy**	72

	M.Sucharitha, B.Ravi Sankar, P.Umamaheswarrao	
144	**Prediction of Optimum Parameters of Hole Geometrical Features in Laser Drilling of Ti-6Al-4V Superalloy Sheet** Satish Namdev, Anand Pandey, Arun Kumar Pandey	73
145	**On-Machine Measurement of Geometric Tolerances on a Five-axis CNC Machining Centre** G. Rajamohan, Sangeeth P	73
146	**Nano Coatings for Development of Wear Properties on ToolMaterials during Machining of Nickel Alloys** Bandaru Kiran, U. Sowri Subhash, Rajyalakshmi G, SrinivasViswanath V, Jayakrishna K	74
147	**Laser Welding Using SPI Fibre Laser** Arava David Brainard,Chandra Neeraj Babu,Gajji Sai kiran	74
148	**Blind Pocket Micro Milling, Raster Mode and 18-W CO2 Pulse laser** Chitoor Damodhar Sai Singh, Bhumi Reddy Praveen Reddy,Chadalawada Vineeth	75
149	**Macro segregation in Casting** K. Manoj Babu, Chandra Niraj Babu, Arava David Brainard	75
150	**Experimental and Numerical Analysis of Friction Stir Welding of 6063 Aluminum Alloy** Srinivas Viswanath V, Sowri Subhash U,Rajyalakshmi G	76
151	**Response Optimization on Wire Electrical Discharge Machining of Monel 400** Srinivas Viswanath V,Sowri Subhash U, Rajyalakshmi G	76
152	**Comparison of Traditional Manufacturing and Current Manufacturing Trends - A Review** Sudarshan B, J.Suresh Babu	77
153	**Novel studies on Thermo-Mechanical Properties of Structural Glass with and without Coating** Nagamadhu M, S. B. Kivade	77
154	**Multi-Objective Optimization of Machining Parameters in Turning of EN8 Steel using Particle Swarm Optimization** S.Indumathi, M.Venkata Kishor Kumar, M. Gouthama Kranthi	78
155	**Effect of process parameters in plasma arc cutting on D2 steel & Optimization parameter with Non-linear regression analysis and TLBO algorithm** Darshan S. Viroliya, Dhruv gosani, M.V.Tadvi, A.B.Pandey	78
156	**Optimisation of Keyhole Plasma Arc Welding Process Using Grey-Based Taguchi Method for Dissimilar Welding of P91-SS316H** S.Indumathi,B. Anil Kumar, M.Gouthama Kranthi	79
157	**Experimental Investigation on Micro Electro Discharge Machining process using Tungsten Carbide and Titanium Nitride coated micro tool electrode for machining of Ti-6Al-4V** Shailesh S. Shirguppikar, Maharudra S. Patil	79
158	**Optimization of fused deposition modelling technique parameters for production of shrinkage in ABS object** Ravi Datt, Rakesh Kuma, Vijay Gautam	80
159	**A Review on Warm formed Tailor Welded Blanks (TWBs)**	80

	Rakesh Kumar, Vijay Gautam	
160	**Design and Analysis of Fixtures for Friction Stir Welding** Sambit K Muduli, Santanu Satpathy, Sanjog Behera, Tejasweeni Acharya, Purusottam Pattnaik, Kanchan Kumari	81
161	**Experimental Investigation on Similar and Dissimilar Alloy of Stainless Steel joints by LBW** B. Narayana Reddy, P. Hema, G. Padmanabhan	81
162	**Simulation of Deep Drawing Process using Abaqus with Johnson-Cook Model** Md.Sabiha Tamkeen, Sainath Nunna, P.S. Ravi Kumar, P. Nanda Kumar	82
163	**Effects of Welding Speed on Microstructure and Mechanical Properties of CO_2 Laser Welded Dissimilar Butt Joints between Low Carbon Steel and Austenitic Stainless Steel** M.P.Prabakaran, G.R.Kannan	82
164	**Experimental Investigations on Inconel 625 Alloy using Plasma ArcMachining** Pothur Hema, Ram Prasad Ganesan, K. Aruna	83
165	**Development and Process Parameter Assessment and Selection in Sheet Metal Spinning through Copra's and ANOVA Approach** S.P. Sundar Singh Sivam, Ganesh Babu Loganathan, K.saravanan, D.Kumaran, N. Harshavardhana	83
166	**Influence of EDM Process Parameters on Machining Characteristics of B_4C and Graphene Reinforced Al 6061 nano-Composites** Saikiran Ammisetty, CH. R. Vikram Kumar,K. Hemachandra Reddy	84
167	**Design and Optimization of gating system to eradicate scabbing defects in manifold casting in Foundry industries using L_9 Taguchi orthogonal array in MINITAB 17.0** Shubham Sharma, P.Vijaya Bhaskara Reddy, K. Raja Sekhar	84
	INDUSTRIAL ENGINEERING	
168	**Modeling and Analysis of Surface Roughness withStatistical and Soft Computing Approach** L.B. Abhang, M. Hameedullah	85
169	**Modified Genetic Algorithm for the Multi-Objective Scheduling of a Flow Shop with Sequence Dependent Setup Times** V. Anjana, V.V. Muhammed Anees, R. Sridharan, P.N. Ram Kumar	85
170	**Simulation modelling and analysis of due date assignment methods and scheduling decision rules in a flexible manufacturing system** V.V. Muhammed Anees, R. Sridharan	86
171	**Parameter Optimization of Assembly Line Balancing using Genetic Approach** Chandra Neeraj Babu,Gajji Sai kiran, Pappuri Hazarathaiah	86
172	**A Comparative Analysis of Vehicle Routing Problem in APSRTC Firm** G. R. PavanKarthik, K. Dharma Reddy	87
173	**Evaluation model of Code price estimation strategies supported by Fuzzy Theory** Aleem Basha Shaik	87
174	**Optimization of inventory using response surface methodology, correlation, simplex techniques and a comparative analysis ofinventory by using ABC-**	88

	XYZ-FSN quantitative analysis in APSRTC organization B. Venkata subbaiah, K. Dharma Reddy	
175	**Optimization of CNC-VTM Parameters for Material Removal Rate & Surface Roughness of Maraging Steel** S. Jayakrishna, P. Nanda Kumar	88
	INTERDISCIPLINARY	
176	**The Flywheel Energy Storage System (FESS)** ChitoorDamodhar Sai Singh,Gajji Sai kiran, Ch.Venkata Purushotham Sai	89
177	**Real Time Remote Monitoring, Control and Reporting Dashboard System to avoid Industrial Disasters using IIOT** L. Guru Kumar, G. Harinatha Reddy, P. Venkata Sai, Sk. Irfan, Mdk. Shabana Asmin	89
178	**A Robust Machine Learning Approach for Multiclass Alzheimer's Disease Detection using 3D Brain Magnetic Resonance Images** G. Nagarjuna Reddy, K. Nagireddy	90
179	**Experimental Investigation on Smart Solar Grass Cutter with Lawn Coverage** S. Satish, Chirag D Bhatt, R. Rahul Kothari, R.Balaji, Ashish Selokar	90
180	**An Experimental Study on Advanced Lane Changing Signal Assist Technology with Smart Helmet** Sourav Dubey, R.Balaji, K.Meghana, S.Seenu, Shivnandan Khatri	91
181	**A Potent based image watermarking using DWT-YIQ with probabilistic neural system** B.Lakshmana Rao, G. RoselineNesa Kumari, S. Maruthu Perumal	91
182	**A novel approach to control the Jointed Arm Robot to track the moving object on a conveyor using Integrated Computer Vision system** Pramod Kumar Thotapalli,CH. R. Vikram Kumar, B.ChandraMohana Reddy	92
183	**Multi-Plane Fused Deposition using Six Axis Industrial Robot** A. Sri Harsha, Ch. R. Vikram Kumar	92
184	**3-Domination Number of a Butterfly Graph** P.Vijaya Jyothi, B. Maheswari	93
185	**Trajectory planning of cooperative crane robots using trigonometric spline techniques and Robot Dynamics** S. Vijaya Bhaskar, L.V.V. Gopala Rao, A. and Gopala Krishna	93
186	**High Efficiency Video Coding: An Approach with Hybrid Wavelet Transform and Content Split Block Search Algorithm** Anitha Perla, P. Sudhakara Reddy, M.N.Giri Prasad	94
	POSTER PRESENTATION	
187	**Working of Spacecraft by Using Nuclear Powered Energy** Patibandla Akash Chowdary, M.Doondiram Chowdary	95
188	**Multi Objective Optimization of Machining Using Topsis and Deng's Similarity Based Approach** D.Lohitha Gayathri, Ch. Gokul Charan, D. Jagadeesh,	95

	P. Vijay Bhaskara Reddy	
189	**Automated Car Braking System Using Neural Network System in Lab View Environment** V.Yamini, N.Srigiri	96
190	**ANN-Based Fuzzy-Pid Controller for Estimating the Throttle Angle in SI Engine** Muttineni Sandeep, Nanga Kusal, Patchineela Srinivasulu	96
191	**Customization of Disposable Bottle Design** P.Thanmayi, Y.Ashok Kumar Reddy, P.Nanda Kumar	97
192	**Finite Element Analysis of Pin Fin** B.Chenchumohan	97
193	**Modeling and 3D Printing of Compound Gear Train used in Lathe Machine** T.Sucharitha, B.Nandini	98
194	**Smart Materials used in Aviation Industry: A Future Scope** Sk. Arshad, Sk. Abbas Ali, B.Hari, M. Sreenivasulu	98
195	**Design and Development of a Low Cost Single Wheeled Self Propelled Pesticides Sprayer for Indian Middle Class Farmers** Sk.Rahaman, V.Hari Krishna, V.Karthik	99
196	**Solar Powered Thermoelectric Cooler** SK.Vali Khan, Nanga Kusal, P. Sai Prudhvi, B. Satheesh Kumar	99
197	**Hydraulic Internal Combustion Engine** S. Kalyan,L. Damodhar, B. Sundarkiran, B. Hari	100
198	**Cloud Computing Applications in Core Engineering** K. Krishnakanth	100
199	**Exergy Analysis with Phase Change Material** G. Sumanth,D. Sujeevan,V. Sai Sumanth, B.Hari	101
200	**Preparation of Sugar Fuel as a Substitute for Traditional Black Powder to Reduce Emission** P.Himavanth,K.Jagadeesh, M. Jyothiswaroop Reddy	101
201	**An Intelligent Braking System** V. Sreekanth,D.Sumanth Reddy,M.Doondi Ram Chowdary, P.Vijaya Bhaskara Reddy	102
202	**NC Manufacturing** G.Anil kumar, P.Nanda Kumar	102
203	**Fabrication of Mini Air Cooler** P.Mahesh	103
204	**Evolving an Era of graphene** K. Abhishek,P. Sumanth, D.Lakshmi Narayana	103
205	**Dynamic data exchange interface between MATLAB and robot controller through socket programming to control the industrial robot based on visual feedback** K. Tharun,Sk. Iliyaz, T. PramodKumar, M. Chandra Sekhar	104
206	**Theo Jansen Mechanism 8 Legs Spider Bot** T.V. Praveen Kumar, P.V. Arudra, T. Pramod Kumar	104
207	**Plastic Drainage System with Waste Plastic** S. Bramhananda Reddy, G.V.S.K.Karthik	105
208	**Water Fuelled Vehicle** D.Mohith babu,D.Lakshmi Narayana,A.Gowtham Kumar G.CharanTeja	105

209	**Artificial Intelligence in Nano Technology** K. VamsiKrishna	106
210	**Stephen Nicolas Vehicle for Handicap People** K.Srihari	106
211	**Comparision of Ride Dynamic Analysis of a Passive and Active Suspesion System Using Matlab Simulink** K.Ravi Kumar, P.Jagadeesh	107
212	**Introduction to LPG Engine** Jalli Venkata Jaswanth Kumar	107
213	**Piezo-Electric Rail** Thatapudi Vishal, V. Yogesh Reddy	108
214	**Case Study e-Examinations** Vanja Aniket	108
215	**Simulation and Control of Vision assisted Robot arm using LabVIEW and Raspberry pie** K. Saisunil, Y. Ashok Kumar Reddy, Sk. Abbhas Ali, K. Baharath Kumar Reddy	109
216	**Selective and Ensemble Learning based Image Retrieval for High Dimensional Features** Gurukumar Lokku, Swathi A, Ganeh K, Madhuri M, Sharabhi A	109

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601,
Guntur (Dist.), A.P.

2021

Applied Mechanics and Materials
ISSN: 1662-7482, Vol. 903, pp 107-115
doi:10.4028/www.scientific.net/AMM.903.107
© 2021 Trans Tech Publications Ltd, Switzerland

Submitted: 2020-04-26
Revised: 2020-09-28
Accepted: 2020-09-28
Online: 2021-04-15

Investigations on Hardness, Machinability and Electrical Conductivity of Stir Casted A356 Nanocomposites Reinforced with SiC Nanoparticles with Ultrasonic Assisted Cavitation

Dr. Suneel Donthamsetty[1,a*], Penugonda Suresh Babu[2,b]

[1]Dean (Academics) & Head of the Dept., Department of Mechanical Engineering, Narasaraopeta Engineering College (Autonomous), Narasaraopet, Guntur District, Andhra Pradesh, India, 522601: Mobile No: 91-9441895535

[2]Associate Professor, Department of Mechanical Engineering, Narasaraopeta Engineering College (Autonomous), Narasaraopet, Guntur District, Andhra Pradesh, India, 522601

[a]deanacademics@nrtec.ac.in, [b]sureshbabudevi.p@gmail.com

Keywords: SiC; A356; Nanocomposites; Hardness; Machinability; Electrical Conductivity

Abstract. The mechanical properties like hardness, machinability and electrical conductivity of nanocomposites are analysed in current work. Inferable from its good castable property, A356 has been picked as matrix material and due to proximity with reference to density; Nano silicon carbide (SiC) is chosen as reinforcement material. A novel technique "Ultrasonic assisted cavitation" is followed for the synthesis of nancomposites for uniform dispersion and better properties. By keeping the size of reinforcement as 50 nm and varying the quantity from 0.1 to 0.5 by wt%; it is perceived that the hardness & drill thrust forces are increased and electrical conductivity is decreased when equated to pure alloy.

1. Introduction

In recent past, researchers are inclined towards Nanocomposites owing to their excellent properties. The matrix material with reinforcing of any type like particle, fiber or whiskers (example-SiC, $CaCo_3$ etc.) of sizes less than 100 nanometers are called Metal Matrix Nanocomposites (MMNCs). They exhibit high strength, stiffness and resistance to corrosion and wear contrasted with regular Metal Matrix Composites (MMCs). Subsequently these are by and large widely utilized in automotive, aeronautical industries, biomedical areas etc., In MMNCs, material properties increases because of more interaction between very small size (nano) reinforcements and matrix phase. This aspect (Orowan strengthening mechanism) also discussed in present research work. The biggest hurdle before researchers is uniform dispersion of nanoparticles in melt. Author of this paper is recipient of funding for a major research project sponsored by University Grants Commission (UGC)-New Delhi and successfully developed A356 Metal Matrix Nanocomposites reinforced with SiC nanoparticles through stir casting allied ultrasonic assisted cavitation and established mechanical properties also. But in previous research works, except Hardness, Machinability and Electrical Conductivity were not presented [1, 2]. Present paper focuses on above properties in detail.

2. Literature Review

There has been an extraordinary improvement in utilizing aluminum composites for auxiliary uses, especially in aviation and car enterprises, attributable to their high conductivity nature, low density and strength, which prompts the weight decrease causes lot of savings. But still their usage is being restricted due to poor wear resistance and low hardness [3]. By reinforcing the SiC particles into A356 Al alloy, the hardness is increased [4].

NATIONAL CONFERENCE ON RECENT ADVANCES IN TECHNOLOGY (NCRAT-2021)

INSTITUTION'S INNOVATION COUNCIL

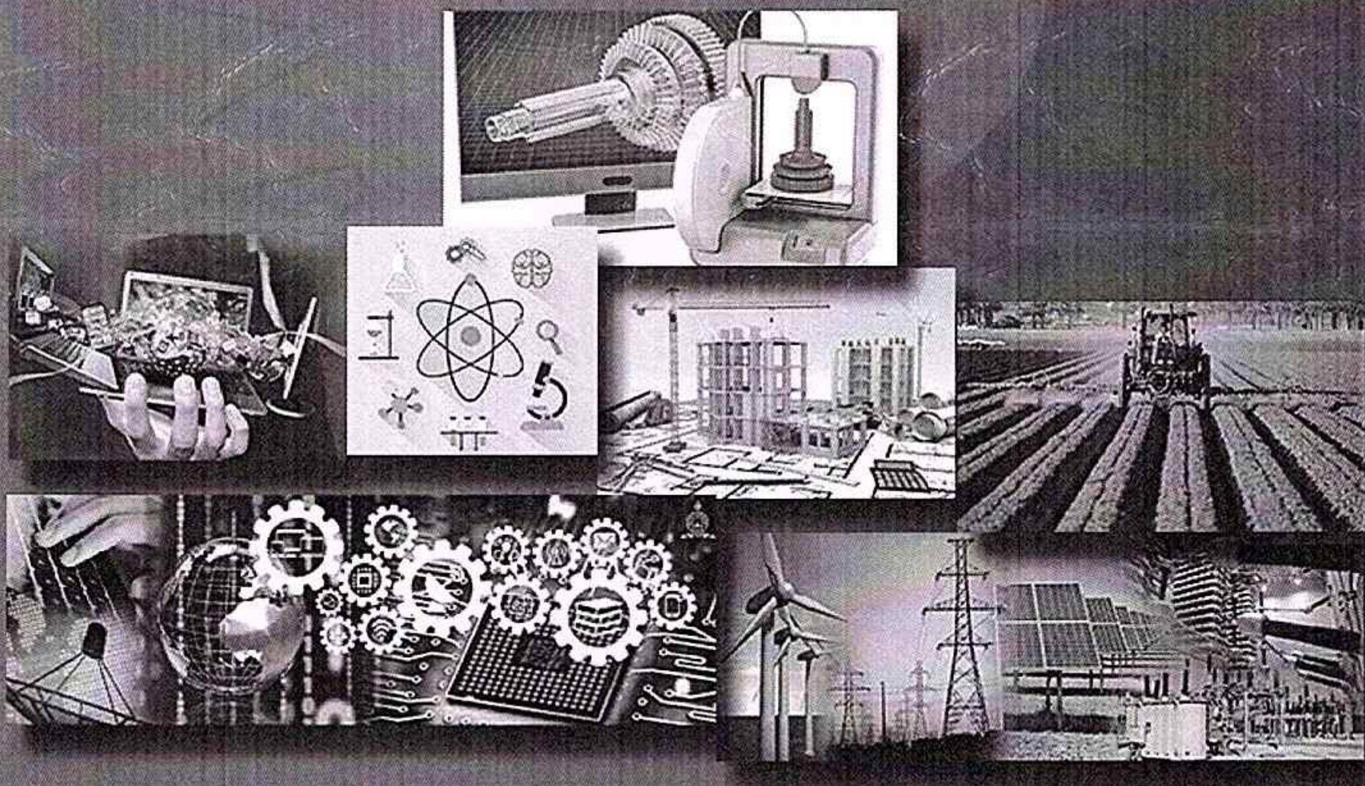
GIFT

NISP GIFT

MSME Ministry of MSME, Govt. of India | IAO International Accreditation Organization | "A" Grade Accreditation by NAAC | NBA EEE, ECE, Mech, CSE NBA Accreditated | Scientific & Industrial Research Organization | ISO

Proceedings of National Conference on Recent Advances in Technology (NCRAT-2021)

29th May 2021



Chief Editor
Dr. Ch. V. S. Parameswara Rao

Editor
Prof. Satyajit Nayak

Editor
Dr. Amar Kumar Barik

GANDHI INSTITUTE FOR TECHNOLOGY (GIFT)

www.gift.edu.in

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

Proceedings of

NATIONAL CONFERENCE
ON
RECENT ADVANCES IN TECHNOLOGY
(NCRAT-2021)

29th May 2021

Editors

Dr. Ch. V. S. Parameswara Rao
Principal

Prof. Satyajit Nayak
Associate Professor
Department of CSE

Dr. Amar Kumar Barik
Associate Professor
Department of EEE

Organized by

Gandhi Institute For Technology, Bhubaneswar

(Accredited by NAAC with 'A' Grade, NBA accredited, An ISO 9001:2015 Certified, Approved by AICTE New Delhi & Affiliated to BPUT, Rourkela, Odisha)

Gandhi Institute for Technology, Bhubaneswar

Campus Office

Gramadiha, Gangapada, Bhubaneswar-754027, Odisha, India
Phone No. +917873008173

Corporate Office

N-2/45, IRC Village, Nayapalli, Bhubaneswar-751015, Odisha, INDIA
Phone No. +917873008182, E-mail: info@gift.edu.in
www.**college.gift.edu.in**

First Edition-2021

ISBN : 978-93-91286-24-8

9 789391 286248

Printed & published by GIFT, Bhubaneswar

INDEX

Sl. No.	Title of the Paper	Page No.
1	Google Application Engine (GAE): The Next Hype of Cloud Computing	01
2	Impact of Big Data in Retail Industry and its future trends	01
3	A Preface to Big Data Utilization	02
4	Defining Metrices and Building Linear Regression Model in Different Context Elements for Mobile Native App Development	02
5	An Automated Traffic Control System for Reducing Traffic Density in Busy Traffic Junctions	03
6	Impact of Electronic Devices and Information and Communication Technology (ICT) on Human Health and Behavioural Success	03
7	A Dynamic Channel Allocation Scheme Using Directional Channel Locking Based Technique for Cognitive Radio Network in GSM Framework	04
8	Mental Workload Evaluation and Estimation of Human Error Probability	04
9	C-CNN Architecture for Discrete Affect Recognition in Real-time HCI	05
10	Low Cost Wi-Fi Service Robot	05
11	Artificial Neural Networks & IoT Based Disaster Management System	06
12	Medical image processing for detection and diagnosis of cancer using CNN and transfer learning	06
13	A systematic study of data augmentation strategies for cancer detection using diffusion-weighted MRI and convolutional neural network	07
14	A parallel algorithm for Multiple Sequence Alignment	07
15	Test Case Generation of Course Registration System Using Model Based Testing	08
16	Alpha analysis of cloud security enhancement using machine learning approach	08
17	Big Data platforms: its usability, benefits and Industry trends	09
18	Future of healthcare using Artificial Intelligence	09
19	Survey Paper on Gene Selection Approaches	10
20	Balancing Energy Consumption in Heterogeneous Wireless Sensor Networks using Genetic Algorithm	10
21	A Recommendation System For farmers Using Data Mining	11
22	A New Proposed Shift Cost Model for List Accessing Problem	11
23	A Study Report on Various Classification Algorithms Using Data mining Applications	12
24	Effective protection and decision of our environment with AI knowledge-based techniques	12
25	Generation of Test Cases for Object-Oriented Systems: A Survey	13
26	Comparative Study of Encryption algorithms in Cloud Systems	13
27	The Futurity of Internet of Things (IoT) and Its Empowered Technologies	14
28	Nano fluid and its applications: A theoretical study	14
29	Synthesis of hot runner injection mould for bottle caps	15
30	Effect of Spherical Textured Profile on Thrust Bearing	15
31	Design and Fabrication of Plastic waste Recycling Machine	16
32	Role of Artificial Intelligence in an automobile car - A Review	16
33	Parametric Control for Abrasive Water Jet Machining of Granite Stone	17
34	Bridge Safety Monitoring System Using Machine Learning	17
35	Studies On Selection Of Wire For Machining With W E D M	18
36	Application of Deep Learning in COVID-19 Research Activity	18
37	Study about Effect of Glass fibre addition to Bamboo Reinforced Composite on Mechanical Properties	19
38	Design of fly-ash concrete	19
39	Modeling and Analysis of Herringbone Gear Using ANSYS	20

Sl. No.	Title of the Paper	Page No.
40	Experimental Study on Partial Replacement of Cement by Fly Ash & Fine Aggregate by Foundry Sand for M20 Grade Concrete	20
41	Synthesis of Al 2024-SiC Metal Matrix Composites via stir casting and Hardness Evaluation	21
42	Curtailment of cooling load of a current structure- a latent cooling	21
43	Characterization of Pyrolysis Products derived from different Waste Plastics and its Future Prospective	22
44	Design And Coupled Field Analysis Of Exhaust Manifold By Using Different Materials	22
45	Combined Effect of Air Film Blade Cooling and Air Humidifier in Gas Turbines	23
46	Plan And Fabrication Of Remote Operated Ploughing Machine For Poultry Farm	23
47	A Novel Polymer Composite For High Temperature & Wear Resistant Application	24
48	Advanced Irrigation Method To Produce Sufficient Food Grain Throughout Year On Limited Resources On Hill Slope Keeping Eye To Present Population Growth	24
49	Flexible Advanced Arrangement In Car Washing Unit To Suit The Public Demand	25
50	Why alternative source Electric, Hybrid, and Fuel Cell Vehicles	25
51	Design and Performance Analysis of Mechanical Hydro Pneumatic Suspension System	26
52	Pedal operated power generator	26
53	Topology Optimization of beam structure using ANSYS	26
54	Kinematics Analysis of 6-DOF Robot using Soft Computing	27
55	Design Of Solar Powered Mower	27
56	Heat Treatment Of Low Carbon Steel-A Short Review	28
57	Study Of Implementation Of Operations Management In Manufacturing Companies	28
58	A Review paper on Additive Manufacturing Aspects and Several Methods Used in the 3D-Printing Process	28
59	Artificial neural network approach on Optimization of process parameters in laser micro-machining of die-steel	29
60	Automatic Bar Feeding And Cutting Machine	29
61	Optimized texture shape for enhanced performance of hydrodynamic thrust bearing based on variable texture height and aspect ratios	30
62	Weight reduction in aircrafts to increase its overall performance efficiency	30
63	A Comprehensive Study on Microgrid Technology	31
64	A novel control strategy for hybrid AC/DC micro grid systems	31
65	Optimal Citing and Sizing of DER in Radial Distribution System	32
66	Harmonic Analysis and Grid Interaction of PMSG driven Wind Turbine	32
67	Microgrid Protection: An Overview	33
68	Low Voltage Ride Through of Wind Energy Conversion System using Superconducting Fault Current Limiter	33
69	Simulation of A H Bridge Multilevel Inverter and its comparison with conventional H bridge Multilevel Inverter	34
70	Voltage Stability of a Wind Generator Connected to Utility Grid using STATCOM	34
71	Exploring sustainable energy from the Ocean	35
72	Fault diagnosis in power systems using superfast ANN radial basis function	35
73	Present and Future Energy Scenario in India	36
74	Sustainable Energy: A Review on Wind Energy	36
75	E-type asymmetric multilevel inverter with reduced number of switches	37
76	Simulation of A H Bridge Multilevel Inverter and its comparison with conventional H bridge Multilevel Inverter	37
77	OFDM based Novel Image Transmission and Reconstruction using Square-root Raised Cosine Filter	38
78	Wind- Turbine and Types with Condition Monitoring	38
79	Significance of Smart Antennas in Wireless Communications	39
80	Design and implementation of water level indicator using GSM module	39

Sl. No.	Title of the Paper	Page No.
81	GSM Based Electricity Billing System	40
82	Analysis of RCS in Multi-bit RFID Tag for Wireless Applications	40
83	Smart security and home automation using internet of things	41
84	Fuzzy Inference for Medical Imaging and Diagnosis	41
85	Robotic based COVID management system in healthcare	42
86	Analysis of Paraboloidal Reflector Antennas in Radio Telescopes	42
87	An Efficient Convolutional Neural Network Architecture for Mobile Devices	43
88	Effect of Interleaving and Channel coding on BER performance analysis of Image transmission using OFDM	43
89	Smart Irrigation monitoring in rural villages	44
90	Application of EM and PSO in non-linear channel Equalization	44
91	MRI image compression with Self Similar Topology and Self Organizing Machine	45
92	A Robust Fragile Watermarking Technique for Digital Image	45
93	Applicability of Intelligent Computational Methods in Smart-Grid Functionalities	46
94	Photonic crystal fiber is a future paradigm in the field of medical Science	46
95	Solar Photovoltaic Water Pumping Based Micro-Irrigation in Tomato Cultivation: A Case Study	47
96	Drying and rehydration characteristics of solar-dried cabbage slices – a review	48
97	Preservation of Tender Coconut (Cocos Nucifera L.) Water by Heat and UV-C Treatments	48
98	Value Addition in Oyster Mushroom	49
99	Micro-level Water Resource Planning and Sustainable Development in a Watershed Using Remote Sensing and GIS	49
100	Runoff and Sediment Yield Processes in Vamsadhara Basin: A Multiple Machine Learning Approach	50
101	A Brief Review on E-Waste management and its Effect on Environment	51
102	Nanotechnology in Agriculture and Food Production	51
103	Nanofluids: Preparation, Properties and Applications	52
104	Study of Photonic crystal fiber as sensor	52
105	Phosphate adsorption capacity of fly ash: A comparative study between synthetic and raw waste water	53
106	A Factor Analysis Approach on Exploring the Underlying Attributes of Tribal Handicrafts	53
107	Darcy-Forchheimer flowof Williamson nanofluid past a nonlinear stretching sheet with uniform heat source	54
108	Review of Fiber Bragg Grating as Sensor	54
109	Numerical analysis of Darcy-Forchheimer flow of micropolar fluid over an exponentially permeable shrinking sheet	55
110	A fuzzy based approach to vector maximum and minimum problem	55
111	Algae as a supplement in food and as an additive in feed industry	56
112	Bianchi Type-I Space Time in Bimetric Theory of Relativity	56
113	Composite behavior of lintel and brick masonry using Ferrochrome slag as coarse aggregate	57
114	Application of ARMA model to predict stream flow of Mahanadi River, Odisha	57
115	Influence of Cement Kiln Dust on Index properties of black cotton soil	58
116	A Conceptual Comparison between Neural Network and Forecasting Technique	58
117	Ecological Impression of Sukinda Chromite Mining	59
118	A Study on micropolar fluids	59
119	Delving Into the Issue of Liability and Legal Personality Sorrounding Artificial Intelligience	60
120	Colossal Magnetoresistance Effects in Manganites	60
121	Performance evaluation of HMA using basic oxygen furnace slag as aggregate	61

Synthesis of Al 2024-SiC Metal Matrix Composites via Stir Casting and Hardness Evaluation

Suneel Donthamsetty
Vice-Principal & Professor in Mechanical Engineering,
Narasaraopeta Engineering College (Autonomous), Narasaraopet, Guntur District, Andhra Pradesh, India, 522601.
Email id: viceprincipal@nrtec.in

Penugonda Suresh Babu
Associate Professor, Department of Mechanical Engineering,
Narasaraopeta Engineering College (Autonomous), Narasaraopet, Guntur District, Andhra Pradesh, India, 522601

***Abstract*— The necessity of Metal Matrix Composites (MMCs) is growing day by day because of their worthy properties of light weight, more strength, corrosion resistance etc. The aim of present work is to fabricate Aluminium Metal Matrix Composites (MMCs) by reinforcing the Silicon Carbide (SiC) particles of 50 micron size with 5% weight percentage using stir casting method. Al 2024 alloy is well known material as a matrix material to form composite due to its strength to weight ratio and good fatigue resistance. Similarly, the silicon carbide is highly refractive material with high melting and thermal conductivity. Moreover densities of Al 2021 and SiC are close to each other which lead to better mixing. Hence Al 2024 alloy & SiC are selected for the preparation of composite in present work. For synthesis of metal matrix composites, stir casting technique is used, which became more popular nowadays. On successful preparation of specimens, analyzed for hardness using Rockwell and Brinell hardness testers and found considerable improvement in the hardness of composites compared to base Al 2024 alloy.**

Curtailment of cooling load of a current structure- a latent cooling

Ayusman Nayak
Department of Mechanical Engineering, Gandhi Institute For Technology, Bhubaneswar, India

Abstract— Step by step human solace is raising its importance. Human solace is that state of brain, which communicates fulfillment with the warm climate according to the American Society of Heating, Refrigeration and Air Conditioning Engineers. The regular methods for accomplishing warm solace is the energy devouring mechanical forced air systems framework and the refrigerant utilized is destructive to the natural framework. The energy is a significant issue. Remembering this factor, the current work has been attempted to lessen the cooling heap of a current structure by utilizing latent cooling ideas instead of utilizing the mechanical cooling framework to disperse heat for warm solace. Among the latent cooling, interior and outside concealing ideas have been carried out for the fenestrations and a utilitarian game plan of earthen pots have been considered for the rooftop cooling. It has been seen that the cooling heap of the structure has been diminished about 47% because of concealing and up to 56% because of utilization of earthen pots when utilized independently.

