REVISED SYLLABUS
FOR B.E.AUTOMOBILE ENGINEERING
III & IV SEMESTER
2016-2017
(For 2015-16 first year entry Batch)

Vision and Mission of the Institute

VISION
“To be recognized as a premier technical institute committed to develop exemplary professionals, offering research based innovative solutions and inspiring inventions for holistic socio economic development”

MISSION
• To pursue excellence through student centric dynamic teaching-learning processes, encouraging freedom of inquiry and openness to change
• To carry out innovative cutting edge research and transfer technology for industrial and societal needs
• To imbibe moral and ethical values and develop compassionate, humane professionals

Vision and Mission of the Department

VISION
“To nurture academic excellence in the field of automobile engineering with innovative and challenge attitudes to societal needs”

MISSION
• To disseminate the knowledge to build the outstanding professionals in automobile engineering through teaching learning process.
• To expertise in the field of automotive design, service, vehicle body engineering and autotronics in tune with industries
• To focus in the research of engines, alternate fuels and vehicle dynamics
• To leverage industry institute interaction and meet societal needs with professional ethics and values
## SCHEME OF TEACHING AND EXAMINATION
### B.E (III SEM) AUTOMOBILE ENGINEERING

<table>
<thead>
<tr>
<th>Sl.No</th>
<th>Subject Code</th>
<th>Subject</th>
<th>Credits</th>
<th>Hours/ Week</th>
<th>Examination Marks</th>
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<td>Lecture</td>
<td>Tutorial</td>
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<td>UMA 301C</td>
<td>Engineering Mathematics -III</td>
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<td>Production Technology</td>
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<td>5</td>
<td>UAU 315 C</td>
<td>Automotive Chassis &amp; Suspension</td>
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<td>6</td>
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<td>Material Science &amp; Metallurgy</td>
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<td>UAU 317L</td>
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<td>Material Testing Lab</td>
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<td>UAU329L</td>
<td>Machine Shop</td>
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<td>UMA300M*</td>
<td>Advanced Mathematics-I</td>
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*Advanced Mathematics-I is a mandatory subject only for students admitted to 3rd semester through lateral entry (Diploma Scheme). Passing the subject is compulsory; however the marks will not be considered for awarding grade/class. A PP/NP grade will be awarded for passing/not passing the subject.
## SCHEME OF TEACHING AND EXAMINATION
### B.E (IV SEM) AUTOMOBILE ENGINEERING

<table>
<thead>
<tr>
<th>Sl.No</th>
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*Advanced Mathematics-II is a mandatory subject only for students admitted to 3rd semester through lateral entry(Diploma Scheme). Passing the subject is compulsory; however the marks will not be considered for awarding grade/class. A PP/NP grade will be awarded for passing/not passing the subject.
Course Objectives:
To enable the students to apply the knowledge of Mathematics in various engineering fields by making them
- to understand the method of solving algebraic, transcendental equations.
- to determine the approximate value of the derivative & definite integral for a given data using numerical techniques.
- able to expand the given periodic function defined in the given range in terms of sine and cosine multiple of terms as a Fourier series.
- able to extremise the functional using integration technique.
- able to form and solve the partial differential equation using different analytical techniques.
- to solve different forms of heat and wave equations.

Course outcomes:
On completion of this course, students are able
- to know how root finding techniques can be used to solve practical engineering problems.
- to apply the concept of numerical analysis to find the relative strengths and weaknesses of each computation method and know which are most applicable for given problem.
- to apply the analytical technique to express periodic function as a Fourier sine and cosine series.
- to apply partial differential techniques to solve the physical engineering problems.
- to implement integration technique to determine the extreme values of a functional.

UNIT-I
Numerical Analysis: 13 Hours
Bisection Method, Newton-Raphson method. Finite differences, forward and backward difference operators (no derivations on relations between operators) Newton-Gregory forward and backward interpolation formulae. (without proof), Lagrange's and Newton's divided difference interpolation formulae (without proof) Numerical differentiation using Newton's forward and backward formulae-problems.

Numerical solutions of first order ODE :
Taylors Series Method, Euler’s and Modified Euler's method, Runge-Kutta 4th order method, Milne's predictor and corrector method (problems only).

UNIT-II
Numerical integration: 13 Hours
Trapezoidal rule, Simpson's one third rule, Simpson's three eighth rule and Weddle's rule (no derivation of any formulae)- problems.
Fourier Series:
Periodic functions, Conditions for Fourier series expansions, Fourier series expansion of continuous and functions having finite number of discontinuities, even and odd functions. Half-range series, practical harmonic analysis.

