# Diploma in Mechanical Engineering

## 1st Semester

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<td>DME101</td>
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## 2nd Semester

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<td>PROJECT WORK &amp; VIVA – VOICE</td>
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SEMESTER 1

DME 101: BASIC MATHEMATICS

UNIT 1:

ALGEBRA
Laws of Indices - Formula of factorization and expansion ( (a^2-b^2), (a+b)^2 etc.) Laws of logarithm with definition of Natural and Common logarithm.

PARTIAL FRACTION
Definition of polynomial fraction proper & improper fractions and definition of partial fractions. To Resolve proper fraction into partial fraction with denominator containing non repeated linear factors, repeated linear factors and irreducible non repeated quadratic factors. To resolve improper fraction into partial fraction.

DETERMINANT AND MATRICES.
Determinant
Definition and expansion of determinants of order 2 and 3. Cramer’s rule to solve simultaneous equations in 2 and 3 unknowns.

Matrices
Definition of a matrix of order m X n and types of matrices. Algebra of matrices such as equality, addition, Subtraction, scalar multiplication and multiplication. Transpose of a matrix. Minor, cofactor of an element of a matrix, adjoint of matrix and inverse of matrix by adjoint method. Solution of simultaneous equations containing 2 and 3 unknowns by matrix inversion method.

BINOMIAL THEOREM
Definition of factorial notation, definition of permutation and combinations with formula. Binomial theorem for positive index. General term. Binomial theorem for negative index. Approximate value (only formula)

UNIT 2:

TRIGONOMETRY.
Measurement of an angle (degree and radian). Relation between degree and radian. Trig ratios of 00, 300, 450 etc. Fundamental identities.

TRIGONOMETRIC RATIOS OF ALLIED, COMPOUND, MULTIPLE & SUBMULTIPLE ANGLES
(Questions based on numerical computations, which can also be done by calculators, need not be asked particularly for allied angles).

FACTORIZATION AND DEFACTORIZATION FORMULAE
INVERSE TRIGONOMETRIC RATIOS
Definition of inverse trigonometric, ratios, Principal values of inverse trigonometric ratios. Relation between inverse trigonometric ratios.

PROPERTIES OF TRIANGLE
Sine, Cosine, Projection and tangent rules (without proof) - Simple problems.

UNIT 3:

COORDINATE GEOMETRY
POINT AND DISTANCES
Distance formula, Section formula, midpoint, centroid of triangle. Area of triangle and condition of collinearity.

STRAIGHT LINE
Slope and intercept of straight line. Equation of straight line in slope point form, slope-intercept form, two-point form, two-intercept form, normal form. General equation of line. Angle between two straight lines condition of parallel and perpendicular lines. Intersection of two lines. Length of perpendicular from a point on the line and perpendicular distance between parallel lines.

CIRCLE
Equation of circle in standard form, centre – radius form, diameter form, two – intercept form. General equation of circle, its centre and radius.

UNIT 4:

VECTORS
Definition of vector, position vector, Algebra of vectors (Equality, addition, subtraction and scalar multiplication) - Dot (Scalar) product with properties. Vector (Cross) product with properties.
Applications
Workdone and moment of force about a point & line

DME102: COMMUNICATION SKILLS

UNIT 1:
Introduction to communication:
Definition , communication cycle/ process, The elements of communication : sender- message – channel- Receiver –Feedback & Context. Definition of communication process. Stages in the process : defining the context, knowing the audience, designing the message, encoding , selecting proper channels, transmitting, receiving, decoding and giving feedback.

UNIT 2:
Types of communication
Formal- Informal, Verbal- Nonverbal, Vertical- horizontaldiagonal
UNIT 3:
Principals of effective communication:
Definition of effective communication - Communication barriers & how to overcome them.
Developing effective messages: Thinking about purpose, knowing the audience, structuring the message, selecting proper channels, minimizing barriers & facilitating feedback.

UNIT 4:
Non verbal- graphic communication:

UNIT 5:
Formal written skills:

DME 103: PHYSICS – I

UNIT 1:
UNITS AND DIMENSIONS
Fundamental and derived units in Si System, Dimensions of Physical Quantitites, Principle of homogeneity - Dimensional equation, Applications of dimensional analysis: Checking the correctness of physical equations, Derivation of simple physical relations, Limitation of Dimensional Analysis, significant figures and Error Analysis.

FORCE AND MOTION
Scalars and Vectors, Velocity & acceleration, Equations of motion, Newton’s law of motion, Force & its derivation from Newton’s laws of motion, Composition and resolution of forces, Parabolic Motion - Horizontal projection and projection at an angle, time of flight, Horizontal range and maximum horizontal range, Simple Problems, Centripetal acceleration, centripetal and centrifugal forces, Concept of friction and its application. Application to banking of roads.

UNIT 2:
WORK, POWER AND ENERGY
Work and its Units, Work done on bodies moving on horizontal and inclined planes (consider frictional forces also). Concept of Power and its units, Calculations of power (simple cases). Concept of Kinetic energy and potential energy Expressions for P.E and K.E, Conservation of energy in the case of freely falling bodies, Principle of conservation of energy.

