CURRICULUM
(REGULATIONS 2013)

First to Eighth Semester

B.E. AUTOMOBILE ENGINEERING
## CURRICULUM

### Regulation-2013

#### B.E – AUTOMOBILE ENGINEERING

#### SEMESTER - I

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## B.E – AUTOMOBILE ENGINEERING

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**TOTAL HOURS – 31**  
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**Total Hours – 31**

**Total Credit – 25**

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**Total Hours – 30**

**Total Credit – 15**

**Total Credits for the Programme = 190**
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<td><strong>Total Credits</strong></td>
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<td><strong>9%</strong></td>
<td><strong>17%</strong></td>
<td><strong>56%</strong></td>
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**Note for Elective Courses:**

The student can choose the electives as per the following guidelines:

- VI semester - Elective I : one from Group 1 or 2 or 3
- VII semester - Elective II : one GST course from Group 4
- VII semester - Elective III : one from Group 1 or 2 or 3
- VIII semester - Elective IV : one from Group 1 or 2 or 3
- VIII semester - Elective V : one from Group 1 or 2 or 4
## ELECTIVE COURSES

### Group - I (Design & Thermal)

<table>
<thead>
<tr>
<th>Code No.</th>
<th>Course Title</th>
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<tbody>
<tr>
<td>U13 AUT E11</td>
<td>Automotive Aerodynamics</td>
<td>3</td>
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<tr>
<td>U13 AUT E12</td>
<td>Vehicle Concept Design and Styling</td>
<td>3</td>
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<tr>
<td>U13 AUT E13</td>
<td>Computational Fluid Dynamics</td>
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<tr>
<td>U13 AUT E14</td>
<td>Design for Manufacture and Assembly</td>
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<tr>
<td>U13 AUT E15</td>
<td>Noise, Vibration and Harshness</td>
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<tr>
<td>U13 AUT E16</td>
<td>Combustion Engineering</td>
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<tr>
<td>U13 AUT E17</td>
<td>Alternate Fuels and Energy Systems</td>
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<td>U13 AUT E18</td>
<td>Computer Simulation of I.C. Engine Processes</td>
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<td>U13 AUT E19</td>
<td>Advanced Theory of I.C. Engines</td>
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### Group – II (Technology & Manufacturing)

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<tbody>
<tr>
<td>U13 AUT E21</td>
<td>Hydraulic and Pneumatic Systems</td>
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<td>U13 AUT E22</td>
<td>Automotive Air-Conditioning</td>
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<tr>
<td>U13 AUT E23</td>
<td>Modern Automobile Accessories</td>
<td>3</td>
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<tr>
<td>U13 AUT E24</td>
<td>Automotive Components Manufacturing</td>
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<tr>
<td>U13 AUT E25</td>
<td>Design of Jigs, Fixtures and Press tools</td>
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<tr>
<td>U13 AUT E26</td>
<td>Robotics</td>
<td>3</td>
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<tr>
<td>U13 AUT E27</td>
<td>Composite Materials and Structures</td>
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<td>U13 AUT E28</td>
<td>Technical Textiles for Automobiles</td>
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<td>U13 AUT E29</td>
<td>Vehicle Testing and Validation</td>
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### Group -III (Advanced Systems / Automotive Electronics)

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<tbody>
<tr>
<td>U13 AUT E31</td>
<td>Automotive Safety</td>
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<tr>
<td>U13 AUT E32</td>
<td>Microprocessor Based System Design</td>
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<tr>
<td>U13 AUT E33</td>
<td>Electric and Hybrid Vehicles</td>
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<tr>
<td>U13 AUT E34</td>
<td>Instrumentation and Control</td>
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<tr>
<td>U13 AUT E35</td>
<td>Fuel Cell Technology</td>
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<tr>
<td>U13 AUT E36</td>
<td>PLC and Data Acquisition Systems</td>
<td>3</td>
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<tr>
<td>U13 AUT E37</td>
<td>Virtual Instrumentation</td>
<td>3</td>
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<td>U13 AUT E38</td>
<td>Embedded Communication System Protocols</td>
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### Group – IV (Management)

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<tr>
<td>U13 GST 002</td>
<td>Total Quality Management</td>
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<td>U13 GST 003</td>
<td>Principles of Management</td>
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<td>U13 GST 004</td>
<td>Operations Research</td>
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<td>U13 GST 005</td>
<td>Engineering Economics and Financial Management</td>
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<td>U13 GST 006</td>
<td>Product Design and Development</td>
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<td>U13 AUT E41</td>
<td>Entrepreneurship Development</td>
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<td>U13 AUT E42</td>
<td>Project Management</td>
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<td>U13 AUT E43</td>
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<td>U13 AUT E44</td>
<td>Quality Control and Reliability</td>
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<tr>
<td>U13 AUT E45</td>
<td>Energy Studies</td>
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SEMESTER 1
OBJECTIVES

• To offer exposure to the extensive usage of Technical English with special reference to corporate world communication
• To embark on systematic, syntactic and semantic proficiency of Technically used English
• To embellish the usage of English to exhibit engineering and technical concepts.
• To improvise the quality of Written Technical English.
• To develop the competency level of professional writing with a keen focus to corporate situations

FUNDAMENTALS OF TECHNICAL ENGLISH 9 Hours

GRAMMAR IN TECHNICAL ENGLISH 9 Hours
Editing (Grammar - Articles, Parts of Speech, Punctuation and Spelling Rules) – Reading Comprehension – Application of Conditional Sentences.

TECHNICAL EXPRESSIONS 9 Hours
Abbreviations and Acronyms – Expressions of Purpose and Function (Devices, Theories & Hypotheses) – Letter for practical training- Industrial visit – Interrogatives (‘Wh’ questions, Verbal Questions & Question Tags) – Reporting an incident / accident

DRAFTING TECHNICAL DETAILS 9 Hours
Usage of Discourse Markers – Comparative Adjectives – Transcoding Graphics into continuous writing and text into graphics – Bar chart / Pie chart / Flow chart / Line graph / Tabulated data / Tree diagram or Organizational chart into text – E-mail Etiquette and its professional application.

APPLICATIONS OF TECHNICAL ENGLISH 9 Hours

TOTAL: 45 HOURS

REFERENCES

COURSE OUTCOMES
➢ Comprehend the technical jargon and define technical / engineering applications
➢ Exhibit practical proficiency in reading and writing skills
➢ Apply and analyze the technical and general communication
OBJECTIVES

On completion of the course, the students are expected
- To know eigen values and eigen vectors and diagonalization of a matrix.
- To know about the geometrical aspects of curvature, evolute and envelope.
- To understand the concepts of partial differentiation, maxima and minima.
- To solve ordinary differential equations of first and higher order of certain types and its applications.

MATRICES

GEOMETRICAL APPLICATIONS OF DIFFERENTIAL CALCULUS
Curvature – Radius, Centre and Circle of curvature in Cartesian, Parametric and Polar form – Evolute – Envelope of family of curves with one and two parameters – Evolute as the envelope of normals.

FIRST ORDER ORDINARY DIFFERENTIAL EQUATIONS
Leibnitz’s equation – Bernoulli’s equation – Equations of first order and higher degree - Clairauts form – Applications: Orthogonal trajectories and simple Electric circuit problems. (Differential equation and associated conditions need to be given).

HIGHER ORDER LINEAR DIFFERENTIAL EQUATIONS
Linear equations of second and higher order with constant coefficients – Euler’s and Legendre’s linear equations – Method of variation of parameters – First order Simultaneous linear equations with constant coefficients - Application - oscillatory electrical circuit. (Differential equation and associated conditions need to be given).

FUNCTIONS OF SEVERAL VARIABLES

L: 45, T: 15, TOTAL: 60 HOURS

REFERENCES

COURSE OUTCOMES
➢ Know eigen values and eigen vectors and its role in the system of equations
➢ Discover the radius, centre and circle of curvature of any curves
➢ Solve the ordinary differential equations of certain types and its applications.
➢ Identify the maximum and minimum values of surfaces.
OBJECTIVES
At the end of the course, students would be exposed to fundamental knowledge in
- Various engineering subjects and applications.
- Structure identification of engineering materials.
- Non-destructive techniques.
- Interferometric techniques in metrology and electrical phenomena.
- Application of lasers in engineering and technology.
- Atomic and Nuclear related theories.

CRYSTAL PHYSICS 9 Hours
Space lattice – unit cell – lattice planes – Bravais space lattices – Miller indices –
calculation of interplanar distances – Atomic radius – co-ordination number – Packing
factor for SC, BCC, FCC and HCP structures – crystal imperfections – point defects –
line defects – surface defects – volume defects – effect of crystal imperfections.

APPLIED OPTICS 9 Hours
Interference – airwedge and its applications – Michelsons interferometer – construction,
working – determination of wave length and thickness – Lasers – spontaneous and
stimulated emissions – Einsteins coefficients – Nd: YAG, Co2 and semiconductor laser –
Homojunction and Hetrojunction (only qualitative description) – applications – CD-
ROM and holography (qualitative only) – optical fibre – principle and propagation of
light in optical fibers – Numerical aperture and acceptance angle – types of optical fibres
– applications – fibre optic communication system – medical endoscopy.

QUANTUM PHYSICS 9 Hours
Plancks quantum theory of black body radiation (derivation) – Photo electric effect –
Compton effect (derivation) and experimental verification of Compton effect – De-
broglies concept - Schrodinger wave equation – time independent and time dependent
equations (derivations) – physical significance of wave function – particle in a box ( one
dimensional case) – Electron microscope – Scanning electron microscope –
Transmission electron microscope.

ULTRASONICS AND NDT 9 Hours
Introduction – production – magnetostriction effect – magnetostriction generator –
piezoelectric effect – piezo electric generator –properties –detection – cavitation –
acoustic grating – velocity measurement – applications –Sonar –velocity of blood flow –
NDT –Liquid Penetrant method – Ultrasonic flaw detector – A scan, B scan, C scan – X-
ray radiography and fluoroscopy – Thermography.

ATOMIC AND NUCLEAR PHYSICS 9 Hours
Introduction – Atomic spectra – Molecular spectra – Applications – Raman effect –
Stokes lines and anti stokes lines – Applications – Nuclear models – Liquid drop model –
The Shell model- Nuclear fission – Theory – Energy released per fission – Chain
reaction – Controlled chain reaction – Nuclear reactors – Condition for sustained chain
reaction – Types of Nuclear reactors – Nuclear fusion – Thermo nuclear reactions –
Differences between fission and fusion.
REFERENCES

COURSE OUTCOMES
➢ Analyze and identify the crystal structure in materials
➢ Categorize and illustrate the optical materials and its application to engineering
➢ Examine and compare samples at nano level
➢ Apply lasers in engineering and technology
➢ Describe the properties nuclear materials
OBJECTIVES

- To inculcate an understanding of the importance of chemistry by providing an overall perspective of theoretical and modern technological aspects of applied chemistry before beginning their more specialized courses.
- To embellish the usage of chemistry to exhibit engineering and technical concepts

ELECTROCHEMISTRY 9 Hours
Introduction - Electrode potential – Nernst equation and problems - Electrochemical series - Application of EMF measurements & problems - Kohlrausch law of independent migration of ions & its application - Conductometric titrations (acid - base & precipitation titration)
Electrodes : Standard and reference electrode (Hydrogen & Calomel) – Types of electrodes (metal – metal ion; Metal – metal insoluble salt, Redox electrode) - Ion selective (glass electrode) – determination of pH using glass electrode
Cells : Galvanic cell – Types of concentration cells

ENERGY STORING DEVICES 9 Hours
Batteries : Primary Battery (Lechlanche& Alkaline battery) - Secondary Battery (Lead acid storage battery, Nickel - cadmium battery & Lithium – Polymer battery) – Flow battery (hydrogen and oxygen Fuel Cell)
Solar Cells: Hybrid Solar cells

THERMODYNAMICS 9 Hours
Introduction - Thermodynamic process (isothermic, isobaric, isochoric and adiabatic processes) - Internal energy – first law of thermodynamics (Mathematical derivation & limitation) - Enthalpy - Second law of thermodynamics - Entropy - Entropy change of an ideal gas & problems - Free energy - work function - Gibbs Helmholtz equation (derivation, applications & problems) - Van’t Hoff isotherm (derivation & problems) - Van’t Hoff isochore - (derivation & problems) - Third law and zeroeth law (Only statements)

SURFACE CHEMISTRY 9 Hours
Introduction of adsorption - Types of Adsorption - Adsorption isotherm (Freundlich isotherm, Langmuir adsorption isotherm, BET isotherm) - Applications of adsorption : Role of adsorption in catalytic reactions, Ion exchange adsorption, adsorption chromatography (Column chromatography)

SPECTROSCOPY 9 Hours
Introduction to spectroscopy - Beer Lambert’s Law - Colorimetric analysis (principle, instrumentation (block diagram only) & application (Estimation of concentration of Ferrous and copper ions a solution by colorimetry) - UV – visible spectroscopy (principles, instrumentation (block diagram only) & simple Applications) - IR spectroscopy (principles, instrumentation (block diagram only) & simple applications) - Flame photometry (Principle, instrumentation (block diagram only) & simple Applications)

TOTAL: 45 HOURS
REFERENCE

COURSE OUTCOMES
➢ Assemble a battery and illustrate the phenomenon of production of electric current
➢ Discuss the thermodynamic concepts and predict the feasibility of chemical reaction
➢ Apply the theory of adsorption in real life situations
➢ Outline the principles and instrumentation of spectroscopic techniques
OBJECTIVES

- To understand the principle of orthographic projection of points, lines, surfaces and solids.
- To understand the principle of section and development of solids.
- To understand the principle of Isometric and Perspective projections.
- To study the principle of free-hand sketching techniques.

PLANE CURVES, PROJECTION OF POINTS AND LINES 15 Hours
Importance of graphics in design process, visualization, communication, documentation and drafting tools. Construction of curves - ellipse, parabola, and hyperbola by eccentricity method only. Orthographic projection of points. Projections of straight lines located in first quadrant - determination of true length and true inclinations.

PROJECTIONS OF SURFACES AND SOLIDS 15 Hours
Projections of plane surfaces - polygonal lamina and circular lamina, located in first quadrant and inclined to one reference plane. Projection of simple solids - prism, pyramid, cylinder and cone. Drawing views when the axis of the solid is inclined to one reference plane.

SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES 15 Hours
Sectioning of simple solids - prisms, pyramids, cylinder and cone. Obtaining sectional views and true shape when the axis of the solid is vertical and cutting plane inclined to one reference plane. Development of lateral surfaces of truncated prisms, pyramids, cylinders and cones.

PICTORIAL PROJECTIONS 15 Hours
Isometric projection, Isometric scale, Isometric views of simple solids, truncated prisms, pyramids, cylinders and cones. Perspective projection of prisms and pyramids when its base resting on the ground by vanishing point method.

FREE-HAND SKETCHING 15 Hours
Free hand sketching techniques, sketching of orthographic views from given pictorial views of objects, including free-hand dimensioning. Sketching pictorial views from given orthographic views.

L: 30, P: 45, TOTAL: 75 Hours

REFERENCES
COURSE OUTCOMES
➢ To describe the principle of orthographic projection of points and lines
➢ To Explain the principle of orthographic projection of surfaces and solids
➢ To Discuss the principle of section and development of solids
➢ To Demonstrate the principle of Isometric and Perspective projections
➢ To Demonstrate the principle of free-hand sketching techniques
U13CS7 101 STRUCTURED PROGRAMMING USING C 3 1 0 4

OBJECTIVES

- To enable students to learn about the basics of computers and problem solving methods
- To learn the various features of C
- To learn how to program using C language

INTRODUCTION


C LANGUAGE BASICS


ARRAYS AND STRINGS


FUNCTIONS AND POINTERS


STRUCTURES AND UNIONS AND FILES


L: 45, T: 15, TOTAL: 60 Hours

REFERENCES

COURSE OUTCOMES
➢ Be able to understand structured programming concepts
➢ Be able to develop a computer program to solve real world problems
➢ Develop simple applications using C
OBJECTIVES

- To apply the theoretical principles and perform experiments
- Experience the importance of theory by using analytical equipments and quantitative and qualitative procedures.

LIST OF EXPERIMENTS

PREPARATION OF SOLUTIONS (STANDARD)
1. Preparation of normal solutions of the following substances - oxalic acid, sodium carbonate, hydrochloric acid.
2. Preparation of phosphate buffer using Henderson equation.

WATER TESTING
3. Determination of total, temporary and permanent hardness by EDTA method.
4. Estimation of DO by Winkler’s method.
5. Estimation of alkalinity by Indicator method.

ELECTRO CHEMICAL ANALYSIS
7. Estimation of hydrochloric acid by pH metry.
8. Conductometric titration of mixture of acids and strong base
9. Conductometric precipitation titration using BaCl₂ and Na₂SO₄.
10. Estimation of Iron by Potentiometry

PHOTOMETRY
11. Estimation of the Ferrous ions (Thiocyanate method) by Spectrophotmetry.
12. Estimation of sodium and potassium by Flame photometry.