UNIT-III
Fourier transforms: 13 Hours
Infinite Fourier transforms and inverse Fourier transforms- simple properties, complex Fourier transform, Fourier sine and Fourier cosine transforms, Inverse Fourier sine and cosine transforms
Calculus of Variations
Variation of a function and a functional, extremal of a functional, variational problems, Euler's equation, standard variational problems including geodesics, minimal surface of revolution, hanging chain and Brachistochrone problems.

UNIT-IV
Partial Differential Equations: 13 Hours

Total 52 Hours

Resources:
1. Numerical Methods for Engineers by Steven C Chapra &Raymond P Canale.
4. Advanced Engineering Mathematics by E Kreyszig (John Wiley & Sons)
Question paper pattern for SEE
1. Total of eight questions with two from each unit to be set uniformly covering the entire syllabus.
2. Each question should not have more than four subdivisions.
3. Any five full questions are to be answered choosing at least one from each unit.

UAU302C: THERMODYNAMICS

4 Credits (4-0-0)

UNIT I

Fundamental Concepts & Definitions: Thermodynamics; definition and scope. Microscopic and Macroscopic approaches. Engineering Thermodynamics Definition, some practical applications of engineering thermodynamic. System (closed system) and Control Volume (open system); Characteristics of system boundary and control surface, examples. Thermodynamic properties; definition and units, intensive and extensive properties. Thermodynamic state, state point, state diagram, path and process, quasi-static process, cyclic and non-cyclic processes; Thermodynamic equilibrium; definition, mechanical equilibrium; dithermic wall, thermal equilibrium, chemical equilibrium- Zeroth law of thermodynamics, Temperature; concepts, scales, measurement. Internal fixed points.

Work & Heat: Mechanics, definition of work and its limitations. Thermo dynamic definition of work; examples, sign. Convention. Displacement work; at part of a system boundary, at whole of a system boundary, expressions for displacement work in various processes through pv diagrams. Shaft work; Electrical work. Other types of work. Heat; definition, units and sign convention.

UNIT II

First Law of Thermodynamics: Joule’s experiments, equivalence of heat and work. Statement of the First law of thermodynamics, extension of the First law to non-cyclic processes, energy, energy as a property, modes of energy, pure substance; definition, two-property rule, Specific heat at constant volume, enthalpy, specific heat at constant pressure..

Second Law of Thermodynamics: Significance of Second law. Kelvin Planck statement of the Second law of Thermodynamic; PMM I and PMM II. Clausius's statement .of Second law of Thermodynamic; Equivalence of the two statements; Reversible and irreversible processes; factors that make a process irreversible, reversible heat engines, Carnot cycle, Carnot principles.

UNIT III

Entropy: Clausiu's inequality; statement, proof, application to a reversible cycle. QR/T as independent of the path. Entropy; definition, a property, principle of increase of entropy, entropy as a quantitative test for irreversibility, calculation of entropy using Tds relations, entropy as a coordinate. Available and unavailable energy.

Pure substances: Entropy,T-S diagram, P-T and P-V diagrams, triple point and critical points. Sub cooled liquid, saturated liquid, mixture of saturated liquid and vapor, saturated vapor and superheated vapor states of a pure substance with water as example. Enthalpy of change of phase (Latent heat). Dryness factor (quality), T -S and h-s diagrams, representation of various processes on these diagrams. Steam tables and its use. Throttling calorimeter, separating and throttling calorimeter.

UNIT IV


Cycle Analysis: Otto, Diesel, Dual, and Brayton cycles, comparison of air standard, fuel air and actual cycles.

Total: 52hours

Text books
2. "Thermodynamics an engineering approach", by Yunus A. Cenegal
Reference Books:

**QUESTION PAPER PATTERN FOR SEE**

1. Total of 8 Questions with 2 from each unit to be set uniformly covering the entire syllabus.
2. Each Question should not have more than 4 sub divisions.
3. Any Five Full questions are to be answered choosing at least one from each unit.

**UAU303C: PRODUCTION TECHNOLOGY**
4 Credits (4-0-0)

**UNIT I**

13 hours


**Patterns**: Definition, functions, Materials used for pattern, various pattern allowances. Classification of patterns.

**Sand Moulding**: Types of base sand, requirement of base sand. Types of sand moulds, Moulding sand mixture ingredients (base sand, binder & additives) for different sand mixtures. Method used for sand moulding.

**Cores**: Definition, Need, Types. Concept of Gating & Risering. Principle involved. and types. Fettling and cleaning of castings. Casting defects & their causes.

**UNIT II**

13 hours

**Moulding Process**: Classification, Green sand, Core sand, Dry sand, and applications. Casting processes, Gravity die-casting, Pressure die casting, applications.

**Special manufacturing techniques**: Metal Forming, procedures, Application, rolling procedure, application. Powder metallurgy procedure and application. Hydro forming, extrusion.