ROTATIONAL AND SIMPLE HARMONIC MOTIONS
Definition of moment of inertia, Moment of inertia of disc, ring & sphere, Torque and angular momentum and their inter relation, Principles of conservation (angular momentum and its applications). Kinetic energy of rolling body, S.H.M – derivation of displacement, velocity,
acceleration, time period and frequency, Motion of cantilever, Free, forced and resonant vibrations (No derivation).

UNIT 3:
HEAT
TEMPERATURE AND ITS MEASUREMENT
Concept of heat and temperature on the basis of K.E. of molecules. Unit of heat Basic Principles of measurement of temperature, Thermocouple, Bimetallic and resistance, Pyrometers and Thermometers - Criteria for the selection of thermometers.
EXPANSION OF SOLIDS
Coefficient of linear, Surface and cubical expansions and relation amongst them,
Thermal stresses (qualitative only) and their applications.

UNIT 4:
HEAT TRANSFER
Three modes of transfer of heat, Coefficient of thermal conductivity, its determination by Searle’s method and Lee’s disc method. Conduction through compound media (Series and parallel for two materials only), Heat radiation, Characteristics of heat radiations, Prevost’s theory of heat exchange, Black body radiations, Emissivity and absorbitivity - Kirchoff’s law and stefan’s law of radiation.

DME 104: CHEMISTRY – I

UNIT 1:
STRUCTURE OF ATOM
Chemistry as important branch of science, Basic concept of Elements Mixture and compound,
Chemical Equation, its balancing , implications and limitations.
Recapitulation of Fundamental Particles of atom i.e electron. Proton and neutron.

UNIT 2:
CHEMICAL EQUATION, OXIDATION & REDUCTION
Concept of Oxidation & Reduction.
Electronic concept of oxidation and reduction.
Redox reactions (direct and indirect).
Oxidation No. balancing of simple redox reactions by oxidation No.

UNIT 3:
IONIC EQUILIBRIUM
Ionization., degree of ionization, Focus effecting ionization
Ionization of water, ionization equilibrium in aqueous solutions, common ion effect
ACIDS AND BASES
Concept of acids and bases, their strength in ionization constant. PH value, acid base titration, choice of indicators. Hydrolysis - Buffer solution.

ELECTROLYSIS
Concept of electrolysis. Faraday’s law of electrolysis. Engineering applications (electrometallurgy, electroplating & electorefining)

UNIT 4:
WATER
Hard and soft water, removal of hardness by:
a. Soda lime process.
b. Permutit’s process.
c. Ion exchange method. Disadvantages of hard water in industrial use, boiler scales, priming, foaming corrosion and caustic embrittlement. Expressing the degree of hardness of water in (with simple problems)
a. Clark’s degree
b. O’Hener’s method
Determination of degree of hardness by (with simple problems):
a. Soap titration method:
b. O’Hener’s method:
Water for drinking purposes.

SOLUTIONS & COLLOIDS
Solute, solvent, solution & colloids. Particle size and colloidal state - Tyndell effect, Brownian movement, coagulation.

DME 105: ENGINEERING DRAWING – I

Drawing Instruments and their uses
1.1 Letters and numbers (single stroke vertical)
1.2 Convention of lines and their applications.
1.3 Scale (reduced, enlarged & full size) plain scale and diagonal scale.
1.4 Sheet layout.
1.5 Introduction to CAD (Basic draw and modify Command).
1.6 Geometrical constructions.

Engineering curves & Loci of Points.
1.2 To draw an ellipse by
2.1.1 Directrix and focus method
2.1.2 Arcs of circle method.
2.1.3 Concentric circles method.
2.2 To draw a parabola by:
2.2.1 Directrix and focus method
2.2.2 Rectangle method
2.3 To draw a hyperbola by:
2.3.1 Directrix and focus method
2.3.2 passing through given points with reference to asymptotes
2.3.3 Transverse Axis and focus method.
2.4 To draw involutes of circle & polygon (up to hexagon)
2.5 To draw a cycloid, 21picycloids, hypocycloid
2.6 To draw Helix & spiral.
2.7 Loci of Points:
2.7.1 Loci of points with given conditions and examples related to simple mechanisms.

Orthographic projections
3.1 Introduction to Orthographic projections.
3.2 Conversion of pictorial view into Orthographic Views (First Angle Projection Method Only)

**DME 106: PHYSICS LAB – I**

1. To determine the density of a cylinder using vernier calipers and balance.
2. To determine area of cross section of wire using screw gauge.
3. To determine the thickness of glass piece using spherometer.
4. Calculation and verification of period of vibration of a cantilever (use graph)
5. Verify Parallelogram law of forces.
6. Measurement of K.E. gained by a body dropped through height h.
7. To find the coefficient of linear expression of given rod.

