

St. PETER'S UNIVERSITY

St. Peter's Institute of Higher Education and Research
(Declared under section 3 of UGC Act 1956)
Avadi, Chennai – 600 054.



B.E. (AUTOMOBILE ENGINEERING) PROGRAMME

(I TO VIII SEMESTERS)

REGULATIONS AND SYLLABI

REGULATIONS – 2012

(Effective from the Academic Year 2012-'13)

B.E. (AUTOMOBILE ENGINEERING) PROGRAMME

Regulations -2012

Regulations and Syllabi

(Effective from the Academic Year 2012-'2013)

1. Eligibility:

(1) Candidates who passed the following Examination or any other equivalent Examination thereto and who appeared for the entrance test conducted by the University or approved institutions wherever prescribed are eligible for admission to Four Year B.E. (Automobile Engineering) Programme.

Higher Secondary Examination with Mathematics, Physics and Chemistry conducted by the Government of Tamil Nadu or its equivalent in the relevant subjects.

(2) Candidates who passed Three Year Diploma in Technical Education in the concerned subject conducted by the Government of Tamil Nadu are eligible for admission to Second Year of Four Year B.E. (Automobile Engineering) Programme.

2. Duration: Four Years comprising 8 Semesters. Each semester has a minimum 90 working days with a minimum of 5 hours a day.

3. Medium: English is the medium of instruction and examination.

4. Weightage for Continuous and End Assessment: The weightage for Continuous Assessment (CA) and End Assessment (EA) be 25:75 unless the ratio is specifically mentioned in the scheme of Examinations.

5. Credit System: Credit system be followed with 18 credits for each semester and each credit is equivalent to 25 hours of effective study provided in the Time Table.

6. Scheme of Examinations

I Semester

| Code No. | Course Title | Credit | Marks | | |
|------------------|------------------------------------|-----------|------------|------------|------------|
| | | | CA | EA | Total |
| 112EHT01 | Technical English - I | 1 | 25 | 75 | 100 |
| 112MAT02 | Mathematics - I | 3 | 25 | 75 | 100 |
| 112PHT03 | Engineering Physics - I | 3 | 25 | 75 | 100 |
| 112CYT04 | Engineering Chemistry - I | 3 | 25 | 75 | 100 |
| 112EGT05 | Engineering Graphics - I | 3 | 25 | 75 | 100 |
| 112FCT06 | Fundamentals of Computing - I | 3 | 25 | 75 | 100 |
| Practical | | | | | |
| 112CLP01 | Computer Practices Laboratory - I | 1 | 25 | 75 | 100 |
| 112ELP02 | Engineering Practices Laboratory I | 1 | 25 | 75 | 100 |
| | Total | 18 | 200 | 600 | 800 |

II Semester

| Code No. | Course Title | Credit | Marks | | |
|------------------|--------------------------------------------------|-----------|------------|------------|------------|
| | | | CA | EA | |
| Theory | | | | | |
| 212EHT01 | Technical English – II | 2 | 25 | 75 | 100 |
| 212MAT02 | Mathematics – II | 3 | 25 | 75 | 100 |
| 212PHT03 | Engineering Physics – II | 2 | 25 | 75 | 100 |
| 212CYT04 | Engineering Chemistry – II | 2 | 25 | 75 | 100 |
| 212EMT05 | Engineering Mechanics | 3 | 25 | 75 | 100 |
| 212EET06 | Basic Electrical & Electronics Engineering | 3 | 25 | 75 | 100 |
| Practical | | | | | |
| 212CLP01 | Computer Practices Laboratory – II | 1 | 25 | 75 | 100 |
| 212ELP02 | Physics & Chemistry Laboratory – II | 1 | 25 | 75 | 100 |
| 212DMP03 | Computer Aided Drafting and Modelling Laboratory | 1 | 25 | 75 | 100 |
| Total | | 18 | 225 | 675 | 900 |

III SEMESTER

| Code No. | Course Title | Credit | Marks | | |
|---------------|-----------------------------------------------|-----------|------------|------------|------------|
| | | | CA | EA | |
| Theory | | | | | |
| 312MAT01 | Transforms And Partial Differential Equations | 3 | 25 | 75 | 100 |
| 312AMT02 | Engineering Thermodynamics | 3 | 25 | 75 | 100 |
| 312AMT03 | Fluid Mechanics and Machinery | 3 | 25 | 75 | 100 |
| 312AMT04 | Automotive Engines | 2 | 25 | 75 | 100 |
| 312AMT05 | Mechanics of Machines | 2 | 25 | 75 | 100 |
| 312AMT06 | Production Technology | 2 | 25 | 75 | 100 |
| 312AMP01 | Automotive Components Laboratory | 1 | 25 | 75 | 100 |
| 312AMP02 | Fluid Mechanics and Machinery Laboratory | 1 | 25 | 75 | 100 |
| 312AMP03 | Manufacturing Technology Laboratory | 1 | 25 | 75 | 100 |
| Total | | 18 | 225 | 675 | 900 |

IV SEMESTER

| Code No. | Course Title | Credit | Marks | | |
|---------------|----------------------------------------------------|-----------|------------|------------|-------------|
| | | | CA | EA | Total |
| Theory | | | | | |
| 412AMT01 | Statistics And Numerical Methods | 3 | 25 | 75 | 100 |
| 412AMT02 | Applied Thermodynamics and Heat Transfer | 3 | 25 | 75 | 100 |
| 412AMT03 | Engineering Materials and Metallurgy | 2 | 25 | 75 | 100 |
| 412AMT04 | Strength of Materials | 2 | 25 | 75 | 100 |
| 412AMT05 | Electronics and Micro-processors | 2 | 25 | 75 | 100 |
| 412AMT06 | Automotive Chassis | 2 | 25 | 75 | 100 |
| 412AMP01 | Engine Performance and Emission Testing Laboratory | 1 | 25 | 75 | 100 |
| 412AMP02 | Computer Aided Machine Drawing Laboratory | 1 | 25 | 75 | 100 |
| 412AMP03 | Electronics and Micro-processors Laboratory | 1 | 25 | 75 | 100 |
| 412AMP04 | Strength of Materials Lab | 1 | 25 | 75 | 100 |
| Total | | 18 | 250 | 750 | 1000 |

V SEMESTER

| Code No. | Course Title | Credit | Marks | | |
|------------------|--------------------------------------------------|-----------|------------|------------|------------|
| | | | CA | EA | Total |
| Theory | | | | | |
| 512AMT01 | Environmental Science and Engineering | 2 | 25 | 75 | 100 |
| 512AMT02 | Design of Machine Elements | 3 | 25 | 75 | 100 |
| 512AMT03 | Automotive Transmission | 3 | 25 | 75 | 100 |
| 512AMT04 | Automotive Electrical and Electronics | 3 | 25 | 75 | 100 |
| 512AMT05 | Vehicle Design and Data Characteristics | 3 | 25 | 75 | 100 |
| 512AMT06 | Automotive Fuels and Lubricants | 2 | 25 | 75 | 100 |
| Practical | | | | | |
| 512AMP01 | Automotive Electrical and Electronics Laboratory | 1 | 25 | 75 | 100 |
| 512AMP02 | Automotive Fuels and Lubricants Laboratory | 1 | 25 | 75 | 100 |
| Total | | 18 | 200 | 600 | 800 |

VI SEMESTER

| Code No. | Course Title | Credit | Marks | | |
|------------------|------------------------------------------------------------------|-----------|------------|------------|------------|
| | | | CA | EA | Total |
| Theory | | | | | |
| 612AMT01 | Principles of Management | 2 | 25 | 75 | 100 |
| 612AMT02 | Automotive Engine Components Design | 3 | 25 | 75 | 100 |
| 612AMT03 | Automotive Chassis Components Design | 3 | 25 | 75 | 100 |
| 612AMT04 | Two and Three Wheelers | 3 | 25 | 75 | 100 |
| 612AMT05 | Finite Element Analysis | 2 | 25 | 75 | 100 |
| 612AMT11 | Elective – I :Quality Control and Reliability Engineering | 2 | 25 | 75 | 100 |
| Practical | | | | | |
| 612AMP01 | Computer Aided Engine Design Laboratory | 1 | 25 | 75 | 100 |
| 612AMP02 | Computer Aided Chassis Design Laboratory | 1 | 25 | 75 | 100 |
| 612AMP03 | Two and Three Wheelers Laboratory | 1 | 25 | 75 | 100 |
| Total | | 18 | 225 | 675 | 900 |

VII SEMESTER

| Code No. | Course Title | Credit | Marks | | |
|------------------|--------------------------------------------------------------------------|--------|-------|----|-------|
| | | | CA | EA | Total |
| Theory | | | | | |
| 712AMT01 | Engine and Vehicle Management Systems | 3 | 25 | 75 | 100 |
| 712AMT02 | Vehicle Dynamics | 3 | 25 | 75 | 100 |
| 712AMT03 | Vehicle Maintenance | 3 | 25 | 75 | 100 |
| 712AMT04 | Automotive Pollution and Control | 3 | 25 | 75 | 100 |
| 712AMT08 | Elective– II & III : Design of Jigs, Fixtures and Press Tools | 2 | 25 | 75 | 100 |
| 712AMT12 | Elective–II &III :Off Road Vehicles | 2 | 25 | 75 | 100 |
| Practical | | | | | |
| 712AMP01 | Vehicle Maintenance and Re-conditioning Laboratory | 1 | 25 | 75 | 100 |
| 712AMP02 | CAD and CAM Laboratory | 1 | 25 | 75 | 100 |

| | | | | | |
|--|--------------|-----------|------------|------------|------------|
| | Total | 18 | 200 | 600 | 800 |
|--|--------------|-----------|------------|------------|------------|

VIII SEMESTER

| Code No. | Course Title | Credit | Marks | | |
|------------------|--------------------------------------------------------|-----------|------------|------------|------------|
| | | | CA | EA | Total |
| Theory | | | | | |
| 812AMT01 | Vehicle Body Engineering | 3 | 25 | 75 | 100 |
| 812AMT04 | Electives – IV & V : Automotive safety | 4 | 25 | 75 | 100 |
| 812AMT08 | Electives – IV & V Total Quality Management | 4 | 25 | 75 | 100 |
| Practical | | | | | |
| 812AMP01 | Project Work | 7 | 25 | 75 | 100 |
| | Total | 18 | 100 | 300 | 400 |

LIST OF ELECTIVE COURSES

| Code No. | Course Title |
|-------------------------------------------|----------------------------------------------------|
| Elective – I (CREDIT-2) | |
| 612AMT06 | Professional Ethics In Engineering |
| 612AMT07 | Automotive Air-conditioning |
| 612AMT08 | Alternate Fuels and Energy Systems |
| 612AMT09 | Vibration , Noise and Harshness Control |
| 612AMT10 | Advanced Theory of I.C. Engines |
| 612AMT11 | Quality Control and Reliability Engineering |
| 612AMT12 | Metrology and Instrumentation |
| Electives– II & III (CREDIT-2) | |
| 712AMT05 | Supercharging And Scavenging |
| 712AMT06 | Automotive Aero-dynamics |
| 712AMT07 | Composite Materials |
| 712AMT08 | Design of Jigs, Fixtures and Press Tools |
| 712AMT09 | Computer Simulation of I.C. Engines |
| 712AMT10 | Robotics |
| 712AMT11 | New Generation and Hybrid Vehicles |
| 712AMT12 | Off Road Vehicles |
| 712AMT13 | Project and Material Management |
| 712AMT14 | Engine Auxiliary Systems |
| Electives – IV & V (CREDIT-4) | |
| 812AMT02 | Marketing Management |
| 812AMT03 | Entrepreneurship Development |
| 812AMT04 | Automotive Safety |
| 812AMT05 | Fuel Cell Technology |
| 812AMT06 | Operations Research |
| 812AMT07 | Transport Management |
| 812AMT08 | Total Quality Management |

- 7. Passing Requirements:** The minimum pass mark (raw score) be 50% in End Assessment (EA) and 50% in Continuous Assessment (CA) and End Assessment (EA) put together. No minimum mark (raw score) in Continuous Assessment (CA) be prescribed unless it is specifically mentioned in the Scheme of Examination.
- 8. Grading System:** Grading System on a 10 Point Scale be followed with 1 mark = 0.1 Grade point to successful candidates as given below.

CONVERSION TABLE

(1 mark = 0.1 Grade Point on a 10 Point Scale)

| Range of Marks | Grade Point | Letter Grade | Classification |
|----------------|-------------|--------------|----------------|
| 90 to 100 | 9.0 to 10.0 | O | First Class |
| 80 to 89 | 8.0 to 8.9 | A | First Class |
| 70 to 79 | 7.0 to 7.9 | B | First Class |
| 60 to 69 | 6.0 to 6.9 | C | First Class |
| 50 to 59 | 5.0 to 5.9 | D | Second Class |
| 0 to 49 | 0 to 4.9 | F | Reappearance |

Procedure for Calculation

| | | |
|-----------------------------------------------|---|--------------------------------------------------------------------|
| Cumulative Grade Point Average (CGPA) | = | $\frac{\text{Sum of Weighted Grade Points}}{\text{Total Credits}}$ |
| | = | $\frac{\sum (CA+EA) C}{\sum C}$ |
| Where Weighted Grade Points in each Course | = | Grade Points (CA+EA) multiplied by Credits |
| | = | (CA+EA)C |
| Weighted Cumulative Percentage of Marks(WCPM) | = | CGPAx10 |

C- Credit, CA-Continuous Assessment, EA- End Assessment

9. Pattern of the Question Paper: The question paper for End Assessment will be set for three hours and for the maximum of 100 marks with following divisions and details.

Part A: 10 questions (with equal distribution to all units in the syllabus).
Each question carries 2 marks.

Part B: 5 question with either or type (with equal distribution to all units in the syllabus). Each question carries 16 marks.

The total marks scored by the candidates will be reduced to the maximum prescribed in the Regulations.

10. Effective Period of Operation for the Arrear Candidates : Two Year grace period is provided for the candidates to complete the arrear examination, if any.

Registrar

11. Syllabus

112EHT01 - TECHNICAL ENGLISH – I

AIM:

To encourage students to actively involve in participative learning of English and to help them acquire Communication Skills.

OBJECTIVES:

1. To help students develop listening skills for academic and professional purposes.
2. To help students acquire the ability to speak effectively in English in real-life situations.
3. To inculcate reading habit and to develop effective reading skills.
4. To help students improve their active and passive vocabulary.
5. To familiarize students with different rhetorical functions of scientific English.
6. To enable students write letters and reports effectively in formal and business situations.

UNIT I

General Vocabulary - changing words from one form to another - Adjectives, comparative adjectives – Adverbs - Active and passive voice – Tenses - simple present, present continuous - Adverb forms – Nouns – compound nouns - Skimming and scanning - Listening and transfer of information – bar chart, flowchart - Paragraph writing, description – Discussing as a group and making an oral report on the points discussed, conversation techniques - convincing others.

Suggested activities:

1. Matching words & meanings - Using words in context – Making sentences.
2. Changing sentences from active to passive voice & vice versa.
3. Skimming, cloze exercises, exercises transferring information from text to graphic form – bar charts, flow charts.
4. Writing descriptions using descriptive words & phrases, and technical vocabulary.
5. Role play, conversation exercises, discussions, oral reporting exercises
Any other related relevant classroom activity

UNIT II

Vocabulary – prefixes & suffixes – simple past tense - Spelling and punctuation – 'wh' Question forms - Scanning, inference - Listening & note-taking - Paragraph writing - comparison and contrast - Creative thinking and speaking.

Suggested Activities:

1. a. Vocabulary activities using prefixes and suffixes.
b. Exercises using questions – asking & answering questions.
2. Scanning the text for specific information
3. Listening guided note-taking - Writing paragraphs using notes, giving suitable headings and subheadings for paragraphs. Using expressions of comparison and contrast.
4. Discussion activities and exploring creative ideas.

Any other related relevant classroom activity

UNIT III

Tenses - simple past, simple future and past perfect - Reading in Context - Listening & note-taking - single line - Definitions - sequencing of sentences - instruction - Persuasive speaking.

Suggested activities:

1. a. Providing appropriate context for the use of tenses
2. Listening and note-taking
3. (a) Writing sentence definitions, instructions
(b) Identifying the discourse links and sequencing jumbled sentences / writing instructions.
4. Speaking exercises, discussions, role play exercises using explaining, convincing and persuasive strategies Any other related relevant classroom activity

UNIT IV

Modal verbs and Probability - Concord subject verb agreement - Correction of errors - Cause and effect expressions - Extended Definition - Speaking about the future plans.

Suggested activities:

1. a. Making sentences using modal verbs to express probability
b. Gap filling using relevant grammatical form of words.
2. Writing extended definitions
3. Speaking - role play activities, discussions, extempore speaking exercises speculating about the future.
4. Any other related relevant classroom activity

UNIT V

'If' conditionals - Gerunds - Intensive reading - Speaking - Presentation of problems & solutions - Itinerary - planning for an industrial visit - Formal Letter writing - Letter to the editor, invitation letter, accepting, declining letter and permission letter.

Suggested activities:

1. a) Sentence completion exercises using 'If' conditionals.
b) Gap filling exercises using gerunds and present participle forms
2. Reading comprehension exercises.
3. Role play, discussion, debating and speaking activities for stating, discussing problems and suggesting solutions.
4. Planning a tour, Writing a travel itinerary. Writing letters to officials and to the editor in formal/official contexts.
Any other related relevant classroom activity

TEXT BOOK:

1. Department of Humanities & Social Sciences, Anna University, 'English for Engineers and Technologists' Combined Edition (Volumes 1 & 2), Chennai: Orient Longman Pvt. Ltd., 2006. Themes 1 - 4 (Resources, Energy, Computer, Transport)

REFERENCES:

1. Meenakshi Raman and Sangeeta Sharma, 'Technical Communication English skills for Engineers', Oxford University Press, 2008.
2. Andrea, J. Rutherford, 'Basic Communication Skills for Technology', Second Edition, Pearson Education, 2007.

Extensive Reading:

A.P.J. Abdul Kalam with Arun Tiwari, 'Wings of Fire' An Autobiography, University Press (India) Pvt. Ltd., 1999, 30th Impression 2007.

NOTE:

The book given under Extensive Reading is meant for inculcating the reading habit of the students. They need not be used for testing purposes.

112MAT02 - MATHEMATICS – I

UNIT I MATRICES

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

UNIT II THREE DIMENSIONAL ANALYTICAL GEOMETRY

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

UNIT III DIFFERENTIAL CALCULUS

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

UNIT IV FUNCTIONS OF SEVERAL VARIABLES

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

UNIT V MULTIPLE INTEGRALS

Double integration – Cartesian and polar coordinates – Change of order of integration – Change of variables between Cartesian and polar coordinates – Triple integration in Cartesian co-ordinates – Area as double integral – Volume as triple integral

TEXT BOOK:

1. Bali N. P and Manish Goyal, "Text book of Engineering Mathematics", Third edition, Laxmi Publications(p) Ltd.,(2008).
2. Grewal. B.S, "Higher Engineering Mathematics", 40th Edition, Khanna Publications, Delhi, (2007).

REFERENCES:

1. Ramana B.V, "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company, New Delhi, (2007).
2. Glyn James, "Advanced Engineering Mathematics", 7th Edition, Pearson Education, (2007).
3. Jain R.K and Iyengar S.R.K," Advanced Engineering Mathematics", 3rd Edition, Narosa Publishing House Pvt. Ltd., (2007).

112PHT03 – ENGINEERING PHYSICS I

UNIT-I: ACOUSTICS & ULTRASONICS

Classifications of sound – Characteristics of musical sound – Intensity – Loudness – Weber Fechner law – Decibel – reverberation – reverberation time, derivation of Sabine's formula for reverberation – (Jager's Method) - absorption coefficient and its determination – factors affecting acoustics of building (optimum reverberation time, loudness, focusing, echo, echelon, effect, resonance, and noise) and their remedies – Ultrasonic production –Magnetostriction and piezoelectric methods – Properties – applications of ultrasonic with particular reference to detection of flaws in metal (Non – Destructive testing NDT) – SONAR.

UNIT II LASER & ITS APPLICATIONS

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

UNIT III CRYSTAL PHYSICS

Lattice –Unit cell –Bravais lattice –Lattice Planes – Miller indices – d spacing in cubic lattice – Calculation of number of atoms per unit cell – atomic radius – Coordination number –Packing factor for SC, BBC, FCC and HCP structure –Polymorphism and allotropy – Crystal defects – point, line and surface defects.

UNIT IV PROPERTIES OF MATTER

Elasticity – types of moduli of elasticity – stress strain diagram –Young's modulus of elasticity – rigidity modulus – bulk modulus – Factors affecting elasticity – twisting couple on a wire – Torsional pendulum – determination of rigidity modulus of a wire – depression of a cantilever – Young's modulus by cantilever – uniform and non uniform bending – viscosity – Coefficient of viscosity – Determination of viscosity - Poiseuille's Method –Ostwalds viscometer – comparison of viscosities.

