LIST OF MINOR COURSES
(Applicable for the Batches Admitted from 2020-21)

For All B.Tech Programmes under R-20

NARASARAOPETA ENGINEERING COLLEGE (AUTONOMOUS)

Kotappakonda Road, Yellamanda (Post), Narasaropet – 522601, Palnadu District, AP
Approved by AICTE, New Delhi & Permanently affiliated to JNTUK, Kakinada, Code: 47, NIRF Ranking in 251 – 300 Band
Accredited by NBA (CSE, ECE) & NAAC 'A+' Grade, ISO 9001: 2015 Certified Institution
Phone: 08647-239904 **Website: www.nrtec.in**

DEPARTMENT OF CIVIL ENGG

LIST OF MINORS

S.No	CODE	Subject	Cat Code	Internal Marks	External Marks	Total Marks	L	T	P	Credits
1	R20CCMN01	Introduction to Civil Engineering- Concepts And Materials	PC	30	70	100	4	0	0	4
2	R20CCMN02	Geomatics	PC	30	70	100	4	0	0	4
3	R20CCMN05	Fundamentals of Structural Engineering	PC	30	70	100	4	0	0	4
4	R20CCMN06	Environmental Engineering	PC	30	70	100	4	0	0	4

MINORS	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	4	0	0	30	70	100	4
CODE: R20CCMN01	**INTRODUCTION TO CIVIL ENGINEERING CONCEPTS AND MATERIALS**						

COURSE OBJECTIVES:

The course is designed to know the basic civil engineering concepts and materials.

COURSE OUTCOMES:

CO 1: Classify rocks and identify particular type of stones

CO 2: Classify different types of bricks

CO 3: Perform laboratory tests of cement to determine properties of cement

CO 4: Identify types of defects of timber

CO 5: Identify and use different types of metals/alloys

UNIT-I

INTRODUCTION TO CIVIL ENGINEERING: Overview of Civil Engineering-Civil Engineering Landmarks-Impact (social, economic, environmental) of Civil Engineering on Society-Future directions-Job opportunities in Civil Engineering-Case studies-Hands-on projects- demonstrations and Field visit.

UNIT-II

CONSTRUCTION MATERIALS

BUILDING STONES:

Classification of Rocks: (General Review) - Geological classification: Igneous, sedimentary and metamorphic rocks - Chemical classification; Calcareous, argillaceous and siliceous rocks-Physical classification: Unratified, stratified and foliated rocks -General characteristics of stones –Requirements of good building stones -Identification of common building stones- Various uses of stones in construction

UNIT-III

BRICKS

INTRODUCTION TO BRICKS - Raw materials for brick manufacturing and properties of good brick making earth - Manufacturing of bricks-Preparation of clay (manual/mechanically) - Moulding: hand moulding and machine moulding brick table; drying of bricks, burning of bricks, types of kilns (Bull's Trench Kiln and Hoffman's Kiln), process of burning, size and weight of standard brick; Classification and specifications of bricks as per BIS:

UNIT-IV

CONSTITUENTS OF CONCRETE (Cement, Aggregates): Proportioning of concrete, Fresh concrete, Hardened concrete, Quality control (Sampling, Acceptance, etc.), Transportation and placing, Testing of concrete (including NDT)

UNIT-V

TIMBER AND WOOD

Identification and uses of different types of timber: Teak, Deodar, Shisham, Sal, Mango, Kail, Chir, Fir, Hollock, Champ-Market forms of converted timber as per BIS Code-Seasoning of timber: Purpose, methods of seasoning as per BIS Code - Properties of timber and specifications of structural timber-Defects in timber, decay in timber -Preservation of timber and methods of treatment as per BIS

UNIT-V

TILES

Building tiles-Types of tiles-wall, ceiling, roofing and flooring tiles, Ceramic, terrazo and PVC tiles, their properties and uses, Vitrified tiles, Paver blocks, interlocking tiles -Stacking of bricks and tiles at site

METALS - Ferrous metals: Composition, properties and uses of cast iron, mild steel, HYSD steel, high tension steel as per BIS. Commercial forms of ferrous, metals. Aluminium & Stainless Steel.

TEXT BOOKS:

1. Dr.P.Naga Sowjanya, Er.K.V.Prataap,"Elements of Building Sciences", Sunraise Publications, ISBN:978-81-952678-2-8,2001.
2. S.C.Rangwala, K.S. Rangwala and P.S. Rangwala [2012], *Engineering materials*, CharotarPublishers, Anand.
3. Dr. B.C. Punmia [2008], *Building construction*, Laxmi Publications (P) Ltd., New Delhi.
4. Dr. N. Kumara Swamy and A. KameswaraRao [2012], *Building Planning and Drawing*, Charotar Publishers, Anand.
5. Gurucharan Singh and Jagdish Singh [2009], *Building Planning Designing and scheduling*, Standard publishers Distributors.

REFERENCE BOOKS:

1. S.K. Duggal [2012], *Building materials*, New Age international (P) Ltd., New Delhi.
2. N.L. Arora and B.L. Gupta [2014], *Building construction*, Satyaprakshan publications.
3. S.V. Deodhar [2005], *Building science and planning*, Khanna Publishers, New Delhi.
4. Bureau of Indian Standards, *National Building Code of India – 2016*, New Delhi.
5. V.K. Jain [2009], *Automation Systems in smart and Green Buildings*, Khanna Publications.
6. S.C. Rangwala [2009], *Civil Engineering Drawing*, Charotar Publishing Hous

MINORS	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	4	0	0	30	70	100	4
CODE: R20CCMN02	**GEOMATICS**						

COURSE OBJECTIVES:

The course is designed to know the Geomatics concepts.

COURSE OUTCOMES:

After the completion of the course student should be able to

CO1: Gain a broad understanding of Land Survey

CO2: Get accustoms with the angular and linear measurements.

CO3: Trained with recording the field information and necessary plot.

CO4: Contemporary issues and developments.

UNIT-I:

Introduction and Basic Concepts

Introduction, Objectives, classification and principles of surveying, Scales, Shrinkage of Map, Conventional symbols and Code of Signals, Surveying accessories, phases of surveying.

Measurement of Distances and Directions

Linear distances- Approximate methods, Direct Methods- Chains- Tapes, ranging, Tape corrections, indirect methods- optical methods.

Prismatic Compass- Bearings, included angles, Local Attraction, Magnetic Declination and dip.

UNIT-II

Leveling and Contouring

Leveling- Basics definitions, types of levels and leveling staves, temporary adjustments, methods of leveling, booking and Determination of levels- HI Method-Rise and Fall method, Effect of Curvature of Earth and Refraction.

Contouring- Characteristics and uses of Contours, Direct & Indirect methods of contour surveying, interpolation and sketching of Contours.

Plan Table Surveying: Introduction of Plane table surveying- Area by the method of radiation and intersection – Two point problem

Computation of Areas and Volumes: Areas- Determination of areas consisting of irregular boundary and regular boundary (coordinates, MDM, DMD methods), Planimeter.

Volumes- Computation of areas for level section and two level sections with and without transverse slopes, determination of volume of earth work in cutting and embankments, volume of borrow pits, capacity of reservoirs.

UNIT-III

Theodolite Surveying

Types of Theodolites, Fundamental Lines, temporary adjustments, measurement of horizontal angle by repetition method and reiteration method, measurement of vertical Angle, Trigonometrical leveling when base is accessible and inaccessible.

Traversing

Methods of traversing, traverse computations and adjustments, Gale's traverse table, Omitted measurements.

UNIT-IV

Tacheometric Surveying

Principles of Tacheometry, stadia and tangential methods of Tacheometry.

Curves Types of curves and their necessity, elements of simple curve, setting out of simple Curves, Introduction to compound curves.

UNIT-V

Modern Surveying Methods

Total Station and Global Positioning System. : Basic principles, classifications, applications, comparison with conventional surveying. Electromagnetic wave theory - electromagnetic distance measuring system - principle of working, E.D.M. method and EDM instruments, Components of GPS – space segment, control segment and user segment, reference systems, satellite orbits, GPS observations. Applications of GPS.

TEXT BOOKS:

1. Chandra A M, "Plane Surveying", New age International Pvt. Ltd., Publishers, New Delhi, 2002.
2. Chandra A M, "Higher Surveying", New age International Pvt. Ltd., Publishers, New Delhi, 2002.
3. Duggal S K, "Surveying (Vol – 1 & 2), Tata Mc.Graw Hill Publishing Co. Ltd. New Delhi, 2004.
4. Hoffman.B, H.Lichtenegga and J.Collins, Global Positioning System - Theory and Practice, Springer - Verlag Publishers, 2001.

REFERENCES:

1. Arthur R Benton and Philip J Taety, Elements of Plane Surveying, McGraw Hill – 2000
2. Arora K R "Surveying Vol 1, 2 & 3), Standard Book House, Delhi, 2004

MINORS	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	4	0	0	30	70	100	4
CODE: R20CCMN05	**FUNDAMENTALS OF STRUCTURAL ENGINEERING**						

COURSE OBJECTIVES:

Upon completion of the course, the student shall be able to

- Understand the concept Equilibrium of Co-Planar forces
- Understand the term Centroid
- Compute the Moment of Inertia and radius of gyration
- Calculate the simple Stresses and Strains in structural materials
- Determine Shear Force and Bending Moment of simple beams analytically

COURSE OUTCOMES:

At the end of the course, the students will be able to:

CO 1: Compute the resultant and moment of a force system and apply the equations of equilibrium for a generalized force system **(Apply)**

CO 2: Interpret the centroids, centers of gravity of inertia of simple geometric shapes and understand the physical applications of these properties. (**Apply**)

CO 3: Interpret the moments of inertia of simple geometric shapes and understand the physical applications of these properties. (**Apply**)

CO 4: Analyse the stresses and strains in a member subjected to different loadings and understand the strain energy under different load conditions. (**Understanding, Analysing**)

CO 5: Apply different methods and analyse the various beams subjected to different loads using shear force and bending moment diagrams (**Applying, Analysing**)

UNIT-I

FORCES & MOMENTS:

Definition of force - vectors and scalars - vector representation of a force - systems of forces - co-planar forces. Resultant of forces at a point – Parallelogram Law and Triangle Law of forces – Lami's theorem – Polygon law of forces –Resolution of forces. Parallel forces – like and unlike – moment of force -its units and sense-couple-moment of a couple – properties of a couple. Conditions of equilibrium of a rigid body subjected to a number of co-planar forces. Structural members supporting co - planar forces.

UNIT-II

CENTROID: Definitions – Centroid, Centre of gravity Position of Centroid of standard figures like rectangle, triangle, parallelogram, circle, semi-circle and trapezium. Determination of location of Centroid of standard sections- T, L, I, Channel section, Z section, built up sections consisting of RSJs & flange plates.

UNIT-III

MOMENT OF INERTIA:

Definition of Moment of Inertia Perpendicular and parallel axes theorems Moment of Inertia of standard sections like rectangle, triangle, circle and hallow circular sections Moment of Inertia of built up sections- T, L, I, Channel section, and Z sections using parallel axis theorem Moment of Inertia and radius of gyration of built-up sections consisting of the combinations of RSJ's & flange plates. Polar Moment of Inertia of solid and hollow circular sections using Perpendicular axis theorem.

UNIT-IV

SIMPLE STRESSES AND STRAINS:

Stress and strain – type of stresses and strains Stress strain curves for ductile materials- mild steel, elastic limit, Limit of proportionality, Yield point, Ultimate stress, breaking stress, Working stress and Factor of safety. Hooke's law – Young's modulus – deformation under axial load. Shear stress and Shear Strain – Modulus of rigidity. Longitudinal and lateral strain - Poisson's ratio, Bulk Modulus –relationship between elastic constants (proof not required, only problems).Composite sections – effect of axial loads Temperature stresses and strains – hoop stress. Resilience – strain energy-proof resilience and modulus of resilience – maximum instantaneous stress due to gradual, sudden and shock loading. Mechanical properties of materials - elasticity, plasticity, ductility, brittleness, malleability, stiffness, hardness, toughness, creep, fatigue- examples of materials which exhibit the above properties.

UNIT-V

SHEAR FORCE AND BENDING MOMENT:

Beams – Types of beams – Cantilevers – Simply supported –Overhanging – Fixed and Continuous. Types of supports – Roller – Hinged – Fixed, Explanation of S.F and B.M. at a section, Relation between rate of loading SF and BM Calculation of S.F. and B.M values at different sections for cantilevers Simply supported beams, overhanging beams under point loads and uniformly distributed loads, position and significance of points of contra flexure. Drawing S.F and B.M diagrams by
analytical methods – location of points of contra flexure.

TEXT BOOKS:

1. Engineering Mechanics – N. H.Dubey (Tata McGraw Hill)
2. Engineering Mechanics - R.S.Kurmi
3. Engineering Mechanics - P.K. Abdul Latheef

REFERENCE BOOKS

1. Engineering Mechanics & Statics – Dayaratnam
2. Engineering Mechanics - N. Srinivasulu,

MINORS	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
CODE: R20CCMN06	4	0	0	30	70	100	4
	ENVIRONMENTAL ENGINEERING						

COURSE OBJECTIVES:

- Outline planning and the design of water supply systems for a community/ town/ city.
- To impart the knowledge of selecting sources of water with reference to quality and quantity in a locality, for domestic usage.
- Provide knowledge of characterization of water and wastewater.
- To introduce various treatment options available and their design principles for water treatment and wastewater treatment at the household and municipal level.
- To elucidate the various collection and disposal options available for water and wastewater, including the distribution networks, layout, construction and maintenance.

COURSE OUTCOMES:

The students will be able to

CO 1: Assess the quality and quantity of water requirements for a city

CO 2: Design of different treatment units and distribution systems for water supply

CO 3: Analyze the characteristics, collection, conveyance and disposal of wastewater

CO 4: Design of sewers and various units in a wastewater treatment plant

CO 5: Design of secondary and biological treatment units

SYLLABUS

UNIT-I:

WATER DEMANDS- STANDARDS -SOURCES

Aspects of Environmental Engineering – Protected water supply – Need – Water borne diseases –Water demands – Fluctuations – Design period-Population forecast – Water quality

– Drinking water standards- Testing and significance – Quality and Quantity and other considerations of surface and sub- surface sources – Yield calculations – Intake works –Types of Intakes – Storage reservoir capacity – Systems of water supply – Requirements – Detection of leakages – Selection of pump – Economical diameter of pumping main.

UNIT– II:

TREATMENT OF WATER AND DISTRIBUTION

Water treatment, conventional treatment flow diagram –Sedimentation types – Principles – Design factors – Coagulation –Design of Clariflocculator – Filtration – Slow, Rapid gravity filters and Pressure filters – Design principles-Disinfection – Theory of Chlorination– Distribution systems– Layouts – Design- and analysis, Hardy Cross method and Equivalent Pipe method. Valves – Other appurtenances.

UNIT-III:

WASTEWATER MANAGEMENT

Introduction: Waste water treatment system – Definitions of terms – Collection and conveyance of sewage – Sewage flow rates – Storm water – Characteristics of sewage– Cycles of decay – BOD – COD – Ultimate disposal of sewage–self-purification of rivers– sewage farming.

UNIT-IV:

DESIGN OF SEWERS AND PRIMARY TREATMENT

Layouts – Design of sewers – Sewers appurtenances – Sewage pumping -Conventional sewage treatment – Primary treatment: - Screens – Grit chamber – Sedimentation tanks – Design principles. Septic tanks and Imhoff tanks - rural latrines – House plumbing – Appurtenances.

UNIT-V:

SECONDARY BIOLOGICAL TREATMENT 14 HOURS

Secondary treatment – Biological treatment – Trickling filters – Activated Sludge Process – Low cost waste treatment methods – Design of Oxidation ponds – Aerobic and Anaerobic lagoons. Sludge Digestion– Disposal.

TEXT BOOKS:

1. B.C. Punmia B C, A.K. Jain and A.K. Jain, ―Water Supply Engineering‖, LaxmiPublications.2nd Edition1995, Reprint 2005.
2. B.C. Punmia, A.K. Jain and A.K. Jain, ―Wastewater Engineering, Laxmi Publications, 2nd Edition 1998, Reprint 2014.

REFERENCE BOOKS:

1. S.K. Garg, ―Water Supply Engineering‖, Khanna Publishers, 26th revised Edition, New Delhi.2010.
2. S.K. Garg, ―Sewage disposal and Air Pollution Enginering‖, Khanna Publishers New Delhi. 36thEdition, 2017.
3. H.S. Peavy, D. Rowe, and G. Tchobanoglous, ―Environmental Engineering‖, McGraw HillPublishers, New Delhi. 1985.
4. G.S. Birdie and J.S. Birdie, ―Water Supply and Sanitary Engineering‖ Dhanpat Rai Publishing Company New Delhi, 6th Edition, 2002

DEPARTMENT OF EEE

R20_GENERAL MINOR TRACKS

S. No.	Subject Code	Subject	Cat. Code	L	T	P	Internal Marks	External Marks	Total Marks	Credits
1	R20CCMN08	Fundamentals of Electrical Circuit	PC	3	1	0	30	70	100	4
2	R20CCMN09	Concepts of Electrical Measurements	PC	3	1	0	30	70	100	4
3	R20CCMN10	Energy Audit and Conservation	PC	3	1	0	30	70	100	4
4	R20CCMN11	Electrical Machines	PC	3	1	0	30	70	100	4
5	R20CCMN12	Renewable Energy Technologies	PC	3	1	0	30	70	100	4
In addition to any of the four subjects, MOOC/NPTEL Courses for 04 credits (02 courses @ 2 credits each) are compulsory in the domain of Electrical and Electronics Engineering										

B. Tech Minor	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	1	0	30	70	100	4
Code: R20CCMN08	FUNDAMENTALS OF ELECTRICAL CIRCUIT						

COURSE OBJECTIVE:

This course introduces

- the basics of circuit concepts, electrical parameters, single phase AC circuits, magnetic circuits, resonance, network topology and network theorems

COURSE OUTCOMES:

At the end of the course, the student will be able to:

CO1: Apply network reduction techniques to simplify electrical circuits

CO2: Analyze electrical circuits using theorems.

CO3: Examine the performance of single-phase AC circuits.

CO4: Demonstrate the locus diagrams and magnetic circuits.

C**O5**: Evaluate the two-port network parameters.