**DME 107: CHEMISTRY LAB – I**

1. Introduction of basic concepts of volumetric analysis & other related equipment.
2. Find the strength in grams per litre of the given solution or sodium hydroxide with the help of standard oxalic acid solution.
3. Find the strength of sulphuric acid in grams per litre using standard oxalic acid solution and an intermediate alkali solution indicator phenolphthalein.
4. Determine the strength of oxalic acid solution in grams per litre using standard sulphuric acid, indicator methyl orange.
5. Determine the total alkalinity in ppm in the given sample of water by soap solution method.
6. Estimate the total hardness of a sample of water by soap solution method.
7. Estimate the amount of chlorides present in water using silver nitrate solution. Indicator potassium chromate.
8. Determine percentage purity of commercial samples like blue vitrol and green vitrol volumetrically.
9. Qualitative analysis of some important acidic & basic radicals with direct testing with demonstration of group analysis.
SEMESTER 2

DME 201: MATHEMATICS – I

UNIT I:
Function and Limit
Function
Definitions of variable, constant, intervals such as open, closed, semi-open etc.
Definition of Function, value of a function and types of functions,
Simple Examples.
Limits
Definition of neighborhood, concept and definition limit.
Limits of algebraic, trigonometric, exponential and logarithmic functions with simple examples.

UNIT 2:
Derivatives
Definition of Derivatives, notations.
Derivatives of Standard Functions
Rules of Differentiation. (Without proof). Such as Derivatives of Sum or difference, scalar multiplication, Product and quotient.
Derivatives of composite function (Chain rule)
Derivatives of inverse and inverse trigonometric functions.
Derivatives of Implicit Function
Logarithmic differentiation
Derivatives of parametric Functions.
Derivatives of one function w.r.t another function
Second order Differentiation.

UNIT 3:
Statistics And Probability
Statistics
Measures of Central tendency (mean, median, mode) for ungrouped and grouped frequency distribution.
Graphical representation (Histogram and Ogive Curves) to find mode and median
Measures of Dispersion such as range, mean deviation, Standard Deviation, Variance and coefficient of variation. Comparison of two sets of observations.
Probability
Definition of random experiment, sample space, event,
Occurrence of event and types of events (impossible, mutually exclusive, exhaustive, equally likely).
Definition of Probability, addition and multiplication theorems of Probability

UNIT 4:
Applications of Derivative
Geometrical meaning of Derivative, Equation of tangent and
Normal
Rates and Motion
Maxima and minima
Radius of Curvature

**Complex number**
Definition of Complex number. Cartesian, polar, Exponential forms of Complex number.
Algebra of Complex number (Equality, addition, Subtraction, Multiplication and Division)
De-Moivre’s theorem (without proof) and simple problems.
Euler’s form of Circular functions, hyperbolic functions and relations between circular & hyperbolic functions

**UNIT 5:**
**Numerical Solution of Algebraic Equations**
Bisection method, Regula-Falsi method and Newton-Raphson method

**Numerical Solution of Simultaneous Equations**
Gauss elimination method
Iterative methods-Gauss Seidal and Jacobi’s method

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**DME 202: APPLIED PHYSICS – II**

**UNIT 1:**
**Waves**
Sound and light as waves frequencies, wavelength and velocities and their relationship.

**UNIT 2:**
**Applications of Sound**
**Ultrasonics**
(a) Production of ultrasonic waves by using magnetostriction and piezo – electric methods.
(b) Applications to drilling cold welding, cleaning, flaw detection and exploration (Sonar).
**Acoustics**
(a) Reflection, refraction and absorption of sound waves by surfaces.
(b) Echo and reverbration.

**Applications of Light**
Refraction and refractive index.
Defects in image formation (Qualitative), Simple and compound microscope, astronomical and Galilean telescopes and their magnifying powers.

**Electrostatics**
Coloumb’s law, Unit charge - Electric field and Electric lines of force. Electric intensity due to charged straight conductor and plane sheet. Capacitance and its units, Parallel plate capacitor.
Grouping of capacitors in series and parallel (simple problems). Dielectric constant its functions.
UNIT 3:
D.C. Circuits

UNIT 4:
Electromagnetism

Modern Physics
Introduction to laser, its characteristics and important applications. Introduction to common modes of communication, viz Fax, Email, Internet etc.

DME 203: CHEMISTRY – II

Module 1:
Water covering, Types of hardness- Units, Determination of hardness by EDTA method, Alkalinity of water and its significance, Numerical problems. Softening methods and Numerical problems based on these methods; Membrane-based processes; Problems with Boiler feed water and its treatments, Specifications for drinking water (BIS and WHO standards), Chlorination of Water; Sources and quality of drinking water, concept of water drainage systems; Concept of water harvesting, storage and recycling; Nature and uses of sludge obtained on treatment of municipal and industrial effluent water, role of a-forestation for water recycling; Toxicity of water; Sources of water pollutants, water pollution through analytical laboratories in schools, colleges and universities, measures for minimization and recycling of laboratory waste water.

Module 2:
Polymers & Composites covering, Basics of Polymer Chemistry, Molecular weight, Molecular shape, Crystallinity, Glass transition temperature and melting point, Visco-elasticity, Structure-property relationship; Methods of polymerization, Thermoplastics and Thermo-sets, Copolymerization, Elastomers-Structure, Applications, curing techniques; Advanced polymeric materials; Conducting polymers, Liquid crystal properties. Dendrimers and their difference from polymers, degradable polymer materials, solubility of polymeric & dendrimeric molecules, physicochemical properties of polymers; Fabrication of polymers-Compression/Injection/Extrusion moulding. Synthesis, Properties and Uses of PE, PVC, PMMA, Formaldehyde resins; Melamineformaldehyde-urea resins, adhesives and their adhesive mechanism; Composites- Basics of composites, Composition and Characteristic properties of composites; Types of Composites-Particle, Fibre, Reinforced, Structural, & their applications; Metallic and non-metallic fillers, molecular and oligomerization mechanism, nano-composites.
Module 3:
*Surfactants and Lubricants* covering, Surface active agents- Methods of preparation of soap, Cleaning mechanism, Types and advantages of detergents; Critical miceller concentration, hydrophilic and hydrophilic interactions. Frigoohestiy of surfactant solutions, HLB values; Lubricants- Concept of tribology; Types of lubricants and Mechanism of lubrication, Physical and Chemical properties of lubricants, Additives of lubricants, Selection of lubricants, freezing points of lubricants.