TOTAL: 45 HOURS

REFERENCES

COURSE OUTCOMES
- Prepare normal solutions
- Analyse the properties of water
- Estimate the concentration of solutions by electrochemical methods
LIST OF EXPERIMENTS

GROUP – I  21 Hours
A. CIVIL ENGINEERING
1. Carpentry
   • Study of carpentry tools
   • Preparation of T joint
   • Preparation of dovetail joint

2. Plumbing
   • Study of pipeline joints

B. MECHANICAL ENGINEERING
1. Fitting
   • Study of fitting tools
   • Preparation of L joint
   • Preparation of square joint

2. Sheet Metal Working
   • Study of sheet metal working tools
   • Preparation of cone and tray

3. Welding
   • Study of arc welding tools and equipment
   • Preparation of butt joint

GROUP - II (ELECTRICAL & ELECTRONICS ENGINEERING)  12 Hours
C. ELECTRICAL ENGINEERING PRACTICE
• Basic household wiring using switches, fuse, indicator-lamp, etc.,
• Preparation of wiring diagrams.
• Stair case light wiring.
• Tube light wiring
• Study of iron-box, fan with regulator, emergency lamp and microwave oven.
D. ELECTRONIC ENGINEERING PRACTICE 12 Hours

1. Assembling simple electronic component on a small PCB and Testing.
2. Soldering simple electronic circuits and checking continuity.
   - DC and AC voltage measurement
   - DC and AC current measurements.
   - Resistance Measurement.
   - Continuity measurement.
4. Testing of Electronic components
   - Resistors
   - Inductors and capacitors
   - Diodes (resistance in forward bias and reverse bias)
   - Transistors
5. Study of CRO and Function generator
   - Study of Panel Controls
   - Measurement of Amplitude, Frequency, phase difference

TOTAL: 45 HOURS
OBJECTIVES
• To enable students to solve problems using C
• To apply the various features of C

LIST OF EXPERIMENTS
1. Simple programs
   • To find whether the given number is prime or not
   • Factorial of the given number
2. Programs involving Control and Looping Structures
   • Arithmetic Progression
   • Trigonometric series evaluation
3. Programs using Arrays
   • Sorting
   • Matrix addition and Multiplication
4. Calculation of median of a frequency distribution.
5. Evaluation of integrals
   • Trapezoidal Rule
6. String Processing
7. Program using Recursive function
8. Using pointers in C
9. Program using Functions, Structures and Files
   • Students Mark Analysis
10. Iterative method for finding Roots of the polynomials
    • Lagrange interpolation method

TOTAL: 45 HOURS

COURSE OUTCOMES
• Develop skills on use of C for simple problem solving
• Develop skills on the usage of C for statistical and scientific problem solving
Acquire skills on the usage of C for statistical and scientific problem solving
U13 GHP 101  HUMAN EXCELLENCE -PERSONAL VALUES I

(Common to all branches of Engineering and Technology)

OBJECTIVE
• To inspire students to become best Humans.
• To know about self.
• To overcome evil temperaments.
• To practice meditation & pranayamam

LIFE & HUMAN EXCELLENCE 3 Hours

BODY, SOUL, MIND & THEIR FUNCTIONAL RELATIONSHIP 3 Hours
Panchboothas and it’s association – Form of the body : physical body, astral body, causal body - Effect: Pain, Disease, Death; Soul – Life force – Bio magnetism – Genetic Centre – Mind : Origin & it’s ten stages.

SELF INTROSPECTION 3 Hours
Introduction – Importance – Blemishes – Six evil temperaments &their maneuvering.

THOUGHT ANALYSIS 3 Hours
Introduction of Thought; process of thought – Mind& Thought relationship – causes for origin of Thoughts;Exercise : Training & Practice of Thought analysis

MEDITATION AND PRANAYAMAM - THEORY WITH PRACTICAL SESSION 3 Hours
Meditation: Introduction to Meditation
Pranayamam: Importance of Naadisudhi, Thanduvadasudhi (Clearance practice), Kabhalabathithi and their practice.

TOTAL: 15 Hours

COURSE OUTCOMES
➢ Acquire knowledge on the individual in relation to Nature and Society.
➢ Demonstrate the skill of self-realization values the significant relationship to be maintained between individual’s Body, Mind and Soul.
➢ Analysis of Thoughts and origin of thoughts
➢ Learn about Purpose and Philosophy of Life
SEMESTER 2
OBJECTIVES

- To enhance application oriented usage of English language
- To inculcate essential language proficiency through a good combination of practical and theoretical exposure
- To widen the area of creative writing skill of the students
- To initiate the students to make use of English to exhibit their professionalism
- To enable the students with adequate language exposure to business, professional and corporate facets of life.

RUBRICS OF PUBLIC SPEAKING  
12 Periods
Vocabulary (Antonyms) – Homonyms- Use of Compound Prepositions – Public address (compering /welcoming / proposing vote of thanks) — Creating Advertisements.

ESSENTIAL REQUISITES OF PROFESSIONAL ENGLISH  
12 Periods
Compound Nouns – Gerunds and Infinitives – Workplace Idioms – Reported Speech– Preparing a Check list- Composing Statement of Purpose (SOP) - Preparing a Resume with Cover letter.

CORPORATE CORRESPONDENCE  
12 Periods

NUANCES OF ENGLISH  
12 Periods

SENSITIZING LANGUAGE SKILLS  
12 Periods

TOTAL: 60 PERIODS

REFERENCES
OBJECTIVES

On completion of the course, the students are expected

- To understand double and triple integrations and enable them to find area and volume using multiple integrals.
- To know the basics of vector calculus comprising gradient, divergence and curl and line, surface and volume integrals.
- To understand analytic functions of complex variables and conformal mappings.
- To know the basics of residues, complex integration and contour integration.
- To understand Laplace transform and use it to represent system dynamic models and evaluate their time responses.

MULTIPLE INTEGRALS

12 Periods
Double integration – Cartesian and polar coordinates – Change of order of integration – Change of variables between cartesian and polar coordinates - Triple integration in cartesian coordinates – Application : Area as double integral – Volume as triple integral

VECTOR CALCULUS

12 Periods
Gradient, divergence and curl – Directional derivative – Irrotational and solenoidal vector fields - Green’s theorem in a plane, Gauss divergence theorem and Stoke’s theorem (excluding proofs) – Simple applications involving cubes and rectangular parallelopipeds.

ANALYTIC FUNCTION

12 Periods
Functions of a complex variable – Analytic functions – Necessary conditions, Cauchy-Riemann equations in Cartesian coordinates and sufficient conditions (excluding proofs) – Properties of analytic function – Construction of analytic function by Milne Thomson method – Conformal mapping : $w = z + c, cz, 1/z$ and bilinear transformation.

COMPLEX INTEGRATION

12 Periods
Statement and applications of Cauchy’s integral theorem and Cauchy’s integral formula (excluding proofs) – Taylor’s and Laurent’s series expansions – Singularities – Residues – Cauchy’s residue theorem (excluding proof) – Application of residue theorem to evaluate real integrals - Unit circle and semi-circular contours (excluding poles on real axis).

LAPLACE TRANSFORM

12 Periods

L: 60, T: 15, TOTAL: 75 PERIODS
REFERENCES
OBJECTIVES

At the end of the course students would be exposed to

- Types of defects in engineering materials and mechanisms of strengthening
- Properties of conducting, super conducting, magnetic and dielectric materials.
- Properties of Semi conducting, optical and new engineering materials.

CONDUCTING AND SUPERCONDUCTING MATERIALS 12 Periods


Superconducting phenomena – properties of superconductors – Meissner effect, Isotope effect, Type I & Type II superconductors – High Tc superconductors - Applications – cryotron, magnetic levitation and squids.

SEMICONTENDING MATERIALS 12 Periods

Origin of band gap in solids (Qualitative treatment only) - Concept of effective mass of an electron and hole – carrier concentration in an intrinsic semi conductor (derivation) – Fermi level – variation of Fermi level with temperature - Electrical conductivity – band gap semiconductor – carrier concentration in n-type and p-type semi conductors (derivation) – Variation of Fermi level with temperature and impurity concentration – Hall effect – Determination of Hall coefficient – experimental set up – Applications.

MAGNETIC & DIELECTRIC MATERIALS 12 Periods


NANOTECHNOLOGY AND NEW ENGINEERING MATERIALS 12 Periods

Metallic glasses – preparation, properties and applications – shape memory alloys (SMA) – characteristics, properties of NiTi alloy applications advantages and disadvantages of SMA.

STRENGTHENING OF MATERIAL

12 Periods

Strengthening mechanisms for the improvement of mechanical properties - cold working precipitation hardening, solute hardening and diffusion hardening - Fracture - Mechanism of brittle fracture (Griffith’s theory) and Ductile fracture - difference between brittle and ductile fracture - fatigue failure and its prevention - creep different stages in creep curve - Factors affecting mechanical properties Grain size and heat treatment - Mechanical test Tensile, compression, hardness, impact creep, fatigue and stress.

TOTAL: 60 PERIODS

References:
1. Avadhanalu M.N. and Kshirsagar P.G., A textbook of Engineering Physics, S. Chand & Company Ltd, New Delhi, 2005, (Units: 1,2,3).
OBJECTIVE
To inculcate essential knowledge on theoretical and modern technological aspects of fuels and combustion, specialty materials, water technology, corrosion studies and powder metallurgy.

FUELS
Classification of fuels - coal varieties - analysis of coal (proximate and ultimate analysis) - coke manufacture (Otto-Hoffman byproduct coke oven method) - characteristics of metallurgical coke - cracking (thermal and catalytic cracking definition only) – manufacturing of synthetic petrol (Fischer Tropsch method, Bergius process) – knocking (octane number, cetane number) - gaseous fuels (production, composition and uses of producer gas, water gas and natural gas).

Combustion : gross and net calorific value - determination of calorific value by bomb calorimeter - explosive range - spontaneous ignition temperature - flue gas analysis (Orsat apparatus).

MECHANICAL ENGINEERING MATERIALS
Abrasives: Moh’s scale of hardness - natural abrasives (diamond, corundum, emery, garnets and quartz) - artificial abrasives (silicon carbide, boron carbide).

Refractories: Characteristics - classification (acid, basic and natural refractories) - properties (refractoriness, refractoriness under load, dimensional stability, porosity, thermal spalling) - General manufacturing methods of refractories - preparation, properties and uses of high alumina bricks, magnesite and zirconia bricks.

Lubricants: Classification - Functions - properties (viscosity index, flash and fire point, oiliness, carbon residue, aniline point, cloud and pour point) - greases (calcium based, sodium based, lithium based) - solid lubricants (graphite, molybdenum disulphide).

CORROSION SCIENCE
Corrosion - Principles of electrochemical corrosion - difference between chemical and electrochemical corrosion - factors influencing corrosion.

Types of corrosion: galvanic corrosion - differential aeration corrosion (soil (microbial) corrosion, pitting corrosion, water line corrosion) - stress corrosion.

Corrosion control: cathodic protection (sacrificial anode) - Protective Coatings (Paint, Electroplating of Copper).

WATER TECHNOLOGY
Boiler feed water: requirements - disadvantages of hard water (formation of deposits in steam boilers, priming, foaming, caustic embrittlement & boiler corrosion).

Prevention of scale formation: external treatment (ion exchange method) - internal treatment (phosphate, calgon, carbonate, colloidal) - desalination by reverse osmosis - Treatment of Domestic water

PHASE RULE
Phase rule - condensed phase rule - construction of phase diagram (thermal analysis) – Applications of phase rule: one component system (Fe system only) - simple eutectic system (Ag-Pb system only).
POWDER METALLURGY
Preparation of metal powders (mechanical pulverization, atomization, chemical reduction, electrolytic process, decomposition) - mixing and blending - compacting - sintering - advantages and limitations of powder metallurgy.

TOTAL: 60 PERIODS

References:
OBJECTIVES

- To understand the concept of equilibrium of particles and rigid bodies.
- To understand the concept of first and second moment of area.
- To understand the concept of various types of frictions.
- To understand the principle of work energy method, Newton’s law and impact of elastic bodies.

BASICS & STATICS OF PARTICLES 12 Periods

EQUILIBRIUM OF RIGID BODIES 12 Periods
Moment of a force about point – Varignon’s theorem- Moment of a couple-Resolution of force in to force couple system-Resultant of coplanar non concurrent system - Types of supports and their reactions- Requirements of stable equilibrium - Equilibrium of Rigid bodies in two dimensions.

PROPERTIES OF SURFACES AND SOLIDS 12 Periods
First moment of area and the Centroid of sections Rectangle, circle, triangle, T section, I section Angle section and Hollow section. Second and product moments of plane area Rectangle, triangle, circle. T Section, I section, Angle section and Hollow section, Parallel axis theorem and perpendicular axis theorem - Polar moment of inertia.

FRICTION 12 Periods
Frictional force-Law of coloumb friction , simple contact friction, Rolling resistance and Belt friction, Ladder friction, Wedge friction.

DYNAMICS OF PARTICLES 12 Periods
Kinematics: Rectilinear & Curvilinear motion of particles, Displacements Velocity and acceleration.

L: 60, T: 15, TOTAL: 75 PERIODS

Reference:
U13 EE7 211  BASICS OF ELECTRICAL AND ELECTRONICS  3 0 0 3  
ENGINEERING

OBJECTIVES
- To study the characteristics of circuit elements
- To understand relationships among current, voltage and power in DC and AC circuits
- To study the construction, characteristics and applications of amplifiers and oscillators circuitry

ELECTRIC CIRCUITS FUNDAMENTALS  9 Hours

ELECTROMAGNETISM  9 Hours

AC-CIRCUITS  9 Hours

ELECTRICAL MACHINES (Qualitative Treatment Only)  9 Hours

ELECTRONIC CIRCUITS  9 Hours
Semiconductor diode – Half wave and Full wave rectifier – Bipolar Junction transistors – circuit configurations – static characteristics – load line and biasing – simple introduction to amplifiers – Introduction to Binary logic gates – AND, OR, NOT, NAND, NOR, EX-OR & EX-NOR.

TOTAL: 45 HOURS
REFERENCES

COURSE OUTCOMES
➢ Acquire the knowledge of fundamental laws of electrical and electronics engineering.
➢ State the definition of magnetic circuits.
➢ Choose suitable motor for desired application.
➢ The students have the ability to apply the fundamental laws of magnetic circuits to electrical machines.
➢ The learners can verify the truth table of digital logic gates.
LIST OF EXPERIMENTS

Any Ten Experiments
1. Lee’s disc - determination of thermal conductivity of a bad conductor
2. Air wedge - determination of thickness of a given specimen.
3. Spectrometer - determination of wavelength of mercury source using grating
4. Compound pendulum - determination of acceleration due to gravity.
5. Carey foster bridge – determination of specific resistance of a given coil of wire.
7. Non-uniform bending – determination of Young’s modulus
8. Ultrasonic interferometer – determination of velocity of sound and compressibility of liquid.
9. Band gap determination of a semiconductor using post office box
10. Semiconductor laser:
   a. Determination of wavelength of laser using grating
   b. Particle size determination
   c. Acceptance angle of optical fibre
11. Torsional pendulum - determination of Rigidity modulus of the wire
12. Field along the axis of a coil – Determination of magnetic moment.

Demonstration experiments:
1. Determination of solar cell parameters
2. Hall effect
3. Four probe apparatus
4. Animations – (Laser, Fiber optics and hysteresis curve)

TOTAL: 45 PERIODS
OBJECTIVES:

To provide computerized drawing skills.

LIST OF EXPERIMENTS:

1. Introduction to CAD Commands
2. Creation of simple objects
3. Special curves
4. Projection & Section of simple solids
5. Orthographic views of solids
6. Isometric views of objects
7. Simple trusses
8. 3D modeling of simple solids
9. 2D multiple views from 3D model

COURSE OUTCOMES:

On successful completion of the course, the learner would be able to

3. Draw 2D and 3D drawings using drafting software
4. Convert orthographic view into isometric view
5. Become familiar to draw Special curves
AIM
To provide experimental skill in the operation of DC, AC machines and Hands on experience in the development of electronic circuits.

OBJECTIVES
• To experimentally verify the principle of operation, performance characteristics of DC Motors and AC Motors.
• To obtain the characteristics of electronic devices and its applications

LIST OF EXPERIMENTS
1. Load Test on DC Shunt Motor
2. Load Test on DC Series Motor
3. Speed Control of DC Shunt Motor
4. Load Test on three phase Induction Motor
5. Load Test on single phase Induction Motor
6. Load test on single phase transformer
7. Half wave and full wave rectifier
8. Characteristics of CE transistor configuration
9. Characteristics of PN diode
10. Verification of truth table of logic gates

TOTAL: 45 HOURS

COURSE OUTCOMES
➢ The Students will gain the basic knowledge and understanding the concept of AC and DC machines.
➢ Students will know the working principle, performance characteristics, (Torque, Speed, Efficiency) control and applications of Electrical Machines.
➢ Students will be able to design and conduct performance experiments in machines and Rectifiers.
➢ To familiarize the starting methods of all rotating machines.
➢ Students will be exposed to the practical applications of identify and solve machines related problems.
OBJECTIVE:
- To inspire students to become blissful humans.
- To make the students able to come out of greed and keep mind pure.
- To outgrow the dangerous emotions.
- To achieve sound health and reach the intuition level.

