NARASARAOPETA
NEC ENGINEERING COLLEGE
(AUTONOMOUS)

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

COURSE FILE

Academic year	**: 2020 – 2021**
Department	**: ECE**
Course Name	**: B. Tech**
Student's batch	**: 2018-2022**
Regulation	**: R16**
Year and Semester	**: III B.Tech I Semester**
Name of the Subject	**: Automotive Electronics**
Subject Code	**: R16CC31OE6**
Faculty in-Charge	**: Mr. N. Srinivasa Rao**

Signature of the Faculty

Head of the Department

HEAD OF THE DEPARTMENT
OF ELECTRONICS AND COMMUNICATION
ENGG.
NARASARAOPETA ENGINEERING COLLEGE
NARASARAOPET-522 601

NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)

Department of Electronics and Communication Engineering

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Submitted By

Approved By

HEAD OF THE DEPARTMENT
DEPT.OF ELECTRONICS AND COMMUNICATION ENGG.
NARASARAOPETA ENGINEERING COLLEGE
NARASARAOPET-522 601

Institute
Vision and Mission

NARASARAOPETA
ENGINEERING COLLEGE
(AUTONOMOUS)

Department of Electronics and Communication Engineering

Institute Vision and Mission

Vision

To emerge a Centre of excellence in technical education with a blend of effective student centric teaching learning practices as well as research for the transformation of lives and community,

Mission

M1:Provide the best class infra- structure to explore the field of engineering and research

M2:Build a passionate and a determined team of faculty with student centric teaching, imbibing experiential, innovative skills

M3:Imbibe lifelong learning skills, entrepreneurial skills and ethical values in students for addressing societal problems

PRINCIPAL

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

Department
Vision and Mission

NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)

Department of Electronics and Communication Engineering

DEPARTMENT VISION AND MISSION

VISION:

To produce creative communication engineers by imparting technical education with ethical and moral values to meet the global standards.

MISSION:

1. To impart technical education theoretically and practically with discipline through dedicated staff.

2. To develop state-of-the-art laboratories and research facilities for effective teaching learning process to produce globally competent ECE graduates.

3. To empower the students with up to date technical trends and establishing industry interactions through consultancy and sponsored research.

HOD

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PEO'S

&

PSO'S

NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)

Department of Electronics and Communication Engineering

PROGRAM EDUCATIONAL OBJECTIVES:

PEO1: To train the students to design and analyze the electronic circuits and equipment for societal benefits.

PEO2: To inculcate in the students the desire for lifelong learning to obtain thorough knowledge in their chosen fields and also to motivate them for higher studies/research.

PEO3: To train the students so that they can effectively perform the duties assigned to them as team leaders or project managers in the industry/organization with ethical and moral values.

PROGRAM SPECIFIC OUTCOMES:

PSO1: Analyze and Design Analog and Digital circuits for a given specification and function.

PSO2: Design a variety of Electronic Systems for applications including Signal Processing, Communications, Computer Networks and Control Systems.

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NARASARAOPET-522 601

Program Outcomes

NARASARAOPETA
ENGINEERING COLLEGE
AUTONOMOUS

Department of Electronics and Communication Engineering

Narasaraopeta Engineering College follows the **Program Outcomes (PO)** as defined by NBA Engineering Graduates will be able to:

PO1	1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	2. **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences
PO3	3. **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4	4.**Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions
PO5	5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO6	6. **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice
PO7	7. **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice
PO9	9. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings
PO10	10. **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions
PO11	11. **Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments
PO12	12. **Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Head of the Department

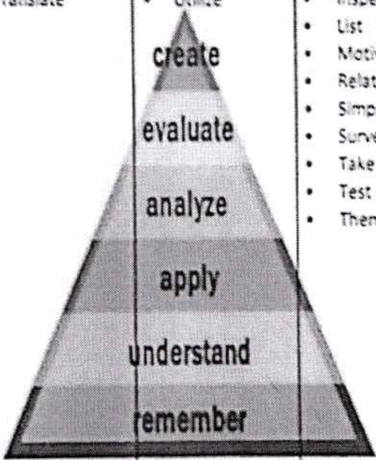
HEAD OF THE DEPARTMENT
DEPT.OF ELECTRONICS AND COMMUNICATION ENGG.
NARASARAOPETA ENGINEERING COLLEGE
NARASARAOPET-522 601

Bloom's Taxonomy levels

NARASARAOPETA ENGINEERING COLLEGE (AUTONOMOUS)-NARASARAOPET

Bloom's Taxonomy Action Verbs

Definitions	I. Remembering	II. Understanding	III. Applying	IV. Analyzing	V. Evaluating	VI. Creating
Bloom's Definition	Exhibit memory of previously learned material by recalling facts, terms, basic concepts, and answers.	Demonstrate understanding of facts and ideas by organizing, comparing, translating, interpreting, giving descriptions, and stating main ideas.	Solve problems to new situations by applying acquired knowledge, facts, techniques and rules in a different way.	Examine and break information into parts by identifying motives or causes. Make inferences and find evidence to support generalizations.	Present and defend opinions by making judgments about information, validity of ideas, or quality of work based on a set of criteria.	Compile information together in a different way by combining elements in a new pattern or proposing alternative solutions.
Verbs	• Choose • Define • Find • How • Label • List • Match • Name • Omit • Recall • Relate • Select • Show • Spell • Tell • What • When • Where • Which • Who • Why	• Classify • Compare • Contrast • Demonstrate • Explain • Extend • Illustrate • Infer • Interpret • Outline • Relate • Rephrase • Show • Summarize • Translate	• Apply • Build • Choose • Construct • Develop • Experiment with • Identify • Interview • Make use of • Model • Organize • Plan • Select • Solve • Utilize	• Analyze • Assume • Categorize • Classify • Compare • Conclusion • Contrast • Discover • Dissect • Distinguish • Divide • Examine • Function • Inference • Inspect • List • Motive • Relationships • Simplify • Survey • Take part in • Test for • Theme	• Agree • Appraise • Assess • Award • Choose • Compare • Conclude • Criteria • Criticize • Decide • Deduct • Defend • Determine • Disprove • Estimate • Evaluate • Explain • Importance • Influence • Interpret • Judge • Justify • Mark • Measure • Opinion • Perceive • Prioritize • Prove • Rate • Recommend • Rule on • Select • Support • Value	• Adapt • Build • Change • Choose • Combine • Compile • Compose • Construct • Create • Delete • Design • Develop • Discuss • Elaborate • Estimate • Formulate • Happen • Imagine • Improve • Invent • Make up • Maximize • Minimize • Modify • Original • Originate • Plan • Predict • Propose • Solution • Solve • Suppose • Test • Theory



Ref: Anderson, L. W., & Krathwohl, D. R. (2001). A taxonomy for learning, teaching, and assessing, Abridged Edition. Boston, MA: Allyn and Bacon.

Course Objectives

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Course Outcomes

NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)

Department of Electronics and Communication Engineering

Course Objectives:

1. To understand the concepts of Automotive Electronics and its evolution and trends
2. To understand the basic electronic components used in automotive systems.
3. To understand all the sensors, actuators and electronics engine control in automotive systems.
4. To understand the basics of microcomputer system and its applications.
5. To understand various communication systems used in vehicle.

Course Outcomes:

CO1: Define basics of automotive and electronics fundamentals.
CO2: List out the different types of automotive and electronic components.
CO3: Explain the concepts involved in micro computer system.
CO4: Interpret the basics of electronics engine control.
CO5: Classify and demonstrate various types of Sensors and Actuators.
CO6: Make use of Future Automotive Electronic Systems for building prototypes and to be able to demonstrate practical competence in these areas.

Faculty Signature

HOD,ECE

Course Information Sheet

NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)

Department of Electronics and Communication Engineering

COURSE INFORMATION SHEET

PROGRAMME: B.Tech Electronics and Communication Engineering	
COURSE: **AUTOMOTIVE ELECTRONICS**	YEAR: **III** SEMESTER: **I** SECTION: ECE-A,B,C&D CREDITS: **4**
COURSE CODE: **R16CC310E6** REGULATION: **R16**	COURSE TYPE (CORE /ELECTIVE / BREADTH/ S&H): **CORE**
COURSE AREA/DOMAIN: **AUTOMOTIVE ELECTRONICS**	PERIODS: **5** per Week.

COURSE PRE-REQUISITES:

C.CODE	COURSE NAME	DESCRIPTION	Year - Sem
RT22045	**DIGITAL ELECTRONICS**	Knowledge of circuit design system	**II-II**
RT31046	**Microprocessor**	Knowledge on interfacing of different controllers	**III-I**

COURSE OUTCOMES:

SNO	Course Outcome Statement
CO1	Define basics of automotive and electronics fundamentals **[K1]**.
CO2	List out the different types of automotive and electronic components **[K2]**.
CO3	Explain the concepts involved in micro computer system **[K3]**.
CO4	Interpret the basics of electronics engine control **[K1]**.
CO5	Classify and demonstrate various types of Sensors and Actuators **[K2]**.
CO6	Make use of Future Automotive Electronic Systems for building prototypes and to be able to demonstrate practical competence in these areas **[K3]**.

SYLLABUS:

UNIT	DETAILS
I	**INTRODUCTION AUTOMOTIVE FUNDAMENTALS** Use of electronics in the automobile, evolution of automotive electronics, the automobile physical configuration, evolution of electronics in the automobile, survey of major automotive systems, engine control or electronic control unit, ignition system.
II	**ELECTRONICS FUNDAMENTALS** Semiconductor devices- diodes, rectifier circuit, transistors, field effect transistors; transistor amplifiers, use of feedback in op amps, summing mode amplifier, analog computers, digital circuits- binary number system, combinational- Basic logic gates, multiplexer (IC 74151), 3 to8 decoder (IC74138) , sequential- flip flops, decade counters(IC 7490).
III	**AUTOMOTIVE MICRO-COMPUTER SYSTEM**

	Microcomputer fundamentals-digital versus analog computers, basic computer block diagram, microcomputer operations, CPU registers, accumulator registers, condition code register-branching; microprocessor architecture, memory-ROM,RAM; I/O parallel interface, digital to analog converter and analog to digital converters with block diagram, microcomputer application in automotive systems.
IV	**BASICS OF ELECTRONICS ENGINE CONTROL** Motivation for electronic engine control, exhaust emissions, fuel economy, concept of an electronic engine control system, engine functions and control, electronic fuel control configuration, electronic ignition with sensors.
V	**SENSORS AND ACTUATORS** Introduction; Basic sensor arrangement; Types of Sensors such as oxygen sensors, Crank angle position sensors, fuel Metering/vehicle speed sensors and detonation sensors, altitude sensors, flow Sensors, throttle position sensors, solenoids, stepper motors, relays. Actuators – Fuel Metering Actuator, Fuel Injector, Ignition Actuator
VI	**VI: FUTURE AUTOMOTIVE ELECTRONIC SYSTEMS** Telematics, Safety: Collision Avoidance Radar warning System with block diagram, speech synthesis, sensor multiplexing, control signal multiplexing with block diagram, fiber optics inside the car, automotive internal navigation system, GPS navigation system, voice recognition cell phone dialing, advanced cruise control system.

TEXT BOOKS	
T	**BOOK TITLE/AUTHORS/PUBLISHER**
T1	William B. Ribbens, "Understanding Automotive Electronics", 6th Edition, SAMS/Elsevier Publishing.
T2	Robert Bosch Gambh, "Automotive Electrics Automotive Electronics Systems and Components", 5th Edition, John Wiley& Sons Ltd., 2007.
REFERENCE BOOKS	
R	**BOOK TITLE/AUTHORS/PUBLISHER**
R1	Ronald K Jurgen, "Automotive Electronics Handbook", 2nd Edition, McGrawHill, 1999.
R2	G. Meyer, J. Valldorf and W. Gessner, "Advanced Microsystems for Automotive Applications", Springer, 2009

WEB SOURCE REFERENCES:

1	https://www.rohm.com/applications/automotive/?utm_source=google&utm_medium=cpc&utm_campaign=920_R_IND_E(S)_applications_automotive&gclid=EAIaIQobChMIxfrX9M_i3gIVVIyPCh3qLgLCEAAYASAAEgJrhfD_BwE
2	https://nptel.ac.in/courses/112103174/4

DELIVERY/INSTRUCTIONAL METHODOLOGIES:

□Chalk & Talk	□ PPT	□Active Learning
□Web Resources	□ Students Seminars	□Case Study
□Blended Learning	□ Quiz	□Tutorials
□Project based learning	□NPTEL/MOOCS	□ Simulation
□Flipped Learning	□Industrial Visit	□Model Demonstration
□Brain storming	□Role Play	□Virtual Labs

Academic Calendar

Narasaraopeta Engineering College (Autonomous)
Kotappakonda Road, Yellamanda (P.O), Narasaraopet- 522601, Guntur District, AP.

ACADEMIC CALENDAR
(B.Tech. 2019, 2018 and 2017 admitted batches, Academic Year 2020-21)

2019 Batch 2nd Year 1st Semester, 2018 Batch 3rd Year 1st Semester and 2017 Batch 4th Year 1st Semester			
Description	**From Date**	**To Date**	**Duration**
Commencement of Class Work	02-11-2020		4 Weeks
1st Spell of Instructions	**02-11-2020**	**30-11-2020**	
I Mid examinations	01-12-2020	05-12-2020	1 Week
2nd Spell of Instructions	**07-12-2020**	**20-02-2021**	11 Weeks
II Mid examinations	22-02-2021	27-02-2021	1 Week
Preparation & Practicals	01-03-2021	06-03-2021	1 Week
Semester End Examinations	08-03-2021	20-03-2021	2 Weeks
2019 Batch 2nd Year 2nd semester, 2018 Batch 3rd Year 2nd Semester and 2017 Batch 4th Year 2nd Semester			
Commencement of Class Work	22-03-2021		7 Weeks
1st Spell of Instructions	**22-03-2021**	**08-05-2021**	
I Assignment Test	**12-04-2021**	**17-04-2021**	
II Assignment Test	**26-04-2021**	**30-04-2021**	
I Mid examinations	10-05-2021	15-05-2021	1 Week
2nd Spell of Instructions	**17-05-2021**	**03-07-2021**	7 Weeks
III Assignment Test	**31-05-2021**	**05-06-2021**	
IV Assignment Test	**21-06-2021**	**26-06-2021**	
II Mid examinations	05-07-2021	10-07-2021	1 Week
Preparation & Practicals	12-07-2021	17-07-2021	1 Week
Semester End Examinations	19-07-2021	31-07-2021	2 Weeks

PRINCIPAL

Time Tables

NEC NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

III Year, I Semester, ECE-A Class TimeTable for the A.Y. 2020-21

Room No.: 3308

w.e.f: 17-08-2020

DAY	1 9:10 to 10:00	2 10:00 to 10:50	10:50 to 11:00	3 11:00 to 11:50	4 11:50 to 12:40	12:40 to 1: 30	5 1:30 to 2:20	6 2:20 to 3:10	7 3:10 to 4:00
MON	AE	CO&MP	BREAK	DC	AWP	LUNCH BREAK	LDICA / DC LAB		
TUE	DC	CO&MP		LDICA (T)	AWP		LDICA / DC LAB		
WED	CO&MP	DC(T)		CRT			MINI PROJECT		
THU	LDICA	AWP		CRT			CO&MP	DC	LDICA
FRI	LDICA	CO&MP		CRT			DC	AE	AWP(T)
SAT	AWP	AE		LDICA	AE		MP&I LAB		

Note: T-Tutorial

LDICA : Linear & Digital IC Applications — Dr. Sk. Bajid Vali

AWP : Antennas and Wave Propagation — Dr. J. Narendra Babu

CO&MP : Computer Organization & Microprocessors — Dr. K. Srinivasa Ravi

AE : Automotive Electronics — Dr. Ayesha

DC : Digital Communications — Dr. N.Veda Kumar

LDICA Lab : LDIC Applications Lab — Dr. Sk. Bajid Vali, Mr.A.Charles Stud, Ms.K.Sheela, Dr. D.Subba Rao, Sk. Ayesha

DC Lab : Digital Communications Lab — Mr. J.V.K.Ratnam, Dr. N.Veda Kumar, Mr.N.Dasaradh, Dr. Amit Gupta, Dr. K.Anjineyulu

MP&I Lab : Microprocessors and Interfacing Lab — Mr.G Samuel Joe Victor, Ms.K.Siva Kumari, Mr. V. R. Krishna Reddy

Mini Project — Dr.K.Srinivasa Ravi, Dr. J. Narendra Babu, Dr. Sk. Bajid Vali, Dr. K. Raju, Dr. V. Venkata Rao, Dr.S.M.ShyamReddy

HEAD OF THE DEPARTMENT
(Dr. V. VENKATA RAO)

NARASARAOPETA ENGINEERING COLLEGE
NARASARAOPET-522 601

PRINCIPAL
(Dr. M. SREENIVASA KUMAR)

NARASARAOPET - 522 6(
Guntur (Dist.), A.P.

NEC NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

III Year, I Semester, ECE-B Class TimeTable for the A.Y. 2020-21

Room No.: 3314 **w.e.f: 17-08-2020**

DAY	1 9:10 to 10:00	2 10:00 to 10:50	10:50 to 11:00	3 11:00 to 11:50	4 11:50 to 12:40	12:40 to 1:30	5 1:30 to 2:20	6 2:20 to 3:10	7 3:10 to 4:00
MON	AWP	LDICA	BREAK	LDICA	DC	LUNCH BREAK	CO&MP	AE	AWP(T)
TUE	AE	AWP		DC(T)	CO&MP		MINI PROJECT		
WED	LDICA	AWP		CRT			LDICA / DC LAB		
THU	DC	LDICA		CRT			LDICA / DC LAB		
FRI	CO&MP	AE		CRT			MP&I LAB		
SAT	AE	DC		CO&MP	DC		LDICA(T)	AWP	CO&MP

Note: T-Tutorial

LDICA	: Linear & Digital IC Applications	Mr. J.V.K.Ratnam
AWP	: Antennas and Wave Propagation	Mr. P. Bhagya Raju
CO&MP	: Computer Organization & Microprocessors	Ms.K.Siva Kumari
AE	: Automotive Electronics	Mr. T. Ravi Kanth
DC	: Digital Communications	Dr. Amit Gupta
LDICA Lab	: LDIC Applications Lab	Mr. J.V.K.Ratnam Dr. N.Veda Kumar Mr. B. Naga Ganesh Ms. K. Sheela Mr. Ch. Karthik
DC Lab	: Digital Communications Lab	Dr. Amit Gupta Mr. Ch.Aadi Babu Mr.G Samuel Joe Victor Mr.V.Naveen Raja Mr. N. Dasaradh
MP&I Lab	: Microprocessors and Interfacing Lab	Mr.Sk.Zuber Basha Ms.K.Siva Kumari Dr.K.Srinivasa Ravi Ms.A.Kanchana Mr.V.R. Krishna Reddy Mr. A. Venkata Siva
Mini Project		Dr. K. Raju Dr. R. S. Siva Nayak Dr. V. Venkata Rao Dr.S.M.ShyamReddy Dr. J. Narendra Babu

HEAD OF THE DEPARTMENT
(Dr. V. VENKATA RAO)

HEAD OF THE DEPARTMENT
DEPT OF ELECTRONICS AND COMMUNICATION ENGG.
NARASARAOPETA ENGINEERING COLLEGE
NARASARAOPET-522 601

PRINCIPAL
(Dr. M. SREENIVASA KUMAR)

(AUTONOMOUS)
NARASARAOPET - 522 601

NEC NARASARAOPETA ENGINEERING COLLEGE
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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

III Year, I Semester, ECE-C Class TimeTable for the A.Y. 2020-21

Room No.: 3315

w.e.f: 17-08-2020

DAY	1 9:10 to 10:00	2 10:00 to 10:50	10:50 to 11:00	3 11:00 to 11:50	4 11:50 to 12:40	12:40 to 1: 30	5 1:30 to 2:20	6 2:20 to 3:10	7 3:10 to 4:00
MON	DC	LDICA / DC LAB					LDICA	AWP	CO&MP
TUE	LDICA	LDICA / DC LAB					AE	DC	AWP
WED	CO&MP	MINI PROJECT					DC	CRT	
THU	AE	LDICA	BREAK	D C(T)	CO&MP		AWP	CRT	
FRI	DC	AWP(T)		LDICA	CO&MP		AE	CRT	
SAT	AWP	MP&I LAB					CO&MP	LDICA(T)	AE

Note: T-Tutorial

LDICA	: Linear & Digital IC Applications	Mr. J. Narasimha Rao
AWP	: Antennas and Wave Propagation	Sk.Md.Umar
CO&MP	: Computer Organization & Microprocessors	Mr. V. R. Krishna Reddy
AE	: Automotive Electronics	Mr. N. Syed Khasim
DC	: Digital Communications	Dr. B. Raghavaiah
LDICA Lab	: LDIC Applications Lab	Mr. J. Narasimha Rao Ms.Sk.Ayesha Mr.N.Narayana Mrs.B.Sueetha Dr. R. Siva Kumar
DC Lab	: Digital Communications Lab	Dr. B. Raghavaiah Ms.M.Amulya Bhanu Mr Sk.Md.Umar Mr. N. Syed Khasim Mr.G Samuel Joe Victor
MP&I Lab	: Microprocessors and Interfacing Lab	Mr. V. R. Krishna Reddy Mr. N. Rajeev Reddy Mr.A.Kanchana Mr.A.Venkata Siva Ms.K.Siva Kumari
Mini Project		Dr.S.M.ShyamReddy Dr. K. Srinivasa Ravi Dr. B. Raghavaiah Dr. J. Narendra Babu Dr. V. Venkata Rao

HEAD OF THE DEPARTMENT
(Dr. V. VENKATA RAO)

PRINCIPAL
(Dr. M. SREENIVASA KUMAR)

NARASARAOPETA ENGINEERING COLLEGE
NEC
(AUTONOMOUS)

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING
III Year, I Semester, ECE-D Class TimeTable for the A.Y. 2020-21

Room No.: 3316 **w.e.f: 17-08-2020**

DAY	1 9:10 to 10:00	2 10:00 to 10:50	10:50 to 11:00	3 11:00 to 11:50	4 11:50 to 12:40	12:40 to 1:30	5 1:30 to 2:20	6 2:20 to 3:10	7 3:10 to 4:00
MON	AWP	MINI PROJECT					CO&MP	LDICA	DC(T)
TUE	AWP	CO&MP	BREAK	AWP	LDICA(T)		DC	LDICA	AE
WED	LDICA	LDICA / DC LAB					CO&MP	CRT	
THU	DC	LDICA / DC LAB					CO&MP	CRT	
FRI	AE	MP&I LAB					DC	CRT	
SAT	CO&MP	DC	BREAK	AWP	LDICA		AE	AE	AWP(T)

Note: T-Tutorial

LDICA	: Linear & Digital IC Applications	Dr. R. Siva Kumar
AWP	: Antennas and Wave Propagation	Mrs. B. Suneetha
CO&MP	: Computer Organization & Microprocessors	Dr. S.M.Shyam Reddy
AE	: Automotive Electronics	Mr. N. Srinivasa Rao
DC	: Digital Communications	Dr. K.Anjineyulu
LDICA Lab	: LDIC Applications Lab	Dr. R. Siva Kumar
		Mr.Ch.Karthik
		Mr. J. Narasimha Rao
		Mr.B.Naga Ganesh
		Ms.B.Suneetha
DC Lab	: Digital Communications Lab	Dr. K.Anjineyulu
		Mr. E.Narendra
		Sk.Md.Umar
		Mr. Ch.Aadi Babu
		Mr. N. Syed Khasim
MP&I Lab	: Microprocessors and Interfacing Lab	Mr.G Samuel Joe Victor
		Dr.S.M.ShyamReddy
		Mr.A.Venkata Sinva
		Ms.A.Kanchana
		Mr.N.RajeevReddy
		Dr.K.Srinivasa Ravi
		Ms.K.Siva Kumari
Mini Project		Mr. V. R. Krishna Reddy
		Dr. B. Raghavaiah
		Dr. Sk. Bajid Vali
		Dr. J. Narendra Babu
		Dr. V. Venkata Rao

HEAD OF THE DEPARTMENT
DEPT. OF ELECTRONICS AND COMMUNICATION ENGG.
NARASARAOPETA ENGINEERING COLLEGE
NARASARAOPET-522 601

HEAD OF THE DEPARTMENT
(Dr. V. VENKATA RAO)

PRINCIPAL
NARASARAOPETA ENGINEERING (AUTONOMOUS)
NARASARAOPET - 522

PRINCIPAL
(Dr. M. SREENIVASA KUMAR)

Syllabus Copy

AUTOMOTIVE ELECTRONICS
(Open Elective – I)

Course Objectives:

1. To understand the concepts of Automotive Electronics and its evolution and trends
2. To understand the basic electronic components used in automotive systems.
3. To understand all the sensors, actuators and electronics engine control in automotive systems.
4. To understand the basics of microcomputer system and its applications.
5. To understand various communication systems used in vehicle.

UNIT – I: AUTOMOTIVE FUNDAMENTALS

Use of electronics in the automobile, evolution of automotive electronics, the automobile physical configuration, evolution of electronics in the automobile, survey of major automotive systems, engine control or electronic control unit, ignition system.

UNIT – II: ELECTRONICS FUNDAMENTALS

Semiconductor devices- diodes, rectifier circuit, transistors, field effect transistors; transistor amplifiers, use of feedback in op amps, summing mode amplifier, analog computers, digital circuits- binary number system, combinational- Basic logic gates, multiplexer (IC 74151), 3 to8 decoder (IC74138) , sequential- flip flops, decade counters(IC 7490).

UNIT – III: AUTOMOTIVE MICRO-COMPUTER SYSTEM

Microcomputer fundamentals-digital versus analog computers, basic computer block diagram, microcomputer operations, CPU registers, accumulator registers, condition code register-branching; microprocessor architecture, memory-ROM,RAM; I/O parallel interface, digital to analog converter and analog to digital converters with block diagram, microcomputer application in automotive systems.

UNIT – IV: BASICS OF ELECTRONICS ENGINE CONTROL

Motivation for electronic engine control, exhaust emissions, fuel economy, concept of an electronic engine control system, engine functions and control, electronic fuel control configuration, electronic ignition with sensors.

UNIT – V: SENSORS AND ACTUATORS

Introduction; Basic sensor arrangement; Types of Sensors such as oxygen sensors, Crank angle position sensors, fuel Metering/vehicle speed sensors and detonation sensors, altitude sensors, flow Sensors, throttle position sensors, solenoids, stepper motors, relays. Actuators – Fuel Metering Actuator, Fuel Injector, Ignition Actuator

UNIT – VI: FUTURE AUTOMOTIVE ELECTRONIC SYSTEMS

Telematics, Safety: Collision Avoidance Radar warning System with block diagram, speech synthesis, sensor multiplexing, control signal multiplexing with block diagram, fiber optics inside the car, automotive internal navigation system, GPS navigation system, voice recognition cell phone dialling, advanced cruise control system.

Text Books:

1. William B. Ribbens, "Understanding Automotive Electronics", 6th Edition, SAMS/Elsevier Publishing.
2. Robert BoschGambh, "Automotive Electrics Automotive Electronics Systems and Components", 5th Edition, John Wiley& Sons Ltd., 2007.

Reference Books:

1. Ronald K Jurgen, "Automotive Electronics Handbook", 2nd Edition, McGrawHill, 1999.
2. G. Meyer, J. Valldorf and W. Gessner, "Advanced Microsystems for Automotive Applications", Springer, 2009.
3. Robert Bosch, "Automotive Hand Book" SAE, 5th Edition, 2000.

Course Outcomes:

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

CO1: Define basics of automotive and electronics fundamentals.

CO2: List out the different types of automotive and electronic components.

CO3: Explain the concepts involved in micro computer system.

CO4: Interpret the basics of electronics engine control.

CO5: Classify and demonstrate various types of Sensors and Actuators.

CO6: Make use of Future Automotive Electronic Systems for building prototypes and to be able to demonstrate practical competence in these areas.

Lesson Plan

NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)

Department of Electronics and Communication Engineering

FACULTY NAME:Mr.N.Srinivasa Rao

REGULATION: R16

CLASS & SEMESTER: III B.TECH & I SEM

ACADEMIC YEAR: 2020-21

COURSE NAME: AUTOMOTIVE ELECTRONICS

LESSON PLAN

Unit No	Outcome		Topics/Activity	Ref Text book	Total Periods	Delivery Method
		Unit-1. INTRODUCTION AUTOMOTIVE FUNDAMENTALS				
1	CO1. Define basics of automotive and electronics fundamentals **[K1]**.	1.1	Use of electronics in the automobile,	T1, R2	10	Chalk & Talk, PPT, & Tutorial
		1.2	Evolution of automotive electronics	T1, R2		
		1.3	The automobile physical configuration,	T1, R2		
		1.4	Evolution of electronics in the automobile	T2, R2		
		1.5	Survey of major automotive systems,	T1, R2		
		1.6	Engine control or electronic control unit	T1,R2		
		1.7	Ignition system	T1,R2		
		Unit-2 ELECTRONICS FUNDAMENTALS				
2	CO2. List out the different types of automotive and electronic components **[K2]**.	2.1	Semiconductor devices- diodes	T1, R2	12	Chalk & Talk, PPT, Tutorial
		2.2	Rectifier circuit	T1, R2		
		2.3	Transistors, field effect transistors	T1, R2		
		2.4	Transistor amplifiers	T1, R2		
		2.5	Use of feedback in op amps	T1, R2		
		2.6	Summing mode amplifier	T1, R2		
		2.7	Analog computers, digital circuits- binary number system,	T1, R2		
		2.8	Spatial domain high-pass filtering	T1, R2		

		2.9	Combinational- Basic logic gates	T1, R2		
		2.10	Multiplexer (IC 74151)	T1, R2		
		2.11	3 to8 decoder (IC74138)	T1, R2		
		2.12	Sequential- flip flop	T1, R2		
		2.13	Decade counters(IC 7490)	T1, R2		
3	CO 3. Explain the concepts involved in micro computer system **[K3]**.	Unit-3. **AUTOMOTIVE MICRO-COMPUTER SYSTEM**				
		3.1	Microcomputer fundamentals-digital versus analog computers	T1, R2	12	Chalk & Talk, PPT& Tutorial
		3.2	Basic computer block diagram	T1, R2		
		3.3	Microcomputer operations	T1, R2		
		3.4	CPU registers, accumulator registers, condition code register-branching;	T1, R2		
		3.5	Microprocessor architecture	T1, R2		
		3.6	Memory-ROM,RAM	T1, R2		
		3.7	I/O parallel interface	T1, R2		
		3.8	Digital to analog converter	T1, R2		
		3.9	Analog to digital converters with block diagram	T1, R2		
		3.10	Microcomputer application in automotive systems	T1, R2		
4	CO 4. Interpret the basics of electronics engine control **[K1]**.	Unit-4. **BASICS OF ELECTRONICS ENGINE CONTROL**				
		4.1	Motivation for electronic engine control,	T1, R2	10	Chalk & Talk, PPT & Tutorial
		4.2	exhaust emissions	T1, R2		
		4.3	Fuel economy	T1, R2		
		4.4	Concept of an electronic engine control system	T1, R2		
		4.5	Engine functions and control	T1, R2		
		4.6	Electronic fuel control configuration	T1, R2		
		4.7	Electronic ignition with sensors	T1, R2		
5	CO5. Classify and demonstrate various types of Sensors and Actuators **[K2]**.	Unit 5 **SENSORS AND ACTUATORS**				
		5.1	Introduction; Basic sensor arrangement;	T1, R2	8	Chalk & Talk, PPT, Case Studies
		5.2	Types of Sensors such as oxygen sensors	T1, R2		
		5.3	Crank angle position sensors	T1, R2		
		5.4	Fuel Metering/vehicle speed sensors and detonation sensors	T1, R2		
		5.5	Altitude sensors, flow Sensors	T1, R2		
		5.5	Throttle position sensors, solenoids	T1, R2		
		5.6	Stepper motors, relays.	T1, R2		
		5.7	Actuators – Fuel Metering Actuator	T1, R2		
		5.8	Fuel Injector, Ignition Actuator			

6	CO6. Make use of Future Automotive Electronic Systems for building prototypes and to be able to demonstrate practical competence in these areas **[K3]**.	**Unit 6 :FUTURE AUTOMOTIVE ELECTRONIC SYSTEMS**				
		6.1	Telematics,	T1, R2	8	Chalk & Talk, PPT Tutorial& Seminars
		6.2	Safety: Collision Avoidance Radar warning System with block diagram,	T1, R2		
		6.3	Speech synthesis,	T1, R2		
		6.4	Sensor multiplexing,	T1, R2		
		6.5	Control signal multiplexing with block diagram,	T1, R2		
		6.6	Fiber optics inside the car, automotive internal navigation system,	T1, R2		
		6.7	GPS navigation system,	T1, R2		
		6.8	Voice recognition cell phone dialing, advanced cruise control system.,	T1, R2		

TEXT BOOKS	
T	**BOOK TITLE/AUTHORS/PUBLISHER**
T1	William B. Ribbens, "Understanding Automotive Electronics", 6th Edition, SAMS/Elsevier Publishing.
T2	Robert Bosch Gambh, "Automotive Electrics Automotive Electronics Systems and Components", 5th Edition, John Wiley& Sons Ltd., 2007.
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R2	G. Meyer, J. Valldorf and W. Gessner, "Advanced Microsystems for Automotive Applications", Springer, 2009

WEB SOURCE REFERENCES:

1	https://www.rohm.com/applications/automotive/?utm_source=google&utm_medium=cpc&utm_campaign=920_R_IND_E(S)_applications_automotive&gclid=EAIaIQobChMIxfrX9M_i3gIVVIyPCh3qLgLCEAAYASAAEgJrhfD_BwE
2	https://nptel.ac.in/courses/112103174/4

Faculty signature

HOD

HEAD OF THE DEPARTMENT
DEPT.OF ELECTRONICS AND COMMUNICATION ENGG.
NARASARAOPETA ENGINEERING COLLEGE
NARASARAOPET-522 601

CO-PO & PSO Mapping and Assessment

NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)

Department of Electronics and Communication Engineering

CO-PO/mapping (Syllabus Based)

Course: B.Tech-ECE
Class/Semester: III/I
Course code:R16CC31OE6
Regulation: R16
Name of the faculty: Mr. N.Srinivasa Rao
Designation: Assoc. Professor
Course Name: : Automotive Electronics
A.Y: 2020-21

MAPPING COs WITH POs

COs	POs											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
C315.1:Define basics of automotive and electronics fundamentals.	-	1	3	3	-	-	-	-	1	-	-	-
C315.2:List out the different types of automotive and electronic components.	2	3	3	3	3	-	-	-	1	-	-	-
C315.3:Explain the concepts involved in micro computer system.	3	3	3	3	3	-	-	-	1	3	-	-
C315.4:Interpret the basics of electronics engine control.	3	3	3	3	3	-	-	-	1	-	-	-
C315.5:Classify and demonstrate various types of Sensors and Actuators.	3	3	3	3	3	-	-	-	1	3	-	-
C315.6:Make use of Future Automotive Electronic Systems for building prototypes and to be able to demonstrate practical competence in these areas.	3	3	3	3	3	-	-	-	1	-	-	-
C315	2.8	2.66667	3	3	3	-	-	-	1	3	-	-

MAPPING COURSE WITH POs & PSOs

PO Attainment												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
PO Attainment	2.8	2.66667	3	3	3				1	3		

1: Low 2: Medium 3: High -: No correlation

CO-PSO Mapping:

COs	PSOs	
	PSO1	PSO2
C315.1	-	-
C315.2	3	2
C315.3	3	2
C315.4	3	3
C315.5	3	3
C315.6	3	2
C315	3	2.4

PSO Attainment:

PSO Attainment		
COs	PSOs	
	PSO1	PSO2
PSO Attainment	3	2.4

COURSE OUTCOME RUBRIC (ASSESMENT PER STUDENT):					
ASSESMENT TOOL WITH WEIGHTAGE	METHOD	ATTAINMENT LEVEL 3 (EXCELLENT)	ATTAINMENT LEVEL 2 (GOOD)	ATTAINMENT LEVEL 1 (AVERAGE)	ATTAINMENT LEVEL 0 (POOR)
Internal tests (40%)	Direct	Student secured ≥ 60% marks of allocated marks for that CO	Student secured ≥ 60% and < 50% marks of allocated marks for that CO	Student secured ≥ 50% and <40% marks of allocated marks for that CO	Student secured < 40% marks of allocated marks for that CO
Assignments (20%)	Direct	Student secured ≥ 80% marks allocated for that CO	Student secured ≥ 70% and <80% marks allocated for that CO	Student secured ≥ 60% and <70% marks allocated for that CO	Student secured < 60% of marks allocated for that CO
End Semester Examination (30%)	Direct	Student secured 70% in External Exam	Student secured below 70% but not less than 50% in External Exam	Student secured below 50% but not less than 40% in External Exam	Student secured less than 50% in External Exam
Course end Survey (10%)	Indirect	Student selected option	Student selected option	Student selected option	Student selected option

Course Coordinator | Module Coordinator | Head of the Department

HEAD OF THE DEPARTMENT
DEPT.OF ELECTRONICS AND COMMUNICATION ENGG.
NARASARAOPETA ENGINEERING COLLEGE
NARASARAOPET-522 601

CO ATTAINMENT

NEC NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)

Department of Electronics and Communication Engineering

	CO Attainment Level (Mid)	CO Attainment Level (External)	Direct CO Attainment Level (Internal * 30%) + (External * 70%)	Indirect CO Attainment Level	Total CO Attainment Level (Direct CO Attainment * 90% + Indirect CO Attainment * 10%)
CO 1	3	3	3	3	3
CO 2	3	3	3	2	3
CO 3	3	3	3	2	3
CO 4	3	3	3	3	3
CO 5	2	3	3	2	3
CO 6	3	3	3	2	3
					3

1. Copy the Direct CO Attaiment Level (Internal) and Diect CO Attaiment Level (External) from the previous sheets and then find the Direct CO Attainment Level.
2. Find Direct CO attainment level using the formula:
   CO Attainment Level (Internal) * 30% + CO Attainment Level (External) * 70%
3. Copy Indirect CO Attainment Level.
4. Find the CO attainment level using the formula:
   Direct CO Attainment Level *90% + Indirect CO Attainment Level * 10%

Web references & other Pedagogical initiates details

TEXT BOOKS	
T	**BOOK TITLE/AUTHORS/PUBLISHER**
T1	William B. Ribbens, "Understanding Automotive Electronics", 6th Edition, SAMS/Elsevier Publishing.
T2	Robert Bosch Gambh, "Automotive Electrics Automotive Electronics Systems and Components", 5th Edition, John Wiley& Sons Ltd., 2007.
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WEB SOURCE REFERENCES:

1	https://www.rohm.com/applications/automotive/?utm_source=google&utm_medium=cpc&utm_campaign=920_R_IND_E(S)_applications_automotive&gclid=EAIaIQobChMIxfrX9M_i3gIVVIyPCh3qLgLCEAAYASAAEgJrhfD_BwE
2	https://nptel.ac.in/courses/112103174/4

Student's Roll list

NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)

DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

STUDENTS LIST FOR THE ACADEMIC YEAR 2020-21

ECE B.Tech., III Year I Semester		
S.NO.	**H.T.NO.**	**NAME OF THE STUDENT**
1	18471A0401	ANUMALASETTY DHARANI
2	18471A0402	AVULA NAVEEN
3	18471A0403	BADUGU PRAKASH BABU
4	18471A0405	BALLIPALLI SAI VENKAT
5	18471A0406	BANDARU SAI KUMAR
6	18471A0407	BATHULA SRINU
7	18471A0408	BEERAM UPENDRA REDDY
8	18471A0409	BHUVANAM NAGA VAMSI
9	18471A0410	BOBBILLA KARTHIK
10	18471A0411	BODLAPATI SRAVYA
11	18471A0412	BURRI NAGAVENI
12	18471A0413	CHAKKA MANOJ KUMAR
13	18471A0414	CHITTINENI SIDDHARTHA
14	18471A0415	CHOPPARA MANOJ KUMAR
15	18471A0416	DASIREDDY NAGI REDDY
16	18471A0417	DEVARAKONDA NITISH KUMAR REDDY
17	18471A0418	DEVARAPALLI KUSUMITHA
18	18471A0419	GADIBOYINA JAYENDRA KUMAR
19	18471A0420	GAYAM RAMYA
20	18471A0421	GOPU GANESH SIVA SAI
21	18471A0422	GOPU SAI MOULI
22	18471A0423	GOTTIPATI VAMSI
23	18471A0424	GUMMALAMPATI MANOJ KUMAR
24	18471A0425	INAGANTI BHARATH TEJA
25	18471A0426	JALADI SAI KRISHNA
26	18471A0427	JILLELLAMUDI SRINIVASU
27	18471A0428	JUPUDI PAVAN KUMAR
28	18471A0429	KANAMARLAPUDI LAKSHMI SAI SUBHASH
29	18471A0430	KARNAM SREE DEVI