NATIONAL CONFERENCE ON RECENT ADVANCES IN TECHNOLOGY (NCRAT-2021)

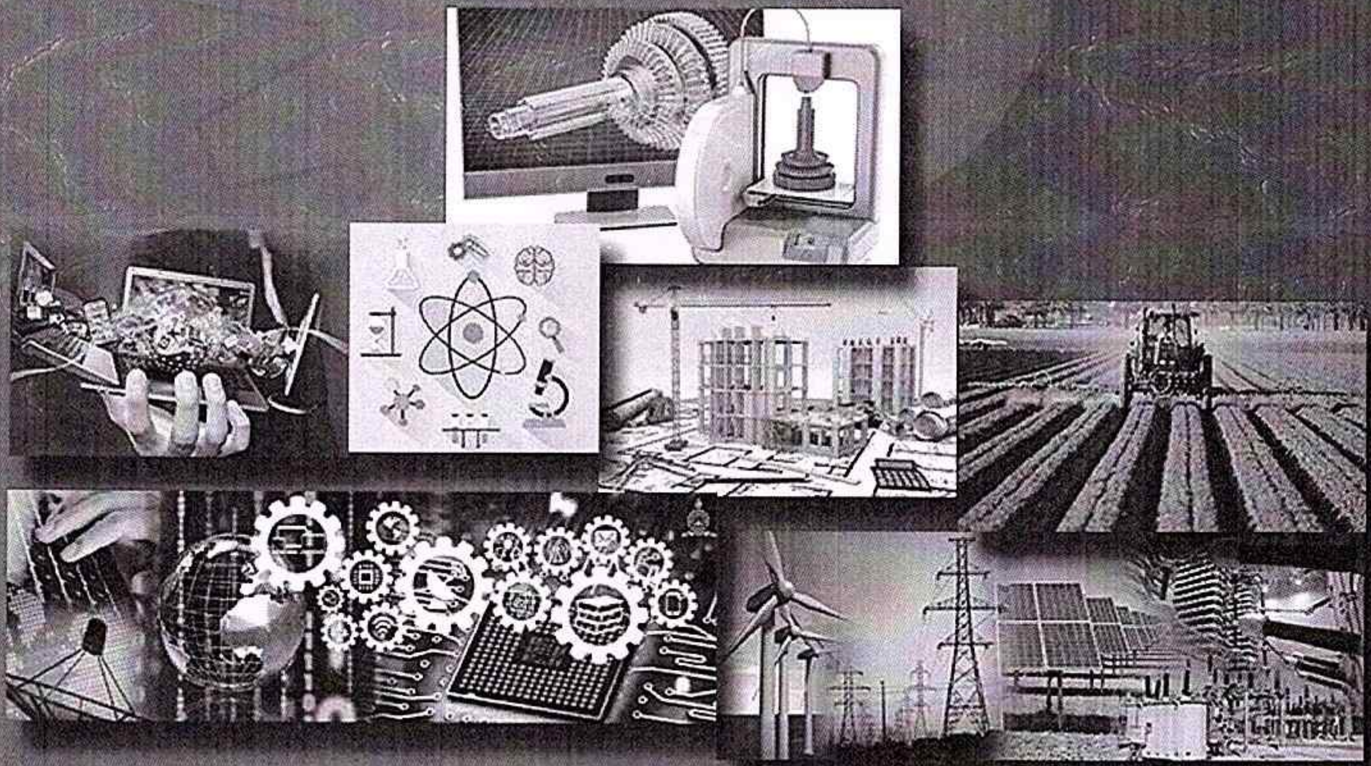
INSTITUTION'S INNOVATION COUNCIL

NISP GIFT

Ministry of MSME, Govt. of India | International Accreditation Organization | "A" Grade Accreditation by NAAC | EEE, ECE, Mech, CSE NBA Accredited | Scientific & Industrial Research Organization

Proceedings of National Conference on Recent Advances in Technology (NCRAT-2021)

29th May 2021



Chief Editor
Dr. Ch. V. S. Parameswara Rao

Editor
Prof. Satyajit Nayak

Editor
Dr. Amar Kumar Barik

GANDHI INSTITUTE FOR TECHNOLOGY (GIFT)

www.gift.edu.in

Principal
NARASARAOPETA ENGINEERING ...
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

IQAC

Proceedings of

NATIONAL CONFERENCE
ON
RECENT ADVANCES IN TECHNOLOGY
(NCRAT-2021)

29th May 2021

Editors

Dr. Ch. V. S. Parameswara Rao
Principal

Prof. Satyajit Nayak
Associate Professor
Department of CSE

Dr. Amar Kumar Barik
Associate Professor
Department of EEE

Organized by

Gandhi Institute For Technology, Bhubaneswar

(Accredited by NAAC with 'A' Grade, NBA accredited, An ISO 9001:2015 Certified, Approved by AICTE New Delhi & Affiliated to BPUT, Rourkela, Odisha)

Gandhi Institute for Technology, Bhubaneswar

Campus Office

Gramadiha, Gangapada, Bhubaneswar-754027, Odisha, India
Phone No. +917873008173

Corporate Office

N-2/45, IRC Village, Nayapalli, Bhubaneswar-751015, Odisha, INDIA
Phone No. +917873008182, E-mail: info@gift.edu.in
www.**college.gift.edu.in**

First Edition-2021

ISBN : 978-93-91286-24-8

9 789391 286248

Printed & published by GIFT, Bhubaneswar

INDEX

Sl. No.	Title of the Paper	Page No.
1	Google Application Engine (GAE): The Next Hype of Cloud Computing	01
2	Impact of Big Data in Retail Industry and its future trends	01
3	A Preface to Big Data Utilization	02
4	Defining Metrices and Building Linear Regression Model in Different Context Elements for Mobile Native App Development	02
5	An Automated Traffic Control System for Reducing Traffic Density in Busy Traffic Junctions	03
6	Impact of Electronic Devices and Information and Communication Technology (ICT) on Human Health and Behavioural Success	03
7	A Dynamic Channel Allocation Scheme Using Directional Channel Locking Based Technique for Cognitive Radio Network in GSM Framework	04
8	Mental Workload Evaluation and Estimation of Human Error Probability	04
9	C-CNN Architecture for Discrete Affect Recognition in Real-time HCI	05
10	Low Cost Wi-Fi Service Robot	05
11	Artificial Neural Networks & IoT Based Disaster Management System	06
12	Medical image processing for detection and diagnosis of cancer using CNN and transfer learning	06
13	A systematic study of data augmentation strategies for cancer detection using diffusion-weighted MRI and convolutional neural network	07
14	A parallel algorithm for Multiple Sequence Alignment	07
15	Test Case Generation of Course Registration System Using Model Based Testing	08
16	Alpha analysis of cloud security enhancement using machine learning approach	08
17	Big Data platforms: its usability, benefits and Industry trends	09
18	Future of healthcare using Artificial Intelligence	09
19	Survey Paper on Gene Selection Approaches	10
20	Balancing Energy Consumption in Heterogeneous Wireless Sensor Networks using Genetic Algorithm	10
21	A Recommendation System For farmers Using Data Mining	11
22	A New Proposed Shift Cost Model for List Accessing Problem	11
23	A Study Report on Various Classification Algorithms Using Data mining Applications	12
24	Effective protection and decision of our environment with AI knowledge-based techniques	12
25	Generation of Test Cases for Object-Oriented Systems: A Survey	13
26	Comparative Study of Encryption algorithms in Cloud Systems	13
27	The Futurity of Internet of Things (IoT) and Its Empowered Technologies	14
28	Nano fluid and its applications: A theoretical study	14
29	Synthesis of hot runner injection mould for bottle caps	15
30	Effect of Spherical Textured Profile on Thrust Bearing	15
31	Design and Fabrication of Plastic waste Recycling Machine	16
32	Role of Artificial Intelligence in an automobile car - A Review	16
33	Parametric Control for Abrasive Water Jet Machining of Granite Stone	17
34	Bridge Safety Monitoring System Using Machine Learning	17
35	Studies On Selection Of Wire For Machining With W E D M	18
36	Application of Deep Learning in COVID-19 Research Activity	18
37	Study about Effect of Glass fibre addition to Bamboo Reinforced Composite on Mechanical Properties	19
38	Design of fly-ash concrete	19
39	Modeling and Analysis of Herringbone Gear Using ANSYS	20

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

IQAC

Sl. No.	Title of the Paper	Page No.
40	Experimental Study on Partial Replacement of Cement by Fly Ash & Fine Aggregate by Foundry Sand for M20 Grade Concrete	20
41	Synthesis of Al 2024-SiC Metal Matrix Composites via stir casting and Hardness Evaluation	21
42	Curtailment of cooling load of a current structure- a latent cooling	21
43	Characterization of Pyrolysis Products derived from different Waste Plastics and its Future Prospective	22
44	Design And Coupled Field Analysis Of Exhaust Manifold By Using Different Materials	22
45	Combined Effect of Air Film Blade Cooling and Air Humidifier in Gas Turbines	23
46	Plan And Fabrication Of Remote Operated Ploughing Machine For Poultry Farm	23
47	A Novel Polymer Composite For High Temperature & Wear Resistant Application	24
48	Advanced Irrigation Method To Produce Sufficient Food Grain Throughout Year On Limited Resources On Hill Slope Keeping Eye To Present Population Growth	24
49	Flexible Advanced Arrangement In Car Washing Unit To Suit The Public Demand	25
50	Why alternative source Electric, Hybrid, and Fuel Cell Vehicles	25
51	Design and Performance Analysis of Mechanical Hydro Pneumatic Suspension System	26
52	Pedal operated power generator	26
53	Topology Optimization of beam structure using ANSYS	26
54	Kinematics Analysis of 6-DOF Robot using Soft Computing	27
55	Design Of Solar Powered Mower	27
56	Heat Treatment Of Low Carbon Steel-A Short Review	28
57	Study Of Implementation Of Operations Management In Manufacturing Companies	28
58	A Review paper on Additive Manufacturing Aspects and Several Methods Used in the 3D-Printing Process	28
59	Artificial neural network approach on Optimization of process parameters in laser micro-machining of die-steel	29
60	Automatic Bar Feeding And Cutting Machine	29
61	Optimized texture shape for enhanced performance of hydrodynamic thrust bearing based on variable texture height and aspect ratios	30
62	Weight reduction in aircrafts to increase its overall performance efficiency	30
63	A Comprehensive Study on Microgrid Technology	31
64	A novel control strategy for hybrid AC/DC micro grid systems	31
65	Optimal Citing and Sizing of DER in Radial Distribution System	32
66	Harmonic Analysis and Grid Interaction of PMSG driven Wind Turbine	32
67	Microgrid Protection: An Overview	33
68	Low Voltage Ride Through of Wind Energy Conversion System using Superconducting Fault Current Limiter	33
69	Simulation of A H Bridge Multilevel Inverter and its comparison with conventional H bridge Multilevel Inverter	34
70	Voltage Stability of a Wind Generator Connected to Utility Grid using STATCOM	34
71	Exploring sustainable energy from the Ocean	35
72	Fault diagnosis in power systems using superfast ANN radial basis function	35
73	Present and Future Energy Scenario in India	36
74	Sustainable Energy: A Review on Wind Energy	36
75	E-type asymmetric multilevel inverter with reduced number of switches	37
76	Simulation of A H Bridge Multilevel Inverter and its comparison with conventional H bridge Multilevel Inverter	37
77	OFDM based Novel Image Transmission and Reconstruction using Square-root Raised Cosine Filter	38
78	Wind- Turbine and Types with Condition Monitoring	38
79	Significance of Smart Antennas in Wireless Communications	39
80	Design and implementation of water level indicator using GSM module	39

Sl. No.	Title of the Paper	Page No.
81	GSM Based Electricity Billing System	40
82	Analysis of RCS in Multi-bit RFID Tag for Wireless Applications	40
83	Smart security and home automation using internet of things	41
84	Fuzzy Inference for Medical Imaging and Diagnosis	41
85	Robotic based COVID management system in healthcare	42
86	Analysis of Paraboloidal Reflector Antennas in Radio Telescopes	42
87	An Efficient Convolutional Neural Network Architecture for Mobile Devices	43
88	Effect of Interleaving and Channel coding on BER performance analysis of Image transmission using OFDM	43
89	Smart Irrigation monitoring in rural villages	44
90	Application of EM and PSO in non-linear channel Equalization	44
91	MRI image compression with Self Similar Topology and Self Organizing Machine	45
92	A Robust Fragile Watermarking Technique for Digital Image	45
93	Applicability of Intelligent Computational Methods in Smart-Grid Functionalities	46
94	Photonic crystal fiber is a future paradigm in the field of medical Science	46
95	Solar Photovoltaic Water Pumping Based Micro-Irrigation in Tomato Cultivation: A Case Study	47
96	Drying and rehydration characteristics of solar-dried cabbage slices – a review	48
97	Preservation of Tender Coconut (Cocos Nucifera L.) Water by Heat and UV-C Treatments	48
98	Value Addition in Oyster Mushroom	49
99	Micro-level Water Resource Planning and Sustainable Development in a Watershed Using Remote Sensing and GIS	49
100	Runoff and Sediment Yield Processes in Vamsadhara Basin: A Multiple Machine Learning Approach	50
101	A Brief Review on E-Waste management and its Effect on Environment	51
102	Nanotechnology in Agriculture and Food Production	51
103	Nanofluids: Preparation, Properties and Applications	52
104	Study of Photonic crystal fiber as sensor	52
105	Phosphate adsorption capacity of fly ash: A comparative study between synthetic and raw waste water	53
106	A Factor Analysis Approach on Exploring the Underlying Attributes of Tribal Handicrafts	53
107	Darcy-Forchheimer flowof Williamson nanofluid past a nonlinear stretching sheet with uniform heat source	54
108	Review of Fiber Bragg Grating as Sensor	54
109	Numerical analysis of Darcy-Forchheimer flow of micropolar fluid over an exponentially permeable shrinking sheet	55
110	A fuzzy based approach to vector maximum and minimum problem	55
111	Algae as a supplement in food and as an additive in feed industry	56
112	Bianchi Type-I Space Time in Bimetric Theory of Relativity	56
113	Composite behavior of lintel and brick masonry using Ferrochrome slag as coarse aggregate	57
114	Application of ARMA model to predict stream flow of Mahanadi River, Odisha	57
115	Influence of Cement Kiln Dust on Index properties of black cotton soil	58
116	A Conceptual Comparison between Neural Network and Forecasting Technique	58
117	Ecological Impression of Sukinda Chromite Mining	59
118	A Study on micropolar fluids	59
119	Delving Into the Issue of Liability and Legal Personality Sorrounding Artificial Intelligience	60
120	Colossal Magnetoresistance Effects in Manganites	60
121	Performance evaluation of HMA using basic oxygen furnace slag as aggregate	61

Synthesis of Al 2024-SiC Metal Matrix Composites via Stir Casting and Hardness Evaluation

Suneel Donthamsetty
Vice-Principal & Professor in Mechanical Engineering,
Narasaraopeta Engineering College (Autonomous), Narasaraopet, Guntur District, Andhra Pradesh, India, 522601.
Email id: viceprincipal@nrtec.in

Penugonda Suresh Babu
Associate Professor, Department of Mechanical Engineering,
Narasaraopeta Engineering College (Autonomous), Narasaraopet, Guntur District, Andhra Pradesh, India, 522601

Abstract— **The necessity of Metal Matrix Composites (MMCs) is growing day by day because of their worthy properties of light weight, more strength, corrosion resistance etc. The aim of present work is to fabricate Aluminium Metal Matrix Composites (MMCs) by reinforcing the Silicon Carbide (SiC) particles of 50 micron size with 5% weight percentage using stir casting method. Al 2024 alloy is well known material as a matrix material to form composite due to its strength to weight ratio and good fatigue resistance. Similarly, the silicon carbide is highly refractive material with high melting and thermal conductivity. Moreover densities of Al 2021 and SiC are close to each other which lead to better mixing. Hence Al 2024 alloy & SiC are selected for the preparation of composite in present work. For synthesis of metal matrix composites, stir casting technique is used, which became more popular nowadays. On successful preparation of specimens, analyzed for hardness using Rockwell and Brinell hardness testers and found considerable improvement in the hardness of composites compared to base Al 2024 alloy.**

Curtailment of cooling load of a current structure- a latent cooling

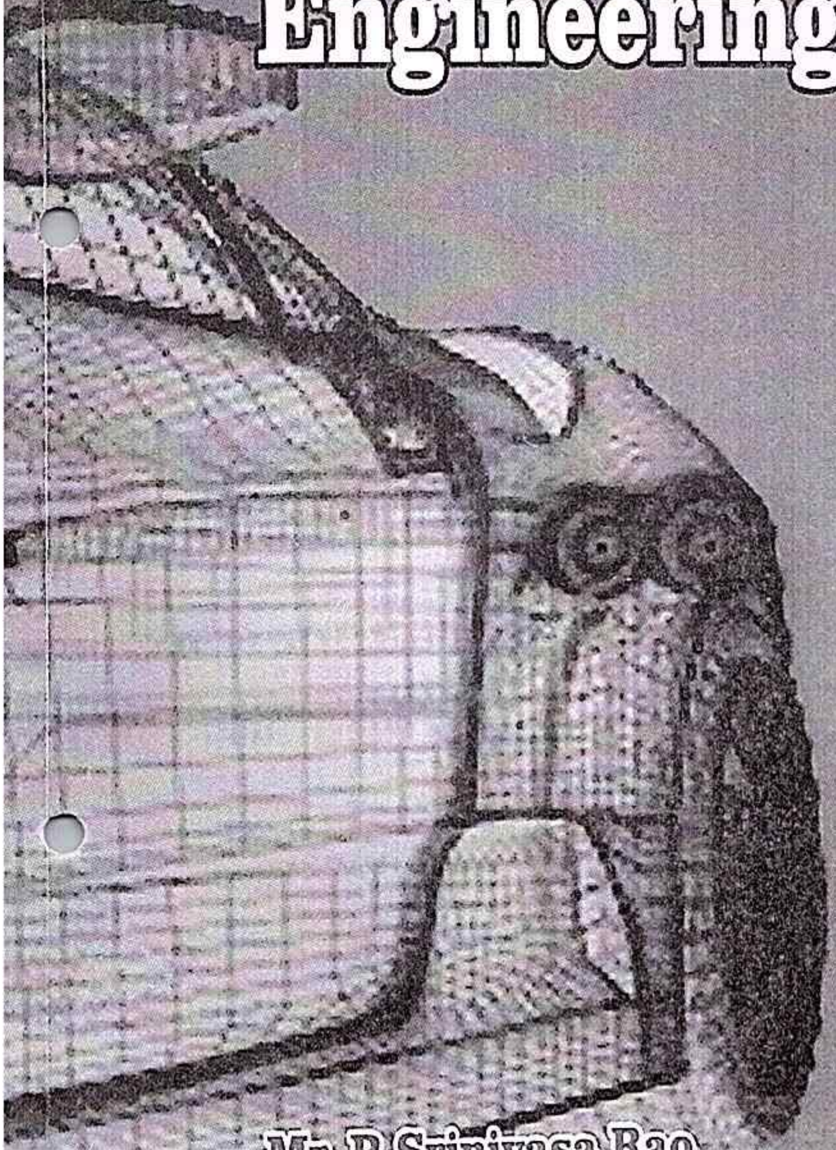
Ayusman Nayak
Department of Mechanical Engineering, Gandhi Institute For Technology, Bhubaneswar, India

Abstract— Step by step human solace is raising its importance. Human solace is that state of brain, which communicates fulfillment with the warm climate according to the American Society of Heating, Refrigeration and Air Conditioning Engineers. The regular methods for accomplishing warm solace is the energy devouring mechanical forced air systems framework and the refrigerant utilized is destructive to the natural framework. The energy is a significant issue. Remembering this factor, the current work has been attempted to lessen the cooling heap of a current structure by utilizing latent cooling ideas instead of utilizing the mechanical cooling framework to disperse heat for warm solace. Among the latent cooling, interior and outside concealing ideas have been carried out for the fenestrations and a utilitarian game plan of earthen pots have been considered for the rooftop cooling. It has been seen that the cooling heap of the structure has been diminished about 47% because of concealing and up to 56% because of utilization of earthen pots when utilized independently.

Spectrum
EDUCATION

As per CBCS

Engineering Drawing



Mr. P. Srinivasa Rao
Mrs. P. Sravani
Mr. M. Venkanna Babu
Mr. M. Venkaiah

SPECTRUM®

ENGINEERING DRAWING

Authors

Mr. P. Srinivasa Rao
Associate Professor
Department of Mechanical Engineering
Narasaraopeta Engineering College(Autonomous)
Narasaraopet, Guntur - 522 601, AP

Mrs. P. Sravani
Assistant Professor
Department of Mechanical Engineering
Narasaraopeta Engineering College(Autonomous)
Narasaraopet, Guntur - 522 601, AP

Mr. M. Venkanna Babu
Assistant Professor
Department of Mechanical Engineering
Narasaraopeta Engineering College(Autonomous)
Narasaraopet, Guntur - 522 601, AP

Mr. M. Venkaiah
Assistant Professor
Department of Mechanical Engineering
Narasaraopeta Engineering College(Autonomous)
Narasaraopet, Guntur - 522 601, AP

SPECTRUM
PUBLISHING HOUSE
Temple of learning...

M/s Spectrum Publishing House, Hyderabad

(An ISO 9001 : 2015 Certified Company)

Head Office

326/C, Level - 2, Surneni Nilayam
Near B K Guda Park, S R Nagar, Hyderabad - 500 038, INDIA
P.No:+91 40 23710657, 238000657 Fax: +91 40 23810657

Reg. Off

5-68, Pedda Gorpadu, Pakala, Tirupati, Chittoor - 517 112 AP, INDIA
mail:studentshelpline.in@gmail.com
www.**studentshelpline**.in

First Edition-2021

ISBN: 978-81-948784-5-2

₹ **599/- Student Edition**

Printed at StudentsHelpline Group, S R Nagar, Hyderabad-38
Published by Surneni Mohan Naidu for Spectrum Publishing House, Hyderabad - 38

ENGINEERING DRAWING

Chapter-1: Introduction to Engineering Drawing

1.0	Objectives	2
1.1	Introduction	2
1.2	Engineering Drawing	2
	1.2.1 Importance of Graphics in Design Process	3
	1.2.2 Role of Engineering Drawing	3
	1.2.3 BIS Codes and Conventions	4
1.3	Various Instruments used in Engineering Drawing	4
	1.3.1 Drawing Templates	10
	1.3.2 Drafting Machine	10
	1.3.3 Mini-drafter	11
	1.3.4 Large Size Divider	12
	1.3.5 Small Bow Divider	12
	1.3.6 Inking Pen	12
	1.3.7 Stencil	13
1.4	Types of Lines	13
1.5	Drawing Sheet Sizes	14
	1.5.1 Layout of Sheets A0, A1, A2, A3, A4, A5	14
1.6	Title Block of the Drawing Sheets	16
1.7	Folding Drawing Sheets and Prints	17
1.8	Lettering	21
	1.8.1 Types of Lettering	21
	1.8.2 Guide Lines for Lettering	22
	1.8.3 Salient Features of the Single Stroke Lettering	25
1.9	Dimensioning	25
	1.9.1 Notation of Tools for Dimensioning	25

1.9.2 Shape and Size Description of Dimensioning 27
1.9.3 Location of Surface Finish Symbols on Drawing 27
1.9.4 Surface Finish in a Drawing 28
1.9.5 General Rules of Dimensioning 28
1.9.6 Aligned and Unidirectional Systems 29
1.9.7 Arrangement of Dimensions 30
1.9.8 Dimensioning Standard Features 32
1.10 Review Questions 41

Chapter-2: Geometrical Constructions

2.0 Objectives 44
2.1 Introduction 44
2.2 Simple Geometrical Constructions 44
2.2.1 To divide a Line 44
2.2.2 Line 46
2.2.3 Bisecting a Line 46
2.2.4 How to Bisect an Angle? 47
2.2.5 Quadrilateral 47
2.2.6 Angle 47
2.2.7 Triangles 47
2.2.8 Circle 48
2.3 Polygons 64
2.4 Construction of Regular Polygons by General Methods 66
2.5 Inscribing Polygons with Circles 74
2.6 Describing Polygons with Circles 80
2.7 Exterior and Interior angles in Regular Polygons 86
2.9 Review Questions 87

Chapter-3: Scales

3.0 Objectives 90
3.1 Introduction 90

3.2 Scales 90
3.3 Common Types of Scales 90
3.4 Uses of Scale 91
3.5 Units of Measurement 91
3.6 Set of Scales 92
3.7 Scale Conversion 93
3.8 Requirements of Scales on Drawing 94
3.9 Representative Fraction (R.F.) 94
3.10 Types of Scales 96
3.11 Plain scales 96
3.11.1 Solved Problems 97
3.12 Diagonal 106
3.12.1 Comparison of Diagonal Scale from Plain Scale 107
3.13 Vernier Scale 116
3.13.1 Least Count of a Vernier 117
3.13.2 Differences between Plain Scale and Vernier Scale 118
3.13.3 Comparison of Diagonal and Vernier Scales 119
3.14 Additional Problems 123
3.16 Review Questions 128

Chapter-4: Conics

4.0 Objectives 132
4.1 Introduction 132
4.2 Conical Sections 133
4.3 Important Terms 133
4.4 Types of Conic Sections 134
4.5 Eccentricity 136
4.6 Ellipse 137
4.6.1 Properties of Ellipse 137

4.6.2 Uses 137

4.6.3 Applications of Ellipse 137

4.7 General Methods of Constructing an Ellipse 137

4.8 Parabola 157

4.8.1 Methods for Generating Parabola 158

4.8.2 Uses of Parabola 159

4.8.3 Parabola (Applications) 159

4.9 Hyperbola 167

4.10 Special Curves 176

4.11 Cycloidal Curves 176

4.11.1 Cycloid 176

4.11.2 Epicycloid and Hycycloid 179

4.11.3 Involute 184

4.12 Additional Problems 186

4.13 Review Questions 201

Chapter-5: Orthographic Projections

5.0 Objectives 206

5.1 Introduction 206

5.2 Principle of Projections 206

5.3 Methods of Projections 207

5.3.1 Method of Obtaining Front View 209

5.3.2 Method of Obtaining Top View 209

5.4 Orthographic Projection 210

5.4.1 Principles of Orthographic Projection 210

5.4.2 Conventional Representation 211

5.5 Plane of Projection 211

5.6 First Angle Projection 213

5.6.1 Features of First Angle Projection 214

5.7	Third Angle Projection	214
	5.7.1 Features of Third Angle Projection	216
5.8	Comparison between First and Third Angle Projections	216
5.9	Review Questions	216

Chapter-6: Projections of Points

6.0	Objectives	218
6.1	Introduction	218
6.2	Projection of Points	218
	6.2.1 Conclusions about Projections of Points	219
6.3	Projections of Points in Various Quadrants	219
6.4	Review Questions	230

Chapter-7: Projections of Straight Lines

7.0	Objectives	232
7.1	Introduction	232
7.2	Fundamental Concepts	232
7.3	Projections of Straight Lines	233
7.4	Positions of Straight Lines	240
7.5	Solved Problems	256
7.6	Traces of Staight Lines	267
	7.6.1 Types of Traces	267
7.7	Additional Problems	276
7.8	Review Questions	277

Chapter-8: Projections of Planes

8.0	Objectives	280
8.1	Introduction	280
8.2	Planes	280
8.3	Location of a Plane	281
8.5	Trace of a Plane	281

8.6 Representation of Perpendicular Planes 282
8.7 Oblique Planes 285
8.8 Projections of Planes parallel to one of the Reference Planes 285
8.9 Projections of Planes Inclined to One Reference Plane and Perpendicular to the Other 287
8.10 Projections of Oblique Planes 292
8.11 Additional Problems 298
8.12 Review Questions 306

Chapter-9: Projections of Solids

9.0 Objectives 310
9.1 Introduction 310
9.2 Solids and Projection of Solid 311
9.3 Types of Solids 311
9.4 Projections of Solids Placed in Different Positions 316
9.5 Projections of a Solid with its Axis Perpendicular to HP and Parallel to VP 316
9.6 Axis Perpendicular to the V.P. and parallel to HP 320
9.7 Axis parallel to both H.P and V.P. 327
9.8 Axis inclined to H.P and parallel to the V.P 327
9.9 Additional Problems 332
9.10 Review Questions 339

Chapter-10: Sections of Solids

10.0 Objectives 342
10.1 Introduction 342
10.2 Types of Sectional Views of Solids 342
10.3 Cutting Planes (or) Sectional Planes 348
10.3.1 Sectional Views 350
10.4 Sections of Prism and Cube 351
10.5 Sections of Pyramids 354

10.6 Sections of Cylinders 357

10.7 sections of Cones 360

10.8 Additional Problems 362

10.9 Review Questions 366

Chapter-11: Development of Surfaces

11.0 Objectives 368

11.1 Introduction 368

11.2 Principle of Development 368

11.3 Methods of Development 368

11.4 Developement of Prism 370

11.5 Developement of Cylinders 372

11.6 Development of Cones 374

11.7 Development of Pyramids & Cones 376

11.8 Development of Lateral Surfaces of Solids With Cut-outs and Holes 379

11.9 Additional Problems 381

11.10 Review Questions 386

Chapter-12: Isometric Projections

12.0 Objectives 388

12.1 Introduction 388

12.2 Axonometric Projections 389

12.3 Principle of Isometric Projection 390

12.4 Isometric Axes, Lines and Planes 391

12.5 Isometric Scale 391

12.6 Isometric Drawing or Isometric View 393

12.7 Conventions 393

12.8 Selection of Views 394

12.9 Principles of Orthographic Projection 395

12.10 Conversion of Isometric Views to Orthographic Views 395

12.11 Conversion of Orthographic Views to Isometric Views 404
12.12 Additional Problems 413
12.13 Review Questions 417

Chapter-13: AutoCAD

13.0 Introduction to AutoCAD 426
13.1 Capabilites of AutoCAD 427
13.2 Advantages of AutoCAD 427
13.3 Main features of AutoCAD 428
13.4 AutoCAD commands 429
13.4.1 Starting AutoCAD 429
13.4.2 AutoCAD Screen 430
13.5 How do you communicate with AutoCAD 431
13.6 Command Aliases 432
13.6.1 Line Command 433
13.6.2 Polyline Command 436
13.6.3 Orthogonal Lines 436
13.6.4 Rectangle Command 437
13.6.5 Circles 437
13.6.6 Arc Command 439
13.6.7 Spline 439
13.6.8 Editing Polylines 440
13.6.9 PEDIT Options 441
13.6.10 Move Command 441
13.6.11 Copy Command 442
13.7 Offset Command 443
13.7.1 Offset Distance 443
13..7.2 Explode Command 443
13.7.3 Extend 444

13.7.4 Stretch 445
13.7.5 Trim 445
13.7.6 Break 446
13.7.7 Mirror 447
13.7.8 Rotate 447
13.7.9 Scale 447
13.8 Text Command 448
13.8.1 Text 448
13.8.2 DTEXT (Dynamic Text) 448
13.8.3 Introduction to Layers and Layer Dialog Box 449
13.8.4 Layer Options 449
13.8.5 Layer Shortcuts 450
13.8.6 Color Command 451
13.8.8 By Block 451
13.9 Linetypes 451
13.9.1 Loading and Changing Linetypes 451
13.10 Lineweights 452
13.10.1 Loading and Changing Lineweights 452
13.10.2 Object Properties 453
13.10.3 BHATCH Command 454
13.10.4 Measuring Distances 455
13.10.5 Linear Dimensions 455
13.10.6 Aligned Dimensions 456
13.10.7 Arclength Dimensions 456
13.10.8 Radial Dimensions 457
13.10.9 Angular and Jogged Dimensions 457
13.10.10 Baseline Dimensions 458
13.10.11 Continued Dimensions 459

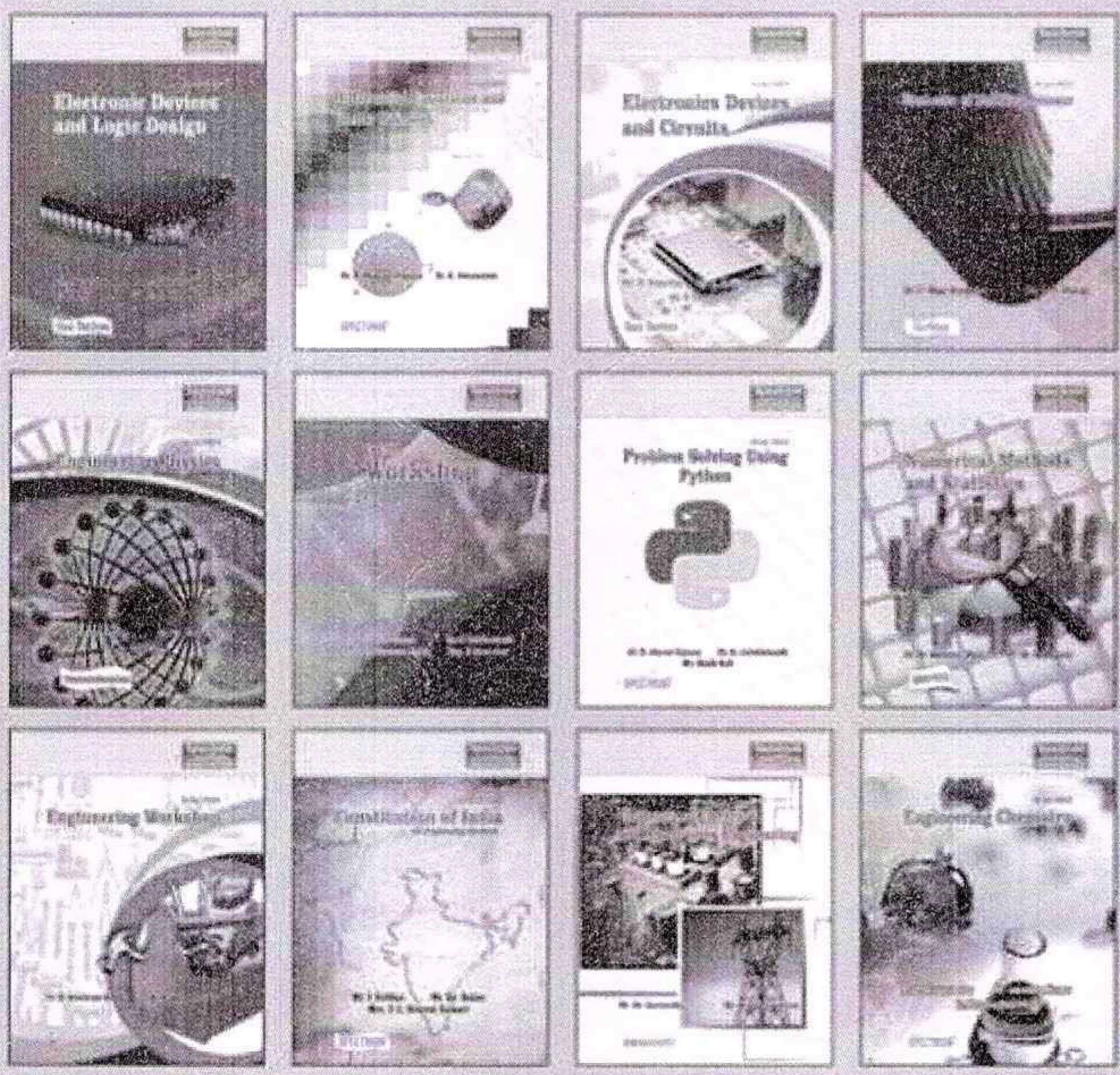
13.10.12 Leaders 459
13.10.13 Leader Settings 460
13.10.14 Quick Dimensions 460
13.10.15 Modifying Dimensions 461
13.10.15.1 DDEDIT 461
13.10.15.2 Stretching Dimensions 461
13.10.16 Dimtedit 462
13.10.17 Dimension Edit Commands 462
13.10.18 Ordinate Dimensions 462
13.10.19 Calculating Areas 462
13.11 Plot Settings 463
13.11.1 On-Line Help 464
13.12 Specifying the Units for the Drawing 465
13.12.1 Shortcuts 465
13.12.2 Saving Your Work 465
13.12.3 Plotting 465
13.12.4 Ending the Program 466
13.13 Two Dimensional Drawing 466
13.13.1 2D Drawing Practices 467
13.13.2 Student Exercises 470
13.14 Review Questions 471

Engineering Drawing

Mr. P. SrinivasaRao
Mrs. P. Sravani
Mr. M. Venkanna Babu
Mr. M. Venkaiah

23

Our Engineering Titles



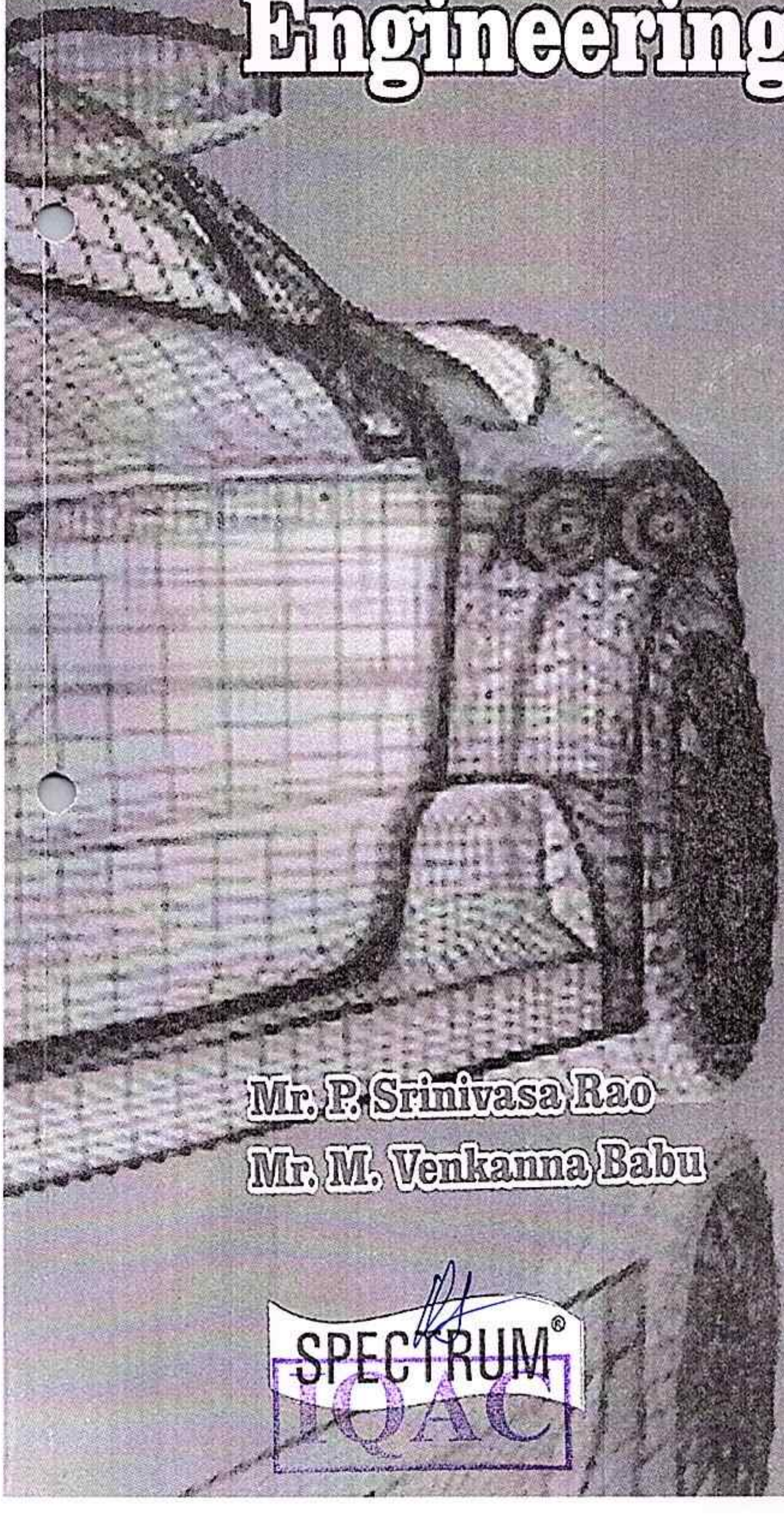
₹xxx/-

ISBN 978-81-948784-5-2
9 788194 878452

Spectrum
EDUCATION

As per CBCS

Engineering Drawing



Mr. P. Srinivasa Rao
Mrs. P. Sravani
Mr. M. Venkanna Babu
Mr. M. Venkaiah

SPECTRUM®

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

ENGINEERING DRAWING

Authors

Mr. P. Srinivasa Rao
Associate Professor
Department of Mechanical Engineering
Narasaraopeta Engineering College(Autonomous)
Narasaraopet, Guntur - 522 601, AP

Mrs. P. Sravani
Assistant Professor
Department of Mechanical Engineering
Narasaraopeta Engineering College(Autonomous)
Narasaraopet, Guntur - 522 601, AP

Mr. M. Venkanna Babu
Assistant Professor
Department of Mechanical Engineering
Narasaraopeta Engineering College(Autonomous)
Narasaraopet, Guntur - 522 601, AP

Mr. M. Venkaiah
Assistant Professor
Department of Mechanical Engineering
Narasaraopeta Engineering College(Autonomous)
Narasaraopet, Guntur - 522 601, AP

SPECTRUM
PUBLISHING HOUSE
Temple of lea

M/s Spectrum Publishing House, Hyderabad

(An ISO 9001 : 2015 Certified Company)

Head Office

326/C, Level - 2, Surneni Nilayam
Near B K Guda Park, S R Nagar, Hyderabad - 500 038, INDIA
P.No:+91 40 23710657, 238000657 Fax: +91 40 23810657

Reg. Off

5-68, Pedda Gorpadu, Pakala, Tirupati, Chittoor - 517 112 AP, INDIA
mail:studentshelpline.in@gmail.com
www.**studentshelpline**.in

First Edition-2021

ISBN: 978-81-948784-5-2

₹ 599/- Student Edition

Printed at StudentsHelpline Group, S R Nagar, Hyderabad-38
Published by Surneni Mohan Naidu for Spectrum Publishing House, Hyderabad - 38