MORALIZATION OF DESIRE  4 Periods
Training: Moralization of Desire.

NEUTRALIZATION OF ANGER  4 Periods
Introduction – Origin of Anger – Alternative forms of Anger – A chain action – Consequence of anger on self & others – neutralization of anger – the point where anger is won.
Training: neutralizing anger.

ERADICATION OF WORRIES  4 Periods
Training: Eradication of Worries.

REALIZATION OF SELF  4 Periods

THEORY & PRACTICAL SESSION ON MEDITATION & PHYSICAL EXERCISE  15 Periods
Who I am? - Understanding Self – need of a guru with eternal wisdom – body or lif-force or mind or consciousness? – from flower to akash – will the true YOU please step forward? - Who am I? - am I god? - you are infinite – the bottom of the lake – shaping one’s destiny – basics – in each dewdrop the same sun.

TOTAL: 30 PERIODS
SEMESTER 3
OBJECTIVES:
- To understand concepts of pseudocode and various errors.
- To solve algebraic, transcendental and system of linear equations by using various techniques.
- To understand the concepts of curve fitting, interpolation with equal and unequal intervals.
- To understand the concepts of numerical differentiation and numerical integral by various methods.
- To solve the ordinary differential equations with initial condition by numerical techniques.
- To solve the partial differential equations using numerical techniques.

INTRODUCTION
Simple mathematical modeling and engineering problem solving – Algorithm Design – Flow charting and pseudocode - Accuracy and precision – round off errors

NUMERICAL SOLUTION OF ALGEBRAIC EQUATIONS
Solution of nonlinear equations - False position method – Fixed point iteration – Newton Raphson method for a single equation and a set of non-linear equations
Solution of linear system of equations by Gaussian elimination, Gauss Jordan method - Gauss Seidel method.

CURVE FITTING AND INTERPOLATION

NUMERICAL DIFFERENTIATION AND INTEGRATION
Numerical differentiation by using Newton’s forward, backward and divided differences – Numerical integration by Trapezoidal and Simpson’s 1/3 and 3/8 rules – Numerical double integration.

NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS

NUMERICAL SOLUTION OF PARTIAL DIFFERENTIAL EQUATION(PDEs)
Use of MATLAB Programs to workout solutions for all the problems of interest in the above topics.

L : 45  T : 15  Total Hrs = 60
REFERENCES:

COURSE OUTCOMES:
On successful completion of the course the learner would be able to:

i. Solve a set of algebraic equations representing steady state models formed in engineering problems
ii. Fit smooth curves for the discrete data connected to each other or to use interpolation methods over these data tables
iii. Find the trend information from discrete data set through numerical differentiation and summary information through numerical integration
iv. Predict the system dynamic behaviour through solution of ODEs modeling the system
v. Solve PDE models representing spatial and temporal variations in physical systems through numerical methods.
vi. Have the necessary proficiency of using MATLAB for obtaining the above solutions.
OBJECTIVES
Study of the Constructional details and Theory of important drive line, Structural, Steering, Braking and Suspension Systems of Automobiles. Problem–Solving in Steering Mechanism, Propeller Shaft, Braking and Suspension Systems are to be done.

INTRODUCTION 9 hrs
Types of Chassis layout, with reference to Power Plant location and drive, various types of frames, Loads acting on vehicle frame, Constructional details and materials for frames, Testing of frames, Types of Front Axles and Stub Axles, Front Wheel Geometry, namely, Castor, Camber, King Pin Inclination and Toe–in, Condition for True Rolling Motion of Wheels during Steering, Ackerman’s and Daut’s Steering Mechanisms, Steering Error Curve, Steering Linkages, Different Types of Steering Gears, Slip Angle, Over–Steer and Under–Steer, Reversible and Irreversible Steering, Power–Assisted Steering.

DRIVE LINE 9 hrs

AXLES 9 hrs
Construction of Drive Axles, Types of Loads acting on drive axles, Full – Floating, Three–Quarter Floating and Semi–Floating Axles, Axle Housings and Types, Types and Constructional Details of Different Types of Wheels and Rims, Different Types of Tyres and their constructional details.

SUSPENSION SYSTEM 9 hrs

BRAKING SYSTEM 9 hrs

Reference book
Course outcome:
On successful completion of the course the learner would be able to:
   i) Understand the construction details of various types of automotive chassis and basic functions of subsystems in the chassis.
   ii) Distinguish various types of suspension system, brake system, steering system and wheels & tires in the vehicles.
   iii) Apply the knowledge for selection of suitable subsystems for a vehicle.
OBJECTIVES
To introduce fundamental concepts in thermodynamics, heat transfer, propulsion and refrigeration and air conditioning.

BASIC THERMODYNAMICS 12hrs

AIR STANDARD CYCLES AND COMPRESSIONS 9 hrs
Otto, Diesel and Dual combustion. Air standard efficiency. Mean effective pressure, Reciprocating compressors. Intercooling – Minimum work requirement

STEAM AND JET PROPULSION 8 hrs

REFRIGERATION AND AIR-CONDITIONING 9 hrs

HEAT TRANSFER 8 hrs

L: 45  T: 15  Total 60 Hrs
(Use of standard thermodynamic tables, Mollier diagram and Refrigerant property tables are permitted)

Reference book

Course outcome:
On successful completion of the course the learner would be able to:
   i. Understand the basics and laws of thermodynamics with respect to heat engines and thermal equipment.
   ii. Apply the knowledge of working fluids in various thermodynamic equipment.
   iii. Understand the modes of heat transfer with respect to various heat exchangers.
   iv. Apply the concept of HVAC in automotive air conditioning.
OBJECTIVES

1. To gain theoretical and theoretical knowledge in material casting processes and develop an understanding of the dependent and independent variables which control materials casting in a production setting.

2. Introduce students to good Machining Process and product design considerations.

3. Understanding manufacturing process, Application to Automotive

CASTING 8 hrs
Casting types, procedure to make sand mould, types of core making, moulding tolls, machine moulding, special moulding processes – CO2 moulding; shell moulding, investment moulding, permanent mould casting, pressure die casting, centrifugal casting, continuous casting, casting defects.

WELDING 8 hrs

MACHINING 13hrs
General principles (with schematic diagrams only) of working and commonly performed operations in the following machines: Lathe, Shaper, Planer, Horizontal milling machine, Universal drilling machine, Cylindrical grinding machine, Capstan and Turret lathe. Basics of CNC machines.

General principles and applications of the following processes: Abrasive jet machining, Ultrasonic machining, Electric discharge machining, Electro chemical machining, Plasma arc machining, Electron beam machining and Laser beam machining.

FORMING AND SHAPING OF PLASTICS 9 hrs

METAL FORMING AND POWDER METALLURGY 7hrs
Principles and applications of the following processes: Forging, Rolling, Extrusion, Wire drawing and Spinning, Powder metallurgy – Principal steps involved advantages, disadvantages and limitations of powder metallurgy.

L: 45  T: 0  Total 45 Hrs

Reference book

**Course outcome:**

On successful completion of the course, the learner would be able to

i) Understand the Casting, Welding & Machining process used for automotive components manufacturing

ii) Understand the basic method of Forming

iii) Apply the knowledge for selecting suitable manufacturing process for various automotive components manufacturing.
OBJECTIVES
To introduce the concepts of fluid statics viscosity and buoyancy. To make the student understand the basic laws namely, mass momentum and energy. To give an introduction on fluid machinery.

BASIC CONCEPTS
9hrs

BASIC EQUATIONS OF FLUID FLOW ANALYSIS
10hrs

INCOMPRESSIBLE INVISCID FLOW
8hrs
Euler’s equations of motion – Bernoulli’s equations – Applications – Methods of pressure measurement – Flow measurement – Orifice plate – Venturi meter – Irrotational flow – Stream function and velocity potential – Laplace equation – Elementary plane flows

INCOMPRESSIBLE VISCOUS FLOW
8hrs
Fully developed laminar flow between infinite parallel plates – Laminar and turbulent flow through pipes – Velocity profiles – Energy considerations in pipe flow – Calculation of head loss Pipe flow problems – Hydraulic and energy grade lines – Moody’s diagram.

FLUID MACHINERY
10hrs

L: 45  T: 15  Total 60 Hrs

Reference book

Course outcome:
On successful completion of the course, the learner would be able to
i. Understand the mathematical techniques of practical flow problems.
ii. Understand the properties of the fluid and solve the fluid flow problems
iii. Analyzing fluid flows through the proper use of modeling and the application of the basic fluid-flow principles
iv. Analyzing the performance of pumps and turbines.
OBJECTIVES
- To gain knowledge of simple stresses, strains and deformation in components due to external loads.
- To assess stresses and deformations through mathematical models of beams, twisting bars or combinations of both.
- Effect of component dimensions and shape on stresses and deformations are to be understood.
- The study would provide knowledge for use in the design courses

AXIAL LOADING 9hrs

STRESSES IN BEAMS 7hrs
Shear force & bending moment diagrams – bending stresses – shear stress variation in beams of symmetric sections – beams of uniform strength.

DEFLECTION OF BEAMS 9hrs

TORSION – SPRINGS – COLUMNS 11hrs

BIAXIAL STRESSES 9hrs
Stresses in thin-walled pressure vessels – combined bending, torsion and axial loading of circular shafts – Mohr’s circle and its construction – determination of principal stresses.

L: 45  T: 15  Total 60 Hrs

Reference book

COURSE OUTCOMES
On successful completion of the course the learner would be able to:
   i.) Gain knowledge about the behavior of members subjected to different types of Forces.
   ii.) Analyze different kinds of material strength using Stress-Strain relationships.
OBJECTIVES

Demonstration and study of the various machines. The Main emphasis will be on a complete understanding of the machine capabilities and processes.

LIST OF EXPERIMENTS

1. LATHE
   1.1. Facing, plain turning and step turning
   1.2. Taper turning using compound rest.
   1.3. Taper turning using taper turning attachment
   1.4. Single start V thread, cutting and knurling

2. SHAPER AND SLOTTER
   2.1. Machining a V-block (in a Shaper)
   2.2. Machining internal key-way (in a Slotter)

3. DRILLING
   3.1. Drilling 4 or 6 holes at a given pitch circle on a plate
   3.2. Drilling, reaming and tapping

4. MILLING
   4.1. Plain Milling Exercise
   4.2. Gear Milling Exercise

5. GRINDING
   5.1. Cylindrical Grinding Exercise

Total: 45Hrs

COURSE OUTCOMES:

On successful completion of the course, the learner would be able to

i. Use appropriate machine tools for Lathe operations
ii. Use appropriate machine tools for drilling
iii. Use appropriate machine tools for grinding
iv. Use appropriate machine tools for manufacturing gears
OBJECTIVES
1. To expose the students to the testing of different materials under the action of various forces and determination of their characteristics experimentally.

2. The students can 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.,

LIST OF EXPERIMENTS
A) STRENGTH OF MATERIALS LABORATORY
   1. Tension test on a mild steel rod
   2. Torsion test on mild steel rod
   3. Hardness test on metals - Brinell and Rockwell Hardness
   4. Deflection test on beams
   5. Compression test on helical springs
   6. Impact Test.

B) FLUID MECHANICS & MACHINERY LABORATORY
   1. Determination of the Coefficient of discharge of a given Orifice meter.
   2. Determination of the Coefficient of discharge of a given Venturi meter.
   3. Determination of friction factor for a given set of pipes.
   4. Performance Characteristic curves of centrifugal pump
   5. Performance characteristics of Francis turbine.

COURSE OUTCOMES:
On successful completion of the course, the learner would be able to
i. Required knowledge in the area of testing of materials and components of structural elements experimentally.
ii. Use the measurement equipments for flow measurement
iii. Do performance test on different fluid machinery

Total: 45Hrs
OBJECTIVES
To provide training the Students to know the details of different Chassis and Engine Components, dismantle and assembling them.

LIST OF EXPERIMENTS

AUTOMOTIVE CHASSIS LABORATORY
1. Study and measurement of the Light duty vehicle chassis frame
2. Front Axle and Rear Axle
3. Differential
4. Steering systems along with any two types of steering gear box
5. Braking systems – hydraulic servo vacuum, compressed air power brakes.

ENGINE COMPONENTS LABORATORY
1. Dismantling of 4 cylinder petrol engine.
5. Study of oil filter, fuel filter, fuel injection system, carburetor, MPFI
6. Study of engine lubrication system components

Total : 45 Hrs

COURSE OUTCOMES:

On successful completion of the course, the learner would be able to
i. Dismantle and Assemble the automobile chassis and Engine components
ii. Identify & differentiate components of SI & CI engines
iii. Understand working of braking, steering, clutch, transmission, Suspension systems.
iv. Differentiate various subsystems of two, three & Four wheeler vehicles
Restraint in family


Spiritual development through good Family life


Peace in Family.


Greatness of womanhood & Food is Medicine

Good–cultured behavioral patterns – love and compassion - Greatness of womanhood – Food is medicine (healthy food habits)

Simplified physical exercises

Simplified physical exercises – Kaya Kalpa Yoga (Benefits related to the Patient, Tolerance, Sacrifice)

Meditation & Yogasanas

SEMESTER 4
Objectives:

• To identify systems, their inputs and outputs
• To apply laws of physics to derive models for simple dynamic systems
• To evaluate the dynamic response of systems of interest with selected excitation signals
• To analyze signals through their frequency components using Fourier series and Fourier transforms
• To appreciate the frequency response characteristics of linear systems and its usefulness in specifying system dynamic behavior.

Fundamental Modeling Concepts: 7 Hours
Systems, Modeling and Analysis – Abstraction of physical behaviour using laws of physics – Linearity and Superposition – Lumped system dynamic behaviour represented by ordinary differential equations – Conservation laws to form dynamic equations

Modeling Elementary Systems: 10 Hours
Modeling Translational Mechanical Systems, RLC Electrical Circuit, Electrical Analogues for Mechanical System Parameters, Modeling of rotational mechanical systems, hydraulic systems and thermal systems, Model Representation of time delay

System Dynamic Response: 10 Hours
Obtaining dynamic response of first order and second order linear systems for step inputs through analytical solution of governing equations – Transient response specifications – Delay time, rise time, peak overshoot, undamped natural frequency, damping factor, settling time – Experimental determination of above parameters.
Dynamic response of general (including non-linear) system models through numerical integration of ODEs using MATLAB.

Fourier analysis of Signals: 8 Hours
Obtaining trigonometric Fourier series – Exponential Fourier Series – Fourier Spectra – Parseval’s Theorem – Fourier Transform pairs and equations relating them – Magnitude and Phase Spectra from Fourier Transforms

Frequency Response of Linear Time–Invariant Systems: 10 Hours
Excitation and response signals of systems – Transfer functions – The sinusoidal steady state – Magnitude and phase response – Bode plots from transfer functions – Contributions from first order poles and zeros and complex conjugate pole pairs in frequency response – Frequency filtering characteristics of simple electrical and mechanical systems.

Total: (45 +15 Tutorial) hours
References:

Course Outcomes:

On successful completion of the course, the learner would be able to
• Attempt modeling real life systems of interest in order to predict its dynamic behavior
• Use simulation tools to determine dynamic response of system following external inputs
• Use Fourier analysis to identify the different frequency components in signals used for monitoring system health
• Use frequency response techniques to appreciate inherent dynamics of linear systems and design suitable feedback controllers
• Take up advanced courses on system dynamics, monitoring and control with familiarity on terminology and techniques employed in the above.
OBJECTIVES
To understand the source of automotive fuels and lubricants, their basic properties, determination of air requirement for the combustion of fuels and basic theory of lubrication.

MANUFACTURE OF FUELS AND LUBRICANTS 9 hrs
Fuels, Structure of petroleum, refining process, thermal and catalytic cracking, products of refining process, manufacture of lubricating oil base stocks and finished automotive lubricants.

FUELS FOR I.C. ENGINES 9 hrs
Types of Fuels, Liquid and gaseous fuels, heating value of fuels, higher and lower heating values, chemical structure of hydro-carbons SI Engine fuels, Volatility characteristics, desirable characteristics of SI Engine fuels, knock rating and additives.

COMBUSTION OF FUELS 9 hrs
Stoichiometry - calculation of theoretically correct air required for combustion of liquid and gaseous fuels, volumetric and gravimetric analysis of the dry products of combustion, mass of dry gas per kg of fuel burnt, mass of carbon in the exhaust gas, mass of carbon burnt to carbon-monoxide per kg of fuel, heat loss due to incomplete combustion, exhaust gas analysis by Orsat apparatus.

LUBRICANTS 9 hrs

ALTERNATE FUELS 9 hrs
Alternate fuels for SI engines and CI engines, desirable characteristics, Octane and cetane rating, biodiesel. Introduction to electric, hybrid and fuel cell vehicles.

L: 45 T: 0 Total 45 Hrs

Reference book

Course outcome:
On successful completion of the course, the learner would be able to
1. Understand the refining process of petroleum
2. Understand the various types of fuels and their properties
3. Apply the knowledge in testing the fuel properties
4. Understand the properties and purpose of lubricants.
5. Understand the Alternate fuels
OBJECTIVES
To impart knowledge on the structure, properties, treatment, testing and applications of metals and on non-metallic materials so as to identify and select suitable materials for various engineering applications.