UNIT V OPTICS & FIBER OPTICS

Air Wedge theory and experiment – testing of flat surfaces –anti reflection coating – Michelson interferometer – types of fringes, determination of wave length of monochromatic source and thickness of a thin transparent sheet – Double refraction – Photoelasticity – Photoelastic effect – Photoelastic analysis –Photoelastic material – Block diagram of a photoelastic bench. Principle and propagation of light in optical fibres – Numerical aperture and Acceptance angle – Types – Types of optical fibres (material, refraction index, mode)- Double crucible technique of fibre drawing – Fibre drawing – Fibre optical communication system (Block diagram)

Text Book:

1. S.Stella Mary , m. Parasuraman and a. Mohammed Hidayathullah , 'Engineering Physics I R.K. Publishers, Coimbatore (2012)

REFERENCES:

1. R.K. Gaur and S.C.Gupta, "Engineering Physics" Dhanpat Rai Publications , New Delhi(2003)
2. M.N. Avadhanulu and PG Kshirsagar, 'A Text book of Engineering Physics' S.Chand and company, Ltd. New Delhi, 2005.
3. Serway and Jewett, 'Physics for Scientists and Engineering with Modern Physics', 6th Edition, Thomson Brooks/Cole, Indian reprint (2007).
4. Rajendran, Vand Marikani A, 'Engineering Physics' Tata McGraw Hill Publications Ltd,III edition New Delhi,(2004).
5. Palaniswamy, P.K. 'Engineering Physics' Scitech publications,Chennai,(2007)
6. Jayakumar.s 'Engineering Physics' , R.K.publishers, Coimbatore. (2007)
7. Jayakumar. S 'Engineering Physics', Pearson Education,New Delhi, (2007).
8. Dr. P. Santhana Raghavan, Dr.P. Ramasamy, Crystal Growth- Process and Methods – KRU Publications-Kumbakonam.

112CYT04 ENGINEERING CHEMISTRY –I

Aim

To impart a sound knowledge on principles of Chemistry involving industrial application oriented topics required for all engineering branches.

Objectives

- * The student should be conversant with the principles, treatment of water for potable and industrial purposes
- Principles of polymer chemistry and its application in industries
- Industrial application of surface chemistry
- Conventional and Non- conventional energy sources and Principle and working of energy storage devices
- Chemistry of engineering materials and their industrial applications.

UNIT I WATER TECHNOLOGY

Characteristics –alkalinity-types of alkalinity and determination - Water - Hardness and problems -Estimation of Hardness by EDTA method - Problems in EDTA Titrations - Domestic water treatment-Disinfection methods (boiling, bleaching powder, chlorination UV treatment, ozonisation) Boiler feed water- Requirements -Disadvantages of using hard water in boilers- Scale and sludge formation, Carry over trouble, Caustic embrittlement and Boiler corrosion – Internal conditioning- colloidal,carbonate,phosphate and calgon conditioning methods. External conditioning -Zeolite Process and Demineralization process- Desalination - Reverse osmosis and Electro dialysis

UNIT II POLYMERS AND COMPOSITES

Polymers - Definition –Nomenclature -Functionality- Polymerization –Types -addition condensation, copolymerization and co-ordination polymerization –Mechanism of free radical and Co-ordination polymerization -Plastics-Classification -Preparation ,properties and uses of PVC, Teflon – Polycarbonates, Polyurethanes,Nylon 6,6, PET- Rubber-Vulcanisation of rubber ,synthetic rubber,Butyl rubber ,SBR.

Composites- Definition – Types of Composites - Polymer matrix composites –Metal matrix composites – Ceramic matrix composites ,properties and their application

UNIT III SURFACE CHEMISTRY

Adsorption – Terminology –Types- physical adsorption and chemical adsorption -Differences - Adsorption of gases on solids -Adsorption isotherms -Freundlich adsorption isotherm - Langmuir adsorption isotherm – Limitation. Adsorption of solutes from solutions - Ion exchange adsorption- Pollution abatement -Chromatography
Catalysis –Types-- Role of adsorbent in catalysis.

UNIT IV NON –CONVENTIONAL ENERGY SOURCES AND ENERGY STORAGE DEVICES

Nuclear energy – Difference between chemical and nuclear reactions -fusion and fission reactions – Binding energy – Mass defect-problems- Nuclear reactor- components -Light water nuclear power plant -Breeder reactor –Atom bomb.
Solar energy conversion-Solar cells, wind energy --Fuel cells– Hydrogen-oxygen fuel cell – Batteries – Dry cell- alkaline battery -Lead - acid battery –Nickel –Cadmium battery - Lithium battery- Lithium – Sulphur battery.

UNIT V ENGINEERING MATERIALS

Refractories –classification –acidic, basic and neutral refractories-properties of refractories – refractoriness- refractoriness under load –dimensional stability-porosity-thermal spalling-chemical inertness-Manufacture of alumina, magnesite and zirconia bricks - Abrasives- natural and synthetic abrasives- Quartz, corundum, emery, garnet, diamond, silicon carbide ,alundum and boron carbide- Lubricants- Mechanism of lubrication – Classification - Solid lubricants-graphite and molybdenum disulphide.- Semi -Solid lubricants – Grease- Liquid lubricants - Synthetic lubricants - Blended oils -Properties- Viscosity ,Viscosity index, Flash and fire points, Cloud and pour points,Oiliness. and their significance –Adhesives -Classification and applications

Nano chemistry- Introduction –Properties –Carbon nanotubes –Classification – Synthesis – Applications.

Text Books

1. P.C.Jain and Monica Jain , 'Engineering Chemistry', Dhanpat Rai Pub Co Ltd New Delhi (2002)
2. S.S.Dara , ' A Text Book of Engineering Chemistry', S.Chand & Co Ltd New Delhi (2006)
3. Dr.Sayeeda Sultana " Engineering chemistry " Vol-I Professional and Technical Publishers, Coimbatore (2011)

Reference Books

1. B.K.Sharma 'Engineering Chemistry',Krishna Prakasan Media (P) Ltd Meerut (2001)
2. B.Shiva Sankar 'Engineering Chemistry',Tata McGraw-Hill Pub Co Ltd New Delhi (2008)

112EGT05 - ENGINEERING GRAPHICS

AIM

To develop graphic skills in students.

OBJECTIVES

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

Concepts and conventions (Not for Examination)

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

UNIT I PLANE CURVES AND FREE HAND SKETCHING

Curves used in engineering practices:

Conics – Construction of ellipse, Parabola and hyperbola by eccentricity method – Construction of cycloid – construction of involutes of square and circle – Drawing of tangents and normal to the above curves.

Free hand sketching:

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

UNIT II PROJECTION OF POINTS, LINES AND PLANE SURFACES

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

UNIT III PROJECTION OF SOLIDS

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

UNIT IV SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES

Sectioning of above solids in simple vertical position by cutting planes inclined to one reference plane and perpendicular to the other – Obtaining true shape of section.

Development of lateral surfaces of simple and truncated solids – Prisms, pyramids, cylinders and cones – Development of lateral surfaces of solids with cylindrical cutouts, perpendicular to the axis.

UNIT V ISOMETRIC AND PERSPECTIVE PROJECTIONS

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

Perspective projection of prisms, pyramids and cylinders by visual ray method.

TEXT BOOKS:

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

REFERENCES:

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

Publication of Bureau of Indian Standards:

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

Special points applicable to University Examinations on Engineering Graphics:

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

112FCT06 - FUNDAMENTALS OF COMPUTING AND PROGRAMMING

AIM :

To provide an awareness to Computing and Programming

OBJECTIVES :

- To enable the student to learn the major components of a computer system
- To know the correct and efficient ways of solving problems
- To learn to use office automation tools
- To learn to program in C

UNIT I INTRODUCTION TO COMPUTERS

Introduction – Characteristics of Computers – Evolution of Computers - Computer Generations – Classification of Computers – Basic Computer organization – Number Systems

UNIT II COMPUTER SOFTWARE

Computer Software –Types of Software – Software Development Steps – Internet Evolution - Basic Internet Terminology – Getting connected to Internet Applications.

UNIT III PROBLEM SOLVING AND OFFICE APPLICATION SOFTWARE

Planning the Computer Program – Purpose – Algorithm – Flow Charts – Pseudocode - Application Software Packages- Introduction to Office Packages (not detailed commands for examination).

UNIT IV INTRODUCTION TO C

Overview of C – Constants, Variables and Data Types – Operators and Expressions – Managing Input and Output operators – Decision Making - Branching and Looping.

UNIT V FUNCTIONS AND POINTERS

Handling of Character Strings – User-defined Functions – Definitions – Declarations - Call by reference – Call by value – Structures and Unions – Pointers – Arrays – The Preprocessor – Developing a C Program : Some Guidelines

TEXT BOOKS:

1. Ashok.N.Kamthane, "Computer Programming", Pearson Education (India) (2008).
2. Behrouz A.Forouzan and Richard.F.Gilberg, "A Structured Programming Approach Using C", II Edition, Brooks-Cole Thomson Learning Publications, (2007).

REFERENCES:

1. Pradip Dey, Manas Ghoush, "Programming in C", Oxford University Press. (2007).
2. Byron Gottfried, "Programming with C", 2nd Edition, (Indian Adapted Edition), TMH publications, (2006).
3. Stephen G.Kochan, "Programming in C", Third Edition, Pearson Education India, (2005).
4. Brian W.Kernighan and Dennis M.Ritchie, "The C Programming Language", Pearson Education Inc., (2005).
5. E.Balagurusamy, "Computing fundamentals and C Programming", Tata McGraw-Hill Publishing Company Limited, (2008).
6. S.Thamarai Selvi and R.Murugan, "C for All", Anuradha Publishers, (2008).

LIST OF EXERCISES

a) Word Processing

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

b) Spread Sheet

5. Chart - Line, XY, Bar and Pie.
6. Formula - formula editor.
7. Spread sheet - inclusion of object, Picture and graphics, protecting the document and sheet.
8. Sorting and Import / Export features.

Simple C Programming *

9. Data types, Expression Evaluation, Condition Statements.
10. Arrays
11. Structures and Unions
12. Functions

* For programming exercises Flow chart and pseudocode are essential

HARDWARE / SOFTWARE REQUIRED FOR A BATCH OF 30 STUDENTS

Hardware

- LAN System with 33 nodes (OR) Standalone PCs – 33 Nos.
- Printers – 3 Nos.

Software

- OS – Windows / UNIX Clone
- Application Package – Office suite
- Compiler – C

112ELP02 - ENGINEERING PRACTICES LABORATORY

OBJECTIVES

To provide exposure to the students with hands on experience on various basic engineering practices in Civil, Mechanical, Electrical and Electronics Engineering.

GROUP A (CIVIL & MECHANICAL)

I CIVIL ENGINEERING PRACTICE

Buildings:

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

Plumbing Works:

- (a) Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, elbows in household fittings.
- (b) Study of pipe connections requirements for pumps and turbines.
- (c) Preparation of plumbing line sketches for water supply and sewage works.
- (d) Hands-on-exercise:
Basic pipe connections – Mixed pipe material connection – Pipe connections with different joining components.
- (e) Demonstration of plumbing requirements of high-rise buildings.

Carpentry using Power Tools only:

- (a) Study of the joints in roofs, doors, windows and furniture.
- (b) Hands-on-exercise:
Wood work, joints by sawing, planing and cutting.

II MECHANICAL ENGINEERING PRACTICE

Welding:

- (a) Preparation of arc welding of butt joints, lap joints and tee joints.
- (b) Gas welding practice

Basic Machining:

- (a) Simple Turning and Taper turning
- (b) Drilling Practice

Sheet Metal Work:

- (a) Forming & Bending:
- (b) Model making – Trays, funnels, etc.
- (c) Different type of joints.

Machine assembly practice:

- (a) Study of centrifugal pump
- (b) Study of air conditioner

Demonstration on:

- (a) Smithy operations, upsetting, swaging, setting down and bending. Example – Exercise
– Production of hexagonal headed bolt.
- (b) Foundry operations like mould preparation for gear and step cone pulley.
- (c) Fitting – Exercises – Preparation of square fitting and vee – fitting models.

GROUP B (ELECTRICAL & ELECTRONICS)**III ELECTRICAL ENGINEERING PRACTICE**

1. Residential house wiring using switches, fuse, indicator, lamp and energy meter.
2. Fluorescent lamp wiring.
3. Stair case wiring
4. Measurement of electrical quantities – voltage, current, power & power factor in RLC circuit.
5. Measurement of energy using single phase energy meter.
6. Measurement of resistance to earth of an electrical equipment.

IV ELECTRONICS ENGINEERING PRACTICE

1. Study of Electronic components and equipments – Resistor, colour coding measurement of AC signal parameter (peak-peak, rms period, frequency) using CR.
2. Study of logic gates AND, OR, EOR and NOT.
3. Generation of Clock Signal.
4. Soldering practice – Components Devices and Circuits – Using general purpose PCB.
5. Measurement of ripple factor of HWR and FWR.

REFERENCES:

1. K.Jeyachandran, S.Natarajan & S, Balasubramanian, "A Primer on Engineering Practices Laboratory", Anuradha Publications, (2007).
2. T.Jeyapoovan, M.Saravanapandian & S.Pranitha, "Engineering Practices Lab Manual", Vikas Publishing House Pvt.Ltd, (2006)
3. H.S. Bawa, "Workshop Practice", Tata McGraw – Hill Publishing Company Limited, (2007).
4. A. Rajendra Prasad & P.M.M.S. Sarma, "Workshop Practice", Sree Sai Publication, (2002).
5. P.Kannaiah & K.L.Narayana, "Manual on Workshop Practice", Scitech Publications, (1999).

SEMESTER EXAMINATION PATTERN

The Laboratory examination is to be conducted for Group A & Group B, allotting 90 minutes for each group, with a break of 15 minutes. Both the examinations are to be taken together in sequence, either in the FN session or in the AN session. The maximum marks for Group A and Group B lab examinations will be 50 each, totaling 100 for the Lab course. The candidates shall answer either I or II under Group A and either III or IV under Group B, based on lots.

Engineering Practices Laboratory List of equipment and components (For a Batch of 30 Students)

CIVIL

- | | |
|-------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| 1. Assorted components for plumbing consisting of metallic pipes, plastic pipes, flexible pipes, couplings, unions, elbows, plugs and other fittings. | 15 Sets. |
| 2. Carpentry vice (fitted to work bench) | 15 Nos. |
| 3. Standard woodworking tools | 15 Sets. |
| 4. Models of industrial trusses, door joints, furniture joints | 5 each |
| 5. Power Tools: (a) Rotary Hammer | 2 Nos |
| (b) Demolition Hammer | 2 Nos |
| (c) Circular Saw | 2 Nos |
| (d) Planer | 2 Nos |
| (e) Hand Drilling Machine | 2 Nos |
| (f) Jigsaw | 2 Nos |

MECHANICAL

- | | |
|-------------------------------------------------------------------------------|-----------|
| 1. Arc welding transformer with cables and holders | 5 Nos. |
| 2. Welding booth with exhaust facility | 5 Nos. |
| 3. Welding accessories like welding shield, chipping hammer, wire brush, etc. | 5 Sets. |
| 4. Oxygen and acetylene gas cylinders, blow pipe and other welding outfit. | 2 Nos. |
| 5. Centre lathe | 2 Nos. |
| 6. Hearth furnace, anvil and smithy tools | 2 Sets. |
| 7. Moulding table, foundry tools | 2 Sets. |
| 8. Power Tool: Angle Grinder | 2 Nos |
| 9. Study-purpose items: centrifugal pump, air-conditioner | One each. |

ELECTRICAL

- | | |
|---------------------------------------------------------------------|---------|
| 1. Assorted electrical components for house wiring | 15 Sets |
| 2. Electrical measuring instruments | 10 Sets |
| 3. Study purpose items: Iron box, fan and regulator, emergency lamp | 1 each |
| 4. Megger (250V/500V) | 1 No. |
| 5. Power Tools: (a) Range Finder | 2 Nos |
| (b) Digital Live-wire detector | 2 Nos |

ELECTRONICS

- | | |
|-----------------------------------------------------------------------|---------|
| 1. Soldering guns | 10 Nos. |
| 2. Assorted electronic components for making circuits | 50 Nos. |
| 3. Small PCBs | 10 Nos. |
| 4. Multimeters | 10 Nos. |
| 5. Study purpose items: Telephone, FM radio, low-voltage power supply | |

COMMON TO ALL BRANCHES

PHYSICS LABORATORY (Any Ten Experiments)

1. Determination of Young's modulus of the material – non uniform bending.
2. Determination of Young's modulus of the material – uniform bending .
3. Determination of viscosity of liquid – Poiseuille's method.
4. Torsional pendulum – Determination of rigidity modulus.
5. Determination of the thermal conductivity of a bad conductor – Lee's Disc method.
6. Determination of the thickness of a thin wire – Air Wedge method.
7. (a) Particle size determination using Diode Laser.
(b) Determination of Laser Parameters – Wave length, and angle of divergence.
(c) Determination of acceptance angle in an optical fiber.
8. Spectrometer dispersive power of a prism.
9. Determination of Wave length of mercury spectrum –Spectrometer grating.
10. Determination of Band Gap of a Semiconductor diode.
11. Determination of velocity of sound and compressibility of liquid- Ultrasonic interferometer.
12. Determination of Hysteresis loss in a ferromagnetic material

- **A minimum of FIVE experiments shall be offered in Each Semester.**
- **Laboratory classes on alternate weeks for physics and chemistry.**
- **The lab examinations will be held only in the second Semester.**

CHEMISTRY LABORATORY – I

LIST OF EXPERIMENTS

1. Estimation of hardness of Water by EDTA method
 2. Estimation of Copper in brass by EDTA method
 3. Determination of DO in water (Winkler's method)
 4. Estimation of Chloride in Water sample (Argentometric)
 5. Estimation of alkalinity of Water sample
 6. Determination of molecular weight and degree of polymerization of a polymer by viscometry.
 7. Determination of cloud and pour point of a Lubricating oil
- Any five experiments

212EHT01 - TECHNICAL ENGLISH II

AIM:

To encourage students to actively involve in participative learning of English and to help them acquire Communication Skills.

OBJECTIVES:

1. To help students develop listening skills for academic and professional purposes.
2. To help students acquire the ability to speak effectively in English in real-life situations.
3. To inculcate reading habit and to develop effective reading skills.
4. To help students improve their active and passive vocabulary.
5. To familiarize students with different rhetorical functions of scientific English.
6. To enable students write letters and reports effectively in formal and business situations.

UNIT I

Technical Vocabulary - meanings in context, sequencing words, Articles- Prepositions, intensive reading& predicting content, Reading and interpretation, extended definitions, Process description

Suggested activities:

1. Exercises on word formation using the prefix 'self' - Gap filling with preposition.
2. Exercises - Using sequence words.
3. Reading comprehension exercise with questions based on inference – Reading headings and predicting the content – Reading advertisements and interpretation.
4. Writing extended definitions – Writing descriptions of processes – Writing paragraphs based on discussions – Writing paragraphs describing the future.

UNIT II

Phrases / Structures indicating use / purpose – Adverbs-Skimming – Non-verbal communication - Listening – correlating verbal and non-verbal communication -Speaking in group discussions – Formal Letter writing – Writing analytical paragraphs.

Suggested activities:

1. Reading comprehension exercises with questions on overall content – Discussions analyzing stylistic features (creative and factual description) - Reading comprehension exercises with texts including graphic communication - Exercises in interpreting non-verbal communication.
2. Listening comprehension exercises to categorise data in tables.
3. Writing formal letters, quotations, clarification, complaint – Letter seeking permission for Industrial visits– Writing analytical paragraphs on different debatable issues.

UNIT III

Cause and effect expressions – Different grammatical forms of the same word - Speaking – stress and intonation, Group Discussions - Reading – Critical reading - Listening, - Writing – using connectives, report writing – types, structure, data collection, content, form, recommendations .

Suggested activities:

1. Exercises combining sentences using cause and effect expressions – Gap filling exercises using the appropriate tense forms – Making sentences using different grammatical forms of the same word. (Eg: object –verb / object – noun)
2. Speaking exercises involving the use of stress and intonation – Group discussions– analysis of problems and offering solutions.
3. Reading comprehension exercises with critical questions, Multiple choice question.
4. Sequencing of jumbled sentences using connectives – Writing different types of reports like industrial accident report and survey report – Writing recommendations.

UNIT IV

Numerical adjectives – Oral instructions – Descriptive writing – Argumentative paragraphs – Letter of application - content, format (CV / Bio-data) - Instructions, imperative forms - Checklists, Yes/No question form – E-mail communication.

Suggested Activities:

1. Rewriting exercises using numerical adjectives.
2. Reading comprehension exercises with analytical questions on content – Evaluation of content.
3. Listening comprehension – entering information in tabular form, intensive listening exercise and completing the steps of a process.
4. Speaking - Role play – group discussions – Activities giving oral instructions.
5. Writing descriptions, expanding hints – Writing argumentative paragraphs – Writing formal letters – Writing letter of application with CV/Bio-data – Writing general and safety instructions – Preparing checklists – Writing e-mail messages.

UNIT V

Speaking - Discussion of Problems and solutions - Creative and critical thinking – Writing an essay, Writing a proposal.