30	18471A0431	KASIREDDY NAGAMAHENDRA
31	18471A0432	KOLLU SAI SURYA
32	18471A0433	KOMMALAPATI CHINNI KRISHNA
33	18471A0434	KUNAGU ASLESHA SAI KUMAR
34	18471A0435	KUNCHAPU SRIKANTH
35	18471A0436	MADASU VIVEK
36	18471A0437	MADHAVARAPU MANOHAR
37	18471A0438	MARELLA VENKATA SIVA RAVI TEJA
38	18471A0439	MATLAPUDI ANIL KUMAR
39	18471A0440	MEDISETTY MANOHAR
40	18471A0441	MIRIYALA VENKATESH
41	18471A0442	MURAM SASIDHAR REDDY
42	18471A0443	MUTHINENI ANJI BABU
43	18471A0444	PAPASANI NAGA MANIKANTA REDDY
44	18471A0445	PARELLA POOJITHA
45	18471A0446	PATHAN MAHABOOB KHAN
46	18471A0447	PONDUGULA BHAVYA LAKSHMI
47	18471A0448	PULIPATI DEVI SRI SRESHTA
48	18471A0449	SENAGALA CHAITANYA REDDY
49	18471A0450	SHAIK AYESHA SIDDIKA
50	18471A0451	SHAIK BURUHAN JANI
51	18471A0452	SHAIK KARISHMA
52	18471A0453	SHAIK MAHAMMAD ASHRAF
53	18471A0454	SHAJAHAN SHAIK
54	18471A0455	SIDDABATHUNI VENKATA HARSHITHA
55	18471A0456	SURE YASWANTH REDDY
56	18471A0457	TALLURI ANJALI
57	18471A0458	UPPUTHOLLA TABITHA
58	18471A0459	VEDANTHAM LAKSHMI MOULYA SRI
59	18471A0460	VEERAMSETTY SWATHI
60	18471A0461	ALAPATI KIRAN BABU
61	18471A0463	ANNAPAREDDY ROHINI
62	18471A0464	BADAM HARINI
63	18471A0465	BATHULA DEVA RAJU
64	18471A0466	BETHALA BULLI BABU
65	18471A0467	BHUKYA SALAMMA
66	18471A0468	BIJJAM PRASANNA
67	18471A0470	BUDDA VENKATA SAI DURGA PRASAD
68	18471A0471	BUSI NARAYANA
69	18471A0472	CHILAKALA DIVYA
70	18471A0473	CHILAKALA PRABHAVATHI

71	18471A0474	DARIVEMULA EBINEZAR
72	18471A0475	DEVARASETTY VENKATA SATYA SUBHASH
73	18471A0476	ESKA RAMANJI REDDY
74	18471A0477	GADE MANOJ KUMAR REDDY
75	18471A0478	GAVIRIBOINA SANJAY
76	18471A0479	GELLI HEMA SUNDARI
77	18471A0480	GERA SANDHYA
78	18471A0481	SARAYU SHAIK
79	18471A0482	GUTHA VENKATESH
80	18471A0483	INAVOLU HARISH
81	18471A0484	JAJJARA AMULYA
82	18471A0485	JEEDIMALLA VENKATA PAVAN KALYAN
83	18471A0486	KAREDLA VENKATA SAI NUBYA
84	18471A0487	KARNATA GAYATHRI
85	18471A0488	KASUKURTHI KIRAN KUMAR
86	18471A0489	KOTHAPALLI CHARAN
87	18471A0490	KOTHURI JASWANTHI
88	18471A0491	KOTHURI UHA VENKATA SAI UJWALA
89	18471A0492	KUNCHALA SAITEJA
90	18471A0493	KUNISETTY V N S P L MAMATHA
91	18471A0494	LAKKIMSETTY MANOJ VENKAT
92	18471A0495	MADDI LEELA GOWRI LAVANYA
93	18471A0496	MADDIRALA MANOJ KUMAR
94	18471A0497	MAGULURU RAJASHEKAR
95	18471A0498	MARRI SRINIVASARAO
96	18471A0499	MEDIDA TEJA
97	18471A04A1	MUKKU SUSHMA
98	18471A04A2	NARISETTY SOWJANYA
99	18471A04A3	NARU MARUTHI REDDY
100	18471A04A4	NEELAM JYOTHIRMAI
101	18471A04A5	PILLI AKHIL
102	18471A04A6	POLISETTI SUSMITHA
103	18471A04A7	RAVURI RAMA NAIDU
104	18471A04A8	SHAIK ARSHATH
105	18471A04A9	SHAIK KAREEM
106	18471A04B0	SHAIK MADDIRALA NAZIROON
107	18471A04B1	SHAIK MOHAMMAD AAQIL ASHRAF
108	18471A04B2	SHAIK NAZEER AHMAD
109	18471A04B3	SINGAMSETTY HANUMANTHA RAO
110	18471A04B4	THONDAPI BHARGAVI
111	18471A04B5	VELAGADA HEMA SUNDAR

112	18471A04B6	VENNA NAGENDRA REDDY
113	18471A04B7	VITTALADEVUNI AKHILKRISHNA
114	18471A04B8	VUTUKURI SRAVANI
115	18471A04B9	YAKKALA NIKILESH
116	18471A04C0	YARRA NAVEEN
117	18471A04C1	ALLADI GOPALA KRISHNA
118	18471A04C2	AMIRISETTY VENKATA SAI LAKSHMI
119	18471A04C3	ANIKALA ROHITH REDDY
120	18471A04C4	ANNEM SRINIVASA RAO
121	18471A04C5	ANUMALASETTY SRAVANI
122	18471A04C6	BADDULA RAVI TEJA
123	18471A04C7	BANDARU RAVI TEJA
124	18471A04C9	BITTU NARESH
125	18471A04D0	BODDAPATI PAVANI
126	18471A04D1	BOGIRI YAMALAIAH
127	18471A04D2	BOILLA PAVAN KALYAN REDDY
128	18471A04D3	BOPPUDI ROHITH SURYA
129	18471A04D4	CHAKKA V S N S L TEJASWINI
130	18471A04D5	CHILAKALA SRI HANUMAN SANJAY GUPTHA
131	18471A04D6	DUDDUKURI SOWJANYA
132	18471A04D7	EDULA MEGHANA
133	18471A04D8	GADE MALLESWARI
134	18471A04D9	GATTINENI YASWANTH
135	18471A04E0	GOTTIPATI AKHILA
136	18471A04E1	GUDA VISHNU GOVARDHAN REDDY
137	18471A04E2	INJAPALLI ISSAC
138	18471A04E3	IRLAPATI SUDHEER
139	18471A04E4	IRRI SRAVANI
140	18471A04E5	KADEM DHANA LAKSHMI
141	18471A04E7	KOTU SAIKRISHNA
142	18471A04E8	KUNCHEPU HARIKRISHNA
143	18471A04E9	KURRA YASWANTH SAI RAM
144	18471A04F0	MADDU CHAITHANYA KUMAR
145	18471A04F1	MALLEMSETTI REVATHI
146	18471A04F2	MANDALI RAVI TEJA
147	18471A04F3	MEKAPOTHU NARSI REDDY
148	18471A04F4	MELAM SINDHU
149	18471A04F5	MINDALA RAJA
150	18471A04F6	MODADUGU VINOD BABU
151	18471A04F7	MULAVEESALA GANESH
152	18471A04F8	NAMBURI ABHISHEK

153	18471A04F9	PALAPARTHI RAKESH
154	18471A04G0	PATTAN ABDUL KALESHA VALI
155	18471A04G1	PEDDETI BHAGYAVATHI
156	18471A04G2	POKURI RUPESH
157	18471A04G3	PONUGOTI VIJAYKRISHNA
158	18471A04G4	POOSAPATI BHANU PRAKASH REDDY
159	18471A04G5	PURIMITLA BHAVANI
160	18471A04G6	RAGAM SHANMUKA VENKATESH
161	18471A04G7	RAMYA PRIYA MEKA
162	18471A04G8	SAI PRAVEEN REDDY BAKKA
163	18471A04G9	SHAIK JOHNVALI
164	18471A04H0	SHAIK MUZEEF
165	18471A04H1	SHAIK NASEEMA
166	18471A04H2	SHAIK NASEEMA
167	18471A04H3	SHAIK SAJID
168	18471A04H4	SHAIK VASEEM
169	18471A04H5	SINGAREDDY RAJA SEKHAR
170	18471A04H6	SRIRAMANENI SAI RAM
171	18471A04H7	SYED MASIVULLA
172	18471A04H8	THADIBOINA APARNA
173	18471A04H9	VARLA IJACK
174	18471A04I0	YENIGANDLA BALA SUBRAMANYAM
175	18471A04I1	ANNALADASU PRASAD RAO
176	18471A04I2	BATCHU LEELA NAGA SASANKA
177	18471A04I3	BATHULA ANUMOHAN REDDY
178	18471A04I4	CHINTHAKUNTA SAI TEJA
179	18471A04I5	CHUPURI SAILAJA
180	18471A04I6	DAVULURI BHANU PRAKASH
181	18471A04I7	GALLA MALLIKHARJUNA RAO
182	18471A04I8	GANTA GOPI KRISHNA
183	18471A04I9	GATTUPALLI LAKSHMI PRAVALLIKA
184	18471A04J0	JUNUBOYINA SRINIVASARAO
185	18471A04J1	KAMBALA NAVYA HARIKA
186	18471A04J2	KAMEPALLI HARISH
187	18471A04J3	KANAPARTHI ROHITH
188	18471A04J4	KARANAM GOPICHAND
189	18471A04J5	LINGAMGUNTLA SHAIK AMEER BASHA
190	18471A04J6	MALAMPATI NAVEEN
191	18471A04J7	MANDAVA PRANAY KUMAR
192	18471A04J8	MARRIKANTI VEERA CHARY
193	18471A04J9	MUDDAPATI SAI TEJA

194	18471A04K0	NARNE PAVANESWAR
195	18471A04K1	PASAM JAYA SAI REDDY
196	18471A04K2	PERIGISETTY SURESH
197	18471A04K3	PERLA BHAVANI
198	18471A04K4	POLURI HARI PRIYA REDDY
199	18471A04K5	PONUGOTI SIVA MANIKANTA SAI
200	18471A04K6	RAJANALA KARTHIKEYA
201	18471A04K7	SARANGI VENKATA SAI
202	18471A04K8	SHAIK ABDUL BASHA
203	18471A04K9	SHAIK BAJI
204	18471A04L0	SHAIK FAREED BABA
205	18471A04L1	SHAIK HAPPSA
206	18471A04L2	SHAIK SADDAM HUSSAIN
207	18471A04L3	SHAIK TANVIR
208	18471A04L4	SHAIK UMRE FAROOQ
209	18471A04L5	SYED MOHAMMAD ALI
210	18471A04L6	TAVVA KANAKA TEJA
211	18471A04L7	THANIGUNDALA RAJASEKHAR REDDY
212	18471A04L8	THIMMISETTY ANIL KUMAR
213	18471A04L9	VEERLA THRINADH
214	18471A04M1	YARLAGADDA NAVYA SAI
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216	18471A04M3	NELAKURTHI HARITHA
217	18471A04M4	ANANTHA LAKSHMI RISHITHA
218	18471A04M5	PATHAN BALASAIDA
219	19475A0401	KOLAGANI TEJANJALI
220	19475A0402	SHAIK MASUDA
221	19475A0403	MUTLURI DAVID
222	19475A0404	VINUKONDA PRIYANKA
223	19475A0405	BANDARU HARIKA
224	19475A0406	BANTUPALLI SUDHEER KUMAR
225	19475A0407	KATTAMURI JAGADEESH KUMAR
226	19475A0408	TELAGATHOTI NAVEEN
227	19475A0409	UDATHA NARENDRA
228	19475A0410	PEDDISETTI PRABHU KUMAR
229	19475A0411	EEMANI LAKSHMI NARAYANA
230	19475A0412	MANNEM SAMBASIVA RAO
231	19475A0413	PARITALA SREEKANTH
232	19475A0414	VADDI NAGALAKSHMI
233	19475A0415	BOLE SRINU
234	19475A0416	ARIKATLA VENU GOPALA REDDY

235	19475A0417	KATTEKOTA JASWANTHIKA SAI KOTESWARI
236	19475A0418	PAMIDIMALLA SAMUEL JOE
237	19475A0419	GALIDINNE PAVAN KALYAN
238	19475A0420	PALAPARTHI CHANDRABABU
239	19475A0421	ALAKUNTA SRIHARI
240	19475A0422	BALIJEPALLI GANGAMMA
241	19475A0423	GUDURI RAJASREE
242	19475A0424	KATIKAM MAHESH BABU
243	19475A0425	KOLA JAYANTH SAI GANESH
244	19475A0426	KOTTAPALLI SAIKUMAR
245	17471A0402	ANNAM PRABHU CHAITANYA

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Hand Written/Printed Lecture Notes

AUTOMOTIVE ELECTRONICS

UNIT – I AUTOMOTIVE FUNDAMENTALS

CONTENTS:

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1.1 Use of Electronics in Automobile:

Some of the present and potential applications for electronics are,

1. Electronic engine control for minimizing exhaust emissions and maximizing fuel economy

2. Instrumentation for measuring vehicle performance parameters and for diagnosis of system malfunction.

3. Driveline control

4. Vehicle motion control

5. Safety and convenience

6. Entertainment/communication/navigation

1.2 EVOLUTION OF AUTOMOTIVE ELECTRONICS:

- Two major events occurred during the 1970s that started the trend toward the use of modern electronics in the automobile

1. The introduction of government regulations for exhaust emissions and fuel economy, which required better control of the engine than was possible with the methods being used.

2. The development of relatively low cost per function solid-state digital electronics that could be used for engine control and other applications.

Some of the present and potential applications for electronics are,

1. Electronic engine control for minimizing exhaust emissions and maximizing fuel economy

2. Instrumentation for measuring vehicle performance parameters and for diagnosis of system malfunction.

3. Driveline control

4. Vehicle motion control

5. Safety and convenience

6. Entertainment/communication/navigation

1.3 THE AUTOMOBILE PHYSICAL CONFIGURATION:

This early configuration is depicted in below Figure, in which many of the important automotive systems are illustrated. These systems include the following:

1. Engine

2. Drivetrain (transmission, differential, axle)

3. Suspension

4. Steering

5. Brakes

6. Instrumentation

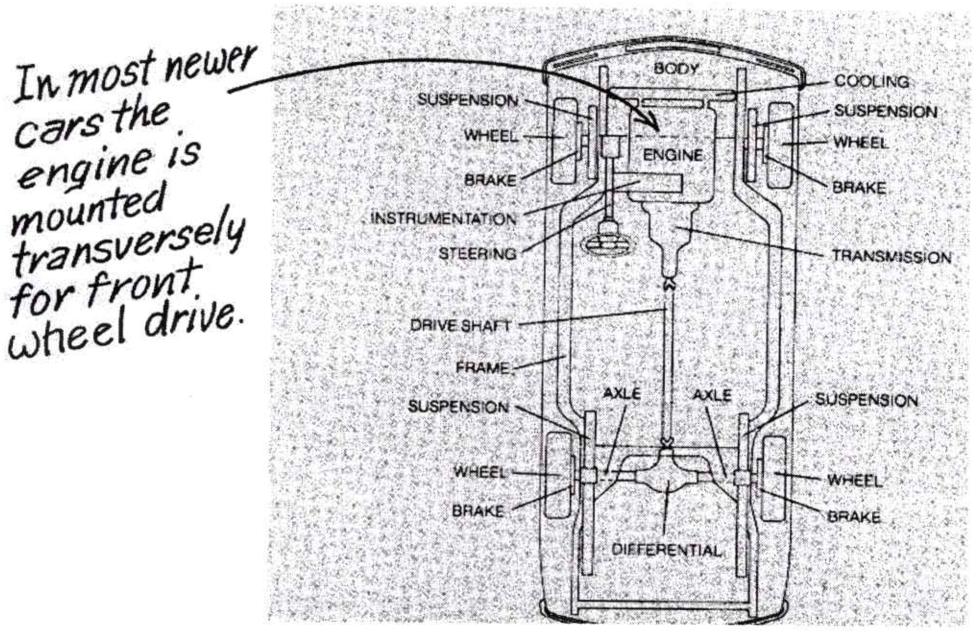
7. Electrical/electronic

8. Motion control

9. Safety

10. Comfort/convenience

11. Entertainment/communication/navigation.



Transmission:

- The transmission is a gear system that adjusts the ratio of engine speed to wheel speed.
- To accomplish this with a manual transmission, the driver selects the correct gear ratio from a set of possible gear ratios (usually three to five for passenger cars).
- An automatic transmission selects this gear ratio by means of an automatic control system.
- The configuration for an automatic transmission consists of a fluid-coupling mechanism, known as a torque converter, and a system of planetary gear sets.

Drive Shaft

- The drive shaft is used on front-engine, rear wheel drive vehicles to couple the transmission output shaft to the differential input shaft.

Differential

The differential serves three purposes

1. The most obvious is the right angle transfer of the rotary motion of the drive shaft to the wheels.

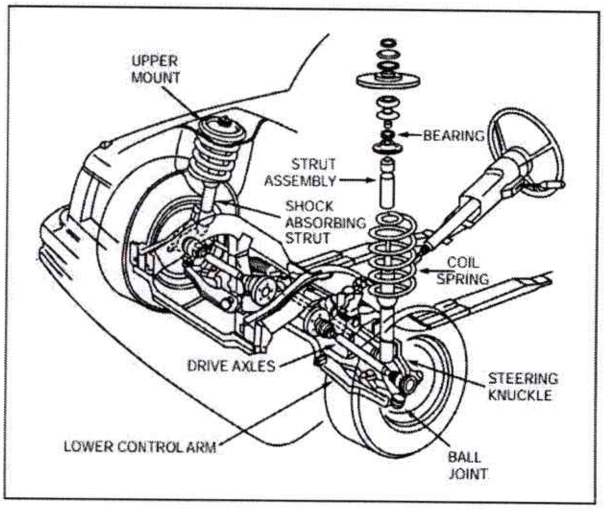
2. The second purpose is to allow each driven wheel to turn at a different speed. This is necessary because the "outside" wheel must turn faster than the "inside'' wheel when the vehicle is turning a corner.

3. The third purpose is the torque increase provided by the gear ratio. This gear ratio can be changed in a repair shop to allow different torque to be delivered to the wheels while using the same engine and transmission. The gear ratio also affects fuel economy.

Suspension:

- Another major automotive subsystem is the suspension system, which is the mechanical assembly that connects each wheel to the car body.
- The primary purpose of the suspension system is to isolate the car body from the vertical motion of the wheels as they travel over the rough road surface.

Figure 1.15
Major Components of a Suspension System



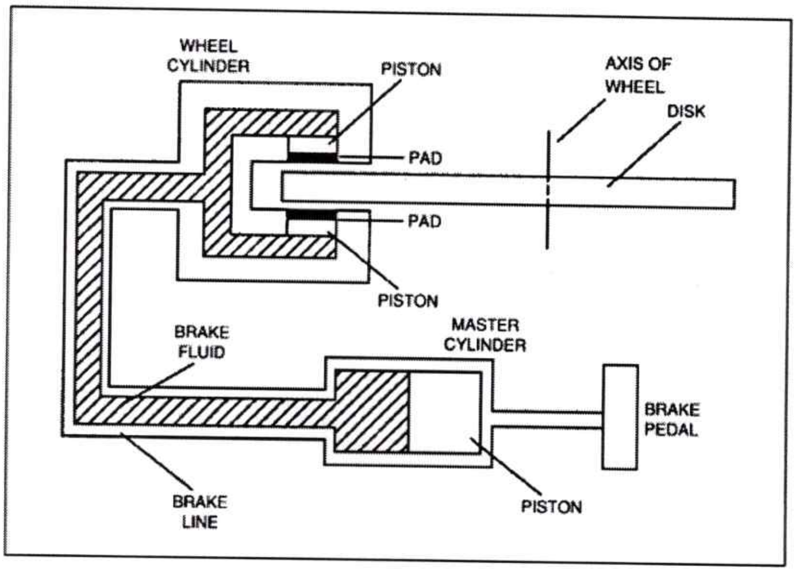
Brakes

- Brakes are as basic to the automobile as the engine drivetrain system and are responsible for slowing and stopping the vehicle.

➢ Most of the kinetic energy of the car is dissipated by the brakes during deceleration and stopping. There are two major types of automotive brakes:

1. Drum brake
2. Disk brake

Figure 1.17
Disk Brake System



Steering System

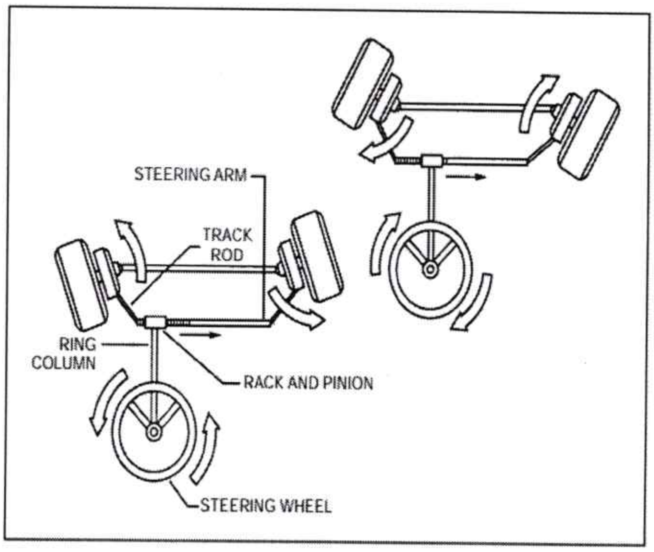
➢ A steering system is one of the major automotive subsystems required for operation of the car

➢ It provides the driver control of the path of the car over the ground.

➢ Steering functions by rotating the plane of the front wheels in the desired direction of the turn. The angle between the front wheel plane and the longitudinal axis of the car is known as the steering angle.

➢ This angle is proportional to the rotation angle of the steering wheel.

Figure 1.18
One Type of Steering Mechanism



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1.4 EVOLUTION OF ELECTRONICS IN THE AUTOMOBILE:

- The first use of a computer in a car was for the purpose of engine control. Automotive manufacturers began introducing early versions of computer controlled systems to perform one specific function.
- In 1968, Volkswagen introduced the first computer controlled electronic fuel injection (EFI) system manufactured by Bosch.
- The ECU uses closed-loop control, a control scheme that monitors outputs of a system to control the inputs to a system, managing the emissions and fuel economy of the engine
- Gathering data from dozens of different sensors, the ECU knows everything from the coolant temperature to the amount of oxygen in the exhaust.
- 1969 - Ford introduces their first computer controlled anti-skid system.
- 1971 - General Motors introduces their first computer controlled transmission.
- 1976 - General Motors and Motorola team up to create custom microcomputer for use in their vehicles.
- 1978 - Cadillac introduces a computer controlled trip computer powered by a Motorola Microprocessor.
- 1981 - All General Motors vehicles now come with a Motorola 6802 based ECM with emissions control.
- 1983 - Intel's 8061 custom designed automotive microcontroller chips start being used in Ford vehicles
- 1986 - Carnegie Mellon University's "Navlab 1" becomes first self-driving, autonomous car.
- 1986 - Chrysler introduces multiplexing wire communication modules with chips supplied from Harris Semiconductor.
- 1987 - First automotive microcontroller chips produced to CAN vehicle bus standards by Intel and Philips Semiconductor.
- 1991 - Ford and Motorola form partnership to design & produce their PTEC powertrain & transmission microcontrollers.
- 2000 - Ford Microelectronics Inc. (FMI) is acquired by Intel Corp.
- 2014 - First commercially available self-driving vehicle introduced - The Navia shuttle.

- 2015 - Daimler's "Freightliner Inspiration" becomes First self-driving, semi-autonomous, Sem Truck.
- 2017 - Tesla "Semi" introduced, their first model of all electric, autonomous self driving, freight truck
- 2017 Intel Corp. acquires Mobileye, a developer of vision-based advanced driver-assistance systems

1.5 SURVEY OF MAJOR AUTOMOTIVE SYSTEMS:

- Modern automotive electronics were first applied to control the engine in order to reduce exhaust emissions and somewhat later to improve fuel economy.
- We review the engine configuration first in this survey.

The Engine:

- The engine in an automobile provides all the power for moving the automobile, for the hydraulic and pneumatic systems, and for the electrical system.
- A variety of engine types have been produced, but one class of engine is used most: the internal combustion, piston-type, 4-stroke/cycle, gasoline- fueled, spark-ignited, liquid-cooled engine.
- The major components of the engine include the following:

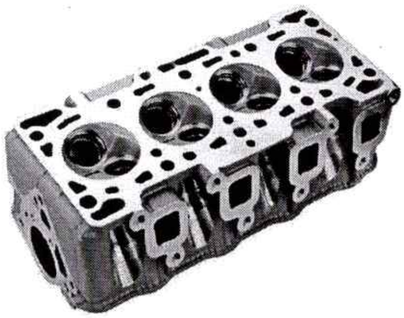
1. Engine block
2. Cylinder
3. Crankshaft
4. Pistons
5. Connecting rods
6. Camshaft
7. Cylinder head
8. Valves

Cylinder:

- The function of the cylinder/engine block is to support and ensure the accurate position of the moving parts such as pistons, connecting rods and crankshafts; to ensure the engine's ventilation, cooling and lubrication.

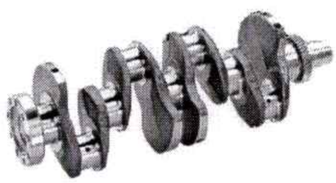
Cylinder Head:

- Cylinder head is fitted on the top of cylinder block and the function of the cylinder head is to seal the working end of cylinder and not to permit entry and exit of gasses on cover head valves of the engine.
- The valves, spark plug, camshaft etc. are fitted on it.



Crankshaft:

- It is a shat which transmits the power developed by the engine to the various parts of the vehicle
- It is located in the bottom end of cylinder block.
- It transmits the reciprocating motion of piston into rotary motion.
- This rotary motion used to rotate wheels of the vehicle



Piston:

- Piston is placed in the cylinder and transmits thurst to the connecting rod
- It is free to move.
- It compresses the air fuel mixture and convert the fuel energy into mechanical energy.
- It transmits the power to the crankshaft.

Connecting rod:

- It connects piston to the crank shaft and transmit the motion and thrust of piston to crankshaft
- The lower end of the connecting rod is connected to the piston and the bigger end is connected to the crankshaft

Camshaft:

- Camshaft is to control the opening and closing of valves at proper timing.
- It is placed at the top or at the bottom of cylinder

Valves:

- Valves are used to control the inlet and exhaust of internal combustion engine.
- Two valves are used for each cylinder one for inlet of air-fuel mixture inside the cylinder and other for exhaust combustion gases
- The valves are fitted in the port at the cylinder head by use of strong spring

Engine block:

- Mechanical rotary power is produced in an engine through the combustion of gasoline inside cylinders in the engine block and a mechanism consisting of pistons (in the cylinders) and a linkage (connecting rod) coupled to the crankshaft.
- Mechanical power is available at the crankshaft. The cylinders are cast in the engine block and machined to a smooth finish.
- The pistons fit tightly into the cylinder and have rings that provide a tight sliding seal against the cylinder wall.
- The pistons are connected to the crankshaft by connecting rods.
- The crankshaft converts the up and down motion of the pistons to the rotary motion and the torque needed to drive the wheels.

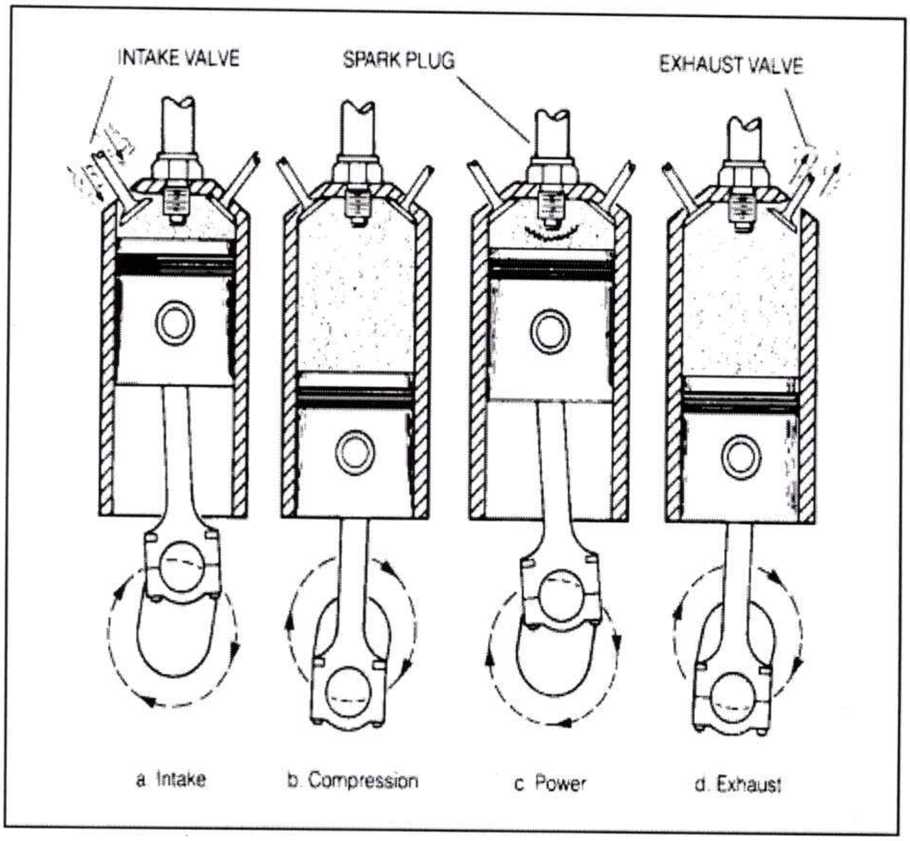
Operation of Engine:

Conventional SI engines operate using four "strokes," with either an up or down movement of each piston. 4 stroke engine has 4 strokes

These strokes are named as,

- *Intake*
- *Compression*
- *Power*
- *Exhaust.*

Figure 1.5
The Four Strokes of a Typical Modern Gasoline-Fueled, Spark-Ignition Engine



Intake

- During the intake stroke the piston is moving from top to bottom and the intake valve is open.
- As the piston moves down, a partial vacuum is created, which draws a mixture of air and vaporized gasoline through the intake valve into the cylinder.

Compression

- During the compression stroke both valves are closed, and the piston moves upward and compresses the fuel and air mixture against the cylinder head.
- When the piston is near the top of this stroke, the ignition system produces an electrical spark at the tip of the spark plug. (The top of the stroke is normally called *top dead centre*—TDC.) The spark ignites the air–fuel mixture and the mixture burns quickly, causing a rapid rise in the pressure in the cylinder.

Power

- During the power stroke (Figure 1.5c), the high pressure created by the burning mixture forces the piston downward. The cylinder pressure creates the force on the piston that results in the torque on the crankshaft as described above.
- It is only during this stroke that actual usable power is generated by the engine.

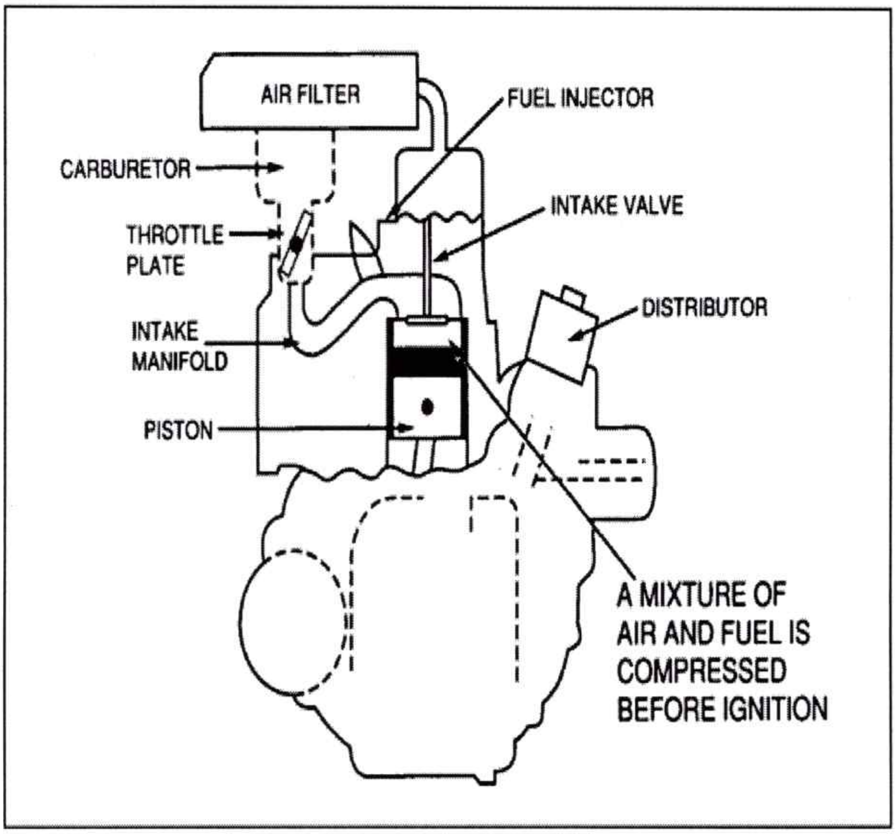
Exhaust

- During the exhaust stroke (Figure 1.5d), the piston is again moving upward. The exhaust valve is open and the piston forces the burned gases from the cylinder through the exhaust port into the exhaust system and out the tailpipe into the atmosphere.

1.6 ENGINE CONTROL:

- Control of the engine in any car means regulating the power that it produces at any time in accordance with driving needs.
- The driver controls engine power via the accelerator pedal, which, in turn, determines the setting of the throttle plate via a mechanical linkage system.
- The air flowing into the engine flows past the throttle plate, which, in fact, controls the amount of air being drawn into the engine during each intake stroke.
- The power produced by the engine is proportional to the mass flow rate of air into the engine.

Figure 1.7
Intake Manifold and
Fuel Metering



- The power produced by the engine is proportional to the mass flow rate of air into the engine.

- The driver then controls engine power directly by controlling this air mass flow rate with the throttle plate. As the accelerator pedal is depressed, the throttle plate rotates, permitting air to flow at an increased rate.
- Of course, the power produced by the engine depends on fuel being present in the correct proportions.
- Fuel is delivered to each cylinder at a rate that is proportional to air flow.
- It should be noted that before the advent of electronic engine controls fuel flow was regulated by a device known as a carburetor.

1.7 IGNITION SYSTEM:

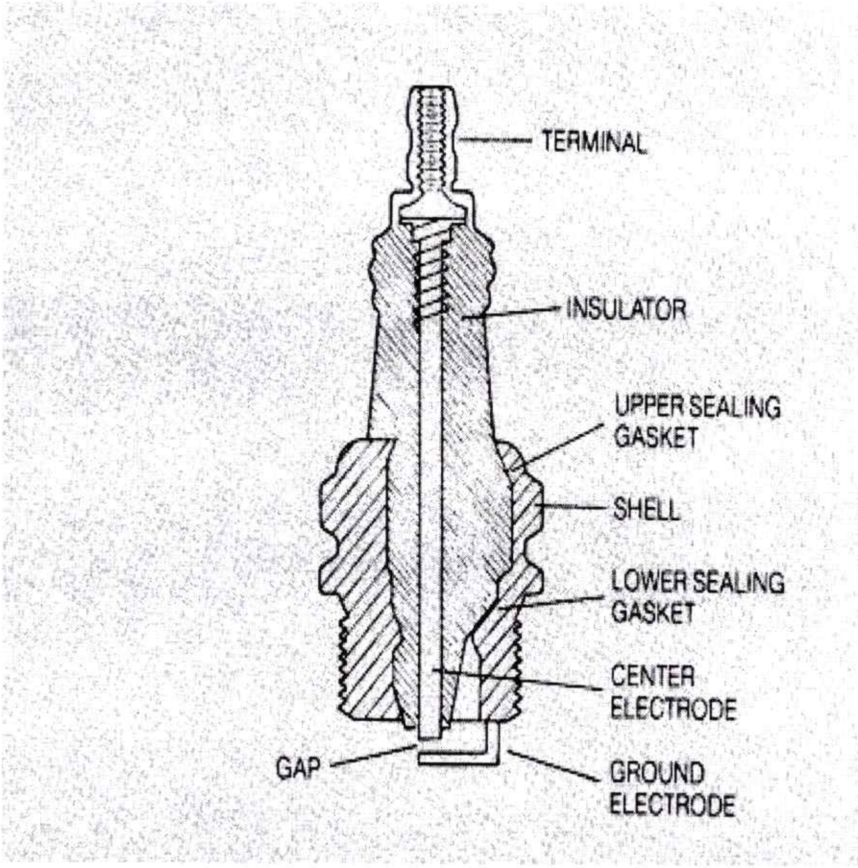
- To produce power, the gasoline engine must not only have a correct mixture of fuel and air, but also some means of initiating combustion of the mixture.
- Essentially the only practical means is with an electric spark produced across the gap between a pair of electrodes of a spark plug.
- The electric arc or spark provides sufficient energy to cause combustion. This phenomenon is called ignition.
-
- The ignition system itself consists of several components:

1. The spark plug
2. One or more pulse transformers
3. Timing control circuitry
4. Distribution apparatus

1. **The spark plug:**

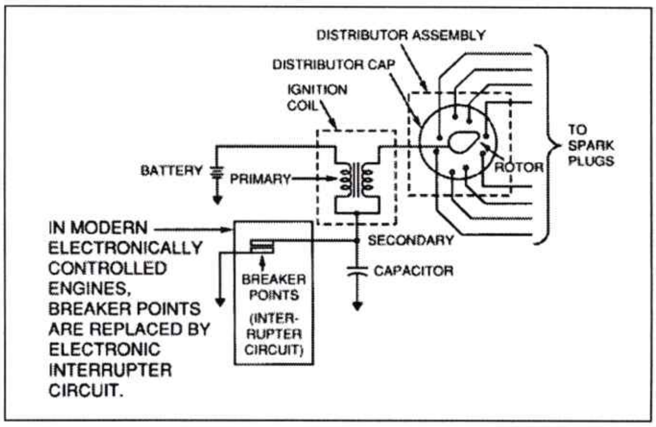
- The spark is produced by applying a high-voltage pulse of from 20kV to 40kV (1kV is 1,000 volts) between the center electrode and ground.
- The actual voltage required to start the arc varies with the size of the gap, the compression ratio, and the air–fuel ratio.

Figure 1.8
Spark Plug Configuration



- The spark plug consists of a pair of electrodes, called the center and ground electrodes, separated by a gap.
- The gap size is important and is specified for each engine. The gap may be 0.025 inch (0.6mm) for one engine and 0.040 inch (1mm) for another engine.
- The center electrode is insulated from the ground electrode and the metallic shell assembly.
- The ground electrode is at electrical ground potential because one terminal of the battery that supplies the current to generate the high-voltage pulse for the ignition system is connected to the engine block and frame.

Figure 1.9
Schematic of the Ignition Circuit



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High-Voltage Circuit and Distribution:

The figure shown above is the ignition system provides the high-voltage pulse that initiates the arc. The high-voltage pulse is generated by inductive discharge of a special high-voltage transformer commonly called an *ignition coil.* The high-voltage pulse is delivered to the appropriate spark plug at the correct time for ignition by a distribution circuit. The distribution of high voltage pulses was accomplished with a rotary switch called the *distributor.*

Ignition timing is actually computed as a function of engine operating conditions in a special-purpose digital computer known as the electronic engine control system. This computation of spark timing has much greater flexibility for optimizing engine performance than a mechanical distributor and is one of the great benefits of electronic engine control.

AUTOMOTIVE ELECTRONICS

UNIT – II ELECTRONICS FUNDAMENTALS

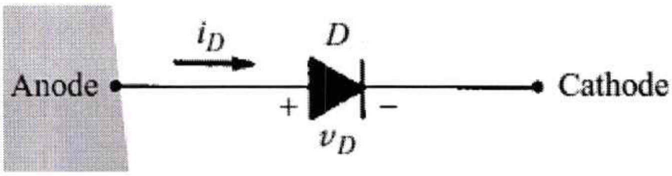
CONTENTS:

2.1 DIODE:

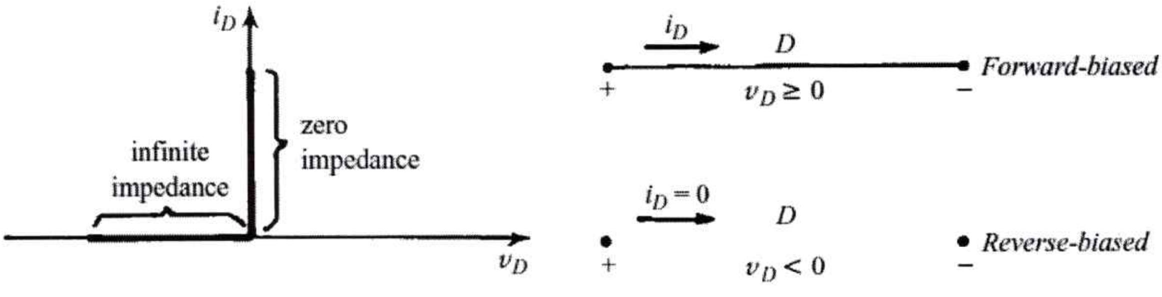
Diodes are among the oldest and most widely used of electronic devices. A diode may be defined as a near-unidirectional conductor whose state of conductivity is determined by the polarity of its terminal voltage. The semiconductor diode is formed by the metallurgical junction of p-type and n-type materials. (A p-type material is a group-IV element doped with a small quantity of a group-V material; n-type material is a group-IV base element doped with a group-III material.)

