



VELS

INSTITUTE OF SCIENCE, TECHNOLOGY
& ADVANCED STUDIES (VISTAS)



(DEEMED TO BE UNIVERSITY Estd. u/s 3 OF THE UGC ACT, 1956)

NAAC ACCREDITED
PALLAVARAM - CHENNAI - INDIA

School of Engineering

B.E Automobile Engineering

Programme Outcome of B.E / B.Tech Programme:

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, 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 team work*: 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: *Life-long learning*: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcome (PSO)

Upon completion of the B.E. in Automobile Engineering, students will demonstrate the ability to emerge as:

PSO-1: An expert in design and analyze the automotive engine components, vehicle chassis, suspension and drive train.

PSO-2: A specialist to solve engineering problems relating to automotive systems.

PSO -3: A Designer with profound knowledge in automotive vehicle body engineering.

PSO -4: A Developer of new systems in automotive passenger safety.

PSO- 5: A forecaster in emerging fields like alternate fuels, fuel cells, electric and hybrid vehicles

PSO - 6: An analyst in interdisciplinary environment to design systems in line with the present automotive emission norms and safety standards.

PSO- 7: An entrepreneur to build the nation, by imparting technical ideas and administrative expertise.

PSO- 8: A team leader with new concepts on developing arenas and pursuing higher education.

School of Engineering

Department of Automobile Engineering

The details of the suggested Board of Studies (BOS) Members for the Department of Automobile Engineering are shown below.

S. No	Name of the Board Member	Designation	Institute / Industry
INTERNAL MEMBERS			
1	Dr. M.Chandrasekaran	Director, Mechanical Engineering	VELS UNIVERSITY
2	Dr. V.Muthuraman	Head, Department of Mechanical Engineering	VELS UNIVERSITY
3	Dr. R.Pughazhenth	Associate Professor, Department of Mechanical Engineering	VELS UNIVERSITY
4	Dr. S.Sivaganesan	Assistant Professor, Department of Mechanical Engineering	VELS UNIVERSITY
EXTERNAL EXPERT MEMBERS			
1	Dr. V.Santhanam	Associate Professor, Department of Mechanical Engineering	Rajalakshmi Engineering College, Chennai
2	Mr. S.Dwarakanathan	Vice President (Retd.)	Brakes India Limited, Chennai
3	Mr. V.Venkatesh	Unit Head	Suprajit Engineering Limited, Sriperumbadur

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PALLAVARAM - CHENNAI - INDIA



VELS
UNIVERSITY



B.E
Automobile Engineering

Curriculum and Syllabus
(Based on Choice Based Credit System)
Effective from the Academic year
2015-2016
(Modified Version)

Department of Automobile Engineering School of Engineering

B.E. - AUTOMOBILE ENGINEERING

CURRICULUM

TOTAL NUMBER OF CREDITS: 195

Category	Code No.	Course	Hours/Week			Credits
			Lecture	Tutorial	Practical	
SEMESTER 1						
AECC	15GBE201	Technical English	3	0	0	3
CORE	15GBE001	Mathematics – I	3	1	0	4
CORE	15GBE002	Engineering Physics	3	1	0	4
CORE	15GBE003	Fundamentals of Computing	3	1	0	4
CORE	15GBE004	Engineering Graphics	2	0	3	4
CORE	15GBE005	Engineering Practices Laboratory	0	0	3	1
CORE	15GBE006	Engineering Physics Laboratory	0	0	3	1
CORE	15GBE007	Computer Practices Laboratory	0	0	3	1
Total			14	3	12	22
SEMESTER 2						
Category	Code No.	Course	Hours/Week			Credits
			Lecture	Tutorial	Practical	
AECC	15GBE202	Communication Skills	3	0	0	3
CORE	15GBE008	Mathematics – II	3	1	0	4
CORE	15GBE009	Engineering Chemistry	3	1	0	4
CORE	15GBE010	Material science	3	0	0	3
CORE	15EAU021	Engineering Mechanics	3	1	0	4
CORE	15EAU022	Basic Electrical and Electronics Engineering	3	0	0	3
CORE	15GBE011	Engineering Chemistry Laboratory	0	0	3	1
AECC	15GBE203	Language Laboratory	0	0	3	1
CORE	15EME022	Computer Aided Drafting Laboratory	0	0	3	1
Total			18	3	9	24

**B.E. - AUTOMOBILE ENGINEERING
CURRICULUM**

Category	Code No.	Course	Hours/Week			Credits
			Lecture	Tutorial	Practical	
SEMESTER 3						
AECC	15GBE204	Environment Science and Engineering	3	0	0	3
CORE	15GBE012	Mathematics – III	3	1	0	4
CORE	15EAU031	Engineering Thermodynamics	3	1	0	4
DSE	15EAU____	Discipline Specific Elective I	3	0	0	3
DSE	15EAU____	Discipline Specific Elective II	3	0	0	3
GE	15EAU____	Generic Elective I	3	0	0	3
SEC	15EAU____	Skill Enhancement Elective I	2	0	0	2
CORE	15EAU032	Automotive Chassis Components Laboratory	0	0	3	1
CORE	15EAU033	Automotive Engine Components Laboratory	0	0	3	1
Total			20	2	6	24
SEMESTER 4						
Category	Code No.	Course	Hours/Week			Credits
			Lecture	Tutorial	Practical	
CORE	15GBE015	Statistics and Numerical methods	3	1	0	4
CORE	15EAU041	Manufacturing Technology	3	0	0	3
CORE	15EAU042	Fluid Mechanics and Machinery	3	1	0	4
DSE	15EAU____	Discipline Specific Elective III	3	0	0	3
DSE	15EAU____	Discipline Specific Elective IV	3	0	0	3
GE	15EAU____	Generic Elective II	3	0	0	3
SEC	15EAU____	Skill Enhancement Elective II	2	0	0	2
CORE	15EAU043	Electronics and Microprocessors Laboratory	0	0	3	1
CORE	15EAU044	Fluid Mechanics and Machinery Laboratory	0	0	3	1
CORE	15BESY41	Basic Life Skills	1	0	1	2
Total			21	2	7	26

**B.E. - AUTOMOBILE ENGINEERING
CURRICULUM**

Category	Code No.	Course	Hours/Week			Credits
			Lecture	Tutorial	Practical	
SEMESTER 5						
CORE	15EAU051	Automotive Pollution and Control	3	1	0	3
CORE	15EAU052	Automotive Transmission	3	1	0	4
CORE	15EAU053	Vehicle Design Data Characteristics	3	1	0	4
DSE	15EAU___	Discipline Specific Elective V	3	0	0	3
DSE	15EAU___	Discipline Specific Elective VI	3	0	0	3
GE	15EAU___	Generic Elective III	3	0	0	3
SEC	15EAU___	Skill Enhancement Elective III	2	0	0	2
CORE	15EAU054	Performance and Emission Testing Laboratory	0	0	3	1
CORE	15EAU055	Computer Aided Engine Design Laboratory	0	0	3	1
CORE		Industrial Safety	2	0	0	2
Total			22	3	6	26
SEMESTER 6						
Category	Code No.	Course	Hours/Week			Credits
			Lecture	Tutorial	Practical	
CORE	15EAU061	Vehicle Dynamics	3	1	0	4
CORE	15EAU062	Two and Three Wheeler	3	1	0	4
CORE	15EAU063	Automotive Chassis Components Design	3	1	0	4
DSE	15EAU___	Discipline Specific Elective VII	3	0	0	3
DSE	15EAU___	Discipline Specific Elective VIII	3	0	0	3
GE	15EAU___	Generic Elective IV	3	0	0	3
SEC	15EAU___	Skill Enhancement Elective IV	2	0	0	2
CORE	15EAU064	Automotive Electrical and Electronics Laboratory	0	0	3	1
CORE	15EAU065	Computer Aided Chassis Design Laboratory	0	0	3	1
CORE	15EAU066	In-Plant Training	0	0	0	1
Total			20	3	6	26

**B.E. - AUTOMOBILE ENGINEERING
CURRICULUM**

Category	Code No.	Course	Hours/Week			Credits
			Lecture	Tutorial	Practical	
SEMESTER 7						
CORE	15EAU071	Vehicle Maintenance	3	0	0	3
CORE	15EAU072	Simulation of IC Engine Processes	3	0	0	3
CORE	15EAU073	Vehicle Body Engineering	3	0	0	3
DSE	15EAU__	Discipline Specific Elective IX	3	0	0	3
DSE	15EAU__	Discipline Specific Elective X	3	0	0	3
GE	15EAU__	Generic Elective V	3	0	0	3
SEC	15EAU__	Skill Enhancement Elective V	2	0	0	2
CORE	15EAU074	Vehicle Maintenance Lab	0	0	3	2
CORE	15EAU075	Vehicle Reconditioning Lab	0	0	3	2
CORE	15EAU076	Mini Project & Seminar	0	0	3	2
Total			20	0	9	26
SEMESTER 8						
Category	Code No.	Course	Hours/Week			Credits
			Lecture	Tutorial	Practical	
DSE	15EAU__	Discipline Specific Elective XI	3	0	0	3
DSE	15EAU__	Discipline Specific Elective XII	3	0	0	3
GE	15EAU__	Generic Elective VI	3	0	0	3
CORE	15EAU081	Project Work	0	0	21	12
Total			9	0	21	21

**B.E. - AUTOMOBILE ENGINEERING
CURRICULUM**

List of Discipline Specific Electives Courses

Code No.	Course	Hours / Week			Credits
		Lecture	Tutorial	Practical	
15EAU101	Special Types of Vehicles	3	0	0	3
15EAU102	Alternate Fuels and energy systems	3	0	0	3
15EAU103	Finite Element Analysis	3	0	0	3
15EAU104	Transport Management	3	0	0	3
15EAU105	Automotive Aerodynamics	3	0	0	3
15EAU106	Modern Automobile Accessories	3	0	0	3
15EAU107	Vibration and Noise Engineering	3	0	0	3
15EAU108	Advanced Theory of I.C. Engines	3	0	0	3
15EAU109	Computer Integrated Manufacturing Systems	3	0	0	3
15EAU110	Hydraulic and Pneumatic systems	3	0	0	3
15EAU111	Waste Heat Recovery and Co-Generation	3	0	0	3
15EAU112	Design and Analysis of Composites	3	0	0	3
15EAU113	Computational Fluid Dynamics	3	0	0	3
15EAU114	Advanced Production Processes for Automotive Components	3	0	0	3
15EAU115	Noise, Vibration and Harshness	3	0	0	3
15EAU116	Metrology and Instrumentation	3	0	0	3
15EAU117	Manufacturing Process of Automotive Components	3	0	0	3
15EAU118	New Generation and Hybrid Vehicles	3	0	0	3
15EAU119	Composite Materials & Structures	3	0	0	3
15EAU120	Automotive Air-Conditioning	3	0	0	3
15EAU121	Design Of Jigs, Fixtures And Press Tools	3	0	0	3
15EAU122	Robotics	3	0	0	3
15EAU123	supercharging And Scavenging	3	0	0	3
15EAU124	Off Road Vehicles	3	0	0	3
15EAU125	Automotive Safety	3	0	0	3
15EAU126	Mechanics of Machines	3	0	0	3
15EAU127	Automotive Engines	3	0	0	3
15EAU128	Automotive Chassis	3	0	0	3
15EAU129	Heat Transfer and Mass Transfer	3	0	0	3
15EAU130	Engineering Materials and Metallurgy	3	0	0	3
15EAU131	Automotive Safety	3	0	0	3

15EAU132	Automotive Engine Components Design	3	0	0	3
15EAU133	Automotive Electrical & Electronics System	3	0	0	3

**B.E. - AUTOMOBILE ENGINEERING
CURRICULUM**

List of Generic Elective Courses

Code No.	Course	Hours / Week			Credits
		Lecture	Tutorial	Practical	
15EAU151	Electrical Drives and Control	3	0	0	3
15EAU152	Principles of Management and Professional Ethics	3	0	0	3
15EAU153	Total Quality Management	3	0	0	3
15EAU154	Quality Control and Reliability Engineering	3	0	0	3
15EAU155	Supply Chain Management	3	0	0	3
15EAU156	Operations Research	3	0	0	3
15EAU157	Energy Audit and Energy Conservation Methods	3	0	0	3
15EAU158	Entrepreneurship Development	3	0	0	3
15EAU159	Value Analysis and Value Engineering	3	0	0	3
15EAU160	Industrial Marketing and Market Research	3	0	0	3

List of Skill Enhancement Elective Courses

Code No.	Course	Hours / Week			Credits
		Lecture	Tutorial	Practical	
15GPD251	PERSONALITY DEVELOPMENT I	2	0	0	2
15GPD252	PERSONALITY DEVELOPMENT II	2	0	0	2
15GPD253	PERSONALITY DEVELOPMENT III	2	0	0	2
15GPD254	PERSONALITY DEVELOPMENT IV	2	0	0	2
15NSS255	NSS I	2	0	0	2
15NSS256	NSS II	2	0	0	2
15NSS257	NSS III	2	0	0	2
15NSS258	NSS IV	2	0	0	2
15NSS259	NSS V	2	0	0	2
15NSS260	NSS VI	2	0	0	2

SYLLABUS CORE COURSES

COURSE OBJECTIVE:

- To develop listening skills for academic and professional purposes.
- To acquire the ability to speak effectively in English in real life situations.
- To inculcate reading habit and to develop effective reading skills.
- To write letters and reports effectively in formal and business situations.

COURSE OUTCOME:

CO-1: Familiar with the grammar and vocabulary

CO-2: Develop listening skills for academic and professional purposes

CO-3: Acquire the English writing skill

CO-4: Attain the English reading skill

CO-5: Acquire the English speaking skill

UNIT I INTRODUCTION TO BASIC GRAMMAR AND VOCABULARY 9

General Vocabulary – Changing words from one form to another, Nouns- Compound nouns, Pronouns - Relative pronouns, Demonstrative pronouns, Adjectives - Comparative adjectives, Verbs- Modal verbs, Linking verbs, Adverbs, Word Links – Connectives, Sequence words, Introducing oneself, Interactive grammar exercises.

UNIT II BASIC SKILL – LISTENING AND INTERPRETATION 9

Listening Skills - Note Making and Note-Taking, Transformation of Sentences – Positive, Comparative, Superlative, Affirmative, Negative, Interrogative and Assertive, Formation of Questions. Information Transfer - Chart – Flow chart, Bar chart, Pie chart. Pair works, SAM sessions.

UNIT III BASIC SKILL-WRITING SKILL AND STRUCTURES 9

Creative thinking and speaking, Tenses – Present Tense – simple present, present continuous, present perfect, present perfect continuous, Past Tense - simple past, past continuous, past perfect, past perfect continuous, Future Tense - simple future, future continuous, future perfect, future perfect continuous, Autobiographical writing, JAM session.

UNIT IV BASIC SKILLS: READING AND WRITING SKILL 9

Reading Skills- Skimming and Scanning, Comprehension Passage Paragraph Writing – Descriptive paragraph, Argumentative paragraph, Persuasive paragraph, Demonstrative paragraph, Compare and contrast, Conversations.

UNIT V BASIC SKILL: SPEAKING SKILL AND VOCABULARY 9

Vocabulary, Prefixes and Suffixes, Cause and Effect relationship, Clauses and Phrases, Super-ordinates and Hyponyms, Expressing Causal Relation, Article, Prepositions, Preposition phrases, Speaking about the future plans, Reading comprehensions, Situational dialogues.

TOTAL:45 Hours

TEXT BOOKS:

1. Department of English, Anna University, Mindscapes, 'English for Technologists and Engineers', Orient Longman Pvt. Ltd, Chennai: 2012.
2. 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.

REFERENCES:

1. N. Lakshmana Perumal, Technical English-I , Second Edition, Hitech Publishing company PVT. Ltd, 2009.
2. S .Sumant., 'Technical English', Second Edition, McGraw-Hill Education (India) Pvt.Ltd., 2008.
3. T.M. Farhathullah, "Communication Skills for Technical Students", Orient Blackswan Private Limited., 2008

COURSE OBJECTIVE:

- To develop the skills in the areas of Matrices, Analytical Geometry, Differential calculus, Functions of several Variables and Multiple Integrals.

