## Automobile Engineering Syllabus

### COURSE STRUCTURE IN AUTOMOBILE ENGINEERING

### THIRD SEMESTER

#### A. THEORY:

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<tr>
<th>Code</th>
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<td>1. AUE 301</td>
<td>Strength of Materials</td>
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<td>2. AUE 302</td>
<td>Fluid Mechanics and Machinery</td>
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<td>3. AUE 303</td>
<td>Engineering Thermodynamics</td>
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<td>4. AUE 304</td>
<td>Manufacturing Methods</td>
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<td>5. M 303</td>
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**Total of Theory**

|                      | 18 | 18 |

#### B. PRACTICAL:

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<th>Code</th>
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<th>Credit points</th>
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<tr>
<td>1. AUE 391</td>
<td>Strength of Materials Laboratory</td>
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<td>2. AUE 392</td>
<td>Fluid Mechanics and Machinery Laboratory</td>
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<td>3. AUE 394</td>
<td>Manufacturing Process Laboratory–I</td>
<td>0</td>
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<td>4. AUE 395</td>
<td>Graphics Laboratory–I</td>
<td>0</td>
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**Total of Practical**

|                      | 12 | 8  |

**Total of 3rd Semester**

|                      | 30 | 26 |
### Automobile Engineering Syllabus

**COURSE STRUCTURE IN AUTOMOBILE ENGINEERING**

**FOURTH SEMESTER**

#### A. THEORY:

<table>
<thead>
<tr>
<th>Code</th>
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<td>1. AUE 401</td>
<td>Engineering Analysis and Numerical Methods</td>
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<td>2. AUE 402</td>
<td>Heat Transfer and Combustion</td>
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<td>3. AUE 403</td>
<td>Automotive Petrol Engines</td>
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<td>4. AUE 404</td>
<td>Theory of Machines</td>
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<td>5. AUE 405</td>
<td>Design of Machine Elements</td>
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<td>6. AUE 406</td>
<td>Measurements and Instrumentation.</td>
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**Total of Theory** 18 18

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<td>1. AUE 492</td>
<td>Thermal Engineering Laboratory</td>
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<td>2. AUE 496</td>
<td>Measurements &amp; Instrumentation Laboratory</td>
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<td>3. AUE 497</td>
<td>Manufacturing Process Laboratory-II</td>
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<td>4. AUE 498</td>
<td>Graphics Laboratory – II</td>
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**Total of Practical** 12 8

#### C. SESSIONAL:

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<tr>
<td>1. HU 481</td>
<td>Technical Report Writing &amp; / Language Practice Laboratory</td>
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**Total of Sessional** 3 2

**Total of 4th Semester** 33 28

- 4 week practical training at an Institute approved organization during vacation, at the end of fourth semester to be credited in fifth semester.
### COURSE STRUCTURE IN AUTOMOBILE ENGINEERING

#### FIFTH SEMESTER

**A. THEORY:**

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<td>AUE 501</td>
<td>Design of Mechanical Systems</td>
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<td>AUE 502</td>
<td>Automotive Diesel Engines</td>
<td>3 0 0</td>
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<tr>
<td>AUE 503</td>
<td>Material Science &amp; Technology</td>
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<td>AUE 504</td>
<td>Power Units and Transmission</td>
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<td>AUE 505</td>
<td>Automotive Chassis</td>
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Total of Practical: 18

**B. PRACTICAL:**

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<td>AUE 591</td>
<td>Design Practice</td>
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<td>AUE 594</td>
<td>Engine Components Laboratory</td>
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<td>AUE 595</td>
<td>Chassis Components Laboratory</td>
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<td>AUE 597</td>
<td>Manufacturing Process Laboratory-III</td>
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Total of Practical: 12

**C. SESSIONAL:**

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<td>AUE 599</td>
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Total of Sessional: 2

Total of 5th Semester: 30

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#### SIXTH SEMESTER

**A. THEORY:**

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<tr>
<td>AUE 601</td>
<td>Automotive Electrical Systems &amp; Electronics</td>
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<td>AUE 602</td>
<td>Vehicle Body Engineering</td>
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<tr>
<td>AUE 603</td>
<td>Two and Three Wheelers</td>
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<td>AUE 604</td>
<td>Automotive Pollution and Control</td>
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<td>AUE 605</td>
<td>Quality Control &amp; Reliability Engineering</td>
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Total of Theory: 18

**B. PRACTICAL:**
### Course Structure in Automobile Engineering

#### Seventh Semester

**A. Theory:**

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<tr>
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<td>AUE 701 Vehicle Dynamics</td>
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<td>AUE 702 Operations Research and Industrial Management</td>
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<td>3.</td>
<td>Elective-I</td>
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<td>HU 701 Ethics in Engineering Profession</td>
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<td>HU 702 Engineering Economy &amp; Financial Management</td>
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**Total of Theory** 16 16

**B. Practical:**

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**Total of Practical** 12 8

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**Total of Sessional** 3 2

**Total of 6th Semester** 33 28

- Industrial training for 4 weeks as arranged by the Institute during vacation at the end of sixth semester, to be credited in the seventh semester.
# Automobile Engineering Syllabus

## EIGHTH SEMESTER

### A. THEORY:

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<td>AUE 801 Transport Management and Automobile Industry.</td>
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**Total of Theory** 12 12

### B. PRACTICAL:

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<tr>
<td>1.</td>
<td>AUE 891 Auto Scanning &amp; Vehicle Testing Laboratory</td>
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**Total of Practical** 3 2

### C. SESSIONAL:

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<td>1.</td>
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<td>2.</td>
<td>AUE 881 Participation in Institutional Activities</td>
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<td>3.</td>
<td>AUE 899 Comprehensive Viva-Voce</td>
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**Total of Sessional** 12 14

**Total of 8th Semester** 27 28

### List of Elective Papers

**Elective – I (Any one subject out the following):**

- AUE 711 Advanced Manufacturing Technology
- AUE 712 Theory and Design of Jigs and Fixtures
Automobile Engineering Syllabus

AUE 713          Modern Vehicle Technology
PE    807  Computer Integrated Manufacturing
ME  702  Advances in Materials Processing
ME  805  Tribology and Terotechnology
ME  812  Robotics and Robot Application