UNIT – I: INTRODUCTION TO ELECTRICAL CIRCUITS

Circuit Concept, R-L-C Parameters, Voltage and Current Sources, Independent and Dependent Sources, Source Transformation, Voltage – Current relationship for Passive Elements (for different input signals –Square, Ramp, Saw tooth and Triangular). Kirchhoff's Laws, Nodal Analysis, Mesh Analysis, Star–to-Delta or Delta-to-Star Transformations

UNIT – II: NETWORK THEOREMS

Superposition, Reciprocity, Thevinin's, Norton's, Maximum Power Transfer, Milliman's and Compensation theorems for D.C excitations.

UNIT – III: SINGLE PHASE A.C. CIRCUITS

R.M.S. and Average values and form factor for different periodic wave forms, Steady State Analysis of R, L and C (in Series, Parallel and Series Parallel Combinations) with Sinusoidal Excitation, Concept of Reactance, Impedance, Susceptance and Admittance, Phase and Phase difference, Concept of Power Factor, Real and Reactive powers

UNIT – IV: LOCUS DIAGRAMS, RESONANCE AND MAGNETIC CIRCUITS

Locus diagrams - series R-L, R-C, R-L-C and parallel combination with variation of various parameters - Resonance-series, parallel circuits, concept of band width and Q factor. Magnetic circuits-Faraday's

laws of electromagnetic induction-concept of self and mutual inductance-dot convention-coefficient of coupling

.UNIT – V: TWO PORT NETWORKS

Two port networks, terminal pairs, relationship of two port variables, impedance parameters, admittance parameters, transmission parameters and hybrid parameters

TEXT BOOKS:

1. Electric Circuits - A.Chakrabarhty, Dhanipat Rai & Sons.2018
2. Network analysis - N.C Jagan and C. Lakhminarayana, BS publications.,3rd Edition,July 2015

REFERENCE BOOKS:

1. Engineering Circuit Analysis - William Hayt ,Jack E. Kemmerly, S M Durbin, Mc Graw Hill Companies, 9th Edition ,2020
2. Electric Circuit Analysis - K.S.Suresh Kumar, Pearson Education,1st Edition,2013.
3. Electrical Circuits - David A.Bell, Oxford University Press.2009.
4. Network Analysis and Circuits - M.Arshad, Infinity Science Press.2008.

B. Tech Minor	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	1	0	30	70	100	4
Code: R20CCMN09	CONCEPTS OF ELECTRICAL MEASUREMENTS						

COURSE OBJECTIVES:

To impart knowledge on the following topics:

- Basic functional elements of measuring instruments
- Fundamentals of measurement of power and energy
- various bridges, display devices and transducers

COURSE OUTCOMES:

Upon successful completion of the course, the students will be able to:

CO1: classify the performance of AC and DC measuring instruments

CO2: utilize the concepts of power and energy measurement

CO3: determine the circuit parameters using AC and DC bridges

CO4: explain the various storage and display devices

CO5: select appropriate transducers for measurement of physical phenomenon

UNIT I: MEASURING INSTRUMENTS

Errors in measurement, Classification, deflecting, control and damping torques, ammeters and voltmeters – PMMC, moving iron type instruments, shunts and multipliers. D.C. Potentiometer

UNIT II: MEASUREMENT OF POWER AND ENERGY

Principle and types of multi meters – Single and three phase watt meters and energy meters – Magnetic measurements – Determination of B-H curve and measurements of iron loss – Instrument transformers – Instruments for measurement of frequency and phase.

UNIT III: DC & AC BRIDGES

Method of measuring low, medium and high resistance –Wheat-stone's bridge, Kelvin's double bridge, loss of charge method. Measurement of inductance- Maxwell's bridge, Measurement of capacitance and loss angle– Schering Bridge.

UNIT IV: STORAGE AND DISPLAY DEVICES

Digital CRO, CRT display, LED, LCD & Dot matrix display Recorders, digital plotters and printers – Data Loggers. Magnetic disk and tape

UNIT V: TRANSDUCERS

Classification of transducers – Selection of transducers – Resistive, capacitive & inductive Transducers – Piezoelectric, Hall effect, optical and digital transducers.

TEXT BOOKS:

1. A.K. Sawhney, 'A Course in Electrical & Electronic Measurements & Instrumentation', hanpat Rai and Co, 2010.
2. J. B. Gupta, 'A Course in Electronic and Electrical Measurements', S. K. Kataria & Sons, Delhi, 2013.
3. Doebelin E.O. and Manik D.N., Measurement Systems – Applications and Design, Special Indian Edition, McGraw Hill Education Pvt. Ltd., 2007.

REFERENCES BOOKS:

1. H.S. Kalsi, 'Electronic Instrumentation', McGraw Hill, III Edition 2010.
2. D.V.S. Murthy, 'Transducers and Instrumentation', Prentice Hall of India Pvt Ltd, 2015.
3. David Bell, 'Electronic Instrumentation & Measurements', Oxford University Press, 2013.
4. Martin Reissland, 'Electrical Measurements', New Age International (P) Ltd., Delhi, 2001.
5. Alan. S. Morris, Principles of Measurements and Instrumentation, 2nd Edition, Prentice Hall of India, 2003.

WEB REFERENCES:

1. https://onlinecourses.nptel.ac.in/noc19_ee44/preview
2. https://www.vssut.ac.in/lecture_notes/lecture1423813026.pdf
3. https://mrcet.com/downloads/digital_notes/EEE/EMI%20DIGITAL%20NOTES.pdf

B. Tech Minor	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	1	0	30	70	100	4
Code: R20CCMN10	ENERGY AUDIT AND CONSERVATION						

COURSE OBJECTIVES:

- To learn principles of energy audit and Energy conservation act
- To estimate/calculate power factor of systems and propose suitable compensation techniques.
- To understand energy conservation in HVAC systems.
- To calculate life cycle costing analysis and return on investment on energy efficient technologies

COURSE OUTCOMES:

After completion of this course students will be able to

CO1: Illustrate energy efficiency, scope, conservation and technologies.

CO2: Interpret the controlling of energy management Evaluate power factor of systems and propose suitable compensation techniques.

CO3: Analyze life cycle costing analysis and return on investment on energy efficient technologies.

CO4: Calculate power factor of systems and propose suitable compensation techniques.

UNIT-I: BASIC PRINCIPLES OF ENERGY AUDIT

Energy audit- definitions, types of audit, energy index, cost index, pie charts, Sankey diagrams, load profiles, Energy conservation schemes- Energy audit of industries- energy saving potential, energy audit in process industry viz., thermal power station, energy audit in buildings, Smart Metering and its implementation.

UNIT-II: ENERGY MANAGEMENT

Principles of energy management, organizing energy management program, initiating, planning, controlling, promoting, monitoring, reporting- Energy manger, Qualities and functions

UNIT-III: POWER FACTOR AND ENERGY INSTRUMENTS

Power factor – Methods of improvement – Location of capacitors – Power factor with nonlinear loads – Effect of harmonics on Power factor – Numerical problems. Energy Instruments – Watt–hour meter – Data loggers – Thermocouples – Pyrometers – Lux meters – Tong testers – Power analyzer.

UNIT–IV: ECONOMIC ASPECTS AND ANALYSIS-I

Economics Analysis – Depreciation Methods – Time value of money – Rate of return – Present worth method – Replacement analysis – Life cycle costing analysis – Energy efficient motors (basic concepts).

UNIT-V: ECONOMIC ASPECTS AND ANALYSIS-II

Calculation of simple payback method – Net present worth method – Power factor correction – Lighting – Applications of life cycle costing analysis – Return on investment.

TEXT BOOKS:

1. Energy management by W.R. Murphy & G. Mckay Butter worth, Elsevier publications, 2012.
2. Energy efficient electric motors by John .C. Andreas, Marcel Dekker Inc Ltd–2nd edition, 1995.

REFERENCE BOOKS:

1. Electric Energy Utilization and Conservation by S C Tripathy, Tata McGraw hill publishing company Ltd. New Delhi.
2. Energy management by Paul o' Callaghan, Mc–Graw Hill Book company–1st edition, 1998.
3. Energy management hand book by W.C.Turner, John wiley and sons.
4. Energy management and conservation –k v Sharma and pvenkata seshaiah-I KInternational Publishing House pvt.ltd, 2011

B. Tech Minor	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	1	0	30	70	100	4
Code: R20CCMN11	ELECTRICAL MACHINES						

COURSE OBJECTIVES:

- This course enables the student to learn the principle, construction and performance characteristics of DC and AC Machines. It also deals with principle and constructional features of transformers.

COURSE OUTCOMES:

Upon successful completion of the course, the students will be able to:
CO 1: Analyze the performance of DC Machines
CO 2: Analyze the operation of transformer
CO 3: Analyze the performance of induction and synchronous machines
CO 4: Demonstrate the operation of special electrical machines

UNIT I: INTRODUCTION

Functional elements of an instrument - Static and dynamic characteristics - Errors in measurement - Statistical evaluation of measurement data – Standards and calibration- Principle and types of analog and digital voltmeters, ammeters.

UNIT II: SINGLE PHASE TRANSFORMERS & TESTING

Single phase transformers-types - constructional details- EMF equation- operation on no-load and on load - phasor diagrams- Equivalent circuit - losses and efficiency-regulation-OC and SC tests

UNIT III: INDUCTION MOTOR

Three-phase Induction motors-construction details-Production of a rotating magnetic field - principle of operation - rotor emf and rotor frequency - rotor reactance, rotor current and power factor- equivalent circuit-torque-slip characteristics

UNIT-IV: SYNCHRONOUS GENERATORS

Synchronous generator – construction, working principle- emf equation–types of rotors-–phasor diagrams-regulation methods – EMF, MMF methods – Applications

UNIT-V: SPECIAL ELECTRICAL MACHINES

Principle of operation and construction of ac servo motors-speed-torque characteristics, BLDC motor- Principle of operation and construction-Applications, stepper motor- Principle of operation and construction-Applications

TEXT BOOKS:

1. P. S. Bimbra, "Electrical Machines", Khanna Publishers, 6th Edition., 2003
2. I.J. Nagrath& D.P. Kothari, "Electric Machines", 4th Ed., Tata McGraw Hill Publishers, 2011.

REFERENCE BOOKS:

1. A. E. Fritzgerald, C. Kingsley and S. Umans, "Electric Machinary", 6th ed., McGraw-Hill Companies, 2003.
2. S. Kamakshaiah, "Electromechanics – I (D.C. Machines)", 2nd Ed., Hi-Tech Publishers, 2012.
3. Clayton & Hancock, "Performance and Design of D.C Machines", 2nd Ed., BPB Publishers, 2004.
4. S.K. Bhattacharya, "Electrical Machines", TMH, 6th Ed., 2014.

B. Tech Minor	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	1	0	30	70	100	4
Code: R20CCMN12	RENEWABLE ENERGY TECHNOLOGIES						

COURSE OBJECTIVES:

- This course enables the student to understand and analyze various renewable energy technologies.

COURSE OUTCOMES:

Upon successful completion of the course, the students will be able to:

CO 1: Explain the principles of renewable energy.

CO 2: Analyze the basic physics of solar and wind power generation

CO 3: Illustrate the ecological context of bio-energy

CO 4: Analyze the performance of fuel cells under different operating conditions for a given application

UNIT–I: PRINCIPLES OF RENEWABLE ENERGY

Introduction, energy and sustainable development, fundamentals, scientific principles of renewable energy, Technical implications.

UNIT–II: THE SOLAR RESOURCE

Introduction, solar radiation spectra, solar geometry, Earth Sun angles, observer Sun angles, solar day length, Estimation of solar energy availability. Solar Photovoltaic Technologies-Amorphous, mono-crystalline, polycrystalline; Solar Thermal Power Generation: Technologies-elementary analysis.

UNIT–III: PHYSICS OF WIND POWER

History of wind power, Wind physics, Betz limit ratio, stall and pitch control, Wind Generator Topologies: Review of modern wind turbine technologies, Fixed and Variable speed wind turbine, Induction Generators, Doubly-Fed Induction Generators and their characteristics.

UNIT-IV: INTRODUCTION TO BIOMASS

Photosynthesis: a key process for life on Earth - Trophic level photosynthesis - Relation of photosynthesis to other plant processes - Photosynthesis at the cellular and molecular level, Biomass production for energy - Wood resource - Crop yield and improvement -Plant physiology and biomass -

Bioengineered photosynthesis - Artificial photosynthesis. Social and environmental aspects: Bio-energy in relation to agriculture and forestry

UNIT-V: INTRODUCTION TO FUEL CELLS

History, Working principle of fuel cells, Fuel cell thermodynamics, fuel cell electrochemistry - Nernst equation, Electrochemical kinetics, Butler-Voltmeter equation, performance evaluation of fuel cells, Types of Fuel Cells: AFC, PAFC, SOFC, MCFC, DMFC, relative merits and demerits. Future trends in fuel cells.

TEXT BOOKS:

1. G. M. Masters, "Renewable and Efficient Electric Power Systems", John Wiley and Sons, 2004.
2. John Twidell, Tony Weir "Renewable Energy Resources", Routledge publishers, third edition 2015.

REFERENCE BOOKS:

1. S. P. Sukhatme, "Solar Energy: Principles of Thermal Collection and Storage", McGraw Hill, 2008.

DEPARTMENT OF ME

LIST OF MINORS

(General Minor Track)

1. The student can opt any 4 subjects from each pool.

2. Concerned BoS can add or delete the subjects as per the decision of the board.

3. Pre requisites to be defined by the board for each course.

4. Compulsory MOOC/NPTEL Courses for 04 credits (02 courses@ 2 credits each)

S. No	Subject	Sub Code	Cat. Code	Internal Marks	External Marks	Total Marks	L	T	P	Credits
1	Advanced Engineering Materials	R20CCMN13	PC	30	70	100	4	0	0	4
2	Power Plant Engineering	R20CCMN14	PC	30	70	100	4	0	0	4
3	Advanced Manufacturing Processes	R20CCMN15	PC	30	70	100	4	0	0	4
4	Innovative Product Design and Development	R20CCMN16	PC	30	70	100	4	0	0	4
5	Industrial Engineering	R20CCMN17	PC	30	70	100	4	0	0	4
6	3D Printing Technology	R20CCMN18	PC	30	70	100	4	0	0	4
7	Advanced Casting Technology	R20CCMN19	PC	30	70	100	4	0	0	4
8	Advanced Metal Joining Process	R20CCMN20	PC	30	70	100	4	0	0	4
9	Computer Integrated Manufacturing	R20CCMN21	PC	30	70	100	4	0	0	4
10	Expert System Manufacturing	R20CCMN22	PC	30	70	100	4	0	0	4
11	Additive Manufacturing	R20CCMN23	PC	30	70	100	4	0	0	4

General Minor	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	4	0	0	30	70	100	4
Code: R20CCMN13	**ADVANCED ENGINEERING MATERIALS**						

COURSE OBJECTIVES:

- The student will able to learn basic concepts of materials used in electrical and electronic industry

COURSE OUTCOMES:

After successful completion of this course, the students will able to:

CO1: Illustrate the concepts of the structure of conducting and insulating materials

CO2: Analyze the properties of conducting materials

CO3: Asses the properties of semi-conducting materials

CO4: Characterize the properties of shape memory alloys

CO5: Explain Nano materials and different applications

UNIT-I

INTRODUCTION: Classification of material into conducting, semi conducting and insulating materials through a brief reference to their atomic structures and energy bands

UNIT-II

CONDUCTING MATERIALS : Introduction, Resistance and factors affecting it such as alloying and temperature , Superconductor, Classification of conducting material as low resistivity and high resistivity materials Low resistance materials- Copper, Aluminium, Steel

UNIT-III

SEMI-CONDUCTING MATERIALS: Introduction, Semi-conductors and their properties, Different semi-conducting materials (silicon and germanium) used in manufacture of various semiconductor devices (p-type and n-type semiconductors), Materials used for electronic components like resistors, capacitors, diodes, transistors and inductors etc.

UNIT-IV

SHAPE MEMORY ALLOYS: Introduction, Phenomenology, and Influence of stress on characteristic temperatures, modelling of shape memory effect. Vibration control through shape memory alloys. Design considerations, multiplexing embedded NiTiNOL actuators.

UNIT-V

NANOMATERIALS: Definition, Types of nanomaterial including carbon nanotubes and Nano composites, Physical and mechanical properties, Applications of nanomaterials.

TEXT BOOKS:

1. Electrical and Electronic Engineering Materials by SK Bhattacharya, Khanna Publishers, New Delhi

2. Smart Materials systems and MEMS: Design and development methodologies by Vijay, K., Vardhan, K.,Vinoy J.,Goplakrishnan S, Willey ,2006

REFERENCES:

1. Electronic Components and Materials by Grover and Jamwal, Dhanpat Rai and Co., New Delhi

2. Electrical Engineering Materials by Sahdev, Unique International Publications

Web References:

1. http://www.crc4mse.org/resources/industry.html
2. https://nptel.ac.in/courses/113/105/113105081/

	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
General Minor	4	0	0	30	70	100	4
Code: R20CCMN14	**POWER PLANT ENGINEERING**						

COURSE OBJECTIVES:

- To acquire knowledge of power generation units in the view of economic, environmental and social requirements.

COURSE OUTCOMES:

After successful completion of this course, the students will able to:

CO1: Illustrate basic power generation types and steam cycles.

CO2: Identify different boilers, turbines and their applications

CO3: Contrast gas power generation units in the view of economic, environmental and social requirements

CO4: Contrast diesel power generation units in the view of economic, environmental and social requirements

CO5: Observe the contemporary issues like nuclear waste disposal

UNIT – I:

INTRODUCTION TO POWER PLANTS: Power plants, Types, Components and layouts, working principle of Steam, Hydro, Nuclear, Gas Turbine and Diesel power plants, Selection of site.

UNIT – II:

STEAM POWER PLANT: Boiler classification, Types of Boilers, Fire tube and Water tube boilers, High pressure boilers, Mountings and Accessories, Steam turbines- Steam power cycle, steam turbines, Impulse & reaction principles, velocity vector diagrams, work done and efficiency.

UNIT – III:

GAS TURBINE POWER PLANT: Brayton cycle- Analysis, Open and closed cycles, Work output & efficiencies, combined cycle power plants, Applications.

UNIT – IV:

DIESEL POWER PLANTS: Gas power cycles- Otto, Diesel, Dual cycles- Work output & efficiencies, Diesel power plant- Subsystems.

UNIT – V:

HYDRO AND NUCLEAR POWER PLANTS: Classification of Hydro-electric power plants and their applications, Impulse and Reaction turbines, work done & efficiency calculations.