COURSE OUTCOME:

- CO-1: Acquire the skill in the matrices
 CO-2: Familiar with the three dimensional geometry
 CO-3: Attain the knowledge on differential calculus
 CO-4: Describe the functions of several variables
 CO-5: Attain the knowledge on multiple integrals

UNIT I MATRICES**12**

Characteristic equation – Eigenvalues and eigenvectors of a real matrix – Properties – Cayley-Hamilton theorem (excluding proof) – Orthogonal transformation of a symmetric matrix to diagonal form – Quadratic form – Reduction of quadratic form to canonical form by orthogonal transformation.

UNIT II THREE DIMENSIONAL ANALYTICAL GEOMETRY**12**

Equation of a sphere – Plane section of a sphere – Tangent Plane – Equation of a cone – Right circular cone – Equation of a cylinder – Right circular cylinder.

UNIT III DIFFERENTIAL CALCULUS**12**

Curvature in Cartesian co-ordinates – Centre and radius of curvature – Circle of curvature – Evolutes – Envelopes – Evolute as envelope of normals.

UNIT IV FUNCTIONS OF SEVERAL VARIABLES**12**

Partial derivatives – Euler's theorem for homogenous functions – Total derivatives – Differentiation of implicit functions – Jacobians – Taylor's expansion – Maxima and Minima – Method of Lagrange's multipliers.

UNIT V MULTIPLE INTEGRALS**12**

Double integration – Cartesian and polar coordinates – Change of order of integration – Change of variables between Cartesian and polar coordinates – Triple integrals – Area as double integral

TOTAL: 60 Hours**TEXT BOOKS:**

- 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, 6th reprint, 2008.

REFERENCES:

- Glyn James, "Advanced Modern Engineering Mathematics", Pearson Education, 3rd Edition, 2012.
- Jain R.K and Iyengar S.R.K, "Advanced Engineering Mathematics", Narosa Publishing House, 4th Edition, 2014

COURSE OBJECTIVE:

- To learn the basics of Ultrasonic, Lasers, Fiber optics and applications, Quantum and crystal physics etc.
- To apply fundamental principles to solve problems related to materials used for engineering applications.

COURSE OUTCOME:

- CO-1: Explain the basics of ultrasonic's
 CO-2: Describe the application of lasers
 CO-3: Explain the fibre optics and it applications
 CO-4: Describe the basics of quantum physics
 CO-5: Describe the basics of crystal physics

UNIT I ULTRASONICS**9**

Introduction – Production – magnetostriction effect – magnetostriction generator – piezoelectric effect – piezoelectric generator – Detection of ultrasonic waves– properties – Cavitations – Velocity measurement – acoustic grating – Industrial applications – drilling, welding, soldering and cleaning –Non Destructive Testing – pulse echo system through transmission and reflection modes – A, B and C scan displays- SONAR – Medical applications – Sonograms.

UNIT II LASERS**9**

Introduction – Principle of Spontaneous emission and stimulated emission – Population inversion, pumping - Einstein's A and B coefficients – derivation – Types of lasers – He-Ne, CO₂, Nd-YAG, Semiconductor lasers homojunction and heterojunction (Qualitative) - Industrial Applications – Lasers in welding, heat treatment, cutting – Medical applications – Holography (construction and reconstruction).

UNIT III FIBRE OPTICS AND APPLICATIONS**9**

Principle and propagation of light in optical fibres – Numerical aperture and Acceptance angle – Types of optical fibres (material, refractive index, mode) – fibre manufacturing (Double crucible technique) – Splicing, Loss in optical fibre – attenuation, dispersion, bending – Fibre optical communication system (Block diagram) – Light sources – Detectors – PIN Photo diode- Fibre optic sensors – temperature and displacement – Endoscope.

UNIT IV QUANTUM PHYSICS**9**

Black body radiation – Planck's radiation law (derivation) – Deduction of Wien's displacement law and Rayleigh – Jeans Law from Planck's theory – Compton effect – Theory and experimental verification – Matter waves – Schrödinger's wave equation – Time independent and time dependent equations – Physical significance of wave function – Particle in a one dimensional box – Electron microscope - Scanning electron microscope – Transmission electron microscope.

UNIT V CRYSTAL PHYSICS**9**

Lattice – Unit cell – Bravais lattice – Lattice planes – Miller indices – d spacing in cubic lattice – Calculation of number of atoms per unit cell – Atomic radius – Coordination number – Packing factor for SC, BCC, FCC and HCP structures – NaCl, ZnS, diamond and graphite structures – Polymorphism and allotropy – Crystal defects – point, line and surface defects – Burger vector.

TOTAL: 45 Hours**TEXT BOOKS:**

1. Gaur, R. K. and Gupta, S.C., 'Engineering Physics' DhanpatRai Publications, New Delhi 2013.
2. Avadhanulu, M.N. and Kshirsagar, P.G., 'A Text book of Engineering Physics', S.Chand and Company, Ltd., New Delhi, 2013.

REFERENCES:

1. Frank J.Faly, "Foundations of Engineering Accoustics", Elsevier Academic press, 2005.
2. Williams T.Silfrast, "Laser Fundamentals", Cambridge University press, 2004.
3. John Gowar, "Optical communication systems", Prentice Hall publications, 1993.
4. Murugesan R and Sivaprasath K, Modern Physics, S. Chand Ltd., 2008.

COURSE OBJECTIVE:

- To understand the concepts of Programming language - C and Html
- To learn the basics of C declarations, operators, expressions and html tags
- To learn on the manipulation of strings, functions and pointers

COURSE OUTCOME:

CO-1: Describe the Characteristics, Classification and Evolution of Computers

CO-2: Explain the problem solving and office application software

CO-3: Describe the basics of C declarations

CO-4: Explain the functions and pointers

CO-5: Define structures and files

UNIT I INTRODUCTION TO COMPUTERS**9**

Introduction – Characteristics, Classification and Evolution of Computers – Computer Generations – Basic Computer organization – Number Systems – Computer Software – Types of Software – Software Development Steps.

UNIT II PROBLEM SOLVING AND OFFICE APPLICATION SOFTWARE**9**

Planning the Computer Program – Purpose – Algorithm – Flow Charts – Pseudocode – Application Software Packages – Introduction to Office Packages – Internet basics: Internet evolution, Html tags- Forms- Frames.

UNIT III INTRODUCTION TO C**9**

Overview of C: Constants, Variables, Keywords, Data Types – Compilation and Execution – Input and Output functions – Operators – C Instructions – Control Instructions : Decision control structure, Loop Control structure, Case Control Structure.

UNIT IV FUNCTIONS AND POINTERS**9**

Functions: Library functions, User defined functions, call by value, call by reference, recursive functions – Pointers – Arrays: one dimensional array, multi-dimensional array, arrays using pointers – Strings: library string functions – pointers in strings.

UNIT V STRUCTURES AND FILES**9**

Structures – Unions – Storage classes – Dynamic memory allocation – Files: file Operations, Preprocessor directives – use of typedef– Command line arguments.

TOTAL: 45 Hours**TEXT BOOKS:**

1. Yashavant Kanetkar, "Let Us C", BPB Publications, Thirteenth Edition 2013.
2. Balagurusamy, E., "Computing fundamentals and C Programming", Tata McGraw-Hill Publishing Company Limited, 2010.
3. Thomno A. Powell, "The Complete Reference HTML and CSS", fifth edition, Tata McGrawHill, 2010.

REFERENCE:

1. Ashok.N.Kamthane, "Computer Programming", Pearson Education (India) 2009.

COURSE OBJECTIVE:

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

COURSE OUTCOME:

CO-1: Explain the basic concepts and conventions

CO-2: Draw the plain curves and free hand sketching

CO-3: Demonstrate the projection of points, lines and plane surfaces

CO-4: Explain the projection of solids

CO-5: Demonstrate the isometric and perspective projections

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 PLANE CURVES AND FREE HAND SKETCHING**12**

Basic Geometrical constructions, Curves used in engineering practices: Conics – Construction of ellipse, parabola and hyperbola by eccentricity method – Construction of cycloid – construction of involutes of square and circle – Drawing of tangents and normal to the above curves, Scales: Construction of Diagonal and Vernier scales. Visualization concepts and Free Hand sketching: Visualization principles –Representation of Three Dimensional objects – Layout of views- Free hand sketching of multiple views from pictorial views of objects.

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

Orthographic projection – principles - Principal planes-First angle projection-projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes -Determination of true lengths and true inclinations by rotating line method and traces Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

UNIT III PROJECTION OF SOLIDS**12**

Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes by rotating object method and auxiliary plane method.

UNIT IV PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES**12**

Sectioning of above solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids cylinders and cones. Development of lateral surfaces of solids with cut-outs and holes

UNIT V ISOMETRIC AND PERSPECTIVE PROJECTIONS**12**

Principles of isometric projection – isometric scale –Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions and miscellaneous problems. Perspective projection of simple solids-Prisms, pyramids and cylinders by visual ray method.

COMPUTER AIDED DRAFTING (Demonstration Only)

Introduction to drafting packages and demonstration of their use.

TOTAL: 60 Hours

TEXT BOOK:

1. Bhatt N.D. and Panchal V.M., "Engineering Drawing", Charotar Publishing House, 50th Edition, 2010.

REFERENCES:

1. Gopalakrishna K.R., "Engineering Drawing" (Vol. I&II combined), Subhas Stores, Bangalore, 2007.
2. Luzzader, Warren.J. and Duff, John M., "Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production, Eastern Economy Edition, Prentice Hall of India Pvt. Ltd, New Delhi, 2005.
3. Shah M.B., and Rana B.C., "Engineering Drawing", Pearson, 2nd Edition, 2009.
4. Venugopal K. and Prabhu Raja V., "Engineering Graphics", New Age International (P) Limited, 2008.
5. Natrajan K.V., "A text book of Engineering Graphics", Dhanalakshmi Publishers, Chennai, 2009.
6. 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. The examination will be conducted in appropriate sessions on the same day

GROUP A – MECHANICAL AND CIVIL ENGINEERING PRACTICES**COURSE OBJECTIVE:**

- To study bench fitting drawings for making male and female fittings
- To study Arc welding drawings for making common weld joints.
- To study sheet metal development drawings for making common metal parts.

COURSE OUTCOME:

- CO-1: Able to perform the welding work
 CO-2: Demonstrate the machining work on machines
 CO-3: Able to perform the fitting work
 CO-4: Demonstrate the sheet metal work
 CO-5: Explain the tools and it uses
 CO-6: Demonstrate the plumping work

LIST OF EXPERIMENTS**MECHANICAL ENGINEERING PRACTICE****1. Welding**

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

2. Basic Machining

To make Simple Turning and Taper turning in the lathe.

3. Fitting Work

To make square, hexagonal, V joint in bench fitting as per the given dimensions and Tolerances.

4. Sheet Metal Work

To make simple Cubical blocks, Rectangular trays in sheet metal with the jigs as per the given dimensions.

CIVIL ENGINEERING PRACTICE**1. Buildings**

Study of plumbing and carpentry components of residential and industrial buildings. Safety aspects.

2. Plumbing Works

a. Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, elbows in household fittings.

b. Basic pipe connections – Mixed pipe material connection – Pipe connections with different joining components.

TOTAL: 45 Hours

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.

COURSE OBJECTIVE:

CO-1: Determine the Young's modulus of the material

CO-2: Determine the Band Gap of the semiconductor material.

CO-3: Able to measure the specific resistance of a given coil of wire.

CO-4: Determine the viscosity of liquid.

CO-5: Explain the dispersive power of a prism.

CO-6: Evaluate the Rigidity modulus of Torsional Pendulum

CO-7: Measure the Velocity of ultrasonic waves and compressibility of liquids.

CO-8: Measure the Wavelength of mercury spectrum.

CO-9: Determine the wavelength of LASER and particle size using Grating.

LIST OF EXPERIMENTS

1. Determination of Young's modulus of the material – Non uniform bending.
2. Determination of Band Gap of a semiconductor material.
3. Determination of specific resistance of a given coil of wire – Carey Foster Bridge.
4. Determination of viscosity of liquid – Poiseuille's method.
5. Spectrometer – Dispersive power of a prism.
6. Determination of Young's modulus of the material – Uniform bending.
7. Torsional Pendulum – Determination of Rigidity modulus.
8. Ultrasonic Interferometer – Velocity of ultrasonic waves and compressibility of liquids.
9. Spectrometer – Grating – Wavelength of mercury spectrum.
10. Determination of wavelength of LASER and particle size using Grating.

TOTAL: 45 Hours

COURSE OBJECTIVE:

- Be familiar with the use of Office software.

COURSE OUTCOME:

CO-1: Familiar with the use of MS Word Office software.

CO-2: Exposed to MS Spread Sheets.

CO-3: Familiar with the PPT presentation and visualization tools.

CO-4: Familiar with programming in C.

CO-5: Exposed to HTML programming.

A) WORD PROCESSING

1. Document creation, Text manipulation with Scientific notations.
2. Table creation, Table formatting and Conversion.
3. Mail merge and Letter preparation.
4. Drawing - flow Chart.

B) SPREAD SHEET

1. Chart - Line, XY, Bar and Pie.
2. Formula - formula editor.
3. Spread sheet - inclusion of object, Picture and graphics, protecting the document and sheet.
4. Sorting and Import / Export features.

C) POWERPOINT

1. Any presentation of minimum five slides.

D) SIMPLE C PROGRAMMING *

1. Data types, Expression Evaluation, Condition Statements.
 2. Arrays.
 3. Structures and Unions.
 4. Functions and Pointers.
 5. File Operations.
- For programming exercises Flow chart and pseudocode are essential

E) HTML PROGRAMMING*

1. Create a webpage to embed an image in that page using HTML tags.
2. HTML program for Table creation.

TOTAL: 45 Hours

COURSE OBJECTIVE:

- To develop listening skills for academic and professional purposes.
- To acquire the ability to speak effectively in English in real life situations.
- To inculcate reading habit and to develop effective reading skills.
- To write letters and reports effectively in formal and business situations.

COURSE OUTCOME:

CO-1: Familiar with the grammar and vocabulary

CO-2: Develop reading and interpretation skills

CO-3: Acquire the English writing and non-verbal communication skill

CO-4: Develop the dialogue writing and group activities

CO-5: Acquire the listening and comprehending conversation skill

UNIT I TECHNICAL VOCABULARY**9**

Technical Vocabulary, Punctuation, Numerical Expressions, Expanding Acronyms and Abbreviations, Concord, 'If' clauses, Infinitives. Homonyms, Homographs and Homophones, Telephone conversations, Reading, comprehensions, Making of an advertisement.

UNIT II READING AND INTERPRETATION**9**

Reading and interpretation, Intensive reading,. Writing reviews on books and films, Descriptions, Process description, Summarizing, Instructions, Oral presentations. Debate.

UNIT III LETTER AND NON-VERBAL COMMUNICATION DRAFTING**9**

Letters – formal, informal, Cover Letter and CV , Synonyms and Antonyms, Indefinite Adjectives, Non-verbal communication, Interactive sessions. Role Plays, Critical reading Listening and Note taking.

UNIT IV DIALOGUE WRITING AND GROUP ACTIVITIES**9**

Active and Passive Voice, Impersonal Passive, Essay Writing, Comprehension Passage, Editing, Correction of errors, Direct and Indirect, Conversations , Dialogue writing, Discourse Markers. Group activities.

UNIT V LISTENING AND COMPREHENDING THE CONVERSATIONS**9**

Reports – Types, structure, data collection, content, form, Definitions, extended definition, Recommendations, Memos, Checklists. Group Discussions, Listening and comprehending the conversations.

TOTAL: 45 Hours**TEXT BOOKS:**

1. Department of English, Anna University, Mindscapes, 'English for Technologists and Engineers', Orient Longman Pvt. Ltd, Chennai: 2012.
2. 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.
3. M.AshrafRizvi, "Effective Technical Communication", TataMcGraw-Hill Publishing Company Limited, New Delhi.2009.