CONSTITUTION OF ALLOYS AND PHASE DIAGRAMS

HEAT TREATMENT

MECHANICAL PROPERTIES AND TESTING

NON-METALLIC MATERIALS

APPLICATION OF MATERIALS
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. Automotive technical textiles.

L: 45  T: 0  Total 45 Hrs

Reference book

Course outcome:
On successful completion of the course, the learner would be able to
1. Understand the importance of engineering materials and their structures, properties
2. Understand the various heat treatments process
3. Select the materials for particular engineering application
OBJECTIVES
To impart knowledge to the students in the principles of operation and constructional details of various Automotive Electrical and Electronic Systems like Batteries, Starting System, Charging System, Ignition System, Lighting System and Dash–Board Instruments.

TYPES OF BATTERIES 9 hrs
Principle and construction of Lead Acid Battery, Nickel – Cadmium Battery, Nickel Metal Hydride Battery, Sodium Sulphur Battery and Aluminum Air Battery, Characteristics of Battery, Battery Rating, Capacity and Efficiency, Various Tests on Battery, Battery– Charging Techniques, Maintenance of batteries.

ELECTRICAL COMPONENTS 9 hrs

IGNITION SYSTEMS 9 hrs

ELECTRICAL AND ELECTRONIC IGNITION SYSTEMS 9hrs

WIRING, LIGHTING AND OTHER INSTRUMENTS AND SENSORS 9hrs

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Total 45 Hrs

Reference book

COURSE OUTCOMES:
On successful completion of the course, the learner would be able to
i. Recognize and understand the different wiring diagrams used in automobile manuals.
ii. Distinguish the various electrical systems of an automobile and identify the sensors from the wiring diagrams.
iii. Apply the knowledge of sensors in the management of the vehicle control.
iv. Analyze and solve the problems related to automobile wiring.
OBJECTIVES
To impart the knowledge on basic concepts on Automotive Petrol Engines and its various sub components along with its functions.

ENGINE CONSTRUCTION AND OPERATION

SI ENGINE FUEL SYSTEM
Carburetor working principle. Requirements of an automotive carburetor – starting, idling, acceleration and normal circuits of a carburetor – Compensation – Maximum power devices – Constant choke and constant vacuum carburetor, multi barrel and multiple venturi systems – Fuel feed system – Mechanical and electrical pumps – Petrol injection.

COOLING AND LUBRICATION SYSTEM
Need for cooling. Types of cooling system – air cooling and Liquid cooled systems. Forced circulation system, pressure cooling system – Need for Lubrication system. Mist lubrication system, wet sump lubrication – Properties of lubricants, properties of coolant.

COMBUSTION AND COMBUSTION CHAMBERS

TWO STROKE ENGINES

Reference book

Course outcome:
On successful completion of the course, the learner would be able to
i) Understand the fundamentals & working of Petrol Engines
ii) Understand the various basic subsystems of a Petrol engine
iii) Apply the knowledge for different Petrol engine and various methods of combustion.
OBJECTIVES
To expose the students the different mechanisms, their method of working, Forces involved and consequent vibration during working

MECHANISMS 9 hrs

FRICTION 9 hrs
Friction in screw and nut – Pivot and collar – Thrust bearing – Plate and disc clutches – Belt (flat and V) and rope drives. Ratio of tensions – Effect of centrifugal and initial tension – Condition for maximum power transmission – Open and crossed belt drive.

GEARING AND CAMS 9 hrs
Gear profile and geometry – Nomenclature of spur and helical gears – Gear trains: Simple, compound gear trains and epicyclic gear trains - Determination of speed and torque- Cams – Types of cams – Design of profiles – Knife edged, flat faced and roller ended followers with and without offsets for various types of follower motions.

BALANCING 9 hrs
Static and dynamic balancing – Single and several masses in different planes –Balancing of reciprocating masses- primary balancing and concepts of secondary balancing – Single and multi cylinder engines (Inline) – Balancing of radial V engine – direct and reverse crank method.

VIBRATION 9 hrs

L: 45  T: 15  Total 60 Hrs

Reference book

Course outcome:
On successful completion of this course, student should be able to:

i) Understand and remember the fundamentals of various mechanisms, structures, inversion mechanisms etc
ii) Applying the knowledge for selecting the suitable drives like belt, ropes, pulleys etc.
iii) Creating the cam profile for required conditions.
iv) Analyzing the various vibrations in the moving components of a mechanism
OBJECTIVES
To provide practical training in designing and drawing of various Automotive components using modeling software

LIST OF EXPERIMENTS
Part Design:
1. Piston
2. Connecting Rod
3. Crank shaft
4. Cam Shaft
5. Valve
6. Flywheel
7. Cylinder Block
8. Cylinder Head
9. Tyre & Rim
10. Clutch Components

Assembly Design:
1. Piston ,Connecting Rod and Crank shaft Assembly
2. Clutch Assembly

Total : 45 Hrs

COURSE OUTCOMES:
On successful completion of the course, the learner would be able to

i. Modeling the Automotive components using Design software
ii. Assemble the Automotive components.
OBJECTIVES
To import the skill of testing conventional and alternative fuels for their properties using various fuels testing equipments.

LIST OF EXPERIMENTS
1. Testing of fuels - Ultimate analysis, proximate analysis
2. ASTM distillation test of liquid fuels
3. Aniline Point test of diesel
5. Calorific value of gaseous fuel.
6. Reid vapour pressure test.
7. Flash and Fire points of petrol and diesel.
8. Copper strip Corrosion Test
11. Viscosity Index of lubricants & Fuels by Saybolt Viscometer
12. Ash content and Carbon Residue Test
13. Drop point of grease and mechanical penetration in grease.

Total : 45 Hrs

COURSE OUTCOMES:
On successful completion of the course, the learner would be able to

1. Understand the process for finding out fuels & lubricant characteristics
2. Analyze the characteristics of fuels & lubricants
OBJECTIVES
(i) The various automotive electrical systems like Batteries, Starting System, Charging System, Ignition System, Lighting System and Dash–Board Instruments the instrumentation systems involved in signal conditioning and data acquisition
(ii) Microprocessor based programming and interfacing

LIST OF EXPERIMENTS

AUTOMOTIVE ELECTRICAL LABORATORY
1. Testing of batteries and battery maintenance
2. Testing of starting motors and generators
3. Testing of regulators and cut-outs
4. Diagnosis of ignition system faults
5. Study of Automobile electrical wiring

AUTOMOTIVE ELECTRONICS LABORATORY
1. Study of rectifiers and filters
2. Study of logic gates, adder and flip-flops
3. Study of SCR and IC timer
4. Study of RTD, LVDT, and Load Cell.
5. Interfacing DAC for Control Application
6. Interfacing A/D converter for simple data acquisition
7. Micro Processor programming and interfacing

Total: 45 Hrs

COURSE OUTCOMES:
On successful completion of the course, the learner would be able to
i. Recognize and understand the different wiring diagrams used in automobile manuals.
ii. Troubleshoot the malfunctions if any, related to automobile wiring.
iii. Interface the various automobile systems with the microprocessor / other signal conditioning units
Personality concepts - 5C’s & 5E’s 5 Hours
Personality-concepts, definition, types of personality-personality development activities-how to develop a good personality factors affecting personality development tools of improve personality-steps to a dynamic personality-5 C’s and 5 E’s

Time Management 5 Hours

Leadership traits 5 Hours

Empowerment of Mind 5 Hours

Simplified Physical Exercise & Yogasanas & Meditation 10 Hours
SEMESTER 5
OBJECTIVES

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

INTRODUCTION


ONE DIMENSIONAL PROBLEMS


TWO DIMENSIONAL PROBLEMS – SCALAR VARIABLE PROBLEMS

Finite element modeling – CST element – Element equations, Load vectors and boundary conditions – Assembly – Application to heat transfer - Automotive Examples.

TWO DIMENSIONAL PROBLEMS – VECTOR VARIABLE PROBLEMS


ISOPARAMETRIC ELEMENTS FOR TWO DIMENSIONAL PROBLEMS


L: 45  T: 15  Total 60 Hrs

Reference book


COURSE OUTCOMES:

On successful completion of the course, the learner would be able to

1. Understand the discretization and finite element approach
2. Select appropriate elements to solve physical and engineering problems with emphasis as an automobile engineering applications
OBJECTIVES
Study of the theory, construction and operation of different measurement technology, instruments transducers and their application

LINEAR MEASUREMENT
Units and standards, terminology and measurement errors. Linear measuring instruments, dial gauges, comparators and linear measuring machines. Angular measuring instruments-measurement of straightness flatness and surface finish. Profilographs.

PRESSURE MEASUREMENT
Bourden tube, diaphragm, bellows and pressure capsules: Transducers used in pressure measurement- potentiometer, strain gauges, LVDT, capacitive and variable reluctance type transducers. Dynamic pressure measurement piezo electric and piezo resistive transducers. Farnboro engine indicator. Low pressure measurement Mc leod gauge, Pirani gauge, thermal conductivity type pressure measurement.

FLOW MEASUREMENT

TEMPERATURE MEASUREMENT

FORCE AND TORQUE MEASUREMENT

COURSE OUTCOMES:
On successful completion of the course, the learner would be able to
1. Handle the basic measurement tools
2. Apply the concept of measurements in inspecting various parameters.

Reference book
U13 AUT 503- AUTOMOTIVE DIESEL ENGINES

OBJECTIVES
To impart the knowledge on basic concepts on Automotive Diesel Engines and its various sub components along with its functions.

DIESEL ENGINE BASIC THEORY 9 hrs

FUEL INJECTION SYSTEM 9 hrs

AIR MOTION, COMBUSTION AND COMBUSTION CHAMBERS 10 hrs

SUPERCHARGING AND TURBOCHARGING 8 hrs

DIESEL ENGINE TESTING AND PERFORMANCE 9 hrs

L: 45 T: 0 Total 45 Hrs

Reference book

Course Outcomes:
On successful completion of the course, the learner would be able to
i. Understand the fundamentals & working of Diesel Engines
ii. Understand the various basic subsystems of an diesel engine
iii. Apply the knowledge for Diesel engine performance testing and various methods of charging.
AIM:
This course gives a complete procedure for designing different kinds of problems occurring in design engineering field especially in automobile engineering.

OBJECTIVES
- To familiarize the various steps involved in the Design Process
- To understand the principles involved in evaluating the shape and dimensions of a component to satisfy functional and strength requirements.
- To learn to use standard practices and standard data
- To learn to use catalogues and standard machine components

INTRODUCTION
Classification of design - Engineering materials and their physical properties as applied to design - Selection of materials - Factors of safety in design – Endurance limit of materials - Determination of endurance limit for ductile materials.
Limits: Types of fits – types of tolerance – calculation of minimum and maximum clearances and allowances.

DESIGN OF SHAFTS AND SPRINGS
Introduction - Material and design stresses - Design of axles - Design of shafts on the basis of strength - Design of shaft on the basis of rigidity - Design of hollow shafts - Design of close coiled helical spring subjected to axial loading - Torsion of helical springs.

GEAR DESIGN

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

DESIGN OF BEARINGS
Design of journal bearings - Ball and Roller bearings - Types of Roller bearings - Bearing life - Static load capacity - Dynamic load capacity - Bearing material - Boundary lubrication - Oil flow and temperature rise.

Reference book

Course Outcomes:
On successful completion of the course, the learner would be able to
i. Understand and Apply Engineering Design process
ii. Apply engineering principles and analytical techniques in the design process
iii. Design the Machine Components like Shafts and Springs Gear Design Flywheels and Bearings.
OBJECTIVES
To give the students an overview of automotive sensors, their principles, types, and fabrication and also provide an exposure to recent developments in this area.

UNIT –I TRANSDUCTOR PRINCIPLES 8 hrs
Introduction to sensors - Variable resistance transducers, Metal and semiconductor strain gages and their signal conditioning, Inductive transducers, Electromagnetic sensors, Hall effect sensors, Capacitive transducers, Piezo electric transducers and their signal conditioning, Ultrasonic sensors

UNIT –II SENSORS FOR TRANSPORTATION 8 hrs
Vehicle Body:- Torque sensors/ Force sensors, Sensors Flap air flow sensors, Temperature sensor, Ultrasonic sensors, Ranging radar (ACC) Power Train:- Fuel level sensors, Speed and RPM sensors, Lambda Oxygen sensor, NOX sensors, Hotwire air mass meter Chassis:- Steering wheel angle sensor, Vibration and acceleration sensors, Pressure sensors, Speed and RPM sensors, torque sensors

UNIT –III ACTUATORS 9 hrs
Automotive Actuator Technologies-Operation and application of DC brushless motors and switched reluctance motors, Magneto-rheological Actuators-Suspension semi active actuators, Magnetostriuctive anti vibration actuators, Solenoids and actuators, Piezo Actuators, Micro positioning, Motion controller-Servo and stepper motors, Exhaust control valves, Smart micro actuators

UNIT –IV INTRODUCTION TO EMBEDDED SYSTEM 10 hrs
Introduction to embedded system, architecture, applications of embedded system, Microcontroller v/s microprocessor, introduction to MPLAB, making and running projects in MPLAB, basic programs, introduction to PIC Microcontroller, Types and products of PIC - architecture - memory devices - addressing modes, memory mapping, System Peripherals and User peripherals – ADC, Interfacing temperature sensor with PIC micro via ADC

UNIT –V INTERRUPTS, TIMERS AND INTERFACING 10 hrs
Programming interrupts, counters and timers and serial communication(MSSP), CCP(Capture Compare PWM gen module), External Memory Interface, simple interfacing programs.

Reference book
1. Automotive Sensors, BOSCH, 2002

COURSE OUTCOME’S:
On successful completion of the above course, the learner would be able to
1. To select sensors for measuring various parameters in automotive systems.
2. Apply the knowledge of sensors in the management of the vehicle control.
3. Program and interface various sensors used in automobiles using PIC microcontroller.
OBJECTIVES
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 generations and how to maintain ecological balance and preserve bio-diversity.

INTRODUCTION TO ENVIRONMENTAL STUDIES AND NATURAL RESOURCES 10hrs
Tool Definition, scope and importance – Need for public awareness – Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and over-utilization of surface and 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.

ECOSYSTEMS AND BIODIVERSITY 14hrs

ENVIRONMENTAL POLLUTION 8 hrs
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 – Soil waste Management: Causes, effects and control measures of urban and industrial wastes – Role of an individual in prevention of pollution – Pollution case studies – Disaster management: floods, earthquake, cyclone and landslides.

SOCIAL ISSUES AND THE ENVIRONMENT 7hrs
HUMAN POPULATION AND THE ENVIRONMENT  6hrs


Field Work
Visit to local area to document environmental assets- river / grassland / hill / mountain, visit to local polluted site- urban / rural / industrial / agricultural, study of common plants, insects, birds, study of simple ecosystems-pond, river, hill slopes etc.

L: 45  T: 0  Total 45 Hrs

Reference book
4. Bharucha Erach, the Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad India., 2002
OBJECTIVES
To enhance analysis skill using FEA tools.

LIST OF EXPERIMENTS
I. STRUCTURAL ANALYSIS
   1. 1-D truss
   2. 2-D truss
   3. 3-D truss
   4. Beam analysis
   5. 2-D structure with various loadings
   6. 2-D structures with different materials
   7. Plate with hole
   8. Modal analysis
   9. Transient Response
II. THERMAL ANALYSIS
    1. Steady State heat transfer
    2. Transient heat transfer
III. FLUID ANALYSIS
    1. Flow through pipes

Total: 45 Hrs

COURSE OUTCOMES:
On successful completion of the course, the learner would be able to

1. Analyze various 1D, 2D and 3D Structures using FEA tools.
2. Analyze heat transfer modes using FEA tools.
3. Analyze fluid flow through pipes using FEA tools.
OBJECTIVES
To provide practical training in conducting performance test on various Automotive Engines and to become familiar with different types of loading devices.

LIST OF EXPERIMENTS
1. Performance study of petrol engine at full throttle and part throttle conditions.
2. Performance study of diesel engine both at full load and part load conditions.
3. Morse test on petrol engines.
4. Determination of compression ratio, volumetric efficiency and optimum cooling water flow rate in IC engines.
5. Heat balance test on an automotive diesel and petrol engine.
7. Testing of 2 wheelers using chassis dynamometers.
8. Study of NDIR Gas Analyser and FID.
9. Study of Chemiluminescent NOx analyzer.
11. Diesel smoke measurement.
12. Study of 2 wheeler chassis Dynamometers.

Total : 45 Hrs

COURSE OUTCOMES:
On successful completion of the course, the learner would be able to
i. Identify & differentiate various types of dynamometers
ii. Conduct the performance test on various engines using various dynamometers.
iii. Calculate the performance characteristics.
iv. Handle various measuring devices related to engines and vehicles.
v. Measure the emission levels from vehicles and compare with Standards.
Responsible citizens to family and society 5 Hours


Politics and need Education 5 Hours

Human being & group – unity of man in society – relationship between individual – society.