Elective – II (Any one subject out of the following):

AUE 811  Optimisation for Engineering Design
AUE 812  Tractors and Farm Equipment
AUE 813  Off-road Vehicles
AUE 814  Total Life Cycle Management
AUE 815  Computer Simulation of IC Engine Processes
AUE 816  Non-Destructive Testing Methods
ME   803  Industrial Engineering
ME  807  Finite Element Method and its Application

Elective –III (Any one subject out of the following) :

AUE 821  Alternate Fuels and Energy Systems
AUE 822  Micro Processor Application in Automobiles
AUE 823  Navigational Aids and Guidance
ME   813  Management Information Systems
ME   821  Total Quality Management
IT    806  Information Technology
IT    816  Entrepreneurship and E-business

Semester-wise Credits

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<th>Semester</th>
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<td>Semester IV</td>
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<td>Semester VII</td>
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<td>Semester VIII</td>
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SEMESTER-III

AUE 301      :  Strength of Materials
Contacts       :  3L
Credit         :  3

Bending of Beams: Shear force and bending moment diagrams for simply supported and cantilever beams. Pure bending. Bending stress in straight beams. Shear stresses in bending of rectangular and I-section beams. Beams of uniform strength.
Automobile Engineering Syllabus


Biaxial Stresses: Analysis of biaxial-stresses, Mohr’s circle. Principal stresses and maximum shear stress-deductions from Mohr’s circle. Stresses in thin walled pressure vessels. Combined bending and torsion.

Deflection of Beams: Differential equation of the elastic axis, double integration and moment methods. Strain energy in tension, compression, shear, bending and torsion. Castigliano’s theorem.

References:

AUE 302 : Fluid Mechanics and Machinery
Contacts : 3L + 1T
Credit : 4


Dimensional Analysis: Buckingham’s theorem, Non-dimensional numbers, similarities of flow. Model studies.


References:

AUE 303 : Engineering Thermodynamics
Contacts : 3L + 1T
Credit : 4


Properties of gases and vapours, Rankine cycle.


Reciprocating air compressors.

One dimensional fluid flow: Application of continuity and energy equations. Isentropic flow of ideal gases through nozzles. Simple jet propulsion system.


Heat Transfer: Conduction in parallel, radial and composite wall, Convective heat transfer with laminar and turbulent flows, Overall heat transfer co-efficient. Flow through heat exchangers. Fundamentals of radiative heat transfer.

References:

AUE 304 : Manufacturing Methods
Contacts : 3L
Credit : 3

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Casting: sand-casting, types, procedure to make sand moulds, cores-moulding tools, pouring of metals, principle of die casting. Centrifugal casting. Investment casting Shell moulding and CO2 process.


Conventional Machining: General principles of working. Types and commonly performed operations in Lathe, Shaper, Planer, Milling machine, Drilling machine, Grinding machine, Gear cutting.


Metal Forming: Basic concepts and classification of forming processes. Principal equipment used and application of Forging, Rolling, Extrusion, Wire drawing, Spinning.

References:

M 303 : Mathematics
Contacts : 3L + 1T
Credits : 4

Allotted Hrs.:48L

Series Solution of Ordinary Differential Equation (ODE); Special Functions:
Introduction, validity of series solution of an ordinary differential equation, general method to solve equation of the type: \( P_0 y'' + P_1 y' + P_2 y = 0 \); problems; Bessel's equation; properties of Bessel's function; Recurrence formula for Bessel's function of first kind \( J_n(x) \); Equation reducible to Bessel's equation; Legendre's equation, Legendre function; Recurrence formula for Legendre function \( P_n(x) \); Orthogonality relation.

Calculus of Complex Variable:

Partial Differential Equations (PDE) and its Applications:
Introduction, linear and nonlinear equation of first order; examples; homogeneous linear equations with constant coefficients and variable coefficient of second order, Separation of variables, Formulation and solution of wave equation; one dimensional heat flow equation and solution; two dimensional heat flow equation and solution.

Linear Programming Problem (L.P.P):
Mathematical Formulation, Graphical Solution and Simplex Method, Charnes Big-M Method, Transportation Problems, Assignment Problems (Hungarian Method).

Total 48L

Reference:
1. Higher Engineering Mathematics by Dr. B. S. Grewal
2. Linear Programming & Game Theory by Chakraborty & Ghosh
3. Complex Variables by M. R. Spiegel

AUE 391 : Strength of Materials Laboratory
Contacts : 3P
Credits : 2

Tension Test: Stress-strain diagram, determination of yield strength, ultimate strength, modulus of elasticity, percentage elongation and percentage reduction in areas; Compression Test, Torsion Test.

Hardness Measurements: Brinnel and Rockwell tests.

Impact tests: Charpy and Izod tests; Bending test: determination of bending stresses; Fatigue Test.
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AUE 392 : Fluid Mechanics and Machinery Laboratory
Contacts : 3P
Credits : 2

Fluid flow measurements: Coefficient of discharge for venturimeter, orifice meter, nozzle meter, weirs.
Flow through pipes: Pipe friction in laminar and turbulent flow regimes. Pitot tube experiments on viscous flow and boundary layer theory.
Experiment on fluid machinery: Pumps, jet pumps, blowers, and compressors.

AUE 394 : Manufacturing Process Laboratory -I
Contacts : 3P
Credit :

Pattern making: pattern material, pattern allowances and types of patterns.
Introduction to primary technology processes involving casting, preparation of foundry sand and molds, Experiments on properties of post casting, fettling, cleaning, deburring, polishing and painting operations.
Mould making Practice: Uses of moulding tools: green sand moulding, gating system, risering system, core making.
Casting: sand preparation, sand testing: specimen preparation, permeability, clay content, grain fineness number, green compression strength, green shear strength, dry strength, hardness. Characterisation of materials - solids and fluids.
Study of cupola.

AUE 395 : Graphics Laboratory-I
Contacts : 3P
Credits : 2

Computer aided drafting problems, Dimension and geometrical tolerancing, Surface modules and representation, Examples.
Problems of two and three-dimensional geometric models, Solid modeling based applications,
Partial views and scientific problems, Auxiliary sections, Simple mechanical assembly drawings, Schematic product symbols for standard components in mechanical, electrical and electronic systems, welding symbols.

