



# VELS



INSTITUTE OF SCIENCE, TECHNOLOGY  
& ADVANCED STUDIES (VISTAS)  
(Deemed to be University under section 3 of UGC Act, 1956)  
NAAC ACCREDITED WITH 'A' GRADE

## **B.E Automobile Engineering**

### **Curriculum and Syllabus**

**Effective from the Academic year  
2018-2019**

**Department of Automobile Engineering  
School of Engineering**

## **PROGRAM EDUCATIONAL OBJECTIVES (PEOS)**

**PEO-1:** The graduates shall have ability to understand and apply core subject knowledge to various automotive engineering problems.

**PEO-2:** The graduates will be able to work in team, investigate the problem, apply engineering knowledge and present a trustworthy solution.

**PEO-3:** The graduates shall be competent in continue their intellectual expansion ability for lifetime learning by pursuing higher education.

**PEO-4:** The graduates will exhibit professionalism in their chosen career and adapt to current technologies, trends and industrial needs.

**PEO-5:** The graduates shall have good communication and leadership skill, high moral and social values.

## **PROGRAM OUTCOMES (POS)**

**PO-1: Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

**PO-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.

**PO-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.

**PO-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.

**PO-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.

**PO-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.

**PO-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.

**PO-8: Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

**PO-9: Individual and teamwork:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

**PO-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.

**PO-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.

**PO-12: Lifelong 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.

### **PROGRAM SPECIFIC OUTCOMES (PSOS)**

**PSO-1:** To apply the concepts of design, development, research, innovation, analysis and maintenance of automotives in the manufacturing and servicing industries.

**PSO-2:** To be employable in Automotive, Manufacturing, Design, Production industries, academic institutes, Research and development organizations.

**PSO-3:** To Identify, formulate and solve automotive engineering problems in the research laboratory and perform multidisciplinary tasks in Automobile Engineering and allied areas.

**PSO-4:** To work as an expert and/or as an entrepreneur by applying Automotive engineering principles and management practices.

**PSO-5:** To pursue higher degrees in engineering and other professional fields to expand their technical and professional skills.

## BOARD OF STUDIES

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S.No	Name	Affiliation	Role
1	Dr. L.KARIKALAN	<i>Associate Professor and Head</i> Dept. of Automobile Engineering VISTAS, Chennai	Chairman
2	Dr. GOLDEN RENJIT NIMAL	<i>Associate Professor</i> Dept. of Mechanical Engineering Bharath Institute of Higher Education and Research, Chennai	Academic Expert
3	Mr. JEROME PETER MOHANDAS	<i>Chief Executive Officer</i> Jerry Motor Company, Chennai	Industrial Expert
4	Dr. M.CHANDRASEKARAN	<i>Director - Mechanical</i> Dept. of Mechanical Engineering VISTAS, Chennai	Internal Member
5	Dr. S.RAMASUBRAMANIAN	<i>Assistant Professor</i> Dept. of Automobile Engineering VISTAS, Chennai	Internal Member
6	Dr. M.RUBAN	<i>Assistant Professor</i> Dept. of Automobile Engineering VISTAS, Chennai	Internal Member
7	Mr. K. MATHAN	<i>Engineer</i> VE Commercial Vehicles Ltd., Chennai	Alumni

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**B.E. - AUTOMOBILE ENGINEERING DEGREE COURSE**  
**COURSE OF STUDY AND SCHEME OF ASSESSMENT**  
**(MINIMUM CREDITS TO BE EARNED: 170)**

Category	Code No.	Course	Hours/Week			C	Maximum Marks		
			L	T	P		CA	SEE	Total
<b>SEMESTER 1</b>									
HSC	18HSAU11	English	2	0	0	2	40	60	100
BSC	18BSAU11	Physics	3	1	0	4	40	60	100
BSC	18BSAU12	Mathematics - I	3	1	0	4	40	60	100
ESC	18ESAU11	Basic Electrical Engineering	3	1	0	4	40	60	100
ESC	18ESAU12	Engineering Graphics & Design	1	0	4	3	40	60	100
BSC	18BSAU13	Physics Laboratory	0	0	4	2	40	60	100
ESC	18ESAU13	Electrical Engineering Laboratory	0	0	2	1	40	60	100
HSC	18HSAU12	English Laboratory	0	0	2	1	40	60	100
<b>Total</b>			<b>12</b>	<b>3</b>	<b>12</b>	<b>21</b>	-	-	-
<b>SEMESTER 2</b>									
Category	Code No.	Course	Hours/Week			C	Maximum Marks		
			L	T	P		CA	SEE	Total
BSC	18BSAU21	Chemistry	3	1	0	4	40	60	100
BSC	18BSAU22	Mathematics - II	3	1	0	4	40	60	100
ESC	18ESAU21	Programming for Problem solving	3	0	0	3	40	60	100
BSC	18BSAU23	Chemistry Lab	0	0	4	2	40	60	100
ESC	18ESAU22	Programming for Problem Solving Lab	0	0	4	2	40	60	100
ESC	18ESAU23	Workshop/Engineering Practices	1	0	4	3	40	60	100
MC	18MCAU21	Constitution of India	0	0	0	0	-	-	-
<b>Total</b>			<b>10</b>	<b>2</b>	<b>12</b>	<b>18</b>	-	-	-

**B.E. - AUTOMOBILE ENGINEERING DEGREE COURSE  
COURSE OF STUDY AND SCHEME OF ASSESSMENT**

Category	Code No.	Course	Hours/Week			C	Maximum Marks		
			L	T	P		CA	SEE	Total
<b>SEMESTER 3</b>									
BSC	18BSAU31	Mathematics III	3	0	0	3	40	60	100
PCC	18PCAU31	Engineering Thermodynamics	3	0	0	3	40	60	100
ESC	18ESAU31	Electrical Drives and Control	3	0	0	3	40	60	100
PCC	18PCAU32	Automotive Engines	3	0	0	3	40	60	100
PCC	18PCAU33	Manufacturing Technology	3	0	0	3	40	60	100
PCC	18PCAU34	Fluid Mechanics and Machinery	3	0	0	3	40	60	100
PCC	18PCAU35	Electronics and Microprocessors Laboratory	0	0	2	1	40	60	100
PCC	18PCAU36	Fluid Mechanics & Strength of Materials Laboratory	0	0	2	1	40	60	100
HSMC	18HSAU31	Personality Development I	2	0	0	2	40	60	100
MC	18MCAU31	Industrial Safety	2	0	0	2	-	100	100
MC	18MCAU32	Industrial Visit/N.S.S	0	0	0	0	-	-	-
<b>Total</b>			<b>22</b>	<b>0</b>	<b>4</b>	<b>24</b>	-	-	-
<b>SEMESTER 4</b>									
Category	Code No.	Course	Hours/Week			C	Maximum Marks		
			L	T	P		CA	SEE	Total
BSC	18BSAU41	Mathematics IV	3	0	0	3	40	60	100
ESC	18PCAU41	Automotive Fuels and Lubricants	3	0	0	3	40	60	100
PCC	18PCAU42	Engineering Metallurgy	3	0	0	3	40	60	100
PCC	18PCAU43	Automotive Chassis	3	0	0	3	40	60	100
PCC	18PCAU44	Heat and Mass Transfer	3	1	0	4	40	60	100
MC	18MCAU41	Environmental Science and Engineering	3	0	0	3	40	60	100
HSMC	18HSAU41	Personality Development II	2	0	0	2	40	60	100
PCC	18PCAU45	Automotive Chassis Components Laboratory	0	0	2	1	40	60	100
PCC	18PCAU46	Automotive Engine Components Laboratory	0	0	2	1	40	60	100
HSC	18BESY41	Basic Life Skills/ Yoga	0	0	2	1	-	100	100
MC	18MCAU41	Industrial Visit/N.S.S	0	0	0	0	-	-	-
<b>Total</b>			<b>20</b>	<b>1</b>	<b>6</b>	<b>24</b>	-	-	-

**B.E. - AUTOMOBILE ENGINEERING DEGREE COURSE  
COURSE OF STUDY AND SCHEME OF ASSESSMENT**

Category	Code No.	Course	Hours/Week			C	Maximum Marks		
			L	T	P		CA	SEE	Total
<b>SEMESTER 5</b>									
PCC	18PCAU51	Automotive Transmission	3	1	0	4	40	60	100
PCC	18PCAU52	Automotive Engine Components Design	3	1	0	4	40	60	100
PCC	18PCAU53	Vehicle Design Data Characteristics	3	0	0	3	40	60	100
PCC	18PCAU54	Automotive Pollution and Control	3	0	0	3	40	60	100
OEC	18PEAU__	Open Elective - I	3	0	0	3	40	60	100
PEC	18PEAU__	Professional Elective - I	3	0	0	3	40	60	100
HSMC	18HSAE51	Personality Development III	2	0	0	2	40	60	100
PCC	18PCAE54	Performance and Emission Testing Laboratory	0	0	2	1	40	60	100
PCC	18PCAU55	Computer Aided Automobile Components Design Laboratory	0	0	2	1	40	60	100
MC	18MCAU51	Industrial Visit/N.S.S	0	0	0	0	-	-	-
<b>Total</b>			<b>20</b>	<b>2</b>	<b>4</b>	<b>24</b>	-	-	-
<b>SEMESTER 6</b>									
Category	Code No.	Course	Hours/Week			C	Maximum Marks		
			L	T	P		CA	SEE	Total
PCC	18PCAU61	Automotive Electrical and Electronics Systems	3	0	0	3	40	60	100
PCC	18PCAU62	Automotive Chassis Components Design	3	1	0	4	40	60	100
PCC	18PCAU63	Two and Three Wheelers	3	0	0	3	40	60	100
PEC	18PEAU__	Professional Elective - II	3	0	0	3	40	60	100
PEC	18PEAU__	Professional Elective - III	3	0	0	3	40	60	100
PEC	18PEAU__	Open Elective - II	3	0	0	3	40	60	100
HSMC	18HSAU61	Personality Development IV	2	0	0	2	40	60	100
PCC	18PCAU64	Automotive Electrical and Electronics Laboratory	0	0	2	1	40	60	100
SI	18PRAU61	Summer Internship	0	0	0	0	-	-	-
<b>Total</b>			<b>20</b>	<b>1</b>	<b>2</b>	<b>22</b>	-	-	-



**B.E. - AUTOMOBILE ENGINEERING DEGREE COURSE  
COURSE OF STUDY AND SCHEME OF ASSESSMENT**

Category	Code No.	Course	Hours/Week			C	Maximum Marks		
			L	T	P		CA	SEE	Total
<b>SEMESTER 7</b>									
PEC	18PEAU__	Professional Elective– IV	3	0	0	3	40	60	100
PEC	18PEAU__	Professional Elective - V	3	0	0	3	40	60	100
PEC	18PEAU__	Professional Elective - VI	3	0	0	3	40	60	100
OEC	18OEAU__	Open Elective - III	3	0	0	3	40	60	100
PCC	18PCAU71	Vehicle Maintenance and Reconditioning Lab	0	0	2	1	40	60	100
HSMC	18HSAU71	N.S.S	2	0	0	2	40	60	100
PROJ	18PRAU71	Project Phase I	0	0	10	5	40	60	100
<b>Total</b>			<b>14</b>	<b>0</b>	<b>12</b>	<b>20</b>	-	-	-
<b>SEMESTER 8</b>									
Category	Code No.	Course	Hours/Week			C	Maximum Marks		
			L	T	P		CA	SEE	Total
PEC	18PEAU__	Professional Elective - VII	3	0	0	3	40	60	100
OEC	18OEAU__	Open Elective - IV	3	0	0	3	40	60	100
OEC	18OEAU__	Open Elective - V	3	0	0	3	40	60	100
PROJ	18PRAU81	Project Phase II	0	0	16	8	40	60	100
<b>Total</b>			<b>9</b>	<b>0</b>	<b>16</b>	<b>17</b>	-	-	-

L : Lecture

T : Tutorial

P : Practical

C : Credits

CA : Continuous Assessment

SEE : Semester End Examination

HSC : Humanities and Social Sciences

BSC : Basic Science Courses

ESC : Engineering Science Courses

HSMC : Humanities and Social Sciences including Management courses

MC : Mandatory courses

PCC : Professional core courses

PEC : Professional Elective courses

OEC : Open Elective courses

SI : Summer Internship

PROJ : Project Work

**B.E. - AUTOMOBILE ENGINEERING**  
**CURRICULUM**  
**LIST OF PROFESSIONAL ELECTIVE COURSES**

Code No.	Course	Hours / Week			Credits
		Lecture	Tutorial	Practical	
18PEAU01	Vehicle Dynamics	3	0	0	3
18PEAU02	Vehicle Maintenance	3	0	0	3
18PEAU03	Simulation of I.C Engine Processes	3	0	0	3
18PEAU04	Vehicle Body Engineering	3	0	0	3
18PEAU05	Special Types of Vehicles	3	0	0	3
18PEAU06	Alternate Fuels and energy systems	3	0	0	3
18PEAU07	Finite Element Analysis	3	0	0	3
18PEAU08	Transport Management	3	0	0	3
18PEAU09	Automotive Aerodynamics	3	0	0	3
18PEAU10	Modern Automobile Accessories	3	0	0	3
18PEAU11	Vibration and Noise Engineering	3	0	0	3
18PEAU12	Advanced Theory of I.C. Engines	3	0	0	3
18PEAU13	Computer Integrated Manufacturing Systems	3	0	0	3
18PEAU14	Hydraulic and Pneumatic Systems	3	0	0	3
18PEAU15	Waste Heat Recovery and Co-Generation	3	0	0	3
18PEAU16	Design and Analysis of Composites	3	0	0	3
18PEAU17	Computational Fluid Dynamics	3	0	0	3
18PEAU18	Advanced Production Processes for Automotive Components	3	0	0	3
18PEAU19	Noise, Vibration and Harshness	3	0	0	3
18PEAU20	Metrology and Instrumentation	3	0	0	3
18PEAU21	Manufacturing Process of Automotive Components	3	0	0	3
18PEAU22	New Generation and Hybrid Vehicles	3	0	0	3
18PEAU23	Composite Materials & Structures	3	0	0	3
18PEAU24	Automotive Air-Conditioning	3	0	0	3
18PEAU25	Design of Jigs, Fixtures and Press Tools	3	0	0	3
18PEAU26	Robotics	3	0	0	3
18PEAU27	Supercharging and Scavenging	3	0	0	3
18PEAU28	Automotive Safety	3	0	0	3
18PEAU29	Mechanics of Machines	3	0	0	3
18PEAU30	Automotive Testing	3	0	0	3
18PEAU31	Design of Machine Elements	3	0	0	3
18PEAU32	Engine and Vehicle Management System	3	0	0	3
18PEAU33	Metrology and Measurements for Automobile Engineers	3	0	0	3
18PEAU34	Off Road Vehicles	3	0	0	3

**B.E. - AUTOMOBILE ENGINEERING  
CURRICULUM  
LIST OF OPEN ELECTIVE COURSES**

Code No.	Course	Hours / Week			Credits
		Lecture	Tutorial	Practical	
18GEAU01	Principles of Management and Professional Ethics	3	0	0	3
18GEAU02	Total Quality Management	3	0	0	3
18GEAU03	Quality Control and Reliability Engineering	3	0	0	3
18GEAU04	Supply Chain Management	3	0	0	3
18GEAU05	Operations Research	3	0	0	3
18GEAU06	Energy Audit and Energy Conservation Methods	3	0	0	3
18GEAU07	Entrepreneurship Development	3	0	0	3
18GEAU08	Value Analysis and Value Engineering	3	0	0	3
18GEAU09	Industrial Marketing and Market Research	3	0	0	3
18GEAU10	Disaster Management	3	0	0	3
18GEAU11	New Product Development	3	0	0	3

**LIST OF HUMANITIES AND SOCIAL SCIENCES COURSES**

Code No.	Course	Hours / Week			Credits
		Lecture	Tutorial	Practical	
18HSPD31	PERSONALITY DEVELOPMENT I	2	0	0	2
18HSPD41	PERSONALITY DEVELOPMENT II	2	0	0	2
18HSPD51	PERSONALITY DEVELOPMENT III	2	0	0	2
18HSPD61	PERSONALITY DEVELOPMENT IV	2	0	0	2
18HSAU71	NSS I	2	0	0	2
18HSAU72	NSS II	2	0	0	2
18HSAU73	NSS III	2	0	0	2
18HSAU74	NSS IV	2	0	0	2
18HSAU75	NSS V	2	0	0	2
18HSAU76	NSS VI	2	0	0	2

# **SYLLABUS**

## **Basic/Engineering Science and Professional Core Courses**

**COURSE OBJECTIVE:**

- To acquire ability to speak effectively in real life situations.
- To write letters and reports effectively in formal and business situations.
- To develop listening skills for academic and professional purposes.
- To gain effective speaking and listening skills in communication.
- To develop the soft skills and interpersonal skills to excel in their career.
- To enhance the performance of students at Placement Interviews, Group Discussions and other recruitment procedures.

**UNIT I VOCABULARY BUILDING****10**

General Vocabulary –Nouns- Compound nouns, Word borrowing & Word making, Foreign machinery in English, Dictionary and Thesaurus usages, Synonyms, Antonyms, Prefixes and Suffixes, Homonyms, Homographs and Homophones, Changing words from one form to another, Acronyms and Abbreviations.

**UNIT II BASIC WRITING****10**

Sentences structures –Kinds of sentences, Types of sentences, Clauses and Phrases, Punctuations, Word Links and Connectives, Summarizing, Precise writing, Paragraph Writing.

**UNIT III IDENTIFYING COMMON ERRORS IN ENGLISH****10**

Articles, Prepositions, Subject-verb Agreement, Pronouns - Relative pronouns, Demonstrative pronouns, Misplaced Modifiers, Redundancies, Clichés, Infinitives & Gerund

**UNIT IV NATURE AND STYLE OF SENSIBLE WRITING****10**

Describing people, place and situations, Process description, Definitions, Numerical Expressions, Information Transfer- Flow chart Bar chart and Pie chart, Checklists, Writing introduction and conclusion.

**UNIT V WRITING PRACTICES****10**

Letter Writing- Formal & Informal Letters, Report Writing- Letter Report, Accident Report, Investigation Report and Survey, Essay writing, Comprehension Passages.

**TOTAL Hrs: 50****COURSE OUTCOMES:**

After successful completion of the Technical English course, the student will be able to

- CO1:** Improve the language proficiency of a technical under-graduate in English with emphasis on Learn, Speak, Read and Write skills.
- CO2:** Acquire the ability to speak effectively in English in real life situations.
- CO3:** Provide learning environment to practice listening, speaking, reading and writing skills.
- CO4:** Assist and carry on the tasks and activities through guided instructions and materials.
- CO5:** Inculcate reading habit and to develop effective reading skills.
- CO6:** Improve their active and passive vocabulary.
- CO7:** Effectively integrate English language learning with employability skills and training.
- CO8:** Provide hands-on experience through case-studies, mini-projects, group and individual presentations.
- CO9:** Write letters and reports effectively in formal and business situations.
- CO10:** Variety of self-instructional modes of language learning and develop learner autonomy.

### TEXT BOOKS:

1. **'English for Scientists**, Prof. K.R.Lakshminarayanan, Former Head, Department of Humanities and Social sciences, Sri Venkateshwara College of Engineering, Pennalur, Sriperumbudur, Tamilnadu SCITECH PUBLICATIONS (INDIA PVT.LTD)2014
2. Department of English, Anna University, Mindscapes, **'English for Technologists and Engineers'**, Orient Longman Pvt. Ltd, Chennai: 2012.
3. Department of Humanities and Social Sciences, Anna University, **'English for Engineers and Technologists'** Combined Edition (Volumes 1 and 2), Chennai: Orient Longman Pvt. Ltd., 2006.
4. Department of English, Anna University, Mindscapes, **'English for Technologists and Engineers'**, Orient Longman Pvt. Ltd, Chennai: 2012.
5. Department of Humanities and Social Sciences, Anna University, **"English for Engineers and Technologists"** Combined Edition (Volumes 1 and 2), Chennai: Orient Longman Pvt. Ltd., 2006.
6. M.AshrafRizvi, **"Effective Technical Communication"**, Tata McGraw-Hill Publishing Company Limited, New Delhi.2009.

### Suggested Readings:

- (i) Practical English Usage. Michael Swan. OUP. 1995.
- (ii) Remedial English Grammar. F.T. Wood. Macmillan.2007
- (iii) On Writing Well. William Zinsser. Harper Resource Book. 2001
- (iv) Study Writing. Liz Hamp-Lyons and Ben Heasley. Cambridge University Press. 2006.
- (v) Communication Skills. Sanjay Kumar and PushpLata. Oxford University Press. 2011.
- (vi) Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press

**COURSE OBJECTIVE:**

- To understand the general concepts in electrostatics, to educate the scientific principles of Electromagnetism and to apply the physics concepts for engineering applications.

**UNIT- 1: ELECTROSTATICS IN VACUUM****9**

Coulomb's inverse square law, Super position principle – Gauss theorem – proof and its application (intensity at a point due to charged sphere and cylinder), Laplace's and Poisson's equations for electrostatic potential-potential difference – equipotential surface- potential at a point due to a point charge.

**UNIT-2: ELECTROSTATICS IN A LINEAR DIELECTRIC MEDIUM****9**

Electric dipole- potential energy of a dipole – Electric field due to an electric dipole (axial point and equatorial line) - Dielectric constant – Electric susceptibility - Types of polarization- point charge at centre of dielectric sphere in uniform magnetic field- Lorentz method- Clausius Mosotti equation –Dielectric loss – Applications of capacitor and transformer in dielectric materials

**UNIT- 3: MAGNETOSTATICS IN A LINEAR MAGNETIC MEDIUM****9**

Bio-Savart law - magnetic induction at a point due to a straight conductor carrying current – magnetic field at centre of a circular coil carrying current- Ampere's circuital law and its application -Field along the axis of a circular coil and solenoid. Intensity of magnetisation - Magnetic susceptibility - Magnetic permeability - Classification of magnetic materials - Domain theory of ferromagnetism – BH curve.

**UNIT-4: FARADAY'S LAW AND MAXWELL'S EQUATION****9**

Faraday's law - Differential form of Faraday's law – Self and Mutual inductance- Self-inductance of a long solenoid- Experimental determination of self-inductance (Rayleigh's method) and Mutual inductance - Maxwell's equations and their derivation – Physical significance of Maxwell's equation – Application – Refraction of radiowave in ionosphere (bending of radiowaves).

**UNIT-5: ELECTROMAGNETIC WAVES****9**

The wave equation - Plane electromagnetic waves in vacuum, their transverse nature - Relation between electric and magnetic fields of an electromagnetic wave- Hertz experiment: production and detection of electromagnetic wave – Practical electromagnetism – Carbon microphone – Electrodynamical microphone – Condenser microphone and Crystal microphone.

**TOTAL Hrs: 45****COURSE OUTCOME:**

- CO 1: Formulate general mechanics parameters and distinguish between central and non-central forces.  
 CO 2: Learn the basics of ultrasonic.  
 CO 3: Understanding about the Fiber optics.  
 CO 4: Explain types of waves and interference of light.  
 CO 5: Derive thermodynamic parameters and apply fundamental laws to solve thermodynamic problems.  
 CO 6: Know about various applications of Lasers.  
 CO 7: Basic information in Quantum Physics and crystal physics etc.

**TEXT BOOKS**

1. R. Murugesan , Electricity and Magnetism, S. Chand & Co, 2017
2. Tai L. Chow, Introduction To Electromagnetic Theory: A Modern Perspective, Laxmi Publications (2012)

**REFERENCE BOOKS:**

1. David Griffiths, Introduction to Electrodynamics, Pearson Publishers, (2015)
2. Halliday and Resnick, Physics, Wiley, (2015)
3. Dr. Wayne M. Saslow, Electricity, Magnetism and Light , Academic Press, (2002)

**Course Objectives:**

The objective of this course is to familiarize the prospective engineers with techniques in calculus and linear algebra. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced level of mathematics and applications that they would find useful in their disciplines.

**UNIT I: CALCULUS****12**

Evolutes and involutes-Evaluation of definite and improper integrals- Beta and Gamma functions and their properties

**UNIT II: CALCULUS****12**

Rolle's Theorem, Mean value theorems, Taylor's and Maclaurin theorems with remainders-indeterminate forms and L'Hospital's rule.

**UNIT III: SEQUENCES AND SERIES****12**

Convergence of sequence and series, tests for convergence- Power series, Taylor's series, series for exponential, trigonometric and logarithm functions.

**UNIT IV: MULTIVARIABLE CALCULUS (DIFFERENTIATION)****12**

Limit, continuity and partial derivatives, directional derivatives, total derivative- Tangent plane and normal line- Maxima, minima and saddle points- Method of Lagrange multipliers.

**UNIT V: MATRICES****12**

Introduction to matrix and rank of a matrix-System of linear equations- Symmetric, skew- symmetric and orthogonal matrices- Eigenvalues and eigenvectors- Diagonalization of matrices-Cayley-Hamilton Theorem, and Orthogonal transformation.

**TOTAL: 60Hrs.****COURSE OUTCOMES:**

CO1: To introduce the idea of applying differential and integral calculus to Notions of curvature and to improper integrals. Apart from some applications it gives a basic introduction on Beta and Gamma functions.

CO2: To introduce the fallouts of Rolle's Theorem that is fundamental to application of analysis to Engineering problems.

CO3: To develop the tool of power series for learning advanced Engineering Mathematics.

CO4: To familiarize the student with functions of several variables that is essential in most branches of engineering.

CO5: To develop the essential tool of matrices in engineering.

**TEXT BOOKS**

1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
2. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11 ,Reprint, 2010

**REFERENCE BOOKS**

1. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi,2008.
3. D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.
4. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
5. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.



**COURSE OBJECTIVE**

- To provide exposure to the students of basic electrical engineering.

**UNIT I DC CIRCUITS 12**

Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff current and voltage laws, Mesh and Nodal analysis, Analysis of simple circuits with dc excitation, Wye↔Delta Transformation, Superposition, Thevenin and Norton Theorems. Time-domain analysis of first-order RL and RC circuits.

**UNIT II AC CIRCUITS 12**

Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance. Three phase balanced circuits, voltage and current relations in star and delta connections.

**UNIT III TRANSFORMERS 12**

Magnetic materials, BH characteristics, ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency. Auto-transformer and three-phase transformer connections.

**UNIT IV ELECTRICAL MACHINES & POWER CONVERTERS 12**

Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, Significance of torque-slip characteristic. Single phase induction motor. Construction, working, torque-speed characteristic and speed control of separately excited dc motor. DC-DC buck and boost converters, duty ratio control. Single phase Bridge Rectifier, Single Phase voltage source inverters.

**UNIT V ELECTRICAL INSTALLATIONS 12**

Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries. Elementary calculations for energy consumption, power factor improvement and battery backup.

**TOTAL Hrs: 60****COURSE OUTCOMES:**

After successful completion of the Basic Electrical Engineering course, the student will be able to

- CO1:** Understand the basics of electrical circuits and measurements.
- CO2:** Understand the Ohm's and Kirchoff's Laws.
- CO3:** Understand the principle and construction of DC motor and generator.
- CO4:** Understand the principle and construction of single phase and three phase induction motors.

**TEXT / REFERENCES:**

- D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010.
- D. C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill, 2009.
- L. S. Bobrow, "Fundamentals of Electrical Engineering", Oxford University Press, 2011.
- E. Hughes, "Electrical and Electronics Technology", Pearson, 2010.
- V. D. Toro, "Electrical Engineering Fundamentals", Prentice Hall India, 1989.

**COURSE OBJECTIVE:**

- To develop in students, graphic skills for communication of concepts, ideas and design of engineering products.
- To expose them to existing national standards related to technical drawings.

**CONCEPTS AND CONVENTIONS (Not for Examination)**

Importance of graphics in engineering applications – Use of drafting instruments – BIS conventions and specifications – Size, layout and folding of drawing sheets – Lettering and dimensioning.

**UNIT I INTRODUCTION TO ENGINEERING DRAWING AND PLANE CURVES 12**

Curves used in engineering practices: Conics – Construction of ellipse, Parabola and hyperbola by eccentricity method – Construction of cycloid, Epicycloid, Hypocycloid – construction of involutes of squad and circle – Drawing of tangents and normal to the above curves. Scales – Plain, Diagonal and Vernier Scales.

**UNIT II PROJECTION OF POINTS, LINES AND PLANE SURFACES 12**

Projection of points and straight lines located in the first quadrant – Determination of true lengths and true inclinations – Projection of polygonal surface and circular lamina inclined to both reference planes - Auxiliary Planes

**UNIT III PROJECTION OF SOLIDS 12**

Projection of simple solids like prisms, pyramids, cylinder and cone when the axis is inclined to one reference plane by change of position method - Auxiliary Views

**UNIT IV SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES 12**

Sectioning of above solids in simple vertical position by cutting planes inclined to one reference plane and perpendicular to the other – Obtaining true shape of section - Auxiliary Views. Development of lateral surfaces of simple and truncated solids – Prisms, pyramids, cylinders and cones – Development of lateral surfaces of solids with cylindrical cutouts, perpendicular to the axis.

**UNIT V ORTHOGRAPHIC PROJECTION AND ISOMETRIC PROJECTION 12**

Free hand sketching: Representation of Three Dimensional objects – General principles of orthographic projection – Need for importance of multiple views and their placement - layout views – Developing visualization skills through free hand sketching of multiple views from pictorial views of objects.

Principles of isometric projection – isometric scale – isometric projections of simple solids, truncated prisms, pyramids, cylinders and cones.

**TOTAL: 60 PERIODS****COURSE OUTCOMES:**

After successful completion of the Engineering Graphics course, the student will be able to

- CO1:** Understand the theory of projection.
- CO2:** Able to know and understand the conventions and the methods of engineering drawing.
- CO3:** Improve their visualization skills so that they can apply these skills in developing new products.
- CO4:** Able to prepare the simple layout of factory buildings.
- CO5:** Impart and inculcate a proper understanding of the theory of projection.
- CO6:** Improve the visualization skills.
- CO7:** Understand the various concepts like dimensioning, conventioning and standards related to working drawings in order to become professionally efficient.
- CO8:** Impart the knowledge for understanding and drawing of simple residential/office buildings.
- CO9:** Ability to produce engineered drawings will improve.
- CO10:** Ability to convert sketches into engineered drawings will increase.

**TEXT BOOKS:**

1. N.D. Bhatt, "Engineering Drawing" Charotar Publishing House, 46 th Edition, (2003).

**REFERENCES:**

1. K. V. Natrajan, "A text book of Engineering Graphics", Dhanalakshmi Publishers, Chennai (2006).
2. M.S. Kumar, "Engineering Graphics", D.D. Publications, (2007).
3. K. Venugopal & V. Prabhu Raja, "Engineering Graphics", New Age International (P) Limited (2008).
4. M.B. Shah and B.C. Rana, "Engineering Drawing", Pearson Education (2005).
5. K. R. Gopalakrishnana, "Engineering Drawing" (Vol.I&II), Subhas Publications (1998).
6. Dhananjay A.Jolhe, "Engineering Drawing with an introduction to AutoCAD" Tata McGraw Hill Publishing Company Limited (2008).
7. Basant Agarwal and Agarwal C.M., "Engineering Drawing", Tata McGraw Hill Publishing Company Limited, New Delhi, (2008).

**Publication of Bureau of Indian Standards:**

1. IS 10711 – 2001: Technical products Documentation – Size and lay out of drawing sheets.
2. IS 9609 (Parts 0 & 1) – 2001: Technical products Documentation – Lettering.
3. IS 10714 (Part 20) – 2001 & SP 46 – 2003: Lines for technical drawings.
4. IS 11669 – 1986 & SP 46 – 2003: Dimensioning of Technical Drawings.
5. IS 15021 (Parts 1 to 4) – 2001: Technical drawings – Projection Methods.

**Special points applicable to University Examinations on Engineering Graphics:**

1. There will be five questions, each of either or type covering all units of the syllabus.
2. All questions will carry equal marks of 20 each making a total of 100.
3. The answer paper shall consist of drawing sheets of A3 size only. The students will be permitted to use appropriate scale to fit solution within A3 size.
4. Whenever the total number of candidates in a college exceeds 150, the University Examination in that college will be conducted in two sessions (FN and AN on the same day) for 50 percent of student (approx) at a time.

**COURSE OBJECTIVE:**

- To study and understand the basic physics concepts and study the young's modulus of the uniform and non uniform bending of the materials.

**LIST OF EXPERIMENTS (Any '8')**

1. Deflection magnetometer – Tan A null deflection method
2. Deflection magnetometer – Tan B null deflection method
3. Deflection magnetometer – Tan A equal deflection method
4. Laser – determination of wavelength and particle size
5. Potentiometer- Calibration of Low range voltmeter
6. Determination of band gap of a semiconductor diode
7. Spectrometer – Grating
8. Spectrometer – Dispersive power of prism
9. Torsional Pendulum
10. Ultrasonic Interferometer.