PRINCIPLES OF NUCLEAR ENERGY: Energy from nuclear reaction, Boiling water reactor,

Pressurized water reactor, Pressurized Heavy Water Reactor, Radiation shielding, Waste disposal.

TEXT BOOKS:

1. P. K. Nag, (2001), Power Plant Engineering: Steam and Nuclear, Tata McGraw-Hill Publishing Company Ltd., Second Edition.
2. A course in Power Plant Engineering, Arora and Domkundwar, Dhanpatrai & Co.

REFERENCES:

1. Power Plant Technology, M. M. El-Wakil, McGraw-Hill International Editions
2. A Text Book of Power Plant Engineering, R. K. Rajput, Laxmi Publications.
3. Power Plant Engineering, P.C.Sharma, S.K.Kataria Publications.

WEB REFERENCES:

1. https://nptel.ac.in/courses/112/107/112107291/

EBOOK:

1. https://books.google.co.in/books?id=XxTLCgAAQBAJ&printsec=frontcover&dq=power+plant+engineering&hl=te&sa=X&ved=2ahUKEwirh4G_8vftAhWpzjgGHZxeDk4Q6AEwBHoECAYQAg#v=onepage&q=power%20plant%20engineering&f=false

General Minor	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	4	0	0	30	70	100	4
Code: R20CCMN15	**ADVANCED MANUFACTURING PROCESSES**						

COURSE OBJECTIVES:

- To learn the different manufacturing processes for advanced technologies.

COURSE OUTCOMES:

After successful completion of this course, the students will able to:

CO1: Explain wafer and lithography manufacturing process.

CO2: Illustrate various IC fabrication technologies.

CO3: Explain Electron beam, Laser beam machining and electro chemical process.

CO4: Illustrate advanced casting methods.

CO5: Understand principles and applications of electron beam, ion beam and laser hybrid welding processes.

UNIT-I

SEMICONDUCTOR MANUFACTURING PROCESS: Wafer processing: Front end process and back end process. Epitaxy: MBE, CVD, Lithography, Ion implantation, Oxidation.

UNIT-II

INTEGRATED CIRCUIT FABRICATION TECHNOLOGY: Thin films deposition- vacuum techniques, sputtering techniques, Etching: wet etching, RIE, RIBE, etchants, Packaging- Die-bonding, wire-bonding, flip-chip technology.

UNIT-III

ADVANCED MACHINING PROCESSES: Electron beam machining, Laser beam machining and Electro-chemical machining processes. Basic principles, theory, mechanism of material removal rate, economic considerations, disadvantages and applications.

UNIT-IV

ADVANCED FOUNDRY TECHNOLOGIES: Ceramic shell casting, Investment casting, Squeeze casting, vacuum mould casting, Evaporative pattern casting.

UNIT-V

ADVANCED JOINING TECHNOLOGIES: Electron beam welding, Laser beam welding and Hybrid welding process. Basic principles, theory, mechanism of material removal rate, economic considerations, disadvantages and applications.

TEXT BOOKS:

1. "Manufacturing Science" A. Ghosh, and A.K. Mallik, Affiliated East-West Press Pvt. Ltd. New Delhi.
2. T K Basak: A course in Electrical Engineering Materials: New Age Science Publications 2009.

REFERENCES:

1. Advanced methods of machining, McGeough, J., Chapman & Hall, 2011.
2. Advanced manufacturing process, V. K. Jain, Allied publications.
3. S.M., Physics of Semiconductor Devices, John Wiley, (1981).

WEB REFERENCES:

1. https://www.substech.com/dokuwiki/doku.php?id=liquid_state_fabrication_of_metal_matrix_composites
2. https://www.slideshare.net/neeleshsahu161/magnetic-moulding
3. https://nptel.ac.in/courses/112107077/module2/lecture1/lecture1.pdf
4. https://nptel.ac.in/courses/112103244/7
5. https://nptel.ac.in/courses/112103244/6
6. http://www.nitc.ac.in/dept/me/jagadeesha/mev303/Chapter2_%20AJM.pdf
7. http://www.ignou.ac.in/upload/modern.pdf

General Minor	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	4	0	0	30	70	100	4
Code: R20CCMN16	**INNOVATIVE PRODUCT DESIGN AND DEVELOPMENT**						

COURSE OBJECTIVES:

- Learn and understanding the basic principles of design concepts for product development.
- Study and calculate the design concepts of DFM and DFE, value engineering and analysis

COURSE OUTCOMES:

After successful completion of this course, the students will able to:

CO 1: Illustrate the product life cycle and product development process.

CO 2: Outline design concepts for product development.

CO 3: Illustrate the design concepts of DFM and DFE.

CO 4: Explain value engineering and analysis.

CO 5: Use the concept of Ergonomics in product development

UNIT I:

INTRODUCTION: Classification/ Specifications of Products. Product life cycle. Product mix. Introduction to product design. Modern product development process. Innovative thinking. Morphology of design.

UNIT II:

CONCEPTUAL DESIGN: Generation, selection & embodiment of concept. Product architecture. Industrial design: process, need. Robust Design: Taguchi Designs & DOE. Design Optimization

UNIT III:

DESIGN FOR MANUFACTURING & ASSEMBLY: Methods of designing for Manufacturing & Assembly. Designs for Maintainability. Designs for Environment. Product costing. Legal factors and social issues. Engineering ethics and issues of society related to design of products.

UNIT IV:

VALUE ENGINEERING / VALUE ANALYSIS: Definition. Methodology. Economic analysis: Qualitative & Quantitative.

UNIT IV:

ERGONOMICS/AESTHETICS: Gross human autonomy. Anthropometry. Man-Machine interaction. Concepts of size and texture, color. Comfort criteria. Psychological & Physiological considerations.

CREATIVITY TECHNIQUES: Creative thinking, conceptualization, brain storming, primary design, drawing, simulation, detail design.

TEXT BOOKS:

1. Karl T Ulrich, Steven D Eppinger, "Product Design & Development." Tata McGrawhill New Delhi 2003
2. David G Ullman, "The Mechanical Design Process." McGrawhill Inc Singapore 1992 N J M Roozenberg , J Ekels , N F M Roozenberg " Product Design Fundamentals and Methods ." John Willey & Sons 1995

REFERENCES:

1. Kevin Otto & Kristin Wood Product Design: "Techniques in Reverse Engineering and new Product Development." 1 / e 2004 , Pearson Education New Delhi
2. L D Miles "Value Engineering."
3. Hollins B & Pugh S "Successful Product Design." Butter worths London.

WEB REFERNCES:

1. https://www.ideareality.design/services/design/design-development/
2. https://sgwdesignworks.com/2018/06/06/innovation-vital-for-product-development-companies/
3. https://books.google.co.in/books?id=dSATqILWWhwC&pg=PA303&dq=innovative+product+design+and+development&hl=te&sa=X&ved=2ahUKEwjRxKWz_PLtAhUd4XMBHQ3ODsQQ6AEwAXoECAIQAg#v=onepage&q=innovative%20product%20design%20and%20development&f=false

General Minor	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	4	0	0	30	70	100	4
Code: R20CCMN17	**INDUSTRIAL ENGINEERING**						

COURSE OBJECTIVES:

- To provide students an insight into the concepts of industrial engineering and organization

COURSE OUTCOMES:

After successful completion of this course, the students will able to:

CO1: Demonstrate concepts of Industrial Engineering

CO2: Asses different methods of decision making

CO3: Demonstrate leadership skills

CO4: Illustrate different applications in service industry

CO5: Predict the applications using virtual reality

UNIT I:

INTRODUCTION: Definition of industrial engineering (I.E), development, applications, role of an industrial engineer, differences between production management and industrial engineering, quantitative tools of IE and productivity measurement.

UNIT-II

METHODS FOR DECISION MAKING: Probabilistic Models and Statistics, Computer Simulation, Optimization. Construction and Improvement algorithms -ALDEP - CORELAP and CRAFT

UNIT-III

ENTERPRISE AND LEADERSHIP: Business Modelling, Analysis and Design, Enterprise Modelling, Technological tools for building an Enterprise, Leadership and assessing Company's Level of Performance

UNIT-IV

PLANT LAYOUT, PRODUCTION PLANNING AND CONTROL: Plant location - Factors - Plant layout - Types - Layout design process - Computerized Layout Planning – applications, quantitative techniques for optimal design of layouts, plant maintenance, preventive and breakdown maintenance.

Types of productions, Production cycle-Process planning, Forecasting, Loading, Scheduling, Dispatching, Routing- Simple problems

UNIT-V

INDUSTRIAL ENGINEERING APPLICATIONS IN SERVICE INDUSTRY: Transportation, Tourism, Health Care, Retailing, Financial asset management.

VIRTUAL REALITY FOR INDUSTRIAL ENGINEERING : Overview – Definitions - Virtual Environment Hardware and Software - Human–Computer Interaction for VE - VR Applications - Process Integration of VR Applications – Future of virtual reality.

TEXT BOOKS:

1. Modern Production / Operations Management, Elwood S Buffa, Rakesh K Sarin, John Wiley & Sons, 2009
2. Industrial Management – Control and Profit: A Technical Approach, Gideon Halevi, Springer, 2014

REFERENCES:

1. Virtual Manufacturing – Khan, Wasim Ahmed, Raouf, A., Cheng, Kai, Springer, 2011,
2. Industrial Engineering and management / O.P Khanna/Khanna Publishers

WEB RESOURCES:

1. https://nptel.ac.in/courses/112/107/112107143/
2. https://nptel.ac.in/courses/112/107/112107292/
3. https://link.springer.com/content/pdf/10.1007%2F978-1-4615-3166-1.pdf

General Minor	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	4	0	0	30	70	100	4
Code: R20CCMN18	**3D PRINTING TECHNOLOGY**						

COURSE OBJECTIVES:

- To acquire the knowledge of 3D printing technology.
- To learn the working of photo polymerization, material jetting and binder jetting 3D Printing technologies.

COURSE OUTCOMES:

After successful completion of this course, the students will able to:

CO 1: Describe the basic knowledge of 3D Printing Technology

CO 2: Induce the knowledge of vat photo polymerization, material jetting and binder jetting 3D Printing technologies

CO 3: Explain the material extrusion and sheet lamination 3D Printing technologies

CO 4: Impart the knowledge on powder bed fusion and directed energy deposition 3D Printing technologies

CO 5: Describe the applications of 3D printing technology

UNIT I:

INTRODUCTION: Basic principle of 3D printing (3DP), need and advantages of 3DP or additive manufacturing (AM), AM Process chain - CAD Model - Input file formats - Generation and Conversion of STL file - File Verification and Repair - Build File Creation - Part Construction - Part Cleaning and finishing, Classification of additive manufacturing processes-baseline approach, raw material-based approach and ASTM classification, Materials used in additive manufacturing, Challenges in Additive Manufacturing.

UNIT II:

VAT PHOTOPOLYMERIZATION, MATERIAL JETTING AND BINDER JETTING 3DP TECHNOLOGIES: Stereo lithography Apparatus (SLA), Digital Light Projection (DLP), Continuous Liquid Interface Production (CLIP), Material Jetting (MJ), Solid Ground Curing (SGC) or Drop on Demand (DoD), Nano Particle Jetting (NPJ), Binder Jetting and Multi Jet Fusion (MJF) processes – Working principle, Materials, Applications, Advantages and Disadvantages.

UNIT III:

MATERIAL EXTRUSION AND SHEET LAMINATION 3DP TECHNOLOGIES: Fused Deposition Modelling (FDM), Contour Crafting (CC), Laminated Object Manufacturing (LOM), Ultrasonic Consolidation (UC), Composite Based AM (CBAM), processes – Working principle, Materials, Applications, Advantages and Disadvantages.

UNIT IV:

POWDER BED FUSION AND DIRECTED ENERGY DEPOSITION 3DP TECHNOLOGIES: Selective Laser Sintering (SLS), Direct Metal Laser Sintering (DMLS) or Selective Laser Melting (SLM), Electron Beam Melting (EBM), Laser Engineered Net Shaping (LENS), Electron Beam Additive Manufacturing (EBAM), Wire Arc Additive Manufacturing (WAAM) - Working principle, Materials, Applications, Advantages and Disadvantages.

UNIT V:

APPLICATIONS OF 3D PRINTING: Applications in prototyping, concept models, visualization aids, replacement parts, tooling, jigs & fixtures, moulds, casting, and end-use parts, Industrial Applications in aerospace, automobile, medical, jewelry, sports, electronics, food, construction and architectural.

TEXT BOOKS:

1. Ian Gibson, David W. Rosen, Brent Stucker., "Additive Manufacturing Technologies: 3D Printing, Rapid Prototyping and Direct Digital Manufacturing", 2nd Edition, Springer, 2010.
2. Chua C.K., and Leong K.F., "3D Printing and Additive Manufacturing: Principles and Applications", 4th Edition, World Scientific Publications, 2015.

REFERENCES:

1. Amit Bandyopadhyay, Susmita Bose., "Additive Manufacturing", 2nd Edition, CRC Press, 2020.
2. Yang, L., Hsu, K., Baughman, B., Godfrey, D., Medina, F., Menon, M., Wiener, S., "Additive Manufacturing of Metals: The Technology, Materials, Design and Production", Springer, 2017.
3. Hilton P.D. and Jacobs P.F., "Rapid Tooling: Technologies and Industrial Applications", CRC press, 2000.
4. John O. Milewski., "Additive Manufacturing of Metals: From Fundamental Technology to Rocket Nozzles, Medical Implants and Custom Jewelry", Springer, 2017.

WEB REFERENCES:

1. https://www.reprap.org
2. https://www.thingiverse.com
3. https://www.3dprintingindustry.com
4. https://www.all3dp.com

General Minor	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	4	0	0	30	70	100	4
Code: R20CCMN19	**ADVANCED CASTING TECHNOLOGY**						

COURSE OBJECTIVES:

- Able to learn the different moulding materials of sands, binders and design of furnaces
- Able know the basic concepts of casting design, design of running and feeding systems
- Able to understand the concepts of nonferrous foundry metallurgical properties of liquid metals, foundry mechanization and process flow charts

COURSE OUTCOMES:

After successful completion of this course, the students will be able to:

CO1: Know and identify the materials for moulding the additives, coating and the methods of sand controls.

CO2: Identify different furnaces for metal melting and design the suitable furnace depending materials

CO3: Explain the concepts related to the casting processes and the factor those influence the design process for metals and alloys

CO4: Select various properties of liquid metals and their compositions and attain the various alloys depending upon the temperature, Iron-carbon diagram

CO5: Illustrate the principles of mechanization of foundries with their layouts and purchase of suitable layout

UNIT-I

MOULDING MATERIALS: Sand — Silica, Zircon, Chromite, Olivine sands; Binders — Bentonite, cement, sodium silicate, Ethyl silicate, plaster of paris, carbohydrates, setting oils, synthetic regins; Additives — Coal dust, wood flour, silica flour; Mould and core coatings; Moulds auxiliary materials; Parting agents, core paste, exothermic, insulating sleeve materials; Sand testing and controls.

UNIT-II

FURNACES DESIGN: features of Arc and Induction furnaces, heat treatment furnaces including salt bath furnaces and induction heating

UNIT-III

PRINCIPLES OF CASTING DESIGN: Basic concepts of Engg. analysis of metal fabrication with particular reference to casting processes. Factors influencing the production' of engg., castings to customers' specifications, attem making. Chvorinov's rule, design of running and feeding systems;

factors influencing the engg. design of castings. Functional design, freezing range alloys in metallic and non — metallic moulds, grain refinement, modification, various types of defects in non — ferrous alloys, influence of form and environment.

UNIT-IV

NONFERROUS FOUNDRY METALLURGY: Properties of liquid metals, their significance in foundry practice, oxidation, solution of gases in metals, fluidity, hot tear, shrinkage and solidification Mechanisms of pure metals, Eutectic and long range freezing alloys — some advances in die casting including Acurad process — some features of steel foundry practice, specification of moulding material, Foundry practice of nonferrous metals and alloys.

UNIT-V

GENERAL PRINCIPLES AND OBJECTIVES: Plant layout Mechanization foundries, selection of equipment, operation and flow process charts

TEXT BOOKS:

1. Principles of MetalCasting, Rosenthal et al., — Tata Mc Grawhill Publishers.
2. Ferrous Foundry Metallurgy, Murphi

REFERENCES:

1 Tompkins and White Facilities planning — John wiley & Sons.
2 Filnn Metal Casting — Prentice Hall India.
3 Principles ofMetal Casting, P. L. Jam — Tata McGrawhill
4 Foundry Technology, O. P. Khanna — Khanna Publishers.

General Minor	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	4	0	0	30	70	100	4
Code: R20CCMN20	**ADVANCED METAL JOINING PROCESSES**						

COURSE OBJECTIVES:

- To provide knowledge about the principle and applications of latest welding processes
- To acquire essential significance of thermal effects of welding and subsequent remedial measures to reduce residual stresses and distortion in weldments.
- To gain knowledge about the Weldability of different commercially available materials, their corresponding weld joints design and automation of welding processes.

COURSEW OUTCOME:

After successful completion of this course, the students will be able to:

CO 1: Select suitable welding process and technique to join a given material.

CO 2: Identify and minimize the distortion and residual stresses induced in weldments.

CO 3: Evolve better design for both static and fatigue loading conditions.

CO 4: Select suitable welding automation for the production of engineering components.

CO 5: Choose different methods for increasing service life of equipment.

UNIT I

SPECIAL WELDING PROCESSES

Electron beam welding, laser beam welding, ultrasonic welding, explosion welding, electro slag and electro gas welding, cold pressure welding, Friction Stir welding, diffusion bonding and adhesive bonding.

UNIT II

HEAT EFFECTS OF WELDING

Metallurgical effects of heat flow in welding-TTT curve- continuous cooling transformation diagrams development of residual stress, methods of relieving or controlling welding residual stresses, types and control of distortion, pre-heat and post welding heat treatment.

UNIT III

WELDABILITY OF FERROUS AND NON-FERROUS ALLOYS

Weldability of carbon and alloy steels, stainless steels, cast irons, copper and its alloys, aluminum and its alloys, titanium and its alloys, Ni and its alloys, weldability tests.

UNIT IV

WELDING DESIGN

Typical joints for different welding processes, principles of welding joint design and location of joint within the member, evolving good weld design, welding symbol- Blue print reading, welding design for static and fatigue loading, fracture toughness.