**UNIT III**

13 hours


**Gas Welding**: Principle, Oxy - Acetylene welding. Reaction in Gas welding, Flame characteristics, Gas torch construction & working. Forward and backward welding.

**Special types of welding**: principles, Seam welding, Butt welding, Spot welding and projection welding. Friction welding, Explosive welding, Thermit welding, Laser welding and Electron beam welding.


**UNIT IV**

13 hours

**Theory of Metal Cutting**: Single point cutting tool nomenclature, geometry, orthogonal and oblique cutting, mechanism of chip formation, types of chips, Merchants analysis, Ernst-Merchant's solution, shear angle relationship, problems of Merchant's analysis, tools life criteria, Taylor's tool life equation, problems on tool evaluation. Machining processes and applications.

**Cutting tool materials**: Desired properties, typed of cutting tool materials - HSS carbides coated carbides, ceramics cutting fluids, desired properties, types and selection. Machinability, factors affecting machinability.

**Total**: 52 hours

**Text Books**:
Reference Books:


QUESTION PAPER PATTERN FOR SEE

1. Total of 8 Questions with 2 from each unit to be set uniformly covering the entire syllabus.
2. Each Question should not have more than 4 sub divisions.
3. Any Five Full questions are to be answered choosing at least one from each unit.

UAU304C: MECHANICS OF MATERIALS

4 Credits (4-0-0)

UNIT I

13hours


Stress in composite section: Volumetric strain, expression for volumetric strain, elastic constants, simple shear stress, shear strain, temperature stresses (including compound bars).

UNIT II

13hours

Compound stresses: Introduction, plane stress, stresses on inclined sections, principal stresses and maximum shear stresses, Mohr's circle for plane stress.

Thick and thin cylinders: Stresses in thin cylinders, changes in dimensions of cylinder (diameter, length and volume), Thick cylinders subjected to internal and external pressures (Lame's equation), (compound cylinders not included)

UNIT III

13hours

Bending moment and Shear force in beams: Introduction, Types of beams, loads and reactions, shear forces and bending moments, rate of loading, sign conventions, relationship between shear force and bending moments, shear force and bending moment diagrams for different beams subjected to concentrated loads, uniform distributed load (UDL) and couple for different types of beams.

Bending and shear stresses in beams: Introduction, theory of simple bending, assumptions in simple bending, relationship between bending stresses and radius of curvature, relationship between bending moment and radius of curvature, moment carrying capacity of a section, shearing stresses in beams, shear stress across rectangular, circular, symmetrical I and T sections. Frames and over hanging beams

UNIT IV

13hours

Deflection of beams: Introduction, differential equation for deflection, equations for deflections, slope and moments, double integration method for cantilever and simply supported beams for point load, UDL, UVL and couple, Macaulay's method.

Torsion of circular shafts and Elastic stability of columns: Introduction, pure torsion, assumptions, derivation of torsional equations, polar modulus, torsional rigidity / stiffness of shafts, power transmitted by solid and hollow circular shafts. Introduction to columns, Euler's theory for axially loaded elastic long columns, derivation of Euler’s load for various end conditions, limitations of Euler's theory, Rankine's formula.

Total: 52hours
Text Books:

Reference Books:

QUESTION PAPER PATTERN:
1. Total of 8 Questions with 2 from each unit to be set uniformly covering the entire syllabus.
2. Each Question should not have more than 4 sub divisions.
3. Any Five Full questions are to be answered choosing at least one from each unit.

UAU 315C: AUTOMOTIVE CHASSIS AND SUSPENSION
4 Credits (4-0-0)

UNIT I
13Hours
Layouts and Frames:
Types of automobiles, different automobile layouts; front wheel drive, rear wheel drive, four wheel drive, rear engine layout. Types of frames, materials, different loads on frame, cross members, channel sections, sub frames, passenger car frames, X member type frame, truck frames, box section type frame, testing of frames, bending and torsion test, body construction and repairs, frame alignment and frame defects.
Suspension:
Objects, basic considerations, types of suspension springs; construction, rigid axle suspension, operation, materials of leaf springs, coil springs, torsion bar, rubber springs, helper springs, air suspension, shock absorbers, independent suspension: front and rear, stabilizer bars, Active suspension systems, Suspension systems for commercial vehicles trouble shooting. Numerical problems.

UNIT II
13Hours
Steering systems:
Two wheeled steering system, four wheeled steering system, steering systems for multi axle vehicles and long wheeled chassis vehicles, steering mechanisms, correct steering angle, cornering force, self-righting torque, under steer and over steer, steering linkages, different types of steering gear boxes: rack and pinion, recirculating ball type, etc steering ratio, turning radius, steering adjustment, steering columns, power steering; hydraulic and electronic, advanced steering systems, trouble shooting of steering systems. EPAS Numerical problems.