REFERENCES:

1. Sumant. S, 'Technical English', Second Edition, McGraw-Hill Education (India) Pvt. Ltd., 2008.
2. Dr. M. Hariprasad," Communicative English "Third Edition, Neelkamal Publications, PVT. LTD.,2007.
3. SangeetaSharma ,Binod Mishra, 'Communication Skills for Engineers and Scientists, PHI Learning Private Limited., New Delhi, 2009.

COURSE OBJECTIVE

- To acquire sound knowledge of techniques in solving differential equations that model engineering problems.
- To learn the concepts of vector calculus needed for problems in all engineering disciplines.

COURSE OUTCOME:

CO-1: Acquire the skill on ordinary differential equations

CO-2: Familiar with the vector calculus

CO-3: Attain the knowledge on analytic functions

CO-4: Describe the functions of complex integration

CO-5: Attain the knowledge on Laplace transform

UNIT I ORDINARY DIFFERENTIAL EQUATIONS**12**

Higher order linear differential equations with constant coefficients – Method of variation of parameters – Cauchy's and Legendre's linear equations – Simultaneous first order linear equations with constant coefficients.

UNIT II VECTOR CALCULUS**12**

Gradient Divergence and Curl – Directional derivative – Irrotational and solenoidal vector fields – Vector integration – Green's theorem in a plane, Gauss divergence theorem and stoke's theorem (excluding proofs) – Simple applications involving cubes and rectangular parallelopipeds.

UNIT III ANALYTIC FUNCTIONS**12**

Functions of a complex variable – Analytic functions – Necessary conditions, Cauchy – Riemann equation and Sufficient conditions (excluding proofs) – Harmonic and orthogonal properties of analytic function – Harmonic conjugate – Construction of analytic functions – Conformal mapping : $w= z+c$, cz , $1/z$, and bilinear transformation.

UNIT IV COMPLEX INTEGRATION**12**

Complex integration – Statement and applications of Cauchy's integral theorem and Cauchy's integral formula – Taylor and Laurent expansions – Singular points – Residues – Residue theorem – Application of residue theorem to evaluate real integrals – Unit circle and semi-circular contour(excluding poles on boundaries).

UNIT V LAPLACE TRANSFORM**12**

Laplace transform – Conditions for existence – Transform of elementary functions – Basic properties – Transform of derivatives and integrals – Transform of unit step function and impulse functions – Transform of periodic functions. Definition of Inverse Laplace transform as contour integral – Convolution theorem (excluding proof) – Initial and Final value theorems – Solution of linear ODE of second order with constant coefficients using Laplace transformation techniques.

TOTAL: 60 Hours**TEXT BOOKS:**

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

REFERENCES:

1. Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley India, 9th Edition, 2011.
2. Glyn James, "Advanced Modern Engineering Mathematics", Pearson Education ,3rd Edition, 2012.
3. Jain R.K and Iyengar S.R.K, "Advanced Engineering Mathematics", Narosa Publishing House ,4th Edition,2014

COURSE OBJECTIVE:

- To learn the basics of chemistry and application of water technology, principles of electrochemistry, nuclear chemistry, Nano chemistry, engineering materials, polymer and composites, corrosion and storage devices.
- To apply these fundamental principles to solve problems related to materials used for engineering applications.

COURSE OUTCOME:

CO-1: Familiar with the water technology

CO-2: Develop skill on electrochemistry, nuclear and nano-chemistry

CO-3: Acquire the knowledge on engineering materials

CO-4: Develop the skill on polymers and composites

CO-5: Acquire the knowledge on corrosion, corrosion control and storage devices

UNIT I WATER TECHNOLOGY**9**

Characteristics – alkalinity – types of alkalinity and determination – hardness – types of estimation by EDTA method (problem) – Domestic water treatment – disinfection methods (Chlorination, ozonation, UV treatment) – Boiler feed water – requirements – disadvantages of using hard water in boilers – internal conditioning (phosphate, calgon and carbonate conditioning methods) – external conditioning – de mineralization process – desalination and reverse osmosis.

UNIT II ELECTROCHEMISTRY, NUCLEAR CHEMISTRY AND NANO CHEMISTRY**9**

Introduction -Electrochemical cells – reversible and irreversible cells – EMF – measurement of emf – Single electrode potential – Nernst equation (problem) – reference electrodes – Standard Hydrogen electrode – Calomel electrode – Ion selective electrode – glass electrode and measurement of pH - Nuclear energy – fission and fusion reactions and light water nuclear reactor for power generator (block diagram only) – Breeder reactor, Nanomaterials – introduction to Nanochemistry – carbon Nanotubes and their applications.

UNIT III ENGINEERING MATERIALS**9**

Refractories – classification – acidic, basic and neutral refractoriness – properties (refractoriness, refractoriness under load, dimensional stability, porosity, thermal spalling) – manufacture of alumina, magnetite and zirconia bricks and their applications. Abrasives – natural and synthetic abrasives – quartz, corundum, emery, garnet, diamond, silicon carbide and boron carbide. Lubricants – mechanism of lubrications – properties – viscosity index – flash and fire points, cloud and pour points – oiliness – solid lubricants – graphite and molybdenum disulphide.

UNIT IV POLYMERS AND COMPOSITES**9**

Polymers – definition – polymerization – types – addition and condensation polymerization – free radical polymerization and mechanism – Plastics, classification – preparation, properties and uses of PVC, Teflon, polycarbonate, polyurethane, nylon-6,6, PET – Rubber – vulcanization of rubber. Synthetic rubbers. Composites – definition, types, polymer matrix composites – FRP only Conducting polymers, semiconducting polymers, molecular switches— examples, mechanism and applications.

UNIT V CORROSION, CORROSION CONTROL AND STORAGE DEVICES**9**

Chemical corrosion – Pilling – Bedworth rule – electrochemical corrosion – different types – galvanic corrosion – differential aeration corrosion – factors influencing corrosion – corrosion control – sacrificial anode and impressed cathodic current methods – corrosion inhibitors – protective coatings – paints – constituents and functions – metallic coatings – electroplating (Au) and electroless (Ni) plating. Solar energy conversion – solar cells – wind energy – fuel cells – hydrogen – oxygen fuel cell – Batteries – alkaline batteries – lead – acid batteries – nickel – cadmium batteries and lithium batteries.

TOTAL: 45 Hours**TEXT BOOKS:**

- B.Sivasankar “Engineering Chemistry” Tata McGraw-Hill Pub.Co.Ltd, New Delhi 2008.
- B.K.Sharma “Engineering Chemistry” Krishna Prakasan Media (P) Ltd., Meerut 2001.
- Puri and Sharma “A text book of Physical chemistry”, Chand and Co., New Delhi.

REFERENCES:

- Jain P.C. and Monica Jain, “Engineering Chemistry”, Dhanpat Rai publishing Company (P) Ltd., New Delhi, 2010.
- Dara S.S, Umare S.S, “Engineering Chemistry”, S. Chand & Company Ltd., New Delhi 2010

COURSE OBJECTIVE:

- To learn the basics of conducting materials, semiconducting materials, magnetic super conducting materials, Di-electric materials and Modern Engineering Materials.
- To apply fundamental principles to solve problems related to materials used for engineering applications

COURSE OUTCOME:

- CO-1: Familiar with the Conducting materials
 CO-2: Acquire skill on semiconducting materials
 CO-3: Attain knowledge on magnetic and superconducting materials
 CO-4: Develop the skill on dielectric materials
 CO-5: Acquire the knowledge on modern engineering materials

UNIT I CONDUCTING MATERIALS 9

Conductors – classical free electron theory of metals – Electrical and thermal conductivity – Wiedemann – Franz law – Lorentz number – Drawbacks of classical theory – Quantum theory – Fermi distribution function – Effect of temperature on Fermi function – Density of energy states – carrier concentration in metals.

UNIT II SEMICONDUCTING MATERIALS 9

Intrinsic semiconductor – carrier concentration derivation – Fermi level – Variation of Fermi level with temperature – electrical conductivity – band gap determination – extrinsic semiconductors – carrier concentration derivation in n-type and p-type semiconductor – variation of Fermi level with temperature and impurity concentration – compound semiconductors – Hall effect – Determination of Hall coefficient – Applications.

UNIT III MAGNETIC AND SUPERCONDUCTING MATERIALS 9

Origin of magnetic moment – Bohr magneton – Dia and para magnetism – Ferro magnetism – Domain theory – Hysteresis – soft and hard magnetic materials – antiferromagnetic materials – Ferrites, applications – magnetic recording and readout, storage of magnetic data, tapes, floppy and magnetic disc drives. Superconductivity - properties – Types of superconductors – BCS theory of superconductivity(Qualitative) – High T_c superconductors – Applications of superconductors – SQUID, cryotron, magnetic levitation.

UNIT IV DIELECTRIC MATERIALS 9

Electrical susceptibility – dielectric constant – electronic, ionic, orientational and space charge polarisation – frequency and temperature dependence of polarisation – internal field – Clausius – Mosotti relation (derivation) – dielectric loss – dielectric breakdown – uses of dielectric materials (capacitor and transformer) – ferroelectricity and applications.

UNIT V MODERN ENGINEERING MATERIALS 9

Metallic glasses: preparation, properties and applications. Shape memory alloys (SMA): Characteristics, properties, application, advantages and disadvantages of SMA. Nanomaterials: synthesis – plasma arcing – chemical vapour deposition – sol-gels – electrodeposition – ball milling – properties of nanoparticles and applications, Carbon nanotubes: fabrication.

TOTAL: 45 Hours**TEXT BOOKS:**

1. Rajendran, V, and Marikani A, 'Materials Science' Tata McGraw Hill publications, New Delhi 2011.
2. Vijaya, M. and Rangarajan G, 'Materials Science' Tata McGraw Hill publications, New Delhi 2006.

REFERENCES:

1. Charles Kittel 'Introduction to Solid State Physics', John Wiley and sons, 7th edition, Singapore 2008.
2. Kasap S.O, " Principles of Electronic Materials", 3rd edition, McGrawHill Higher Education, 2005.
3. Pradeep T, "A text book of Nanoscience and Nano technology, McGrawHill Higher Education, 2012.
4. Palanisamy P.K, 'Materials Science', Scitech publications, Chennai, 2007.

COURSE OBJECTIVE:

- To understand the vectorial and scalar representation of forces and moments, static equilibrium of particles and rigid bodies both in two dimensions and also in three dimensions.

COURSE OUTCOME:

CO-1: Familiar with the basics and statics of particles

CO-2: Explain the equilibrium of rigid bodies

CO-3: Attain knowledge on properties of surfaces and solids

CO-4: Develop the skill on dynamics of particles

CO-5: Acquire the knowledge on friction and elements of rigid body dynamics

UNIT I BASICS AND STATICS OF PARTICLES**12**

Introduction – Units and Dimensions – Laws of Mechanics – Lame's theorem, Parallelogram and triangular Law of forces – Vectors – Vectorial representation of forces and moments – Vector operations: additions, subtraction, dot product, cross product – Coplanar Forces – Resolution and Composition of forces – Equilibrium of a particle – Forces in space – Equilibrium of a particle in space – Equivalent systems of forces – Principle of transmissibility – Single equivalent force.

UNIT II EQUILIBRIUM OF RIGID BODIES**12**

Free body diagram – Types of supports and their reactions – requirements of stable equilibrium – Moments and Couples – Moment of a force about a point and about an axis – Vectorial representation of moments and couples – Scalar components of a moment – Varignon's theorem – Equilibrium of Rigid bodies in two dimensions – Equilibrium of Rigid bodies in three dimensions – Examples

UNIT III PROPERTIES OF SURFACES AND SOLIDS**12**

Determination of Areas and Volumes – First moment of area and the Centroid of sections – Rectangle, circle, triangle from integration – T section, I section, Angle section, Hollow section by using standard formula – second and product moments of plane area – Rectangle, triangle, circle from integration – T section, I section, Angle section, Hollow section by using standard formula – Parallel axis theorem and perpendicular axis theorem – Polar moment of inertia – Principal moments of inertia of plane areas – Principal axes of inertia – Mass moment of inertia – Derivation of mass moment of inertia for rectangular section, prism, sphere from first principle – Relation to area moments of inertia.

UNIT IV DYNAMICS OF PARTICLES**12**

Displacements, Velocity and acceleration, their relationship – Relative motion – Curvilinear motion – Newton's law – Work Energy Equation of particles – Impulse and Momentum – Impact of elastic bodies.

UNIT V FRICTION AND ELEMENTS OF RIGID BODY DYNAMICS**12**

Frictional force – Laws of Coulomb friction – simple contact friction – Rolling resistance – Belt friction. Translation and Rotation of Rigid Bodies – Velocity and acceleration – General Plane motion.

TOTAL: 60 Hours**TEXT BOOKS:**

- Beer, F.P and Johnson Jr. E.R. "Vector Mechanics for Engineers", Vol. 1 Statics and Vol. 2 Dynamics, McGraw-Hill International Edition, 1997.
- Rajasekaran. S, Sankarasubramanian. G., "Fundamentals of Engineering Mechanics", Vikas Publishing House Pvt. Ltd., 2000.

REFERENCES:

- Hibbeler, R.C., "Engineering Mechanics", Vol. 1 Statics, Vol. 2 Dynamics, Pearson Education Asia Pvt. Ltd., 2000.
- Palanichamy, M.S., Nagam, S., "Engineering Mechanics – Statics and Dynamics", Tata McGraw-Hill, 2001.
- Irving H. Shames, "Engineering Mechanics – Statics and Dynamics", IV Edition – Pearson Education Asia Pvt. Ltd., 2003.
- Ashok Gupta, "Interactive Engineering Mechanics – Statics – A Virtual Tutor (CDROM)", Pearson Education Asia Pvt., Ltd., 2002.

COURSE OBJECTIVE:

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

COURSE OUTCOME:

CO-1: Familiar with the electrical circuits and measurements

CO-2: Describe the electrical machines

CO-3: Attain knowledge on semiconductor devices and applications

CO-4: Develop the skill on digital electronics

CO-5: Acquire the knowledge on fundamentals of communication engineering

UNIT I ELECTRICAL CIRCUITS AND MEASUREMENTS**12**

Ohm's Law – Kirchoff's Laws – Steady State Solution of DC Circuits – Introduction to AC Circuits – Waveforms and RMS Value – Power and Power factor – Three Phase Balanced Circuits. Operating Principles of Moving Coil and Moving Iron Instruments (Ammeters and Voltmeters), Dynamometer type Watt meters and Energy meters.

UNIT II ELECTRICAL MACHINES**12**

Construction, Principle of Operation, Basic Equations and Applications of DC Generators, DC Motors, 1-Phase Transformer, 3-phase Induction Motors.

UNIT III SEMICONDUCTOR DEVICES AND APPLICATIONS**12**

Characteristics of PN Junction Diode –Half wave and Full wave Rectifiers – Zener Effect – Zener Diode and its Characteristics – Voltage Regulation. Bipolar Junction Transistor – CB, CE, CC Configurations and Characteristics – Elementary Treatment of Small Signal Amplifier.

UNIT IV DIGITAL ELECTRONICS**12**

Binary Number System – Logic Gates – Boolean Algebra – Half and Full Adders – Flip-Flops – Registers and Counters – A/D and D/A Conversion (single concepts).

UNIT V FUNDAMENTALS OF COMMUNICATION ENGINEERING**12**

Types of Signals: Analog and Digital Signals – Modulation and Demodulation: Principles of Amplitude and Frequency Modulations. Communication Systems: Radio, TV, Fax, Microwave, Satellite and Optical Fibre (Block Diagram Approach only).

TOTAL: 60 Hours**TEXT BOOKS:**

- Muthusubramanian R, Salivahanan S and Muraleedharan K A, "Basic Electrical, Electronics and Computer Engineering", Tata McGraw Hill, Second Edition, 2006.
- Murugesh Kumar,K., and Jaganathan, V., "Basic Electrical and Electronics Engineering", Vikas Publishing House PVT Ltd, New Delhi 2001.