ENGINEERING DRAWING

Chapter-1: Introduction to Engineering Drawing

1.0 Objectives 2

1.1 Introduction 2

1.2 Engineering Drawing 2

1.2.1 Importance of Graphics in Design Process 3

1.2.2 Role of Engineering Drawing 3

1.2.3 BIS Codes and Conventions 4

1.3 Various Instruments used in Engineering Drawing 4

1.3.1 Drawing Templates 10

1.3.2 Drafting Machine 10

1.3.3 Mini-drafter 11

1.3.4 Large Size Divider 12

1.3.5 Small Bow Divider 12

1.3.6 Inking Pen 12

1.3.7 Stencil 13

1.4 Types of Lines 13

1.5 Drawing Sheet Sizes 14

1.5.1 Layout of Sheets A0, A1, A2, A3, A4, A5 14

1.6 Title Block of the Drawing Sheets 16

1.7 Folding Drawing Sheets and Prints 17

1.8 Lettering 21

1.8.1 Types of Lettering 21

1.8.2 Guide Lines for Lettering 22

1.8.3 Salient Features of the Single Stroke Lettering 25

1.9 Dimensioning 25

1.9.1 Notation of Tools for Dimensioning 25

1.9.2 Shape and Size Description of Dimensioning 27
1.9.3 Location of Surface Finish Symbols on Drawing 27
1.9.4 Surface Finish in a Drawing 28
1.9.5 General Rules of Dimensioning 28
1.9.6 Aligned and Unidirectional Systems 29
1.9.7 Arrangement of Dimensions 30
1.9.8 Dimensioning Standard Features 32
1.10 Review Questions 41

Chapter-2: Geometrical Constructions

2.0 Objectives 44
2.1 Introduction 44
2.2 Simple Geometrical Constructions 44
2.2.1 To divide a Line 44
2.2.2 Line 46
2.2.3 Bisecting a Line 46
2.2.4 How to Bisect an Angle? 47
2.2.5 Quadrilateral 47
2.2.6 Angle 47
2.2.7 Triangles 47
2.2.8 Circle 48
2.3 Polygons 64
2.4 Construction of Regular Polygons by General Methods 66
2.5 Inscribing Polygons with Circles 74
2.6 Describing Polygons with Circles 80
2.7 Exterior and Interior angles in Regular Polygons 86
2.9 Review Questions 87

Chapter-3: Scales

3.0 Objectives 90
3.1 Introduction 90

3.2	Scales	90
3.3	Common Types of Scales	90
3.4	Uses of Scale	91
3.5	Units of Measurement	91
3.6	Set of Scales	92
3.7	Scale Conversion	93
3.8	Requirements of Scales on Drawing	94
3.9	Representative Fraction (R.F.)	94
3.10	Types of Scales	96
3.11	Plain scales	96
3.11.1	Solved Problems	97
3.12	Diagonal	106
3.12.1	Comparison of Diagonal Scale from Plain Scale	107
3.13	Vernier Scale	116
3.13.1	Least Count of a Vernier	117
3.13.2	Differences between Plain Scale and Vernier Scale	118
3.13.3	Comparison of Diagonal and Vernier Scales	119
3.14	Additional Problems	123
3.16	Review Questions	128

Chapter-4: Conics

4.0	Objectives	132
4.1	Introduction	132
4.2	Conical Sections	133
4.3	Important Terms	133
4.4	Types of Conic Sections	134
4.5	Eccentricity	136
4.6	Ellipse	137
4.6.1	Properties of Ellipse	137

4.6.2 Uses 137
4.6.3 Applications of Ellipse 137
4.7 General Methods of Constructing an Ellipse 137
4.8 Parabola 157
4.8.1 Methods for Generating Parabola 158
4.8.2 Uses of Parabola 159
4.8.3 Parabola (Applications) 159
4.9 Hyperbola 167
4.10 Special Curves 176
4.11 Cycloidal Curves 176
4.11.1 Cycloid 176
4.11.2 Epicycloid and Hycycloid 179
4.11.3 Involute 184
4.12 Additional Problems 186
4.13 Review Questions 201

Chapter-5: Orthographic Projections

5.0 Objectives 206
5.1 Introduction 206
5.2 Principle of Projections 206
5.3 Methods of Projections 207
5.3.1 Method of Obtaining Front View 209
5.3.2 Method of Obtaining Top View 209
5.4 Orthographic Projection 210
5.4.1 Principles of Orthographic Projection 210
5.4.2 Conventional Representation 211
5.5 Plane of Projection 211
5.6 First Angle Projection 213
5.6.1 Features of First Angle Projection 214

5.7 Third Angle Projection 214

5.7.1 Features of Third Angle Projection 216

5.8 Comparison between First and Third Angle Projections 216

5.9 Review Questions 216

Chapter-6: Projections of Points

6.0 Objectives 218

6.1 Introduction 218

6.2 Projection of Points 218

6.2.1 Conclusions about Projections of Points 219

6.3 Projections of Points in Various Quadrants 219

6.4 Review Questions 230

Chapter-7: Projections of Straight Lines

7.0 Objectives 232

7.1 Introduction 232

7.2 Fundamental Concepts 232

7.3 Projections of Straight Lines 233

7.4 Positions of Straight Lines 240

7.5 Solved Problems 256

7.6 Traces of Staight Lines 267

7.6.1 Types of Traces 267

7.7 Additional Problems 276

7.8 Review Questions 277

Chapter-8: Projections of Planes

8.0 Objectives 280

8.1 Introduction 280

8.2 Planes 280

8.3 Location of a Plane 281

8.5 Trace of a Plane 281

8.6 Representation of Perpendicular Planes 282
8.7 Oblique Planes 285
8.8 Projections of Planes parallel to one of the Reference Planes 285
8.9 Projections of Planes Inclined to One Reference Plane and Perpendicular to the Other 287
8.10 Projections of Oblique Planes 292
8.11 Additional Problems 298
8.12 Review Questions 306

Chapter-9: Projections of Solids

9.0 Objectives 310
9.1 Introduction 310
9.2 Solids and Projection of Solid 311
9.3 Types of Solids 311
9.4 Projections of Solids Placed in Different Positions 316
9.5 Projections of a Solid with its Axis Perpendicular to HP and Parallel to VP 316
9.6 Axis Perpendicular to the V.P. and parallel to HP 320
9.7 Axis parallel to both H.P and V.P. 327
9.8 Axis inclined to H.P and parallel to the V.P 327
9.9 Additional Problems 332
9.10 Review Questions 339

Chapter-10: Sections of Solids

10.0 Objectives 342
10.1 Introduction 342
10.2 Types of Sectional Views of Solids 342
10.3 Cutting Planes (or) Sectional Planes 348
10.3.1 Sectional Views 350
10.4 Sections of Prism and Cube 351
10.5 Sections of Pyramids 354

10.6 Sections of Cylinders 357

10.7 sections of Cones 360

10.8 Additional Problems 362

10.9 Review Questions 366

Chapter-11: Development of Surfaces

11.0 Objectives 368

11.1 Introduction 368

11.2 Principle of Development 368

11.3 Methods of Development 368

11.4 Developement of Prism 370

11.5 Developement of Cylinders 372

11.6 Development of Cones 374

11.7 Development of Pyramids & Cones 376

11.8 Development of Lateral Surfaces of Solids With Cut-outs and Holes 379

11.9 Additional Problems 381

11.10 Review Questions 386

Chapter-12: Isometric Projections

12.0 Objectives 388

12.1 Introduction 388

12.2 Axonometric Projections 389

12.3 Principle of Isometric Projection 390

12.4 Isometric Axes, Lines and Planes 391

12.5 Isometric Scale 391

12.6 Isometric Drawing or Isometric View 393

12.7 Conventions 393

12.8 Selection of Views 394

12.9 Principles of Orthographic Projection 395

12.10 Conversion of Isometric Views to Orthographic Views 395

12.11 Conversion of Orthographic Views to Isometric Views 404
12.12 Additional Problems 413
12.13 Review Questions 417

Chapter-13: AutoCAD

13.0 Introduction to AutoCAD 426
13.1 Capabilites of AutoCAD 427
13.2 Advantages of AutoCAD 427
13.3 Main features of AutoCAD 428
13.4 AutoCAD commands 429
13.4.1 Starting AutoCAD 429
13.4.2 AutoCAD Screen 430
13.5 How do you communicate with AutoCAD 431
13.6 Command Aliases 432
13.6.1 Line Command 433
13.6.2 Polyline Command 436
13.6.3 Orthogonal Lines 436
13.6.4 Rectangle Command 437
13.6.5 Circles 437
13.6.6 Arc Command 439
13.6.7 Spline 439
13.6.8 Editing Polylines 440
13.6.9 PEDIT Options 441
13.6.10 Move Command 441
13.6.11 Copy Command 442
13.7 Offset Command 443
13.7.1 Offset Distance 443
13..7.2 Explode Command 443
13.7.3 Extend 444

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

13.7.4 Stretch 445
13.7.5 Trim 445
13.7.6 Break 446
13.7.7 Mirror 447
13.7.8 Rotate 447
13.7.9 Scale 447
13.8 Text Command 448
13.8.1 Text 448
13.8.2 DTEXT (Dynamic Text) 448
13.8.3 Introduction to Layers and Layer Dialog Box 449
13.8.4 Layer Options 449
13.8.5 Layer Shortcuts 450
13.8.6 Color Command 451
13.8.8 By Block 451
13.9 Linetypes 451
13.9.1 Loading and Changing Linetypes 451
13.10 Lineweights 452
13.10.1 Loading and Changing Lineweights 452
13.10.2 Object Properties 453
13.10.3 BHATCH Command 454
13.10.4 Measuring Distances 455
13.10.5 Linear Dimensions 455
13.10.6 Aligned Dimensions 456
13.10.7 Arclength Dimensions 456
13.10.8 Radial Dimensions 457
13.10.9 Angular and Jogged Dimensions 457
13.10.10 Baseline Dimensions 458
13.10.11 Continued Dimensions 459

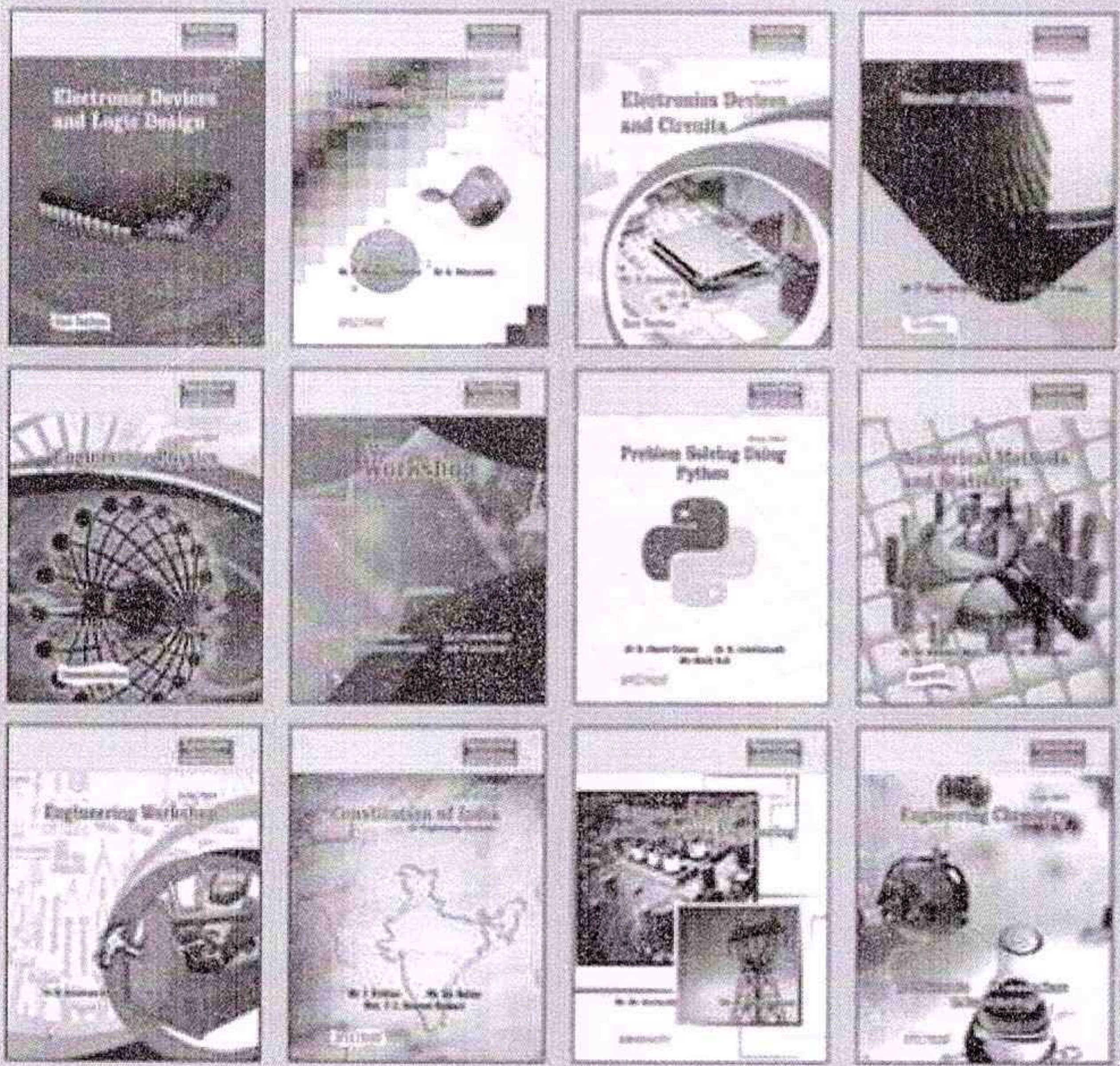
13.10.12 Leaders 459
13.10.13 Leader Settings 460
13.10.14 Quick Dimensions 460
13.10.15 Modifying Dimensions 461
13.10.15.1 DDEDIT 461
13.10.15.2 Stretching Dimensions 461
13.10.16 Dimtedit 462
13.10.17 Dimension Edit Commands 462
13.10.18 Ordinate Dimensions 462
13.10.19 Calculating Areas 462
13.11 Plot Settings 463
13.11.1 On-Line Help 464
13.12 Specifying the Units for the Drawing 465
13.12.1 Shortcuts 465
13.12.2 Saving Your Work 465
13.12.3 Plotting 465
13.12.4 Ending the Program 466
13.13 Two Dimensional Drawing 466
13.13.1 2D Drawing Practices 467
13.13.2 Student Exercises 470
13.14 Review Questions 471

Engineering Drawing

Mr. P. SrinivasaRao
Mrs. P. Sravani
Mr. M. Venkanna Babu
Mr. M. Venkaiah

23

Our Engineering Titles



₹xxx/-

ISBN 978-81-948784-5-2

SPECTRUM PUBLICATIONS
knowledge at your hands...
(An ISO 9001:2015 Certified Publisher)

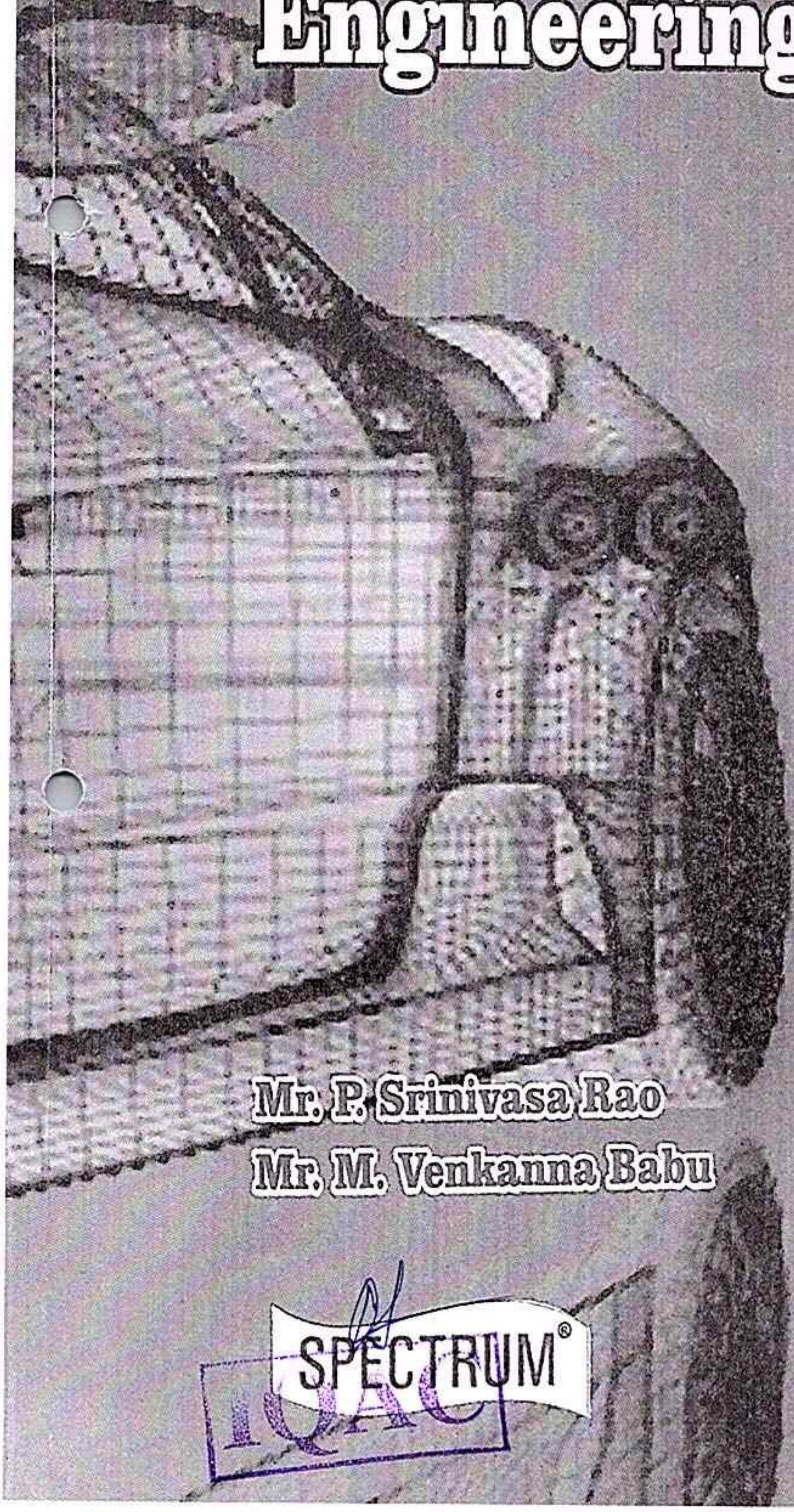
IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.) A.P.

Spectrum
EDUCATION

As per CBCS

Engineering Drawing



Mr. P. Srinivasa Rao
Mr. M. Venkanna Babu
Mrs. P. Sravani
Mr. M. Venkaiah

SPECTRUM®

ENGINEERING DRAWING

Authors

Mr. P. Srinivasa Rao
Associate Professor
Department of Mechanical Engineering
Narasaraopeta Engineering College(Autonomous)
Narasaraopet, Guntur - 522 601, AP

Mrs. P. Sravani
Assistant Professor
Department of Mechanical Engineering
Narasaraopeta Engineering College(Autonomous)
Narasaraopet, Guntur - 522 601, AP

Mr. M. Venkanna Babu
Assistant Professor
Department of Mechanical Engineering
Narasaraopeta Engineering College(Autonomous)
Narasaraopet, Guntur - 522 601, AP

Mr. M. Venkaiah
Assistant Professor
Department of Mechanical Engineering
Narasaraopeta Engineering College(Autonomous)
Narasaraopet, Guntur - 522 601, AP

SPECTRUM
PUBLISHING HOUSE
Temple of learning..

M/s Spectrum Publishing House, Hyderabad

(An ISO 9001 : 2015 Certified Company)

Head Office

326/C, Level - 2, Surneni Nilayam
Near B K Guda Park, S R Nagar, Hyderabad - 500 038, INDIA
P.No:+91 40 23710657, 238000657 Fax: +91 40 23810657

Reg. Off

5-68, Pedda Gorpadu, Pakala, Tirupati, Chittoor - 517 112 AP, INDIA
mail:studentshelpline.in@gmail.com
www.**studentshelpline**.in

First Edition-2021

ISBN: 978-81-948784-5-2

₹ **599/- Student Edition**

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

IQAC

Printed at StudentsHelpline Group, S R Nagar, Hyderabad-38
Published by Surneni Mohan Naidu for Spectrum Publishing House, Hyderabad - 38

ENGINEERING DRAWING

Chapter-1: Introduction to Engineering Drawing

1.0 Objectives 2

1.1 Introduction 2

1.2 Engineering Drawing 2

  1.2.1 Importance of Graphics in Design Process 3

  1.2.2 Role of Engineering Drawing 3

  1.2.3 BIS Codes and Conventions 4

1.3 Various Instruments used in Engineering Drawing 4

  1.3.1 Drawing Templates 10

  1.3.2 Drafting Machine 10

  1.3.3 Mini-drafter 11

  1.3.4 Large Size Divider 12

  1.3.5 Small Bow Divider 12

  1.3.6 Inking Pen 12

  1.3.7 Stencil 13

1.4 Types of Lines 13

1.5 Drawing Sheet Sizes 14

  1.5.1 Layout of Sheets A0, A1, A2, A3, A4, A5 14

1.6 Title Block of the Drawing Sheets 16

1.7 Folding Drawing Sheets and Prints 17

1.8 Lettering 21

  1.8.1 Types of Lettering 21

  1.8.2 Guide Lines for Lettering 22

  1.8.3 Salient Features of the Single Stroke Lettering 25

1.9 Dimensioning 25

  1.9.1 Notation of Tools for Dimensioning 25

1.9.2 Shape and Size Description of Dimensioning 27
1.9.3 Location of Surface Finish Symbols on Drawing 27
1.9.4 Surface Finish in a Drawing 28
1.9.5 General Rules of Dimensioning 28
1.9.6 Aligned and Unidirectional Systems 29
1.9.7 Arrangement of Dimensions 30
1.9.8 Dimensioning Standard Features 32
1.10 Review Questions 41

Chapter-2: Geometrical Constructions

2.0 Objectives 44
2.1 Introduction 44
2.2 Simple Geometrical Constructions 44
2.2.1 To divide a Line 44
2.2.2 Line 46
2.2.3 Bisecting a Line 46
2.2.4 How to Bisect an Angle? 47
2.2.5 Quadrilateral 47
2.2.6 Angle 47
2.2.7 Triangles 47
2.2.8 Circle 48
2.3 Polygons 64
2.4 Construction of Regular Polygons by General Methods 66
2.5 Inscribing Polygons with Circles 74
2.6 Describing Polygons with Circles 80
2.7 Exterior and Interior angles in Regular Polygons 86
2.9 Review Questions 87

Chapter-3: Scales

3.0 Objectives 90
3.1 Introduction 90

3.2 Scales 90

3.3 Common Types of Scales 90

3.4 Uses of Scale 91

3.5 Units of Measurement 91

3.6 Set of Scales 92

3.7 Scale Conversion 93

3.8 Requirements of Scales on Drawing 94

3.9 Representative Fraction (R.F.) 94

3.10 Types of Scales 96

3.11 Plain scales 96

3.11.1 Solved Problems 97

3.12 Diagonal 106

3.12.1 Comparison of Diagonal Scale from Plain Scale 107

3.13 Vernier Scale 116

3.13.1 Least Count of a Vernier 117

3.13.2 Differences between Plain Scale and Vernier Scale 118

3.13.3 Comparison of Diagonal and Vernier Scales 119

3.14 Additional Problems 123

3.16 Review Questions 128

Chapter-4: Conics

4.0 Objectives 132

4.1 Introduction 132

4.2 Conical Sections 133

4.3 Important Terms 133

4.4 Types of Conic Sections 134

4.5 Eccentricity 136

4.6 Ellipse 137

4.6.1 Properties of Ellipse 137

4.6.2 Uses 137
4.6.3 Applications of Ellipse 137
4.7 General Methods of Constructing an Ellipse 137
4.8 Parabola 157
4.8.1 Methods for Generating Parabola 158
4.8.2 Uses of Parabola 159
4.8.3 Parabola (Applications) 159
4.9 Hyperbola 167
4.10 Special Curves 176
4.11 Cycloidal Curves 176
4.11.1 Cycloid 176
4.11.2 Epicycloid and Hycycloid 179
4.11.3 Involute 184
4.12 Additional Problems 186
4.13 Review Questions 201

Chapter-5: Orthographic Projections

5.0 Objectives 206
5.1 Introduction 206
5.2 Principle of Projections 206
5.3 Methods of Projections 207
5.3.1 Method of Obtaining Front View 209
5.3.2 Method of Obtaining Top View 209
5.4 Orthographic Projection 210
5.4.1 Principles of Orthographic Projection 210
5.4.2 Conventional Representation 211
5.5 Plane of Projection 211
5.6 First Angle Projection 213
5.6.1 Features of First Angle Projection 214

5.7 Third Angle Projection 214

5.7.1 Features of Third Angle Projection 216

5.8 Comparison between First and Third Angle Projections 216

5.9 Review Questions 216

Chapter-6: Projections of Points

6.0 Objectives 218

6.1 Introduction 218

6.2 Projection of Points 218

6.2.1 Conclusions about Projections of Points 219

6.3 Projections of Points in Various Quadrants 219

6.4 Review Questions 230

Chapter-7: Projections of Straight Lines

7.0 Objectives 232

7.1 Introduction 232

7.2 Fundamental Concepts 232

7.3 Projections of Straight Lines 233

7.4 Positions of Straight Lines 240

7.5 Solved Problems 256

7.6 Traces of Staight Lines 267

7.6.1 Types of Traces 267

7.7 Additional Problems 276

7.8 Review Questions 277

Chapter-8: Projections of Planes

8.0 Objectives 280

8.1 Introduction 280

8.2 Planes 280

8.3 Location of a Plane 281

8.5 Trace of a Plane 281

8.6 Representation of Perpendicular Planes 282
8.7 Oblique Planes 285
8.8 Projections of Planes parallel to one of the Reference Planes 285
8.9 Projections of Planes Inclined to One Reference Plane and Perpendicular to the Other 287
8.10 Projections of Oblique Planes 292
8.11 Additional Problems 298
8.12 Review Questions 306

Chapter-9: Projections of Solids

9.0 Objectives 310
9.1 Introduction 310
9.2 Solids and Projection of Solid 311
9.3 Types of Solids 311
9.4 Projections of Solids Placed in Different Positions 316
9.5 Projections of a Solid with its Axis Perpendicular to HP and Parallel to VP 316
9.6 Axis Perpendicular to the V.P. and parallel to HP 320
9.7 Axis parallel to both H.P and V.P. 327
9.8 Axis inclined to H.P and parallel to the V.P 327
9.9 Additional Problems 332
9.10 Review Questions 339

Chapter-10: Sections of Solids

10.0 Objectives 342
10.1 Introduction 342
10.2 Types of Sectional Views of Solids 342
10.3 Cutting Planes (or) Sectional Planes 348
10.3.1 Sectional Views 350
10.4 Sections of Prism and Cube 351
10.5 Sections of Pyramids 354

10.6 Sections of Cylinders 357

10.7 sections of Cones 360

10.8 Additional Problems 362

10.9 Review Questions 366

Chapter-11: Development of Surfaces

11.0 Objectives 368

11.1 Introduction 368

11.2 Principle of Development 368

11.3 Methods of Development 368

11.4 Developement of Prism 370

11.5 Developement of Cylinders 372

11.6 Development of Cones 374

11.7 Development of Pyramids & Cones 376

11.8 Development of Lateral Surfaces of Solids With Cut-outs and Holes 379

11.9 Additional Problems 381

11.10 Review Questions 386

Chapter-12: Isometric Projections

12.0 Objectives 388

12.1 Introduction 388

12.2 Axonometric Projections 389

12.3 Principle of Isometric Projection 390

12.4 Isometric Axes, Lines and Planes 391

12.5 Isometric Scale 391

12.6 Isometric Drawing or Isometric View 393

12.7 Conventions 393

12.8 Selection of Views 394

12.9 Principles of Orthographic Projection 395

12.10 Conversion of Isometric Views to Orthographic Views 395

12.11 Conversion of Orthographic Views to Isometric Views 404
12.12 Additional Problems 413
12.13 Review Questions 417

Chapter-13: AutoCAD

13.0 Introduction to AutoCAD 426
13.1 Capabilites of AutoCAD 427
13.2 Advantages of AutoCAD 427
13.3 Main features of AutoCAD 428
13.4 AutoCAD commands 429
13.4.1 Starting AutoCAD 429
13.4.2 AutoCAD Screen 430
13.5 How do you communicate with AutoCAD 431
13.6 Command Aliases 432
13.6.1 Line Command 433
13.6.2 Polyline Command 436
13.6.3 Orthogonal Lines 436
13.6.4 Rectangle Command 437
13.6.5 Circles 437
13.6.6 Arc Command 439
13.6.7 Spline 439
13.6.8 Editing Polylines 440
13.6.9 PEDIT Options 441
13.6.10 Move Command 441
13.6.11 Copy Command 442
13.7 Offset Command 443
13.7.1 Offset Distance 443
13..7.2 Explode Command 443
13.7.3 Extend 444

13.7.4 Stretch 445

13.7.5 Trim 445

13.7.6 Break 446

13.7.7 Mirror 447

13.7.8 Rotate 447

13.7.9 Scale 447

13.8 Text Command 448

13.8.1 Text 448

13.8.2 DTEXT (Dynamic Text) 448

13.8.3 Introduction to Layers and Layer Dialog Box 449

13.8.4 Layer Options 449

13.8.5 Layer Shortcuts 450

13.8.6 Color Command 451

13.8.8 By Block 451

13.9 Linetypes 451

13.9.1 Loading and Changing Linetypes 451

13.10 Lineweights 452

13.10.1 Loading and Changing Lineweights 452

13.10.2 Object Properties 453

13.10.3 BHATCH Command 454

13.10.4 Measuring Distances 455

13.10.5 Linear Dimensions 455

13.10.6 Aligned Dimensions 456

13.10.7 Arclength Dimensions 456

13.10.8 Radial Dimensions 457

13.10.9 Angular and Jogged Dimensions 457

13.10.10 Baseline Dimensions 458

13.10.11 Continued Dimensions 459

13.10.12 Leaders 459
13.10.13 Leader Settings 460
13.10.14 Quick Dimensions 460
13.10.15 Modifying Dimensions 461
13.10.15.1 DDEDIT 461
13.10.15.2 Stretching Dimensions 461
13.10.16 Dimtedit 462
13.10.17 Dimension Edit Commands 462
13.10.18 Ordinate Dimensions 462
13.10.19 Calculating Areas 462
13.11 Plot Settings 463
13.11.1 On-Line Help 464
13.12 Specifying the Units for the Drawing 465
13.12.1 Shortcuts 465
13.12.2 Saving Your Work 465
13.12.3 Plotting 465
13.12.4 Ending the Program 466
13.13 Two Dimensional Drawing 466
13.13.1 2D Drawing Practices 467
13.13.2 Student Exercises 470
13.14 Review Questions 471

Engineering Drawing

Mr. P. SrinivasaRao

Mrs. P. Sravani

Mr. M. Venkanna Babu

Mr. M. Venkaiah

Our Engineering Titles

₹xxx/-

ISBN 978-81-948784-5-2

SPECTRUM PUBLICATIONS

knowledge at your hands..

(An ISO 9001:2015 Certified Publisher)

amazon.in

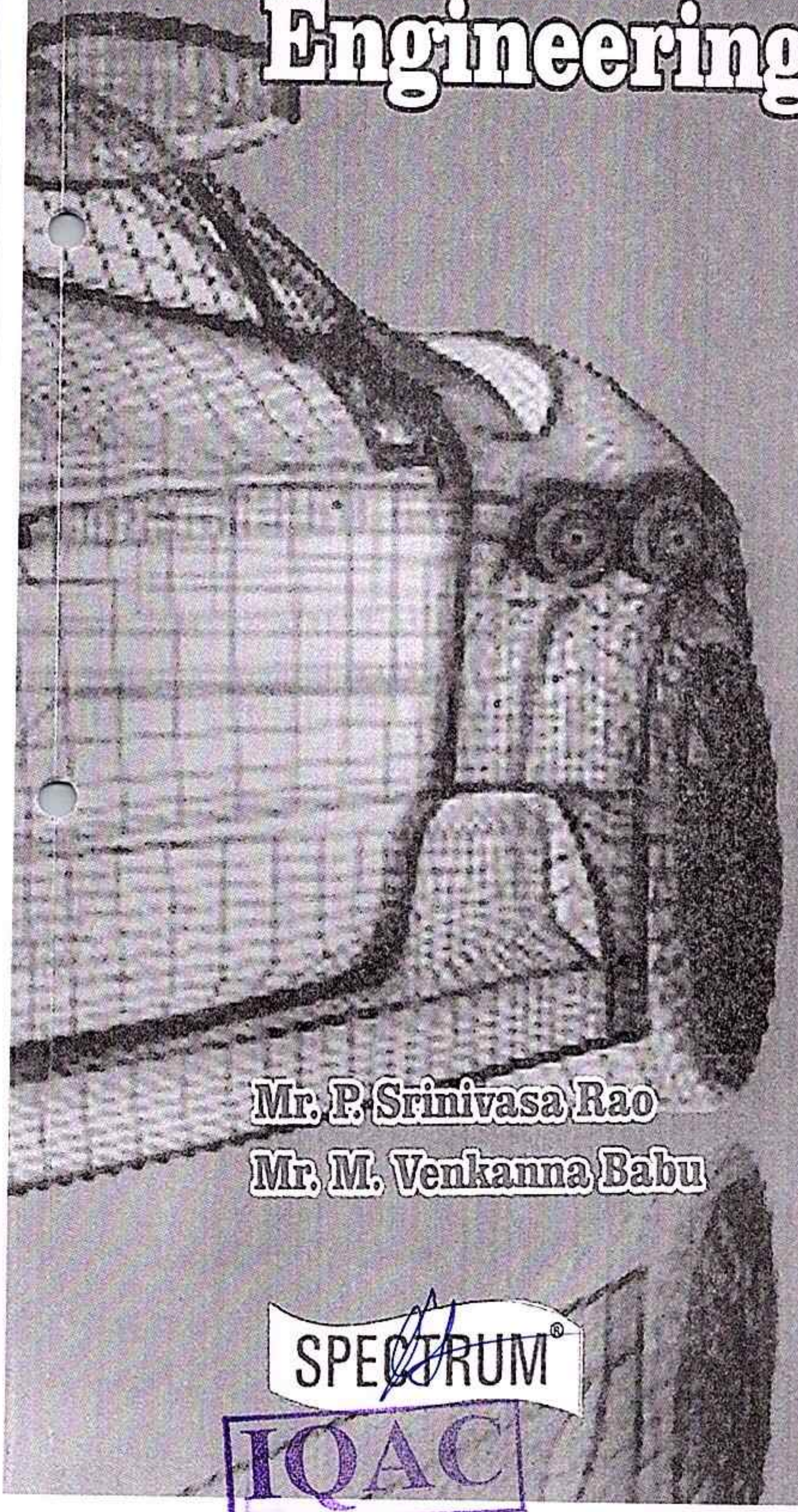
AatmaNirbharBharat Abhiyan

+91 9392575657

Spectrum
EDUCATION

As per CBCS

Engineering Drawing



Mr. P. Srinivasa Rao
Mr. M. Venkanna Babu
Mrs. P. Sravani
Mr. M. Venkaiah

SPECTRUM®

ENGINEERING DRAWING

Authors

Mr. P. Srinivasa Rao
Associate Professor
Department of Mechanical Engineering
Narasaraopeta Engineering College(Autonomous)
Narasaraopet, Guntur - 522 601, AP

Mrs. P. Sravani
Assistant Professor
Department of Mechanical Engineering
Narasaraopeta Engineering College(Autonomous)
Narasaraopet, Guntur - 522 601, AP

Mr. M. Venkanna Babu
Assistant Professor
Department of Mechanical Engineering
Narasaraopeta Engineering College(Autonomous)
Narasaraopet, Guntur - 522 601, AP

Mr. M. Venkaiah
Assistant Professor
Department of Mechanical Engineering
Narasaraopeta Engineering College(Autonomous)
Narasaraopet, Guntur - 522 601, AP

SPECTRUM
PUBLISHING HOUSE
Temple of learning

M/s Spectrum Publishing House, Hyderabad

(An ISO 9001 : 2015 Certified Company)

Head Office

326/C, Level - 2, Surneni Nilayam
Near B K Guda Park, S R Nagar, Hyderabad - 500 038, INDIA
P.No:+91 40 23710657, 238000657 Fax: +91 40 23810657

Reg. Off

5-68, Pedda Gorpadu, Pakala, Tirupati, Chittoor - 517 112 AP, INDIA
mail:studentshelpline.in@gmail.com
www.**studentshelpline**.in

First Edition-2021

ISBN: 978-81-948784-5-2

₹ 599/- Student Edition

Printed at StudentsHelpline Group, S R Nagar, Hyderabad-38
Published by Surneni Mohan Naidu for Spectrum Publishing House, Hyderabad - 38

ENGINEERING DRAWING

Chapter-1: Introduction to Engineering Drawing

1.0 Objectives	2
1.1 Introduction	2
1.2 Engineering Drawing	2
1.2.1 Importance of Graphics in Design Process	3
1.2.2 Role of Engineering Drawing	3
1.2.3 BIS Codes and Conventions	4
1.3 Various Instruments used in Engineering Drawing	4
1.3.1 Drawing Templates	10
1.3.2 Drafting Machine	10
1.3.3 Mini-drafter	11
1.3.4 Large Size Divider	12
1.3.5 Small Bow Divider	12
1.3.6 Inking Pen	12
1.3.7 Stencil	13
1.4 Types of Lines	13
1.5 Drawing Sheet Sizes	14
1.5.1 Layout of Sheets A0, A1, A2, A3, A4, A5	14
1.6 Title Block of the Drawing Sheets	16
1.7 Folding Drawing Sheets and Prints	17
1.8 Lettering	21
1.8.1 Types of Lettering	21
1.8.2 Guide Lines for Lettering	22
1.8.3 Salient Features of the Single Stroke Lettering	25
1.9 Dimensioning	25
1.9.1 Notation of Tools for Dimensioning	25