**TOTAL: 45 Hours****COURSE OUTCOMES:**

After successful completion of the Engineering Physics Laboratory course, the student will be able to

- CO1:** Ability to Design and Conduct experiments as well as to Analyze and Interpret Data.
- CO2:** Ability to Identify, Formulate, and Solve Engineering Problems.
- CO3:** Ability to use Techniques and Skills associated with Modern Engineering Tools such as Lasers and Fiber Optics.
- CO4:** Provide pre requisite hands-on experience for engineering laboratories.
- CO5:** Study and understand the basic physics concepts and study the Young's modulus of the uniform and nonuniform bending of the materials.
- CO6:** Develop skills to impart practical knowledge in real time solution.
- CO7:** Understand principle, concept, working, and application of new technology and comparison of results with theoretical calculations.
- CO8:** Design new instruments with practical knowledge.
- CO9:** Gain knowledge of new concept in the solution of practically oriented problems and
- CO10:** To understand more deep knowledge about the theoretical solution problems.
- CO11:** Understand measurement technology, usage of new instruments and real-time applications in engineering studies.

**COURSE OBJECTIVE:**

To provide exposure to the students with hands on experience on various basic engineering practices in Electrical Engineering.

**LIST OF LABORATORY EXPERIMENTS/DEMONSTRATIONS:**

1. Basic safety precautions. Introduction and use of measuring instruments – voltmeter, ammeter, multi-meter, oscilloscope. Real-life resistors, capacitors and inductors.
2. Sinusoidal steady state response of R-L, and R-C circuits – impedance calculation and verification.
3. Resonance in R-L-C circuits.
4. Loading of a transformer: measurement of primary and secondary voltages and currents, and power
5. Three-phase transformers: Star and Delta connections. Voltage and Current relationships (line-line voltage, phase-to-neutral voltage, line and phase currents).
6. Load Characteristics of a DC Motor
7. Torque - Slip Characteristic of an Induction motor
8. Three phase induction motors - Direction reversal by change of phase-sequence of connections.
9. Demonstration of dc-dc converter.
10. Demonstration of dc-ac converter.
11. Demonstration of ac-dc converter.

**TOTAL: 30 Hrs**

**COURSE OUTCOMES:**

After successful completion of the Electrical Engineering Laboratory course, the student will be able to

- CO1:** Measure power in three phase circuits.
- CO2:** Distinguish between the effects of Eddy current and hysteresis losses in magnetic materials.
- CO3:** Measure performance characteristics of DC generators and three-phase induction motors.
- CO4:** Perform power transformer open and short circuit tests and determine the values of elements of the equivalent circuit.
- CO5:** Design the experiments for measuring characteristics of different semiconductor diodes.
- CO6:** Measuring characteristics and efficiency of a solar cell.
- CO7:** Extract model parameters of diodes and solar cell from measured I-V characteristics.
- CO8:** Design the experiments and measure characteristics of transistors.
- CO9:** Extract transistor model parameters from the measured characteristics.
- CO10:** Write a professional quality laboratory report describing their work, results and analysis.

**COURSE OBJECTIVE:**

- ❖ To gain effective speaking and listening skills in communication.
- ❖ To develop the soft skills and interpersonal skills to excel in their job.
- ❖ To enhance the performance of students at Placement Interviews, Group Discussions and other recruitment exercises.

**ORAL COMMUNICATION**

40

**(This unit involves interactive practice sessions in Language Lab)**

**Listening comprehensions, Pronunciation, Phonology, Intonation, Stress and Rhythm, Situational Dialogues, Communication in workplace, Interviews, Seminar, Formal Presentations, Group Discussions, Debates, JAM sessions**

**COURSE OUTCOMES:**

After successful completion of the Language Laboratory course, the student will be able to

- CO1:** Improve the listening capability.
- CO2:** Get the writing capability through the practices.
- CO3:** Engage to improve the language capability for reading and writing.
- CO4:** Use strong vocabulary and fluently like foreigners.
- CO5:** Prepare their, own resume in professional method.
- CO6:** Understand the Structure of presentation and the tools available in the power point presentation.
- CO7:** Present the given topics or their own topic of interest.
- CO8:** Participates in group discussion without any hesitation.
- CO9:** Participate in mock interviews to remove the fear factors.
- CO10:** Get all types of training to prepare them for interview.

**TEXT BOOKS:**

1. Anderson, P.V, Technical Communication, Thomson Wadsworth, Sixth Edition, New Delhi, 2007.
2. Prakash, P, Verbal and Non-Verbal Reasoning, Macmillan India Ltd., Second Edition, New Delhi, 2004.

**REFERENCES:**

1. John Seely, The Oxford Guide to Writing and Speaking, Oxford University Press, New Delhi, 2004.
2. Evans, D, Decisionmaker, Cambridge University Press, 1997.
3. Thorpe, E, and Thorpe, S, Objective English, Pearson Education, Second Edition, New Delhi, 2007.
4. Turton, N.D and Heaton, J.B, Dictionary of Common Errors, Addison Wesley.

**COURSE OBJECTIVE**

- To learn about the molecular orbital, ionic interactions and periodic properties.
- Rationalize periodic properties such as ionization potential, electro negativity, oxidation states and electro negativity.
- List major chemical reactions that are used in the synthesis of molecules.

**UNIT I ATOMIC AND MOLECULAR STRUCTURE, INTERMOLECULAR FORCES AND POTENTIAL ENERGY SURFACES****14**

Molecular orbitals of diatomic molecules and plots of the multicentre orbitals. Equations for atomic and molecular orbitals. Energy level diagrams of diatomics. Pi-molecular orbitals of butadiene and benzene and aromaticity. Crystal field theory and the energy level diagrams for transition metal ions and their magnetic properties.

Ionic, dipolar and van Der Waals interactions. Equations of state of real gases and critical phenomena. Potential energy surfaces of H<sub>3</sub>, H<sub>2</sub>F and HCN.

**UNIT II SPECTROSCOPIC TECHNIQUES AND APPLICATIONS****12**

Principles of spectroscopy and selection rules. Electronic spectroscopy. Vibrational and rotational spectroscopy of diatomic molecules. Applications. Diffraction and scattering

**UNIT III USE OF FREE ENERGY IN CHEMICAL EQUILIBRIA****12**

Thermodynamic functions: energy, entropy and free energy. Estimations of entropy and free energies. Free energy and emf. Cell potentials, the Nernst equation and applications. Acid base, oxidation reduction and solubility equilibria. Water chemistry. Corrosion.

**UNIT IV PERIODIC PROPERTIES****12**

Variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electronegativity, polarizability, oxidation states, coordination numbers and geometries, hard soft acids and bases, molecular geometries.

**UNIT V ORGANIC REACTIONS AND SYNTHESIS OF A DRUG MOLECULE****10**

Introduction to reactions involving substitution, addition, elimination, oxidation, reduction, cyclization and ring openings. Synthesis of a commonly used drug molecule.

**TOTAL Hrs: 60****COURSE OUTCOMES:**

After successful completion of the Engineering Chemistry course, the student will be able to

**CO1:** Analyze microscopic chemistry in terms of atomic and molecular orbital and intermolecular forces.

**CO2:** Rationalize bulk properties and processes using thermodynamic considerations.

**CO3:** Distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques.

### TEXT BOOKS

1. Chemistry: Principles and Applications, by M. J. Sienko and R. A. Plane.
2. Fundamentals of Molecular Spectroscopy, by C. N. Banwell.
3. Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S. Krishnan.

### REFERENCE BOOKS

1. Physical Chemistry, by P. W. Atkins.
2. Organic Chemistry: Structure and Function by K. P. C. Vollhardt and N. E. Schore, 5th Edition  
<http://bcs.whfreeman.com/vollhardtschore5e/default.asp>.
3. University chemistry, by B. H. Mahan.



**COURSE OBJECTIVE:**

- The objective of this course is to familiarize the prospective engineers with techniques in multivariate integration, ordinary and partial differential equations and complex variables.
- It aims to equip the students to deal with advanced level of mathematics and applications that would be essential for their disciplines.

**UNIT 1: MULTIVARIABLE CALCULUS (INTEGRATION)**

12

Multiple Integration: Double integrals (Cartesian)-change of order of integration in double integrals-Change of variables (Cartesian to polar)- Triple integrals(Cartesian)-orthogonal curvilinear coordinates- Green ,Gauss and Stokes theorems (statement only)-Simple problems.

**UNIT2: FIRST ORDER ORDINARY DIFFERENTIAL EQUATIONS**

12

Exact, linear and Bernoulli's equations, Euler's equations, Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type.

**UNIT3: ORDINARY DIFFERENTIAL EQUATIONS OF HIGHER ORDERS**

12

Second order linear differential equations with variable coefficients, method of variation of parameters, Cauchy-Euler equation; Power series solutions; Legendre polynomials,

**UNIT4: COMPLEX VARIABLE – DIFFERENTIATION**

12

Differentiation, Cauchy-Riemann equations, analytic functions, harmonic functions, finding harmonic conjugate; elementary analytic functions (exponential, trigonometric, logarithm) and their properties; Conformal mappings, Mobius transformations and their properties.

**UNIT 5: COMPLEX VARIABLE – INTEGRATION**

12

Contour integrals, Cauchy-Goursat theorem (without proof), Cauchy Integral formula (without proof)-Taylor's series, zeros of analytic functions, singularities, Laurent's series; Residues, Cauchy Residue theorem (without proof), Evaluation of definite integral involving sine and cosine.

**TOTAL: 60Hrs.****COURSE OUTCOMES:**

CO1: To introduce the idea of applying integral calculus to improper integrals.

CO2: Applications of Differential equations in engineering

CO3: To develop the ordinary differential equation for learning advanced Engineering Mathematics.

CO4: To familiarize the student with functions of several variables that is essential in most branches of engineering.

CO5: To develop the essential tool of complex variable (Integration) in engineering.

**TEXT/REFERENCE BOOKS**

1. G.B.Thomas and R.L.Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
2. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
3. W.E.Boyce and R.C.Di Prima, Elementary Differential Equations and Boundary Value Problems, Wiley India, 2009.
4. S.L.Ross, Differential Equations, 3rd Ed., Wiley India, 1984.
5. E.A.Coddington, An Introduction to Ordinary Differential Equations, Prentice Hall India, 1995.
6. E.L.Ince, Ordinary Differential Equations, Dover Publications, 1958.
7. J.W.Brown and R.V.Churchill, Complex Variables and Applications, 7th Ed., Mc-Graw Hill, 2004.
8. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
9. B.S.Grewal, Higher Engineering Mathematics, Khanna Publishers, 36<sup>th</sup> Edition, 2010.

**COURSE OBJECTIVE:**

- To understand the basic concepts of programming – Flow chart, Pseudocode.
- To learn the fundamentals of C programming - declarations, operators, expressions and control statements.
- To learn the manipulation of strings, functions, pointers and file operations.
- To understand the concepts of arrays, basic sorting and searching algorithms.
- To find the order of time complexity of basic algorithms

**UNIT I INTRODUCTION TO PROGRAMMING****9**

Introduction to Programming (Flow chart/pseudo code, compilation etc.), Variables (including data types) -Arithmetic expressions and precedence, Conditional Branching and Loops -Writing and evaluation of conditionals and consequent branching - Iteration and loops

**UNIT II ARRAYS AND BASIC ALGORITHMS****9**

Arrays (1-D, 2-D), Character arrays and Strings, Searching, Basic Sorting Algorithms, Finding roots of equations, Notion of order of time complexity through example programs

**UNIT III FUNCTION AND POINTERS****9**

Functions (including using built in libraries), Parameter passing in functions, call by value ,Passing arrays to functions: idea of call by reference, Recursion with example programs such as Finding Factorial, Fibonacci series, etc. Pointers - Defining pointers, Use of Pointers in self-referential structures

**UNIT IV STRUCTURES AND UNIONS****9**

Structures - Defining structures and Array of Structures, Structures containing Pointers, Unions - Storage classes: auto, static, extern, register – Dynamic memory allocation

**UNIT V STRING FUNCTIONS AND FILES****9**

Strings - library string functions, pointers in strings, pointers and function arguments, Files - file Operations, processing a file, Preprocessor directives, use of type def, Command line arguments, Enumerated data types.

**TOTAL Hrs: 45****COURSE OUTCOME:**

At the end of this course, the Student will be able to

- CO 1. Understand the principles of algorithm, flowchart and pseudo code.
- CO 2. Find the order of time complexity of algorithms.
- CO 3. Write programs involving control instructions, arrays, structures and unions.
- CO 4. Use string manipulations, and to write functions for various applications using C programming constructs.
- CO 5. Handle file operations in C programming

**TEXT BOOKS:**

1. Byron Gottfried, "Schaum's Outline of Programming with C", McGraw-Hill
2. E. Balaguruswamy, "Programming in ANSI C", Tata McGraw-Hill

**REFERENCES:**

1. Brian W. Kernighan and Dennis M. Ritchie, "The C Programming Language", PrenticeHall of India
2. Yashavant Kanetkar, "Let Us C", BPB Publications
3. Ashok.N.Kamthane, "Computer Programming", Pearson Education (India)

**COURSE OBJECTIVE:**

- The chemistry laboratory course will consist of experiments illustrating the principles of chemistry relevant to the study of science and engineering.
- The students will learn to:
  - Estimate rate constants of reactions from concentration of reactants/products as a function of time
  - Measure molecular/system properties such as surface tension, viscosity, conductance of solutions, redox potentials, chloride content of water, etc
  - Synthesize a small drug molecule and analyze a salt sample

**CHOICE OF 10-12 EXPERIMENTS FROM THE FOLLOWING**

1. Determination of surface tension and viscosity
2. Thin layer chromatography
3. Ion exchange column for removal of hardness of water
4. Determination of chloride content of water
5. Colligative properties using freezing point depression
6. Determination of the rate constant of a reaction
7. Determination of cell constant and conductance of solutions
8. Potentiometry - determination of redox potentials and emfs
9. Synthesis of a polymer/drug
10. Saponification/acid value of an oil
11. Chemical analysis of a salt
12. Lattice structures and packing of spheres
13. Models of potential energy surfaces
14. Chemical oscillations- Iodine clock reaction
15. Determination of the partition coefficient of a substance between two immiscible liquids
16. Adsorption of acetic acid by charcoal
17. Use of the capillary viscosimeters to demonstrate the isoelectric point as the pH of minimum viscosity for gelatin sols and/or coagulation of the white part of egg .

**COURSE OUTCOME**

- The students will know to estimate the rate constants of reactions, freezing point depression and partial coefficient of immiscible liquids.
- To Synthesize a small drug molecule and analyse a salt sample.
- To find the viscosity and partition coefficient of a substance.

**TEXT BOOKS**

1. S. Sundaram and K. Raghavan "Practical Chemistry", S. Viswanathan. Co. 3<sup>rd</sup> edition **2011**.
2. Gnanaprakasam, Ramamurthy, "Organic Chemistry Lab Manual" S. Viswanathan Pvt. Ltd. 3<sup>rd</sup> edition **2011**

**REFERENCE BOOKS**

1. Vogel's – "Textbook of qualitative organic Analysis", Longmann, 12<sup>th</sup> edition, **2011**
2. J. N. Gurtu and R. Kapoor "Advanced experimental Chemistry", S. Chand and Co. 6<sup>th</sup> edition, **2010**

**COURSE OBJECTIVE:**

To design and develop C Programs for various applications

**LIST OF EXPERIMENTS:**

1. Familiarization with programming environment
2. Simple computational problems using arithmetic expressions
3. Problems involving if-then-else structures
4. Iterative problems
5. 1D Array manipulation
6. Matrix problems
7. String operations
8. Simple functions
9. Solving Numerical methods problems
10. Recursive functions
11. Pointers and structures
12. File operations

**COURSE OUTCOME:**

At the end of this course, the Student will be able to

- CO 1. Familiarize with the Programming Environment.
- CO 2. Develop programs using various control instructions and operator precedence in C Programming.
- CO 3. Implement string manipulations, arrays and functions for various applications in C.
- CO 4. Analyze the use of structures, unions and pointers in C.
- CO 5. Handle various file operations in C.

**COURSE OBJECTIVE:**

- To study bench fitting drawings for making male and female fittings as per the given dimensions and Tolerances.
- To study Arc welding drawings for making common weld joints as per the given dimensions.
- To study sheet metal development drawings for making common metal parts/components as per the given dimensions.

**Workshop/Manufacturing Practices [ [L : 1; T:0; P : 0 (1 credit)]**

**Lectures & videos: (10 hours)**

**Detailed contents:**

1. Manufacturing Methods- casting, forming, machining, joining, advanced manufacturing methods (3 lectures)
2. CNC machining, Additive manufacturing (1 lecture)
3. Fitting operations & power tools (1 lecture)
4. Electrical & Electronics (1 lecture)
5. Carpentry (1 lecture)
6. Plastic moulding, glass cutting (1 lecture)
7. Metal casting (1 lecture)
8. Welding (arc welding & gas welding), brazing (1 lecture)

**(ii) Workshop Practice: (60 hours)[ L : 0; T:0 ; P : 4 (2 credits)]**

**1. Machine shop (10 hours)**

To make Facing and plain turning, step turning, drilling in the lathe

**2. Fitting shop (8 hours)**

To make square, V joint in bench fitting as per the given dimension and Tolerances

**3. Carpentry (6 hours)**

To make half lap joint, dovetail, TEE Lap joint

**4. Electrical & Electronics (8 hours)**

- (i) To make fluorescent lamp wiring.
- (ii) To make stair case wiring.
- (iii) To make residential wiring.
- (iv) To measure Peak-peak, rms, period, frequency using CRO.
- (v) To solder components devices and circuits by using general purpose PCB.

**5. Welding shop (8 hours (Arc welding 4 hrs + gas welding 4 hrs)**

- To make single, butt, lap and T fillet joint by arc welding with the back hand and fore hand welding techniques as per the given dimensions.

## 6. Plumbing Works

- Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, elbows in household fittings.
- Basic pipe connections – Mixed pipe material connection – Pipe connections with different joining components.

## 7. Sheet Metal Work

- To make simple Dust pan, Rectangular trays in sheet metal with the jigs as per the given Dimensions.

### COURSE OUTCOMES:

After successful completion of the Engineering Practices Laboratory course, the student will be able to

- CO1:** Able to make various joints in the given object with the available work material.
- CO2:** Able to know how much time a joint will take for the assessment of time.
- CO3:** Familiarity with different types of woods used and tools used in wood Working technology.
- CO4:** Familiarity with different types of tools used in sheet metal working.
- CO5:** Developments of sheet metal jobs from GI sheets, knowledge of basic concepts of soldering.
- CO6:** Familiarity with different types of tools used in forging technology.
- CO7:** Knowledge of different types of furnaces like coal-fired, electrical furnaces etc.
- CO8:** Familiarity with different types of tools used in fitting technology.
- CO9:** Utilize the hands-on experience in various fields.
- CO10:** Basic Engineering Practices in Civil, Mechanical, Electrical and Electronics Engineering.

**COURSE CONTENT**

1. Meaning of the constitution law and constitutionalism
2. Historical perspective of the Constitution of India
3. Salient features and characteristics of the Constitution of India
4. Scheme of the fundamental rights
5. The scheme of the Fundamental Duties and its legal status
6. The Directive Principles of State Policy – Its importance and implementation
7. Federal structure and distribution of legislative and financial powers between the Union and the States
8. Parliamentary Form of Government in India – The constitution powers and status of the President of India
9. Amendment of the Constitutional Powers and Procedure
10. The historical perspectives of the constitutional amendments in India
11. Emergency Provisions : National Emergency, President Rule, Financial Emergency
12. Local Self Government – Constitutional Scheme in India
13. Scheme of the Fundamental Right to Equality
14. Scheme of the Fundamental Right to certain Freedom under Article 19
15. Scope of the Right to Life and Personal Liberty under Article 21

**COURSE OBJECTIVE:**

- To understand Fourier series representation of periodic signals. The analysis of signal is far more convenient in the frequency domain.

**UNIT I FOURIER SERIES**

12

Dirichlet's conditions – General Fourier series – Odd and even functions – Half range sine series – Half range cosine series – Parseval's identity – Harmonic Analysis.

**UNIT II FOURIER TRANSFORM**

12

Fourier integral theorem (without proof) – Fourier transform pair – Fourier Sine and Cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity.

**UNIT III PARTIAL DIFFERENTIAL EQUATIONS**

12

Formation of partial differential equations - singular integrals- Solutions of standard types of first order partial differential equations – Lagrange's linear equation - Linear partial differential equations of second and higher order with constant coefficients of homogeneous functions.

**UNIT IV APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS**

12

Classification PDE-Method of separation of variables – One dimensional wave and heat equation – Steady state solution of two-dimensional heat equation (square plate only) .

**UNIT V Z -TRANSFORM AND DIFFERENCE EQUATIONS**

12

Z-transform –Introduction- properties – Inverse Z-transform (using partial fraction and residues) – Convolution theorem - Formation of difference equations – Solution of difference equations using Z- transform.

**TOTAL: 60 Hours****COURSE OUTCOME:**

CO1: Develop Fourier series for different types of functions.

CO2: Define and determine Fourier Transform.

CO3: Derive and obtain the solution of wave, heat equation

CO4: Problems of Fourier series and Fourier transforms used in engineering applications.

CO5: Students understand the z-transforms and its properties

**TEXTBOOKS:**

- Grewal. B.S, "Higher Engineering Mathematics", Khanna Publications, Delhi, 43rd Edition, 2013.
- Ramana B.V, "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company, New Delhi, 6<sup>th</sup> reprint,2008.

**REFERENCE BOOKS:**

- Bali.N.P. and Manish Goyal 'A Textbook of Engineering Mathematics', Laxmi Publications, 9<sup>th</sup> edition,2011.
- Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley India, 9<sup>th</sup> Edition, 2011.
3. Glyn James, "Advanced Modern Engineering Mathematics", Pearson Education, 3rd Edition, 2012.
- Sivaramakrishna Das.P & Vijayakumari.C , A Text book of Engineering Mathematics-III
- Transforms and partial differential equations- A.Singaravelu



**COURSE OBJECTIVE:**

- To familiarize the students to understand the fundamentals of thermodynamics and to perform thermal analysis on their behavior and performance.

(Use of Standard and approved Steam Table, Mollier Chart, Compressibility Chart and Psychrometric Chart permitted)

**UNIT I BASIC CONCEPT AND FIRST LAW****12**

Basic concepts - concept of continuum, macroscopic approach, thermodynamic systems - closed, open and isolated. Property, state, path and process, quasi-static process, work, modes of work, Zeroth law of thermodynamics – concept of temperature and heat, Concept of ideal and real gases, First law of thermodynamics – application to closed and open systems, internal energy, specific heat capacities, enthalpy, steady flow process with reference to various thermal equipments.

**UNIT II SECOND LAW AND ENTROPY****12**

Second law of thermodynamics – Kelvin's and Clausius statements of second law, Reversibility and irreversibility. Carnot theorem, Carnot cycle, reversed carnot cycle, efficiency, COP, Thermodynamic temperature scale, Clausius inequality, concept of entropy, entropy of ideal gas, principle of increase of entropy.

**UNIT III THERMODYNAMIC AVAILABILITY****12**

Basics – Energy in non-flow processes: Expressions for the Energy of a closed system- Equivalence between mechanical energy forms and Energy – Flow of energy associated with heat flow – Energy consumption and entropy generation. Energy in steady flow processes: Expressions for Energy in steady flow processes – Energy dissipation and entropy generation.

**UNIT IV PROPERTIES OF PURE SUBSTANCE AND STEAM POWER CYCLE****12**

Properties of pure substances – Thermodynamic properties of pure substances in solid, liquid and vapour phases, phase rule, P-V, P-T, T-V, T-S, H-S diagrams, PVT surfaces, thermodynamic properties of steam. Calculations of work done and heat transfer in non-flow and flow processes, Standard Rankine cycle, Reheat and regenerative cycle.

**UNIT V PSYCHROMETRY****12**

Psychrometry and psychrometric charts, property calculations of air vapour mixtures. Psychrometric process – Sensible heat exchange processes. Latent heat exchange processes. Adiabatic mixing, evaporative cooling, problems.

**TOTAL: 60 Hours****COURSE OUTCOMES:**

Upon the completion of this course the students will be able to

- CO1: Apply the first law of thermodynamics for simple open and closed systems under steady and unsteady conditions.
- CO2: Apply second law of thermodynamics to open and closed systems and calculate entropy and availability.
- CO3: Apply Rankine cycle to steam power plant and compare few cycle improvement methods
- CO4: Derive simple thermodynamic relations of ideal and real gases
- CO5: Calculate the properties of gas mixtures and moist air and its use in psychrometric processes

**TEXT BOOKS:**

1. Nag.P.K., "Engineering Thermodynamics", Tata McGraw-Hill, New Delhi, 1998.
2. Lynn D Russell, George A, Adebiyi "Engineering Thermodynamics" Indian Edition, Oxford University Press, New Delhi, 2007.

**REFERENCES:**

1. Yunus A angel and Michael Boleo, Thermodynamics an Engineering Approach
2. E.Ratha Krishnan, Fundamentals of Engineering Thermodynamics, 2nd Edition, Prentice Hall of India Pvt. Ltd, 2006.
3. Arora C.P, "Thermodynamics", Tata McGraw-Hill, New Delhi, 2003.
4. Merala C, Pother, Craig W, Somerton, "Thermodynamics for Engineers", Schaum Outline Series, Tata McGraw-Hill, New Delhi, 2004.
5. Venwylen and Sontag, "Classical Thermodynamics", Wiley Eastern, 1987
6. Holman.J.P., "Thermodynamics", 3rd Ed. McGraw-Hill, 1995.

**COURSE OBJECTIVE:**

- To understand the basic concepts of different types of electrical machines and their performance.
- To study the different methods of starting D.C motors and induction motors.
- To study the conventional and solid-state drives

**UNIT I INTRODUCTION****9**

Fundamentals of electric drives – advances of electric drive-characteristics of loads – different types of mechanical loads – choice of an electric drive – control circuit components: Fuses, switches, circuit breakers, contactors, Relay – control transformers.

**UNIT II SPEED CONTROL OF DC MACHINES****9**

DC shunt motors – Speed Torque characteristics - Ward Leonard method, DC series motor – series parallel control – solid state DC drives – Thyristor bridge rectifier circuits- chopper circuits.

**UNIT III SPEED CONTROL OF AC MACHINES****9**

Induction motor – Speed torque Characteristics – pole changing, stator frequency variation - slip-ring induction motor – stator voltage variation - Rotor resistance variation, slip power recovery – basic inverter circuits- variable voltage frequency control.

**UNIT IV MOTOR STARTERS AND CONTROLLERS****9**

DC motor starters: using voltage sensing relays, current sensing relays and time delay relays - wound rotor induction motor starters – starters using frequency sensing relays - DOI –starter and auto transformers starter.

**UNIT V HEATING AND POWER RATING OF DRIVE MOTORS****9**

Load diagram, over load capacity, insulating materials, heating and cooling of motors, service condition of electric drive – continuous, intermittent and short time – industrial application.

**TOTAL 45 Hours****COURSE OUTCOME:**

- CO-1: Describe the electrical drives and components  
 CO-2: Familiar with speed control of DC machines  
 CO-3: Familiar with speed control of AC machines  
 CO-4: Describe the various starters and relays  
 CO-5: Describe the heating and power rating of drive motors

**TEXT BOOKS:**

1. N.K De and P.K Sen 'Electric Drives' Prentice Hall of India Private Ltd, 2002.
2. Vedam Subramaniam 'Electric Drives' Tata McGraw Hill, New Delhi, 2007.
3. V.K Mehta and Rohit Mehta 'Principle of Electrical Engineering', S Chand & Company, 2008.

**REFERENCES:**

1. S.K Bhattacharya Brinjinder Singh 'Control of Electrical Machines' New Age International Publishers, 2002.
2. John Bird 'Electrical Circuit theory and technology' Elsevier, First Indian Edition, 2006.

**COURSE OBJECTIVE:**

- ❖ To understand the basic principles of engines used for automobiles and different systems.

**UNIT I CONSTRUCTION AND OPERATION 9**

Constructional details of spark ignition (SI) and compression ignition (CI) engines. Working principles. Two stroke SI and CI engines – construction and working. Comparison of SI and CI engines and four stroke and two stroke engines. Engine classification, firing order. Otto, diesel and dual cycles.

**UNIT II FUEL SYSTEMS 9**

Air fuel ratio requirements of SI engines, Air fuel ratio and emissions, working of a simple fixed venture carburetor, Constant vacuum carburetor. Diesel fuel injection systems-Jerk pumps, distributor pumps, pintle and multihole nozzles, Unit injector and common rail injection systems. Injection pump calibration. Need for a governor for diesel engines. Description of a simple diesel engine governor.

**UNIT III COMBUSTION AND COMBUSTION CHAMBERS 9**

Introduction to combustion in SI and diesel engines and stages of combustion. Dependence of ignition timing on load and speed. Knock in SI and CI engines. Combustion chambers for SI and CI engines. Direct and indirect injection combustion chambers for CI engines. Importance of Swirl, squish and turbulence. Factors controlling combustion chamber design.

**UNIT IV SUPERCHARGING ,TURBOCHARGING AND ENGINE TESTING 9**

Supercharging and Turbocharging, Different methods of turbocharging, Intercooling, Turbocharger controls including, waster gate, variable geometry, variable nozzle types. Dynamometers, Indicated thermal, brake thermal and volumetric efficiencies. Measurement of friction, Cylinder pressure measurement. Engine performance maps, Engine testing standards.

**UNIT V COOLING AND LUBRICATION SYSTEMS 9**

Need for cooling, types of cooling systems- air and liquid cooling systems. Thermosyphon and forced circulation and pressurized cooling systems. Properties of coolants. Requirements of lubrication systems. Types-mist, pressure fed, dry and wet sump systems. Properties of lubricants.

**TOTAL: 45 Hours****COURSE OUTCOME**

- CO 1 : Understand the construction and operation of engines
- CO 2 : Grasp the fuel systems in engines
- CO 3 : Describe various types of fuel injection systems
- CO 4 : Understand various types of combustion chamber in SI and CI engines
- CO 5 : Familiar with supercharging, Turbo charging and Engine Testing
- CO 6 : Importance of cooling and its types
- CO 7: Importance of Lubrication and its types

**TEXT BOOKS:**

1. Bosch - "Automotive Handbook" - 5th edition - SAE publication - 2000.
2. Kirpal Singh, "Automobile Engineering", Standard publishers, Distributors, Delhi, 1999.
3. G.B.S.Narang, "Automobile Engineering", Khanna Publishers, Twelfth reprint New Delhi, 2005.

**COURSE OBJECTIVE:**

To understand the automobile components production processes involving casting, welding, machining, metal forming, power metallurgy etc.

**UNIT I                      CASTING****8**

Casting types, procedure to make sand mould, types of core making, moulding tools, machine moulding, special moulding processes – CO<sub>2</sub> moulding; shell moulding, investment moulding, permanent mould casting, pressure die casting, centrifugal casting, continuous casting, casting defects.

**UNIT II                      WELDING****8**

Classification of welding processes. Principles of Oxy-acetylene gas welding. A.C metal arc welding, resistance welding, submerged arc welding, tungsten inert gas welding, metal inert gas welding, plasma arc welding, thermit welding, electron beam welding, laser beam welding, defects in welding, soldering and brazing.

**UNIT III                      MACHINING****13**

General principles (with schematic diagrams only) of working and commonly performed operations in the following machines: Lathe, Shaper, Planer, Horizontal milling machine, Universal drilling machine, Cylindrical grinding machine, Capstan and Turret lathe. Basics of CNC machines. General principles and applications of the following processes: Abrasive jet machining, Ultrasonic machining, Electric discharge machining, Electro chemical machining, Plasma arc machining, Electron beam machining and Laser beam machining.

**UNIT IV                      FORMING AND SHAPING OF PLASTICS****7**

Types of plastics - Characteristics of the forming and shaping processes – Moulding of Thermoplastics – Working principles and typical applications of - Injection moulding – Plunger and screw machines – Blow moulding – Rotational moulding – Film blowing – Extrusion - Typical industrial applications – Thermoforming – Processing of Thermosets – Working principles and typical applications - Compression moulding – Transfer moulding – Bonding of Thermoplastics – Fusion and solvent methods – Induction and Ultrasonic methods

**UNIT V                      METAL FORMING AND POWDER METALLURGY****9**

Principles and applications of the following processes: Forging, Rolling, Extrusion, Wire drawing and Spinning, Powder metallurgy – Principal steps involved advantages, disadvantages and limitations of powder metallurgy.

**TOTAL: 45 Periods****COURSE OUTCOME:**

- CO-1: Familiar with the theory of casting and its techniques
- CO-2: Acquire the knowledge on welding and its techniques
- CO-3: Attain the knowledge on various machining processes
- CO-4: Describe the surface finishing processes
- CO-5: Attain the knowledge on metal forming and powder metallurgy

**TEXT BOOKS:**

1. Hajra Choudhury, "Elements of Workshop Technology", Vol. I and II, Media Promoters and Publishers Pvt., Ltd., Mumbai, 2005.
2. Nagendra Parashar B.S. and Mittal R.K., "Elements of Manufacturing Processes", Prentice-Hall of India Private Limited, 2007.