UNIT V

AUTOMATION IN WELDING

Welding sequence and classification of processes, manual and semi-automatic, automatic, automated welding- adaptive controls- remote welding, robotic welding- selecting welding system, gravity welding and fire cracker welding, under water welding- wet and dry.

TEXT BOOKS:

1. Parmar.R.S," Welding Processes and technology", 3 rd Edition, Khanna Publishers,2013.
2. ASM Hand book, Forming and Forging, Ninth edition, Vol – 14, 2003

REFERENCES:

1. Roa P.N. "Manufacturing Technology ", Tata McGraw -Hill, 2005.
2. Avitzur , "Metal Forming Processes and Analysis ", Tata McGraw - Hill ,2005.
3. Dieter, "Mechanical Metallurgy ", Tata McGraw - Hill, 2005.
4. Harris, J.N., "Mechanical working of Metals - Theory and Practice", Pergamon Press ,1995
5. Altan T., "Metal forming – Fundamentals and applications" , American Society of Metals, Metals park, 2003.

WEB REFERENCE:

1. www.kkai.com/matproc.html

Specialized Minor	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	4	0	0	30	70	100	4
Code: R20CCMN21	**COMPUTER INTEGRATED MANUFACTURING**						

COURSE OBJECTIVES:

- To impart knowledge of automated processes in a modern manufacturing environment.
- To give broad understanding of using engineering design and modeling techniques towards flow lines, numerical control and the integration of computer control/usage in manufacturing.
- To learn contemporary manufacturing/production strategies such as agile manufacturing and group technology

COURSE OUTCOMES:

After successful completion of this course, the students will be able to:

CO1: Illustrate the effect of manufacturing automation strategies and derive production metrics.

CO2: Analyze automated flow lines and assembly systems, and balance the line.

CO3: Design automated material handling and storage systems for a typical production system.

CO4: Select a manufacturing cell and cellular manufacturing system.

CO5: Develop CAPP systems for rotational and prismatic parts.

UNIT-I

INTRODUCTION: Scope of computer integrated manufacturing, Product cycle, Production automation.

GROUP TECHNOLOGY: Role of group technology in CAD/CAM integration, Methods for developing part families, Classification and coding, Examples of coding systems, Facility design using group technology, Benefits of G.T.

UNIT-II

COMPUTER AIDED PROCESS PLANNING: Role of Process Planning, Approaches to process planning- Manual, Variant, Generative approach; Examples of Process planning systems - CAPP, DCLASS, CMPP; Criteria for selecting a CAPP system, Benefits of CAPP.

UNIT-III

FLEXIBLE MANUFACTURING SYSTEM (FMS) AND AUTOMATED GUIDED VEHICLE SYSTEM (AGVS) : Types of Flexibility – FMS – FMS Components – FMS Application & Benefits – FMS Planning and Control– Quantitative analysis in FMS – Simple Problems. Automated Guided

Vehicle System (AGVS) – AGVS Application – Vehicle Guidance technology – Vehicle Management & Safety.

UNIT-IV

COMPUTER AIDED QUALITY CONTROL: Terminology in quality control, Contact inspection methods, Non-contact inspection methods, Computer aided testing, Integration of CAQC with CAD/CAM.

UNIT-V

COMPUTER INTEGRATED MANUFACTURING SYSTEMS: Types of manufacturing systems, Machine tools and related equipment, Material handling systems, Computer control systems, CIMS Benefits.

TEXT BOOKS

1. Computer Integrated Design and Manufacturing by David D. Bedworth, Mark R. Henderson, Philip M. Wolfe
2. CAD / CAM by Groover & Zimmers (PHI)

REFERENCES

1. Automation, Production systems and Computer Integrated Manufacturing- by M.P.Groover (PHI)
2. "Computer Integrated Manufacturing System", Yorem koren, McGraw-Hill, 1983.
3. "Computer Integrated Manufacturing", Ranky, Paul G., Prentice Hall International, 1986.

General Minor	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	4	0	0	30	70	100	4
Code: R20CCMN22	**EXPERT SYSTEMS IN MANUFACTURING**						

COURSE OBJECTIVES:

- Able to understand the concepts of Artificial Intelligence and expert systems
- To learn, how to represent knowledge and interface in manufacturing application

COURSE OUTCOMES:

After successful completion of this course, the students will be able to:

CO1: Explain the fundamental theories, concepts, and applications of computer science in solving real-time problems.

CO2: Demonstra**te** working knowledge of reasoning in the presence of incomplete and/or uncertain information.

CO3: Apply knowledge representation, reasoning, and machine learning techniques to real-world problems.

CO4: Solve the problems in the field of machining, inventory control, process planning with the help of expert systems.

CO5: Organize the typical applications and facility layout management

UNIT-I

ARTIFICIAL INTELLIGENCE & EXPERT SYSTEMS: Definition — Justification — Structure Knowledge acquisition; Knowledge base, Inference engine, User interface, Explanatory module, Forward and backward chaining

UNIT-II

KNOWLEDGE REPRESENTATION AND INFERENCING: Building expert systems Suitability of task, architecture, hardware, software, personnel — Expert system building tools language, shells.

UNIT-III

SOFTWARE APPLICATIONS: Commercial software for manufacturing applications in CAD, CAPP, MRP, CAM, MRP II, Adaptive control of devices, Robotics, Process control, Fault diagnosis, Failure analysis etc.;

UNIT-IV

LINKING EXPERT SYSTEMS: Linking expert systems to other software such as DBMS, MIS, MDB, Process control and office — automation.

UNIT-V

CASE STUDIES: Case studies of typical applications in process planning tool selection, cutting tool selection, part classification, inventory control, facilities planning, etc. The IITM rule selection.

TEXT BOOKS:

1. Adodji. B, BAd1I. N Expert System Applications in Engineering & Manufacturing —John Wiley & Sons(l 995)
2. Introduction to Expert Systems, Peter Jackson

REFERENCES:

1. Dimitris N. Chorafas , "Expert Systems in Manufacturing (Automation in Manufacturing) "Van Nostrand Reinhold Computer (1 January 1992)

General Minor	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	4	0	0	30	70	100	4
Code: R20CCMN23	**ADDITIVE MANUFACTURING**						

COURSE OBJECTIVES:

- The student will learn advanced concepts of manufacturing using additive methodologies and fundamentals of additive manufacturing processes along with the various file formats, software tools, processes, techniques and applications.
- The expected outcome of the course is train student who can innovate new processes, select right process for the right component and provide basic scientific understanding of this emerging technology.

COURSE OUTCOMES:

After successful completion of this course, the students will be able to:

CO1 Demonstrate comprehensive knowledge of the broad range of AM processes, devices, capabilities and materials that are available.

CO2 Apply technique of CAD and reverse engineering for geometry transformation in Additive Manufacturing.

CO3 Analyze and select suitable process and materials used in Additive Manufacturing.

CO4 Employ a suitable manufacturing system related to Additive Manufacturing.

CO5 Apply knowledge of additive manufacturing for various real-life applications.

UNIT-I

INTRODUCTION TO ADDITIVE MANUFACTURING (AM): General Overview, Why Additive Manufacturing, Direct Digital Manufacturing and AM; parts and their uses, Computer Aided Design (CAD) and Manufacturing (CAM) and AM, Different AM processes and relevant Process Physics.

UNIT-II

MODELLING AND PROCESSING: Tessellated Models, STL Format, STL File Problems, STL File Manipulation and Repair Algorithms, AMF and 3MF files, AM Data Processing: Part Orientation and Support Structure Generation, Model Slicing and Contour Data Organization, Direct and Adaptive Slicing, Hatching Strategies and Tool Path Generation.

UNIT-III

VAT PHOTOPOLYMERIZATION, MATERIAL JETTING AND BINDER JETTING TECHNOLOGIES: Stereo lithography Apparatus (SLA), Digital Light Projection (DLP), Continuous Liquid Interface Production (CLIP), Material Jetting (MJ), Solid Ground Curing (SGC) or Drop on Demand (DoD), Nano Particle Jetting (NPJ) – Working principle, Materials, Applications, Advantages and Disadvantages.

UNIT-IV

POWDER BED FUSION AND DIRECTED ENERGY DEPOSITION TECHNOLOGIES: Selective Laser Sintering (SLS), Direct Metal Laser Sintering (DMLS) or Selective Laser Melting (SLM), Laser Engineered Net Shaping (LENS), Electron Beam Additive Manufacturing (EBAM) - Working principle, Materials, Applications, Advantages and Disadvantages.

MATERIAL EXTRUSION AND SHEET LAMINATION TECHNOLOGIES:

Fused Deposition Modelling (FDM), Laminated Object Manufacturing (LOM), Ultrasonic Consolidation (UC), Composite Based AM (CBAM), processes – Working principle, Materials, Applications, Advantages and Disadvantages.

UNIT -V

APPLICATION OF AM FOR VARIOUS INDUSTRIES: Aerospace: Reactive and Lightweight materials; Automobile: Light Weight components, mold Thermal and Wear management; Oil and Gas: Wear and Corrosion management; Agriculture: Wear and Corrosion management; Medical: Bio-printing, Tissue & Organ Engineering. Business value of AM: Intellectual Property, Product Development, Commercialization, Trends, Business Opportunities.

TEXT BOOKS:

1. Additive Manufacturing Methodologies: Rapid Prototyping to Direct Digital Manufacturing by Gibson I, Rosen D W., and Stucker B, Springer, 2010
2. Rapid prototyping: Principles and applications by Chua C.K., Leong K.F., and Lim C.S., Third Edition, World Scientific Publishers, 2010

REFERENCES:

1. Rapid Prototyping: Laser-based and Other Technologies Patri K. Venuvinod and Weiyin Ma, Springer, 2004
2. Rapid Prototyping and Engineering applications: A tool box for prototype development by Liou L.W. and Liou F.W., CRC Press, 2007
3. Rapid Prototyping: Theory and practice by Kamrani A.K. and Nasr E.A., Springer, 2006

4. Laser Metal Deposition Process of Metals, Alloys, and Composite Materials, Engineering Materials and Processes, by Mahamood R.M., Springer International Publishing AG, 2018

WEB RECOURSES:

1. https://nptel.ac.in/courses/110/106/110106146/
2. https://www.cs.cmu.edu/~scoros/cs15869-s15/lectures/

E BOOKS:

1. http://home.iitk.ac.in/~nsinha/Additive_Manufacturing%20I.pdf
2. http://s550682939.onlinehome.fr/CommissionsThematiques/DocComThematiques/EPMA_Additive_Manufacturing.pdf
3. http://web.mit.edu/2.810/www/files/lectures/2015_lectures/lec9-additive-manuf-201

DEPARTMENT OF ECE

LIST OF MINOR SUBJECTS

Any four of the following subjects, which are not chosen earlier, are to be considered for Minor Degree.

S. No.	Subject	Subject Code	L	T	P	Internal Marks	External Marks	Total Marks	Credits
1	Electronics Devices and Circuits	R20CCMN24	4	0	0	30	70	100	4
2	Digital Electronics	R20CCMN25	4	0	0	30	70	100	4
3	Fundamentals of Signals Processing	R20CCMN26	4	0	0	30	70	100	4
4	Principles of Communications	R20CCMN27	4	0	0	30	70	100	4
5	Computer Architecture and Organization	R20CCMN28	4	0	0	30	70	100	4
6	Introduction to Microcontrollers	R20CCMN29	4	0	0	30	70	100	4
7	Introduction to Embedded Systems	R20CCMN30	4	0	0	30	70	100	4
8	Internet of Things	R20CCMN31	4	0	0	30	70	100	4
9	Basics of VLSI Design	R20CCMN32	4	0	0	30	70	100	4
10	Introduction to Wireless Sensor Networks	R20CCMN33	4	0	0	30	70	100	4

General Minor	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	4	0	0	30	70	100	4
Code: R20CCMN24	**ELECTRONICS DEVICES AND CIRCUITS**						

COURSE OBJECTIVES:

- Understand the operation and principles of P-N diode.
- Understand the operation and principles of special diodes.
- Understand various types of rectifiers and filters.
- Explore the operation of BJT.
- Know the working of FET.

COURSE OUTCOMES:

After completion of the course, students will be able to

CO1: Demonstrate P-N diodes in electronic circuits. **[K2]**

CO2: Demonstrate special diodes in electronic circuits. **[K2]**

CO3: Demonstrate rectifiers in electronic circuits. **[K2]**

CO4: Summarize the operation of BJT and its applications. **[K2]**

CO5: Summarize the operation of FET. **[K2]**

SYLLABUS:

UNIT- I: PN JUNCTION DIODE CHARACTERISTICS

Intrinsic and Extrinsic Semiconductors. P-N Junction Diode - Formation of P-N Junction, Biased P-N Junction - Forward Bias, Reverse Bias, V-I Characteristics of Diode - Forward Bias, Reverse Bias.

UNIT- II: SPECIAL DIODES

Zener Diode - V-I Characteristics, Applications, Breakdown Mechanisms - Zener Breakdown and Avalanche Breakdown, Construction, Operation, Characteristics and applications of LED, Photodiode, Varactor Diode and Tunnel diode.

UNIT- III: RECTIFIERS

Basic Rectifier setup, Half Wave Rectifier, Full Wave Rectifier, Bridge Rectifier, Inductive and Capacitive Filters, L– Section and π- Section, Comparison of rectifier parameters with and without filter.

UNIT- IV: BIPOLAR JUNCTION TRANSISTOR (BJT)

Bipolar Junction Transistor – Types, Symbols and Operation, Transistor Configurations - CB, CE and CC, Transistor as a switch, Transistor as an Amplifier, Characteristics of Transistor in Common Base Configuration, Common Emitter and Common Collector Configurations - Input and output characteristics, Comparison of CB, CE and CC Configurations.

UNIT- V: FET

FET Types and Symbols - JFET and MOSFET/IGFET, JFET: N-Channel and P-Channel Construction, Operation, Characteristics - Drain and Transfer, Parameters - Drain Resistance, Amplification factor, Transconductance, Pinch-off voltage.

TEXT BOOKS:

1. J. Millman, C. Halkias, "Electronic Devices and Circuits", Tata McGraw-Hill, Third edition, 2010.
2. Allen Mottershed, "Electronic Devices and Circuits", PHI, 2011.
3. Salivahanan, N. Suresh Kumar, A. Vallavaraj, "Electronic Devices and Circuits" Tata McGraw-Hill, Second Edition, 2008.

REFERENCE BOOKS:

1. Jacob Millman, C. Halkies, C.D. Parikh, Satyabrata Jit, "Integrated Electronics", Tata McGraw-Hill, Second Edition, 2011.
2. R.L. Boylestad and Louis Nashelsky, "Electronic Devices and Circuit Theory", Pearson Publications, Eleventh Edition, 2013

General Minor	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	4	0	0	30	70	100	4
Code: R20CCMN25	DIGITAL ELECTRONICS						

COURSE OBJECTIVES:

- To classify and work on different types of number systems and codes that are used in the design of digital systems.
- To demonstrate theorems and postulates of Boolean algebra for construction of digital circuits.
- To make use of theorems and postulates of Boolean algebra and K-Map to minimize various Boolean expressions.
- To construct the basic logic circuits and combinational circuits.
- To construct the sequential circuits.

COURSE OUTCOMES:

After completion of this course, the students would be able to

CO1: Classify and work on different types of number systems and codes that are used in the design of digital systems. **[K2]**

CO2: Make use of theorems and postulates of Boolean algebra for construction of digital circuits. **[K3]**

CO3: Make use of theorems and postulates of Boolean algebra and K-Map to minimize various Boolean expressions. **[K3]**

CO4: Construct the basic logic circuits and combinational circuits. **[K3]**

CO5: Construct the sequential circuits. **[K3]**

SYLLABUS:

UNIT- I: NUMBER SYSTEMS & CODES

Review of number systems – Binary, Octal, Hexadecimal numbers, 1's complement, 2's complement, Gray codes, Ex-3 Codes, Code Conversions.

UNIT- II: LOGIC OPERATIONS

Basic logical operations, logic gates and universal gates, Pin configurations of 74XX-IC series. Boolean postulates and theorems, representation of switching functions–standard SOP & POS forms.

UNIT- III: MINIMIZATION TECHNIQUES

Minimization of logic functions using Boolean theorems, K-Map representation up to 4 variables.

UNIT- IV: COMBINATIONAL CIRCUITS

Adders, Subtractors and their applications, Encoders, Decoder, Multiplexers, Demultiplexers, code converters, Comparators.

UNIT- V: SEQUENTIAL CIRCUITS

Sequential circuits versus combinational circuits, classification of sequential circuits, Latches, flip-flops – D, T, SR, JK and Master Slave JK flip-flops, Race condition, Toggle, Registers - Shift registers, Counters – Mod-10 counter.

TEXT BOOKS:

1. M. Morris Mano, "Digital Design", PHI, Fourth Edition, 2008.
2. A. Anand Kumar, "Switching Theory and Logic Design", PHI, Pvt. Ltd, 2nd Ed, 2014.
3. Zvi Kohavi, "Switching and Finite Automata Theory", Cambridge University Press, 3rd Edition, 2009.

REFERENCE BOOKS:

1. R. P. Jain, "Modern Digital Electronics", Tata McGraw Hill, 4th Edition, 2010.
2. Charles H. Roth Jr, "Fundamentals of Logic Design", CENGAGE Learning, 7th Edition.
3. A. P. Godse, D. A. Godse, "Switching Theory & Logic Design", Technical publications, 2nd Edition, 2013.

General Minor	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	4	0	0	30	70	100	4
Code: R20CCMN26	FUNDAMENTALS OF SIGNALS PROCESSING						

COURSE OBJECTIVES:

- To explain about signals and perform various operations on it and to summarize the sampling
- To build Trigonometric and Exponential Fourier series of various signals
- To develop Fourier transforms for various signals.
- To solve Laplace transforms and z-transforms for various signals.
- To examine sampling effect on signals

COURSE OUTCOMES:

After completion of this course, the students will be able to

CO1: Define basic signals and its operations. **[K1]**

CO2: Identify Trigonometric and Exponential Fourier Series of signals. **[K1]**

CO3: Develop Fourier Transforms for various signals. **[K3]**

CO4: Solve Laplace Transform and z-Transform for various signals. **[K3]**

CO5: Examine sampling effect on signals. **[K4]**

SYLLABUS:

UNIT- I: CLASSIFICATION OF SIGNALS

Analog, Discrete, Digital, Deterministic & Random, Periodic & Aperiodic, Even & Odd, Energy & Power signals. Basic Operations on Signals: Time-Shifting, Time-Scaling, Time-Reversal, Amplitude Scaling and Signal Addition. Elementary Signals: Unit Step, Unit Ramp, Unit Parabolic, Impulse, Sinusoidal function, Exponential function, Gate function, Triangular function, Sinc function and Signum function.