Development of Science, education & Economics 5 Hours


Disparity among human beings 5 Hours


Service and Sacrifice 3 Hours

Social welfare – need – pure & pure society.

Yogasanas & Meditation 7 Hours

Pancha bhootha navagraha meditation.

Total : 45 Hrs
Globalization has brought in numerous opportunities for the teeming millions, with more focus on the students’ overall capability apart from academic competence. Many students, particularly those non-English medium schools, find that they are not preferred due to their inadequacy of communication skills and soft skills, despite possessing sound knowledge in their subject area along with technical capability. Keeping in view their pre-employment needs and career requirements, this course on Communication Skills Laboratory will prepare students to adapt themselves with ease to the Industry environment, thus rendering them as prospective assets to Industries. The course will equip the student with the necessary communication skills that would go a long way in helping them in their profession.

**OBJECTIVES**

- To equip students of engineering and technology with effective speaking and listening skills in English.
- To help them develop their soft skills and people skills, which will make the transition from college to workplace smoother and help them to excel in their jobs.
- To enhance students’ performance at Placement Interviews, Group discussions and other recruitment exercises.

**PC based session (Weightage - 40%)**

24 periods

I. **English Language Lab (18 Periods)**

1. **Listening Comprehension**
   - Listening – Listening and sequencing of sentences – Filling in the Blanks – Listening and answering the question

2. **Reading Comprehension and Vocabulary**
   - Filling in the blanks – Cloze Exercises – Vocabulary building – Reading and Answering questions

3. **Speaking:**
   - **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. Career Lab (6 Periods) (Samples are available to learn and practice in the class room session)

1. **Resume / Report Preparation / Letter Writing (1)**
   - Structuring the resume / report – Letter writing / E-mail communication – Samples

2. **Presentation Skills (1)**

3. **Soft Skills (2)**
   - Time Management – Articulateness – Assertiveness – Innovation and Creativity – Stress Management & Poise

4. **Group Discussion (1)**
   - Why is GD part of selection process? – Structure of a GD- Moderator-led and Other GDs – Strategies in GD – team work – Body Language –Mock GD

5. **Interview Skills**
   - Kinds of Interviews – Required Key Skills – Corporate culture- Mock Interviews
II. Class Room Session (weightage-60%)  

24 periods

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 (8)

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

5. **Note:**  
   Classroom sessions are practice sessions

**REFERENCES BOOKS:**


**CD’s**


2. BEC Series.

3. Look Ahead by Cambridge University Press.
OBJECTIVES:

To create awareness of motorsport engineering and its rules and regulations.

1. **Introduction to motorsport engineering**
   The history of motorsport engineering-Review of motorsport engineering-Pioneers of Motorsport engineering -Motorsport technology evolution review.

2. **List of motorsport competitions for students**
   A brief look at all the events students can take part to develop their skills - Formula SAE - Baja SAE - SAE Super mileage.

3. **Professional motorsport events**
   The various types of professional motorsport events that take place around the world - Cars – Formula One, World rally championship, Touring car championship, GP2, GP3, World Endurance Racing Championship, dirt track racing, NASCAR, Indy Car, Cross Country rallies, drag racing - Motorcycles – MotoGP, Superbike, Endurance, Motocross, Supermoto, Freestyle, Trials, Cross-country rallies, Speedway, Board track, drag racing.

4. **Rules and regulations of motorsports**

5. **Career in motorsports Engineering**
   Motorsport Engineer Race Driver / Rider - Test Driver / Rider - Design engineer - Race technician -Aerodynamics Engineer - Race official / steward

   **Total : 15 Hrs**

**COURSE OUTCOMES:**
**On successful completion of the course, the learner would be able to**

1. Participate in various activities of motorsport engineering
SEMESTER 6
OBJECTIVES

At the end of the course the student will be able to understand the fundamental principles involved in design of components of automotive chassis, the complete design exercise and arrive at important dimensions of chassis components.

Note: (Use of P S G Design Data Book and Approved Design Data books are permitted in the University examination)

INTRODUCTION TO CHASSIS FRAME AND SUB-SYSTEMS 9 hrs

Types of vehicles – Classification of vehicles – conventional and off-highway vehicles – Multi axle vehicles - vehicle specifications - Different layouts of power plant with reference to location and drive - Types of frames – Frameless chassis - various forces acting on frames, different sections-materials.

Calculation of power required to propel a vehicle.

DESIGN OF STEERING AND SUSPENSION SYSTEM 10 hrs

Functions and requirements of steering system - conditions for true rolling of wheels — roll centre and roll axis - Steering linkages - steering kinematics - under steering and over steering –Calculation of steering wheel effort and pitman arm torque-design of pitman arm for equivalent stresses.

Need of suspension system - factors affecting ride quality - Types of suspension systems—need anti-roll bar – Design of leaf and torsion bar spring –Basics of pneumatic suspension and design- Basics of shock absorber design-empirical relationships

BRAKING SYSTEM 9 hrs

Function, stopping time and distance, weight transfer during braking, brake actuating mechanisms – mechanical, hydraulic and pneumatic, disc and drum brakes - design and analysis of brake shoes and friction pads. Brake shoe materials and leading and trailing brakes.

GEAR BOX 8 hrs

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

DRIVE LINE AND REAR AXLE 9 hrs

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

L: 45  T: 15  Total 60 Hrs

Reference book

COURSE OUTCOMES:

On successful completion of the course, the learner would be able to

1. Understand the design assumptions.
2. Design of various automotive Chassis components.
OBJECTIVES
To make the students understand the design concept and principles of various engine components. These concepts and principles are familiarized for design of components.

Note: (Use of P S G Design Data Book and Approved Design Data books are permitted in the University examination)

UNIT –I DESIGN OF CYLINDER AND PISTON 9 hrs
Choice of material for cylinder and piston, design assumptions and procedure for cylinder and piston. Design of cylinder, piston, piston pin, piston rings, piston failures, lubrication of piston assembly.

UNIT –II CONNECTING ROD 9 hrs
Design of 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 hrs
Balancing of I.C. engines, significance of firing order. Material for crankshaft, design of crankshaft under bending and twisting, balancing weight calculations, development of short and long crank arms. Front and rear-end details.

UNIT –IV CLUTCH 9 hrs
Design of single plate clutch, multiplate clutch, design of centrifugal clutch, and cone clutch, energy dissipated, torque capacity of clutch, design of Clutch Components, Design details of roller and sprag type of clutches.

UNIT –V DESIGN OF VALVES AND VALVE TRAIN 9 hrs

L: 45 T: 15 Total 60 Hrs

Reference book
1. Engine Design – Giles J. G., Lliffe Book Ltd.1968
2. Engine Design – Crouse, Tata McGraw Publication, Delhi

Reference book
COURSE OUTCOMES:
On successful completion of the course, the learner would be able to
1. Understand the design assumptions.
2. Design of various Automotive Engine components
OBJECTIVES
The main objective of this course is to impart knowledge in automotive transmission. The detailed 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. The design of clutch and gearbox will all so be introduce to the students. At the end of the course the students will have command over automotive transmission concepts and application.

CLUTCH AND GEAR BOX  
Problems on performance of automobile - such as resistance to motion, tractive effort, engine speed, engine power and acceleration. Requirement of transmission system. Different types of clutches, principle, Construction and torque capacity. Determination of gear ratios for vehicles. Different types of gearboxes such as Sliding mesh gearbox, Constant mesh gearbox and Synchromesh gearbox.

HYDRODYNAMIC DRIVE  

PLANETARY GEAR BOXES  

AUTOMATIC TRANSMISSION APPLICATIONS  

HYDROSTATIC AND ELECTRIC DRIVE  

L: 45 T: 0 Total 45 Hrs

Reference book

COURSE OUTCOMES:
On successful completion of the course, the learner would be able to
1. Understand the purpose of clutch, gear box and drive train
2. Compare various types of transmission system
3. Understand the various types of drives
OBJECTIVES
To make the students realize the impact of automobile emissions on the environment and expose students to factors affecting the formation and control of automobile pollutants.

INTRODUCTION 9 hrs
Vehicle population assessment in metropolitan cities and contribution to pollution, effects on human health and environment, global warming, types of emission, transient operational effects on pollution. National and international pollution control norms.

POLLUTANT FORMATION IN SI ENGINES 9 hrs
Pollutant formation in SI Engines, mechanism of HC and CO formation in four stroke and two stroke SI engines, NOx formation in SI engines, effects of design and operating variables on emission formation, control of evaporative emission. Two stroke engine pollution.

POLLUTANT FORMATION IN CI ENGINES 9 hrs
Pollutant formation in CI engines, smoke and particulate emissions in CI engines, effects of design and operating variables on CI engine emissions. Nox formation and control. Color and Aldehyde emissions Noise pollution from automobiles, measurement and standards.

CONTROL OF EMISSIONS FROM SI AND CI ENGINES 9 hrs
Design of engine, optimum selection of operating variables for control of emissions, EGR, Air injector PCV system, Thermal reactors, secondary air injection, catalytic converters, catalysts, fuel modifications, fuel cells, Two stroke engine pollution control.

MEASUREMENT TECHNIQUES EMISSION STANDARDS AND TEST PROCEDURE 9 hrs
NDIR, FID, Chemiluminescent analyzers, Gas Chromatograph, smoke meters, emission standards, driving cycles – USA, Japan, Euro and India. Test procedures – ECE, FTP Tests. SHED Test – chassis dynamometers, dilution tunnels.

L: 45 T: 0 Total 45 Hrs

Reference book

COURSE OUTCOMES:
On successful completion of the course, the learner would be able to
1. Familiarize the norms of pollution standards
2. Analyze the sources of pollution from automobiles
3. Understand the pollution control methods and apply.
OBJECTIVES
To understand the electronic advancements achieved in the field of automobile technology

UNIT –I EMBEDDED CONTROL SYSTEMS 9 hrs
Introduction to Embedded control systems, Microcontroller and processors used in Automotive systems, need for electronics in automobiles, Engine control unit, Electronic – Input devices- Sensors- wheel speed sensor, Crash sensor etc.

UNIT –II ELECTRONIC FUEL INJECTION & IGNITION SYSTEM 9hrs
Introduction, feedback carburettor system, throttle body injection, advanced GDI and multi point fuel injection system, injection system controls, advantage of electronic ignition systems, types of solid state ignition system and their principles of operation, electronic spark timing control.

UNIT –III BRAKING AND ELECTRONIC STABILITY CONTROL 9hrs
Vehicle motion control, collision avoidance control – cruise control, Adaptive cruise control, Electronic transmission control. Vehicle stabilization system -Antilock braking system, Traction control system, Anti slip regulation, Electronic stability program. On-board diagnosis system.

UNIT –IV PASSIVE SAFETY SYSTEMS 9 hrs
Air bags and seat belt pretensioner systems: Sensor functions, Distributed front air bag sensing systems, Single-point sensing systems, Side-impact sensing – driver monitoring systems.

UNIT –V INFOTAINMENT SYSTEMS 9 hrs
Global positioning systems, geographical information systems, navigation systems, automotive vision system, lane departure warning system, driver assistance systems such as power seats, Power windows, and Remote keyless entry systems.

Reference book
7. Telematics Communication Technologies and Vehicular Networks: Wireless Architectures and Applications-Chung-Ming Huang, National Cheng Kung University, Taiwan; Yuh-Shyan Chen, National Taipei University, Taiwan
8. Active Safety and the Mobility Industry -Dr. Andrew Brown, Jr.-SAE International

COURSE OUTCOMES:
On successful completion of the course, the learner would be able to
1. Understand the advancements in the fuel injection system.
2. Compare the various types of advanced braking systems.
3. Outline the active and passive safety systems in automobiles.
LABORATORY

OBJECTIVES
To enhance design and analysis skill for Chassis and Engine components using modeling and FEA tools.

List of Experiments:

DESIGN AND ANALYSIS FOR FOLLOWING CHASSIS COMPONENTS:

1. Chassis Frame
2. Helical spring
3. Leaf Spring
4. Clutch
5. Propeller Shaft

DESIGN AND ANALYSIS FOR FOLLOWING ENGINE COMPONENTS:

1. Cylinder
2. Piston
3. Connecting Rod
4. Crank Shaft
5. Valve

COURSE OUTCOMES:
On successful completion of the course, the learner would be able to
1. Design and analyze the Chassis components using Modeling / FEA tools
2. Design and analyze the Engine components using Modeling / FEA tools

Total : 45 Hrs
OBJECTIVES

To understand the electronic advancements achieved in the field of automobile technology

List of Experiments:
1. PIC microcontroller programming and interfacing
2. RPM Measurement Using
   (i) Hall effect Sensor
   (ii) Inductive Type Sensor
3. Brake Pedal Position measurement
   (i) using Hall Effect sensor
   (ii) Designing of P, PI, PID controllers using performance criteria
4. Labview Programming:
   (i) Temperature Conversion
   (ii) Debugging and Sub-VI creation
   (iii) Loops and Waveform Charts
   (iv) Case statements, Arrays and Clusters
   (v) Strings and File Input/output
5. Data Acquisition Systems and Labview
   (i) Strain measurement system
   (ii) Temperature measurement system
   (iii) Pressure measurement system
6. Matlab/Simulink Programming
   Case Study 1: ABS
   Case Study 2: TCS

Total: 45 Hrs

COURSE OUTCOMES:
On successful completion of the course, the learner would be able to
1. Apply the knowledge of sensors in the management of the vehicle control.
2. Program and interface various sensors used in automobiles using PIC microcontroller
3. Interface and simulate various sensors used in automotive systems to Labview and Matlab
OBJECTIVES

The objective of this project is to provide opportunity for the students to implement their skills acquired in the previous semesters to practical problems.

GUIDELINES:

1. Selection of a topic or project title in consultation with a staff member.
2. Develop a project planning strategy.
3. If it is an industry – sponsored project, a concurrent letter from industry is required.
4. A maximum of 4 students per group will do the project.
5. The project may be done in one of the labs under the supervision of a guide or in the selected industry.
6. At the end of the project, a report will be written and a technical presentation along with demonstration will be made by the students.
7. The report, project demonstration and technical presentation will be evaluated by the internal and external examiners

Total : 60 Hrs

COURSE OUTCOMES:

On successful completion of the course, the learner would be able to

1. Design, analyze and fabricate device and mechanisms of automotive specific.
OBJECTIVES

The objective of this project is to provide opportunity for the students to implement their skills acquired in the previous semesters to practical problems.

GUIDELINES:

Rights and responsible citizenship 5 Hours

Citizenship- its significance-Enlightened citizenship - what are the rights to citizenship
Emerging India-its glory today- Global perspective

Greatness of Indian culture 5 Hours


Indian culture and it’s greatness – dress coding - festivals – food is medicine – games – traditional medicines

India and Peace 5 Hours

India and Peace – who are the person to participate world peace - India and Spirituality-

India’s message to the world 7 Hours


Global peace 3 Hours


Meditation & Yogasanas 5 Hours

Nine Centre Meditations , Yogasanas - II

Total :30Hrs
OBJECTIVES
Car design courses, such as this one focused on race cars, give students the opportunity to create their own cars from scratch.

Design Expressions
Design methodology, Lifestyle board, Mood board, Theme board, Design trends, Design movements, Application of design principles and product aesthetics

Introduction to Concept Cars
Importance of concept cars, Blending technology, Form in concept cars

Car Design
Art and colour, Product styling, Introduction to human factors engineering, Digital design, Concept to reality, Auto show vehicles

Visual Factors in Design
Colour harmony, Colour in design, Artist’s spectrum, Basic color schemes

COURSE OUTCOMES:
On successful completion of the course, the learner would be able to

Total: 15 Hrs
SEMESTER 7
OBJECTIVES
To familiarize the students in vehicle dynamics.

INTRODUCTION

PERFORMANCE MODE
Acceleration - free body diagram of accelerating vehicle, maximum transferable tractive force, gradability, deceleration - maximum decelerating rates, stopping distance, maximum braking force, adhesion utilization - Straight line motion - aerodynamic forces and moments, viscosity effects - separation and its control - aerodynamic lift and its control - ground effect - profile for minimum drag.

RIDE MODE
Effects of damping the vibration, vibration absorbers, pitch and bounce motion, oscillation centers - active and semi active suspension - Orthogonality of mode shapes, modal analysis, vehicle performance testing.

HANDLING MODE
Tyres - mechanics, testing and modeling, vehicle control - low speed cornering and static steering - Ackerman steering geometry, steady-state cornering - steering factors, vehicle control parameters (under steer, neutral steer and over steer), steady state handling - lateral acceleration gain, characteristic speed, yaw velocity gain and critical speed - effect of braking on vehicle handling - constant radius testing - fish hook measurement testing.

VEHICLE STABILITY AND NOISE
Load distribution. Calculation of Tractive effort and reactions for different drives - Stability of a vehicle on a slope, on a curve and a banked road. Properties of sound – sound level designation and measurements techniques - Sound isolation and absorption - machine enclosures, silencers and mufflers.