**REFERENCES:**

1. Adithan. M and Gupta. A.B., "Manufacturing Technology", New Age, 2006.
2. "H.M.T. Production Technology – Handbook", Tata McGraw-Hill, 2000.
3. Jain. R.K. and S.C. Gupta, "Production Technology", Khanna Publishers. 16<sup>th</sup> Edition, 2001.
4. Roy. A. Linberg, "Process and Materials of Manufacture", PHI, 2000.
5. Serope Kalpajian, Steven R.Schmid, "Manufacturing Processes for Engineering Materials", Fourth Edition, Pearson Education, Inc. 2007.

**COURSE OBJECTIVE:**

- To understand the importance of various types of flow in pumps and turbines
- To understand the importance of dimensional analysis
- The applications of the conservation laws to flow through pipes and hydraulic machines are studied.

**UNIT I INTRODUCTION****9**

Units & Dimensions. Properties of fluids – Specific gravity, specific weight, viscosity, compressibility, vapour pressure and gas laws – capillarity and surface tension. Flow characteristics: concepts of system and control volume. Application of control volume to continuity equation, energy equation, momentum equation and moment of momentum equation.

**UNIT II FLOW THROUGH CIRCULAR CONDUITS****9**

Laminar flow through circular conduits and circular annuli, Boundary layer concepts, Boundary layer thickness. Hydraulic and energy gradient, Darcy – Weisbach equation, Friction factor and Moody diagram, Commercial pipes, Minor losses, Flow through pipes in series and in parallel.

**UNIT III DIMENSIONAL ANALYSIS****9**

Dimension and units: Buckingham's  $\Pi$  theorem, Discussion on dimensionless parameters, Models and similitude, Navier-Stokes equations Introduction of dimensionless parameters, Applications of dimensionless parameters.

**UNIT IV ROTO DYNAMIC MACHINES****9**

Homologous units, Specific speed, Elementary cascade theory, Theory of turbo machines, Euler's equation, Hydraulic efficiency, Velocity components at the entry and exit of the rotor.

Velocity triangle for single stage radial flow and axial flow machines, Centrifugal pumps, turbines, performance curves for pumps and turbines.

**UNIT V POSITIVE DISPLACEMENT MACHINES****9**

Reciprocating pumps Single acting, Double acting-advantages and disadvantages, Indicator diagrams, air vessels-Work saved by air vessels, Rotary pumps, Classification, Working principle and performance curves.

**TOTAL: 45 Hours****COURSE OUTCOME:**

- CO-1: Familiar with the properties of fluids  
 CO-2: Acquire the skill on flow through circular conduits  
 CO-3: Attain the knowledge on dimensional analysis  
 CO-4: Describe the roto-dynamic machines  
 CO-5: Attain the knowledge on positive displacement machines

**TEXT BOOKS:**

1. Streeter. V. L., and Wylie, E.B., Fluid Mechanics, McGraw Hill, 1983.
2. Rathakrishnan. E, Fluid Mechanics, Prentice Hall of India (II Ed.), 2007.

**REFERENCES:**

1. Ramamritham. S, Fluid Mechanics, Hydraulics and Fluid Machines, Dhanpat Rai & Sons, Delhi, 1988.
2. Kumar. K.L., Engineering Fluid Mechanics (VII Ed.)Eurasia Publishing House (P) Ltd., New Delhi, 1995.
3. Bansal, R.K., Fluid Mechanics and Hydraulics Machines, Laxmi Publications (P) Ltd., New Delhi.

**COURSE OBJECTIVE:**

- To supplement the theoretical knowledge with practical use of electronic components and programming and control using micro-processors

**LIST OF EXPERIMENTS****ELECTRONICS****30**

- 1.VI Characteristics of PN Junction Diode
- 2.VI Characteristics of Zener Diode
- 3.Characteristics of CE Transistor
- 4.Characteristics of JFET
- 5.Characteristics of Uni Junction Transistor
- 6.RC or Wein Bridge Oscillator
7. Study of Logic Gates (Basic Gates)
8. Half Adder and Full Adder
9. Shift Registers and Counters
10. Operational Amplifier (Adder, Subtractor, Differentiator, Integrator, Inverting and Non - Inverting)

**MICROPROCESSOR****15**

1. Block Transfer
2. 8 bit Addition, Subtraction
3. Multiplication and Division
4. Maximum and Minimum of block of data
5. Sorting
6. Stepper Motor Interfacing

**TOTAL : 45 Hours****LIST OF EQUIPMENTS**

- |   |        |
|---|--------|
| 1. Voltmeters   | 5 No.  |
| 2. Ammeters   | 5 No.  |
| 3. PN Diode, BJT, JFET, Logic Gates, Shift Registers and Counters | 1 set. |
| 4. Digital Logic Trainer Kits                                     | 1 No.  |
| 5. Breadboards  | 1 No.  |
| 6. Microprocessor Kits – 8085                                     | 5 No.  |
| 7. D/A Converter Interface  | 1 No.  |
| 8. Stepper Motor Interface  | 1 No.  |
| 9. CRO  | 1 No.  |
| 10. Wavefarm Generator  | 1 No.  |
| 11. Multimeter  | 1 No.  |

**COURSE OUTCOME:**

- CO-1: Describe the characteristics of PN Junction Diode and Zener Diode  
 CO-2: Describe the characteristics of CE Transistor, JFET and Uni Junction Transistor  
 CO-3: Explain the RC/Wein Bridge Oscillator and Logic Gates  
 CO-4: Explain the Half Adder and Full Adder  
 CO-5: Define Shift Registers, Counters and Operational Amplifier  
 CO-6: Define the Block Transfer, 8 bit Addition, Subtraction  
 CO-7: Explain the Multiplication and Division  
 CO-8: Explain the Maximum and Minimum of block of data  
 CO-9: Describe the Sorting and Stepper Motor Interfacing

**COURSE OBJECTIVES:**

- To study the mechanical properties of materials when subjected to different types of loading.
- To verify the principles studied in Fluid Mechanics theory by performing experiments in lab.

**STRENGTH OF MATERIALS (30Hrs)****LIST OF EXPERIMENTS (Any Five of the following)**

1. Tension test on a mild steel rod
2. Double shear test on Mild steel and Aluminium rods
3. Torsion test on mild steel rod
4. Impact test on metal specimen
5. Hardness test on metals - Brinnell and Rockwell Hardness Number
6. Deflection test on beams
7. Compression test on helical springs

**COURSE OUTCOME:**

- Ability to perform Tension, Torsion, Hardness, Compression, and Deformation test on Solid materials.

**LIST OF EQUIPMENT FOR BATCH OF 30 STUDENTS**

S.No.	NAME OF THE EQUIPMENT	Qty.
1	Universal Tensile Testing machine with double 1 shear attachment – 40 Ton Capacity	1
2	Torsion Testing Machine (60 NM Capacity)	1
3	Impact Testing Machine (300 J Capacity)	1
4	Brinell Hardness Testing Machine	1
5	Rockwell Hardness Testing Machine	1
6	Spring Testing Machine for tensile and compressive loads (2500 N)	1

**FLUID MECHANICS AND MACHINES LABORATORY (30Hrs)****LIST OF EXPERIMENTS (Any Five of the following)**

1. Determination of the Coefficient of discharge of given Orifice meter.
2. Determination of the Coefficient of discharge of given Venturi meter.
3. Calculation of the rate of flow using Rota meter.
4. Determination of friction factor for a given set of pipes.
5. Conducting experiments and drawing the characteristic curves of centrifugal pump/ submergible pump
6. Conducting experiments and drawing the characteristic curves of reciprocating pump.
7. Conducting experiments and drawing the characteristic curves of Gear pump.

**TOTAL: 60 PERIODS****COURSE OUTCOME:**

- Perform Tension, Torsion, Hardness, Compression, and Deformation test on Solid materials.
- Perform test on different fluid machinery.

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS**

S. NO.	NAME OF THE EQUIPMENT	Qty.
1	Orifice meter setup	1
2	Venturi meter setup	1
3	Rota meter setup	1
4	Pipe Flow analysis setup	1
5	Centrifugal pump/submergible pump setup	1
6	Reciprocating pump setup	1
7	Gear pump setup	1



**COURSE OBJECTIVE:**

The objective is to provide the necessary basic concepts of a few statistical and numerical methods familiar with the procedures for solving numerically different kinds of problems occurring in engineering.

**UNIT I TESTING OF HYPOTHESIS****12**

Sampling distributions – Large samples-Tests for single mean, Proportion, Difference of means Small samples – Tests for single mean, two mean and paired t-test-F-test – chi-square test for goodness of fit – Independence of attributes-Design of Experiments-Completely randomized design – Randomized block design – Latin square design .

**UNIT II CORRELATION AND REGRESSION ANALYSIS****12**

Introduction to Correlation Analysis- Karl Pearson's Coefficient of Correlation-Rank Correlation-Regression Analysis- Curve fitting-Introduction- method of least squares.

**UNIT III SOLUTION OF EQUATIONS****12**

Introduction-Bisection method-Newton-Raphson's method- Regula falsi method- Gauss Elimination method -Gauss-Jordan methods –Matrix Inversion by Gauss-Jordan method.

**UNIT IV INTERPOLATION, NUMERICAL DIFFERENTIATION AND NUMERICAL INTEGRATION****12**

Introduction-Newton's forward and backward interpolation – Lagrange's Interpolation formula-Derivatives using Newton's forward and backward difference formula -Numerical integration using Trapezoidal ,Simpson's 1/3 rules and Simpson's 3/8 rules.

**UNIT V NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS****12**

Introduction-Taylor's series method -Euler's method - Modified Euler's method – Second and Fourth order Runge-Kutta method for solving first order equations-Milne's Predictor corrector method and Adams-Bashforth method (Simple problems).

**TOTAL: 60 Hours****COURSE OUTCOME:**

CO-1: Acquire the skill on testing of hypothesis

CO-2: Familiar with the design of experiments

CO-3: Attain the knowledge on solution of equations and eigen value problems

CO-4: Describe the applications of interpolation, numerical differentiation and numerical integration

CO-5: Attain the knowledge on numerical solution of ordinary differential equations

**TEXT BOOKS:**

1. Grewal, B.S. and Grewal, J.S., " Numerical methods in Engineering and Science", 9<sup>th</sup> Edition, Khanna Publishers, New Delhi, 2012.(For units 3, 4 and 5).
2. Johnson R.A. and Gupta C.B, "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 7<sup>th</sup> edition, 2007 (For units 1 and 2).
3. Dr.Kandasamy .P, Dr.Thilagavathi, Dr.Gunavathi.K, "Statistics and numerical methods", s.chand and company, first edition,2010.

**REFERENCE BOOKS:**

1. Chapra, S. C and Canale, R. P. "Numerical Methods for Engineers", Tata McGraw-Hill, New Delhi, 7<sup>th</sup> Edition,2014.
2. Walpole R.E, Myers R.H, Myers S.L, and Ye. K, "Probability and Statistics for Engineers and Scientists", Pearson Education, Asia , 9<sup>th</sup> edition, 2011.

**OBJECTIVE:**

To understand the properties of fuels and lubricants for the design and operation of the I.C engines.

**UNIT I MANUFACTURE OF FUELS AND LUBRICANTS****9**

Structure of petroleum, refining process, fuels, thermal cracking, catalytic cracking, polymerization, alkylation, isomerisation, blending, products of refining process. Manufacture of lubricating oil base stocks, manufacture of finished automotive lubricants.

**UNIT II THEORY OF LUBRICATION****9**

Engine friction: introduction, total engine friction, effect of engine variables on friction, hydrodynamic lubrication, elasto hydrodynamic lubrication, boundary lubrication, bearing lubrication, functions of the lubrication system, introduction to design of a lubricating system.

**UNIT III LUBRICANTS****9**

Specific requirements for automotive lubricants, oxidation deterioration and degradation of lubricants, additives and additive mechanism, synthetic lubricants, classification of lubricating oils, properties of lubricating oils, tests on lubricants. Grease, classification, properties, test used in grease.

**UNIT IV PROPERTIES AND TESTING OF FUELS****9**

Thermo-chemistry of fuels, properties and testing of fuels, relative density, calorific value, flash point, fire point, distillation, vapour pressure, spontaneous ignition temperature, viscosity, pour point, flammability, ignitability, diesel index, API gravity, aniline point, carbon residue, copper strip corrosion etc.

**UNIT V COMBUSTION & FUEL RATING****9**

SI Engines – flame propagation and mechanism of combustion, normal combustion, knocking, octane rating, fuel requirements. CI Engine, mechanism of combustion, diesel knock, cetane rating, fuel requirements. Additive - mechanism, requirements of an additive, petrol fuel additives and diesel fuel additives – specifications of fuels.

**TOTAL : 45 PERIODS****OUTCOME:**

At the end of the course, the student can understand the importance, manufacturing methods, testing methods, combustion methodology of automotive fuels and lubricants.

**TEXT BOOKS:**

1. Ganesan.V., "Internal Combustion Engineering", Tata McGraw-Hill Publishing Co., New Delhi, 2003.
2. Mathur. M.L., Sharma. R.P. "A course in internal combustion engines", Dhanpatrai publication, 2003.
3. Obert. E.F "Internal Combustion Engineering and Air Pollution", International book Co., 1988.

**REFERENCES:**

1. Brame, J.S.S. and King, J.G. – "Fuels Solids, Liquids, Gaseous". Edward Arnold, 1961
2. Francis, W, "Fuels and Fuel Technology", Vol. I & II, Pergamon, 1965
3. Hobson, G.D. & Pohl.W "Modern Petroleum Technology", 1974
4. Lansdown. A.R., Lubrication, "A practical guide to lubricant selection", Pergamon press, 1982.
5. Raymond. C. Gunther, "Lubrication", Chilton Book Co., 1971.

**COURSE OBJECTIVE:**

To impart knowledge on the structure, properties, treatment, testing and applications of metals and non-metallic materials so as to identify and select suitable materials for various engineering applications.

**UNIT I ALLOYS AND PHASE DIAGRAMS****9**

Constitution of alloys – Solid solutions, substitutional and interstitial – phase diagrams, Isomorphous, eutectic, eutectoid, peritectic, and peritectoid reactions, Iron – carbon equilibrium diagram. Classification of steel and cast Iron microstructure, properties and application.

**UNIT II HEAT TREATMENT****9**

Definition – Full annealing, stress relief, recrystallisation and spheroidising – normalising, hardening and Tempering of steel. Isothermal transformation diagrams – cooling curves superimposed on I.T. diagram CCR – Hardenability, Jominy end quench test - Austempering, martempering – case hardening, carburizing, Nitriding, cyaniding, carbonitriding – Flame and Induction hardening – Vacuum and Plasma hardening.

**UNIT III FERROUS AND NON-FERROUS METALS****9**

Effect of alloying additions on steel-  $\alpha$  and  $\beta$  stabilisers– stainless and tool steels – HSLA, Maraging steels – Cast Iron - Grey, white, malleable, spheroidal – alloy cast irons, Copper and copper alloys. Brass, Bronze and Cupronickel – Aluminium and Al-Cu – precipitation strengthening treatment – Bearing alloys, Mg-alloys, Ni-based super alloys and Titanium alloys.

**UNIT IV NON-METALLIC MATERIALS****9**

Polymers – types of polymer, commodity and engineering polymers – Properties and applications of various thermosetting and thermoplastic polymers (PP, PS, PVC, PMMA, PET, PC, PA, ABS, PI, PAI, PPO, PPS, PEEK, PTFE, Polymers – Urea and Phenol formaldehydes)- Engineering Ceramics  
Properties and applications of  $Al_2O_3$ , SiC,  $Si_3N_4$ , PSZ and SIALON –Composites-Classifications- Metal Matrix and FRP - Applications of Composites.

**UNIT V MECHANICAL PROPERTIES AND DEFORMATION MECHANISMS****9**

Mechanisms of plastic deformation, slip and twinning – Types of fracture – Testing of materials under tension, compression and shear loads – Hardness tests (Brinell, Vickers and Rockwell), hardness tests, Impact test Izod and Charpy, fatigue and creep failure mechanisms.

**TOTAL: 45 PERIODS****COURSE OUTCOMES**

**Upon the completion of this course the students will be able to**

- CO1 Explain alloys and phase diagram, Iron-Iron carbide diagram and steel classification.
- CO2 Explain isothermal transformation, continuous cooling diagrams and different heat treatment processes.
- CO3 Summarize the mechanism of plastic deformation and testing mechanical properties.
- CO4 Clarify the effect of alloying elements on ferrous and non-ferrous metals.
- CO5 Differentiate different non-metallic materials.

**TEXT BOOKS:**

1. Avner,, S.H., "Introduction to Physical Metallurgy", McGraw Hill Book Company,1997.
2. Williams D Callister, "Material Science and Engineering" Wiley India Pvt Ltd, Revised Indian Edition 2014

**REFERENCES:**

1. Kenneth G.Budinski and Michael K. Budinski, "Engineering Materials", Prentice Hall of India Private Limited, 2010.
2. Raghavan.V, "Materials Science and Engineering", Prentice Hall of India Pvt. Ltd., 2015.
3. U.C.Jindal : Material Science and Metallurgy, "Engineering Materials and Metallurgy", First Edition, Dorling Kindersley, 2012
4. Upadhyay. G.S. and Anish Upadhyay, "Materials Science and Engineering", Viva Books Pvt. Ltd., New Delhi, 2006.

**COURSE OBJECTIVE :**

- Study of the Constructional details and Theory of important drive lines
- Steering, Braking and Suspension Systems of Automobiles.

**UNIT I LAYOUT, FRAME, FRONT AXLE AND STEERING SYSTEM****9**

Basic construction of chassis, Types of Chassis layout, with reference to Power Plant location and drive, various, types of frames, Loads acting on vehicle frame, Types of Front Axles and Stub Axles, Front Wheel Geometry. Condition for True Rolling Motion. Ackerman's and Davi's Steering Mechanisms, Steering Linkages, Different Types of Steering Gear boxes, Slip Angle, Over-Steer and Under-Steer, Reversible and Irreversible Steering, Power Steering.

**UNIT II DRIVE LINE, FINAL DRIVE AND DIFFERENTIAL****9**

Driving Thrust and its effects, torque reactions and side thrust, Hotchkiss drive, torque tube drive, radius rods and stabilizers, Propeller Shaft, Universal Joints, Constant Velocity Universal Joints, Final drive, different types of final drive, Worm and Worm wheel, straight bevel gear, spiral bevel gear and hypoid gear final drive. Differential principle. Constructional details of differential unit, Differential housings, Non-Slip differential, Differential locks.

**UNIT III REAR AXLES, WHEELS, RIMS AND TYRES****9**

Construction of rear axles, Types of Loads acting on rear axles, Full -Floating, Three-Quarter Floating and Semi-Floating Axles, Twist beam rear axle, Types, Multi axles vehicles. Wheels and Rims, Types of Tyres and their constructional details.

**UNIT IV BRAKE SYSTEMS****9**

Need for Brake systems, Stopping Distance, Time and Braking Efficiency, Effect of Weight Transfer during Braking, Classification of brakes , Braking Torque, drum brake and disc Brake Theory, Types and Construction of Hydraulic Braking System, Mechanical Braking System, Pneumatic Braking System, Power-Assisted Braking System, Servo Brakes, Retarders – antilock braking systems(ABS).

**UNIT V SUSPENSION SYSTEM****9**

Requirement of Suspension System, Types of Suspension Springs, Constructional details and characteristics of Single Leaf, Multi-Leaf spring, Coil and Torsion bar Springs, Rubber, Pneumatic and Hydro – elastic Suspension Spring Systems, Independent Suspension System, Shock Absorbers, Types and Constructional details of Leaf and Coil Springs.

**TOTAL: 45 Hours****COURSE OUTCOME:**

- CO – 1: Clearly explain the vehicle layout and drives.  
 CO – 2: Understand the steering system and its components.  
 CO – 3: Familiar with the driveline system components and its working.  
 CO – 4: Clearly explain the concept of various types of braking system and its components.  
 CO – 5: Clearly understand suspension systems and its components.

**TEXT BOOKS:**

1. K. Newton, W. Steeds and T.K. Garret, "The Motor Vehicle", 13<sup>th</sup> Edition, Butterworth Heinemann, India, 2004.
2. P.M. Heldt, "Automotive Chassis", Chilton Co., New York, 1982.
3. W. Steed, "Mechanics of Road Vehicles", Illiffe Books Ltd., London. 1992.

**REFERENCES:**

1. Harban Singh Rayat, "The Automobile", S. Chand & Co. Ltd, New Delhi, 2000.
2. G.J.Giles, "Steering Suspension and Tyres", Illiffe Books Ltd., London, 1975.
3. Kirpal Singh, "Automobile Engineering", Standard publishers, Distributors, Delhi, 1999.
4. G.B.S.Narang, "Automobile Engineering", Khanna Publishers, Twelfth reprint New Delhi, 2005.
5. R.P.Sharma, "Automobile Engineering", DhanpatRai& Sons, New Delhi, 2000.

**COURSE OBJECTIVE :**

- To learn the thermal analysis and sizing of heat exchangers and to understand the basic
- To understand the concepts of heat transfer through extended surfaces.
- To understand the mechanisms of heat transfer under steady and transient conditions. concepts of mass transfer.

(Use of standard HMT data book permitted)

**UNIT I CONDUCTION****12**

Basic Concepts – Mechanism of Heat Transfer – Conduction, Convection and Radiation – General Differential equation of Heat Conduction – Fourier Law of Conduction – Cartesian and Cylindrical Coordinates – One Dimensional Steady State Heat Conduction – Conduction through Plane Wall, Cylinders and Spherical systems – Composite Systems – Conduction with Internal Heat Generation – Extended Surfaces – Unsteady Heat Conduction – Lumped Analysis – Use of Heislers Chart.

**UNIT II CONVECTION****12**

Basic Concepts – Convective Heat Transfer Coefficients – Boundary Layer Concept – Types of Convection – Forced Convection – Dimensional Analysis – External Flow – Flow over Plates, Cylinders and Spheres – Internal Flow – Laminar and Turbulent Flow – Combined Laminar and Turbulent – Flow over Bank of tubes – Free Convection – Dimensional Analysis – Flow over Vertical Plate, Horizontal Plate, Inclined Plate, Cylinders and Spheres.

**UNIT III PHASE CHANGE HEAT TRANSFER AND HEAT EXCHANGERS****12**

Nusselts theory of condensation-pool boiling, flow boiling, correlations in boiling and condensation. Types of Heat Exchangers – LMTD Method of heat Exchanger Analysis – Effectiveness – NTU method of Heat Exchanger Analysis – Overall Heat Transfer Coefficient – Fouling Factors.

**UNIT IV RADIATION****12**

Basic Concepts, Laws of Radiation – Stefan Boltzman Law, Kirchoff Law –Black Body Radiation –Grey body radiation Shape Factor Algebra – Electrical Analogy – Radiation Shields –Introduction to Gas Radiation.

**UNIT V MASS TRANSFER****12**

Basic Concepts – Diffusion Mass Transfer – Fick's Law of Diffusion – Steady state Molecular Diffusion – Convective Mass Transfer – Momentum, Heat and Mass Transfer Analogy – Convective Mass Transfer Correlations

**TOTAL: 60 Hours****COURSE OUTCOME**

CO-1: Ability to design and analyze the performance of heat exchangers

CO-2; Describe the physical phenomena associated with convection;

CO-3: Analyze external and internal, forced and free convection problems.

CO-4: Explain the physical mechanisms involved in radiation heat transfer.

CO-5: Analyze the radiative heat exchange between surfaces and in diffuse, gray enclosures.

**TEXT BOOKS:**

1. Sachdeva R C, "Fundamentals of Engineering Heat and Mass Transfer" New Age International, 1995.
2. Yadav R "Heat and Mass Transfer" Central Publishing House, 1995.

**REFERENCES:**

1. Nag P.K, " Heat Transfer", Tata McGraw-Hill, New Delhi, 2002
2. Holman J.P "Heat and Mass Transfer" Tata McGraw-Hill, 2000.
3. Kothandaraman C.P "Fundamentals of Heat and Mass Transfer" New Age International, New Delhi, 1998
4. Frank P. Incropera and David P. DeWitt, "Fundamentals of Heat and Mass Transfer", John Wiley and Sons, 1998.
5. Velraj R, "Heat & Mass Transfer", Ane Books, New Delhi, 2004

**COURSE OBJECTIVE:**

- At the end of this course the student is expected to understand what constitutes the environment, what are precious resources in the environment, how to conserve these resources, what is the role of a human being in maintaining a clean environment and useful environment for the future

**UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY 9**

Definition – Scope and importance – Need for public awareness – Concepts of an Ecosystem – Structure and Function of an Ecosystem –Producers, Consumers and Decomposers – Energy Flow in the Ecosystem – Ecological Succession – Food Chains, Food Webs and Ecological Pyramids – Introduction, Types, Characteristic Features, Structure and Function of the (A) Forest Ecosystem (B) Grassland Ecosystem (C) Desert Ecosystem (D) Aquatic Ecosystems (Ponds, Streams, Lakes, Rivers, Oceans, Estuaries) – Introduction to Biodiversity – Definition: Genetic, Species and Ecosystem Diversity – Bio-geographical Classification of India – Value of Biodiversity: Consumptive Use, Productive Use, Social, Ethical, Aesthetic and Option Values – Biodiversity at Global, National and Local Levels – India as a Mega-Diversity Nation – Hot-Spots of Biodiversity – Threats to Biodiversity: Habitat Loss, Poaching of Wildlife, Man-Wildlife Conflicts – endangered and Endemic Species of India – Conservation of Biodiversity: In-Situ and Ex-Situ conservation of Biodiversity. Field Study of Common Plants, Insects and Birds.

Field study of simple ecosystems - pond, river, hill slopes, etc.

**UNIT II ENVIRONMENTAL POLLUTION 9**

Definition – Causes, Effects and Control Measures of (A) Air Pollution (B) Water Pollution (C) Soil Pollution (D) Marine Pollution (E) Noise Pollution (F) Thermal Pollution (G) Nuclear Hazards – Solid Waste Management:- Causes, Effects and Control Measures of municipal solid Wastes – Role of an Individual in Prevention of Pollution – Pollution Case Studies – disaster Management - Floods, Earthquake, Cyclone and Landslides. Field study of local polluted site – Urban / Rural / Industrial / Agricultural.

**UNIT III NATURAL RESOURCES 9**

Forest resources -Use and over – Exploitation – Deforestation – Case studies – Timber extraction –Mining – Dams and their ground water – Floods – Drought – Conflicts over water –Dams – Benefits and Problems – Mineral Resources- Use and Exploitation, Environmental Effects of Extracting and Using Mineral Resources, Case Studies – Food Resources: World Food Problems, Changes caused by Agriculture and Overgrazing, Effects of Modern Agriculture, Fertilizer- Pesticide Problems, Water Logging, salinity, Case Studies – Energy Resources:- Growing Energy Needs, Renewable and Non Renewable Energy Sources, Use of Alternate Energy Sources, Case Studies – Land Resources - Land as a Resource, Land Degradation, Man Induced Landslides, Soil Erosion and Desertification – Role of an Individual in Conservation of Natural Resources – Equitable use of Resources for Sustainable Lifestyles.

Field study of local area to document environmental assets – river / forest / grassland / hill / mountain.

**UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT 9**

From Unsustainable To Sustainable Development – Urban Problems Related to energy – Water conservation, Rain Water Harvesting, Watershed Management – Resettlement and Rehabilitation of People, its Problems and Concerns, Case Studies Role of non – governmental organization - Environmental Ethics- Issues and Possible Solutions – Climate Change, Global Warming, Acid Rain, Ozone Layer Depletion, Nuclear Accidents and Holocaust, Case Studies – Wasteland Reclamation – Consumerism and Waste Products – Environment Production Act – Air (Prevention and Control of Pollution) Act – Water (Prevention and Control of Pollution) Act – Wildlife Protection Act – Forest Conservation Act –enforcement machinery involved in environmental Legislation – Central and state pollution control boards - Public Awareness.

**UNIT V****HUMAN POPULATION AND THE ENVIRONMENT****9**

Population Growth, Variation among Nations – Population Explosion Family Welfare Programme – environment and Human Health – Human Rights –Value Education – HIV /AIDS – Women and Child Welfare – Role of Information Technology in Environment and Human Health – Case Studies.

**Total: 45 Hours****COURSE OUTCOME:**

CO-1: Define the environment, ecosystems and biodiversity

CO-2: Describe the environmental pollution

CO-3: Explain the natural resources

CO-4: Describe the social issues and the environment

CO-5: Describe the human population and the environment

**TEXT BOOKS:**

1. Gilbert M.Masters, 'Introduction to Environmental Engineering and Science', 2nd edition, Pearson Education (2004).
2. Benny Joseph, 'Environmental Science and Engineering', Tata McGraw- Hill, NewDelhi, (2006).

**REFERENCES:**

1. R.K. Trivedi, 'Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards', Vol.I and II, Enviro Media.
2. Cunningham, W.P. Cooper, T.H. Gorhani, 'Environmental Encyclopedia', Jaico Publ., House, Mumbai, 2001.
3. Dharmendra S. Sengar, 'Environmental law', Prentice hall of India PVT LTD, New Delhi, 2007.
4. Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press (2005)



**COURSE OBJECTIVE:**

To train the Students to know the details of different chassis components, dismantling and assembling them.

**LIST OF EXPERIMENTS****Study and measurement of the following chassis frames:**

1. Heavy duty vehicle frame (Leyland, Tata etc)
2. Light duty vehicle frame (Ambassador, Maruti van etc)
3. Front Axle
4. Rear Axle
5. Differential
6. Steering systems along with any two types of steering gear box
7. Braking systems – hydraulic servo vacuum, compressed air power brakes.
8. Leaf spring, coil spring, torsion bar spring, Hydraulic shock absorber
9. Clutch assembly of different types
10. Gear Box
11. Transfer case

**THE LIST OF EQUIPMENTS - Each 1 No (For A Batch of 30 Students)**

1. Heavy duty vehicle chassis frame (Leyland or Tata)
2. Light duty vehicle chassis frame
3. Front axle
4. Rear axle
5. Steering system
2. Steering gear box (Rack and pinion, recirculating Ball type)
3. Hydraulic brake system
4. Air brake system
5. Leaf spring, coil spring, torsion bar
6. Hydraulic shock absorber
7. Diaphragm clutch assembly
8. Gear box (light duty, heavy duty)
9. Transfer case

**TOTAL: 45 Hours****COURSE OUTCOME:**

- CO-1: Describe the Heavy duty vehicle frame
- CO-2: Describe the Light duty vehicle frame
- CO-3: Demonstrate the dismantling and assembling of Front Axle, Rear Axle and Differential
- CO-4: Define the Steering systems along with any two types of steering gear box
- CO-5: Explain the Braking systems – hydraulic servo vacuum, compressed air power brakes.
- CO-6: Describe the Leaf spring, coil spring, torsion bar spring, Hydraulic shock absorber
- CO-7: Explain the Clutch assembly of different types
- CO-8: Describe the Gear Box and Transfer case

**COURSE OBJECTIVE:**

To train the Students to know the details of different engine components, dismantling and assembling them.

**LIST OF EXPERIMENTS**

1. Dismantling of 4 cylinder petrol engine.
2. Assembling of 4 cylinder petrol engine.
3. Dismantling of 6 cylinder diesel engine.
4. Assembling of 6 cylinder diesel engine.
5. Study of oil filter, fuel filter, fuel injection system, carburetor, MPFI
6. Study of ignition system components – coil, magneto and electronic ignition systems.
7. Study of engine cooling system components
8. Study of engine lubrication system components
9. Ovality and taper measurement of cylinder bore and comparison with standard specifications
10. Ovality and taper measurement of engine crank shaft and comparison with standard specification

**LIST OF EQUIPMENTS - Each 1 No**

1. Four cylinder petrol engine
2. Six cylinder diesel engine
3. Fuel filter, fuel injection pump, injector, carburetor, MPFI component
4. Ignition coil, magneto, electronic ignition system components
5. Water pump, thermostat, radiator, temperature gauge
6. Lub oil pump, pressure relief valve, filter, oil pressure gauge
7. Internal micrometer, external micrometer, dial gauges.

**TOTAL: 45 Hours****COURSE OUTCOME:**

- CO-1: Demonstrate the Dismantling and Assembling of 4 cylinder petrol engine.
- CO-2: Demonstrate the Dismantling and Assembling of 6 cylinder diesel engine.
- CO-3: Describe the oil filter, fuel filter, fuel injection system, carburetor, MPFI
- CO-4: Explain the ignition system components – coil, magneto and electronic ignition systems.
- CO-5: Describe the engine cooling system components
- CO-6: Describe the engine lubrication system components
- CO-7: Perform the Ovality and taper measurement of cylinder bore.
- CO-8: Perform the Ovality and taper measurement of engine crank shaft.