SEMESTER -IV

AUE 401 : Engineering Analysis & Numerical Methods
Contacts : 3L
Credit :

Interpolation: Newton’s divided difference formula, Lagrange and Hermite’s polynomials. Newton forward and backward difference formulae, Stirling’s and Bessel’s central difference formulae.
Boundary value problems for ordinary and partial differential equations: Finite difference solution for the second order ordinary differential equations. Finite difference solution for one-dimensional heat equation one-dimensional wave equation and two-dimensional Laplace and Poisson equations.

References:

AUE 402 : Heat Transfer and Combustion
Contacts : 3L
Credit : 3
Automobile Engineering Syllabus


Fins: rectangular and pin fins. Fin effectiveness and efficiency.


Convection: Introduction, Newton's law of cooling and significance of the heat transfer co-efficient. Momentum and energy equations in two dimensions, nondimensionalisation, importance of nondimensional quantities and their physical significance. Order of magnitude analysis for flow over a flat plate. Velocity and Analogies between momentum, heat and mass transfer. Natural convection.


References:

AUE 403 : Automotive Petrol Engines
Contacts : 3L
Credit : 3


References:

AUE 404 : Theory of Machines
Contacts : 3L
Credit : 3

Mechanisms and machines; Elements of kinematic chain, mobility and range of movements, miscellaneous mechanisms, Straight line generating mechanisms. Intermittent motion mechanism. Velocity and acceleration- analysis of displacement, planar mechanisms by graphical, analytical and computer aided methods, Synthesis of linkages, Kinematic analysis of machine elements, Freudeenstein's equation, Dimensional analysis for motion, Functioning and path generation. Dynamics of rotary and reciprocating machines, Critical speeds, Turning moment diagrams and flywheels, Cam profile analysis, gear tooth profiles, static and dynamic force analysis of constrained kinematic systems, Precisional motions and gyroscopic stability.

References:
3. Theory of Machines by S.S.Rattan, TMH.

AUE 405 : Design of Machine Elements
Contacts : 3L
Credit : 3
Automobile Engineering Syllabus

General considerations and procedure of machine design, design stress, factor of safety, stress and deflection analysis, engineering materials and applications, fits and tolerances, design of fasteners and fastenings - pin, cotter, knuckle, screw, rivets and welded joints. Design of shafts and couplings, common power and force transmitting power screws, belt drives and springs.

References:

AUE 406 : Measurement and Instrumentation
Contacts : 3L
Credit : 3

Basic concepts: Definition of terms, calibration, standards, generalized measurement systems static and dynamic performance characteristic; Analysis of experimental data; Instrumentation for measurement of position and displacement, force, velocity, temperature, proximity and range. Concept of feedback; Open and close loop control systems, transducers and devices for engineering applications, digital readouts, data acquisition and processing.

Metrology: Standards, slip gauges, Measurement of angles, tapers, threads, coordinates, inspection of straightness, flatness, alignment and surface finish, gear measurements, Measurements of various product features using Mechanical, Pneumatic, Optical and Electronic Instruments, Interferometry and use of optical flats.

References:
4. Instrumentation, Measurement and Analysis by B.C.Nakra and K.K.Chaudhary, TMH.

AUE 492 : Thermal Engineering Laboratory
Contacts : 3P
Credit : 2

Experiments on heat transfer: thermal conductivity of solids, liquids and gases, natural and forced convection, boiling heat transfer, cooling tower;
Experiments on emissivity and absorvity; Heat exchangers: LMTD methods, mass transfer.

AUE 496 : Measurement and Instrumentation Lab.
Contacts : 3P
Credit : 2

Lab experiments involving: Measurements of position, displacement, velocity, force, temperature, proximity/range. Measurements of various product features using mechanical, pneumatic, optical and electronic instruments, interferometer, surface roughness measurements, measurements of threads and gears.
Laboratory experiments and exercises involving hardware and software modular based off-line and on-line product gauging and inspection, information recording and processing etc.

AUE 497 : Manufacturing Process Laboratory - II
Contacts : 3P
Credit : 2

Surface preparation and etching techniques, heat treatment and metallographic studies.
Laboratory experiments in fabrication processes: Spot, MIG, ARC and Gas Welding, Testing of Joints.
Basic Forging processes like upsetting, drawing down and forge welding

AUE 498 : Graphics Laboratory – II
Contacts : 3P
Credit : 2

Drafting exercises involving preparation of detailed drawings of product assembly
Aggregation of assembly, exploded machine kinematics, foundation of structure Drawings and multilayered system drawing, Computer aided drafting using softwares like CATIA, AUTOCAD and Pro Engineer.
Automobile Engineering Syllabus

HU 481 : Technical Report Writing & Language Practice Laboratory
Contacts : 3S
Credits : 2

Topics to be covered and number of hours required for it:

1. Introductory lecture is to be given to the students so that they get a clear idea of the syllabus and understand the need for having such a practice lab in the first place (3 hours).
2. Conversation practice is done on given situation topics. The students are also made to listen to pre-recorded cassettes produced by the British Council and also by the Universities of Oxford and Cambridge (6 hours).
3. Group Discussions: The students are made to understand the difference between the language of conversation and group discussion. Strategies of such discussions are to be taught to them. It is also helpful to use video cassettes produced by the U.G.C. on topics like group discussion. Afterwards the class is divided into groups and the students have to discuss on given topics on current socio-economic-political-educational importance (12 hours).
4. Interview sessions: students are taught the do’s and don’ts of facing a successful interview. They then have to face rigorous practices of mock-interviews. There would be simulations of real life interview sessions where students have to face an interview panel (12 hours).
5. Presentations: The secrets of an effective presentation are taught to the students. Then each and every student has to make lab presentations with the help of the overhead projector using power point presentation and other audio-visual aids in the laboratory. They also have to face the question answer sessions at the end of their presentation (12 hours).
6. Classes are also allotted to prepare the students for competitive examinations like the TOEFL by making the students listen to specially produced C/D cassettes of such examinations (3 hours).

The overall aim of this course is to inculcate a sense of confidence in the students and help them to become good communicators in their social as well as professional lives.