Module 4:
*Biotechnology* covering, Significance and application of Biotechnology, Bio-reactors, Biotechnological processes; Fermentation, Production of Alcohol, Production of Vitamins; Industrial enzymes, Bio-fuels, Biosensors, Bio-fertilizers, Bio-surfactants; Applications of Biochips; Intra-molecular multiple force theory (IMMFT) of Bio-surfactants. *(6 Lectures)*

Module 5:
*Green Chemistry* covering, Introduction, Significance and latest research in this field; Various Industrial applications of green chemistry; Green technology- Latest green laboratory technology for saving experimental resources and infrastructural framework; R4M4 (Reduce, Reuse, Recycle, Redesign; Multipurpose, Multidimensional, Multitasking, Multi-tracking;) model with special reference of survisimeter, econoburette; Safer Technique for Sustainable Sodium Extract Preparation for Extra Elements Detection; Concept of molecular and atomic economy & its use in green chemistry; Life cycle analysis technique (cradle to grave approach) *(6 Lectures)*

Module 6:
*Instrumental Techniques* covering, Fundamentals of Spectroscopy; Principles and applications of UV-visible, IR & Atomic absorption Spectroscopy; Flame photometry; Principles and applications of chromatographic techniques including Gas, Column, HPLC. NMR & DSC working.

**DME 204: CONCEPTS IN INFORMATION TECHNOLOGY**

Unit I
**Concepts in computer & Programming; Computer Appreciation:** Definition of electronic Computer, Generations, Characteristic and Application of Computers, Computer Hardware, CPU, RAM/ROM, Various I/O devices, Software Definition, Role and Categories.

Unit II
**Number System:** Various codes, decimal, binary, octal, hexadecimal conversion.

Unit III
DME 205: APPLIED MECHANICS

Unit – I
Concept of mechanics and applied mechanics - Explanation of Mechanics and applied - Mechanics, its importance and necessity, giving suitable examples on bodies at rest and in motion, - explanation of branches of this subject - Concept of rigid bodies.

Unit – II
Laws of Forces - Force and its effects, units and measurement of force, characteristics of force vector representation - Bow’s notation, Types of forces, action and reaction, tension, thrust and shear force - Force systems: Coplanar and space force systems - Coplanar concurrent and non-concurrent forces. Free body diagrams, Resultant and components concept of equilibrium - Parallelogram law of forces - Equilibrium of two forces, superposition and transmissibility of forces - Newton's third law, triangle of forces, different cases of concurrent coplanar, two force systems, extension of parallelogram law and triangle law to many forces acting at one point - polygon law of forces, method of resolution into orthogonal components for finding the resultant, graphical methods, special case of three concurrent coplanar forces - Lami’s theorem.

Unit - III
Concept of moment - Varignon’s theorem (statement only) - Principle of moments –application of moments to simple mechanism - parallel forces - calculation of their resultant - concept of couple properties and effect - moving a force parallel to its line of action - general cases of coplanar force system - general conditions of equilibrium of bodies under coplanar forces.

Concept of friction, laws of friction, limiting friction and coefficient of friction, sliding friction.

Unit - IV
Concept of gravity - gravitational force, centroid and center of gravity - centroid for regular lamina and center of gravity for regular solids - Position of center of gravity of compound bodies and centroid of composition area - CG of bodies with portions removed.
Unit - V

Laws of Motion - Concept of momentum - Newton’s laws of motion & their application - derivation of force equation from second law of motion - numerical problems on second law of motion, piles, lifts and bodies tied with string - Newton's third law of motion and numerical problems based on it - conservation of momentum - impulsive force (definition only).

Concept of machine - mechanical advantage, velocity ratio and efficiency of a machine their relationship - law of machine - simple machines (lever, wheel and axle, pulleys, jacks winch crabs only)

DME 206: ENGINEERING DRAWING – II

Sections - Importance and salient features, Methods of representing sections, conventional sections of various materials, classification of sections, conventional in sectioning. Drawing of full section, half section, partial or broken out sections, offset sections, revolved sections and removed sections. Drawing of different conventions for materials in section, conventional breaks for shafts, pipes, rectangular, square angle, channel, rolled sections. Exercises on sectional views of different objects.

Isometric Views - Fundamentals of isometric projections (Theoretical Projections) Isometric views from 2 to 3 given orthographic views. Preparation of simple working drawing of Furniture items like table, stool and any job prepared in the workshop.

Development of Surfaces - Parallel line and redial line methods of development. Development of simple and truncated surfaces (Cube, prism, cylinder, cone and pyramid).