REFERENCES:

- Nagsarkar T K and Sukhija M S, "Basics of Electrical Engineering", Oxford press 2005.
- Mehta V K, "Principles of Electronics", S.Chand and Company Ltd, 1995.

COURSE OBJECTIVE:

- To acquire practical skills in the determination of water quality parameters through volumetric analysis.
- To determine the molecular weight of a polymer by viscometry.

COURSE OUTCOME:

CO-1: Determine the total, permanent and temporary hardness of the given water sample by EDTA method

CO-2: Determine the type and amount of alkalinity present in the given water sample.

CO-3: Estimate the amount of chloride present in the water sample by Argentometric analysis

CO-4: Determination of molecular weight of given polymer solution by Ostwald viscometer method.

CO-5: Determine the amount of strong acid and weak acid (HCl and CH₃COOH)

CO-6: Determine the strength of the given hydrochloric acid by pH-metry with 0.2N sodium hydroxide solution.

LIST OF EXPERIMENTS

1. Determine the total, permanent and temporary hardness of the given water sample by EDTA method. A standard hard water and EDTA solutions are provided.
2. Determine the type and amount of alkalinity present in the given water sample. A standard solution of sodium hydroxide of strength 0.1N is given.
3. Estimate the amount of chloride present in the water sample by Argentometric analysis. A standard solution of strength 0.01N and sodium chloride solutions are provided
4. Determination of molecular weight of given polymer solution by Ostwald viscometer method.
5. Determine the amount of strong acid and weak acid (HCl and CH₃COOH) present in 1 litre of the given mixture of acid solution by conducto-metric titration using standard NaOH of normality 0.2N.
6. Determine the amount of barium chloride present in 1 litre of the given solution by conductometric titration using standard solution of sodium sulphate of normality 0.2N.
7. Estimate the amount of ferrous ion present in the whole of the given solution. A standard solution of potassium dichromate of strength 0.1N is provided.
8. Determine the strength of the given hydrochloric acid by pH-metry with 0.2N sodium hydroxide solution.

TOTAL: 45 Hours

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.

COURSE OUTCOME:

CO-1: Develop listening and reading comprehension skills

CO-2: Develop speaking skills

CO-3: Familiar with the resume / report preparation / letter writing

CO-4: Develop presentation and soft skills

CO-5: Acquire the group discussion and interview skill

I. PC based session (Weight age 40%)**24 Hours****A. ENGLISH LANGUAGE LAB****18 Hours****1. LISTENING COMPREHENSION****6**

Listening and typing – Listening and sequencing of sentences – Filling in the blanks - Listening and answering questions.

2. READING COMPREHENSION**6**

Filling in the blanks - Close exercises – Vocabulary building - Reading and answering questions.

3. SPEAKING**6**

Phonetics: Intonation – Ear training - Correct Pronunciation – Sound recognition exercises – Common Errors in English.
Conversations: Face to Face Conversation – Telephone conversation – Role play activities (Students take on roles and engage in conversation)

B. DISCUSSION OF AUDIO-VISUAL MATERIALS 6 Hours

(Samples are available to learn and practice)

1. RESUME / REPORT PREPARATION / LETTER WRITING (1)

Structuring the resume / report - Letter writing / Email Communication - Samples.

2. PRESENTATION SKILLS: (1)

Elements of effective presentation – Structure of presentation – Presentation tools – Voice Modulation – Audience analysis - Body language – Video samples

3. SOFT SKILLS: (2)

Time management – Articulateness – Assertiveness – Psychometrics – Innovation and Creativity - Stress Management & Poise - Video Samples

4. GROUP DISCUSSION: (1)

Why is GD part of selection process ? - Structure of GD – Moderator – led and other GDs - Strategies in GD – Team work - Body Language - Mock GD –Video samples

5. INTERVIEW SKILLS: (1)

Kinds of interviews – Required Key Skills – Corporate culture – Mock interviews- Video samples.

1. Resume / Report Preparation / Letter writing: Students prepare their own resume and report. (2)

2. Presentation Skills: Students make presentations on given topics. (8)

3. Group Discussion: Students participate in group discussions. (6)

4. Interview Skills: Students participate in Mock Interviews (8)

II. Practice Session (Weight age – 60%)**24 Hours**

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 develop the student's graphic skill for communication of concepts, ideas and design of engineering products and expose them to existing CAD Packages related to technical drawings.

COURSE OUTCOME:

CO-1: Explain the basic concepts and conventions

CO-2: Draw the plain curves and free hand sketching

CO-3: Demonstrate the projection of points, lines and plane surfaces

CO-4: Explain the projection of solids

CO-5: Demonstrate the isometric and perspective projections

List of Exercises using software capable of Drafting

- Importance of graphics in engineering applications – BIS conventions and specifications – Size and layout of drawing sheets – Lettering and dimensioning. Study of capabilities of CAD Packages for drafting – Coordinate systems. (Theory)
- Creation of simple figures like polygon and general multi-line figures.
- Construction of ellipse, Parabola and hyperbola.
- Construction of involutes of square and polygon.
- 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 one reference planes.
- Projection of simple solids like prisms, pyramids, cylinder and cone when the axis is inclined to one reference plane by change of position method.
- Sectioning of simple solids like prisms, pyramids, cylinder and cone in vertical position by cutting planes inclined to one reference plane and perpendicular to the other.
- Draw the orthographic projection in the 1st angle for the objects such as step block, solid bearing block, gland as per the dimensions given.
- Draw the isometric view or 3D model of a V – block, shaft bracket, jig plate as per the dimensions given.

TOTAL: 45 Hours

TEXT BOOKS:

- Dhananjay A. Jolhe, "Engineering Drawing with an introduction to AutoCAD" Tata McGraw Hill Publishing Company Limited 2008.
- K. Venugopal & V. Prabhu Raja, "Engineering Graphics", New Age International (P) Limited 2008.

REFERENCES:

- N.D. Bhatt, "Engineering Drawing" Charotar Publishing House, 46th Edition, 2003.
- M.S. Kumar, "Engineering Graphics", D.D. Publications, 2007.
- M.B. Shah and B.C. Rana, "Engineering Drawing", Pearson Education 2005.
- S. Gowri and T. Jeyapooan, "Engineering Graphics", 6th Edition, Vikas Publishing house Pvt Ltd 2011.

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

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

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

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, New Delhi, (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 understand the mathematical principles on Fourier series and transforms, partial differential equations and Z transform would provide them the ability to formulate and solve some of the problems of engineering.

COURSE OUTCOME:

CO-1: Acquire the skill on Fourier series

CO-2: Familiar with the Fourier transforms

CO-3: Attain the knowledge on partial differential equations

CO-4: Describe the applications of partial differential equations

CO-5: Attain the knowledge on transform and difference equations

UNIT I FOURIER SERIES**12**

Dirichlet's conditions – General Fourier series – Odd and even functions – Half range sine series – Half range cosine series – Complex form of Fourier 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 both homogeneous and non- homogeneous types.

UNIT IV APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS**12**

Classification PDE-Method of separation of variables - Solutions of one dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two-dimensional heat equation (excluding Insulated edges) .

UNIT V Z -TRANSFORM AND DIFFERENCE EQUATIONS**12**

Z-transform - Elementary 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**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, 6th reprint,2008.

REFERENCES:

- Bali.N.P. and Manish Goyal 'A Textbook of Engineering Mathematics', Laxmi Publications, 9th edition,2011.
- Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley India, 9th Edition, 2011.
- Glyn James, "Advanced Modern Engineering Mathematics", Pearson Education,3rd Edition, 2012.
- SivaramakrishnaDas.P&Vijayakumari.C,A Text book of Engineering Mathematics-III (Transforms &Partial Differential equations), Pearson Education Limited, 5th Edition,2013.

COURSE OBJECTIVE:

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

COURSE OUTCOME:

CO-1: Acquire the skill on basic concept and first law

CO-2: Familiar with the second law and entropy

CO-3: Attain the knowledge thermodynamic availability

CO-4: Describe the properties of pure substance and steam power cycle

CO-5: Attain the knowledge on psychrometry

(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

(Use of standard thermodynamic tables, Mollier diagram, Psychrometric chart and refrigerant property tables are permitted)

TEXT BOOKS:

1. Nag.P.K., "Engineering Thermodynamics", Tata McGraw-Hill, New Delhi, 1998.
2. Lynn D Russell, George A, Adebisi "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 train the Students to know the details of different chassis components, dismantling and assembling them.

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

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 OBJECTIVE:

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

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.

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 OBJECTIVE:

- 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.

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

UNIT I TESTING OF HYPOTHESIS**12**

Sampling distributions - Tests for single mean, Proportion, Difference of means (large and small samples) – Tests for single variance and equality of variances – chi-square test for goodness of fit – Independence of attributes.

UNIT II DESIGN OF EXPERIMENTS**12**

Completely randomized design – Randomized block design – Latin square design - 2^2 factorial design.

UNIT III SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS**12**

Newton-Raphson method- Gauss Elimination method – Pivoting - Gauss-Jordan methods – Iterative methods of Gauss-Jacobi and Gauss-Seidel - Matrix Inversion by Gauss-Jordan method- Eigenvalues of a matrix by Power method .

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

Lagrange's and Newton's divided difference interpolation – Newton's forward and backward difference interpolation - Approximation of derivatives using interpolation polynomials - Numerical integration using Trapezoidal and Simpson's 1/3 rules.

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

Taylor's series method - Euler's method - Modified Euler's method - Fourth order Runge-Kutta method for solving first and second order equations - Milne's and Adams predictor-corrector methods for solving first order equations .

TOTAL: 60 Hours**TEXT BOOKS:**

1. Grewal, B.S. and Grewal, J.S., " *Numerical methods in Engineering and Science*", 9th 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, 7th edition, 2007 (For units 1 and 2).

REFERENCES:

1. Chapra, S. C and Canale, R. P. " *Numerical Methods for Engineers*", Tata McGraw-Hill, New Delhi, 7th 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, 9th edition, 2011.
3. Dr. Kandasamy .P, Dr. Thilagavathi, Dr. Gunavathi. K, " *Statistics and numerical methods*", s.chand and company, first edition, 2010.

COURSE OBJECTIVE:

- Familiar with the production processes like casting, welding, machining, metal forming, power metallurgy etc.

COURSE OUTCOME:

CO-1: Familiar with the theory of metal cutting

CO-2: Acquire the skill on centre lathe and special purpose lathes

CO-3: Attain the knowledge on reciprocating and milling machines

CO-4: Describe the surface finishing processes

CO-5: Attain the knowledge on sawing, broaching and gear cutting

UNIT I THEORY OF METAL CUTTING 9

Introduction to types of machine tools, Theory of metal cutting -material removal processes: chip formation, orthogonal cutting, oblique cutting. Merchant circle-problems, cutting tool materials, tool wear, tool life-problems, surface finish, cutting fluids.

UNIT II CENTRE LATHE AND SPECIAL PURPOSE LATHES 9

Centre lathe, constructional features, cutting tools, various operations, taper turning methods, thread cutting methods, special attachments, machining time and power estimation. Capstan and turret lathes – automatic lathes : semi automatic, automats – single spindle : cutting off, swiss type, automatic screw type – multi spindle; cutting off, bar type

UNIT III RECIPROCATING AND MILLING MACHINES 9

Purpose and types of milling machines, general purpose milling machines, different types of milling operations, milling cutters, attachments extending the processing capabilities of general purpose milling machines, Indexing, Helical milling operation and its set up.

UNIT IV SURFACE FINISHING PROCESSES 9

Abrasive processes: grinding wheel – specifications and selection, types of grinding process – cylindrical grinding, surface grinding, centreless grinding – honing, lapping, super finishing, polishing and buffing, abrasive jet grinding

UNIT V SAWING, BROACHING AND GEAR CUTTING 9

Sawing machine: hack saw machine, band saw machine, circular saw machine; broaching machines: broach construction – push, pull, surface and continuous broaching machines, gear cutting: forming, generation, shaping, hobbing.

TOTAL: 45 Hours**TEXT BOOKS:**

- Rao, P.N. "Manufacturing Technology", Metal Cutting and Machine Tools, Tata McGraw-Hill, New Delhi, 2003.
- Richard R.Kibbe, John E. Neely, Roland O. Merges and Warren J. White, "Machine Tool Practices", Prentice Hall of India, 2003.

REFERENCES:

- HMT, "Production Technology", Tata McGraw-Hill, 1998.
- P.C.Sharma, "A Text Book of Production Engineering", S.Chand and Co. Ltd, IV edition, 1993.
- Hajra Choudry, "Elements of Work Shop Technology – Vol. II", Media Promoters. 2002.
- Geoffrey Boothroyd, "Fundamentals of Metal Machining and Machine Tools", McGraw Hill, 1984.

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.

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

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 Π 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**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

COURSE OBJECTIVE:

- 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

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 OBJECTIVE:

- Able to have hands on experience in flow measurements using different devices and also perform calculation related to losses in pipes and also perform characteristic study of pumps, turbines etc.,

COURSE OUTCOME:

- CO-1: Determine the Coefficient of discharge of given Orifice meter.
 CO-2: Determine the Coefficient of discharge of given Venturi meter.
 CO-3: Calculate the rate of flow using Rota meter.
 CO-4: Determine the friction factor for a given set of pipes.
 CO-5: Draw the characteristic curves of centrifugal pump / submergible pump
 CO-6: Draw the characteristic curves of reciprocating pump.
 CO-7: Draw the characteristic curves of Gear pump.
 CO-8: Draw the characteristic curves of Pelton wheel.
 CO-9: Draw the characteristics curves of Francis turbine.
 CO-10: Draw the characteristic curves of Kaplan turbine.

LIST OF EXPERIMENTS

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.
8. Conducting experiments and drawing the characteristic curves of Pelton wheel.
9. Conducting experiments and drawing the characteristics curves of Francis turbine.
10. Conducting experiments and drawing the characteristic curves of Kaplan turbine.

LIST OF EQUIPMENTS

1. Orificemeter setup
2. Venturi meter setup
3. Rotameter setup
4. Pipe Flow analysis setup
5. Centrifugal pump/submergible pump setup30
6. Reciprocating pump setup
7. Gear pump setup
8. Pelton wheel setup
9. Francis turbine setup
10. Kaplan turbine setup

TOTAL: 45 Hours

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

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

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.**REFERENCE BOOKS:**

1. Vethathiri Maharishi, 16th Edi.2013, Yoga for Modern Age, Vethathiri Publications, Erode.
2. Vethathiri Maharishi, 2014, Simplified Physical Exercises, Vethathiri Publications, Erode.
3. Vethathiri Maharishi, 3rd 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 pollution control techniques of pollutants like UBHC, CO, NO_x, particulate matter and smoke for both SI and CI engine will be taught to the students.

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 :Explain the control of emission in SI engine
 CO – 5 :Identify the formation of pollutant in CI engine
 CO – 6 :Understand the control of emission in CI engine
 CO – 7 :Describe about noise pollution from automobiles
 CO – 8 :Clearly explain the various noise and noise reduction in automobile
 CO – 9 :Aware of US, Euro, and Indian emission norms
 CO – 10: Describe standards CVS sampling and test procedures.

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—Poly-nuclear 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 umber 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

TEXTBOOKS:

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.
5. A.Alexander, J.P.Barde, C.lomure and F.J. Langdan, 'Road traffic noise', Applied science publisher ltd., London,1987.

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.

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: Learn about the different drive systems.
 CO-6: Identify the different parts of the automobile
 CO-7: Explain the working of various parts like engine, transmission, clutch, brakes
 CO-8: Describe how the steering and the suspension systems operate.
 CO-9: Understand the environmental implications of automobile emissions
 CO-10: Develop a strong base for understanding future developments in the automobile industry.

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**TEXTBOOK:**

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

REFERENCES:

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

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.

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.

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**TEXT BOOKS:**

- 1 N. K. Giri, Automotive Mechanics, Khanna Publishers, New Delhi, 2005.
2. Heldt, P.M., High Speed Combustion Engines, Oxford 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:

Familiar with the performance test and emission test on the IC engines

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, CO₂, O₂ using exhaust gas analyzer
- CO-10: Describe the Diesel smoke measurement.