References:
1. Business Correspondence & Report Writing by R.C. Sharma and K. Mohan, TMH
2. How to prepare for Group Discussion & Interview (With Audio Cassette) by Prasad, TMH
3. Spoken English – A self-learning guide to conversation practice (with Cassette) by Sasikumar, TMH

SEMESTER-V

AUE 501 : Design of Mechanical Systems
Contacts : 3L +1T
Credit : 3

Design for variable loads: Endurance limit, Goodman and Soderberg criteria, Design of shafts, clutches and brakes - calculation of heat generation and heat dissipation; Gears: Gear tooth geometry, tooth systems, gear trains, gear box design, design of helical, bevel and worm gears from strength and wear considerations; Flywheel design; Bearings and lubrication: selection procedure of antifriction bearings, journal bearings, hydrodynamic theory, design factors, the relation of the variables, heat balance, hydrostatic bearings. Concept of concurrent and simultaneous engineering. Example problems in design of mechanical systems.

References:

AUE 502 : Automotive Diesel Engines
Contacts : 3L
Credit : 3


References:
Automobile Engineering Syllabus


AUE 503 : Materials Science and Technology
Contacts : 4L
Credit : 4

Fracture, Fatigue and Creep: Fracture, classification and types, Griffith’s theory, notch effects, stress concentration, concept of fracture toughness. Ductile brittle transition. Fatigue Mechanism of crack initiation and growth, factors affecting fatigue creep, creep curve, Ashby deformation mechanism maps, and creep mechanism, metallurgical variables of creep.
Characteristics of Materials: Castability, machinability, formability and weldability of engineering materials such as steel, cast iron, alloy steels, brass, bronze and aluminium alloys.
Composite materials: Fabrication techniques, materials for high temperature. Cryogenic wear, corrosion fatigue and oxidation resistance application.
Selection of materials: Criteria of selecting materials for automotive components viz Cylinder block, Cylinder head, Piston, Piston ring, Gudgeon pin, Connecting rod, Crank shaft, Crank case, Cam, Cam shaft, Engine valve, Gear wheel, Clutch plate, Axle bearings, Chassis, Spring, body panel radiator, brake lining etc. Application of non-metallic materials such as composite, ceramic and polymers in automobile.

References:

AUE 504 : Power Units and Transmission
Contacts : 4L
Credit : 4

Requirement of transmission system.
Different types of clutch: Principle, construction, torque capacity and design aspects.
Determination of gear ratios for vehicles. Performance characteristic in different speeds. Different types of gearbox, conventional gearbox.
Torque Converter: Principle of operation, constructional details, performance characteristics, converter coupling, multistage torque converters and polyphase torque converters.

References:
4. SAE Transactions 900550 & 930910.

AUE 505 : Automotive Chassis
Automobile Engineering Syllabus

Contacts : 3L  
Credit : 3


Suspension System: Need of suspension system, types of suspension, suspension springs, constructional details and characteristics of leaf, coil and torsion bar springs. Independent suspension, Rubber suspension, Pneumatic suspension, Shock absorbers.


References:

AUE 591 : Design Practice  
Contacts : 3P  
Credit : 2

Drawing board exercises compatible to the course AUE 405 : Design of Machine Elements.

AUE 594 : Engine Components Laboratory  
Contacts : 3P  
Credit : 2

Study of various makes of four-stroke and two-stroke spark-ignition and compression ignition engines and components by dismantling and assembling various parts. Comparison of engine components.

AUE 595 : Chassis Components Laboratory  
Contacts : 3P  
Credit : 2

Study and measurement of various makes of Automobile Chassis, such as Tata, Leyland, Ambassador etc. Study, dismantling and Assembling of Front axle, Rear axle, Clutch, Gear box, Steering system, Braking system, Differential mechanism.

AUE 597 : Manufacturing Process Laboratory - III  
Contacts : 3P  
Credit : 2

Laboratory exercises involving machining of complex product configurations, machining of spur and helical gears, relieving and profiling, contouring, finishing processes. Grinding of tools and cutters.

SEMESTER - VI

AUE 601 : Automotive Electrical Systems and Electronics  
Contacts : 4L  
Credit : 4

Automobile Engineering Syllabus


Ignition Systems: Types, Construction & working of battery coil and magneto ignition systems. Relative merits, Centrifugal and vacuum advance mechanisms, types and construction of spark plugs, electronic ignition systems.


Electronic Fuel Injection and Ignition Systems: Introduction, feed back carburetor systems. Throttle body injection and multi port or point fuel injection, fuel injection systems, Injection system controls. Advantages of electronic ignition systems: Types of solid-state ignition systems and their principle of operation, Contact less electronic ignition system, and electronic spark timing control.

Digital Engine Control System: Open loop and closed loop control systems-Engine cranking and warm up control-Acceleration enrichment-Deceleration leaning and idle speed control. Distributor less ignition-Integrated engine control systems, Exhaust emission control engineering.

Electronic dashboard instruments-Onboard diagnosis system, security and warning system.

References:

AUE 602 : Vehicle Body Engineering

Contacts : 3L
Credit : 3


Vehicle Aerodynamics: Objectives, Vehicle drag 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 drag. Wind tunnel testing: Flow visualization techniques, scale model testing. Component balance to measure forces and moments.


Commercial Vehicle Details: Types of body, Flat platform, drop side, fixed side, tipper body, tanker body. Light commercial vehicle body types, Dimensions of driver’s seat in relation to controls, driver’s cabin design.


References:

AUE 603 : Two and Three Wheelers

Contacts : 3L
Credit : 3P
Automobile Engineering Syllabus


References:
5. Raymond Broad, Lambretta – A practical guide to maintenance and repair, 1987

AUE 604 : Automotive Pollution and Control
Contacts : 4L
Credit : 4P


CI engine Combustion and Emissions: Basic of diesel combustion-Smoke emission in diesel engines-Particulate emission in diesel engines. Color and aldehyde emissions from diesel engines, Effect of operating variables on emission formation.
Control Techniques for SI and CI: Design changes, optimization of operating factors, exhaust gas re-circulation, fumigation, air injector PCV system-Exhaust treatment in SI engines-Thermal reactors-Catalytic converters, Catalysts, Use of unleaded petrol.