Suggested Activities:

1. Case Studies on problems and solutions
2. Brain storming and discussion
3. Writing Critical essays
4. Writing short proposals of 2 pages for starting a project, solving problems, etc.
5. Writing advertisements.

TEXT BOOK:

1. Chapters 5 – 8. Department of Humanities & Social Sciences, Anna University, 'English for Engineers and Technologists' Combined Edition (Volumes 1 & 2), Chennai: Orient Longman Pvt. Ltd., 2006. Themes 5 – 8 (Technology, Communication, Environment, Industry)

REFERENCES:

1. P. K. Dutt, G. Rajeevan and C.L.N Prakash, 'A Course in Communication Skills', Cambridge University Press, India 2007.
2. Krishna Mohan and Meera Banerjee, 'Developing Communication Skills', Macmillan India Ltd., (Reprinted 1994 – 2007).
3. Edgar Thorpe, Showick Thorpe, 'Objective English', Second Edition, Pearson Education, 2007.

Extensive Reading:

1. Robin Sharma, 'The Monk Who Sold His Ferrari', Jaico Publishing House, 2007

Note:

The book listed under Extensive Reading is meant for inculcating the reading habit of the students. They need not be used for testing purposes.

UNIT I ORDINARY DIFFERENTIAL EQUATIONS

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

UNIT II VECTOR CALCULUS

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

UNIT III ANALYTIC FUNCTIONS

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

UNIT IV COMPLEX INTEGRATION

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

UNIT V LAPLACE TRANSFORM

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

TEXT BOOK:

1. Bali N. P and Manish Goyal, "Text book of Engineering Mathematics", 3rd Edition, Laxmi Publications (p) Ltd., (2008).
2. Grewal. B.S, "Higher Engineering Mathematics", 40th Edition, Khanna Publications, Delhi, (2007).

REFERENCES:

1. Ramana B.V, "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company, New Delhi, (2007).
2. Glyn James, "Advanced Engineering Mathematics", 3rd Edition, Pearson Education, (2007).
3. Erwin Kreyszig, "Advanced Engineering Mathematics", 7th Edition, Wiley India, (2007).
4. Jain R.K and Iyengar S.R.K, "Advanced Engineering Mathematics", 3rd Edition, Narosa Publishing House Pvt. Ltd., (2007).

212PHT03 – ENGINEERING PHYSICS II

UNIT I: CONDUCTING MATERIALS

Conductors – classical free electron theory of metals-Electrical and thermal conductivity – Derivation – Wiedemann – Franz law – Lorentz number – Draw backs of Classical free electron theory –Quantum theory – Fermi distribution function – Effect of temperature on Fermi function – Density of energy states – Carrier concentration in metals.

UNIT II: SEMICONDUCTING MATERIALS

INTRINSIC SEMICONDUCTOR: Intrinsic semiconductor – Density of electrons in conduction band – Density of holes in valence band – Intrinsic carrier concentration – derivation – Fermi level – Variation – of Fermi with temperature – electrical conductivity – mobility – band gap determination.

EXTRINSIC SEMICONDUCTOR: Extrinsic semiconductors – carrier concentration derivation in n- type and p- type semiconductor variation of Fermi level with temperature and impurity concentration – compound semiconductors.

UNIT III: DIELECTRIC MATERIALS

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

UNIT IV: QUANTUM AND SUPER CONDUCTING MATERIALS

Black body radiation – Planck's theory (derivation) – Deduction of Wien' displacement law and Rayleigh – jeans' Law from Planck's theory - Compton Effect – Theory and experimental verification – Matter waves – Schrodinger's wave equation – Time independent and time dependent equations – Physical significance of wave function – Particle in a one dimensional box – Superconductivity: Properties – Types of super conductors – BCS theory of superconductivity(Qualitative) – High T_c superconductors – Applications of super conductors - SQUID, cryotron, magnetic levitation.

UNIT V: NEW ENGINEERING & NANO MATERIALS

Metallic glasses: Preparation, properties and applications – Shape memory alloys (SMA): Characteristic, Properties of NiTi alloy, application, advantages and disadvantages of SMA-synthesis –Plasma arcing – Chemical vapour deposition – sol-gels – eletrodeposition – ball milling – properties of nanoparticles and applications Carbon nanotubes: fabrication – arc method –pulsed laser deposition – chemical vapour deposition –Structure – properties and applications.

Text Books:

1. S. Stella Mary, M. Parasuraman and A. Mohammed Hidayathullah, 'Engineering Physics II' R.K Publishers, Coimbatore(2012).

REFERENCES:

1. Charles Kittel 'Introduction to solid state physics', John Wiley & Sons, 7th edition, Singapore (2007).
2. Charles P.Poole and Frank J. Ownen, 'Introduction to nanotechnology' Wiley India (2007)(for unit V)
3. Rajendran. v and Marikani.A. 'Materials Science' Tata McGraw hill publications, (2004) New Delhi.
4. Jayakumar. S, 'Materials Science' R.K. Publishers, Coimbatore, (2008).
5. Palanisamy P.K, 'Materials Science' , Scitech publications (India) Pvt. Ltd., Chennai, Second Edition(2007).
6. M. Arumugam, 'Materials Science' Anuradha Publications, Kumbakonam, (2006).

212CYT04 ENGINEERING CHEMISTRY –II

To impart a sound knowledge on principles of Chemistry involving industrial application oriented topics required for all engineering branches.

Objectives

- * The student should be conversant with the principles of Electrochemistry
Electrochemical cells and their applications.
- Principles of corrosion and its inhibition.
 - * Chemistry of fuels and combustion.
- Importance of phase rule, alloys and their industrial application.
- Analytical techniques and their instrumentation.

UNIT I ELECTROCHEMISTRY

Electrochemical cells-Reversible and irreversible cells-Concentration cells -EMF Measurement of emf- Single electrode potential -Nernst equation(problem)-Reference electrodes-Standard hydrogen electrode-Calomel electrode-Ion selective electrode-Glass electrode-Measurement of pH- Electrochemical series-significance- Potentiometric titration (redox Fe^{2+} Vs Dichromate,) - Conductometric titrations (acid-base and precipitation titrations)

UNIT II CORROSION AND CORROSION CONTROL

Chemical corrosion -Pilling- Bedworth rule-electrochemical corrosion -mechanism Different types of corrosion-Galvanic corrosion-Differential aeration corrosion -pitting corrosion-waterline corrosion -stress corrosion -crevice corrosion-Factors influencing corrosion -corrosion control-sacrificial anode and impressed cathodic current methods-corrosion inhibitors -protective coatings-paints-constituents-functions- metallic coatings- anodic coating -cathodic coating-metal cladding -diffusion coating - electroplating of gold and electroless plating of nickel.

UNIT III FUELS AND COMBUSTION

Calorific value -Classification-coal -Proximate analysis and Ultimate analysis-Metallurgical Coke-Manufacture by Bee-hive oven and Otto-Hoffmann method-Petroleum processing and fractions-Cracking -Catalytic cracking and methods-Knocking -octane number -cetane number-Synthetic petrol-Fischer -Tropsch and Bergius process-Gaseous fuels-,Water gas-Producer gas., CNG and LPG-Flue gas analysis-Orsat apparatus-Theoretical air for combustion-Problems

UNIT IV PHASE RULE AND ALLOYS

Statement and Explanation of terms involved with examples- Phase diagram-One Component system-Water system- Condensed phase rule-Construction of phase diagram by Thermal analysis-Simple eutectic system(Lead-silver system only)- Limitations of phase rule-Alloys-importance of Ferrous alloys-Nichrome-Alnico -Stainless steel-Heat treatment of steel -Non-Ferrous alloys -Brass and Bronze.

UNIT V ANALYTICAL TECHNIQUES

Spectroscopy -Atomic and molecular spectroscopy-Absorption spectrum -Emission spectrum - Absorbance-Beer-Lamberts law-Problems-UV Visible spectroscopy -IR spectroscopy-(principle,instrumentation (block diagram only)and applications colorimetry(principle ,instrumentation and applications)-Estimation of iron by colorimetry.Flame photometry-(principle , instrumentation and applications)-Estimation of Sodium by Flame photometry-Atomic absorption spectroscopy(principle , instrumentation and applications)-Estimation of Nickel by Atomic absorption spectroscopy.

Text Books

1. P.C.Jain and Monica Jain , "Engineering Chemistry", Dhanpat Rai Pub Co Ltd ,New Delhi (2002)
2. S.S.Dara , " A Text Book of Engineering Chemistry", S.Chand & Co Ltd New Delhi (2006)
3. Dr.Sayeeda Sultana " Engineering chemistry " Vol -II, Professional and Technical publishers ,Coimbatore (2011)

Reference Books

1. B.K.Sharma "Engineering Chemistry",Krishna Prakasan Media (P) Ltd Meerut (2001)
2. B.Shiva Sankar "Engineering Chemistry",Tata McGraw-Hill Pub Co Ltd New Delhi (2008)

212EMT05 - ENGINEERING MECHANICS

OBJECTIVE

At the end of this course the student should be able to understand the vectorial and scalar representation of forces and moments, static equilibrium of particles and rigid bodies both in two dimensions and also in three dimensions. Further, he should understand the principle of work and energy. He should be able to comprehend the effect of friction on equilibrium. He should be able to understand the laws of motion, the kinematics of motion and the interrelationship. He should also be able to write the dynamic equilibrium equation. All these should be achieved both conceptually and through solved examples.

UNIT I BASICS & STATICS OF PARTICLES

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

UNIT II EQUILIBRIUM OF RIGID BODIES

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

UNIT III PROPERTIES OF SURFACES AND SOLIDS

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

UNIT IV DYNAMICS OF PARTICLES

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

UNIT V FRICTION AND ELEMENTS OF RIGID BODY DYNAMICS

Frictional force – Laws of Coloumb friction – simple contact friction – Rolling resistance – Belt friction.

Translation and Rotation of Rigid Bodies – Velocity and acceleration – General Plane motion.

TEXT BOOK:

1. Beer, F.P and Johnson Jr. E.R. "Vector Mechanics for Engineers", Vol. 1 Statics and Vol. 2 Dynamics, McGraw-Hill International Edition, (1997).

REFERENCES:

1. Rajasekaran, S, Sankarasubramanian, G., "Fundamentals of Engineering Mechanics", Vikas Publishing House Pvt. Ltd., (2000).
2. Hibbeler, R.C., "Engineering Mechanics", Vol. 1 Statics, Vol. 2 Dynamics, Pearson Education Asia Pvt. Ltd., (2000).
3. Palanichamy, M.S., Nagam, S., "Engineering Mechanics – Statics & Dynamics", Tata McGraw-Hill, (2001).
4. Irving H. Shames, "Engineering Mechanics – Statics and Dynamics", IV Edition – Pearson Education Asia Pvt. Ltd., (2003).
5. Ashok Gupta, "Interactive Engineering Mechanics – Statics – A Virtual Tutor (CDROM)", Pearson Education Asia Pvt., Ltd., (2002).

212EET06 - BASIC ELECTRICAL AND ELECTRONICS ENGINEERING

(Common to branches Aero, Auto, Mechanical , Civil , Chemical Bio- Medical Engineering)

UNIT I ELECTRICAL CIRCUITS & MEASUREMENTS

Ohm's Law – Kirchoff's Laws – Steady State Solution of DC Circuits – Introduction to AC Circuits – Waveforms and RMS Value – Power and Power factor – Single Phase and Three Phase Balanced Circuits.

Operating Principles of Moving Coil and Moving Iron Instruments (Ammeters and Voltmeters), Dynamometer type Watt meters and Energy meters.

UNIT II ELECTRICAL MECHANICS

Construction, Principle of Operation, Basic Equations and Applications of DC Generators, DC Motors, Single Phase Transformer, single phase induction Motor.

UNIT III SEMICONDUCTOR DEVICES AND APPLICATIONS

Characteristics of PN Junction Diode – Zener Effect – Zener Diode and its Characteristics – Half wave and Full wave Rectifiers – Voltage Regulation.

Bipolar Junction Transistor – CB, CE, CC Configurations and Characteristics – Elementary Treatment of Small Signal Amplifier.

UNIT IV DIGITAL ELECTRONICS

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

UNIT V FUNDAMENTALS OF COMMUNICATION ENGINEERING

Types of Signals: Analog and Digital Signals – Modulation and Demodulation: Principles of Amplitude and Frequency Modulations.

Communication Systems: Radio, TV, Fax, Microwave, Satellite and Optical Fibre (Block Diagram Approach only).

TEXT BOOKS:

1. V.N. Mittle "Basic Electrical Engineering", Tata McGraw Hill Edition, New Delhi, 1990.
2. R.S. Sedha, "Applied Electronics" S. Chand & Co., 2006.

REFERENCES:

1. Muthusubramanian R, Salivahanan S and Muraleedharan K A, "Basic Electrical, Electronics and Computer Engineering", Tata McGraw Hill, Second Edition, (2006).
2. Nagsarkar T K and Sukhija M S, "Basics of Electrical Engineering", Oxford press (2005).
3. Mehta V K, "Principles of Electronics", S.Chand & Company Ltd, (1994).
4. Mahmood Nahvi and Joseph A. Edminister, "Electric Circuits", Schaum' Outline Series, McGraw Hill, (2002).
5. Premkumar N, "Basic Electrical Engineering", Anuradha Publishers, (2003).

LIST OF EXPERIMENTS

1. UNIX COMMANDS

Study of Unix OS - Basic Shell Commands - Unix Editor

2. SHELL PROGRAMMING

Simple Shell program - Conditional Statements - Testing and Loops

3. C PROGRAMMING ON UNIX

Dynamic Storage Allocation-Pointers-Functions-File Handling

HARDWARE / SOFTWARE REQUIREMENTS FOR A BATCH OF 30 STUDENTS

Hardware

- 1 UNIX Clone Server
- 33 Nodes (thin client or PCs)
- Printer – 3 Nos.

Software

- OS – UNIX Clone (33 user license or License free Linux)
- Compiler - C

**212PCP02
COMMON TO ALL BRANCHES**

PHYSICS LABORATORY (Any Ten Experiments)

1. Determination of Young's modulus of the material – non uniform bending.
2. Determination of Young's modulus of the material – uniform bending .
3. Determination of viscosity of liquid – Poiseuille's method.
4. Torsional pendulum – Determination of rigidity modulus.
5. Determination of the thermal conductivity of a bad conductor – Lee's Disc method.
6. Determination of the thickness of a thin wire – Air Wedge method.
7. (a) Particle size determination using Diode Laser.
(b) Determination of Laser Parameters – Wave length, and angle of divergence.
(c) Determination of acceptance angle in an optical fiber.
8. Spectrometer dispersive power of a prism.
9. Determination of Wave length of mercury spectrum –Spectrometer grating.
10. Determination of Band Gap of a Semiconductor diode.
11. Determination of velocity of sound and compressibility of liquid- Ultrasonic interferometer.
12. Determination of Hysteresis loss in a ferromagnetic material

- **A minimum of FIVE experiments shall be offered in Each Semester.**
- **Laboratory classes on alternate weeks for physics and chemistry.**
- **The lab examinations will be held only in the second Semester.**

CHEMISTRY LABORATORY – II

LIST OF EXPERIMENTS

1. Conductometric titration (Simple acid base)
2. Conductometric titration (Mixture of weak and strong acidsVs base)
3. Conductometric titration using BaCl_2 Vs Na_2SO_4
4. Potentiometric Titration ($\text{Fe}^{2+}/\text{KMnO}_4$ or $\text{K}_2\text{Cr}_2\text{O}_7$)
5. PH titration (acid & base)
6. Determination of water of crystallization of a crystalline salt (Copper sulphate)
7. Estimation of Ferric iron by spectrophotometry.
8. Estimation of sodium and potassium by flame photometry.

- Any five experiments.

212DMP03 - COMPUTER AIDED DRAFTING AND MODELING LABORATORY

List of Exercises using software capable of Drafting and Modeling

- 1.** Study of capabilities of software for Drafting and Modeling – Coordinate systems (absolute, relative, polar, etc.) – Creation of simple figures like polygon and general multi-line figures.
- 2.** Drawing of a Title Block with necessary text and projection symbol.
- 3.** Drawing of curves like parabola, spiral, involute using Bspline or cubic spline.
- 4.** Drawing of front view and top view of simple solids like prism, pyramid, cylinder, cone, etc, and dimensioning.
- 5.** Drawing front view, top view and side view of objects from the given pictorial views (eg. V-block, Base of a mixie, Simple stool, Objects with hole and curves).
- 6.** Drawing of a plan of residential building (Two bed rooms, kitchen, hall, etc.)
- 7.** Drawing of a simple steel truss.
- 8.** Drawing sectional views of prism, pyramid, cylinder, cone, etc,
- 9.** Drawing isometric projection of simple objects.
- 10.** Creation of 3-D models of simple objects and obtaining 2-D multi-view drawings from 3-D model.

Note: Plotting of drawings must be made for each exercise and attached to the records written by students.

List of Equipments for a batch of 30 students:

1. Pentium IV computer or better hardware, with suitable graphics facility -30 No.
2. Licensed software for Drafting and Modeling. – 30 Licenses
3. Laser Printer or Plotter to print / plot drawings – 2 No.

SEMESTER III

312MAT01 - TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS (Common to all branches)

OBJECTIVES

The course objective is to develop the skills of the students in the areas of Transforms and Partial Differential Equations. This will be necessary for their effective studies in a large number of engineering subjects like heat conduction, communication systems, electro-optics and electromagnetic theory. The course will also serve as a prerequisite for post graduate and specialized studies and research.

1. FOURIER SERIES

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

2. FOURIER TRANSFORMS

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

3. PARTIAL DIFFERENTIAL EQUATIONS

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

4. APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS

Solutions of one dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two-dimensional equation of heat conduction (Insulated edges excluded) – Fourier series solutions in cartesian coordinates.

5. Z -TRANSFORMS AND DIFFERENCE EQUATIONS

Z-transforms - Elementary properties – Inverse Z-transform – Convolution theorem - Formation of difference equations – Solution of difference equations using Z-transform.

TEXT BOOKS

1. Grewal, B.S, 'Higher Engineering Mathematics' 40th Edition, Khanna publishers, Delhi, (2007)

REFERENCES

1. Bali.N.P and Manish Goyal 'A Textbook of Engineering Mathematics', Seventh Edition, Laxmi Publications(P) Ltd. (2007)
2. Ramana.B.V. 'Higher Engineering Mathematics' Tata Mc-GrawHill Publishing Company limited, New Delhi (2007).
3. Glyn James, 'Advanced Modern Engineering Mathematics', Third edition-Pearson Education (2007).
4. Erwin Kreyszig 'Advanced Engineering Mathematics', Eighth edition-Wiley India (2007).

312AMT02 - ENGINEERING THERMODYNAMICS

OBJECTIVE

To achieve an understanding of principles of thermodynamics and to be able to use it in accounting for the bulk behaviour of the simple physical systems.

To provide in-depth study of thermodynamic principles, thermodynamics of state, basic thermodynamic relations, Principle of Psychrometry & Properties of pure substances

To enlighten the basic concepts of vapour power cycles.

UNIT- I: BASIC CONCEPT AND FIRST LAW

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

UNIT-II: SECOND LAW, ENTROPY AND AVAILABILITY

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

UNIT-III. PROPERTIES OF PURE SUBSTANCE AND STEAM POWER CYCLE

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

UNIT-IV IDEAL & REAL GASES AND THERMO DYNAMIC RELATIONS

Gas mixtures – Properties of ideal and real gases, equation of state, Avogadro's law, Vander Waal's equation of states, compressibility, compressibility chart. Dalton's law of partial pressure, Exact differentials, T-D, relations, Maxwell relations, Clausius Clapeyron equations, Joule Thomson Coefficient.

UNIT-V PSYCHROMETRY

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

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

TEXT BOOKS

1. Nag.P.K., "Engineering Thermodynamics", Tata McGraw-Hill, New Delhi, 2007.
2. Rathakrishnan E., "Fundamentals of Engineering Thermodynamics", Prentice-Hall of India, 2005.

REFERENCES

1. Ramalingam K.K. "Thermodynamics", Sci-Tech Publications, 2006
2. Holman.J.P., "Thermodynamics", 3rd Ed. McGraw-Hill, 2007.
3. Venwylen and Sontag, "Classical Thermodynamics", Wiley Eastern, 1987
4. Arora C.P, " Thermodynamics", Tata McGraw-Hill, New Delhi, 2003.
5. Merala C, Pother, Craig W, Somerton, " Thermodynamics for Engineers", Schaum Outline Series, Tata McGraw-Hill, New Delhi, 2004.

312AMT03 - FLUID MECHANICS AND MACHINERY
(Common to Aeronautical, Mechanical, Automobile & Production)

Objectives:

- a. The student is introduced to the mechanics of fluids through a thorough understanding of the properties of the fluids. The dynamics of fluids is introduced through the control volume approach which gives an integrated understanding of the transport of mass, momentum and energy.
- b. The applications of the conservation laws to flow through pipes and hydraulics machines are studied

I. INTRODUCTION

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

II. FLOW THROUGH CIRCULAR CONDUITS

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

III. DIMENSIONAL ANALYSIS

Dimension and units: Buckingham's Π theorem. Discussion on dimensionless parameters. Models and similitude. Applications of dimensionless parameters.