**COURSE OBJECTIVE:**

- Providing value education to improve the students' character - understanding of principled life and physical health - maintaining youthfulness - measures and methods in five aspects of life

**UNIT I: PHYSICAL HEALTH 6**

1. Manavalakalai (SKY) Yoga: Introduction - Education as a means for youth empowerment - Greatness of Education - Yoga for youth Empowerment.
2. Simplified Physical Exercises: Hand, Leg, Breathing, Eye exercises - Kapalabathi, Makarasana Part I, Makarasana Part II, Body Massage, Acu pressure, Relaxation exercises - Benefits.
3. Yogasanas: Pranamasana - Hastha Uttanasana - Pada Hasthasana – AswaSanjalana Asana - Thuvipatha asva Sanjalana asana - Astanga Namaskara - Bhujangasana - Atha Muktha Savasana - Aswa Sanjalana Asana - Pada Hasthasana - Hastha Uttanasana - Pranamasana.
4. Pranayama : Naddi suddi - Clearance Practice - Benefits.

**UNIT II: LIFE FORCE 6**

1. Reasons for Diseases - Natural reasons (Genetic / imprints, Planetary Position, Natural calamities and climatic changes) - Unnatural reasons (Food habits, Thoughts, Deeds)
2. Philosophy of Kaya kalpa - Physical body - Sexual vital fluid - Life force - Bio-Magnetism - Mind.
3. Maintaining youthfulness : Postponing old age - Transformation of food into seven components - Importance of sexual vital fluid.
4. Measure and method in five aspects of life - Controlling undue Passion.
5. Kayakalpa practice - Aswini Mudra - Ojas breath - Benefits of Kaya Kalpa.

**UNIT III: MENTAL HEALTH 6**

- 1) Mental Frequencies - Beta, Apha, Theta and Delta wave - Agna Meditation explanation - benefits.
- 2) Shanthi Meditation explanation - Benefits
- 3) Thuriya Meditation explanation - Benefits
- 4) Benefits of Blessing - Self blessing (Auto suggestion) - Family blessing - Blessing the others - World blessing - Divine protection

**UNIT IV: VALUES 6**

- Human Values:
  - 1) Self control - Self confidence - Honesty
  - 2) Contentment - Humility - Modesty
  - 3) Tolerance - Adjustment - Sacrifice - Forgiveness
  - 4) Purity (Body, Dress, Environment) - Physical purity - Mental purity - Spiritual purity
- Social Values:
  - 1) Non violence - Service
  - 2) Patriotism - Equality
  - 3) Respect for parents and elders - care and protection - Respect for teacher
  - 4) Punctuality - Time Management

**UNIT V: MORALITY (VIRTUES) 6**

- 1) Importance of Introspection - I - Mine (Ego, Possessiveness).
- 2) Six Evil Temperaments - Greed - Anger - Miserliness - Immoral sexual passion - Inferiority and superiority Complex – Vengeance.

- 3) Maneuvering of Six Temperaments - Contentment - Tolerance - Charity - Chastity - Equality - Pardon (Forgiveness).
- 4) Five essential Qualities acquired through Meditation: Perspicacity - Magnanimity - Receptivity - Adaptability – Creativity.
- 5) Improved Memory Power - Success in the Examination.

**Total: 30 hrs.**

**COURSE OBJECTIVE:**

CO-1: Define the physical health

CO-2: Explain the life force

CO-3: Describe the mental health

CO-4: Explain the human values

Co-5: Describe the morality

**REFERENCE BOOKS:**

1. Vethathiri Maharishi, 16<sup>th</sup> Edi.2013, Yoga for Modern Age, Vethathiri Publications, Erode.
2. Vethathiri Maharishi, 2014, Simplified Physical Exercises, Vethathiri Publications, Erode.
3. Vethathiri Maharishi, 3<sup>rd</sup> Edi.2014, Kayakalpam, Vethathiri Publications, Erode.
4. Rev.Dr.G.U.pope, 2016, Thirukkural, Giri Trading Agency,
5. Vethathiri Maharishi, 1994, Mind, Vethathiri Publications, Erode.
6. Chandrasekaran.K, 1999, Sound Health through yoga, Sedapati, Tamilnadu, Premkalyan Publications.
7. Iyengar, B.K.S. 2008, Light on Yoga, Noida, UP India, Harber Collins Publishing India Ltd.,

**COURSE OBJECTIVE:**

To impart knowledge in automotive transmission concept, construction and principle of operation of various types of mechanical transmission components, hydrodynamic devices, hydrostatic devices and automatic transmission system will be taught to the students.

**UNIT I CLUTCH AND GEAR BOX 9**

Requirement of Transmission system. Different types of clutches: Principle, construction and operation of friction clutches. Objective of the gear box. Problems on performance of automobile such as Resistance to motion, Tractive effort, Engine speed & power and acceleration. Determination of gear box ratios for different vehicle applications. Different types of gear boxes.

**UNIT II HYDRODYNAMIC DRIVES 9**

Principles, performance and limitations of fluid coupling Constructional details of a typical fluid coupling. Reduction of drag torque, Principle, construction and advantages of hydrodynamic torque converters. Performance characteristics, converter couplings. Multi-stage Torque converter and poly phase torque converter.

**UNIT III AUTOMATIC TRANSMISSION 9**

Automatic transmission: relative merits and demerits when compared to conventional transmission, automatic control of gears, study of typical automatic transmissions, Ford—T-model gearbox, Wilson gearbox, Electro-magnetic transmission, Automatic overdrive, Hydraulic control system for automatic transmission.

**UNIT IV HYDROSTATIC DRIVE AND ELECTRIC DRIVE 9**

Principle of hydrostatic drive systems. Construction and working of typical drives. Advantages and limitations. Control of hydrostatic transmissions, Principle of electric drive. Early and modified Ward Leonard control systems.

**UNIT V AUTOMATIC TRANSMISSION APPLICATIONS 9**

Chevrolet "Turbo glide" transmission. Toyota's Automatic transmission with Electronic control system, Automatic Transmission with Intelligent Electronic controls system, Hydraulic Actuation system. Continuously Variable Transmission (CVT) – types – Operations.

**TOTAL: 45 Hours****COURSE OUTCOME**

CO-1: Describe the concept of gear motions, drive line positions.

CO-2: Study about different types of gearboxes.

CO-3: Describe the multi stage and polyphase torque converters, performance characteristics

CO-4: Study about Automatic transmission

CO-5: Explain the working of various parts like engine, transmission, clutch, brakes

**TEXT BOOK:**

1. Heldt P.M, Torque Converters, Chilton Book Co., 1992.
2. K. Newton, W.Steeds and T.K.Garret, "The Motor Vehicle", 13th Edition, Butterworth Heinemann, India, 2004.

**REFERENCES:**

1. Harald Naunheimer, Bernd Bertsche, Joachim Ryborz, Wolfgang Novak, "Automotive Transmissions: Fundamentals, Selection, Design and Application", 2nd ed., Springer, 2011.
2. Heinz Heisler, "Advanced Vehicle Technology", second edition, Butterworth – Heinemann, New York, 2002
3. Dr. N. K. Giri, "Automobile Mechanics", Seventh reprint, Khanna Publishers, Delhi, 2005

**COURSE OBJECTIVE:**

- To make the students understand the design concept and principles of various engine components. These concepts and principles are familiarized for design of components.

**UNIT I INTRODUCTION****9**

Engineering materials - Introduction endurance limit, notch sensitivity. Tolerances, types of tolerances and fits, design considerations for interference fits, surface finish, surface roughness, Rankine's formula - Tetmajer's formula - Johnson formula- design of push- rods.

**UNIT II DESIGN OF CYLINDER, PISTON AND CONNECTING ROD****9**

Choice of material for cylinder and piston, design of cylinder, piston, piston pin, piston rings, piston failures, lubrication of piston assembly. Material for connecting rod, determining minimum length of connecting rod, small end design, shank design, design of big end cap bolts.

**UNIT III DESIGN OF CRANKSHAFT****9**

Balancing of I.C. engines, significance of firing order. Material for crankshaft, design of crankshaft under bending and twisting, balancing weight calculations, development of short and long crank arms. Front and rear-end details.

**UNIT IV DESIGN OF FLYWHEELS****9**

Determination of the mass of a flywheel for a given co- efficient of speed fluctuation. Engine flywheel - stresses on the rim of the flywheels. Design of hubs and arms of the flywheel, turning moment diagram.

**UNIT V DESIGN OF VALVES AND VALVE TRAIN****9**

Design aspects of intake & exhaust manifolds, inlet & exhaust valves, valve springs, tappets and valve train. Design of cam & camshaft. Design of rocker arm. Cam profile generation.

**TOTAL: 45 Hours****COURSE OUTCOME:**

- CO – 1: Define the concept of interference fits & surface finish.
- CO – 2: Describe the Rankine's formula, Tetmajer's formula & Johnson formula.
- CO – 3: Explain the concepts of cylinder and piston design.
- CO – 4: Analyze the Material for connecting rod.
- CO – 5: Familiar with the various types of firing order.
- CO – 6: Estimate the front and rear-end details.
- CO – 7: Analyze the mass of a flywheel for a given co- efficient of speed fluctuation.
- CO – 8: Explain the turning moment diagram.
- CO – 9: Know the different types of intake & exhaust manifolds.

**TEXT BOOK:**

- Khurmi. R.S. & Gupta.J.K., A textbook of Machine Design, Eurasia Publishing House (Pvt) Ltd, 2001.

**REFERENCES:**

- Jain.R.K, "Machine Design", Khanna Publishers, New Delhi, 2005.
- Giri.N.K, Automobile Mechanics, Khanna Publishers, New Delhi, 2007.

**COURSE OBJECTIVE:**

- ❖ To understand the concepts of designing the vehicle and various resistances.
- ❖ To familiarize with vehicle and engine performance curves.
- ❖ To impart knowledge on calculation of vehicle gear ratios.

**UNIT I INTRODUCTION****12**

Assumptions to be made in designing a vehicle, Range of values for Gross Vehicle Weight, Frontal Area, maximum speed, maximum acceleration, grad ability of vehicle in different gears, Basics of Automobile Design.

**UNIT II RESISTANCE TO VEHICLE MOTION****12**

Calculation, Tabulation and Plotting of Curves for Air and Rolling Resistances at various vehicle speeds, Calculation and Plotting of Driving force, Power requirement for different loads and acceleration, Maximum Power calculation.

**UNIT III PERFORMANCE CURVES-I****12**

Calculation, Tabulation and Plotting of Torque and Mechanical Efficiency for different vehicle speeds, Interpolation of Pressure – Volume diagram, Calculation of frictional Mean Effective Pressure, Calculation of Engine Cubic Capacity, Bore and Stroke Length.

**UNIT IV PERFORMANCE CURVES-II****12**

Connecting rod length to Crank Radius Ratio, Plotting of Piston Velocity and Acceleration against Crank Angle, Plotting Gas force, inertia force and Resultant force against Crank Angle, Turning Moment and Side Thrust against Crank Angle.

**UNIT V GEAR RATIOS****12**

Determination of Gear Ratios for first, second, third and top gears, Acceleration and Grad ability vehicle, Typical problems occur on Vehicle performance.

**TOTAL: 60 Hours****COURSE OUTCOME:**

- CO-1: Describe the concepts and assumptions to be made in designing a vehicle.
- CO-2: Interpret the various data for designing the vehicle.
- CO-3: Identify the various resistances to vehicle motion and plot the graphs.
- CO-4: Formulate the engine performance parameters and draw the performance curves.
- CO-5: Evaluate the various forces and moments and plot the graphs.
- CO-6: Evaluate the vehicle performance parameters and draw the performance curves.
- CO-7: Demonstrate the calculation of various gear ratios for vehicle.

**TEXT BOOKS:**

- 1 N. K. Giri, Automotive Mechanics, Khanna Publishers, New Delhi, 2005.
2. Heldt, P.M., High Speed Combustion Engines, Oxfore and I.B.H. Publishing Co.,Kolkata, 2002.

**REFERENCES:**

1. Heinz Heisler, Advanced Vehicle Technology, Butterworth-Heinemann Ltd; 2nd Revised edition edition. 2002.
2. R.B.Gupta, Automobile Engineering, Satya Prakashan, New Delhi, 2012.

**COURSE OBJECTIVE:**

To impart knowledge in automotive pollution control techniques of pollutants like UBHC, CO, NO<sub>x</sub>, particulate matter and smoke for both SI and CI engine will be taught to the students.

**UNIT I EMISSION FROM AUTOMOBILES 5**

Vehicle population assessment in metropolitan cities and contribution to pollution, effects on human health and environment, global warming, various emissions from Automobiles — Formation, transient operational effects on pollution.

**UNIT II EMISSIONS FROM SPARK IGNITION ENGINE AND ITS CONTROL 12**

Emission formation in SI Engines- Carbon monoxide- Unburned hydrocarbon Nitric oxide. Lead particulate—Polynuclear Aromatic hydrocarbon emissions—Effects of design and operating variables on emission formation- controlling of pollutants from Engine- Thermal reacts — Catalytic converters — Charcoal Canister Control for evaporative emission — Positive Crank case ventilation system for UBHC emission reduction.

**UNIT III EMISSION FROM COMPRESSION IGNITION ENGINE AND ITS CONTROL 12**

Physical and Chemical delay — Significance — Intermediate Compounds Formation — emission formation due to incomplete Combustion — Effect of Operating variables on Emission formation — White, Blue, and Black Smokes. Nitric Oxide and Particulate controlling of Emission — Operating Behavior- Fumigation EGR- Air Injection — Cetane number Effect.

**UNIT – IV NOISE POLLUTION FROM AUTOMOBILES 8**

Causes for Noise from Automobiles—Traffic Noise—Engine Noise—Transmission Noise—vehicle structural Noise, Exhaust Noise, Noise reduction in Automobiles — Encapsulation technique for noise reduction — Silencer Design on Sound reduction in automobiles.

**UNIT – V TEST PROCEDURES AND EMISSION MEASUREMENTS 8**

Constant Volume Sampling I and 3 (CVSI & CVS3) Systems- Sampling Procedures — Seven mode and thirteen mode cycles for Emission Sampling — Sampling problems — Quantifying Emissions — Measurement of CO, CO by NDIR. Hydrocarbon emission by FID- Chemiluminescent detector for Measurement of NOR— Smoke meters — Dilution Tunnel Technique for particulate Measurement- Sound level meters.

**TOTAL : 45 Hours****COURSE OUTCOME:**

- CO – 1: Analyze the impact of vehicle population on pollution
- CO – 2: Describe the emission and its effect on human health and environment
- CO – 3: Describe the formation of pollutant in SI engine.
- CO – 4: Identify the formation of pollutant in CI engine
- CO – 5: Clearly explain the various noise and noise reduction in automobile
- CO – 6: Aware of US, Euro, and Indian emission norms

**TEXT BOOKS:**

1. G.P.Springer and D.J.Patterson, Engine Emissions, Pollutant formation, Plenum Press, New York, 1986.
2. D.J.Patterson and N.A.Henin, 'Emission from Combustion Engine and their control', Anna Arbor Science Publication, 1985.

**REFERENCES:**

1. V.Ganesan, 'Internal combustion Engines', Tata McGraw Hill Book Co, Eighth Reprint, 2005.
2. Crouse and Anglin, 'Automotive Emission Control', McGraw Hill company., Newyork 1993.
3. L.Lberanek, 'Noise Reduction', Mcgrawhill Company., Newyork1993.
4. C.Duerson, 'Noise Abatment', Butterworths Ltd., London1990.



**COURSE OBJECTIVE:**

To conduct performance test and emission test on the IC engines.

**LIST OF EXPERIMENTS**

1. Study of Pressure pickups, charge amplifier, storage oscilloscope and signal analysers used for IC engine testing.
2. Performance study of petrol and diesel engines both at full load and part load conditions.
3. Morse test on petrol and diesel engines.
4. Determination of compression ratio, volumetric efficiency and optimum cooling water flow rate in engines.
5. Heat balance test on an automotive engine.
6. Testing of 2 and 4 wheelers using chassis dynamometers.
7. Study of NDIR Gas Analyser and FID
8. Study of Chemiluminescent NOx analyzer
9. Measurement of HC, CO, CO<sub>2</sub>, O<sub>2</sub> using exhaust gas analyzer
10. Diesel smoke measurement.

**TOTAL: 45 Hours****COURSE OUTCOME:**

CO-1: Define the Pressure pickups, charge amplifier, storage oscilloscope and signal analyzers.

CO-2: Evaluate the performance of petrol and diesel engines both at full load and part load conditions.

CO-3: Perform the Morse test on petrol and diesel engines.

CO-4: Find the compression ratio, volumetric efficiency in engines.

CO-5: Perform the Heat balance test on an automotive engine.

CO-6: Demonstrate the testing of 2 and 4 wheelers using chassis dynamometers.

CO-7: Describe the NDIR Gas Analyser and FID

CO-8: Describe the Chemiluminescent NOx analyzer

CO-9: Explain the measurement of HC, CO, CO<sub>2</sub>, O<sub>2</sub> using exhaust gas analyzer

CO-10: Describe the Diesel smoke measurement.

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**COURSE OBJECTIVE:**

- To familiarize the students to use modeling software to model engine components design

**LIST OF EXPERIMENTS**

1. Design and drawing of piston.
2. Piston pin and piston rings and drawing of these components.
3. Design of connecting rod small end and big end, shank design, design of big end cap, bolts and drawing of the connecting rod assembly
4. Design of crankshaft and balancing weight calculation.
5. Development of short and long crank arms, front end and rear end details, drawing of the crank shaft assembly.
6. Design and drawing of flywheel.
7. Ring gear design, drawing of the flywheel including the development of ring gear teeth.
8. Design and drawing of the inlet and exhaust valves.
9. Design of cam and camshaft, cam profile generation, drawing of cam and camshaft
10. Complete design of clutch components.

**THE LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS**

1. Computer nodes - 30 Nos.
2. Software like AutoCAD or Pro-E - 15 licenses

**TOTAL: 45 Hours****COURSE OUTCOME:**

- CO-1: Perform the design and drawing of piston.
- CO-2: Explain the drawing of Piston pin and piston pin.
- CO-3: Perform the design and drawing of the connecting rod assembly
- CO-4: Perform the design of crankshaft, balancing weight calculations.
- CO-5: Explain the design and drawing of flywheel.
- CO-6: Demonstrate the Ring gear design
- CO-7: Perform the design and drawing of the inlet and exhaust valves.
- CO-8: Explain the design and drawing of camshaft.
- CO-9 Describe the design procedure of clutch components
- CO-10: Draw the clutch components using drafting software

## 18PCAU61 AUTOMOTIVE ELECTRICAL AND ELECTRONICS SYSTEM

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### COURSE OBJECTIVE

- To be familiar with electrical and electronic components used in automobiles.

#### UNIT I BATTERIES AND STARTING SYSTEM

10

Different types of Batteries – principle, rating, testing and charging. Starter motors characteristics, capacity requirements. Drive mechanisms. Starter switches.

#### UNIT II CHARGING SYSTEM LIGHTING AND ACCESSORIES

9

DC Generators and Alternators their characteristics. Control unit – cut out, electronic regulators. Vehicle interior lighting system. Vehicle exterior lighting system. Wiring requirements. Lighting design. Dashboard instruments. Horn, trafficator.

#### UNIT III ELECTRONIC IGNITION AND INJECTION SYSTEM

9

Spark plugs. Advance mechanisms. Different types of ignition systems. Electronic fuel injection systems, mono and multi point fuel injection system (MPFI).

#### UNIT IV SAFETY SYSTEMS

8

Antilock braking system, air bag restraint system, voice warning system, seat belt system, road navigation system, anti theft system.

#### UNIT V SENSORS AND MICROPROCESSORS IN AUTOMOBILES

9

Basic sensor arrangements. Types of sensors – oxygen sensor, hot wire anemometer sensor, vehicle speed sensor, detonation sensor, accelerometer sensor, crank position sensor. Microprocessor and microcomputer controlled devices in automobiles such voice warning system, travel information system, keyless entry system, automatic transmission system, electronic steering system.

**TOTAL: 45 Hours**

### COURSE OUTCOME:

- CO-1: Explain all the sub-systems of an Automobile and 4 stroke IC Engine.
- CO-2: Explain the concepts of automotive sensors and actuators, their application and uses
- CO-3: Define the details systems like Engine System, Chassis, Transmission, Power train, Braking Systems etc
- CO-4: Obtain an overview of automotive components, subsystems, design cycles, communication protocols.
- CO-5: Interface automotive sensors and actuators with microcontrollers
- CO-6: Develop, simulate and integrate control algorithms for ECUs with hardware
- CO-7: Identify and interpret electrical/electronic system concern; determine necessary action.
- CO-8: Use wiring diagrams during diagnosis of electrical circuit problems.

### TEXT BOOKS:

- Young A.P. & Griffiths. L. "Automotive Electrical Equipment", ELBS & New Press- 1999.
- William B.Riddens "Understanding Automotive Electronics", 5th edition - Butter worth Heinemann Woburn, 1998.
- Crouse, W.H "Automobile Electrical Equipment", McGraw-Hill Book Co., Inc., New York, 3rd edition, 1986.

### REFERENCES:

- Bechhold "Understanding Automotive Electronics", SAE, 1998.
- Judge A.W "Modern Electrical Equipment of Automobiles", Chapman & Hall, London, 1992.
- Kholi.P.L "Automotive Electrical Equipment", Tata McGraw-Hill Co., Ltd., New Delhi, 1975.
- Robert Bosch "Automotive Hand Book", SAE (5th Edition), 2000.
- Ganesan.V. "Internal Combustion Engines", Tata McGraw-Hill Publishing Co., New Delhi, 2003.

**COURSE OBJECTIVE :**

- To study the Constructional details and Theory of important drive line.
- To familiarize with Steering, Braking and Suspension Systems of Automobile.
- To impart knowledge on Problem–Solving in Steering, Propeller Shaft, Braking and Suspension Systems.

**UNIT I VEHICLE FRAME AND SUSPENSION 9**

Study of loads-moments and stresses on frame members. Design of frame for passenger and commercial vehicle - Design of leaf Springs-Coil springs and torsion bar springs.

**UNIT II FRONT AXLE AND STEERING SYSTEMS 9**

Analysis of loads-moments and stresses at different sections of front axle. Determination of bearing loads at Kingpin bearings. Wheel spindle bearings. Choice of Bearings. Determination of optimum dimensions and proportions for steering linkages, ensuring minimum error in steering. Design of front axle beam.

**UNIT III CLUTCH 9**

Design of single plate clutch, multiplate clutch and cone clutch. Torque capacity of clutch. Design of clutch components, Design details of roller and sprag type of clutches.

**UNIT IV GEAR BOX 9**

Gear train calculations, layout of gearboxes. Calculation of bearing loads and selection of bearings. Design of three speed and four speed gearboxes.

**UNIT V DRIVE LINE AND REAR AXLE 9**

Design of propeller shaft. Design details of final drive gearing. Design details of full floating, semi- floating and three quarter floating rear shafts and rear axle housings and design aspects of final drive.

**TOTAL: 45 Hours****COURSE OUTCOME:**

- CO-1: Analyze the frames in vehicles.
- CO-2: Explain testing of frames and materials used in frames.
- CO-3: Describe the construction details of steering linkages.
- CO-4: Sketch the steering linkages layout for conventional and independent suspensions.
- CO-5: Evaluate the effect of driving thrust and torque.
- CO-6: Differentiate the rear axle construction-full floating, three quarter floating and semi-floating arrangements.
- CO-7: Write the disc brake, drum brake theory and constructional details.
- CO-8: Explain the testing of Brakes and factors affecting brake performance
- CO-9: Describe the types of suspension springs
- CO-10: Write the types of tyres and constructional details

**TEXT BOOKS:**

1. Giri, N.K., "Automobile Mechanics", Khanna publishers, New Delhi, 2007.
2. Khurmi. R.S. & Gupta. J.K., "A textbook of Machine Design", Eurasia Publishing House (Pvt) Ltd, 2001.

**REFERENCES:**

1. Dean Aaverns, "Automobile Chassis Design", Illife Book Co., 2001.
2. Heldt, P.M., "Automotive Chassis", Chilton Book Co., 1992.

**COURSE OBJECTIVE:**

- To understand about constructional details operating characteristics and vehicle design aspect.
- To familiarize with Indian model heavy & light duty vehicle.

**UNIT I POWER UNIT****9**

Two stroke SI engine, four stroke SI engine; merits and demerits, Symmetrical and unsymmetrical port timing diagrams, Types of scavenging processes, merits and demerits, scavenging pumps, Rotary valve engine. Fuel system, Lubrication system. Magneto coil and battery coil spark ignition system, electronic ignition system. Starting system, Kick starter system.

**UNIT II CHASSIS AND SUB-SYSTEMS****9**

Mainframe and its types. Chassis and shaft drive, Single, multiple plates and centrifugal clutches. Gear box and gear controls. Front and rear suspension systems. Shock absorbers. Panel meters and controls on handle bar.

**UNIT III BRAKES, WHEELS AND TYRES****9**

Brakes-Drum brakes, disc brakes, front and rear brake links, layouts, Wheels-Spoked wheel, cast wheel, disc wheel, disc types. Tyres and tubes.

**UNIT IV TWO WHEELERS****9**

Case study of major Indian models of motorcycles, scooters and mopeds, TVS mopeds and motorcycles, Hero Honda motorcycles, Bajaj scooters and motorcycles, Yamaha, Enfield motorcycles. Servicing and maintenance.

**UNIT V THREE WHEELERS****9**

Case study of major Indian models of three wheeler-, Bajaj Auto rickshaws, pickup vans, delivery vans, Ape load autos and trailer, Servicing and Maintenance: daily, weekly, monthly, Fault tracing.

**Total: 45 Hours****COURSE OUTCOME:**

- CO – 1: Clearly explain the scavenging processes.
- CO – 2: Explain the electronic ignition system.
- CO –3: Familiar with the shaft drive.
- CO – 4: Describe the Suspension system.
- CO – 5: Familiar with the different types of brake.
- CO – 6: Describe the tyre and tube.
- CO – 7: Describe study of major Indian models of motorcycles.
- CO – 8: Familiar with the concept of servicing and maintenance.
- CO – 9: Clearly understand of Indian model vehicle.
- CO – 10: Familiar with the vehicle body maintenance.

**TEXT BOOKS:**

1. Irving.P.E. - Motor Cycle Engineering - Temple Press Book, London – 1992.

**REFERENCES:**

1. The Cycle Motor Manual - Temple Press Limited, London - 1990
2. Encyclopedia of Motorcycling - 20 volume Marshall, Cavensih, UK - 1989
3. Brayant R.V, Vespa - Maintenance and Repair Series – S.Chand & Co., New Delhi - 1986.
4. Raymond Broad Lambretta - A Practical Guide to maintenance and repair – S.Chand. & Co., New Delhi - 1987.

**COURSE OBJECTIVE :**

- Explain with the testing procedure for automotive electrical system components.
- Explain with the testing procedure for automotive electronics system components.

**LIST OF EXPERIMENTS****a. Electrical Laboratory**

1. Testing of batteries and battery maintenance
2. Testing of starting motors and generators
3. Testing of regulators and cut – outs relay
4. Diagnosis of ignition system faults
5. Study of automobile electrical wiring

**b. Electronics Laboratory**

6. Study of rectifiers and filters
7. Study of logic gates, adder and flip-flops
8. Study of SCR and IC timer
9. Interfacing A/D converter and simple data acquisition
10. Micro controller programming and interfacing

**THE LIST OF EQUIPMENTS - Each 1 No****(For A Batch of 30 Students)**

- i. Battery, hydrometer, voltage tester
- ii. Starter motor, regulator, cutout
- iii. Distributor, ignition coil, spark plug
- iv. Auto electrical wiring system
- v. Rectifiers, filters
- vi. Amplifier
- vii. IC timer
- viii. Data logger

**TOTAL: 45 Hours****COURSE OUTCOME:**

- CO-1: Perform the testing of batteries and battery maintenance
- CO-2: Perform the testing of starting motors and generators
- CO-3: Perform the testing of regulators and cut – outs relay
- CO-4: Identify the ignition system faults
- CO-5: Describe the automobile electrical wiring
- CO-6: Define the rectifiers and filters
- CO-7: Describe the logic gates, adder and flip-flops
- CO-8: Define the SCR and IC timer
- CO-9: Explain the interfacing A/D converter and simple data acquisition
- CO-10: Explain the micro controller programming and interfacing

**COURSE OBJECTIVE :**

- Ensure the maximum availability of vehicle without any major problem.
- Educate the customer for safe driving.
- To train the students in maintaining the vehicle in good condition.
- To train the students in identifying the fault and rectification.

**LIST OF EXPERIMENTS FOR VEHICLE MAINTENANCE**

1. Study and Layout of Automobile Repair Shop.
2. Study and Preparation of Workshop Statements.
3. Study and List of Tools And Instruments.
4. Minor and Major Tuning of Diesel And Petrol Engines.
5. Fault Diagnosis of Ignition, Starting And Charging System.
6. Fault Diagnosis of Petrol And Diesel Fuel System And Filters & Air Cleaners.
7. Fault Diagnosis of Lighting System Horn & Wiper.
8. Performing Body Repair Works.
9. Adjustment Of Pedal Play In Clutch Brake, Hand Brake And Steering Wheel.
10. A) Bleeding Of Hydraulic Brake System and Diesel Fuel System.  
B) Wheel Bearing Adjustment.  
C) Adjustment of Head Lights.

**LIST OF EQUIPMENTS FOR VEHICLE MAINTENANCE LABORATORY**

1. Cylinder reboring – checking the cylinder bore.
2. Valve grinding, valve lapping.
3. Setting the valve angle and checking for valve leakage
4. Wheel alignment – testing of camber, caster.
5. Testing kingpin inclination, toe-in and toe-out.
6. Brake adjustment
7. Brake bleeding.
8. Removal of Tyre & Tube.

**LIST OF EXPERIMENTS FOR VEHICLE RECONDITIONING**

1. Engine Analyzer
2. Cylinder compression pressure gauge
3. Vacuum gauge
4. Spark plug cleaner and tester
5. Cam angle and rpm tester
6. Tacho-meter
7. Wheel alignment apparatus
8. Gas welding equipment
9. Bearing puller
10. Head light alignment gauge
11. Service manuals of petrol, diesel engines

**LIST OF EQUIPMENTS FOR VEHICLE RECONDITIONING**

1. Cylinder re-boring machine
2. Valve grinding machine
3. Valve lapping machine
4. Wheel alignment apparatus
5. Tyre remover

**TOTAL: 45 Hours**

**COURSE OUTCOME:**

- CO-1: Explain the preparation of workshop layout and statements
- CO-2: Describe the tools and instruments required for workshop
- CO-3: Demonstrate the fault diagnosis of electrical systems.
- CO-4: Demonstrate the fault diagnosis of air and fuel systems.
- CO-5: Perform adjustment of Clutch, Brake and Steering
- CO-6: Demonstrate the head light and wheel bearing adjustment.
- CO-7: Demonstrate the cylinder re-boring
- CO-8: Perform the valve grinding and lapping.
- CO-9: Demonstrate the Wheel alignment for a vehicle.
- CO-10: Demonstrate the removal of tyre and tube



# **SYLLABUS**

## **Professional Elective Courses**

**COURSE OBJECTIVE:**

- ❖ To study about vibrations and how to reduce the vibration under different loads.
- ❖ To familiarize with speed and road conditions in order to improve the comfort for the passengers

**UNIT I BASIC OF VIBRATION****12**

Classification of vibration, definitions, mechanical vibrating systems, mechanical vibration and human comfort. Modeling and simulation studies. Single degree of freedom, free, forced and damped vibrations. Magnification factor and transmissibility. Vibration absorber. Vibration measuring instruments. Two degree of freedom system. modal analysis.

**UNIT II TYRES****12**

Tire forces and moments, Tire structure, Longitudinal and Lateral force at various slip angles, rolling resistance, Tractive and cornering property of tire. Performance of tire on wet surface. Ride property of tires. Test on Various road surfaces. Tire vibration.

**UNIT III PERFORMANCE CHARACTERISTICS OF VEHICLE****12**

Equation of motion and maximum tractive effort. Aerodynamics forces and moments. Power plant and transmission characteristics. Prediction of vehicle performance. Braking performance- Braking Force, Brake Factor, Braking Efficiency and Stopping Distance.

**UNIT IV HANDLING CHARACTERISTICS OF VEHICLES****12**

Mathematical model of handling, Fundamental condition for true Rolling Steady State Handling: Slip angle, cornering power, Neutral steer, under steer and over steer, Steady state response, Lateral Acceleration, Transient response characteristics. Directional stability of vehicle.

**UNIT V DYNAMICS OF SUSPENSION SYSTEM****12**

Requirements of suspension system. Spring mass frequency, wheel hop, Wheel wobble, wheel shimmy, choice of suspension spring rate. Calculation of effective spring rate. Vehicle suspension in fore and aft, Hydraulic dampers and choice of damping characteristics. Compensated suspension systems.

**TOTAL: 60 Hours****COURSE OUTCOME:**

- CO – 1: Describe the vehicle vibration and simulation modelling.
- CO – 2: Define the vehicle degrees of freedom.
- CO –3: Describe the force and moment on tyre.
- CO – 4: Clearly explain the tyre properties.
- CO – 5: Familiar with the Aerodynamics forces and moments.
- CO – 6: Describe the Prediction of vehicle performance.
- CO – 7: Clearly explain the concept of steering geometry.
- CO – 8: Well versed with the concept of directional stability of vehicle.
- CO – 9: Clearly explain the suspension systems and its components.
- CO – 10: Analysis the concept of Load distribution.