UNIT- II: FOURIER SERIES

Representation of Fourier series, Continuous time periodic signals, Properties of Fourier Series, Dirichlet conditions, Trigonometric Fourier Series and Exponential Fourier Series,

UNIT- III: FOURIER TRANSFORMS

Fourier Transform of arbitrary signal, Fourier Transform of standard signals, Fourier Transform of periodic signals. Properties of Fourier Transform.

UNIT- IV: LAPLACE TRANSFORMS AND Z TRANSFORMS

Laplace Transforms: Laplace transforms, Partial fraction expansion, Inverse Laplace transform, Concept of Region of Convergence (ROC), Properties of Laplace transforms.

Z-Transforms: Concept of Z-transform of a discrete sequence, Region of convergence in Z-Transform, inverse Z-transform, properties of Z-Transforms.

UNIT-V: SAMPLING

Sampling theorem, Types of Sampling: Impulse Sampling, Natural and flattop Sampling, Effect of undersampling – Aliasing.

TEXT BOOKS:

1. B.P. Lathi, "Signals, Systems and Communications", BS Publications, 2008.
2. Simon Haykin and Van Veen, Wiley, "Signals and Systems", Second Edition, 2003.
3. A.V. Oppenheim, A.S. Will sky and S.H. Nawab, "Signals and Systems", PHI, Second Edition, 2013.

REFERENCE BOOKS:

1. Ramesh Babu, "Signals and Systems", SciTech Publications, Third Edition, 2011.
2. A. Anand Kumar, "Signals and Systems", PHI Publications, Third Edition, 2013.
3. Tarun Kumar and Rawat - SIGNALS AND SYSTEMS, Oxford Publications, 2010.

General Minor	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	4	0	0	30	70	100	4
Code: R20CCMN27	PRINCIPLES OF COMMUNICATIONS						

COURSE OBJECTIVES:

- To elaborate the basic concepts of analog communication systems
- To analyze radio transmitters & receivers.
- To elaborate the basic concepts of pulse communication systems.
- To construct different digital modulation techniques.
- To assess different source coding methods for data transmission.

COURSE OUTCOMES:

After completion of this course, the student should able to

CO1: Elaborate the basic concepts of analog communication systems. **[K2]**

CO2: Analyze radio transmitters & receivers. **[K4]**

CO3: Elaborate the basic concepts of pulse communication systems. **[K2]**

CO4: Construct different digital modulation techniques. **[K3]**

CO5: Assess different source coding methods for data transmission. **[K4]**

SYLLABUS:

UNIT I: ANALOG COMMUNICATION

Introduction to Communication Systems – Modulation – Types – Need for Modulation. Theory of Amplitude Modulation – Generation of AM waves- Square law Modulator, Detection of AM waves- Envelope detector. – Theory of Frequency Modulation and Phase Modulation.

UNIT II: RADIO TRANSMITTERS & RECEIVERS

Radio Transmitters-Function of a Transmitter, Basic Components of a Radio Transmitter, Radio Receivers - Tuned radio frequency receiver-Block Diagram, Super heterodyne receiver-Block Diagram and Advantages.

UNIT-III: PULSE COMMUNICATION

Pulse Communication: Pulse Amplitude Modulation (PAM) – Pulse Time Modulation (PTM) – Pulse Code Modulation (PCM) – Comparison of various Pulse Communication System, Delta modulation.

UNIT IV: DIGITAL MODULATION TECHNIQUES

Amplitude Shift Keying (ASK) – Frequency Shift Keying (FSK) - Phase Shift Keying (PSK). Comparison of various Digital Communication System (ASK – FSK – PSK)

UNIT V: SOURCE CODING

Entropy, Source encoding theorem, Shannon-Fano coding, Huffman coding, channel capacity, channel coding theorem.

TEXT BOOKS:

1. Principles of Communication Systems by Herbert Taub, Donald L Schiling, Goutam Saha, 3rd Edition, McGraw-Hill, 2008
2. Communication Systems by Simon Haykins John Wiley & Sons, 4th Edition.

REFERENCES:

1. Electronic communication systems fundamentals through advanced by Wayne Thomasi, 4th edition.
2. Communication Systems by R. P. Singh, S. D. Sapre, McGraw-Hill Education, 2008.
3. Analog and Digital Communication by K. Sam Shanmugam, Willey, 2005.
4. Electronics & Communication System by George Kennedy and Bernard Davis, TMH, 2004.

General Minor	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	0	0	40	60	100	3
Code: R20CCMN28	COMPUTER ARCHITECTURE AND ORGANIZATION						

COURSE OBJECTIVES:

- To familiarize with the computer system.
- To learn the concepts of computer arithmetic operations, computer instructions and its memory organization.
- To learn the concepts of memory organization.
- To understand the 8086 architecture.

COURSE OUTCOMES:

After completion of the course, students will be able to

CO1: Recall the basic concepts, elements & operations of digital computer system. **[K1]**

CO2: Recall the central processing unit concepts. **[K1]**

CO3: Recall the concepts of control unit. **[K1]**

CO4: Demonstrate memory organization. **[K2]**

CO5: Demonstrate 8086 microprocessor. **[K2]**

SYLLABUS:

UNIT – I: COMPUTER SYSTEM

Computer components, computer function, Interconnection structures, Bus interconnection, arithmetic and logic unit, integer representation, integer arithmetic, floating point representation, floating point arithmetic.

UNIT – II: CENTRAL PROCESSING UNIT

Instruction Sets, Characteristics and addressing modes – Machine instruction characteristics, Types of operands and operators, addressing modes, instruction formats, Assembly language,

Process Structure and Functions – Process organization, register organization, instruction cycle, instruction pipelining, RISC versus CISC.

UNIT – III: CONTROL UNIT AND MICRO PROGRAMMED CONTROL

Micro operations, control of the processor, hardwired implementation, micro programmed control, micro instruction sequencing and micro instruction execution.

UNIT – IV: MEMORY SYSTEM

Computer Memory System Overview, Cache Memory Principles, Semiconductor Main Memory, Advanced DRAM Organization, Magnetic Disk, Optical Memory, DMA.

UNIT – V: 8086 MICROPROCESSORS

Architecture and pin diagram of 8086, Register organization of 8086, physical memory organization, general bus operation, I/O addressing capability, Minimum mode, maximum mode of 8086 system and timings, addressing modes of 8086.

TEXT BOOKS:

1. William Stallings, "Computer Organization and Architecture", 8th Edition, Pearson, 2010.
2. A.K.Ray, K.M.Bhurchandi, "Advanced Microprocessors and Peripherals", Tata McGraw Hill Publications, 2000.

REFERENCES BOOKS:

1. Morris Mano, "Computer system architecture", 3rd Edition, Pearson Education, 2007.
2. Douglas V Hall, "Microprocessors and interfacing, Programming and Hardware", 2nd Edition, TMH, 2006

General Minor	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	4	0	0	30	70	100	4
Code: R20CCMN29	INTRODUCTION TO MICROCONTROLLERS						

COURSE OBJECTIVES:

- To explain 8051 architecture.
- To demonstrate the function of on-chip hardware units in 8051.
- To demonstrate serial communication.
- To develop 8051 embedded C programs for interfacing LED, LCD and Keyboard.
- To develop 8051 embedded C programs for interfacing DAC, ADC and 7segment LED Display.

COURSE OUTCOMES:

After completion of the course, students will be able to

CO1: Explain 8051 architecture. **[K2]**

CO2: Demonstrate the function of on-chip hardware units in 8051. **[K2]**

CO3: Demonstrate serial communication. **[K2]**

CO4: Develop 8051 embedded C programs for interfacing LED, LCD and Keyboard. **[K3]**

CO5: Develop 8051 embedded C programs for interfacing DAC, ADC and 7segment LED Display. **[K3]**

SYLLABUS:

UNIT–I: INTRODUCTION TO 8051 MICROCONTROLLER

Microprocessors vs. Microcontrollers. Overview of 8051 microcontroller, Architecture, I/O Ports.

UNIT–II: MEMORY ORGANIZATION AND ADDRESSING MODES

Memory organization, addressing modes and instruction set of 8051.

UNIT–III: INTERRUPTS AND SERIAL COMMUNICATION

Interrupts, timer/ Counter and serial communication.

UNIT-IV: INTERFACING OF 8051

Interfacing 8051 to LED, LCD and Keyboard Interfacing.

UNIT–V: INTERFACING AND APPLICATIONS OF 8051

Interfacing Seven segment display, ADC and DAC Interfacing.

TEXT BOOKS:

1. A.K.Ray, K.M.Bhurchandi, "Advanced Microprocessors and Peripherals", Tata McGraw Hill Publications, 2000.
2. Ayala, K.J., "The 8051 Microcontroller Architecture, Programming and Applications", 3rd Edition, Penram International, 2007.
3. Ajay V Deshmukh, "Microcontrollers", McGraw-Hill Education, 2017.

REFERENCE BOOKS:

1. Douglas V Hall, "Microprocessors and interfacing, Programming and Hardware", 2nd Edition, TMH, 2006
2. N.Sentil Kumar,M.Saravanan, S.Jeevananthan, "Microprocessors and Microcontrollers", Oxford University Press, 2010.

WEB REFERENCES:

1. http:// http://nptel.ac.in/courses/106108100/
2. https://onlinecourses.nptel.ac.in/noc18_ec03/
3. https://www.electronicshub.org/8051-microcontroller-introduction/
4. https://www.edgefx.in/8051-microcontroller-architecture/

General Minor	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	4	0	0	30	70	100	4
Code: R20CCMN30	INTRODUCTION TO EMBEDDED SYSTEMS						

COURSE OBJECTIVES:

- To gain knowledge and fundamental concepts and basic building blocks of an embedded system
- To learn characteristics, quality attributes and applications of embedded systems
- To understand the concept of real time operating systems
- To learn the RTOS basics and various Communication & Synchronization techniques
- To understand the classification and applications of embedded systems

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Illustrate the classification and applications of embedded systems. **[K3]**

CO2: Classify the memory devices and passive components of embedded systems**. [K4]**

CO3: Summarize various Communication interface in Embedded Systems. **[K2]**

CO4: Summarize the steps involved in developing application specific embedded systems with suitable example. **[K6]**

CO5: Describe the RTOS basics and various Communication & Synchronization techniques.**[K2]**

SYLLABUS:

UNIT–I: INTRODUCTION

Embedded Systems vs. general computing systems, classification of embedded systems, major application areas of embedded systems, purpose of embedded systems.

UNIT–II: CORE AND MEMORY

Core of the embedded system: general purpose and domain specific processors, ASICs, PLDs, Commercial Off-The-Shelf Components (COTS). Memory: ROM and RAM types.

UNIT–III: COMMUNICATION INTERFACE AND EMBEDDED SYSTEM COMPONENTS

Communication Interface: Onboard and external Communication Interfaces embedded firmware. Embedded system Components: reset circuit, brown-out protection circuit, oscillator unit, Real Time Clock (RTC), watchdog timer, PCB and passive components.

UNIT–IV: CHARACTERISTICS, QUALITY ATTRIBUTES AND EXAMPLES OF EMBEDDED SYSTEMS.

Characteristics of embedded systems and quality attributes of embedded systems. Embedded systems application and domain-specific: washing machine-application-specific embedded system, automotive- domain-specific embedded system.

UNIT–V: RTOS BASED EMBEDDED SYSTEM DESIGN

Operating system basics, types of operating systems, tasks, process and threads, multitasking, task scheduling – Non-Preemptive FIFO and SJF algorithms, Task communication – Shared memory types, task synchronization – Semaphore and mutex , task communication/synchronization issues.

TEXT BOOKS:

1. Shibu K.V, Introduction to Embedded Systems, Mc Graw Hill Education, 2013.
2. Raj Kamal, Embedded Systems, TMH, 2007.
3. Tammy Noergaard, Embedded systems Architecture, Elsevier publications, 2005.

REFERENCE BOOKS:

1. Frank Vahid, Tony Givargis, Embedded System Design, John Wiley, 1999.
2. David E. Simon, An Embedded Software Primer, Pearson Education, 1999.

WEB RESOURCES:

1. http://www.embeddedtechnology.com/
2. http://www.omg.org/realtime/
3. http://www.eembc.org
4. http://www.instantweb.com/~foldoc/
5. http://www.realtime-info.be/magazine/98q4/1998q4_p014.pdf
6. http://www.eet.com/
7. http://www.zdnet.com/intweek/

General Minor	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	4	0	0	30	70	100	4
Code: R20CCMN31	INTERNET OF THINGS						

COURSE OBJECTIVES:

- To present interconnection and integration of the physical world and the cyber space.
- To demonstrate applications of Internet of Things
- To educate building blocks and characteristics of Internet of Things
- To build a small low cost embedded system using Arduino/Raspberry Pi or equivalent boards.
- To apply the concept of internet of things in the real world scenario.

COURSE OUTCOMES:

After successful completion of this course, the students will be able to:

CO1: Outline the concept of internet of things. **[K2]**

CO2: Analyze the requirements, specifications to design IoT applications. **[K4]**

CO3: Analyze domain specific applications using Arduino and Raspberry pi. **[K4]**

CO4: Make use of embedded C and python programming to implement Internet of Things. **[K3]**

CO5: Build IoT applications using Raspberry Pi. **[K3]**

SYLLABUS:

UNIT- I:

INTRODUCTION & CONCEPTS:

Introduction to Internet of Things, physical design of IoT, logical design of IoT, IoT levels.

UNIT-II:

IoT DESIGN METHODOLOGY:

Purpose & Requirements Specification, Process Specification, Domain Model Specification, Information Model Specification, Service Specification, IoT Level Specification, Functional View Specification, Operational View specification, Device & Component Integration and Application Development.

UNIT- III:

IOT & M2M:

M2M, Difference between IOT and M2M, SDN and NFV for IOT, Software defined Networking, Network Function Virtualization

UNIT-IV:

PROTOTYPING EMBEDDED DEVICE WITH ARDUINO & RASPBERRY PI:

Sensors, Actuators, Arduino – Developing (IDE, pushing code, language and debugging) on the Arduino.

Raspberry PI – Introduction, cases and Extension Board (difference between raspberry pi and beagle bone black board), Developing (operating system, programming language and debugging) on the Raspberry PI.

UNIT- V:

DOMAIN SPECIFIC APPLICATIONS OF IOT:

Home Automation, Agriculture Applications, Smart City applications.

TEXT BOOKS:

1. Vijay Madisetti, Arshdeep Bahga, Internet of Things A Hands-On- Approach, 2014.

REFERENCE BOOKS:

1. Matt Richardson & Shane Wallace, Getting Started with Rasperry Pi, O'Reilly (SPD), 2014.
2. Adrian McEwen, Designing the Internet of Things, Wiley Publishers, 2013
3. Daniel Kellmereit, The Silent Intelligence: The Internet of Things, 2013

General Minor	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	4	0	0	30	70	100	4
Code: R20CCMN32	BASICS OF VLSI DESIGN						

COURSE OBJECTIVES:

- To learn the MOS Process Technology
- To understand the operation of MOS devices
- Understand and learn the characteristics of CMOS circuit construction.
- Describe the general steps required for processing of CMOS integrated circuits.
- To impart in-depth knowledge about analog and digital CMOS circuits.

COURSE OUTCOMES:

On successful completion of this course, student will be able to

CO1: Apply the concept of fabrication steps involved in IC design for various MOS transistors and come across basic electrical properties of MOSFET **[K3]**

CO2: Develop the expressions for inverter and propagation delays **[K3]**

CO3: Analyse the usage of scaling in Circuit design process. **[K4]**

CO4: Build combinational and sequential logic circuits using CMOS Logic design **[K4]**

CO5: Apply the knowledge of FPGA design to introduce advanced technologies **[K3]**

SYLLABUS:

UNIT-I: BASIC ELECTRICAL PROPERTIES OF MOS CIRCUITS

VLSI Design Flow, Introduction to IC technology, Fabrication process: nMOS, pMOS and CMOS. Regions of operation of MOSFET. Ids versus Vds Relationships.

UNIT-II: BASIC CIRCUIT CONCEPTS

Sheet Resistance, Sheet Resistance concept applied to MOS transistors and Inverters, Area Capacitance of Layers, Standard unit of capacitance, some area Capacitance Calculations, The Delay Unit, Inverter Delays, driving large capacitive loads, Propagation Delays. Switch logic, Gate logic.

UNIT-III: VLSI CIRCUIT DESIGN PROCESS

MOS Layers, Stick Diagrams, Design Rules and Layout, Layout Diagrams for MOS circuits.

SCALING OF MOS CIRCUITS: Scaling models and scaling factors, Scaling factors for device parameters, Limitations of scaling, Limits on logic levels and supply voltage due to noise and current density.

UNIT-IV: CMOS CIRCUIT DESIGN

STATIC CMOS DESIGN: Introduction to Complementary CMOS, Rationed Logic, Pass Transistor Logic.

DYNAMIC CMOS DESIGN: Dynamic Logic-Basic Principles, Speed and Power Dissipation of Dynamic Logic, Issues in Dynamic Design, Cascading Dynamic Gates, instability, Metastability.

UNIT-V: FPGA DESIGN

FPGA design flow, Basic FPGA architecture, FPGA Technologies.

TEXT BOOKS:

1. Essentials of VLSI Circuits and Systems - Kamran Eshraghian, Douglas and A. Pucknell and Sholeh Eshraghian, Prentice-Hall of India Private Limited, 2005 Edition.
2. Design of Analog CMOS Integrated Circuits by Behzad Razavi , McGraw Hill, 2003
3. Digital Integrated Circuits, Jan M. Rabaey, Anantha Chandrakasan and Borivoje Nikolic, 2nd Edition, 2016.

REFERENCE BOOKS:

1. Introduction to VLSI Circuits and Systems, John P. Uyemura, John Wiley & Sons, reprint 2009.
2. Integrated Nano electronics: Nano scale CMOS, Post-CMOS and Allied Nanotechnologies Vinod Kumar Khanna, Springer India, 1st edition, 2016.
3. FinFETs and other multi-gate transistors, Colinge JP, Editor New York, Springer, 2008.