The ideal diode:

The symbol for the common, or rectifier, diode is shown in Fig. 2-1(a). The device has two terminals, labelled anode (p-type) and cathode (n-type), which makes understandable the choice of diode as its name. When the terminal voltage is nonnegative ($v_D \geq 0$), the diode is said to be forward-biased or ''on''; the positive current that flows ($i_D \geq 0$) is called forward current. When $v_D < 0$, the diode is said to be reverse-biased or ''off,'' and the corresponding small negative current is referred to as reverse current.



The ideal diode is a perfect two-state device that exhibits zero impedance when forward-biased and infinite impedance when reverse-biased (Fig. 2-2). Note that since either current or voltage is zero at any instant, no power is dissipated by an ideal diode. In many circuit applications, diode forward voltage drops and reverse currents are small compared to other circuit variables; then, sufficiently accurate results are obtained if the actual diode is modelled as ideal.



(*a*) Terminal characteristics (*b*) Circuit models

Use of the Fermi-Dirac probability function to predict charge neutralization gives the static (non-time- varying) equation for diode junction current:

$$i_D = I_o(e^{v_D/\eta V_T} - 1) \quad A$$

where $V_T \equiv kT/q$, V

$v_D \equiv$ diode terminal voltage, V

$I_o \equiv$ temperature-dependent saturation current, A

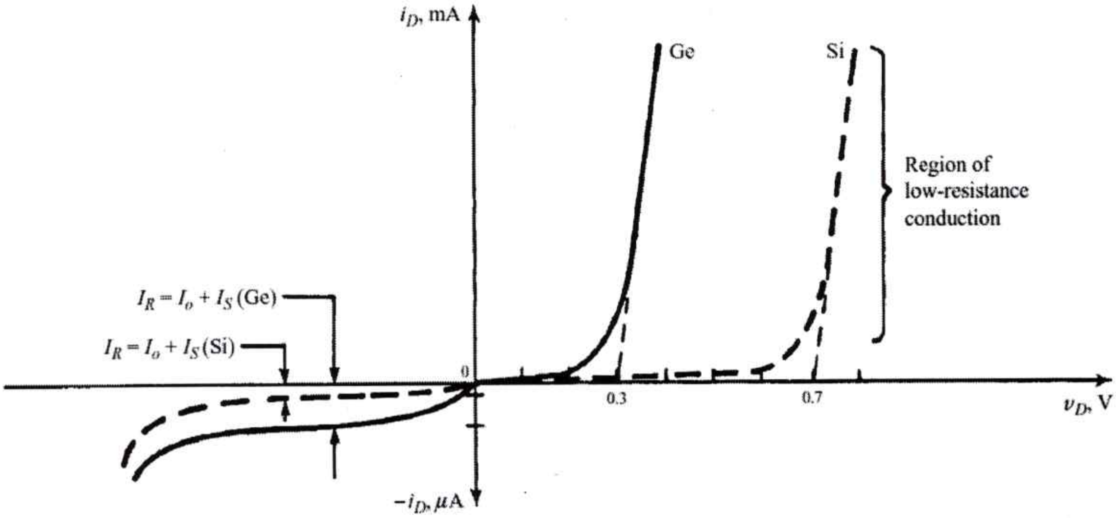
$T \equiv$ absolute temperature of *p-n* junction, K

$k \equiv$ Boltzmann's constant (1.38×10^{-23} J/K)

$q \equiv$ electron charge (1.6×10^{-19} C)

$\eta \equiv$ empirical constant, 1 for Ge and 2 for Si

In commercially available diodes, proper doping (impurity addition) of the base material results in distinct static terminal characteristics. A comparison of Ge- and Si-base diode characteristics is shown in below Fig.

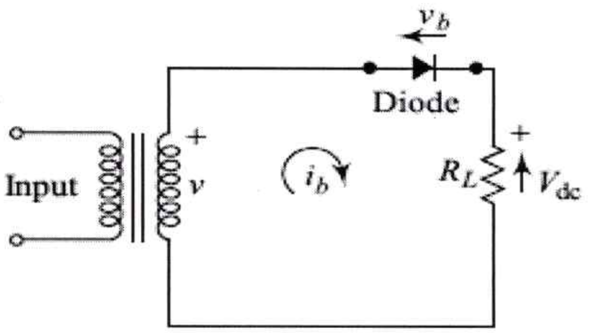


2.2 RECTIFIER CIRCUIT:

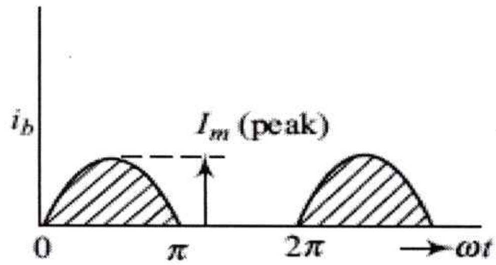
Rectifiers are circuits that convert alternating current to direct current. Nearly all types of electronic equipment require dc input to power them. The most common form of rectifiers operates with single phase inputs.

Half-wave Rectifier

Figure shows a half-wave rectifier circuit employing an ideal *p-n* junction diode.



(a)



(b)

An ideal *p-n* junction diode, it may be recollected, has a negligible forward voltage drop and zero reverse leakage current. The diode in the circuit shown in figure allows current to pass through it when it is forward biased and does not allow any current under reverse bias conditions. Thus the junction diode connects the ac source to the load when its *p*-region is positive with respect to the *n*-region and disconnects the source and the load under opposite polarity conditions.

The current pulses during the two half-cycles of the voltage are given by

$$i_b = \frac{V_m \sin \omega t}{R_L} \text{ for } 0 \le \sin \omega t \le 1$$

And

$$i_b = 0 \text{ for } -1 \le \sin \omega t \le 0$$

The current waveform is shown in Figure it is clear that the voltage across the load, v_L is given by

$$v_L = i_b R_L$$

Thus, the load voltage has the same pulse shape as the current i_b sketched in Figure (b). If V_m represents the peak voltage across the load, then a Fourier analysis of the half-sinusoid voltage pulses across the load R_L leads to

$$v_L = \frac{V_m}{\pi} + \frac{V_m}{2} \sin \omega t - \frac{2V_m}{3\pi} \cos 2\omega t - \frac{2V_m}{15\pi} \cos 4\omega t - \cdots$$

The dc voltage across the load resistor, R_L, is the average of the above series. This results in

$$V_{dc} = \frac{V_m}{\pi}$$

The corresponding current I_{dc} is given by

$$I_{dc} = \frac{V_m}{\pi R} = \frac{I_m}{\pi}$$

Where,

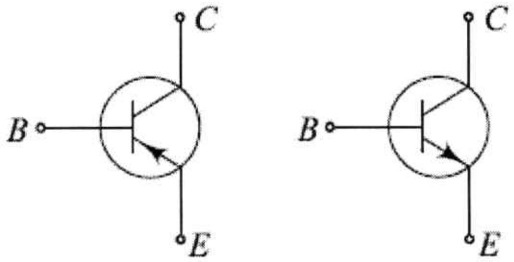
$$I_m = \frac{V_m}{R}$$

I_m represents the peak current magnitude.

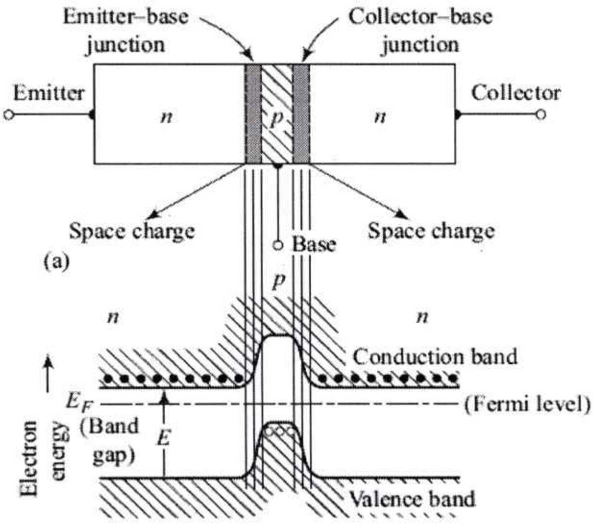
Rectifier also contains the harmonic frequencies that are not a part of the dc output. The harmonic terms, however, result in power dissipation in resistive loads, reduced power efficiency, and lead to *ripple* in the rectifier output waveform. Circuits like the half-wave rectifier have too high a ripple to be of any direct use in electronic equipment. More efficient rectifier circuits are available for such applications.

2.3 Transistor:

A bipolar junction transistor consists of two *p-n* junctions placed back to back. The two *p-n* junctions are coupled to each other by a semi-conducting region, which is common to both the junctions. This common region is known as the *base* region of the transistor. The other two regions of the same conductivity type are called the *emitter* and the *collector*. The symbolic representations of *n-p-n* and *p-n-p* transistors. The emitter terminal in the symbolic representation has an arrow which points in the direction of emitter current.

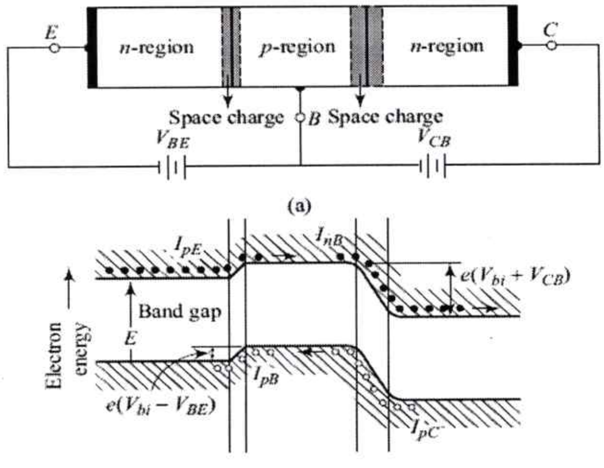


Under no external applied bias and in thermal equilibrium the Fermi energy levels in all the three regions must lie along the same line.



The emitter and collector regions are of *n*-type, whereas the base region is of *p*-type, such a transistor is called an *n-p-n* transistor. The other type of transistor is called a *p-n-* transistor. In the *p-n-p* transistor, the emitter and collector regions are *p*-type and the base region is *n*-type.

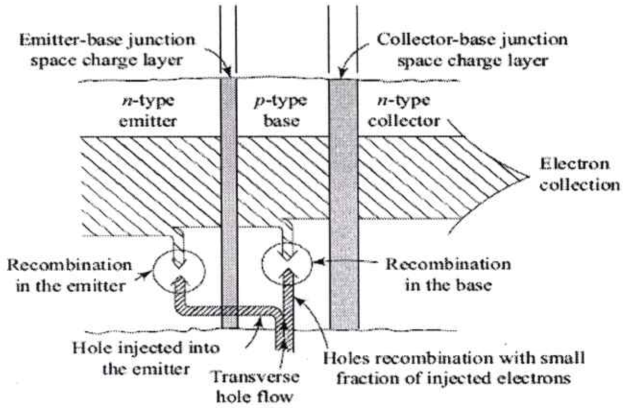
At zero bias the net current density is zero throughout the transistor. The net electron-current density, due to diffusion and drift, is equal to zero. Similarly, the net hole current density is also zero. To understand the basic control action of a transistor, let us assume the emitter junction to be forward biased and the collector junction to be reverse biased.



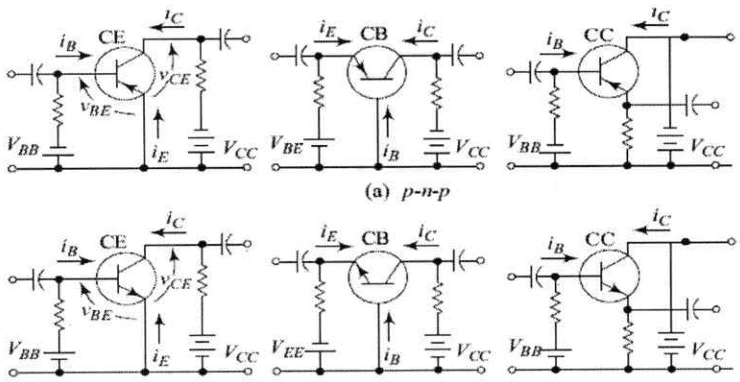
Electrons are injected from the emitter region, where they happen to be majority carriers, into the base region, where they are minority carriers. In the base region, a small fraction of these electrons recombines with the majority carrier holes. The remaining electrons diffuse across the thin base region and reach the space charge region of the collector junction.

The *n*-type collector region is positively biased, due to which the electrons are collected by the collector. The collected electrons dominate the collector current. Thus, *the collector current is controlled by the emitter-to-base voltage.*

The internal currents flowing in an *n-p-n* transistor are depicted schematically in Fig



One of the best ways of biasing the two junctions is to keep one of three terminals common. This results in the following three configurations, namely common–emitter (CE), common–base (CB), and common–collector (CC).

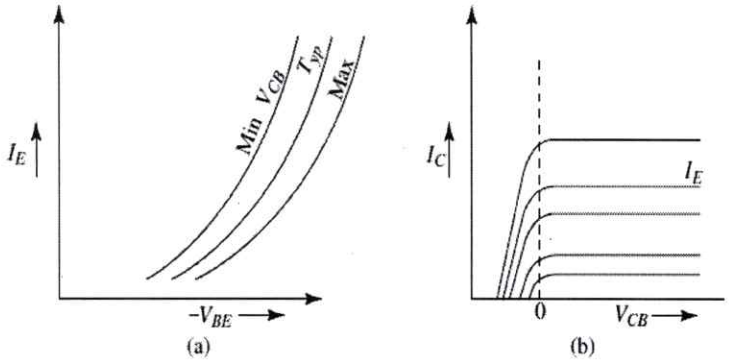


BJT Characteristics

A bipolar junction transistor (BJT) can be operated in four possible modes. The modes are characterized by the biasing configurations of the emitter-base and base-collector junctions.

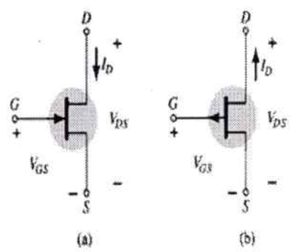
- In the *active* or *normal mode* the emitter-base junction is forward biased whereas the base-collector junction is reverse biased.
- Both the junctions are reverse biased in *cut-off mode*
- Both the junctions are forward biased in the *saturation mode.*
- In the *inverse active* mode, the emitter-base junction is reverse biased whereas the base-collector junction is forward biased.

The I-V characteristics are dependent upon the configuration used for the BJT. Figure shows the I-V characteristics for the common-base configuration of a *p-n-p* transistor.



2.4 FIELD-EFFECT TRANSISTORS:

The graphic symbols for the n -channel and p -channel JFETs are provided in Fig. Note that the arrow is pointing in for the n -channel device of to represent the direction in which I G would flow if the p – n junction were forward-biased. For the p -channel device the only difference in the symbol is the direction of the arrow in the symbol.



JFET symbols: (a) n-channel; (b) p-channel.

CONSTRUCTION AND CHARACTERISTICS OF JFETs

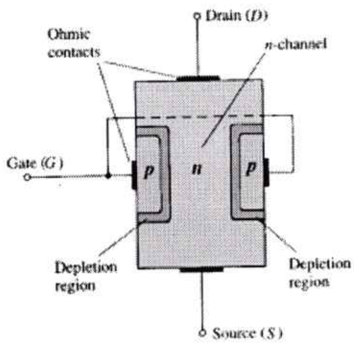
The basic construction of the n -channel JFET is shown in Fig. Note that the major part of the structure is the n -type material, which forms the channel between the embedded layers of p -type material. The top of the n -type channel is connected through an ohmic contact to a terminal referred to as the drain (D) , whereas the lower end of the same material is connected through an ohmic contact to a terminal referred to as the source (S). The two p -type materials are connected together and to the gate (G) terminal.

In essence, therefore, the drain and the source are connected to the ends of the n -type channel and the gate to the two layers of p -type material.

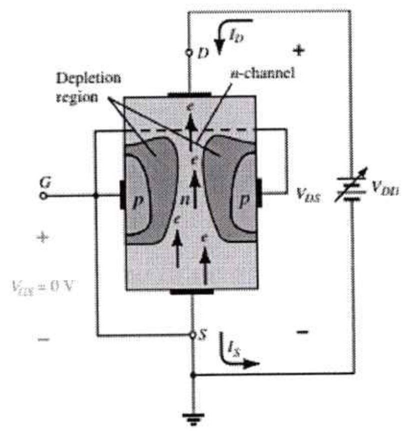
In the absence of any applied potentials the JFET has two p – n junctions under no-bias conditions. The result is a depletion region at each junction, as shown in Fig. that resembles the same region of a diode under no-bias conditions.

VGS= 0 V, VDS Some Positive Value

In Fig. a positive voltage V DS is applied across the channel and the gate is connected directly to the source to establish the condition V GS 0 V. The result is a gate and a source terminal at the same potential and a depletion region in the low end of each p –material similar to the distribution of the no-bias conditions of Fig.



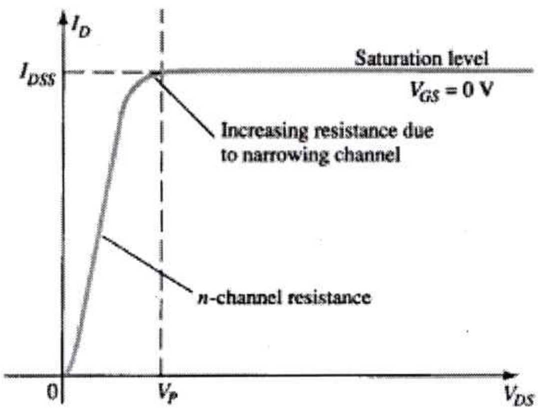
The instant the voltage VDD (=VDS) is applied, the electrons are drawn to the drain terminal, establishing the conventional current I D with the defined direction of Fig. 6.5 . The path of charge flow clearly reveals that the drain and source currents are equivalent (ID = IS). Under the conditions in Fig. the flow of charge is relatively uninhibited and is limited solely by the resistance of the n -channel between drain and source. It is important to note that the depletion region is wider near the top of both p –type materials.



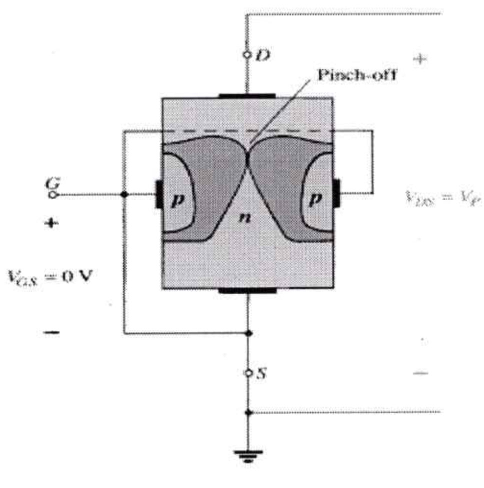
JFET at $V_{GS} = 0$ V and $V_{DS} > 0$ V.

As the voltage V DS is increased from 0 V to a few volts, the current will increase as determined by Ohm's law and the plot of I D versus V DS will appear as shown in Fig.

The relative straightness of the plot reveals that for the region of low values of V DS , the resistance is essentially constant. As V DS increases and approaches a level referred to as V P in Fig., the depletion regions will widen, causing a noticeable reduction in the channel width. The reduced path of conduction causes the resistance to increase and the curve in the graph of Fig. to occur. The more horizontal the curve, the higher the resistance, suggesting that the resistance is approaching "infinite" ohms in the horizontal region. If V DS is increased to a level where it appears that the two depletion regions would"touch" as shown in Fig., a condition referred to as pinch off will result. The level of V DS that establishes this condition is referred to as the pinch-off voltage and is denoted by V P



I_D versus V_{DS} for $V_{GS} = 0$ V.

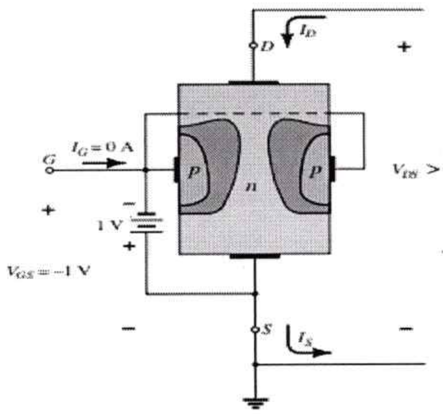


Pinch-off ($V_{GS} = 0$ V, $V_{DS} = V_P$).

As V DS is increased beyond V P , the region of close encounter between the two depletion regions increases in length along the channel, but the level of I D remains essentially the same. IDSS is the maximum drain current for a JFET and is defined by the conditions VGS = 0 V and VDS >VP .

V GS < 0 V

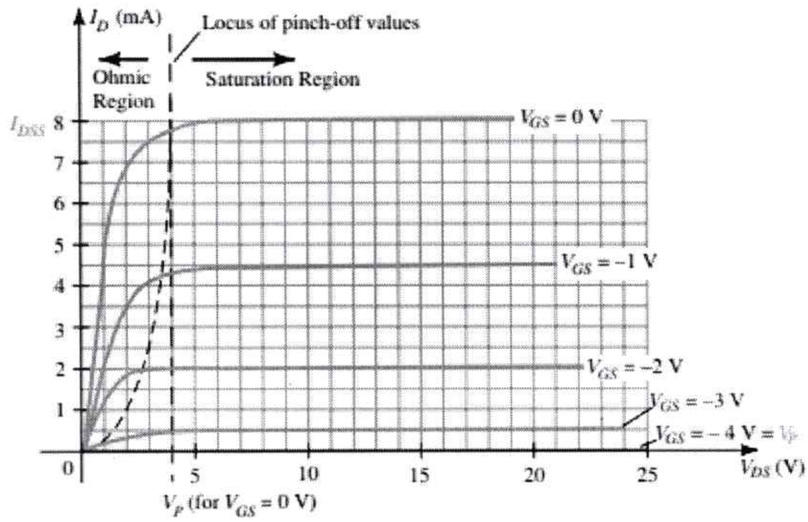
For the n -channel device the controlling voltage V GS is made more and more negative from its V GS 0 V level. In other words, the gate terminal will be set at lower and lower potential levels as compared to the source.



Application of a negative voltage to the gate of a JFET.

A negative voltage of 1 V is applied between the gate and source terminals for a low level of V DS . The effect of the applied negative-bias V GS is to establish depletion regions similar to those obtained with V GS 0 V, but at lower levels of V DS . Therefore, the result of applying a negative bias to the gate is to reach the saturation level at a lower level of V DS , as shown in Fig. for VGS = -1 V. The resulting saturation level for I D has been reduced and in fact will continue to decrease as V GS is made more and more negative. Note also in Fig. how the pinch-off voltage continues to drop in a parabolic manner as V GS becomes more and more negative. Eventually, V GS when VGS = -VP will be sufficiently negative to establish a saturation level that is essentially 0 mA, and for all practical purposes the device has been "turned off."

In summary: The level of V GS that results in I D 0 mA is defined by VGS VP, with V P being a negative voltage for n-channel devices and a positive voltage for p-channel JFETs.



n-Channel JFET characteristics with $I_{DSS} = 8$ mA and $V_P = -4$ V.

On most specification sheets the pinch-off voltage is specified as VGS(off) rather than V P . A specification sheet will be reviewed later in the chapter when the majority of the contr-olling elements have been introduced. The region to the right of the pinch-off locus of Fig. is the region typically employed in linear amplifiers (amplifiers with minimum distortion of the applied signal) and is commonly referred to as the constant-current, saturation, or linear amplification region.

The relationship between I D and V GS is defined by Shockley's equation

control variable

$$I_D = I_{DSS}\left(1 - \frac{V_{GS}}{V_P}\right)^2$$

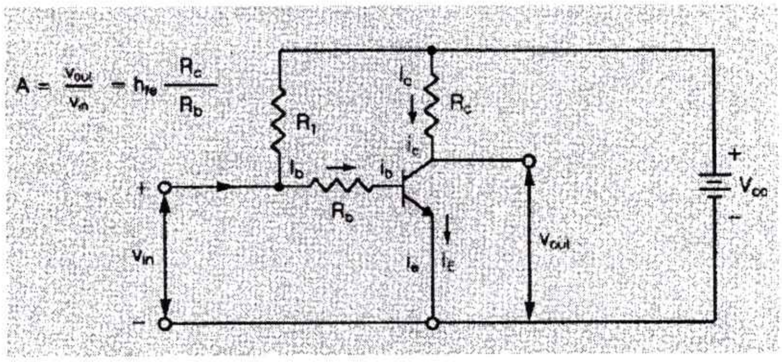
constants

When $V_{GS} = 0$ V, $I_D = I_{DSS}$

When $V_{GS} = V_P$, $I_D = 0$ mA

2.5 TRANSISTOR AMPLIFIERS:

Figure shows a transistor amplifier. The ac voltage source, *V*in, supplies a signal current to the base-emitter circuit. The transistor is biased to operate in the linear region at some steady state *Ib* and *Ic*. The voltage source, *V*cc, supplies the steady-state base and collector dc currents *Ib* and *Ic*, respectively, and any signal current change *ic* to the collector-emitter circuit.



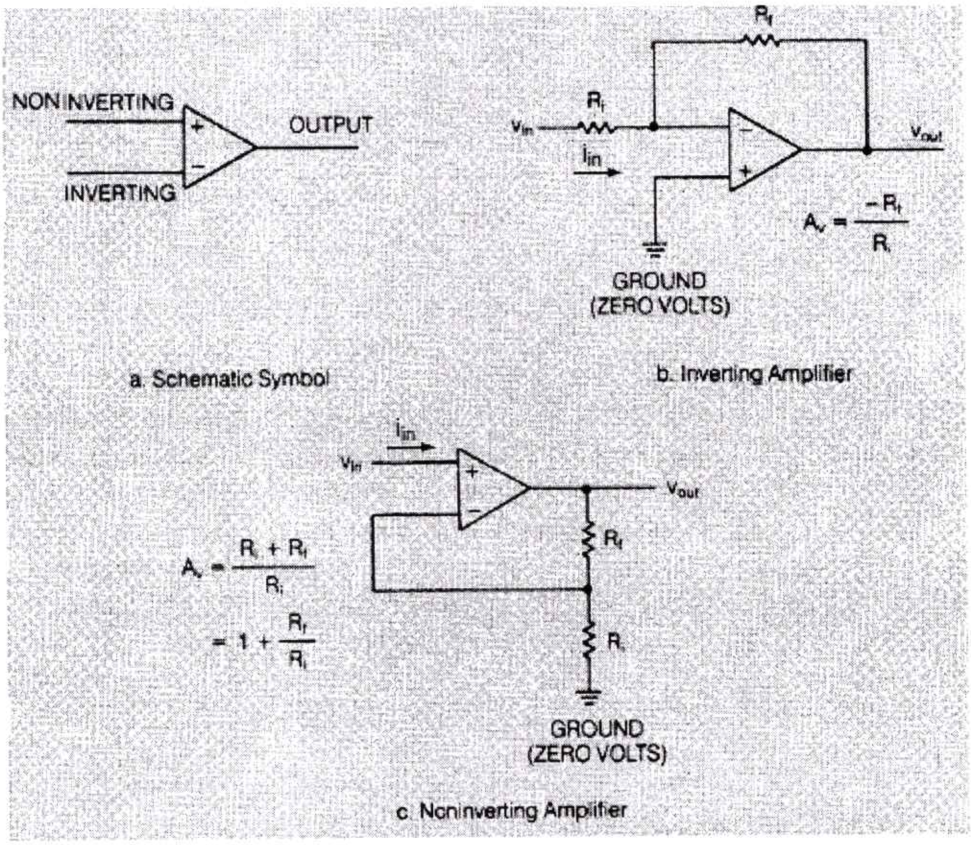
$$A = \frac{V_{out}}{V_{in}} = h_{fe}\frac{R_c}{R_b}$$

The small signal voltage *V*in varies the base current around the steady dc operating point. This small current change is *ib*, and it causes a corresponding but larger change in collector current *ic* around the steady-state operating current *Ic*. The small signal current change causes a *V*out change across the load resistor *Rc*. The small signal voltage gain of the circuit is as shown in Figure This is found by using the model and the equations *V*out = *icRc*, *ic* = *hfeib*, and *ib* = *V*in/*Rb*, where hfe is the small signal current gain.

Circuits such as those depicted in Figure 3.3 are combined to make many types of amplifiers that are used in a variety of applications. Such circuits, especially when made in one package with integrated circuit technology (to be discussed later), are called *linear circuits* or *analog circuits*.

2.6 USE OF FEEDBACK IN OP AMPS:

An operational amplifier (op amp) is another standard building block of integrated circuits and has many applications in analog electronic systems. It is normally connected in a circuit with external circuit elements (e.g., resistors and capacitors) that determine its operation. An op amp typically has a very high voltage gain of 10,000 or more and has two inputs and one output (with respect to ground), as shown in Figure 3.4a. A signal applied to the inverting input (-) is amplified and inverted at the output. A signal applied to the noninverting input (+) is amplified but is not inverted at the output.



The op amp is normally not operated at maximum gain, but feedback techniques can be used to adjust the gain to the value desired. Some of the output is connected to the input through circuit elements (resistors, capacitors, etc.) to oppose the input changes. In the example of Figure b, the feedback path consists of resistor *Rf*. The gain is adjusted by the ratio of the two resistors and is calculated by the following equation

$$A_v = -\frac{R_f}{R_i} = \frac{V_{\text{out}}}{V_{\text{in}}}$$

Negative feedback also can help to correct for the amplifier's nonlinear operation and distortion.

2.7 SUMMING MODE AMPLIFIER:

One of the important op amp applications is summing of voltages. Figure is a schematic drawing of a summing mode op amp circuit. In this circuit, a pair of voltages *va* and *vb* (relative to ground) are connected through resistances *R* to the inverting input. The output voltage *vo* is proportional to the sum of the input voltages

$$v_o = \frac{-R_f(v_a + v_b)}{R}$$

For example, a compatible stereo broadcast system incorporating a right channel and a left channel characterized by voltages *vR* and *vL*, respectively, transmits the sum *vS* of the channel voltages

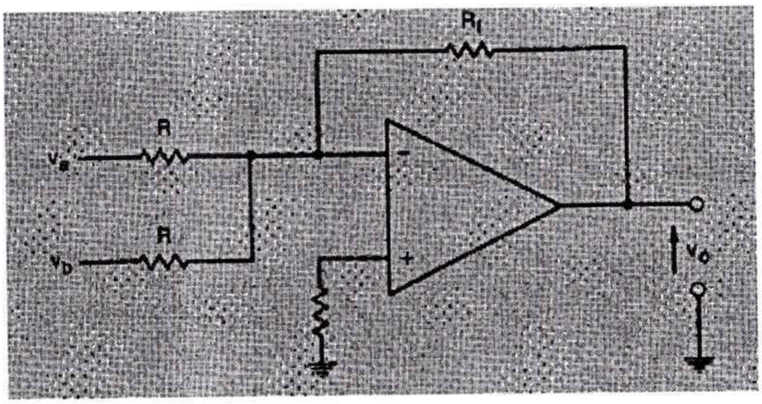
$$v_S = v_R + v_L$$

At the same time, the difference voltage *vD* is transmitted on a subcarrier

$$v_D = v_R - v_L$$

The right-channel voltage can be separated from the sum and difference voltages using the circuit of Figure Replacing voltages *va* and *vb* by *vS* and *vD*, respectively, yields an output

$$v_o = \frac{-R_f}{R}(v_R + v_L + v_R - v_L)$$
$$= \left(\frac{-2R_f}{R}\right)v_R$$



2.8 ANALOG COMPUTERS:

The op amp is the basic building block for analog computers. Analog computers are used to simulate the behaviour of other systems. Virtually any system that can be described in a block diagram using standard building blocks can be duplicated on an analog computer. If a control system designer is building an automotive speed controller and does not want to waste a lot of time and money testing prototypes on a real car, he or she can program the analog computer to simulate the car's speed electronically. By varying amplifier gains, frequency responses, and resistor, capacitor, and inductor values, system parameters can be varied to study their effect on system performance. Such system studies help to determine the parts needed for a system before any hardware is built. The main problem with analog circuits and analog computers is that their performance changes with changes in temperature, supply voltage, signal levels, and noise levels. While most of these problems are eliminated when digital circuits are used, analog computers are much more cost effective when dealing with relatively simple systems. However, analog computers have effectively been replaced in all practical applications by a corresponding digital computer.

2.11 MULTIPLEXER (IC 74151):

The sizes of commercially available MSI multiplexers are limited by the number of pins available in an inexpensive IC package. Commonly used muxes come in 16-pin packages. At one extreme is the 74x151, shown in Figure 5-62, which selects among eight 1-bit inputs. The select inputs are named C, B, and A, where C is most significant numerically. The enable input EN_L is active low; both active-high (Y) and active-low (Y_L) versions of the output are provided.

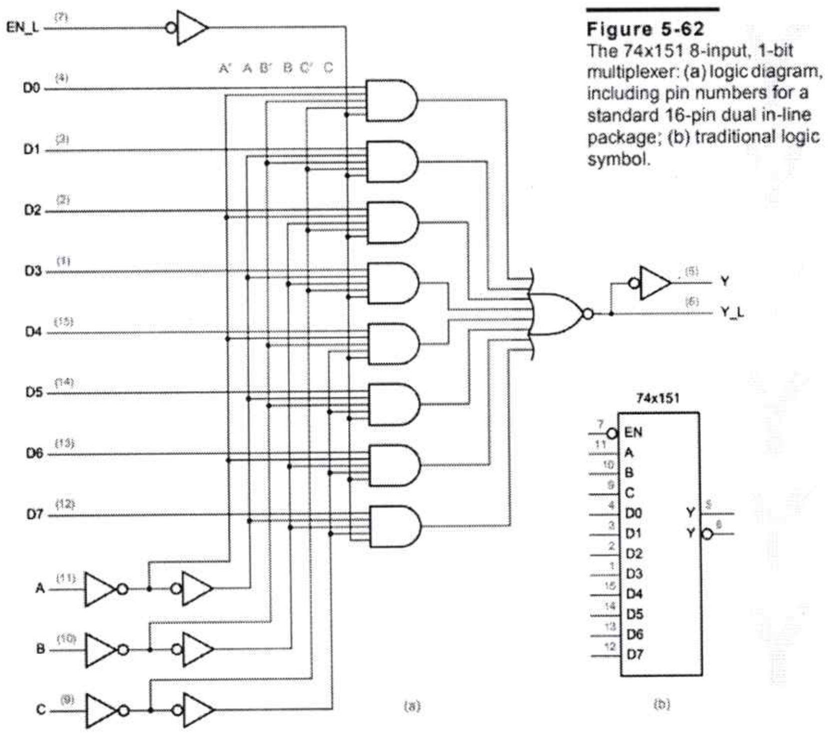


Figure 5-62
The 74x151 8-input, 1-bit multiplexer: (a) logic diagram, including pin numbers for a standard 16-pin dual in-line package; (b) traditional logic symbol.

Truth table of IC74151:

Inputs				Outputs	
EN_L	C	B	A	Y	Y_L
1	x	x	x	0	1
0	0	0	0	D0	D0′
0	0	0	1	D1	D1′
0	0	1	0	D2	D2′
0	0	1	1	D3	D3′
0	1	0	0	D4	D4′
0	1	0	1	D5	D5′
0	1	1	0	D6	D6′
0	1	1	1	D7	D7′

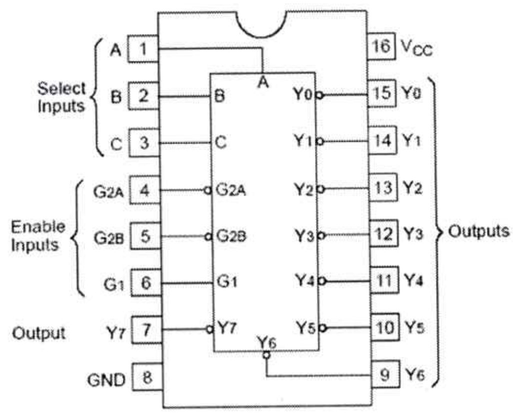
2.12 3 To 8 Decoder (IC 74138):

The 74x138 is a commercially available MSI 3-to-8 decoder whose gate-level circuit diagram and symbol are shown in Figure 5-37; its truth table is given in the 74x138 has active-low outputs, and it has three enable inputs (G1, /G2A, /G2B), all of which must be asserted for the selected output to be asserted.

The logic function of the 3 to8 is straightforward an output is asserted if and only if the decoder is enabled and the output is selected. Thus, we can easily write logic equations for an internal output signal such as Y5 in terms of the internal input signals:

$$Y5 = \underbrace{G1 \cdot G2A \cdot G2B}_{\text{enable}} \cdot \underbrace{C \cdot B' \cdot A}_{\text{select}}$$

However, because of the inversion bubbles, we have the following relations between internal and external signals:

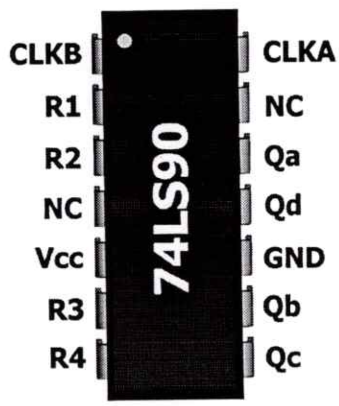


Truth table for IC 74X138

Inputs						Outputs							
G1	G2A_L	G2B_L	C	B	A	Y7_L	Y6_L	Y5_L	Y4_L	Y3_L	Y2_L	Y1_L	Y0_L
0	x	x	x	x	x	1	1	1	1	1	1	1	1
x	1	x	x	x	x	1	1	1	1	1	1	1	1
x	x	1	x	x	x	1	1	1	1	1	1	1	1
1	0	0	0	0	0	1	1	1	1	1	1	1	0
1	0	0	0	0	1	1	1	1	1	1	1	0	1
1	0	0	0	1	0	1	1	1	1	1	0	1	1
1	0	0	0	1	1	1	1	1	1	0	1	1	1
1	0	0	1	0	0	1	1	1	0	1	1	1	1
1	0	0	1	0	1	1	1	0	1	1	1	1	1
1	0	0	1	1	0	1	0	1	1	1	1	1	1
1	0	0	1	1	1	0	1	1	1	1	1	1	1

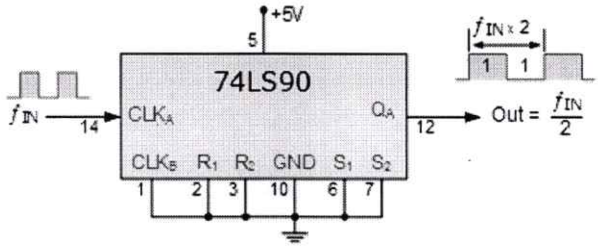
2.14 Decade Counters (IC7490):

The 74LS90 integrated circuit is basically a MOD-10 decade counter that produces a BCD output code. The 74LS90 consists of four master-slave JK flip-flops internally connected to provide a MOD-2 (count-to-2) counter and a MOD-5 (count-to-5) counter. The 74LS90 has one independent toggle JK flip-flop driven by the CLK A input and three toggle JK flip-flops that form an asynchronous counter driven by the CLK B.



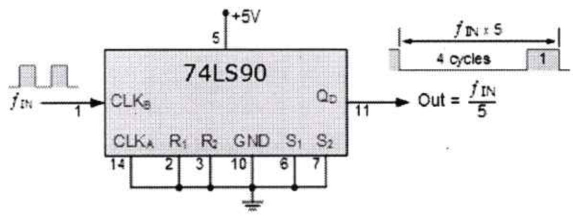
The 74LS90 counter consists of a divide-by-2 counter and a divide-by-5 counter within the same package. Then we can use either counter to produce a divide-by-2 frequency counter only, a divide-by-5 frequency counter only or the two together to produce our desired divide-by-10 BCD counter.