References:
3. SAE Transactions, Vehicle emission, 1982 (3 volums).
7. Automobiles and Pollution SAE Transaction, 1995

AUE 605 : Quality Control and Reliability Engineering
Contacts : 3L
Credit : 4P


Life Testing-Reliability-Systems Approach: Life testing-objects-classification-failure characteristics-failure data analysis-mean time to failure-maintainability and availability-reliability-system reliability-series and parallel systems-systems reliability in terms of probability of failure-MTBF-Acceptance sampling based on reliability test OC curves.

Quality and Reliability: Reliability improvement-techniques, use of parato analysis - Design for reliability, Redundancy, standby redundancy, failsafe systems-optimization in reliability, product design, product analysis, product development product cycle.

References:
Automobile Engineering Syllabus


AUE 691 : Automotive Electrical and Electronics Laboratory
Contacts : 3P
Credit : 2

AUE 694 : Engine Testing and Pollution Measurement Laboratory
Contacts : 3P
Credit : 2
Study of Pressure pickups, charge amplifier, storage oscilloscope and signal analysers used for IC engine testing.
Performance study of petrol and diesel engines both at full load and part load conditions.
Morse test on petrol and diesel engines.
Determination of compression ratio, volumetric efficiency and optimum cooling water flow rate in engines.
Heat balance test on an automotive engine.
Testing of 2 and 4 wheelers using chassis dynamometers.
Study of NDIR Gas Analyser and FID
Study of Chemiluminescent NOx analyzer
Measurement of HC, CO, CO2, O2 using exhaust gas analyzer
Diesel smoke measurement.

References:

AUE 696 : CAD Application in Automotive Engineering - I
Contacts : 3P
Credit : 2
Design and drawing of piston, piston pin and piston rings.
Design and drawing of connecting rod small end and big end, shank design, design of big and cap bolts and drawing of the connecting rod assembly.
Design and drawing of crankshaft, balancing weight calculations, development of short and long crankarms, front end and rear end details.
Design and drawing of flywheel, ring gear design.
Design and drawing of the inlet and exhaust valves.

References:

AUE 697 : Vehicle Maintenance Laboratory
Contacts : 3P
Credit : 2
Study and layout of an automobile repair, service and maintenance shop.
Study and preparation of different statements/records required for the repair and maintenance works
Study and preparation of the list of different types of tools and instruments required
Minor and major tune up of gasoline and diesel engines
Fault diagnosis in electrical ignition system gasoline fuel system, diesel fuel system and rectification
Study of faults in the electrical systems such as Head lights, Side of Parking lights, Trafficator lights, Electric horn system, Windscreen wiper system, Starter system and Charging system
Study of fuel filters (both gasoline and diesel engines) and air cleaners (dry and wet)
Simple tinkering, soldering works of body panels, sutudy of door lock and window glass rising mechanisms.
Practice of the following:
Adjustment of pedal play in clutch, brake, hand brake lever and steering wheel play
Air bleeding from hydraulic brakes, air bleeding of diesel fuel system
Automobile Engineering Syllabus

Wheel bearings tightening and adjustment
Adjustment of head lights beam
Removal and fitting of tyre and tube

References:
1. Automotive Trouble shooting and Maintenance by Anderson Ashburn.

SEMESTER-VII

AUE 701 : Vehicle Dynamics
Contacts : 3L
Credit : 3


Calculation of effective spring rate. Vehicle suspension in fore and aft directions. Ride characteristics of tyres, behaviour while cornering, power consumed by tyre, effect of driving and braking torque-Gough’s tyre characteristics.
Stability of Vehicles: Load distribution. Calculation of tractive effort and reactions for different drives-Stability of a vehicle on a slope, on a curve and a banked road.
Numerical Methods: Approximate methods for fundamental frequency, Dunker-Ley’s lower bound, Rayleigh’s upper bound-Holzer method for close-coupled systems and branched systems.

References:

AUE 702 : Operations Research and Industrial Management
Contacts : 3L + 1T
Credit : 4

Operations Research: Introduction to OR, definition, linear programming; graphical method, simplex method, dual problem, dual simplex method, transportation and assignment problems, Project Management: CPM and PERT, Queuing theory, Game theory, Markov chain, Monte Carlo Simulation.

Industrial Management: Principles and functions of Management: Leadership and decision making.
Human resources: personnel management, industrial legislation and relations, industrial psychology, manpower planning, training and development, health, safety, welfare, remuneration and incentive schemes.
Materials, Purchase and Stores Management: Inventory control.
Sales and Marketing Management.
Cost Accounting and Control, Budget and Budgetary control.

References:

HU 701 : Ethics in Engineering Profession
Contacts : 3L
Credit : 3

Science, Technology and Engineering as knowledge and as social and professional activities.
Inter-relationship of technology growth and social, economic and cultural growth; historical perspective.
Ancient, medieval and modern technology/industrial revolution and its impact; the Indian Science and Technology.
Social and human critiques of technology; Mumford and Ellul.
Rapid technological growth and depletion of resources; reports of the club of Rome; limits to growth; sustainable development.
Energy crisis, renewable energy resources.
Environmental degradation and pollution; eco-friendly technologies; environmental regulations; environmental ethics.
Technology and the arms race; the nuclear threat.
Appropriate technology movement of Schumacher; later developments.
Automobile Engineering Syllabus

Technology and the developing nations; problems of technology transfer; technology assessment/impact analysis.
Human operator in engineering projects and industries; problems of man-machine interaction; impact of assembly line and automation; human centred technology.
Industrial hazards and safety; safety regulations, safety engineering.
Politics and technology; authoritarian versus democratic control of technology; social and ethical audit of industrial organizations.
Engineering profession; ethical issues in engineering practice; conflicts between business demands and professional ideals; social and ethical responsibilities of the engineer; codes of professional ethics; whistle blowing and beyond; case studies.