IV. ROTO DYNAMIC MACHINES

Homologous units. Specific speed. Elementary cascade theory. Theory of turbo machines. Euler's equation. Hydraulic efficiency. Velocity components at the entry and exit of the rotor. Velocity triangle for single stage radial flow and axial flow machines. Centrifugal pumps, turbines, performance curves for pumps and turbines.

V. POSITIVE DISPLACEMENT MACHINES

Reciprocating pumps, Indicator diagrams, Work saved by air vessels. Rotary pumps. Classification. Working and performance curves.

TEXT BOOKS:

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

REFERENCES:

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

312AMT04 - AUTOMOTIVE ENGINES

OBJECTIVE

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

UNIT-I: CONSTRUCTION AND OPERATION:

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

UNIT-II: FUEL SYSTEMS:

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

UNIT-III: COMBUSTION AND COMBUSTION CHAMBERS:

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

UNIT-IV: SUPERCHARGING , TURBOCHARGING AND ENGINE TESTING

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

UNIT-V: COOLING AND LUBRICATION SYSTEMS

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

TEXT BOOKS:

1. Internal Combustion Engines by V. Ganesan, 2007, Tata Mc Graw Hill
2. Ramalingam K.K., "Internal Combustion Engines", Sci-Tech Publications, 2005.

REFERENCES

1. Advanced Engine Technology by Heisler, SAE Publication
2. Edward F. Obert Internal Combustion Engines
3. H.N. Gupta Fundamentals of Internal Combustion Engines by, PHI
4. Mathur and Sharma Intendamental Combustion Engines Dhanpat Rai and Sons 2002
5. John B. Heywood, "Fundamentals of Internal Combustion Engines",

**312AMT05 - MECHANICS OF MACHINES
(Common to Production, Automobile and Aero)**

OBJECTIVE

To expose the students the different mechanisms, their method of working, Forces involved and consequent vibration during working

UNIT- I : MECHANISMS

Machine Structure – Kinematic link, pair and chain – Grueblers criteria – Constrained motion – Degrees of freedom - Slider crank and crank rocker mechanisms – Inversions – Applications – Kinematic analysis of simple mechanisms – Determination of velocity and acceleration.

UNIT- II : FRICTION

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.

UNIT- III : GEARING AND CAMS

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

UNIT-IV: BALANCING

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

UNIT-V : VIBRATION

Free, forced and damped vibrations of single degree of freedom systems – Force transmitted to supports – Vibration isolation – Vibration absorption – Torsional vibration of shaft – Single and multi rotor systems – Geared shafts – Critical speed of shaft.

TEXT BOOKS

1. Rattan.S.S, "Theory of Machines", Tata McGraw–Hill Publishing Co., New Delhi,2004
2. Ballaney.P.L, "Theory of Machines", Khanna Publishers, New Delhi, 2002.

REFERENCES

1. Rao,J.S and Dukkupati, R.V, "Mechanism and Machine Theory", Second Edition, Wiley Eastern Ltd., 2002.
2. Malhotra, D.R and Gupta, H.C., "The Theory of Machines", Satya Prakasam, Tech. India Publications, 2005.
3. Gosh, A. and Mallick, A.K., "Theory of Machines and Mechanisms", Affiliated East West Press, 2006.

312AMT06 - PRODUCTION TECHNOLOGY

OBJECTIVE

The automobile components such as piston, connecting rod, crankshaft, engine block, front axle, frame, body etc., are manufactured by various types of production processes involving casting, welding, machining, metal forming, power metallurgy etc. Hence B.E. Automobile Engineering students must study this course Production Technology.

UNIT-I: CASTING

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

UNIT-II: WELDING

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

UNIT III: MACHINING

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

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

UNIT- IV: FORMING AND SHAPING OF PLASTICS

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

UNIT-V: METAL FORMING AND POWDER METALLURGY

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.

TEXT BOOKS

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

REFERENCES

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

312AMP01 - AUTOMOTIVE COMPONENTS LABORATORY

1. Dismantling and study of Multi-cylinder Petrol Engine
2. Assembling of Multi-cylinder Petrol Engine
3. Dismantling and study of Multi-cylinder Diesel Engine
4. Assembling of Multi-cylinder Diesel Engine
5. Study of petrol engine fuel system
6. Study of diesel engine fuel system
7. Study and measurement of light and heavy commercial Vehicle Frame
8. Study, dismantling and assembling of front and rear Axles
9. Study, dismantling and assembling of differential
10. Study, dismantling and assembling of Clutch
11. Study, dismantling and assembling of Gear Box
12. Study of steering system

LIST OF EQUIPMENTS

(for a batch of 30 students)

- | | | |
|-----|-------------------------------------------------|-------|
| 1. | Multi Cylinder Petrol Engine | 2 No. |
| 2. | Multi Cylinder Diesel Engine | 2 No. |
| 3. | Petrol and Diesel fuel systems | 2No |
| 4. | Heavy duty vehicle chassis frame | 1 No. |
| 5. | Light duty vehicle chassis frame | 1 No. |
| 6. | Front axle | 2 No. |
| 7. | Rear axle | 2 No. |
| 8. | Differential | 2 No. |
| 9. | Clutch and Gear box (light duty, heavy duty) | 2 No. |
| 10. | Steering systems with different gearboxes | 4 No. |

312AMP02 - FLUID MECHANICS AND MACHINERY LAB
(OFFERED AUTOMOBILE ONLY)

LIST OF EXPERIMENTS

1. Determination of the Coefficient of discharge of given Orifice and Venturi meter.
2. Calculation of the rate of flow using Rota meter.
3. Determination of friction factor of given set of pipes.
4. Conducting experiments and drawing the characteristic curves of centrifugal pump/ submergible pump
5. Conducting experiments and drawing the characteristic curves of reciprocating pump.
6. Conducting experiments and drawing the characteristic curves of Gear pump.
7. Conducting experiments and drawing the characteristic curves of Pelton wheel.
8. Conducting experiments and drawing the characteristics curves of Francis turbine.
9. Conducting experiments and drawing the characteristic curves of Kaplan turbine.
10. Flow visualization experiment on the effects of sharp corner and rounded corner and add-on devices in automobiles
11. Drag estimation on models of automobiles of different shapes

LIST OF EQUIPMENTS
(for the batch of 30 students)

1. Orifice meter setup
2. Venturi meter setup
3. Rotameter setup
4. Pipe Flow analysis setup
5. Centrifugal pump/submergible pump setup
6. Reciprocating pump setup
7. Gear pump setup
8. Pelton wheel setup
9. Francis turbine setup Kaplan turbine setup
10. Wind tunnel with pressure measuring devices

312AMP03 - MANUFACTURING TECHNOLOGY LABORATORY

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
- 1.5. Boring and internal thread cutting.

2. SHAPER AND SLOTTER

- 2.1. Machining a V- block (in a Shaper)
- 2.2. Machining hexagonal shape (in a Shaper)
- 2.3. 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

Cylindrical Grinding Exercise

LIST OF EQUIPMENTS(For A Batch Of 30 Students)

| | | |
|----|-------------------------------|-------|
| 1. | Centre Lathe with accessories | 5No. |
| 2. | Shaping Machine | 2 No. |
| 3. | Slotting Machine | 1 No. |
| 4. | Radial Drilling Machine | 2No. |
| 5. | Upright Drilling Machine | 2No. |
| 6. | Milling Machine | 2No. |
| 7. | Cylindrical Grinding Machine | 1 No. |

SEMESTER IV

412AMT01 - STATISTICS AND NUMERICAL METHODS (CREDIT =3)

(Common to Mechanical, Automobile and Production)

1. TESTING OF HYPOTHESIS

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

2. DESIGN OF EXPERIMENTS

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

3. SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEM

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

4. INTERPOLATION, NUMERICAL DIFFERENTIATION AND NUMERICAL INTEGRATION

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

5. NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS

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

TEXT BOOKS

1. R.A. Johnson and C.B. Gupta, "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 7th edition, 2007 (For units 3, 4 and 5).
2. Grewal, B.S. and Grewal, J.S., " Numerical methods in Engineering and Science", 6th Edition, Khanna Publishers, New Delhi, 2004.

BOOKS FOR REFERENCES:

1. R.E. Walpole, R.H. Myers, S.L. Myers, and K Ye, "Probability and Statistics for Engineers and Scientists", Pearson Education, Asia , 8th edition, 2007.
2. M.R. Spiegel, J. Schiller and R.A. Srinivasan, "Schaum's Outlines Probability and Statistics", Tata McGraw Hill edition, 2004.
3. Chapra, S. C and Canale, R. P. "Numerical Methods for Engineers", 5th Edition, Tata McGraw-Hill, New Delhi, 2007.
4. Gerald, C. F. and Wheatley, P. O., "Applied Numerical Analysis", 6th Edition, Pearson Education Asia, New Delhi, 2006.

UNIT-I GAS POWER CYCLES

Air standard cycles-Otto-Diesel-Dual-Work output, Efficiency and MEP calculations – comparison of the cycles for same compression ratio and heat addition, same compression ratio and heat rejection, same peak pressure, peak temperature and heat rejection, same peak pressure and heat input, same peak pressure and work output, Brayton cycle with intercooling, reheating and regeneration.

UNIT-II: RECIPROCATING AIR COMPRESSORS & REFRIGERATION CYCLES

Single acting and double acting air compressors, work required, effect of clearance volume, volumetric efficiency, isothermal efficiency, free air delivery, multistage compression, condition for minimum work. Fundamentals of refrigeration, C.O.P., reversed Carnot cycle, simple vapour compression refrigeration system, T-S, P-H diagrams, simple vapour absorption refrigeration system, desirable properties of an ideal refrigerant.

UNIT-III: CONDUCTION

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

UNIT-IV: CONVECTION

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

UNIT-V: RADIATION

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

TEXT BOOKS

1. R.K.Rajput "Applied Thermodynamics", Laxmi Publishing Co., New Delhi, 2007
2. J.P. Holman "Heat Transfer", Tata Mc Graw –Hill, 2003

REFERENCES

1. P.K.Nag "Basic and applied Thermodynamics" Tata McGraw –Hill Publishing Co. Ltd, New Delhi, 2004
2. P..K.Nag " Heat Transfer", Tata McGraw-Hill, New Delhi, 2002
3. C.P Kothandaraman "Fundamentals of Heat and Mass Transfer" New Age International, New Delhi, 1998

412AMT03 – ENGINEERING MATERIALS AND METALLURGY

Objective

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

Review (Not for Exam)

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

Unit-I : CONSTITUTION OF ALLOYS AND PHASE DIAGRAMS

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

Unit-II : HEAT TREATMENT

Definition – Full annealing, stress relief, recrystallisation and spheroidizing –normalising, hardening and tempering of steel. Isothermal transformation diagrams – cooling curves superimposed on I.T. diagram, CCR - Hardenability, Jominy end quench test – Austempering, martempering – case hardening - carburising, nitriding, cyaniding, carbonitriding, flame and induction hardening.

Unit-III : MECHANICAL PROPERTIES AND TESTING

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

Unit-IV : FERROUS AND NON FERROUS METALS

Effect of alloying elements on steel (Mn, Si, Cr, Mo, V, Ti & W) - stainless and tool steels – HSLA - maraging steels – Cast Irons - Grey, White malleable, spheroidal- Graphite, Alloy cast irons, Copper and Copper alloys - Brass, Bronze and Cuproni- -ckel – Aluminum and Al-Cu alloy – precipitation hardening– Bearing alloys.

Unit-V : NON-METALLIC MATERIALS

Polymers – types of polymer, commodity and engineering polymers – Properties and applications of PE, PP, PS, PVC, PMMA, PET, PC, PA, ABS, PI, PAI, PPO, PPS, PEEK, PTFE Polymers – Urea and Phenol Formaldehydes – Engineering Ceramics –Introduction to Fibre reinforced plastics.

TEXT BOOKS

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

REFERENCE BOOKS

1. William D Callister "Material Science and Engineering", John Wiley and Sons 2007.
2. Raghavan.V "Materials Science and Engineering", Prentice Hall of India Pvt., Ltd., 2007.
3. Sydney H.Avner "Introduction to Physical Metallurgy" McGraw Hill Book Company, 2007.
4. Dieter G. E., Mechanical Metallurgy, Mc Graw Hill Book Company, 1988.
5. O.P. Khanna , A text book of Materials Science and Metallurgy, Khanna Publishers, 2003.
6. Vijaya. M.S. and G. Rangarajan, Material Science, Tata McGraw-Hill , 2007

412AMT04 - STRENGTH OF MATERIALS (Common to Mechanical, Automobile & Production)

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

UNIT I STRESS STRAIN DEFORMATION OF SOLIDS

Rigid and Deformable bodies – Strength, Stiffness and Stability – Stresses; Tensile, Compressive and Shear – Deformation of simple and compound bars under axial load – Thermal stress – Elastic constants – Strain energy and unit strain energy – Strain energy in uniaxial loads.

UNIT II BEAMS - LOADS AND STRESSES

Types of beams: Supports and Loads – Shear force and Bending Moment in beams – Cantilever, Simply supported and Overhanging beams – Stresses in beams – Theory of simple bending – Stress variation along the length and in the beam section – Effect of shape of beam section on stress induced – Shear stresses in beams – Shear flow

UNIT III TORSION

Analysis of torsion of circular bars – Shear stress distribution – Bars of Solid and hollow circular section – Stepped shaft – Twist and torsion stiffness – Compound shafts – Fixed and simply supported shafts – Application to close-coiled helical springs – Maximum shear stress in spring section including Wahl Factor – Deflection of helical coil springs under axial loads – Design of helical coil springs – stresses in helical coil springs under torsion loads

UNIT IV BEAMDEFLECTION

Elastic curve of Neutral axis of the beam under normal loads – Evaluation of beam deflection and slope: Double integration method, Macaulay Method, and Moment-area Method –Columns – End conditions – Equivalent length of a column – Euler equation – Slenderness ratio – Rankine formula for columns

UNIT V ANALYSIS OF STRESSES IN TWO DIMENSIONS

Biaxial state of stresses – Thin cylindrical and spherical shells – Deformation in thin cylindrical and spherical shells – Biaxial stresses at a point – Stresses on inclined plane – Principal planes and stresses – Mohr's circle for biaxial stresses – Maximum shear stress - Strain energy in bending and torsion.

TEXT BOOKS

1. Popov E.P, "Engineering Mechanics of Solids", Prentice-Hall of India, New Delhi, 1997
2. Beer F. P. and Johnston R, "Mechanics of Materials", McGraw-Hill Book Co, Third Edition, 2002.

REFERENCES

1. Nash W.A, "Theory and problems in Strength of Materials", Schaum Outline Series, McGraw-Hill Book Co, New York, 1995
2. Kazimi S.M.A, "Solid Mechanics", Tata McGraw-Hill Publishing Co., New Delhi, 1981.
3. Ryder G.H, "Strength of Materials, Macmillan India Ltd"., Third Edition, 2002
4. Ray Hulse, Keith Sherwin & Jack Cain, "Solid Mechanics", Palgrave ANE Books, 2004.
5. Singh D.K "Mechanics of Solids" Pearson Education 2002.
6. Timoshenko S.P, "Elements of Strength of Materials", Tata McGraw-Hill, NewDelhi, 1997.

412AMT05 - ELECTRONICS AND MICROPROCESSORS

(Common to Mechanical, Production & Automobile)

Objective

To enable the students to understand the fundamental concepts of Semi Conductors, Transistors, Rectifiers, Digital Electronics and 8085 Microprocessors.

Unit-I : SEMICONDUCTORS AND RECTIFIERS

Classification of solids based on energy band theory-Intrinsic semiconductors-Extrinsic semiconductors-P type and N type-PN junction-Zenor effect-Zenor diode characteristics-Half wave and full wave rectifiers -Voltage regulation.

Unit-II : TRANSISTORS AND AMPLIFIERS

Bipolar junction transistor- CB, CE, CC configuration and characteristics-Biasing circuits-Class A, B and C amplifiers- Field effect transistor-Configuration and characteristic of FET amplifier- SCR, Diac, Triac, UJT-Characteristics and simple applications-Switching transistors-Concept of feedback-Negative feedback-Application in temperature and motor speed control.

Unit-III : DIGITAL ELECTRONICS

Binary number system - AND, OR, NOT, NAND, NOR circuits-Boolean algebra-Exclusive OR gate - Flip flops-Half and full adders-Registers-Counters-A/D and D/A conversion.

Unit-IV : MICROPROCESSOR

Block diagram of microcomputer-Architecture of 8085-Pin configuration-Instruction set-Addressing modes-Simple programs using arithmetic and logical operations.

Unit-V : INTERFACING AND APPLICATIONS OF MICROPROCESSOR

Basic interfacing concepts - Interfacing of Input and Output devices-Applications of microprocessor Temperature control, Stepper motor control, traffic light control.

TEXT BOOKS

1. Milman and Halkias, "Integrated Electronics", Tata McGraw-Hill publishers, 1995.
2. Ramesh Goankar, "Microprocessor Architecture", Programming and Applications with 8085, Wiley Eastern, 1998.

REFERENCE BOOKS

1. Malvino and Leach, "Digital Principles and Applications", Tata McGraw-Hill,1996
2. Mehta V.K, "Principles of Electronics", S. Chand and Company Ltd.,1994
3. Douglas V.Hall, "Microprocessor and Interfacing", Programming and Hardware, Tata McGraw-Hill, 1999.
4. Salivahanan S, Suresh Kumar N, Vallavaraj A, "Electronic Devices and Circuits" First Edition, Tata McGraw-Hill, 1999.

412AMT06 - AUTOMOTIVE CHASSIS

OBJECTIVE:

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.

UNIT-I: INTRODUCTION

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.

UNIT-II: DRIVE LINE

Effect of Driving Thrust, torque reactions and side thrust, Hotchkiss drive, torque tube drive, radius rods and stabilizers, Propeller Shaft, Universal Joints, Constant Velocity Universal Joints, Front Wheel drive, Final drive, different types, Double reduction and twin speed final drives, Multi-axled vehicles, Differential principle and types, Differential housings, Non-Slip differential, Differential locks, Final drive of Crawler Tractors.

UNIT -III: AXLES

Construction and Design 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.

UNIT- IV: SUSPENSION SYSTEM

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

UNIT-V: BRAKING SYSTEM

Theory of Automobile Braking, Stopping Distance Time and Braking Efficiency, Effect of Weight Transfer during Braking, Theory of Drum Brakes, Loading and Trailing Shoes, Braking Torque, Constructional Details of Drum Brake and its Activators, Disc Brake Theory, Types and Construction, Hydraulic Braking System, Mechanical Braking System, Pneumatic Braking System, Power-Assisted Braking System, Servo Brakes, Retarders, Types and Construction, Anti-Lock Braking System, Constructional Details.

TEXT BOOKS

1. Kripal Singh, "Automobile Engineering"
2. R.K. Rajput, "A Text-Book of Automobile Engineering", Laxmi Publications Private Limited
3. N.K. Giri, "Automotive Mechanics" Khanna Publishers, New Delhi, 2005.

REFERENCES

1. Heldt P.M., "Automotive Chassis" Chilton Co., New York.
2. Newton Steeds and Garret, "Motor Vehicles" 13th Edition, Butterworth, London, 2005.
3. Heinz Hazler, "Modern Vehicle Technology", Butterworth, London, 2005.

412AMP01 - ENGINE PERFORMANCE AND EMISSION TESTING LAB

LIST OF EXPERIMENTS

1. Study of hydraulic, electrical and eddy current dynamometers
2. Valve timing and port timing diagram
3. Performance and emission test on two wheeler SI engine
4. Performance and emission test on automotive multi-cylinder SI engine
5. Performance and emission test on automotive multi-cylinder CI engine
6. Retardation test on I.C. Engines.
7. Heat balance test on automotive multi-cylinder SI engine
8. Heat balance test on automotive multi-cylinder CI engine
9. Morse test on multi-cylinder SI engine
10. P- θ and P-V diagrams for IC engine with piezo-electric pick up, charge amplifier, angle encoder and PC

LIST OF EQUIPMENTS (for a batch of 30 students)

- | | |
|------------------------------------------------------------------------------|-------------|
| 1. Hydraulic dynamometer | - 1 No. |
| 2. Eddy current dynamometer | - 1 No. |
| 3. Electrical dynamometer | - 1 No. |
| 4. Single cylinder two stroke cut section engine | - 1 No. |
| 5. Single cylinder four stroke cut section engine | - 1 No. |
| 6. Two-wheeler engine test rig. | - 1 No. |
| 7. Automotive multicylinder SI engine test rig with heat balance arrangement | - 1 No. |
| 8. Automotive multicylinder CI engine test rig with heat balance arrangement | - 1 No. |
| 9. Emission Measuring Instruments for Petrol & Diesel Engines | - 1 No each |
| 10. Piezo-electric pick up, Charge Amplifier, Angle Encoder and PC | - 1 set |

412AMP02 - COMPUTER AIDED MACHINE DRAWING LAB (Common to Automobile & Production)

1. Drawing of automobile components such as piston, connecting rod, valves, manifold and crank shaft.
2. Assembly drawing of screw jack, piston – connecting rod assembly, valve assembly, clutch assembly and gear box assembly.