74LS90 Divide-by-2 Counter:



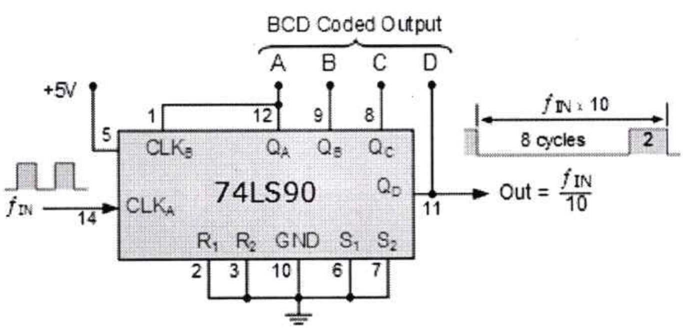
To produce a standard divide-by-5 counter, we can disable the first flip-flop above, and apply the clock input signal directly to pin 1 (CLK_B) with the output signal being taken from pin 11 (Q_D)

74LS90 Divide-by-5 Counter:



To produce a divide-by-10 BCD decade counter, both internal counter circuits are used giving a 2 times 5 divide-by value. Since the first output Q_A from flip-flop "A" is not internally connected to the succeeding stages, the counter can be extended to form a 4-bit BCD counter by connecting this Q_A output to the CLK_B input.

74LS90 Divide-by-10 Counter:



Then we can see that BCD counters are binary counters that count from 0000 to 1001 and then resets as it has the ability to clear all of its flip-flops after the ninth count.

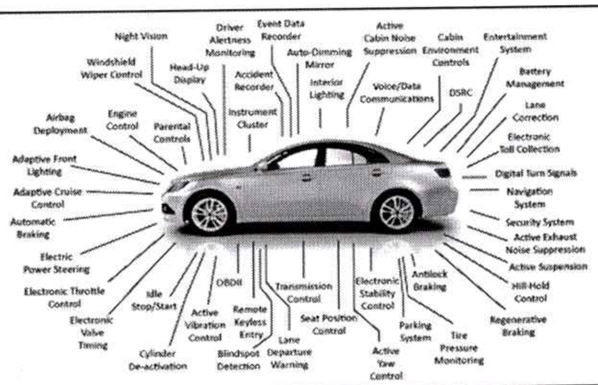
Power Point Presentation Slides

AE UNIT-1 PPTS

Automotive Electronics

By:

N.Srinivasa Rao



EVOLUTION OF AUTOMOTIVE ELECTRONICS:

- Two major events occurred during the 1970s that started the trend toward the use of modern electronics in the automobile

1. The introduction of government regulations for exhaust emissions and fuel economy, which required better control of the engine than was possible with the methods being used.

2. The development of relatively low cost per function solid-state digital electronics that could be used for engine control and other applications.

Some of the present and potential applications for electronics are,

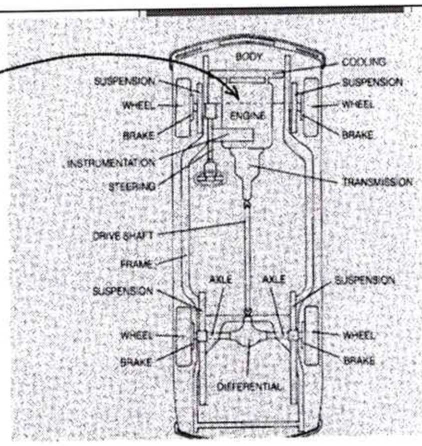
1. Electronic engine control for minimizing exhaust emissions and maximizing fuel economy
2. Instrumentation for measuring vehicle performance parameters and for diagnosis of system malfunction.
3. Driveline control
4. Vehicle motion control
5. Safety and convenience
6. Entertainment/communication/navigation

The Automobile Physical Configuration:

These systems include the following:

1. Engine
2. Drivetrain (transmission, differential, axle)
3. Suspension
4. Steering
5. Brakes
6. Instrumentation
7. Electrical/electronic
8. Motion control
9. Safety
10. Comfort/convenience
11. Entertainment/communication/navigation

In most newer cars the engine is mounted transversely for front wheel drive.



Transmission:

- The transmission is a gear system that adjusts the ratio of engine speed to wheel speed.
- To accomplish this with a manual transmission, the driver selects the correct gear ratio from a set of possible gear ratios (usually three to five for passenger cars).
- An automatic transmission selects this gear ratio by means of an automatic control system.
- The configuration for an automatic transmission consists of a fluid-coupling mechanism, known as a torque converter, and a system of planetary gear sets.

Drive Shaft

- The drive shaft is used on front-engine, rear wheel drive vehicles to couple the transmission output shaft to the differential input shaft.

Differential

The differential serves three purposes

1. The most obvious is the right angle transfer of the rotary motion of the drive shaft to the wheels.

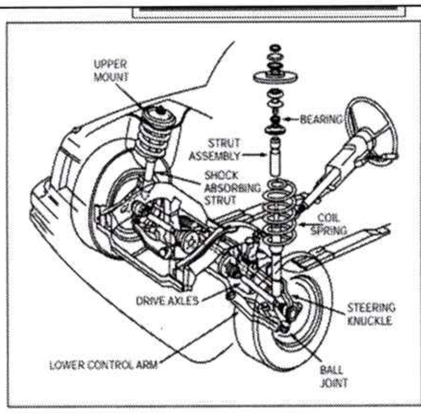
2. The second purpose is to allow each driven wheel to turn at a different speed. This is necessary because the "outside" wheel must turn faster than the "inside" wheel when the vehicle is turning a corner.

3. The third purpose is the torque increase provided by the gear ratio. This gear ratio can be changed in a repair shop to allow different torque to be delivered to the wheels while using the same engine and transmission. The gear ratio also affects fuel economy.

Suspension:

- Another major automotive subsystem is the suspension system, which is the mechanical assembly that connects each wheel to the car body.
- The primary purpose of the suspension system is to isolate the car body from the vertical motion of the wheels as they travel over the rough road surface.

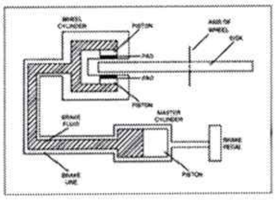
Figure 1.15
Major Components of a Suspension System



Brakes

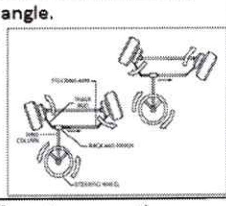
- Brakes are as basic to the automobile as the engine drivetrain system and are responsible for slowing and stopping the vehicle.
- Most of the kinetic energy of the car is dissipated by the brakes during deceleration and stopping. There are two major types of automotive brakes:

1. Drum brake
2. Disk brake



Steering System

- A steering system is one of the major automotive subsystems required for operation of the car
- It provides the driver control of the path of the car over the ground.
- Steering functions by rotating the plane of the front wheels in the desired direction of the turn. The angle between the front wheel plane and the longitudinal axis of the car is known as the steering angle.
- This angle is proportional to the rotation angle of the steering wheel.



EVOLUTION OF ELECTRONICS IN THE AUTOMOBILE:

- The first use of a computer in a car was for the purpose of engine control. Automotive manufacturers began introducing early versions of computer controlled systems to perform one specific function.
- In 1968, Volkswagen introduced the first computer controlled electronic fuel injection (EFI) system manufactured by Bosch.
- The ECU uses closed-loop control, a control scheme that monitors outputs of a system to control the inputs to a system, managing the emissions and fuel economy of the engine
- Gathering data from dozens of different sensors, the ECU knows everything from the coolant temperature to the amount of oxygen in the exhaust.

- 1969 - Ford introduces their first computer controlled anti-skid system.
- 1971 - General Motors introduces their first computer controlled transmission.
- 1976 - General Motors and Motorola team up to create custom microcomputer for use in their vehicles.
- 1978 - Cadillac introduces a computer controlled trip computer powered by a Motorola Microprocessor.
- 1981 - All General Motors vehicles now come with a Motorola 6802 based ECM with emissions control.
- 1983 - Intel's 8061 custom designed automotive microcontroller chips start being used in Ford vehicles
- 1986 - Carnegie Mellon University's "Navlab 1" becomes first self-driving, autonomous car.
- 1986 - Chrysler introduces multiplexing wire communication modules with chips supplied from Harris Semiconductor.
- 1987 - First automotive microcontroller chips produced to CAN vehicle bus standards by Intel and Philips Semiconductor.
- 1991 - Ford and Motorola form partnership to design & produce their PTEC powertrain & transmission microcontrollers.
- 2000 - Ford Microelectronics Inc. (FMI) is acquired by Intel Corp.
- 2014 - First commercially available self-driving vehicle introduced - The Navia shuttle.
- 2015 - Daimler's "Freightliner Inspiration" becomes First self-driving, semi-autonomous, Sem Truck.
- 2017 - Tesla "Semi" introduced, their first model of all electric, autonomous self driving, freight truck
- 2017 Intel Corp. acquires Mobileye, a developer of vision-based advanced driver-assistance systems

SURVEY OF MAJOR AUTOMOTIVE SYSTEMS:

- Modern automotive electronics were first applied to control the engine in order to reduce exhaust emissions and somewhat later to improve fuel economy.
- we review the engine configuration first in this survey.

The Engine:

- The engine in an automobile provides all the power for moving the automobile, for the hydraulic and pneumatic systems, and for the electrical system.
- A variety of engine types have been produced, but one class of engine is used most: the internal combustion, piston-type, 4-stroke/cycle, gasoline- fueled, spark-ignited, liquid-cooled engine.

The major components of the engine include the following:

1. Engine block
2. Cylinder
3. Crankshaft
4. Pistons
5. Connecting rods
6. Camshaft
7. Cylinder head
8. Valves

Cylinder:

The function of the cylinder/engine block is to support and ensure the accurate position of the moving parts such as pistons, connecting rods and crankshafts; to ensure the engine's ventilation, cooling and lubrication.

Cylinder Head:

Cylinder head is fitted on the top of cylinder block and the function of the cylinder head is to seal the working end of cylinder and not to permit entry and exit of gasses on cover head valves of the engine.

The valves, spark plug, camshaft etc. are fitted on it.

Crankshaft:

It is a shat which transmits the power developed by the engine to the various parts of the vehicle

It is located in the bottom end of cylinder block.

It transmits the reciprocating motion of piston into rotary motion.

This rotary motion used to rotate wheels of the vehicle

Piston:

Piston is placed in the cylinder and transmits thurst to the connecting rod

It is free to move.

It compresses the air fuel mixture and convert the fuel energy into mechanical energy.

It transmits the power to the crankshaft.

Connecting rod:

It connects piston to the crank shaft and transmit the motion and thrust of piston to crankshaft

The lower end of the connecting rod is connected to the piston and the bigger end is connected to the crankshaft

Camshaft:

Camshaft is to control the opening and closing of valves at proper timing.

It is placed at the top or at the bottom of cylinder

Valves:

Valves are used to control the inlet and exhaust of internal combustion engine.

Two valves are used for each cylinder one for inlet of air-fuel mixture inside the cylinder and other for exhaust combustion gases

The valves are fitted in the port at the cylinder head by use of strong spring

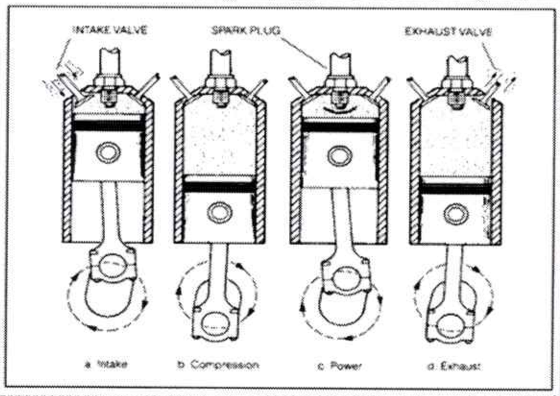
ENGINE BLOCK:

- Mechanical rotary power is produced in an engine through the combustion of gasoline inside cylinders in the engine block and a mechanism consisting of pistons (in the cylinders) and a linkage (connecting rod) coupled to the crankshaft.
- Mechanical power is available at the crankshaft. The cylinders are cast in the engine block and machined to a smooth finish.
- The pistons fit tightly into the cylinder and have rings that provide a tight sliding seal against the cylinder wall.
- The pistons are connected to the crankshaft by connecting rods.
- The crankshaft converts the up and down motion of the pistons to the rotary motion and the torque needed to drive the wheels.

Operation of Engine:

Conventional SI engines operate using four "strokes," with either an up or down movement of each piston. 4 stroke engine has 4 strokes These strokes are named as,

- *Intake*
- *Compression*
- *Power*
- *Exhaust.*



Intake

- During the intake stroke the piston is moving from top to bottom and the intake valve is open.
- As the piston moves down, a partial vacuum is created, which draws a mixture of air and vaporized gasoline through the intake valve into the cylinder.

Compression

- During the compression stroke both valves are closed, and the piston moves upward and compresses the fuel and air mixture against the cylinder head.
- When the piston is near the top of this stroke, the ignition system produces an electrical spark at the tip of the spark plug. (The top of the stroke is normally called *top dead centre*—TDC.) The spark ignites the air-fuel mixture and the mixture burns quickly, causing a rapid rise in the pressure in the cylinder.

Power

- During the power stroke (Figure 1.5c), the high pressure created by the burning mixture forces the piston downward. The cylinder pressure creates the force on the piston that results in the torque on the crankshaft as described above.
- It is only during this stroke that actual usable power is generated by the engine.

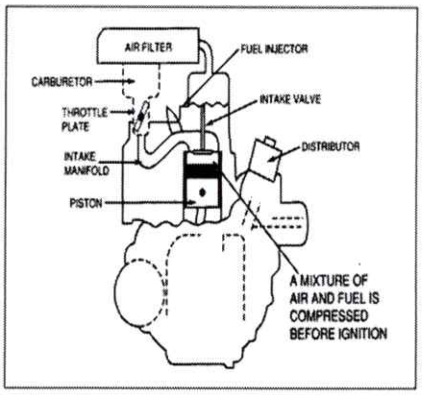
Exhaust

- During the exhaust stroke (Figure 1.5d), the piston is again moving upward. The exhaust valve is open and the piston forces the burned gases from the cylinder through the exhaust port into the exhaust system and out the tailpipe into the atmosphere.

ENGINE CONTROL

- Control of the engine in any car means regulating the power that it produces at any time in accordance with driving needs.
- The driver controls engine power via the accelerator pedal, which, in turn, determines the setting of the throttle plate via a mechanical linkage system.
- The air flowing into the engine flows past the throttle plate, which, in fact, controls the amount of air being drawn into the engine during each intake stroke.
- The power produced by the engine is proportional to the mass flow rate of air into the engine.

Figure 1.7
Intake Manifold and Fuel Metering



AE UNIT-4

UNIT-IV

The Basics of Electronic Engine Control

Engine control means:

1. regulating fuel
2. air intake as well as spark timing to achieve desired performance in the form of torque or power output.

The motivation for electronic engine control came in part from two government requirements.

1. result of legislation to **regulate automobile exhaust emissions** under the authority of the Environmental Protection Agency (EPA).
2. Thrust to **improve the national average fuel economy** by government regulation.

Exhaust Emissions

1. The **engine exhaust** consists of the products of combustion of the **air** and **gasoline mixture**.
2. **Gasoline** is a mixture of chemical compounds that are called ***hydrocarbons***.
3. Gasoline also contains **natural impurities as well as chemicals** added by the refiner.
4. All of these can produce **undesirable exhaust elements**.

During the combustion process-> **carbon** and **hydrogen** combine with **oxygen** from the **air** -> releasing **heat energy** and forming various **chemical compounds.**

If the combustion were **perfect**->the exhaust gases would consist only of carbon dioxide (**CO_2**) and water (**H_2O**)->neither of which are considered harmful in the atmosphere.

Unfortunately, the combustion of the **SI engine is not perfect**->In addition to the **CO_2** and **H_2O**, the exhaust contains amounts of **carbon monoxide** (CO), **oxides of nitrogen** (chemical unions of nitrogen and oxygen that are denoted **NO_x**), **unburned hydrocarbons (HC)**, **oxides of sulfur**, and other compounds -> the exhaust constituents are considered harmful.

Fuel Economy

It is related to the number of miles that can be driven for each gallon of gasoline consumed. It is referred to as **miles per gallon (MPG)** or simply ***mileage***.

the mileage of a vehicle is not unique. It depends on size, shape, weight, and how the car is driven.

The best mileage is achieved under steady cruise conditions. City driving, with many starts and stops, yields worse mileage than steady highway driving.

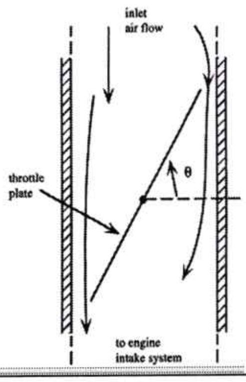
CONCEPT OF AN ELECTRONIC ENGINE CONTROL SYSTEM

how the power produced by the engine is controlled?

Any driver understands intuitively that the throttle directly regulates the power produced by the engine at any operating condition.

It does this by controlling the air flow into the engine.

the mass flow rate of air into the engine varies directly with throttle plate angular position



The **performance of engine** is affected strongly by the **mixture** (ratio of air and fuel).

In the **U.S system** of units, an air flow of about 6 lb/hr produces 1 horse power of usable mechanical power as the out put of the engine.

$$P_b = kM_A$$

Where, P_b=power from the engine (hp or kw)

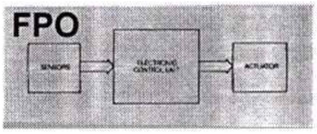
M_A=mass air flow rate (kg/hr)

K=constant relating power to air flow (hp/kg/hr)

An electronic engine control system

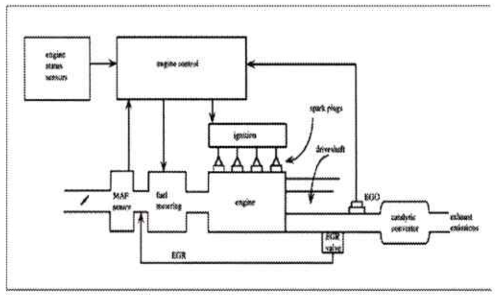
- it is an assembly of **electronic** and **electromechanical** components that **continuously varies the fuel and spark settings** in order to satisfy government exhaust emission and fuel economy regulations.

Figure 5.4 Generic Electronic Engine Control System



- It **receives** input electrical signals from the **various sensors** that **measure the state of the engine.**
- the **controller** generates **output electrical signals** to the **actuators** that **determine the engine calibration** (i.e., correct fuel delivery and spark timing).

Engine Functions and Control



Mass air flow rate (MAF)

Exhaust gas recirculation (EGR)

Exhaust gas oxygen (EGO)

•There is a **fuel metering system** to **set the air–fuel mixture** flowing into the engine through the intake manifold.

•**Spark control** determines when the air–fuel mixture is **ignited after it is compressed** in the cylinders of the engine.

•The power is delivered at the driveshaft.

•the gases that result from combustion flow out of the exhaust system.

•In the exhaust system, there is a **valve** to control the amount of exhaust gas being **recirculated** back to the input.

•**catalytic converter** to further control emissions.

DEFINITION OF GENERAL TERMS

Parameters:

A *parameter is a* ***numerical value of some engine dimension*** *that is* ***fixed*** by design.

Examples:

-Piston diameter (*bore*)

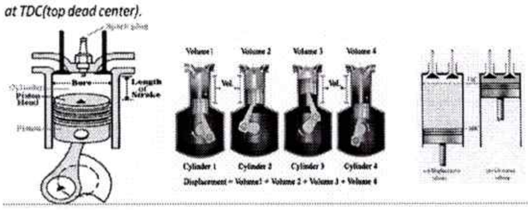
-The distance the piston travels on one stroke (stroke)

-The length of the crankshaft lever arm (*throw*).

-The bore and stroke determine the cylinder volume and the displacement.

-Displacement is the total volume of air that is displaced as the engine rotates through two complete revolutions.

-Compression ratio is the ratio of cylinder volume at BDC(bottom dead center) to the volume at TDC(top dead center).



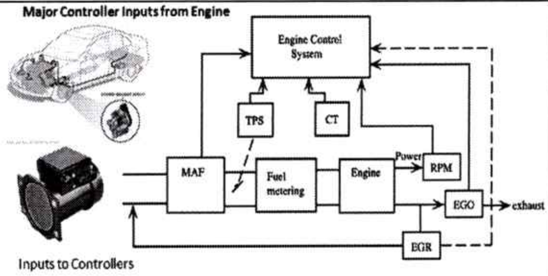
Variable:

A ***variable*** *is a quantity that changes or may be changed as the engine* operates, typically under the control of the electronic control system.

Examples:

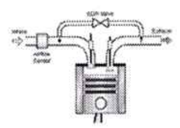
- Mass air flow
- Fuel flow rate
- Spark timing
- Power
- Intake manifold pressure and many others

Major Controller Inputs from Engine

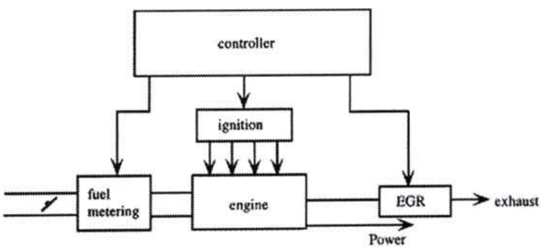


Inputs to Controllers

1. Throttle position sensor (TPS)
2. Mass air flow rate (MAF)
3. Engine temperature (coolant temperature) CT)
4. Engine speed (RPM) and position
5. Exhaust gas recirculation (EGR) valve position
6. Exhaust gas oxygen (EGO)



Major Controller Outputs to Engine



Outputs from Controllers

1. Fuel metering control
2. Ignition control
3. Ignition timing
4. Exhaust gas recirculation control

DEFINITION OF ENGINE PERFORMANCE TERMS:

- ***Power*** *is the rate at* which the engine is doing useful work.
- It normally is given in kilowatts or formerly, in horsepower. (note: 3/4 kilowatt = 1 horsepower).
- It varies with engine speed and throttle angle.
- Power may be measured at the drive wheels or at the engine output shaft.

The power delivered by the **engine to the dynamometer** is called the ***brake power*** *and is designated* P_b.

The **total amount of power** that is actually developed in the engine is called the ***indicated power*** *of the engine and is denoted* P_i.

$$P_b = P_i - \text{friction and other losses.}$$

BSFC (*brake-specific fuel consumption)*

- Fuel economy can be measured while the engine delivers power to the dynamometer.

- The engine is typically operated at:
  a **fixed RPM** and a **fixed brake power** (fixed dynamometer load)
- The fuel consumption is then given as the **ratio of the fuel flow rate (r_f)** *to the* ***brake power output*** ***(P_b)***.
- *This fuel consumption is known as the* ***brake-specific fuel consumption,*** *or BSFC.*

$$BSFC = r_f / P_b$$

TORQUE

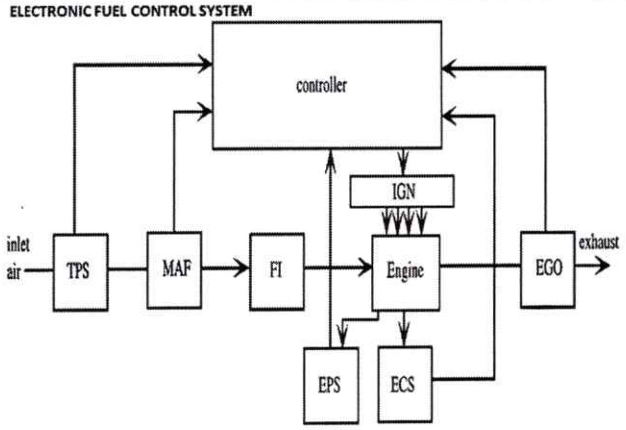
Engine *torque is the twisting action produced on the crankshaft by the* cylinder pressure pushing on the piston during the power stroke.

Torque is produced whenever a force is applied to a lever.

The length of the lever (the lever arm) in the engine is determined by the throw of the crankshaft.

The torque is expressed as the product of this force and the length of the lever

ELECTRONIC FUEL CONTROL SYSTEM



The primary function of this fuel control system is to **accurately determine the mass air flow rate** into the engine.

the **control system precisely regulates fuel delivery** such that the ratio of the mass of air to the mass of fuel in each cylinder is as close as **possible to stoichiometry.**

The components of this block diagram are as follows:

1. Throttle position sensor (TPS)
2. Mass air flow sensor (MAF)
3. Fuel injectors (FI)
4. Ignition systems (IGN)
5. Exhaust gas oxygen sensor (EGO)
6. Engine coolant sensor (ECS)
7. Engine position sensor (EPS)

EPS -> the capability of measuring crankshaft angular speed (**RPM**) as well as crankshaft **angular position** -> used in conjunction with a **stable and precise electronic clock.**

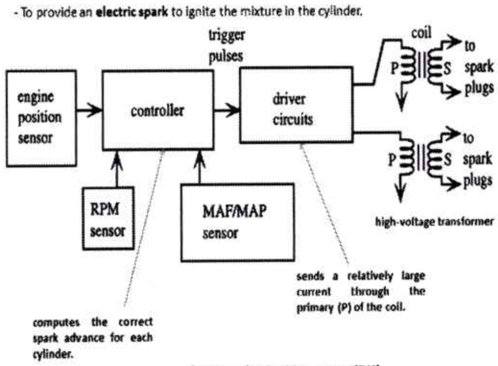
The **signals from** the various sensors **enable the controller** to determine the **correct fuel flow in relation to the air flow** to obtain the stoichiometric **mixture**.

the correct **fuel delivery is regulated via fuel injectors.**

optimum ignition timing is determined and **appropriate timing pulses** are sent to the ignition control module (IGN)

ELECTRONIC IGNITION

- To provide an **electric spark** to ignite the mixture in the cylinder.



distributorless ignition system (DIS)

Based on measurements from the sensors for engine position, mass air flow or manifold pressure, and RPM, the electronic controller **computes the correct spark advance** for each cylinder.

At the appropriate time the controller sends a trigger signal to the driver circuits, thereby initiating spark.

spark plugs are fired in pairs through a common coil, or high-voltage transformer.
Before the spark occurs, the driver circuit **sends a relatively large current through the primary (P) of the coil.**

When the spark is to occur, a trigger pulse is sent to the driver circuit for the coil associated with the appropriate spark plug.

This trigger causes the driver circuit to interrupt the current in the primary. A very high voltage is induced at this time in the secondary (S) of the coil.

Typically, one of the two cylinders will be in this compression stroke.

Combustion will occur in this cylinder, resulting in power delivery during its power stroke.

The other cylinder will be in its exhaust stroke and the spark will have no effect.

An ignition system such as this is often called a ***distributorless ignition system (DIS)*** *because the multiple coil packs and drivers are a modern* replacement for the distributor.

AE UNIT-5

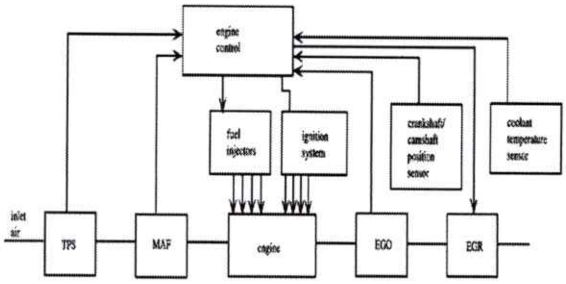
Sensors:

provide measurements of important plant variables in a format suitable for the digital microcontroller.

Actuators:

They are electrically operated devices that regulate inputs to the plant that directly control its output.

Ex: Fuel injectors



The position of the throttle plate, sensed by the throttle position sensor (TPS), directly regulates the air flow into the engine, thereby controlling output power.

A set of fuel injectors (one for each cylinder) delivers the correct amount of fuel to a corresponding cylinder during the intake stroke under control of the electronic engine controller.

The ignition control system fires each spark plug at the appropriate time under control of the electronic engine controller.

The exhaust gas recirculation (EGR) is controlled by yet another output from the engine controller.

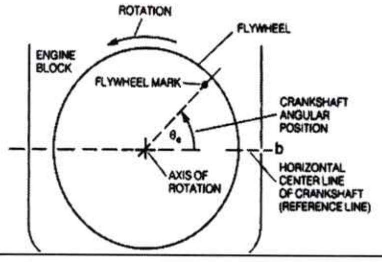
All critical engine control functions are based on measurements made by various sensors connected to the engine in an appropriate way. Computations made within the engine controller based on these inputs yield output signals to the actuators.

Engine Crankshaft Angular Position Sensor

important measurement is the angular position of the crankshaft relative to a reference position.

It can also be used to calculate its instantaneous angular speed.

this measurement be made without any mechanical contact with the rotating crankshaft.
- magnetic or optical phenomena as the physical basis
(they are unaffected by oil, dirt, or other contaminants)



The circular steel disk called the flywheel that is connected to and rotates with the crankshaft.

A reference line is taken to be a line through the crankshaft axis of rotation and a point (b) on the engine block.

The crankshaft angular position is the angle between the reference line and the line through the axis and the flywheel mark.

Imagine that the flywheel is rotated so that the mark is directly on the reference line. This is an angular position of zero degrees.

assume that this angular position corresponds to the No. 1 cylinder at TDC (top dead center) on either intake or power strokes.

one complete engine cycle corresponds to the crankshaft angular position going from zero to 720. (one full engine cycle-> two complete revolutions of the crankshaft).

During each cycle, it is important to measure the crankshaft position relative to the reference for each cycle in each cylinder.

This information is used by the electronic engine controller to set ignition timing and, in most cases, to set the fuel injector pulse timing.

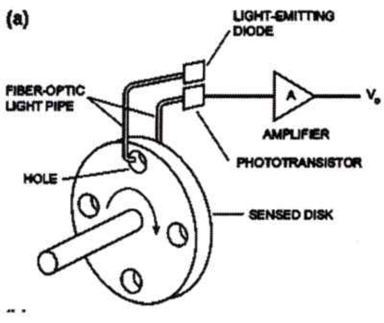
Optical Crankshaft Position Sensor

A disk is directly coupled to the crankshaft.

The hole in the disk allows transmission of light through the light pipes from the light-emitting diode (LED) source to the phototransistor used as a light sensor.

Light would not be transmitted from source to sensor when there is no hole because the solid disk blocks the light.

whenever a disk hole is aligned with one of the fiber-optic light pipes, light from the LED passes through the disk to the phototransistor.



Optical angular position sensor.

Throttle Angle Sensor

the throttle plate is linked mechanically to the accelerator pedal and moves with it.

When the driver depresses the accelerator pedal, this linkage causes the throttle plate angle to increase, allowing more air to enter the engine and thereby increasing engine power.

Most throttle angle sensors are essentially potentiometers.

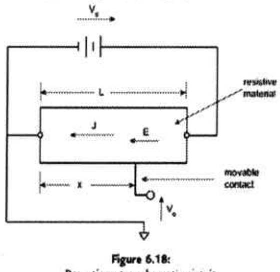


Figure 6.18:
Potentiometer schematic circuit

The basis for the throttle angle position sensor is the influence of geometric size and shape on the resistance of a conductive material.

The current density of a current flowing through this area J is related to the electric field intensity E along the conductor long axis by

$$J = \sigma E$$

The total current through the conductor I for uniform J is given by

$$I = \int_A J\,ds$$
$$= JA$$

the terminal voltage at the conductor ends is given by

$$V = -\int_0^L E\,dx = EL$$

The voltage relative to ground (at x = 0) varies linearly with position x:

$$V(x) = \frac{V_S x}{L} \quad 0 \le x \le L$$

The resistance R of this conductor is defined as

$$R = \frac{V}{I}$$
$$= \frac{EL}{\sigma EA}$$

$$R = \frac{L\rho}{A}$$

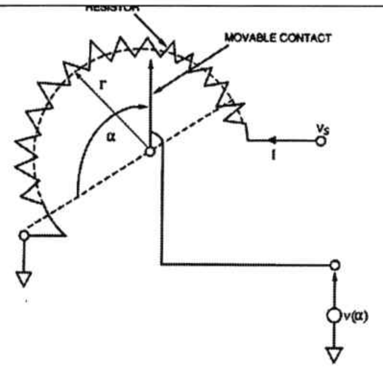


Figure 6.19:
Throttle angle sensor: a potentiometer.

$$R(\alpha) = \frac{R_p \alpha}{\alpha_{max}}$$

$$I = \frac{V_s}{R_p}$$

$$V(\alpha) = IR(\alpha) = \frac{V_s}{R_p}R(\alpha) = V_s\frac{\alpha}{\alpha_{max}}$$

the voltage V(α) provides a measurement of the throttle angle and thereby yields a measurement of the driver command for engine power.

A movable metallic contact that pivots about the center of the circular arc makes contact with the resistive material at an angle α.

The opposite end of the material (at an angle α_{max}) is connected to a constant voltage Vs.

the total resistance from the end of the material which is connected to V_s be denoted R_p

the resistance from the movable contact to ground at any angle α be denoted R(α).

$$R(\alpha) = \frac{R_p \alpha}{\alpha_{max}}$$

The current I flowing into this potentiometer is given by

$$I = \frac{V_s}{R_p}$$

The open circuit voltage at the movable contact $V(\alpha)$ is given by

$$V(\alpha) = IR(\alpha)$$
$$= \frac{V_s}{R_p}R(\alpha)$$
$$= V_s\frac{\alpha}{\alpha_{max}}$$

AIRFLOW RATE SENSOR

This is normally mounted as part of the intake air assembly, where it measures airflow into the intake manifold.

single-unit sensor that includes solid-state electronic signal processing.

In operation, the MAF sensor generates a continuous signal that varies as a function of true mass airflow M_a.

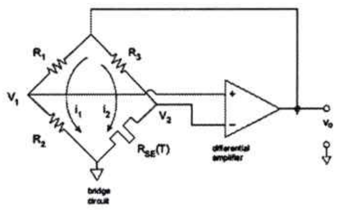


Figure 6.2:
Mass airflow sensor.

The mass flow rate of the moving air stream is measured via a measurement of the change in resistance.

There are many potential methods for measuring mass airflow via the influence of mass airflow on the sensing element resistance. One such scheme involves connecting the element into a so-called bridge circuit.

In the bridge circuit, three resistors (R1, R2, and R3) are connected along with a resistive sensing element denoted $R_{SE}(T)$.

This sensing element consists of a thin film of conducting (e.g., Ni) or semiconducting material that is deposited on an insulating substrate.

The voltages V_1 and V_2 are connected to the inputs of a relatively high-gain differential amplifier. The output voltage of this amplifier v_o is connected to the bridge and provides the electrical excitation for the bridge.

This voltage is given by $v_o = G(V_1 - V_2)$

where **G** is the amplifier voltage gain

In this bridge circuit, only that sensing element is placed in the moving air stream whose mass flow rate is to be measured.

three resistances are mounted such that they are at the same ambient temperature (T_a) as regards the moving air.

The combination bridge circuit and differential amplifier form a closed-loop in which the temperature difference ΔT between the sensing element and the ambient air temperature remains fixed independent of T_a

$$\Delta V = V_1 - V_2$$

$$= v_0\left[\frac{R_2}{R_1 + R_2} - \frac{R_{SE}}{R_{SE} + R_3}\right] \qquad v_o = G\Delta V, \qquad \frac{1}{G} = \left[\frac{R_2}{R_1 + R_2} - \frac{R_{SE}}{R_{SE} + R_3}\right]$$

In the present MAF sensor configuration, it is assumed that G >> 1

$$R_{SE}(T) = \frac{R_2 R_3}{R_1}$$

the temperature difference between the sensing element and the ambient air is given approximately by

$$k_T \Delta T = \frac{R_2 R_3}{R_1} - [R_0 + k_T(T_a - T_{ref})]$$

where T_{ref} is an arbitrary reference temperature.

MAF sensor output voltage varies as given below:

$$v_o(\dot{M}_a) = [v_o^2(0) + K_{MAF}\dot{M}_a]^{1/2}$$

where K_{MAF} is the constant for the MAF configuration.

SPEED SENSOR

A speed sensor can be implemented magnetically or optically.

For the hypothetical optical sensor, a flexible cable drives a slotted disk that rotates between a light source and a light detector.

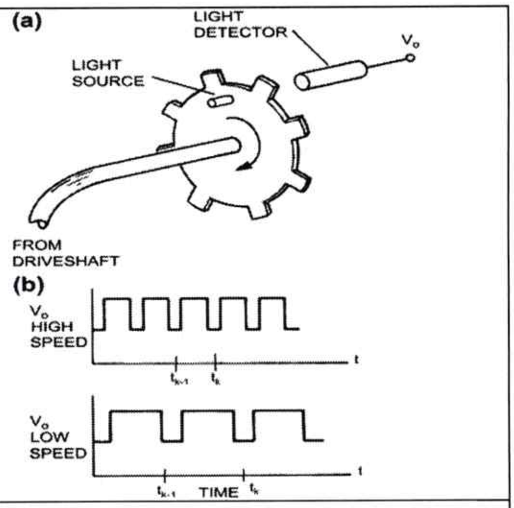
The placement of the source, disk, and detector is such that the slotted disk interrupts or passes the light from source to detector, depending on whether a slot is in the line of sight from source to detector.

The light detector produces an output voltage whenever a pulse of light from the light source passes through a slot to the detector.

The number of pulses generated per second is proportional to the number of slots in the disk and the vehicle speed.

$$f = NVK$$

Where, f is the frequency in pulses per second
N is the number of slots in the sensor disk
V is the vehicle speed
K is the proportionality constant
that accounts for differential gear ratio and wheel size.



Actuators

An actuator is a device **that receives an electrical input** (e.g., from the engine controller) and **produces an output of a different physical form** (e.g. mechanical or thermal or other).

Examples of actuators include various types of **electric motors, solenoids** and **piezoelectric force generators.**

SOLENOID

it is relatively simple and inexpensive.

It is used in applications ranging from precise fuel controlto mundane applications such as electric door locks.

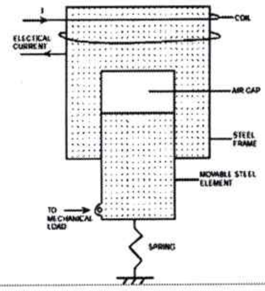
The solenoid consists of a fixed steel (i.e.,ferromagnetic) frame with a movable steel element.

A spring holds the movable element in position such that there is a gap between the end of the movable element and the opening in the frame.

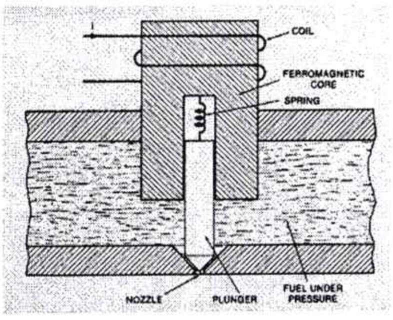
A coil is wound around the steel frame, forming a powerful electromagnet.

When a current passes through the coil, a magnetic field is created thattends to pull the movable element toward the steel frame.

Applications of solenoids in automotive electronics include fuel injectors and EGR valves.

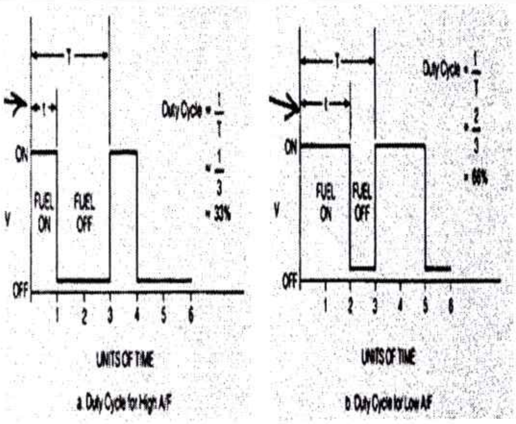


FUEL INJECTION



Schematic Drawing of Fuel Injector

the quantity of fuel injected into the air stream is proportional to the time the valve is open.



A fuel injector is (in essence) a solenoid-operated valve.

The valve opens or closes to permit or block fuel flow to the engine.

The valve is attached to the movable element of the solenoid and is switched by th solenoid activation In a fuel injector with no current flowing, the solenoid movable elemer is held down against the stop, covering the aperture or nozzle.

Fuel is thereby blocked from flowing from the pressurized fuel chamber into the aperture.

AE UNIT-6

Telematics

Telematics is a term that combines the words **telecommunications** and **informatics** to broadly describe the integrated use of **communications and information technology** to **transmit, store** and **receive information** from **telecommunications devices to remote objects over a network.**

how to present the **information and services** that are potentially available to the **driver without distraction** from the driving tasks.

- **video monitors** in rear seats can provide entertainment.

- **game playing** on any standard computer Internet terminal via on-board DVD

- **wireless connection,** be it **cell phone** or **satellite links.**

voice-activated cell phone dialing.

The use of satellite communication with automobiles provides many significant applications. These include **satellite radio, navigation,** and **safety** applications.

"**OnStar**" provides the capability of completely **hands-free telephone connection.**

GPS Navigation

The GPS navigation system, **global positioning system** (GPS), has provided the capability of some relatively sophisticated **vehicle navigation systems.**

A GPS-equipped vehicle has the capability for relatively **precise and accurate measurements of the vehicle position.** This position information combined with electronic versions of maps yields the capability to navigate optimally between any **two locations without requiring any paper road maps.**

The GPS system consists of **24 satellites** arranged in **groups of four in each of six orbital planes** inclined at **55° spaced 60° apart in longitude** and at a **nominal altitude of 11,000 n miles** above the local surface.