**TEXT BOOKS:**

1. Rao J.S and Gupta. K "Theory and Practice of Mechanical Vibrations", Wiley Eastern Ltd., 2002.
2. J.Y.Wong,' Theory of ground vehicle', 4<sup>th</sup> Edition, John Wiley and Sons Inc., Newyork, 2008
3. Dr. N. K. Giri, "Automobile Mechanics", Seventh reprint, Khanna Publishers, Delhi, 2005

**REFERENCES:**

1. Massimo Guiggiani, "The Science of Vehicle Dynamics: Handling, Braking, and Ride of Road and Race Cars", Springer, 2014 edition
2. Groover, "Mechanical Vibration", 7<sup>th</sup> Edition, Nem Chand & Bros, Roorkee, India, 2003.
3. W.Steeds, 'Mechanics of road vehicle' Illiffe Books Ltd, London 1992
4. JG.Giles, 'Steering, Suspension tyres', Illife Books Lid London 1975
5. P.M.Heldt, 'Automotive chassis', Chilton Co ., Newyork, 1982

**COURSE OBJECTIVE:**

- ❖ To have a complete knowledge of the vehicle maintenance procedures.
- ❖ To impart knowledge on engine maintenance – repair and overhauling.

**UNIT I MAINTENANCE OF RECORDS AND SCHEDULES 10**

Requirements and importance of maintenance, types of maintenance, preparation of check lists, Inspection schedule, maintenance of records, log sheets and other forms, safety precautions in maintenance. Motor vehicle acts, insurance etc and traffic rules, motor vehicle driving rules and regulation.

**UNIT II ENGINE MAINTENANCE – REPAIR AND OVERHAULING 9**

Dismantling of engine components and cleaning, cleaning methods, visual and dimensional inspections, minor and major reconditioning of various components, reconditioning methods, engine assembly, special tools used for maintenance overhauling, engine tune up, including modern engines.

**UNIT III CHASSIS MAINTENANCE - REPAIR AND OVERHAULING 10**

Mechanical and automobile clutch, fluid flywheel, torque converter, automatic transmission and gear box, servicing and maintenance. Maintenance servicing of propeller shaft and differential system. Maintenance servicing of suspension systems. Brake systems, types and servicing techniques. Steering systems, overhauling and maintenance. Wheel alignment, computerized alignment and wheel balancing.

**UNIT IV ELECTRICAL AND ELECTRONIC SYSTEM MAINTENANCE 8**

Testing methods for checking electrical and electronic components, checking battery, starter motor, charging systems, DC generator and alternator, ignitions system, lighting systems. Fault diagnosis and maintenance of modern electronic controls, checking and servicing of dash board instruments.

**UNIT V MAINTENANCE OF FUEL, COOLING, LUBRICATION SYSTEMS AND VEHICLE BODY 8**

Servicing and maintenance of fuel system of different types of vehicles, calibration and tuning of engine for optimum fuel supply. Cooling systems, water pump, radiator, thermostat, anticorrosion and antifreeze additives. Lubrication maintenance, lubricating oil changing, greasing of parts. Vehicle body maintenance, minor and major repairs. Door locks and window glass actuating system maintenance.

**TOTAL: 45 Hours****COURSE OUTCOME:**

- CO –1: Demonstrate the dismantling of engine components and cleaning.
- CO – 2: List the minor and major reconditioning of various engine components.
- CO – 3: Illustrate the maintenance and servicing of suspension systems.
- CO – 4: Analyze the testing methods for checking battery, starter motor, charging systems, ignitions system.
- CO – 5: Discuss the fault diagnosis and maintenance of modern electronic controls.
- CO – 6: Explain the Servicing and maintenance of fuel system of different types of vehicles.

**TEXT BOOKS:**

1. John Doke "Fleet Management", McGraw-Hill Co. 1984.
2. Automotive Mechanics W.H. Crouse

**REFERENCES:**

1. James D Halderman - Advanced Engine Performance Diagnosis–PHI 1998.
2. Service Manuals from Different Vehicle Manufacturers. 66
3. Automobile Engineering by Kirpal Singh
4. Bosch Hand Book – 3rd Edition SAE 1993.

**COURSE OBJECTIVE:**

- To understand combustion phenomenon inside the cylinder and its computer simulation.

**UNIT I INTRODUCTION****9**

Introduction. Heat of reaction, complete combustion in C/H/O/N Systems, Constant volume adiabatic combustion, constant pressure adiabatic combustion. Calculation of adiabatic flame temperature.

**UNIT II SI ENGINE SIMULATION WITH FUEL AIR AS WORKING MEDIUM****9**

Deviation between actual and air standard cycles of operation- problems, SI engine simulation with adiabatic constant volume combustion with fuel and air being considered, calculation of temperature drop due to fuel vaporization, calculation of mean effective pressure, torque and thermal efficiency at full throttle, part throttle and supercharged conditions.

**UNIT III ACTUAL CYCLE SIMULATION IN SI ENGINES****9**

Progressive combustion; gas exchange process, heat transfer process, friction. Validation of the computer code with experimental data based on performance parameters and pressure crank angle diagram.

**UNIT IV SIMULATION OF 2-STROKE SI ENGINE****9**

Simulation of the scavenging process, determination of the pressure-crank angle variation, computation of performance parameters.

**UNIT V DIESEL ENGINE SIMULATION****9**

Main difference between SI and CI engine simulation, differences between ideal and actual cycles, zero dimensional combustion model for diesel engine, heat transfer and gas exchange processes. Performance prediction and comparison of results.

**TOTAL: 45 Hours****COURSE OUTCOME:**

- CO-1: Describe the classifications and applications of engine cycle simulation model  
 CO-2: Grasp the major modeling and simulation methods and the influence of model  
 CO-3: Familiar with the modeling of filling/ emptying method and ability to build up control-oriented simulation model  
 CO-4: Familiar with the essential models of engine cycle simulation and calculation of engine parameters  
 CO-5: Simulate the different engine processes  
 CO-6: Conversant with Basic Concept of Modeling  
 CO-7: Describe the combustion and emission formation in the spark ignited engine  
 CO-8: Describe the combustion and emission formation in the diesel engine  
 CO-9: Explain the Possibilities and limitations of using a simulation program for engine performance  
 CO-10: Describe the Simulation of IC Engines and its new concepts

**TEXT BOOKS:**

- Ganesan. V. - Computer Simulation of spark ignition engine process, -Universities Press (I) Ltd, 1996.
- Ganesan. V. - Computer Simulation of compression ignition engine process – Universities Press (I) Ltd, 2000.
- Ashley Campbel - Thermodynamic analysis of combustion engines - John Wiley and Sons, New York - 1986.

**REFERENCES:**

- Benson.R.S., Whitehouse. N.D., - Internal Combustion Engines - Pergamon Press, oxford, 1979
- Ramoss.A.L., - Modelling of Internal Combustion Engines Processes - McGraw-Hill Publishing Co., 1992

**COURSE OBJECTIVE:**

- ❖ To impart knowledge in the construction of vehicle.
- ❖ To familiarize the aerodynamic concept & panelling of passenger car body trim.
- ❖ To study the design of external vehicle body.

**UNIT I CAR BODY DETAILS 9**

Types of car bodies - visibility: regulation, driver's visibility, methods of improving visibility- safety: safety design, safety aspects. Constructional details of a passenger car.

**UNIT II BUS BODY DETAILS 9**

Classification of bus bodies – based on distance traveled, based on capacity of the bus and based on style & shape. Types of metal section used in the construction. Construction of Conventional and integral type bus.

**UNIT III CAR AERODYNAMICS 9**

Objects — Vehicle types of drag. Various types of forces and moments. Effects of forces and moments. Various body optimization techniques for minimum drag. Principle of wind tunnel technology. Flow visualization techniques. Test with scale models.

**UNIT IV COMMERCIAL VEHICLE DETAILS 9**

Classification of commercial vehicle bodies. Construction of Tanker body and Tipper body. Dimensions of drivers seat in relation to controls. Driver's cab design. Compactness of Driver's cab. Segmental construction of driver's cab.

**UNIT V COMMERCIAL VEHICLE AERODYNAMICS 9**

Effects of rounding sharp front body edges. Effects of different cab to trailer body Fore body pressure distribution. Effects of a cab to trailer body roof height. Commercial vehicle drag reducing devices. Modern painting process of a passenger car body.

**TOTAL : 45 Hours****COURSE OUTCOME:**

- CO – 1: Describe the concept of car body design.
- CO – 2: Explain the passenger safety, crumple zone and crash testing.
- CO – 3: Explain the concepts of wind tunnel testing.
- CO – 4: Analyze vehicle body optimization techniques to reduce drag.
- CO – 5: Familiar with the various types of bus body construction.
- CO – 6: Estimate the seating layout and regulations and comfort.
- CO – 7: Analyze the various heavy vehicle bodies.
- CO – 8: Explain driver's visibility and cabin design.
- CO – 9: Explain the different types of painting materials.
- CO – 10: Analyze the different types of painting techniques for vehicle body.

**TEXTBOOKS:**

1. Powloski, J., 'Vehicle Body Engineering', Business Books Ltd, 1970
2. J.G. Giles, 'Body Construction and Design', Butterworth and Co., 1975

**REFERENCES:**

1. John Fenton 'Vehicle Body layout and analysis', Mechanical Engineering Publication Ltd., 1984
2. Heinz Heisler, "Advanced Vehicle Technology", second edition, Butterworth – Heinemann, New York, 2002

**COURSE OBJECTIVE :**

- To understand the concept and principle of operation of special vehicles such as Bulldozers, Ditchers, Bucket excavators, farm equipments, military vehicles etc..

**UNIT I TRACTORS AND FARM EQUIPMENTS****9**

Classification and power required - Design consideration - Ride and stability characteristics power plants and transmission – Special features and constructional detail- Farm equipments.

**UNIT II EARTH MOVING MACHINES****9**

Construction layout, capacity and applications of earthmovers for dumpers, front-end loaders, bulldozers, excavators, backhoe loaders, scrapers, motor graders etc. criteria for selection of prime mover for dumpers and front end loaders based on vehicle performance characteristics.

**UNIT III POWER TRAIN CONCEPTS****9**

Engine – converter match curves. Epicyclic type transmissions. Selection criteria for universal joints. Constructional details of steerable and drive axles of dumper.

**UNIT IV SPECIAL PURPOSE VEHICLES FOR INDUSTRIAL APPLICATIONS****9**

Constructional features, capacity and stability of jib cranes. Vibratory compactors. Special features and constructional detail-Stackers, bore well machines, concrete mixtures.

**UNIT V TWO AND THREE WHEELERS****9**

Constructional details of engine components in moped, scooter, motorcycle and three wheelers. Magneto ignition systems multiple disc clutch and centrifugal clutch details. Types of gear boxes, types of drive – chain drive, shaft drive, frame and front forks, two wheeler suspension system.

**TOTAL: 45 Hours****COURSE OUTCOME:**

- CO – 1: Describe the various earth moving equipments.  
 CO – 2: Familiar with the vehicle performance characteristics.  
 CO –3: Describe the converter match curves.  
 CO – 4: Explain the Constructional details of steerable and drive axles of dumper.  
 CO – 5: Define the OCDB and dry disc caliper brakes.  
 CO – 6: Describe the firefighting equipment..  
 CO – 7: Clearly explain the Study of capacity and stability of jib cranes.  
 CO – 8: Describe the concept of concrete mixtures.  
 CO – 9: Clearly explain the military and combat vehicles.

**TEXT BOOKS:**

- Construction planning, Equipment and Methods – Robert L. Peurifoy, William B. Ledbrtter, Clifford J. Schexnayder - McGrawHill, Fifth Edition.

**REFERENCES:**

- A. Gurevich and E.Soreking, Tractors Mir Publishers, Moscow, 1967.
- V. Rodichev & G. Rodicheva, Tractors and automobiles, MIR Publishers, Moscow.

**COURSE OBJECTIVE:**

- At the end of the course, the student will be able to acquire knowledge of alternate fuels and the changes in the engine design for handling them and understand various energy systems for use in the automobiles.

**UNIT I INTRODUCTION****12**

Need for alternate fuel, availability and properties of alternate fuels, general use of alcohols, LPG, hydrogen, ammonia, CNG and LNG, vegetable oils and biogas, merits and demerits of various alternate fuels, introduction to alternate energy sources. Like EV, hybrid, fuel cell and solar cars.

**UNIT II ALCOHOLS****12**

Properties as engine fuel, alcohols and gasoline blends, performance in SI engine, methanol and gasoline blends, combustion characteristics in CI engines, emission characteristics, DME, DEE properties performance analysis, performance in SI & CI Engines.

**UNIT III NATURAL GAS, LPG, HYDROGEN AND BIOGAS****12**

Availability of CNG, properties, modification required to use in engines, performance and emission characteristics of CNG using LPG in SI & CI engines, performance and emission of LPG. Hydrogen; storage and handling, performance and safety aspects.

**UNIT IV VEGETABLE OILS****12**

Various vegetable oils for engines, desertification, performance in engines, performance and emission characteristics, bio diesel and its characteristics

**UNIT V ELECTRIC, HYBRID, FUEL CELL AND SOLAR CARS****12**

Layout of an electric vehicle, advantage and limitations, specifications, system components, electronic control system, high energy and power density batteries, hybrid vehicle, fuel cell vehicles, solar powered vehicles.

**Total: 60 Hours****COURSE OUTCOME:**

- CO – 1: Describe the need of the alternative fuels
- CO – 2: Explain the need of the Gaseous fuels.
- CO – 3: Describe and ethanol usage, storage, chemical structure, pros and cons.
- CO – 4 : Evaluate the performance characteristics of alcohols fuels
- CO – 5: Describe the natural gas, LPG, hydrogen, and biogas.
- CO – 6: Describe engine modification, handling and safety aspects.
- CO – 7 : Identify the manufacturing process of Bio-diesel
- CO – 8 : Evaluate the performance characteristics of Bio-diesel
- CO – 9: Familiar with electric and hybrid vehicles.
- CO – 10: Explain the fuel cell and solar powered vehicles.

**TEXT BOOK:**

- Richard.L.Bechfold – Alternative Fuels Guide Book - SAE International Warrendale - 1997.

**REFERENCES:**

- Maheswar Dayal - "Energy today & tomorrow" - I & B Horishr India - 1982.
- Nagpal - "Power Plant Engineering" - Khanna Publishers - 1991.
- " Alcohols as motor fuels progress in technology" - Series No.19 - SAE Publication USE - 1980.
- SAE paper nos. 840367, 841333, 841334, 841156, Transactions, SAE, USA.

**COURSE OBJECTIVE:**

- To understand the principles involved in discretization and finite element approach
- To learn to form stiffness matrices and force vectors for simple elements

**UNIT I INTRODUCTION****12**

Historical background – Matrix approach – Application to the continuum – Discretisation – Matrix algebra – Gaussian elimination – Governing equations for continuum – Classical Techniques in FEM – Weighted residual method – Ritz method

**UNIT II ONE DIMENSIONAL PROBLEMS****12**

Finite element modeling – Coordinates and shape functions- Potential energy approach – Galarkin approach – Assembly of stiffness matrix and load vector – Finite element equations – Quadratic shape functions – Applications to plane trusses

**UNIT III TWO DIMENSIONAL CONTINUUM****12**

Introduction – Finite element modelling – Scalar valued problem – Poisson equation – Laplace equation – Triangular elements – Element stiffness matrix – Force vector – Galarkin approach - Stress calculation – Temperature effects

**UNIT IV AXISYMMETRIC CONTINUUM****12**

Axisymmetric formulation – Element stiffness matrix and force vector – Galarkin approach – Body forces and temperature effects – Stress calculations – Boundary conditions – Applications to cylinders under internal or external pressures – Rotating discs

**UNIT V ISOPARAMETRIC ELEMENTS FOR TWO DIMENSIONAL CONTINUUM****12**

The four node quadrilateral – Shape functions – Element stiffness matrix and force vector – Numerical integration - Stiffness integration – Stress calculations – Four node quadrilateral for axisymmetric problems.

**TOTAL: 60 Hours****COURSE OUTCOME:**

- CO-1: Familiarize the basic concept of finite element methods  
 CO-2: Acquire the knowledge on one dimensional problems  
 CO-3: Acquire the knowledge on two dimensional continuum  
 CO-4: Develop the skill on approaching the Heat transfer and fluid flow problems.  
 CO-5: Gain knowledge on application of finite element method in Automobiles

**TEXT BOOKS:**

1. Chandrupatla T.R., and Belegundu A.D., Introduction to Finite Elements in Engineering, Pearson Education 2002, 3rd Edition.
2. David V Hutton "Fundamentals of Finite Element Analysis"2004. McGraw-Hill Int. Ed.

**REFERENCES:**

1. Rao S.S., The Finite Element Method in Engineering, Pergammon Press, 1989
2. Logan D.L., A First course in the Finite Element Method, Third Edition, Thomson Learning, 2002.
3. Robert D.Cook., David.S, Malkucs Michael E Plesha , "Concepts and Applications of Finite Element Analysis", 2003.
4. Ed. Wiley.Reddy J.N., An Introduction to Finite Element Method, McGraw-Hill International Student Edition, 1985.
5. O.C.Zienkiewicz and R.L.Taylor, The Finite Element Methods, Vol.1. The basic formulation and linear problems, Vol.1, Butterworth Heineman, 5th Edition, 2000.



**COURSE OBJECTIVE:**

- After completion of this course the students are able to manage a transport fleet and their related activities for minimizing operational cost.

**UNIT I INTRODUCTION****9**

Personnel management; COURSE OBJECTIVES and functions of personnel management, psychology, sociology and their relevance to organization, personality problems. Selection process: job description, employment tests, interviewing, introduction to training COURSE OBJECTIVES, advantages, methods of training, training procedure, psychological tests.

**UNIT II TRANSPORT SYSTEMS****9**

Introduction to various transport systems. Advantages of motor transport. Principal function of administrative, traffic, secretarial and engineering divisions. chain of responsibility, forms of ownership by state, municipality, public body and private undertakings.

**UNIT III SCHEDULING AND FARE STRUCTURE****9**

Principal features of operating costs for transport vehicles with examples of estimating the costs. Fare structure and method of drawing up of a fare table. Various types of fare collecting methods. Basic factors of bus scheduling. Problems on bus scheduling.

**UNIT IV MOTOR VEHICLE ACT****9**

Traffic signs, fitness certificate, registration requirements, permit insurance, constructional regulations, description of vehicle-tankers, tippers, delivery vans, recovery vans, Power wagons and fire fighting vehicles. Spread over, running time, test for competence to drive.

**UNIT V MAINTENANCE****9**

Preventive maintenance system in transport industry, tyre maintenance procedures. Causes for uneven tyre wear; remedies, maintenance procedure for better fuel economy, Design of bus depot layout.

**TOTAL: 45 Hours****COURSE OUTCOME:**

- CO-1: Describe the functions of Personnel Management and their relevance to organization.  
 CO-2: Justify the Employment tests, training procedure and psychological tests.  
 CO-3: Illustrate the principal function of administrative, traffic, secretarial and engineering divisions.  
 CO-4: Describe the responsibility in forms of state, municipality, public and private undertakings.  
 CO-5: State the principal features of operating costs for transport vehicles.  
 CO-6: Select the types of fare collecting methods and basic factors of bus scheduling.  
 CO-7: Indicate fitness certificate, registration requirement and constructional regulations for vehicles.  
 CO- 8: Determine spread over, running time and test for competence to drive.  
 CO- 9: Explain Preventive Maintenance system and tyre maintenance in transport industry.  
 CO- 10: Identify the Maintenance Procedure for better fuel economy.

**TEXT BOOK:**

1. John Duke - Fleet Management – McGraw-Hill Co, USA -1984.

**REFERENCES:**

1. Government Motor Vehicle Act – Eastern Book Company, Lucknow - 1989
2. Kitchin.L.D., - Bus Operation - Illiffe and Sons Co., London, III edition - 1992
3. The motor vehicle Act 1939 - Ejaz Ahemad, Ashok law house, India – 1989

**COURSE OBJECTIVE:**

- At the end of the course, the students will be able to apply basic principles of aerodynamics for the design of vehicle body.

**UNIT I INTRODUCTION****9**

Scope, historical developments, fundamental of fluid mechanics, flow phenomenon related to vehicles, external and Internal flow problem, resistance to vehicle motion, performance, fuel consumption and performance potential of vehicle aerodynamics, engine cooling requirement, air flow to passenger compartment, duct for air conditioning, cooling of transverse engine and rear engine.

**UNIT II AERODYNAMIC DRAG OF CARS****9**

Cars as a bluff body, flow field around car, drag force, types of drag force, analysis of aerodynamic drag, drag coefficient of cars, strategies for aerodynamic development, low drag profiles.

**UNIT III SHAPE OPTIMIZATION OF CARS****9**

Front end modification, front and rear wind shield angle, boat tailing, hatch back, fast back and square back, dust flow patterns at the rear, effects of gap configuration, effect of fasteners.

**UNIT IV VEHICLE HANDLING****9**

The origin of forces and moments on a vehicle, lateral stability problems, methods to calculate forces and moments – vehicle dynamics under side winds, the effects of forces and moments, characteristics of forces and moments, dirt accumulation on the vehicle, wind noise, drag reduction in commercial vehicles.

**UNIT V WIND TUNNELS FOR AUTOMOTIVE AERODYNAMICS****9**

Introduction, principle of wind tunnel technology, limitation of simulation, stress with scale models, full scale wind tunnels, measurement techniques, equipment and transducers, road testing methods, numerical methods.

**TOTAL: 45 Hours****COURSE OUTCOME:**

CO-1: Evaluate basic fluid theory.

CO-2: Demonstrate a knowledge and understanding of aerodynamics in automotive field.

CO-3: Explain the principles and functions of wind tunnel.

CO-4: Conceptual understanding of the mathematics, numerical analysis, statistics, and computer and information.

CO-5: Application of established engineering methods to complex engineering problem solving.

CO-6: Application of engineering techniques, tools and resources.

CO-7: Analyze data from experimental and computational studies and interpret these in the context of vehicle design

**TEXT BOOK:**

1. Hucho.W.H. - "Aerodynamic of Road Vehicles" - Butterworths Co., Ltd., - 1997.

**REFERENCES:**

1. A. Pope - "Wind Tunnel Testing"- John Wiley & Sons - 2nd Edition, New York - 1974.
2. Automotive Aerodynamic: Update SP-706 - SAE – 1987.
3. Vehicle Aerodynamics - SP-1145 - SAE – 1996.

**COURSE OBJECTIVE:**

- To introduce the modern developments in vehicle technology.

**UNIT I ENGINE MANAGEMENT SYSTEMS****9**

Electronically controlled SI and CI engine fuel injection systems, related hardware and software. Closed loop ignition system. Catalytic converters and particulate traps.

**UNIT II CHASSIS****9**

Suspensions – front and rear Active suspension control- Ride Comfort, Suspension Travel, Road Handling -advantages, disadvantages, Pneumatic suspensions.

**UNIT III HEATING AND AIR CONDITIONING****9**

Vehicle air conditioning and heating- Compressor, condenser evaporator, working Principles, TXV operation Working principle of vehicle air conditioning.

**UNIT IV COMFORT AND CONVENIENCE****9**

Adaptive cruise control, car entertainment, power windows, navigation system, adaptive noise control, electric seats, driver information system. Power windows, power steering.

**UNIT V SAFETY AND SECURITY SYSTEMS****9**

Airbags, seat belt tightening system, collapsible and tilt able steering column, Anti theft system, anti lock braking system, electronic stability control system/traction control system, roll over protection system.

**TOTAL: 45 Hours****COURSE OUTCOME:**

CO – 1: Familiar with the advanced fuel injection systems techniques in both the SI and CI engines.

CO – 2: Describe the Knowledge of pneumatic & active suspension control system.

CO – 3: Describe the heating and air conditioning system.

CO – 4: Familiar with the navigation systems, power steering, power windows.

CO – 5: Gain knowledge about various safety & security systems such as airbags, seat belts, ABS, EBS.

**TEXT BOOKS:**

- Tom Denton - "Automobile Electrical and Electronic Systems" - Edward Arnold, London - 1995.
- Eric Chowanietz - 'Automotive Electronics' - SAE International USA - 1995.

**REFERENCE:**

- Bosch Automotive Hand Book - 5th Edition - SAE Publication, USA - 2000.

**COURSE OBJECTIVE:**

- The students will be able to understand the sources of vibration and noise in automobiles and make design modifications to reduce the vibration and noise and improve the life of the components

**UNIT I BASICS OF VIBRATION****9**

Introduction, classification of vibration: free and forced vibration, un damped and damped vibration, linear and non linear vibration, response of damped and un damped systems under harmonic force, analysis of single degree and two degree of freedom systems, torsion vibration, determination of natural frequencies.

**UNIT II BASICS OF NOISE****9**

Introduction, amplitude, frequency, wavelength and sound pressure level, addition, subtraction and averaging decibel levels, noise dose level, legislation, measurement and analysis of noise, measurement environment, equipment, frequency analysis, tracking analysis, sound quality analysis.

**UNIT III AUTOMOTIVE NOISE SOURCES****9**

Noise Characteristics of engines, engine overall noise levels, assessment of combustion noise, assessment of mechanical noise, engine radiated noise, intake and exhaust noise, engine accessory contributed noise, transmission noise, aerodynamic noise, tyre noise, brake noise.

**UNIT IV CONTROL TECHNIQUES****9**

Vibration isolation, tuned absorbers, unturned viscous dampers, damping treatments, application dynamic forces generated by IC engines, engine isolation, crank shaft damping, modal analysis of the mass elastic model shock absorbers.

**UNIT V SOURCE OF NOISE AND CONTROL****9**

Methods for control of engine noise, combustion noise, mechanical noise, predictive analysis, palliative treatments and enclosures, automotive noise control principles, sound in enclosures, sound energy absorption, sound transmission through barriers

**TOTAL: 45 Hours****COURSE OUTCOME:**

- CO – 1: Describe the basic concepts of vibration.  
 CO – 3: Identify to simulate noise control and be able to design systems taking accordingly.  
 CO – 4: Illustrate the performance of spatial, modal and response models of vibrating systems.  
 CO – 6: Describe the concepts of engineering noise and vibration, measurement techniques and instruments.  
 CO – 8: Describe the knowledge on application dynamic forces generated by IC engines.

**TEXT BOOKS:**

- Singiresu S.Rao - "Mechanical Vibrations" - Pearson Education, ISBN –81-297-0179-0 – 2004.
- Kewal Pujara "Vibrations and Noise for Engineers, Dhanpat Rai & Sons, 1992.

**REFERENCES:**

- Bernard Challen and Rodica Baranescu - "Diesel Engine Reference Book" – Second edition - SAE International.
- Julian Happian-Smith - "An Introduction to Modern Vehicle Design"- Butterworth- Heinemann, 2004.
- John Fenton - "Handbook of Automotive body Construction and Design Analysis - Professional Engineering Publishing, ISBN 1-86058-073- 1998.

**COURSE OBJECTIVE:**

- At the end of the course, the students will be able to understand the significance of various processes in I.C Engines.

**UNIT I CYCLE ANALYSIS****9**

Otto, Diesel, Dual, Stirling and Brayton cycles, comparison of air standard, fuel air and actual cycles, simple problems on the above topics.

**UNIT II COMBUSTION****9**

Combustion reactions and stoichiometry, heat of reaction, adiabatic flame temperature in constant pressure and constant volume systems, fuels for internal combustion engines and their properties, premixed and diffusion combustion as applicable to SI and CI engines, concepts of burning rate and flame velocity, fuel spray characteristics and combustion in diesel engines.

**UNIT III COMBUSTION MODELLING****9**

Basic concepts of engine simulation, governing equations, simulation of various engine processes for SI and CI engines. Adiabatic flame temperature, Heat release calculations. Thermodynamic and Fluid mechanic based models.

**UNIT IV ADVANCES IN IC ENGINES****9**

LHR engines, surface ignition concept and multi fuel engines, stratified charge and lean burn engines, performance and emission characteristics, merits and demerits.

**UNIT V ELECTRONIC ENGINE MANAGEMENT****9**

Computer control of SI & CI engines for better performance and low emissions, closed loop control of engine parameters of fuel injection and ignition

**TOTAL: 45 Hours****COURSE OUTCOME:**

- CO – 1: Compare with various cycles with actual cycles..
- CO – 2: Familiar with combustion reactions and stoichiometry.
- CO – 3: Understand premixed and diffusion combustion in SI and CI engines.
- CO – 4: Optimize the concepts of engine simulation governing equations.
- CO – 5: Describe simulation of various engine processes for SI and CI engines.

**TEXT BOOKS:**

- Ganesan .V - "IC Engines" - Tata McGraw-Hill, 2003.
- John B. Haywood, "Internal Combustion Engine Fundamentals", McGraw-Hill Automotive Technology Series ISBN 0-07-1000499-8, 1988.

**REFERENCES:**

- Ganesan .V – 'Computer Simulation of Spark Ignition Processes' – Universities Process Ltd, Hyderabad - 1993.
- Ganesan.V. – Computer Simulation of compression ignition engines – Orcent Longman – 2000.
- Richard Stone – "Introduction to IC Engines" – 2nd edition – Macmilan – 1992.

**COURSE OBJECTIVE:**

- To develop an understanding of computer-integrated manufacturing (CIM) and its impact on productivity, product cost, and quality.

**UNIT I COMPUTER AIDED DESIGN****9**

Concept of CAD as drafting and designing facility, desirable features of CAD package, drawing features in CAD – Scaling, rotation, translation, editing, dimensioning, labeling, Zoom, pan, redraw and regenerate, typical CAD command structure, wire frame modeling, surface modeling and solid modeling (concepts only) in relation to popular CAD packages.

**UNIT II COMPONENTS OF CIM****9**

CIM as a concept and a technology, CASA/Sme model of CIM, CIM II, benefits of CIM, communication matrix in CIM, fundamentals of computer communication in CIM – CIM data transmission methods – serial, parallel, asynchronous, synchronous, modulation, demodulation, simplex and duplex. Types of communication in CIM – point to point (PTP), star and multiplexing. Computer networking in CIM – the seven layer OSI model, LAN model, MAP model, network topologies – star, ring and bus, advantages of networks in CIM

**UNIT III GROUP TECHNOLOGY AND COMPUTER AIDED PROCESS PLANNING****9**

History Of Group Technology – role of G.T in CAD/CAM Integration – part families- classification and coding – DCLASS and MCLASS and OPTIZ coding systems – facility design using G.T – benefits of G.T – cellular manufacturing. Process planning - role of process planning in CAD/CAM Integration – approaches to computer aided process planning – variant approach and generative approaches – CAPP and CMPP systems.

**UNIT IV SHOP FLOOR CONTROL AND INTRODUCTION TO FMS****9**

Shop floor control – phases – factory data collection system – automatic identification methods – Bar code technology – automated data collection system.  
FMS – components of FMS – types – FMS workstation – material handling and storage system –FMS layout- computer control systems – applications and benefits.

**UNIT V COMPUTER AIDED PLANNING AND CONTROL AND COMPUTER MONITORING****9**

Production planning and control – cost planning and control – inventory management – material requirements planning (MRP) – shop floor control. Lean and Agile Manufacturing. Types of production monitoring systems – structure model of manufacturing – process control and strategies – direct digital control.

**TOTAL: 45 Hours****COURSE OUTCOME:**

- CO-1: Describe the Computer Aided Manufacturing (CAM) systems  
CO-2: Describe the Computer Aided Process Planning (CAPP) Systems  
CO-3: Describe the Automated Material Handling Systems  
CO-4: Analyze automated flow lines and assembly systems, and balance the line.  
CO-5: Design the automated material handling and storage systems

**TEXT BOOK:**

- Mikell. P. Groover “Automation, Production Systems and Computer Integrated Manufacturing”, Pearson Education 2001.

**REFERENCES:**

- Mikell. P. Groover and Emory Zimmers Jr., “CAD/CAM”, Prentice hall of India Pvt. Ltd., 1998.
- James A. Regh and Henry W. Kreabber, “Computer Integrated Manufacturing”, Pearson Education second edition, 2005.
- Chris McMahon and Jimmie Browne, “CAD CAM Principles, Practice and Manufacturing Management”, Pearson Education second edition, 2005.
- Ranky, Paul G., “Computer Integrated Manufacturing”, Prentice hall of India Pvt. Ltd., 2005.
- Yorem Koren, “Computer Integrated Manufacturing”, McGraw Hill, 2005.
- P N Rao, “CAD/CAM Principles and Applications”, TMH Publications, 2007.

**COURSE OBJECTIVE:**

- To Design and understand the electro-hydraulic and electro-pneumatic circuits

**UNIT I FLUID POWER SYSTEMS AND FUNDAMENTALS****12**

Introduction to fluid power, Advantages of fluid power, Application of fluid power system. Types of fluid power systems, Properties of hydraulic fluids – General types of fluids – Fluid power symbols. Basics of Hydraulics-Applications of Pascals Law- Laminar and Turbulent flow – Reynold's number – Darcy's equation – Losses in pipe, valves and fittings.