1.9.2 Shape and Size Description of Dimensioning 27
1.9.3 Location of Surface Finish Symbols on Drawing 27
1.9.4 Surface Finish in a Drawing 28
1.9.5 General Rules of Dimensioning 28
1.9.6 Aligned and Unidirectional Systems 29
1.9.7 Arrangement of Dimensions 30
1.9.8 Dimensioning Standard Features 32
1.10 Review Questions 41

Chapter-2: Geometrical Constructions

2.0 Objectives 44
2.1 Introduction 44
2.2 Simple Geometrical Constructions 44
2.2.1 To divide a Line 44
2.2.2 Line 46
2.2.3 Bisecting a Line 46
2.2.4 How to Bisect an Angle? 47
2.2.5 Quadrilateral 47
2.2.6 Angle 47
2.2.7 Triangles 47
2.2.8 Circle 48
2.3 Polygons 64
2.4 Construction of Regular Polygons by General Methods 66
2.5 Inscribing Polygons with Circles 74
2.6 Describing Polygons with Circles 80
2.7 Exterior and Interior angles in Regular Polygons 86
2.9 Review Questions 87

Chapter-3: Scales

3.0 Objectives 90
3.1 Introduction 90

3.2 Scales 90
3.3 Common Types of Scales 90
3.4 Uses of Scale 91
3.5 Units of Measurement 91
3.6 Set of Scales 92
3.7 Scale Conversion 93
3.8 Requirements of Scales on Drawing 94
3.9 Representative Fraction (R.F.) 94
3.10 Types of Scales 96
3.11 Plain scales 96
3.11.1 Solved Problems 97
3.12 Diagonal 106
3.12.1 Comparison of Diagonal Scale from Plain Scale 107
3.13 Vernier Scale 116
3.13.1 Least Count of a Vernier 117
3.13.2 Differences between Plain Scale and Vernier Scale 118
3.13.3 Comparison of Diagonal and Vernier Scales 119
3.14 Additional Problems 123
3.16 Review Questions 128

Chapter-4: Conics

4.0 Objectives 132
4.1 Introduction 132
4.2 Conical Sections 133
4.3 Important Terms 133
4.4 Types of Conic Sections 134
4.5 Eccentricity 136
4.6 Ellipse 137
4.6.1 Properties of Ellipse 137

4.6.2 Uses 137

4.6.3 Applications of Ellipse 137

4.7 General Methods of Constructing an Ellipse 137

4.8 Parabola 157

4.8.1 Methods for Generating Parabola 158

4.8.2 Uses of Parabola 159

4.8.3 Parabola (Applications) 159

4.9 Hyperbola 167

4.10 Special Curves 176

4.11 Cycloidal Curves 176

4.11.1 Cycloid 176

4.11.2 Epicycloid and Hycycloid 179

4.11.3 Involute 184

4.12 Additional Problems 186

4.13 Review Questions 201

Chapter-5: Orthographic Projections

5.0 Objectives 206

5.1 Introduction 206

5.2 Principle of Projections 206

5.3 Methods of Projections 207

5.3.1 Method of Obtaining Front View 209

5.3.2 Method of Obtaining Top View 209

5.4 Orthographic Projection 210

5.4.1 Principles of Orthographic Projection 210

5.4.2 Conventional Representation 211

5.5 Plane of Projection 211

5.6 First Angle Projection 213

5.6.1 Features of First Angle Projection 214

5.7 Third Angle Projection 214

5.7.1 Features of Third Angle Projection 216

5.8 Comparison between First and Third Angle Projections 216

5.9 Review Questions 216

Chapter-6: Projections of Points

6.0 Objectives 218

6.1 Introduction 218

6.2 Projection of Points 218

6.2.1 Conclusions about Projections of Points 219

6.3 Projections of Points in Various Quadrants 219

6.4 Review Questions 230

Chapter-7: Projections of Straight Lines

7.0 Objectives 232

7.1 Introduction 232

7.2 Fundamental Concepts 232

7.3 Projections of Straight Lines 233

7.4 Positions of Straight Lines 240

7.5 Solved Problems 256

7.6 Traces of Staight Lines 267

7.6.1 Types of Traces 267

7.7 Additional Problems 276

7.8 Review Questions 277

Chapter-8: Projections of Planes

8.0 Objectives 280

8.1 Introduction 280

8.2 Planes 280

8.3 Location of a Plane 281

8.5 Trace of a Plane 281

8.6 Representation of Perpendicular Planes 282

8.7 Oblique Planes 285

8.8 Projections of Planes parallel to one of the Reference Planes 285

8.9 Projections of Planes Inclined to One Reference Plane and Perpendicular to the Other 287

8.10 Projections of Oblique Planes 292

8.11 Additional Problems 298

8.12 Review Questions 306

Chapter-9: Projections of Solids

9.0 Objectives 310

9.1 Introduction 310

9.2 Solids and Projection of Solid 311

9.3 Types of Solids 311

9.4 Projections of Solids Placed in Different Positions 316

9.5 Projections of a Solid with its Axis Perpendicular to HP and Parallel to VP 316

9.6 Axis Perpendicular to the V.P. and parallel to HP 320

9.7 Axis parallel to both H.P and V.P. 327

9.8 Axis inclined to H.P and parallel to the V.P 327

9.9 Additional Problems 332

9.10 Review Questions 339

Chapter-10: Sections of Solids

10.0 Objectives 342

10.1 Introduction 342

10.2 Types of Sectional Views of Solids 342

10.3 Cutting Planes (or) Sectional Planes 348

10.3.1 Sectional Views 350

10.4 Sections of Prism and Cube 351

10.5 Sections of Pyramids 354

10.6 Sections of Cylinders 357
10.7 sections of Cones 360
10.8 Additional Problems 362
10.9 Review Questions 366

Chapter-11: Development of Surfaces

11.0 Objectives 368
11.1 Introduction 368
11.2 Principle of Development 368
11.3 Methods of Development 368
11.4 Developement of Prism 370
11.5 Developement of Cylinders 372
11.6 Development of Cones 374
11.7 Development of Pyramids & Cones 376
11.8 Development of Lateral Surfaces of Solids With Cut-outs and Holes 379
11.9 Additional Problems 381
11.10 Review Questions 386

Chapter-12: Isometric Projections

12.0 Objectives 388
12.1 Introduction 388
12.2 Axonometric Projections 389
12.3 Principle of Isometric Projection 390
12.4 Isometric Axes, Lines and Planes 391
12.5 Isometric Scale 391
12.6 Isometric Drawing or Isometric View 393
12.7 Conventions 393
12.8 Selection of Views 394
12.9 Principles of Orthographic Projection 395
12.10 Conversion of Isometric Views to Orthographic Views 395

12.11 Conversion of Orthographic Views to Isometric Views 404

12.12 Additional Problems 413

12.13 Review Questions 417

Chapter-13: AutoCAD

13.0 Introduction to AutoCAD 426

13.1 Capabilites of AutoCAD 427

13.2 Advantages of AutoCAD 427

13.3 Main features of AutoCAD 428

13.4 AutoCAD commands 429

13.4.1 Starting AutoCAD 429

13.4.2 AutoCAD Screen 430

13.5 How do you communicate with AutoCAD 431

13.6 Command Aliases 432

13.6.1 Line Command 433

13.6.2 Polyline Command 436

13.6.3 Orthogonal Lines 436

13.6.4 Rectangle Command 437

13.6.5 Circles 437

13.6.6 Arc Command 439

13.6.7 Spline 439

13.6.8 Editing Polylines 440

13.6.9 PEDIT Options 441

13.6.10 Move Command 441

13.6.11 Copy Command 442

13.7 Offset Command 443

13.7.1 Offset Distance 443

13..7.2 Explode Command 443

13.7.3 Extend 444

13.7.4 Stretch 445
13.7.5 Trim 445
13.7.6 Break 446
13.7.7 Mirror 447
13.7.8 Rotate 447
13.7.9 Scale 447
13.8 Text Command 448
13.8.1 Text 448
13.8.2 DTEXT (Dynamic Text) 448
13.8.3 Introduction to Layers and Layer Dialog Box 449
13.8.4 Layer Options 449
13.8.5 Layer Shortcuts 450
13.8.6 Color Command 451
13.8.8 By Block 451
13.9 Linetypes 451
13.9.1 Loading and Changing Linetypes 451
13.10 Lineweights 452
13.10.1 Loading and Changing Lineweights 452
13.10.2 Object Properties 453
13.10.3 BHATCH Command 454
13.10.4 Measuring Distances 455
13.10.5 Linear Dimensions 455
13.10.6 Aligned Dimensions 456
13.10.7 Arclength Dimensions 456
13.10.8 Radial Dimensions 457
13.10.9 Angular and Jogged Dimensions 457
13.10.10 Baseline Dimensions 458
13.10.11 Continued Dimensions 459

13.10.12 Leaders 459
13.10.13 Leader Settings 460
13.10.14 Quick Dimensions 460
13.10.15 Modifying Dimensions 461
13.10.15.1 DDEDIT 461
13.10.15.2 Stretching Dimensions 461
13.10.16 Dimtedit 462
13.10.17 Dimension Edit Commands 462
13.10.18 Ordinate Dimensions 462
13.10.19 Calculating Areas 462
13.11 Plot Settings 463
13.11.1 On-Line Help 464
13.12 Specifying the Units for the Drawing 465
13.12.1 Shortcuts 465
13.12.2 Saving Your Work 465
13.12.3 Plotting 465
13.12.4 Ending the Program 466
13.13 Two Dimensional Drawing 466
13.13.1 2D Drawing Practices 467
13.13.2 Student Exercises 470
13.14 Review Questions 471

Engineering Drawing

Mr. P. SrinivasaRao
Mrs. P. Sravani
Mr. M. Venkanna Babu
Mr. M. Venkaiah

23

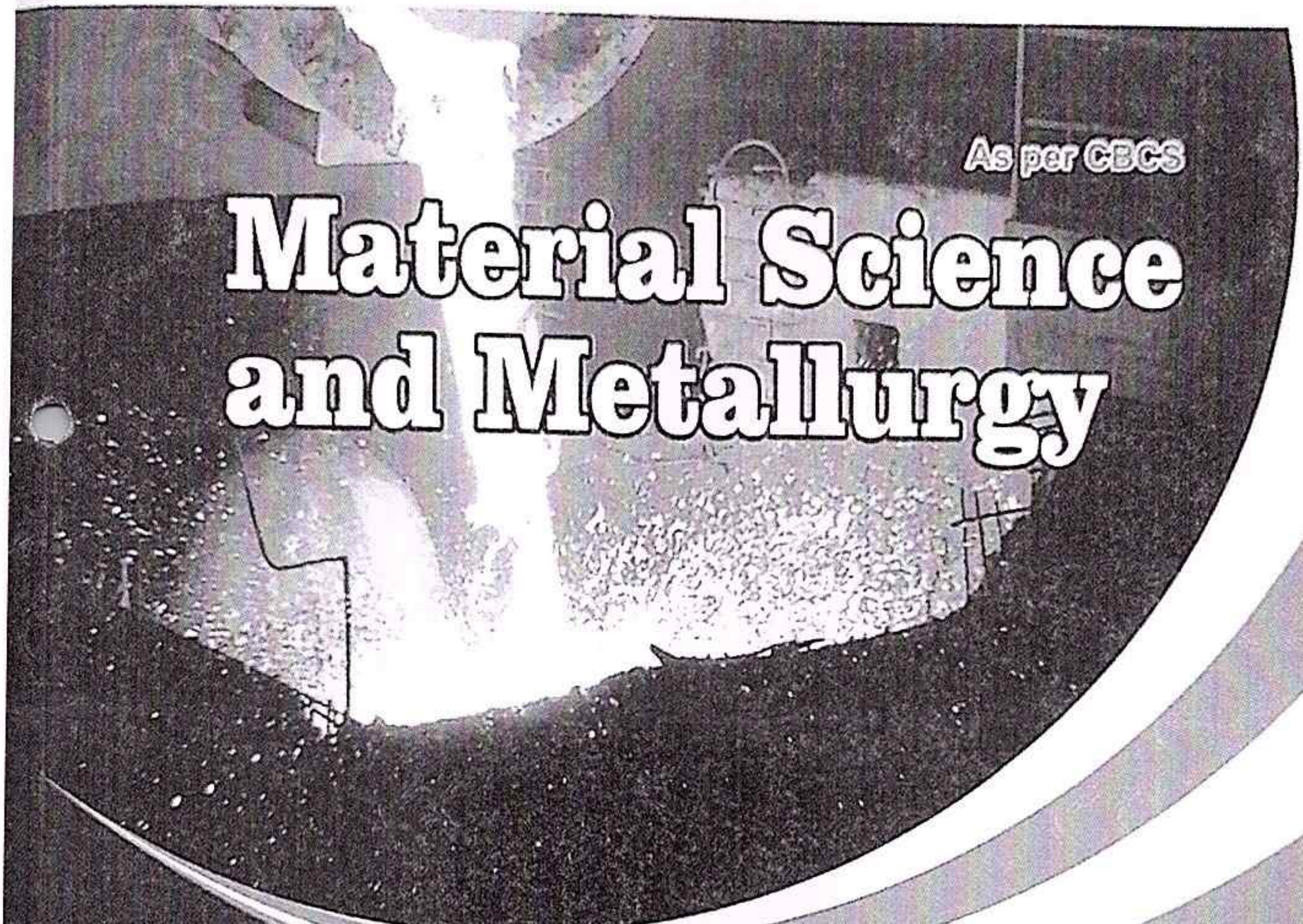
Our Engineering Titles

₹xxx/-

ISBN 978-81-948784-5-2

SPECTRUM PUBLICATIONS
knowledge at your hands..
(An ISO 9001:2015 Certified Publisher)

Spectrum
EDUCATION



As per CBCS

Material Science and Metallurgy

Dr. D. Suneel Dr. P. Suresh Babu
Dr. B. Venkata Siva

SunRaise

Material Science and Metallurgy

Authors

Dr. D. Suneel
Vice Principal & Professor
Department of Mechanical Engineering
Narasaraopeta Engineering College(Autonomous)
Narasaraopet, Guntur - 522 601, A.P.

Dr. P. Suresh Babu
Assoicate Professor
Department of Mechanical Engineering
Narasaraopeta Engineering College(Autonomous)
Narasaraopet, Guntur - 522 601, A.P.

Dr. B. Venkata Siva
HOD & Professor
Department of Mechanical Engineering
Narasaraopeta Engineering College(Autonomous)
Narasaraopet, Guntur, A.P. - 522 601

SUNRAISE INTERNATIONAL PUBLISHERS

M/s SunRaise International Publishers

A Part of StudentsHelpline Publishing House (P) Ltd. , Hyderabad

(An ISO 9001 : 2015 Certified Company)

Head Office

326/C, Level - 4, Surneni Nilayam
Near B K Guda Park, S R Nagar, Hyderabad - 500 038, INDIA
P.No:+91 40 23710657, 238000657 Fax: +91 40 23810657

Reg. Off

5-68, Pedda Gorpadu, Pakala, Tirupati, Chittoor - 517 112 AP, INDIA
mail:studentshelpline.in@gmail.com
www.**studentshelpline.in**

First Edition-2021

ISBN 978-81-952678-1-1

` **370/-**

Printed at StudentsHelpline Group, S R Nagar, Hyderabad-38
Published by Surneni Mohan Naidu for SunRaise International Publishers, Hyderabad-38

Material Science and Metallurgy

Unit-1: Structure of Metals and Constitution of Alloys

1.0	Objectives	2
1.1	Ontroduction	2
1.2	Classification of Solids	2
	1.2.1 Comparison of Crystalline Solids and Amorphous Solids	5
1.3	Space Lattice	6
1.4	Basis and Crystal Structure	6
1.5	Crystal Lattice	7
1.6	Unit Cell	7
1.7	Primitive Cell	8
1.8	Crystal Lattice and Crystal Systems	8
	1.8.1 Nearest Neighbour Distances in Cubic Crystals	12
1.9	Lattice Parameter and Bravais Lattices	12
1.10	Important Terms Related to Cubic Crystals	15
1.11	Simple Cubic Structure (SC)	15
1.12	Body Centered Cubic Structure (BCC)	17
1.13	Face-Centered Cubic Structure (FCC)	19
1.14	Hexagonal Close Packed (HCP)	20
1.15	X-ray Diffraction	22
1.16	Directions and Planes in Crystals - Miller Indices	22
	1.16.1 Features of the Miller Indices	23
	1.16.2 Crystal Planes and Directions	24
	1.16.3 Miller Indices for a Cubic Crystal	25
1.17	Inter Planar Spacing of Orthogonal Crystal Systems	26
	1.17.1 Calculation of Distance of Separation 'd' between Successive *hkl* Planes	27
1.18	Bragg's Law	27
1.19	Experimental Methods in X-ray Diffraction	29
1.20	Solved Examples	34

1.21	Solid Solutions and Compounds	41
1.22	Types of Solid Solutions	42
1.23	Interstitial Solid Solutions	44
1.24	Compounds	44
1.25	Imperfections in Crystals and Their Effect on Properties	47
1.25.1	Point Defects	48
1.25.2	Line Defects (Dislocations)	51
1.25.3	Surface Defects	57
1.25.4	Volume Defects	61
1.25.5	Experimental Techniques for Observing Dislocations	61
1.26	Solute Strengthening	61
1.27	Hume-rothery's Rules	62
1.28	Outcomes	63
1.29	Review Questions	64
1.30	Multile Choice Questions	65

Unit-2: Equilibrium Diagrams

2.0	Objectives	72
2.1	Intoduction	72
2.2	Limitation of Phase Diagrams	73
2.3	Application of Phase Equilibrium Diagrams	73
2.4	Terms used for Study of Phase Equilibrium	73
2.4.1	Phase	73
2.4.2	System	73
2.4.3	Component	74
2.4.4	Equilibrium	74
2.4.5	Degree of Freedom	74
2.4.6	Structural Constituent	74
2.4.7	Single Phase & Multi-phase Solids	74
2.5	Types of phase diagrams	76
2.6	Unary Phase Diagram	76
2.7	Binary Phase Diagrams	77

2.8 Allotropy of Iron 77
2.9 Iron-iron Carbide Equlibirum Diagram 79
2.9.1 Phases Present and their Properties 80
2.10 Types of Reactions between Phases 84
2.10.1 Eutectic Reaction 84
2.11 Engineering Materials & Metallurgy 84
2.11.1 Eutectoid Reaction 85
2.11.2 Peritecdc Reaction(Transformation) 85
2.11.3 Peritectoid Reaction 85
2.12 Cooling Curves 86
2.13 Lever-arm Principle 88
2.14 Gibb's Free Energy for Thermodynamic Stability of Phases 90
2.15 Gibbs Phase Rule 91
2.16 Outcomes 92
2.17 Review Questions 93
2.18 Multiple Choice Questions 94

Unit-3: Ferrous Metals and Alloys

3.0 Objectives 100
3.1 Introduction 100
3.2 Classification of Metals 100
3.3 Different Stages of Iron 101
3.3.1 Pig Iron 101
3.3.2 Wrought Iron 102
3.3.3 Gray Cast Iron 103
3.3.4 Malleable Cast Iron 104
3.3.5 White Cast Iron(Mottled Iron) 105
3.4 Classification of Steel 105
3.5 Mild Steel 106
3.6 Medium Carbon Steels 106
3.7 High Carbon Steels 107
3.8 Constituents, Microstructures and Properties of Plain Carbon Steels 108

3.9 Alloy Steels	110
3.10 Effect of Alloying Elements	110
3.10.1 Effect of Alloying Elements on Ferrite	110
3.10.2 Effect of Alloying Elements on Carbide	111
3.10.3 Effect of Alloying Elements on the Iron - Iron Carbide Diagram	111
3.10.4 Effect of Alloying Elements on Tempering	111
3.10.5 Formation of Intormetallic Compounds	112
3.10.6 Effect of Alloying Element Critical Cooling Rate	112
3.11 Classification of Alloying Elements	112
3.12 Properties and uses of Alloying Elements	112
3.13 Various Alloy Steels	115
3.14 Stainless Steels	118
3.14.1 Classification of Stainless Steels	120
3.14.2 Sensitisation and Weld Decay	122
3.14.3 Heat Treatment of Stainless Steels	123
3.15 Tools Steels	124
3.15.1 Selection of Tool Steels	124
3.15.2 Properties of Tool Steels	125
3.15.3 Engineering Materials & Metallurgy	125
3.15.4 TYpes/Classification of Tool Steels	126
3.15.5 Heat Treatment Cycle for High Speed Tool Steel	127
3.16 Maraging Steels	128
3.17 Engineering Materials and Metallurgy	129
3.17.1 Composition and Mechanical Properties of Typical Maraging Steels	129
3.17.2 Characteristics of Maraging Steels	129
3.17.3 Applications of Maraging Steels	129
3.17.4 Die steel	130
3.18 Cast Irons	130
3.18.1 What are the Features that make Cast Iron an Important Material	131
3.18.2 Composition of Cast Iron	131
3.18.3 Effect of Composition Elements on Cast Iron	131
3.18.4 The Influence of Cooling Rate on the Properties of a Cast Iron	132

3.18.5 The Effect of Heat Treatment on Cast Irons 132
3.18.6 Types of Cast Irons 133
3.19 Grey Cast Iron 133
3.19.1 Microstructure of Grey Cast Iron 133
3.19.2 Designation of Grey Cast Iron 134
3.19.3 Characteristics of Grey Cast Iron 134
3.19.4 Applications of Grey Cast Iron 135
3.20 White Cast Iron 135
3.20.1 Microstructure of White Cast Iron 135
3.20.2 Characteristics of White Cast Iron 136
3.20.3 Applications of White Cast Iron 136
3.21 Malleable Cast Iron 136
3.21.1 Microstructure of Malleable Cast Iron 136
3.21.2 Types of Malleable irons 137
3.21.3 Designation of Malleable Cast Iron 137
3.21.4 Characteristics of Malleable Cast Iron 138
3.21.5 Applications of Malleable Cast Iron 138
3.22 Spheroidal Graphite or Nodular Cast Iron (or Ductile Cast Iron) 138
3.22.1 Microstructure of SG Cast Iron 138
3.22.2 Designation of SG Iron 139
3.22.3 Characteristics of SG Cast Iron 140
3.22.4 Applications of SG Cast Iron 140
3.23 Alloy Cast Iron 140
3.23.1 Effects of Alloying Elements in Cast Iron 140
3.23.2 Properties and Applications of Alloy Cast Irons 141
3.24 Outcomes 142
3.25 Review Questions 142
3.26 Multile Choice Questions 144

Unit-4: Heat Treatment Processor

4.0 Objectives 150
4.1 Intodaction 150
4.2 Purpose of Heat Treatment 151

4.3 Principles of Heat Treatment 152

4.4 Factors to be Considered When Heat Treating 153

4.5 Heat Treatment Processes 154

4.6 Annealing 155

4.6.1 Full Annealing 157

4.6.2 Process Annealing 159

4.6.3 Spheroidise Annealing 159

4.6.4 Isothermal Annealing 160

4.6.5 Stress Relief Annealing 160

4.7 Normalizing 160

4.7.1 Comparison between Annealing and Normalizing 163

4.8 Hardening 164

4.8.1 Heat Removal During Quenching 165

4.8.2 Quenching Mediums 165

4.9 Tempering 166

4.9.1 Classification of Tempering Processes 168

4.9.2 Theory of Tempering 169

4.9.3 Spheroidising 170

4.10 Isothermal Heat Treatments 171

4.11 Isothermal Transformation Diagrams (TTT Diagrams) 171

4.11.1 Difference Between $Fe - Fe_3C$ Equilibrium Diagram and TTT Diagram 172

4.11.2 Time-Temperature-Transformation (or TTT) Diagrams 172

4.11.3 Construction of a TTT Diagram 172

4.11.4 TTT Diagram for a Eutectoid Steel 174

4.11.5 Significance of TTT Diagram in the Heat Treatment of Steel 176

4.12 Continuous-cooling Transformation (or CCT) Diagrams 176

4.12.1 CCT Diagram for a Eutectoid Carbon Steel 176

4.12.2 Effect of Cooling Rate in terms of TTT Curves 177

4.12.3 Critical Cooling Rate 179

4.13 Hardenability 179

4.13.1 Hardness Vs Haedenability 179

4.13.2 Factors Affecting Hardenability 180
4.13.3 Determining Hardenability(Jominy End-Quench Test) 180
4.13.3.1 End-Quench Specimen 180
4.13.3.2 Testing Procedure 180
4.13.4 Use of Hardenability Curves 182
4.14 Austempering 182
4.15 Martempering 184
4.16 Ausforming 185
4.17 Case Hardening 187
4.17.1 Carburizing 187
4.17.1.1 Pack-Carburizing 188
4.17.1.2 Liquid Carburizing 189
4.17.1.3 Gas Carburizing 189
4.17.1.4 Advantages of Gas Carburizing 190
4.17.2 Nitriding 190
4.17.2.1 Advantages and Disadvantages of Nitriding 190
4.17.3 Cyaniding 191
4.17.3.1 Advantages and Disadvantages of Cyaniding 191
4.17.4 Carbo-nitriding 191
4.18 SURFACE HARDENING 192
4.18.1 Flame Hardening 192
4.18.2 Induction Dardening 194
4.19 Vaccum and Plasma Surface Hardening 196
4.19.1 Vacuum Surface Hardening 196
4.19.1.1 Suitability 196
4.19.1.2 Vacuum Carburising Process 196
4.19.1.3 Advantages of Vacuum Carburising 198
4.19.1.4 Disadvantages of Vacuum Carburising 198
4.19.2 Plasma Surface Hanrdening 198
4.19.2.1 Suitability 199
4.19.2.2 Plasma Carburising Process 199

4.19.2.3 Advantages of Plasma Carburising 200
4.19.2.4 Disadvantages of Plasma Carburising 201
4.20 Outcomes 201
4.21 Review Questions 202
4.22 Multile Choice Questions 203

Unit-5: Non-ferrous Metals

5.0 Objectives 208
5.1 Introduction 208
5.2 Copper and its Alloys 209
5.2.1 Brasses 209
5.2.2 Bronzes 213
5.2.3 Copper-Nickel Alloys 218
5.2.4 Nickel-Silvers 218
5.3 Properties of Copper 220
5.4 Extraction of Copper 221
5.5 Classification of Copper Alloys 222
5.5.1 Uses of Copper 222
5.6 Aluminum and its Alloys 223
5.6.1 Aluminum 223
5.6.1.1 Propertics of Aluminum 223
5.7 Extraction of Aluminium 226
5.8 Aluminium Alloys 227
5.9 Effects of Alloying Elements with Aluminium 228
5.9.1 Characteristics of Aluminium 229
5.9.2 Aluminiun vs Copper 230
5.9.3 Applications of Aluminium 230
5.9.4 Al-Cu Alloys 230
5.10 Precipitation Strengthening Treatment (Age Hardening) 230
5.10.1 Precipitation Hardening 230
5.11 Magnesium 231
5.11.1 Magnesium Alloys 232

5.11.2 Applications of Magnessium Alloys 232
5.12 Titanium 233
5.13 Outcomes 235
5.14 Review Questions 235
5.15 Multile Choice Questions 237

Unit-6: Polymers

6.0 Objectives 242
6.1 Introduction to Polymers 242
6.2 Terminology 242
6.3 Classification of Polymers 245
6.4 Types or Methods of Polymerization 248
6.5 DifferenceS between Addition and Condensation Polymerization 251
6.6 Ionic Addition Polymerization 251
6.6.1 Differences between Free-radical and Ionic Chain Polymerization 256
6.7 Coordination Polymerization or Ziegler-Natta Polymerization 256
6.8 Methods of Polymerization 257
6.9 Properties of Polymers 258
6.10 Introduction to Plastics 262
6.11 Plastics as Engineering materials 262
6.12 Types of plastics 264
6.12.1 Differences between Thermoplastics and Thermosetting Plastics 266
6.13 Compounding of Plastics 266
6.13.1 Fabrication or Moulding of Plastics 268
6.13.2 Comparison of Compression and Injection Moulding 271
6.14 Preparation, Properties and Applications of Polymers 271
6.14.1 Polyethylene 271
6.14.2 PVC (Polyvinyl Chloride) 273
6.14.3 Bakelite or Phenol-formaldehyde Resin 274
6.14.4 Teflon or Poly tetra fluoro ethylene (PTFE) or Fluon 276
6.14.5 Polystyrene 277
6.14.6 Urea-formaldehyde(UF) 277

6.15 Introduction to Rubbers and Elastomers 278
6.15.1 Natural Rubber 279
6.15.2 Rubber Latex 281
6.15.3 Preparation of Rubber 282
6.16 Vulcanization of Rubber 284
6.16.1 Differences between Natural and Vulcanized Rubber 286
6.17 Elastomers-Rubber and their Uses 286
6.17.1 Butyl Rubber 287
6.18 Synthetic Rubbers or Artificial Rubbers 287
6.18.1 Styrene Rubber (GR-S or Buna-S) 287
6.18.2 Nitrile Rubber (GR-A or Buna-N) 288
6.18.3 Neoprene Rubber 289
6.19 Applications of Rubber and Elastomers 290
6.20 Fibers 291
6.21 Fibre-Reinforced Plastics (FRPs) 291
6.22 Processing techniques adopted in FRP 292
6.23 Conducting polymers 293
6.23.1 Engineering Applications of Conducting Polymers 296
6.24 Outcomes 297
6.25 Review questions 297
6.26 Multiple Choice Questions 299

Unit-7: Ceramics and Composite Materials

7.0 Objectives 304
7.1 Introduction 304
7.2 Types of Ceramics 306
7.3 Engineering Ceramics 307
7.4 Glasses 315
7.4.1 Structure of Glass 316
7.4.2 Types of Glasses 316
7.4.3 Production and Forming of Glass 319
7.5 Cermets 319

7.6 Abrasives 320
7.7 Properties and Applications of Ceramics 321
7.8 Processing of Ceramics 323
7.9 Nanomaterials 325
7.10 Significance of Nano Scale 326
7.11 Properties of Nanomaterial 327
7.12 Chemical Methods of Preparation of Nanmaterials and Oxide Metals 329
7.12.1 Sol-gel Method 329
7.12.2 Hydrothermal Synthesis 331
7.12.3 Microwave Assisted Synthesis 331
7.12.4 Polyol Synthesis 332
7.13 Characterization of Nano Materials 332
7.14 Composites 333
7.15 Constituents of Composites 334
7.15.1 Role of Interface 336
7.16 Classification of Composites 336
7.17 Fiber-reinforced Composites 337
7.18 Micromechanic of Fiber and Particle-reinforced Composites 339
7.18.1 Density 339
7.18.2 Longitudinal Strength and Stiffness of Unidirectional Composites 341
7.18.3 Transverse Stiffness and Strength 342
7.18.4 Solved Examples 343
7.19 Particulate-reinforced Composites 343
7.20 Structural Reinforced Composites 345
7.20.1 Laminar Composites 345
7.20.2 Sandwich Structures 346
7.21 Advantages of Composites 346
7.21.1 Applications of Composites 347
7.22 Advanced Fibre-reinforced Composites 347
7.22.1 Metal - Matrix Composites (MMCs) 347
7.22.2 Ceramic Matrix Composites (CMCs) 348

7.22.3 Carbon - Carbon Composites (C-C Composites) 349

7.22.4 Hybrid Composites 349

7.23 Outcomes 349

7.24 Review Questions 349

7.25 Multiple Choice Questions 351

Unit-8: Powder Metallurgy

8.0 Objectives 356

8.1 Introduction 356

8.2 Applications of Powder Metallurgy 356

8.3 Manufacturing Process 357

8.3.1 Characteristics of Metal Powders 358

8.3.2 Production of Metal Powder 359

8.4 Methods of Producing Metal Powders 360

8.4.1 Blending and Maxing of Powerd 361

8.4.2 Compacting 362

8.4.3 Sintering 363

8.4.4 Hot Isostatic Pressing (HIP) 364

8.5 Advantages of Powder Metallurgy 365

8.6 Disadvantages of Powder Metallurgy 367

8.7 Some Specific Products of Powder Metallurgy 368

8.7.1 Cemented Carbide Tools 368

8.7.2 Self Lubricating Bearing 369

8.7.3 Friction Materials 370

8.8 Outcomes 371

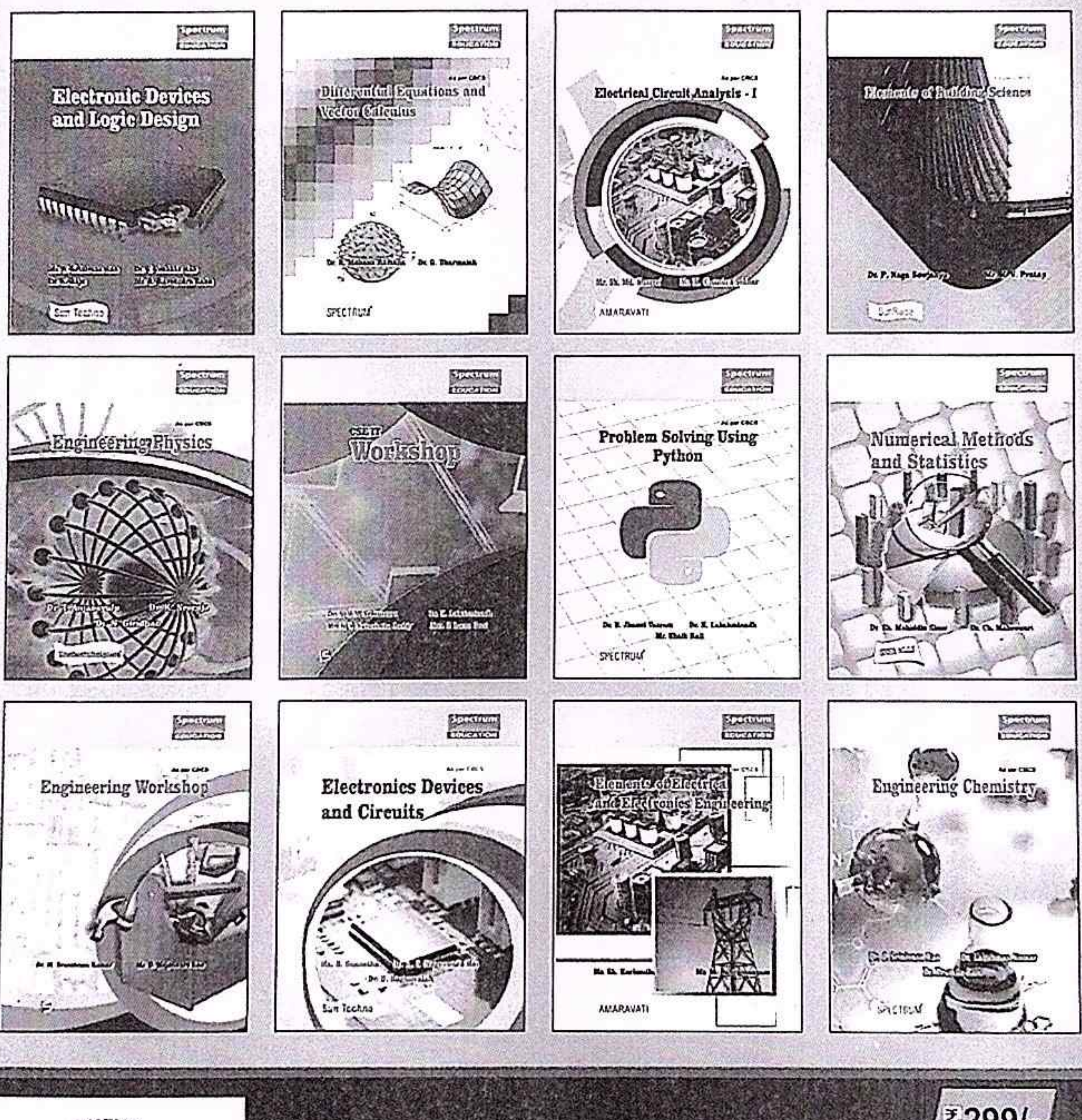
8.9 Review Questions 371

8.10 Multiple Choice Questions 372

Material Science and Metallurgy

Dr. D. Suneel
Dr. P. Suresh Babu
Dr. B. Venkata Siva

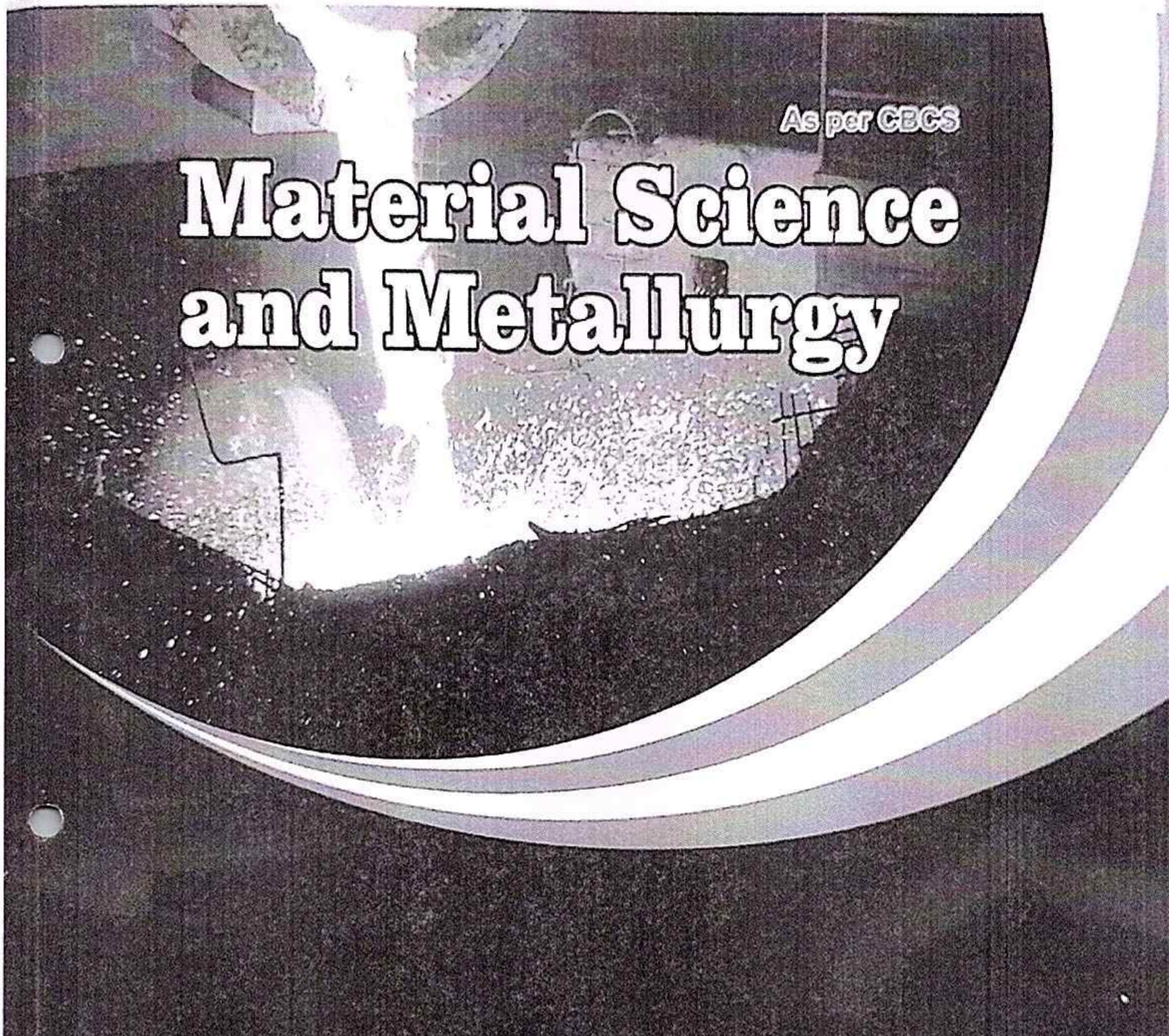
Our Engineering Titles



₹299/-

ISBN 978-81-952678-1-1

Spectrum
EDUCATION



As per CBCS

Material Science and Metallurgy

Dr. D. Suneel Dr. P. Suresh Babu
Dr. B. Venkata Siva

SunRaise

Material Science and Metallurgy

Authors

Dr. D. Suneel
Vice Principal & Professor
Department of Mechanical Engineering
Narasaraopeta Engineering College(Autonomous)
Narasaraopet, Guntur - 522 601, A.P.