HU 702 : Engineering Economy and Financial Management
Contacts : 3L
Credit : 3

Interaction between economic theory and production; concept of firm, industry and economy.
Consumer behavior, utility, indifference curves and maps; consumers' supply, demand function.
Production function, effect of technology, short and long ranges cost functions, monopoly and competition, determination of price, price discrimination, pricing of products.
Function of financial management and financial executive; nature of risk, interrelationship between risk and return; effect of tax on return.
Analysis and interpretation of standard financial statements.
Concept of operating cycle and working capital management.
Planning of profit and leverage (operating and financial).
Project evaluation indices like NPV, IRR.
Definition and scope of cost accountancy and costing methods; Elements of cost identifications; Recording, ascertainment of direct material and labour cost; Overhead classification, distribution and absorption; Process costing, uniform, marginal and standard costing methods; Case studies showing application of financial management and costing methods.

References:
1. Engineering Economics by E.Paul Degermo.

AUE 794 : CAD Application for Automotive Engineering - II
Contacts : 3P
Credit : 2

Design and drawing of Cam and Camshaft, Cam profile generation.
Design and drawing of engine complete assembly with cylinder block, cylinder head, crankcase, valve ports, water jackets, front and rear end details.
Clutch: Components and assembly drawing using CAD Software.
Gear Box: Gear train calculations. Layout of gearbox. Calculation of bearing loads and selection of bearings. Complete assembly drawing using CAD Software.

References:

AUE 795 : Project
Contacts : 9P
Credit : 6

Students will be exposed to lecture modules on project and thesis work followed by assignment of individual projects involving manufacturing/design an Automobile components. An industrial project may also be undertaken by the student to be supervised jointly by industry personnel and the teacher.
Automobile Engineering Syllabus

Elective Papers I

**AUE 711 :** Advanced Manufacturing Technology
Contacts : 3L
Credits : 3

Integrated automation, computers and managerial challenges; modern cutting tools and tool management, CAPP, high speed machining, precision machining;
Non-traditional machining: EDM, ECM, USM, PAM, EB, AJM, WJM, Explosive forming and LBM.
Graphics standards - CAD and CAE, Computer networking, GT concept, FMS, CIM, Computer aided Quality Control, CMM, Application of AI in CAD/CAM/CIM, Reverse Engineering, Rapid Prototyping and Tooling.

**AUE 712 :** Theory And Design Of Jigs and Fixtures
Credit : 3

Introduction: Definitions of Jigs and Fixtures – Principles of Jigs and Fixtures design – Preliminary analysis and planning of Jigs and fixture parts and their materials – Basic steps in the design of jigs and fixtures – Advantages of Jigs & Fixtures.
Loading and unloading problems: Loading – Entering, locating and clamping, symmetric consideration.
Unloading – Bur clearance, ejectors, receivers, chip problems, relief and projection, shields and seals.
Design of Jigs and Fixtures: Three construction principles- Builtup type, casting and weldment. Practicing the various types of jigs – Practicing the various types of milling fixtures – broaching fixtures – function of broaching fixtures-internal and external broaching fixtures.

References:

**AUE 713 :** Modern Vehicle Technology
Contacts : 3L
Credits : 3

Vehicle Operation and Control: Computer Control for pollution and noise control and for fuel economy-Transducers and operation of the vehicle like optimum speed and direction.

References:

**PE 807 :** Computer Integrated Manufacturing
Contact : 3L
Credits : 3

Concept of Computer Integrated Manufacturing (CIM); Basic components of CIM; Distributed database system; distributed communication system, computer networks for manufacturing; future automated factory; social and economic factors.

**Computer Aided Design (CAD):** CAD hardware and software; product modeling, automatic drafting; engineering analysis; FEM design review and evaluation; Group Technology Centre.

Computer Aided Manufacturing (CAM): Computer assisted NC part programming; Computer assisted robot programming; computer aided process planning (CAPP); computer aided material requirements planning (MRP); computer aided production scheduling; computer aided inspection planning; computer aided inventory planning; flexible manufacturing system (FMS); concept of flexible manufacturing; Integrating NC machines, robots, AGVs, and other NC equipment; Computer aided quality control; business functions, computer aided forecasting.

Management Information Systems (MIS), Various CIM systems - examples.

References :
Automobile Engineering Syllabus

ME 702 : Advances in Materials Processing
Contacts : 3L
Credits : 3

Introduction to advanced materials: composites, ceramics, refractory metals and alloys, super alloys; Solidification processing: principles of solidification, processing and applications of recent solidification techniques like infiltration techniques, rheocasting, squeeze casting, compocasting, rapid solidification techniques and zone refining; Powder metallurgy processing: Metal and ceramic powder production, characterisation, mixing techniques; Mechanical alloying and process variables; Various compaction techniques and the process variables; Mechanism of sintering and various sintering techniques, viz., solid state sintering, liquid phase sintering, reaction sintering, hot pressing, HIP and self propagating combustion sintering; Recent advances in powder metallurgy like Ospray and Deposition techniques.

References:
3. Modern Ceramic Engineering by D.W.Richardson, Marcel Dekker Inc.

ME 805 : Tribology and Terotechnology
Contact : 3L
Credits : 3

Introduction to tribological systems and their characteristic features: Physico-mechanical interactions at interfacial contact surfaces; Analysis and assessment of topography; Deterministic and stochastic trib- models for asperity contact, frictional resistance and wear; Frictional instability and stick-slip phenomenon; Models of adheso-diffusion wear process; Kinetics of solid state interfacial interactions. Principles of lubrication: Hydro-dynamic, hydro-static, elastohydrodynamic cases; Boundary film lubrication; Solid lubricants; Tribological design of machine elements and systems; Principles of life-cycle analysis and their application. Terotechnology: Introduction, Life cycle cost analysis of plants and concept of terotechnology; Various maintenance management strategies; Production maintenance interface and terotechnology based planning and control; Maintenance policy determination; Fixed time replacement prior to failure; Concept of health and usage monitoring of plants (HUM); Condition based maintenance; Design out maintenance; Preventive maintenance; Reliability, maintainability and availability of plants and equipments; Replacement strategies, Computer application in terotechnology based critical analyses.

References:
2. Principles of Tribology by Halling J. (Editor), Macmillan, London.