**UNIT II HYDRAULIC SYSTEM & COMPONENTS****12**

Sources of Hydraulic Power: Pumping theory – Pump classification – Gear pump, Vane Pump, piston pump, construction and working of pumps – pump performance – Variable displacement pumps. Fluid Power Actuators: Linear hydraulic actuators – Types of hydraulic cylinders – Single acting, Double acting special cylinders like tandem, Rodless, Telescopic, Cushioning mechanism, Construction of double acting cylinder, Rotary actuators – Fluid motors, Gear, Vane and Piston motors.

**UNIT III HYDRAULIC CONTROL AND CIRCUITS****12**

Construction of Control Components : Director control valve – 3/2 way valve – 4/2 way valve – Shuttle valve – check valve – pressure control valve – pressure reducing valve, sequence valve, Flow control valve – Fixed and adjustable, electrical control solenoid valves, Relays, ladder diagram. Accumulators and Intensifiers: Types and sizing of accumulators – intensifier – Applications of Intensifier. circuits for controlling single acting and double acting cylinders, Accumulators circuits – Intensifier circuit.

**UNIT IV PNEUMATIC CONTROL AND CIRCUITS****12**

Pneumatic Components: Properties of air – Compressors – Filter, Regulator, Lubricator Unit – Air control valves, Quick exhaust valves, pneumatic actuators. Fluid Power Circuit Design, Speed control circuits, synchronizing circuit, Pneumo hydraulic circuit, Sequential circuit design for simple applications using cascade method.

**UNIT V SERVO SYSTEMS, FLUIDICS AND FLUID POWER TROUBLE SHOOTING****12**

Servo systems – Hydro Mechanical servo systems, Electro hydraulic servo systems and proportional valves, Fluidics – Introduction to fluidic devices, simple circuits, Introduction to Electro Hydraulic Pneumatic logic circuits, ladder diagrams, PLC applications in fluid power control. Fluid power circuits; failure and troubleshooting.

**TOTAL: 60 Hours****COURSE OUTCOME:**

CO-1: Describe the fundamental theoretical concepts governing fluid power

CO-2: Ability to formulate the mathematical models of hydraulic and pneumatic circuits.

CO-3: Identify the with common hydraulic and pneumatic components

CO-4: Describe the working principle of pneumatic cylinders and motors.

CO-5: Analyze the pneumatic circuits by considering the possible failures.

**TEXT BOOKS:**

- Anthony Esposito, "Fluid Power with Applications", Pearson Education 2000.
- Majumdar S.R., "Oil Hydraulics", Tata McGraw-Hill, 2000.

**REFERENCES:**

- Majumdar S.R., "Pneumatic systems – Principles and maintenance", Tata McGraw Hill, 1995
- Anthony Lal, "Oil hydraulics in the service of industry", Allied publishers, 1982.
- Harry L. Stevart D.B, "Practical guide to fluid power", Taraoeala sons and Port Ltd. Broadey, 1976.
- Michael J, Prinches and Ashby J. G, "Power Hydraulics", Prentice Hall, 1989.
- Dudelyt, A. Pease and John T. Pippenger, "Basic Fluid Power", Prentice Hall, 1987.

**18PEAU15 WASTE HEAT RECOVERY AND CO-GENERATION**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**COURSE OBJECTIVE:**

- To understand the waste heat recovery systems, economic analysis and environmental considerations.

**UNIT I INTRODUCTION****9**

Source and utilization of waste heat, thermodynamic analysis - Second law and waste heat, Recovery of waste heat engines and other power plants -Heat pump for waste heat recovery.

**UNIT II DESIGN OF WASTE HEAT RECOVERY SYSTEMS****9**

Design of waste heat recovery system - Heat exchanger - Theory and design, Organic fluid systems – Analysis and design.

**UNIT III COGENERATION PRINCIPLES****9**

Cogeneration principles and thermodynamics power cycle analysis, combined for power generation and process heat.

**UNIT IV APPLICATIONS OF COGENERATION****9**

Applications in sugar mills rice mills, textile factories, and other process and engineering industries.

**UNIT V COST ANALYSIS OF COGENERATION SYSTEMS****9**

Financial considerations, operating and maintenance cost, investment costs of waste heat recovery and Cogeneration system, environmental and air quality consideration.

**TOTAL: 45 Hours****COURSE OUTCOME:**

CO-1: Define the utilization of waste heat, second law and thermodynamic analysis of waste heat.

CO-2: Resolve the theory, design and analysis of waste heat recovery systems and organic fluid systems

CO-3: Evaluate the Cogeneration principles and thermodynamic power cycle analysis.

CO-4: Derive the power generation and process heat in waste heat process.

CO-5: Determine the Financial Considerations of Waste heat Recovery systems.

**TEXT BOOKS:**

1. Charles H.Butler, "Cogeneration ", Mc Graw Hill Book Co., 1984.
2. Goldstick R., et.al, "Principles of Waste Heat Recovery ", The Fairment Press, Inc., Georgia, 1986

**REFERENCES:**

1. Kiang Y.H., "Waste Utilization Technology ", Maecel Dekker Inc., 1981.
2. David Hu and Gerald Hrd, "Waste recycling for Energy Conservation ", John Wiley and Sons, New York, 1981.
3. Sydney Reiter, " Industrial and Commercial Heat Recovery Systems ", Van Nostrand Reinhold, 1985.
4. Spiewak Scott A, "Cogeneration and Small Power Production Manual ",The Fairment Press,1987.
5. Nelson E, Hay, "Guide to Natural Gas Cogeneration ", The Fairment Press Inc., 1980.



**COURSE OBJECTIVE:**

- To study about linear elastic analysis of composite materials.
- To understand the anisotropic material behavior.

**UNIT I COMPOSITE MATERIALS AND THEIR APPLICATIONS****9**

Introduction Fibers Matrix materials Material forms and fabrication methods Current applications

**UNIT II CONCEPTS OF SOLID MECHANICS****9**

Tensors Stress and strain Plane stress and plane strain energy density Generalized Hooke's Law Material symmetry Engineering constants 3 Coordinate transformations Thermal effects, Moisture effects Chemical aging, flammability

**UNIT III CONCEPTS OF MICROMECHANICS****9**

Effective properties Survey and model comparison from strength of materials approximations, continuum mechanics approaches

**UNIT IV STRESS-STRAIN FOR AN ORTHOTROPIC LAMINA AND LAMINATE ANALYSIS****9**

Orthotropic properties in plane stress, Deformation due to extension/shear and bending/torsion A, B, D matrices hydrothermal behavior Special laminates Average stress-strain properties

**UNIT V CONCEPTS OF FAILURE OF LAMINATES AND SHAFTS****9**

Tensile failure of fiber composites Compressive failure of fiber composites Effect of multi axial stresses (failure criteria by Tsai-Wu, Hashin, etc.) Edge effects, Effective stiffness of beams Effective stiffness of shafts.

**TOTAL: 45 Hours****COURSE OUTCOME:**

CO – 1: Explain the applications of Matrix materials.

CO – 2: Explain the Moisture effects.

CO – 3: Describe the properties of micromechanics.

CO – 4: Describe the properties in plane stress.

CO – 5: Explain the effective stiffness of shafts.

**TEXT BOOKS:**

1. Carl T. Herakovich, Mechanics of Fibrous Composites, 1997,
2. Stephen R. Swanson, Introduction to Design and Analysis with Advanced Composite Materials, Prentice-Hall, 1997.

**REFERENCES:**

1. Hyer M. W., Stress Analysis of Fiber-Reinforced Composite Materials, McGraw-Hill, 1997
2. Gibson R. F., Principles of Composite Material Mechanics, 2nd edition, CRC Press.

**COURSE OBJECTIVE:**

- To introduce numerical modeling and its role in the field of heat transfer and fluid flow.
- To create confidence to solve complex problems in the field of heat transfer and fluid dynamics by using high speed computers.

**Unit I GOVERNING EQUATIONS AND BOUNDARY CONDITIONS****12**

Basics of computational fluid dynamics – Governing equations of fluid dynamics – Continuity, Momentum and Energy equations – Chemical species transport – Physical boundary conditions – Time-averaged equations for Turbulent flow - Turbulence -Kinetic -Energy Equations – mathematical behavior of PDEs on CFD: Elliptic, Parabolic and Hyperbolic equations.

**Unit II DISCRETIZATION AND SOLUTION METHODOLOGIES****12**

Methods of Deriving the Discretization Equations - Taylor Series formulation – Finite difference method – Control volume Formulation – Spectral method. Solution methodologies: Direct and iterative methods, Thomas algorithm, Relaxation method, Alternating Direction Implicit method.

**Unit III HEAT CONDUCTION****12**

Finite difference and finite volume formulation of steady/transient one-dimensional conduction equation, Source term linearization, Incorporating boundary conditions, Finite volume formulations for two and three dimensional conduction problems

**Unit IV CONVECTION AND DIFFUSION****12**

Finite volume formulation of steady one-dimensional convection and Diffusion problems, Central, upwind, hybrid and power-law schemes - Discretization equations for two dimensional convection and diffusion.

**Unit – V: CALCULATION OF FLOW FIELD****12**

Representation of the pressure - Gradient term and continuity equation - Staggered grid - Momentum equations - Pressure and velocity corrections - Pressure - Correction equation, SIMPLE algorithm and its variants. Turbulence models: mixing length model, Two equation (k-e) models.

**TOTAL: 60 Hours****COURSE OUTCOME:**

- CO-1: Demonstrate the ability to use modern CFD software tools  
 CO-2: Demonstrate the ability to analyze the flow visualization and analysis tools.  
 CO-3: Ability to simplify a real fluid-flow system into a simplified model problem  
 CO-4: Ability to communicate the results of this detailed fluid-flow study.  
 CO-5: Describe the mathematical properties of governing Navier-Stokes equations

**TEXT BOOKS:**

1. Versteeg, H.K, and Malalasekera, W., "An Introduction to Computational Fluid Dynamics: The Finite Volume Method", Longman, 1998
2. Ghoshdastidar, P.S., "Computer Simulation of flow and heat transfer", Tata McGraw- Hill Publishing Company Ltd., 1998.

**REFERENCES:**

1. Patankar, S.V., "Numerical Heat Transfer and Fluid Flow", McGraw-Hill, 1980. Ane-Books 2004 Indian Edition.
2. Muralidhar, K and Sundarajan .T., "Computational Fluid Flow and Heat Transfer", Narosa Publishing House, New Delhi, 1995.
3. Bose, T.K., "Numerical Fluid Dynamics", Narosa publishing House, 1997.
4. Muralidhar, K and Biswas "Advanced Engineering Fluid Mechanics", Narosa Publishing House, New Delhi, 1996.
5. Anderson, J.D., "Computational fluid dynamics – the basics with applications", 1995.

**18PEAU18    ADVANCED PRODUCTION PROCESSES FOR AUTOMOTIVE COMPONENTS**

**L    T    P    C**  
**3    0    0    3**

**COURSE OBJECTIVE:**

- To learn the available manufacturing process based on quality/time/cost/ mechanical properties.

**UNIT I POWDER METALLURGY**

**9**

Process flow chart – production of metal powders and their raw materials – Manufacture of friction lining materials for clutches and brakes – testing and inspection of PM parts.

**UNIT II FORMING PROCESS**

**9**

Forging – process flow chart, forging of valves – connecting rod, crank shaft, cam shaft, propeller shaft, transmission gear blanks, foot brake linkage, steering knuckles. Extrusion: Basic process steps, extrusion of transmission shaft, steering worm blanks, brake anchor pins, rear axle drive shaft, axle housing spindles, piston pin and valve tappets. Hydro forming: Process, hydro forming of manifold and comparison with conventional methods – Hydro forming of tail lamp housing stretch forming – process, stretch forming of auto body panels – super plastic alloys for auto body panels.

**UNIT III GEAR MANUFACTURING**

**9**

Different methods of gear manufacture – Gear hobbing and gear shaping machines specifications – gear generation – different methods – gear finishing and shaving – Grinding and lapping of hobs and shaping cutters – gear honing – gear broaching.

**UNIT IV CONCEPT & PROGRAMMING OF CNC MACHINES**

**9**

NC, CNC & DNC – types of CNC – constructional features – drives and control systems – feedback devices – manual part programming – steps involved – sample program in lathe & milling.

**UNIT V RECENT TRENDS IN MANUFACTURING OF AUTO COMPONENTS**

**9**

Power injection moulding – Shot peen hardening of gears – production of aluminum MMC liners for engine blocks – Plasma spray coated engine blocks and valves – Recent developments in auto body panel forming – Squeeze casting of pistons – aluminum composite brake rotors.

**TOTAL: 45 Hours**

**COURSE OUTCOME:**

- CO – 1: Summarize the production methods of engine components chassis components
- CO – 2: Explain the different types of forming process used in various automobiles.
- CO – 3: Identify the various extrusion processes.
- CO – 4: Describe the different types of gear manufacturing process.
- CO – 5: Teach the detail procedure of gear lapping, gear honing and gear broaching methods.

**TEXT BOOK:**

1. Heldt, P.M., High Speed Combustion Engines, Oxford Publishing Co., New York, 1990

**REFERENCES:**

1. Haslehurst, S.E., Manufacturing Technology, ELBS, London, 1990
2. Rusinoff, Forging and Forming of metals, D.B. Taraporevala Sons & Co., Pvt. Ltd., Mumbai, 1995.
3. Subroff, A.M. & Other, Forging Materials & Processes, Reinhold Book Corporation, New York, 1998.
4. High Velocity Forming of Metals, ASTM, Prentice Hall of India (P) Ltd., New Delhi, 1990
5. Groover. M.P. Automatic production systems and computer integrated manufacturing prentice – hall, 1990.

**COURSE OBJECTIVE**

- To identify, measure and control the noise, vibration and harshness.

**UNIT I FUNDAMENTALS OF ACOUSTICS AND NOISE, VIBRATION 9**

Theory of Sound—Predictions and Measurement, Sound Sources, Sound Propagation in the Atmosphere, Sound Radiation from Structures and Their Response to Sound, General Introduction to Vibration, Vibration of Simple Discrete and Continuous Systems, Random Vibration, Response of Systems to Shock, Passive Damping

**UNIT II EFFECTS OF NOISE, BLAST, VIBRATION, AND SHOCK ON PEOPLE 9**

General Introduction to Noise and Vibration Effects on People and Hearing Conservation, Slip Disturbance due to Transportation Noise Exposure, Noise-Induced Annoyance, Effects of Infrasound, Low-Frequency Noise, and Ultrasound on People, Auditory Hazards of Impulse and Impact Noise, Effects of Intense Noise on People and Hearing Loss, Effects of Vibration on People, Effects of Mechanical Shock on People, Rating Measures, Descriptors, Criteria, and Procedures for Determining Human Response to Noise.

**UNIT III TRANSPORTATION NOISE AND VIBRATION—SOURCES, PREDICTION, AND CONTROL 9**

Introduction to Transportation Noise and Vibration Sources, Internal Combustion Engine Noise Prediction and Control—Diesel, Exhaust and Intake Noise and Acoustical Design of Mufflers, Tire/Road Noise—Generation, Measurement, and Abatement, Aerodynamic Sound Sources in Vehicles—Prediction and Control, Transmission and Gearbox Noise and Vibration Prediction and Control, Brake Noise Prediction and Control.

**UNIT IV INTERIOR TRANSPORTATION NOISE AND VIBRATION SOURCES – PREDICTION AND CONTROL 9**

Introduction to Interior Transportation Noise and Vibration Sources, Automobile, Bus, and Truck Interior Noise and Vibration Prediction and Control, Noise and Vibration in Off-Road Vehicle Interiors- Prediction and Control,

**UNIT V NOISE AND VIBRATION TRANSDUCERS, ANALYSIS EQUIPMENT, SIGNAL PROCESSING, AND MEASURING TECHNIQUES 9**

General Introduction to Noise and Vibration Transducers, Measuring Equipment, Measurements, Signal Acquisition, and Processing, Acoustical Transducer Principles and Types of Microphones, Vibration Transducer Principles and Types of Vibration Transducers, Sound Level Meters, Noise Dosimeters, Analyzers and Signal Generators, Equipment for Data Acquisition, Noise and Vibration Measurements, Determination of Sound Power Level and Emission Sound Pressure Level, Sound Intensity Measurements, Noise and Vibration Data Analysis, Calibration of Measurement Microphones, Calibration of Shock and Vibration Transducers, Metrology and Traceability of Vibration and Shock Measurements.

**TOTAL : 45 Hours****COURSE OUTCOME:**

- CO – 1: Identify the methods of vibration and noise measurement.  
 CO – 2: Compare the effect of noise on human comfort and environment  
 CO – 3: Describe the concept of mufflers, tire/road noise.  
 CO – 4: Describe the interior transportation noise and vibration sources.  
 CO – 5: Describe the various noise and vibration measurements.

**TEXT BOOKS:**

- Clarence W. de Silva, "Vibration Monitoring, Testing, and Instrumentation", CRC Press, 2009
- David A. Bies and Colin H. Hansen "Engineering Noise Control: Theory and Practice", Spon Press, London, 2009

**REFERENCES:**

- Alan G. Piersol, Thomas L. Paez "Haris' Shock and Vibration Handbook", McGraw-Hill, New Delhi, 2010
- Colin H Hansen "Understanding Active Noise Cancellation", Spon Press, London 2003
- Mathew Harison "Vehicle Refinement: Controlling Noise and Vibration in Road Vehicles", Elsevier Butterworth-Heinemann, Burlington, 2004

**COURSE OBJECTIVE**

- This course provides required knowledge, skills and creates self confidence in students so that they can work on shop floor independently for accurate and precise measurements and manufacturing.

**UNIT I INTRODUCTION TO MEASUREMENTS AND SENSORS****9**

Sensors: Functions- Classifications- Main technical requirement and trends Units and standards- Calibration methods- Classification of errors- Error analysis- Limiting error- Probable error- Propagation of error- Odds and uncertainty-principle of transduction- Classification. Static characteristics- mathematical model of transducers- Zero, First and Second order transducers- Dynamic characteristics of first and second order transducers for standard test inputs.

**UNIT II VARIABLE RESISTANCE AND INDUCTANCE SENSORS****9**

Principle of operation- Construction details- Characteristics and applications of resistive potentiometer- Strain gauges- Resistive thermometers- Thermistors- Piezo resistive sensors Inductive potentiometer- Variable reluctance transducers:- EI pickup and LVDT

**UNIT III VARIABLE AND OTHER SPECIAL SENSORS****9**

Variable air gap type, variable area type and variable permittivity type- capacitor microphone Piezoelectric, Magneto strictive, Hal Effect, semiconductor sensor- digital transducers-Humidity Sensor. Rain sensor, climatic condition sensor, solar, light sensor, ant glare sensor.

**UNIT IV AUTOMOTIVE PRESSURE AND FORCE/TORQUE SENSOR****9**

Pressure Sensor: Typical automotive applications- Thick film pressure sensor- Semiconductor pressure sensor Integrated silicon intake-manifold pressure sensor-Integrated silicon combustion-pressure sensor- Piezo electric sensor-High pressure sensor with metal diaphragm. Force/Torque Sensor: Typical automotive applications- Magneto elastic bearing-pin sensor- Magneto elastic tension/compressive-force sensor according to the cross-ductor principle – Basic principle of torque measurement –Stress and Angle measuring torque sensor

**UNIT V AUTOMOTIVE POSITION AND RPM/VELOCITY SENSORS****9**

Position Sensors:- Typical automotive applications- Wiper potentiometers- Short-circuiting ring sensor- Half-differential sensor- Eddy-current pedal-travel sensor- Integrated Hal IC's – Hal acceleration sensor- Knock sensors-RPM and Velocity Sensors: - Inductive rotational speed sensor- Hal effect sensor Temperature Sensors:- Typical automotive applications -Sintered-Ceramic resistors-Thin film resistors-Thick film resistors- Mono crystalline silicon semiconductor resistor- Thermopile sensors Flow Sensors:- Ultrasonic flow sensors-Pitot tube air-flow sensor- Hot wire air-mass flow meter- Micro mechanical hot-film air-mass flow meter- Lambda sensor -Imaging sensor-Rain Sensor Introduction to MEMs

**TOTAL : 45 Hours****COURSE OUTCOME:**

CO-1: Clearly explain the Calibration methods.

CO-2: Describe the Strain gauges.

CO-3: Explain the automotive applications of sensor.

CO-4: Describe the concept of stress and Angle measuring torque sensor.

CO-5: Clearly explain the Integrated Hal IC's.

**TEXT BOOKS:**

1. Doebelin E.O, "Measurement Systems : Applications and Design", 5th Edition, Tata McGraw-Hill Publishing Co.,2007
2. Robert Brandy, " Automotive Electronics and Computer System", Prentice Hall, 2001
3. William Kimberley, " Bosch Automotive Handbook", 6th Edition, Robert Bosch GmbH, 2004

**REFERENCES:**

1. Bentley J.P, " Principles of Measurement Systems", 4th Edition, Addison Wesley Longman Ltd., U.K, 2004
2. Patranabis.D, " Sensors and Transducers", 2nd Edition, Prentice Hall India Ltd, 2003
3. Murthy D.V.S, "Transducers and Instrumentation", Prentice Hall of India, 2007
4. Neuberger H.K.P., " Instrument Transducers- An Introduction to their Performance and Design" Oxford University Press, Cambridge, 2003.

**COURSE OBJECTIVE**

- To make the students to understand various processes like forming, milling, casting and moulding involved in manufacturing of automotive components.

**UNIT I POWDER METALLURGY****5**

Process flow chart – Production of metal powders and their raw materials – Manufacture of friction lining materials for clutches and brakes – Testing and inspection of PM parts.

**UNIT II FORMING PROCESS****15**

Forging – process flow chart, forging of valves, connecting rod, crank shaft, cam shaft, propeller shaft, transmission gear blanks, foot brake linkage, steering knuckles. Extrusions: Basic process steps, extrusion of transmission shaft, steering worm blanks, brake anchor pins, rear axle drive shaft, axle housing spindles, piston pin and valve tappets. Hydro forming: Process, hydro forming of manifold and comparison with conventional methods – Hydro forming of tail lamp housing. Stretch forming – Process, stretch forming of auto body panels – Super plastic alloys for auto body panels.

**UNIT III CASTING AND MACHINING****12**

Sand casting of cylinder block and liners – Centrifugal casting of flywheel, piston rings, bearing bushes and liners, permanent mould casting of piston, pressure die casting of carburetor and other small auto parts. Machining of connecting rods – crank shafts – cam shafts – pistons – piston pins – piston rings – valves – front and rear axle housings – flywheel – Honing of cylinder bores – copy turning and profile grinding machines.

**UNIT IV GEAR MANUFACTURING****5**

Gear milling, Hobbing and shaping – Gear finishing and inspection.

**UNIT V RECENT TRENDS IN MANUFACTURING OF AUTO COMPONENTS****8**

Powder injection moulding – Shot peen hardening of gears – Production of aluminum MMC liners for engine blocks – Plasma spray coated engine blocks and valves – Recent developments in auto body panel forming – Squeeze casting of pistons – aluminum composite brake rotors.

**Total: 45 Hours****COURSE OUTCOME:**

- CO – 1: Summarize the knowledge on basic principle of powder metallurgy manufacturing process.  
 CO – 2: Research on forming process in which various automotive components, manufacturing process.  
 CO – 3: Analyze the casting and machining process in which various automotive components manufacturing  
 CO – 4: List the various gear manufacturing process.  
 CO – 5: Illustrate the powder injection moulding.

**TEXT BOOK**

1. Heldt.P.M., High Speed Combustion Engines, Oxford publishing co., New York, 1990.

**REFERENCES**

1. Haslehurst.S.E., Manufacturing Technology, ELBS, London, 1990.
2. Rusinoff., Forging and forming of metals, D.B, Taraporevla Son & co Pvt ltd, Mumbai, 1995.
3. Sabroff.A.M. & Others, Forging Materials & Processes, Reinhold Book Corporation, New York, 1988.
4. Upton, Pressure Die Casting, Pergamon Press, 1985.
5. High Velocity Forming of metals, ASTME, Prentice Hall of India (P) Ltd., New Delhi, 1990.

**COURSE OBJECTIVE:**

- To understand the basic electrochemistry that occurs in batteries for Hybrid Electric Vehicles.

**UNIT I INTRODUCTION****9**

Electric and hybrid vehicles, flexible fuel vehicles (FFV), solar powered vehicles, magnetic track vehicles, fuel cells vehicles.

**UNIT II POWER SYSTRM AND NEW GENERATION VEHICLES****9**

Hybrid Vehicle engines, Stratified charge engines, lean burn engines, low heat rejection engines, hydrogen engines, HCCI engine, VCR engine, surface ignition engines, VVTI engines. High energy and power density batteries, fuel cells, solar panels, flexible fuel systems.

**UNIT III VEHICLE OPERATION AND CONTROL****9**

Computer Control for pollution and noise control and for fuel economy – Transducers and actuators - Information technology for receiving proper information and operation of the vehicle like optimum sped and direction.

**UNIT IV VEHICLE AUTOMATED TRACKS****9**

Preparation and maintenance of proper road network - National highway network with automated roads and vehicles - Satellite control of vehicle operation for safe and fast ravel, GPS.

**UNIT V SUSPENSION, BRAKES, AERODYNAMICS AND SAFETY****9**

Air suspension – Closed loop suspension, compensated suspension, anti skid braking system, retarders, regenerative braking, safety gauge air backs- crash resistance. Aerodynamics for modern vehicles, safety systems, materials and standards.

**TOTAL: 45 Hours****COURSE OUTCOME:**

- CO-1: Justify Electric & hybrid vehicles, Solar Powered and fuel cells vehicles.  
 CO-2: Illustrate High Energy and Power density batteries, Solar Panels and Flexible Fuel systems.  
 CO- 3: Explain Satellite control of vehicle operation for safe, GPS and fast ravel.  
 CO- 4: Criticize closed loop, Compensated, types of Suspension and Braking system.  
 CO- 5: State aerodynamics, safety system and its standards for modern vehicles.

**TEXT BOOKS:**

- Heinz, "Modern Vehicle Technology" Second Edition,BU.
- Bosch Hand Bok, SAE Publication, 2000.

**REFERENCES:**

- Light weight electric for hybrid vehicle design.
- Advance hybrid vehicle power transmission, SAE.
- Noise reduction, Branek L.L., McGraw Hill Bok company, New York, 1993.

**COURSE OBJECTIVE:**

- To understand the fabrication, analysis and design of composite materials & structures.

**Unit I INTRODUCTION TO COMPOSITES****8**

Fundamentals of composites - need for composites – Enhancement of properties - classification of composites – Matrix-Polymer matrix composites (PMC), Metal matrix composites (MMC), Ceramic matrix composites (CMC) – Reinforcement – Particle reinforced composites, Fibre reinforced composites. Applications of various types of composites.

**Unit II POLYMER MATRIX COMPOSITES****12**

Polymer matrix resins – Thermosetting resins, thermoplastic resins – Reinforcement fibres – Rovings – Woven fabrics – Non woven random mats – various types of fibres. PMC processes - Hand lay up processes – Spray up processes – Compression moulding – Reinforced reaction injection moulding - Resin transfer moulding – Pultrusion – Filament winding – Injection moulding. Fibre reinforced plastics (FRP), Glass fibre reinforced plastics (GRP).

**Unit III METAL MATRIX COMPOSITES****9**

Characteristics of MMC, Various types of Metal matrix composites Alloy vs. MMC, Advantages of MMC, Limitations of MMC, Metal Matrix, Reinforcements – particles – fibres. Effect of reinforcement - Volume fraction – Rule of mixtures. Processing of MMC – Powder metallurgy process – diffusion bonding – stir casting – squeeze casting.

**Unit IV CERAMIC MATRIX COMPOSITES****9**

Engineering ceramic materials – properties – advantages – limitations – Monolithic ceramics - Need for CMC – Ceramic matrix - Various types of Ceramic Matrix composites- oxide ceramics – non oxide ceramics – aluminium oxide – silicon nitride – reinforcements – particles- fibres- whiskers. Sintering - Hot pressing – Cold isostatic pressing (CIPing) – Hot isostatic pressing (HIPing).

**Unit V Advances in composites****7**

Carbon /carbon composites – Advantages of carbon matrix – limitations of carbon matrix Carbon fibre – chemical vapour deposition of carbon on carbon fibre perform. Sol gel technique.Composites for aerospace applications.

**TOTAL: 45Hours****COURSE OUTCOME:**

CO-1: Explain the fundamentals of composites.

CO-2: Familiar with the thermoplastic resins.

CO-3: Explain the Metal matrix composites Alloy.

CO-4: Describe the diffusion bonding.

CO-5: Describe study of engineering ceramic materials

**TEXT BOOKS:**

- Mathews F.L. and Rawlings R.D., “Composite materials: Engineering and Science”, Chapman and Hall, London, England, 1st edition, 1994.
- Chawla K.K., “Composite materials”, Springer – Verlag, 1987

**REFERENCES:**

- Clyne T.W. and Withers P.J., “Introduction to Metal Matrix Composites”, Cambridge University Press, 1993.
- Strong A.B., “Fundamentals of Composite Manufacturing”, SME, 1989.
- Sharma S.C., “Composite materials”, Narosa Publications, 2000.
- “Short Term Course on Advances in Composite Materials, Composite Technology Centre, Department of Metallurgy”, IIT- Madras, December 2001.



**COURSE OBJECTIVE**

- To study the components of the automotive air-conditioning and their functions.
- To familiarize with latest developments in this field.

**UNIT I AIR CONDITIONING FUNDAMENTALS****9**

Basic air conditioning system - location of air conditioning components in a car, schematic layout of a refrigeration system, compressor components, condenser and high pressure service ports, thermostatic expansion valve, expansion valve calibration, controlling evaporator temperature, evaporator pressure regulator, evaporator temperature regulator.

**UNIT II AIR CONDITIONER – HEATING SYSTEM****9**

Automotive heaters, manually controlled air conditioner, heater system, automatically controlled air conditioner and heater systems, automatic temperature control, air conditioning protection, engine protection.

**UNIT III REFRIGERANT****9**

Containers handling refrigerants, tapping into the refrigerant container, refrigeration system diagnosis, diagnostic procedure, ambient conditions affecting system pressures.

**UNIT IV AIR ROUTING AND TEMPERATURE CONTROL****9**

COURSE OBJECTIVES, evaporator airflow through the recirculation unit, automatic temperature control, duct system, controlling flow, vacuum reserve, testing the air control and handling systems.

**UNIT V AIR CONDITIONING SERVICE****9**

Air conditioner maintenance and service, servicing heater system removing and replacing components, trouble shooting of air controlling system, compressor service.

**TOTAL: 45 Hours****COURSE OUTCOME:**

- CO – 1: List and explain the air conditioning components.
- CO – 2: Clearly explain the air conditioning protection.
- CO – 3: Familiar with the handling refrigerants & diagnostic procedure.
- CO – 4: Describe the ambient conditions affecting system pressures.
- CO – 5: Clearly explain the air conditioner maintenance and service.

**TEXT BOOKS**

1. William H. Crouse and Donald I. Anglin - "Automotive Air conditioning" - McGraw Hill. - 1990.
2. Boyce H.DWiggins - "Automotive Air Conditioning" - Delmar – 2002

**REFERENCES**

1. Mitchell information Services, Inc - "Mitchell Automatic Heating and Air Conditioning Systems" - Prentice Hall Ind. - 1989.
2. Paul Weiser - "Automotive Air Conditioning" - Reston Publishing Co., Inc., - 1990.
3. MacDonald, K.I., - "Automotive Air Conditioning" - Theodore Audel series - 1978
4. Goings.L.F. – "Automotive Air Conditioning" - American Technical services - 1974.

**COURSE OBJECTIVES:**

- To understand the functions and design principles of Jigs, fixtures and press tools

**UNIT I LOCATING AND CLAMPING PRINCIPLES****8**

Tool design- Function and advantages of Jigs and fixtures – Basic elements– principles of location – Locating methods and devices – Redundant Location –Principles of clamping – Mechanical actuation – pneumatic and hydraulic actuation Standard parts – Drill bushes and Jig buttons – Tolerances and materials used.

**UNIT II JIGS AND FIXTURES****10**

Design and development of jigs and fixtures for given component- Types of Jigs – Post, Turnover, Channel, latch, box, pot, angular post jigs – Indexing jigs – General principles of milling, Lathe, boring, broaching and grinding fixtures – Assembly, Inspection and Welding fixtures – Modular fixturing systems- Quick change fixtures.

**UNIT III PRESS WORKING TERMINOLOGIES AND ELEMENTS OF CUTTING DIES****10**

Press Working Terminologies - operations – Types of presses – press accessories –Computation of press capacity – Strip layout – Material Utilization – Shearing action –Clearances – Press Work Materials – Center of pressure- Design of various elements of dies – Die Block – Punch holder, Die set, guide plates – Stops – Strippers – Pilots –Selection of Standard parts – Design and preparation of four standard views of simple blanking, piercing, compound and progressive dies.