UNIT III
13Hours
Brakes:

UNIT IV
13Hours
Wheels and tyres:
Types of wheels, construction, wheel dimensions, structure and function, desirable tyre properties types, materials, manufacture, designation, factors affecting tyre life, rotation and trouble shooting. Heat dissipation, wheel alignment, wheel balancing.
Front axle:
Types of front axle, stub axle, materials, loads and stresses, drive line, construction working of drive shaft, types of drive shaft
Rear Axle:
Types of drive, Torque reaction, driving thrust, construction of rear axle supporting–fully floating, semi floating, three quarter floating arrangements, trouble shooting. Numerical problems.

Total: 52Hours
TEXT BOOKS:
1. Automotive Chassis – P.M. Heldt, Chilton & Co.

REFERENCE BOOKS:
1. Automotive chassis and body – P.L. Kohli, TMH
2. Automotive mechanics – William Crouse
3. Introduction to automobile engineering – N.R. Khatawate, Khanna pub. New Delhi

UAU306C: MATERIAL SCIENCE & METALLURGY
3 Credits (3-0-0)

UNIT I
10 Hours
Structure of crystalline solids: Fundamental concepts of unit cell space lattice, Bravais space lattices, unit cells for cubic structure & HCP, crystallographic planes and directions, Miller indices, computation of the unit cell indices, calculations of radius, Coordination Number and Atomic Packing Factor for different cubic structures. Crystal imperfections-point, line, surface & volume defects. Diffusion: Diffusion Mechanism, Fick’s laws of diffusion.


UNIT II
10 Hours


UNIT III
10 Hours

Heat treatment of steel: Annealing, and its types, normalizing, hardening, tempering, martempering, austempering, surface hardening like case hardening, carburizing, cyaniding, nitriding Induction hardening, Hardenabilty, Jominy end-quench test, Age hardening of Al & Cu alloys.

UNIT IV
10 Hours

Total: 40hous

Reference Books:
1. **Review of graphic interface of the software**
   Review of basic sketching commands and navigational commands. Standard sheet templates, and creating new templates, different line types and their applications

2. **Section of solids**: sections of square pyramids, hexagonal prism, cones and cylinders.

3. **Orthographic views**: Conventions used in machine drawings. Sectional planes, Conversion of pictorial views into orthographic projections of simple machine parts with or without section (Bureau of Indian Standards conventions are to be followed for the drawings). Dimensioning and annotations


5. **Fasteners**:
   Hexagonal head bolt, nut and washer (assembly), square headed bolt and nut with washer (assembly) simple assembly using stud bolts with nut and lock nut. Flanged nut, slotted nut, taper and split pin for locking, counter sunk head screw, grub screw, Allen screw.

6. **Keys & Joints**
   Parallel key, Taper key, Feather key, Gibhead key and Woodruff key, cotter joint (socket and spigot), knuckle joint (pin joint) for two rods.

7. **Couplings**
   Split Muff coupling, protected type flanged coupling, pin (bush), type flexible coupling, Oldham's coupling and universal coupling (Hooks' Joint).

   **Assembly Drawings** (Part drawings should be given)

   1) Plummer block (Pedestal Bearing)
   2) Screw jack (Bottle type)
   3) Petrol Engine piston
   4) I.C. Engine connecting rod

**Laboratory Assessment:**

1. This subject is to be evaluated for 100 marks (50 CIE and 50 SEE)
2. Allocation of 50 marks for CIE
   - Performance and preparation of drawings:
     10 sheets manually drawn shall be submitted and each sheet shall be evaluated for 3 marks.
   - One practical test for 20 marks. (5 mark for conversion from isometric to orthographic, 15 marks assembly and printing).
3. The SEE practical is conducted for 50 marks of three hours duration. The distribution of marks as 30% from orthographic view, 70% for part modeling, assembling and creating 2 D views from assembly using CAD Software. No viva voce.
4. Question paper shall have two parts, questions for first part shall be asked from conversion of isometric to orthographic views and second part shall be asked from assembly.
5. Student should answer two questions choosing one question from each part. At least one question shall be asked from first 3 assemblies
UAU318L: MATERIAL TESTING LABORATORY.
1.0 Credit (0-0-2)

Part A
a. Tensile, and compression tests of metallic and non-metallic specimens using a Universal Testing Machine
b. Shear test of metallic and non-metallic specimens using a Universal Testing Machine
c. Torsion tests
d. Bending Test on metallic and nonmetallic specimens.
e. Izode and Charpy tests on M.S. Specimen.
f. Brinell, Rockwell and Vickers's Hardness test
h. Fatigue Test(demonstration)

Part-B
a) Demonstration of various models and linkage mechanisms
b) Mechanisms (One sheet each minimum of 8 mechanisms)
c) Velocity and acceleration diagrams (two sheets containing minimum of 4 problems in each sheet)
d) Problems in cam (one sheet containing four problems)