At any given time for any given receiver location a subset (I) of satellites are available for use by the receiver.

Each satellite carries a **precise (atomic) clock** and **repetitively transmits its position and time** (i.e. ephemeris data).

By measuring the **time difference δt** from transmission of the signal to its reception, the receiver obtains a measurement of the transit time from satellite to receiver, which yields an estimate of the range R from the satellite to receiver.

$$R = c\delta t = \sqrt{(x - x_s)^2 + (y - y_s)^2 + (z - z_s)^2}$$

where **c is the** speed of propagation of the satellite-transmitted signal, x, y, z are the receiver **location** coordinates, and xs, ys, zs are the coordinates of the satellite.

In practice, impossible to exactly synchronize these two clocks. The actual measured time difference between satellite i clock and receiver clock time yields an estimate of R (denoted R_i) called pseudo-range. Because of the receiver clock uncertainty, at least four measurements are required to estimate position and receiver clock error. The pseudo-range model is given by

$$R_i = \sqrt{(x - x_i)^2 + (y - y_i)^2 + (z - z_i)^2} + B$$

where B is a bias resulting from the receiver clock error Δt_c:

$$B = c\Delta t_c,$$

that is, Δt_c is the error between true GPS time as carried by the satellite and the receiver clock time and c is propagation speed of the GPS signal.

voice-activated cell phone dialing

In which the cell phone user verbally gives the phone number, speaking each digit separately. Included within the cell phone is a very sophisticated algorithm for recognizing speech. Speech recognition software identifies spoken words or numbers based on patterns in the waveform at the output of a microphone into which the user speaks.

There are two major categories of speech recognition software: speaker dependent and speaker independent.

Speaker-dependent software recognizes the speech of a specific individual who must work with the system. The user is prompted to say a specific digit a number of times until the software can reliably identify the waveform patterns associated with that particular speaker. By this process, the system is "trained" to the individual user. It may not be capable of recognizing other users to whose speech it has not been trained.

Speaker-independent voice recognition software can recognize spoken digits regardless of the user. It is generally more sophisticated than speaker-dependent speech recognition. Unfortunately, it is also prone to recognition errors in excess of the speaker-dependent systems.

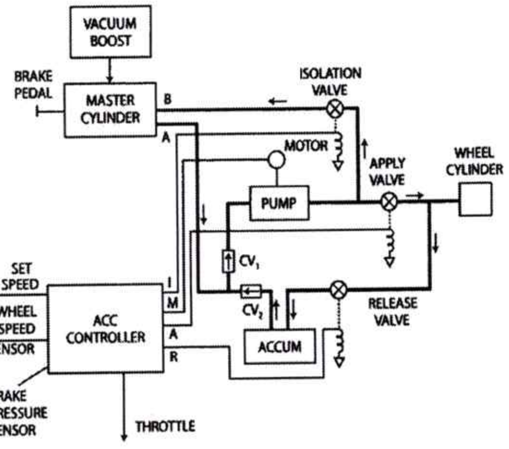
Advanced Cruise Control

The cruise control system described is adequate for maintaining constant speed, provided that any required deceleration can be achieved by a throttle reduction (i.e. reduced engine power).

The engine has limited braking capability with a closed throttle, and this braking in combination with aerodynamic drag and tire-rolling resistance may not provide sufficient deceleration to maintain the set speed.

An advanced cruise control (ACC) system has a means of automatic brake application whenever deceleration with throttle input alone is inadequate. This system consists of a conventional brake system with master cylinder wheel cylinders, vacuum boost (power brakes), and various brake lines.

In cruise control mode, the ACC controller regulates the throttle as well as the brake system via electrical output signals and in response to inputs, including the vehicle speed sensor and set cruise speed switch.



In this automatic brake mode, an electrical signal is sent from the M (i.e. motor) output of the controller to the motor, causing the pump to send more brake fluid (under pressure) through the apply valve (maintained open) to the wheel cylinder. At the same time, the release valve remains closed such that brakes are applied.

The braking pressure can be regulated by varying the isolation valve, thereby bleeding some brake fluid back to the master cylinder. By activating isolation valves separately to the four wheels, brake proportioning can be achieved. Brake release can be accomplished by sending signals from the ACC to close the apply valve and open the release valve.

Collision Avoidance Radar Warning System

An onboard low-power radar system can be used as a sensor for an electronic collision avoidance system to provide warning of a potential collision with an object lying in the path of the vehicle.

The transmitter is switched on for a very short time, then it is switched off. During the off time, the receiver is set to receive a reflected signal. if a reflecting object is in the path of the transmitted microwave pulse, a corresponding pulse will be reflected to the receiver. The round trip time, **t**, from transmitter to object and back to receiver is proportional to the range, **R** to the object.

$$t = 2R/c$$

the range, R, to the object and the closing speed, V + S, are measured.

Figure 11.11
Range to Object for Anticollision Warning System

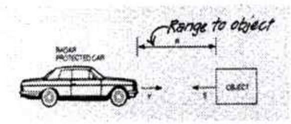
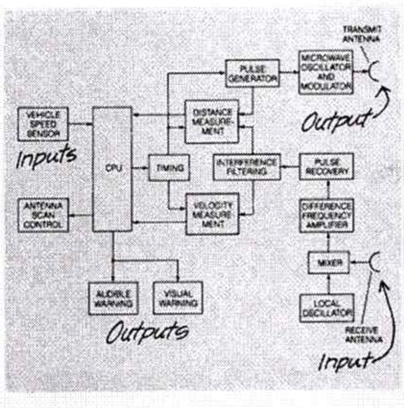


Figure 11.12
Collision Avoidance Warning System



Speech Synthesis

In the true speech synthesis system, relatively complex messages can be generated in response to outputs from various electronic subsystems.

For example, the trip computer could give **fuel status** in relationship to the **car's present position** and known **fuelling stations.**

By combining **information from several subsystems** on board the car it is possible to inform the driver of trip status at any preprogrammed level of detail.

A **phoneme** is a basic sound that is used to build speech.

the electrical signal produced by the computer is converted to sound by a loudspeaker

Synthesized speech is being used to automatically provide **data over the phone from computer-based systems** and is available on **some production cars.**

MULTIPLEXING IN AUTOMOBILES

One of the **high-cost items** in **building and servicing** vehicles is the electrical wiring

electrical wiring for a car is in the form of a complex, expensive cable assembly called a **harness.**

Sensor Multiplexing

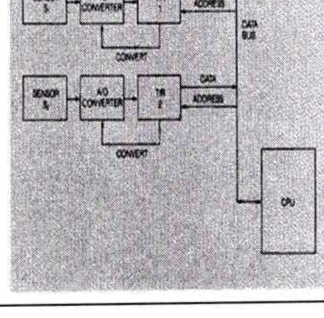
The use of **microprocessors** for computer engine control, instrumentation computers, etc., offers the possibility of significantly **reducing the complexity of the harness.**

In the present configuration, each sensor and actuator has a separate wire connection to the CPU. However, each sensor only communicates periodically with the computer for a short time interval during sampling.

It is possible to connect all the sensors to the CPU with only a **single wire (data bus),** provides the communication link between all of the sensors and the CPU

Each sensor would have exclusive use of this bus to send data (i.e., measurement of the associated engine variable or parameter) during its time slot. A separate time slot would be provided for each sensor. **(time division multiplexing)**

Figure 11.16
Sensor Multiplexing
Block Diagram



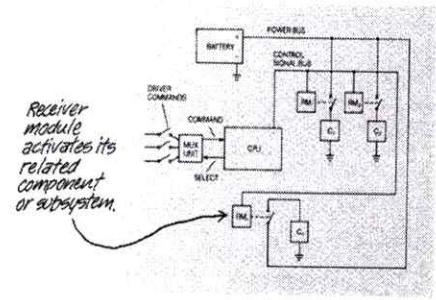
The CPU controls the use of the data bus by signalling each sensor through a transmitter/receiver (T/R) unit. Whenever the CPU requires data from any sensor, it sends a coded message on the bus, which is connected to all T/R units. However, the message consists of a sequence of binary voltage pulses that are coded for the particular T/R unit. A T/R unit responds only to one particular sequence of pulses, which can be thought of as the address for that unit.

Whenever a T/R unit receives data corresponding to its address, it activates an analog-to-digital converter. The sensor's analog output at this instant is converted to a digital binary number as already discussed. This number and the T/R unit's address are included so that the CPU can identify the source of the data. Thus, the CPU interrogates a particular sensor and then receives the measurement data from the sensor on the data bus. The CPU then sends out the address of the next T/R unit whose sensor is to be sampled.

Control Signal Multiplexing

It also is possible to multiplex control signals to control switching of electrical power. Electrical power must be switched to lights, electric motors, solenoids, and other devices.

Figure 11 17
Control Signal Multiplexing Block Diagram



In a system of this type, a remote switch applies battery power to the component when activated by the receiver module (RM). The receiver module is activated by a command from the CPU that is transmitted along the control signal bus.

This control signal bus operates very much like the sensor data bus described in the multiplexed engine control system. The particular component to be switched is initially selected by switches operated by the driver. (Of course, these switches can be multiplexed at the input of the CPU.) The CPU sends an RM address as a sequence of binary pulses along the control signal bus. Each receiver module responds only to one particular address. Whenever the CPU is to turn a given component on or off, it transmits the coded address and command to the corresponding RM. When the RM receives its particular code, it operates the corresponding switch, either applying battery power or removing battery power, depending on the command transmitted by the CPU.

Fiber Optics

The **address voltage pulses** from the CPU are **converted to corresponding pulses of light** that are transmitted over an optical fiber. An optical fiber, which is also known as a **light pipe**, consists of a thin transparent cylinder of light-conducting glass about the size of a human hair.

Light will **follow the light pipe along its entire path**, even around corners, just as **electricity follows** the path of wire.

A big **advantage** of the optical fiber signal bus that **external electrical noise doesn't interfere** with the transmitted signal.

The **high-voltage pulses** in the **ignition circuit**, which are a major potential source of interference in automotive electronic systems, **will not affect the signals** traveling on the optical signal bus.

For such a system, each component has an RM that has an optical detector coupled to the signal bus. Each detector receives the light pulses that are sent along the bus. Whenever the correct sequence (i.e., address) is received at the RM, the corresponding switch is either closed or opened.

ASSIGNMENT QUESTION PAPERS WITH SCHEME OF EVALUATION

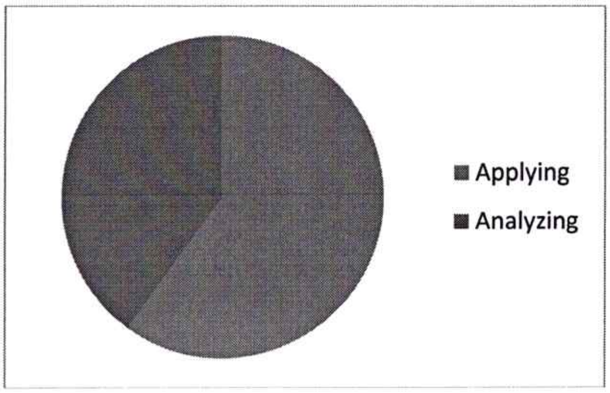
NARASARAOPETA ENGINEERING COLLEGE, NARASARAOPET
(AUTONOMOUS)
DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING
III B.TECH I-SEMESTER ASSIGNMENT TEST-I, December-2020

SUBJECT: Automotive Electronics **DATE: 19-12-2020**

DURATION: 30 MIN **MAX MARKS: 10**

Q. No	Questions	Course Outcome (CO)	Knowledge Levels as Per Bloom's Taxonomy	Marks
1	**Construct** the automobile physical configuration with a neat diagram.and explain each part in detail.	CO-1	Applying (K3)	10
2	**Classify** different types of Engines. And explain various parts in engine with neat sketches.	CO-1	Analyzing (K4)	10
3	**Analyze** the operation of a 4-stroke engine.in detail.	CO-1	Analyzing (K4)	10
4	**Identify** the uses of electronics in the automobile and explain about drive train.	CO-1	Applying (K3)	10
5	**Make use of** Ignition system in automobiles.discuss how the electric spark generate from ignition system.	CO-1	Applying (K3)	10

BT LEVEL	MARKS	%
I.REMEMBERING		
II.UNDERSTANDING		
III.APPLYING	30	60%
IV.ANALYZING	20	40%
V.EVALUATING		
VI.CREATING		



SCHEME OF EVALUATION for III B.Tech I- SEM Assingment-I EXAMINATION

1.) **Construct** the automobile physical configuration with a neat diagram.and explain each part in detail.

Block Diagram ----------------5M

Explanation ---------------------5M

2.) **Classify** different types of Engines. And explain various parts in engine with neat sketches.

Types ---------------------------3M

Explanation ---------------------7M

3.) **Analyse** the operation of a 4-stroke engine.in detail.

Block Diagram ----------------4M

Explanation ---------------------6M

4.) **Identify** the uses of electronics in the automobile and explain about drive train.

Uses ---------------------------------3M

Explain drive train ---------------------7M

5.) **Make use of** Ignition system in automobiles.discuss how the electric spark generate from ignition system.

Block Diagram ----------------5M

Explanation ---------------------5M

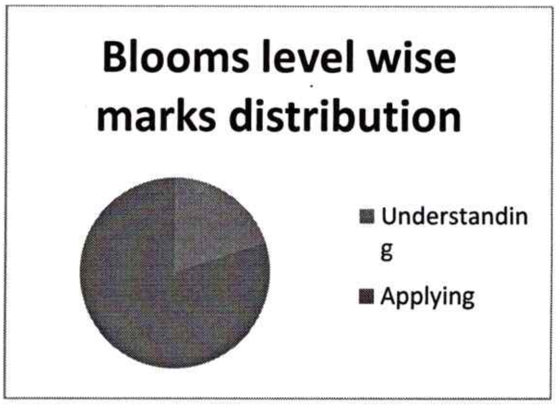
NARASARAOPETA ENGINEERING COLLEGE::NARASARAOPET
DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING
III BTECH (ECE) I SEMESTER, ASSIGNMENT-II, December-2020

SUBJECT : Automotive Electronics **DATE:28**-12-2020

DURATION: 30 MIN **MAX MARKS:** 10

Q. No	Questions	Course Outcome (CO)	Knowledge Level as Per Bloom's Taxonomy	Marks
1	**Explain** the operation of Field Effect Transistor with V-I characteristics.	CO-2	Understanding(K2)	10
2	**Make use of** Feedback in Op-Amps and explain Summing Mode Amplifier.	CO-2	Applying (K3)	10
3	**Construct** 3 To 8 Decoder (IC 74138) and brief out with truth table.	CO-2	Applying (K3)	10
4	**Build** 8X1 Multiplexer (IC 74151) and draw its circuit diagram.	CO-2	Applying (K3)	10
5	**Identify** the pin configuration of IC7490 and implement Decade Counters (IC7490)	CO-2	Applying (K3)	10

BT LEVEL	MARKS	%
I.REMEMBERING		
II.UNDERSTANDING	10	20%
III.APPLYING	40	80%
IV.ANALYZING		
V.EVALUATING		
VI.CREATING		



SCHEME OF EVALUATION for III B.Tech I- SEM Assingment-II EXAMINATION

1.) Explain the operation of Field Effect Transistor with V-I characteristics.

Characteristics ----------------2M

Explanation ---------------------8M

2.) Make use of Feedback in Op-Amps and explain Summing Mode Amplifier.

Feedback in Op-amp ----------------3M

Explanation ---------------------7M

3.) Construct 3 To 8 Decoder (IC 74138) and brief out with truth table.

Block Diagram ----------------5M

Explanation ---------------------5M

4.) **Build** 8X1 Multiplexer (IC 74151) and draw its circuit diagram.

Block Diagram ----------------3M

Truth table-----------------------2M

Explanation ---------------------5M

5.) Identify the pin configuration of IC7490 and implement Decade Counters (IC7490)

Pin Diagram ----------------4M

Explanation ---------------------6M

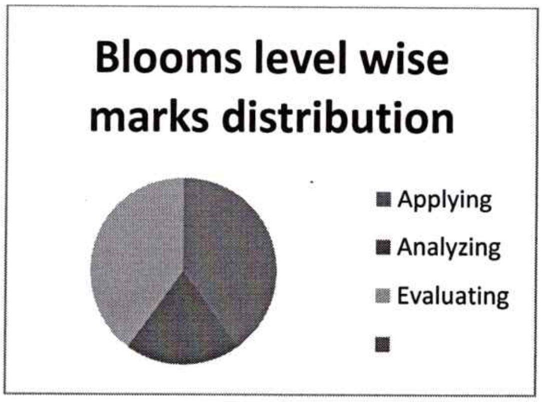
NARASARAOPETA ENGINEERING COLLEGE::NARASARAOPET
DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING
III BTECH (ECE) I SEMESTER, ASSIGNMENT-III, January-2021

SUBJECT : Automotive Electronics **DATE:23**-01-2021

DURATION: 30 MIN **MAX MARKS:** 10

Q. No	Questions	Course Outcome (CO)	Knowledge Level as Per Bloom's Taxonomy	Marks
1	**Explain** the concept of electronic engine control system.	CO-4	Evaluating (K5)	10
2	**Explain** about engine functions and control.in automobile system.	CO-4	Evaluating (K5)	10
3	**Build** the circuit of electronic ignition with sensors.and describe in brief	CO-4	Applying (K3)	10
4	**Construct** and explain the electronic fuel control configuration.	CO-4	Applying (K3)	10
5	**Analyzing** the exhaust emissions and fuel economy in electronic engine.in detail.	CO-4	Analyzing (K4)	10

BT LEVEL	MARKS	%
I.REMEMBERING		
II.UNDERSTANDING		
III.APPLYING	20	40%
IV.ANALYZING	10	20%
V.EVALUATING	20	40%
VI.CREATING		



SCHEME OF EVALUATION for III B.Tech I- SEM Assingment-III EXAMINATION

1.) **Explain** the concept of electronic engine control system.

Block Diagram ----------------6M

Explanation ---------------------4M

2.) **Explain** about engine functions and control.in automobile system.

Block Diagram ----------------6M

Explanation ---------------------4M

3.) **Build** the circuit of electronic ignition with sensors.and describe in brief

Circuit Diagram ----------------5M

Explanation ---------------------5M

4.) **Construct** and explain the electronic fuel control configuration.

Block Diagram ----------------6M

Explanation ---------------------4M

5.) **Analyzing** the exhaust emissions and fuel economy in electronic engine.in detail.

Block Diagram ----------------5M

Explanation ---------------------5M

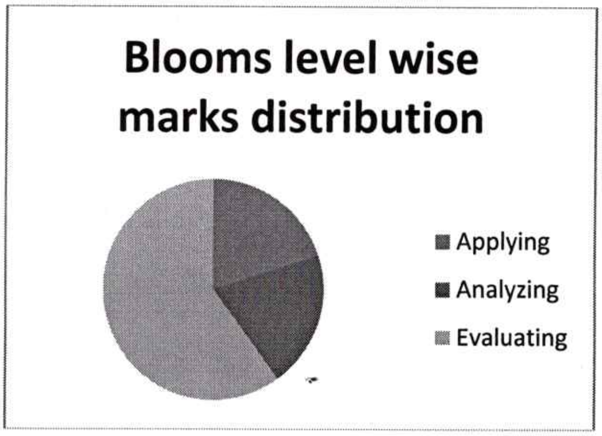
NARASARAOPETA ENGINEERING COLLEGE::NARASARAOPET
DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING
III BTECH (ECE) I SEMESTER, ASSIGNMENT-IV, Febrauary-2021

SUBJECT : Automotive Electronics **DATE:27**-02-2021

DURATION: 30 MIN **MAX MARKS:** 10

Q. No	Questions	Course Outcome (CO)	Knowledge Level as Per Bloom's Taxonomy	Marks
1	**Explain** the operation engine crank shaft angular position sensor with neat diagram.	CO-5	Evaluating (K5)	10
2	**What** is purpose of throttle? **explain** the operation of throttle angle sensor with neat diagram.	CO-5	Evaluating (K5)	10
3	**Analyze the** operation of air flow rate sensor with neat diagram.	CO-5	Analyzing (K4)	10
4	**Construct** the optical speed sensor with neat diagram and explain in detail	CO-5	Applying (K3)	10
5	**Define** actuator and **explain** the operation of solenoid actuator with neat diagram	CO-5	Evaluating (K5)	10

BT LEVEL	MARKS	%
I.REMEMBERING		
II.UNDERSTANDING		
III.APPLYING	10	20%
IV.ANALYZING	10	20%
V.EVALUATING	30	60%
VI.CREATING		



SCHEME OF EVALUATION for III B.Tech I- SEM Assingment-IV EXAMINATION

1.) Explain the operation engine crank shaft angular position sensor with neat diagram.

Circuit Diagram ----------------6M

Explanation ---------------------4M

2.) What is purpose of throttle? **explain** the operation of throttle angle sensor with neat diagram.

Circuit Diagram ----------------5M

Explanation ---------------------5M

3.) Analyze the operation of air flow rate sensor with neat diagram.

Block Diagram ----------------5M

Explanation ---------------------5M

4.) Construct the optical speed sensor with neat diagram and explain in detail

Circuit Diagram ----------------5M

Explanation ---------------------5M

5.) Define actuator and **explain** the operation of solenoid actuator with neat diagram

Define----------------------------2M
Block Diagram ---------------3M

Explanation ---------------------5M

NARASARAOPETA ENGINEERING COLLEGE, NARASARAOPET.
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NEC

ASSIGNMENT TEST ANSWER BOOK

B.Tech. / M.Tech. / M.B.A. / M.C.A. / B. tech (Br.) ECE **2020 (A)** 81607

Year: III Semester: I Sec.: A Test No.: 02

Sub: AE Date:

Name: k sai kanth

HALL TICKET NO.									
1	8	4	7	1	A	0	4	3	5

MARKS | 0 | 9 | Marks in words | zero | nine |

Signature of the Principal Signature of the Examiner - I Signature of the Examiner - II

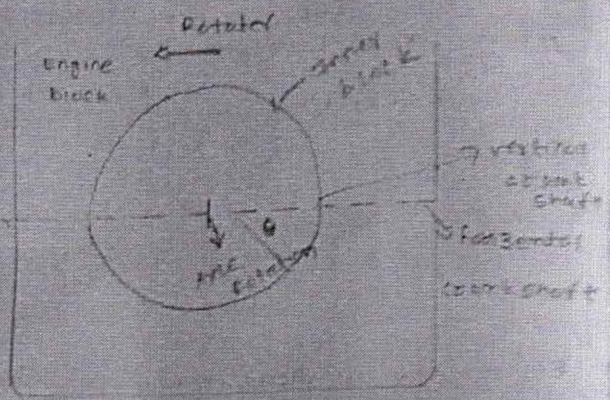
(1) Explain the operation engine crank shaft angular position sensor with diagram

A. → the crankshaft mainly formed angular Position sensor with at a time to be Formed below condition method to be electronic device to Axle position to be Formed. In these method we have to used rotarary crank shaft method to be Formed below condition method.

→ The angular position method to be Formed below condition type of rotatary method of crank shaft

→ In these crank shaft method mainly form ed below vertical and horizont. crank shaft is formed.

Sr.	Question	Course Outcome	Knowledge Levels as	Marks
	Explain the operation engine crank shaft angular position sensor with neat diagram.	CO-5	Evaluating (K5)	10



→ the Crank shaft mainly formed passing through the origin value to be formed below condition method. the θ value has been formed below these method

the engine block mainly formed rotatory shift diagram formed to this diagram is verified. In the diagram formed mainly inner block condition and outer block condition method., the crank shaft is moving to the two different types method to be formed.

The Crankshaft mainly moved middle of origin value and θ value is formed below to reference line formed. these conditions mainly formed to sensor diagram. the crank shaft mainly worked in sensor. in this diagram we have to be compulsary generate sensor value. the sensor at a time generate to below condition method.

the engine is main part of the above diagram the rotatory start from one point and to the same point to the condition at a time formed. the engine is main part of the condition formed above the diagram these method mainly formed to the times of rotation value formed.

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NEC

ASSIGNMENT TEST ANSWER BOOK

B.Tech. / M.Tech. / M.B.A. / M.C.A. / B-Tech (Br.) ECE **2020 [A]** 83020

Year: III Semester: I Sec: A Test No.: IV

Sub: AE Date: 27/02/21

Name: U. Tabitha

HALL TICKET NO.									
1	8	4	7	1	A	0	4	5	8

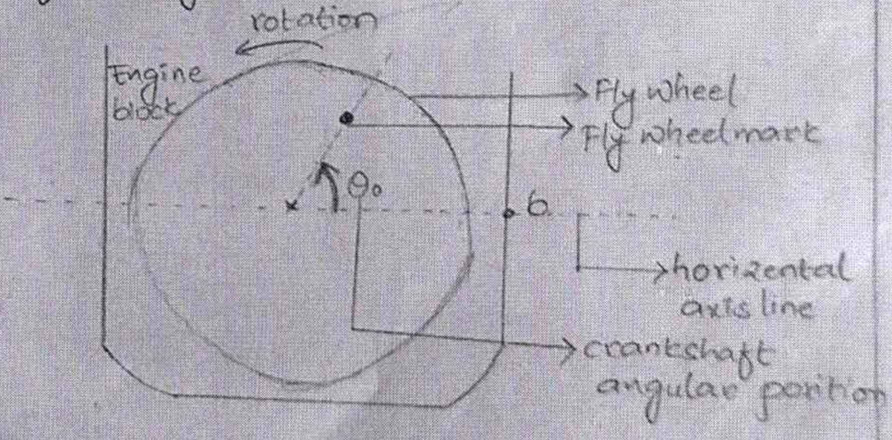
MARKS 1 0 Marks in words: Tens: One Ones: Zero

Signature of the Principal Signature of the Examiner - I Signature of the Examiner - II

1) Engine crank shaft angular position sensor

→ It is used to measure the angular position of the crank shaft relative to the position of the engine

→ It is also used to find the instantaneous angular speed of the engine



10

→ Consider a circular disk called fly wheel is rotating. A line at the center drawn as an axis line and point b is indicated on engine block.

→ crankshaft angular position is the angle between the axis line and the line joining the axis line and fly mark wheels. which is indicated as θo in above figure.

NARASARAOPETA ENGINEERING COLLEGE, NARASARAOPET.

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NEC

ASSIGNMENT TEST ANSWER BOOK

B.Tech. / M.Tech. / M.B.A. / M.C.A.: B.Tech (Br.) ECE

2020 (A) 81597

Year: III Semester: 2 Sec: A Test No.: 04

Sub: AE Date: 27-02-2021

Name: M. Vivek

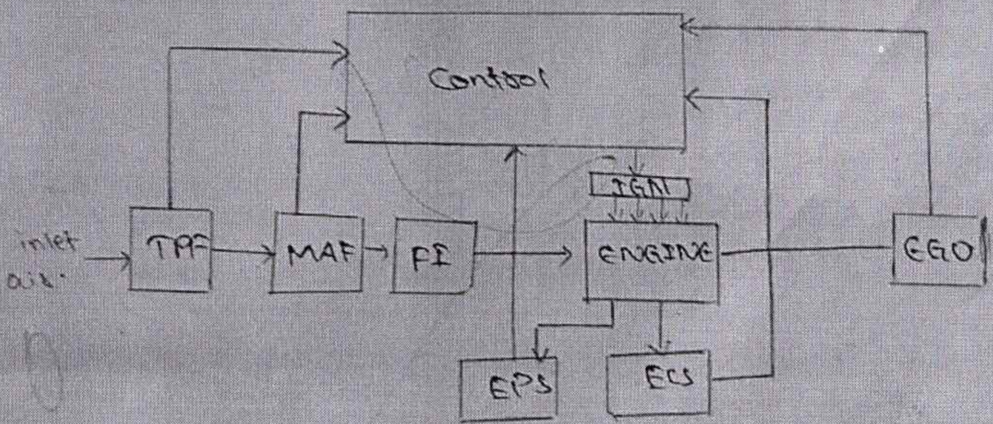
HALL TICKET NO.

1	8	4	7	1	A	0	4	3	6

MARKS | 0 | 0 | Marks in words (Tens) Zero (Ones) Zero

Signature of the Principal Signature of the Examiner - I Signature of the Examiner - II

(1) Engine Crank Shaft angular position Sensor:-



↳ to Ammed.

MID EXAM QUESTION PAPERS WITH SCHEME OF EVALUATION

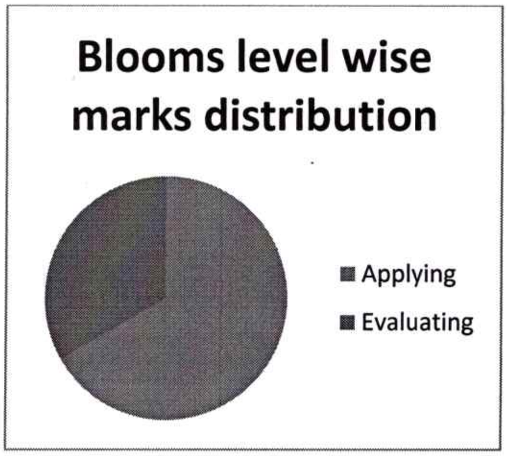
NARASARAOPETA ENGINEERING COLLEGE, NARASARAOPET
(AUTONOMOUS)
DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING
III B.Tech ECE, I Semester I Mid Examinations, Dec-2020

Subject : Automotive Electronics — **Max. Marks : 30M**
Date : 27-12-2020 — **Time : 90Min**

Answer ALL of the following questions

Q. No	Question	Course Outcome (CO)	Knowledge level as per Bloom's taxonomy	Marks
1	**Construct** the automobile physical configuration with a neat diagram. And explain each part in detail.	CO-1	Applying (K3)	10
2	**Build** 8X1 Multiplexer (IC 74151) and draw its circuit diagram.	CO-2	Applying (K3)	10
3	**Explain** about Digital to analog converter with a neat diagram.	CO-3	Evaluating (K5)	10

BT LEVEL	MARKS	%
I.REMEMBERING		
II.UNDERSTANDING		
III.APPLYING	20	66.66%
IV.ANALYZING		
V.EVALUATING	10	33.33%
VI.CREATING		



SCHEME OF EVALUATION for III B.Tech I- SEM MID-I EXAMINATION

1.Construct the automobile physical configuration with a neat diagram. And explain each part in detail.

Block Diagram ----------------5M

Explanation ---------------------5M

2.Build 8X1 Multiplexer (IC 74151) and draw its circuit diagram.

Circuit Diagram ----------------4M

Truth Table -----------------------3M

Explanation ---------------------3M

3.**Explain** about Digital to analog converter with a neat diagram.

Block Diagram ----------------5M

Explanation ---------------------5M

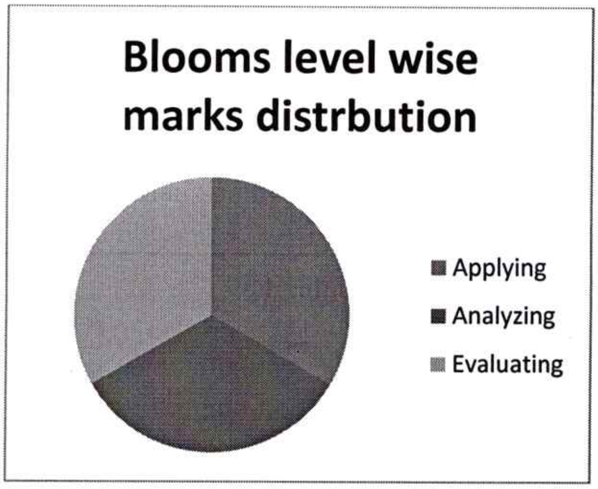
NARASARAOPETA ENGINEERING COLLEGE, NARASARAOPET
(AUTONOMOUS)
DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING
III B.Tech ECE, I Semester II Mid Examinations, February-2021

Subject : Automotive Electronics **Max. Marks : 30M**
Date : 27-02-2021 **Time : 90Min**

Answer ALL of the following questions

Q. No	Question	Course Outcome (CO)	Knowledge level as per Bloom's taxonomy	Marks
1	Construct and explain the electronic fuel control configuration.	CO-4	Applying (K3)	10
2	Analyze the operation of air flow rate sensor with neat diagram.	CO-5	Analyzing (K4)	10
3	Explain the operation of collision avoidance radar waring system in detail.	CO-6	Evaluating (K5)	10

BT LEVEL	MARKS	%
I.REMEMBERING		
II.UNDERSTANDING		
III.APPLYING	10	33.33%
IV.ANALYZING	10	33.33%
V.EVALUATING	10	33.33%
VI.CREATING		



SCHEME OF EVALUATION for III B.Tech II- SEM MID-I EXAMINATION

1.Construct and explain the electronic fuel control configuration.

Block Diagram ----------------5M

Explanation ---------------------5M

2.Analyze the operation of air flow rate sensor with neat diagram.

Block Diagram ----------------5M

Explanation ---------------------5M

3.Explain the operation of collision avoidance radar waring system in detail

Block Diagram ----------------6M

Explanation ---------------------4M

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MAIN ANSWER BOOK

2021 (A) 21988

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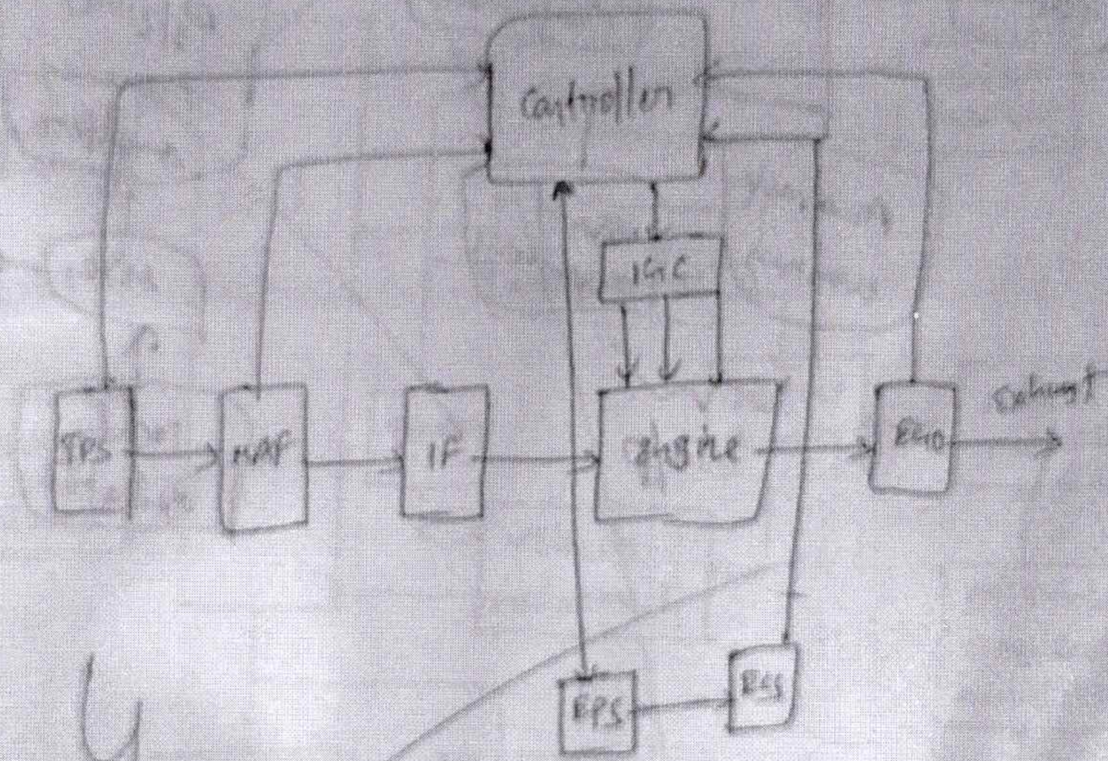
(1 A) electronic fuel control configuration :



TPS — Throttle position sensor

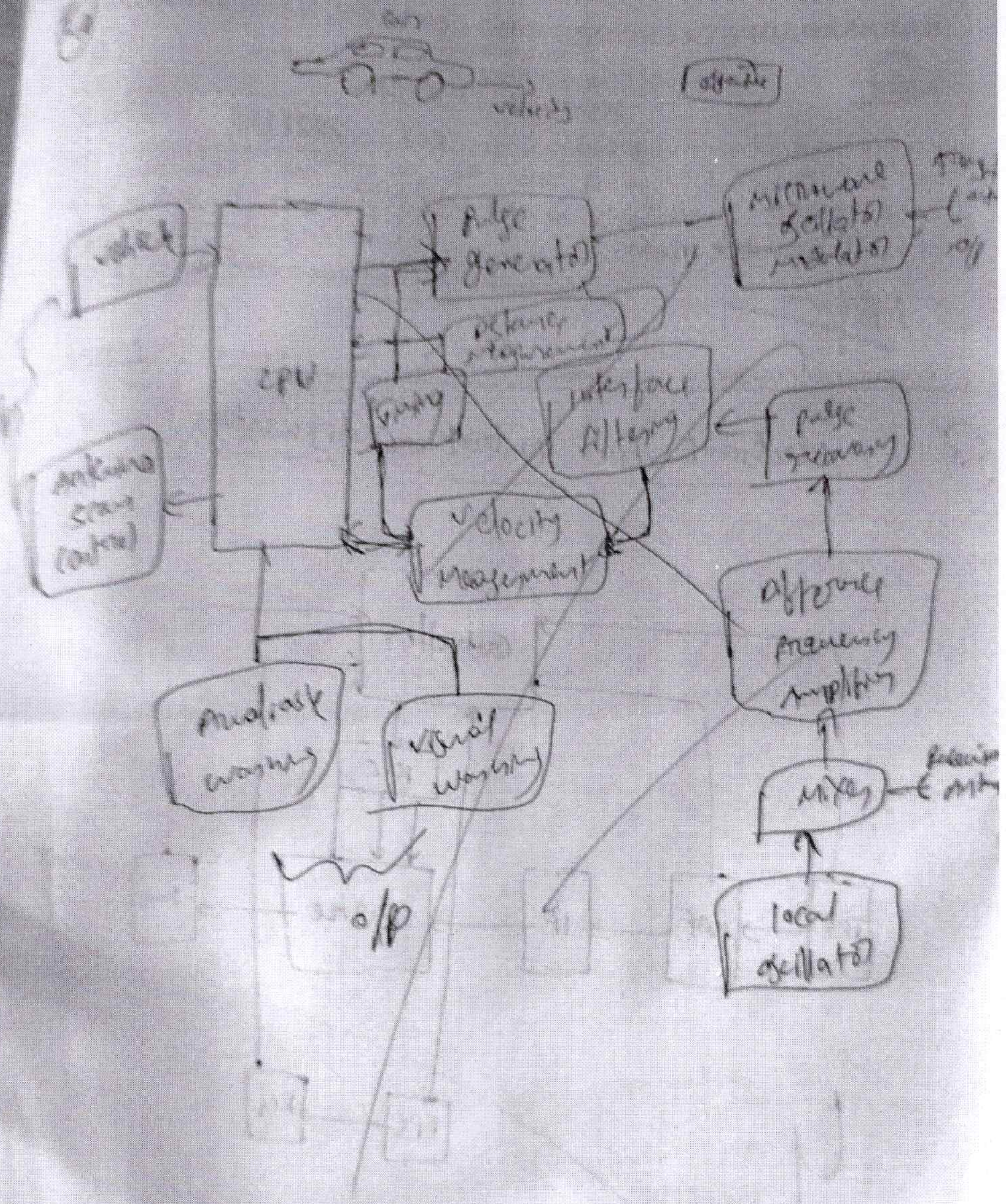
MAF — Mass of Air flow sensor

IF — incoming fuel sensor

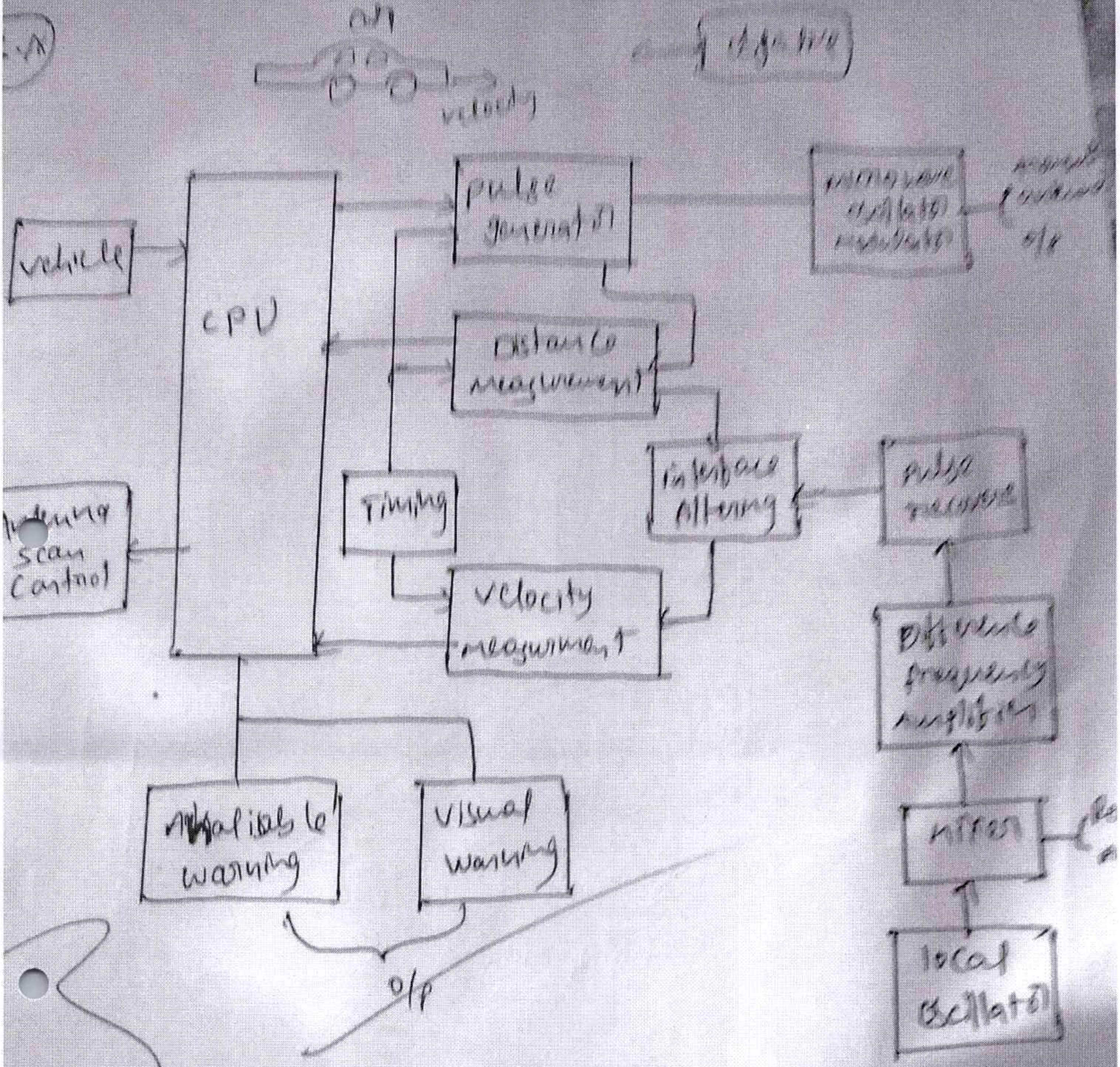
EGO — Exhaust oxygen sensor

EPS — Engine position sensor

ECS — Engine coolant sensor



car
velocity
vehicle
CPU
Pulse generator
Microwave oscillator modulator
distance measurement
interface filtering
pulse frequency
velocity measurement
antenna scan control
difference frequency amplifier
visual warning
mixer
local oscillator
o/p



operation of collision avoidance radar working

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MAIN ANSWER BOOK

B.Tech / M.Tech / MBA / MCA : III B.tech (R) ECE — 2021 (A) 05620

Year: III Semester: I Sec: Lab Md No: 3

Sub: AE Date: 2-12-21

Name: D Bhanuprasad

HALL TICKET NO: 1 8 4 7 1 A 0 4 1 6

MARKS: 1 5 — Marks in words: One Five

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2. Collision Avoidance radar waring system