L: 45  T: 15  Total  60 Hrs

Reference book

COURSE OUTCOMES:
On successful completion of the course, the learner would be able to
1. Understand the concept of mechanical vibrating system.
2. Analyze the performance, ride and handling mode of the vehicle.
3. Analyze the stability and noise of vehicle.
OBJECTIVES
At the end of the course, the students will be able to have a sound knowledge for the design of the vehicles body to give maximum comfort for the passengers and exposed to the methods of stream lining the vehicles body to minimize drag.

CAR BODY DETAILS 9 hrs

VEHICLE AERODYNAMICS 9 hrs
To make the students understand the design concept and principles of various engine components. These concepts and principles are familiarized for design of components.

BUS BODY DETAILS 9 hrs
Types: Mini bus, single decker, double decker, two level, split level and articulated bus – Bus body lay out – Constructional details: Types of metal sections used – Regulations – Conventional and integral type construction.

COMMERCIAL VEHICLE DETAILS 9 hrs
Different types of commercial vehicle bodies – Light commercial vehicle body types – Construction details of flat platform body, Tipper body & Tanker body – Dimensions of driver’s seat in relation to controls – Drivers cab design.

BODY MATERIALS, TRIM AND MECHANISMS 9 hrs

L: 45  T: 0  Total 45 Hrs

Reference book

COURSE OUTCOMES:
On successful completion of the course, the learner would be able to
1. Understand various category of vehicle frames
2. Understand various types of vehicle body construction
3. Familiarize various aero dynamic styles of vehicle body
OBJECTIVES
At the end of the course, the students will be able to understand the various Off road vehicle and their systems and feature.

CLASSIFICATION AND REQUIREMENTS OF OFF ROAD VEHICLES  6 hrs
Construction layout, capacity and applications. Power Plants, Chassis and Transmission, Multi axle vehicles.

EARTH MOVING MACHINES  10hrs
Earthmovers like dumpers, loaders - single bucket, Multi bucket and rotary types - bulldozers, excavators, backhoe loaders, scrappers, drag and self powered types, Bush cutters, stumpers, tree dozer, rippers etc. – Power and capacity of earth moving machines.

SCRAPPERS, GRADERS, SHOVELS AND DITCHERS  10hrs
Scrappers, elevating graders, motor graders, self powered scrappers and graders, Power shovel, revolving and stripper shovels – drag lines – ditches – capacity of shovels.

FARM EQUIPMENTS, MILITARY AND COMBAT VEHICLES  8hrs
Power take off, special implements. Special features and constructional details of tankers, gun carriers and transport vehicles.

VEHICLE SYSTEMS, FEATURES  11hrs

L: 45  T: 0  Total 45 Hrs

Reference book

COURSE OUTCOMES:
On successful completion of the course, the learner would be able to
1. Understand special type of vehicles based on the need and purpose.
2. Understand the working of power take off shaft
3. Understand various types of wheels for off road vehicles
OBJECTIVES

- To create an awareness on Engineering Ethics and its use in ones profession
- To instill moral values, social values and loyalty
- To provide an insight into ones professional rights and a view of professional ethics in the global context

ENGINEERING ETHICS AND THEORIES  9 hrs

Definition, Moral issues, Types of inquiry, Morality and issues of morality, Kohlberg and Gilligan’s theories, consensus and controversy, Professional and professionalism, moral reasoning and ethical theories, virtues, professional responsibility, integrity, self respect, duty ethics, ethical rights, self interest, egos, moral obligations.

SOCIAL ETHICS AND ENGINEERING AS SOCIAL EXPERIMENTATION  9 hrs

Engineering as social experimentation, codes of ethics, Legal aspects of social ethics, the challenger case study, Engineers duty to society and environment.

SAFETY  9 hrs


RESPONSIBILITIES AND RIGHTS OF ENGINEERS  9 hrs


GLOBAL ISSUES AND ENGINEERS AS MANAGERS, CONSULTANTS AND LEADERS  9 hrs

Multinational Corporations – Environmental ethics – computer ethics – weapons development – engineers as managers – consulting engineers – engineers as expert witnesses and advisors – moral leadership – Engineers as trend setters for global values.

L: 45  T: 0  Total 45 Hrs

Reference books


COURSE OUTCOMES:

On successful completion of the course, the learner would be able to

1. CO1 - Understand the ethical theories and concepts
2. CO2 - Understanding an engineer’s work in the context of its impact on society
3. CO3 - Understand and analyze the concepts of safety and risk
4. CO4 - Understand the professional responsibilities and rights of Engineers
5. CO5 - Understand the concepts of ethics in the global context
OBJECTIVES
To study various dynamic behavior of road vehicles under various loading conditions as well as computer simulation of the same.

List of Experiments:
1. Study on automotive systems simulation
2. Simulation and analysis of Rigid Axle Suspension system
3. Simulation and analysis of Independent Suspension system
4. Simulation and analysis of hydraulic brake system
5. Simulation and analysis of air brake system
6. Simulation of steady state cornering characteristics of vehicle
7. Modeling of tires and analysis of cornering characteristics
8. Roll stability and Rollover threshold analysis
9. Simulation of a half car model for pitch and bounce
10. Simulation of Quarter car model for sprung mass response for road inputs

COURSE OUTCOMES:
On successful completion of the course, the learner would be able to
1. Analyze the Dynamic modeling and simulations of road vehicles and their subsystems.

Total : 45 Hrs
OBJECTIVES
To provide training to the Students to know about the trouble shooting and Maintenance of Automotive vehicles.

List of Experiments:

1. Study and layout of an automobile repair, service and maintenance shop.
2. Study and preparation of different statements/records required for the repair and maintenance works.
3. Minor and Major Tuning of Diesel and Petrol Engines and Fault diagnosis.
4. Fault Diagnosis of Ignition, Starting and Charging System.
5. Fault Diagnosis of Lighting System, Horn & Wiper and Head Lights- Beam alignment
6. (i) Hand Brake, Brake, Clutch and Steering Wheel Play Adjustment.
   (ii) Study of Steering gearbox trouble shooting and maintenance
7. (i) Brake system (Air, Hydraulic, Mechanical) trouble shooting and Maintenance
   (ii) Bleeding of Hydraulic Brake System
8. Wheel maintenance and Removal, fitting of tire and tube and checking wheel balance
9. Wheel alignment – Testing of camber, caster, kingpin inclination, toe-in and toe-out
10. (i) Study of suspension system trouble shooting and maintenance.
    (ii) Study of door lock and window glass rising mechanisms.
12. Valve grinding, valve lapping. Setting the valve angle and checking for valve leakage

TOTAL: 45Hrs

COURSE OUTCOMES:
On successful completion of the course, the learner would be able to
1. Identify the faults and knowledge on maintenance
2. Understand the Engine Trouble shooting and Maintenance
OBJECTIVES:
To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same.

GUIDELINES:
1. The students in a group of 3 to 4 works on a topic approved by the head of the department under the guidance of a faculty member and prepare a comprehensive project report after completing the work to the satisfaction of the supervisor.
2. A Project topic must be selected either from published lists or the students themselves may propose suitable topics in consultation with their guides. The aim of the project work is to deepen comprehension of principles by applying them to a new problem which may be the design and manufacture of a device, a research investigation, a computer or management project or a design problem.
3. The progress of the project is evaluated based on a minimum of three reviews. The review committee may be constituted by the Head of the Department.
4. A project report is required at the end of the semester.
5. The project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department.

TOTAL: 45Hrs

COURSE OUTCOMES:
On successful completion of the course, the learner would be able to
1. Execute the project based on the design developed during Phase I
2. Prepare a report based on their project identified.
Global brotherhood and protect globe

Global values – understanding and identification – its importance - Racial discrimination and solution

Man is the Cause and Man is the Solution


Greatness of Culture

Social inequality and solution – live case discussions and debate – black money – poverty people - Cultural degradation – live case discussions and debate – difference between Indian culture & western culture – impact of western culture in India – how to retain our culture and solution.

Emergence of monoculture

Emergence of monoculture – solution - Global terrorism – it’s cause and effect – solution

Marginalization of Global Economic

Economic marginalization and solution – it’s impact in the globe – globalization in market – its effect in local market – merits – demerits of globalization - Man is the cause and man is the solution.

Meditation & Yogasanas

Nithyananda Meditation & Divine Meditation
Yogasanas - III

TOTAL: 30Hrs
OBJECTIVES:
To give an overview of engine management systems and the various control techniques involved.
- An overview of Engine Management System
- Current trends in automotive electronic engine management system
- Control of SI & CI engines for better performance and low emissions
- Closed loop control of engine parameters of fuel injection and ignition.
- Digital control techniques – Dwell angle calculation, Ignition timing calculation and Injection duration calculation.
- Electronics emission control techniques

COURSE OUTCOMES:
On successful completion of the course, the learner would be able to
1. Familiarize the importance of ECU for better performance of engines.

Total: 15 Hrs
SEMESTER 8
U13 AUP 801 – PROJECT PHASE – II

OBJECTIVES:
To train the students in preparing project reports and to face reviews and viva voce examination.

GUIDELINES:
1. The progress of the project is evaluated based on a minimum of three reviews.
2. The review committee may be constituted by the Head of the Department.
3. A project and project reports are required at the end of the semester.
4. The project work is evaluated jointly by external and internal examiners constituted by the Head of the Department based on oral presentation and the project report.

TOTAL: 45Hrs

COURSE OUTCOMES:
On successful completion of the course, the learner would be able to
1. Take up industrial design and fabrication projects.
2. Create innovative ideas to solve real time engineering problems.
Group 1

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

INTRODUCTION
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.

AERODYNAMIC DRAG OF CARS
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.

SHAPE OPTIMIZATION OF CARS
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.

VEHICLE HANDLING
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.

WIND TUNNELS FOR AUTOMOTIVE AERODYNAMICS
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.

L: 45  T:  0  Total  45 Hrs

Reference book
INTRODUCTION
Drawing in product design, drawing by hand, drawing by computer, mass production, geometric versus naturalistic drawing, modernist design. Basic drawing skills - Perspectives, metric projections, spherical projections, orthographic projections, sections and scrap views. Tools and materials - Pencils, pens, erasers, markers, paints, ink, airbrush, drawing instruments, paper and aboard.

COMPUTER SYSTEMS
The computer processor, system software, the central processing unit, memory, frame buffers, display, input devices, hardcopy output, 3D output devices, networking, health and safety. Concept design - Satisfying the client, sketch, schematic, evaluating the design, 3D modelling concepts, hybrid approach, commercial computer solutions, drawing in space, creating organic forms.

PRESENTATION DRAWING AND VISUALS
From watercolour washes to markers, painting by numbers, the art of design, visual tricks, making marker drawing. 2D computer programs: paint and vector, 3D computer aided styling (CAS), creating virtual reality, shading a computer model, ray tracing and radiosity, adding texture, fractals and commercial modelers.

FROM GENERAL ARRANGEMENTS DRAWING TO PRODUCTION
Technical production documentation, the general arrangement drawing, drafting standards, computer aided drafting, geometric constructions, controlling curves, parametric design, CAD data - Exchange standards and all change in the CAD market.

TECHNICAL ILLUSTRATION
Art of technical illustration, techniques of technical illustration, thick and thin lines, sections, cutaways and ghosting, photo-tracing, annotation and labeling, computer aided illustration, interactive technical illustration and commercial solutions.

Reference Book
OBJECTIVES
• This course aims to introduce numerical modeling and its role in the field of heat and fluid flow;
• It will enable the students to understand the various discretisation methods and solving methodologies and to create confidence to solve complex problems.

INTRODUCTION
Application areas of CFD, Basic concepts of fluid flow - Governing equations, conservation of mass, momentum and energy – Navier-stokes and energy equation for Newtonian fluid, Mathematical classification of flow - Hyperbolic, parabolic, elliptic and mixed flow types.

DISCRETISATION

CFD TECHNIQUES
Lax - Wendroff technique, MacCormack’s technique, relaxation technique. ADI technique, pressure correction technique, SIMPLE algorithm. Fluid flow and convection problems - Upwind scheme and stability criteria.

TURBULENCE MODELING
Turbulence energy equation - One-equation model, k-ω model and k-ε model.

CASE STUDIES
Modelling and analysis of heat transfer, fluid flow and automobile components using CFD packages

L: 45 T: 0 Total 45 Hrs

Reference Books
DFM APPROACH, SELECTION AND SUBSTITUTION OF MATERIALS IN INDUSTRY 9 hrs
DFM approach, DFM guidelines, standardisation, group technology, value engineering, comparison of materials on cost basis.

GEOMETRIC DIMENSIONING & TOLERANCE INTRODUCTION 9 hrs
Process capability, process capability metrics, Cp, Cpk , cost aspects, feature tolerances, geometric tolerances, surface finish, review of relationship between attainable tolerance grades and different machining process, cumulative effect of tolerances, sure fit law, normal law and truncated normal law, 6σ concept.

TOLERANCE CHARTING TECHNIQUE 9 hrs
Operation sequence for typical shaft type of components, preparation of process drawings for different operations, tolerance worksheets and centrality analysis, examples.

DESIGN FOR MANUFACTURE 9 hrs
Design features to facilitate machining, datum features - Functional and manufacturing, component design-machining considerations, redesign for manufacture, examples. Redesign of castings based on parting line considerations, minimising core requirements, redesigning cast members using weldments, use of welding symbols – Case studies.

SELECTIVE ASSEMBLY 9 hrs
Interchangeable and selective assembly, deciding the number of groups, Model-I: group tolerances of mating parts equal; Model-II: total and group tolerances of shaft, control of axial play-introducing secondary machining operations, laminated shims, examples

L: 45  T: 0  Total 45 Hrs

Reference Books:
OBJECTIVE
This course reviews the fundamental concepts of acoustics, noise propagation and vibrations. Focus is given to the theory and equipment pertaining to the measurement of automotive acoustics, sound quality and vibration.

FUNDAMENTALS OF ACCoustics, NOISE AND VIBRATION 8 hrs

EFFECT OF NOISE, BLAST, VIBRATION AND SHOCK ON PEOPLE 7 hrs

TRANSPORTATION NOISE AND VIBRATION – SOURCES, PREDICTION AND CONTROL 10 hrs

INTERIOR TRANSPORTATION NOISE AND VIBRATION – PREDICTION AND CONTROL 10 hrs
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,

NOISE AND VIBRATION TRANSDUCERS, ANALYSIS EQUIPMENT, SIGNAL PROCESSING AND MEASURING TECHNIQUES. 10 hrs

L: 45  T:  0  Total  45 Hrs
Reference
## OBJECTIVES

- To provide information on various types of fuels, their property and characterization.
- To understand the thermodynamics and kinetics of combustion.
- To understand and analyze the combustion of various fuels.

### INTRODUCTION


### THERMODYNAMICS AND KINETICS OF COMBUSTION


### COMBUSTION OF SOLID FUELS


### COMBUSTION OF LIQUID FUELS

Spray formation and droplet behaviour - oil fired furnace combustion - gas turbine spray combustion – direct and indirect Injection combustion in IC engines.

### COMBUSTION OF GASEOUS FUELS


### Reference Book

# U13 AUT E17 - ALTERNATE FUELS AND ENERGY SYSTEMS

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**OBJECTIVES**

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.

**ALCOHOLS AS FUELS**  
10 hrs


**VEGETABLE OILS AS FUELS**  
10 hrs


**HYDROGEN AS ENGINE FUEL**  
9 hrs


**BIOGAS, NATURAL GAS AND LPG AS FUELS**  
8 hrs

Production methods of Biogas, Natural gas and LPG. Properties studies. CO₂ and H₂S scrubbing in Biogas., Modification required to use in SI and CI Engines- Performance and emission characteristics of Biogas, NG and LPG in SI and CI engines.

**ELECTRIC, HYBRID AND FUEL CELL VEHICLES**  
8 hrs


*L:* 45  
*T:* 0  
*Total* 45 Hrs

**Reference Book**

4. Transactions of SAE on Biofuels (Alcohols, vegetable oils, CNG, LPG, Hydrogen, Biogas etc.)
OBJECTIVE:
To impart knowledge in simulating IC engine processes. The detailed concept of air standard, fuel air cycle, progressive and actual cycle simulation of SI engine will be taught to the students. At the end of the course the students will have command over simulation of IC engine process.

INTRODUCTION 9 hrs

COMBUSTION AND STOICHIOMETRY 9 hrs
Reactive processes, Heat of reaction, measurement of URP, measurement of HRP. Introduction - combustion equation for hydrocarbon fuels. Calculation of minimum air required for combustion, excess air supplied and stoichiometric air required for complete combustion. Conversion of volumetric analysis to mass analysis.

ADIABATIC FLAME TEMPERATURE 9 hrs
Introduction, complete combustion in C-H-N-O systems, constant volume adiabatic combustion, constant pressure adiabatic combustion, calculation of adiabatic flame temperature, isentropic changes of state. SI Engine simulation with air as working medium, deviation between actual and ideal cycle.

SIMULATION OF IC ENGINES 9 hrs
SI and CI engine simulation – Air standard cycle, fuel-air cycle, progressive combustion cycle and actual cycle simulation – Part throttle, full throttle and supercharged conditions.