Laboratory Assessment:
1. Each Laboratory subject is evaluated for 100 marks (50 CIE and 50 SEE)
2. Allocation of 50 marks for CIE
   • Performance and journal write-up:
     Marks for each experiment = 30 marks/No. of proposed experiments.
   • One practical test for 20 marks. (5 write-up, 10 conduction, calculation, results etc., 5 viva-voce).
3. Allocation of 50 marks for SEE
   Part-A : 20 Marks
   Part-B : 20 Marks
   Viva-Voce : 10 Marks

UAU329L: MACHINE SHOP
1 Credits (0-0-2)

1. Introduction to lathe, milling machine, shaping machine, slotting machine and grinding machine (construction and working, operations)
3. Cutting of gear teeth using milling machine
5. Demonstration of surface grinding.

Laboratory Assessment:
1. Each Laboratory subject is evaluated for 100 marks (50 CIE and 50 SEE)
2. Allocation of 50 marks for CIE
   a. Performance and journal write-up:
      Marks for each experiment = 30 marks/No. of experiments.
   b. One practical test for 20 marks. (5 write-up, 10 conduction, calculation, results etc., 5 viva-voce).
3. Allocation of 50 marks for SEE
   Lathe work : 30 Marks
   Shaping or Milling : 10 Marks
   Viva-Voce : 10 Marks
1. **Differential Calculus:** 18 Hours

2. **Integral Calculus:** 11 Hours
   Reduction formula for functions $\sin^n x$, $\cos^n x$, $\tan^n x$, $\sin^m x \cos^n x$. and evaluation of these integrals with standard limits-problems. Double and Triple integrals simple problems(with standard limits). Beta and Gamma functions, properties, relation between Beta and Gamma functions simple problems.

3. **Higher Order Differential Equations:** 11 Hours
   Differential equations of second and higher orders with constant coefficients. Method of undetermined coefficients, Variation of parameters and Cauchy’s homogeneous linear equations.

**Resources:**

**Question Paper Pattern for SEE:**
1. Total of eight questions to be set, covering the entire syllabus.
2. Each question should not have more than 4 sub divisions.
3. Any five full questions are to be answered.
UMA401C: ENGINEERING MATHEMATICS-IV
4 Credits (4-0-0)

Course Objectives:
To enable the students to apply the knowledge of Mathematics in various Engineering fields by making them

- To identify the functions in engineering problems as analytic function and their study as a functions of a complex variables.
- to specify some difficult integration that appear in applications can be solved by complex integration.
- to understand the method of finding the series solution of Bessel’s and Legendre’s differential equations.
- to form a specific relation for the given group of data using least square sense method.
- to specify probability is an area of study which involves predicting the relative likely hood of various outcomes.

Course outcomes:
On completion of this course, students are able

- to solve Engineering problems using complex variable techniques.
- to evaluate the line integrals of a complex valued function.
- to apply series solution of Bessel’s and Legendre’s differential equations for BVP arising in cylindrical and spherical coordinate system respectively.
- to apply the least square sense method to construct the specific relation for the given group of data.
- to apply the concept of probability to find the physical significance of various distribution phenomena.

UNIT-I

Complex Variables: 13 Hours
Analytic function, Cauchy-Reimann equations in Cartesian and polar forms. Construction of analytic function (Cartesian and polar forms), Discussion of conformal transformations: $z^2$, $e^z$ and $z + a/z (z \neq 0)$, Bilinear transformations.

Complex Integration: Line integral, Cauchy's theorem - corollaries, Cauchy's integral formula. Taylor’s and Laurent's series (statements only), singularities, poles, calculation of residues, Cauchy's residue theorem (without proof) - problems.

UNIT-II

Special Functions: 13 Hours
Series solution of Bessel's differential equation, recurrence formulae, generating function, orthogonal property, Bessel's integral formula. Series solution of Legendre's differential equation, recurrence formulae, generating function, orthogonal property, Rodrigue's formula.

UNIT-III

Statistics and Probability: 13 Hours
Curve fitting by the method of least squares: $y = a + bx$, $y = ab^x$, $y = a + bx + cx^2$. Correlation, expression for the rank correlation coefficient and regression.
Probability: addition rule, conditional probability, multiplication rule, Baye’s rule.

UNIT-IV

Probability distributions: 13 Hours
Discrete and continuous random variables-Probability density function, Cumulative distribution Function, Binomial distributions Poisson distributions and Normal distributions

Joint Probability Distribution and Markov Chains:
Concept of joint probability, Joint distributions - discrete and continuous random variables, Independent random variables, Problems on expectation and variance.