ME 812 : Robotics and Robot Applications
Contact : 3L
Credits : 3

Robot definition: Robotic systems - Its role in automated manufacturing; robot anatomy; robot classifications and specifications. Robot kinematics, forward and reverse transformation, homogeneous transformations. Robot actuators and control; Pneumatic, hydraulic and electrical drives and controls used in robots. Robot end-effectors, mechanical, magnetic and vacuum grippers, gripping forces RCC and design features of grippers. Robot sensors, different types of contact and non-contact sensors; Robot vision and their interfaces.

References:
1. Industrial Robotic Technology - Programming and Application by M.P.Groover et. al., McGrawhill
4. Robotics Technologies and Flexible Automation by S.R.Deb, TMH.

SEMESTER –VIII

AUE 801 : Transport Management and Automobile Industry
Contacts : 4L
Credit : 4
Automobile Engineering Syllabus


Vehicle Maintenance: Scheduled and unscheduled maintenance Planning and scope. Evaluation of PMI program, Work scheduling, Overtime, Breakdown analysis, Control of repair backlogs, Cost of options.

Vehicle Parts, Supply Management and Budget: Cost of inventory, Balancing inventory cost against downtime, Parts control, Bin tag systems.


Scheduling and Fare Structure: Route planning, Scheduling of transport vehicles, Preparation of timetable, Costs, fare structure, methods of the fare collection, Preparation of fare table.

Motor Vehicle Act: Schedules and sections, Registration of motor vehicles, Licensing of drivers, Control of permit, Limits of speed, traffic signs. Constructional regulations. Description of goods carrier, delivery van, tanker, tipper, Municipal, fire fighting and breakdown service vehicle.

Automobile Industry: History and development of the automobile industry, market trends, current scenario in Indian auto industry, Auto ancillary industries, Role of the automobile industry in national growth.

References:


AUE 891 : Auto Scanning and Vehicle Testing Laboratory
Contact : 3P
Credits : 2

Computerized engine analyzer study and practice; Computerized wheel balancing machine study and practice; Computerized wheel alignment machine study and practice; Exhaust emission test of petrol and diesel engine; Two wheeler chassis dynamometer study and practice; Road worthiness test: Acceleration, Gradability, Maximum speed, Constant Speed fuel consumption, City drive fuel consumption tests; Head light focusing test; Visibility test; Braking distance test.
Automobile Engineering Syllabus

Elective Papers II

AUE 811 : Optimisation for Engineering Design
Contacts : 4L
Credit : 4


Specialized Algorithms : Integer programming – Geometric programming.


References:

AUE 812 : Tractors and Farm Equipment
Contacts : 4L
Credit : 4

General Design of Tractors : Classification of Tractors-Main components of Tractor-Safety Rules.

Control of the Tractor and Fundamentals of Engine Operation: Tractor controls and the starting of the tractor engines-Basic notions and definition-Engine cycles-Operation of multicylinder engines-General engine design - Basic engine performance characteristics.

Engine Frame Work and Valve Mechanism of Tractor: Cylinder and pistons-Connecting rods and crankshafts Engine balancing – Construction and operation of the valve mechanism-Valve mechanism components – Valve mechanism troubles.


Farm Equipments: Working attachment of tractors-Farm equipment – Classification – Auxiliary equipment – Trailers and body tipping mechanism.

References:

AUE 813 : Off-Road Vehicles
Contacts : 4L
Credit : 4

Classification and Requirements of Off Road Vehicles: Power plants, chassis and transmission, Multiaxle vehicles.

Land clearing machines: Bush cutter, stumpers, Tree dozer, Rippers.


Scrapers and Graders: Scrapers, elevating graders, self powered scrapers and graders.

Shovels and Ditchers : Power shovel, revolving and stripper shovels – drag lines – ditchers – Capacity of shovels.

References:

AUE 814 : Total Life Cycle Management
Contacts : 4L
Credit : 4

Definition of total life cycle (TLC)-Concept of TLC-Life cycle impacts-Integrating life cycle technologies-Products and processes within TLC-TLC methodology-TLC assessment data to complex products-Results Improvement for product.

Vehicle End Life: Design for end of old vehicle management – Problems of old vehicles in emerging markets-recovery and economic feasibility of materials such as Plastics, rubber aluminum, steel,etc.

References:
Automobile Engineering Syllabus

Tradeoffs: Applying life cycle thinking to define tradeoffs along the supply, manufacture-use and end of life chain-Effect on the customer-Expectation of the customer-Evaluate product cost on fuel consumption, emissions, durability, environment and health.
Sustainability: What is sustainability-Use of renewable resources-View to design horizon.
Harmonization of Environmental Goals: TLC for emerging vs. developed markets-Rules and regulations to guide designers-International common practices for end of life vehicles.

AUE 815 : Computer Simulation of IC Engines Processes
Contacts : 4L
Credit : 4

SI Engine Simulation With Air As Working Medium: Deviation between actual and ideal cycle-Problems, I engine simulation with adiabatic combustion, temperature drop due to fuel vapourisation, full throttle operation-efficiency calculation, part-throttle operation, super charged operation
Simulation of 2-Stroke SI Engine:
Diesel Engine Simulation: Multi Zone model for combustion, different heat transfer models, simulation of engine performance, simulation for pollution estimation.

References:

AUE 816 : Non-Destructive Testing Methods
Contacts : 4L
Credit : 4

Non-Destructive Testing: Introduction, classification of NDT techniques,
Visual examination: Bore-scopes, video devices,
Magnetic particle testing: Operating principal, magnetising technique.
Liquid Penetrating technique: Principle, process description.
Ultrasonic Testing: Definition, advantages and applications, inspection methods.
Thermography: Infrared theory, contact, non-contact methods.
Acoustic emission testing, eddy current testing.
Leak testing: Bubble emission testing, Air leak testing.
Case studies on defects in casting, rolling, welding, and heat-treating.

References:

ME 801 : Industrial Engineering
Contacts : 4L
Credit : 4

Production Planning and Control; Product: product design, customer requirements, value engineering, quality, reliability, service life, and competitiveness;
Processes: Job, batch and flow production methods, Group Technology Work study and Time and Motion study, Work/job evaluation, quality control (SPC), control charts;
Resource planning: production/ operation control, forecasting, capacity management, scheduling and loading, line balancing, break-even analysis, inventory of materials and their control, manufacturing planning, MRP - II, JIT.