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, CO₂, O₂ using exhaust gas analyzer
10. Diesel smoke measurement.

TOTAL: 45 Hours

REFERENCES:

1. Giles. J.G., Vehicle Operation and performance, Illiffe Books Ltd., London, 1989.
2. Crouse. W.H. and Anglin. D.L., Motor Vehicle Inspection, McGraw Hill Book Co., 1978.
3. Ganesan. V., Internal Combustion engines, Tata McGraw Hill Co., 1994.
4. BIS code Books, IS-10000 series, 1988.

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COURSE OBJECTIVE:

- Familiar with the use of modeling software and to design engine components

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: Demonstrate the design of combustion chamber.

LIST OF EXPERIMENTS

- Design and drawing of piston.
- Piston pin and piston rings and drawing of these components.
- Design of connecting rod small end and big end, shank design, design of big end cap, bolts and drawing of the connecting rod assembly
- Design of crankshaft, balancing weight calculations.
- Development of short and long crank arms, front end and rear end details, drawing of the crankshaft assembly.
- Design and drawing of flywheel.
- Ring gear design, drawing of the flywheel including the development of ring gear teeth.
- Design and drawing of the inlet and exhaust valves.
- Design of cam and camshaft, cam profile generation, drawing of cam and camshaft.
- Design of combustion chamber.

TOTAL: 45 Hours**LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS**

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

COURSE OBJECTIVE :

- To be familiar with the industrial safety on working with various machines.

COURSE OUTCOME:

- CO – 1: Describe the safety in metal and wood working machinery
 CO – 2: Define the principles of machine guarding.
 CO –3: Describe the safety in welding and gas cutting
 CO – 4: Explain the safety in cold farming and hot working of metals.
 CO – 5: Familiar with the safety in finishing, inspection and testing

UNIT I SAFETY IN METAL WORKING MACHINERY AND WOOD WORKING MACHINES

6

General safety rules, principles, maintenance, Inspections of turning machines, boring machines, milling machine, planning machine and grinding machines, CNC machines.

UNIT II PRINCIPLES OF MACHINE GUARDING

6

Guarding during maintenance, Zero Mechanical State (ZMS), Definition, Policy for ZMS – guarding of hazards - point of operation protective devices, machine guarding, types, fixed guard, interlock guard, automatic guard, trip guard, electron eye, positional control guard, fixed guard fencing- guard construction- guard opening.
 Selection and suitability: lathe-drilling-boring-milling -grinding-shaping

UNIT III SAFETY IN WELDING AND GAS CUTTING

6

Gas welding and oxygen cutting, resistances welding, arc welding and cutting, common hazards, personal protective equipment, training, safety precautions in brazing, soldering and metalizing – leak detection-pipe line safety-storage and handling of gas cylinders.

UNIT IV SAFETY IN COLD FARMING AND HOT WORKING OF METALS

6

Cold working, power presses, point of operation safe guarding, auxiliary mechanisms, feeding and cutting mechanism, hand or foot-operated presses, power press electric controls.Hot working safety in forging, hot rolling mill operation, safe guards in hot rolling mills. Safety in gas furnace operation.

UNIT V SAFETY IN FINISHING, INSPECTION AND TESTING

6

Heat treatment operations, electro plating, sand and shot blasting, safety in inspection and testing, dynamic balancing, hydro testing. Health and welfare measures in engineering industry-pollution control in engineering industry-industrial waste disposal.

TOTAL: 30 PERIODS**REFERENCES**

1. "Accident Prevention Manual" – NSC, Chicago, 1982.
2. "Occupational safety Manual" BHEL, Trichy, 1988.
3. "Safety Management by John V. Grimaldi and Rollin H. Simonds, All India Travelers Book seller, New Delhi, 1989.
4. "Safety in Industry" N.V. Krishnan Jaico Publishery House, 1996.
5. Indian Boiler acts and Regulations, Government of India.
6. Safety in the use of wood working machines, HMSO, UK 1992.
7. Health and Safety in welding and Allied processes, welding Institute, UK, High Tech. Publishing Ltd., London, 1989.

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 and life of the various components of the vehicle.

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.

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.

TEXTBOOKS:

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', 4th 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", 7th 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
6. J. R. Ellis, 'Vehicle Dynamics', Business Books, London, 1969.

COURSE OBJECTIVE :

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

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.

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**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 :

- 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.

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

UNIT I INTRODUCTION**9**

Layout with reference to power plant, steering location and types of drives, frames in vehicles, Frameless constructional details, materials used in frames, testing of frames, integral body construction.

UNIT II FRONT AXLE STEERING SYSTEM**9**

Front axle type, rigid axle and split axle, Constructional Details, Materials, Front wheel geometry viz., camber, castor, kingpin inclination, toe-in and toe-out. Condition for true rolling motion of road wheels during steering. Steering geometry. Ackermann and Davis steering. Construction details of steering linkages. Different types of steering gear box. Steering linkages layout for conventional and independent suspensions. Turning radius, instantaneous centre, wheel wobble and shimmy. Over-steer and under-steer. Power and power assisted steering

UNIT III DRIVE LINE STUDY**9**

Effect of driving thrust and torque –reaction. Hotchkiss drives. Torque tube drive, radius rods. Propeller shaft. Universal joints. Final drive- different types. Two speed rear axle. Rear axle construction-full floating, three quarter floating and semi-floating arrangements. Differential-conventional type, Non-slip type, Differential locks and differential housing.

UNIT IV BRAKING SYSTEM**9**

Type of brakes, Principles of shoe brakes. Constructional details – materials, braking torque developed by leading and trailing shoes. Disc brake, drum brake theory, constructional details, advantages, Brake actuating systems. Factors affecting brake performance, Exhaust brakes, power and power assisted brakes. Testing of brakes.

UNIT V SUSPENSION SYSTEMS**9**

Types of suspension, Factors influencing ride comfort, Types of suspension springs- independent suspension- front and rear. Rubber, pneumatic, hydro- elastic suspension. Shock absorbers. Types of wheels. Construction of wheel assembly. Types of tyres and constructional details. Static and rolling properties of pneumatic tyres, tubeless tyres and aspect ratio of tubed tyres.

TOTAL: 45 Hours**TEXT BOOKS:**

1. K. Newton, W. Steeds and T.K. Garret, "The Motor Vehicle", 13th 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. Giancarlo Genta, "Automotive Chassis Vol. I: Components Design", Springer, 2013
2. Harban Singh Rayat, "The Automobile", S. Chand & Co. Ltd, New Delhi, 2000.
3. G.J.Giles, "Steering Suspension and Tyres", Illiffe Books Ltd., London, 1975.
4. Kirpal Singh, "Automobile Engineering", Standard publishers, Distributors, Delhi, 1999.
5. G.B.S.Narang, "Automobile Engineering", Khanna Publishers, Twelfth reprint New Delhi, 2005.
6. R.P.Sharma, "Automobile Engineering", Dhanpat Rai & Sons, New Delhi, 200

COURSE OBJECTIVE :

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

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

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 OBJECTIVE :

- Familiar with the use of modeling software and to design the chassis components.

COURSE OUTCOME :

CO-1: Describe the design procedure of clutch components

CO-1: Draw the clutch components using drafting software

CO-3: Compute the Gear train calculations.

CO-4: Demonstrate the layout of gear box.

CO-5: Perform the calculation of bearing loads

CO-6: Justify the selection of bearings.

CO-7: Describe the assembly drawing of gear box using drafting software

CLUTCH

1. Complete design of clutch components.
2. Assembly drawing of clutch using drafting software.

GEAR BOX

3. Gear train calculations.
4. Layout of gear box.
5. Calculation of bearing loads
6. Selection of bearings.
7. Assembly drawing of gear box using drafting software.

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 OBJECTIVE :

- To have a complete knowledge of the vehicle maintenance procedures.
- To acquire skills in handling situations where the vehicle is likely to fail
- To impart knowledge on engine maintenance – repair and overhauling.

COURSE OUTCOME:

- CO – 1: Explain the requirements and importance of maintenance.
- CO – 2: Describe the technical information required for vehicle repairs.
- CO –3: Demonstrate the dismantling of engine components and cleaning.
- CO – 4: List the minor and major reconditioning of various engine components.
- CO – 5: Describe the automatic transmission and gear box.
- CO – 6: Illustrate the maintenance and servicing of suspension systems.
- CO – 7: Analyze the testing methods for checking battery, starter motor, charging systems, ignitions system.
- CO – 8: Discuss the fault diagnosis and maintenance of modern electronic controls.
- CO – 9: Explain the Servicing and maintenance of fuel system of different types of vehicles.
- CO – 10: Perform the Lubrication maintenance, lubricating oil changing, greasing of parts.

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**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.

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

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

TEXT BOOKS:

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

REFERENCES:

1. Benson.R.S., Whitehouse. N.D., - Internal Combustion Engines - Pergamon Press, oxford - 1979.
2. Ramoss.A.L., - Modelling of Internal Combusion 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.

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.

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 Forebody 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**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 :

- List down the various maintenance procedures.
- Ensure the maximum availability of vehicle without any major problem.
- Educate the customer for safe driving.

COURSE OUTCOME:

- CO-1: Explain the preparation of workshop layout and statements
 CO-2: Describe the tools and instruments required for workshop
 CO-3: Perform tuning of diesel and petrol engines
 CO-4: Demonstrate the fault diagnosis of electrical systems.
 CO-5: Demonstrate the fault diagnosis of air and fuel systems.
 CO-6: Perform the vehicle body repair works
 CO-7: Perform adjustment of Clutch, Brake and Steering
 CO-8: Demonstrate the bleeding of brake and fuel system
 CO-9: Demonstrate the head light and wheel bearing adjustment.

LIST OF EXPERIMENTS**VEHICLE MAINTENANCE LABORATORY**

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 - Each 1 No

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

TOTAL: 45 Hours

COURSE OBJECTIVE :

- Identifying and rectifying the fault of the vehicles.
- Ensure the maximum availability of vehicle without any major problem.
- Educate the customer for safe driving.

COURSE OUTCOME:

- CO-1: Demonstrate the cylinder re-boring
 CO-2: Perform the valve grinding and lapping.
 CO-3: Show the Setting of valve angle and checking for valve leakage
 CO-4: Demonstrate the Wheel alignment for a vehicle.
 CO-5: Perform the testing of kingpin inclination, toe-in and toe-out.
 CO-6: Perform the brake adjustment and bleeding.
 CO-7: Demonstrate the removal of tyre and tube.

Re-Conditioning 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 EQUIPMENTS FOR RECONDITIONING**(For a batch of 30 students) Each 1 No**

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

TOTAL: 45 Hours

**SYLLABUS
DISCIPLINE SPECIFIC ELECTIVE
COURSES**

COURSE OBJECTIVE :

- To study the constructional and earth moving equipments.
- To understand the power train concepts.
- To familiarize with military and combat vehicles

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.

UNIT ITRACTORS 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, scrappers, motor graders etc. criteria for selection of prime mover fro dumpers and front end loaders based on vehicle performance characteristics.

UNIT IIIPOWER TRAIN CONCEPTS**9**

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

UNIT IVSPECIAL 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 driver – chain drive, shaft drive, frame and front forks, two wheeler suspension system.

TOTAL: 45 Hours**TEXT BOOKS:**

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

REFERENCES:

1. A. Gurevich and E.Soreking, Tractors Mir Publishers, Moscow, 1967.
2. 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.

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.

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**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 principle involved in discretization and finite element approach
- To learn to form stiffness matrices and force vectors for simple elements

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

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

Approximate solution of boundary value problems-Methods of weighted residuals, Approximate solution using variational method, Modified Galerkin method, Boundary conditions and general comments, Two dimensional example Basic finite element concepts-Basic ideas in a finite element solution, General finite element solution procedure, Finite element equations using modified Galerkin method, Application: Axial deformation of bars, Axial spring element, Analysis of trusses-Two dimensional truss element, Three dimensional space truss element, Stresses due to lack of fit and temperature changes

UNIT II**ONE DIMENSIONAL PROBLEMS****9**

Beam bending-Governing differential equation for beam bending, Two node beam element, Exact solution for uniform beams subjected to distributed loads using superposition, Calculation of stresses in beams, Thermal stresses in beams Analysis of structural frames-Plane frame element, Thermal stresses in frames, Three dimensional space frame element. General one dimensional boundary value problem and its applications-One dimensional heat flow, Fluid flow between flat plates-Lubrication Problem, Column buckling

UNIT III**TWO DIMENSIONAL CONTINUUM****9**

Higher order elements for one dimensional problems-Shape functions for second order problems, Isoparametric mapping concept, Quadratic isoparametric element for general one dimensional boundary value problem, One dimensional numerical integration, Application: Heat conduction through a thin film.Two dimensional boundary value problems using triangular elements, Equivalent functional for general 2D BVP, A triangular element for general 2D BVP, Numerical examples. Isoparametric quadrilateral elements-Shape functions for rectangular elements, Isoparametric mapping for quadrilateral elements, Numerical integration for quadrilateral elements, Four node quadrilateral element for 2D BVP, Eight node serendipity element for 2D BVP

UNIT IV**AXISYMMETRIC CONTINUUM****9**

Isoparametric triangular elements-Natural (or Area) coordinates for triangles, Shape functions for triangular elements, Natural coordinate mapping for triangles, Numerical integration for triangles, Six node triangular element for general 2D BVP.Numerical integration-Newton-Cotes rules, Trapezium rule, Simpson's rule, Error term, Gauss-Legendre rules, Changing limits of integration, Gauss-Legendre rule, Multiple integrals, Numerical integration for quadrilateral elements, Numerical integration for triangular elements.Applications based on general two dimensional boundary value problem-Ideal fluid flow around an irregular object, Two dimensional steady state heat flow, Torsion of prismatic bars

UNIT V ISOPARAMETRIC ELEMENTS FOR TWO DIMENSIONAL CONTINUUM 9

Two dimensional elasticity-Governing differential equations, Constant strain triangular element, Four node quadrilateral element, Eight node isoparametric element. Axisymmetric elasticity problems-Governing equations for axisymmetric elasticity, Axisymmetric linear triangular element, Axisymmetric four node isoparametric element. Three dimensional elasticity-Governing differential equations, Four node tetrahedral element, Eight node hexahedral (brick) element, Twenty node isoparametric solid element, Prestressing, initial strains and thermal effects

TOTAL: 45 Hours

TEXT BOOK:

1. P.Seshu, "Text Book of Finite Element Analysis", Prentice-Hall of India Pvt. Ltd., New Delhi, 2007. ISBN-978-203-2315-5

REFERENCES:

1. J.N.Reddy, "An Introduction to the Finite Element Method", McGraw-Hill International Editions (Engineering Mechanics Series), 1993.
2. Chandrupatla&Belagundu, "Introduction to Finite Elements in Engineering", 3rd Edition, Prentice-Hall of India, Eastern Economy Editions.
3. David V.Hutton,"Fundamentals of Finite Element Analysis", Tata McGraw-Hill Edition 2005.
4. Cook,Robert.D., Plesha,Michael.E&Witt,Robert.J. "Concepts and Applications of Finite Element Analysis",Wiley Student Edition, 2004.

COURSE OBJECTIVE:

- To understand the students and manage a transport fleet and their related activities for minimizing operational cost.

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.

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**TEXTBOOK:**

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

REFERENCES:

- Government Motor Vehicle Act – Eastern Book Company, Lucknow - 1989
- Kitchin.L.D., - Bus Operation - Illiffe and Sons Co., London, III edition - 1992
- 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.

COURSE OUTCOME

CO-1: Evaluate basic fluid theory.

CO-2: Apply CFD to a range of problems.

CO-3: Describe lift, drag and down force definitions and calculations.

CO-4: Demonstrate a knowledge and understanding of aerodynamics in automotive field.

CO-5: Explain the principles and functions of wind tunnel.

CO-6: Conceptual understanding of the mathematics, numerical analysis, statistics, and computer and information.