Dr. P. Suresh Babu
Assoicate Professor
Department of Mechanical Engineering
Narasaraopeta Engineering College(Autonomous)
Narasaraopet, Guntur - 522 601, A.P.

Dr. B. Venkata Siva
HOD & Professor
Department of Mechanical Engineering
Narasaraopeta Engineering College(Autonomous)
Narasaraopet, Guntur, A.P. - 522 601

SUNRAISE INTERNATIONAL PUBLISHERS

M/s SunRaise International Publishers

A Part of StudentsHelpline Publishing House (P) Ltd. , Hyderabad

(An ISO 9001 : 2015 Certified Company)

Head Office

326/C, Level - 4, Surneni Nilayam
Near B K Guda Park, S R Nagar, Hyderabad - 500 038, INDIA
P.No:+91 40 23710657, 238000657 Fax: +91 40 23810657

Reg. Off

5-68, Pedda Gorpadu, Pakala, Tirupati, Chittoor - 517 112 AP, INDIA
mail:studentshelpline.in@gmail.com
www.**studentshelpline.in**

First Edition-2021

ISBN 978-81-952678-1-1

` 370/-

Printed at StudentsHelpline Group, S R Nagar, Hyderabad-38
Published by Surneni Mohan Naidu for SunRaise International Publishers, Hyderabad - 38

Material Science and Metallurgy

Unit-1: Structure of Metals and Constitution of Alloys

1.0	Objectives	2
1.1	Ontroduction	2
1.2	Classification of Solids	2
	1.2.1 Comparison of Crystalline Solids and Amorphous Solids	5
1.3	Space Lattice	6
1.4	Basis and Crystal Structure	6
1.5	Crystal Lattice	7
1.6	Unit Cell	7
1.7	Primitive Cell	8
1.8	Crystal Lattice and Crystal Systems	8
	1.8.1 Nearest Neighbour Distances in Cubic Crystals	12
1.9	Lattice Parameter and Bravais Lattices	12
1.10	Important Terms Related to Cubic Crystals	15
1.11	Simple Cubic Structure (SC)	15
1.12	Body Centered Cubic Structure (BCC)	17
1.13	Face-Centered Cubic Structure (FCC)	19
1.14	Hexagonal Close Packed (HCP)	20
1.15	X-ray Diffraction	22
1.16	Directions and Planes in Crystals - Miller Indices	22
	1.16.1 Features of the Miller Indices	23
	1.16.2 Crystal Planes and Directions	24
	1.16.3 Miller Indices for a Cubic Crystal	25
1.17	Inter Planar Spacing of Orthogonal Crystal Systems	26
	1.17.1 Calculation of Distance of Separation 'd' between Successive *hkl* Planes	27
1.18	Bragg's Law	27
1.19	Experimental Methods in X-ray Diffraction	29
1.20	Solved Examples	34

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

1.21 Solid Solutions and Compounds 41
1.22 Types of Solid Solutions 42
1.23 Interstitial Solid Solutions 44
1.24 Compounds 44
1.25 Imperfections in Crystals and Their Effect on Properties 47
1.25.1 Point Defects 48
1.25.2 Line Defects (Dislocations) 51
1.25.3 Surface Defects 57
1.25.4 Volume Defects 61
1.25.5 Experimental Techniques for Observing Dislocations 61
1.26 Solute Strengthening 61
1.27 Hume-rothery's Rules 62
1.28 Outcomes 63
1.29 Review Questions 64
1.30 Multile Choice Questions 65

Unit-2: Equilibrium Diagrams

2.0 Objectives 72
2.1 Intoduction 72
2.2 Limitation of Phase Diagrams 73
2.3 Application of Phase Equilibrium Diagrams 73
2.4 Terms used for Study of Phase Equilibrium 73
2.4.1 Phase 73
2.4.2 System 73
2.4.3 Component 74
2.4.4 Equilibrium 74
2.4.5 Degree of Freedom 74
2.4.6 Structural Constituent 74
2.4.7 Single Phase & Multi-phase Solids 74
2.5 Types of phase diagrams 76
2.6 Unary Phase Diagram 76
2.7 Binary Phase Diagrams 77

2.8 Allotropy of Iron 77
2.9 Iron-iron Carbide Equlibirum Diagram 79
2.9.1 Phases Present and their Properties 80
2.10 Types of Reactions between Phases 84
2.10.1 Eutectic Reaction 84
2.11 Engineering Materials & Metallurgy 84
2.11.1 Eutectoid Reaction 85
2.11.2 Peritecdc Reaction(Transformation) 85
2.11.3 Peritectoid Reaction 85
2.12 Cooling Curves 86
2.13 Lever-arm Principle 88
2.14 Gibb's Free Energy for Thermodynamic Stability of Phases 90
2.15 Gibbs Phase Rule 91
2.16 Outcomes 92
2.17 Review Questions 93
2.18 Multiple Choice Questions 94

Unit-3: Ferrous Metals and Alloys

3.0 Objectives 100
3.1 Introduction 100
3.2 Classification of Metals 100
3.3 Different Stages of Iron 101
3.3.1 Pig Iron 101
3.3.2 Wrought Iron 102
3.3.3 Gray Cast Iron 103
3.3.4 Malleable Cast Iron 104
3.3.5 White Cast Iron(Mottled Iron) 105
3.4 Classification of Steel 105
3.5 Mild Steel 106
3.6 Medium Carbon Steels 106
3.7 High Carbon Steels 107
3.8 Constituents, Microstructures and Properties of Plain Carbon Steels 108

3.9 Alloy Steels 110
3.10 Effect of Alloying Elements 110
3.10.1 Effect of Alloying Elements on Ferrite 110
3.10.2 Effect of Alloying Elements on Carbide 111
3.10.3 Effect of Alloying Elements on the Iron - Iron Carbide Diagram 111
3.10.4 Effect of Alloying Elements on Tempering 111
3.10.5 Formation of Intormetallic Compounds 112
3.10.6 Effect of Alloying Element Critical Cooling Rate 112
3.11 Classification of Alloying Elements 112
3.12 Properties and uses of Alloying Elements 112
3.13 Various Alloy Steels 115
3.14 Stainless Steels 118
3.14.1 Classification of Stainless Steels 120
3.14.2 Sensitisation and Weld Decay 122
3.14.3 Heat Treatment of Stainless Steels 123
3.15 Tools Steels 124
3.15.1 Selection of Tool Steels 124
3.15.2 Properties of Tool Steels 125
3.15.3 Engineering Materials & Metallurgy 125
3.15.4 TYpes/Classification of Tool Steels 126
3.15.5 Heat Treatment Cycle for High Speed Tool Steel 127
3.16 Maraging Steels 128
3.17 Engineering Materials and Metallurgy 129
3.17.1 Composition and Mechanical Properties of Typical Maraging Steels 129
3.17.2 Characteristics of Maraging Steels 129
3.17.3 Applications of Maraging Steels 129
3.17.4 Die steel 130
3.18 Cast Irons 130
3.18.1 What are the Features that make Cast Iron an Important Material 131
3.18.2 Composition of Cast Iron 131
3.18.3 Effect of Composition Elements on Cast Iron 131
3.18.4 The Influence of Cooling Rate on the Properties of a Cast Iron 132

	3.18.5 The Effect of Heat Treatment on Cast Irons	132
	3.18.6 Types of Cast Irons	133
3.19	Grey Cast Iron	133
	3.19.1 Microstructure of Grey Cast Iron	133
	3.19.2 Designation of Grey Cast Iron	134
	3.19.3 Characteristics of Grey Cast Iron	134
	3.19.4 Applications of Grey Cast Iron	135
3.20	White Cast Iron	135
	3.20.1 Microstructure of White Cast Iron	135
	3.20.2 Characteristics of White Cast Iron	136
	3.20.3 Applications of White Cast Iron	136
3.21	Malleable Cast Iron	136
	3.21.1 Microstructure of Malleable Cast Iron	136
	3.21.2 Types of Malleable irons	137
	3.21.3 Designation of Malleable Cast Iron	137
	3.21.4 Characteristics of Malleable Cast Iron	138
	3.21.5 Applications of Malleable Cast Iron	138
3.22	Spheroidal Graphite or Nodular Cast Iron (or Ductile Cast Iron)	138
	3.22.1 Microstructure of SG Cast Iron	138
	3.22.2 Designation of SG Iron	139
	3.22.3 Characteristics of SG Cast Iron	140
	3.22.4 Applications of SG Cast Iron	140
3.23	Alloy Cast Iron	140
	3.23.1 Effects of Alloying Elements in Cast Iron	140
	3.23.2 Properties and Applications of Alloy Cast Irons	141
3.24	Outcomes	142
3.25	Review Questions	142
3.26	Multile Choice Questions	144

Unit-4: Heat Treatment Processor

4.0	Objectives	150
4.1	Intoduction	150
4.2	Purpose of Heat Treatment	151

4.3 Principles of Heat Treatment 152
4.4 Factors to be Considered When Heat Treating 153
4.5 Heat Treatment Processes 154
4.6 Annealing 155
4.6.1 Full Annealing 157
4.6.2 Process Annealing 159
4.6.3 Spheroidise Annealing 159
4.6.4 Isothermal Annealing 160
4.6.5 Stress Relief Annealing 160
4.7 Normalizing 160
4.7.1 Comparison between Annealing and Normalizing 163
4.8 Hardening 164
4.8.1 Heat Removal During Quenching 165
4.8.2 Quenching Mediums 165
4.9 Tempering 166
4.9.1 Classification of Tempering Processes 168
4.9.2 Theory of Tempering 169
4.9.3 Spheroidising 170
4.10 Isothermal Heat Treatments 171
4.11 Isothermal Transformation Diagrams (TTT Diagrams) 171
4.11.1 Difference Between $Fe - Fe_3C$ Equilibrium Diagram and TTT Diagram 172
4.11.2 Time-Temperature-Transformation (or TTT) Diagrams 172
4.11.3 Construction of a TTT Diagram 172
4.11.4 TTT Diagram for a Eutectoid Steel 174
4.11.5 Significance of TTT Diagram in the Heat Treatment of Steel 176
4.12 Continuous-cooling Transformation (or CCT) Diagrams 176
4.12.1 CCT Diagram for a Eutectoid Carbon Steel 176
4.12.2 Effect of Cooling Rate in terms of TTT Curves 177
4.12.3 Critical Cooling Rate 179
4.13 Hardenability 179
4.13.1 Hardness Vs Haedenability 179

4.13.2 Factors Affecting Hardenability 180
4.13.3 Determining Hardenability(Jominy End-Quench Test) 180
4.13.3.1 End-Quench Specimen 180
4.13.3.2 Testing Procedure 180
4.13.4 Use of Hardenability Curves 182
4.14 Austempering 182
4.15 Martempering 184
4.16 Ausforming 185
4.17 Case Hardening 187
4.17.1 Carburizing 187
4.17.1.1 Pack-Carburizing 188
4.17.1.2 Liquid Carburizing 189
4.17.1.3 Gas Carburizing 189
4.17.1.4 Advantages of Gas Carburizing 190
4.17.2 Nitriding 190
4.17.2.1 Advantages and Disadvantages of Nitriding 190
4.17.3 Cyaniding 191
4.17.3.1 Advantages and Disadvantages of Cyaniding 191
4.17.4 Carbo-nitriding 191
4.18 SURFACE HARDENING 192
4.18.1 Flame Hardening 192
4.18.2 Induction Dardening 194
4.19 Vaccum and Plasma Surface Hardening 196
4.19.1 Vacuum Surface Hardening 196
4.19.1.1 Suitability 196
4.19.1.2 Vacuum Carburising Process 196
4.19.1.3 Advantages of Vacuuum Carburising 198
4.19.1.4 Disadvantages of Vacuum Carburising 198
4.19.2 Plasma Surface Hanrdening 198
4.19.2.1 Suitability 199
4.19.2.2 Plasma Carburising Process 199

4.19.2.3 Advantages of Plasma Carburising 200
4.19.2.4 Disadvantages of Plasma Carburising 201
4.20 Outcomes 201
4.21 Review Questions 202
4.22 Multile Choice Questions 203

Unit-5: Non-ferrous Metals

5.0 Objectives 208
5.1 Introduction 208
5.2 Copper and its Alloys 209
5.2.1 Brasses 209
5.2.2 Bronzes 213
5.2.3 Copper-Nickel Alloys 218
5.2.4 Nickel-Silvers 218
5.3 Properties of Copper 220
5.4 Extraction of Copper 221
5.5 Classification of Copper Alloys 222
5.5.1 Uses of Copper 222
5.6 Aluminum and its Alloys 223
5.6.1 Aluminum 223
5.6.1.1 Propertics of Aluminum 223
5.7 Extraction of Aluminium 226
5.8 Aluminium Alloys 227
5.9 Effects of Alloying Elements with Aluminium 228
5.9.1 Characteristics of Aluminium 229
5.9.2 Aluminiun vs Copper 230
5.9.3 Applications of Aluminium 230
5.9.4 Al-Cu Alloys 230
5.10 Precipitation Strengthening Treatment (Age Hardening) 230
5.10.1 Precipitation Hardening 230
5.11 Magnesium 231
5.11.1 Magnesium Alloys 232

5.11.2 Applications of Magnessium Alloys 232
5.12 Titanium 233
5.13 Outcomes 235
5.14 Review Questions 235
5.15 Multile Choice Questions 237

Unit-6: Polymers

6.0 Objectives 242
6.1 Introduction to Polymers 242
6.2 Terminology 242
6.3 Classification of Polymers 245
6.4 Types or Methods of Polymerization 248
6.5 DifferenceS between Addition and Condensation Polymerization 251
6.6 Ionic Addition Polymerization 251
6.6.1 Differences between Free-radical and Ionic Chain Polymerization 256
6.7 Coordination Polymerization or Ziegler-Natta Polymerization 256
6.8 Methods of Polymerization 257
6.9 Properties of Polymers 258
6.10 Introduction to Plastics 262
6.11 Plastics as Engineering materials 262
6.12 Types of plastics 264
6.12.1 Differences between Thermoplastics and Thermosetting Plastics 266
6.13 Compounding of Plastics 266
6.13.1 Fabrication or Moulding of Plastics 268
6.13.2 Comparison of Compression and Injection Moulding 271
6.14 Preparation, Properties and Applications of Polymers 271
6.14.1 Polyethylene 271
6.14.2 PVC (Polyvinyl Chloride) 273
6.14.3 Bakelite or Phenol-formaldehyde Resin 274
6.14.4 Teflon or Poly tetra fluoro ethylene (PTFE) or Fluon 276
6.14.5 Polystyrene 277
6.14.6 Urea-formaldehyde(UF) 277

6.15 Introduction to Rubbers and Elastomers 278
6.15.1 Natural Rubber 279
6.15.2 Rubber Latex 281
6.15.3 Preparation of Rubber 282
6.16 Vulcanization of Rubber 284
6.16.1 Differences between Natural and Vulcanized Rubber 286
6.17 Elastomers-Rubber and their Uses 286
6.17.1 Butyl Rubber 287
6.18 Synthetic Rubbers or Artificial Rubbers 287
6.18.1 Styrene Rubber (GR-S or Buna-S) 287
6.18.2 Nitrile Rubber (GR-A or Buna-N) 288
6.18.3 Neoprene Rubber 289
6.19 Applications of Rubber and Elastomers 290
6.20 Fibers 291
6.21 Fibre-Reinforced Plastics (FRPs) 291
6.22 Processing techniques adopted in FRP 292
6.23 Conducting polymers 293
6.23.1 Engineering Applications of Conducting Polymers 296
6.24 Outcomes 297
6.25 Review questions 297
6.26 Multiple Choice Questions 299

Unit-7: Ceramics and Composite Materials

7.0 Objectives 304
7.1 Introduction 304
7.2 Types of Ceramics 306
7.3 Engineering Ceramics 307
7.4 Glasses 315
7.4.1 Structure of Glass 316
7.4.2 Types of Glasses 316
7.4.3 Production and Forming of Glass 319
7.5 Cermets 319

7.6 Abrasives 320
7.7 Properties and Applications of Ceramics 321
7.8 Processing of Ceramics 323
7.9 Nanomaterials 325
7.10 Significance of Nano Scale 326
7.11 Properties of Nanomaterial 327
7.12 Chemical Methods of Preparation of Nanmaterials and Oxide Metals 329
7.12.1 Sol-gel Method 329
7.12.2 Hydrothermal Synthesis 331
7.12.3 Microwave Assisted Synthesis 331
7.12.4 Polyol Synthesis 332
7.13 Characterization of Nano Materials 332
7.14 Composites 333
7.15 Constituents of Composites 334
7.15.1 Role of Interface 336
7.16 Classification of Composites 336
7.17 Fiber-reinforced Composites 337
7.18 Micromechanic of Fiber and Particle-reinforced Composites 339
7.18.1 Density 339
7.18.2 Longitudinal Strength and Stiffness of Unidirectional Composites 341
7.18.3 Transverse Stiffness and Strength 342
7.18.4 Solved Examples 343
7.19 Particulate-reinforced Composites 343
7.20 Structural Reinforced Composites 345
7.20.1 Laminar Composites 345
7.20.2 Sandwich Structures 346
7.21 Advantages of Composites 346
7.21.1 Applications of Composites 347
7.22 Advanced Fibre-reinforced Composites 347
7.22.1 Metal - Matrix Composites (MMCs) 347
7.22.2 Ceramic-Matrix Composites (CMCs) 348

7.22.3 Carbon - Carbon Composites (C-C Composites) 349
7.22.4 Hybrid Composites 349
7.23 Outcomes 349
7.24 Review Questions 349
7.25 Multiple Choice Questions 351

Unit-8: Powder Metallurgy

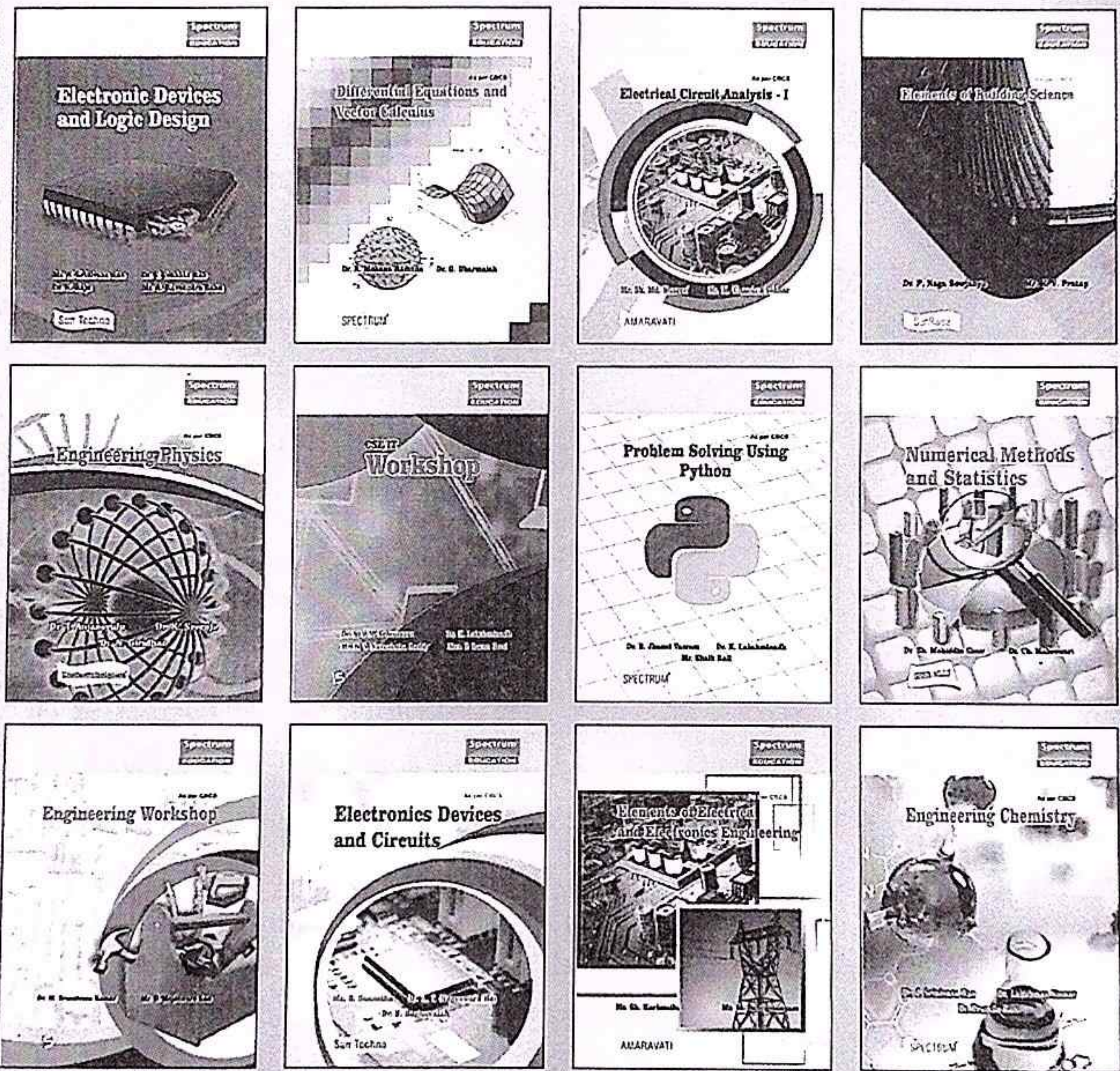
8.0 Objectives 356
8.1 Introduction 356
8.2 Applications of Powder Metallurgy 356
8.3 Manufacturing Process 357
8.3.1 Characteristics of Metal Powders 358
8.3.2 Production of Metal Powder 359
8.4 Methods of Producing Metal Powders 360
8.4.1 Blending and Maxing of Powerd 361
8.4.2 Compacting 362
8.4.3 Sintering 363
8.4.4 Hot Isostatic Pressing (HIP) 364
8.5 Advantages of Powder Metallurgy 365
8.6 Disadvantages of Powder Metallurgy 367
8.7 Some Specific Products of Powder Metallurgy 368
8.7.1 Cemented Carbide Tools 368
8.7.2 Self Lubricating Bearing 369
8.7.3 Friction Materials 370
8.8 Outcomes 371
8.9 Review Questions 371
8.10 Multiple Choice Questions 372

Material Science and Metallurgy

Dr. D. Suneel
Dr. P. Suresh Babu
Dr. B. Venkata Siva

SINCE 23

Our Engineering Titles



SUNRAISE INTERNATIONAL PUBLISHERS

StudentsHelpline Group

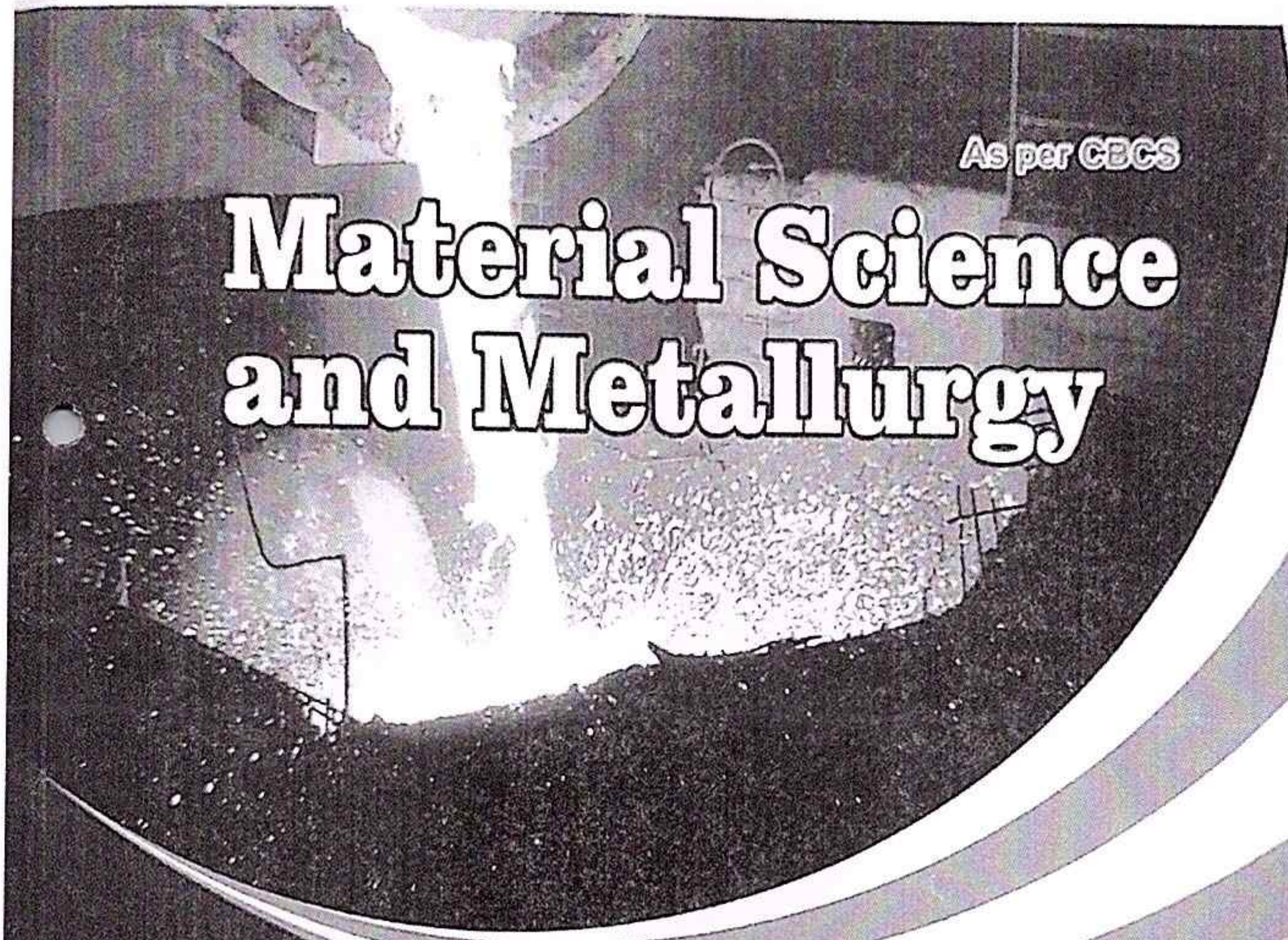
స్వచ్ఛ భారత్

₹299/-

ISBN 978-81-952678-1-1

9 788195 267811

Spectrum EDUCATION



As per CBCS

Material Science and Metallurgy

Dr. D. Suneel Dr. P. Suresh Babu

Dr. B. Venkata Siva

SunRaise

Material Science and Metallurgy

Authors

Dr. D. Suneel
Vice Principal & Professor
Department of Mechanical Engineering
Narasaraopeta Engineering College(Autonomous)
Narasaraopet, Guntur - 522 601, A.P.

Dr. P. Suresh Babu
Assoicate Professor
Department of Mechanical Engineering
Narasaraopeta Engineering College(Autonomous)
Narasaraopet, Guntur - 522 601, A.P.

Dr. B. Venkata Siva
HOD & Professor
Department of Mechanical Engineering
Narasaraopeta Engineering College(Autonomous)
Narasaraopet, Guntur, A.P. - 522 601

SUNRAISE INTERNATIONAL PUBLISHERS

M/s SunRaise International Publishers

A Part of StudentsHelpline Publishing House (P) Ltd. , Hyderabad

(An ISO 9001 : 2015 Certified Company)

Head Office

326/C, Level - 4, Surneni Nilayam
Near B K Guda Park, S R Nagar, Hyderabad - 500 038, INDIA
P.No:+91 40 23710657, 238000657 Fax: +91 40 23810657

Reg. Off

5-68, Pedda Gorpadu, Pakala, Tirupati, Chittoor - 517 112 AP, INDIA
mail:studentshelpline.in@gmail.com
www.**studentshelpline.in**

First Edition-2021

ISBN 978-81-952678-1-1

` 370/-

Printed at StudentsHelpline Group, S R Nagar, Hyderabad-38
Published by Surneni Mohan Naidu for SunRaise International Publishers, Hyderabad - 38

Material Science and Metallurgy

Unit-1: Structure of Metals and Constitution of Alloys

1.0	Objectives	2
1.1	Ontroduction	2
1.2	Classification of Solids	2
	1.2.1 Comparison of Crystalline Solids and Amorphous Solids	5
1.3	Space Lattice	6
1.4	Basis and Crystal Structure	6
1.5	Crystal Lattice	7
1.6	Unit Cell	7
1.7	Primitive Cell	8
1.8	Crystal Lattice and Crystal Systems	8
	1.8.1 Nearest Neighbour Distances in Cubic Crystals	12
1.9	Lattice Parameter and Bravais Lattices	12
1.10	Important Terms Related to Cubic Crystals	15
1.11	Simple Cubic Structure (SC)	15
1.12	Body Centered Cubic Structure (BCC)	17
1.13	Face-Centered Cubic Structure (FCC)	19
1.14	Hexagonal Close Packed (HCP)	20
1.15	X-ray Diffraction	22
1.16	Directions and Planes in Crystals - Miller Indices	22
	1.16.1 Features of the Miller Indices	23
	1.16.2 Crystal Planes and Directions	24
	1.16.3 Miller Indices for a Cubic Crystal	25
1.17	Inter Planar Spacing of Orthogonal Crystal Systems	26
	1.17.1 Calculation of Distance of Separation 'd' between Successive *hkl* Planes	27
1.18	Bragg's Law	27
1.19	Experimental Methods in X-ray Diffraction	29
1.20	Solved Examples	34

1.21 Solid Solutions and Compounds 41
1.22 Types of Solid Solutions 42
1.23 Interstitial Solid Solutions 44
1.24 Compounds 44
1.25 Imperfections in Crystals and Their Effect on Properties 47
1.25.1 Point Defects 48
1.25.2 Line Defects (Dislocations) 51
1.25.3 Surface Defects 57
1.25.4 Volume Defects 61
1.25.5 Experimental Techniques for Observing Dislocations 61
1.26 Solute Strengthening 61
1.27 Hume-rothery's Rules 62
1.28 Outcomes 63
1.29 Review Questions 64
1.30 Multile Choice Questions 65

Unit-2: Equilibrium Diagrams

2.0 Objectives 72
2.1 Intoduction 72
2.2 Limitation of Phase Diagrams 73
2.3 Application of Phase Equilibrium Diagrams 73
2.4 Terms used for Study of Phase Equilibrium 73
2.4.1 Phase 73
2.4.2 System 73
2.4.3 Component 74
2.4.4 Equilibrium 74
2.4.5 Degree of Freedom 74
2.4.6 Structural Constituent 74
2.4.7 Single Phase & Multi-phase Solids 74
2.5 Types of phase diagrams 76
2.6 Unary Phase Diagram 76
2.7 Binary Phase Diagrams 77

2.8	Allotropy of Iron	77
2.9	Iron-iron Carbide Equlibirum Diagram	79
	2.9.1 Phases Present and their Properties	80
2.10	Types of Reactions between Phases	84
	2.10.1 Eutectic Reaction	84
2.11	Engineering Materials & Metallurgy	84
	2.11.1 Eutectoid Reaction	85
	2.11.2 Peritecdc Reaction(Transformation)	85
	2.11.3 Peritectoid Reaction	85
2.12	Cooling Curves	86
2.13	Lever-arm Principle	88
2.14	Gibb's Free Energy for Thermodynamic Stability of Phases	90
2.15	Gibbs Phase Rule	91
2.16	Outcomes	92
2.17	Review Questions	93
2.18	Multiple Choice Questions	94

Unit-3: Ferrous Metals and Alloys

3.0	Objectives	100
3.1	Introduction	100
3.2	Classification of Metals	100
3.3	Different Stages of Iron	101
	3.3.1 Pig Iron	101
	3.3.2 Wrought Iron	102
	3.3.3 Gray Cast Iron	103
	3.3.4 Malleable Cast Iron	104
	3.3.5 White Cast Iron(Mottled Iron)	105
3.4	Classification of Steel	105
3.5	Mild Steel	106
3.6	Medium Carbon Steels	106
3.7	High Carbon Steels	107
3.8	Constituents, Microstructures and Properties of Plain Carbon Steels	108

3.9 Alloy Steels 110
3.10 Effect of Alloying Elements 110
3.10.1 Effect of Alloying Elements on Ferrite 110
3.10.2 Effect of Alloying Elements on Carbide 111
3.10.3 Effect of Alloying Elements on the Iron - Iron Carbide Diagram 111
3.10.4 Effect of Alloying Elements on Tempering 111
3.10.5 Formation of Intormetallic Compounds 112
3.10.6 Effect of Alloying Element Critical Cooling Rate 112
3.11 Classification of Alloying Elements 112
3.12 Properties and uses of Alloying Elements 112
3.13 Various Alloy Steels 115
3.14 Stainless Steels 118
3.14.1 Classification of Stainless Steels 120
3.14.2 Sensitisation and Weld Decay 122
3.14.3 Heat Treatment of Stainless Steels 123
3.15 Tools Steels 124
3.15.1 Selection of Tool Steels 124
3.15.2 Properties of Tool Steels 125
3.15.3 Engineering Materials & Metallurgy 125
3.15.4 TYpes/Classification of Tool Steels 126
3.15.5 Heat Treatment Cycle for High Speed Tool Steel 127
3.16 Maraging Steels 128
3.17 Engineering Materials and Metallurgy 129
3.17.1 Composition and Mechanical Properties of Typical Maraging Steels 129
3.17.2 Characteristics of Maraging Steels 129
3.17.3 Applications of Maraging Steels 129
3.17.4 Die steel 130
3.18 Cast Irons 130
3.18.1 What are the Features that make Cast Iron an Important Material 131
3.18.2 Composition of Cast Iron 131
3.18.3 Effect of Composition Elements on Cast Iron 131
3.18.4 The Influence of Cooling Rate on the Properties of a Cast Iron 132