LIST OF EQUIPMENTS
(for a batch of 30 students)

- | | |
|-------------------|---------------|
| 1. Computer nodes | - 30 Nos. |
| 2. Software | |
| i) Auto CAD | - 15 licenses |
| ii) Pro-E | - 5 Nos. |

412AMP03 - ELECTRONICS AND MICROPROCESSORS LAB

Objective

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

LIST OF EXPERIMENTS

ELECTRONICS

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

MICROPROCESSORS

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

LIST OF EQUIPMENT (for a batch of 30 students)

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

412AMP04 - STRENGTH OF MATERIALS LAB
(Common to Auto, Mechanical & Production)

OBJECTIVE

To supplement the theoretical knowledge gained in Mechanics of Solids with practical testing for determining the strength of materials under externally applied loads. This would enable the student to have a clear understanding of the design for strength and stiffness

LIST OF EXPERIMENTS

1. Tension test on a mild steel rod
2. Double shear test on Mild steel and Aluminium rods
3. Torsion test on mild steel rod
4. Impact test on metal specimen
5. Hardness test on metals - Brinnell and Rockwell Hardness Number
6. Deflection test on beams
7. Compression test on helical springs
8. Strain Measurement using Rosette strain gauge
9. Effect of hardening- Improvement in hardness and impact resistance of steels.
10. Tempering- Improvement Mechanical properties Comparison
 - (i) Unhardened specimen
 - (ii) Quenched Specimen and
 - (iii) Quenched and tempered specimen.
11. Microscopic Examination of
 - (i) Hardened samples and
 - (ii) Hardened and tempered samples.

LIST OF EQUIPMENT
(for a batch of 30 students)

- | | |
|-------------------------------------------------------------------------------------|---|
| 1. Universal Tensile Testing machine with double shear attachment – 40 Ton Capacity | 1 |
| 2. Torsion Testing Machine (60 NM Capacity) | 1 |
| 3. Impact Testing Machine (300 J Capacity) | 1 |
| 4. Brinell Hardness Testing Machine | 1 |
| 5. Rockwell Hardness Testing Machine | 1 |
| 6. Spring Testing Machine for tensile and compressive loads (2500 N) | 1 |
| 7. Metallurgical Microscopes | 3 |
| Muffle Furnace (800 °C) | |

V SEMESTER

512AMT01 - ENVIRONMENTAL SCIENCE AND ENGINEERING (Common to Auto, Aero and Mechanical)

AIM

The aim of this course is to create awareness in every engineering graduate about the importance of environment, the effect of technology on the environment and ecological balance and make them sensitive to the environment problems in every professional endeavour that they participate.

OBJECTIVE

At the end of this course the student is expected to understand what constitutes the environment, what are precious resources in the environment, how to conserve these resources, what is the role of a human being in maintaining a clean environment and useful environment for the future generations and how to maintain ecological balance and preserve bio-diversity. The role of government and non-government organization in environment managements.

UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY

Definition, scope and importance of environment – need for public awareness - concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers – energy flow in the ecosystem – ecological succession – food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to biodiversity definition: genetic, species and ecosystem diversity – bio geographical classification of India – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – Biodiversity at global, national and local levels – India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity. Field study of common plants, insects, birds Field study of simple ecosystems – pond, river, hill slopes, etc.

UNIT II ENVIRONMENTAL POLLUTION

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 municipal solid wastes – role of an individual in prevention of pollution – pollution case studies – disaster management: floods, earthquake, cyclone and landslides. Field study of local polluted site – Urban / Rural / Industrial / Agricultural.

UNIT III NATURAL RESOURCES

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

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT

From unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting, watershed management – resettlement and rehabilitation of people; its problems and concerns, case studies – role of nongovernmental organization- environmental ethics: Issues and possible solutions – climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies. – wasteland reclamation – consumerism and waste products – environment production act – Air (Prevention and Control of Pollution) act – Water (Prevention and control of Pollution) act – Wildlife protection act – Forest conservation act – enforcement machinery involved in environmental legislation central and state pollution control boards- Public awareness.

UNIT V HUMAN POPULATION AND THE ENVIRONMENT

Population growth, variation among nations – population explosion – family welfare programme – environment and human health – human rights – value education – HIV / AIDS – women and child welfare – role of information technology in environment and human health – Case studies.

TEXT BOOKS

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

REFERENCES

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

512AMT02 - DESIGN OF MACHINE ELEMENTS

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

UNIT I STEADY STRESSES AND VARIABLE STRESSES IN MACHINE MEMBERS

Introduction to the design process - factor influencing machine design, selection of materials based on mechanical properties -- Preferred numbers, fits and tolerances – Direct, Bending and torsional stress equations – Impact and shock loading – calculation of principle stresses for various load combinations, eccentric loading – Design of curved beams – crane hook and 'C' frame - Factor of safety - theories of failure – stress concentration – design for variable loading – Soderberg, Goodman and Gerber relations

UNIT II DESIGN OF SHAFTS AND COUPLINGS

Design of solid and hollow shafts based on strength, rigidity and critical speed – Design of keys, key ways and splines - Design of crankshafts -- Design of rigid and flexible couplings.

UNIT III DESIGN OF TEMPORARY AND PERMANENT JOINTS

Threaded fasteners - Design of bolted joints including eccentric loading, Knuckle joints, Cotter joints – Design of welded joints, riveted joints for structures - theory of bonded joints.

UNIT IV DESIGN OF ENERGY STORING ELEMENTS

Design of various types of springs, optimization of helical springs -- rubber springs -- Design of flywheels considering stresses in rims and arms, for engines and punching machines.

UNIT V DESIGN OF BEARINGS AND MISCELLANEOUS ELEMENTS

Sliding contact and rolling contact bearings -- Design of hydrodynamic journal bearings, McKee's Eqn., Sommerfield Number, Raimondi & Boyd graphs, -- Selection of Rolling Contact bearings - Design of Seals and Gaskets -- Design of Connecting Rod.

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

TEXT BOOKS

1. Shigley J.E and Mischke C. R., "Mechanical Engineering Design", Sixth Edition, Tata McGraw-Hill , 2003.
2. Bhandari V.B, "Design of Machine Elements", Second Edition, Tata McGraw-Hill Book Co, 2007.

REFERENCES

1. Sundararajamoorthy T. V, Shanmugam .N, "Machine Design", Anuradha Publications, Chennai, 2003.
2. Orthwein W, "Machine Component Design", Jaico Publishing Co, 2003.
3. Ugural A.C, "Mechanical Design – An Integral Approach, McGraw-Hill Book Co, 2004.
4. Spotts M.F., Shoup T.E "Design and Machine Elements" Pearson Education, 2004.

STANDARDS

1. IS 10260 : Part 1 : 1982 Terms, definitions and classification of Plain bearings Part 1 : Construction.
2. IS 10260 : Part 1 : 1982 Terms, definitions and classification of Plain bearings Part 2 : Friction and Wear.
3. IS 10260 : Part 1 : 1982 Terms, definitions and classification of Plain bearings Part 3 : Lubrication.

512AMT03 - AUTOMOTIVE TRANSMISSION

OBJECTIVE

To impart basic knowledge to students with respect to transmission system of automobiles and impart knowledge that will enable the students to understand the latest developments in the field.

UNIT I CLUTCH

Requirement of transmission system. Types of transmission system. Types of clutches. Requirement of clutches. Principle of friction clutch. Construction and operation of single plate coil spring clutch. Single plate diaphragm spring clutch, multiplate clutch, cone clutch and electromagnetic clutch.

UNIT II GEAR BOX

Problems on performance of automobile such as resistance to motion, attractive effort, engine speed & power and acceleration. Determination of gear ratio for passenger car, heavy vehicle and tractors. Objectives and need of gear box in a vehicle. Construction and operation of Sliding mesh gear box, constant mesh gear box, Synchronizers –need, principle of operation and types such as Early Warner and Later Warner gear synchronizers.

UNIT III HYDROMATIC DRIVE

Fluid coupling: Principle of operation. Constructional details. Torque capacity. Performance characteristics. Reduction of drag torque. Hydrodynamic torque converter: Principle of operation, constructional details, performance characteristics, multistage torque converter, polyphase torque converter and converter coupling.

UNIT IV EPICYCLIC GEAR BOXES

Introduction to epicyclic gear train – external mesh and internal mesh planetary gear trains. Ford – T – model gear box. Wilson gear box, Cotal Electromagnetic gear box, Automatic transmission. Hydraulic control system for automatic transmission.

UNIT V HYDROSTATIC AND ELECTRIC DRIVE

Hydrostatic drive: Various types of hydrostatic drives, principle of hydrostatic drive system, advantages & limitations, comparison of hydrostatic drive with hydrodynamic drive, construction and working of typical Janny hydrostatic drive. Electric drives: Principle of early Ward Leonard and modified Ward Leonard control system, advantages & limitations.

TEXT BOOKS

1. Newton and Steeds, Motor vehicles, Illife Publishers, 2002.
2. Heldt .P.M, Torque converters, Chilton Book Co., 1992.

REFERENCES

1. Judge.A.W. Modern Transmission systems, Chapman and Hall Ltd, 2000.
2. Heinz Heisler, Advanced Vehicle Technology, Butterworth Heinemann, 2002.
3. Hydrostatic Transmission for vehicle applications, I.Mech E.Conference, 1981-

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512AMT04 - AUTOMOTIVE ELECTRICAL AND ELECTRONICS

OBJECTIVE

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.

UNIT I TYPES OF BATTERIES

Principle and construction of Lead Acid Battery, Nickel – Cadmium Battery, Nickel Metal, Hybrid Battery, Sodium Sulphur Battery and Aluminium Air Battery, Characteristics of Battery, Battery Rating, Capacity and Efficiency, Various Tests on Battery, Battery-Charging Techniques, .Maintenance of batterie.

UNIT II ELECTRICAL COMPONENTS

Requirements of Starter Motor, Starter Motor types, construction and characteristics, Starter drive mechanisms, Starter Switches and Solenoids, Charging system components, Generators and Alternators ,types, construction and Characteristics . Voltage and Current Regulation, Cut –out relays and regulators, Charging circuits for D.C. Generator, A.C. Single Phase and Three – Phase Alternators.

UNIT III IGNITION SYSTEMS

Battery Coil and Magneto-Ignition System, Circuit details and Components of Battery Coil and Magneto-Ignition System, Centrifugal and Vacuum Advance Mechanisms, Spark Plugs, Constructional details and Types.

UNIT IV ELECTRICAL AND ELECTRONIC IGNITION SYSTEMS

Electronically-Assisted and Full Electronic Ignition System, Non-Contact-type Ignition Triggering devices, Capacitive Discharge Ignition Distributor-less Ignition System, Digital Ignition System, Control Strategy of Electronic Ignition System.

UNIT V WIRING, LIGHTING AND OTHER INSTRUMENTS AND SENSORS

Automotive Wiring, Insulated and Earth Return System, Positive and Negative Earth Systems, Head Lamp and Indicator Lamp Details, Anti-Dazzling and Dipper Details, Electrical and Electronic Fuel Lift Pumps, Theory and Constructional Details of Dash Board Instruments and their Sensors like Speedometer, Odometer, Fuel Level Indicator Oil Pressure and Coolant Temperature Indicators, Horns and Wiper Mechanisms, Automotive Wiring Circuits.

TEXT BOOKS

1. Young, A.P. and Griffith, S.L., Automobile Electrical Equipments, ELBS and New Press.
2. Kholi .P.L.Automotive Electrical Equipment,Tata McGraw-Hill co ltd,New Delhi, 2004.

REFERENCES

1. Crouse.W.H.Automobile Electrical Equi\pment,McGraw Hill Book Co Inc.NewYork, 2005.
2. Judge.A.W.Modern Electrical Equipments of Automobiles,Chapman & Hall, London 2004.
3. Robert Bosch, Automotive Handbook, Bently Publishers, 2004.

512AMT05 - VEHICLE DESIGN AND DATA CHARACTERISTICS

OBJECTIVE

Students have to collect important technical specifications of an automobile from automobile Journals and keeping this, as a guide, they have to calculate and tabulate various vehicle performance parameters and design parameters and to draw curves using these data.

UNIT I INTRODUCTION

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

UNIT II RESISTANCE TO VEHICLE MOTION

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

UNIT III PERFORMANCE CURVES

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

UNIT IV

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

UNIT V GEAR RATIOS

Determination of Gear Ratios, Acceleration and Gradability, Typical Problems on Vehicle performance .

TEXT BOOKS

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

REFERENCE

1. R.B.Gupta, Automobile Engineering.

512AMT06 - AUTOMOTIVE FUELS AND LUBRICANTS

OBJECTIVE

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.

UNIT I MANUFACTURE OF FUELS AND LUBRICANTS

Fuels, Structure of petroleum, refining process, thermal and catalytic cracking, products of refining process, manufacture of lubricating oil base stocks and finished automotive lubricants.

UNIT II FUELS FOR I.C. ENGINES

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, alternate fuels for SI engines. CI engine fuels, desirable characteristics, cetane rating, alternate fuels for CI engines, biodiesels.

UNIT III COMBUSTION OF FUELS

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.

UNIT IV THEORY OF LUBRICATION

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

UNIT V LUBRICANTS

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

TEXT BOOKS

1. V.Ganesan, "Internal Combustion Engines" Tata McGraw-Hill Publishing Co. Newdelhi.
2. M.L.Mathur and P.Sharma "A course in internal combustion engines", Dhanpatrai Publications.

REFERENCES

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

512AMP01 - AUTOMOTIVE ELECTRICAL AND ELECTRONICS LABORATORY

LIST OF EXPERIMENTS

a. Electrical Laboratory

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

b. 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. Interfacing Sensors like RTD, LVDT, Load Cell etc.
5. Interfacing ADC for Data Acquisition
6. Interfacing DAC for Control Application
7. Interfacing A/D converter and simple data acquisition
8. Micro controller programming and interfacing
9. Interfacing Actuators
10. EPROM Programming
11. Fault Diagnosis of various sensors

LIST OF EQUIPMENT

(For a batch of 30 students)

| | |
|----------------------------------------|--------------|
| Battery, hydrometer, voltage tester | - 1 No. each |
| Starter motor, regulator, cut-out | - 1 No. each |
| Distributor, ignition coil, spark plug | - 1 No. each |
| Auto electrical wiring system | - 1 No |
| Rectifiers, filters | - 1 No. each |
| Amplifier | - 1 No |
| IC timer | - 1 No |
| Data logger | - 1 No |
| 8085 trainer kit | - 10 Nos |
| ADC interface board | - 2 Nos |
| DAC interface board | - 2 Nos |
| Sensors like RTD, Load cell, LVDT | - 2 Nos |
| Actuators like stepper motor | - 2 Nos |

512AMP02 - AUTOMOTIVE FUELS AND LUBRICANTS LABORATORY

LIST OF EXPERIMENTS

1. Study of International and National standards for fuels and lubricants.
2. Study of Octane and Cetane Number of fuels.
3. ASTM distillation test of liquid fuels
4. Aniline Point test of diesel
5. Calorific value of liquid fuel.
6. Calorific value of gaseous fuel.
7. Reid vapour pressure test.
8. Flash and Fire points of oil.
9. Copper strip Corrosion Test
10. Cloud & Pour point Test.
11. Temperature dependence of viscosity of lubricants & Fuels by Redwood Viscometer.
12. Viscosity Index of lubricants & Fuels by Saybolt Viscometer
13. Ash content and Carbon Residue Test
14. Drop point of grease and mechanical penetration in grease.

**LIST OF EQUIPMENT
(For a batch of 30 students)**

| | |
|--------------------------------------------------------------------------|--------------|
| 1. Fuel Analysis Test Apparatus (for Ultimate and proximate analysis) | - 1 No. each |
| 2. Flash and fire point apparatus | - 1 No |
| 3. Aniline point Apparatus | - 1 No |
| 4. Reid vapor pressure test Apparatus | - 1 No |
| 5. Bomb and Gas Calorimeters | - 1 No. each |
| 6. Carbon Residue Test Apparatus | - 1 No |
| 7. Copper Strip Corrosion Test Apparatus | - 1 No |
| 8. Cloud and Pour point Apparatus | - 1 No |
| 9. Redwood Viscometer | - 1 No |
| 10. Say bolt Viscometer | - 1 No |
| 11. ASTM distillation test Apparatus | - 1 No |
| 12. Ash content Test Apparatus | - 1 No |
| 13. Drop point and penetration Apparatus for grease | - 1 No |

VI SEMESTER

**612AMT01 - PRINCIPLES OF MANAGEMENT
(Common to all Branches)**

UNIT I OVERVIEW OF MANAGEMENT

Definition - Management - Role of managers - Evolution of Management thought - Organization and the environmental factors - Trends and Challenges of Management in Global Scenario.

UNIT II PLANNING

Nature and purpose of planning - Planning process - Types of plans - Objectives - Managing by objective (MBO) Strategies - Types of strategies - Policies - Decision Making - Types of decision - Decision Making Process - Rational Decision Making Process - Decision Making under different conditions.

UNIT III ORGANIZING

Nature and purpose of organizing - Organization structure - Formal and informal groups / organization - Line and Staff authority - Departmentation - Span of control - Centralization and Decentralization - Delegation of authority - Staffing - Selection and Recruitment - Orientation - Career Development - Career stages - Training - Performance Appraisal.

UNIT IV DIRECTING

Creativity and Innovation - Motivation and Satisfaction - Motivation Theories -Leadership Styles - Leadership theories - Communication - Barriers to effective communication - Organization Culture - Elements and types of culture – Managing cultural diversity.

UNIT V CONTROLLING

Process of controlling - Types of control - Budgetary and non-budgetary control techniques - Managing Productivity - Cost Control - Purchase Control – Maintenance Control - Quality Control - Planning operations.

TEXT BOOKS:

1. Stephen P. Robbins and Mary Coulter, 'Management', Prentice Hall of India, 8th edition.
2. Charles W L Hill, Steven L McShane, 'Principles of Management', Mcgraw Hill Education, Special Indian Edition, 2007.

REFERENCES:

2. Hellriegel, Slocum & Jackson, ' Management - A Competency Based Approach', Thomson South Western, 10th edition, 2007.
2. Harold Koontz, Heinz Wehrich and Mark V Cannice, 'Management - A global & Entrepreneurial Perspective', Tata Mcgraw Hill, 12th edition, 2007.
3. Andrew J. Dubrin, 'Essentials of Management', Thomson Southwestern, 7th, edition, 2007.

612AMT02 - AUTOMOTIVE ENGINE COMPONENTS DESIGN

OBJECTIVE

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

UNIT I INTRODUCTION

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

UNIT II DESIGN OF CYLINDER, PISTON AND CONNECTING ROD

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

UNIT III DESIGN OF CRANKSHAFT

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

UNIT IV DESIGN OF FLYWHEELS

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

UNIT V DESIGN OF VALVES AND VALVE TRAIN

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

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

TEXT BOOKS

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

REFERENCE

1. Jain.R.K, "Machine Design", Khanna Publishers, New Delhi, 2005.

612AMT03 - AUTOMOTIVE CHASSIS COMPONENTS DESIGN

OBJECTIVE

- 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.

UNIT I VEHICLE FRAME AND SUSPENSION

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

UNIT II FRONT AXLE AND STEERING SYSTEMS

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

UNIT III CLUTCH

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

UNIT IV GEAR BOX

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

UNIT V DRIVE LINE AND REAR AXLE

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.

TEXT BOOKS

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

REFERENCES

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

612AMT04 - TWO AND THREE WHEELERS

OBJECTIVE

- The aim of this course is to make the students to know and understand the constructional details operating characteristics and vehicle design aspects.

UNIT I POWER UNIT

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

UNIT II CHASSIS AND SUB-SYSTEMS

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

UNIT III BRAKES, WHEELS AND TYRES

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

UNIT IV TWO WHEELERS

Case study of major Indian models of motorcycles, scooters and mopeds. TVS mopeds and motorcycles, HeroHonda motorcycles, Bajaji scooters and motorcycles, Yamaha, Enfield motorcycles. Servicing and maintenance.

UNIT V THREE WHEELERS

Case study of Indian models. Auto rickshaws, pickup van, delivery van and trailer. Maintenance:& Fault tracing.

TEXT BOOKS

1. Irving.P.E. - Motor Cycle Engineering - Temple Press Book, London – 1992.
2. The Cycle Motor Manual - Temple Press Limited, London - 1990

REFERENCES

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

612AMT05 - FINITE ELEMENT ANALYSIS

INTRODUCTION (Not for examination)

Solution to engineering problems – mathematical modeling – discrete and continuum modeling – need for numerical methods of solution – relevance and scope of finite element methods – engineering applications of FEA

UNIT I : FINITE ELEMENT FORMULATION OF BOUNDARY VALUE PROBLEMS

Weighted residual methods –general weighted residual statement – weak formulation of the weighted residual statement –comparisons – piecewise continuous trial functions- example of a bar finite element –functional and differential forms – principle of stationary total potential – Rayleigh Ritz method – piecewise continuous trial functions – finite element method – application to bar element

UNIT II : ONE DIMENSIONAL FINITE ELEMENT ANALYSIS

General form of total potential for 1-D applications – generic form of finite element equations – linear bar element – quadratic element –nodal approximation – development of shape functions – element matrices and vectors – example problems – extension to plane truss– development of element equations – assembly – element connectivity – global equations – solution methods –beam element – nodal approximation – shape functions – element matrices and vectors – assembly – solution – example problems

UNIT III : TWO DIMENSIONAL FINITE ELEMENT ANALYSIS

Introduction – approximation of geometry and field variable – 3 noded triangular elements – four noded rectangular elements – higher order elements – generalized coordinates approach to nodal approximations – difficulties – natural coordinates and coordinate transformations – triangular and quadrilateral elements – iso-parametric elements – structural mechanics applications in 2-dimensions – elasticity equations – stress strain relations – plane problems of elasticity – element equations – assembly – need for quadrature formulæ – transformations to natural coordinates – Gaussian quadrature – example problems in plane stress, plane strain and axisymmetric applications.