An on board low power radar system can be used as a sensor for an electronic circuit avoidance system and provide waring of a potential radar waring system collision with an objectly in the part of the vehicle

fig: To Object for Anticollision waring system

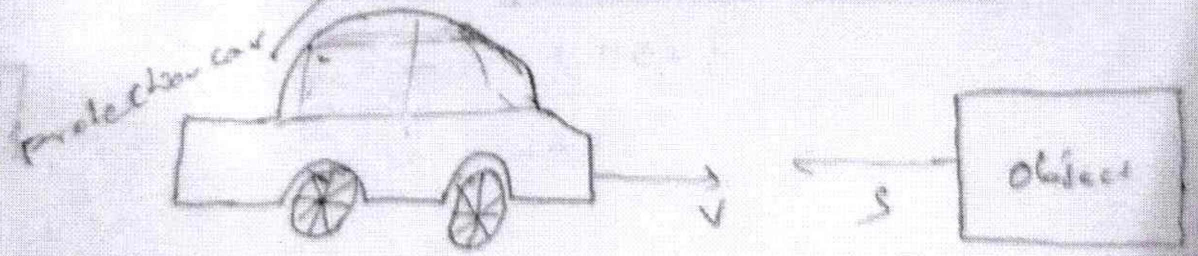


fig2: Collision Avoidance waring system

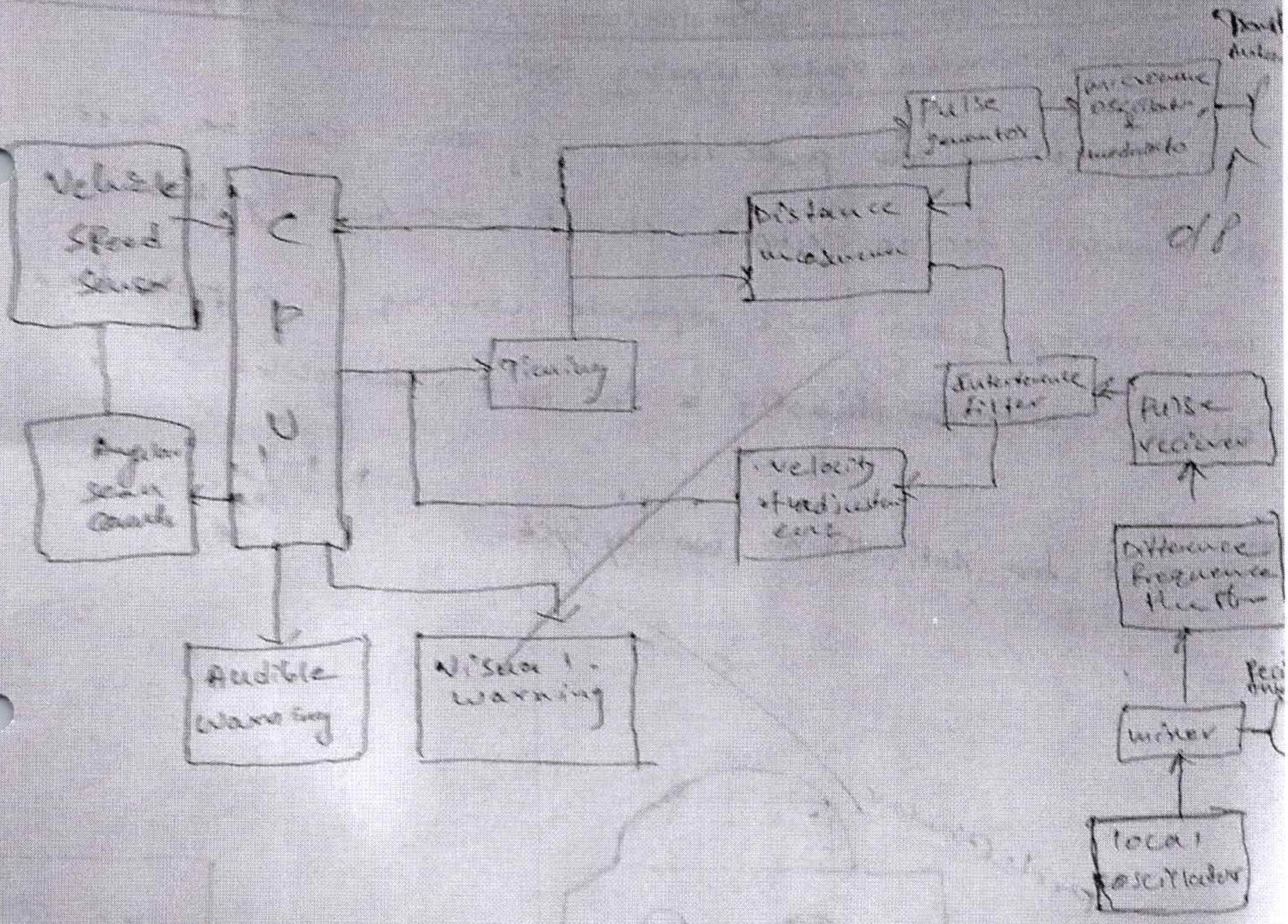
the transmitter is switched on the for away should then it is switched off, During the off time, the recievers of recieve a reflected signal. it reflecting the objects is the path of the transmitter

corresponding pulse will

time t, from transmitter object back receiver operator to the range R to the object

$t = 2R/c$

- The Range R to the object the closing speed V+R are measured



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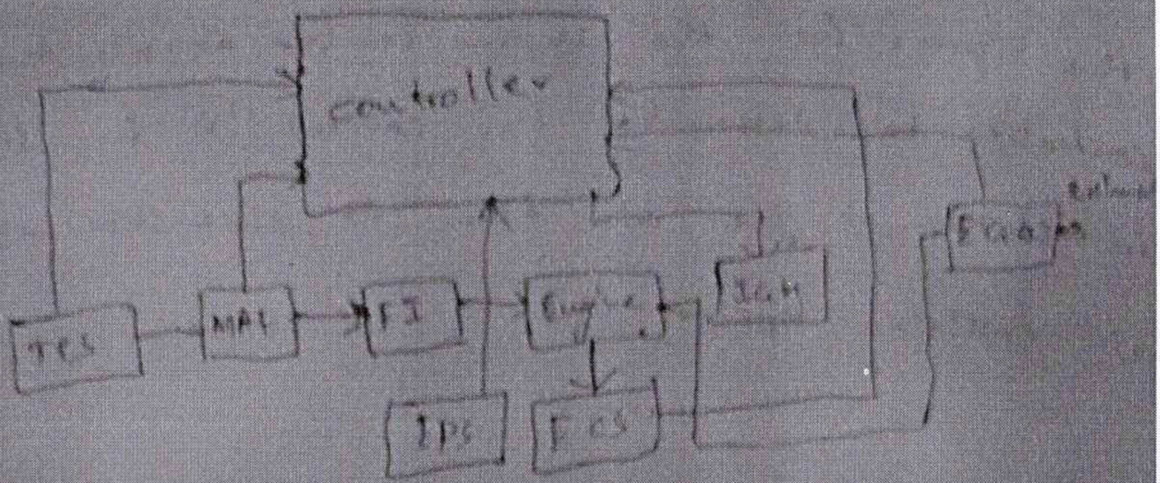

the primary function of the fixed control system is actually determine the mass air flow rate into the engine

the control system positively regulates as fuel delivery the ratio of the mass fair to the mass of the fuel in cylinder is as close as possible to stoichiometry

the components is also close as possible to stoichiometry

the components of the block diagram are as follows

1. Throttle position sensor (TPS)
2. mass air flow sensor (MAF)
3. fuel injection (FI)
4. Ignition system (IGN)
5. Exhaust oxygen sensor (EGO)
6. Engine Coolant Sensor (ECS)
7. Engine position sensor (EPS)

In ECS the Engine coolant the sensor

The EPS capability of crank shaft Engine Conduction

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NARASARAOPETA ENGINEERING COLLEGE: (AUTONOMOUS)
DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING
III B.TECH I SEM, MID –I EXAMINATIONS; DECEMBER -2020
AUTOMOTIVE ELECTRONICS

Max Marks: 10M **Time Duration: 20 min** **Date: 28-12-2020**

NAME OF THE STUDENT:- SK. Johnvali

7 / 10

ROLL NO:- 1 8 4 7 1 A 0 4 G 9

Each Question carrying ½ marks

1.Forward conventional current for a PNP transistor flows from
a. base to ground b. base to emitter c. emitter to base d. collector to base [b] X

2. An SI engine is
a. a type of internal combustion engine b. a Stirling engine
c. always fuel injected d. none of the above [d] X

3.The suspension system
a. partially isolates the body of a car from road vibrations b. holds the wheels on the axles
c. suspends the driver and passengers d. consists of four springs [a] ✓

4.The camshaft
a. operates the intake and exhaust valves b. rotates at the same speed as the crankshaft
c. has connecting rods attached to it d. opens and closes the breaker points [b] X

5.The air–fuel ratio is
a. the rate at which combustible products enter the engine
b. the ratio of the mass of air to the mass of fuel in a cylinder before ignition
c. the ratio of gasoline to air in the exhaust pipe d. intake air and fuel velocity [b] ✓

6.The distributor is
a. a system that generates the spark in the cylinders b. a system for smoothing tire load
c. a rotary switch that connects the ignition coil to the various spark plugs d. a section of the drivetrain [d] X

7.Power is produced during
a.intake stroke b. compression stroke c. power stroke d. exhaust stroke [c] ✓

8.Flip-flops are used in what type of logic systems?
a. memories b. counters c. data registers d. all of the above [d] ✓

9.The op amp is what type of circuit?
a. digital b. analog c. logic gate d. none of the above [b] ✓

10 A half adder circuit can be made from
a. an operational amplifier b. three NOT gates
c. two OR gates d. an XOR gate in combination with an AND gate [d] ✓

11.A full adder can be made from
a. a half adder with carry in b. two half adder circuits with carry in
c. an R-S flip-flop d. all of the above [d] X

12. What decimal number does the binary number 0110 represent? [d]
a. 4 b. 3 c. 110 d. 6

13. What device is used to smooth out the bumpy output of the rectifier circuit? [ ]
a. capacitor b. resistor c. diode d. transistor

14. What does a microcomputer use to interface with other systems? [d]
a. parallel interface b. analog-to-digital converter
c. digital-to-analog converter d. all of the above

15. Which control line do peripherals use to get the computer's attention? [c]
a. power line b. read/write line c. interrupt line d. clock line

16. What type of memory is used to permanently store programs? [b]
a. RAM b. ROM c. MAP d. RPM

17. What type of memory is used to temporarily store data and variables? [a]
a. RAM b. ROM c. MAP d. RPM

18. A programmer uses what type of statements in an assembly language program? [b]
a. op codes b. mnemonics c. machine code

19. Which register keeps track of program steps? [a]
a. program counter b. stack pointer c. condition code register d. accumulator

20. Most microcomputers use how many bits to address memory? [b]
a. 16 b. 32 c. 4 d. 6

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NARASARAOPETA ENGINEERING COLLEGE (AUTONOMOUS)

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

III B.TECH I SEM, MID -I EXAMINATIONS, DECEMBER -2020

AUTOMOTIVE ELECTRONICS

Max Marks: 10M Time Duration: 20 min Date: 28-12-2020

NAME OF THE STUDENT: [illegible]

ROLL NO:- 1 8 4 7 1 A 0 4 C 6

3 / 10

Each Question carrying ½ marks

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a. operates the intake and exhaust valves b. rotates at the same speed as the crankshaft [c] X
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5.The air-fuel ratio is
a. the rate at which combustible products enter the engine
b. the ratio of the mass of air to the mass of fuel in a cylinder before ignition
c. the ratio of gasoline to air in the exhaust pipe d. intake air and fuel velocity [d] X

6.The distributor is
a. a system that generates the spark in the cylinders b. a system for smoothing tire load
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NARASARAOPETA ENGINEERING COLLEGE, NARASARAOPET.
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MAIN ANSWER BOOK

B.Tech. / M.Tech. / M.B.A. / M.C.A. / B·Tech (Br.) ECE | 2020 (A) | 09385

Year: III Semester: I Sec.: C Mid No.: 1

Sub: AE Date: 28/12/20

HALL TICKET NO. 1 8 4 7 1 A 0 4 C 5

Name: A· Sravani

MARKS 30 | Marks in words: Three Zero

Signature of the Principal | Signature of the Examiner - I | Signature of the Examiner - II

1) 4 - Stroke Engine:

The operation of 4- stroke Engine is

→ Intake

→ Compression

→ Power

→ Exhaust

Intake:

In Intake the values are open the fuel is enter into the open value and their is air inside. The fuel and air combines like a Mixture.

And the piston inside moves from top to buttom.

And here the mixture is formed.

Compression:

In compression the valves are closed because the mixture of fuel and air doesn't come out.

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Department of Electronics and Communication Engin...

III B. TECH, I SEM, II MID OBJECTIVE EXAMINATIONS, F...

AUTOMOTIVE ELECTRONICS

Max Marks: 10 Time Duration: 20 Min Date: 27-02-2021

Name of the Student: A. Prasad Rao

Roll No. | 1 | 8 | 4 | 7 | 1 | A | 0 | 4 | J | 1 |

Signature of the Invigilator: 4

3/10

Each Question carrying ½ marks

1. What does a sensor do? [D]
   - A) it selects transmission gear ratio
   - B) it measures some variable
   - C) it is an output device
   - D) it sends signals to the driver
2. What does an actuator do? [B]
   - A) it is an input device for an engine control system
   - B) It provides a mathematical model for an engine
   - C) It causes an action to be performed in response to an electrical signal
   - D) It indicates the results of a measurement
3. What type of sensor is commonly used for fuel quantity measurement? [C]
   - A) a thermistor
   - B) a strain gauge
   - C) a piezoelectric sensor
   - D) a potentiometer whose movable arm is connected to a float
4. How is coolant temperature measured? [C]
   - A) with a mercury bulb thermometer
   - B) with a strain gauge
   - C) with a thermistor as a sensor
   - D) none of the above
5. A D/A converter [D]
   - A) is a disk access device
   - B) stores analog data
   - C) enters digital data in a computer
   - D) converts the digital output of an instrumentation computer to an analog form
6. An LCD display uses? [A]
   - A) a nematic liquid
   - B) an incandescent lamp
   - C) large electrical power
   - D) a picket fence
7. Fuel ecnomy is calculated in a trip computer by? [B]
   - A) S.F
   - B) F/S
   - C) S/F
   - D) none of the above
8. The term MUX refers to ? [D]
   - A) an electronic switch that selects one of a set of inputs per an input code
   - B) a digital output device
   - C) a time slot
   - D) none of the above
9. The resistance of a thermistor [B]
   - A) varies inversely with temperature
   - B) varies directly with temperature
   - C) is always 100000 ohms
   - D) none of the above
10. An EGO sensor is [B]
    - A) a perfectly linear sensor
    - B) unaffected by exhaust oxygen levels
    - C) a sensor having two different output levels depending on air/fuel ratio
    - D) unaffected by temperature
11. A potentiometer is [A]
    - A) a variable capacitance circuit component
    - B) all of the above
    - C) sometimes used to sense air flow
    - D) usable in a throttle angle sensor
12. What does exhaust gas recirculation do [A]
    - A) improves fuel economy
    - B) reduces NO_x emission
    - C) increases engine torque
    - D provides air for the catalytic converter
13. What electronic device is used in engine controls [C]
    - A) AM radio
    - B) catalytic converter
    - C) Microcomputer

14. What is the primary purpose of spark timing controls?
A) to maximize fuel economy B) to minimize exhaust emissions
C) to optimize catalytic converter efficiency
D) to optimize some aspect of engine performance [D]
15. What is yhe primary purpose of fuel control?
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16. What is air/fuel ratio?
A) the mass of air in a cylinder divided by the mass of fuel
B) the volume of air in a cylinder divided by the volume of fuel
C) the ratio of the mass of HC to mass of NO_x [A]
17. An optical fiber is
A) a tiny beam of light B) an optical waveguide that is often called a light pipe
C) an optical switch D) none of the above [B]
18. Speech synthesis is?
A) a system that automatically recognizes human speech
B) an automatic checkbook balancing system
C) a visual display of speech waveforms
D) a means of electronically generating human speech [C]
19. The crankshaft angular position sensor measures
A) the angle between the connecting rods and the crankshaft
B) the angle between a line drawn through the crankshaft axis and a mark on that fly wheel a reference line
C) the pitch angle of the crankshaft
D) the oil pressure angle [C]
20. What is a MAP sensor
A) a sensor that measures manifold absolute pressure
B) a vacation route planning scheme
C) a measurement of fluctuations in manifold air
D) an acronym for mean atmospheric pressure [B]

NARASARAOPETA ENGINEERING COLLEGE, NARASARAOPET

(AUTONOMOUS)

Department of Electronics and Communication Engineering

III B. TECH, I SEM, II MID OBJECTIVE EXAMINATIONS, FEB-2021

AUTOMOTIVE ELECTRONICS

Max Marks: 10 Time Duration: 20 Min Date: 17-02-2021

Name of the Student: Sk Abdul Gaffar

Roll No. 18471A0448

Signature of the Invigilator:

Each Question carrying ½ marks

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MAIN ANSWER BOOK

B.Tech / M.Tech / MBA / MCA / B.Tech (Br) ECE | 2021 (A) | 16694
Year: II Semester: I Sec: D Mid No: 02
Sub: AE Date: 27/08/21
Name: G.L.pravallika

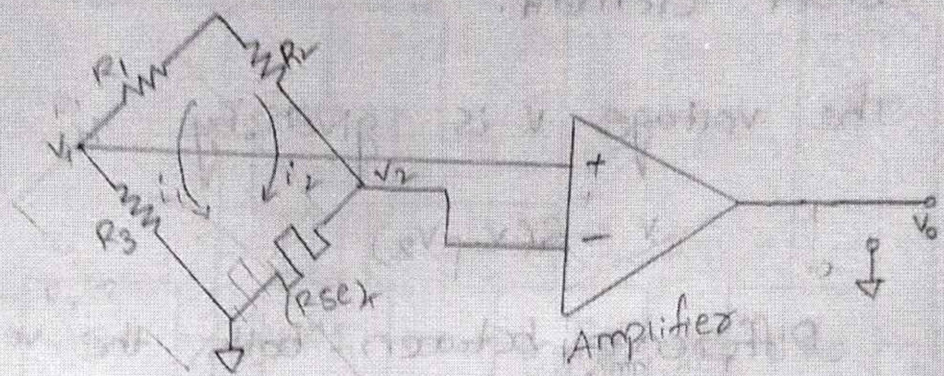
HALL TICKET NO.

1	8	4	7	1	A	0	4	I	9

MARKS	Tens	Ones	Marks in words
	3	0	Three zero

Signature of the Principal   Signature of the Examiner - I   Signature of the Examiner - II

operation of Air flow rate Sensor



construction of Air flow rate sensor is as Shown in above figure

In the figure we have a bridge circutit and an amplifier and a resistive Sensor element.

In the bridge circuit there are 3 Resistors R_1, R_2 and R_3 and Resistive sensor element denoted by $(R_{se})_T$

V_1 and V_2 are ... Amplifier and from bridge circuit to Amplifier and currents are i_1 and i_2.

And output voltage V_o from the amplifier the inverting amplifier is connected across the R_1 and R_3 and Non-inverting amplifier is connected across the R_2 and Resistive sensor element.

The voltage V is given by

$$V = G(V_1 - V_2)$$

Difference between both the voltage is denoted by ΔV and is given by

$$\Delta V = V_1 - V_2$$

$$V = \left[\frac{R_2}{R_1+R_2} - \frac{R_{se}}{R_{se}+R_3}\right]$$

the output voltage V_o is given by

$$V_o = G\,\Delta V$$

$$\frac{1}{G} = \left[\frac{R_2}{R_1+R_2} - \frac{R_{se}}{R_{se}+R_3}\right]$$

$$R_{se} = \frac{R_2 R_3}{R_1}$$

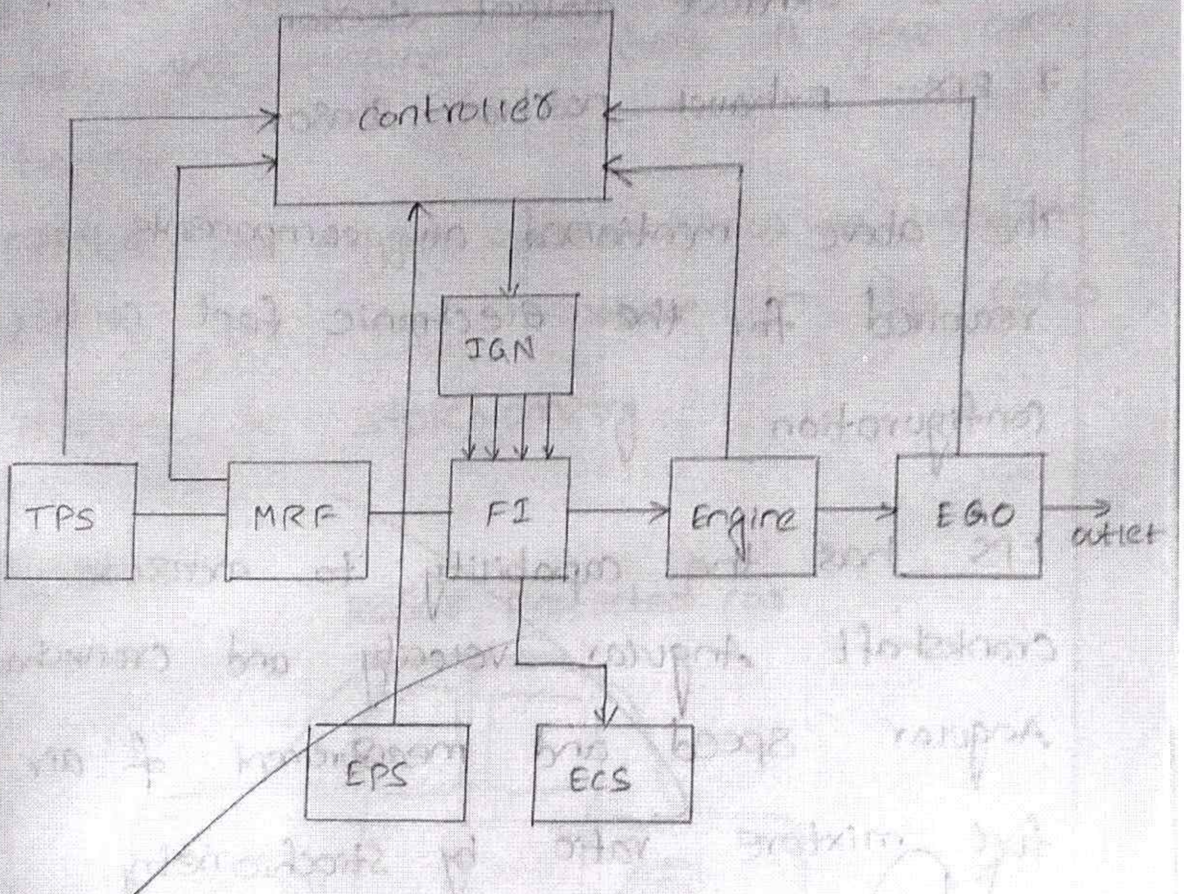
$$K_T \Delta T = \frac{R_2 R_3}{R_1} - \left[R_0 + K_T (T_a - T_{ref})\right]$$

T_{ref} is the referential temperature

$$V_0(m_0) = \left[V_0^2(0) + K_{mAF} - m_0\right]^{1/2}$$

K_{mAF} is the constant

1. Electronic fuel control configuration



The primary function of the electronic fuel control configuration is that it regulates the amount of ratio of fuel provided in accordance with the air mixture by stiochiometry.

The components required for the electronic fuel control configuration are

1. Throttle position sensor (TPS)

2. MRF - Mass air flow sensor

3. FI - Fuel injectors

4. EGO - Exhaust gas oxygen system

5. IGN - Ignition system

6. ECS - Exhaust coolent sensor

7. EPS - Exhaust position sensor.

The above mentioned all components are reaoired for the electronic fuel control configuration.

EPS has the capability to measure crankshaft Angular velocity and crankshaft Angular speed and measurement of air fuel mixture ratio by stiochiometry.

10

There are inexpensive sensors and whose air fuel ration are decided in accordance with the stiochiometry.

The system provides the fuel to all the cylinders as reauired by then as possible to stoichiometry.

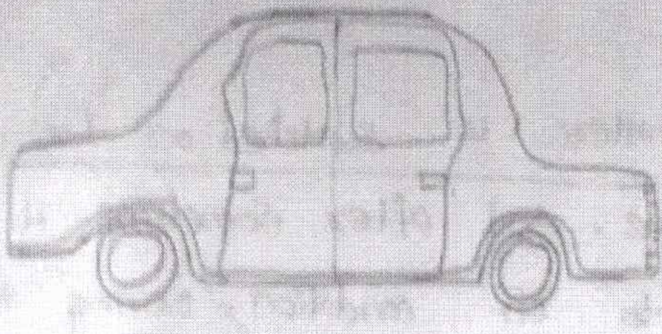
Here the continuous system regulates the flow of fuel to all the cylinders as precise to stoichiometry

Fuel injectors (FI) are used to inject the fuel into the engine

Exhaust coolant sensor (ECS) is used to cool the engine whenever it gets over heated.

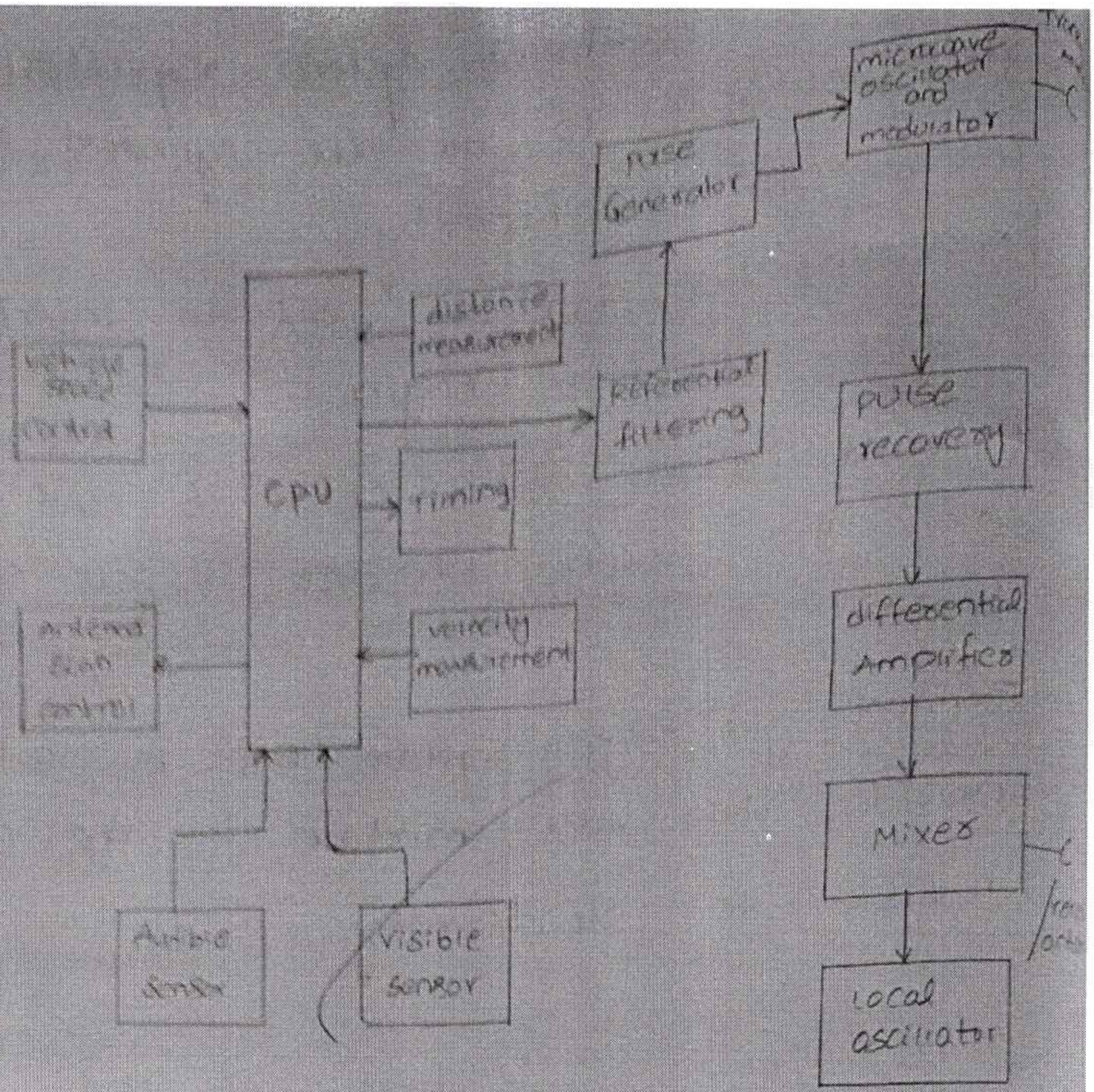
Exhaust gas oxygen system (EGO) is used to provide the fuel mixture in the ratio relative to stoichiometry.

Radar protected car



The above figure is the collision avoidance Radar warning car system. It is a Radar protected car

When there is an obstacle or an object in the path of way then the reflector senses and reflects the object to the sensor



The transmitter is switched on for a very short time. And after sometime it is switched to off condition. During the off condition if there is an object in the path of way then the reflector reflects the object from the sensor. The round over time t from the transmitter to object and back to receiver. And the time is given by

$$\boxed{T = 2R/c}$$

from the block diagram of collision avoidance radar warning system we have a distance measurement to measure distance and velocity measurement to measure velocity of a vehicle pulse generator to generate a pulse. Audible and visible sensors are to sense the Audio and videos. And also transmitting Antenna and Receiving antenna for Signals to transmit and Receive.

This radar warning system is to avoid the collision of object and whenever the two objects colloid then the radar gives warning message to avoid collision.

10

END EXAM QUESTION PAPER
WITH KEY

NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)

Department of Electronics and Communication Engineering

Narasaraopeta Engineering College (Autonomous)
Kotappakonda Road, Yellamanda (P.O), Narasaraopet- 522601, Guntur District, AP.

Subject Code: R16CC31OE6

III B.Tech I Semester Regular & Supple Examinations, March-2021

AUTOMOTIVE ELECTRONICS (OPEN ELECTIVE-I)

(ECE)

Time: 3 hours Max Marks: 60

Question Paper Consists of Part-A and Part-B.
Answering the question in Part-A is Compulsory & Four Questions should be answered from Part-B
All questions carry equal marks of 12.

PART-A

1. a) Provide 4 - Stroke/Cycle SI engine basic elements. [2M]
   b) Explain Half-wave rectifier concept. [2M]
   c) Draw 1-bit SRAM memory cell [2M]
   d) Define stoke and decide how Low/High stokes will be good for a system [2M]
   e) Differentiate Sensor and Actuator. [2M]
   f) What is the expected future automotive application? [2M]

PART-B

4 X 12 = 48

2. Depict the configuration of automotive system and briefly explain each part of it. [12M]

3. a) Why op-amp not operated at maximum gain? Explain the use of feedback in Op-Amps. [6M]
   b) Show a 4-stage synchronous counter block diagram and timing diagrams. Explain its operation. [6M]

4. a) What are the use of CC registers and flag registers. Depict registers and bit locations. [4M]
   b) Draw the typical microprocessor architecture. [4M]
   c) List applications of micro-computers in automotive systems. [4M]

5. a) Explain the concept of electronic engine control system, along with intake system with throttle plate analytics. [6M]
   b) Show the fuel control configuration block diagram and provide critical path of control. [6M]

6. a) List what to be sensed in engine control. [6M]
   b) Explain the micro model of strain gauge MAP sensors, also label elements in top view and front view of the diaphragm used. [6M]

7. a) Design a futuristic circuit for automatic ignition with relay and transistor [6M]
   b) Draw the block diagram of telepath intelligent transportation system. [6M]

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NARASARAOPETA
NEC ENGINEERING COLLEGE
(AUTONOMOUS)

Department of Electronics and Communication Engineering

III BTECH I SEM REGULAR &SUPPLE EXAMINATION MAR-2021

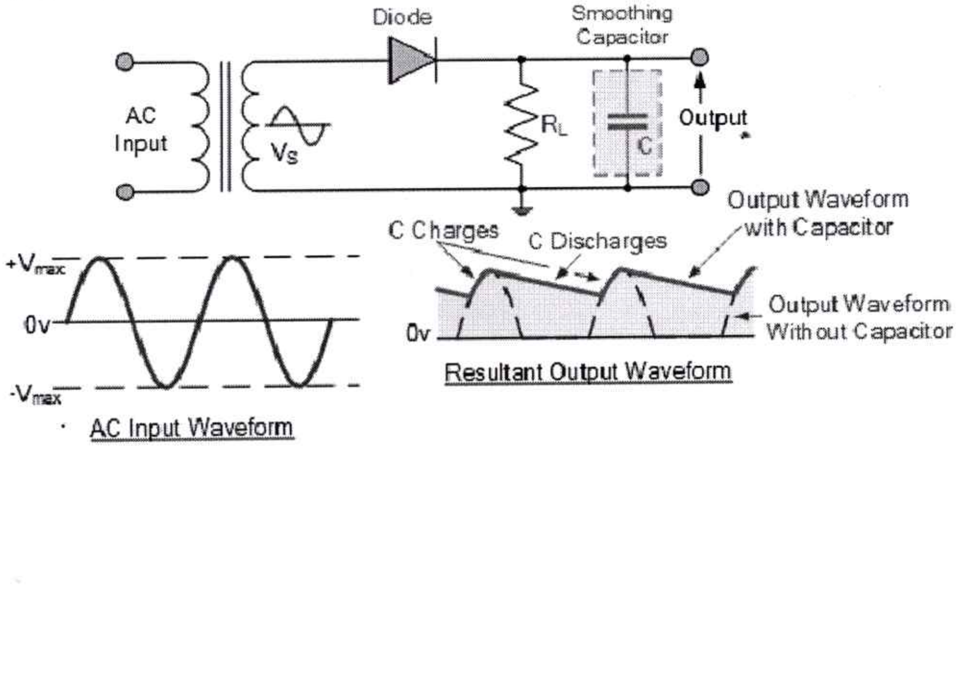
AUTOMOTIVE ELETRONICS KEY

ECE

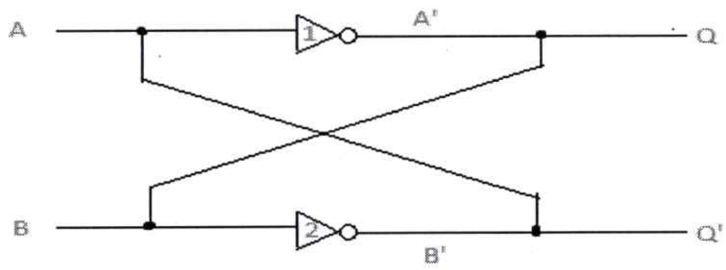
PART-A

1. **1Intake**: Also known as induction or suction. This stroke of the piston begins at top dead center (T.D.C.) and ends at bottom dead center (B.D.C.). In this stroke the intake valve must be in the open position while the piston pulls an air-fuel mixture into the cylinder by producing vacuum pressure into the cylinder through its downward motion. T
2. **Compression**: This stroke begins at B.D.C, or just at the end of the suction stroke, and ends at T.D.C. In this stroke the piston compresses the air-fuel mixture in preparation for ignition during the power stroke (below).
3. **Combustion**: Also known as power or ignition. This is the start of the second revolution of the four stroke cycle. At this point the crankshaft has completed a full 360 degree revolution. While the piston is at T.D.C. (the end of the compression stroke) the compressed air-fuel mixture is ignited by a spark plug (in a gasoline engine) or by heat generated by high compression (diesel engines), forcefully returning the piston to B.D.C.
4. **Exhaust**: Also known as outlet. During the *exhaust* stroke, the piston, once again, returns from B.D.C. to T.D.C. while the exhaust valve is open. This action expels the spent air-fuel mixture through the exhaust valve.

b) Explain Half wave rectifier concept



c)



D) Define stroke

- A phase of the engine's cycle (e.g. compression stroke, exhaust stroke), during which the piston travels from top to bottom or vice versa.
- The type of power cycle used by a piston engine (e.g. two-stroke engine, four-stroke engine).
- "Stroke length", the distance travelled by the piston during each cycle. The stroke length—along with bore diameter—determines the engine's displacement.

e) Differentiate sensor and actuator

Sensors:

provide measurements of important plant variables in a format suitable for the digital microcontroller.

Actuators:

They are electrically operated devices that regulate inputs to the plant that directly control its output.

Ex: Fuel injectors

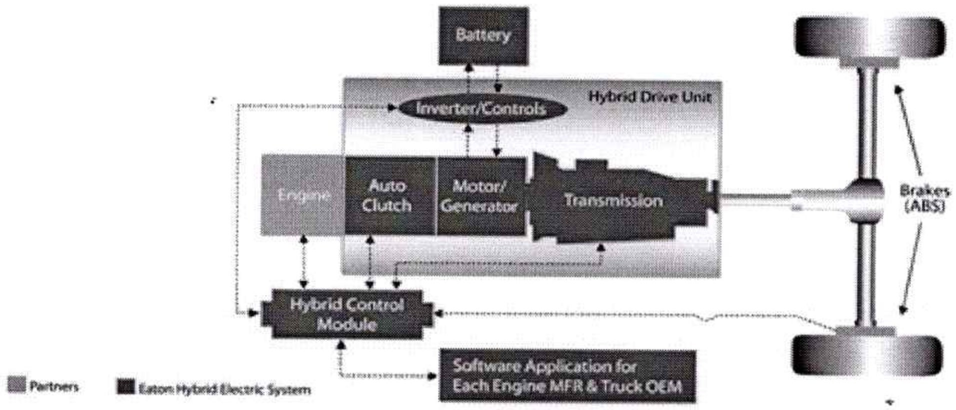
f) what is the expected future automotive applications

- Autonomous Vehicles (AV) ...
- Connectivity. ...
- Electrification. ...
- Shared Mobility. ...
- Artificial Intelligence (AI) ...
- Big Data & Data Analytics. ...
- Human-Machine Interface. ...
- Blockchain.