CO-7: Application of established engineering methods to complex engineering problem solving.

CO-8: Application of engineering techniques, tools and resources.

CO-9: Analyze data from experimental and computational studies and interpret these in the context of vehicle design

CO-10: Design and implement experimental testing and computational simulations relevant to new vehicle development

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**TEXT BOOK:**

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

REFERENCES:

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

COURSE OBJECTIVE:

- To introduce the modern developments in vehicle technology.

COURSE OUTCOME:

- CO – 1: Identify the ability to familiar with the advanced manufacturing techniques evolved in manufacturing.
- CO – 2: Identify the various the Ignition (closed loop) system, catalytic converter & particulate traps.
- CO – 3: Evaluate the various latest technological advancements in chassis System.
- CO – 4: Describe the Knowledge of pneumatic & active suspension control system.
- CO – 5: Describe the heating and air conditioning system.
- CO – 6: Formulate the comfort & convenience, safety and security systems.
- CO – 7: Identify the various environmental implications of automobile emissions.
- CO – 8: Develop a strong base for future developments in the automobile industry.
- CO – 9: Familiar with the navigation systems, power steering, power windows.
- CO – 10: Gain knowledge about various safety & security systems such as airbags, seat belts, ABS, EBS.

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**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

COURSE OUTCOME:

- CO – 1: Describe the basic concepts of vibration.
- CO – 2: Apply mathematical models for various vibrations.
- 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 – 5: Criticize to measure the noise for various applications.
- CO – 6: Describe the concepts of engineering noise and vibration, measurement techniques and instruments.
- CO – 7: Apply the knowledge in vibration isolation.
- CO – 8: Describe the knowledge on application dynamic forces generated by IC engines.
- CO – 9: Identify the physical phenomena to generate noise in mechanical systems.
- CO – 10: Apply different solutions for control the noise.

UNIT I BASICS OF VIBRATION**9**

Introduction, classification of vibration: free and forced vibration, undamped and damped vibration, linear and non linear vibration, response of damped and undamped 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, untuned 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

TEXT BOOKS:

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

REFERENCES:

1. Bernard Challen and Rodica Baranescu - "Diesel Engine Reference Book" – Second edition - SAE International.
2. Julian Happian-Smith - "An Introduction to Modern Vehicle Design"- Butterworth- Heinemann,2004.
3. 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.

COURSE OUTCOME:

- CO – 1: Compare with various cycles with actual cycles..
- CO – 2: Describe air standard cycle with actual cycle
- CO – 3: Familiar with combustion reactions and stoichiometry.
- CO – 4: Understand premixed and diffusion combustion in SI and CI engines.
- CO – 5: Optimize the concepts of engine simulation governing equations.
- CO – 6: Describe simulation of various engine processes for SI and CI engines.
- CO – 7: Evaluate performance and emission characteristics of engines
- CO – 8: Understand the various operation of engines
- CO – 9: Apply appropriate electronic system in engine to needs.
- CO – 10: Describe closed loop control of engine parameters

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**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 – Macmillan – 1992.

COURSE OBJECTIVE:

- To develop an understanding of computer-integrated manufacturing (CIM) and its impact on productivity, product cost, and quality.
- To obtain an overview of computer technologies including computers, database and data collection, networks, machine control, etc, as they apply to factory management and factory floor operations.

COURSE OUTCOME:

- CO-1: Define the CAD systems and graphical modeling.
 CO-2: Acquainted with data bases and numerical analysis related to CIM
 CO-3: Describe the Computer Aided Manufacturing (CAM) systems
 CO-4: Describe the Computer Aided Process Planning (CAPP) Systems
 CO-5: Describe the Automated Material Handling Systems
 CO-6: Describe the effect of manufacturing automation strategies and derive production metrics.
 CO-7: Analyze automated flow lines and assembly systems, and balance the line.
 CO-8: Design the automated material handling and storage systems
 CO-9: Design the manufacturing cell and cellular manufacturing system.
 CO-10: Develop the CAPP systems for rotational and prismatic parts.

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

TEXT BOOK:

1. Mikell. P. Groover "Automation, Production Systems and Computer Integrated Manufacturing", Pearson Education 2001.

REFERENCES:

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

COURSE OBJECTIVE:

By completing this module, the student should be able to:

- Understand the main components of the hydraulic and pneumatic systems
- Design hydraulic and pneumatic circuits.
- Design and understand the electro-hydraulic and electro-pneumatic circuits

COURSE OUTCOME:

- CO-1: Explain the fundamental theoretical concepts governing fluid power
 CO-2: Describe the fundamental theoretical concepts governing fluid power
 CO-3: Ability to formulate the mathematical models of hydraulic and pneumatic circuits.
 CO-4: Identify the with common hydraulic and pneumatic components
 CO-5: Design and implement simple fluid power systems.
 CO-6: Familiar with the actual components and fluid power circuits.
 CO-7: Describe the working principle of pneumatic cylinders and motors.
 CO-8: Analyze the pneumatic circuits by considering the possible failures.
 CO-9: Describe the properties of hydraulic cylinders.
 CO-10: Identify the standard symbols, pumps, control valves, control assemblies, and actuators

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 tanden, 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

TEXT BOOKS:

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

REFERENCES:

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

COURSE OBJECTIVE :

- To understand and apply the basic thermodynamic principles of cogeneration concepts.
- To familiarize with the cogeneration technologies based on steam turbine, gas turbine and IC engine,
- To impart knowledge on the issues and applications of cogeneration technologies,.

COURSE OUTCOME:

- CO-1: Define the utilization of waste heat, second law and thermodynamic analysis of waste heat.
- CO-2: Identify the recovery of waste heat engines, Power plants and Heat pump for waste heat recovery.
- CO-3: Conclude the design of waste heat recovery system and Heat exchanger.
- CO-4: Resolve the theory, design and analysis of waste heat recovery systems and organic fluid systems
- CO-5: Evaluate the Cogeneration principles and thermodynamic power cycle analysis.
- CO-6: Derive the power generation and process heat in waste heat process.
- CO-7: Perform in Sugar mills and rice mills.
- CO-8: Assess in Engineering industries and textile factories.
- CO-9: Determine the Financial Considerations of Waste heat Recovery systems.
- CO-10: Recognize Cogeneration system and air quality consideration.

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**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.

COURSE OUTCOME:

- CO – 1: Describe the Fibers Matrix materials.
- CO – 2: Explain the applications of Matrix materials.
- CO – 3: Describe the strain Plane stress.
- CO – 4: Explain the Moisture effects.
- CO – 5: Define the continuum mechanics.
- CO – 6: Describe the properties of micromechanics.
- CO – 7: Describe the properties in plane stress.
- CO – 8: Explain the average stress-strain properties.
- CO – 9: Familiar with the Compressive failure system.
- CO – 10: Explain the effective stiffness of shafts.

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**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 enable the students to understand the various discretization methods and solving methodologies.
- To create confidence to solve complex problems in the field of heat transfer and fluid dynamics

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 recognize the type of fluid flow

CO-4: Ability to describe various flow features

CO-5: Ability to simplify a real fluid-flow system into a simplified model problem

CO-6: Ability to communicate the results of this detailed fluid-flow study.

CO-7: Define and setup flow problem properly within CFD context.

CO-8: Explain the solution of aerodynamic flows

CO-9: Describe the mathematical properties of governing Navier-Stokes equations

CO-10: Use CFD software to model relevant engineering flow problems.

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

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.

COURSE OBJECTIVE:

- To learn the available manufacturing process based on quality/time/cost/ mechanical properties.

COURSE OUTCOME:

- CO – 1: Summarize the production methods of engine components chassis components
- CO – 2: Describe the automotive engine and chassis components.
- CO – 3: Explain the different types of forming process used in various automobiles.
- CO – 4: Identify the various extrusion process.
- CO – 5: Describe the different types of gear manufacturing process.
- CO – 6: Teach the detail procedure of gear lapping, gear honing and gear broaching methods.
- CO – 7: Visualize how to write the CNC programming for various machining process.
- CO – 8: Describe the feedback devices and part programming.
- CO – 9: Describe the recent trends in manufacturing of auto components.
- CO – 10: Identify the plasma spray coated engine for various applications.

UNIT I POWDER METALLURGY

9

Process flow chart – production of metal powers and their raw materials – Manufacture offriction 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: Basicprocess steps, extrusion of transmission shaft, steering worm blanks, brake anchor pins, rear axledrive shaft, axle housing spindles, piston pin and valve tappets. Hydro forming: Process, hydroforming of manifold and comparison with conventional methods – Hydro forming of tail lamphousing stretch forming – process, stretch forming of auto body panels – super plastic alloys forauto body panels.

UNIT III GEAR MANUFACTURING

9

Different methods of gear manufacture – Gear hobbig and gear shaping machines specifications– gear generation – different methods – gear finishing and shaving – Grinding and lapping ofhobs 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 linersfor engine blocks – Plasma spray coated engine blacks and valves – Recent developments in autobody panel forming – Squeeze casting of pistons – aluminum composite brake rotors.

TOTAL: 45 Hours

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 introduce source of noise and vibration
- To broaden the understanding of sound measurement and human sensitivity
- To underline the importance of simulation, anechoic chamber and acoustic holography
- To broaden the importance of statistical and frequency analysis 5. To introduce active control techniques

COURSE OUTCOME:

- CO – 1: Describe the sources, effects, prediction, control techniques, measurement techniques of noise,
 CO – 2: Identify the methods of vibration and noise measurement.
 CO – 3: Compare the effect of noise an human comfort and environment
 CO – 4: Identify the sources of noise and vibration, measure sound intensity
 CO – 5: Infer the knowledge about noise prediction and control.
 CO – 6: Describe the concept of mufflers, tire/road noise.
 CO – 7: Describe the interior transportation noise and vibration sources.
 CO – 8: Analyze the vibration prediction and control.
 CO – 9: Describe the various noise and vibration measurements.
 CO – 10: Compare the calibration of measurement.

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

TEXT BOOKS:

1. Clarence W. de Silva ,“Vibration Monitoring, Testing, and Instrumentation “,CRC Press, 2009
2. David A.Bies and Colin H.Hansen “Engineering Noise Control: Theory and Practice “Spon Pres, London, 2009

REFERENCES:

1. Alan G. Piersol ,Thomas L. Paez “Haris’ Shock and Vibration Handbok” , McGraw-Hil ,New Delhi, 2010
2. Colin H Hansen “Understanding Active Noise Cancelation“ ,Spon Pres ,London 2003
3. Mathew Harison “Vehicle Refinement: Controlling Noise and Vibration in Road Vehicles “, Elsevier Buterworth-Heineman, Burlington, 2004

COURSE OBJECTIVE :

- To study the Metrology & Instrumentation,
- To understand the accurate and precise.

COURSE OUTCOME:

- CO – 1: Clearly explain the Calibration methods.
- CO – 2: Familiar with the first and second order transducers.
- CO –3: Describe the Strain gauges.
- CO – 4: Define the EI pickup and LVDT.
- CO – 5: Predict the Variable air gap type.
- CO – 6: Describe the different sensor
- CO – 7: Explain the automotive applications of sensor.
- CO – 8: Describe the concept of stress and Angle measuring torque sensor.
- CO – 9: Clearly explain the Integrated Hal IC's.

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- Piezoresistive 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, Magnetostrictive, Hall Effect, semiconductor sensor- digital transducers- Humidity Sensor. Rain sensor, climatic condition sensor, solar, light sensor, anti-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-duct 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 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- 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

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. Neupert 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.

COURSE OUTCOME:

- CO – 1: Describe the basic principle and production methods of automotive components.
- CO – 2: Summarize the knowledge on basic principle of powder metallurgy manufacturing process.
- CO – 3: Teach the knowledge in detail about hydro forming.
- CO – 4: Research on forming process in which various automotive components, manufacturing process.
- CO – 5: Analyze the casting and machining process in which various automotive components manufacturing
- CO – 6: Describe the knowledge on stretch forming.
- CO – 7: Illustrate the various gear manufacturing process.
- CO – 8: Classify the knowledge about gear finishing and inspection.
- CO – 9: Illustrate the powder injection moulding.
- CO – 10: Identify recent trends in automotive manufacturing process.

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

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, NewYork, 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 introduction to Battery Technology for Hybrid Electric Vehicles.
- To Familiarize with the basic electrochemistry that occurs in batteries.
- To Impart knowledge on the batteries that are used as energy storage

COURSE OUTCOME:

- CO-1: Justify Electric & hybrid vehicles, Solar Powered and fuel cells vehicles.
- CO-2: Define Flexible fuel vehicles and Magnetic track vehicles.
- CO-3: State Hybrid vehicle, Learn burn Engine, VCR, HCCI, and Hydrogen Engines.
- CO-4: Illustrate High Energy and Power density batteries, Solar Panels and Flexible Fuel systems.
- CO-5: Explain Computer control for Pollution & noise Control for Fuel Economy.
- CO-6: Determine Information Technology for receiving proper Information like optimum speed and direction.
- CO-7: Describe Maintenance of proper road and National Highway network with automated roads.
- CO- 8: Explain Satellite control of vehicle operation for safe, GPS and fast ravel.
- CO- 9: Criticize closed loop, Compensated ,types of Suspension and Braking system.
- CO- 10: State aerodynamics, safety system and its standards for modern vehicles.

UNIT I INTRODUCTION**9**

Electric and hybrid vehicles, flexible fuel vehicles (FFV), solar powered vehicles, magnetic trackvehicles, fuel cells vehicles.

UNIT II POWER SYSTRM AND NEW GENERATION VEHICLES**9**

Hybrid Vehicle engines, Stratified charge engines, learn burn engines, low heat rejection engines,hydrogen engines, HCCI engine, VCR engine, surface ignition engines, VVTI engines. High energyand 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 optimumsped and direction.

UNIT IV VEHICLE AUTOMATED TRACKS**9**

Preparation and maintenance of proper road network - National highway network with automatedroads 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 modernvehicles, safety systems, materials and standards.

TOTAL: 45 Hours**TEXT BOOKS:**

1. Heinz, "Modern Vehicle Technology" Second Edition,BU.
2. Bosch Hand Bok, SAE Publication, 2000.

REFERENCES:

1. Light weight electric for hybrid vehicle design.
2. Advance hybrid vehicle power transmission, SAE.
3. Noise reduction, Branek L.L., McGraw Hill Bok company, New York, 1993.

COURSE OBJECTIVE :

- To understand the fabrication, analysis and design of composite materials.
- To familiarize with different structures of composite materials.

COURSE OUTCOME:

CO – 1: Explain the fundamentals of composites.

CO – 2: Describe the fibre reinforced composites.

CO –3: Familiar with the thermoplastic resins.

CO – 4: Describe the resin transfer moulding.

CO – 5: Explain the Metal matrix composites Alloy.

CO – 6: Describe the diffusion bonding.

CO – 7: Describe study of engineering ceramic materials

CO – 8: Familiar with the Cold isostatic pressing.

CO – 9: Clearly explain the carbon matrix.

CO – 10: Familiar with the aerospace applications

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**TEXT BOOKS:**

1. Mathews F.L. and Rawlings R.D., “Composite materials: Engineering and Science”, Chapman and Hall, London, England, 1st edition, 1994.
2. Chawla K.K., “Composite materials”, Springer – Verlag, 1987

REFERENCES:

1. Clyne T.W. and Withers P.J., “Introduction to Metal Matrix Composites”, Cambridge University Press, 1993.
2. Strong A.B., “Fundamentals of Composite Manufacturing”, SME, 1989.
3. Sharma S.C., “Composite materials”, Narosa Publications, 2000.
4. “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.

COURSE OUTCOME:

- CO – 1: List and explain the air conditioning components.
- CO – 2: Describe the pressure regulator & temperature regulator.
- CO –3: Familiar with the manually controlled air conditioner.
- CO – 4: Clearly explain the air conditioning protection.
- CO – 5: Familiar with the handling refrigerants & diagnostic procedure.
- CO – 6: Describe the ambient conditions affecting system pressures.
- CO – 7: Explain the automatic temperature control.
- CO – 8: Familiar with the vacuum reserve.
- CO – 9: Clearly explain the air conditioner maintenance and service.
- CO – 10: Explain the concept of air controlling system.