3.18.5 The Effect of Heat Treatment on Cast Irons 132
3.18.6 Types of Cast Irons 133
3.19 Grey Cast Iron 133
3.19.1 Microstructure of Grey Cast Iron 133
3.19.2 Designation of Grey Cast Iron 134
3.19.3 Characteristics of Grey Cast Iron 134
3.19.4 Applications of Grey Cast Iron 135
3.20 White Cast Iron 135
3.20.1 Microstructure of White Cast Iron 135
3.20.2 Characteristics of White Cast Iron 136
3.20.3 Applications of White Cast Iron 136
3.21 Malleable Cast Iron 136
3.21.1 Microstructure of Malleable Cast Iron 136
3.21.2 Types of Malleable irons 137
3.21.3 Designation of Malleable Cast Iron 137
3.21.4 Characteristics of Malleable Cast Iron 138
3.21.5 Applications of Malleable Cast Iron 138
3.22 Spheroidal Graphite or Nodular Cast Iron (or Ductile Cast Iron) 138
3.22.1 Microstructure of SG Cast Iron 138
3.22.2 Designation of SG Iron 139
3.22.3 Characteristics of SG Cast Iron 140
3.22.4 Applications of SG Cast Iron 140
3.23 Alloy Cast Iron 140
3.23.1 Effects of Alloying Elements in Cast Iron 140
3.23.2 Properties and Applications of Alloy Cast Irons 141
3.24 Outcomes 142
3.25 Review Questions 142
3.26 Multile Choice Questions 144

Unit-4: Heat Treatment Processor

4.0 Objectives 150
4.1 Intoduction 150
4.2 Purpose of Heat Treatment 151

4.3 Principles of Heat Treatment 152
4.4 Factors to be Considered When Heat Treating 153
4.5 Heat Treatment Processes 154
4.6 Annealing 155
4.6.1 Full Annealing 157
4.6.2 Process Annealing 159
4.6.3 Spheroidise Annealing 159
4.6.4 Isothermal Annealing 160
4.6.5 Stress Relief Annealing 160
4.7 Normalizing 160
4.7.1 Comparison between Annealing and Normalizing 163
4.8 Hardening 164
4.8.1 Heat Removal During Quenching 165
4.8.2 Quenching Mediums 165
4.9 Tempering 166
4.9.1 Classification of Tempering Processes 168
4.9.2 Theory of Tempering 169
4.9.3 Spheroidising 170
4.10 Isothermal Heat Treatments 171
4.11 Isothermal Transformation Diagrams (TTT Diagrams) 171
4.11.1 Difference Between $Fe - Fe_3C$ Equilibrium Diagram and TTT Diagram 172
4.11.2 Time-Temperature-Transformation (or TTT) Diagrams 172
4.11.3 Construction of a TTT Diagram 172
4.11.4 TTT Diagram for a Eutectoid Steel 174
4.11.5 Significance of TTT Diagram in the Heat Treatment of Steel 176
4.12 Continuous-cooling Transformation (or CCT) Diagrams 176
4.12.1 CCT Diagram for a Eutectoid Carbon Steel 176
4.12.2 Effect of Cooling Rate in terms of TTT Curves 177
4.12.3 Critical Cooling Rate 179
4.13 Hardenability 179
4.13.1 Hardness Vs Haedenability 179

4.13.2 Factors Affecting Hardenability 180
4.13.3 Determining Hardenability(Jominy End-Quench Test) 180
4.13.3.1 End-Quench Specimen 180
4.13.3.2 Testing Procedure 180
4.13.4 Use of Hardenability Curves 182
4.14 Austempering 182
4.15 Martempering 184
4.16 Ausforming 185
4.17 Case Hardening 187
4.17.1 Carburizing 187
4.17.1.1 Pack-Carburizing 188
4.17.1.2 Liquid Carburizing 189
4.17.1.3 Gas Carburizing 189
4.17.1.4 Advantages of Gas Carburizing 190
4.17.2 Nitriding 190
4.17.2.1 Advantages and Disadvantages of Nitriding 190
4.17.3 Cyaniding 191
4.17.3.1 Advantages and Disadvantages of Cyaniding 191
4.17.4 Carbo-nitriding 191
4.18 SURFACE HARDENING 192
4.18.1 Flame Hardening 192
4.18.2 Induction Dardening 194
4.19 Vaccum and Plasma Surface Hardening 196
4.19.1 Vacuum Surface Hardening 196
4.19.1.1 Suitability 196
4.19.1.2 Vacuum Carburising Process 196
4.19.1.3 Advantages of Vacuuum Carburising 198
4.19.1.4 Disadvantages of Vacuum Carburising 198
4.19.2 Plasma Surface Hanrdening 198
4.19.2.1 Suitability 199
4.19.2.2 Plasma Carburising Process 199

4.19.2.3 Advantages of Plasma Carburising 200
4.19.2.4 Disadvantages of Plasma Carburising 201
4.20 Outcomes 201
4.21 Review Questions 202
4.22 Multile Choice Questions 203

Unit-5: Non-ferrous Metals

5.0 Objectives 208
5.1 Introduction 208
5.2 Copper and its Alloys 209
5.2.1 Brasses 209
5.2.2 Bronzes 213
5.2.3 Copper-Nickel Alloys 218
5.2.4 Nickel-Silvers 218
5.3 Properties of Copper 220
5.4 Extraction of Copper 221
5.5 Classification of Copper Alloys 222
5.5.1 Uses of Copper 222
5.6 Aluminum and its Alloys 223
5.6.1 Aluminum 223
5.6.1.1 Propertics of Aluminum 223
5.7 Extraction of Aluminium 226
5.8 Aluminium Alloys 227
5.9 Effects of Alloying Elements with Aluminium 228
5.9.1 Characteristics of Aluminium 229
5.9.2 Aluminiun vs Copper 230
5.9.3 Applications of Aluminium 230
5.9.4 Al-Cu Alloys 230
5.10 Precipitation Strengthening Treatment (Age Hardening) 230
5.10.1 Precipitation Hardening 230
5.11 Magnesium 231
5.11.1 Magnesium Alloys 232

5.11.2 Applications of Magnessium Alloys 232
5.12 Titanium 233
5.13 Outcomes 235
5.14 Review Questions 235
5.15 Multile Choice Questions 237

Unit-6: Polymers

6.0 Objectives 242
6.1 Introduction to Polymers 242
6.2 Terminology 242
6.3 Classification of Polymers 245
6.4 Types or Methods of Polymerization 248
6.5 DifferenceS between Addition and Condensation Polymerization 251
6.6 Ionic Addition Polymerization 251
6.6.1 Differences between Free-radical and Ionic Chain Polymerization 256
6.7 Coordination Polymerization or Ziegler-Natta Polymerization 256
6.8 Methods of Polymerization 257
6.9 Properties of Polymers 258
6.10 Introduction to Plastics 262
6.11 Plastics as Engineering materials 262
6.12 Types of plastics 264
6.12.1 Differences between Thermoplastics and Thermosetting Plastics 266
6.13 Compounding of Plastics 266
6.13.1 Fabrication or Moulding of Plastics 268
6.13.2 Comparison of Compression and Injection Moulding 271
6.14 Preparation, Properties and Applications of Polymers 271
6.14.1 Polyethylene 271
6.14.2 PVC (Polyvinyl Chloride) 273
6.14.3 Bakelite or Phenol-formaldehyde Resin 274
6.14.4 Teflon or Poly tetra fluoro ethylene (PTFE) or Fluon 276
6.14.5 Polystyrene 277
6.14.6 Urea-formaldehyde(UF) 277

6.15 Introduction to Rubbers and Elastomers 278
6.15.1 Natural Rubber 279
6.15.2 Rubber Latex 281
6.15.3 Preparation of Rubber 282
6.16 Vulcanization of Rubber 284
6.16.1 Differences between Natural and Vulcanized Rubber 286
6.17 Elastomers-Rubber and their Uses 286
6.17.1 Butyl Rubber 287
6.18 Synthetic Rubbers or Artificial Rubbers 287
6.18.1 Styrene Rubber (GR-S or Buna-S) 287
6.18.2 Nitrile Rubber (GR-A or Buna-N) 288
6.18.3 Neoprene Rubber 289
6.19 Applications of Rubber and Elastomers 290
6.20 Fibers 291
6.21 Fibre-Reinforced Plastics (FRPs) 291
6.22 Processing techniques adopted in FRP 292
6.23 Conducting polymers 293
6.23.1 Engineering Applications of Conducting Polymers 296
6.24 Outcomes 297
6.25 Review questions 297
6.26 Multiple Choice Questions 299

Unit-7: Ceramics and Composite Materials

7.0 Objectives 304
7.1 Introduction 304
7.2 Types of Ceramics 306
7.3 Engineering Ceramics 307
7.4 Glasses 315
7.4.1 Structure of Glass 316
7.4.2 Types of Glasses 316
7.4.3 Production and Forming of Glass 319
7.5 Cermets 319

7.6 Abrasives 320
7.7 Properties and Applications of Ceramics 321
7.8 Processing of Ceramics 323
7.9 Nanomaterials 325
7.10 Significance of Nano Scale 326
7.11 Properties of Nanomaterial 327
7.12 Chemical Methods of Preparation of Nanmaterials and Oxide Metals 329
7.12.1 Sol-gel Method 329
7.12.2 Hydrothermal Synthesis 331
7.12.3 Microwave Assisted Synthesis 331
7.12.4 Polyol Synthesis 332
7.13 Characterization of Nano Materials 332
7.14 Composites 333
7.15 Constituents of Composites 334
7.15.1 Role of Interface 336
7.16 Classification of Composites 336
7.17 Fiber-reinforced Composites 337
7.18 Micromechanic of Fiber and Particle-reinforced Composites 339
7.18.1 Density 339
7.18.2 Longitudinal Strength and Stiffness of Unidirectional Composites 341
7.18.3 Transverse Stiffness and Strength 342
7.18.4 Solved Examples 343
7.19 Particulate-reinforced Composites 343
7.20 Structural Reinforced Composites 345
7.20.1 Laminar Composites 345
7.20.2 Sandwich Structures 346
7.21 Advantages of Composites 346
7.21.1 Applications of Composites 347
7.22 Advanced Fibre-reinforced Composites 347
7.22.1 Metal - Matrix Composites (MMCs) 347
7.22.2 Ceramic-Matrix Composites (CMCs) 348

7.22.3 Carbon - Carbon Composites (C-C Composites) 349
7.22.4 Hybrid Composites 349
7.23 Outcomes 349
7.24 Review Questions 349
7.25 Multiple Choice Questions 351

Unit-8: Powder Metallurgy

8.0 Objectives 356
8.1 Introduction 356
8.2 Applications of Powder Metallurgy 356
8.3 Manufacturing Process 357
8.3.1 Characteristics of Metal Powders 358
8.3.2 Production of Metal Powder 359
8.4 Methods of Producing Metal Powders 360
8.4.1 Blending and Maxing of Powerd 361
8.4.2 Compacting 362
8.4.3 Sintering 363
8.4.4 Hot Isostatic Pressing (HIP) 364
8.5 Advantages of Powder Metallurgy 365
8.6 Disadvantages of Powder Metallurgy 367
8.7 Some Specific Products of Powder Metallurgy 368
8.7.1 Cemented Carbide Tools 368
8.7.2 Self Lubricating Bearing 369
8.7.3 Friction Materials 370
8.8 Outcomes 371
8.9 Review Questions 371
8.10 Multiple Choice Questions 372

Material Science and Metallurgy

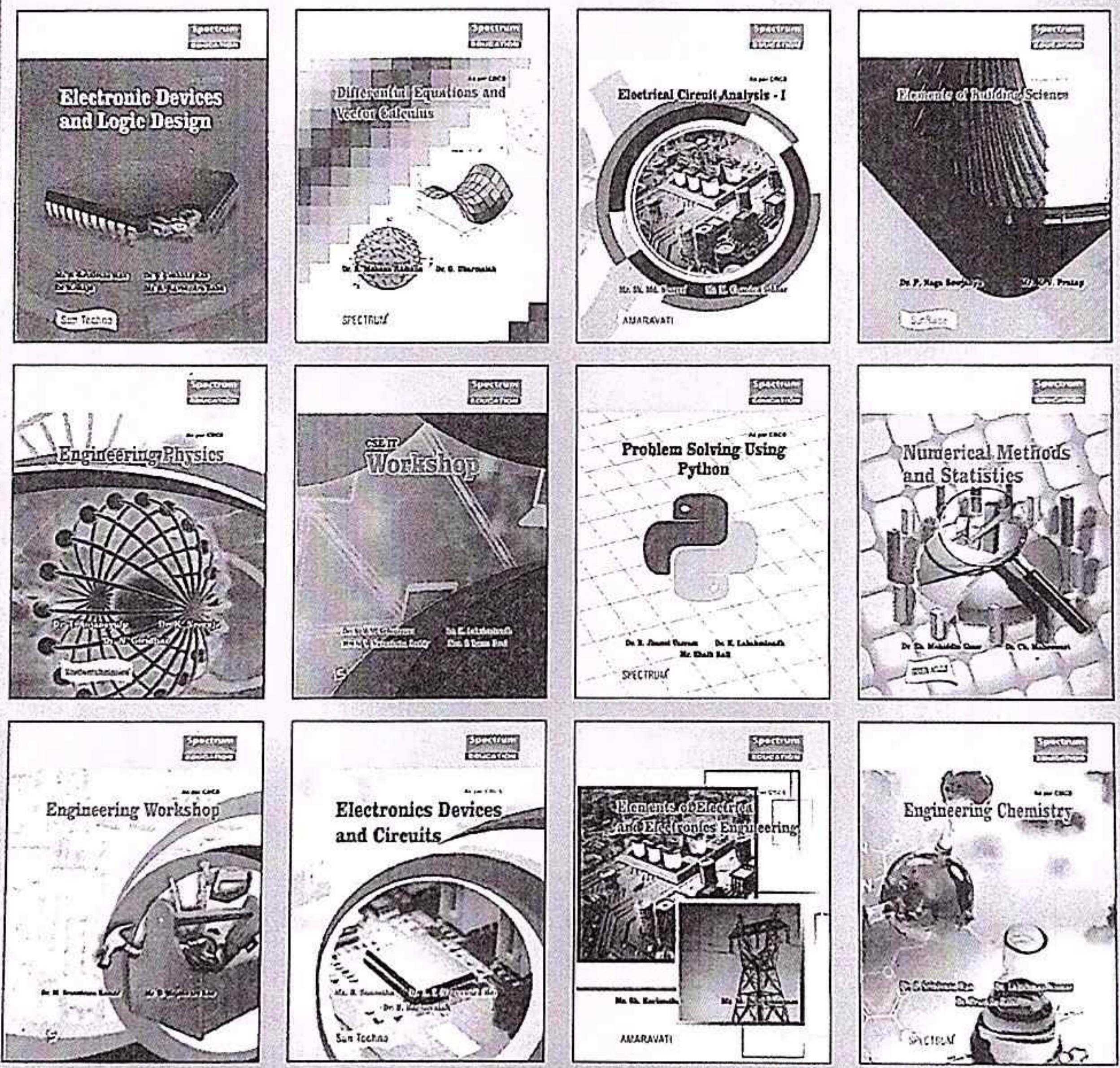
Dr. D. Suneel

Dr. P. Suresh Babu

Dr. B. Venkata Siva

SINCE 23

Our Engineering Titles



SUNRAISE INTERNATIONAL PUBLISHERS

StudentsHelpline Group

స్వచ్ఛ భారత్

₹299/-

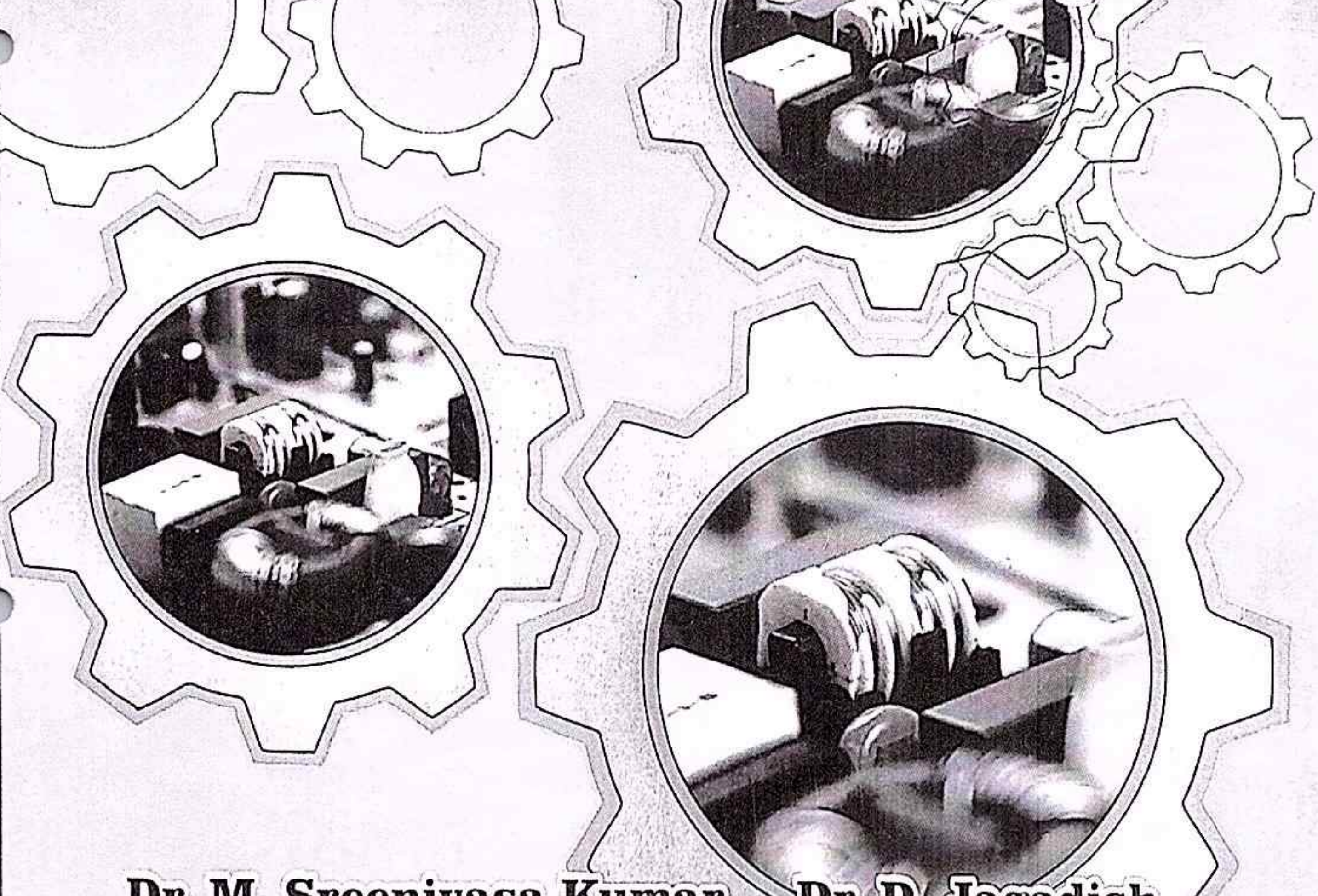
ISBN 978-81-952678-1-1

9 788195 267811

Spectrum
EDUCATION

As per CBCS

Elements of Mechanical and Electrical Engineering



Dr. M. Sreenivasa Kumar **Dr. D. Jagadish**
Mr. Sk. Karimulla

Elements of Mechanical and Electrical Engineering

Authors

Dr. M. Sreenivasa Kumar
Principal & Professor
Department of Mechanical Engineering
Narasaraopeta Engineering College(Autonomous)
Narasaraopet, Guntur, A.P. - 522 601

Dr. D. Jagadish
Professor
Department of Mechanical Engineering
Narasaraopeta Engineering College(Autonomous)
Narasaraopet, Guntur, A.P. - 522 601

Mr. Sk. Karimulla
Assistant Professor
Department of Electrical & Electronics Engineering
Narasaraopeta Engineering College(Autonomous)
Narasaraopet, Guntur, A.P. - 522 601

AMARAVATHI PUBLICATIONS

AMARAVATI PUBLICATIONS

The Temple of Education

M/s Amaravati Publications, Hyderabad

A Part of StudentsHelpline Publishing House (P) Ltd.

(An ISO 9001 : 2015 Certified Company)

Head Office

326/C, III Floor, Surneni Nilayam
Near B K Guda Park, S R Nagar, Hyderabad - 500 038, INDIA
P.No:+91 40 23710657, 238000657 Fax: +91 40 23810657

Reg. Off

5-68, Pedda Gorpadu, Pakala, Tirupati, Chittoor - 517 112 AP, INDIA
mail:studentshelpline.in@gmail.com
www.**studentshelpline**.org

First Edition-2021

ISBN: 978-81-953687-0-9

₹ **352/-**

Printed at StudentsHelpline Group, S R Nagar, Hyderabad-38
Published by Surneni Mohan Naidu for Amaravati Publications, Hyderabad - 38

Elements of Mechanical and Electrical Engineering

Unit-1: Basic Laws and Circuits

1.0 Objectives 2
1.1 Introduction 2
1.2 Basic Definitions 3
1.3 Types of Elements 9
1.4 Ohm's Law 10
1.4.1 Limitations of Ohm's Law 11
1.4.2 Applications of Ohm's Law 11
1.4.3 Solved Examples 11
1.5 R-L-C Parameters 15
1.5.1 Resistance (R) 15
1.5.1.1 Classification of Resistors 17
1.5.1.2 Specifications of Resistors 18
1.5.1.3 Colour Coding of Resistors 18
1.5.2 Inductor (L) 19
1.5.2.1 Classification of Inductors 21
1.5.2.2 Specifications of Inductor 21
1.5.2.3 Conductivity 22
1.5.3 Concept of Capacitor 22
1.5.3.1 Classifications of Capacitors 24
1.5.3.2 Specifications of the Capacitor 25
1.5.4 Comparison of Active and Passive Components 25
1.5.5 Important Characteristics of the Basic Elements 26
1.5.6 Solved Examples 26
1.6 Kirchhoff's Current and Voltage Law's 31
1.6.1 Kirchhoff's Current Law 32
1.6.2 Kirchhoff's Voltage Law 33
1.6.3 Application of Kirchhoff's Circuit Laws in the Analysis of Circuits 35
1.6.4 Solved Examples 35
1.7 Series and Parallel Networks 42

1.7.1 Resistance in Series 42
1.7.1.1 Equivalent Resistance for Series Connections 42
1.7.1.2 Characteristics of a Series Circuit 44
1.7.1.3 Application of Series Combination 44
1.7.1.4 Disadvantage of Series Circuits 44
1.7.2 Voltage Divider Rule 45
1.7.3 Resistance in Parallel 46
1.7.3.1 Characteristics of a Parallel Circuits 48
1.7.3.2 Advantages of Parallel Circuits 48
1.7.3.3 Applications of Parallel Circuits 48
1.7.4 Series-Parallel Combination 48
1.7.5 Division of Current in Parallel Branch Circuit 49
1.7.6 Solved Examples 52
1.7.7 Comparison of Series and Parallel Circuits 69
1.7.8 Series and Parallel Inductors 70
1.7.9 Solved Examples 72
1.7.10 Series and Parallel Capacitors 73
1.7.11 Solved Examples 75
1.8 Star to Delta or Delta to Star Transformations 76
1.8.1 Delta-Star Transformation 78
1.8.2 Star-Delta Transformation 79
1.8.3 Conversion of Star into Equivalent Delta 81
1.8.4 Conversion of Delta into Equivalent Star 82
1.8.5 Solved Examples 84
1.9 Faraday's Laws of Electomagnetic Induction 97
1.9.1 Electromagnetic Induction 97
1.9.2 Lenz's Law 99
1.9.3 Solved Examples 99
1.10 Measurement and Instrument 101
1.10.1 Necessary Requirements for Measuring an Instrument 102
1.10.2 Methods of Measurement 102
1.11 Classification of Measuring Instruments 102
1.11.1 Advantages of Electronic Measurement 105

1.12 Principle of Operation Electrical Measuring Instruments 105
1.12.1 Essential Requirements of Indicating Type Instruments 106
1.13 Permanent-magnet Moving-coil (PMMC) Instrument 108
1.14 Moving Iron Instruments 111
1.14.1 Moving-iron Attraction Type Instrument 111
1.14.2 Repulsion Type Moving-iron Instrument 113
1.14.3 Advantages & Disadvantages of mi Instruments 114
1.15 Outcomes 115
1.16 Review Questions 115
1.17 Multiple Choice Questions 119

Unit-2: DC Machines

2.0 Objectives 124
2.1 Introduction 124
2.2 Faraday's Laws 124
2.3 Induced E.M.F 125
2.3.1 Dynamically Induced E.M.F 126
2.3.2 Statically Induced E.M.F 127
2.4 Lenz's Law 130
2.5 Fleming's Left Hand Rule 130
2.6 Working Principle of DC Generator 130
2.6.1 Fleming's Right Hand Rule 131
2.7 Constructional Features of a D.C. Machine 132
2.7.1 Description of Parts of D.C.Machines 133
2.8 Terminology in Armature Windings 136
2.9 Types of Armature Windings 138
2.9.1 Lap Winding 139
2.9.2 Wave Winding 139
2.9.3 Difference between Lap Winding and Wave Winding 140
2.10 E.M.F. Equation of D.C.Generator 140
2.10.1 Solved Examples 142
2.11 Types of D.C. Generators 146
2.11.1 Separately Excited D.C. Generators 146
2.11.2 Self-excited Generators 147

2.11.2.1 Series-wound Generators 147
2.11.2.2 Shunt-wound Generator 148
2.11.2.3 Compound-Wound Generator 149
2.12 Characteristics of Series Shunt and Compound Generators 151
2.12.1 Solved Examples 154
2.13 Working Principle of D.C. Machine as a Motor 160
2.14 Back E.M.F. 161
2.14.1 Significance of Back e.m.f. 163
2.15 Torque developed in DC Motor 164
2.16 Types of D.C.Motors 166
2.16.1 D.C. Shunt Motors 167
2.16.2 D.C. Series Motors 168
2.16.3 D.C.Compound Motors 169
2.17 D.C. Motor Characteristics 170
2.18 Speed of a D.C. Motor 178
2.18.1 For Series Motor 179
2.18.2 For Shunt Motor 179
2.19 Applications 179
2.19.1 Solved Examples 180
2.20 Necessity of Starter 187
2.20.1 Three-Point Starter 188
2.21 Outcomes 190
2.22 Review Questions 190
2.23 Multiple Choice Questions 192

Unit-3: Transformers and Induction Motors

3.0 Objectives 196
3.1 Introduction 196
3.2 Transformer 196
3.2.1 Constructional Details of Transformer 197
3.2.2 Principle & Operation of Transformer 198
3.3 EMF Equation of a Transformer 199
3.4 Ideal Transformer 201
3.5 Practical Transformer 202

3.6 Transformer on no Load 203
3.7 Transformer on Load 204
3.8 Types of Transformers 207
3.9 O.C and S.C Test on Transformer 208
3.9.1 Solved Examples 218
3.10 Power (or) Energy Losses in a Transformer 218
3.11 Efficiency of a Transformer 220
3.11.1 Condition for Maximum Efficiency 220
3.11.2 All-day Efficiency 221
3.12 Regulation of a Transformer 222
3.13 Auto-Transformer 223
3.14 Solved Examples 225
3.15 Three-Phase Transformer 232
3.16 Three-Phase Transformer Connections 235
3.16.1 Solved Examples 237
3.17 Induction Motor 240
3.17.1 Three Phase Induction Motor 240
3.17.2 Construction of 3-Phase Induction Motors 241
3.17.3 Comparison Between Slip Ring and Squirrel Cage Rotors 244
3.17.4 Applicatuions of Squirrel Cage and Slip Ring Rotors 245
3.18 Working of 3-Phase Induction Motors 245
3.18.1 Solved Examples 246
3.19 Rotating Magnetic Field 247
3.19.1 Production of Rotating Magnetic Field 248
3.20 Synchronous Speed (N_s) 252
3.21 SLIP and its Importance 252
3.21.1 Rotor Current Frequency 253
3.21.2 Solved Examples 254
3.22 Torque Developed by an Induction Motor 259
3.23 Torque-Slip Characteristics 261
3.23.1 Torque Ratios 264
3.23.2 Solved Examples 266
3.24 Efficiency of an Induction Motor 267

3.24.1 Solved Examples 268
3.25 Starting and Speed Control of Induction Motor 269
3.25.1 Direct on Line (DOL) Starter 270
3.25.2 Star-Delta Starter 271
3.25.3 Auto-Transformer Starters 272
3.25.4 Rotor Resistance Starter 272
3.25.5 Advantages of Rotor Resistance Starter 273
3.25.6 Speed control of Induction Motors 273
3.26 Single Phase Induction Motor 264
3.26.1 Working Principle 264
3.26.2 Types of the Single-phase Induction Motors 264
3.26.3 Applications of the Single-phase 275
3.27 Principle of Synchronous Motor 275
3.27.1 Effect of Varying the Excitation of a Synchronous Motor 276
3.27.2 Applications of Synchronous Motor 277
3.27.3 Choice of Particular AC Motor 277
3.27.4 Advantages and Disadvantages of Synchronous Motor 278
3.27.5 Solved Examples 278
3.28 Application of Induction Motors 280
3.29 Outcomes 280
3.30 Review Questions 281
3.31 Multiple Choice Questions 283

Unit-4: Heat Power Generation

4.0 Objectives 290
4.1 Introduction 290
4.2 Thermodynamic Basics 291
4.3 Laws of Thermodynamics 292
4.3.1 First law of Thermodynamics 292
4.3.2 Zeroth law of Thermodynamics 293
4.3.3 Second law of Thermodynamics 293
4.4 Steam Power Generation 293
4.5 Classification of Power Plant Cycles 294
4.5.1 Carnot Cycle 294

4.6	Rankine Cycle	295
4.6.1	Real Rankine Cycle	267
4.7	Steam Power Plant	298
4.8	Applications of a Steam	300
4.9	Internal Combustion Engines	300
4.9.1	Classification IC Engines	300
4.9.2	Parts if I.C Engine	301
4.9.3	I.C. Engine Terminology	302
4.10	Cycle of operation	302
4.10.1	Four-stroke Cycle Petrol Engine	302
4.10.2	Four Stroke Cycle Diesel Engine	304
4.10.3	Two Stroke Cycle Engine	305
4.10.4	Two Stroke Cycle Petrol Engine	305
4.10.5	Two Stroke Cycle Diesel Engine	306
4.10.6	Comparison between Petrol Engine and Diesel Engine	306
4.10.7	Comparison between Four Stroke and two Stroke Engines	308
4.10.8	Advantages of a Two Stroke Engine over a Four Stroke Engine	309
4.10.9	Disadvantages of Two Stroke Engines	309
4.11	Applications of IC Engines	310
4.11.1	Diesel Power Plant	310
4.12	Layout of Diesel Power Plant	312
4.12.1	Advantage of Diesel Power Plant	312
4.12.2	Disadvantage of Diesel Power Plant	312
4.12.3	Application of Diesel Power Plant	313
4.13	Gas Turbines	313
4.13.1	Brayton Cycle	313
4.13.2	Gas Turbine Power Plant	315
4.14	Classification of Gas Turbine Power Plant	315
4.14.1	Differences between open Cycle and Closed Cycle Gas Turbine	317
4.15	Refrigeration Cycles	318
4.15.1	Reversed Carnot Cycle Emplyoing a Gas	319
4.15.2	Comparison between Gas Cycles and Vapour Cycles	320
4.15.3	Parts of a Refrigerator	320

4.16	Types of Refrigeration System	321
	4.16.1 Vapour Compression Refrigeration System	321
	4.16.2 Vapour Absorption Refrigerator	324
4.17	Comparison between Vapour Compression and Absorption Systems	325
4.18	Refrigerants Commonly Used in Practice	326
4.19	Properties of a Good Refrigerant	327
4.20	Outcomes	328
4.21	Review Questions	329
4.22	Multiple Choice Questions	329

Unit-5: Power Transmission

5.0	Objectives	322
5.1	Introduction	332
5.2	Selection of a Belt Drive	332
5.3	Types of Belt Drives	333
5.4	Types of Belts	333
5.5	Material used for Belts	334
	5.5.1 Properties of a Belt Material	334
5.6	Types of Flat Belt Drives	335
5.7	Law of Belting	337
5.8	V-belt Drive	338
5.9	Rope Drive	339
	5.9.1 Fibre Ropes	340
	5.9.2 Wire Ropes	341
5.10	Chain Drives	341
	5.10.1 Advantages and Disadvantages of Chain Drive over Belt or Rope Drive	342
	5.10.2 Terms Used in Chain Drive	342
	5.10.3 Classification of Chains	343
	5.10.4 Conveyor Chains	343
	5.10.5 Power Transmitting Chains	344
5.11	Gears	345
	5.11.1 Friction Wheels	345
	5.11.2 Classification of Toothed Wheels	346
5.12	Gear Terminology	349

5.13 Applications 351
5.14 Outcomes 352
5.15 Review Questions 352
5.16 Multiple Choice Questions 352

Unit-6: Joining and Forming Processes

6.0 Objectives 356
6.1 Introduction 356
6.2 Joining Processes 356
6.3 Welding 356
6.3.1 Uses of Welding 357
6.3.2 Principle of Welding 357
6.3.3 Types of Welding 357
6.3.4 Advantages 357
6.3.5 Disadvantages 357
6.3.6 Applications 358
6.4 Arc Welding / Shielded Metal Arc Welding (SMAW) / Manual Metal Arc Welding (MMAW) 358
6.4.1 Arc Welding 358
6.4.2 Arc Shielding 359
6.4.3 Power Source in Arc Welding 359
6.4.4 SMAW (Shielded Metal Arc Welding) 359
6.4.5 Submerged arc Welding (SAW) 361
6.5 Resistance Welding 361
6.5.1 Parameter Affecting Resistance Welding 362
6.5.2 Important Resistance Welding Processes 362
6.6 Gas Welding 363
6.6.1 Oxy-acetylene Welding 364
6.7 Welding Defects 365
6.8 Brazing 366
6.8.1 Process 366
6.8.2 The Various Methods used to Melt the Filler Metal and Flux are 366
6.8.3 Applications 366
6.8.4 Advantages and Disadvantages 366

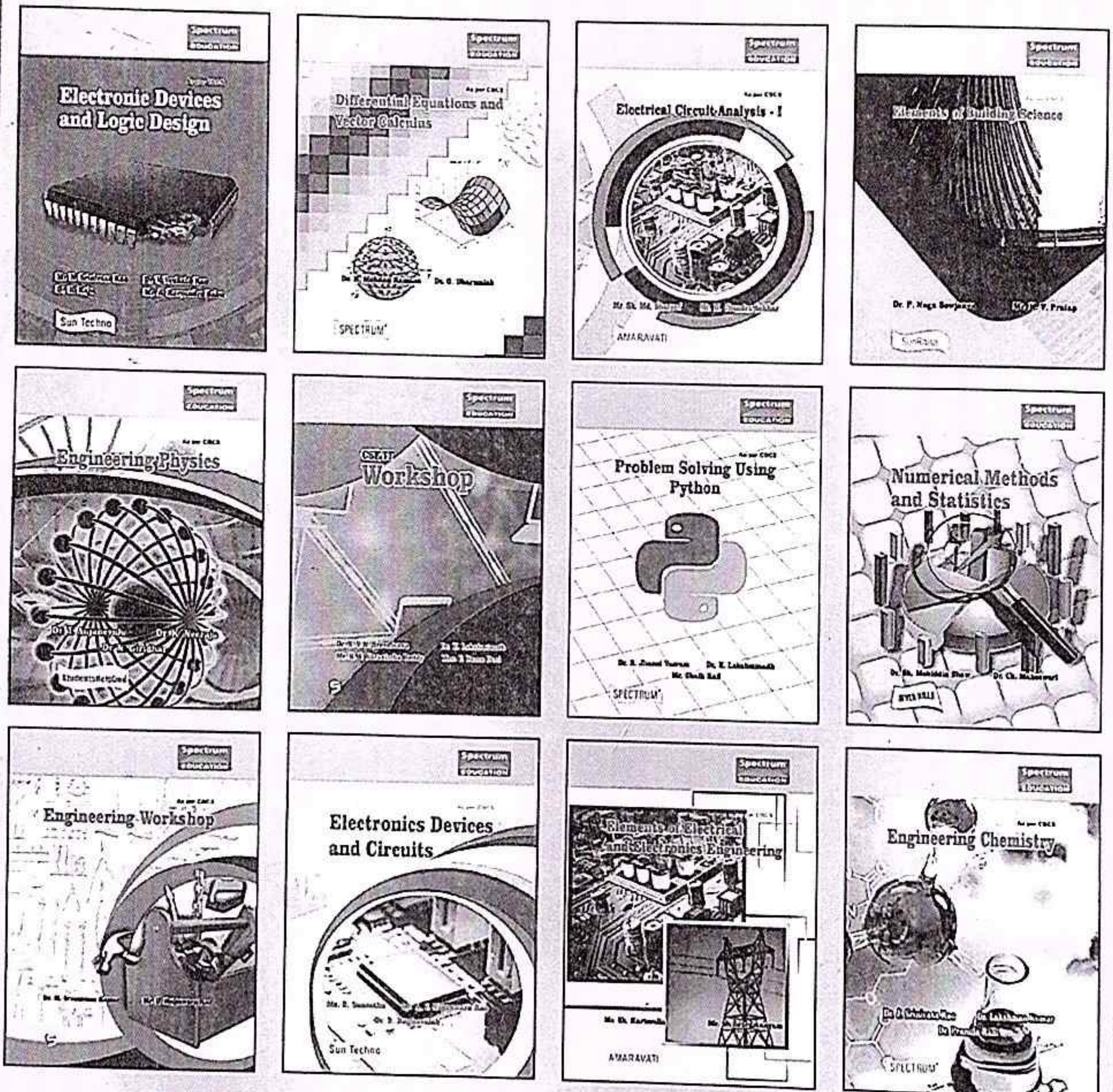
6.9	Soldering	367
	6.9.1 Process	367
	6.9.2 Method of Soldering	367
	6.9.3 Applications	367
	6.9.4 Advantages and Disadvantages	368
	6.9.5 Difference between Soldering and Brazing	368
6.10	Metal Forming	369
	6.10.1 Difference between Hot Working and Cold Working	369
6.11	FORGING	370
	6.11.1 Advantages and Disadvantages of Forging Process	371
	6.11.2 Applications	371
	6.11.3 Forging Defects	372
	6.11.4 Forging Remedies	372
6.12	Rolling	372
	6.12.1 Rolling Process	372
	6.12.2 Principle of Rolling	373
	6.12.3 Rolling Mill	374
	6.12.4 Difference between Hot Rolling and Cold Rolling	374
	6.12.5 Defects in Rolling	375
	6.12.6 Applications of Rolling	375
6.13	Extrusion	376
	6.13.1 Applications	376
	6.13.2 Advantages and Disadvantages of Extrusion	376
6.14	Classification	376
	6.14.1 Forward or Direct Extrusion	376
	6.14.2 Backward or Indirect Extrusion	377
	6.14.3 Impact Extrusion or Cold Extrusion	378
	6.14.4 Hydrostatic Extrusion	378
	6.14.5 Defects in Extrusion	379
6.15	Outcomes	379
6.16	Review Questions	380
6.17	Multiple Choice Questions	381

Elements of Mechanical and Electrical Engineering

Dr. M. Sreenivasa Kumar
Dr. D. Jagadish
Mr. Sk. Karimulla

SINCE 23

Our Engineering Titles



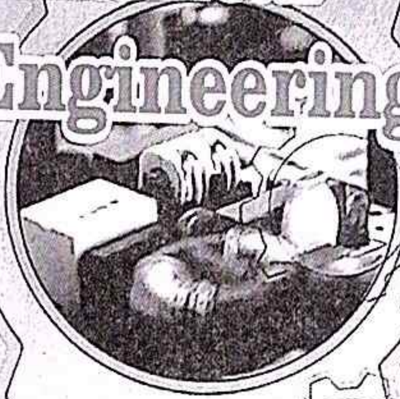
₹352/-

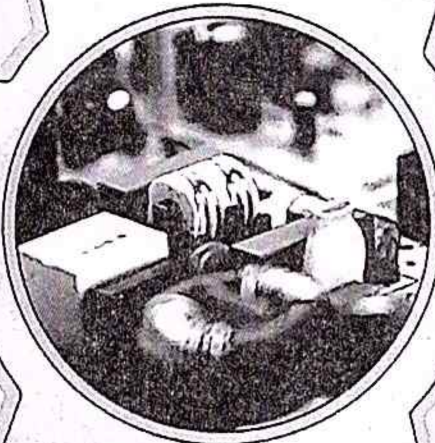
ISBN 978-81-953687-0-9

Spectrum
EDUCATION

As per CBCS

Elements of Mechanical and Electrical Engineering





Dr. M. Sreenivasa Kumar Dr. D. Jagadish
Mr. Sk. Karimulla

Elements of Mechanical and Electrical Engineering

Authors

Dr. M. Sreenivasa Kumar
Principal & Professor
Department of Mechanical Engineering
Narasaraopeta Engineering College(Autonomous)
Narasaraopet, Guntur, A.P. - 522 601

Dr. D. Jagadish
Professor
Department of Mechanical Engineering
Narasaraopeta Engineering College(Autonomous)
Narasaraopet, Guntur, A.P. - 522 601

Mr. Sk. Karimulla
Assistant Professor
Department of Electrical & Electronics Engineering
Narasaraopeta Engineering College(Autonomous)
Narasaraopet, Guntur, A.P. - 522 601

VICE PRINCIPAL
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601,
Guntur (Dist.), A.P.