References:
Automobile Engineering Syllabus

ME 807 : Finite Element Methods and its Application
Contacts : 4L
Credit : 4


Discrete Elements: Use of bar and beam elements in structural analysis. Computer implementation of procedure for these elements.


ISO Parametric Elements: Definition and use of different forms of 2D and 3D elements. Computer implementation of formulation of these elements for the analysis of typical structural parts.


References:
Automobile Engineering Syllabus

Elective Papers - III

AUE 821 : Alternate Fuels and Energy Systems
Contacts : 4L
Credit : 4


Vegetable Oils: Various vegetable oils for engines-Esterification-Performance in engines-Performance and emission characteristics.

Electrical and Solar Powered Vehicles: Layout of an electric vehicle-Advantage and limitations-Specifications-System component, Electronic control system-High energy and power density batteries-Hybrid vehicle-Solar powered vehicles

References:
1. Maheswar Dayal, Energy today & tomorrow, I & B Horishr India, 1982
3. Alchohols and Motor fuels progress in technology, Series No.19,SAEPublication USA 1980.
4. SAE paper Nos.840367, 841156, 841133, 841334.
5. The properties and performance of modern alternate fuels SAE paper No 841210.

AUE 822 : Microprocessor Application in Automobiles
Contacts : 4L
Credit : 4

Architecture: General 8 bit microprocessor and its architecture 8085,Z-80 and MC 6800 MPU and its pin functions-Architecture-Functions of different sections.


Assembly Language Programming: Construct of the language programming-Assembly format of 8085-Assembly Directive-Multiple precision addition and subtraction-BCD to Binary and Binary to BCD Multiplication, Division, Code conversion using look up tables-stack and subroutines.

Data Transfer Schemes: Interrupt structure-Programmed I/O, DMA-Serial I/O.


Applications: Data acquisitions-Temperature control-Stepper motor control-Automotive applications engine control, Suspension system control, Driver information systems, Development of a high speed, high precision learning control system for the engine control.

References:
4. SAE Transactions,1986 Sec 3.

ME 813 : Management Information Systems
Contact : 4L
Credits : 4

Introduction to Management Information Systems (MIS); Data, information and knowledge concepts, concepts of information representation: storage, dissemination, discrimination and transmission.

Data base management systems, design and implementation of RDBMS for managerial applications, retrieval aspects, and security and privacy aspects.

Specification and configuration of computer based systems; Manufacturing Management Information systems- its subsystems and outputs; costing and performance audit applications in MIS.

References:

ME 821 : Total Quality Management
Contact : 4L
Credits : 4

Automobile Engineering Syllabus

Process control: Machine and process capability analysis. Use of control charts and process engineering techniques for implementing the quality plan.

Acceptance Sampling: single, double and multiple sampling, lot quality protection, features and types of acceptance sampling tables, acceptance sampling of variables and statistical tolerance analysis. Quality education, principles of participation and participative approaches to quality commitment.

Emerging concepts of quality management: Taguchi's concept of off-line quality control and Ishikawa's cause and effect diagram.

References:
1. Total Quality Management – An Introductory Text by Paul James, Prentice Hall
2. Quality Control and Applications by House & Ghose
3. Industrial Engineering Management by O.P. Khanna

IT 806  :   Information Technology
Contact :  4L
Credits :  4

Hardware: CPU architecture, memory, registers, addressing modes, buses, instruction sets, multi processors versus single processors;
Peripheral devices: hard disks, CDs, video display monitors, device controllers, input/output; operating systems - functions and types;
Operating system modules: processes, process management, memory and file system management; examples of hardware architectures;
examples of operating systems; basic network components, switches, multiplexers and media; installation and configuration of multi user operating systems.

Data structure and representation: characters, records, files, multimedia; precision of data; information representation, organisation and storage; algorithm development; object representation compared to conventional data flow notation; programming control structures; program correctness, verifications and validations; file structures and representation.
Communication devices, media, systems; network hardware and software; network configuration; network applications; coding of data; cost/benefit analysis; distributed versus centralised systems; architectures, topologies and protocols; installation and operation of bridges, routers and gateways; network performance analysis; privacy, security, reliability; installation and configuration of LAN and WAN networks; monitoring of networks; management of telecommunications and communications standards. Intranet and Internet.

References:
2. Data Structure and Program Design – Robert L. Kruse, PHI
3. Modern Operating System – Andrew S. Tanenbaum, PHI

IT 816 : Entrepreneurship and E-Business
Contact :  4L
Credits :  4

Introduction: Concept of Entrepreneurship - need and scope for entrepreneurship - Entrepreneur and society - qualities of entrepreneur Risks, relevance and benefits of small scale Industry - definition of tiny, small ancillary industry - prevailing industrial policy of SSI - incentives and benefits of SSI units.

Motivation theories - Maslow, McCllend - Motivation model - need, want, motive and behaviour - attitude towards work - self assessment and goal setting - Achievement, motivation and behaviour measurement, SWOT analysis, TA analysis - Stress and conflict management; coping with uncertainty; creativity and innovation.

Project identification and formulation: Sources of information - opportunity guidance - choice of technology and its evaluation; Consumer behaviour; market survey and research; demand and resource based industry- servicing industry - import substitution- Techno economic feasibility assessment - short listing, preliminary project report, detailed project report, assessing viability and feasibility of a report. Forms of business organisations/ownership - formation of a Company - procedures and formalities for setting up of new industry-

Sources of information to contact for what and where - subsidies and concessions for SSI - role of State and Central Government Agencies in promotion of Small Scale Industry. Sickness and nursing of sickness in SSI.


Taxation - State and Central - Concessions.

Introduction to e-business; EDI and e-commerce; EDI standard, implementation and Tools; e-commerce imperatives, e-commerce applications: I - Markets, Customer care, Vendor Management and Extended supply chain management; security aspects - cryptography, digital signature, digital watermarking, secured socket layers, understanding threats to security, securing internet connections, Firewall techniques, electronic payment systems - ATM model, Payment Models, credit card based payment system, 1st virtual banking, e-cash, smart cards; Electronic Data interchange EDI) - Value added networks.

References:
2. Entrepreneurial Development by P.Saravanavel.