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**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
- To gain proficiency in the development of required views of the final design.

COURSE OUTCOME

CO-1: Explain the basics of Jigs and fixtures.

CO-2: Describe the Location of clamping.

CO-3: Comprehend the mounting of Jigs and Fixtures on machine tool.

CO-4: Explain the different types of Fixtures and Gauges

CO-5: Explain the constructional features and working principles of jigs and fixture

CO-6: Explain the construction and working principles of different types of press and press tools

CO-7: Describe the Manufacture and assemble of different press tools

CO-8: Select the locating and clamping devices for given component.

CO-9: Ability to classify and explain various press tools and press tools operations.

CO-10: Interpret designation system of cutting tool and tool holder.

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

TEXT BOOKS

1. Joshi, P.H. "Jigs and Fixtures", Second Edition, Tata McGraw Hill Publishing Co., Ltd., New Delhi, 2004.
2. Donaldson, Lecain and Goold "Tool Design", III rd Edition Tata McGraw Hill, 2000.

REFERENCES:

1. K. Venkataraman, "Design of Jigs Fixtures & Press Tools", Tata McGraw Hill, NewDelhi, 2005. Kempster, "Jigs and Fixture Design", Hoddes and Stoughton – ThirdEdition 1974.
2. Joshi, P.H. "Press Tools" – Design and Construction", Wheels publishing, 1996.
3. Hoffman "Jigs and Fixture Design" – Thomson Delmar Learning, Singapore, 2004.
4. ASTM Fundamentals of Tool Design Prentice Hall of India.
5. 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

COURSE OUTCOME

CO-1: Classify the robots based on joints and arm configurations.

CO-2: Design the application of specific End Effectors for robots.

CO-3: Compute forward and inverse kinematics of robots and determine trajectory plan.

CO-4: Program robot to perform typical tasks including Pick and Place, Stacking and Welding.

CO-5: Design and select robots for Industrial and Non-Industrial applications.

CO-6: Describe the automation and brief history of robot and applications.

CO-7: Familiar with the kinematic motions of robot.

CO-8: Gain knowledge about robot end effectors and their design concepts.

CO-9: Describe the Programming methods & various Languages of robots.

CO-10: Explain the principles of various Sensors and their applications in robots

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, Payload – 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 Servicing 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 2 Dimensional), 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

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 understand the need for supercharging and the various types of superchargers used .
- To Familiarize the Design of components.
- To Impart knowledge on the Performance characteristics and the scavenging methods for two stroke engines.

COURSE OUTCOME:

- CO-1: Describe the effects on Engine performance and Engine modification.
 CO-2: Justify the Mechanical Supercharging and Turbocharging
 CO-3: State the types of compressors, blowers and its Performance Characteristics Curves.
 CO-4: Illustrate the Surging, Matching of supercharger, Compressor, Turbine and Engine.
 CO-5: Define the peculiarities of two stroke Engines, and its Scavenging and Charging process.
 CO-6: Explain Scavenging modeling, Perfect mixing and Complex scavenging models.
 CO-7: Classify porting and design considerations of ports.
 CO-8: Evaluate the design of Intake and Exhaust systems.
 CO-9: Determine the Experimental techniques for evaluating scavenging and Engine Firing test.
 CO-10: Criticize the Port Flow Characteristics and Orbital Engine combustion system.

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**TEXT BOOKS:**

1. Watson, N. and Janota, M.S., Turbocharging the I.C. Engine, MacMillan Co., 1982.
2. John B. Heywood, Two Stroke Cycle Engine, SAE Publications, 1997.

REFERENCES:

1. Obert, E.F., Internal Combustion Engines and Air Pollution, Intext Educational Publishers, 1980.
2. Richard Stone, Internal Combustion Engines, SAE, 1992.
3. Vincent, E.T., Supercharging the I.C. Engines, McGraw-Hill. 1943
4. Schweitzer, P.H., Scavenging of Two Stroke Cycle Diesel Engine, MacMillan Co., 1956

COURSE OBJECTIVE :

- To understand the various off road vehicles and their systems and features.
- To familiarize with the earth moving machines scrappers, graders, shovels and ditchers.
- To familiarize with the farm equipments, military and combat vehicles.

COURSE OUTCOME:

CO – 1: Sketch the Construction layout of off road vehicles.

CO – 2: Discuss the Multi axle vehicles.

CO – 3: Compare the single bucket, Multi bucket and rotary type's earth moving machines.

CO – 4: Analyze the power and capacity of earth moving machines.

CO – 5: Familiarize the self powered scrappers and graders.

CO – 6: Estimate the capacity of shovels.

CO – 7: List the Farm equipments, military and combat vehicles.

CO – 8: Describe the constructional details of tankers, gun carriers and transport vehicles

CO – 9: Explain the Power steering system.

CO – 10: Evaluate the Design aspects on dumper body, loader bucket and water tank of sprinkler.

UNIT I CLASSIFICATION AND REQUIREMENTS OF OFF ROAD VEHICLES**6**

Construction layout, capacity and applications. Power Plants, Chassis and Transmission, Multi axle vehicles.

UNIT II EARTH MOVING MACHINES**10**

Earthmovers like dumpers, loaders - single bucket, Multi bucket and rotary types -bulldozers, excavators, backhoe loaders, scrappers, drag and self powered types, Bushcutters, stumpers, tree dozer, rippers etc. – Power and capacity of earth moving machines.

UNITY III SCRAPPERS,GRADERS, SHOVELS AND DITCHERS**10**

Scrappers, elevating graders, motor graders, self powered scrappers and graders, Power shovel, revolving and stripper shovels – drag lines – ditchers – capacity of shovels.

UNIT IV FARM EQUIPMENTS, MILITARY AND COMBAT VEHICLES**8**

Power take off, special implements. Special features and constructional details of tankers, gun carriers and transport vehicles.

UNIT V VEHICLE SYSTEMS,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. Kinematics for loader and bulldozer operational linkages. Safety features, safe warning system for dumper. Design aspects on dumper body, loader bucket and water tank of sprinkler.

TOTAL: 45 Hours

TEXT BOOKS:

1. Robert L Peurifoy, "Construction, planning, equipment and methods" TataMcGrawel Hill Publishing company Ltd.
2. Nakra C.P., "Farm machines and equipments" Dhanparai Publishing company Pvt. Ltd.
3. Abrosimov.K. Bran berg.A and Katayer.K., Road making machinery, MIRPublishers, Moscow, 1971.
4. SAE Handboob Vol. III. Wong.J.T., Theory of Ground Vehicles", John Wiley & Sons, New York, 1987.

REFERENCES:

1. Off the road wheeled and combined traction devices – Ashgate Publishing Co. Ltd.1988.
2. Schulz Erich.J, Diesel equipment I & II, Mcgraw Hill company, London.
3. Bart H Vanderveen, Tanks and Transport vehicles, Frederic Warne and Co Ltd.,London.
4. Satyanarayana. B., Construction planning and equipment, standard publishers and distributors, New Delhi.

COURSE OBJECTIVE :

- To study about the safety system.
- To understand the safety aspects including safety equipments.

COURSE OUTCOME:

- CO – 1: Explain the concept of energy equation.
- CO – 2: Describe the passenger safety, crumple zone and crash testing.
- CO – 3: Familiar with the concepts of safety.
- CO – 4: Define the speed and acceleration system.
- CO – 5: Describe the various safety equipments.
- CO – 6: Describe the electronic system for activating air bags.
- CO – 7: Familiar with the various Collision warning system.
- CO – 8: Explain the object detection system with braking system interactions.
- CO – 9: Describe Steering adjustment system.
- CO – 10: Explain the different types of sensor system.

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**TEXT BOOKS:**

1. Bosch - "Automotive Handbook" - 5th edition - SAE publication - 2000.
2. J.Powloski - "Vehicle Body Engineering" - Business books limited, London - 1969.

REFERENCE

1. Ronald.K.Jurgen - "Automotive Electronics Handbook" - Second edition- McGraw-Hill Inc., - 1999.

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 OBJECTIVE:

- To understand the basic principles of engines used in automobiles

COURSE OUTCOME

- CO – 1: Describe SI and CI engine system application in automobiles.
- CO – 2 : Understand the construction and operation of engines
- CO – 3 : Grasp the fuel systems in engines
- CO – 4 : Describe various types of fuel injection systems
- CO – 5 : Understand various types of combustion chamber in SI and CI engines
- CO – 6: Importance of Swirl, squish and turbulence.
- CO – 7 : Familiar with supercharging, Turbo charging and Engine Testing
- CO – 8 : Analyze the various engine efficiency
- CO – 9 : Importance of cooling and its types
- CO – 10 : Importance of Lubrication and its types

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 fourstroke 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 venturi 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, wastegate, 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**TEXT BOOKS:**

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

COURSE OBJECTIVE :

- To understand the vehicle constructional details, materials and testing methods.
- To familiarize with various systems like steering, suspension, braking and drive lines.
- To impart knowledge on problem solving in steering, suspension, braking and drive line systems.

COURSE OUTCOME:

- CO – 1: Clearly explain the vehicle layout and drives.
- CO – 2: Describe the vehicle frames and its materials.
- CO –3: Well versed with the steering geometry and front axle.
- CO – 4: Understand the steering system and its components.
- CO – 5: Familiar with the driveline system components and its working.
- CO – 6: Describe the rear axle and it types, differential and its construction details.
- CO – 7: Clearly explain the concept of various types of braking system and its components.
- CO – 8: Understand the concept of exhaust and power assisted braking system.
- CO – 9: Clearly understand suspension systems and its components.
- CO – 10: Well versed with wheels and tyres.

UNIT I INTRODUCTION**9**

Layout with reference to power plant, steering location and drive, frames, Frameless constructional details, materials, testing of frames, integral body construction.

UNIT II FRONT AXLE STEERING SYSTEM**9**

Front axle type, rigid axle and split axle, Constructional Details, Materials, Front wheel geometry viz., camber, castor, kingpin inclination, toe-in and toe-out. Condition for true rolling motion of road wheels during steering. Steering geometry. Ackermann and Davis steering. Construction details of steering linkages. Different types of steering gear box. Steering linkages layout for conventional and independent suspensions. Turning radius, instantaneous centre, wheel wobble and shimmy. Over-steer and under-steer. Power and power assisted steering

UNIT III DRIVE LINE STUDY**9**

Effect of driving thrust and torque –reaction. Hotchkiss drives. Torque tube drive, radius rods. Propellershaft. Universal joints. Final drive- different types. Two speed rear axle. Rear axle construction-full floating, three quarter floating and semi-floating arrangements. Differential-conventional type, Non-slip type, Differential locks and differential housing.

UNIT IV BRAKING SYSTEM**9**

Type of brakes, Principles of shoe brakes. Constructional details – materials, braking torque developed by leading and trailing shoes. Disc brake, drum brake theory, constructional details, advantages, Brake actuating systems. Factors affecting brake performance, Exhaust brakes, power and power assisted brakes. Testing of brakes.

UNIT V SUSPENSION SYSTEMS**9**

Types of suspension, Factors influencing ride comfort, Types of suspension springs- independent suspension- front and rear. Rubber, pneumatic, hydro- elastic suspension. Shock absorbers. Types of wheels. Construction of wheel assembly. Types of tyres and constructional details. Static and rolling properties of pneumatic tyres, tubeless tyres and aspect ratio of tubed tyres.

TEXT BOOKS:

1. K. Newton, W.Steeds and T.K.Garret, "The Motor Vehicle", 13th 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.

COURSE OUTCOME

CO-1: Ability to solve conduction, convection and radiation problems

CO-2: Ability to design and analyze the performance of heat exchangers

CO-3: Ability to design and analyze reactor heating and cooling systems

CO-4: Explain the phenomenological origin of Fourier's law

CO-5: Analyze extended surfaces (fins and fin arrays).

CO-6; Describe the physical phenomena associated with convection;

CO-7: Analyze external and internal, forced and free convection problems.

CO-8: Explain the physical mechanisms involved in radiation heat transfer.

CO-9: Analyze the radiative heat exchange between surfaces and in diffuse, gray enclosures.

CO-10: Analyze diffusional processes and calculate the flux in a diffusion process.

(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

Note: (Use of standard heat and mass transfer data book is permitted in the University examination)

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 :

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

COURSE OUTCOME:

CO – 1: Clearly explain the Constitution of alloys.

CO – 2: List the Classification of steel and cast Iron microstructure.

CO –3: Well versed with the Isothermal transformation diagrams.

CO – 4: Classify flame and Induction hardening.

CO – 5: Represent the criteria of selecting materials for automotive components.

CO – 6: Describe the selection of materials for connecting rod, crank shaft, crank case, cam, cam shaft, etc.

CO – 7: Discuss the types of polymer, properties and applications.

CO – 8: Differentiate the fibre and particulate reinforced composites.

CO – 9: Demonstrate the testing of materials under tension, compression and shear loads.

CO – 10: Illustrate the hardness tests (Brinell, Vickers and Rockwell) and Impact test.

Review (Not for Exam):

Crystal structure – BCC, FCC and HCP structure – unit cell – crystallographic planes and directions, miller indices – crystal imperfections, point, line, planar and volume defects – Grain size, ASTM grain size number.

UNIT I CONSTITUTION OF ALLOYS AND PHASE DIAGRAMS**10**

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

UNIT II HEAT TREATMENT**11**

Definition – Full annealing, stress relief, recrystallisation and spheroidizing – normalizing, 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.

UNIT III SELECTION OF MATERIALS**9**

Criteria of selecting materials for automotive components viz cylinder block, Cylinder head, piston, piston ring, Gudgeon pin, connecting rod, crank shaft, crank case, cam, cam shaft, engine valve, gear wheel, clutch plate, axle, bearings, chassis, spring, body panel, radiator, brake lining etc.

UNIT IV NON-METALLIC MATERIALS**9**

Polymers – types of polymer, commodity and engineering polymers – Properties and applications of PE, 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 Al₂O₃, SiC, Si₃N₄, PSZ and Sialon – Fibre and particulate reinforced composites.

UNIT V MECHANICAL PROPERTIES AND TESTING**6**

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

Total: 45 Hours**TEXT BOOK:**

1. Kenneth G. Budinski and Michael K. Budinski "Engineering Materials" Prentice-Hall of India Private Limited, 4th Indian Reprint 2002.

REFERENCES:

1. William D. Callister "Material Science and Engineering", John Wiley and Sons 1997.
2. Raghavan. V. Materials Science and Engineering, Prentice Hall of India Pvt. Ltd., 1999
3. Sydney H. Avner "Introduction to Physical Metallurgy" McGraw-Hill Book Company, 1994

COURSE OBJECTIVE:

- At the end, the student will have good exposure to Automotive safety aspects including safety equipments.

COURSE OUTCOME:

- CO – 1: Well versed with the concept of energy equation.
- CO – 2: Clearly explain the passenger safety, crumple zone and crash testing.
- CO – 3: Familiarize the concepts of safety.
- CO – 4: Clearly explain the speed and acceleration system.
- CO – 5: Familiarize the safety equipments.
- CO – 6: Clearly explain the electronic system for activating air bags.
- CO – 7: Well versed with the various Collision warning system.
- CO – 8: Clearly explain the object detection system with braking system interactions.
- CO – 9: Well versed with Steering adjustment system.
- CO – 10: Clearly explain the different types of sensor system.

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 behaviour of vehicle body, speed and acceleration characteristics of passenger compartment on impact.

UNIT III SAFETY EQUIPMENTS**9**

Seat belt, regulations, automatic seat belt tightener 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**TEXT BOOK:**

1. Bosch - "Automotive Handbook" - 5th edition - SAE publication - 2000.

REFERENCES:

1. J.Powloski - "Vehicle Body Engineering" - Business books limited, London - 1969.
2. Ronald.K.Jurgen - "Automotive Electronics Handbook" - Second edition- McGraw-Hill Inc., - 1999.