UNIT IV : DYNAMIC ANALYSIS USING FINITE ELEMENT METHOD

Introduction – vibrational problems – equations of motion based on weak form – longitudinal vibration of bars – transverse vibration of beams – consistent mass matrices – element equations – solution of eigenvalue problems – vector iteration methods – normal modes – transient vibrations – modeling of damping – mode superposition technique – direct integration methods.

UNIT V : APPLICATIONS IN HEAT TRANSFER & FLUID MECHANICS

One dimensional heat transfer element – application to one-dimensional heat transfer problems- scalar variable problems in 2-Dimensions – Applications to heat transfer in 2-Dimension – Application to problems in fluid mechanics in 2-D.

TEXT BOOKS

1. P.Seshu, "Text Book of Finite Element Analysis", Prentice-Hall of India Pvt. Ltd., New Delhi, 2007. ISBN-978-203-2315-5.
2. J.N.Reddy, "An Introduction to the Finite Element Method", McGraw-Hill International Editions(Engineering Mechanics Series), 1993.ISBN-0-07-051355-4

REFERENCES

1. Chandrupatla & Belagundu, "Introduction to Finite Elements in Engineering", 3rd Edition, Prentice-Hall of India, Eastern Economy Editions. ISBN-978-81-203- 2106-9
2. David V.Hutton,"Fundamentals of Finite Element Analysis", Tata McGraw-Hill Edition 2005. ISBN-0-07-239536-2
3. Cook,Robert.D., Plesha,Michael.E & Witt,Robert.J. "Concepts and Applications of Finite Element Analysis",Wiley Student Edition, 2004. ISBN-10 81-265-1336-5.

ELECTIVE I

612AMT06 - PROFESSIONAL ETHICS IN ENGINEERING

UNIT I ENGINEERING ETHICS

Senses of 'Engineering Ethics' – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Professions and Professionalism – Professional Ideals and Virtues – Uses of Ethical Theories

UNIT II ENGINEERING AS SOCIAL EXPERIMENTATION

Engineering as Experimentation – Engineers as responsible Experimenters – Research Ethics - Codes of Ethics – Industrial Standards - A Balanced Outlook on Law – The Challenger Case Study

UNIT III ENGINEER'S RESPONSIBILITY FOR SAFETY

Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis – Reducing Risk – The Government Regulator's Approach to Risk - Chernobyl Case Studies and Bhopal.

UNIT IV RESPONSIBILITIES AND RIGHTS

Collegiality and Loyalty – Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) - Discrimination

UNIT V GLOBAL ISSUES

Multinational Corporations – Business Ethics - Environmental Ethics – Computer Ethics - Role in Technological Development – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Honesty – Moral Leadership – Sample Code of Conduct

TEXT BOOKS

1. Mike Martin and Roland Schinzinger, "Ethics in Engineering", McGraw Hill, New York (2005).
2. Charles E Harris, Michael S Pritchard and Michael J Rabins, "Engineering Ethics– Concepts and Cases", Thompson Learning, (2000).

REFERENCES

1. Charles D Fleddermann, "Engineering Ethics", Prentice Hall, New Mexico,

- (1999).
2. John R Boatright, "Ethics and the Conduct of Business", Pearson Education, (2003).
 3. Edmund G Seebauer and Robert L Barry, "Fundamentals of Ethics for Scientists and Engineers", Oxford University Press, (2001).
 4. Prof. (Col) P S Bajaj and Dr. Raj Agrawal, "Business Ethics – An Indian Perspective", Biztantra, New Delhi, (2004).
 5. David Ermann and Michele S Shauf, "Computers, Ethics and Society", Oxford University Press, (2003).

612AMT07 - AUTOMOTIVE AIR-CONDITIONING

OBJECTIVE

- 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.

UNIT I AIRCONDITIONING FUNDAMENTALS

Basic air conditioning system - location of air conditioning components in a car, schematic layout of a refrigeration system, compressor components, condenser and high pressure service ports, thermostatic expansion valve, expansion valve calibration, controlling evaporator temperature, evaporator pressure regulator, evaporator temperature regulator.

UNIT II AIR CONDITIONER – HEATING SYSTEM

Automotive heaters, manually controlled air conditioner, heater system, automatically controlled air conditioner and heater systems, automatic temperature control, air conditioning protection, engine protection.

UNIT III REFRIGERANT

Containers handling refrigerants, tapping into the refrigerant container, refrigeration system diagnosis, diagnostic procedure, ambient conditions affecting system pressures.

UNIT IV AIR ROUTING AND TEMPERATURE CONTROL

Objectives, evaporator airflow through the recirculating unit, automatic temperature control, duct system, controlling flow, vacuum reserve, testing the air control and handling systems.

UNIT V AIR CONDITIONING SERVICE

Air conditioner maintenance and service, servicing heater system removing and replacing components, trouble shooting of air controlling system, compressor service.

TEXT BOOKS

1. William H. Crouse and Donald I. Anglin - "Automotive Air conditioning" – McGraw Hill Inc. - 1990.
2. Boyce H.DWiggins - "Automotive Air Conditioning" - Delmar – 2002

REFERENCES

1. Mitchell information Services, Inc - "Mitchell Automatic Heating and Air Conditioning Systems" - Prentice Hall Ind. - 1989.
2. Paul Weiser - "Automotive Air Conditioning" - Reston Publishing Co., Inc., - 1990.

3. MacDonald, K.I., - "Automotive Air Conditioning" - Theodore Audel series - 1978
4. Goings.L.F. - "Automotive Air Conditioning" - American Technical services - 1974.

612AMT08 - ALTERNATE FUELS AND ENERGY SYSTEMS

OBJECTIVE

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

UNIT I INTRODUCTION

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

UNIT II ALCOHOLS

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

UNIT III NATURAL GAS, LPG, HYDROGEN AND BIOGAS

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

UNIT IV VEGETABLE OILS

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

UNIT V ELECTRIC, HYBRID, FUEL CELL AND SOLAR CARS

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

TEXT BOOK

1. Richard.L.Bechfold - Alternative Fuels Guide Book - SAE International Warrendale - 1997.
2. Maheswar Dayal - "Energy today & tomorrow" - I & B Horishr India - 1982.

REFERENCES

1. Nagpal - "Power Plant Engineering" - Khanna Publishers - 1991.
2. "Alcohols as motor fuels progress in technology" - Series No.19 - SAE Publication USE - 1980.
3. SAE paper nos. 840367, 841333, 841334, 841156, Transactions, SAE, USA.

612AMT09 - VIBRATION, NOISE AND HARSHNESS CONTROL

OBJECTIVE

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

UNIT I BASICS OF VIBRATION

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

UNIT II VIBRATION CONTROL TECHNIQUES

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

UNIT III BASICS OF NOISE AND SOURCES

Introduction, , noise dose level, legislation, measurement and analysis of noise in engines, Noise characteristics, overall noise levels, assessment of combustion noise, assessment of mechanical noise, engine radiated noise, intake and exhaust noise, engine accessory contributed noise, transmission noise, aerodynamic noise, tyre noise, brake noise.

UNITIV NOISE CONTROL

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

UNIT V HARSHNESS AND ITS CONTROL

Harshness, sources.its effects,. measurement and control.

TEXT BOOKS

1. Singiresu S.Rao - "Mechanical Vibrations" - Pearson Education, ISBN -81-297-0179-0 - 2004.
2. Rao V. Dukkipati and J.Srinivas , "Text book of Mechanical Vibrations", Prentice-Hall of India P Ltd, New Delhi. 2004
3. Kewal Pujara "Vibrations and Noise for Engineers, Dhanpat Rai & Sons, 1992.

REFERENCES

1. Bernard Challen and Rodica Baranescu - "Diesel Engine Reference Book" - Second edition - SAE International - ISBN 0-7680-0403-9 - 1999.
2. Julian Happian-Smith - "An Introduction to Modern Vehicle Design"- Butterworth-Heinemann, ISBN 0750-5044-3 - 2004
3. John Fenton - "Handbook of Automotive body Construction and Design Analysis- Professional Engineering Publishing, ISBN 1-86058-073- 1998.

612AMT10 - ADVANCED THEORY OF I.C ENGINES

OBJECTIVE

- To explain the theory of combustion processes in SI and CI .Engines and the gas exchange processes and the various possible alternate fuels and the developments in the recent years in this area.

UNIT I COMBUSTION IN SI ENGINES

Stages of combustion - ignition, flame propagation, factors affecting flame structure and speed, cycle by cycle variations, misfire, knock and pre-ignition. Factors controlling combustion chamber design. Combustion in diesel engines, comparison of different combustion systems, fuel spray structure and factors affecting it. Models for combustion in SI and CI engines.

UNIT II GAS EXCHANGE PROCESSES

Gas exchange processes in two and four stroke engines, factors affecting volumetric efficiency, flow through valves and ports, multi valve concept. Charge motion within the cylinder. Turbocharging and Turbocharger control. Different methods of charging and scavenging two stroke engines.

UNIT III COMBUSTION ANALYSIS

Introduction to HWA, LDA and PIV systems to analyse engine flows. Engine heat transfer and energy balance, correlations for heat transfer coefficient, variables affecting heat transfer in engines. Cylinder pressure data acquisition and thermodynamic analysis of engine pressure data to yield heat release rates.

UNIT IV ALTERNATIVE FUELS

Alternative gaseous and liquid fuels for SI and CI engines, Alcohols, Biogas, LPG, CNG, Hydrogen, Biodiesel and Straight Vegetable oils, their properties and characteristics when used as engine fuels. Production, storage and distribution of different alternative fuels.

UNIT V RECENT DEVELOPMENTS

Homogeneous charge compression ignition, Stratified charge and gasoline direct injection, Dual fuel, lean burn and Hot surface Ignition engine concepts. Hybrid Electric Drives.

TEXT BOOKS

1. Internal Combustion Engines by V. Ganesan, 2007, Tata Mc Graw Hill.
2. Internal Combustion Engine Fundamentals, John B Heywood, Mc Graw Hill.
3. Advanced Engine Technology by Heisler, SAE Publication.

REFERENCES

1. Internal Combustion Engines by Richard Stone, Macmillan Book Company alsoSAE Publications.
2. Internal Combustion Engines by Colin R Ferguson, John Wiley and Sons.
3. Design and Simulation of Two Stroke Engines, GP Blair SAE Publications.

612AMT11 - QUALITY CONTROL AND RELIABILITY ENGINEERING
(Common to Mechanical, Automobile and Production- VI semester core)

OBJECTIVES

- To introduce the concept of SQC
- To understand process control and acceptance sampling procedure and their application.
- To learn the concept of reliability.

UNIT I INTRODUCTION AND PROCESS CONTROL FOR VARIABLES

Introduction, definition of quality, basic concept of quality, definition of SQC, benefits and limitation of SQC, Quality assurance, Quality control: Quality cost-Variation in process-causes of variation – Theory of control chart- uses of control chart – Control chart for variables – X chart, R chart and \bar{x} chart -process capability – process capability studies and simple problems. Six sigma concepts.

UNIT II PROCESS CONTROL FOR ATTRIBUTES

Control chart for attributes – control chart for non conformings– p chart and np chart – control chart for nonconformities– C and U charts, State of control and process out of control identification in charts, pattern study.

UNIT III ACCEPTANCE SAMPLING

Lot by lot sampling – types – probability of acceptance in single, double, multiple sampling techniques – O.C. curves – producer's Risk and consumer's Risk. AQL, LTPD, AOQL concepts- standard sampling plans for AQL and LTPD- uses of standard sampling plans.

UNIT IV LIFE TESTING - RELIABILITY

Life testing – Objective – failure data analysis, Mean failure rate, mean time to failure, mean time between failure, hazard rate – Weibull model, system reliability, series, parallel and mixed configuration – simple problems. Maintainability and availability – simple problems. Acceptance sampling based on reliability test – O.C Curves.

UNIT V QUALITY AND RELIABILITY

Reliability improvements – techniques- use of Pareto analysis – design for reliability – redundancy unit and standby redundancy – Optimization in reliability – Product design – Product analysis – Product development – Product life cycles.

Note: Use of approved statistical table permitted in the examination.

TEXT BOOKS

1. Douglas.C.Montgomery, " Introduction to Statistical quality control" John wiley 4th edition 2001.
2. L.S.Srinath, "Reliability Engineering", Affiliated East west press, 1991.

REFERENCES

1. John.S. Oakland. "Statistical process control", Elsevier, 5th edition, 2005
2. Connor, P.D.T.O., " Practical Reliability Engineering", John Wiley, 1993
3. Grant, Eugene .L "Statistical Quality Control", McGraw-Hill, 1996
4. Monohar Mahajan, "Statistical Quality Control", Dhanpat Rai & Sons, 2001.
5. R.C.Gupta, "Statistical Quality control", Khanna Publishers, 1997.
6. Besterfield D.H., "Quality Control", Prentice Hall, 1993.
7. Sharma S.C., "Inspection Quality Control and Reliability", Khanna Publishers,

1998.
8. Danny Samson, "Manufacturing & Operations Strategy", Prentice Hall, 1991

612AMT12 - METROLOGY AND INSTRUMENTATION

OBJECTIVE

Study of the theory, construction and operation of different measurement technology, instruments transducers and their application

UNIT I LINEAR MEASUREMENT

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

UNIT II 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 McLeod gauge, Pirani gauge,, thermal conductivity type pressure measurement.

UNIT III FLOW MEASUREMENT

Obstruction type flow meter- orifice plate, venturimeter, flow nozzles, pitot tube, rotometer. Positive displacement flow meters – turbine flow meter, fluted tube flowmeter, anemometer, ultrasonic flow meter, magnetic flow meters. Alcock viscous air flow meter.

UNIT IV TEMPERATURE MEASUREMENT:

Temperature scales – mechanical temperature sensors, liquid in glass, vapour pressure, bimetal temperature gauges. Resistance type temperature sensors. Thermistors, thermocouples, Laws of thermocouple, types of thermocouples. Construction and circuits for thermocouples. High temperature measurement pyrometers.

UNIT V FORCE AND TORQUE MEASUREMENT:

Force measuring devices- Balances, platform scales, weigh bridges, load cells, proving ring. Torque measurement – prony brake, rope brake and fan type brakes. Dynamometers – hydraulic, electric cardle and eddy current dynamometers. Transmission dynamometers. Chassis dynamometers.

TEXT BOOKS

1. Jain R.K., Engineering metrology, Khanna publishers, New Delhi
2. Rangan C.S., Sarma G.E and Mani V.S Instrumentation devices and systems. TMH Publishing Co. New Delhi
3. Beckwith T.G & Buck N.L Mechanical measurements, Oxford and IBH Publishing house New Delhi

REFERENCES

1. Patranabis D, Principles of industrial instrumentation, TMH Publishing Co. New Delhi.
2. Jain R.K., Mechanical & Industrial measurements , Khanna publishers, New Delhi.
3. Doebelin, "Measurement System Application & Design" McGraw Hill ,New Delhi
4. Gaylor F.W and Shotbolt C.R Metrology for engineers, ELBS.

612AMP01 - COMPUTER AIDED ENGINE DESIGN LAB

LIST OF EXPERIMENTS

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

LIST OF EQUIPMENTS

(For a batch of 30 students)

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

612AMP02 - COMPUTER AIDED CHASSIS DESIGN LAB

LIST OF EXPERIMENTS

CLUTCH

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

GEAR BOX

3. Gear train calculations.
4. Layout of gear box.
5. Calculation of bearing loads
6. Selection of bearings.
7. Assembly drawing of gear box using drafting software.
- 9

DRIVE LINE AND REAR AXLE

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

LIST OF EQUIPMENTS

(For a batch of 30 students)

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

612AMP03 - TWO AND THREE WHEELERS LAB

LIST OF EXPERIMENTS

1. Performance test of a two wheeler using chassis dynamometer.
2. Performance test on shock absorber

3. Performance test on coil spring.
4. Two wheeler chain test
5. Brake and Clutch adjustment as per specification.
6. Dismantling and assembling of two wheeler gear box and finding gear ratios
7. Dismantling and assembling of three wheeler box and finding gear ratios
8. Three wheeler brake and clutch play adjustment
9. Dismantling and assembling of three wheeler steering system.
10. Study of three wheeler chassis frame and power transmission system.

LIST OF EQUIPMENTS

(For a batch of 30 students)

1. Two wheeler chassis dynamometer - 1 No.
2. Coil spring test rig - 1 No.
3. Chain tension test rig - 1No.
4. Shock absorber test rig - 1 No.
5. Two-wheeler gearbox - 2 Nos.
6. Two-wheeler clutch - 2 Nos.
7. Three-wheeler brake assembly - 2 Nos.
8. Three-wheeler steering assembly - 2 Nos.
9. Three-wheeler gear box - 2 Nos.

SEVENTH SEMESTER 712AMT01 - ENGINE AND VEHICLE MANAGEMENT SYSTEM

OBJECTIVE

To explain the principle of engines and vehicle electronic management system and different sensors used in the systems.

UNIT I FUNDAMENTALS OF AUTOMOTIVE ELECTRONICS

Microprocessor architecture, open and closed loop control strategies, PID control, Look up tables, introduction to modern control strategies like Fuzzy logic and adaptive control. Parameters to be controlled in SI and CI engines and in the other parts of the automobile.

UNIT II SENSORS

Inductive, Hall effect, hot wire, thermistor, piezo electric, piezoresistive, based sensors. Throttle position, air mass flow, crank shaft position, cam position, engine and wheel speed, steering position, tire pressure, brake pressure, steering torque, fuel level, crash, exhaust oxygen level (two step and linear lambda), knock, engine temperature, manifold temperature and pressure sensors.

UNIT III SI ENGINE MANAGEMENT

Three way catalytic converter, conversion efficiency versus lambda. Layout and working of SI engine management systems like Bosch L-Jetronic and LH-Jetronic. Group and sequential injection techniques. Working of the fuel system components. Cold start and warm up phases, idle speed control, acceleration and full load enrichment, deceleration fuel cutoff. Fuel control maps, open loop control of fuel injection and closed loop lambda control. Electronic ignition systems and spark timing control. Closed loop control of knock.

UNIT IV CI ENGINE MANAGEMENT

Fuel injection system parameters affecting combustion, noise and emissions in CI engines. Pilot, main, advanced post injection and retarded post injection. Electronically controlled Unit Injection system. Layout of the common rail fuel injection system. Working of components like fuel injector, fuel pump, rail pressure limiter, flow limiter, EGR valves,

UNIT V VEHICLE MANAGEMENT SYSTEMS

ABS system, its need, layout and working. Electronic control of suspension – Damping control, Electric power steering, Supplementary Restraint System of air bag system – crash sensor, seat belt tightening. Cruise control. Vehicle security systemsalarms, vehicle tracking system. On board diagnostics. Collision avoidance Radar warning system.

TEXT BOOKS

1. Understanding Automotive Electronics William B Ribbens, SAE 1998.
2. Automobile Electronics by Eric Chowanietz SAE.

REFERENCES

1. Diesel Engine Management by Robert Bosch, SAE Publications.
2. Gasoline Engine Management by Robert Bosch, SAE Publications.

712AMT02 - VEHICLE DYNAMICS

OBJECTIVE

- When the vehicle is at dynamic condition more vibration will be produced. It is essential to study about vibrations and how to reduce the vibration under different loads, speed and road conditions in order to improve the comfort for the passengers and life of the various components of the vehicle. In this subject these aspects have been given.

UNIT I INTRODUCTION

Fundamentals of vibration, single degree of freedom, two degree of freedom, multidegree freedom, free, forced and damped vibrations, modeling and simulation studies, model of an automobile, magnification factor, transmissibility, vibration absorber.

UNIT II STABILITY OF VEHICLES

Load distribution, calculation of acceleration, tractive effort and reactions for different drives, stability of a vehicle on a curved track, slope and a banked road,.

UNIT III MULTI DEGREE FREEDOM SYSTEMS

Closed and far coupled system, eigen value problems, orthogonality of mode shapes, modal analysis, forced vibration by matrix inversion.

UNIT IV SUSPENSION, TYRES AND VEHICLE HANDLING

Requirements, sprung mass frequency, wheel hop, wheel wobble, wheel shimmy, choice of suspension spring rate, calculation of effective spring rate, vehicle suspension in fore and aft, roll axis and vehicle under the action of side forces, tyre, dynamics, ride characteristics power consumed by a tyre. Oversteer, under steer, steady state cornering, effect of braking, driving torques on steering, effect of camber, transient effects in cornering.