DME 207: PHYSICS LAB – II

1. To find the diameter of wire using a screw gauge.
2. To find volume of solid cylinder and hollow cylinder using a vernier caliper.
3. To determine the thickness of glass strip and radius of curvature of a concave surface using a spherometer.
4. To verify the parallelogram law of forces.
5. To determine the atmospheric pressure at a place using Fortin’s Barometer.
6. To determine the surface tension of a liquid by capillary rise method.
**DME 208: CHEMISTRY LAB – II**

1. To determine the Chloride content in supplied water sample by using Mohr’s methods.
2. Determination of temporary hardness of water sample by O-Hener’s method.
3. To determine the total hardness of water sample in terms of CaCO3 by EDTA titration method using EBT indicator.
4. To determine the percentage of available Chlorine in the supplied sample of Bleaching powder.

**DME 209: INFORMATION TECHNOLOGY LAB**

1. Create a document using functions: Save as, page number, Bullets and numbering.
2. Create a document using styles and Formatting options.
3. Create a document using different fonts.
4. Create a document, using the function page set up, & page preview, and then print that document.
5. Create a table & perform operation in it.
6. Create a table, chart in excel and implement all formula as addition, subtraction, multiplication and division.
7. How to use Mail Merge in MS Word.
8. Create a Power point presentation using slide designing.
9. Create, Save & print the power point presentation.
10. Create a power point presentation using clipart, Word art gallery & then add transition & Animation effects.
SEMESTER 3

DME 301: MATHEMATICS - II

Unit – I

DIFFERENTIAL CALCULUS: Concept of limits with standard limits. Differentiation by definition of $x^n$, $\sin x$, $\cos x$, $\tan x$, $e^x$, differentiation of sum, product and quotient of functions, differentiation of function as a function, differentiation of trigonometric inverse functions, logarithmic differentiation, successive differentiation (excluding $n^{th}$ order).

Applications: rate measure, Errors, Maxima and minima. Equation of tangent to a curve for the explicit functions and equation of normal. Newton’s method of solving equation using the formula $f(a)/f'(a)$.

Unit – II

Integral calculus: Integration as inverse operation of differentiation. Simple integration by substitution by parts and by partial fraction (for linear factors) only. Evaluation of definite integral

$$\int_0^{\pi/2} \sin^n x \, dx, \int_0^{\pi/2} \cos^n x \, dx, \int_0^{\pi/2} \sin^n x \cos^n x$$

Using formula without proof.

Applications: Area bounded by a curve and axes, volume of solid formed by revolution of an area about axes, centre of gravity, moment of inertia, average value, root mean square of a function, gamma function.

Unit – III

Differential equation: Concept of formation of differential equation and solution of first order differential equation, Variable separation, homogeneous differential equation, linear differential equation, solution of linear differential equation.

Unit – IV

Matrix: Addition, subtraction, multiplication, rank of matrix.

DME 302: THERMODYNAMICS

Unit – I
Basic Concepts and Gas Laws - Gas laws: Boyle's laws, Charle's law, Characteristics equation, Gas Constant, Universal Gas constant, Thermodynamics property, system (open and closed), surroundings, Heat and work, specific heat

Laws of Thermodynamics and Processes - Explanation of the zeroth law of thermodynamics, Explanation of first law of thermodynamics. Concept of enthalpy, internal energy, specific heat, work and heat. Clausius and Kelvin Plank statements of second law of thermodynamics. Concept of Entropy, Constant volume, Constant pressure, isothermal, adiabatic and polytropic processes, throttling and free Expansion, work done under these processes.

Unit – II

Formation of steam and its properties - Steam formation, Wet steam, dry steam and saturated steam; Dryness fraction, super heated steam; Degree of super heat, Latent heat of vaporisation. Entropy increase during evaporation, Temperature Entropy diagram, Mollier Diagram (HS diagram)

Unit - III


Unit – IV


Unit – V


DME-303 MECHANICS OF SOLIDS

Unit - I

Properties of Materials - Classification of materials, elastic materials, plastic materials, ductile materials, brittle materials. Tensile test, compressive test, impact test, fatigue test, torsion test - Simple Stresses and Strains - Concept of stress, normal and shear stresses due to torsion Concept of strain, strain and deformation, longitudinal and lateral strain, poison's ratio, Volumetric strain Hooke's law, modulus of elasticity and rigidity, Bulk modulus of elasticity, relationship between the elastic constants. Stresses and strains in bars subjected to tension and compression. Extension of uniform bar under its own weight, stress produces in compound bars (two or three) due to axial load. Stress strain diagram for mild steel, mechanical properties, factor of safety Temperature stresses and strains

Unit - II

Bending Moment and Shear Force - Concept of a beam and supports (Hinges, Roller and Fixed), types of beams: simply supported, cantilever, fixed and continuous beams .Types of loads (point, uniformly distributed and varying loads) Concept of bending moment and shear force, sign conventions ,Bending Moment and shear force diagrams for cantilever, simply supported and overhanging beams subjected to concentrated, uniformly distributed and uniformly varying loads
B.M. and S.F. diagrams should preferably be drawn on graph paper. Relationship between load, shear force and bending moment, point of maximum bending moment and contra flexure.