AMARAVATHI PUBLICATIONS

AMARAVATI PUBLICATIONS
The Temple of Education

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

M/s Amaravati Publications, Hyderabad

A Part of StudentsHelpline Publishing House (P) Ltd.

(An ISO 9001 : 2015 Certified Company)

Head Office

326/C, III Floor, Surneni Nilayam
Near B K Guda Park, S R Nagar, Hyderabad - 500 038, INDIA
P.No:+91 40 23710657, 238000657 Fax: +91 40 23810657

Reg. Off

5-68, Pedda Gorpadu, Pakala, Tirupati, Chittoor - 517 112 AP, INDIA
mail:studentshelpline.in@gmail.com
www.**studentshelpline**.org

First Edition-2021

ISBN: 978-81-953687-0-9

₹ **352/-**

Printed at StudentsHelpline Group, S R Nagar, Hyderabad-38
Published by Surneni Mohan Naidu for Amaravati Publications, Hyderabad - 38

Elements of Mechanical and Electrical Engineering

Unit-1: Basic Laws and Circuits

1.0	Objectives		2
1.1	Introduction		2
1.2	Basic Definitions		3
1.3	Types of Elements		9
1.4	Ohm's Law		10
	1.4.1	Limitations of Ohm's Law	11
	1.4.2	Applications of Ohm's Law	11
	1.4.3	Solved Examples	11
1.5	R-L-C Parameters		15
	1.5.1	Resistance (R)	15
		1.5.1.1 Classification of Resistors	17
		1.5.1.2 Specifications of Resistors	18
		1.5.1.3 Colour Coding of Resistors	18
	1.5.2	Inductor (L)	19
		1.5.2.1 Classification of Inductors	21
		1.5.2.2 Specifications of Inductor	21
		1.5.2.3 Conductivity	22
	1.5.3	Concept of Capacitor	22
		1.5.3.1 Classifications of Capacitors	24
		1.5.3.2 Specifications of the Capacitor	25
	1.5.4	Comparison of Active and Passive Components	25
	1.5.5	Important Characteristics of the Basic Elements	26
	1.5.6	Solved Examples	26
1.6	Kirchhoff's Current and Voltage Law's		31
	1.6.1	Kirchhoff's Current Law	32
	1.6.2	Kirchhoff's Voltage Law	33
	1.6.3	Application of Kirchhoff's Circuit Laws in the Analysis of Circuits	35
	1.6.4	Solved Examples	35
1.7	Series and Parallel Networks		42

1.7.1 Resistance in Series 42

1.7.1.1 Equivalent Resistance for Series Connections 42

1.7.1.2 Characteristics of a Series Circuit 44

1.7.1.3 Application of Series Combination 44

1.7.1.4 Disadvantage of Series Circuits 44

1.7.2 Voltage Divider Rule 45

1.7.3 Resistance in Parallel 46

1.7.3.1 Characteristics of a Parallel Circuits 48

1.7.3.2 Advantages of Parallel Circuits 48

1.7.3.3 Applications of Parallel Circuits 48

1.7.4 Series-Parallel Combination 48

1.7.5 Division of Current in Parallel Branch Circuit 49

1.7.6 Solved Examples 52

1.7.7 Comparison of Series and Parallel Circuits 69

1.7.8 Series and Parallel Inductors 70

1.7.9 Solved Examples 72

1.7.10 Series and Parallel Capacitors 73

1.7.11 Solved Examples 75

1.8 Star to Delta or Delta to Star Transformations 76

1.8.1 Delta-Star Transformation 78

1.8.2 Star-Delta Transformation 79

1.8.3 Conversion of Star into Equivalent Delta 81

1.8.4 Conversion of Delta into Equivalent Star 82

1.8.5 Solved Examples 84

1.9 Faraday's Laws of Electomagnetic Induction 97

1.9.1 Electromagnetic Induction 97

1.9.2 Lenz's Law 99

1.9.3 Solved Examples 99

1.10 Measurement and Instrument 101

1.10.1 Necessary Requirements for Measuring an Instrument 102

1.10.2 Methods of Measurement 102

1.11 Classification of Measuring Instruments 102

1.11.1 Advantages of Electronic Measurement 105

1.12 Principle of Operation Electrical Measuring Instruments 105

1.12.1 Essential Requirements of Indicating Type Instruments 106

1.13 Permanent-magnet Moving-coil (PMMC) Instrument 108

1.14 Moving Iron Instruments 111

1.14.1 Moving-iron Attraction Type Instrument 111

1.14.2 Repulsion Type Moving-iron Instrument 113

1.14.3 Advantages & Disadvantages of mi Instruments 114

1.15 Outcomes 115

1.16 Review Questions 115

1.17 Multiple Choice Questions 119

Unit-2: DC Machines

2.0 Objectives 124

2.1 Introduction 124

2.2 Faraday's Laws 124

2.3 Induced E.M.F 125

2.3.1 Dynamically Induced E.M.F 126

2.3.2 Statically Induced E.M.F 127

2.4 Lenz's Law 130

2.5 Fleming's Left Hand Rule 130

2.6 Working Principle of DC Generator 130

2.6.1 Fleming's Right Hand Rule 131

2.7 Constructional Features of a D.C. Machine 132

2.7.1 Description of Parts of D.C.Machines 133

2.8 Terminology in Armature Windings 136

2.9 Types of Armature Windings 138

2.9.1 Lap Winding 139

2.9.2 Wave Winding 139

2.9.3 Difference between Lap Winding and Wave Winding 140

2.10 E.M.F. Equation of D.C.Generator 140

2.10.1 Solved Examples 142

2.11 Types of D.C. Generators 146

2.11.1 Separately Excited D.C. Generators 146

2.11.2 Self-excited Generators 147

	2.11.2.1 Series-wound Generators	147
	2.11.2.2 Shunt-wound Generator	148
	2.11.2.3 Compound-Wound Generator	149
2.12	Characteristics of Series Shunt and Compound Generators	151
	2.12.1 Solved Examples	154
2.13	Working Principle of D.C. Machine as a Motor	160
2.14	Back E.M.F.	161
	2.14.1 Significance of Back e.m.f.	163
2.15	Torque developed in DC Motor	164
2.16	Types of D.C.Motors	166
	2.16.1 D.C. Shunt Motors	167
	2.16.2 D.C. Series Motors	168
	2.16.3 D.C.Compound Motors	169
2.17	D.C. Motor Characteristics	170
2.18	Speed of a D.C. Motor	178
	2.18.1 For Series Motor	179
	2.18.2 For Shunt Motor	179
2.19	Applications	179
	2.19.1 Solved Examples	180
2.20	Necessity of Starter	187
	2.20.1 Three-Point Starter	188
2.21	Outcomes	190
2.22	Review Questions	190
2.23	Multiple Choice Questions	192

Unit-3: Transformers and Induction Motors

3.0	Objectives	196
3.1	Introduction	196
3.2	Transformer	196
	3.2.1 Constructional Details of Transformer	197
	3.2.2 Principle & Operation of Transformer	198
3.3	EMF Equation of a Transformer	199
3.4	Ideal Transformer	201
3.5	Practical Transformer	202

3.6	Transformer on no Load	203
3.7	Transformer on Load	204
3.8	Types of Transformers	207
3.9	O.C and S.C Test on Transformer	208
	3.9.1 Solved Examples	218
3.10	Power (or) Energy Losses in a Transformer	218
3.11	Efficiency of a Transformer	220
	3.11.1 Condition for Maximum Efficiency	220
	3.11.2 All-day Efficiency	221
3.12	Regulation of a Transformer	222
3.13	Auto-Transformer	223
3.14	Solved Examples	225
3.15	Three-Phase Transformer	232
3.16	Three-Phase Transformer Connections	235
	3.16.1 Solved Examples	237
3.17	Induction Motor	240
	3.17.1 Three Phase Induction Motor	240
	3.17.2 Construction of 3-Phase Induction Motors	241
	3.17.3 Comparison Between Slip Ring and Squirrel Cage Rotors	244
	3.17.4 Applicatuions of Squirrel Cage and Slip Ring Rotors	245
3.18	Working of 3-Phase Induction Motors	245
	3.18.1 Solved Examples	246
3.19	Rotating Magnetic Field	247
	3.19.1 Production of Rotating Magnetic Field	248
3.20	Synchronous Speed (N_s)	252
3.21	SLIP and its Importance	252
	3.21.1 Rotor Current Frequency	253
	3.21.2 Solved Examples	254
3.22	Torque Developed by an Induction Motor	259
3.23	Torque-Slip Characteristics	261
	3.23.1 Torque Ratios	264
	3.23.2 Solved Examples	266
3.24	Efficiency of an Induction Motor	267

3.24.1	Solved Examples	268
3.25	Starting and Speed Control of Induction Motor	269
3.25.1	Direct on Line (DOL) Starter	270
3.25.2	Star-Delta Starter	271
3.25.3	Auto-Transformer Starters	272
3.25.4	Rotor Resistance Starter	272
3.25.5	Advantages of Rotor Resistance Starter	273
3.25.6	Speed control of Induction Motors	273
3.26	Single Phase Induction Motor	264
3.26.1	Working Principle	264
3.26.2	Types of the Single-phase Induction Motors	264
3.26.3	Applications of the Single-phase	275
3.27	Principle of Synchronous Motor	275
3.27.1	Effect of Varying the Excitation of a Synchronous Motor	276
3.27.2	Applications of Synchronous Motor	277
3.27.3	Choice of Particular AC Motor	277
3.27.4	Advantages and Disadvantages of Synchronous Motor	278
3.27.5	Solved Examples	278
3.28	Application of Induction Motors	280
3.29	Outcomes	280
3.30	Review Questions	281
3.31	Multiple Choice Questions	283

Unit-4: Heat Power Generation

4.0	Objectives	290
4.1	Introduction	290
4.2	Thermodynamic Basics	291
4.3	Laws of Thermodynamics	292
4.3.1	First law of Thermodynamics	292
4.3.2	Zeroth law of Thermodynamics	293
4.3.3	Second law of Thermodynamics	293
4.4	Steam Power Generation	293
4.5	Classification of Power Plant Cycles	294
4.5.1	Carnot Cycle	294

4.6	Rankine Cycle	295
	4.6.1 Real Rankine Cycle	267
4.7	Steam Power Plant	298
4.8	Applications of a Steam	300
4.9	Internal Combustion Engines	300
	4.9.1 Classification IC Engines	300
	4.9.2 Parts if I.C Engine	301
	4.9.3 I.C. Engine Terminology	302
4.10	Cycle of operation	302
	4.10.1 Four-stroke Cycle Petrol Engine	302
	4.10.2 Four Stroke Cycle Diesel Engine	304
	4.10.3 Two Stroke Cycle Engine	305
	4.10.4 Two Stroke Cycle Petrol Engine	305
	4.10.5 Two Stroke Cycle Diesel Engine	306
	4.10.6 Comparison between Petrol Engine and Diesel Engine	306
	4.10.7 Comparison between Four Stroke and two Stroke Engines	308
	4.10.8 Advantages of a Two Stroke Engine over a Four Stroke Engine	309
	4.10.9 Disadvantages of Two Stroke Engines	309
4.11	Applications of IC Engines	310
	4.11.1 Diesel Power Plant	310
4.12	Layout of Diesel Power Plant	312
	4.12.1 Advantage of Diesel Power Plant	312
	4.12.2 Disadvantage of Diesel Power Plant	312
	4.12.3 Application of Diesel Power Plant	313
4.13	Gas Turbines	313
	4.13.1 Brayton Cycle	313
	4.13.2 Gas Turbine Power Plant	315
4.14	Classification of Gas Turbine Power Plant	315
	4.14.1 Differences between open Cycle and Closed Cycle Gas Turbine	317
4.15	Refrigeration Cycles	318
	4.15.1 Reversed Carnot Cycle Emplyoing a Gas	319
	4.15.2 Comparison between Gas Cycles and Vapour Cycles	320
	4.15.3 Parts of a Refrigerator	320

4.16 Types of Refrigeration System 321
4.16.1 Vapour Compression Refrigeration System 321
4.16.2 Vapour Absorption Refrigerator 324
4.17 Comparison between Vapour Compression and Absorption Systems 325
4.18 Refrigerants Commonly Used in Practice 326
4.19 Properties of a Good Refrigerant 327
4.20 Outcomes 328
4.21 Review Questions 329
4.22 Multiple Choice Questions 329

Unit-5: Power Transmission

5.0 Objectives 322
5.1 Introduction 332
5.2 Selection of a Belt Drive 332
5.3 Types of Belt Drives 333
5.4 Types of Belts 333
5.5 Material used for Belts 334
5.5.1 Properties of a Belt Material 334
5.6 Types of Flat Belt Drives 335
5.7 Law of Belting 337
5.8 V-belt Drive 338
5.9 Rope Drive 339
5.9.1 Fibre Ropes 340
5.9.2 Wire Ropes 341
5.10 Chain Drives 341
5.10.1 Advantages and Disadvantages of Chain Drive over Belt or Rope Drive 342
5.10.2 Terms Used in Chain Drive 342
5.10.3 Classification of Chains 343
5.10.4 Conveyor Chains 343
5.10.5 Power Transmitting Chains 344
5.11 Gears 345
5.11.1 Friction Wheels 345
5.11.2 Classification of Toothed Wheels 346
5.12 Gear Terminology 349

5.13 Applications 351
5.14 Outcomes 352
5.15 Review Questions 352
5.16 Multiple Choice Questions 352

Unit-6: Joining and Forming Processes

6.0 Objectives 356
6.1 Introduction 356
6.2 Joining Processes 356
6.3 Welding 356
6.3.1 Uses of Welding 357
6.3.2 Principle of Welding 357
6.3.3 Types of Welding 357
6.3.4 Advantages 357
6.3.5 Disadvantages 357
6.3.6 Applications 358
6.4 Arc Welding / Shielded Metal Arc Welding (SMAW) / Manual Metal Arc Welding (MMAW) 358
6.4.1 Arc Welding 358
6.4.2 Arc Shielding 359
6.4.3 Power Source in Arc Welding 359
6.4.4 SMAW (Shielded Metal Arc Welding) 359
6.4.5 Submerged arc Welding (SAW) 361
6.5 Resistance Welding 361
6.5.1 Parameter Affecting Resistance Welding 362
6.5.2 Important Resistance Welding Processes 362
6.6 Gas Welding 363
6.6.1 Oxy-acetylene Welding 364
6.7 Welding Defects 365
6.8 Brazing 366
6.8.1 Process 366
6.8.2 The Various Methods used to Melt the Filler Metal and Flux are 366
6.8.3 Applications 366
6.8.4 Advantages and Disadvantages 366

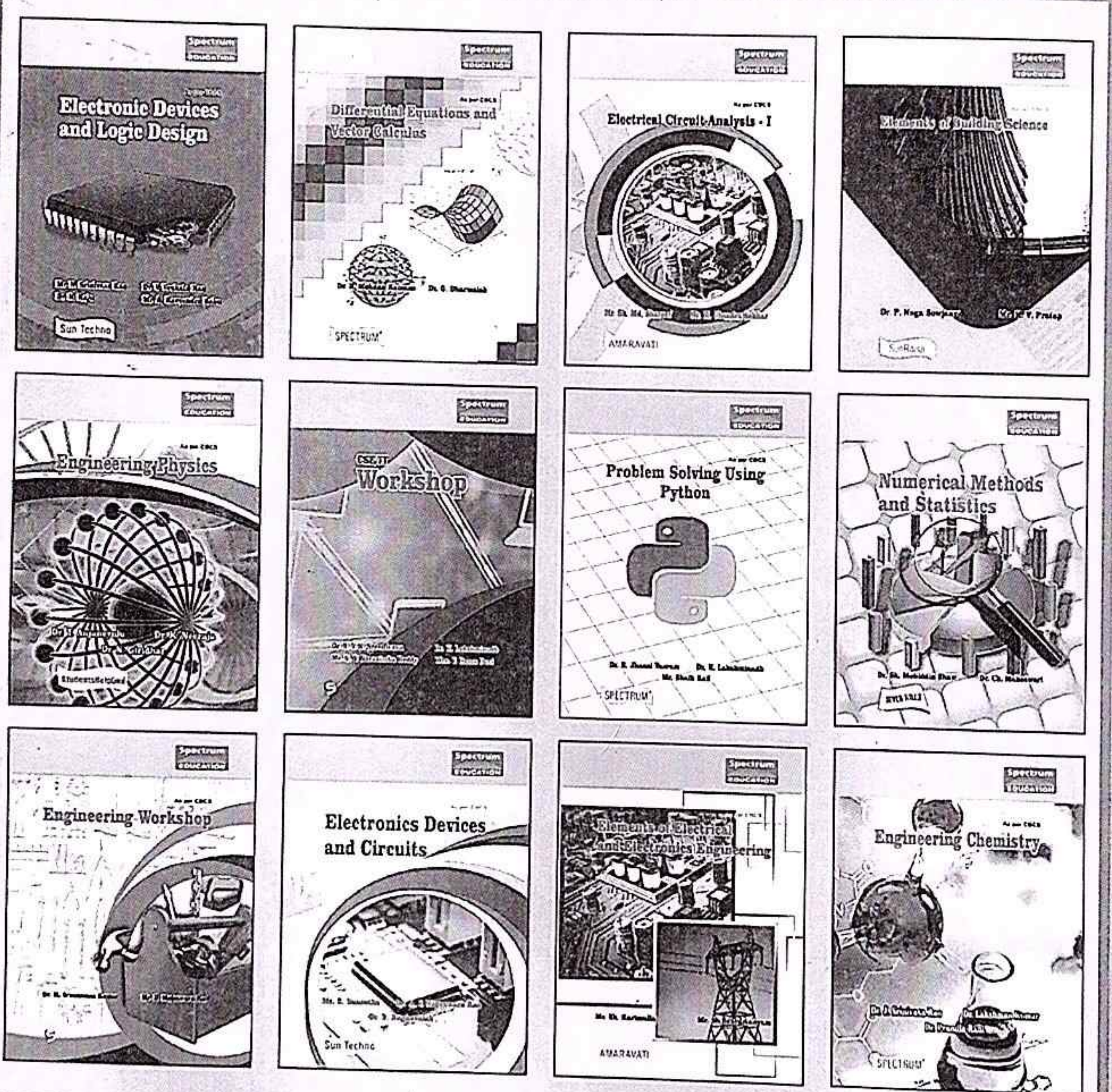
6.9 Soldering 367
6.9.1 Process 367
6.9.2 Method of Soldering 367
6.9.3 Applications 367
6.9.4 Advantages and Disadvantages 368
6.9.5 Difference between Soldering and Brazing 368
6.10 Metal Forming 369
6.10.1 Difference between Hot Working and Cold Working 369
6.11 FORGING 370
6.11.1 Advantages and Disadvantages of Forging Process 371
6.11.2 Applications 371
6.11.3 Forging Defects 372
6.11.4 Forging Remedies 372
6.12 Rolling 372
6.12.1 Rolling Process 372
6.12.2 Principle of Rolling 373
6.12.3 Rolling Mill 374
6.12.4 Difference between Hot Rolling and Cold Rolling 374
6.12.5 Defects in Rolling 375
6.12.6 Applications of Rolling 375
6.13 Extrusion 376
6.13.1 Applications 376
6.13.2 Advantages and Disadvantages of Extrusion 376
6.14 Classification 376
6.14.1 Forward or Direct Extrusion 376
6.14.2 Backward or Indirect Extrusion 377
6.14.3 Impact Extrusion or Cold Extrusion 378
6.14.4 Hydrostatic Extrusion 378
6.14.5 Defects in Extrusion 379
6.15 Outcomes 379
6.16 Review Questions 380
6.17 Multiple Choice Questions 381

Elements of Mechanical and Electrical Engineering

Dr. M. Sreenivasa Kumar
Dr. D. Jagadish
Mr. Sk. Karimulla

SINCE 23

Our Engineering Titles



AMARAVATI PUBLICATIONS
The Temple of Education

StudentsHelpline Group
Expect more from us

₹352/-

ISBN 978-81-953687-0-9

9 788195 368709

amazon.in

AatmaNirbharBharat Abhiyan

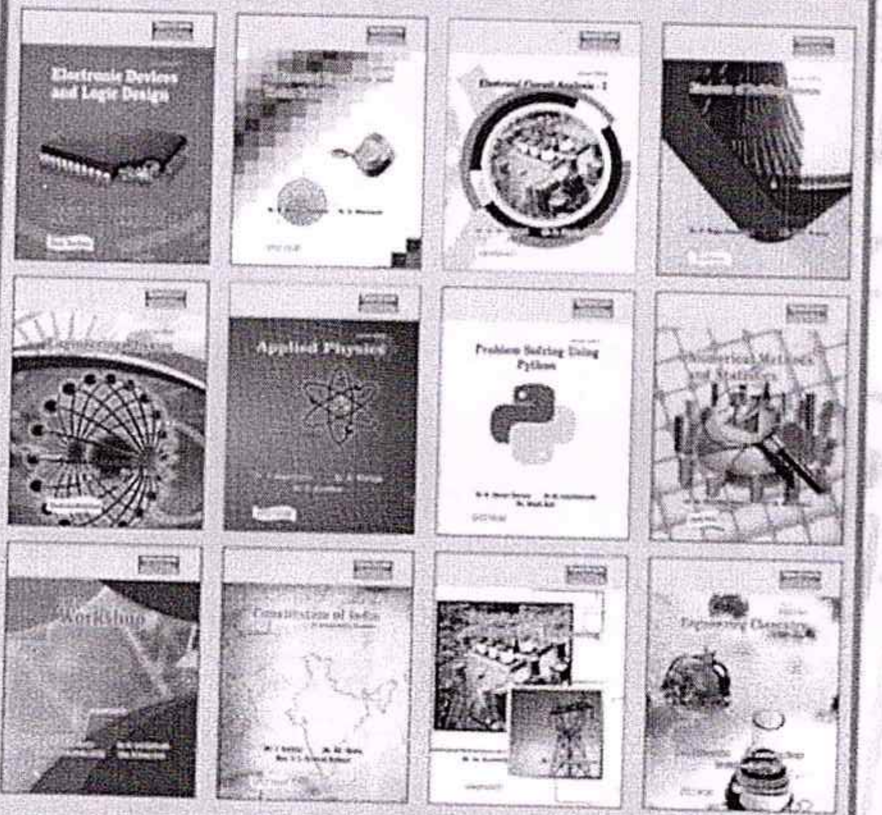
+91 9392575657

Engineering Workshop

Dr. M Sreenivasa Kumar
Mr. D. Mojeswara Rao

23

Our Engineering Titles



`xxx/-

ISBN 978-81-952679-8-9

International Publishers

amazon.in

AatmaNirbhar Bharat Abhiyan

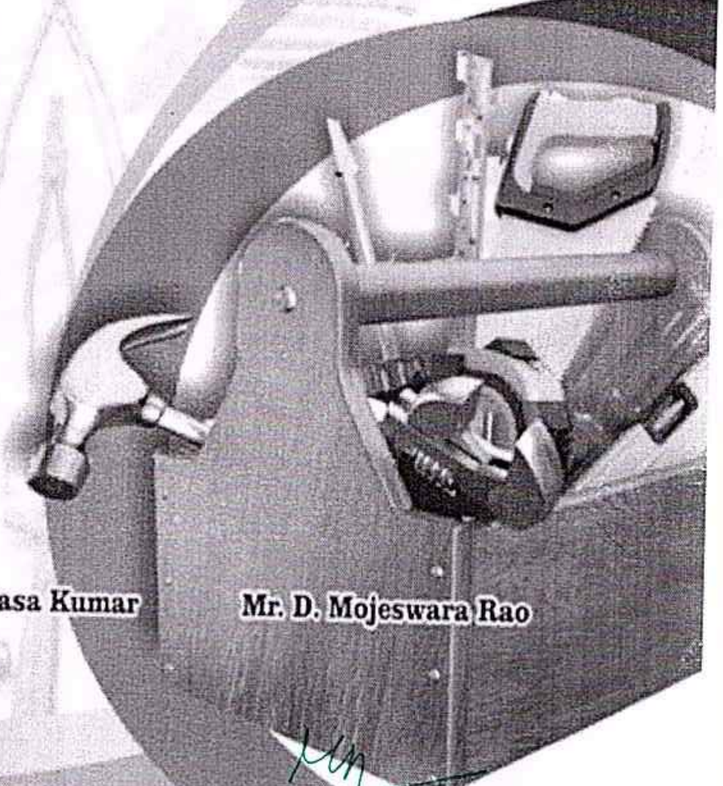
+91 9392575657

Engineering Workshop   Dr. M. Sreenivasa Kumar   Mr. D. Mojeswara Rao   B.Tech

Spectrum EDUCATION

As per CBCS

Engineering Workshop



Dr. M. Sreenivasa Kumar   Mr. D. Mojeswara Rao

INDEX

S. No.	Name of the Experiment	Page	Date of Experiment	Date of Submission	Faculty Sign
1	**Experiment-1: Carpentry** 1. Cross-Lap joint 2. Dove tail joint				
2	**Experiment-2: Fitting** 1. V-fit 2. Square fit				
3	**Experiment-3: Tin smithy** 1. Square box without lid 2. Tapper tray				
4	**Experiment-4: House Wiring** 1. Two lamps series connection & parallel connection 2. Fluorescent Tube Wiring & Stair Case Wiring				
5	**Experiment-5: Black Smithy** 1. S-Hook 2. Round rod to square rod				

Engineering Workshop

Dr. M Sreenivasa Kumar
Mr. D. Mojeswara Rao

23

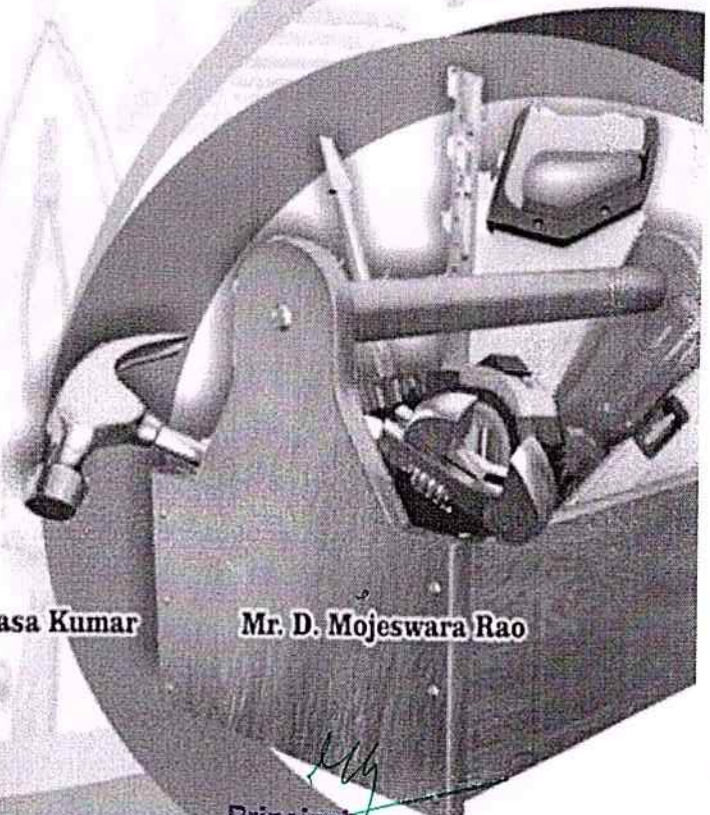
Our Engineering Titles

ISBN 978-81-952679-8-9

Engineering Workshop — Dr. M. Sreenivasa Kumar — Mr. D. Mojeswara Rao — B.Tech

As per CBCS

Engineering Workshop



Dr. M. Sreenivasa Kumar
Mr. D. Mojeswara Rao

INDEX

S. No.	Name of the Experiment	Page	Date of Experiment	Date of Submission	Faculty Sign
1	**Experiment-1: Carpentry** 1. Cross-Lap joint 2. Dove tail joint				
2	**Experiment-2: Fitting** 1. V-fit 2. Square fit				
3	**Experiment-3: Tin smithy** 1. Square box without lid 2. Tapper tray				
4	**Experiment-4: House Wiring** 1. Two lamps series connection & parallel connection 2. Fluorescent Tube Wiring & Stair Case Wiring				
5	**Experiment-5: Black Smithy** 1. S-Hook 2. Round rod to square rod				

IQAC

Principal
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

Spectrum
EDUCATION

As per CBCS

Engineering Mechanics

Dr. M. Sreenivasa Kumar
Dr. D. Suneel
Mr. Ch. Sekhar

Engineering Mechanics

Chapter-1: Introduction to Engineering Mechanics

1.0	Objectives	2
1.1	Introduction	2
1.2	Engineering Mechanics	2
1.3	Classification of Engineering Mechanics	3
1.4	Applications of Engineering Mechanics	5
1.5	Fundamental Concepts	5
1.6	Fundamentals of Vectors	7
	1.6.1 Types of Vectors	8
	1.6.2 Addition and Subtraction of Vectors	8
	1.6.3 Dot Product of Vectors	10
	1.6.4 Cross Product of Vectors	10
1.7	Components in Space	11
	1.7.1 Resctangular Components of a Force in Space	11
	1.7.2 Resultant	12
1.8	Basic laws of Mechanics	12
	1.8.1 Newtons law of motion	12
	1.8.2 Parallelogram law of forces	13
	1.8.3 Traingle law of forces	15
	1.8.4 Polygon of forces	15
	1.8.5 Lami's theorem	16
	1.8.6 Principles of Transmissibilty	17
1.9	Equilibrium of A Particle	17
	1.9.1 Particle Equilibrium in 2-Dimensions	18
	1.9.2 Particle Equilibrium in 3-Dimensions	19
1.10	Rigid Body Equilibrium	20
1.11	Classification of System of Forces	21
1.12	Characteristics of Various System Forces	22
1.13	Moment of Forces	23
	1.13.1 Varigons Theorem	25
	1.13.2 Applications of Varigon's Theorem	25
1.14	Couple	26
	1.14.1 Moment of A Couple	26
	1.14.2 Properties of A Couple	27

1.15 Resultant of Force 27
1.16 Solved Problems 30
1.17 Equilibrium of System of Forces 37
1.17.1 Equations of Equilibrium 37
1.17.2 Support Conditions 37
1.17.3 Link Representation 38
1.18 Free Body Diagrams 39
1.18.1 Construction of Free Body Diagram 40
1.18.2 Examples of Free Body Diagram 40
1.19 Equations of Equilibrium 42
1.20 Equilibrium of Spatial System 43
1.20.1 Solved Problems 45
1.21 Static Indeterminacy 50
1.22 Additional Problems 52
1.23 Summary 68
1.24 Review Questions 69
1.25 Multiple Choice Questions 73

Chapter-II: Friction

2.0 Objectives 80
2.1 Introduction 80
2.2 Friction 80
2.2.1 Factors that Affect Friction 81
2.2.2 Causes of Friction 81
2.3 Examples of Friction 82
2.4 Properties of Frictional Forces 82
2.5 Types of Friction 82
2.6 Methods of Increasing Friction 83
2.7 Methods of Reducing Friction 84
2.8 Limiting Friction 84
2.9 Laws of Friction 85
2.9.1 Static Laws of Friction 85
2.9.2 Kinetic Laws of Friction 85
2.9.3 Rolling Laws of Friction 86
2.10 Co-Efficient of Friction 86
2.10.1 Coefficient of Static Friction 87
2.10.2 Coefficient of Kinetic Friction 87

2.10.3 Co-efficient of Rolling Friction 88
2.10.4 Solved Problems 88
2.11 Friction Angles 92
2.11.1 Angle of Friction 92
2.11.2 Angle of Repose 93
2.11.3 Cone of Friction 95
2.12 Motion of Bodies 96
2.12.1 Solved Problems 98
2.13 Wedge Friction 100
2.13.1 Solved Problems 102
2.14 Screw Friction 104
2.14.1 Differential Screw Jack 105
2.14.2 Solved Problems 106
2.15 Ladder Friction 108
2.16 Advantages and Disadvantages of Friction 108
2.17 Additional Problems 110
2.18 Summary 121
2.19 Review Questions 121
2.20 Multiple Choice Questions 123

Chapter-III: Cetroid and Centre of Gravity

3.0 Objectives 130
3.1 Introduction 130
3.2 Centroid 130
3.3 Fundamental Definitions 131
3.4 Centroidal Axis 132
3.5 Axis of Symmetry 133
3.6 Centroids of Areas and Lines 134
3.7 Centroid of Volume 135
3.8 Symmetry and Signs 136
3.9 Centroid of Symmetrical Figures 137
3.10 First Moment and Centroid 137
3.11 Determination of Centroid from First Principle 138
3.12 Centroid of Simple Figures from Basic Principle 139
3.12.1 Centroid of a Triangle 139
3.12.2 Centroid of a Semicircle 140
3.12.3 Centroid of Sector of a Circle 140

3.12.4 Centroid of Parabolic Spandrel 141
3.13 Methods of Determination of Centroid 143
3.13.1 Analytical Method for Location of the Centroid 143
3.13.2 Graphical Method 144
3.13.3 Experimental Method 145
3.14 Centroid by Integration 146
3.15 Solved Problems 147
3.16 Composite Areas 156
3.17 Stuctural Sections 157
3.18 Centroid of Composite Figures 157
3.18.1 Solved Problems 159
3.19 Gravity 167
3.20 Centre of Gravity 167
3.21 Centre of Mass 168
3.22 Centre of Gravity of a Flat Plate 169
3.23 Centre of Gravity from Basic Principles 170
3.23.1 Centre of Gravity of Simple Figures 171
3.24 Centre of Gravity of Composite Bodies 171
3.25 Method for Finding Centre of Gravity 171
3.25.1 Solved Problems 174
3.26 Differences Between Center of Gravity and Centroid 177
3.27 Pappus and Guldings Theorem 177
3.27.1 Applications of Pappus and Guldinus Theorems 179
3.27.2 Solved Problems 179
3.28 Additional Problems 181
3.29 Summary 193
3.30 Review Questions 193
3.31 Multiple Choice Questions 195