PART-B

2) Depict the configuration of automotive system and briefly explain each part of it.

This early configuration is depicted in below Figure, in which many of the important automotive systems are illustrated. These systems include the following: 1. Engine 2. Drivetrain (transmission, differential, axle) 3. Suspension 4. Steering 5. Brakes 6. Instrumentation 7. Electrical/electronic 8. Motion control 9. Safety 10. Comfort/convenience 11. Entertainment/communication/navigation



Transmission: ➢ The transmission is a gear system that adjusts the ratio of engine speed to wheel speed. ➢ To accomplish this with a manual transmission, the driver selects the correct gear ratio from a set of possible gear ratios (usually three to five for passenger cars). ➢ An automatic transmission selects this gear ratio by means of an automatic control system. ➢ The configuration for an automatic transmission consists of a fluid-coupling mechanism, known as a torque converter, and a system of planetary gear sets.

Drive Shaft ➢ The drive shaft is used on front-engine, rear wheel drive vehicles to couple the transmission output shaft to the differential input shaft.

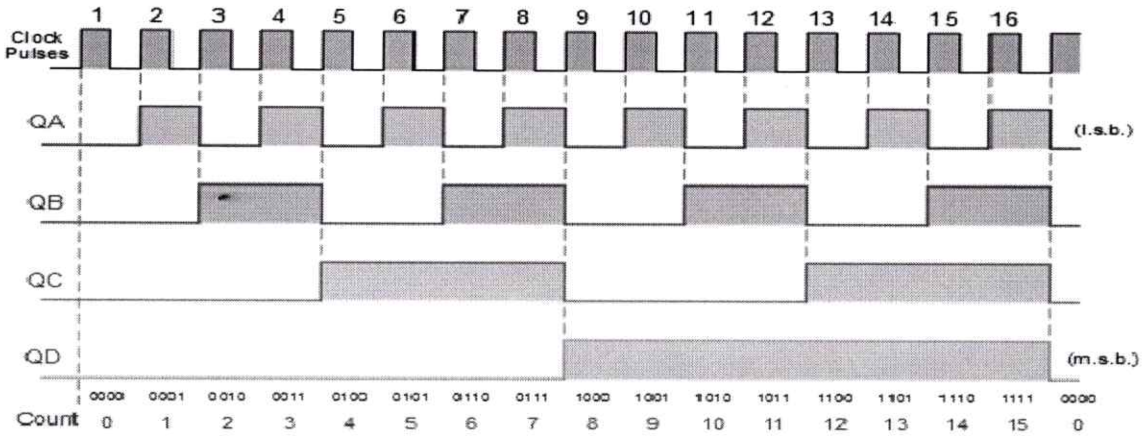
Differential The differential serves three purposes 1. The most obvious is the right angle transfer of the rotary motion of the drive shaft to the wheels. 2. The second purpose is to allow each driven wheel to turn at a different speed. This is necessary because the "outside" wheel must turn faster than the "inside'' wheel when the vehicle is turning a corner. 3. The third purpose is the torque increase provided by the gear ratio. This gear ratio can be changed in a repair shop to allow different torque to be delivered to the wheels while using the same engine and transmission. The gear ratio also affects fuel economy.

Suspension: ➢ Another major automotive subsystem is the suspension system, which is the mechanical assembly that connects each wheel to the car body. ➢ The primary purpose of the suspension system is to isolate the car body from the vertical motion of the wheels as they travel over the rough road surface.

Brakes ➢ Brakes are as basic to the automobile as the engine drivetrain system and are responsible for slowing and stopping the vehicle. 5 ➢ Most of the kinetic energy of the car is dissipated by the brakes during deceleration and stopping.

There are two major types of automotive brakes: 1. Drum brake 2. Disk brake

Steering System ➢ A steering system is one of the major automotive subsystems required for operation of the car ➢ It provides the driver control of the path of the car over the ground.



If we enable each JK flip-flop to toggle based on whether or not all preceding flip-flop outputs (Q) are "HIGH" we can obtain the same counting sequence as with the asynchronous circuit but without the ripple effect, since each flip-flop in this circuit will be clocked at exactly the same time.

Then as there is no inherent propagation delay in synchronous counters, because all the counter stages are triggered in parallel at the same time, the maximum operating frequency of this type of frequency counter is much higher than that for a similar asynchronous counter circuit.

4 a)

A **status register**, **flag register**, or **condition code register** (**CCR**) is a collection of status flag bits for a processor. Examples of such registers include FLAGS register in the x86 architecture, flags in the program status word (PSW) register in the IBM System/360 architecture through z/Architecture, and the application program status register (APSR) in the ARM Cortex-A architecture.[1]

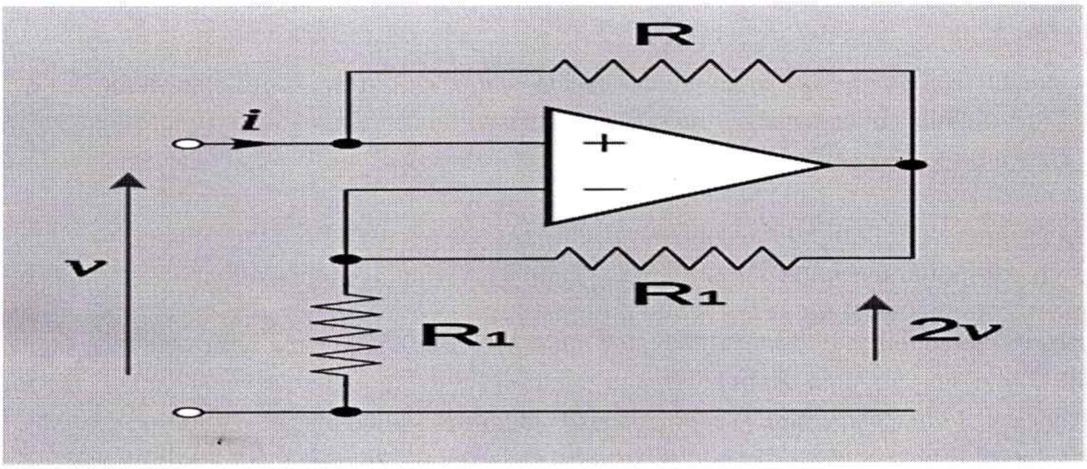
The status register is a hardware register that contains information about the state of the processor. Individual bits are implicitly or explicitly read and/or written by the machine code instructions executing on the processor. The status register lets an instruction take action contingent on the outcome of a previous instruction.

Typically, flags in the status register are modified as effects of arithmetic and bit manipulation operations. For example, a Z bit may be set if the result of the operation is zero and cleared if it is nonzero.

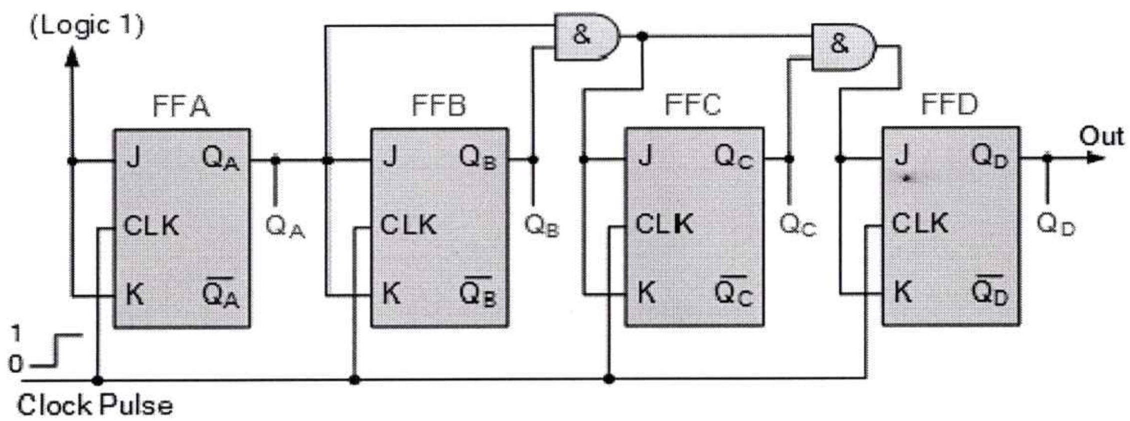
3.a)

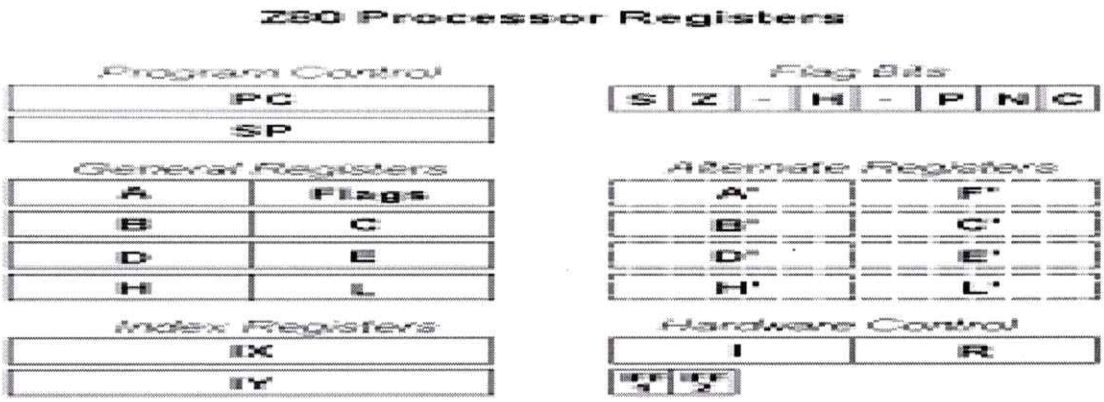
An operational amplifier (op amp) is another standard building block of integrated circuits and has many applications in analog electronic systems. It is normally connected in a circuit with external circuit elements (e.g., resistors and capacitors) that determine its operation. An op amp typically has a very high voltage gain of 10,000 or more and has two inputs and one output (with respect to ground), as shown in Figure 3.4a. A signal applied to the inverting input (-) is amplified and inverted at the output. A signal applied to the noninverting input (+) is amplified but is not inverted at the output.

The op amp is normally not operated at maximum gain, but feedback techniques can be used to adjust the gain to the value desired. Some of the output is connected to the input through circuit elements (resistors, capacitors, etc.) to oppose the input changes. In the example of Figure b, the feedback path consists of resistor Rf . The gain is adjusted by the ratio of the two resistors and is calculated by the following equation Negative feedback also can help to correct for the amplifier's nonlinear operation and distortion.

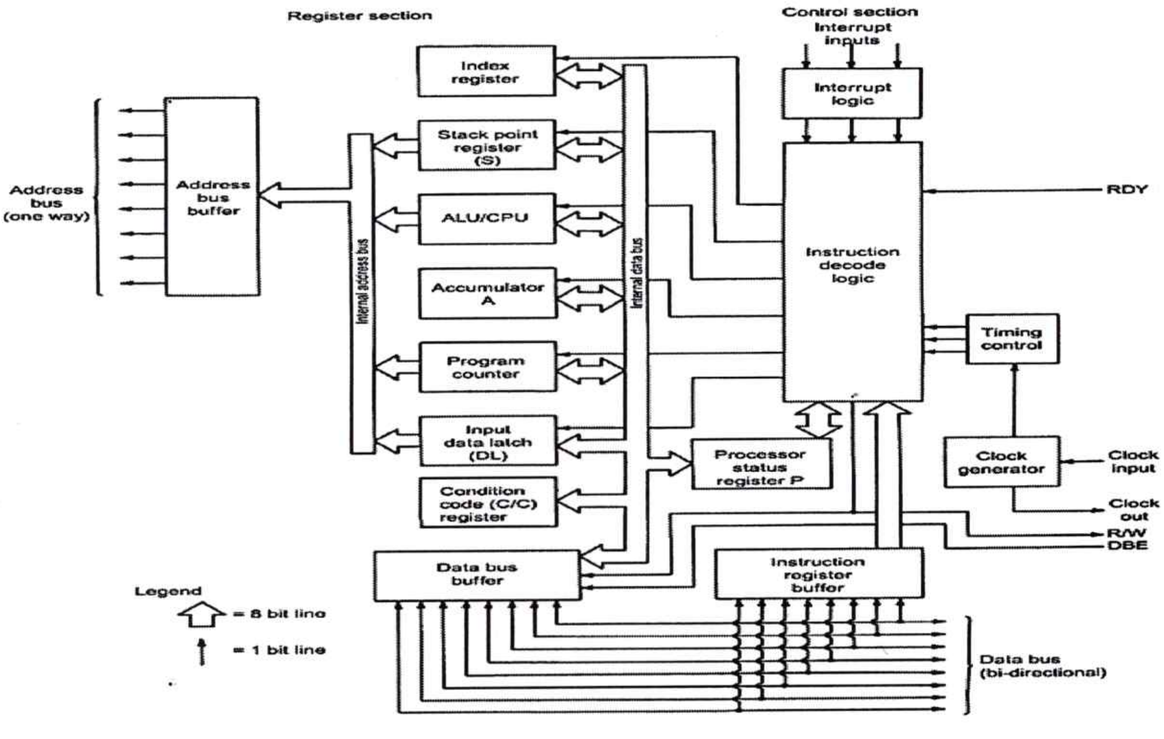


3.b)





4 b)



1. This block diagram is divided into two main portions—a register section and a control section.
2. The actual operations performed by the microprocessor are accomplished in the register section.

3. The specific operations performed during the execution of a given step in the program are controlled by electrical signals from the instruction decoder.
4. During each program step, an instruction in the form of an 8-bit (or possibly 16-bit) number is transferred from memory to the instruction register.
5. The data upon which the operation is performed is similarly transferred from memory to the data bus buffer.
6. From this buffer the data is then transferred to the desired component in the register section for execution of the operation.

4 c)

Microcomputer Applications in Automotive Systems:

There is a great variety of applications of microprocessors in automobiles. As will be explained in later chapters of this book, microprocessors find applications in engine and driveline control, instrumentation, ride control, antilock braking and other safety devices, entertainment, heating/air conditioning control, automatic seat position control, and many other systems. In each of these applications, the microprocessor serves as the functional core of what can properly be called a special-purpose microcomputer

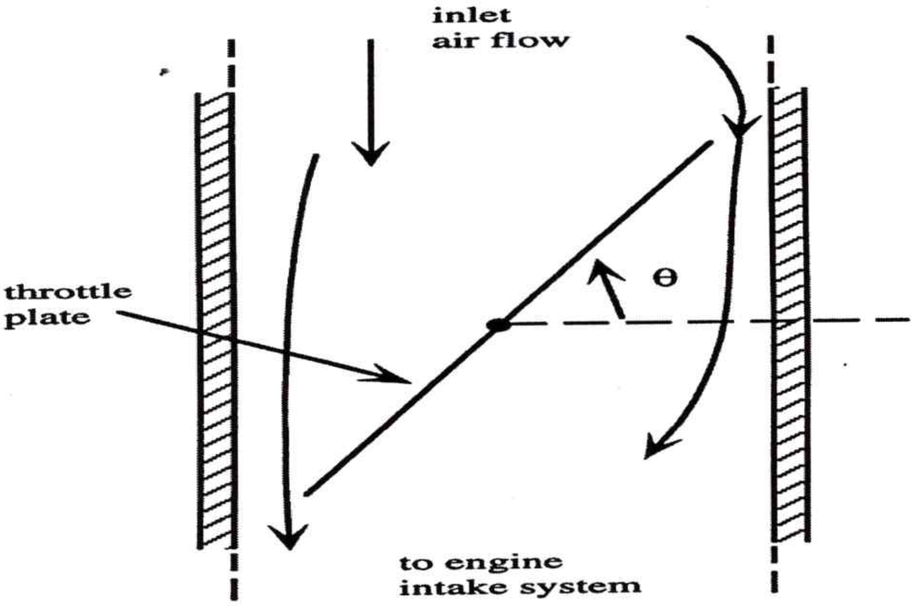
5 a)

how the power produced by the engine is controlled?

Any driver understands intuitively that the throttle directly regulates the power produced by the engine at any operating condition.

It does this by controlling the air flow into the engine.

the mass flow rate of air into the engine varies directly with throttle plate angular position



The **performance of engine** is affected strongly by the **mixture** (ratio of air and fuel).

In the **U.S system** of units , an air flow of about 6 lb/hr produces 1 horse power of usable mechanical power as the out put of the engine.

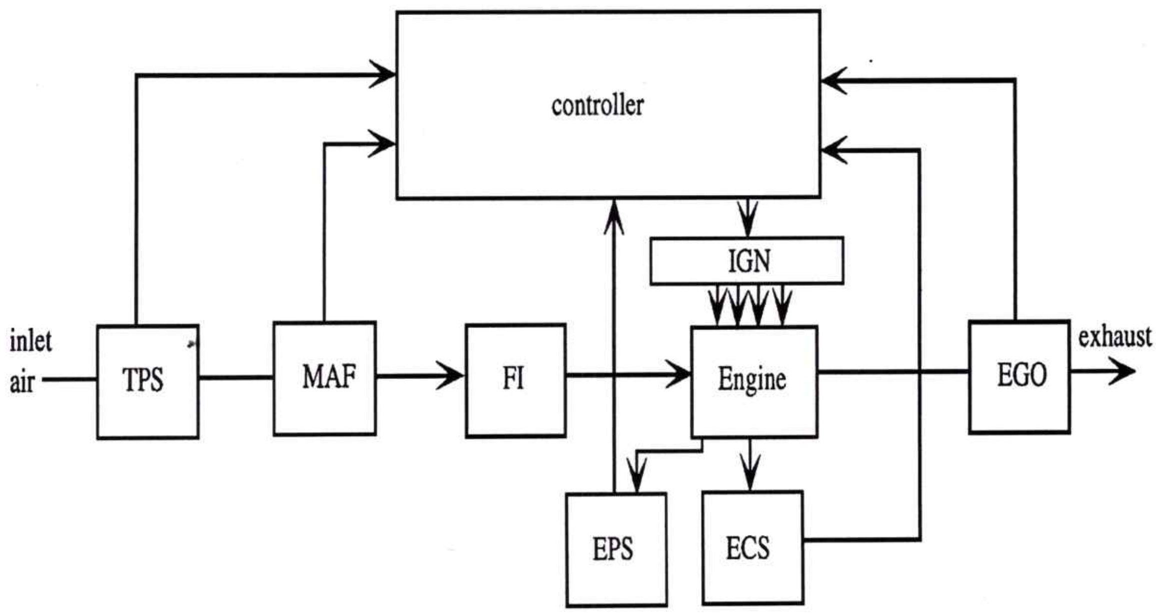
$$P_b = kM_A$$

Where, P_b=power from the engine (hp or kw)

M_A =mass air flow rate (kg/hr)

K=constant relating power to air flow (hp/kg/hr)

5 b)



The primary function of this fuel control system is to **accurately determine the mass air flow rate** into the engine.

the **control system precisely regulates fuel delivery** such that the ratio of the mass of air to the mass of fuel in each cylinder is as close as **possible to stoichiometry**

The components of this block diagram are as follows:

1. Throttle position sensor (TPS)

2. Mass air flow sensor (MAF)

3. Fuel injectors (FI)

4. Ignition systems (IGN)

5. Exhaust gas oxygen sensor (EGO)

6. Engine coolant sensor (ECS)

7. Engine position sensor (EPS)

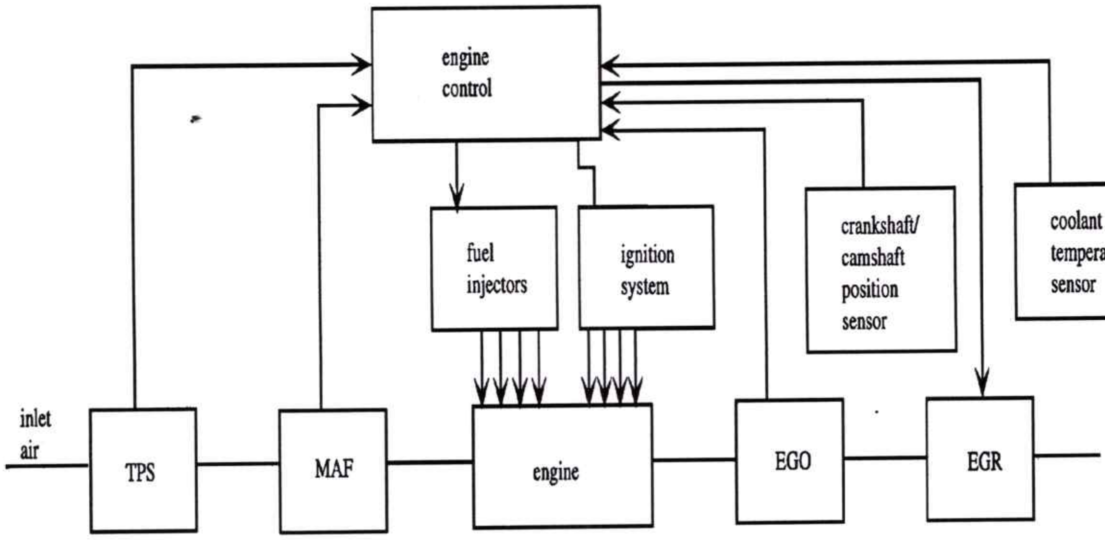
EPS -> the capability of measuring crankshaft angular speed (**RPM**) as well as crankshaft **angular position** -> used in conjunction with a **stable and precise electronic clock.**

The **signals from** the various sensors **enable the controller** to determine the **correct fuel flow in relation to the air flow** to obtain the **stoichiometric mixture.**

the correct **fuel delivery is regulated via fuel injectors.**

optimum ignition timing is determined and **appropriate timing pulses** are sent to the ignition control module (IGN)

6 a)



The position of the throttle plate, sensed by the throttle position sensor (TPS), directly regulates the air flow into the engine, thereby controlling output power.

A set of fuel injectors (one for each cylinder) delivers the correct amount of fuel to a corresponding cylinder during the intake stroke under control of the electronic engine controller.

The ignition control system fires each spark plug at the appropriate time under control of the electronic engine controller.

The exhaust gas recirculation (EGR) is controlled by yet another output from the engine controller.

All critical engine control functions are based on measurements made by various sensors connected to the engine in an appropriate way. Computations made within the engine controller based on these inputs yield output signals to the actuators.

Variables sensed in engine control includes the following:

1. Mass air flow (MAF) rate

2. Exhaust gas oxygen concentration (possibly heated)

3. Throttle plate angular position

4. Crankshaft angular position/RPM

5. Coolant temperature

6. Intake air temperature

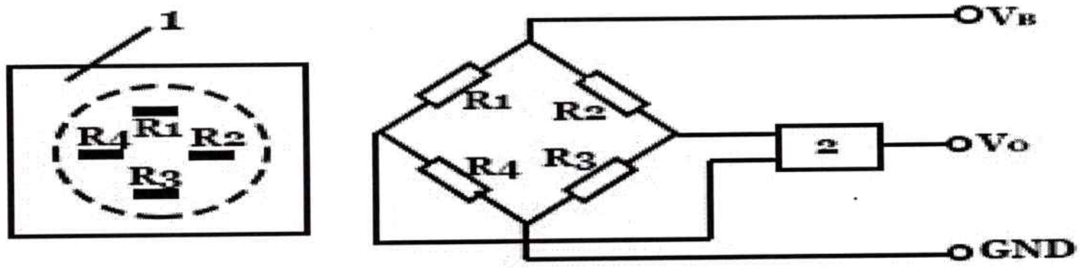
7. Manifold absolute pressure (MAP)

8. Differential exhaust gas pressure

9. Vehicle speed

10. Transmission gear selector position

6 b)



a) Semiconductor strain gauge position b) Sensor measurement circuit

1-Silicon diaphragm 2-Integrated amplifier circuit

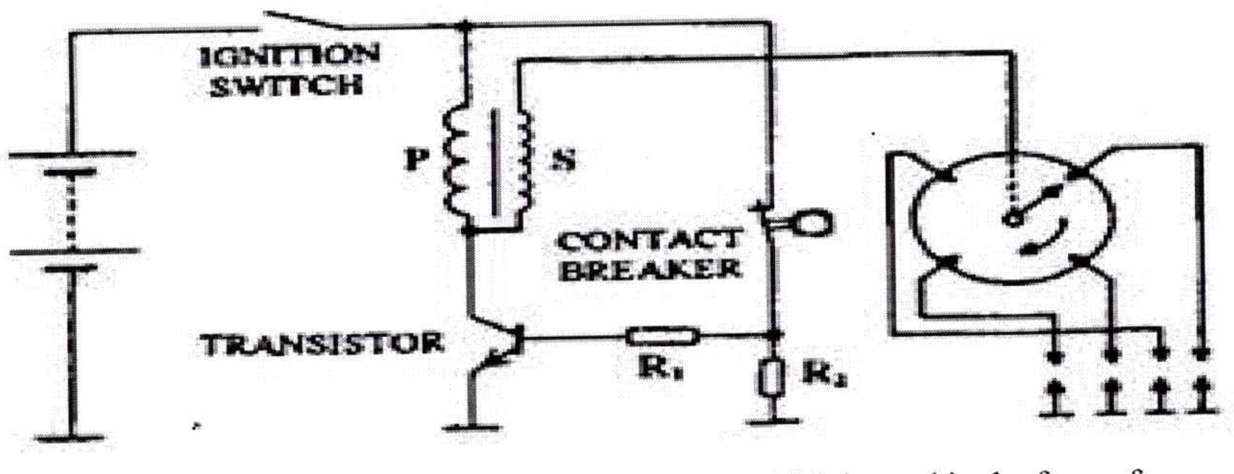
R1 R2 R3 R4-Semiconductor strain gauge

The **manifold absolute pressure sensor** (**MAP sensor**) is one of the sensors used in an internal combustion engine's electronic control system.

Engines that use a MAP sensor are typically fuel injected. The manifold absolute pressure sensor provides instantaneous manifold pressure information to the engine's electronic control unit (ECU). The data is used to calculate air density and determine the engine's air mass flow rate, which in turn determines the required fuel metering for optimum combustion (see stoichiometry) and influence the advance or retard of ignition timing. A fuel-injected engine may alternatively use a mass airflow sensor (MAF sensor) to detect the intake airflow. A typical naturally aspirated engine configuration employs one or the other, whereas forced induction engines typically use both; a MAF sensor on the charge pipe leading to the throttle body and a MAP sensor on the intake tract post-turbo.

MAP sensor data can be converted to air mass data by using a second variable coming from an IAT Sensor (intake air temperature sensor). This is called the speed-density method. Engine speed (RPM) is also used to determine where on a look up table to determine fuelling, hence speed-density (engine speed / air density). The MAP sensor can also be used in OBD II (on-board diagnostics) applications to test the EGR (exhaust gas recirculation) valve for functionality, an application typical in OBD II equipped General Motors engines.

7 a)



A relay, as we all know is an electromechanical device which is used in the form of a switch.

It is responsible for switching an external load connected to its contacts in response to a relatively smaller electrical power applied across an associated coil.

Basically the coil is wound over an iron core, when a small DC is applied to the coil, it energizes and behaves like an electromagnet.

A spring loaded contact mechanism placed at a close proximity to the coil immediately responds and gets attracted toward the energized coil electromagnet force. In the course the contact connects one of its pair together and disconnects an complementary pair associated with it.

The reverse happens when the DC is switched OFF to the coil and the contacts return to its original position, connecting the previous set of complementary contacts and the cycle may be repeated as many times as possible.

An electronic circuit will normally need a relay driver using a transistor circuit stage in order to converter it's low power DC switching output into a high power mains AC switching output.

7 b)

voice-activated cell phone dialing

in which the cell phone user verbally gives the phone number, speaking each digit separately. Included within the cell phone is a very sophisticated algorithm for recognizing speech. Speech recognition software identifies spoken words or numbers based on patterns in the waveform at the output of a microphone into which the user speaks.

There are two major categories of speech recognition software: speaker dependent and speaker independent.

Speaker-dependent software recognizes the speech of a specific individual who must work with the system. The user is prompted to say a specific digit a number of times until the software can reliably identify the waveform patterns associated with that particular speaker. By this process, the system is "trained" to the individual user. It may not be capable of recognizing other users to whose speech it has not been trained.

Speaker-independent voice recognition software can recognize spoken digits regardless of the user. It is generally more sophisticated than speaker-dependent speech recognition.

Unfortunately, it is also prone to recognition errors in excess of the speaker-dependent

systems.

Unit wise important questions

Unit-wise Sample assessment questions

S.No.	QUESTION	KNOWLEDGE LEVEL	CO
	UNIT I		
1	**Explain** use of electronics in automobile, also list present and potential electronics application in automobiles.	K2	CO1
2	**Draw** the automobile physical configuration and explain it.	K2	CO1
3	**Rephrase** the evolution of electronics in the automobile.	K2	CO1
	UNIT 2		
1	**Explain** the half wave rectifier with a neat circuit diagram.	K2	CO2
2	**Derive** the summing amplifier output V_o, and draw neat circuit using Op-amp	K3	CO2
3	**Draw** and explain multiplexer (IC 74151).	K2	CO2
	UNIT 3		
1	**Contrast** digital versus analog computers	K1	CO3
2	**Summarize** analog to digital converters with block diagram	K2	CO3
3	**List** the various microcomputer applications in automotive systems.	K1	CO3
	UNIT 4		
1	**Explain** the motivation for electronic engine control system.	K2	CO4
2	**Outline** exhausts emissions standards of Regulating authority.	K2	CO4
3	**Draw** the diagram of electronic fuel control configuration and explain it?	K2	CO4
	UNIT 5		
1	**List** the various types of sensors using auto motives.	K2	CO5
2	**How** the solenoids are working explain?	K1	CO5
3	**Interpret** the Crank angle position sensors of automobile with a diagram.	K2	CO5
	UNIT 6		
1	**Explain** how the future advancements will evolve in auto mobiles	K2	CO6
2	**With a** block diagram ,explain Collision Avoidance Radar warning System	K3	CO6
3	**Summarize** ,the working of advanced cruise control system	K2	CO6

S No		Question	Cognitive Level	CO	Marks
1	a	**List** four (4) elements of automobile physical configurations	K1	1	2
	b	**Draw** a very common circuit of half wave rectifier	K2	2	2
	c	**What** is the task of microcomputer in auto mobile system?	K1	2	2
	d	**Define** fuel economy and expand MPG in automobile engines.	K1	3	2
	e	**How** fuel injection happens in electronic automobile system?	K1	3	2
	f	**Why** transmission control used and how it works?	K2	4	2

S. No		Question	Cognitive Level	CO	Marks
2	a	**Explain** use of electronics in automobile, also list present and potential electronics application in automobiles.	K2	1	6
	b	**What** are the major components of fundamental engine? And explain piston concept and cooling system.	K1	1	6
3	a	**Draw** 4 bit digital adder and denote sum S for A(a0,a1,a2,a3)&(b0,b1,b2,b3)inputs.	K2	2	6
	b	**Derive** the summing amplifier output Vo, and draw neat circuit using Op-amp	K3	2	6
4	a	**List** the various microcomputer applications in automotive systems.	K1	3	6
	b	**Summarize** analog to digital converters with block diagram	K2	3	6
5	a	**Explain** the concept of electronic engine control system in mathematical terms.	K2	4	6
	b	**With** the block diagram help, explain the electronic distributor less ignition system.	K2	4	6
6	a	**Draw** and explain mass air flow sensor concept along with calibration curve.	K1	5	6

	b	**List** various types of sensor and explain about Hall Effect position sensor.	**K1**	**5**	**6**
7	a	**What** are technical improvements can be expected in future and explain them.	**K1**	**6**	**6**
	b	**What** is multiplexing in automobiles and brief about control signal multiplexing with block diagram.	**K1**	**6**	**6**

Previous University question papers

Narasaraopeta Engineering College (Autonomous)
Kotappakonda Road, Yellamanda (P.O), Narasaraopet- 522601, Guntur District, AP.

Subject Code: R16CC31OE6

III B.Tech I Semester Supple Examinations, October-2021

AUTOMOTIVE ELECTRONICS (OPEN ELECTIVE-I)

(ECE)

Time: 3 hours **Max Marks: 60**

Question Paper Consists of **Part-A** and **Part-B.**

Answering the question in **Part-A** is Compulsory & Four Questions should be answered from Part-B

All questions carry equal marks of 12.

PART-A

1. (a) Explain importance of electronics in the automobile industries?
   (b) Design 4X1 Mux?
   (c) Differentiate the types of memory devices?
   (d) Brief about Exhaust Emission?
   (e) What is the difference between sensors and actuators?
   (f) List out the few applications of Future Automotive Electronics Systems?

[2+2+2+2+2+2]

PART-B

4 X 12 = 48

2. (a) Explain automobile physical configurations in detail?
   (b) Explain about the electronic engine control unit?

3. (a) Explain the operations of the transistor with neat sketches?
   (b) Implement the 4:16 decoder using two 74LS 138 ICs?

4. (a) Explain the electronic ignition with sensors?
   (b) Define any three engine performance parameters?

5. (a) Explain Automotive Control System applications of sensors and actuators?
   (b) Explain stepper motors and relays usage in automobiles?

6. (a) Explain Radar Warning system with block diagram?
   (b) Describe GPS Navigation system?

7. (a) Explain the operation of J-K Flip flop?
   (b) Discuss the operation of fuel injector and ignition actuator?

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Narasaraopeta Engineering College (Autonomous)

NEC Kotappakonda Road, Yellamanda (P.O), Narasaraopet- 522601, Guntur District, AP.

Subject Code: R16CC31OE6

III B.Tech I Semester Regular Examinations, November-2018.

AUTOMOTIVE ELECTRONICS (OPEN ELECTIVE-I)

(ECE)

Time: 3 hours **Max Marks: 60**

Question Paper Consists of **Part-A** and **Part-B.**

Answering the question in Part-A is Compulsory & Four Questions should be answered from Part-B

All questions carry equal marks of 12.

PART-A

1. (a) List four (4) elements of the automobile physical configurations.
   (b) Draw a very common diode circuit of half wave rectifier.
   (c) What is the task of microcomputer in automobile system?
   (d) Define fuel economy and expand MPG in automobile engines.
   (e) How fuel injection happens in electronic automobile system?
   (f) Why transmission control used and how it works?

[2+2-2+2+2+2]

PART-B

4 X 12 = 48

2. (a) Explain use of electronics in automobile, also list present and potential electronics application in automobiles.
   (b) What are the major components of fundamental engine? and explain piston concept and cooling system.

3. (a) Draw the 4 bit digital adder and denote sum S for A (a1,a1,a2,a3) & B (b0,b1,b2,b3) inputs.
   (b) Derive the summing amplifier output V_o, and draw neat circuit using Op-amp.

4. (a) With a neat circuit diagram explain Digital to Analog converter.
   (b) Explain microcomputer applications in automotive systems.

5. (a) Explain the concept of electronic engine control system in mathematical terms.
   (b) With the block diagram help, explain the electronic distributor-less ignition system.

6. (a) Draw and explain mass air flow sensor concept along with calibration curve.
   (b) List various types of sensor and explain about Hall Effect position sensor.

7. (a) What are technical improvements can be expected in future and explain them.
   (b) what is multiplexing in automobiles and brief about control signal multiplexing with block diagram.

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NEC **Narasaraopeta Engineering College (Autonomous)**
Kotappakonda Road, Yellamanda (P.O), Narasaraopet- 522601, Guntur District, AP.

Subject Code: R16CC31OE6

III B.Tech I Semester Supple Examinations, October-2020
AUTOMOTIVE ELECTRONICS (OPEN ELECTIVE-I)
(ECE)

Time: 3 hours **Max Marks: 60**

Question Paper Consists of **Part-A** and **Part-B.**
Answering the question in **Part-A** is Compulsory & Four Questions should be answered from Part-B
All questions carry equal marks of 12

PART-A

1. (a) What is the functionality of Engine control block in car
(b) Draw the schematic symbol of diode and draw its transfer characteristics
(c) What is the use of program counter in CPU
(d) Define the term BSFC
(e) List out the different types of actuators and mention where they are used.
(f) Expand the term HUD and write what is the use of this.

[2+2+2+2+2+2]

PART-B

4 X 12 = 48

2. (a) List the major components of the engine and explain any three components
(b) Explain about spark pulse generation

3. (a) Explain the use of feedback in op Amps and derive the output voltage equation for summing amplifier
(b) Explain about four stage synchronous counter with JK flip-flop

4. (a) Explain about microprocessor internal architecture
(b) Explain about digital to analog convertors with circuit diagram and output voltage characteristics?

5. (a) Explain about electronic engine control system
(b) Explain about electronic fuel control system

6. (a) Explain the working of engine crankshaft angular position sensor
(b) Explain about magnetic Reluctance Position Sensor

7. (a) Explain the Collision Avoidance Radar warning System with block diagram
(b) Explain about control signal multiplexing with block diagram

Subject Code: R16CC31OE6

III B.Tech I Semester Regular & Supple Examinations, March-2021

AUTOMOTIVE ELECTRONICS (OPEN ELECTIVE-I)

(ECE)

Time: 3 hours **Max Marks: 60**

Question Paper Consists of Part-A and **Part-B.**

Answering the question in Part-A is Compulsory & Four Questions should be answered from Part-B

All questions carry equal marks of 12.