WEB RESOURCES:

1. https://www.youtube.com/watch?v=b75At6VGQzQ&list=PL0c0N7xv8s06jXRL5qzmEpyJjHcPKl17S
2. https://www.youtube.com/watch?v=OAxIm8up7QY

General Minor	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	4	0	0	30	70	100	4
Code: R20CCMN33	INTRODUCTION TO WIRELESS SENSOR NETWORKS						

COURSE OBJECTIVES:

- Obtain a broad understanding about wireless sensor networking concepts and components
- Understand the architecture of wireless sensor network (WSN) and optimization goals.
- Gain the knowledge on networking technologies and protocols for WSN.
- Study security issues in WSN.

COURSE OUTCOMES:

After completion of the course, student will able to

CO1: Interpret wireless sensor networks and the key components. **[K4]**

CO2: Illustrate various physical and wireless MAC layers. **[K2]**

CO3: Analyze different Ad hoc routing protocols. **[K4]**

CO4: Recall about transport layer protocols and challenges for providing QOS. **[K1]**

CO5: Recall security concepts of wireless sensor networks. **[K1]**

SYLLABUS:

UNIT-I: OVERVIEW OF WIRELESS SENSOR NETWORKS

Introduction to sensor networks, Key definitions of sensor networks, Advantages of sensor Networks, Unique constraints and challenges, Driving Applications, Enabling Technologies for Wireless Sensor Networks.

UNIT-II: ARCHITECTURES AND NETWORKING TECHNOLOGIES

Single-Node Architecture - Hardware Components, Energy Consumption of Sensor Nodes, Operating Systems and Execution Environments, Network Architecture - Sensor Network, Scenarios, Optimization Goals and Figures of Merit.

UNIT-III: MAC PROTOCOLS FOR WIRELESS SENSOR NETWORKS

Issues in Designing a MAC protocol for Ad Hoc Wireless Networks, Design goals of MAC Protocol for Ad Hoc Wireless Networks, Classifications of MAC Protocols, Contention - Based Protocols, Contention - Based Protocols with reservation Mechanisms.

UNIT-IV: ROUTING PROTOCOLS

Introduction, Issues in Designing a Routing Protocol for Ad Hoc Wireless Networks, Classification of Routing Protocols, Table – Driven Routing Protocols, On–Demand Routing Protocols, Hybrid Routing Protocols, Hierarchical Routing Protocols.

UNIT-V: SECURITY IN WSNs

Security in Ad Hoc Wireless Networks, Network Security Requirements, Issues and Challenges in Security Provisioning, Network Security Attacks, Key Management, Secure Routing in Ad Hoc Wireless Networks.

TEXT BOOKS:

1. C. Siva Ram Murthy and B. S. Manoj, "Ad Hoc Wireless Networks: Architectures and Protocols", PHI 2004.
2. Holger Karl & Andreas Willig, "Protocols And Architectures for Wireless Sensor Networks", John Wiley, 2005.
3. Feng Zhao & Leonidas J. Guibas, "Wireless Sensor Networks- An Information Processing Approach", Elsevier, 2007.
4. Jagannathan Sarangapani, "Wireless Ad- hoc and Sensor Networks: Protocols, Performance and Control", CRC Press, 2007.

REFERENCE BOOKS:

1. Kazem Sohraby, Daniel Minoli, & Taieb Znati, "Wireless Sensor Networks- Technology, Protocols, and Applications", John Wiley, 2007.
2. C.K. Toh, "Ad- Hoc Mobile Wireless Networks: Protocols & Systems", 1st Edition, Pearson Education, 2007.
3. C. S. Raghavendra, Krishna M. Sivalingam,"Wireless Sensor Networks", 2004, Springer.
4. S Anandamurugan, "Wireless Sensor Networks", Lakshmi Publications, 2010.

DEPARTMENT OF CSE

LIST OF MINORS

(General Minor Track)

1. The student can opt any 4 subjects from each pool.
2. Concerned BoS can add or delete the subjects as per the decision of the board.
3. Pre requisites to be defined by the board for each course.
4. Compulsory MOOC/NPTEL Courses for 04 credits (02 courses@ 2 credits each)

S.No.	HONOR Subject Title	Sub Code	Cat. Code	Internal Marks	External Marks	Total Marks	L	T	P	Credits
1	Front End Web Technologies	R20CCMN03	PC	30	70	100	4	0	0	4
2	Software Engineering	R20CCMN34	PC	30	70	100	4	0	0	4
3	Data Warehousing and Data Mining	R20CCMN35	PC	30	70	100	4	0	0	4
4	Big Data Analytics	R20CCMN36	PC	30	70	100	4	0	0	4
5	Cloud Computing	R20CCMN37	PC	30	70	100	4	0	0	4
6	DevOps	R20CCMN38	PC	30	70	100	4	0	0	4

General Minor	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	-	-	30	70	100	3
SUBCODE: R20CCMN03	**FRONT END WEB TECHNOLOGIES**						

COURSE OBJECTIVE:

- This course is designed to introduce students with no programming experience to the programming languages and techniques associated with the World Wide Web. The course will introduce web-based media-rich programming tools for creating interactive web pages.

COURSE OUTCOMES:

After completion of this course, the students would be able to

CO1: Interpret a webpage and identify its elements and attributes.[K2].

CO2: Build webpages using HTML5 [K3].

CO3: Make use of Cascading Style Sheets on webpages [K3].

CO4: Make use of Java Script to write interactive webpages [K3].

SYLLABUS:

UNIT I

HTML5: - Fundamentals of HTML, - working with text, - organizing text in HTML,- working with Links and URLs

- creating tables

UNIT II

Multimedia:- Working with Images,- Colors and Canvas, -working with Forms, - Interactive elements, - working with Multimedia. - Embedding Audio, Video elements

UNIT–III:

Introduction to Cascading Style Sheets: -Overview of CSS3., - CSS3-Introduction to Cascading Style Sheets Features, - Inline style, - Internal or embedded style sheets, - External Style Sheet, - Backgrounds and color gradients in CSS, - Fonts and text styles.

UNIT–IV:

CSS Implementation: -Creating boxes and columns using CSS. -Displaying, positioning and floating an element, -list styles, table layouts,- Pseudo-classes and pseudo-elements. Effects in CSS.

UNIT–V:

Introduction to JavaScript: -General syntactic characteristics, -primitives, -operations, expressions and Control Statements.

Objects in JavaScript: Object creation and modification, Arrays, Functions.

TEXT BOOKS:

1. Kogent Learning solutions Inc., "HTML 5 Black book", Dreamtech.,2011, (Unit I,II,III).
2. Uttam K Roy, "Web Technologies",Oxford,2010 (Unit IV).

REFERENCE BOOKS:

1. Robert W Sebesta, "Programming the World Wide Web", 7ed, Pearson, 2012
2. Paul S Wang, Sanda S Katila, "An Introduction to Web Design, Programming", Cengage, 2003.

WEB REFERENCES:

1. https://www.w3schools.com/
2. nptel.ac.in/courses/106105084/13
3. https://www.coursera.org
4. https://www.w3schools.com/

General Minor	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	-	-	30	70	100	3
SUBCODE: R20CCMN34	**SOFTWARE ENGINEERING**						

COURSE OBJECTIVES:

- The student will have a broad understanding of the discipline of software engineering and its application to the development and management of software systems.

COURSE OUTCOMES:

After successful completion of this course, the students will be able to:

CO 1: Analyse basic software engineering models. [K4].

CO 2: Demonstrate the various Object Oriented Design models [K2].

CO 3: Outline the software prototyping, analysis and design [K2].

CO 4: Outline the importance of software testing and project management [K4].

SYLLABUS

UNIT I

Introduction to software engineering : Evolution and impact of software engineering, Software life cycle models, Waterfall model, Prototyping model, Evolution and spiral models, Feasibility study, Functional and non-functional requirements, Requirement gathering, Requirement analysis and specification.

UNIT II

SRS Documentation: Requirements Elicitation, Requirements Documentation, Use Cases, Unified Modeling Language, Introduction

Conceptual Model of the UML, Architecture, **Class Diagrams**-Terms and Concepts, Common Modeling Techniques- Modeling Logical Database Schema, Forward and Reverse Engineering, **Object Diagrams**- Terms and Concepts, Common Modeling Techniques, Modeling Object Structures, Forward and Reverse Engineering, **Interaction Diagrams**- Terms and Concepts, Common Modeling Techniques-Modeling a Flows of Control by Time Ordering, Modeling a Flows of Control by Organization, Forward and Reverse Engineering.

UNIT III

Use cases- Terms and Concepts, **Use case Diagrams**- Terms and Concepts, Common Modeling Techniques- Modeling the Requirements of a System, Forward and Reverse

Engineering, **Activity Diagrams**- Terms and Concepts, Common Modeling Techniques- Modeling a Workflow, Modeling an Operation, Forward and Reverse Engineering, **State Machines**-Terms and Concepts, **State Chart Diagrams**- Terms and Concepts, Common Modeling Techniques- Modeling Reactive Objects, Forward and Reverse Engineering, **Component**-Terms and Concepts, **Deployment**- Terms and Concepts, **Component Diagrams**- Terms and Concepts, Common Modeling Techniques- Modeling Executable Release, Modeling a Physical Database, Forward and Reverse Engineering and **Deployment Diagrams**- Terms and Concepts, Common Modeling Techniques- Modeling an Embedded System, Modeling a Client/Server System, Forward and Reverse Engineering.

UNIT IV

Analysis Phase: Analysis Object Model (Domain Model), Analysis Dynamic Model, Non-Functional Requirements, Analysis Patterns.

Design Phase: System Design Architecture, Design Principles, Design Concepts, Design Patterns, Architecture Styles, Dynamic Object Modeling, Static Object Modeling, Interface Specification, Object Constraint Language.

UNIT V

Testing: Fundamentals of testing, Black box testing techniques, White box testing techniques, Levels of testing, Test cases

Software project management : Project management, Project planning and control, Cost estimation, Project scheduling using PERT and GANTT charts, Software configuration management.

TEXT BOOKS:

1. Software Engineering:A Practitioner Approach By Roger S.Pressman, Mcgraw Hill Education
2. Grady Booch, James Rumbaugh, Lvor Jacobson, "The Unified Modeling Language - User Guide", Addition Wesley 1999.

REFERENCES:

1. Software Engineering By Ian Sommerville, Pearson
2. Fundamentals Of Software Engineering By Rajib Mall, Prentice Hall
3. Software Engineering Fundamentals By Ali Behforooz And Fredericks J. Hudson, Oxford University Press

WEB REFERENCES:

1.URL: https://www.youtube.com/watch?v=BqVqjJq7_vI
2.URL: https://nptel.ac.in/noc/courses/noc16/SEM2/noc16-cs19/

E-BOOKS:

1. https://www.edutechlearners.com/object-oriented-system-development-by-ali-bahrami/

General Minor	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	0	0	30	70	100	3
SUBCODE: R20CCMN35	**DATA WAREHOUSING AND DATA MINING**						

COURSE OBJECTIVES:

- Identify the scope and necessity of Data Mining & Warehousing for the society.
- Describe the design of Data Warehousing so that it can be able to solve the root problems.
- Categorize and carefully differentiate between situations for applying different data mining techniques: mining frequent patterns, association, correlation, classification, prediction, and cluster analysis.
- Evaluate the performance of different data mining algorithms.
- To develop further interest in research and design of new Data Mining Techniques.

COURSE OUTCOMES:

After successful completion of this course, the students will be able to:

CO 1: Interpret the data mining terminology and types of data to be mined. [K2]

CO 2: Outline the need and importance of pre-processing techniques and apply them.[K2]

CO 3: Interpret data warehousing concepts and operations. [K2]

CO 4: Compare and contrast different dominant Data Mining Algorithms for Classificationand Clustering and apply them. [K4]

CO 5: Analyze the performance of Association Rules. [K4]

SYLLABUS

UNIT– I

Introduction to data mining: -What Is Data Mining, -Motivating Challenges, -The Origins of Data Mining, - Data Mining Tasks, -Types of Data: Attributes and Measurement, Types of Data Sets, -

UNIT–II

Data:- Data Preprocessing: Aggregation, Sampling, Dimensionality Reduction, Feature Subset Selection, Feature Creation, Discretization and Binarization, Variable Transformation,

UNIT–III

Data Warehouse and OLAP Technology for Data Mining: -What is a Data Warehouse, -A Multidimensional Data Model: From tables to data cubes, Stars, snowflake, and fact constellations(schemas for multidimensional databases), Examples for defining star, snowflake, and fact constellation schemas,

UNIT-IV

Classification: Basic Concepts, Decision Trees, and Model Evaluation: -Preliminaries, -General Approach to Solving a Classification Problem, Decision Tree Induction: How a Decision Tree Works, How to Build a Decision Tree,

UNIT-V

Association Analysis: Basic Concepts and Algorithms: -Problem Definition, -Frequent Itemset Generation: The Apriori principle, Frequent Itemset Generation in the Apriori Algorithm, -Compact Representation of Frequent Itemsets:

TEXT BOOKS:

1. Pang-Ning tan, Michael Steinbach, Vipin kumar, “Introduction to Data Minin”, Addision- Wesley.
2. Jiawei Han, Micheline Kamber, “Data Mining, Concepts and Techniques”, Elsevier, 2/e, 2006.

REFERENCE BOOKS:

1. Margaret H Dunham, “Data Mining: Introductory and Advanced Topics”, Pearson, 2008.
2. GK Gupta, “Introduction to Data Mining with Case Studies”, Prentice Hall.
3. Jarke, Lenzerini, Vassiliou, Vassiliadis, “Fundamentals of data warehouses”, 2/e, Springer. 4. Soman,Diwakar, Ajay, “Data Mining Theory and Practice", PHI, 2006.

WEB REFERENCES:

1. https://onlinecourses.nptel.ac.in/noc18_cs14
2. www.oracle.com/Data/Warehousing
3. www.databaseanswers.org/data_warehousing.html
4. https://www.wileyindia.com/data-warehousing-data-mining.html

General Minor	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	0	0	30	70	100	3
SUBCODE: R20CCMN36	**BIG DATA ANALYTICS**						

COURSE OBJECTIVES:

- Introducing Java concepts required for developing map reduce programs.
- Optimize business decisions and create competitive advantage with Big Data analytics.
- Derive business benefit from unstructured data.
- Imparting the architectural concepts of Hadoop and introducing map reduce paradigm.
- To introduce programming tools PIG & HIVE in Hadoop echo system.

COURSE OUTCOMES:

After successful completion of this course, the students will be able to:

CO 1: Interpret the architectural elements of big data and Hadoop framework. [K2]

CO 2: Analyse various big data applications using map reduce programming module. [K4]

CO 3: Analyse Spark capabilities such as distributed datasets, in-memory caching, and the interactive shell. [K4]

CO 4: Summarize Spark's powerful built-in libraries, including Spark SQL, Spark Streaming. [K2]

CO 5: Analyze Hadoop data with PIG and Hive. Interpret the applications and architecture of Mobile Computing and multiplexing techniques. [K4]

SYLLABUS:

UNIT– I

Starting Hadoop: -Google File System, -The building blocks of Hadoop: Namenode, Datanode, Secondary Namenode, JobTracker, TaskTracker. -Setting up SSH for a Hadoop cluster: Define a common account, Verify SSH installation, Generate SSH key pair, Distribute public key and validate logins. - Running Hadoop: Local (standalone) mode, Pseudo-distributed mode, Fully distributed mode.

UNIT–II

MapReduce: -A Weather Dataset: Data Format, -Analyzing the Data with Hadoop: Map and Reduce, Java MapReduce: A test run, The old and the new Java MapReduce APIs.

Basic programs of Hadoop MapReduce: Driver code, Mapper code, Reducer code, RecordReader, Combiner, Partitioner.

UNIT–III

Programming with RDDs: What Is Apache Spark, RDD Basics, Creating RDDs, RDD Operations, Passing Functions to Spark, Common Transformations and Actions, Persistence (Caching).

UNIT-IV

Pig: Hadoop Programming Made Easier: -Admiring the Pig Architecture, -Going with the Pig Latin Application Flow, -Working through the ABCs of Pig Latin: Uncovering Pig Latin structures, Looking at Pig data types and syntax. -Evaluating Local and Distributed Modes of Running Pig Scripts, -Checking out the Pig Script Interfaces, -Scripting with Pig Latin

UNIT-V

Applying Structure to Hadoop Data with Hive: -Saying Hello to Hive, -Seeing How the Hive is Put Together, -Getting Started with Apache Hive, -Examining the Hive Clients: The Hive CLI client, The web browser as Hive client, SQuirreL as Hive client with the JDBC Driver. -Working with Hive Data Types, -Creating and Managing Databases and Tables: Managing Hive databases, Creating and managing tables with Hive. -Seeing How the Hive Data Manipulation Language Works: LOAD DATA examples, INSERT examples, Create Table As Select (CTAS) examples. Querying and Analyzing Data: Joining tables with Hive, Improving your Hive queries with indexes, Windowing in HiveQL, Other key HiveQL features.

TEXT BOOKS:

1. Tom White, “Hadoop: The Definitive Guide” 3rd Edition, O’Reilly Media.
2. Matei Zaharia, Holden Karau, Andi Konwinski, Patric Wendell, Learning Spark, O’Reilly Media,2015.
3. by Chuck Lam, “Hadoop in Action” MANNING Publ.
4. Dirk deRoos, Paul C.Zikopoulos, Roman B.Melnyk,Bruce Brown, Rafael Coss, “Hadoop for Dummies”

REFERENCE BOOKS:

1. Alex Holmes, “Hadoop in Practice”, MANNING Publ.
2. Srinath Perera, “Hadoop MapReduce Cookbook”, Thilina Gunarathne

WEB REFERENCES:

1. https://www.edx.org/learn/big-data
2. https://www.edureka.co/big-data-and-hadoop

General Minor	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	-	-	30	70	100	3
SUBCODE: R20CCMN37	**CLOUD COMPUTING**						

COURSE OBJECTIVES:

- To gain knowledge about virtualization and Virtual Machines
- To familiarize Cloud Computing and its services

COURSE OUTCOMES:

After successful completion of this course, the students will be able to:

CO1: Interpret various types of Virtualization.

CO2: Outline the Cloud Computing Architectures and Models.

CO3: Analyze the Cloud Infrastructure Management and Migration and Disaster Management in Cloud

CO4: Analyze AWS and MS Azure services.

SYLLABUS

UNIT-I:

Overview of Cloud Computing: Essentials of Cloud Computing, History of Cloud Computing, Business and Information, Benefits of Cloud Computing, Limitations of Cloud Computing, Characteristics of Cloud Computing, How to Develop Cloud Infrastructure, Vendors of Cloud Computing.