SIMULATION OF NEW ENGINE CONCEPT 9 hrs
Dual fuel engine, low heat rejection engine, lean burn engine, variable compression ratio engine, homogeneously charged compression ignition engine and controlled auto ignition engine.

L: 45 T: 0 Total: 45 Hrs.

Reference Book
U13 AUT E19 – ADVANCED THEORY OF I.C. ENGINES

L: 45 T: 0 Total 45 Hrs

COMBUSTION PROCESSES

- Combustion in premixed and diffusion flames, combustion process in IC engines, adiabatic flame temperature, effect of super charging and scavenging on combustion.

ABNORMAL COMBUSTION IN SI ENGINES

- Stages of combustion, flame propagation, rate of pressure rise, cycle-to-cycle variation, abnormal combustion, theories of detonation, heat release.

COMBUSTION AND KNOCK IN CI ENGINES

- Droplet and spray combustion theory, stages of combustion, delay period, peak pressure, heat release, gas temperature, diesel knock.

COMBUSTION OF FUELS

- Combustion stoichiometry of petrol, diesel, alcohol and hydrogen fuels, chemical energy and heating values, chemical equilibrium and maximum temperature, flame velocity and area of flame front, fuel spray characteristics - Droplet size, penetration and atomization.

ADVANCED IC ENGINES

- Adiabatic and low heat rejection engines, homogeneously charged compression ignition engines - MAN combustion chamber and multi-fuel engines, stratified charged and lean burn engines.

Reference Books:
Group 2

Technology & Manufacturing
OBJECTIVES
This course will give an appreciation of the fundamental principles, design and operation of hydraulic and pneumatic machines, components and systems and their application in recent automation revolution.

INTRODUCTION TO FLUID POWER & PRINCIPLE  
9 hrs
Introduction to fluid power control- Hydraulic and pneumatics- Selection criteria, application of fluid power, application of pascal’s law, equation, Transmission and multiplication of force pressure losses- fluids, selection and properties- ISO symbols

FLUID POWER DRIVES  
12 hrs
Fluid power drives- Pumps- working principle and construction details of gear, vane and piston pumps, hydraulic motor, Hydrostatic transmission drives and characteristics- Hydraulic supply components- Pneumatic power supply- Compressor, air distribution, air motors. Case study related to automotive application

FLUID POWER ELEMENTS  
12 hrs
Control valves- pressure, flow direction- working principles and construction- Special type valves- cartridge, modular, proportional and servo- Selection and actuation methods.
Actuators- Selection and specification, cylinders- mounting, cushioning, pipe fittings- Fluid conditioning elements- Accumulators. Case study related to automotive application.

HYDRAULICS AND PNEUMATICS CIRCUITS DESIGN  
9 hrs

AUTOMOTIVE APPLICATIONS  
6 hrs
Use of electrical timers, switches, solenoid, relay, proximity sensors etc. Electro pneumatic sequencing Ladder diagram- PLC: – elements, function and selection- PLC programming-
Ladder and different programming methods- Sequencing circuits. Case study related to automotive application.

L: 45   T: 0       Total   45 Hrs
Reference book
OBJECTIVES
At the end of the course, the students will be able to understand the components of the automotive air-conditioning and their functions and the latest developments in this field.

AUTOMOTIVE AIRCONDITIONING FUNDAMENTALS 9 hrs
Air conditioning system - Schematic layout, compressor, condenser, expansion valve, evaporator, controlling evaporator temperature, evaporator pressure regulator, evaporator temperature regulator.

PSYCHROMETRY 9 hrs
Moist air behaviour, psychrometric chart, psychrometric processes - Summer and winter airconditioning, cooling load calculations.

REFRIGERANT 9 hrs
Properties of refrigerants, common refrigerants, containers, handling refrigerants, tapping into the refrigerant container, ambient conditions affecting air conditioning system, refrigeration system diagnostics

AIR ROUTING & TEMPERATURE CONTROL 9 hrs
Objectives – Evaporator case air flow through the Dash recirculating unit – Automatic temperature control – Ducting system in Passenger car and Bus– Controlling flow – Vacuum reserve – Testing the air control and handling systems- Load calculations - Psychrometry

AIR CONDITIONING 9 hrs
Automotive heaters - Heater system, manually and automatically controlled air conditioner, air conditioning in cars, busses, trucks, location, working and maintenance

Reference book
5. Steven Daly “Automotive Air Conditioning and climate control systems”, Butterworth Heinemann, Burlington, 2011
OBJECTIVES
At the end of the course, the students will be able to apply and introduce the modern developments in vehicle technology with their advancements, comfort, and security. etc.,

ENGINE MANAGEMENT SYSTEMS 9hrs
Electronically controlled SI and CI engine fuel injection systems, related hardware and software. Closed loop ignition system. Catalytic converters and particulate traps.

CHASSIS 9 hrs
Active suspension control, Pneumatic suspensions, Power train monitoring, safety views-Modern development in Chassis management of vehicles.

HEATING AND AIR CONDITIONING 9 hrs

COMFORT AND CONVENIENCE 9 hrs
Adaptive cruise control, car entertainment, power windows, navigation system, adaptive noise control, electric seats, driver information system. Power windows, power steering.

SAFETY AND SECURITY SYSTEMS 9 hrs
Airbags, seat belt tightening system, collapsible and tiltable steering column, Anti-theft system, anti-lock braking system, electronic stability control system/traction control system, roll over protection system.

L: 45 T: 0 Total 45 Hrs

Reference book
ENGINE COMPONENTS

Casting of engine block - conventional and expendable pattern, machining of engine blocks in machining center. Preparation of casting for cylinder heads, forging of crank shaft, connecting rod and gudgeon pins, machining and heat treatment, casting of piston by gravity casting, squeeze casting, machining and finishing, upset forging of valves, heat treatment and surface improvement, cylinder liners and piston ring manufacturing.

Engine bearing manufacturing.

TRANSMISSION COMPONENTS-I


TRANSMISSION COMPONENTS-II

Continuous casting of propeller shaft, extrusion of propeller shaft, extrusion dies, heat treatment and surface hardening of propeller shaft, composite propeller shaft manufacturing. Forging of rear axles, casting of rear axle casing, wheels, brake drum, tyre manufacturing.

BODY COMPONENTS


SURFACE COATINGS AND ELECTRICAL COMPONENTS:

Chemical vapour deposition, physical vapour deposition, sol-gel processing, spraying, plating, painting in paint booth.

Starter motor, alternator, regulator, battery, lamps, control switches, electronic gauges.

L: 45  T: 0  Total 45 Hrs

Text Book

OBJECTIVES
• To understand the principles, functions and design practices of Jigs, Fixtures and dies for press working
• To understand the Principles of jigs and fixtures design, locating principles, locating elements and clamping Devices.

PURPOSE TYPES AND FUNCTIONS OF JIGS AND FIXTURES 8hrs

JIGS 9hrs
Drill bushes –different types of jigs-plate latch, channel, box, post, angle plate, angular post, turnover, pot jigs-Automatic drill jigs-Rack and pinion operated. Air operated Jigs components. Design and development of Jigs for given components.

FIXTURES 9 hrs
General principles of boring, lathe, milling and broaching fixtures- Grinding, planning and shaping fixtures, assembly, Inspection and welding fixtures- Modular fixtures. Design and development of fixtures for given component

PRESS WORKING TERMINOLOGIES AND ELEMENTS OF DIES AND STRIP LAY OUT 10hrs

DESIGN AND DEVELOPMENT OF DIES 9hrs
Design and development of progressive and compound dies for Blanking and piercing operations. Bending dies – development of bending dies-forming and drawing dies-Development of drawing dies. Design considerations in forging, extrusion, casting and plastic dies.

L: 45 T: 0 Total 45 Hrs

Reference Books:
OBJECTIVES
- At the end of the course, the students will be able to understand about the basics of robots.
- Understanding the usage of Robots in Automotive Industries

FUNDAMENTALS OF ROBOT

ROBOT DRIVE SYSTEMS AND END EFFECTORS

SENSORS AND MACHINE VISION

ROBOT KINEMATICS AND ROBOT PROGRAMMING
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) – DH matrices - Deviations and Problems.
Teach Pendant Programming, Lead through programming, Robot programming Languages – VAL Programming – Motion Commands, Sensor Commands, End effector commands, and Simple programs

IMPLEMENTATION AND ROBOT ECONOMICS
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

Reference Books
OBJECTIVES
At the end of the course, the students will be able to understand the fabrication, analysis and design of composite materials & structures.

STRESS STRAIN RELATION 6hrs

METHODS OF ANALYSIS 12hrs

LAMINATED PLATES 12hrs
Governing differential equation for a general laminate, angle ply and cross ply laminates. Failure criteria for composites.

SANDWICH CONSTRUCTIONS 8 hrs
Basic design concepts of sandwich construction -Materials used for sandwich construction - Failure modes of sandwich panels.

FABRICATION PROCESS 7 hrs

L: 45 T: 0 Total 45 Hrs

Reference Books
Objective

- To impart knowledge on use of textiles in automotive interior and body.
- Various parts made out of woven and non-woven fabrics in automotive.
- The properties of the textiles which can absorb noise and enhance the performance of vehicle due to textile composite structures etc.

**AUTOMOTIVE TEXTILES**

9 hrs

Requirements for automotive textiles, design demands, woven & knitted, non-woven fabrics used in automotive interiors, Recycling of automotive textiles – Future trends

**SMART TEXTILES IN AUTOMOTIVE INTERIORS**

9hrs

Car seats- Types of materials used as cushions. Technology for replacing polyurethane foams in car seats. Smart textiles: definition, textile sensors, textile actuators - heating fabrics for car interior, Shape memory alloys for car seats.

**TRANSPORTATION TEXTILES**

9hrs

Materials used in automobiles – tire cord, filter, air bag - future applications, belt, seat cover, acoustic textiles for noise insulation; Design and development of textile reinforced composites in automobile industry

**AUTOMOTIVE TEXTILE STRUCTURES & COMPOSITES**

9hrs

2D and 3D textile structures for load bearing applications in automobiles, future trends in applications of textile structures in automobiles, composite structural components

**SAFETY APPLICATIONS & FUTURE TRENDS**

9 hrs

Recent developments in fibre/textile reinforcements used in tyres, fibre-rubber adhesion in tyres resent advances in tyre design,

L: 45  T: 0  Total 45 Hrs

**Reference book**

MEASUREMENT SYSTEMS  9hrs
Introduction to Measurement systems-static and dynamic measurement –closed and open loop system - Requirements and characteristics – Analysis of experimental detail. Error analysis

TRANSDUCERS, MODIFIERS AND TERMINATING DEVICES  9hrs
Transducers for Automotive Applications – Amplifiers- filters –data Acquisition-Indicators,
Printers and displays –Signal Analyzing

MECHANICAL MEASUREMENT  9hrs
Instrumentation for measuring Weight, Force, torque, pressure power, temperature, fluid flow, vibration, rotational speed, velocity, acceleration and angular motion

ENGINE EXPERIMENTAL TECHNIQUES  9hrs

VEHICLE EXPERIMENTAL TECHNIQUES  9hrs
Laboratory tests- test tracks - Endurance Tests- crash tests- Vehicle performance test – Brake tests.

L:  45  T:  0  Total  45 Hrs

Reference Book
1. A.W. JUDGE, Engineering Precision Measurement, Chapman and Hall Ltd, Essex Street W.C.,1951,
2. T.G. Beckwith and Buck, Mechanical Measurements, Oxford and IBH Publishing House, New Delhi, 1995
Group 3

Advanced Systems / Automotive Electronics
OBJECTIVES
At the end, the student will have good exposure to Automotive safety aspects including safety equipments.

INTRODUCTION
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 crumble zone, safety sandwich construction.

SAFETY CONCEPTS
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.

SAFETY EQUIPMENTS
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.

COLLISION WARNING AND AVOIDANCE
Collision warning system, causes of rear end collision, frontal object detection, rear vehicle object detection system, object detection system with braking system interactions.

COMFORT AND CONVENIENCE SYSTEM
Steering and mirror adjustment, central locking system, Garage door opening system, tyre pressure control system, rain sensor system, environment information system

Reference books
OBJECTIVES

- At the end of the course, the students will be able to understand the need of microcontroller 8 bits and 16 bits in a device/instrument development.
- This course aims in developing the students with adequate knowledge about microprocessors and its importance in Automobile sector.

INTRODUCTION

Need for microprocessor based system design – Design cycle – dimensions of the design problem – Hardware design and software design – System integration.

INPUT AND OUTPUT ALGORITHMIC PROCESSES


TROUBLESHOOTING SYSTEMS – LOGIC ANALYSERS


8086/8088 BASED MULTIPROCESSING SYSTEM


SYSTEM DESIGN APPLICATIONS


L: 45  T: 0  Total 45 Hrs

Reference Book:
OBJECTIVES
To illustrate the electric and hybrid vehicles and their operation and controls

INTRODUCTION TO ELECTRIC VEHICLES 9 hrs
Layout of an electric vehicle, performance of electric vehicles – traction motor characteristics, tractive effort, transmission requirements, vehicle performance, energy consumption, advantage and limitations, specifications, system components, electronic control system.

HYBRID VEHICLES 8 hrs
Concepts of hybrid electric drive train, types, architecture of series and parallel hybrid electric drive train, merits and demerits, series and parallel hybrid electric drive train design.

ELECTRIC PROPULSION SYSTEMS, GENERATORS, MOTOR CONTROLLERS AND CONTROL SYSTEMS 10 hrs
DC motors, AC motors, permanent magnet motors, brushless DC and reluctance motors, characteristics, regenerative braking.
DC generators, AC generators, voltage and frequency regulations.
Control system principles, speed and torque control – DC motors and AC motors.

ENERGY STORAGES 9 hrs
Electromechanical batteries- types of batteries – lead acid batteries, nickel based batteries, lithium based batteries, electrochemical reactions, thermodynamic voltage, specific energy, specific power, energy efficiency, ultracapacitors.

FUEL CELLS & SOLAR CARS 9 hrs
Fuel cell, construction, working, equations, possible fuel sources, fuel reformer, design.
Solar cars- photovoltaic cells, tracking, efficiency and cost comparison

L: 45   T: 0   Total 45 Hrs

Text Book
OBJECTIVES
To enable the students to understand the fundamentals of Instrumentation and control available for monitoring/measuring in domestic / industrial applications.

MEASUREMENT OF FORCE, TORQUE AND VELOCITY 9 hrs

MEASUREMENT OF ACCELERATION, VIBRATION AND DENSITY 9 hrs
Accelerometers – LVDT, piezo-electric, strain gauge and variable reluctance type accelerometers – mechanical type vibration instruments seismic instruments as an accelerometer and vibrometer – calibration of vibration pick ups – units of density, specific gravity and viscosity used in industries – pressure head type densitometer – float type densitometer – ultrasonic densitometer

MEASUREMENT OF PRESSURE & TEMPERATURE 10hrs

TRANSFER FUNCTIONS 8 hrs
Definitions, Transfer function – Mathematical modeling of mechanical (translation and rotational), Electrical systems- mechanical-electrical analogies– Block Diagram reduction technique and Signal flow graphs.

RESPONSE AND STABILITY ANALYSIS 9 hrs

L: 45 T: 0 Total 45 Hrs

Reference book
3 Katsuhiko Ogata, Modern Control Engineering, 2nd edition, Prentice Hall of India Private Ltd, New Delhi, 1995
OBJECTIVES
To introduce the concept of fuel cells for use in automobiles, analyse the performance characteristics of the various components and compare them with the other powering devices

INTRODUCTION TO FUEL CELLS
9 hrs
Introduction – working and types of fuel cell – low, medium and high temperature fuel cell, liquid and methanol types, proton exchange membrane fuel cell solid oxide, hydrogen fuel cells – thermodynamics and electrochemical kinetics of fuel cells.

FUEL CELLS FOR AUTOMOTIVE APPLICATIONS
9 hrs

FUEL CELL COMPONENTS AND THEIR IMPACT ON PERFORMANCE
9 hrs
Fuel cell performance characteristics – current/voltage, voltage efficiency and power density, ohmic resistance, kinetic performance, mass transfer effects – membrane electrode assembly components, fuel cell stack, bi-polar plate, humidifiers and cooling plates.

FUELING
9 hrs

FUEL CYCLE ANALYSIS
9 hrs
Introduction to fuel cycle analysis – application to fuel cell and other competing technologies like battery powered vehicles, SI engine fueled by natural gas and hydrogen and hybrid electric vehicle.

L: 45  T: 0
Total 45 Hrs

Reference Book
U13 AUT E36 - PLC AND DATA ACQUISITION SYSTEMS

OBJECTIVES
To provide students the fundamentals of PLC and Data acquisition system
On completion of the course the students will be able to
1. Understand the basic of data conversion and data acquisition
2. Understand the fundamental of PLC.

COMPUTER CONTROL-INTRODUCTION 10hrs
Need of computer in a control system-Functional block diagram of a computer control system-Data loggers- Supervisory computer control- Direct digital control-Digital control interfacing-SCADA. (Elementary treatment only).