COURSE OBJECTIVE :

- To impart knowledge of the Engine components.
- To familiarize the design concept of engine & component function.
- To study the principles are familiarized for design of components.

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.
 CO – 10: Analyze the different types of Cam profile generation

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 crankarms. 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

Note: (Use of P S G Design Data Book is permitted in the University examination)

TEXT BOOK:

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

REFERENCES:

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

COURSE OBJECTIVE

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

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.

CO-9: Demonstrate the proper use of a digital multimeter (DMM) during diagnosis of electrical circuit problems,

CO-10: Perform fundamental electrical tests.

UNIT I BATTERIES AND ACCESSORIES**9**

Principle and construction of lead acid battery, characteristics of battery, rating capacity and efficiency of batteries, various tests on batteries, maintenance and charging. Lighting system: insulated and earth return system, details of head light and side light, LED lighting system, head light dazzling and preventive methods – Horn, wiper system and trafficator.

UNIT II STARTING SYSTEM**9**

Condition at starting, behavior of starter during starting, series motor and its characteristics, principle and construction of starter motor, working of different starter drive units, care and maintenances of starter motor, starter switches.

UNIT III CHARGING SYSTEM**9**

Generation of direct current, shunt generator characteristics, armature reaction, third brush regulation, cutout, Voltage and current regulators, compensated voltage regulator, alternators principle and constructional aspects and bridge rectifiers, new developments.

UNIT IV FUNDAMENTALS OF AUTOMOTIVE ELECTRONICS**9**

Current trends in automotive electronic engine management system, electromagnetic interference suppression, electromagnetic compatibility, electronic dashboard instruments, onboarddiagnostic system, security and warning system.

UNIT V SENSORS AND ACTIVATORS**9**

Types of sensors: sensor for speed, throttle position, exhaust oxygen level, manifold pressure, crankshaft position, coolant temperature, exhaust temperature, air mass flow for engine application. Solenoids, stepper motors, relay.

Total: 45 Hours

TEXT BOOKS:

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

REFERENCES:

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

SYLLABUS GENERIC ELECTIVE COURSES

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

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

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**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 enable the students to study the evolution of Management, to study the functions and principles of management and to learn the application of the principles in an organization.
- To enable the students 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.

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

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

TEXT BOOKS:

1. Stephen P. Robbins and Mary Coulter, 'Management', Prentice Hall of India, 8th edition.
2. Charles W L Hill, Steven L McShane, 'Principles of Management', McGraw Hill Education, Special Indian Edition, 2007.
3. Mike W. Martin and Roland Schinzinger, "Ethics in Engineering", Tata McGraw Hill, New Delhi, 2003.

REFERENCES:

1. Hellriegel, Slocum & Jackson, ' Management - A Competency Based Approach', Thomson South Western, 10th edition, 2007.
2. Harold Koontz, Heinz Weihrich and Mark V Cannice, 'Management - A global & Entrepreneurial Perspective', Tata McGraw Hill, 12th edition, 2007.
3. Andrew J. Dubrin, 'Essentials of Management', Thomson Southwestern, 7th edition, 2007.
4. Charles B. Fleddermann, "Engineering Ethics", Pearson Prentice Hall, New Jersey, 2004.
5. John R Boatright, "Ethics and the Conduct of Business", Pearson Education, New Delhi, 2003

COURSE OBJECTIVE:

- To facilitate the understanding of Quality Management principles and process.

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.

UNIT I	INTRODUCTION	9
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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
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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 – PDSA cycle, 5s, Kaizen - Supplier partnership – Partnering, Supplier selection, Supplier Rating.

UNIT III	TQM TOOLS & TECHNIQUES I	9
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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
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Quality circles – Quality Function Deployment (QFD) – Taguchi quality loss function – TPM – Concepts, improvement needs – Cost of Quality – Performance measures.

UNIT V	QUALITY SYSTEMS	9
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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

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", 6th Edition, South-Western (Thomson Learning), 2005.
- Oakland, J.S. "TQM – Text with Cases", Butterworth – Heinemann Ltd., Oxford, 3rd Edition, 2003.
- 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. Pugazhenthir, 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

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

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, mean 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

TEXT BOOKS:

- Douglas.C.Montgomery, "Introduction to Statistical quality control", John wiley, 4th 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.
- Gupta R.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.

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

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**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.

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 queuing models, systems and structures.

CO-5: Describe the decision models and game theory

UNIT I LINEAR MODELS**9**

The phase of an operation research study – Linear programming – Graphical method– Simplexalgorithm – 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 – Stochasticinventory 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 multiserver 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- Algebraicsolution– Linear Programming solution – Replacement models – Models based on service life –Economic life– Single / Multi variable search technique – Dynamic Programming – Simple Problem.

TOTAL: 45 Hours**TEXT BOOK:**

- Taha H.A., "Operations Research", Sixth Edition, Prentice Hall of India, 2003.

REFERENCES:

- Shennoy 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 Libeberman, "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.

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

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: 45Hours**TEXT BOOKS:**

- MurphyW.R. and McKAYG., "Energy Management, Butterworths, London, 1982.
- TrivediP.R.,JulkaB.R., "Energy Management",Common wealth publishers, 1997.

REFERENCES:

- David Merick, Richard Marshal, "Energy, present and future options", Vol. I and II, John Wiley and Sons, 1981.
- Chaigier N.A. "Energy Consumption and Environment ", McGraw-Hill, 1981.
- Ikken P.A. Swart R.J and Zwerves.S, "Climate and Energy ", 1989.
- Ray D.A. "Industrial Energy Conservation ", Pergamaon Press, 1980.

COURSE OBJECTIVE:

- To be familiar with the basic entrepreneurial skills and understanding to run a business efficiently.

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.

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**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" 2nd 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.

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

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**TEXT BOOKS:**

- Mukhopadhyaya 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.

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

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

TEXT BOOKS:

1. Ralph S. Alexander, James S. Cross, Richard M. Hill, "Industrial Marketing", Homewood, 1967.
2. RajendraNargundkar, "Marketing Research", Tata McGraw Hill, 2008.

REFERENCES:

1. Robert R. Reeder; Edward G. Brierty; Betty H. Reeder, "Industrial Marketing – Analysis, Planning and Control",Prentice Hall, 1991.
2. GhoshPK,"Industrial Marketing", Oxford University Press, India.
3. RamanujMajumdar,"Marketing Research-Text, Applications and Case Studies".
4. Donald R.Cooper, "Business research Methods", McGraw-Hill, 2005.

**SYLLABUS
SKILL ENHANCEMENT ELECTIVE
COURSES**

COURSE OBJECTIVE:

- To develop the soft skills, soft skills in action, self awareness, self esteem and self motivation

COURSE OUTCOME:

CO-1: Develop the soft skills

CO-2: Develop the soft skills in action

CO-3: Familiar with the self awareness

CO-4: Familiar with the self esteem

CO-5: Familiar with the self motivation

UNIT I	SOFT SKILLS I	6
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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
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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
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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
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Definitions-Components of self awareness-Developing Self awareness-Self esteem-meaning-Steps to improve self esteem

UNIT V	SELF MOTIVATION	6
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Motivation –Meaning-Techniques of self motivation-Motivation & goal setting – Motivation and emotion – Motivation at work.

Total: 30 Hours

REFERENCES:

- Personality Development And Soft Skills---Barun K Mitra, Oxford Publication
- Seven habits of Hightly Effective people – Stephen R. Covey
- Emotion, motivation and Self regulation - Nathan C. Hall , McGill University, Canada, Thomas Goetz, University of Konstanz, Germany
- <http://www.emeraldgroupublishing.com/>
- Psychology of Selfesteem – Nathaniel Branden, Nash (1st edition), Jossey-Bass (32nd anniversary edition)

COURSE OBJECTIVE:

- To develop the verbal aptitude, soft skills, time management and team building

COURSE OUTCOME:

CO-1: Develop the verbal aptitude skills

CO-2: Develop the soft skills

CO-3: Familiar with the time management skills

CO-4: Acquire knowledge on team building

UNIT I	VERBAL APPTITUDE I	6
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Phonetics/Neutral Accent/Pronunciation – Speech Mechanism/Mouth & Face Exercise – Vowels & Consonants – Sounds – Syllable and Syllable Stress/ Word Stress – Sentence Stress & Intonation – Articulation Exercise – Rate of Speech / Flow of Speech / Idiomatic Phrases.

UNIT II	VERBAL APTITUDE II	6
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Singular/plural-present tense/past tense—genders - Prepositions-conjunctions-Choice of words—simple sentences—compound sentences- summarising phrases—Synonyms—Antonyms—Analogies—Similar Words

UNIT III	SOFT SKILLS IV	6
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Attitude—Meaning- Features of attitude-Formation-Personality Factors-Types of attitude-change in attitude-Developing Positive attitude.

UNIT IV	TIME MANAGEMENT	6
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Definition –Meaning-Importance, Value of time as an important resource- comparison of Time and Money-Circle of influence and circle of control—Definition of URGENT and IMPORTANT—Time Wasters and how to reduce—Procrastination—meaning and impact- 4 Quadrants.

UNIT V	TEAM BUILDING	6
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Meaning—Aspects of team building—Process of team building—Types of Teams-Team ethics and Understanding-Team trust and commitment

TOTAL: 30 Hours

REFERENCES:

- Managing Soft Skills And Personality--B N GhoshMcgraw Hill Publications
- Principles and Practices of Management Shejwalkar and Ghanekar McGraw Hill Latest
- Time management for Busy people – Roberta roesch, TatamcGraw-Hill Edition
- Personality Development --Dr V M Selvaraj, Bhavani Publications

COURSE OBJECTIVE:

- To develop the soft, communication and presentation skills and familiar with the change management

COURSE OUTCOME:

CO-1: Develop the soft skills

CO-2: Develop the communication skills

CO-3: Develop the presentation skills

CO-4: Familiar with the change management

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:**

- Helping employees embrace change - LaClair, J. and Rao, R. Helping Employees Embrace Change, McKinsey Quarterly, 2002, Number 4.
- Who Moved My Cheese by Spencer Johnson published by Vermilion first edition
- Effective Communication. Adair, John. London: Pan Macmillan Ltd., 2003.
- Business Communication Today: Bovee, Courtland L, John V. Thill & Barbara E. Schatzman.Tenth Edition. New Jersey: Prentice Hall, 2010.

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NSS – I

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COURSE OBJECTIVE:

- To be familiar with the concept of NSS, NSS programs and activities, understanding youth community mobilization and volunteerism

COURSE OUTCOME:

CO-1: Familiar with the concept of NSS

CO-2: Familiar with the NSS programs and activities

CO-3: Acquire knowledge on understanding the youth

CO-4: Organize the community mobilization

CO-5: Familiar with the volunteerism and shramdan

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

COURSE OBJECTIVE:

- To be familiar with the importance and role of youth leadership, life competencies, social harmony and national integration and youth development programmes in india

COURSE OUTCOME:

CO-1: Familiar with the importance and role of youth leadership

CO-2: Familiar with the life competencies

CO-3: Acquire knowledge on harmony and national integration

CO-4: Organize the youth development programmes in india

UNIT I	IMPORTANCE AND ROLE OF YOUTH LEADERSHIP	7
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Meaning and types of leadership-Qualities of good leaders; traits of leadership- Importance and role of youth leadership

UNIT II	LIFE COMPETENCIES	7
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Definition and importance of life competencies-Communication- Inter personal- Problem solving and decision-making

UNIT III	SOCIAL HARMONY AND NATIONAL INTEGRATION	8
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Indian history and culture-Role of youth in peace-building and conflict resolution- Role of youth in Nation building

UNIT IV	YOUTH DEVELOPMENT PROGRAMMES IN INDIA	8
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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

COURSE OBJECTIVE:

- To acquire knowledge on citizenship, family and society, health, hygiene & sanitation youth health and yoga

COURSE OUTCOME:

CO-1: Familiar with the fundamental Rights and duties

CO-2: Familiar with the family and society

CO-3: Acquire knowledge on health, hygiene & sanitation

CO-4: Attain knowledge on youth health and yoga

UNIT I	CITIZENSHIP	6
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Basic features of constitution of India-Fundamental Rights and duties- Human rights- Consumer awareness and the legal rights of consumer- RTI

UNIT II	FAMILY AND SOCIETY	6
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Concept of family-community(PRIs and community-based organization) and society-Growing up in the family-dynamics and impact-Human values-Gender justice

UNIT III	HEALTH, HYGIENE & SANITATION	6
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Health Education Definition, needs and scope-Food and nutrition- Safe drinking water- water born diseases and sanitation(Swachh Bharath Abhiyan)-National Health Programme- Reproductive health

UNIT IV	YOUTH HEALTH	6
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Healthy Lifestyles-HIV AIDS, Drugs and substance abuse- Home nursing- First aid.

UNIT V	YOUTH AND YOGA	6
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Yoga: History, philosophy and concept-Myths and misconceptions about yoga- Different yoga traditions and their impact-Yoga as a preventive,promotive and curative method- Yoga as a tool for healthy lifestyle

Preparation of research project report.

TOTAL: 30 Hours

COURSE OBJECTIVE:

- To gain knowledge on environment issues, disaster management, project cycle management, documentation and reporting.

COURSE OUTCOME:

CO-1: Familiar with the environment issues

CO-2: Develop disaster management skills

CO-3: Acquire project cycle management skills

CO-4: Familiar with the documentation and reporting

UNIT I	ENVIRONMENT ISSUES	7
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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
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Introduction to Disaster management-classification of disasters-Role of youth in disaster management

UNIT III	PROJECT CYCLE MANAGEMENT	8
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Project planning-Project implementation- Project monitoring- Project evaluation-Impact Assessment

UNIT IV	DOCUMENTATION AND REPORTING	8
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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

COURSE OBJECTIVE:

- To gain knowledge on skill development, self defense, resource mobilization and life skills

COURSE OUTCOME:

CO-1: Develop the employability skills

CO-2: Develop the entrepreneurship skills

CO-3: Familiar with Factors influencing youth crime

UNIT I	VOCATIONAL SKILL DEVELOPMENT	15
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This unit will aim to enhance the employment potential of the NSS volunteers- alternately to help them to set up small business enterprises. For this purpose, a list of 12-15 vocational skills will be drawn up ,based on local conditions and opportunities - Each volunteer will have the option to select two skill-areas out of this list-one such skill in each semester-The education institution (or the university)will make arrangements for developing these skills in collaboration with established agencies that possess the necessary expertise in the related vocational skills.

UNIT II	ENTREPRENEURSHIP DEVELOPMENT	8
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Definitions & meaning- Qualities of good Entrepreneur- Steps/ways in opening an enterprise- Role of financial and support service Institutions.

UNIT III	YOUTH AND CRIME	7
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Sociological and Psychological Factors influencing youth crime- Peer monitoring in preventing crimes Awareness about Anti-Ragging -Cyber Crime and its prevention- Juvenile justice

TOTAL: 30 Hours

COURSE OBJECTIVE:

- To gain knowledge on skill development, self defense, resource mobilization and life skills

COURSE OUTCOME:

CO-1: Develop vocational skills

CO-2: Develop self defense skills

CO-3: Familiar with the resource mobilization

CO-4: Develop life skills

UNIT I	VOCATIONAL SKILL DEVELOPMENT	15
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This unit will aim to enhance the employment potential of the NSS volunteers- alternately to help them to set up small business enterprises. For this purpose, a list of 12-15 vocational skills will be drawn up ,based on local conditions and opportunities-Each volunteer will have the option to select two skill-areas out of this list-one such skill in each semester- The education institution (or the university)will make arrangements for developing these skills in collaboration with established agencies that possess the necessary expertise in the related vocational skills.

UNIT II	CIVIL/SELF DEFENSE	5
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Civil defense services-aims and objectives of civil defense - Needs for Self defense training.

UNIT III	RESOURCE MOBILISATION	3
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Writing a project proposal- Establishment of SFUs .

UNIT IV	ADDITIONAL LIFE SKILLS	7
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Positive thinking- Self confidence and self esteem- Setting life goals and working to achieve them- Management of stress including time management

TOTAL: 30 Hours