UNIT-II:

Introduction to virtualization and virtual machine: Types of virtualization: Server virtualization, Application/ desktop virtualization, client virtualization, storage virtualization, Network virtualization service / application infrastructure virtualization, virtual machines & virtualization middleware.

Cloud Computing Architecture: Grid Framework Overview, Grid Architecture, Cloud Computing Architecture, Key Design Aspects of Cloud Architecture, Cloud Services, and Cloud Applications, Similarities and Differences Between Grid and Cloud Computing, Cloud and Dynamic Infrastructure.

UNIT-III:

Models of Cloud Computing: Cloud Service Models, Cloud Computing Sub Service Models, Cloud Deployment Models, Alternative Deployment Models, Cloud Stack, Cloud Storage.

UNIT-IV:

Cloud Infrastructure Management and Migration: Administrating Clouds, Cloud Management

Products, Processes in Cloud Service Management, Cloud Providers and Traditional IT Service Providers, How to Access the Cloud, Migrating to Clouds.

Disaster Recovery: Disaster Recovery Planning, Disasters in the Cloud, Disaster Management

UNIT-V:

What is Microsoft Azure?, Types of Azure Clouds, Azure key Concepts, Azure Domains (Components), Traditional vs. Azure Cloud Model, Applications of Azure, Advantages of Azure, Disadvantages of Azure. What is AWS?, History of AWS,Important AWS Services , Amazon Web Services Cloud Platform: Compute & Networking , Storage & Content Delivery Network, Database, Analytics, Application Services, Deployment and Management ,Applications of AWS ,services, Companies using AWS, Advantages of AWS, Disadvantages of AWS, Comparison between Azure and AWS.

TEXT BOOKS:

1. Cloud Computing –Shailendra Singh Oxford University Press.

REFERENCE BOOKS:

1. Cloud Computing and SOA Convergence in Your Enterprise: A Step-by-Step Guide David S. Linthicum Addison-Wesley Professional.
2. Distributed & Cloud Computing From Parallel Processing to the Internet of Things by Kai Hwang. Geoffrey C. Fox. Jack J. Dongarra

ONLINE REFERENCES:

1. http://nptel.ac.in/courses/106106129/21
2. https://freevideolectures.com/course/3649/cloud-computing
3. https://www.youtube.com/watch?v=Eg4AAGCE7X4&list=PL2UlrhJ_JwyA5IlOCdEWlNArFke4jgtlg

General Minor	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	-	-	30	70	100	3
SUBCODE: R20CCMN38	**DEVOPS**						

COURSE OBJECTIVES:

- DevOps improves collaboration and productivity by automating infrastructure and workflows and continuously measuring applications performance

COURSE OUTCOMES:

At the end of the course, student will be able to

CO 1: Demonstrate the phases of software development life cycle. [K2]

CO 2: Outline the basic Fundamentals of DevOps. [K2]

CO 3: Adopt the DevOps technology into the project. [K6]

CO 4: Evaluate the CI/CD concepts and metrics to track CI/CD practices. [K5]

CO 5: Summarize the importance of DevOps maturity models. [K2]

SYLLABUS:

UNIT- I

Phases of Software Development life cycle. Values and principles of agile software development.

UNIT- II

Fundamentals of DevOps: Architecture, Deployments, Orchestration, Need, Instance of Applications, DevOps delivery pipeline, DevOps eco system.

UNIT- III

DevOps adoption in projects: Technology aspects, Agiling capabilities, Tool stack implementation, People aspect, processes

UNIT- IV

CI/CD: Introduction to Continuous Integration, Continuous Delivery and Deployment, Benefits

of CI/CD, Metrics to track CICD practices

UNIT- V

Devops Maturity Model: Key factors of DevOps maturity model, stages of Devops maturity Model, DevOps maturity Assessment.

TEXT BOOKS:

1. Gene Kim , John Willis , Patrick Debois, "The DevOPS Handbook: How to Create World-Class Agility, Reliability, and Security in Technology Organizations" Jez Humb,O'Reilly Publications
2. Mike Loukides, "What is Devops? Infrastructure as code" O'Reilly publications.
3. Jez Humble and David Farley, "Continuous Delivery: Reliable Software Releases Through Build, Test, and Deployment Automation",
4. Dave Harrison, Knox Lively, "Achieving DevOps: A Novel About Delivering the Best of Agile, DevOps, and Microservices.
5. Joakim Verona , Packt, "Practical Devops"

REFERENCE BOOKS:

1. Mandi Walls, "Building a DevOps Culture", O'Reilly publications
2. Viktor Farcic, "The DevOps 2.0 Toolkit: Automating the Continuous Deployment Pipeline With Containerized Micro services"

WEB REFERENCES:

1. https://www.youtube.com/watch?v=hQcFE0RD0cQ
2. https://www.youtube.com/watch?v=YSkDtQ2RA_c
3. https://www.svrtechnologies.video/courses/devops-training-free/lectures/10955807
4. https://www.youtube.com/watch?v=MOZMw5_fBFA

DEPARTMENT OF IT

GENERAL MINOR TRACKS

S. NO.	SUBJECT CODE	SUBJECT	L	T	P	CREDITS
1	R20CCMN04	FUNDAMENTALS OF ARTIFICIAL INTELLIGENCE	3	1	0	4
2	R20CCMN39	FUNDAMENTALS OF DATA SCIENCE	3	1	0	4
3	R20CCMN40	FUNDAMENTALS OF MACHINE LEARNING	3	1	0	4
4	R20CCMN41	FUNDAMENTALS OF DEEP LEARNING	3	1	0	4
5	R20CCMN42	INTRODUCTION TO BIG DATA ANALYTICS	3	1	0	4
	In addition to any of the four subjects, MOOC/NPTEL Courses for 04 credits (02 courses @ 2 credits each) are compulsory in the domain of Electrical and Electronics Engineering					

MINORS	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	1	-	30	70	100	4
SUBCODE: R20CCMN04	**FUNDAMENTALS OF ARTIFICIAL INTELLIGENCE**						

COURSE OBJECTIVE:

Develop a basic understanding of the building blocks of AI as presented in terms of intelligent agents: Search, Knowledge representation, inference, logic and learning.

• The knowledge of artificial intelligence plays a considerable role in some applications students develop for courses in the program.

COURSE OUTCOMES:

After completion of this course, the students would be able to

CO1: Summarize the characteristics of AI that make it useful to real-world problems. [K2]

CO2: Analyse different search techniques and predicate logic in artificial Intelligence. [K4]

CO3: Interpret knowledge representation and symbolic reasoning using different rules. [K2]

CO4: Apply the basic knowledge on learning and reinforcement learning. [K3]

CO5: Make use of the power of AI in Natural language processing as an advanced Application of AI. [K3]

SYLLABUS:

UNIT - I

Introduction to AI, Problems, agent, agent types ,Problem Spaces and Search: Defining the Problem as a State space Search, Production Systems - advantages & disadvantages , features of production system, production system rules, classifications.

UNIT – II

Heuristic Search Techniques: Hill Climbing algorithm, problems, Best-First Search(greedy approach), A* search Algorithm Problem Reduction, Constraint Satisfaction

Knowledge Representation Using Predicate Logic: Representing Simple Facts in logic, Representing Instance and Isa Relationship.

UNIT - III

Representing Knowledge Using Rules: Procedural versus Declarative Knowledge, Logic Programming, Forward versus Backward Reasoning.

UNIT – IV

Learning: machine learning, types , Reinforcement Learning: Markov Decision Problem, Q-Learning, Q-Learning Algorithm

UNIT – V

Natural Language Processing: Syntactic Processing, Semantic Analysis, Discourse and Pragmatic Processing, Statistical Natural language Processing, Spell Checking.

TEXT BOOKS:

1. Elaine Rich & Kevin Knight, "Artificial Intelligence", Tata McGraw Hill Edition, 3rd Edition, Reprint 2008.

2. Artificial Intelligence- Saroj Kaushik, CENGAGE Learning,

3. Carl Townsend, "Introduction to TURBO PROLOG", BPB Publications. 2011 4. Tom M Mitchell, "Machine Learning", McGraw-Hill Science/Engineering/Math, 1997.

REFERENCE BOOKS:

1. Artificial Intelligence- Saroj Kaushik, CENGAGE Learning,

2. Patrick Henry Winston, 'Artificial Intelligence', Pearson Education, 2003

3. Russel and Norvig, 'Artificial Intelligence', Pearson Education, PHI, 2003

WEB REFERENCES:

1. https://www.coursera.org/learn/machine-learning

2. https://www.simplilearn.com/big-data-and-analytics/machine-learning

3. https://www.appliedaicourse.com/course/applied-ai-course-online

MINORS	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	1	-	30	70	100	4
SUBCODE: R20CCMN39	**FUNDAMENTALS OF DATA SCIENCE**						

COURSE OBJECTIVE:

- To familiarize students with how various statistics like mean median etc. can be collected for data exploration in Python
- To provide a solid undergraduate foundation in both probability theory and mathematical statistics and at the same time provides an indication of the relevance and importance of the theory in solving practical problems in the real world

COURSE OUTCOMES:

After completion of this course, the students will be able to:

CO 1: Demonstrate the basic arithmetic programming in python [K3]

CO 2: Analyze different data structures and choose suitable one for a given problem [K4]

CO 3: Demonstrate Data cleaning, processing for the given dataset using respective packages. [K3]

CO 4: Perform Data visualization [K3]

CO 5: Solve the problems related to Descriptive and Inferential Statistics for a given scenario. [K4]

SYLLABUS:

UNIT-I

What is Data science?, The Data science process, A data scientist role in this process, NumPy Basics: The NumPy ndarray: A Multidimensional Array Object(Creating ndarrays ,Data Types for ndarrays,Operations between Arrays and Scalars, Basic Indexing and Slicing, Boolean Indexing, FancyIndexing), Data Processing Using Arrays(Expressing Conditional Logic as Array Operations ,Methods for Boolean Arrays , Sorting , Unique)

UNIT-II

Getting Started with pandas: Introduction to pandas, Library Architecture, Features, Applications, Data Structures(Series, DataFrame, Index Objects), Essential Functionality(

Reindexing, Dropping entries from an axis, Indexing, selection, and filtering), Sorting and ranking, Summarizing and Computing Descriptive Statistics(Unique Values, Value Counts), Handling Missing Data.

UNIT-III

Data Loading, Storage, and File Formats : Reading and Writing Data in Text Format(Reading Text Files in Pieces, Writing Data Out to Text Format, Manually Working with Delimited Formats,

UNIT-IV

Data Wrangling: Clean, Transform, Merge, Reshape: Combining and Merging Data Sets (Database-style DataFrame Merges, Merging on Index, Concatenating Along an Axis, Combining Data with Overlap)

Plotting and Visualization: A Brief matplotlib API Primer (Figures and Subplots, Colors, Markers, and Line Styles, Ticks, Labels, and Legends, Annotations and Drawing on a Subplot, Saving Plots to File), Plotting Functions in pandas (Line Plots, Bar Plots, Histograms, Scatter Plots)

UNIT-V

Data Aggregation and Group Operations: GroupBy Mechanics(Iterating Over Groups, Selecting a Column or Subset of Columns, Grouping with Dicts and Series, Grouping with Functions, Grouping by Index Levels) Data Aggregation(Column-wise and Multiple Function Application, Returning Aggregated Data in "unindexed" Form)

TEXT BOOKS:

Wes McKinney, "Python for Data Analysis", O'REILLY, ISBN: 978-1-449-31979-3, 1st edition, October 2012.

REFERENCE BOOKS:

1. Rachel Schutt & O'neil, "Doing Data Science", O'REILLY, ISBN:978-1-449-35865-5, 1st edition, October 2013.
2. Joel Grus, "Data Science from Scratch", O'REILLY, 1st edition, April 2015

WEB REFERENCES:

https://www.greatlearning.in/

https://onlinecourses.nptel.ac.in/noc20_cs62/

https://nptel.ac.in/noc/courses/noc20/SEM2/noc2

MINORS	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	1	-	30	70	100	4
SUBCODE: R20CCMN40	**FUNDAMENTALS OF MACHINE LEARNING**						

COURSE OBJECTIVES:

- To understand how machine learning algorithms are evaluated.
- To be Familiar with a set of well-known supervised, unsupervised and semi-supervised learning algorithms.
- To be able to implement some basic machine learning algorithms.

COURSE OUTCOMES:

After successful completion of this course, the students will be able to:

CO 1: Summarize the characteristics of Machine Learning that make it useful to real-world Problems. [K2]

CO 2: Outline the need and importance of pre-processing techniques and apply them. [K2]

CO 3: Evaluate and compare the performance of different unsupervised algorithms for typical learning problems and apply them. [K5]

CO 4: Analyze the performance of Association Rules. [K4]

CO 5: Evaluate and compare the performance of different supervised algorithms for typical learning problems and apply them. [K5]

SYLLABUS

UNIT– I

Introduction: Definition of learning systems, Goals and applications of machine learning, training data, concept representation. Supervised Learning: Learning a Class from Examples, Vapnik Chervonenkis (VC) Dimension, Probably Approximately Correct (PAC) Learning

UNIT–II

Bayesian Decision Theory: Classification, Losses and Risks, Parametric Methods: Maximum Likelihood Estimation, Evaluating an Estimator: Bias and Variance, The Bayes' Estimator, Parametric Classification, Regression, Tuning Model Complexity: Bias/Variance Dilemma

UNIT–III

Dimensionality Reduction: Subset Selection, Principal Components Analysis, Factor Analysis, Linear Discriminant Analysis Association learning: Basics of Association, Apriori Algorithm, Eclat Algorithm, FP Growth Algorithm with examples

UNIT-IV

Unsupervised Learning: Self-Organizing Maps(SOM),learning Process in SOM, Algorithm: SOM, Clustering: k-Means Clustering, Expectation-Maximization Algorithm, Supervised Learning after Clustering, Fuzzy Clustering, Document Clustering example, Hierarchical Clustering

UNIT-V

Decision Trees: Univariate Trees, Pruning, Rule Extraction from Trees, Learning Rules from Data. Random Forest: basic Principle, Decision Tree vs random Forest, Random Forest Algorithm with Example

TEXT BOOKS:

Ethem Alpaydin, “Introduction to Machine Learning”, The MIT Press, 2010

Artificial Intelligence and Machine Learning, by Vinod Chandra PHI Learning.

Aurélien Géron, “Handson machine learning with scikit learn and tensorflow” O’REILLY

MINORS	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	1	-	30	70	100	4
SUBCODE: R20CCMN41	**FUNDAMENTALS OF DEEP LEARNING**						

COURSE OBJECTIVE:

- This course covers the basics of machine learning, neural networks and deep learning. Model for deep learning technique and the various optimization and generalization mechanisms are included. Major topics in deep learning and dimensionality reduction techniques are covered. The objective of this course is:
- To present the mathematical, statistical and computational challenges of building neural networks. • To study the concepts of deep learning
- To introduce dimensionality reduction techniques
- To enable the students to know deep learning techniques to support real-time applications
- To examine the case studies of deep learning techniques

COURSE OUTCOMES:

After successful completion of this course, the students will be able to:

CO 1: Compare and Contrast concepts of deep learning[K2].

CO 2: Make use of various deep learning models[K3].

CO 3: Interpret Statistical reasoning and filler structures[K2].

CO 4: Analyze optimization and generalization in deep learning[K4].

CO 5: Analyze the deep learning applications[K4]

SYLLABUS:

UNIT-I

INTRODUCTION :Introduction to machine learning- Linear models (SVMs and Perceptrons, logistic regression)- Intro to Neural Nets: What a shallow network computes- Training a network: loss functions, back propagation and stochastic gradient descent- Neural networks as universal function approximates

UNIT-II

DEEP NETWORKS History of Deep Learning- A Probabilistic Theory of Deep LearningBackpropagation and regularization, batch normalization- VC Dimension and Neural Nets-Deep Vs Shallow Networks Convolutional Networks- Generative Adversarial Networks (GAN), Semisupervised Learning

UNIT-III

DIMENTIONALITY REDUCTION Linear (PCA, LDA) and manifolds, metric learning - Auto encoders and dimensionality reduction in networks - Introduction to Convnet - Architectures – AlexNet, VGG, Inception, ResNet - Training a Convnet: weights initialization, batch normalization, hyperparameter optimization

UNIT-IV

OPTIMIZATION AND GENERALIZATION Optimization in deep learning– Non-convex optimization for deep networks- Stochastic Optimization Generalization in neural networks- Spatial Transformer Networks

UNIT-V

RECURRENT NEURAL NETWORK Recurrent networks, LSTM - Recurrent Neural Network Language Models- Word-Level RNNs & Deep Reinforcement Learning - Computational & Artificial Neuroscience

TEXT BOOKS:

1. Cosma Rohilla Shalizi, " Advanced Data Analysis from an Elementary Point of View", 2015.
2. Deng & Yu, "Deep Learning: Methods and Applications", Now Publishers, 2013.
3. Ian Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning", MIT Press, 2016.
4. Michael Nielsen, "Neural Networks and Deep Learning", Determination Press, 2015.

MINORS	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	1	-	30	70	100	4
SUBCODE: R20CCMN42	**FUNDAMENTALS OF BIG DATA ANALYTICS**						

COURSE OBJECTIVES:

- Introducing Java concepts required for developing map reduce programs.
- Optimize business decisions and create competitive advantage with Big Data analytics.
- Derive business benefit from unstructured data.
- Imparting the architectural concepts of Hadoop and introducing map reduce paradigm.
- To introduce programming tools PIG & HIVE in Hadoop echo system.

COURSE OUTCOMES:

After successful completion of this course, the students will be able to:

CO 1: Interpret the architectural elements of big data and Hadoop framework. [K2]

CO 2: Analyse various big data applications using map reduce programming module. [K4]

CO 3: Analyse Spark capabilities such as distributed datasets, in-memory caching, and the interactive shell. [K4]

CO 4: Summarize Spark's powerful built-in libraries, including Spark SQL, Spark Streaming. [K2]

CO 5: Analyze Hadoop data with PIG and Hive. Interpret the applications and architecture of Mobile Computing and multiplexing techniques. [K4]

SYLLABUS:

UNIT– I

Starting Hadoop: -Google File System, -The building blocks of Hadoop: Namenode, Datanode, Secondary Namenode, JobTracker, TaskTracker. -Setting up SSH for a Hadoop cluster: Define a common account, Verify SSH installation, Generate SSH key pair, Distribute public key and validate logins. - Running Hadoop: Local (standalone) mode, Pseudo-distributed mode, Fully distributed mode.