**UNIT IV BENDING FORMING AND DRAWING DIES****10**

Difference between bending, forming and drawing – Blank development for above operations – Types of Bending dies – Press capacity – Spring back – knockouts – direct and indirect – pressure pads – Ejectors – Variables affecting Metal flow in drawing operations – draw die inserts – draw beads- ironing – Design and development of bending, forming, drawing reverse re-drawing and combination dies – Blank development for ax- symmetric, rectangular and elliptic parts – Single and double action dies.

**UNIT V MISCELLANEOUS TOPICS****7**

Bulging, Swaging, Embossing, coining, curling, hole flanging, shaving and sizing, assembly, fine Blanking dies – recent trends in tool design- computer Aids for sheet metal forming Analysis – basic introduction - tooling for numerically controlled machines- setup reduction for work holding – Single minute exchange of dies – Poka Yoke - Course should be supplemented with visits to industries.

(Use of Approved design Data Book permitted).

**TOTAL: 45 Hours****COURSE OUTCOME**

CO-1: Explain the basics of Jigs and fixtures.

CO-2: Explain the different types of Fixtures and Gauges

CO-3: Explain the construction and working principles of different types of press and press tools

CO-4: Describe the Manufacture and assemble of different press tools

CO-5: Ability to classify and explain various press tools and press tools operations.

**TEXT BOOKS**

- Joshi, P.H. "Jigs and Fixtures", Second Edition, Tata McGraw Hill Publishing Co., Ltd., New Delhi, 2004.
- Donaldson, Lecain and Goold "Tool Design", III rd Edition Tata McGraw Hill, 2000.

**REFERENCES:**

- K. Venkataraman, "Design of Jigs Fixtures & Press Tools", Tata McGraw Hill, New Delhi, 2005.Kempster, "Jigs and Fixture Design", Hoddes and Stoughton – Third Edition 1974.
- Joshi, P.H. "Press Tools" – Design and Construction", Wheels publishing, 1996.
- Hoffman "Jigs and Fixture Design" – Thomson Delmar Learning, Singapore, 2004.
- ASTME Fundamentals of Tool Design Prentice Hall of India.
- Design Data Hand Book, PSG College of Technology, Coimbatore.

**COURSE OBJECTIVE:**

- To understand the basic concepts associated with the design and functioning and applications of Robots
- To study about the drives and sensors used in Robots
- To learn about analyzing robot kinematics and robot programming

**UNIT I FUNDAMENTALS OF ROBOT****7**

Robot – Definition – Robot Anatomy – Co-ordinate Systems, Work Envelope, types and classification – Specifications – Pitch, Yaw, Roll, Joint Notations, Speed of Motion, Pay Load – Robot Parts and Functions – Need for Robots – Different Applications.

**UNIT II ROBOT DRIVE SYSTEMS AND END EFFECTORS****10**

Pneumatic Drives – Hydraulic Drives – Mechanical Drives – Electrical Drives – D.C.Servo Motors, Stepper Motor, A.C. Servo Motors – Salient Features, Applications and Comparison of Drives End Effectors – Grippers – Mechanical Grippers, Pneumatic and Hydraulic Grippers, Magnetic Grippers, Vacuum Grippers; Two Fingered and Three Fingered Grippers; Internal Grippers and External Grippers; Selection and Design Considerations.

**UNIT III SENSORS AND MACHINE VISION****10**

Requirements of a sensor, Principles and Applications of the following types of sensors– Position of sensors (Piezo Electric Sensor, LVDT, Resolvers, Optical Encoders, Pneumatic Position Sensors), Range Sensors (Triangulation Principle, Structured, Lighting Approach, Time of Flight Range Finders, Laser Range Meters), Proximity Sensors (Inductive, Hall Effect, Capacitive, Ultrasonic and Optical Proximity Sensors), Touch Sensors, (Binary Sensors, Analog Sensors), Wrist Sensors, Compliance Sensors, Slip Sensors. Camera, Frame Grabber, Sensing and Digitizing Image Data – Signal Conversion, Image Storage, Lighting Techniques. Image Processing and Analysis –Data Reduction: Edge detection, Segmentation Feature Extraction and Object Recognition - Algorithms. Applications – Inspection, Identification, Visual Serving and Navigation.

**UNIT IV ROBOT KINEMATICS AND ROBOT PROGRAMMING****10**

Forward Kinematics, Inverse Kinematics and Differences; Forward Kinematics and Reverse Kinematics of Manipulators with Two, Three Degrees of Freedom (In 2Dimensional), Four Degrees of Freedom (In 3 Dimensional) – Deviations and Problems. Teach Pendant Programming, Lead through programming, Robot programming Languages – VAL Programming – Motion Commands, Sensor Commands, End effector commands, and Simple programs.

**UNIT V IMPLEMENTATION AND ROBOT ECONOMICS****8**

RGV, AGV; Implementation of Robots in Industries – Various Steps; Safety Considerations for Robot Operations; Economic Analysis of Robots – Pay back Method ,EUAC Method, Rate of Return Method.

**TOTAL: 45 Hours****COURSE OUTCOME**

CO-1: Classify the robots based on joints and arm configurations.

CO-2: Program robot to perform typical tasks including Pick and Place, Stacking and Welding.

CO-3: Design and select robots for Industrial and Non-Industrial applications.

CO-4: Describe the automation and brief history of robot and applications.

CO-5: Describe the Programming methods & various Languages of robots.

**TEXT BOOK:**

1. M.P.Groover, "Industrial Robotics – Technology, Programming and Applications", McGraw-Hill, 2001

**REFERENCES:**

1. Fu.K.S. Gonzalz.R.C., and Lee C.S.G., "Robotics Control, Sensing, Vision and Intelligence", McGraw-Hill Book Co., 1987

2. Yoram Koren, "Robotics for Engineers", McGraw-Hill Book Co., 1992

3. Janakiraman.P.A., "Robotics and Image Processing", Tata McGraw-Hill, 1995

**COURSE OBJECTIVE:**

- To make the students understand the need for supercharging and the various types of superchargers used and their performance characteristics and the scavenging methods for two stroke engines.

**UNIT I SUPERCHARGING**

8

Effects on engine performance – engine modification required Thermodynamics of Mechanical Supercharging and Turbocharging – Turbocharging methods – Engine exhaust manifolds arrangements.

**UNIT II SUPERCHARGERS**

10

Types of compressors – Positive displacement blowers – Centrifugal compressors –Performance characteristic curves – Suitability for engine application – Surging –Matching of supercharger compressor and Engine – Matching of compressor, Turbine, Engine.

**UNIT III SCAVENGING OF TWO STROKE ENGINES**

12

Peculiarities of two stroke cycle engines – Classification of scavenging systems –Mixture control through Reed valve induction – Charging Processes in two stroke cycle engine – Terminologies – Shankey diagram – Relation between scavenging terms –scavenging modeling – Perfect displacement, Perfect mixing – Complex scavenging models.

**UNIT IV PORTS AND MUFFLER DESIGN**

8

Porting – Design considerations – Design of Intake and Exhaust Systems – Tuning.

**UNIT V EXPERIMENTAL METHODS**

7

Experimental techniques for evaluating scavenging – Firing engine tests – Non firing engine tests – Port flow characteristics – Kadenacy system – Orbital engine combustion system.

**TOTAL: 45 Hours****COURSE OUTCOME:**

CO-1: Describe the effects on Engine performance and Engine modification.

CO-2: State the types of compressors, blowers and its Performance Characteristics Curves.

CO-3: Define the peculiarities of two stroke Engines, and its Scavenging and Charging process.

CO-4: Evaluate the design of Intake and Exhaust systems.

CO-5: Determine the Experimental techniques for evaluating scavenging and Engine Firing test.

**TEXT BOOKS:**

- Watson, N. and Janota, M.S., Turbocharging the I.C.Engine, MacMillan Co., 1982.
- John B.Heywood, Two Stroke Cycle Engine, SAE Publications, 1997.

**REFERENCES:**

- Obert, E.F., Internal Combustion Engines and Air Pollution, Intext Educational Publishers, 1980.
- Richard Stone, Internal Combustion Engines, SAE, 1992.
- Vincent, E.T., Supercharging the I.C.Engines, McGraw-Hill. 1943
- Schweitzer, P.H., Scavenging of Two Stroke Cycle Diesel Engine, MacMillan Co., 1956

**COURSE OBJECTIVE:**

- To understand the various safety equipments and devices used in the automobile.

**UNIT I INTRODUCTION****9**

Design of the body for safety, energy equation, engine location, deceleration of vehicle inside passenger compartment, deceleration on impact with stationary and movable obstacle, concept of crumple zone, safety sandwich construction.

**UNIT II SAFETY CONCEPTS****9**

Active safety: driving safety, conditional safety, perceptibility safety, operating safety passive safety: exterior safety, interior safety, deformation behavior of vehicle body, speed and acceleration characteristics of passenger compartment on impact.

**UNIT III SAFETY EQUIPMENTS****9**

Seat belt, regulations, automatic seat belt tightened system, collapsible steering column, tiltable steering wheel, air bags, electronic system for activating air bags, bumper design for safety.

**UNIT IV COLLISION WARNING AND AVOIDANCE****9**

Collision warning system, causes of rear end collision, frontal object detection, rear vehicle object detection system, object detection system with braking system interactions.

**UNIT V COMFORT AND CONVENIENCE SYSTEM****9**

Steering and mirror adjustment, central locking system, Garage door opening system, tyre pressure control system, rain sensor system, environment information system

**TOTAL: 45 Hours****COURSE OUTCOME:**

- CO – 1: Describe the passenger safety, crumple zone and crash testing.  
 CO – 2: Familiar with the concepts of safety.  
 CO – 3: Describe the various safety equipments.  
 CO – 4: Describe the electronic system for activating air bags.  
 CO – 5: Explain the object detection system with braking system interactions.  
 CO – 6: Describe Steering adjustment system.

**TEXT BOOKS:**

- Bosch - "Automotive Handbook" - 5th edition - SAE publication - 2000.
- J.Powloski - "Vehicle Body Engineering" - Business books limited, London - 1969.

**REFERENCE**

- Ronald.K.Jurgen - "Automotive Electronics Handbook" - Second edition- McGraw-Hill Inc., - 1999.

**COURSE OBJECTIVE:**

- To understand the different mechanisms, the method of working of different mechanisms
- To impart on knowledge on the Forces involved and consequent vibration during working.

**UNIT I KINEMATIC OF MECHANICS****9**

Mechanisms – Terminology and definitions – kinematics inversions of 4 bar and slide crank chain –kinematics analysis in simple mechanisms – velocity and acceleration polygons – Analytical methods – computer approach – cams – classifications – displacement diagrams - layout of plate cam profiles – derivatives of flowers motion – circular arc and tangent cams.

**UNIT II GEARS and GEAR TRAINS****9**

Spur gear – law of toothed gearing – involute gearing – Interchangeable gears – Gear tooth action interference and under cutting – non standard teeth – gear trains – parallel axis gears trains – epicyclic gear trains – automotive transmission gear trains.

**UNIT III FRICTION****9**

Sliding and Rolling Friction angle – friction in threads – Friction Drives – Friction clutches – Belt and rope drives – brakes – Tractive resistance.

**UNIT IV FORCE ANALYSIS****9**

Applied and Constrained Forces – Free body diagrams – static Equilibrium conditions – Two, Three and four members – Static Force analysis in simple machine members – Dynamic Force Analysis – Inertia Forces and Inertia Torque – D'Alembert's principle – super position principle – dynamic Force Analysis in simple machine members.

**UNIT V BALANCING AND VIBRATION****9**

Static and Dynamic balancing – Balancing of revolving and reciprocating masses – Balancing machines – free vibrations – Equations of motion – natural Frequency – Damped Vibration – bending critical speed of simple shaft – Torsional vibration – Forced vibration – harmonic Forcing – Vibration solution.

**TOTAL: 45 Hours****COURSE OUTCOME:**

- CO-1: Analyze the different types of motions and Displacement diagram of Cam and Follower.  
 CO-2: Discuss about the Frictional forces in an Inclined Planes, Screw threads and Clutches.  
 CO-3: Analyze the Tensions, Forces and Power in different types of Belt and Rope drives and Brakes.  
 CO- 4: Compare the Dynamic Force analysis, inertial force and Torque in Simple Machine Members.  
 CO- 5: Evaluate the Free vibrations, balancing of revolving and reciprocating masses of rotating shaft.

**TEXT BOOKS:**

1. Ambekar A.G., "Mechanism and Machine Theory" Prentice Hal of India, New Delhi, 207
2. Shigley J.E., Penock G.R and Uicker J.J., "Theory of Machines and Mechanisms", OxfordUniversity

**REFERENCES:**

1. Thomas Bevan, "Theory of Machines", CBS Publishers and Distributors, 1984.
2. Ghosh.A, and A.K.Malick, "Theory and Machine", Afiliated East-West Pvt. Ltd., New Delhi,198.
3. Rao.J.S. andDukipati R.V. "Mechanisms and Machines", Wiley-Eastern Ltd., New Delhi,192.
4. Ramamurthi. V., "Mechanisms of Machine", Narosa Publishing House, 202.
5. Robert L.Norton, "Design of Machinery", McGraw-Hil, 204.

**COURSE OBJECTIVES:**

- To introduce the learners with the need for automotive testing methods and their importance.
- To equip them with knowledge in various testing standards and guidelines.

**UNIT I VEHICLE WIND TUNNEL TESTING AND BODY TESTING 10**

Wind tunnel test requirements - Ground boundary simulation - wind tunnel selection and Reynolds number capability, model details, mounting of model, Test procedure. Body test - Dynamics simulation sled testing - Dolly roll over test - Dolly roll over fixture - vehicle roof strength test - Door system crash test.

**UNIT II COLLISION AND CRASH TESTING 9**

Crash testing: Human Testing, Dummies, Crash worthiness, pole crash testing, near crash testing, vehicle to vehicle impact, side impact testing, crash test sensor, sensor mounting positions, crash test data acquisition, braking distance test.

**UNIT III TESTING OF WHEELS AND BRAKES 10**

Wheels: Dynamic cornering fatigue, dynamic radial fatigue tests-procedures, bending moment and radial load calculations. Impact test -Road hazard impact test for wheel and tyre assemblies test procedures, Failure criteria and performance criteria.

**UNIT IV ENERGY AND FUEL CONSUMPTION TESTING 7**

Engine cooling fan, air conditioning and brake compressors, hydraulic pumps power consumptions, ABS energy consumption. Test Route selection, vehicle test speeds, cargo, weights, driver selection, Tested data, finding and calculations. Test on rough terrain, Pot hole with laden and unladen conditions.

**UNIT V VEHICLE COMPONENT RELATED TESTING 9**

Reading - longer texts - close reading, writing - brainstorming - writing short essays - developing an outline - identifying main and subordinate ideas - dialogue writing. Listening - listening to talks - conversations. Speaking - participating in conversations - short group conversations. Language development -modal verbs-present/post perfect tense. Vocabulary development - collocations.

**TOTAL : 45 PERIODS****COURSE OUTCOMES:**

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

- CO-1: Prepare the vehicle for testing according to standards  
 CO-2: Test the vehicle in static and dynamic conditions.  
 CO-3: Incorporate all the automotive testing regulations while testing a vehicle  
 CO-4: Test on effectiveness and efficiency of all the components  
 CO-5: Analyze the vehicle and report the results.

**REFERENCES:**

1. Beck with. T.G. and Buck. N.L."Mechanical Measurements", Addition Wesley publishing company Limited, 1995.
2. SAE Hand book, Vol 3, SAE, Publications, 2000
3. Tim Grilles, "Automotive Service" Delmar publishers, 1998
4. W.H. course& D.L. Anglin, "Automotive Mechanics" TMG publishing company, 2004
5. Automotive Handbook, Bosch.
6. Website: [www.mainindia.com/Draft](http://www.mainindia.com/Draft), AIS standards. asp.

**COURSE OBJECTIVES:**

- ❖ To familiarize the various steps involved in the Design Process
- ❖ To understand the principles involved in evaluating the shape and dimensions of a component to satisfy functional and strength requirements.
- ❖ To learn to use standard practices and standard data
- ❖ To learn to use catalogues and standard machine components (Use of P S G Design Data Book is permitted)

**UNIT I STEADY STRESSES AND VARIABLE STRESSES IN MACHINE MEMBERS 9**

Introduction to the design process - factors influencing machine design, selection of materials based on mechanical properties - Preferred numbers, fits and tolerances – Direct, Bending and torsional stress equations – Impact and shock loading – calculation of principle stresses for various load combinations, eccentric loading – curved beams – crane hook and ‘C’ frame- Factor of safety - theories of failure – Design based on strength and stiffness – stress concentration – Design for variable loading.

**UNIT II SHAFTS AND COUPLINGS 9**

Design of solid and hollow shafts based on strength, rigidity and critical speed – Keys, keyways and splines - Rigid and flexible couplings.

**UNIT III TEMPORARY AND PERMANENT JOINTS 9**

Threaded fasteners - Bolted joints including eccentric loading, Knuckle joints, Cotter joints – Welded joints, riveted joints for structures - theory of bonded joints.

**UNIT IV ENERGY STORING ELEMENTS AND ENGINE COMPONENTS 9**

Various types of springs, optimization of helical springs - rubber springs - Flywheels considering stresses in rims and arms for engines and punching machines- Connecting Rods and crank shafts.

**UNIT V BEARINGS 9**

Sliding contact and rolling contact bearings - Hydrodynamic journal bearings, Sommerfeld Number, Raimondi and Boyd graphs, -- Selection of Rolling Contact bearings.

**TOTAL: 45 PERIODS****COURSE OUTCOMES:**

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

- CO-1: Explain the influence of steady and variable stresses in machine component design.
- CO-2: Apply the concepts of design to shafts, keys and couplings.
- CO-3: Apply the concepts of design to temporary and permanent joints.
- CO-4: Apply the concepts of design to energy absorbing members, bearings and connecting rod.
- CO-5: Apply the concepts of design to bearings.

**TEXT BOOKS:**

1. Bhandari V, “Design of Machine Elements”, 4<sup>th</sup> Edition, Tata McGraw-Hill Book Co, 2016.
2. Joseph Shigley, Charles Mischke, Richard Budynas and Keith Nisbett “Mechanical Engineering Design”, 9<sup>th</sup> Edition, Tata McGraw-Hill, 2011

**REFERENCES:**

1. Alfred Hall, Halowenko, A and Laughlin, H., “Machine Design”, Tata McGraw-Hill Book Co. (Schaum’s Outline), 2010
2. Ansel Ugural, “Mechanical Design – An Integral Approach”, 1<sup>st</sup> Edition, Tata McGraw-Hill Book Co, 2003.
3. P.C. Gope, “Machine Design – Fundamental and Application”, PHI learning private ltd, New Delhi, 2012.
4. Sundararajamoorthy T.V. Shanmugam. N., “Machine Design”, Anuradha Publications, Chennai, 2015.



**COURSE OBJECTIVE:**

- ❖ To explain the principle of engines and vehicle electronic management system and different sensors used in the systems.

**UNIT I FUNDAMENTALS OF AUTOMOTIVE ELECTRONICS 9**

Microprocessor architecture, open and closed loop control strategies, PID control, Look up tables, introduction to modern control strategies like Fuzzy logic and adaptive control. Parameters to be controlled in SI and CI engines and in the other parts of the automobile.

**UNIT II SENSORS 9**

Inductive, Hall effect, hot wire, thermistor, piezo electric, piezoresistive, based sensors. Throttle position, mass air flow, crank shaft position, cam position, engine and wheel speed, steering position, tire pressure, brake pressure, steering torque, fuel level, crash, exhaust oxygen level (two step and linear lambda), knock, engine temperature, manifold temperature and pressure sensors, gyro sensors.

**UNIT III SI ENGINE MANAGEMENT 9**

Three way catalytic converter, conversion efficiency versus lambda. Layout and working of SI engine management systems like Bosch L-Jetronic and LH-Jetronic. Group and sequential injection techniques. Working of the fuel system components. Cold start and warm up phases, idle speed control, acceleration and full load enrichment, deceleration fuel cutoff. Fuel control maps, open loop control of fuel injection and closed loop lambda control. Electronic ignition systems and spark timing control. Closed loop control of knock.

**UNIT IV CI ENGINE MANAGEMENT 9**

Fuel injection system parameters affecting combustion, noise and emissions in CI engines. Pilot, main, advanced post injection and retarded post injection. Electronically controlled Unit Injection system. Layout of the common rail fuel injection system. Working of components like fuel injector, fuel pump, rail pressure limiter, flow limiter, EGR valves

**UNIT V VEHICLE MANAGEMENT SYSTEMS 9**

ABS system, its need, layout and working. Electronic control of suspension – Damping control, Electric power steering, Supplementary Restraint System of air bag system – crash sensor, seat belt tightening. Cruise control. Vehicle security systems- alarms, vehicle tracking system. On board diagnostics. Collision avoidance Radar warning system.

**TOTAL: 45 PERIODS****COURSE OUTCOME:**

At the end of the course, the student will

- CO-1:** Understand the fundamentals of automotive electronics
- CO-2:** Understand the role of various sensors, its construction and working principle
- CO-3:** Familiar with the S.I Engine Management system
- CO-4:** Familiar with the C.I Engine Management system
- CO-5:** Familiar with the Vehicle Management system

**TEXT BOOKS:**

1. Eric Chowanietz "Automobile Electronics" SAE Publications, 1994
2. William B Ribbens "Understanding Automotive Electronics", SAE Publications, 1998

**REFERENCES:**

1. Robert Bosch "Diesel Engine Management" SAE Publications, 2006.
2. Robert Bosch, "Gasoline Engine Management" SAE Publications, 2006.

**COURSE OBJECTIVE:**

- Knowledge in usage of software to measure parameters like speed, position, velocity, pressure, force, torque, temperature etc

**UNIT I INTRODUCTION TO MEASUREMENTS AND SENSORS 9**

Sensors: Functions- Classifications- Main technical requirement and trends Units and standards- Calibration methods- Classification of errors- Error analysis- Limiting error- Probable error- Propagation of error- Odds and uncertainty-principle of transduction- Classification.

Static characteristics- mathematical model of transducers- Zero, First and Second order transducers- Dynamic characteristics of first and second order transducers for standard test inputs.

**UNIT II VARIABLE RESISTANCE, INDUCTANCE AND CAPACITIVE SENSOR 11**

Principle of operation- Construction details- Characteristics and applications of resistive potentiometer- Strain gauges- Resistive thermometers- Thermistors- Piezoresistive sensors Inductive potentiometer- Variable reluctance transducers:- EI pick up and LVDT

**Special Sensors**

Variable air gap type, variable area type and variable permittivity type- capacitor microphone Piezoelectric, Magnetostrictive, Hall Effect, semiconductor sensor- digital transducers-Humidity Sensor. Rain sensor, climatic condition sensor, solar, light sensor, antiglare sensor.

**UNIT III AUTOMOTIVE PRESSURE AND FORCE/TORQUE SENSOR 9**

**Pressure Sensor:**

Typical automotive applications- Thick film pressure sensor- Semiconductor pressure sensor- Integrated silicon intake-manifold pressure sensor-Integrated silicon combustion-pressure sensor- Piezo electric sensor-High pressure sensor with metal diaphragm.

**Force/Torque Sensor:**

Typical automotive applications- Magneto elastic bearing-pin sensor- Magneto elastic tension/compressive-force sensor – Basic principle of torque measurement – steering- Angle measuring torque sensor.

**UNIT IV AUTOMOTIVE POSITION AND RPM/VELOCITY SENSORS 9**

**Position Sensors:-** Typical automotive applications- Wiper potentiometers- Short-circuiting ring sensor- Half-differential sensor- Eddy-current pedal-travel sensor- Integrated Hall IC's - Hall acceleration sensor- Knock sensors-RPM and Velocity Sensors: - Inductive rotational speed sensor- Hall effect sensor

**Temperature Sensors:-** Typical automotive applications -Sintered-Ceramic resistors-Thin film resistors-Thick film resistors- Monocrystalline silicon semiconductor resistor- Thermopile sensors **Flow Sensors:-** Ultrasonic flow sensors- Pitot tube air-flow sensor- Hot wire air-mass flow meter- Micro mechanical hot-film air-mass flow meter- Lambda sensor -Imaging sensor-Rain Sensor Introduction to MEMs

**UNIT V METROLOGY 7**

Basic concept - scientific, industrial and legal metrology - linear and angular measuring instruments, measurement of screw thread - Two, three wire method, measurement with optical flats, laser interferometer, coordinate measuring machine.

**TOTAL : 45 PERIODS**

**COURSE OUTCOME:**

- ❖ At the end of the course, the students will aware the various instruments that are available to measure parameters like speed, position, velocity, pressure, force, torque, temperature etc.

**TEXT BOOKS/ REFERENCES:**

1. Robert Brandy, " Automotive Electronics and Computer System", Prentice Hall, 2001
2. William Kimberley," Bosch Automotive Handbook", 6<sup>th</sup> Edition, Robert Bosch GmbH, 2004
3. Bentley J.P , " Principles of Measurement Systems", 4<sup>th</sup> Edition, Addison Wesley Longman Ltd., U.K, 2004
4. Jain R. K. "Engineering Metrology" Khanna Publishers, New Delhi, 2012
5. Murthy D.V.S, "Transducers and Instrumentation", Prentice Hall of India, 2007

**COURSE OBJECTIVE:**

- To understand the various safety concepts, systems and working of safety equipments.

**UNIT I INTRODUCTION****9**

Design of the body for safety, energy equation, engine location, deceleration of vehicle inside passenger compartment, deceleration on impact with stationary and movable obstacle, concept of crumple zone, safety sandwich construction.

**UNIT II SAFETY CONCEPTS****9**

Active safety: driving safety, conditional safety, perceptibility safety, operating safety passive safety: exterior safety, interior safety, deformation behavior of vehicle body, speed and acceleration characteristics of passenger compartment on impact.

**UNIT III SAFETY EQUIPMENTS****9**

Seat belt, regulations, automatic seat belt tightened system, collapsible steering column, tiltable steering wheel, air bags, electronic system for activating air bags, bumper design for safety.

**UNIT IV COLLISION WARNING AND AVOIDANCE****9**

Collision warning system, causes of rear end collision, frontal object detection, rear vehicle object detection system, object detection system with braking system interactions.

**UNIT V COMFORT AND CONVENIENCE SYSTEM****9**

Steering and mirror adjustment, central locking system, Garage door opening system, tyre pressure control system, rain sensor system, environment information system

**TOTAL: 45 Hours****COURSE OUTCOME:**

- CO – 1 Familiar with the concepts of safety.  
 CO – 2: Describe the various safety equipments.  
 CO – 3: Describe the electronic system for activating air bags.  
 CO – 4: Familiar with the various Collision warning system.  
 CO – 5: Explain the object detection system with braking system interactions.  
 CO –6: Explain the different types of sensor system.

**TEXT BOOKS:**

- Bosch - "Automotive Handbook" - 5th edition - SAE publication - 2000.
- J.Powloski - "Vehicle Body Engineering" - Business books limited, London - 1969.

**REFERENCE**

- Ronald.K.Jurgen - "Automotive Electronics Handbook" - Second edition- McGraw-Hill Inc., - 1999.

**COURSE OBJECTIVE:**

- At the end of the course, the students will be able to understand the various Off road vehicle and their systems and features

**UNIT I CLASSIFICATION AND REQUIREMENTS OF OFF ROAD VEHICLES 6**

Construction layout, capacity and applications of off road vehicle - prime mover, chassis and transmission, Multi-axle vehicles.

**UNIT II EARTH MOVING CONSTRUCTIONAL MACHINES 10**

dumpers - safety features, safe warning system for dumper , Design aspects on dumper body, Articulated Dumpers, loaders - single bucket, Multi bucket and rotary types - bulldozers, kinematics for loader and bulldozers with operational linkages, excavators, backhoe loaders, scrapers, motor graders, power shawl, bush cutters, Bush cutters, stumpers, rippers.

**UNITY III INDUSTRIAL APPLICATIONS 10**

Constructional and working details of Jib crane, concrete ready mixers, compactors - vibratory compactors, forklift, utility vehicles, man - lift, scissors, lift trucks, material handlers, powergenerators.

**UNIT IV VEHICLE SYSTEMS AND IT FEATURES 11**

Brake system and actuation – OCDB and dry disc caliper brakes. Body hoist and bucket operational hydraulics. Hydro-pneumatic suspension cylinders. Power steering system. Articulated steering assembly - power and capacity of earth moving machines.

**UNIT V FARM EQUIPMENTS, MILITARY AND COMBAT VEHICLES 8**

Tractors, classification - working attachments, power take off, special implements, paddy harvester, sugarcane harvester, feller bunchers, special features and constructional details of military tankers, AVLB gun carriers and transport vehicles.

**TOTAL: 45 Periods****COURSE OUTCOME:**

- CO – 1: Describe the various off-road vehicles.  
 CO – 2: Familiar with the off-road vehicle application.  
 CO – 3: Describe the off-road vehicles systems ad their features  
 CO – 4: Describe the concept of concrete mixtures.  
 CO – 5: Clearly explain the military and combat vehicles.

**TEXT BOOKS:**

1. Abrosimov.K. Bran berg.A and Katayer.K., "Road making machinery", MIR Publishers, Moscow, 1971.
2. Nakra C.P., "Farm machines and equipments" Dhanparai Publishing company Pvt. Ltd.
3. Robert L Peurifoy, "Construction, planning, equipment and methods" Tata McGraw Hill Publishing company Ltd.
4. SAE Handbook Vol. III., Society of Automotive Engineers, 1997
5. Wong.J.T., "Theory of Ground Vehicles", John Wiley & Sons, New York, 1987.

**REFERENCES:**

1. Bart H Vanderveen, "Tanks and Transport Vehicles", Frederic Warne and Co Ltd., London.la.
2. S. Ageikin, "Off the Road Wheeled and Combined Traction Devices: Theory and Calculation", Ashgate Publishing Co. Ltd. 1988.
3. Schulz Erich.J, "Diesel equipment I & II", McGraw Hill company, London, 1982.
4. Satyanarayana. B., "Construction planning and equipment", standard publishers and distributors, New Delhi, 1985.

# **SYLLABUS**

## **Open/General Elective Courses**

**COURSE OBJECTIVE:**

- To enable the students to study the evolution of Management, to study the functions and principles of management and to create an awareness on Engineering Ethics and Human Values, to instill Moral and Social Values and Loyalty and to appreciate the rights of others.

**UNIT I OVERVIEW OF MANAGEMENT 9**

Definition - Management - Role of managers - Evolution of Management thought – Organization and the environmental factors – Trends and Challenges of Management in Global Scenario.

**UNIT II PLANNING & ORGANIZING 9**

Nature and purpose of planning and Organizing - Planning process - Types of plans – Managing by objective (MBO) Strategies - Types of strategies - Policies - Decision Making - Types of decision - Decision Making Process - Rational Decision Making Process - Decision Making under different conditions. - Organization structure - Formal and informal groups I organization - Line and Staff authority - Departmentation - Span of control - Centralization and Decentralization - Delegation of authority - Staffing - Selection and Recruitment - Orientation - Career Development - Career stages – Training - Performance Appraisal.

**UNIT III DIRECTING & CONTROLLING 9**

Creativity and Innovation - Motivation and Satisfaction - Motivation Theories - Leadership Styles - Leadership theories - Communication - Barriers to effective communication – Organization Culture - Elements and types of culture - Managing cultural diversity. Process of controlling - Types of control - Budgetary and non-budgetary control techniques - Managing Productivity - Cost Control - Purchase Control - Maintenance Control - Quality Control - Planning operations.

**UNIT IV ENGINEERING ETHICS & HUMAN VALUES 9**

Definition - Societies for engineers – Code of Ethics – Ethical Issues involved in cross border research - Ethical and Unethical practices – case studies – situational decision making - Morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time – Cooperation – Commitment – Empathy – Self confidence – Character – Spirituality – Introduction to Yoga and meditation for professional excellence and stress management.

**UNIT V SAFETY RESPONSIBILITIES AND RIGHTS 9**

Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk - Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination – Global issues - Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Moral Leadership –Code of Conduct – Corporate Social Responsibility.

**TOTAL: 45 Hours**

**COURSE OBJECTIVE:**

- CO-1: Define management, managers role and management challenges
- CO-2: Explain planning, organizing, decision making, delegation, staffing and recruitment
- CO-3: Describe the directing and controlling functions
- CO-4: Explain the engineering ethics and human values
- CO-5: Describe the safety responsibilities and rights

**TEXT BOOKS:**

- Stephen P. Robbins and Mary Coulter, 'Management', Prentice Hall of India, 8th edition.
- Charles W L Hill, Steven L McShane, 'Principles of Management', Mcgraw Hill Education, 2007.
- Mike W. Martin and Roland Schinzinger, "Ethics in Engineering", Tata McGraw Hill, New Delhi, 2003.

**REFERENCES:**

- Hellriegel, Slocum & Jackson, ' Management - A Competency Based Approach', Thomson South Western, 2007.
- Harold Koontz, Heinz Weihrich and Mark V Cannice, 'Management - A global & Entrepreneurial Perspective', Tata Mcgraw Hill, 12th edition, 2007.
- Andrew J. Dubrin, 'Essentials of Management', Thomson Southwestern, 7th edition, 2007.