DATA CONVERTERS 9 hrs
DACs-Basic DAC Techniques-Weighted Resistor, R-2R Ladder and Inverted R-2R ladder type DACs- ADCs – Parallel ADC, Dual slope ADC, Successive Approximation ADC-Comparison of A/D conversion techniques- DAC/ADC specifications - Typical IC’s for DAC, ADC – Isolation amplifiers.

DATA ACQUISITION SYSTEMS 10hrs
Sampling theorem – Sampling and digitizing – Aliasing – Sample and hold circuit – Practical implementation of sampling and digitizing – Definition, design and need for data acquisition systems – Interfacing ADC and DAC with Microprocessor / Multiplexer - Multiplexed channel operation –Microprocessor/PC based acquisition systems.

PLC 10hrs

COMMUNICATION IN PLC’S 6hrs
Requirement of communication networks of PLC – connecting PLC to computer – Interlocks and alarms – Case study of Tank level control system and Sequential switching of motors.

L: 45 T: 0 Total 45 Hrs

Reference books
2 Hughes,T., Programmable Logic Controllers, ISA Press, 1989.
INTRODUCTION
Virtual Instrumentation-Definition and flexibility-Block diagram and Architecture of Virtual Instrumentation- Virtual instruments versus Traditional Instruments- Review of software in virtual Instrumentation- VI programming techniques- VI, sub VI, Loops and charts, Arrays, Clusters and Graphs, Case and Sequence Structures, Formula nodes, string and File Input / Output.

DATA ACQUISITION IN VI
A/D and D/A Converters, plug-in Analog input / Output cards- Digital Input and Output cards, Organization of the DAQ VI system- Opto Isolation- Performing analog input and analog output- Scanning multiple analog channels- issues involved in selection of data acquisition cards- Data acquisition modules with serial communication- Design of digital voltmeter with transducer input-Timers and Counters.

COMMUNICATION NETWORKED MODULES

REAL TIME CONTROL IN VI
Design of ON/OFF controller and proportional controller for a mathematically described processes using VI software- Modeling and basic control of level and Reactor Processes-Case Studies on development of HMI, SCADA in VI.

AUTOMOTIVE APPLICATIONS
PC based digital storage oscilloscope- Sensor technology and signal processing- virtual laboratory- spectrum analyzer- wave form generator- Data visualization and multiple locations:- Distributed monitoring and control-Vision and motion control. Case study related to automotive applications.

Reference books:

Total 45 Hrs
UNIT I – EMBEDDED NETWORKING: 9hrs

UNIT II - CONTROLLER AREA NETWORK (CAN) PROTOCOL: 9hrs
History and foundation of CAN, CAN Applications, Main characteristics of CAN, CAN in OSI Reference Model, CAN Data Link Layer, Principles of data exchange in CAN, Arbitration, Data Frame, Remote Frame, Error detection and management in CAN, CAN physical Layer, Bit encoding, Bit timing and synchronization, Relationship between data rate and bus length, Single wire and twin wire media, CAN repeaters, Medium-to-medium gateway, Protocol handlers, Micro-controllers and line drivers, Time-Triggered CAN (TTCAN), Comparison with other IVN protocols, CANoe based applications development

UNIT III - LOCAL INTERCONNECT NETWORK (LIN) PROTOCOL 9hrs
Introduction to LIN, LIN consortium, LIN specification, LIN features, Technical overview, Work flow concept, LIN operation, LIN frame format, Scheduling table, Network management of LIN cluster, LIN Transport Layer, LIN node configuration and identification, LIN diagnostics, LIN physical layer, Comparison with other IVN protocols and Case Study

UNIT IV - FLEXRAY PROTOCOL: 9hrs
Future on board systems, Need for FlexRay, FlexRay consortium, FlexRay Objectives, FlexRay Features, Application requirements, Working of FlexRay, Network topologies, ECU architecture, Segment Configuration, Communication Cycles, FlexRay frame format, Timing of configuration protocol, Error control, and FlexRay core mechanisms, Coding and Decoding, Medium Access Control, Frame and Symbol Processing, Clock Synchronization, FlexRay Components, Comparison with other IVN protocols and Case Study

UNITY-IN VEHICLE NETWORK DIAGNOSTICS: 9hrs

L: 45 T: 0 Total 45 Hrs

References:
3. Jan Axelson, ‘Parallel Port Complete’, Penram publications
Group 4
Management
U13 GST 002- TOTAL QUALITY MANAGEMENT

OBJECTIVES
1. Acquire knowledge on TQM concepts
2. Acquire knowledge on quality systems
3. Develop skills to use TQM tools for domain specific applications

INTRODUCTION 9hrs
Definition of Quality, Dimensions of Quality, Quality costs, Top Management Commitment, Quality Council, Quality Statements, Barriers to TQM Implementation, Contributions of Deming, Juran and Crosby, Team Balancing

TQM PRINCIPLES 9hrs
Customer satisfaction – Customer Perception of Quality, Customer Complaints, Service Quality, Customer Retention, Continuous Process Improvement, 5S, Kaizen, Just-In-Time and TPS

STATISTICAL PROCESS CONTROL 9 hrs
The seven tools of quality, New seven Management tools, Statistical Fundamentals – Measures of central Tendency and Dispersion, Population and Sample, Normal Curve, Control Charts for variables and attributes, Concept of six sigma.

TQM TOOLS 9hrs
Quality Policy Deployment (QPD), Quality Function Deployment (QFD), Benchmarking, Taguchi Quality Loss Function, Total Productive Maintenance (TPM), FMEA

QUALITY SYSTEMS 9hrs

Total 45 Hrs

Reference Book

COURSE OUTCOMES:
On successful completion of the course, the learner would be able to
CO1 - Understand quality concepts and philosophies of TQM
CO2 - Apply TQM principles and concepts of continuous improvement
CO3- Apply and analyze the quality tools, management tools and statistical fundamentals to improve quality
CO4 - Understand the TQM tools as a means to improve quality
CO5 - Remember and understand the quality systems and procedures adopted
OBJECTIVES
1. To study the importance and functions of management in an organization
2. To study the importance of planning and also the different types of plan
3. To understand the different types of organization structure in management
4. To understand the basis and importance of directing and controlling in management
5. To understand to the importance of corporate governance and social responsibilities.

MANAGEMENT CONTEXT 9 hrs

PLANNING 9 hrs

ORGANISING 9 hrs

DIRECTING & CONTROLLING 9 hrs

CONTEMPORARY ISSUES IN MANAGEMENT 9 hrs

L: 45 T: 0 Total 45 Hrs
Reference book
COURSE OUTCOMES:
On successful completion of the course, the learner would be able to
CO1: Understand the concepts of management, administration and the evolution of management thoughts.
CO2: Understand and apply the planning concepts.
CO3: Analyze the different organizational structures and understand the staffing process.
CO4: Analyze the various motivational and leadership theories and understand the communication and controlling processes.
CO5: Understand the various international approaches to management
OBJECTIVES

- Apply knowledge of OR techniques to domain specific industrial situations to optimize the quality of decisions
- Conduct investigations by the use of OR techniques

LINEAR MODEL  9hrs
The phases of OR study – formation of an L.P model – graphical solution – simplex algorithm – artificial variables technique (Big M method, two phase method), duality in simplex

TRANSPORTATION AND ASSIGNMENT PROBLEM 9hrs
Assignment model – formulation – balanced and unbalanced assignment problems

PROJECT MANAGEMENT BY PERT & CPM  9 hrs
Basic terminologies – Constructing a project network – Scheduling computations – PERT - CPM – Resource smoothening, Resource leveling, PERT cost

REPLACEMENT AND SEQUENCING MODELS  9hrs
Replacement policies - Replacement of items that deteriorate with time (value of money not changing with time) – Replacement of items that deteriorate with time (Value of money changing with time) – Replacement of items that fail suddenly (individual and group replacement policies).
Sequencing models- n job on 2 machines – n jobs on 3 machines – n jobs on m machines, Traveling salesman problem

INVENTORY AND QUEUING THEORY  9hrs
Variables in inventory problems, EOQ, deterministic inventory models, order quantity with price break, techniques in inventory management.
Queuing system and its structure – Kendall’s notation – Common queuing models - M/M/1: FCFS/∞/∞ - M/M/1: FCFS/n/∞ - M/M/C: FCFS/∞/∞ - M/M/1: FCFS/n/m

L: 45  T: 0  Total  45 Hrs

Reference book

COURSE OUTCOMES:
On successful completion of the course, the learner would be able to

CO1 - Apply linear programming model and assignment model to domain specific situations
CO2 - Analyze the various methods under transportation model and apply the model for testing the closeness of their results to optimal results
CO3 - Apply the concepts of PERT and CPM for decision making and optimally managing projects
CO4 - Analyze the various replacement and sequencing models and apply them for arriving at optimal decisions
CO5 - Analyze the inventory and queuing theories and apply them in domain specific situations.
Objectives:

- Acquire knowledge of economics to facilitate the process of economic decision making
- Acquire knowledge on basic financial management aspects
- Develop the skills to analyze financial statements

ECONOMICS, COST AND PRICING CONCEPTS


CONCEPTS ON FIRMS AND MANUFACTURING PRACTICES


NATIONAL INCOME, MONEY AND BANKING, ECONOMIC ENVIRONMENT


CONCEPTS OF FINANCIAL MANAGEMENT


ACCOUNTING SYSTEM, STATEMENT AND FINANCIAL ANALYSIS


TOTAL: 45 HOURS

REFERENCE BOOKS:

1. Prasanna Chandra, “Financial Management (Theory & Practice) TMH
2. Weston & Brigham, “Essentials of Managerial Finance”
5. Financial Management & Policy -James C. Van Horne
7. Management Accounting Principles & Practice -P. Saravanavel

COURSE OUTCOMES:

On successful completion of the course, the learner would be able to

CO1 - Evaluate the economic theories, cost concepts and pricing policies
CO2 - Understand the market structures and integration concepts
CO3 - Understand the measures of national income, the functions of banks and concepts of globalization
CO4 - Apply the concepts of financial management for project appraisal
CO5 - Understand accounting systems and analyze financial statements using ratio analysis
Objectives:

- Acquire knowledge on the various stages of a product development process
- Develop skills for using the various tools and techniques for developing products
- Acquire knowledge on project management techniques

INTRODUCTION - DEVELOPMENT PROCESSES AND ORGANIZATIONS - PRODUCT PLANNING

Characteristics of successful product development to Design and develop products, duration and cost of product development, the challenges of product development.
A generic development process, concept development: the front-end process, adapting the generic product development process, the AMF development process, product development organizations, the AMF organization.
The product planning process, identify opportunities. Evaluate and prioritize projects, allocate resources and plan timing, complete pre project planning, reflect all the results and the process.

IDENTIFYING CUSTOMER NEEDS - PRODUCT SPECIFICATIONS

Gathering raw data from customers, interpreting raw data in terms of customer needs, organizing the needs into a hierarchy, establishing the relative importance of the needs and reflecting on the results and the process.
Specifications, establish specifications, establishing target specifications setting the final specifications.

CONCEPT GENERATION - CONCEPT SELECTION - CONCEPT TESTING

The activity of concept generation clarify the problem search externally, search internally, explore systematically, reflect on the results and the process.
Overview of methodology, concept screening, concept scoring, caveats.
Purpose of concept test, choosing a survey population and a survey format, communicate the concept, measuring customer response, interpreting the result, reflecting on the results and the process.

PRODUCT ARCHITECTURE - INDUSTRIAL DESIGN - DESIGN FOR MANUFACTURING

Meaning of product architecture, implications of the architecture, establishing the architecture, variety and supply chain considerations, platform planning, related system level design issues.
Assessing the need for industrial design, the impact of industrial design, industrial design process, managing the industrial design process, is assessing the quality of industrial design.
Definition, estimation of manufacturing cost, reducing the cost of components, assembly, supporting production, impact of DFM on other factors.

PROTOTYPING - PRODUCT DEVELOPMENT ECONOMICS - MANAGING PROJECTS

Prototyping basics, principles of prototyping, technologies, planning for prototypes.
Elements of economic analysis, base case financial mode, Sensitive analysis, project trade-offs, influence of qualitative factors on project success, qualitative analysis.
Understanding and representing task, baseline project planning, accelerating projects, project execution, and postmortem project evaluation.

TOTAL: 45 HOURS
REFERENCE BOOKS:
2. Product Design and Manufacturing: A C Chitale and R C Gupta, PHI
4. Product Design for Manufacture and Assembly: Geoffery Boothroyd, Peter Dewhurst and Winston Knight.

COURSE OUTCOMES:
On successful completion of the course, the learner would be able to
1. CO1 - Understand the process to plan and develop products
2. CO2 - Understand the process of collecting information and developing product specifications
3. CO3 - Understand the concept generation, selection and testing processes
4. CO4 - Understand the concepts of product architecture, industrial design and design for manufacture
5. CO4 -Understand the basics of prototyping, economic analysis and project planning and execution processes
U13 AUT E41    ENTREPRENEURSHIP DEVELOPMENT

OBJECTIVES
To develop and strengthen entrepreneurial quality and motivation in students and to impart basic entrepreneurial skills and understanding to run a business efficiently and effectively.

ENTREPRENEURSHIP 9hrs

MOTIVATION 9hrs
Major Motives Influencing an Entrepreneur – Achievement Motivation Training, Self Rating, Business Games, Thematic Apperception Test – Stress Management, Entrepreneurship Development Programs – Need, Objectives.

BUSINESS 9 hrs

FINANCING AND ACCOUNTING 9hrs

SUPPORT TO ENTREPRENEURS 9hrs

L: 45  T: 0  Total 45 Hrs

References Book
PROJECT MANAGEMENT CONCEPTS
Introduction, project characteristics, taxonomy of projects, project identification and formulation. Establishing the project and goals. Nature & context of project management; phases of PM. A framework for PM issues, PM as a conversion process, project environment & complexity. Organizing human resources, organizing systems & procedures for implementation. Project direction.

PROJECT ORGANIZATION & PROJECT CONTRACTS
Introduction, functional organization, project organization, matrix organization, modified matrix organization, pure project organization, selection of project organization structure, project breakdown structures, project contracts, types of contracts, types of payments to contractors.

PROJECT APPRAISAL & COST ESTIMATION
Introduction, technical appraisal, commercial appraisal, economic appraisal, financial appraisal, management appraisal, social cost/benefit analysis, project risk analysis. Cost analysis of the project, components of capital cost of a project, modern approach to project performance analysis.

PROJECT PLANNING & SCHEDULING
Introduction to PERT & CPM, planning and scheduling networks, time estimation, determination of critical path, CPM model, event slacks & floats, PERT model, expected time for activities, expected length of critical path, calculating the project length and variance, PERT & CPM cost accounting systems, lowest cost schedule, crashing of networks, linear programming formulation of event oriented networks, updating of networks, LOB technique.

MODIFICATION & EXTENSIONS OF NETWORK MODELS
Complexity of project scheduling with limited resources, resource leveling of project schedules, resource allocation in project scheduling - heuristic solution. Precedence networking- examples with algorithm, decision networks, probabilistic networks, computer aided project management- essential requirements of PM software, software packages for CPM. Enterprise- wide PM, using spread sheets for financial projections.

L: 45  T: 0  Total 45 Hrs

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

INTRODUCTION 9hrs
Personnel management; 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 objectives, advantages, methods of training, training procedure, psychological tests.

TRANSPORT SYSTEMS 9 hrs
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

SCHEDULING AND FARE STRUCTURE 9 hrs
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.

MOTOR VEHICLE ACT 9 hrs
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.

MAINTENANCE 9 hrs
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

L: 45 T: 0 Total 45 Hrs

Reference Books
STATISTICAL PROCESS CONTROL 9 hrs

ACCEPTANCE SAMPLING 9 hrs
Lot by lot sampling types – probability of acceptance in single, double, multiple sampling plans – OC curves – Producer’s risk and consumer’s risk. AQL, LTPD, AOQL, Concepts Design of single sampling plan – standard sampling plans for AQL and LTPD – Use of standard sampling plans – Sequential sampling plan.

EXPERIMENTAL DESIGN & TAGUCHI METHOD 9 hrs

RELAIBILITY AND ITS PREDICTION 9 hrs

FAILURE DATA ANALYSIS 9 hrs
Real time distribution, exponential, normal, log normal, gamma and weibull – reliability data requirements – Graphical evaluation.

L: 45 T: 0 Total 45 Hrs

Reference Books
ENERGY SOURCES  9 hrs
Fossil fuels, Nuclear fuels, hydel, solar, wind and bio fuels in India, Energy conservation, Nuclear energy through fission and fusion processes.

ENERGY CONVERSION  9 hrs
Energy conversion from source to utility, Solar, Nuclear, Geothermal, Tide and Wind Energies.

GLOBAL ENERGY SCENARIO  9 hrs
Role of energy in economic development and social transformation, Overall energy demand, availability and consumption, Depletion of energy resources and its impact on economy, Non proliferation of nuclear energy. International energy policies of G-8, G-20, OPEC and European union countries.

INDIAN ENERGY SCENARIO  9 hrs
Commercial and noncommercial forms of energy, Utilization pattern in the past, present and also future prediction, Sector wise energy consumption.

ENERGY POLICY  9 hrs

L: 45  T: 0  Total 45 Hrs

Reference Books