Unit – III

Second Moment of Area - Concept of second moment of area, radius of gyration Theorems of parallel and perpendicular axes Second moment of area for sections of Rectangle, Triangle, Circle, Trapezium, Angle, Tee, I, Channel and Compound sections. (No derivation) - Bending and Shear Stresses - Theory of simple bending Application of the equation M / I = sigma / Y = E/R (No derivation is required) Moment of resistance, sectional modulus and permissible bending stresses in circular, rectangular, I, T and L sections; Comparison of strengths of the above sections.

Unit - IV

Slope and Deflection - Necessity for determination of reflection Moment area theorems (no derivation) - Computation of slopes and deflections using moment area theorems for: (a) Simple supported beam with UDL over entire span and concentrated load at any point (c) Cantilever with UDL over entire span and concentrated load at free end – Columns - Theory of columns, Euler, Rankine’s and I.S. formulae.

Unit - V

Combined Direct and Bending Stresses - Concentric and eccentric loads, eccentricity - Effect of eccentric load on the section, stresses due to eccentric loads, examples in the case of short columns. Effect of wind pressure on walls and chimneys; Water pressure on dams and earth pressure on retaining walls their causes of failures and their stability - Analysis of Trusses - Concept of a frame, redundant and deficient frame, End supports, ideal and practical trusses. Analysis of trusses by: (i) Methods of joints (ii) Method of sections and (iii) Graphical method

DME 304: ELECTRICAL & ELECTRONICS ENGINEERING

Unit-1

D.C motors - principles of operation - back emf - lap and wave winding - commutator-speed and torque equations-method of speed control-speed torque characteristics of series, shunt and compound motors@ - efficiency - swin burnes test - application of d.c motors-starters-necessity and use-types of starters and connections.

Unit-2

Transformer - working principle - phasor diagram for no load and loaded conditions-equivalent circuit-o.c and s.c tests - efficiency and voltage regulation - auto transformer-three phase transformers-constructional features-connections - line voltage and current relations.

Unit-3

Alternators - principle of operation and constructional features- salient and non-salient pole machines-voltage regulation - emf method-synchronous motor - phasor diagram-power factor control-application.

Unit-4

p-n junction - characteristics and uses of semi conductor devices: diode, photo diodes,zener diodes,bjt,fet,ujt & scr, rectifier circuits-half wave, full wave and bridge-filters-zener voltage regulators.

Unit-5

Transistorized amplifiers and oscillators: classification and characteristics - voltage, current and power gain-frequency response-audio amplifier-principle of negative feedback-emitter follower-power amplifier-class a,b,c-applications – oscillators - rc phase shift-Hartley and ujt oscillators.

DME 305: MATERIAL SCIENCE

Unit – 1


Unit – 2

Description of material properties like strength, hardness, toughness, ductility, brittleness their importance in engineering application of materials and manufacturing quantitative evaluation of these properties with destructive testing methods

Unit -3

Plastic deformation mechanism of plastic deformation, role of dislocations, slip and twinning, strain hardening and recrystallisation. Elementary treatment of creep, fatigue and fracture.

Phase diagrams – phase and phase equilibrium: solidification of pure metals and alloys, phase diagrams. Eutectic, eutectoid, peritectic and peritectoid system.allotropy of iron and Fe-C diagram.

Unit – 4

Unit – 5

Engineering materials: ferrous, cast iron, carbon and alloy steel and their coding. On -ferrous: aluminum, copper, nickel, chromium, zinc, lead, tin, tungsten etc. and their alloys, classification, structure, general properties and applications of polymers, ceramics and composites.

DME306 MACHINE DRAWING

UNIT-I

Free hand sketches:


Coupling and Joints:


UNIT-II

Orthographic and Assembly drawings.

To draw orthographic views from the given isometric views of simple objects. Detailed assembly drawing of and additional views from the given drawing.

a) Shaft coupling – Protected type and pin type flexible coupling.
b) Bearings and supports – bushed bearing, foot step bearing and plummer block.
c) Steam engine stuffing box
d) Screw jack

Production Drawing:

a) Side Crank
b) Universal coupling

c) Petrol engine connecting rod

**DME 307: WORKSHOP PRACTICE - I**

The objective of this practical Course is to provide the basic concepts about tools used in an Engineering Workshop. Detailed concepts are proposed in all the major trades of current interest.

**Module 1:**
*Mechanical Engineering* covering, the following trades for experiments (with a minimum of two exercises under each trade) - Carpentry, Fitting, Tin-Smithy and Development of jobs carried out and soldering, Black Smithy, House Wiring, Foundry (Moulding only), Plumbing;

**Module 2:**
*Mechanical Engineering* covering, the following trades for demonstration for exposure - Power tools in Construction, Wood working, Electrical and Mechanical Engineering practices;

**DME 308: APPLIED MECHANICS LAB**

**SIMPLE MACHINES:**

- To find the Mechanical advantage and efficiency of simple screw jack, compound screw jack, worm wheel, differential wheel and axle.
- To find the reaction at supports of a simply supported beam carrying point loads only.
- To find the forces in the jib & tie of a jib crane.
SEMESTER 4

DME 401: FLUID MECHANICS

UNIT I:

UNIT II:

UNIT III:
Viscous Flow: Flow Regimes and Reynolds’s Number, Relationship Between Shear Stress and Pressure Gradient, Unidirectional Flow Between Stationary and Moving Parallel Plates, Movement Of Piston In a dashpot, Power absorbed in Bearings. Flow Through Pipes: Loss of Head due to friction, Bend and Elbows, Sudden Enlargement, Sudden Contraction, Obsoletion and at Entrance, Darcy Weisbach formula, Co-Efficient of Friction, Flow through Compound Pipes, Siphon.