**COURSE OBJECTIVE:**

- To facilitate the understanding of Quality Management principles and process.

**UNIT I INTRODUCTION 9**

Introduction - Need for quality - Evolution of quality - Definition of quality - Dimensions of manufacturing and service quality - Basic concepts of TQM - Definition of TQM – TQM Framework - Contributions of Deming, Juran and Crosby – Barriers to TQM.

**UNIT II TQM PRINCIPLES 9**

Leadership – Strategic quality planning, Quality statements - Customer focus – Customer orientation, Customer satisfaction, Customer complaints, Customer retention - Employee involvement – Motivation, Empowerment, Team and Teamwork, Recognition and Reward, Performance appraisal - Continuous process improvement – PDCA cycle, 5s, Kaizen - Supplier partnership – Partnering, Supplier selection, Supplier Rating.

**UNIT III TQM TOOLS & TECHNIQUES I 9**

The seven traditional tools of quality – New management tools – Six-sigma: Concepts, methodology, applications to manufacturing, service sector including IT – Bench marking – Reason to bench mark, Bench marking process – FMEA – Stages, Types.

**UNIT IV TQM TOOLS & TECHNIQUES II 9**

Quality circles – Quality Function Deployment (QFD) – Taguchi quality loss function – TPM – Concepts, improvement needs – Cost of Quality – Performance measures.

**UNIT V QUALITY SYSTEMS 9**

Need for ISO 9000- ISO 9000-2000 Quality System – Elements, Documentation, Quality auditing- QS 9000 – ISO 14000 – Concepts, Requirements and Benefits – Case studies of TQM implementation in manufacturing and service sectors including IT.

**TOTAL: 45 Hours****COURSE OUTCOME:**

CO-1: Define quality, concepts of quality and TQM

CO-2: Explain in detail about the TQM principles

CO-3: Describe the various tools and techniques of TQM

CO-4: Define quality circle and performance measures

CO-5: List the quality systems implemented in manufacturing and service sectors including IT.

**TEXT BOOK:**

- Dale H. Besterfield, etc at "Total Quality Management", Pearson Education Asia, Third Edition, 2006.

**REFERENCES:**

- James R. Evans and William M. Lindsay, "The Management and Control of Quality", 6<sup>th</sup> Edition, South-Western (Thomson Learning), 2005.
- Suganthi, L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd., 2006.
- Janakiraman, B and Gopal, R.K, "Total Quality Management – Text and Cases", Prentice Hall (India) Pvt. Ltd.
- R. Pugazhenth, A. Baradeswaran, K. Balachandran, and P. Balamurali, "Total Quality Management", sams publications, 2015.

**COURSE OBJECTIVE:**

- To be familiar with the various quality control techniques and control charts for variables and attributes

**UNIT I INTRODUCTION AND PROCESS CONTROL FOR VARIABLES****9**

Introduction, definition of quality, basic concept of quality, definition of SQC, benefits and limitation of SQC, Quality assurance, Quality control: Quality cost-Variation in process causes of variation –Theory of control chart- uses of control chart – Control chart for chart -process capability – process capability studies for variables – X chart, R chart and simple problems, Six sigma concepts.

**UNIT II PROCESS CONTROL FOR ATTRIBUTES****9**

Control chart for attributes –control chart for non conformings– p chart and np chart – control chart for nonconformities– C and U charts, State of control and process out of control identification in charts, pattern study.

**UNIT III ACCEPTANCE SAMPLING****9**

Lot by lot sampling – types – probability of acceptance in single, double, multiple sampling techniques – O.C. curves – producer's Risk and consumer's Risk. AQL, LTPD, AOQL concepts-standard sampling plans for AQL and LTPD- uses of standard sampling plans.

**UNIT IV LIFE TESTING – RELIABILITY****9**

Life testing – Objective – failure data analysis, Mean failure rate, means time to failure, mean time between failure, hazard rate – Weibull model, system reliability, series, parallel and mixed configuration – simple problems. Maintainability and availability –simple problems, Acceptance sampling based on reliability test – O.C Curves.

**UNIT V QUALITY AND RELIABILITY****9**

Reliability improvements – techniques- use of Pareto analysis – design for reliability – redundancy unit and standby redundancy – Optimization in reliability – Product design – Product analysis – Product development – Product life cycles.

**Note:** Use of approved statistical table permitted in the examination.

**TOTAL: 45 Hours****COURSE OUTCOME:**

- CO-1: Define quality control, quality assurance and control charts.  
 CO-2: Describe the process control charts for attributes.  
 CO-3: Define sampling and its types  
 CO-4: Explain life testing, reliability, availability and maintainability  
 CO-5: Describe the reliability design and techniques.  
 CO-6: Explain product design, development and life cycle

**TEXT BOOKS:**

- Douglas.C.Montgomery, "Introduction to Statistical quality control", John wiley, 4<sup>th</sup> edition 2001.
- Srinath L.S., "Reliability Engineering", Affiliated East west press, 1991.

**REFERENCES:**

- John.S.Oakland. "Statistical process control", Elsevier, 5th edition, 2005
- Grant, Eugene .L "Statistical Quality Control", McGraw-Hill, 1996
- MonoharMahajan, "Statistical Quality Control", DhanpatRai& Sons, 2001.
- GuptaR.C., "Statistical Quality control", Khanna Publishers, 1997.
- Besterfield D.H., "Quality Control", Prentice Hall, 1993.



**COURSE OBJECTIVE:**

- To be familiar with the various concepts and functions of supply chain management.

**UNIT I INTRODUCTION**

9

Definition of Logistics and SCM: Evolution, Scope, Importance & Decision Phases – Drivers of SC Performance and Obstacles.

**UNIT II LOGISTICS MANAGEMENT**

9

Factors – Modes of Transportation - Design options for Transportation Networks-Routing and Scheduling – Inbound and outbound logistics- Reverse Logistics – 3PL- Integrated Logistics Concepts- Integrated Logistics Model – Activities - Measuring logistics cost and performance – Warehouse Management - Case Analysis.

**UNIT III SUPPLY CHAIN NETWORK DESIGN**

9

Distribution in Supply Chain – Factors in Distribution network design –Design options-Network Design in Supply Chain – Framework for network Decisions - Managing cycle inventory and safety.

**UNIT IV SOURCING, AND PRICING IN SUPPLY CHAIN**

9

Supplier selection and Contracts - Design collaboration - Procurement process.Revenue management in supply chain.

**UNIT V COORDINATION AND TECHNOLOGY IN SUPPLY CHAIN**

9

Supply chain coordination - Bullwhip effect – Effect of lack of co-ordination and obstacles – IT and SCM - supply chain IT frame work, E Business & SCM, Metrics for SC performance – Case Analysis

**TOTAL: 45 Hours****COURSE OUTCOME:**

CO-1: Define logistics and supply chain management

CO-2: Describe the modes of transportation and warehouse management

CO-3: Explain the supply chain network design, managing cycle inventory and safety

CO-4: Describe the sourcing and pricing in the SCM

CO-5: Explain in detail about coordination and technology in the SCM

**TEXT BOOKS:**

- Supply Chain Management, Strategy, Planning, and operation – Sunil Chopra and Peter Meindl- PHI, Second edition, 2007
- Logistics, David J.Bloomberg, Stephen Lemay and Joe B.Hanna, PHI 2002

**REFERENCES:**

- Logistics and Supply Chain Management –Strategies for Reducing Cost and Improving Service. Martin Christopher, Pearson Education Asia, Second Edition.
- Modeling the supply chain, Jeremy F.Shapiro, Thomson Duxbury, 2002.
- Handbook of Supply chain management, James B.Ayers, St.Lucle Press, 2000.

**COURSE OBJECTIVE:**

- To be familiar with the optimization techniques under limited resources for the engineering.

**UNIT I LINEAR MODELS****9**

The phase of an operation research study – Linear programming – Graphical method– Simplex algorithm – Duality formulation – Sensitivity analysis.

**UNIT II TRANSPORTATION MODELS AND NETWORK MODELS****9**

Transportation Assignment Models –Traveling Salesman problem-Networks models – Shortest route– Minimal spanning tree – Maximum flow models –Project network – CPM and PERT networks –Critical path scheduling – Sequencing models.

**UNIT III INVENTORY MODELS****9**

Inventory models – Economic order quantity models – Quantity discount models – Stochastic inventory models – Multi product models – Inventory control models in practice.

**UNIT IV QUEUEING MODELS****9**

Queueing models - Queueing systems and structures – Notation parameter – Single server and multi server models – Poisson input – Exponential service – Constant rate service – Infinite population –Simulation.

**UNIT V DECISION MODELS****9**

Decision models – Game theory – Two person zero sum games – Graphical solution- Algebraic solution– Linear Programming solution – Replacement models – Models based on service life –Economic life– Single / Multi variable search technique – Dynamic Programming – Simple Problem.

**TOTAL: 45 Hours****COURSE OUTCOME:**

CO-1: Define linear programming, simplex algorithm and sensitivity analysis

CO-2: Explain the transportation assignment models and network models

CO-3: Describe the various inventory models

CO-4: Explain the queueing models, systems and structures.

CO-5: Describe the decision models and game theory

**TEXT BOOK:**

- Taha H.A., "Operations Research", Sixth Edition, Prentice Hall of India, 2003.

**REFERENCES:**

- Shenoy G.V. and Srivastava U.K., "Operation Research for Management", Wiley Eastern, 1994.
- Bazara M.J., Jarvis and Sherali H., "Linear Programming and Network Flows", John Wiley, 1990.
- Philip D.T. and Ravindran A., "Operations Research", John Wiley, 1992.
- Hillier and Liberman, "Operations Research", Holden Day, 1986
- Budnick F.S., "Principles of Operations Research for Management", Richard D Irwin, 1990.
- Tulsian and Pasdey V., "Quantitative Techniques", Pearson Asia, 2002.

**COURSE OBJECTIVE:**

- This course provides the knowledge about energy audit and energy conservation methods in I.C. Engines.

**UNIT I ENERGY AND ENVIRONMENT 9**

Introduction - fossil fuels reserves - world energy consumption - green house effect, global warming -Renewable energy sources - environmental aspects utilization - energy prizes - energy policies.

**UNIT II ENERGY CONSERVATION 9**

Energy conservation schemes - industrial energy use - energy surveying and auditing - energy index –Energy cost - cost index - energy conservation in engineering and process industry, in thermal Systems, in buildings and non-conventional energy resources scheme

**UNIT III ENERGY TECHNOLOGIES 9**

Fuels and consumption - boilers - furnaces - waste heat recovery systems - heat pumps and Refrigerators - storage systems - insulated pipe work systems - heat exchangers.

**UNIT IV ENERGY MANAGEMENT 9**

Energy management principles - energy resource management - energy management information Systems - instrumentation and measurement - computerized energy management - energy Auditing.

**UNIT V ECONOMICS AND FINANCE 9**

Costing techniques - cost optimization - optimal target investment schedule - financial appraisal and Profitability - project management.

**TOTAL: 45 Hours**

**COURSE OUTCOME:**

- CO-1: Describe the energy sources, utilization and policies
- CO-2: Explain the energy conservation in industries and buildings
- CO-3: Describe the various energy developing systems
- CO-4: Explain the energy management and auditing
- CO-5: Define the cost economics and optimization

**TEXT BOOKS:**

1. MurphyW.R. and McKAYG.,“Energy Management, Butterworths, London, 1982.
2. TrivediP.R.,JulkaB.R., “Energy Management”,Common wealth publishers, 1997.

**REFERENCES:**

3. David Merick, Richard Marshal, “Energy, present and future options”, Vol. I and II, John Wiley and Sons, 1981.
4. Chaigier N.A. “Energy Consumption and Environment ”, McGraw-Hill, 1981.
5. Ikken P.A. Swart R.J and Zwerves.S, “Climate and Energy ”, 1989.
6. Ray D.A. “Industrial Energy Conservation ”, Pergamaon Press, 1980.

**COURSE OBJECTIVE:**

- To develop and strengthen entrepreneurial quality and motivation in students and to impart basic entrepreneurial skills and understanding to run a business efficiently and effectively.

**UNIT I ENTREPRENEURSHIP****9**

Entrepreneur – Types of Entrepreneurs – Difference between Entrepreneur and Intrapreneur Entrepreneurship in Economic Growth, Factors Affecting Entrepreneurial Growth.

**UNIT II MOTIVATION****9**

Major Motives Influencing an Entrepreneur – Achievement Motivation Training, Self Rating, Business Games, Thematic Apperception Test – Stress Management, Entrepreneurship Development Programs – Need, objective.

**UNIT III BUSINESS****9**

Small Enterprises – Definition, Classification – Characteristics, Ownership Structures – Project Formulation – Steps involved in setting up a Business – identifying, selecting a Good Business opportunity, Market Survey and Research, Techno Economic Feasibility Assessment – Preparation of Preliminary Project Reports – Project Appraisal – Sources of Information – Classification of Needs and Agencies.

**UNIT IV FINANCING AND ACCOUNTING****9**

Need – Sources of Finance, Term Loans, Capital Structure, Financial Institution, Management of working Capital, Costing, Break Even Analysis, Taxation – Income Tax, Excise Duty – Sales Tax.

**UNIT V SUPPORT TO ENTREPRENEURS****9**

Sickness in small Business – Concept, Magnitude, Causes and Consequences, Corrective Measures- Business Incubators – Government Policy for Small Scale Enterprises – Growth Strategies in small industry – Expansion, Diversification, Joint Venture, Merger and Sub Contracting.

**TOTAL : 45 Hours****COURSE OUTCOME:**

CO-1: Define entrepreneur and its types

CO-2: Explain motivation, self-rating and stress management

CO-3: Describe the small enterprise and steps involved in setting up a business

CO-4: Define the sources of finance, loans and taxation

CO-5: Describe the government policies for small scale industries.

**TEXT BOOKS :**

- Khanka. S.S., "Entrepreneurial Development" S.Chand & Co. Ltd., Ram Nagar, New Delhi, 2013.
- Donald F Kuratko, "Entrepreneurship – Theory, Process and Practice", 9th Edition, Cengage Learning, 2014.

**REFERENCES :**

- Hisrich R D, Peters M P, "Entrepreneurship" 8th Edition, Tata McGraw-Hill, 2013.
- Mathew J Manimala, "Entrepreneurship theory at cross roads: paradigms and praxis" 2<sup>nd</sup> Edition Dream tech, 2005.
- Rajeev Roy, "Entrepreneurship" 2nd Edition, Oxford University Press, 2011.
- EDII "Faulty and External Experts – A Hand Book for New Entrepreneurs Publishers: Entrepreneurship Development", Institute of India, Ahmadabad, 1986.

**COURSE OBJECTIVE:**

- To provide the basic concepts and features of value analysis and value engineering.

**UNIT I CONCEPTS****9**

Introduction – status of VE in India and origin country – impact of VE application – types of values – types of function – function identification on product – function matrix – function analysis – elements of costs – calculation of costs – cost allocation to function – evaluation of worth in VE methodology.

**UNIT II TECHNIQUES****9**

General techniques: brain storming – godson feasibility ranking – morphological analysis – ABC analysis – probability approach – make or buy.

**UNIT III ANALYSIS****9**

Function – cost-worth analysis – function analysis – system techniques – function analysis matrix – customer oriented FAST diagram – fire alarm – Langrange plan – evaluation methods – matrix in evaluation – break even analysis.

**UNIT IV VALUE ENGINEERING IN JOB PLAN****9**

Orientation phase – information phase – functional analysis – creative phase – evaluation phase – recommendation phase – implementation phase – audit phase.

**UNIT V CASE STUDIES****9**

Water treatment plant – engineering management, pump component, motor component, wet grinder, automobile, hospital.

**TOTAL: 45 Hours****COURSE OUTCOME:**

CO-1: Define value engineering and its types.

CO-2: Explain brain storming, morphological and ABC analysis

CO-3: Describe the cost worth and function analysis, evaluation methods and break even analysis

CO-4: Describe the value engineering in the different work phase.

CO-5: Illustrate the various case studies for value engineering and analysis

**TEXT BOOKS:**

- Mukhophadyaya A K, "Value Engineering", Sage Publications Pvt. Ltd., New Delhi, 2003.
- Richard J Park, "Value Engineering – A Plan for Inventions", St.Lucie Press, London, 1998.

**REFERENCES:**

- Larry W Zimmesman. P E , "VE –A Practical Approach for Owners Designers and Contractors", CBS Publishers, New Delhi, 1992.
- Arthus E Mudge, "Value Engineering", McGraw Hill Inc., New York, 1971.
- Army Materiel Command U S, "Value Engineering (Engineering Design Handbook)", University Press of the Pacific, 2006.

**COURSE OBJECTIVE:**

- To be familiar with the newer concepts of marketing concepts like strategic marketing segmentation, pricing, advertisement and strategic formulation.

**UNIT I INDUSTRIAL MARKETING****9**

Nature of Industrial Marketing; Industrial Marketing Vs Consumer Marketing Relational approach to Industrial Marketing- The Nature of Industrial Demand & Industrial Customer. Types of Industrial Products: Major Equipment; Accessory Equipment; Raw and Processed Materials; Component Parts and Sub- Assemblies; Operating Supplies; Standardized and Non-standardized parts, Industrial services.

**UNIT II PRICING****9**

Pricing for Industrial Products – Pricing COURSE OBJECTIVE - Price Decision Analysis –Breakeven analysis – net pricing – discount pricing – trade discounts – geographic pricing – factory pricing – freight allowance pricing – Terms of Sale – Outright purchase – Hire-purchase – Leasing.

**UNIT III MARKET RESEARCH****9**

Introduction to Market Research, Types of Research – Basic & Applied, Nature, Scope, objective, Importance & Limitations of Market Research. Sources and collection of Marketing Data. Secondary data – Advantages & Limitations, Sources – Govt. & Non Govt. Primary Data – Advantages & Limitations, Sources, Methods of Collection Primary Data – Observation, Mail, Personal Interview, Telephonic Interview, Internet Interviewing.

**UNIT IV TECHNIQUES****9**

Market Research Techniques. National readership survey, Retail Store Audit, Consumer Panels, Test Marketing, Research in Advertising Decisions, Marketing Audit, Data Base Marketing, Focus Group Interviews. Sampling, Questionnaire & Scaling Techniques. Probability and Non Probability Sampling, Sampling methods, Sample Design, Questionnaire design and drafting. Scaling techniques like Nominal, Ordinal, Interval, Ratio, Perceptual Map, Semantic Differential, Likert, Rating & Ranking Scales.

**UNIT V IMPLEMENTATION****9**

Setting up & Implementation of Marketing Research Project, Steps in formulating Market Research Projects, One project for consumer durables and one for non durables to be discussed.

**TOTAL: 45 Hours****COURSE OUTCOME:**

CO-1: Define industrial marketing, industrial demand and customer.

CO-2: Explain the product pricing, price decision, discounts, purchase and leasing.

CO-3: Explain the market research and its types, sources and collection of marketing data.

CO-4: Describe in detail about the market research techniques

CO-5: Describe the Setting up and Implementation of Marketing Research Project

**TEXT BOOKS:**

- Ralph S. Alexander, James S. Cross, Richard M. Hill, "Industrial Marketing", Homewood, 1967.
- Rajendra Nargundkar, "Marketing Research", Tata McGraw Hill, 2008.

**REFERENCES:**

- Robert R. Reeder; Edward G. Brierty; Betty H. Reeder, "Industrial Marketing – Analysis, Planning and Control", Prentice Hall, 1991.
- Ghosh PK, "Industrial Marketing", Oxford University Press, India.
- Ramanuj Majumdar, "Marketing Research-Text, Applications and Case Studies".
- Donald R. Cooper, "Business research Methods", McGraw-Hill, 2005.

**COURSE OBJECTIVES:**

- To ensure that students begin to understand the relationship between vulnerability, disasters, disaster prevention and risk reduction
- To gain a preliminary understanding of approaches of Disaster Risk Reduction (DRR)
- To enhance awareness of institutional processes in the country and

**UNIT I INTRODUCTION TO DISASTERS 9**

Definition: Disaster, Hazard, Vulnerability, Resilience, Risks – Disasters: Types of disasters – Earthquake, Landslide, Flood, Drought, Fire etc - Classification, Causes, Impacts including social, economic, political, environmental, health, psychosocial, etc.- Differential impacts- in terms of caste, class, gender, age, location, disability - Global trends in disasters: urban disasters, pandemics, complex emergencies, Climate change- Dos and Don'ts during various types of Disasters.

**UNIT II APPROACHES TO DISASTER RISK REDUCTION (DRR) 9**

Disaster cycle - Phases, Culture of safety, prevention, mitigation and preparedness community based DRR, Structural-nonstructural measures, Roles and responsibilities of- community, Panchayati Raj Institutions / Urban Local Bodies (PRIs/ULBs), States, Centre, and other stake-holders- Institutional Processes and Framework at State and Central Level- State Disaster Management Authority(SDMA) – Early Warning System – Advisories from Appropriate Agencies.

**UNIT III INTER-RELATIONSHIP BETWEEN DISASTERS AND DEVELOPMENT 9**

Factors affecting Vulnerabilities, differential impacts, impact of Development projects such as dams, embankments, changes in Land-use etc.- Climate Change Adaptation- IPCC Scenario and Scenarios in the context of India - Relevance of indigenous knowledge, appropriate technology and local resources.

**UNIT V DISASTER MANAGEMENT: APPLICATIONS AND CASE STUDIES AND FIELD WORKS 9**

Landslide Hazard Zonation: Case Studies, Earthquake Vulnerability Assessment of Buildings and Infrastructure: Case Studies, Drought Assessment: Case Studies, Coastal Flooding: Storm Surge Assessment, Floods: Fluvial and Pluvial Flooding: Case Studies; Forest Fire: Case Studies, Man Made disasters: Case Studies, Space Based Inputs for Disaster Mitigation and Management and field works related to disaster management.

**UNIT IV DISASTER RISK MANAGEMENT IN INDIA 9**

Hazard and Vulnerability profile of India, Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management, Institutional arrangements (Mitigation, Response and Preparedness, Disaster Management Act and Policy - Other related policies, plans, programmes and legislation – Role of GIS and Information Technology Components in Preparedness, Risk Assessment, Response and Recovery Phases of Disaster – Disaster Damage Assessment.

**TOTAL: 45 PERIODS****COURSE OUTCOMES:**

The students will be able to

- CO-1: Differentiate the types of disasters, causes and their impact on environment and society  
 CO-2: Assess vulnerability and various methods of risk reduction measures as well as mitigation.  
 CO-3: Disaster damage assessment and management.

**TEXT BOOKS:**

1. Gupta Anil K, Sreeja S. Nair. Environmental Knowledge for Disaster Risk Management, NIDM, New Delhi, 2011
2. Kapur Anu Vulnerable India: A Geographical Study of Disasters, IIAS and Sage Publishers, New Delhi, 2010.
3. Singhal J.P. "Disaster Management", Laxmi Publications, 2010. ISBN-10: 9380386427 ISBN-13: 978-9380386423
4. Tushar Bhattacharya, "Disaster Science and Management", McGraw Hill India Education Pvt. Ltd., 2012.

**REFERENCES:**

1. Govt. of India: Disaster Management Act , Government of India, New Delhi, 2005
2. Government of India, National Disaster Management Policy,2009.

**COURSE OBJECTIVES:**

- To understand to the basic concepts of engineering design and product development with focus on the front end processes.

**UNIT I INTRODUCTION 9**

Need for developing products – the importance of engineering design – types of design –the design process – relevance of product lifecycle issues in design –designing to codes and standards- societal considerations in engineering design –generic product development process – various phases of product development-planning for products –establishing markets- market segments- relevance of market research

**UNIT II CUSTOMER NEEDS 9**

Identifying customer needs –voice of customer –customer populations- hierarchy of human needs- need gathering methods – affinity diagrams – needs importance- establishing engineering characteristics-competitive benchmarking- quality function deployment- house of quality- product design specification-case studies

**UNIT III CREATIVE THINKING 9**

Creative thinking –creativity and problem solving- creative thinking methods- generating design concepts-systematic methods for designing –functional decomposition – physical decomposition – functional representation –morphological methods-TRIZ- axiomatic design

**UNIT IV DECISION MAKING AND PRODUCT ARCHITECTURE 9**

Decision making –decision theory –utility theory –decision trees –concept evaluation methods –Pugh concept selection method- weighted decision matrix –analytic hierarchy process – introduction to embodiment design –product architecture – types of modular architecture –steps in developing product architecture

**UNIT V DESIGN AND COST ANALYSIS 9**

Industrial design – human factors design –user friendly design – design for serviceability – design for environment – prototyping and testing – cost evaluation –categories of cost – overhead costs – activity based costing –methods of developing cost estimates – manufacturing cost –value analysis in costing

**TOTAL: 45 PERIODS****COURSE OUTCOMES:**

- CO-1: Understand the need for developing new products  
 CO-2: Attain the knowledge of creative thinking to develop new products  
 CO-3: Familiar with decision making on new product development  
 CO-4: Gain the knowledge on new product design and cost analysis  
 CO-5: Familiar with the concept generation and selection tools

**TEXT BOOKS**

- Anita Goyal, Karl T Ulrich, Steven D Eppinger, "Product Design and Development ", Tata McGraw-Hill Education, 4th Edition, 2009
- Kevin Otto, Kristin Wood, "Product Design", Pearson Education, Indian Reprint 2015,

**REFERENCES**

- Clive L.Dym, Patrick Little, "Engineering Design: A Project-based Introduction", 3rd Edition, John Wiley & Sons, 2009,
- George E.Dieter, Linda C.Schmidt, "Engineering Design", McGraw-Hill International Edition, 4th Edition, 2009,
- Yousef Haik, T. M. M. Shahin, "Engineering Design Process", 2nd Edition Reprint, Cengage Learning, 2010,



# **SYLLABUS**

## **Humanities & Social Science Courses**

**UNIT I            SOFT SKILLS    I****6**

Introduction to Personality Development – Meaning-Features of personality=Dimensions of Personality=Determinants of Personality-Features and Traits- Components of self concept-Barriers-Self analysis

**UNIT II            SOFT SKILLS    II****6**

Importance of Soft Skills – First impression-Work Place requirements-Discipline-Cleanliness-Hygiene-general Appearance--Building Confidence—Concept of Thinking and Usage-Value of Time-Focus & Commitment.

**UNIT III            SOFT SKILLS IN ACTION****6**

Grooming – Attire – Understanding others- – Stability & Maturity Development – Strength s – Weakness –Opportunities-threats -Merits of SWOT Analysis-Components-how to convert weakness into strengths-Goal settings

**UNIT IV            SELF AWARENESS AND SELF ESTEEM****6**

Definitions-Components of self awareness-Developing Self awareness-Self esteem-meaning-Steps to improve self esteem

**UNIT V            SELF MOTIVATION****6**

Motivation –Meaning-Techniques of self motivation-Motivation & goal setting – Motivation and emotion – Motivation at work.

**Total: 30 Hours****REFERENCES:**

1. Personality Development And Soft Skills---Barun K Mitra, Oxford Publication
2. Seven habits of Higly Effective people – Stephen R. covey
3. Emotion, motivation and Self regulation - Nathan C. Hall , McGill University, Canada, Thomas Goetz, University of Konstanz, Germany
4. <http://www.emeraldgrouppublishing.com/>
5. Psychology of Selfesteem – Nathaniel Branden, Nash (1st edition), Jossey-Bass (32nd anniversary edition)

**UNIT I            SOFT SKILLS    III****6**

Basic Etiquette – Email etiquette – Business etiquette – Telephone etiquette – Meeting etiquette – Adjustment of Role & Leadership – Team Management & Development

**UNIT II            QUANTITATIVE APTITUDE I****6**

Percentage – Profit Loss -Discount – Ratio Proportion – Time & Work – Time, Speed & Distance. Problems relating to ages- Permutation & Combination-Probability

**UNIT III            QUANTITATIVE APTITUDE II****6**

Mensuration    Clocks and Calendars- Boats-Simple Interest –Compound Interest- Fractions and Decimals – Square roots – Functions.

**UNIT IV            ANALYTICAL PROBLEMS****6**

Introduction – Linear Sequencing – Seating Arrangements – Distribution/Double Line Up – Selection – Ordering and Sequencing – Binary Logic – Venn Diagrams –Directions.

**UNIT V            LOGICAL PROBLEMS****6**

Introduction to Logical problems – Cause and Effect – Course of Action – Statement and Assumption – Letter and Symbol series – Analogies.

**TOTAL: 30 Hours****REFERENCES:**

1. Personality Enrichment--K R Dhanalakshmi And N S Raghunathan, Margham Publications
2. Personality Development --Dr V M Selvaraj Bhavani Publications
3. Quantitative Aptitude – R. S Aggarwal
4. Logical and Analytical Reasoning (English) 30th Edition – A.K Gupta



**UNIT I           SOFT SKILLS   V****6**

Assertiveness—Meaning—Importance of assertiveness- Characteristics of assertive communication-Merits –forms of assertion—Causes of misunderstanding

**UNIT II           COMMUNICATION SKILLS****6**

Meaning—Elements of communication—Functions of communication—Principles of communication—Formal and Informal communication—Barriers in Communication—Characteristics of good communication—Feedback—communication systems.

**UNIT III           PRESENTATION SKILLS I****6**

Meaning—Importance of Presentation—Concept of 5 w's and one H--- understanding the audience—Types of presentations—How to make effective presentation

**UNIT IV           PRESENTATION SKILLS II****6**

Use of slide, PPT's. and visuals—Rules for slide presentation—precautions ---seminars and conferences-Steps to eliminate Stage fear.

**UNIT V           CHANGE MANAGEMENT****6**

Definition – Necessity - Resistance towards Change – 10 Principles of Change Management – Leaders approach – Effective Change management.

**TOTAL: 30 Hours****REFERENCES:**

1. Helping employees embrace change - LaClair, J. and Rao, R. Helping Employees Embrace Change, McKinsey Quarterly, 2002, Number 4.
2. Who Moved My Cheese by Spencer Johnson published by Vermilion first edition
3. Effective Communication. Adair, John. London: Pan Macmillan Ltd., 2003.
4. Business Communication Today: Bovee, Courtland L, John V. Thill & Barbara E. Schatzman. Tenth Edition. New Jersey: Prentice Hall, 2010.

**UNIT I INTRODUCTION AND BASIC CONCEPTS OF NSS 6**

NSS: History, philosophy, aims, objectives –Emblem: flag, motto, song, badge- NSS functionaries: Organizational structure, roles and responsibilities.

**UNIT II NSS PROGRAMS AND ACTIVITIES 6**

Concept of regular activities- special camping-day camps-Basis of adoption of village/slums, Methodology of conducting survey-Financial pattern of the scheme- other youth program/schemes of GOI- Coordination with different agencies-Maintenance of the dairy

**UNIT III UNDERSTANDING YOUTH 6**

Youth: Definition, profile of youth, categories – youth: Issues, challenges and opportunities - Youth as an agent of social change.

**UNIT IV COMMUNITY MOBILIZATION 6**

Mapping of community stakeholders-Designing the message in the context of the problem and the culture of the community-Identifying methods of mobilization-Youth adult partnership

**UNIT V VOLUNTEERISM AND SHRAMDAN 6**

Indian Tradition of volunteerism-Needs& Importance of volunteerism- Motivation and constraints of volunteerism-Shramdan as a part of volunteerism.

**TOTAL: 30 Hours**

<b>UNIT I</b>	<b>IMPORTANCE AND ROLE OF YOUTH LEADERSHIP</b>	<b>7</b>
Meaning and types of leadership-Qualities of good leaders; traits of leadership- Importance and role of youth leadership		
<b>UNIT II</b>	<b>LIFE COMPETENCIES</b>	<b>7</b>
Definition and importance of life competencies-Communication- Inter personal- Problem solving and decision-making		
<b>UNIT III</b>	<b>SOCIAL HARMONY AND NATIONAL INTEGRATION</b>	<b>8</b>
Indian history and culture-Role of youth in peace-building and conflict resolution- Role of youth in Nation building		
<b>UNIT IV</b>	<b>YOUTH DEVELOPMENT PROGRAMMES IN INDIA</b>	<b>8</b>
National youth policy-Youth development programmes at the National level, state level and voluntary sector-Youth focused and youth-led organization		
Conducting surveys on special theme and preparing a report thereof.		

**TOTAL: 30 Hours**





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**NSS – IV**

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**UNIT I ENVIRONMENT ISSUES**

**7**

Environment: conservation, enrichment and sustainability-Climate change- Waste management- Natural resource management(Rainwater harvesting, energy conservation, wasteland development, soil conservations and afforestation)

**UNIT II DISASTER MANAGEMENT**

**7**

Introduction to Disaster management-classification of disasters-Role of youth in disaster management

**UNIT III PROJECT CYCLE MANAGEMENT**

**8**

Project planning-Project implementation- Project monitoring- Project evaluation-Impact Assessment

**UNIT IV DOCUMENTATION AND REPORTING**

**8**

Collection and analysis of data- Preparation of Documentation/Reports- Dissemination of documents/Reports

Workshops/seminars on personality development and improvement of communication skills.

**TOTAL: 30 Hours**