Resources:
2. Theory and problems of probability by Seymour Lipschutz (Schaum’s Series).
3. Advanced Engineering Mathematics by H. K. Dass
4. Advanced Engineering Mathematics by E Kreyszig (John Wiley & Sons)
UAU402C: FLUID MECHANICS AND MACHINES
4 Credits (4-0-0)

UNIT I

Properties of Fluids: Introduction, properties of fluids, Classification of fluids, thermodynamic properties of fluids
Fluid Statics: Fluid pressure at a point, Pascal’s law, pressure variation in a static fluid, absolute, gauge, atmospheric and vacuum pressures, simple manometers, differential manometers, total pressure and center of pressure, vertical plane surface submerged in liquid, horizontal plane surface submerged in liquid, inclined plane surface submerged in liquid, curved surface submerged in liquid. Buoyancy, center of buoyancy, metacenter and metacentric height, conditions of equilibrium of floating and submerged bodies.

UNIT II

Fluid Kinematics: Types of fluid flow, flow net, continuity equation, continuity equation in three dimensions (Cartesian coordinate system only), velocity and acceleration, velocity potential function and stream function.
Dimensional Analysis: Introduction, derived quantities, dimensions of physical quantities, dimensional homogeneity, Buckingham’s-π theorem, Raleigh’s method, dimensionless numbers, similitude, types of similitude.

UNIT III

Fluid Dynamics: Introduction, equations of motion, Euler’s equation of motion, Bernoulli’s equation from Euler’s equation, Bernoulli’s equation for real fluids.
Flow through pipes: Frictional loss in pipe flow, Darcy- Equation for loss of head due to friction in pipes, Chezy’s equation for loss of head due to friction in pipes, hydraulic gradient and total energy line.
Laminar flow and viscous effects: Reynolds’s number, critical Reynolds’s number, Laminar flow through circular pipe-Hagen poiseulle’s equation, Laminar flow between parallel and stationary plates.

UNIT IV

Turbines: Classification, reaction, impulse turbine, outward and inward flow turbines, efficiency and power calculation.
Pumps:
a. Reciprocating pumps- work done, single acting and double acting, coefficient of discharge, percentage of slip, effect of acceleration, air vessels.
b. Centrifugal pumps, advantages of centrifugal pumps over reciprocating pumps, working of centrifugal pump, work done by the impeller, losses and efficiency, multistage pumps.
c. Gear pumps

Total 52 hours

References:
UNIT I
13 Hours

Introduction: Definitions: Link or element, kinematics pairs, degrees of freedom, Grubler's criterion (without derivation), Kinematic chain, Mechanism, structure, Mobility of Mechanism, Inversion, Machine.

Kinematic chains and inversions: Inversions of Four bar chain; Single slider crank chain and Double slider crank chain.
Mechanisms: Quick return motion mechanisms-Drag link mechanism, Whitworth mechanism and Crank and slotted lever Mechanism.

Straight line motion mechanisms: Peaucellier's mechanism and Robert's mechanism. Intermittent Motion mechanisms - Geneva mechanism and Ratchet and Pawl mechanism. Toggle mechanism, Pantograph, Ackerman steering gear mechanism.

UNIT II
13 Hours

Velocity and acceleration analysis of mechanisms (graphical methods)
Velocity and acceleration analysis of Four Bar mechanism, slider crank mechanism and Simple Mechanisms by vector polygons: Relative velocity and acceleration of particles in a common link, relative velocity and accelerations of coincident Particles on separate links- Corolis component of acceleration. Angular velocity and angular acceleration of links, velocity of rubbing.

Velocity analysis by instantaneous center method: Definition, Kennedy's Theorem, Determination of linear and angular velocity using instantaneous center method
Klein's construction: Analysis of velocity and acceleration of single slider crank mechanism

UNIT III
13 hrs

Velocity and acceleration analysis of mechanisms (analytical methods): Analysis of four bar chain and slider crank chain using analytical expressions. (use of complex algebra and vector algebra)

Spur gears: Gear terminology, law of gearing, Characteristics of involute action, Path of contact, Arc of contact, Contact ratio, Interference in involute gears, Methods of avoiding interference, Back lash, Comparison of involute and cycloidal teeth.

UNIT IV
13 Hours


Cams: Types of cams, Types of followers, Displacement, Velocity and Acceleration time curves for cam profiles. Disc cam with reciprocating follower having knife-edge, roller and flat-faced follower, Disc cam with oscillating roller follower, Follower motions including SHM, Uniform velocity, uniform acceleration and retardation and Cycloidal motion.

Total: 52 Hours

Text Books:


Reference books:


QUESTION PAPER PATTERN:

1. Total of 8 Questions with 2 from each unit to be set uniformly covering the entire syllabus.
2. Each Question should not have more than 4 sub divisions.
3. Any Five Full questions are to be answered choosing at least one from each unit.
UNIT I

13 Hours

Introduction: Classification of design, design procedure, standardization, preferred numbers. Selection of materials, manufacturing consideration in design.