Chapter-IV: Area Moment of Inertia

4.0 Objectives 200
4.1 Introduction 200
4.2 Moment of Inertia 200
4.3 Concept of Moment of Inertia 201
4.3.1 Units of Moment of Inertia 202
4.4 Moment of Inertia of A Plane Area 202
4.5 Procedure for Analysis in Moment of Inertia 203

4.5.1 Simple Planar Areas 203
4.5.2 Composite Areas 204
4.6 Moment of Inertia of Plane Sections from First Principles 205
4.7 Moment of Inertia of Standard Sections 207
4.7.1 Solved Problems 211
4.8 Moment of Inertia of A Composite Figures 214
4.8.1 Solved Problems 216
4.9 Polar Moment of Inertia 221
4.10 Radius of Gyration 222
4.11 Perpendicalar Axis Theorem 223
4.12 Parallel Axis Theorem 224
4.13 Solved Problems 225
4.14 Product of Inertia 229
4.14.1 Product of Inertia of a Right Angle Triangle with Respect to x and y- Axis 230
4.14.2 Product of Inertia of Rectangle with Respect to x and y-Axis 231
4.14.3 Product of Inertia of a Quarter Circle with Respect to x and y-Axis 231
4.14.4 Solved Problems 232
4.15 Mass Moment of Inertia 234
4.16 Procedure for Determination of Mass Moment of Inertia 235
4.17 Mass Moment of Inertia of Simple Solids 236
4.17.1 Mass Moment of Inertia of a Rectangular Plate 236
4.17.2 Mass Moment of Inertia of a Slender Rod 237
4.17.3 Mass Moment of Inertia of a Slender Rod with Inclination to y-axis 237
4.17.4 Mass Moment of Inertia of a Homogeneous Thin Plate 238
4.17.5 Mass Moment of Inertia of a Thin Circular Disc 238
4.17.6 Mass Moment of Inertia of a Circular Ring 239
4.17.7 Solved Problems 240
4.18 Transfer Formula for Mass Moments of Inertia 247
4.18.1 Solved Problems 248
4.19 Mass Moment of Inertia of Composite Bodies 250
4.19.1 Mass Moment of Inertia of a Circular Cylinder 250
4.19.2 Mass Moment of Inertia of a Homogeneous Sphere 252
4.19.3 Mass Moment of Inertia of a Right Circular Cone 252
4.19.4 Mass Moment of Inertia of Prism 254
4.19.5 Solved Problems 257
4.20 Mass Moment of Inertia Versus Area Moment of Inertia 262

4.21 Additional Problems 264
4.22 Summary 272
4.23 Review Questions 272
4.24 Multiple Choice Questions 275

Chapter-V: Kinemaics and Kinetics

5.0 Objectives 280
5.1 Introduction 280
5.2 Fundamental Definitions 280
5.3 Rectilinear Motion of A Particle 283
  5.3.1 Motion Under Variable Acceleration 284
  5.3.2 Solved Problems 286
  5.3.3 Motion Under Constant Acceleration (Uniform Acceleration) 290
  5.3.4 Distance Travelled in the T^{th} Second (in Constant Acceleration) 291
  5.3.5 Motion under Force of Gravity 291
  5.3.6 Solved Problems 291
5.4 Plane Curvilinear Motion 293
  5.4.1 Rectangular Co-Ordinates 295
  5.4.2 Polar Co-Ordinates 296
5.5 3-D Curvilinear Motion 299
5.6 Projectile Motion 299
  5.6.1 Examples of Projectile Motion 300
  5.6.2 Assumptions of Motion 300
  5.6.3 Equation for A Path of Projectile 301
  5.6.4 Solved Problems 303
5.7 Prinicple of Physical Independence of Motions 304
5.8 Horizontal Projectile 304
5.9 Devivation For The Path Of Horizontal Projectile 306
5.10 Derivation For the Path of an Oblique Projectile 308
5.11 Magnitude & Direction of reasultant velocity in Oblique Projection 312
  5.11.1 Solved Problems 313
5.12 Relative and Constrained Motion 317
5.13 Relationship Between Circular Motion and Linear Motion 318
  5.13.1 Solved Problems 318
5.14 Newton's 2nd Law 320
5.15 Kinetics of Rigid Bodies 322
5.16 General Principles in Dynamics 323

5.17 Motion and its Types 324
5.18 Types of Motion 324
5.19 Instantaneous Centre of Rotation in Plane Motion 326
 5.19.1 Solved Problems 328
5.20 D'Alembert's Principle 329
 5.20.1 Application of D'Alembert's Principle 330
 5.20.2 Solved Problems 331
5.21 Principle of Work & Energy 333
 5.21.1 Plane Motion of Connected Bodies 334
 5.21.2 Solved Problems 335
5.22 Kinetics of Rotary Motion 337
 5.22.1 Moment of Momentum (or) Angular Momentum (H) 337
 5.22.2 Kinetic Energy of Rotating Bodies 337
 5.22.3 Radius of Gyration 338
 5.22.4 Newton's Law for Rotary Motion 338
 5.22.5 Equation of Motion 338
 5.22.6 Solved Problems 339
5.23 Additional Problems 342
5.24 Summary 352
5.25 Review Questions 353
5.26 Multiple Choice Questions 354

Chapter-VI: Work, Power and Energy and Mechanical Vibrations

6.0 Objectives 360
6.1 Introduction 360
6.2 Work 360
 6.2.1 Units of Work 362
 6.2.2 Solved Problems 362
 6.2.3 Work done by Torque 363
6.3 Power 363
 6.3.1 Units of Power 364
 6.3.2 Power Developed by a Torque 365
 6.3.3 Solved Problems 365
6.4 Energy 366
 6.4.1 Units of Energy 366
 6.4.2 Mechanical Energy 366
 6.4.3 Solved Problems 368

6.5	Impulse - Momentum	370
6.5.1	Principle of Impulse and Momentum	370
6.5.2	Law of Conservation of Momentum	370
6.5.3	Linear Impulse-Momentum	371
6.5.4	Angular Momentum	372
6.5.5	Conservation of Angular Momentum	373
6.5.6	Solved Problems	373
6.6	Impact	375
6.6.1	Direct Central Impact	375
6.6.2	Oblique of Indirect Impact	376
6.6.3	Coefficient of Restitution (e)	377
6.6.4	Loss of Kinetic Energy	377
6.6.5	Solved Problems	377
6.7	Vibration	379
6.8	Basic Definitions	379
6.9	Free and Forced Vibrations	380
6.9.1	Types of Free Vibration	381
6.9.2	Solved problems	382
6.9.3	Free Vibrations Without Damping	384
6.9.4	Forced Vibrations of Single Degree of Freedom System to Harmonic Excitation Force	390
6.10	Resonance and its Effects	390
6.11	Degree of Freedom	392
6.12	Single Degree of Freedom System	393
6.12.1	Rigid Body Oscillations	393
6.12.2	Solved Problems	394
6.12.3	Spring-Mass-Damper Systems	395
6.13	Free Vibrations without Damping and Single Degree of Freedom System	400
6.13.1	Solved Problems	403
6.14	Pendulum and Types of Pendulum	406
6.14.1	Types of Pendulums	406
6.14.2	Solved Problems	410
6.14.3	Applications of Pendulums	413
6.15	Additional Problems	414
6.16	Outcomes	419
6.17	Summary	419
6.18	Review Questions	419
6.19	Multiple Choice Questions	420

Engineering Mechanics

Dr. M. Sreenivasa Kumar
Dr. D. Suneel
Mr. Ch. Sekhar

SINCE 23

Our Engineering Titles

₹ 523/-

ISBN 978-81-953919-2-9

9 788195 391929

Sri Krishna Techno Books
Enlighten your career...

StudentsHelpline Group

amazon.in

AatmaNirbharBharat Abhiyan

+91 9392575657

Spectrum
EDUCATION

As per CBCS

Engineering Mechanics

Dr. M. Sreenivasa Kumar   Dr. D. Suneel
Mr. Ch. Sekhar

Engineering Mechanics

Chapter-1: Introduction to Engineering Mechanics

1.0	Objectives	2
1.1	Introduction	2
1.2	Engineering Mechanics	2
1.3	Classification of Engineering Mechanics	3
1.4	Applications of Engineering Mechanics	5
1.5	Fundamental Concepts	5
1.6	Fundamentals of Vectors	7
1.6.1	Types of Vectors	8
1.6.2	Addition and Subtraction of Vectors	8
1.6.3	Dot Product of Vectors	10
1.6.4	Cross Product of Vectors	10
1.7	Components in Space	11
1.7.1	Resctangular Components of a Force in Space	11
1.7.2	Resultant	12
1.8	Basic laws of Mechanics	12
1.8.1	Newtons law of motion	12
1.8.2	Parallelogram law of forces	13
1.8.3	Traingle law of forces	15
1.8.4	Polygon of forces	15
1.8.5	Lami's theorem	16
1.8.6	Principles of Transmissibilty	17
1.9	Equilibrium of A Particle	17
1.9.1	Particle Equilibrium in 2-Dimensions	18
1.9.2	Particle Equilibrium in 3-Dimensions	19
1.10	Rigid Body Equilibrium	20
1.11	Classification of System of Forces	21
1.12	Characteristics of Various System Forces	22
1.13	Moment of Forces	23
1.13.1	Varigons Theorem	25
1.13.2	Applications of Varigon's Theorem	25
1.14	Couple	26
1.14.1	Moment of A Couple	26
1.14.2	Properties of A Couple	27

1.15 Resultant of Force 27
1.16 Solved Problems 30
1.17 Equilibrium of System of Forces 37
1.17.1 Equations of Equilibrium 37
1.17.2 Support Conditions 37
1.17.3 Link Representation 38
1.18 Free Body Diagrams 39
1.18.1 Construction of Free Body Diagram 40
1.18.2 Examples of Free Body Diagram 40
1.19 Equations of Equilibrium 42
1.20 Equilibrium of Spatial System 43
1.20.1 Solved Problems 45
1.21 Static Indeterminacy 50
1.22 Additional Problems 52
1.23 Summary 68
1.24 Review Questions 69
1.25 Multiple Choice Questions 73

Chapter-II: Friction

2.0 Objectives 80
2.1 Introduction 80
2.2 Friction 80
2.2.1 Factors that Affect Friction 81
2.2.2 Causes of Friction 81
2.3 Examples of Friction 82
2.4 Properties of Frictional Forces 82
2.5 Types of Friction 82
2.6 Methods of Increasing Friction 83
2.7 Methods of Reducing Friction 84
2.8 Limiting Friction 84
2.9 Laws of Friction 85
2.9.1 Static Laws of Friction 85
2.9.2 Kinetic Laws of Friction 85
2.9.3 Rolling Laws of Friction 86
2.10 Co-Efficient of Friction 86
2.10.1 Coefficient of Static Friction 87
2.10.2 Coefficient of Kinetic Friction 87

2.10.3 Co-efficient of Rolling Friction 88

2.10.4 Solved Problems 88

2.11 Friction Angles 92

2.11.1 Angle of Friction 92

2.11.2 Angle of Repose 93

2.11.3 Cone of Friction 95

2.12 Motion of Bodies 96

2.12.1 Solved Problems 98

2.13 Wedge Friction 100

2.13.1 Solved Problems 102

2.14 Screw Friction 104

2.14.1 Differential Screw Jack 105

2.14.2 Solved Problems 106

2.15 Ladder Friction 108

2.16 Advantages and Disadvantages of Friction 108

2.17 Additional Problems 110

2.18 Summary 121

2.19 Review Questions 121

2.20 Multiple Choice Questions 123

Chapter-III: Cetroid and Centre of Gravity

3.0 Objectives 130

3.1 Introduction 130

3.2 Centroid 130

3.3 Fundamental Definitions 131

3.4 Centroidal Axis 132

3.5 Axis of Symmetry 133

3.6 Centroids of Areas and Lines 134

3.7 Centroid of Volume 135

3.8 Symmetry and Signs 136

3.9 Centroid of Symmetrical Figures 137

3.10 First Moment and Centroid 137

3.11 Determination of Centroid from First Principle 138

3.12 Centroid of Simple Figures from Basic Principle 139

3.12.1 Centroid of a Triangle 139

3.12.2 Centroid of a Semicircle 140

3.12.3 Centroid of Sector of a Circle 140

3.12.4 Centroid of Parabolic Spandrel 141
3.13 Methods of Determination of Centroid 143
3.13.1 Analytical Method for Location of the Centroid 143
3.13.2 Graphical Method 144
3.13.3 Experimental Method 145
3.14 Centroid by Integration 146
3.15 Solved Problems 147
3.16 Composite Areas 156
3.17 Stuctural Sections 157
3.18 Centroid of Composite Figures 157
3.18.1 Solved Problems 159
3.19 Gravity 167
3.20 Centre of Gravity 167
3.21 Centre of Mass 168
3.22 Centre of Gravity of a Flat Plate 169
3.23 Centre of Gravity from Basic Principles 170
3.23.1 Centre of Gravity of Simple Figures 171
3.24 Centre of Gravity of Composite Bodies 171
3.25 Method for Finding Centre of Gravity 171
3.25.1 Solved Problems 174
3.26 Differences Between Center of Gravity and Centroid 177
3.27 Pappus and Guldings Theorem 177
3.27.1 Applications of Pappus and Guldinus Theorems 179
3.27.2 Solved Problems 179
3.28 Additional Problems 181
3.29 Summary 193
3.30 Review Questions 193
3.31 Multiple Choice Questions 195

Chapter-IV: Area Moment of Inertia

4.0 Objectives 200
4.1 Introduction 200
4.2 Moment of Inertia 200
4.3 Concept of Moment of Inertia 201
4.3.1 Units of Moment of Inertia 202
4.4 Moment of Inertia of A Plane Area 202
4.5 Procedure for Analysis in Moment of Inertia 203

4.5.1 Simple Planar Areas 203
4.5.2 Composite Areas 204
4.6 Moment of Inertia of Plane Sections from First Principles 205
4.7 Moment of Inertia of Standard Sections 207
4.7.1 Solved Problems 211
4.8 Moment of Inertia of A Composite Figures 214
4.8.1 Solved Problems 216
4.9 Polar Moment of Inertia 221
4.10 Radius of Gyration 222
4.11 Perpendicalar Axis Theorem 223
4.12 Parallel Axis Theorem 224
4.13 Solved Problems 225
4.14 Product of Inertia 229
4.14.1 Product of Inertia of a Right Angle Triangle with Respect to x and y- Axis 230
4.14.2 Product of Inertia of Rectangle with Respect to x and y-Axis 231
4.14.3 Product of Inertia of a Quarter Circle with Respect to x and y-Axis 231
4.14.4 Solved Problems 232
4.15 Mass Moment of Inertia 234
4.16 Procedure for Determination of Mass Moment of Inertia 235
4.17 Mass Moment of Inertia of Simple Solids 236
4.17.1 Mass Moment of Inertia of a Rectangular Plate 236
4.17.2 Mass Moment of Inertia of a Slender Rod 237
4.17.3 Mass Moment of Inertia of a Slender Rod with Inclination to y-axis 237
4.17.4 Mass Moment of Inertia of a Homogeneous Thin Plate 238
4.17.5 Mass Moment of Inertia of a Thin Circular Disc 238
4.17.6 Mass Moment of Inertia of a Circular Ring 239
4.17.7 Solved Problems 240
4.18 Transfer Formula for Mass Moments of Inertia 247
4.18.1 Solved Problems 248
4.19 Mass Moment of Inertia of Composite Bodies 250
4.19.1 Mass Moment of Inertia of a Circular Cylinder 250
4.19.2 Mass Moment of Inertia of a Homogeneous Sphere 252
4.19.3 Mass Moment of Inertia of a Right Circular Cone 252
4.19.4 Mass Moment of Inertia of Prism 254
4.19.5 Solved Problems 257
4.20 Mass Moment of Inertia Versus Area Moment of Inertia 262

4.21 Additional Problems 264
4.22 Summary 272
4.23 Review Questions 272
4.24 Multiple Choice Questions 275

Chapter-V: Kinemaics and Kinctics

5.0 Objectives 280
5.1 Introduction 280
5.2 Fundamental Definitions 280
5.3 Rectilinear Motion of A Particle 283
5.3.1 Motion Under Variable Acceleration 284
5.3.2 Solved Problems 286
5.3.3 Motion Under Constant Acceleration (Uniform Acceleration) 290
5.3.4 Distance Travelled in the T^{th} Second (in Constant Acceleration) 291
5.3.5 Motion under Force of Gravity 291
5.3.6 Solved Problems 291
5.4 Plane Curvilinear Motion 293
5.4.1 Rectangular Co-Ordinates 295
5.4.2 Polar Co-Ordinates 296
5.5 3-D Curvilinear Motion 299
5.6 Projectile Motion 299
5.6.1 Examples of Projectile Motion 300
5.6.2 Assumptions of Motion 300
5.6.3 Equation for A Path of Projectile 301
5.6.4 Solved Problems 303
5.7 Prinicple of Physical Independence of Motions 304
5.8 Horizontal Projectile 304
5.9 Devivation For The Path Of Horizontal Projectile 306
5.10 Derivation For the Path of an Oblique Projectile 308
5.11 Magnitude & Direction of reasultant velocity in Oblique Projection 312
5.11.1 Solved Problems 313
5.12 Relative and Constrained Motion 317
5.13 Relationship Between Circular Motion and Linear Motion 318
5.13.1 Solved Problems 318
5.14 Newton's 2nd Law 320
5.15 Kinetics of Rigid Bodies 322
5.16 General Principles in Dynamics 323

5.17 Motion and its Types 324
5.18 Types of Motion 324
5.19 Instantaneous Centre of Rotation in Plane Motion 326
5.19.1 Solved Problems 328
5.20 D'Alembert's Principle 329
5.20.1 Application of D'Alembert's Principle 330
5.20.2 Solved Problems 331
5.21 Principle of Work & Energy 333
5.21.1 Plane Motion of Connected Bodies 334
5.21.2 Solved Problems 335
5.22 Kinetics of Rotary Motion 337
5.22.1 Moment of Momentum (or) Angular Momentum (H) 337
5.22.2 Kinetic Energy of Rotating Bodies 337
5.22.3 Radius of Gyration 338
5.22.4 Newton's Law for Rotary Motion 338
5.22.5 Equation of Motion 338
5.22.6 Solved Problems 339
5.23 Additional Problems 342
5.24 Summary 352
5.25 Review Questions 353
5.26 Multiple Choice Questions 354

Chapter-VI: Work, Power and Energy and Mechanical Vibrations

6.0 Objectives 360
6.1 Introduction 360
6.2 Work 360
6.2.1 Units of Work 362
6.2.2 Solved Problems 362
6.2.3 Work done by Torque 363
6.3 Power 363
6.3.1 Units of Power 364
6.3.2 Power Developed by a Torque 365
6.3.3 Solved Problems 365
6.4 Energy 366
6.4.1 Units of Energy 366
6.4.2 Mechanical Energy 366
6.4.3 Solved Problems 368

6.5 Impulse - Momentum 370
- 6.5.1 Principle of Impulse and Momentum 370
- 6.5.2 Law of Conservation of Momentum 370
- 6.5.3 Linear Impulse-Momentum 371
- 6.5.4 Angular Momentum 372
- 6.5.5 Conservation of Angular Momentum 373
- 6.5.6 Solved Problems 373

6.6 Impact 375
- 6.6.1 Direct Central Impact 375
- 6.6.2 Oblique of Indirect Impact 376
- 6.6.3 Coefficient of Restitution (e) 377
- 6.6.4 Loss of Kinetic Energy 377
- 6.6.5 Solved Problems 377

6.7 Vibration 379

6.8 Basic Definitions 379

6.9 Free and Forced Vibrations 380
- 6.9.1 Types of Free Vibration 381
- 6.9.2 Solved problems 382
- 6.9.3 Free Vibrations Without Damping 384
- 6.9.4 Forced Vibrations of Single Degree of Freedom System to Harmonic Excitation Force 390

6.10 Resonance and its Effects 390

6.11 Degree of Freedom 392

6.12 Single Degree of Freedom System 393
- 6.12.1 Rigid Body Oscillations 393
- 6.12.2 Solved Problems 394
- 6.12.3 Spring-Mass-Damper Systems 395

6.13 Free Vibrations without Damping and Single Degree of Freedom System 400
- 6.13.1 Solved Problems 403

6.14 Pendulum and Types of Pendulum 406
- 6.14.1 Types of Pendulums 406
- 6.14.2 Solved Problems 410
- 6.14.3 Applications of Pendulums 413

6.15 Additional Problems 414

6.16 Outcomes 419

6.17 Summary 419

6.18 Review Questions 419

6.19 Multiple Choice Questions 420

Engineering Mechanics

Dr. M. Sreenivasa Kumar
Dr. D. Suneel
Mr. Ch. Sekhar

23 SINCE

Our Engineering Titles

ISBN 978-81-953919-2-9
9 788195 391929

Spectrum EDUCATION

As per CBCS

Engineering Mechanics

Dr. M. Sreenivasa Kumar
Dr. D. Suneel
Mr. Ch. Sekhar

SriKrishna

Engineering Mechanics

Chapter-1: Introduction to Engineering Mechanics

1.0 Objectives 2
1.1 Introduction 2
1.2 Engineering Mechanics 2
1.3 Classification of Engineering Mechanics 3
1.4 Applications of Engineering Mechanics 5
1.5 Fundamental Concepts 5
1.6 Fundamentals of Vectors 7
1.6.1 Types of Vectors 8
1.6.2 Addition and Subtraction of Vectors 8
1.6.3 Dot Product of Vectors 10
1.6.4 Cross Product of Vectors 10
1.7 Components in Space 11
1.7.1 Resctangular Components of a Force in Space 11
1.7.2 Resultant 12
1.8 Basic laws of Mechanics 12
1.8.1 Newtons law of motion 12
1.8.2 Parallelogram law of forces 13
1.8.3 Traingle law of forces 15
1.8.4 Polygon of forces 15
1.8.5 Lami's theorem 16
1.8.6 Principles of Transmissibilty 17
1.9 Equilibrium of A Particle 17
1.9.1 Particle Equilibrium in 2-Dimensions 18
1.9.2 Particle Equilibrium in 3-Dimensions 19
1.10 Rigid Body Equilibrium 20
1.11 Classification of System of Forces 21
1.12 Characteristics of Various System Forces 22
1.13 Moment of Forces 23
1.13.1 Varigons Theorem 25
1.13.2 Applications of Varigon's Theorem 25
1.14 Couple 26
1.14.1 Moment of A Couple 26
1.14.2 Properties of A Couple 27

1.15 Resultant of Force 27
1.16 Solved Problems 30
1.17 Equilibrium of System of Forces 37
1.17.1 Equations of Equilibrium 37
1.17.2 Support Conditions 37
1.17.3 Link Representation 38
1.18 Free Body Diagrams 39
1.18.1 Construction of Free Body Diagram 40
1.18.2 Examples of Free Body Diagram 40
1.19 Equations of Equilibrium 42
1.20 Equilibrium of Spatial System 43
1.20.1 Solved Problems 45
1.21 Static Indeterminacy 50
1.22 Additional Problems 52
1.23 Summary 68
1.24 Review Questions 69
1.25 Multiple Choice Questions 73

Chapter-II: Friction

2.0 Objectives 80
2.1 Introduction 80
2.2 Friction 80
2.2.1 Factors that Affect Friction 81
2.2.2 Causes of Friction 81
2.3 Examples of Friction 82
2.4 Properties of Frictional Forces 82
2.5 Types of Friction 82
2.6 Methods of Increasing Friction 83
2.7 Methods of Reducing Friction 84
2.8 Limiting Friction 84
2.9 Laws of Friction 85
2.9.1 Static Laws of Friction 85
2.9.2 Kinetic Laws of Friction 85
2.9.3 Rolling Laws of Friction 86
2.10 Co-Efficient of Friction 86
2.10.1 Coefficient of Static Friction 87
2.10.2 Coefficient of Kinetic Friction 87

2.10.3 Co-efficient of Rolling Friction 88
2.10.4 Solved Problems 88
2.11 Friction Angles 92
2.11.1 Angle of Friction 92
2.11.2 Angle of Repose 93
2.11.3 Cone of Friction 95
2.12 Motion of Bodies 96
2.12.1 Solved Problems 98
2.13 Wedge Friction 100
2.13.1 Solved Problems 102
2.14 Screw Friction 104
2.14.1 Differential Screw Jack 105
2.14.2 Solved Problems 106
2.15 Ladder Friction 108
2.16 Advantages and Disadvantages of Friction 108
2.17 Additional Problems 110
2.18 Summary 121
2.19 Review Questions 121
2.20 Multiple Choice Questions 123

Chapter-III: Cetroid and Centre of Gravity

3.0 Objectives 130
3.1 Introduction 130
3.2 Centroid 130
3.3 Fundamental Definitions 131
3.4 Centroidal Axis 132
3.5 Axis of Symmetry 133
3.6 Centroids of Areas and Lines 134
3.7 Centroid of Volume 135
3.8 Symmetry and Signs 136
3.9 Centroid of Symmetrical Figures 137
3.10 First Moment and Centroid 137
3.11 Determination of Centroid from First Principle 138
3.12 Centroid of Simple Figures from Basic Principle 139
3.12.1 Centroid of a Triangle 139
3.12.2 Centroid of a Semicircle 140
3.12.3 Centroid of Sector of a Circle 140

3.12.4 Centroid of Parabolic Spandrel 141
3.13 Methods of Determination of Centroid 143
3.13.1 Analytical Method for Location of the Centroid 143
3.13.2 Graphical Method 144
3.13.3 Experimental Method 145
3.14 Centroid by Integration 146
3.15 Solved Problems 147
3.16 Composite Areas 156
3.17 Stuctural Sections 157
3.18 Centroid of Composite Figures 157
3.18.1 Solved Problems 159
3.19 Gravity 167
3.20 Centre of Gravity 167
3.21 Centre of Mass 168
3.22 Centre of Gravity of a Flat Plate 169
3.23 Centre of Gravity from Basic Principles 170
3.23.1 Centre of Gravity of Simple Figures 171
3.24 Centre of Gravity of Composite Bodies 171
3.25 Method for Finding Centre of Gravity 171
3.25.1 Solved Problems 174
3.26 Differences Between Center of Gravity and Centroid 177
3.27 Pappus and Guldings Theorem 177
3.27.1 Applications of Pappus and Guldinus Theorems 179
3.27.2 Solved Problems 179
3.28 Additional Problems 181
3.29 Summary 193
3.30 Review Questions 193
3.31 Multiple Choice Questions 195

Chapter-IV: Area Moment of Inertia

4.0 Objectives 200
4.1 Introduction 200
4.2 Moment of Inertia 200
4.3 Concept of Moment of Inertia 201
4.3.1 Units of Moment of Inertia 202
4.4 Moment of Inertia of A Plane Area 202
4.5 Procedure for Analysis in Moment of Inertia 203

4.5.1 Simple Planar Areas 203
4.5.2 Composite Areas 204
4.6 Moment of Inertia of Plane Sections from First Principles 205
4.7 Moment of Inertia of Standard Sections 207
4.7.1 Solved Problems 211
4.8 Moment of Inertia of A Composite Figures 214
4.8.1 Solved Problems 216
4.9 Polar Moment of Inertia 221
4.10 Radius of Gyration 222
4.11 Perpendicalar Axis Theorem 223
4.12 Parallel Axis Theorem 224
4.13 Solved Problems 225
4.14 Product of Inertia 229
4.14.1 Product of Inertia of a Right Angle Triangle with Respect to x and y- Axis 230
4.14.2 Product of Inertia of Rectangle with Respect to x and y-Axis 231
4.14.3 Product of Inertia of a Quarter Circle with Respect to x and y-Axis 231
4.14.4 Solved Problems 232
4.15 Mass Moment of Inertia 234
4.16 Procedure for Determination of Mass Moment of Inertia 235
4.17 Mass Moment of Inertia of Simple Solids 236
4.17.1 Mass Moment of Inertia of a Rectangular Plate 236
4.17.2 Mass Moment of Inertia of a Slender Rod 237
4.17.3 Mass Moment of Inertia of a Slender Rod with Inclination to y-axis 237
4.17.4 Mass Moment of Inertia of a Homogeneous Thin Plate 238
4.17.5 Mass Moment of Inertia of a Thin Circular Disc 238
4.17.6 Mass Moment of Inertia of a Circular Ring 239
4.17.7 Solved Problems 240
4.18 Transfer Formula for Mass Moments of Inertia 247
4.18.1 Solved Problems 248
4.19 Mass Moment of Inertia of Composite Bodies 250
4.19.1 Mass Moment of Inertia of a Circular Cylinder 250
4.19.2 Mass Moment of Inertia of a Homogeneous Sphere 252
4.19.3 Mass Moment of Inertia of a Right Circular Cone 252
4.19.4 Mass Moment of Inertia of Prism 254
4.19.5 Solved Problems 257
4.20 Mass Moment of Inertia Versus Area Moment of Inertia 262

4.21 Additional Problems 264
4.22 Summary 272
4.23 Review Questions 272
4.24 Multiple Choice Questions 275

Chapter-V: Kinemaics and Kinetics

5.0 Objectives 280
5.1 Introduction 280
5.2 Fundamental Definitions 280
5.3 Rectilinear Motion of A Particle 283
5.3.1 Motion Under Variable Acceleration 284
5.3.2 Solved Problems 286
5.3.3 Motion Under Constant Acceleration (Uniform Acceleration) 290
5.3.4 Distance Travelled in the T^{th} Second (in Constant Acceleration) 291
5.3.5 Motion under Force of Gravity 291
5.3.6 Solved Problems 291
5.4 Plane Curvilinear Motion 293
5.4.1 Rectangular Co-Ordinates 295
5.4.2 Polar Co-Ordinates 296
5.5 3-D Curvilinear Motion 299
5.6 Projectile Motion 299
5.6.1 Examples of Projectile Motion 300
5.6.2 Assumptions of Motion 300
5.6.3 Equation for A Path of Projectile 301
5.6.4 Solved Problems 303
5.7 Prinicple of Physical Independence of Motions 304
5.8 Horizontal Projectile 304
5.9 Devivation For The Path Of Horizontal Projectile 306
5.10 Derivation For the Path of an Oblique Projectile 308
5.11 Magnitude & Direction of reasultant velocity in Oblique Projection 312
5.11.1 Solved Problems 313
5.12 Relative and Constrained Motion 317
5.13 Relationship Between Circular Motion and Linear Motion 318
5.13.1 Solved Problems 318
5.14 Newton's 2nd Law 320
5.15 Kinetics of Rigid Bodies 322
5.16 General Principles in Dynamics 323

5.17 Motion and its Types 324
5.18 Types of Motion 324
5.19 Instantaneous Centre of Rotation in Plane Motion 326
5.19.1 Solved Problems 328
5.20 D'Alembert's Principle 329
5.20.1 Application of D'Alembert's Principle 330
5.20.2 Solved Problems 331
5.21 Principle of Work & Energy 333
5.21.1 Plane Motion of Connected Bodies 334
5.21.2 Solved Problems 335
5.22 Kinetics of Rotary Motion 337
5.22.1 Moment of Momentum (or) Angular Momentum (H) 337
5.22.2 Kinetic Energy of Rotating Bodies 337
5.22.3 Radius of Gyration 338
5.22.4 Newton's Law for Rotary Motion 338
5.22.5 Equation of Motion 338
5.22.6 Solved Problems 339
5.23 Additional Problems 342
5.24 Summary 352
5.25 Review Questions 353
5.26 Multiple Choice Questions 354

Chapter-VI: Work, Power and Energy and Mechanical Vibrations

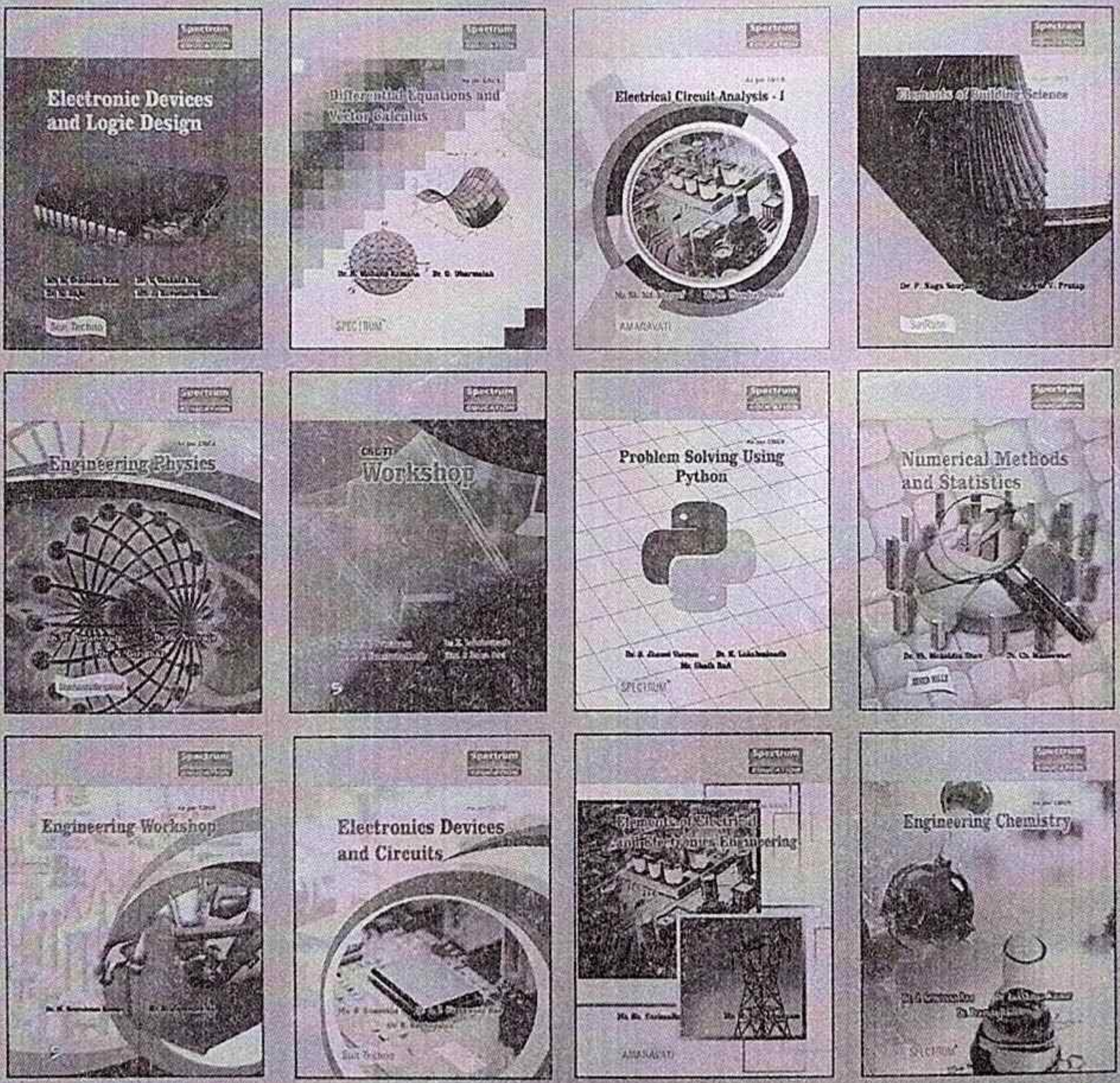
6.0 Objectives 360
6.1 Introduction 360
6.2 Work 360
6.2.1 Units of Work 362
6.2.2 Solved Problems 362
6.2.3 Work done by Torque 363
6.3 Power 363
6.3.1 Units of Power 364
6.3.2 Power Developed by a Torque 365
6.3.3 Solved Problems 365
6.4 Energy 366
6.4.1 Units of Energy 366
6.4.2 Mechanical Energy 366
6.4.3 Solved Problems 368

6.5 Impulse - Momentum 370
6.5.1 Principle of Impulse and Momentum 370
6.5.2 Law of Conservation of Momentum 370
6.5.3 Linear Impulse-Momentum 371
6.5.4 Angular Momentum 372
6.5.5 Conservation of Angular Momentum 373
6.5.6 Solved Problems 373
6.6 Impact 375
6.6.1 Direct Central Impact 375
6.6.2 Oblique of Indirect Impact 376
6.6.3 Coefficient of Restitution (e) 377
6.6.4 Loss of Kinetic Energy 377
6.6.5 Solved Problems 377
6.7 Vibration 379
6.8 Basic Definitions 379
6.9 Free and Forced Vibrations 380
6.9.1 Types of Free Vibration 381
6.9.2 Solved problems 382
6.9.3 Free Vibrations Without Damping 384
6.9.4 Forced Vibrations of Single Degree of Freedom System to Harmonic Excitation Force 390
6.10 Resonance and its Effects 390
6.11 Degree of Freedom 392
6.12 Single Degree of Freedom System 393
6.12.1 Rigid Body Oscillations 393
6.12.2 Solved Problems 394
6.12.3 Spring-Mass-Damper Systems 395
6.13 Free Vibrations without Damping and Single Degree of Freedom System 400
6.13.1 Solved Problems 403
6.14 Pendulum and Types of Pendulum 406
6.14.1 Types of Pendulums 406
6.14.2 Solved Problems 410
6.14.3 Applications of Pendulums 413
6.15 Additional Problems 414
6.16 Outcomes 419
6.17 Summary 419
6.18 Review Questions 419
6.19 Multiple Choice Questions 420

Engineering Mechanics

Dr. M. Sreenivasa Kumar
Dr. D. Suneel
Mr. Ch. Sekhar

Our Engineering Titles



ISBN 978-81-953919-2-9
9 788195 391929