UNIT IV:
UNIT V:
Buckingham's Theorem - Physical Significance of Dimensionless Number - Mach number - Reynolds Number - Froude Number and Weber Number.

DME402 HEAT ENGINEERING – I

UNIT-I

UNIT-II

UNIT-III

UNIT-IV

UNIT-V

DME403 MANUFACTURING PROCESS – I

UNIT-I FOUNDRY
UNIT-II METAL FORMING

Hot and cold working – principles of forging, rolling and extrusion process – conditions for yielding of metals – stress-strain relations in elastic and plastic deformations – basics of explosive forming.


UNIT-III WELDING

Oxy-acetylene gas welding – types of flames and their uses – principles of arc welding, resistance welding – TIG and MIG welding and atomic hydrogen welding – Basics of explosive welding – soldering and brazing.

UNIT-IV MACHINE TOOLS-I


Shaper, Planner and Slotter – General arrangement – principle of operation – drive mechanisms.

UNIT-VMACHINE TOOLS-II

Milling, Drilling, Boring and Sawing Milling Machines: Types and specification – operations – types of cutters – attachments and accessories – example of work.


Sawing: power saws – types and principle of operation.

DME404: INDUSTRIAL ENGINEERING AND MANAGEMENT

UNIT-I Management

Functions of management, scientific management Contributions of F.W.Taylor, Frank & Lilian Gilbreth, H. Grantt, Henry Foyal’s principles of management.

Management by objectives (MBO), Management by exception (MBE) – Strategies and policies – Decision making &group decision making – Line & staff functions – Organizational development.

Comparative and international management – Management information system (MIS) – information system – systems modeling for MIS – data base managements systems.
UNIT-II Engineering Economics

Nature and scope of managerial economics – basic economic tools in managerial economics – introduction to macro & micro economics.

Law of demand & supply, elasticity – determinants and uses.

Cost and Revenue: average, total, marginal and fixed cost concepts – Average, Marginal and Total revenue concepts – their significance.

Market conditions: perfect, monopoly, monopolistic & oligopoly – Porter’s five forces model of competition.


UNIT-III Organizational Behaviour

Introduction to organizational behavior – Motivation & work performance – content and cognitive theories – stress management – Inter group dynamics & management of groups.


UNIT-IV Production Management

Plant location – objectives and models – Break-even model, factor comparison model, Brown Gibson model – illustrative problems.


UNIT-V Work Study

Work simplification – basic procedure – process charts – SIMO, diagrams, momomotion & cyclographs.

Motion study – therbligs – principles of motion economy.

Work measurement – basic procedure – stop watch method (rating method) work sampling, PMTS, estimating – analytical & comparative.
DME405 THEORY OF MACHINES – I

UNIT-I


Velocity and acceleration of simple mechanisms by relative velocity method. – Klein’s construction for slider-crank chain.

UNIT-II

Friction – clutches – single plate, multi plate and cone clutches.

Belt and rope drives – tension due to centrifugal force – maximum power transmitted – chain drive – brakes.


UNIT-III

Cams – Layout of cam profile for uniform velocity, simple harmonic, cycloidal and uniform acceleration and retardation with reciprocating and oscillating followers of different types Knife edged, roller and flat – Calculation of maximum velocity and acceleration of followers.

Gyroscopic couple – applications to ship, motor cycle, air crafts and automobiles.

UNIT-IV


UNIT-V


DME406 STRENGTH OF MATERIAL LABORATORY
Tension, compression and shear tests on different materials – deflection tests on beams –
Hardness, impact and ductility tests (on metals, torsion tests on rods and spring fatigue test,
demonstration only)

**DME407 ELECTRICAL LABORATORY**

The syllabus is to cover experiments in the theory syllabus under DME304. Experiments will include
D.C. & A.C. machines, energy meters and electronic devices including amplifiers.

**DME408 WORKSHOP PRACTICE - II**

**Welding & Joinery:**

**Foundry:**
Hand tools, moulding sands, pattern, types, materials and allowances, moulding methods, uses
of gates, risers and runners, cores, chaplets, fettling and finishing casting defects.

**Machine Tools:**
Use of centre Lathe and bench drilling machine, simple turning operations – Cylindrical, Taper
turning, external threading and knurling.

**Sheet Metal Works:**
Simple exercises line funnel and tray.
SEMESTER 5

DME501 HYDRAULICS AND MACHINERIES

UNIT-I


UNIT-II


UNIT-III


Reciprocating pumps – Bucket, Plunger and deep well pump – slip and coefficient of discharge – pump duty – pressure variation in single cylinder single acting pump with and without air vessel.