Stresses in elementary machine parts: Definitions derived from stress - strain diagram, loads, stress, strain, stress strain diagrams. Factors of safety, Combined stresses, Eccentric loading, Theories of failure stress concentration and stress concentration factor, variable stresses, endurance limit, fatigue stress concentration factor, notch sensitivity, impact loading, design criteria.

UNIT II

13 Hours

Shafts: Introduction, material used for shafting, stresses in shafts, design of shafts, shafts subjected to twisting moment, bending moment. Combined bending and twisting moment, axial load in addition to bending and torsion, fluctuating loads, Design of shaft on the basic of rigidity ASME and ISI codes for design of transmission shafting.


UNIT III

13 Hours

Threaded fasteners and power screws: Uses of screw threads, design of screw threads, design of screw threads, threaded fasteners, effect of initial tension, effect of applied loads; bolt stress, bolt spacing, effect of dynamic loads, bolts subjected to shear and eccentric loading, bolts subjected to Shear eccentric loading, power screws; efficiency of screw threads', differential screws stress in power screws.

UNIT IV

13 Hours

Riveted joints: Types of joints, design stresses, design of typical joints, boiler joint, tank. and structural joints.

Welded joints: Types of joint deign stresses, design of typical joints, eccentrically loaded welded joints

Total: 52hours

Text books :
1. Theory and problems of Machine Design by Hall (Schaum's 'Outline)
2. Design of Machine Members by Vallance and doughtle

References:

QUESTION PAPER PATTERN:

1. Total of 8 Questions with 2 from each unit to be set uniformly covering the entire syllabus.
2. Each Question should not have more than 4 sub divisions.
3. Any Five Full questions are to be answered choosing at least one from each unit.
UNIT I

Introduction: Historical development of Automobiles. Types of power plant, principle of engine operation. Classification of engines; V-Engines, stratified charge engines, variable compression ratio engine.

Fuel air cycles: Uses of fuel air cycle, variation of specific heats, dissociation, comparison of PV diagram of air standard cycle and fuel air cycle for SI engine, thermal efficiency and fuel consumption, effect of variables.

Two stroke and four stroke engines: Principles of engine operation (SI and CI), scavenging systems, theoretical processes, parameters, relative merits and demerits, valve and port timing diagrams

UNIT II

Liquid Fuels: Properties and tests: Specific Gravity, viscosity, flash and fire points, calorific value, rating of fuels,

Petrol fuel: Octane no., chemical energy of fuels, reaction equation, volatility properties of A/F mixture, combustion temp, combustion charts


UNIT III

Diesel Fuels: Properties and rating of fuels; Cetane no, chemical energy of fuels, reaction equation, properties of A/F mixture, combustion temp, combustion charts. Vapor pressure, cloud and pour point, annealing point, diesel index, carbon residue.

Combustion in CI Engines: Stages of combustion, air fuel ratio in CI engines, delay period, variables affecting delay period, diesel knock, methods of controlling diesel knock, CI combustion chambers, open & divided. Induction swirl, turbulent combustion chambers, types, M-combustion chamber.

UNIT IV


Text books :

1. I.C. Engines By Mathur & Sharma, Dhanpat Rai & Sons, New Delhi, 1994

Reference books:
2. I.C. Engines by Lichty
4. Combustion fundamentals by Roger A Strehlow

QUESTION PAPER PATTERN:

1.Total of 8 Questions with 2 from each unit to be set uniformly covering the entire syllabus.
2.Each Question should not have more than 4 sub divisions.
3.Any Five Full questions are to be answered choosing at least one from each unit.
UNIT I

10 Hours

Standards of measurement: Definition and Objectives of metrology, Standards of length - International prototype meter, Imperial standard yard, Wave length standard, subdivision of standards, line gauges, and end standard, comparison, transfer from line standard to end standard, calibration of end bars (Numerical), Slip gauges, Wringing phenomena, Indian Standards (M81, M-112), Numerical problems on building of slip System of limits, Fits, Tolerances and gauging: Definition of tolerance, Specification in assembly, Principle of inter changeability and selective assembly limits of size, Indian standards, concept of limits of size and tolerances, compound tolerances, accumulation of tolerances, definition of fits, types of fits and their designation (IS 919 -1963), geometrical tolerance, positional - tolerances, hole basis system, shaft basis of system, classification of gauges, brief concept of design of gauges (Taylor's principles), Wear allowance on gauges, Types of gauges - plain plug gauge, ring Gauge, snap gauge, limit gauge and gauge materials

UNIT II

10 Hours


UNIT III

10 hours

Measurements and Measurement systems: Definition, Significance of measurement, generalized measurement system, definitions and concept of accuracy, precision, calibration, threshold, sensitivity, hysteresis, repeatability, linearity, loading effect, system response-times delay. Errors in Measurements, Classification of Errors. Transducers, Transfer efficiency, Primary and Secondary transducers, electrical, Mechanical, electronic transducers, advantages of each type transducers.