UNIT–II

MapReduce: -A Weather Dataset: Data Format, -Analyzing the Data with Hadoop: Map and Reduce, Java MapReduce: A test run, The old and the new Java MapReduce APIs. Basic programs of Hadoop MapReduce: Driver code, Mapper code, Reducer code, RecordReader, Combiner, Partitioner.

UNIT–III

Programming with RDDs: What Is Apache Spark, RDD Basics, Creating RDDs, RDD Operations, Passing Functions to Spark, Common Transformations and Actions, Persistence (Caching).

UNIT-IV

Pig: Hadoop Programming Made Easier: -Admiring the Pig Architecture, -Going with the Pig Latin Application Flow, -Working through the ABCs of Pig Latin: Uncovering Pig Latin structures, Looking at Pig data types and syntax. -Evaluating Local and Distributed Modes of Running Pig Scripts, -Checking out the Pig Script Interfaces, -Scripting with Pig Latin

UNIT-V

Applying Structure to Hadoop Data with Hive: -Saying Hello to Hive, -Seeing How the Hive is Put Together, -Getting Started with Apache Hive, -Examining the Hive Clients: The Hive CLI client, The web browser as Hive client, SQuirreL as Hive client with the JDBC Driver. -Working with Hive Data Types, -Creating and Managing Databases and Tables: Managing Hive databases, Creating and managing tables with Hive. -Seeing How the Hive Data Manipulation Language Works: LOAD DATA examples, INSERT examples, Create Table As Select (CTAS) examples. Querying and Analyzing Data: Joining tables with Hive, Improving your Hive queries with indexes, Windowing in HiveQL, Other key HiveQL features.

TEXT BOOKS:

1. Tom White, “Hadoop: The Definitive Guide” 3rd Edition, O’Reilly Media.

2. Matei Zaharia, Holden Karau, Andi Konwinski, Patric Wendell, Learning Spark, O’Reilly Media,2015.

3. by Chuck Lam, “Hadoop in Action” MANNING Publ.

4. Dirk deRoos, Paul C.Zikopoulos, Roman B.Melnyk,Bruce Brown, Rafael Coss, “Hadoop for Dummies”

REFERENCE BOOKS:

1. Alex Holmes, “Hadoop in Practice”, MANNING Publ.

2. Srinath Perera, “Hadoop MapReduce Cookbook”, Thilina Gunarathne

WEB REFERENCES:

1. https://www.edx.org/learn/big-data

2. https://www.edureka.co/big-data-and-hadoop

DEPARTMENT OF CSE (AI)

GENERAL MINOR TRACKS

S. NO.	SUBJECT CODE	SUBJECT	L	T	P	CREDITS
1	R20CCMN04	FUNDAMENTALS OF ARTIFICIAL INTELLIGENCE	3	1	0	4
2	R20CCMN43	FUNDAMENTALS OF DATA SCIENCE	3	1	0	4
3	R20CCMN44	FUNDAMENTALS OF MACHINE LEARNING	3	1	0	4
4	R20CCMN45	FUNDAMENTALS OF DEEP LEARNING	3	1	0	4
5	R20CCMN46	INTRODUCTION TO BIG DATA ANALYTICS	3	1	0	4
	In addition to any of the four subjects, MOOC/NPTEL Courses for 04 credits (02 courses @ 2 credits each) are compulsory in the domain of Electrical and Electronics Engineering					

MINORS	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	1	-	30	70	100	4
SUBCODE: R20CCMN04	**FUNDAMENTALS OF ARTIFICIAL INTELLIGENCE**						

COURSE OBJECTIVE:

Develop a basic understanding of the building blocks of AI as presented in terms of intelligent agents: Search, Knowledge representation, inference, logic and learning.

• The knowledge of artificial intelligence plays a considerable role in some applications students develop for courses in the program.

COURSE OUTCOMES:

After completion of this course, the students would be able to

CO1: Summarize the characteristics of AI that make it useful to real-world problems. [K2]

CO2: Analyse different search techniques and predicate logic in artificial Intelligence. [K4]

CO3: Interpret knowledge representation and symbolic reasoning using different rules. [K2]

CO4: Apply the basic knowledge on learning and reinforcement learning. [K3]

CO5: Make use of the power of AI in Natural language processing as an advanced Application of AI. [K3]

SYLLABUS:

UNIT - I

Introduction to AI, Problems, agent, agent types ,Problem Spaces and Search: Defining the Problem as a State space Search, Production Systems - advantages & disadvantages , features of production system, production system rules, classifications.

UNIT – II

Heuristic Search Techniques: Hill Climbing algorithm, problems, Best-First Search(greedy approach), A* search Algorithm Problem Reduction, Constraint Satisfaction

Knowledge Representation Using Predicate Logic: Representing Simple Facts in logic, Representing Instance and Isa Relationship.

UNIT - III

Representing Knowledge Using Rules: Procedural versus Declarative Knowledge, Logic Programming, Forward versus Backward Reasoning.

UNIT – IV

Learning: machine learning, types , Reinforcement Learning: Markov Decision Problem, Q-Learning, Q-Learning Algorithm

UNIT – V

Natural Language Processing: Syntactic Processing, Semantic Analysis, Discourse and Pragmatic Processing, Statistical Natural language Processing, Spell Checking.

TEXT BOOKS:

1. Elaine Rich & Kevin Knight, "Artificial Intelligence", Tata McGraw Hill Edition, 3rd Edition, Reprint 2008.

2. Artificial Intelligence- Saroj Kaushik, CENGAGE Learning,

3. Carl Townsend, "Introduction to TURBO PROLOG", BPB Publications. 2011 4. Tom M Mitchell, "Machine Learning", McGraw-Hill Science/Engineering/Math, 1997.

REFERENCE BOOKS:

1. Artificial Intelligence- Saroj Kaushik, CENGAGE Learning,

2. Patrick Henry Winston, 'Artificial Intelligence', Pearson Education, 2003

3. Russel and Norvig, 'Artificial Intelligence', Pearson Education, PHI, 2003

WEB REFERENCES:

1. https://www.coursera.org/learn/machine-learning

2. https://www.simplilearn.com/big-data-and-analytics/machine-learning

3. https://www.appliedaicourse.com/course/applied-ai-course-online

MINORS	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	1	-	30	70	100	4
SUBCODE: R20CCMN43	**FUNDAMENTALS OF DATA SCIENCE**						

COURSE OBJECTIVE:

- To familiarize students with how various statistics like mean median etc. can be collected for data exploration in Python
- To provide a solid undergraduate foundation in both probability theory and mathematical statistics and at the same time provides an indication of the relevance and importance of the theory in solving practical problems in the real world

COURSE OUTCOMES:

After completion of this course, the students will be able to:

CO 1: Demonstrate the basic arithmetic programming in python [K3]

CO 2: Analyze different data structures and choose suitable one for a given problem [K4].

CO 3: Demonstrate Data cleaning, processing for the given dataset using respective packages. [K3]

CO 4: Perform Data visualization [K3]

CO5: Solve the problems related to Descriptive and Inferential Statistics for a given scenario.[K4]

SYLLABUS:

UNIT-I

What is Data science?, The Data science process, A data scientist role in this process, NumPy Basics: The NumPy ndarray: A Multidimensional Array Object(Creating ndarrays ,Data Types for ndarrays,Operations between Arrays and Scalars, Basic Indexing and Slicing, Boolean Indexing, FancyIndexing), Data Processing Using Arrays(Expressing Conditional Logic as Array Operations ,Methods for Boolean Arrays , Sorting , Unique)

UNIT-II

Getting Started with pandas: Introduction to pandas, Library Architecture, Features, Applications, Data Structures(Series, DataFrame, Index Objects), Essential Functionality(Reindexing, Dropping entries from an axis, Indexing, selection, and filtering), Sorting and

ranking, Summarizing and Computing Descriptive Statistics(Unique Values, Value Counts), Handling Missing Data.

UNIT-III

Data Loading, Storage, and File Formats : Reading and Writing Data in Text Format(Reading Text Files in Pieces, Writing Data Out to Text Format, Manually Working with Delimited Formats,

UNIT-IV

Data Wrangling: Clean, Transform, Merge, Reshape: Combining and Merging Data Sets (Database-style DataFrame Merges, Merging on Index, Concatenating Along an Axis, Combining Data with Overlap)

Plotting and Visualization: A Brief matplotlib API Primer (Figures and Subplots, Colors, Markers, and Line Styles, Ticks, Labels, and Legends, Annotations and Drawing on a Subplot, Saving Plots to File), Plotting Functions in pandas (Line Plots, Bar Plots, Histograms, Scatter Plots)

UNIT-V

Data Aggregation and Group Operations: GroupBy Mechanics(Iterating Over Groups, Selecting a Column or Subset of Columns, Grouping with Dicts and Series, Grouping with Functions, Grouping by Index Levels) Data Aggregation(Column-wise and Multiple Function Application, Returning Aggregated Data in "unindexed" Form)

TEXT BOOKS:

Wes McKinney, "Python for Data Analysis", O'REILLY, ISBN: 978-1-449-31979-3, 1st edition, October 2012.

REFERENCE BOOKS:

1. Rachel Schutt & O'neil, "Doing Data Science", O'REILLY, ISBN:978-1-449-35865-5, 1st edition, October 2013.
2. Joel Grus, "Data Science from Scratch", O'REILLY, 1st edition, April 2015

WEB REFERENCES:

https://www.greatlearning.in/

https://onlinecourses.nptel.ac.in/noc20_cs62/

https://nptel.ac.in/noc/courses/noc20/SEM2/noc2

MINORS	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	1	-	30	70	100	4
SUBCODE: R20CCMN44	**FUNDAMENTALS OF MACHINE LEARNING**						

COURSE OBJECTIVES:

- To understand how machine learning algorithms are evaluated.
- To be Familiar with a set of well-known supervised, unsupervised and semi-supervised learning algorithms.
- To be able to implement some basic machine learning algorithms.

COURSE OUTCOMES:

After successful completion of this course, the students will be able to:

CO 1: Summarize the characteristics of Machine Learning that make it useful to real-world Problems. [K2]

CO 2: Outline the need and importance of pre-processing techniques and apply them. [K2]

CO 3: Evaluate and compare the performance of different unsupervised algorithms for typical learning problems and apply them. [K5]

CO 4: Analyze the performance of Association Rules. [K4]

CO 5: Evaluate and compare the performance of different supervised algorithms for typical learning problems and apply them. [K5]

SYLLABUS

UNIT– I

Introduction: Definition of learning systems, Goals and applications of machine learning, training data, concept representation. Supervised Learning: Learning a Class from Examples, Vapnik Chervonenkis (VC) Dimension, Probably Approximately Correct (PAC) Learning

UNIT–II

Bayesian Decision Theory: Classification, Losses and Risks, Parametric Methods: Maximum Likelihood Estimation, Evaluating an Estimator: Bias and Variance, The Bayes' Estimator, Parametric Classification, Regression, Tuning Model Complexity: Bias/Variance Dilemma

UNIT–III

Dimensionality Reduction: Subset Selection, Principal Components Analysis, Factor Analysis, Linear Discriminant Analysis Association learning: Basics of Association, Apriori Algorithm, Eclat Algorithm, FP Growth Algorithm with examples

UNIT-IV

Unsupervised Learning: Self-Organizing Maps(SOM),learning Process in SOM, Algorithm: SOM, Clustering: k-Means Clustering, Expectation-Maximization Algorithm, Supervised Learning after Clustering, Fuzzy Clustering, Document Clustering example, Hierarchical Clustering.

UNIT-V

Decision Trees: Univariate Trees, Pruning, Rule Extraction from Trees, Learning Rules from Data. Random Forest: basic Principle, Decision Tree vs random Forest, Random Forest Algorithm with Example

TEXT BOOKS:

Ethem Alpaydin, “Introduction to Machine Learning”, The MIT Press, 2010

Artificial Intelligence and Machine Learning, by Vinod Chandra PHI Learning.

Aurélien Géron, “Handson machine learning with scikit learn and tensorflow” O’REILLY

MINORS	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	1	-	30	70	100	4
SUBCODE: R20CCMN45	**FUNDAMENTALS OF DEEP LEARNING**						

COURSE OBJECTIVE:

- This course covers the basics of machine learning, neural networks and deep learning. Model for deep learning technique and the various optimization and generalization mechanisms are included. Major topics in deep learning and dimensionality reduction techniques are covered. The objective of this course is:
- To present the mathematical, statistical and computational challenges of building neural networks. • To study the concepts of deep learning
- To introduce dimensionality reduction techniques
- To enable the students to know deep learning techniques to support real-time applications
- To examine the case studies of deep learning techniques

COURSE OUTCOMES:

After successful completion of this course, the students will be able to:

CO 1: Compare and Contrast concepts of deep learning [K2].

CO 2: Make use of various deep learning models [K3].

CO 3: Interpret Statistical reasoning and filler structures [K2].

CO 4: Analyze optimization and generalization in deep learning [K4].

CO 5: Analyze the deep learning applications [K4]

SYLLABUS:

UNIT-I

INTRODUCTION: Introduction to machine learning- Linear models (SVMs and Perceptrons, logistic regression)- Intro to Neural Nets: What a shallow network computes- Training a network: loss functions, back propagation and stochastic gradient descent- Neural networks as universal function approximates

UNIT-II

DEEP NETWORKS History of Deep Learning- A Probabilistic Theory of Deep LearningBackpropagation and regularization, batch normalization- VC Dimension and Neural Nets-Deep Vs Shallow Networks Convolutional Networks- Generative Adversarial Networks (GAN), Semisupervised Learning

UNIT-III

DIMENTIONALITY REDUCTION Linear (PCA, LDA) and manifolds, metric learning - Auto encoders and dimensionality reduction in networks - Introduction to Convnet - Architectures – AlexNet, VGG, Inception, ResNet - Training a Convnet: weights initialization, batch normalization, hyperparameter optimization

UNIT-IV

OPTIMIZATION AND GENERALIZATION Optimization in deep learning– Non-convex optimization for deep networks- Stochastic Optimization Generalization in neural networks- Spatial Transformer Networks

UNIT-V

RECURRENT NEURAL NETWORK Recurrent networks, LSTM - Recurrent Neural Network Language Models- Word-Level RNNs & Deep Reinforcement Learning - Computational & Artificial Neuroscience

TEXT BOOKS:

1. Cosma Rohilla Shalizi, " Advanced Data Analysis from an Elementary Point of View", 2015.
2. Deng & Yu, "Deep Learning: Methods and Applications", Now Publishers, 2013.
3. Ian Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning", MIT Press, 2016.
4. Michael Nielsen, "Neural Networks and Deep Learning", Determination Press, 2015.

MINORS	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	1	-	30	70	100	4
SUBCODE: R20CCMN46	**FUNDAMENTALS OF BIG DATA ANALYTICS**						

COURSE OBJECTIVES:

- Introducing Java concepts required for developing map reduce programs.
- Optimize business decisions and create competitive advantage with Big Data analytics.
- Derive business benefit from unstructured data.
- Imparting the architectural concepts of Hadoop and introducing map reduce paradigm.
- To introduce programming tools PIG & HIVE in Hadoop echo system.

COURSE OUTCOMES:

After successful completion of this course, the students will be able to:

CO 1: Interpret the architectural elements of big data and Hadoop framework. [K2]

CO 2: Analyse various big data applications using map reduce programming module. [K4]

CO 3: Analyse Spark capabilities such as distributed datasets, in-memory caching, and the interactive shell. [K4]

CO 4: Summarize Spark's powerful built-in libraries, including Spark SQL, Spark Streaming. [K2]

CO 5: Analyze Hadoop data with PIG and Hive. Interpret the applications and architecture of Mobile Computing and multiplexing techniques. [K4]

SYLLABUS:

UNIT– I

Starting Hadoop: -Google File System, -The building blocks of Hadoop: Namenode, Datanode, Secondary Namenode, JobTracker, TaskTracker. -Setting up SSH for a Hadoop cluster: Define a common account, Verify SSH installation, Generate SSH key pair, Distribute public key and validate logins. - Running Hadoop: Local (standalone) mode, Pseudo-distributed mode, Fully distributed mode.

UNIT–II

MapReduce: -A Weather Dataset: Data Format, -Analyzing the Data with Hadoop: Map and Reduce, Java MapReduce: A test run, The old and the new Java MapReduce APIs. Basic

programs of Hadoop MapReduce: Driver code, Mapper code, Reducer code, RecordReader, Combiner, Partitioner.

UNIT–III

Programming with RDDs: What Is Apache Spark, RDD Basics, Creating RDDs, RDD Operations, Passing Functions to Spark, Common Transformations and Actions, Persistence (Caching).

UNIT-IV

Pig: Hadoop Programming Made Easier: -Admiring the Pig Architecture, -Going with the Pig Latin Application Flow, -Working through the ABCs of Pig Latin: Uncovering Pig Latin structures, Looking at Pig data types and syntax. -Evaluating Local and Distributed Modes of Running Pig Scripts, -Checking out the Pig Script Interfaces, -Scripting with Pig Latin

UNIT-V

Applying Structure to Hadoop Data with Hive: -Saying Hello to Hive, -Seeing How the Hive is Put Together, -Getting Started with Apache Hive, -Examining the Hive Clients: The Hive CLI client, The web browser as Hive client, SQuirreL as Hive client with the JDBC Driver. -Working with Hive Data Types, -Creating and Managing Databases and Tables: Managing Hive databases, Creating and managing tables with Hive. -Seeing How the Hive Data Manipulation Language Works: LOAD DATA examples, INSERT examples, Create Table As Select (CTAS) examples. Querying and Analyzing Data: Joining tables with Hive, Improving your Hive queries with indexes, Windowing in HiveQL, Other key HiveQL features.

TEXT BOOKS:

1. Tom White, “Hadoop: The Definitive Guide” 3rd Edition, O’Reilly Media.

2. Matei Zaharia, Holden Karau, Andi Konwinski, Patric Wendell, Learning Spark, O’Reilly Media,2015.

3. by Chuck Lam, “Hadoop in Action” MANNING Publ.

4. Dirk deRoos, Paul C.Zikopoulos, Roman B.Melnyk,Bruce Brown, Rafael Coss, “Hadoop for Dummies”

REFERENCE BOOKS:

1. Alex Holmes, “Hadoop in Practice”, MANNING Publ.

2. Srinath Perera, “Hadoop MapReduce Cookbook”, Thilina Gunarathne

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