UNIT V NUMERICAL METHODS

Approximate methods for determining fundamental frequency, Dunkerleys lower bound, Rayleighs upper bound, Holzer method for closed coupled system and branched systems.

TEXT BOOKS

1. Rao J.S and Gupta. K "Theory and Practice of Mechanical Vibrations", Wiley Eastern Ltd., 2002.
2. Giri N.K – Automotive Mechanics, Khanna Publishers, 2007.

REFERENCES

1. Ham B, Pacejka - Tyre and Vehicle Dynamics - SAE Publication - 2002.
2. Ellis.J.R - "Vehicle Dynamics"- Business Books Ltd., London- 1991
3. Gillespie T.D, "Fundamentals of Vehicle Dynamics", SAE USA 1992.
4. Giles.J.G.Steering - "Suspension and Tyres", Illiffe Books Ltd., London- 1998

712AMT03 - VEHICLE MAINTENANCE

OBJECTIVE

- At the end of the course, the students will be able to have a complete knowledge of the vehicle maintenance procedures and acquire skills in handling situations where the vehicle is likely to fail.

UNIT I MAINTENANCE OF RECORDS AND SCHEDULES

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

UNIT II ENGINE MAINTENANCE – REPAIR AND OVERHAULING

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

UNIT III CHASSIS MAINTENANCE - REPAIR AND OVERHAULING

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

UNIT IV : ELECTRICAL AND ELECTRONIC SYSTEM MAINTENANCE – SERVICING AND REPAIRS

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

UNIT V : MAINTENANCE OF FUEL SYSTEM, COOLING SYSTEMS, LUBRICATION SYSTEM AND VEHICLE BODY

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

TEXT BOOKS

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

REFERENCES

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

712AMT04 - AUTOMOTIVE POLLUTION AND CONTROL

OBJECTIVE

- To make the students to realize the impact of automobile emissions on the environment and expose student to factors affecting the formation and control of automobile pollutants.

UNIT I INTRODUCTION

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, noise vibration and harshness (NVH).

UNIT II POLLUTANT FORMATION IN ENGINES

Pollutant formation in Engines, mechanism of HC and CO formation in four stroke and two stroke engines, NO_x formation in engines, smoke and particulate emissions in CI engines, effects of design and operating variables on emission formation, control of evaporative emission. Two stroke engine pollution.

UNIT III CONTROL OF EMISSIONS FROM ENGINES

Design strategies to control emission from engines, optimum selection of operating variables for control of emissions, EGR, Thermal reactors, secondary air injection, catalytic converters, catalysts, fuel modifications, fuel cells, Two stroke engine pollution control.

UNIT IV NOISE POLLUTION FROM AUTOMOBILES

Noise, Vibration And Harshness, Sources of Noise, Measurement of Noise –Engine Combustion Noise, Inlet And Exhaust Noise, Traffic Noise, Vehicle Body Noise - control of noise, control devices and noise proof materials.

UNIT V MEASUREMENT TECHNIQUES EMISSION STANDARDS AND TEST PROCEDURE

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.

TEXT BOOKS

1. Paul Degobert – Automobiles and Pollution – SAE International ISBN-1-56091-563-3, 1991.
2. Ganesan, V- "Internal Combustion Engines"- Tata McGraw-Hill Co.- 2003.
3. Beranek.L.L. " Noise Reduction", McGraw Hill Book co., Inc, New York, 1993.

REFERENCES

1. SAE Transactions- "Vehicle Emission"- 1982 (3 volumes).
2. Obert.E.F.- "Internal Combustion Engines"- 1988
3. Marco Nute- " Emissions from two stroke engines, SAE Publication – 1998.

ELECTIVE II & III

712AMT05 - SUPERCHARGING AND SCAVENGING

OBJECTIVE

- To make the students understand the need for supercharging and the various types of superchargers used and their performance characteristics and the scavenging methods for two stroke engines. These concepts and principles are familiarized for design of components.

UNIT I SUPERCHARGING

Effects on engine performance – engine modification required Thermodynamics of Mechanical Supercharging and Turbocharging – Turbocharging methods – Engine exhaust manifolds arrangements.

UNIT II SUPERCHARGERS

Types of compressors – Positive displacement blowers – Centrifugal compressors – Performance characteristic curves – Suitability for engine application – Surging – Matching of supercharger compressor and Engine – Matching of compressor, Turbine, Engine.

UNIT III SCAVENGING OF TWO STROKE ENGINES

Peculiarities of two stroke cycle engines – Classification of scavenging systems – Mixture control through Reed valve induction – Charging Processes in two stroke cycle engine –

Terminologies – Shankey diagram – Relation between scavenging terms – scavenging modeling – Perfect displacement, Perfect mixing – Complex scavenging models.

UNIT IV PORTS AND MUFFLER DESIGN

Porting – Design considerations – Design of Intake and Exhaust Systems – Tuning.

UNIT V EXPERIMENTAL METHODS

Experimental techniques for evaluating scavenging – Firing engine tests – Non firing engine tests – Port flow characteristics – Kadenacy system – Orbital engine combustion system.

TEXT BOOKS

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

REFERENCES

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

712AMT06 - AUTOMOTIVE AERODYNAMICS

OBJECTIVE

- To make the students understand the design concept of automobile bodies and to determine their drag coefficients and optimize their shapes. The use of wind tunnel for the same will be illustrated.

UNIT I INTRODUCTION

Scope – historical development trends – Fundamentals of fluid mechanics – Flow phenomenon related to vehicles – External & Internal flow problems.. – Resistance to vehicle motion – Performance – Fuel consumption and performance – Potential of vehicle aerodynamics.

UNIT II AERODYNAMIC DRAG OF CABS

Car as a bluff body – Flow field around car – drag force – types of drag force – analysis of aerodynamic drag – drag coefficient of cars – strategies for aerodynamic development – low drag profiles.

UNIT III SHAPE OPTIMIZATION OF CABS

Front and modification – front and rear wind shield angle – Boat tailing – Hatch back, fast back and square back – Dust flow patterns at the rear – Effect of gap configuration – effect of fasteners.

UNIT IV VEHICLE HANDLING

The origin of force and moments on a vehicle – side wind problems – methods to calculate forces and moments – vehicle dynamics Under side winds – the effects of forces and moments

– Characteristics of forces and moments – Dirt accumulation on the vehicle – wind noise – drag reduction in commercial vehicles.

UNIT V WIND TUNNELS FOR AUTOMOTIVE AERODYNAMICS

Introduction – Principles 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.

TEXT BOOKS

1. Hucho, W.H., Aerodynamics of Road vehicles, Butterworths Co. Ltd., 1987.
2. Pope, A., Wind Tunnel Testing, John Wiley & Sons, 2nd Edn., New York, 1974.

REFERENCES

1. Automotive Aerodynamics: Update SP-706, SAE, 1987.
2. Vehicle Aerodynamics, SP-1145, SAE, 1996.

712AMT07 - COMPOSITE MATERIALS

OBJECTIVES

- To understand the fundamentals of composite material strength and its mechanical behavior.
- Understanding the analysis of fiber reinforced Laminate design for different combinations of plies with different orientations of the fiber.
- Thermo-mechanical behavior and study of residual stresses in Laminates during processing.
- Implementation of Classical Laminate Theory (CLT) to study and analysis for residual stresses in an isotropic layered structure such as electronic chips.

UNIT I : INTRODUCTION, LAMINA CONSTITUTIVE EQUATIONS & MANUFACTURING

Definition – Need – General Characteristics, Applications. Fibers – Glass, Carbon, Ceramic and Aramid fibers. Matrices – Polymer, Graphite, Ceramic and Metal Matrices – Characteristics of fibers and matrices. Lamina Constitutive Equations: Lamina Assumptions – Macroscopic Viewpoint. Generalized Hooke's Law. Reduction to Homogeneous Orthotropic Lamina – Isotropic limit case, Orthotropic Stiffness matrix (Q_{ij}), Typical Commercial material properties, Rule of Mixtures. Generally Orthotropic Lamina – Transformation Matrix, Transformed Stiffness. Manufacturing: Bag Moulding – Compression Moulding – Pultrusion – Filament Winding – Other Manufacturing Processes

UNIT II : FLAT PLATE LAMINATE CONSTITUTE EQUATIONS

Definition of stress and Moment Resultants. Strain Displacement relations. Basic Assumptions of Laminated anisotropic plates. Laminate Constitutive Equations – Coupling Interactions, Balanced Laminates, Symmetric Laminates, Angle Ply Laminates, Cross Ply Laminates. Laminate Structural Moduli. Evaluation of Lamina Properties from Laminate Tests. Quasi-Isotropic Laminates. Determination of Lamina stresses within Laminates.

UNIT III LAMINA STRENGTH ANALYSIS

Introduction - Maximum Stress and Strain Criteria. Von-Misses Yield criterion for Isotropic Materials. Generalized Hill's Criterion for Anisotropic materials. Tsai-Hill's Failure Criterion for Composites. Tensor Polynomial (Tsai-Wu) Failure criterion. Prediction of laminate Failure.

UNIT IV THERMAL ANALYSIS

Assumption of Constant C.T.E's. Modification of Hooke's Law. Modification of Laminate Constitutive Equations. Orthotropic Lamina C.T.E's. C.T.E's for special Laminate Configurations - Unidirectional, Off-axis, Symmetric Balanced Laminates, Zero C.T.E laminates, Thermally Quasi-Isotropic Laminates

UNIT V ANALYSIS OF LAMINATED FLAT PLATES

Equilibrium Equations of Motion. Energy Formulations. Static Bending Analysis. Buckling Analysis. Free Vibrations - Natural Frequencies

TEXT BOOK

1. Gibson, R.F., Principles of Composite Material Mechanics, McGraw-Hill, 1994, Second Edition - CRC press in progress.
2. Hyer, M.W., "Stress Analysis of Fiber - Reinforced Composite Materials", McGraw-Hill, 1998

REFERENCES

1. Issac M. Daniel and Ori Ishai, "Engineering Mechanics of Composite Materials", Oxford University Press-2006, First Indian Edition - 2007
2. Mallick, P.K., Fiber - "Reinforced Composites: Materials, Manufacturing and Design", Manel Dekker Inc, 1993.
3. Halpin, J.C., "Primer on Composite Materials, Analysis", Techomic Publishing Co., 1984.
4. Agarwal, B.D., and Broutman L.J., "Analysis and Performance of Fiber Composites", John Wiley and Sons, New York, 1990.
5. Mallick, P.K. and Newman, S., (edition), "Composite Materials Technology: Processes and Properties", Hansen Publisher, Munish, 1990.

712AMT08 - DESIGN OF JIGS, FIXTURES & PRESS TOOLS

OBJECTIVES

- To understand the functions and design principles of Jigs, fixtures and press tools
- To gain proficiency in the development of required views of the final design.

UNIT I LOCATING AND CLAMPING PRINCIPLES

Objectives of tool design- Function and advantages of Jigs and fixtures – Basic elements – principles of location – Locating methods and devices – Redundant Location – Principles of clamping – Mechanical actuation – pneumatic and hydraulic actuation Standard parts – Drill bushes and Jig buttons – Tolerances and materials used.

UNIT II JIGS AND FIXTURES

Design and development of jigs and fixtures for given component- Types of Jigs – Post, Turnover, Channel, latch, box, pot, angular post jigs – Indexing jigs – General principles of milling, Lathe, boring, broaching and grinding fixtures – Assembly, Inspection and Welding fixtures – Modular fixturing systems- Quick change fixtures.

UNIT III : PRESS WORKING TERMINOLOGIES AND ELEMENTS OF CUTTING DIES

Press Working Terminologies - operations – Types of presses – press accessories – Computation of press capacity – Strip layout – Material Utilization – Shearing action – Clearances – Press Work Materials – Center of pressure- Design of various elements of dies – Die Block – Punch holder, Die set, guide plates – Stops – Strippers – Pilots – Selection of Standard parts – Design and preparation of four standard views of simple blanking, piercing, compound and progressive dies.

UNIT IV BENDING FORMING AND DRAWING DIES

Difference between bending, forming and drawing – Blank development for above operations – Types of Bending dies – Press capacity – Spring back – knockouts – direct and indirect – pressure pads – Ejectors – Variables affecting Metal flow in drawing operations – draw die inserts – draw beads- ironing – Design and development of bending, forming, drawing reverse re-drawing and combination dies – Blank development for ax- symmetric, rectangular and elliptic parts – Single and double action dies.

UNIT V MISCELLANEOUS TOPICS

Bulging, Swaging, Embossing, coining, curling, hole flanging, shaving and sizing, assembly, fine Blanking dies – recent trends in tool design- computer Aids for sheet metal forming Analysis – basic introduction - tooling for numerically controlled machines- setup reduction for work holding – Single minute exchange of dies – Poka Yoke - Course should be supplemented with visits to industries. (Use of Approved design Data Book permitted).

TEXT BOOKS

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

REFERENCES

1. K. Venkataraman, "Design of Jigs Fixtures & Press Tools", Tata McGraw Hill, New Delhi, 2005.Kempster, "Jigs and Fixture Design", Hoddes and Stoughton –Third Edition 1974.
2. Joshi, P.H. "Press Tools" – Design and Construction", Wheels publishing, 1996.
3. Hoffman "Jigs and Fixture Design" – Thomson Delmar Learning, Singapore, 2004.
4. ASTME Fundamentals of Tool Design Prentice Hall of India.
5. Design Data Hand Book, PSG College of Technology, Coimbatore.

712AMT09 - COMPUTER SIMULATION OF I.C. ENGINES

OBJECTIVE

- To make the students understand the basic principles of simulation of the combustion processes in engines used for automobiles and the heat transfer mechanism and friction losses of the different systems.

UNIT I COMBUSTION CALCULATIONS

Heat of reaction at constant volume and constant pressure, Calculation of properties of the working medium in an engine, Constant volume and constant pressure adiabatic combustion, Calculation of Adiabatic flame temperature.

UNIT II SIMULATION OF SI ENGINE COMBUSTION

Engine kinematics, Ideal Otto cycle, SI engine simulation with adiabatic combustion with air as the working substance under full and part throttle conditions. Actual SI engine heat release rate curves. SI engine combustion models including Wiebe's function.

UNIT III SIMULATION OF CI ENGINE COMBUSTION

CI engine simulation with adiabatic combustion with air as the working substance under naturally aspirated, supercharged and turbocharged conditions. Actual heat release rates of diesel engines, Hardenberg and Hase and other ignition delay models for diesel engines, Zero dimensional combustion models for CI engines – Watsons and White House and Way models.

UNIT IV GAS EXCHANGE PROCESSES

Flow through valves their characteristics, compressible and incompressible flow through valves, volumetric efficiency and Mach index, Effect of valve timing on volumetric efficiency, Swirl and squish, SI engine simulation with gas exchange, influence of valve timing and area. CI engine simulation with gas exchange.

UNIT V HEAT TRANSFER AND FRICTION IN ENGINES

Engine friction variation, models for engine friction, Heat transfer mechanisms in engines, Models for heat transfer in engines. Two stroke engine scavenging parameters like delivery ratio, scavenging efficiency, trapping efficiency. Perfect displacement and perfect mixing models for scavenging.

TEXT BOOKS

1. Computer simulation of compression ignition engine processes by V. Ganesan,Universities Press, 2000.
2. Computer simulation of Spark Ignition Engine Processes by V Ganesan,

REFERENCES

1. Internal Combustion Engines – Applied Thermo Sciences, Colin R Ferguson, John Wiley and Sons.
2. Internal Combustion Engine Fundamentals, John B Heywood, Mc Graw Hill

712AMT10 - ROBOTICS

(Common to Mechanical, Automobile and Production - core)

OBJECTIVES

- To understand the basic concepts associated with the design and functioning and applications of Robots.
- To study about the drives and sensors used in Robots.
- To learn about analyzing robot kinematics and robot programming.

UNIT I FUNDAMENTALS OF ROBOT

Robot – Definition – Robot Anatomy – Co-ordinate Systems, Work Envelope, types and classification – Specifications – Pitch, Yaw, Roll, Joint Notations, Speed of Motion, Pay Load – Robot Parts and Functions – Need for Robots – Different Applications.

UNIT II ROBOT DRIVE SYSTEMS AND END EFFECTORS

Pneumatic Drives – Hydraulic Drives – Mechanical Drives – Electrical Drives – D.C. Servo Motors, Stepper Motor, A.C. Servo Motors – Salient Features, Applications and Comparison of Drives End Effectors – Grippers – Mechanical Grippers, Pneumatic and Hydraulic Grippers, Magnetic Grippers, Vacuum Grippers; Two Fingered and Three Fingered Grippers; Internal Grippers and External Grippers; Selection and Design Considerations

UNIT III SENSORS AND MACHINE VISION

Requirements of a sensor, Principles and Applications of the following types of sensors – Position of sensors (Piezo Electric Sensor, LVDT, Resolvers, Optical Encoders, Pneumatic Position Sensors), Range Sensors (Triangulation Principle, Structured, Lighting Approach, Time of Flight Range Finders, Laser Range Meters), Proximity Sensors (Inductive, Hall Effect, Capacitive, Ultrasonic and Optical Proximity Sensors), Touch Sensors, (Binary Sensors, Analog Sensors), Wrist Sensors, Compliance Sensors, Slip Sensors. Camera, Frame Grabber, Sensing and Digitizing Image Data – Signal Conversion, Image Storage, Lighting Techniques. Image Processing and Analysis – Data Reduction: Edge detection, Feature Extraction and Object Recognition - Algorithms. Applications – Inspection, Identification, Visual Servicing and Navigation.

UNIT IV 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) – Deviations and Problems. Teach Pendant Programming, Lead through programming, Robot programming Languages – VAL Programming – Motion Commands, Sensor Commands, End effector commands, and Simple programs

UNIT V IMPLEMENTATION AND ROBOT ECONOMICS

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.

TEXT BOOK

1. M.P.Groover, "Industrial Robotics – Technology, Programming and Applications", McGraw-Hill, 2001

REFERENCES

1. Fu.K.S. Gonzalz.R.C., and Lee C.S.G., "Robotics Control, Sensing, Vision and Intelligence", McGraw-Hill Book Co., 1987
2. Yoram Koren, "Robotics for Engineers", McGraw-Hill Book Co., 1992
3. Janakiraman.P.A., "Robotics and Image Processing", Tata McGraw-Hill, 1995.

712AMT11 - NEW GENERATION AND HYBRID VEHICLES

OBJECTIVE

- To illustrate the new generation vehicles and their operation and controls

UNIT I INTRODUCTION

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

UNIT II POWER SYSTRM AND NEW GENERATION VEHICLES

Hybrid Vehicle engines, Stratified charge engines, learn burn engines, low heat rejection engines, hydrogen engines, HCCI engine, VCR engine, surface ignition engines, VVTI engines. High energy and power density batteries, fuel cells, solar panels, flexible fuel systems.

UNIT III VEHICLE OPERATION AND CONTROL

Computer Control for pollution and noise control and for fuel economy – Transducers and actuators - Information technology for receiving proper information and operation of the vehicle like optimum speed and direction.

UNIT IV VEHICLE AUTOMATED TRACKS

Preparation and maintenance of proper road network - National highway network with automated roads and vehicles - Satellite control of vehicle operation for safe and fast travel, GPS.

UNIT V SUSPENSION, BRAKES, AERODYNAMICS AND SAFETY

Air suspension – Closed loop suspension, compensated suspension, anti skid braking system, retarders, regenerative braking, safety gauge air backs- crash resistance. Aerodynamics for modern vehicles, safety systems, materials and standards.

TEXT BOOKS

1. Modern Vehicle Technology by Heinz.
2. Bosch Hand Book, SAE Publication,, 2000

REFERENCES

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

712AMT12 - OFF ROAD VEHICLES

OBJECTIVE

- At the end of the course, the students will be able to understand the various Off road vehicles and their systems and features

UNIT I CLASSIFICATION AND REQUIREMENTS OF OFF ROAD VEHICLES

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

UNIT II EARTH MOVING MACHINES

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

UNIT III SCRAPERS, GRADERS, SHOVELS AND DITCHERS

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

UNIT IV FARM EQUIPMENTS, MILITARY AND COMBAT VEHICLES

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

UNIT V VEHICLE SYSTEMS, FEATURES

Brake system and actuation – O/CDB and dry disc caliper brakes. Body hoist and bucket operational hydraulics. Hydro-pneumatic suspension cylinders. Power steering system. Kinematics for loader and bulldozer operational linkages. Safety features, safe warning system for dumper. Design aspects on dumper body, loader bucket and water tank of sprinkler.

TEXT BOOKS

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

REFERENCES

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

712AMT13 - PROJECT AND MATERIALS MANAGEMENT

OBJECTIVE

- To enable the students understand the concept of project and materials management and illustrate the various systems and procedures involved

UNIT I PROJECT MANAGEMENT

Concept of project-Categories of projects-Project life cycle - Concept of project management - Tools and techniques for project management-The project manager- Roles and responsibilities of project manager- Project formulation- Formulation of stages-Bottlenecks-Feasibility Report-Financing arrangements- Finalization of project-Implementation of project..