UNIT IV

10 hours

Measurement of Force and Torque, pressure: Principle, analytical balance, platform balance, proving ring, Torque measurement, Prony brake, hydraulic dynamometer. Pressure Measurements, Principle, use of elastic members, Bridgeman gauge, Pirani Gauge.

Temperature and strain measurement: Resistance thermometers, thermocouple, law of thermocouple, materials used for construction, pyrometer, Optical Pyrometer. Strain Measurements, Strain gauge, preparation and mounting of strain gauges, gauge factor, methods of strain measurement

Text books :

Reference Books:
1. ” Engineering Metrology” by I.c.Gupta, Dhanpat Rai Publications, Delhi
2. ”Mechanical measurements” by R.K.Jain
3. ”Industrial Instrumentation” Alsutko, Jerry. D.Faulk, Thompson Asia Pvt. Ltd.2002
4. “Measurement Systems Applications and Design” by Ernest 0, Doblin, McGRA W Hill Book

QUESTION PAPER PATTERN:
1.Total of 8 Questions with 2 from each unit to be set uniformly covering the entire syllabus.
2.Each Question should not have more than 4 sub divisions.
3.Any Five Full questions are to be answered choosing at least one from each unit.
UAA417L : FOUNDRY AND FORGING LABORATORY

1.5 Credit (0-0-3)

Part-A
1. Testing of Molding sand and Core sand
Preparation of sand specimens and conduction of the following tests:
   b. Permeability test
   c. Core hardness & Mould hardness tests.
   d. Grain fineness number test (Sieve Analysis test)
   e. Clay content test.
   f. Moisture content test.

Part-B
2. Foundry Practice
   a. Use of foundry tools and other equipments.
   b. Preparation of moulds using two molding boxes using patterns or without
      Patterns. (Split pattern, Match plate pattern and Core boxes).
   c. Preparation of one casting (Aluminum or cast iron-Demonstration only)

Part-C
3. Forging Operations
   Preparing minimum three forged models involving upsetting, drawing and bending operations.

Laboratory Assessment:
1. Each Laboratory subject is evaluated for 100 marks (50 CIE and 50 SEE)
2. Allocation of 50 marks for CIE
   Performance and journal write-up:
   Marks for each experiment = 30 marks/No. of experiments.
   One practical test for 20 marks. (5 write-up, 10 conduction, calculation, results etc.,5 for viva-voce.
3. Allocation of 50 marks for SEE

   Part-A : 20 Marks
   Part-B or Part-C : 20 Marks
   Viva-Voce : 10 Marks

UAA418L I.C. ENGINE AND FUELS LABORATORY.

1.5 Credits (0-0-3)

Part-A
Fuels Lab:
1. Determination of Flash point and Fire point of lubricating oil using Abel Pensky and Pensky Martins Apparatus.
2. Study the determination of Calorific value of solid, liquid and gaseous fuels.
3. Determination of Viscosity of a lubricating oil using Redwoods, Saybolt's and Viscometers
4. Valve, Timing opening diagram of an I.C. engine (4 stroke/2 stroke)

Part-B
Test on IC Engines:
   (a) Four stroke Diesel Engine
   (b) Four stroke petrol Engine.
   (c) Multi cylinder Diesel/Petrol Engine, (Morse test)
Two stroke Petrol Engine

Performance study against malfunctioning
Design of experimentation, emission tests.

**Laboratory Assessment:**

1. Each Laboratory subject is evaluated for 100 marks (50 CIE and 50 SEE).
2. Allocation of 50 marks for CIE Performance and journal write-up:
   - Marks for each experiment = 30 marks/No. of proposed experiments.
   - One practical test for 20 marks. (5 write-up, 10 conduction, calculation, results etc., 5 viva-voce).
3. Allocation of 50 marks for SEE
   - Part-A: 10 Marks
   - Part-B: 30 Marks
   - Viva-Voce: 10 Marks

**ADVANCED MATHEMATICS-II**

Subject Code: UMA400M

**Mandatory Subject**

1. **Solid Geometry:** 11 Hours
   - Distance formula (without proof), Division formula, direction cosines and direction ratios, planes and straight lines, angle between the planes.

2. **Vector Differentiation:** 10 Hours

3. **Laplace Transforms:** 19 Hours

**Resources:**


**Question paper pattern for SEE:**

4. Total of eight questions to be set, covering the entire syllabus.
5. Each question should not have more than 4 sub divisions.
6. Any five full questions are to be answered.