PART-A

1. a) Provide 4 - Stroke/Cycle SI engine basic elements. [2M]

   b) Explain Half-wave rectifier concept. [2M]

   c) Draw 1-bit SRAM memory cell [2M]

   d) Define stoke and decide how Low/High stokes will be good for a system [2M]

   e) Differentiate Sensor and Actuator. [2M]

   f) What is the expected future automotive application? [2M]

PART-B

4 X 12 = 48

2. Depict the configuration of automotive system and briefly explain each part of it. [12M]

3. a) Why op-amp not operated at maximum gain? Explain the use of feedback in Op-Amps. [6M]

   b) Show a 4-stage synchronous counter block diagram and timing diagrams. Explain its operation. [6M]

4. a) What are the use of CC registers and flag registers. Depict registers and bit locations. [4M]

   b) Draw the typical microprocessor architecture. [4M]

   c) List applications of micro-computers in automotive systems. [4M]

5. a) Explain the concept of electronic engine control system, along with intake system with throttle plate analytics. [6M]

   b) Show the fuel control configuration block diagram and provide critical path of control. [6M]

6. a) List what to be sensed in engine control. [6M]

   b) Explain the micro model of strain gauge MAP sensors, also label elements in top view and front view of the diaphragm used. [6M]

7. a) Design a futuristic circuit for automatic ignition with relay and transistor [6M]

   b) Draw the block diagram of telepath intelligent transportation system. [6M]

***

Beyond Syllabus Topics

AUTOMOTIVE ELECTRONICS BEYOND SYLLABUS TOPICS

1. Lighting System & Accessories
2. Digital Engine Control System
3. Electronic dashboard instruments-Onboard diagnosis system
4. security and warning system.
5. Current Trends in Automotive Electronic Engine Management System
6. introduction to modern control strategies like Fuzzy logic and adaptive control
7. Spark Advance Correction Scheme
8. **Power train and chassis control domain**

Remedial/Corrective actions

NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)

Department of ELECTRONICS & COMMUNICATION ENGINEERING

Name of the Faculty: N. Sayedu Khasim. Academic Year: 2020-21
Subject: A E. Year/Sem: III/II
Branch: ECE. Section: A, B, C, & D

S. NO	Date	Name Of The Topic	Signature of the faculty
1	7-1-2021	Automobile physical configuration	[signature]
2	21-1-2021	Multiplexer and 3 to 8 Decoder	[signature]
3	28-1-2021	Analog to Digital and Digital to Analog converter	[signature]
4	4-2-2021	Electronic fuel control configuration	[signature]
5	11-2-2021	Crank angle position sensors	[signature]
6	18-2-2021	Automotive internal navigation system	[signature]

[signature]
HOD

RESULTS

NARASARAOPETA ENGINEERING COLLEGE::NARASARAOPET

(AUTONOMOUS)

(R16) 2018 BATCH III B.TECH I SEM FINAL INTERNAL MARKS-2020-21

BRANCH/SEC - ECE/A **SUBJECT NAME & CODE : AUTOMOTIVE ELECTRONICS (OPEN ELECTIVE-I) (R16CC31OE6)**

SL.NO.	H.T.NO.	A1	A2	D1	O1	CYCLE-1	A3	A4	D2	O2	CYCLE-2	TOTAL
1	18471A0401	10	10	18	4	32	10	9	18	8	36	35
2	18471A0402	8	3	14	3	25	0	0	16	4	20	24
3	18471A0403	10	7	17	5	32	10	1	20	8	38	37
4	18471A0405	10	9	17	5	32	9	10	20	6	36	35
5	18471A0406	8	7	12	9	29	9	0	18	4	31	31
6	18471A0407	10	5	17	5	32	9	1	19	6	34	34
7	18471A0408	10	1	9	3	22	A	0	6	2	8	19
8	18471A0409	8	10	14	3	27	0	0	18	3	21	26
9	18471A0410	A	8	16	2	26	5	9	18	6	33	32
10	18471A0411	9	9	14	7	30	9	0	18	6	33	33
11	18471A0412	A	10	18	10	38	10	0	20	7	37	38
12	18471A0413	10	7	17	6	33	10	10	20	8	38	37
13	18471A0414	9	9	16	5	30	10	0	20	7	37	36
14	18471A0415	9	0	8	7	24	10	0	19	3	32	30
15	18471A0416	10	10	17	7	34	9	0	20	6	35	35
16	18471A0417	A	9	10	5	24	A	9	17	2	28	27
17	18471A0418	6	10	18	5	33	2	10	20	5	35	35
18	18471A0419	10	9	19	4	33	10	0	20	4	34	34
19	18471A0420	10	10	18	3	31	9	10	19	9	38	37
20	18471A0421	10	10	20	7	37	8	1	20	8	36	37

21	18471A0422	10	5	16	7	33	0	10	19	6	35	35
22	18471A0423	10	9	18	4	32	10	0	19	5	34	34
23	18471A0424	10	10	20	2	32	2	10	19	7	36	35
24	18471A0425	A	A	A	A	0	10	A	A	A	10	8
25	18471A0426	A	10	14	3	27	A	9	18	3	30	30
26	18471A0427	10	8	17	3	30	2	10	19	5	34	33
27	18471A0428	10	8	19	5	34	2	A	A	A	2	26
28	18471A0429	10	8	19	7	36	10	10	20	8	38	38
29	18471A0430	10	10	20	5	35	10	10	20	9	39	38
30	18471A0431	10	10	15	7	32	9	10	20	7	37	36
31	18471A0432	A	8	15	5	28	7	A	A	A	7	23
32	18471A0433	10	9	12	3	25	6	10	19	6	35	33
33	18471A0434	9	8	15	6	30	6	0	19	5	30	30
34	18471A0435	10	10	16	6	32	10	9	19	6	35	35
35	18471A0436	10	0	12	5	27	6	0	18	7	31	30
36	18471A0437	10	10	15	6	31	10	10	20	9	39	37
37	18471A0438	10	10	16	5	31	8	0	20	9	37	36
38	18471A0439	8	A	A	A	8	1	A	A	A	1	7
39	18471A0440	10	0	14	2	26	10	0	17	4	31	30
40	18471A0441	10	0	17	4	31	8	0	20	5	33	33
41	18471A0442	8	0	13	5	26	7	0	17	1	25	26
42	18471A0443	10	9	18	7	35	9	1	20	6	35	35
43	18471A0444	10	0	8	5	23	6	0	8	1	15	21
44	18471A0445	10	0	19	6	35	10	0	20	4	34	35
45	18471A0446	10	0	18	4	32	10	9	19	7	36	35
46	18471A0447	10	8	20	5	35	10	0	20	7	37	37
47	18471A0448	A	10	19	8	37	10	10	19	8	37	37

48	18471A0449	10	6	13	4	27	A	0	12	5	17	25
49	18471A0450	10	10	16	4	30	8	0	20	6	34	33
50	18471A0451	10	0	18	9	37	10	0	19	6	35	37
51	18471A0452	8	8	13	9	30	6	0	16	4	26	29
52	18471A0453	9	10	17	6	33	10	9	0	6	16	29
53	18471A0454	10	0	16	6	32	10	0	0	5	15	28
54	18471A0455	10	0	16	5	31	10	0	19	7	36	35
55	18471A0456	9	9	13	6	28	10	7	20	7	37	35
56	18471A0457	A	10	18	9	37	2	10	20	7	37	37
57	18471A0458	9	10	20	9	39	10	10	20	7	37	39
58	18471A0459	8	0	18	4	30	10	0	20	4	34	33
59	18471A0460	9	0	17	7	33	7	0	18	8	33	33

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(AUTONOMOUS)

(R16) 2018 BATCH III B.TECH I SEM FINAL INTERNAL MARKS-2020-21

BRANCH/SEC - ECE/B

SUBJECT NAME & CODE : AUTOMOTIVE ELECTRONICS (OPEN ELECTIVE-I) (R16CC31OE6)

SL.NO.	H.T.NO.	A1	A2	D1	O1	CYCLE-1	A3	A4	D2	O2	CYCLE-2	TOTAL
1	18471A0461	9	8	18	4	31	10	0	16	5	31	31
2	18471A0463	10	4	20	5	35	5	10	20	8	38	38
3	18471A0464	9	0	17	4	30	10	0	17	6	33	33
4	18471A0465	A	0	14	5	19	A	0	4	8	12	18

5	18471A0466	10	2	18	3	31	A	0	18	5	23	29
6	18471A0467	A	10	17	2	29	10	0	18	2	30	30
7	18471A0468	6	3	20	6	32	9	0	18	7	34	34
8	18471A0470	10	10	20	5	35	10	0	20	6	36	36
9	18471A0471	10	2	16	5	31	10	0	18	4	32	32
10	18471A0472	9	10	19	5	34	10	0	20	6	36	36
11	18471A0473	10	10	20	6	36	9	0	19	5	33	36
12	18471A0474	A	10	14	4	28	10	0	14	9	33	32
13	18471A0475	10	10	9	6	25	10	9	20	7	37	34
14	18471A0476	4	8	14	6	28	9	0	14	7	30	30
15	18471A0477	9	5	20	4	33	10	0	20	6	36	36
16	18471A0478	9	9	16	4	29	10	0	18	4	32	32
17	18471A0479	9	7	19	6	34	10	0	18	5	33	34
18	18471A0480	10	10	19	5	34	9	10	19	5	34	34
19	18471A0481	10	9	20	5	35	10	1	19	5	34	35
20	18471A0482	9	0	16	5	30	10	0	19	9	38	36
21	18471A0483	10	0	15	8	33	10	0	12	5	27	32
22	18471A0484	10	8	19	4	33	10	0	19	7	36	36
23	18471A0485	10	0	20	6	36	10	0	18	5	33	36
24	18471A0486	10	10	20	10	40	10	10	20	9	39	40
25	18471A0487	10	10	20	4	34	10	0	17	5	32	34
26	18471A0488	6	0	10	3	19	10	0	14	4	28	26
27	18471A0489	9	0	19	7	35	10	0	16	4	30	34
28	18471A0490	10	10	20	6	36	9	0	20	6	35	36
29	18471A0491	A	10	16	5	31	10	0	19	7	36	35
30	18471A0492	10	5	14	3	27	A	A	A	A	0	21
31	18471A0493	0	10	20	6	36	10	0	18	6	34	36

32	18471A0494	A	A	A	A	0	9	A	A	A	9	7
33	18471A0495	9	1	17	2	28	10	0	19	8	37	35
34	18471A0496	6	0	14	4	24	10	0	17	4	31	30
35	18471A0497	1	0	6	2	9	9	1	13	6	28	24
36	18471A0498	9	10	13	5	28	10	0	10	9	29	29
37	18471A0499	10	5	17	5	32	10	0	15	6	31	32
38	18471A04A1	9	7	16	6	31	9	0	20	8	37	36
39	18471A04A2	10	10	18	6	34	9	0	20	7	36	36
40	18471A04A3	10	8	16	6	32	A	8	19	10	37	36
41	18471A04A4	10	10	18	7	35	9	9	18	6	33	35
42	18471A04A5	9	10	14	3	27	9	A	A	A	9	23
43	18471A04A6	10	0	16	5	31	10	0	20	7	37	36
44	18471A04A7	A	0	4	3	7	9	A	A	A	9	9
45	18471A04A8	9	7	14	4	27	A	9	20	6	35	33
46	18471A04A9	A	0	3	2	5	9	0	12	3	24	20
47	18471A04B0	8	10	15	4	29	10	0	20	3	33	32
48	18471A04B1	8	7	13	5	26	10	0	18	4	32	31
49	18471A04B2	2	6	12	3	21	10	A	A	A	10	19
50	18471A04B3	8	6	15	7	30	10	0	17	5	32	32
51	18471A04B4	10	5	20	6	36	7	0	18	3	28	34
52	18471A04B5	9	7	16	4	29	10	0	16	4	30	30
53	18471A04B6	9	10	14	7	31	10	0	18	6	34	34
54	18471A04B7	10	9	16	6	32	A	0	16	7	23	30
55	18471A04B8	9	6	20	3	32	10	0	20	7	37	36
56	18471A04B9	9	0	16	7	32	A	7	18	5	30	32
57	18471A04C0	5	0	15	6	26	10	A	A	A	10	22

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(R16) 2018 BATCH III B.TECH I SEM FINAL INTERNAL MARKS-2020-21

BRANCH/SEC - ECE/C		SUBJECT NAME & CODE : AUTOMOTIVE ELECTRONICS (OPEN ELECTIVE-I) (R16CC31OE6)										
SL.NO.	**H.T.NO.**	**A1**	**A2**	**D1**	**O1**	**CYCLE-1**	**A3**	**A4**	**D2**	**O2**	**CYCLE-2**	**TOTAL**
1	18471A04C1	5	0	14	5	24	9	0	7	2	18	23
2	18471A04C2	10	8	20	3	33	10	0	20	7	37	36
3	18471A04C3	10	0	19	4	33	9	0	17	6	32	33
4	18471A04C4	10	10	20	3	33	10	10	20	3	33	33
5	18471A04C5	10	4	20	5	35	10	0	20	8	38	38
6	18471A04C6	10	0	19	3	32	9	0	19	3	31	32
7	18471A04C7	10	10	20	4	34	10	10	20	7	37	37
8	18471A04C9	10	10	20	4	34	10	10	20	8	38	37
9	18471A04D0	10	0	20	3	33	10	0	20	6	36	36
10	18471A04D1	10	0	20	7	37	10	0	20	6	36	37
11	18471A04D2	9	10	20	5	35	A	10	20	6	36	36
12	18471A04D3	10	0	20	4	34	9	0	20	5	34	34
13	18471A04D4	10	2	20	6	36	10	0	20	8	38	38
14	18471A04D5	10	0	20	7	37	10	2	19	6	35	37
15	18471A04D6	10	1	20	5	35	10	0	20	5	35	35

16	18471A04D7	10	0	20	5	35	10	0	20	6	36	36
17	18471A04D8	10	10	20	5	35	10	10	20	7	37	37
18	18471A04D9	10	0	18	2	30	9	1	19	5	33	33
19	18471A04E0	10	10	19	5	34	10	0	20	6	36	36
20	18471A04E1	10	9	20	8	38	10	9	20	10	40	40
21	18471A04E2	10	A	A	A	10	10	9	19	4	33	28
22	18471A04E3	10	0	20	2	32	10	8	20	8	38	37
23	18471A04E4	10	7	20	7	37	10	1	20	9	39	39
24	18471A04E5	10	5	20	4	34	10	8	20	7	37	37
25	18471A04E7	1	7	19	4	30	A	0	18	6	24	29
26	18471A04E8	10	9	20	4	34	A	10	20	7	37	37
27	18471A04E9	A	10	20	4	34	8	0	15	7	30	33
28	18471A04F0	A	10	20	6	36	10	0	20	10	40	39
29	18471A04F1	10	4	20	6	36	10	0	20	9	39	39
30	18471A04F2	10	0	20	4	34	8	0	20	9	37	37
31	18471A04F3	10	0	20	3	33	10	0	20	10	40	39
32	18471A04F4	10	0	20	5	35	10	0	20	7	37	37
33	18471A04F5	10	1	20	6	36	A	10	20	7	37	37
34	18471A04F6	10	0	20	6	36	9	0	20	8	37	37
35	18471A04F7	10	2	20	5	35	9	0	20	7	36	36
36	18471A04F8	10	A	A	A	10	8	0	20	7	35	29
37	18471A04F9	A	A	A	A	0	9	0	19	5	33	25
38	18471A04G0	10	5	20	4	34	10	7	20	6	36	36
39	18471A04G1	10	0	20	7	37	10	7	20	7	37	37
40	18471A04G2	10	10	20	6	36	10	9	20	6	36	36
41	18471A04G3	10	2	20	7	37	10	8	20	10	40	40
42	18471A04G4	10	0	20	5	35	8	0	20	7	35	35

43	18471A04G5	10	0	20	4	34	10	0	20	4	34	34
44	18471A04G6	A	10	20	7	37	10	9	20	10	40	40
45	18471A04G7	10	0	20	7	37	10	10	20	10	40	40
46	18471A04G8	7	0	20	5	32	10	0	20	3	33	33
47	18471A04G9	10	2	20	7	37	10	0	20	10	40	40
48	18471A04H0	10	1	20	5	35	10	0	20	7	37	37
49	18471A04H1	10	0	20	6	36	10	8	20	6	36	36
50	18471A04H2	10	0	20	7	37	10	0	20	9	39	39
51	18471A04H3	5	8	19	7	34	9	0	20	9	38	37
52	18471A04H4	9	0	18	6	33	9	0	18	8	35	35
53	18471A04H5	10	0	20	6	36	10	0	20	5	35	36
54	18471A04H6	9	0	20	5	34	9	0	14	3	26	32
55	18471A04H7	5	10	20	6	36	10	0	20	9	39	39
56	18471A04H8	10	0	20	7	37	10	10	20	6	36	37
57	18471A04H9	10	1	20	7	37	A	10	20	5	35	37
58	18471A04I0	4	1	20	6	30	9	0	16	4	29	30

NARASARAOPETA ENGINEERING COLLEGE::NARASARAOPET

(AUTONOMOUS)

(R16) 2018 BATCH III B.TECH I SEM FINAL INTERNAL MARKS-2020-21

BRANCH/SEC - ECE/D

SUBJECT NAME & CODE : AUTOMOTIVE ELECTRONICS (OPEN ELECTIVE-I) (R16CC31OE6)

SL.NO.	H.T.NO.	A1	A2	D1	O1	CYCLE-1	A3	A4	D2	O2	CYCLE-2	TOTAL

1	18471A04I1	7	9	18	6	33	9	0	14	3	26	32
2	18471A04I2	10	7	20	5	35	10	8	20	4	34	35
3	18471A04I3	10	9	20	5	35	8	8	20	6	34	35
4	18471A04I4	10	0	19	6	35	10	0	14	4	28	34
5	18471A04I5	10	0	20	6	36	10	0	14	6	30	35
6	18471A04I6	9	0	19	6	34	9	0	10	2	21	31
7	18471A04I7	10	10	20	4	34	9	6	16	3	28	33
8	18471A04I8	9	8	18	3	30	9	2	14	4	27	30
9	18471A04I9	10	10	20	4	34	10	0	20	5	35	35
10	18471A04J0	10	10	20	4	34	10	10	20	4	34	34
11	18471A04J1	10	0	20	5	35	10	0	20	5	35	35
12	18471A04J2	5	10	20	5	35	10	0	16	4	30	34
13	18471A04J3	0	10	20	7	37	10	0	20	2	32	36
14	18471A04J4	8	10	20	4	34	9	10	20	4	34	34
15	18471A04J5	3	10	17	4	31	10	0	17	3	30	31
16	18471A04J6	10	6	20	5	35	10	0	14	3	27	33
17	18471A04J7	10	0	20	6	36	10	0	20	6	36	36
18	18471A04J8	9	4	17	5	31	10	0	17	2	29	31
19	18471A04J9	10	10	20	6	36	10	0	20	3	33	36
20	18471A04K0	6	A	A	A	6	9	0	20	2	31	25
21	18471A04K1	3	10	20	1	31	9	8	19	3	31	31
22	18471A04K2	4	10	20	8	38	10	0	18	5	33	37
23	18471A04K3	6	10	20	3	33	10	0	19	6	35	35
24	18471A04K4	10	0	20	4	34	10	6	20	5	35	35
25	18471A04K5	10	4	20	4	34	8	0	16	6	30	33
26	18471A04K6	10	0	20	5	35	A	10	20	6	36	36
27	18471A04K7	10	0	20	6	36	9	2	20	5	34	36

28	18471A04K8	10	6	20	6	36	9	10	20	7	37	37
29	18471A04K9	9	0	19	3	31	7	0	17	4	28	31
30	18471A04L0	10	0	20	5	35	A	6	20	4	30	34
31	18471A04L1	10	0	20	3	33	10	0	20	6	36	36
32	18471A04L2	9	0	20	5	34	A	0	20	5	25	32
33	18471A04L3	A	5	18	3	26	A	10	16	3	29	29
34	18471A04L4	10	0	19	5	34	9	8	20	4	33	34
35	18471A04L5	10	0	18	4	32	10	0	20	4	34	34
36	18471A04L6	7	10	20	4	34	10	0	20	5	35	35
37	18471A04L7	10	10	20	4	34	7	0	20	7	34	34
38	18471A04L8	7	10	20	5	35	10	0	20	4	34	35
39	18471A04L9	A	0	18	5	23	8	7	17	4	29	28
40	18471A04M1	10	0	20	7	37	10	0	20	4	34	37
41	18471A04M2	10	0	17	3	30	10	0	16	5	31	31
42	18471A04M3	6	5	20	5	31	10	0	20	5	35	34
43	18471A04M4	7	5	20	5	32	10	0	20	7	37	36
44	18471A04M5	10	6	18	3	31	10	9	20	6	36	35
45	19475A0401	8	10	20	5	35	A	10	20	5	35	35
46	19475A0402	10	10	20	5	35	10	10	20	4	34	35
47	19475A0403	10	5	20	7	37	10	0	20	4	34	37
48	19475A0404	10	5	20	8	38	10	0	20	6	36	38
49	19475A0405	10	1	20	10	40	10	0	20	7	37	40
50	19475A0406	10	2	20	6	36	10	0	20	7	37	37
51	19475A0407	10	6	16	4	30	9	0	18	3	30	30
52	19475A0408	10	2	20	6	36	9	0	20	2	31	35
53	19475A0409	10	10	20	5	35	10	8	20	4	34	35
54	19475A0410	10	10	20	6	36	9	10	20	8	38	38

55	19475A0411	10	0	16	4	30	10	8	20	2	32	32
56	19475A0412	10	4	16	5	31	9	4	20	4	33	33
57	19475A0413	10	0	17	5	32	10	8	20	3	33	33
58	19475A0414	10	0	20	5	35	10	2	20	6	36	36
59	19475A0415	10	10	20	5	35	10	1	20	6	36	36
60	19475A0416	10	2	20	4	34	10	6	20	3	33	34
61	19475A0417	6	10	20	6	36	10	1	20	5	35	36
62	19475A0418	10	0	20	10	40	10	8	20	8	38	40
63	19475A0419	10	0	14	4	28	A	0	12	6	18	26
64	19475A0420	10	0	20	4	34	A	10	20	4	34	34
65	19475A0421	10	1	20	8	38	9	2	20	6	35	38
66	19475A0422	A	10	20	3	33	10	1	20	6	36	36
67	19475A0423	10	1	20	7	37	10	10	20	5	35	37
68	19475A0424	10	0	19	3	32	9	0	5	6	20	29
69	19475A0425	9	0	16	6	31	9	0	17	5	31	31
70	19475A0426	10	0	20	6	36	8	0	18	6	32	35
71	17471A0402	A	A	A	A	0	A	A	A	A	0	0

Signature of the Faculty **Signature of the HOD**

NARASARAOPETA ENGINEERING COLLEGE::NARASARAOPET				
(AUTONOMOUS)				
(R16) 2018 BATCH III B.TECH I SEM FINAL INTERNAL MARKS-2020-21				
SL.NO.	**H.T.NO.**	**STUDENT NAME**	**AUTOMOTIVE ELECTRONICS (OPEN ELECTIVE-I) (R16CC31OE6)**	
1	18471A0401	ANUMALASETTY DHARANI	R16CC31OE6	35
2	18471A0402	AVULA NAVEEN	R16CC31OE6	24
3	18471A0403	BADUGU PRAKASH BABU	R16CC31OE6	37
4	18471A0405	BALLI PALLI SAI VENKAT	R16CC31OE6	35
5	18471A0406	BANDARU SAI KUMAR	R16CC31OE6	31
6	18471A0407	BATHULA SRINU	R16CC31OE6	34
7	18471A0408	BEERAM UPENDRA REDDY	R16CC31OE6	19
8	18471A0409	BHUVANAM NAGA VAMSI	R16CC31OE6	26
9	18471A0410	BOBBILLA KARTHIK	R16CC31OE6	32
10	18471A0411	BODLAPATI SRAVYA	R16CC31OE6	33
11	18471A0412	BURRI NAGAVENI	R16CC31OE6	38
12	18471A0413	CHAKKA MANOJ KUMAR	R16CC31OE6	37
13	18471A0414	CHITTINENI SIDDHARDHA	R16CC31OE6	36
14	18471A0415	CHOPPARA MANOJ KUMAR	R16CC31OE6	30
15	18471A0416	DASIREDDY NAGI REDDY	R16CC31OE6	35
16	18471A0417	DEVARAKONDA NITISH KUMAR REDDY	R16CC31OE6	27
17	18471A0418	DEVARAPALLI KUSUMITHA	R16CC31OE6	35
18	18471A0419	GADIBOYINA JAYENDRA KUMAR	R16CC31OE6	34
19	18471A0420	GAYAM RAMYA	R16CC31OE6	37
20	18471A0421	GOPU GANESH SIVA SAI	R16CC31OE6	37
21	18471A0422	GOPU SAI MOULI	R16CC31OE6	35

22	18471A0423	GOTTIPATI VAMSI	R16CC31OE6	34
23	18471A0424	GUMMALAMPATI MANOJ KUMAR	R16CC31OE6	35
24	18471A0425	INAGANTI BHARATH TEJA	R16CC31OE6	8
25	18471A0426	JALADI SAI KRISHNA	R16CC31OE6	30
26	18471A0427	JILLELLAMUDI SRINIVASU	R16CC31OE6	33
27	18471A0428	JUPUDI PAVAN KUMAR	R16CC31OE6	26
28	18471A0429	KANAMARLAPUDI LAKSHMI SAI SUBHASH	R16CC31OE6	38
29	18471A0430	KARNAM SREE DEVI	R16CC31OE6	38
30	18471A0431	KASIREDDY NAGAMAHENDRA	R16CC31OE6	36
31	18471A0432	KOLLU SAI SURYA	R16CC31OE6	23
32	18471A0433	KOMMALAPATI CHINNI KRISHNA	R16CC31OE6	33
33	18471A0434	KUNAGU ASLESHASAIKUMAR	R16CC31OE6	30
34	18471A0435	KUNCHAPU SRIKANTH	R16CC31OE6	35
35	18471A0436	MADASU VIVEK	R16CC31OE6	30
36	18471A0437	MADHAVARAPU MANOHAR	R16CC31OE6	37
37	18471A0438	MARELLA VENKATA SIVA RAVI TEJA	R16CC31OE6	36
38	18471A0439	MATLAPUDI ANIL KUMAR	R16CC31OE6	7
39	18471A0440	MEDISETTY MANOHAR	R16CC31OE6	30
40	18471A0441	MIRIYALA VENKATESH	R16CC31OE6	33
41	18471A0442	MURAM SASIDHAR REDDY	R16CC31OE6	26
42	18471A0443	MUTHINENI ANJI BABU	R16CC31OE6	35
43	18471A0444	PAPASANI NAGA MANIKANTA REDDY	R16CC31OE6	21
44	18471A0445	PARELLA POOJITHA	R16CC31OE6	35
45	18471A0446	PATHAN MAHABOOB KHAN	R16CC31OE6	35
46	18471A0447	PONDUGULA BHAVYA LAKSHMI	R16CC31OE6	37
47	18471A0448	PULIPATI DEVI SRI SRESHTA	R16CC31OE6	37
48	18471A0449	SENAGALA CHAITANYA REDDY	R16CC31OE6	25

49	18471A0450	SHAIK AYESHA SIDDIKA	R16CC31OE6	33
50	18471A0451	SHAIK BURUHAN JANI	R16CC31OE6	37
51	18471A0452	SHAIK KARISHMA	R16CC31OE6	29
52	18471A0453	SHAIK MAHAMMAD ASHRAF	R16CC31OE6	29
53	18471A0454	SHAJAHAN SHAIK	R16CC31OE6	28
54	18471A0455	SIDDABATHUNI VENKATA HARSHITHA	R16CC31OE6	35
55	18471A0456	SURE YASWANTH REDDY	R16CC31OE6	35
56	18471A0457	TALLURI ANJALI	R16CC31OE6	37
57	18471A0458	UPPUTHOLLA TABITHA	R16CC31OE6	39
58	18471A0459	VEDANTHAM LAKSHMI MOULYA SRI	R16CC31OE6	33
59	18471A0460	VEERAMSETTY SWATHI	R16CC31OE6	33
60	18471A0461	ALAPATI KIRAN BABU	R16CC31OE6	31
61	18471A0463	ANNAPAREDDY ROHINI	R16CC31OE6	38
62	18471A0464	BADAM HARINI	R16CC31OE6	33
63	18471A0465	BATHULA DEVA RAJU	R16CC31OE6	18
64	18471A0466	BETHALA BULLI BABU	R16CC31OE6	29
65	18471A0467	BHUKYA SALAMMA	R16CC31OE6	30
66	18471A0468	BIJJAM PRASANNA	R16CC31OE6	34
67	18471A0470	BUDDA VENKATA SAI DURGA PRASAD	R16CC31OE6	36
68	18471A0471	BUSI NARAYANA	R16CC31OE6	32
69	18471A0472	CHILAKALA DIVYA	R16CC31OE6	36
70	18471A0473	CHILAKALA PRABHAVATHI	R16CC31OE6	36
71	18471A0474	DARIVEMULA EBINEZAR	R16CC31OE6	32
72	18471A0475	DEVARASETTY VENKATA SATYA SUBHASH	R16CC31OE6	34
73	18471A0476	ESKA RAMANJI REDDY	R16CC31OE6	30
74	18471A0477	GADE MANOJ KUMAR REDDY	R16CC31OE6	36
75	18471A0478	GAVIRIBOINA SANJAY	R16CC31OE6	32

76	18471A0479	GELLI HEMA SUNDARI	R16CC31OE6	34
77	18471A0480	GERA SANDHYA	R16CC31OE6	34
78	18471A0481	SARAYU SHAIK	R16CC31OE6	35
79	18471A0482	GUTHA VENKATESH	R16CC31OE6	36
80	18471A0483	INAVOLU HARISH	R16CC31OE6	32
81	18471A0484	JAJJARA AMULYA	R16CC31OE6	36
82	18471A0485	JEEDIMALLA VENKATA PAVAN KALYAN	R16CC31OE6	36
83	18471A0486	KAREDLA VENKATA SAI NUBYA	R16CC31OE6	40
84	18471A0487	KARNATA GAYATHRI	R16CC31OE6	34
85	18471A0488	KASUKURTHI KIRAN KUMAR	R16CC31OE6	26
86	18471A0489	KOTHAPALLI CHARAN	R16CC31OE6	34
87	18471A0490	KOTHURI JASWANTHI	R16CC31OE6	36
88	18471A0491	KOTHURI UHA VENKATA SAI UJWALA	R16CC31OE6	35
89	18471A0492	KUNCHALA SAITEJA	R16CC31OE6	21
90	18471A0493	KUNISETTY V N S P L MAMATHA	R16CC31OE6	36
91	18471A0494	LAKKIMSETTY MANOJ VENKAT	R16CC31OE6	7
92	18471A0495	MADDI LEELA GOWRI LAVANYA	R16CC31OE6	35
93	18471A0496	MADDIRALA MANOJ KUMAR	R16CC31OE6	30
94	18471A0497	MAGULURU RAJASHEKAR	R16CC31OE6	24
95	18471A0498	MARRI SRINIVASARAO	R16CC31OE6	29
96	18471A0499	MEDIDA TEJA	R16CC31OE6	32
97	18471A04A1	MUKKU SUSHMA	R16CC31OE6	36
98	18471A04A2	NARISETTY SOWJANYA	R16CC31OE6	36
99	18471A04A3	NARU MARUTHI REDDY	R16CC31OE6	36
100	18471A04A4	NEELAM JYOTHIRMAI	R16CC31OE6	35
101	18471A04A5	PILLI AKHIL	R16CC31OE6	23
102	18471A04A6	POLISETTI SUSMITHA	R16CC31OE6	36

103	18471A04A7	RAVURI RAMA NAIDU	R16CC31OE6	9
104	18471A04A8	SHAIK ARSHATH	R16CC31OE6	33
105	18471A04A9	SHAIK KAREEM	R16CC31OE6	20
106	18471A04B0	SHAIK MADDIRALA NAZIROON	R16CC31OE6	32
107	18471A04B1	SHAIK MOHAMMAD AAQIL ASHRAF	R16CC31OE6	31
108	18471A04B2	SHAIK NAZEER AHMAD	R16CC31OE6	19
109	18471A04B3	SINGAMSETTY HANUMANTHA RAO	R16CC31OE6	32
110	18471A04B4	THONDAPI BHARGAVI	R16CC31OE6	34
111	18471A04B5	VELAGADA HEMA SUNDAR	R16CC31OE6	30
112	18471A04B6	VENNA NAGENDRA REDDY	R16CC31OE6	34
113	18471A04B7	VITTALADEVUNI AKHILKRISHNA	R16CC31OE6	30
114	18471A04B8	VUTUKURI SRAVANI	R16CC31OE6	36
115	18471A04B9	YAKKALA NIKILESH	R16CC31OE6	32
116	18471A04C0	YARRA NAVEEN	R16CC31OE6	22
117	18471A04C1	ALLADI GOPALA KRISHNA	R16CC31OE6	23
118	18471A04C2	AMIRISETTY VENKATA SAI LAKSHMI	R16CC31OE6	36
119	18471A04C3	ANIKALA ROHITH REDDY	R16CC31OE6	33
120	18471A04C4	ANNEM SRINIVASA RAO	R16CC31OE6	33
121	18471A04C5	ANUMALASETTY SRAVANI	R16CC31OE6	38
122	18471A04C6	BADDULA RAVI TEJA	R16CC31OE6	32
123	18471A04C7	BANDARU RAVI TEJA	R16CC31OE6	37
124	18471A04C9	BITTU NARESH	R16CC31OE6	37
125	18471A04D0	BODDAPATI PAVANI	R16CC31OE6	36
126	18471A04D1	BOGIRI YAMALAIAH	R16CC31OE6	37
127	18471A04D2	BOILLA PAVAN KALYAN REDDY	R16CC31OE6	36
128	18471A04D3	BOPPUDI ROHITH SURYA	R16CC31OE6	34
129	18471A04D4	CHAKKA V S N S L TEJASWINI	R16CC31OE6	38

130	18471A04D5	CHILAKALA SRI HANUMAN SANJAY GUPTHA	R16CC31OE6	37
131	18471A04D6	DUDDUKURI SOWJANYA	R16CC31OE6	35
132	18471A04D7	EDULA MEGHANA	R16CC31OE6	36
133	18471A04D8	GADE MALLESWARI	R16CC31OE6	37
134	18471A04D9	GATTINENI YASHWANTH	R16CC31OE6	33
135	18471A04E0	GOTTIPATI AKHILA	R16CC31OE6	36
136	18471A04E1	GUDA VISHNU GOVARDHAN REDDY	R16CC31OE6	40
137	18471A04E2	INJAPALLI ISSAC	R16CC31OE6	28
138	18471A04E3	IRLAPATI SUDHEER	R16CC31OE6	37
139	18471A04E4	IRRI SRAVANI	R16CC31OE6	39
140	18471A04E5	KADEM DHANA LAKSHMI	R16CC31OE6	37
141	18471A04E7	KOTU SAIKRISHNA	R16CC31OE6	29
142	18471A04E8	KUNCHEPU HARIKRISHNA	R16CC31OE6	37
143	18471A04E9	KURRA YASWANTH SAI RAM	R16CC31OE6	33
144	18471A04F0	MADDU CHAITHANYA KUMAR	R16CC31OE6	39
145	18471A04F1	MALLEMSETTI REVATHI	R16CC31OE6	39
146	18471A04F2	MANDALI RAVI TEJA	R16CC31OE6	37
147	18471A04F3	MEKAPOTHU NARSI REDDY	R16CC31OE6	39
148	18471A04F4	MELAM SINDHU	R16CC31OE6	37
149	18471A04F5	MINDALA RAJA	R16CC31OE6	37
150	18471A04F6	MODADUGU VINOD BABU	R16CC31OE6	37
151	18471A04F7	MULAVEESALA GANESH	R16CC31OE6	36
152	18471A04F8	NAMBURI ABHISHEK	R16CC31OE6	29
153	18471A04F9	PALAPARTHI RAKESH	R16CC31OE6	25
154	18471A04G0	PATTAN ABDUL KALESHA VALI	R16CC31OE6	36
155	18471A04G1	PEDDETI BHAGYAVATHI	R16CC31OE6	37
156	18471A04G2	POKURI RUPESH	R16CC31OE6	36

157	18471A04G3	PONUGOTI VIJAYKRISHNA	R16CC31OE6	40
158	18471A04G4	POOSAPATI BHANU PRAKASH REDDY	R16CC31OE6	35
159	18471A04G5	PURIMITLA BHAVANI	R16CC31OE6	34
160	18471A04G6	RAGAM SHANMUKA VENKATESH	R16CC31OE6	40
161	18471A04G7	RAMYA PRIYA MEKA	R16CC31OE6	40
162	18471A04G8	SAI PRAVEEN REDDY BAKKA	R16CC31OE6	33
163	18471A04G9	SHAIK JOHNVALI	R16CC31OE6	40
164	18471A04H0	SHAIK MUZEEF	R16CC31OE6	37
165	18471A04H1	SHAIK NASEEMA	R16CC31OE6	36
166	18471A04H2	SHAIK NASEEMA	R16CC31OE6	39
167	18471A04H3	SHAIK SAJID	R16CC31OE6	37
168	18471A04H4	SHAIK VASEEM	R16CC31OE6	35
169	18471A04H5	SINGAREDDY RAJA SEKHAR REDDY	R16CC31OE6	36
170	18471A04H6	SRIRAMANENI SAI RAM	R16CC31OE6	32
171	18471A04H7	SYED MASIVULLA	R16CC31OE6	39
172	18471A04H8	THADIBOINA APARNA	R16CC31OE6	37
173	18471A04H9	VARLA IJACK	R16CC31OE6	37
174	18471A04I0	YENAGANDLA BALASUBRAMANYAM	R16CC31OE6	30
175	17471A04M9	BONTHA NAVEEN	R16CC31OE6	0
176	18471A04I1	ANNALADASU PRASAD RAO	R16CC31OE6	32
177	18471A04I2	BATCHU LEELA NAGA SASANKA	R16CC31OE6	35
178	18471A04I3	BATHULA ANUMOHAN REDDY	R16CC31OE6	35
179	18471A04I4	CHINTHAKUNTA SAI TEJA	R16CC31OE6	34
180	18471A04I5	CHUPURI SAILAJA	R16CC31OE6	35
181	18471A04I6	DAVULURI BHANU PRAKASH	R16CC31OE6	31
182	18471A04I7	GALLA MALLIKARJUNA RAO	R16CC31OE6	33
183	18471A04I8	GANTA GOPI KRISHNA	R16CC31OE6	30

184	18471A04I9	GATTUPALLI LAKSHMI PRAVALLIKA	R16CC31OE6	35
185	18471A04J0	JUNUBOYINA SRINIVASARAO	R16CC31OE6	34
186	18471A04J1	KAMBALA NAVYA HARIKA	R16CC31OE6	35
187	18471A04J2	KAMEPALLI HARISH	R16CC31OE6	34
188	18471A04J3	KANAPARTHI ROHITH	R16CC31OE6	36
189	18471A04J4	KARANAM GOPI CHAND	R16CC31OE6	34
190	18471A04J5	LINGAMGUNTLA SHAIK AMEER BASHA	R16CC31OE6	31
191	18471A04J6	MALAMPATI NAVEEN	R16CC31OE6	33
192	18471A04J7	MANDAVA PRANAY KUMAR	R16CC31OE6	36
193	18471A04J8	MARRIKANTI VEERA CHARY	R16CC31OE6	31
194	18471A04J9	MUDDAPATI SAI TEJA	R16CC31OE6	36
195	18471A04K0	NARNE PAVANESWAR	R16CC31OE6	25
196	18471A04K1	PASAM JAYA SAI REDDY	R16CC31OE6	31
197	18471A04K2	PERIGISETTY SURESH	R16CC31OE6	37
198	18471A04K3	PERLA BHAVANI	R16CC31OE6	35
199	18471A04K4	POLURI HARI PRIYA REDDY	R16CC31OE6	35
200	18471A04K5	PONUGOTI SIVA MANIKANTA SAI	R16CC31OE6	33
201	18471A04K6	RAJANALA KARTHIKEYA	R16CC31OE6	36
202	18471A04K7	SARANGI VENKATA SAI	R16CC31OE6	36
203	18471A04K8	SHAIK ABDUL BASHA	R16CC31OE6	37
204	18471A04K9	SHAIK BAJI	R16CC31OE6	31
205	18471A04L0	SHAIK FAREED BABA	R16CC31OE6	34
206	18471A04L1	SHAIK HAPPSA	R16CC31OE6	36
207	18471A04L2	SHAIK SADDAM HUSSAIN	R16CC31OE6	32
208	18471A04L3	SHAIK TANVIR	R16CC31OE6	29
209	18471A04L4	SHAIK UMRE FAROOQ	R16CC31OE6	34
210	18471A04L5	SYED MOHAMMAD ALI	R16CC31OE6	34

211	18471A04L6	TAVVA KANAKA TEJA	R16CC31OE6	35
212	18471A04L7	THANIGUNDALA RAJASEKHAR REDDY	R16CC31OE6	34
213	18471A04L8	THIMMISETTY ANIL KUMAR	R16CC31OE6	35
214	18471A04L9	VEERLA THRINADH	R16CC31OE6	28
215	18471A04M1	YARLAGADDA NAVYA SAI	R16CC31OE6	37
216	18471A04M2	LAKKAKULA AKASH	R16CC31OE6	31
217	18471A04M3	NELAKURTHI HARITHA	R16CC31OE6	34
218	18471A04M4	ANANTHA LAKSHMI RISHITHA	R16CC31OE6	36
219	18471A04M5	PATHAN BALASAIDA	R16CC31OE6	35
220	19475A0401	KOLAGANI TEJANJALI	R16CC31OE6	35
221	19475A0402	SHAIK MASUDA	R16CC31OE6	35
222	19475A0403	MUTLURI DAVID	R16CC31OE6	37
223	19475A0404	VINUKONDA PRIYANKA	R16CC31OE6	38
224	19475A0405	BANDARU HARIKA	R16CC31OE6	40
225	19475A0406	BANTUPALLI SUDHEER KUMAR	R16CC31OE6	37
226	19475A0407	KATTAMURI JAGADEESH KUMAR	R16CC31OE6	30
227	19475A0408	TELAGATHOTI NAVEEN	R16CC31OE6	35
228	19475A0409	UDATHA NARENDRA	R16CC31OE6	35
229	19475A0410	PEDDISETTI PRABHU KUMAR	R16CC31OE6	38
230	19475A0411	EEMANI LAKSHMI NARAYANA	R16CC31OE6	32
231	19475A0412	MANNEM SAMBASIVA RAO	R16CC31OE6	33
232	19475A0413	PARITALA SREEKANTH	R16CC31OE6	33
233	19475A0414	VADDI NAGALAKSHMI	R16CC31OE6	36
234	19475A0415	BOLE SRINU	R16CC31OE6	36
235	19475A0416	ARIKATLA VENU GOPALA REDDY	R16CC31OE6	34
236	19475A0417	KATTEKOTA JASWANTHIKA SAI KOTESWARI	R16CC31OE6	36
237	19475A0418	PAMIDIMALLA SAMUEL JOE	R16CC31OE6	40

238	19475A0419	GALIDINNE PAVAN KALYAN	R16CC31OE6	26
239	19475A0420	PALAPARTHI CHANDRABABU	R16CC31OE6	34
240	19475A0421	ALAKUNTA SRIHARI	R16CC31OE6	38
241	19475A0422	BALIJEPALLI GANGAMMA	R16CC31OE6	36
242	19475A0423	GUDURI RAJASREE	R16CC31OE6	37
243	19475A0424	KATIKAM MAHESH BABU	R16CC31OE6	29
244	19475A0425	KOLA JAYANTH SAI GANESH	R16CC31OE6	31
245	19475A0426	KOTTAPALLI SAIKUMAR	R16CC31OE6	35
246	17471A0402	ANUMALASETTY DHARANI	R16CC31OE6	0