UNIT II PROJECT EXECUTION AND CONTRACT

Administrative agencies for project approval- Ministry of finance- Bureau of public enterprises -Planning commission- Public Investment Board. Organizing human resources and contracting- Delegation of project manager's authority-Project organization-Accountability in project execution-Contracts- 'R' of contracting-Tendering and selection of contractors-Team building

UNIT III SYSTEMS AND PROCEDURES

Organizing and working of systems-Design of systems-Project work system design- work breakdown structure-project execution plan-project procedure-manual project control system-planning, scheduling, monitoring and controlling-monitoring contracts and project diary. Project implementation-stages of project direction- communication in a project coordination guidelines for effective implementation-Reporting in project management-project evaluation and its objectives, types, and methods.

UNIT IV MATERIAL MANAGEMENT

Concept and importance of Material Management-organization of Material management-purchase methods-Dynamic purchasing-Purchasing decisions (quality, quantity, suppliers, time, price) - Purchasing function-Selection of Materials and vendors-purchasing organization-concept of value analysis-import substitution vendor rating-vendor development.

UNIT V INVENTORY MANAGEMENT

Material requirement planning , forecasting and Inventory management-inventory control-factors affecting inventory control policy -Inventory costs, Basic EOQ model- Re-order level-ABC analysis-statistical methods in inventory control-inventory classification methods. Store keeping and warehouse management-objectives-functions-store keeper duties-responsibilities-location of store-stores ledger.Cost control& cost reduction programmes.

TEXT BOOKS

1. B.B. Goel-Project Management-Deep and Deep Publications, New Delhi,2004
2. Choudhury-S. Project Management -TaTa Mc Graw -Hill- Publishing Company Limited, New Delhi,2005
3. Datta.A.K. Integrated Material Management
4. Gopalakrishnan.P. and Sthuram. M. Material management-An integral Approach
5. M.V.Varma -Material Management

REFERENCES

1. Mattin.C.C. Project Management-American Management Association, New York,1976.

712AMT14 - ENGINE AUXILLARY SYSTEMS

OBJECTIVE

- To make the students understand the various auxiliary systems used in automobiles and their functions.

UNIT I CARBURETION

Properties of air-petrol mixtures, Mixture requirements for steady state and transient operation, Mixture formation studies of volatile fuels, design of elementary carburetor, Chokes, Effects of altitude on carburetion, Carburetor for 2-stroke and 4- stroke engines, carburetor systems for emission control.

UNIT II GASOLINE INJECTION AND IGNITION SYSTEMS

Petrol Injection, Pneumatic and Electronic Fuel Injection Systems types. Ignition system requirements, Timing, Ignition Systems, breaker mechanism and spark plugs, Factors affecting energy requirement of the ignition system, factors affecting spark plug operation, Electronic Ignition Systems.

UNIT III DIESEL FUEL INJECTION

Factors influencing fuel spray atomization, penetration and dispersion of diesel and heavy oils and their properties, rate and duration of injection, fuel line hydraulics, fuel pump, injectors, CRDI systems and its merits and demerits.

UNIT IV MANIFOLDS AND MIXTURE DISTRIBUTION

Intake system components, Discharge coefficient, Pressure drop, Air filter, Intake manifold, Connecting pipe, Exhaust system components, Exhaust manifold and exhaust pipe, Spark arresters, Waste heat recovery, Exhaust mufflers, Type of mufflers, exhaust manifold expansion.

UNIT V LUBRICATION AND COOLING SYSTEMS

Lubricants, lubricating systems, Lubrication of piston rings, bearings, oil consumption, Oil cooling. Heat transfer coefficients, liquid and air cooled engines, coolants, additives and lubricity improvers, concept of adiabatic engines.

TEXT BOOKS

1. Ramalingam,K.K, Internal Combustion Engine, Scitech Publication (India)
2. Ganesan, V., Internal Combustion Engines, Tata McGraw-Hill Book Co., 1995.

REFERENCES

1. Domkundwar, V.M, A Course in Internal Combustion Engines, Dhanpat Rai andCo., 1999.
2. Mathur,M.L., and Sharma,R.P., A Course in Internal Combustion Engines, Dhanpat Rai Publications (P) Ltd., 1998.
3. Duffy Smith, Auto Fuel Syststems, The Good Heart Willcox Company Inc., Publishers, 1987.
4. Edward F, Obert, Internal Combustion Engines and Air Pollution, Intext Education Publishers, 1980.

712AMP01 - VEHICLE MAINTENANCE AND RECONDITIONING LAB

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. Cylinder reboring – checking the cylinder bore, Setting the tool and reboring.
4. Valve grinding, valve lapping - Setting the valve angle, grinding and lapping and checking for valve leakage
5. Calibration of fuel injection pump
6. Minor and major tune up of gasoline and diesel engines.
7. Study and checking of wheel alignment - testing of camber, caster.
8. Testing kingpin inclination, toe-in and toe-out
9. Brake adjustment and Brake bleeding.
10. Simple tinkering, soldering works of body panels, study of door lock and window glass rising mechanisms.
11. Battery testing and maintenance.
12. **Practice the following:**
 1. Adjustment of pedal play in clutch, brake, hand brake lever and steering wheel play
 2. Air bleeding from hydraulic brakes, air bleeding of diesel fuel system
 3. Wheel bearings tightening and adjustment
 4. Adjustment of head lights beam
 5. Removal and fitting of tyre and tube

LIST OF EQUIPMENTS (for a batch of 30 students)

1. Engine Analyzer - 1 No.
2. Cylinder compression pressure gauge - 1 No.
3. Vacuum gauge - 1 No.
4. Spark plug cleaner and tester - 1 No.
5. Cam angle and rpm tester - 1 No.
6. Tachometer - 1 No.
7. Wheel alignment apparatus - 1 No.
8. Gas welding equipment - 1 No.
9. Tyre remover - 1 No.
10. Bearing puller - 1 No.
11. Head light alignment gauge - 1 No.
12. Service manuals of petrol, diesel engines - 1 No: each
13. Cylinder reboring machine - 1No.
14. Valve grinding machine - 1 No.
15. Valve lapping machine - 1 No.
16. Fuel injection calibration test bench with nozzle tester - 1 No.
17. HRD tester, Clamp on meter, Hydrometer -1 No: each

712AMP02 - CAD/CAM LAB

OBJECTIVES

1. To be able to understand and handle design problems in a systematic manner.
2. To gain practical experience in handling 2D drafting and 3D modeling software systems.
3. To be able to apply CAD in real life applications.
4. To understand the concepts G and M codes and manual part programming.
5. To expose students to modern control systems (Fanuc, Siemens etc)
6. To know the application of various CNC machines
7. To expose students to modern CNC application machines EDM, EDM wire cut and Rapid Prototyping

3D Geometric Modeling

Creation of 3D Models - Wire Frame, Surface, Solid modeling Techniques Using CAD Packages - CSG, B-Rep Approaches in Solid Modeling - Feature Based Modeling Technique - Assembly - Detailing - Exposure to Industrial Components - Application of GD&T.

STL File Generation – Reverse Engineering

Manual CNC Part Programming

Manual CNC Part Programming Using Standard G and M Codes - Tool Path Simulation - Exposure to Various Standard Control Systems- Machining simple components by Using CNC machines.

Computer Aided Part Programming

CL Data Generation by Using CAM Software- Post Process Generation for Different Control System - Machining of Computer Generated Part Program by Using Machining Center and Turning Center.

Study of Experiments

Multi-axial Machining in CNC Machining Center -EDM - EDM Wire Cut - Rapid Prototyping.

LIST OF EQUIPMENTS (For a batch of 30 students)

I. HARDWARES

1. Computer server 1 No.
2. Computer nodes or systems (Pentium IV with 256MB Ram) networked to the server 15 Nos.
3. A3 size plotter 2 Nos.
4. Laser Printer 2 Nos.
5. Trainer CNC lathe 2 Nos.
6. Trainer CNC milling 2 Nos.

II. SOFTWARES

1. CAD/CAM Software 15 licenses
(Pro -E or IDEAS or Unigraphics or CATIA)
2. CAM Software 15 licenses
(CNC programming and tool path simulation for FANUC, Sinumeric and Heiden controller)

OBJECTIVE

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 bodt to minimize drug.

UNIT I CAR BODY DETAILS

Types Saloon, convertibles, Limousine, Estate Van, racing and sports car – Visibility: regulations, driver's visibility, tests for visibility – Methods of improving visibility and space in cars – Safety: safety design, safety equipments for car. Car body construction.

UNIT II VEHICLE AERODYNAMICS

Objectives, Vehicle drug and types; various types of forces and moments, effects of forces and moments, side wind effects on forces and moments. Various body optimization techniques for minimum drug, wind tunnel testing; flow visualization techniques, scale model testing, component balance to measure forces and moments.

UNIT III BUS BODY DETAILS

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.

UNIT IV COMMERCIAL VEHICLE DETAILS

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.

UNIT V BODY MATERIALS, TRIM AND MECHANISMS

Steel sheet, timber, plastics, GRP, properties of materials – Corrosion – Anticorrosion methods – Selection of paint – Modern painting process in details – Body trim items – Body mechanisms.

TEXT BOOKS

1. Powloski,J., Vehicle Body Engineering, Business Books Ltd., 1989.
2. John Fenton, Vehicle Body layout and analysis, Mechanical Engg. Publication Ltd., London, 1982.

REFERENCES

1. Giles,G.J., Body construction and design, Illiffe Books Butterworth & Co., 1971.
2. Braithwaite,J.B., Vehicle Body building and drawing, Heinemann Educational Books Ltd., London, 1977.
3. Dieler Anselm., The passenger car body, SAE International, 2000.

ELECTIVE IV & V

812AMT02 - MARKETING MANAGEMENT (Common to Mechanical, Production and Mechatronics)

OBJECTIVES

- To understand the various processes involved in Marketing and its Philosophy.
- To learn the Psychology of consumers.
- To formulate strategies for advertising, pricing and selling

UNIT I MARKETING PROCESS

Definition, Marketing process, dynamics, needs, wants and demands, marketing concepts, environment, mix, types. Philosophies, selling versus marketing, organizations, industrial versus consumer marketing, consumer goods, industrial goods, product hierarchy

UNIT II BUYING BEHAVIOUR AND MARKET SEGMENTATION

Cultural, demographic factors, motives, types, buying decisions, segmentation factors - demographic - Psycho graphic and geographic segmentation, process, patterns.

UNIT III PRODUCT PRICING AND MARKETING RESEARCH

Objectives, pricing, decisions and pricing methods, pricing management. Introduction, uses, process of marketing research.

UNIT IV MARKETING PLANNING AND STRATEGY FORMULATION

Components of marketing plan-strategy formulations and the marketing process, implementations, portfolio analysis, BCG, GEC grids.

UNIT V ADVERTISING, SALES PROMOTION AND DISTRIBUTION

Characteristics, impact, goals, types, and sales promotions- point of purchase unique selling proposition. Characteristics, wholesaling, retailing, channel design, logistics, and modern trends in retailing.

TEXT BOOKS

1. Govindarajan. M, "Marketing management – concepts, cases, challenges and trends", Prentice hall of India, second edition 2007.
2. Philip Kotler, Koshy Jha "Marketing Management", Pearson Education , Indian adapted edition.2007.

REFERENCES

1. Ramasamy and Nama kumari, "Marketing Environment: Planning, implementation and control the Indian context", 1990.
2. Czinkota & Kotabe, "Marketing management", Thomson learning, Indian edition 2007
3. Adrain palmer, " Introduction to marketing theory and practice", Oxford university press IE 2004.
4. Donald S. Tull and Hawkins, "Marketing Research", Prentice Hall of India-1997.
5. Philip Kotler and Gary Armstrong "Principles of Marketing" Prentice Hall of India, 2000.
6. Steven J. Skinner, "Marketing", All India Publishers and Distributors Ltd. 1998.
7. Graeme Drummond and John Ensor, Introduction to marketing concepts, Elsevier, Indian Reprint, 2007.

812AMT03 - ENTREPRENEURSHIP DEVELOPMENT (Common to all branches)

OBJECTIVE

- Study of this subject provides an understanding of the scope of an entrepreneur, key areas of development, financial assistance by the institutions, methods of taxation and tax benefits, etc.

UNIT I ENTREPRENEURSHIP

Entrepreneur – Types of Entrepreneurs – Difference between Entrepreneur and Intrapreneur – Entrepreneurship in Economic Growth, Factors Affecting Entrepreneurial Growth.

UNIT II MOTIVATION

Major Motives Influencing an Entrepreneur – Achievement Motivation Training, self Rating, Business Game, Thematic Apperception Test – Stress management, Entrepreneurship Development Programs – Need, Objectives.

UNIT III BUSINESS

Small Enterprises – Definition, Classification – Characteristics, Ownership Structures – Project Formulation – Steps involved in setting up a Business – identifying, selecting a Good Business opportunity, Market Survey and Research, Techno Economic Feasibility Assessment – Preparation of Preliminary Project Reports – Project Appraisal – Sources of Information – Classification of Needs and Agencies.

UNIT IV FINANCING AND ACCOUNTING

Need – Sources of Finance, Term Loans, Capital Structure, Financial Institution, management of working Capital, Costing, Break Even Analysis, Network Analysis Techniques of PERT/CPM – Taxation – Income Tax, Excise Duty – Sales Tax.

UNIT V SUPPORT TO ENTREPRENEURS

Sickness in small Business – Concept, Magnitude, causes and consequences, Corrective Measures – Government Policy for Small Scale Enterprises – Growth Strategies in small industry – Expansion, Diversification, Joint Venture, Merger and Sub Contracting.

TEXT BOOKS

1. S.S.Khanka "Entrepreneurial Development" S.Chand & Co. Ltd. Ram Nagar New Delhi, 1999.
2. Kuratko & Hodgetts, "Enterprenuership – Theory, process and practices", Thomson learning 6th edition.

REFERENCES

1. Hisrich R D and Peters M P, "Entrepreneurship" 5th Edition Tata McGraw-Hill, 2002.
2. Mathew J Manimala," Enterprenuership theory at cross roads: paradigms and praxis" Dream tech 2nd edition 2006.
3. Rabindra N. Kanungo "Entrepreneurship and innovation", Sage Publications, New Delhi, 1998.
4. EDII " Faulty and External Experts – A Hand Book for New Entrepreneurs Publishers: Entrepreneurship Development" Institute of India, Ahmadabad, 1986.

812AMT04 - AUTOMOTIVE SAFETY

OBJECTIVE

- At the end, the students will have good exposure to automotive safety aspects including the understanding of the various safety equipments.

UNIT I 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.

UNIT II 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.

UNIT III 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.

UNIT IV 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.

UNIT V 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.

TEXT BOOKS

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

REFERENCE

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

812AMT05 - FUEL CELLS TECHNOLOGY

OBJECTIVE

- 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

UNIT I INTRODUCTION TO FUEL CELLS

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.

UNIT II FUEL CELLS FOR AUTOMOTIVE APPLICATIONS

Fuel cells for automotive applications – technology advances in fuel cell vehicle systems – onboard hydrogen storage – liquid hydrogen and compressed hydrogen – metal hydrides, fuel cell control system – alkaline fuel cell – road map to market.

UNIT III : FUEL CELL COMPONENTS AND THEIR IMPACT ON PERFORMANCE

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.

UNIT IV FUELING

Hydrogen storage technology – pressure cylinders, liquid hydrogen, metal hydrides, carbon fibers – reformer technology – steam reforming, partial oxidation, auto thermal reforming – CO removal, fuel cell technology based on removal like biomass.

UNIT V FUEL CYCLE ANALYSIS

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.

TEXT BOOKS

1. Fuel Cells for automotive applications – professional engineering publishing UK. ISBN 1-86058 4233, 2004.
2. Fuel Cell Technology Handbook SAE International Gregor Hoogers CRC Press ISBN 0-8493-0877-1-2003.

812AMT06 - OPERATIONS RESEARCH

(Common to Mechanical, Metallurgy, Automobile and Mechatronics – VI semester Elective)

OBJECTIVES

- To create awareness about optimization in utilization of resources.
- To understand and apply operations research techniques to industrial operations.

UNIT I LINEAR MODEL

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 LPP. Transportation problems- VAM – MODI technique, Assignment problems.

UNIT II NETWORK MODELS

Shortest route – minimal spanning tree - maximum flow models – project network- CPM and PERT network-critical path scheduling.

UNIT III INVENTORY MODEL

Types of Inventory- EOQ –ERL- Deterministic inventory problems – Price breaks - Stochastic inventory problems- selective inventory control techniques.

UNIT IV REPLACEMENT MODELS

Replacement of items that deteriorate with time – value of money changing with time –not charging with time – optimum replacement policy – individual and group replacement. Sequencing problem: models with n jobs with 2 machines – problem with n jobs with m machines.

UNIT V QUEUING THEORY

Queuing models – queuing systems and structures – notation –parameter – single server and multiserver models – Poisson input – exponential service – constant rate service – infinite population.

TEXT BOOKS

1. Wayne.L.Winston, Operations research applications and algorithms, Thomson learning,4th edition 2007.
2. Taha H.A, "Operation Research", Pearson Education sixth edition, 2003

REFERENCES

1. Frederick.S.Hiller and Gerald.J.Lieberman, "Operations research concepts and cases", TMH (SIE) 8th edition.
2. J.K.Sharma, "Operations research theory and applications", Macmillan India 3rd edition 2007,
3. Hira and Gupta " Problems in Operations Research", S.Chand and Co,2002.
4. Panneerselvam, "Operations Research" Prentice Hall of India, 2003.
5. G Srinivasan, "Operations research principles and applications", PHI (EEE) 2007.
6. Wagner, "Operations Research", Prentice Hall of India, 2000.

812AMT07 - TRANSPORT MANAGEMENT

OBJECTIVE

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

UNIT I INTRODUCTION

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.

UNIT II TRANSPORT SYSTEMS

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

UNIT III SCHEDULING AND FARE STRUCTURE

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

UNIT IV MOTOR VEHICLE ACT

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

UNIT V MAINTENANCE

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.

TEXTBOOKS

1. John Duke - Fleet Management – McGraw-Hill Co, USA -1984.
2. Kitchin.L.D., - Bus Operation - Illiffee and Sons Co., London, III edition - 1992

REFERENCE

1. Government Motor Vehicle Act –Publication on latest act to be used as on date

812AMT08 - TOTAL QUALITY MANAGEMENT

UNIT I INTRODUCTION

Introduction - Need for quality - Evolution of quality - Definition of quality - Dimensions of manufacturing and service quality - Basic concepts of TQM - Definition of TQM – TQM Framework - Contributions of Deming, Juran and Crosby – Barriers to TQM.

UNIT II TQM PRINCIPLES

Leadership – Strategic quality planning, Quality statements - Customer focus – Customer orientation, Customer satisfaction, Customer complaints, Customer retention - Employee involvement – Motivation, Empowerment, Team and Teamwork, Recognition and Reward, Performance appraisal - Continuous process improvement – PDSA cycle, 5s, Kaizen - Supplier partnership – Partnering, Supplier selection, Supplier Rating.

UNIT III TQM TOOLS & TECHNIQUES I

The seven traditional tools of quality – New management tools – Six-sigma: Concepts, methodology, applications to manufacturing, service sector including IT – Bench marking – Reason to bench mark, Bench marking process – FMEA – Stages, Types.

UNIT IV TQM TOOLS & TECHNIQUES II

Quality circles – Quality Function Deployment (QFD) – Taguchi quality loss function – TPM – Concepts, improvement needs – Cost of Quality – Performance measures.

UNIT V QUALITY SYSTEMS

Need for ISO 9000- ISO 9000-2000 Quality System – Elements, Documentation, Quality auditing- QS 9000 – ISO 14000 – Concepts, Requirements and Benefits – Case studies of TQM implementation in manufacturing and service sectors including IT.

TEXT BOOKS

1. Dale H. Besterfield, et al., "Total Quality Management", Pearson Education Asia, Third Edition, Indian Reprint (2006).
2. Suganthi, L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd., 2006.

REFERENCES

1. James R. Evans and William M. Lindsay, "The Management and Control of Quality", 6th Edition, South-Western (Thomson Learning), 2005.
2. Oakland, J.S. "TQM – Text with Cases", Butterworth – Heinemann Ltd., Oxford, 3rd Edition, 2003.
3. Janakiraman, B and Gopal, R.K, "Total Quality Management – Text and Cases", Prentice Hall (India) Pvt. L

812AMP02 - PROJECT WORK (Common to all Branches)

OBJECTIVES

- The objective of the project work is to enable the students in convenient groups of not more than 4 members on a project involving theoretical and experimental studies related to the branch of study. Every project work shall have a guide who is the member of the faculty of the institution. Six periods per week shall be allotted in the time table and this time shall be utilized by the students to receive the directions from the guide, on library reading, laboratory work, computer analysis or field work as assigned by the guide and also to present in periodical seminars on the progress made in the project.
- Each student shall finally produce a comprehensive report covering background information, literature survey, problem statement, project work details and conclusion. This final report shall be typewritten form as specified in the guidelines.
- The continuous assessment shall be made as prescribed by the Anna University regulations.