UNIT-IV

Fluid systems and circuits - Introduction to Industrial hydraulics. ram, air lift pump, actuators, pressure switches. Electro hydraulic and mechanical hydraulic servo systems. Compressors, filter, regulator, lubricator, muffler. Air control valves, quick exhaust valves – pneumatic actuators.

UNIT-V

Selection of components for hydraulic and pneumatic system applications. Installation, fault diagnosis, and maintenance. Microprocessor and PLC applications, power packs.

DME502 HEAT ENGINEERING-II

UNIT-I

Rotary Compressors: Centrifugal compressor-velocity diagrams-performance characteristics-pressure coefficient and slip factor-surgeing axial, radial and mixed flow compressors-velocity diagram-performance characteristics.

UNIT-II

30 | Page

UNIT-III


UNIT-IV


UNIT-V


TEXT BOOKS:


DME503 Manufacturing Process – II

UNIT-I Special Purpose Machines

Broaching: Types of broaching machines – broach nomenclature.

Gear manufacture: elementary ideas of gear shaping – gear hopping and gear generation.

Surface finishing process: elementary ideas of lapping and honing – surface finish – polishing and buffing.

UNIT-II Metal Cutting


UNIT-III Grinding and Metrology
Grinding and allied processes – types of grinding machines – grinding wheels specifications
abrasive materials. Metrology: Line standards and end standards – comparators for inspection – use
of optical flat and autocollimator – measurements of surface finish - gear inspection.

UNIT-IV Jigs and Fixtures

Basic concepts – advantages – types of jigs – elements of jigs and fixtures – locating devises
and types – 3-2-1 principle – clamping devises and types – drill jigs – template jigs – types of fixtures –
milling fixtures – turning fixtures.

UNIT-V Unconventional manufacturing Process

Principle and mechanism of Electro discharge machining, Ultra sonic machining, Laser
machining, abrasive jet machining. Automats and transfer machines: single spindle and multiple
spindle automatic lathes, transfer machines – rotary indexing and drum type transfer machines.

Text Books:

DME504 THEORY OF MACHINES – II

UNIT I:

Turning moment and flywheel – inertia force and inertia torque calculation – turning moment
in reciprocating engine – coefficient of fluctuation of energy – fluctuation of speed – Flywheel for
machine like punch press and I.C engines.

UNIT II:

Static and dynamic balancing – balancing of rotating masses indifferent planes.

UNIT III:

Balancing of reciprocating masses – multi cylinder in-line, V type, radial and locomotive
engines – primary and secondary forces – partial balancing – tractive efforts, swaying couple hammer
blow in locomotives – Direct and reverse crank method.

UNIT IV:

Vibration: Vibration of single degree freedom systems – free damped oscillation – damping
factor logarithmic decrement force vibration – Magnification factor – Vibrating isolation and
transmissibility – Vibration measuring instruments.

UNIT V:
Transverse vibration – natural frequency by energy method - Dunkerly method – Whirling of shafts – critical speed with single and two rotors.

Tensational oscillation of two or three rotor systems – equipment shaft – geared systems.

TEXT BOOKS:

1. Abdulla Sheriff, Theory of Machines, Dhanpat Rai, New Delhi

DME505 REFRIGERATION AND AIR CONDITIONING

UNIT-I


UNIT-II


UNIT-III


UNIT-IV


UNIT-V

TEXT BOOKS:

DME506 POWER PLANT ENGINEERING

UNIT-I


UNIT-II


UNIT-III


UNIT-IV

Basics of nuclear fuels – fission and chain reaction – reactor classification – boiling water, pressurerised water, homogenous, gas cooled breeding and metal cooled.

UNIT-V

Actual load curves – fixed and operating cost – tariff methods for electrical energy – peak load and variable load operations – selection of generation type and general equipment. Introduction to safety aspects in power plants – environmental impacts assessment for thermal power plant.
TEXT BOOKS

1) G. R. Nagpal, Power Plant Engineering, Khanna Publications.
2) Arora C. P. and Domkundwar, A course in power plant engineering, Dhanpat Rai Publications.

ME507 Mechanical Engineering Laboratory – I

Experiments in I.C. Engines, Steam, Fuel & Combustion and Measurements & Control Laboratories.

The syllabi for the above will be framed by the Head of the Department from time to time depending on textual background, availability of machines and any future infrastructural development.

ME508 REFRIGERATION & AIR CONDITIONING LABORATORY

Study and Performance test on Refrigeration and Air-conditioning Plant.
SEMESTER 6
DME601 MACHINE DESIGN

UNIT-I

Introduction: Types of design factors. Factor of safety, Theories of failure – curved beam, crank hook and C frames.


UNIT-II

Shafts – Material and design stresses – Calculation of equivalent bending moment and twisting moment – Design of shafts subjected to combined bending moment and twisting moment.


UNIT-III

Theory of columns: design of push rod, piston rod and I.C. Engine connecting rods section.

Wire Ropes – Stresses – selection design procedure.

UNIT-IV

Coupling – types – design and selection of coupling – Flange coupling, Bushed pin type, flexible coupling design and selection.

Power screws – thread forms design consideration and materials – wear and shear – design procedure.

UNIT-V

Design of Joints:


DME602 RENEWABLE ENERGY RESOURCES

UNIT-I

UNIT-II

UNIT-III

UNIT-IV
Solar space heating and cooling system – Elementary design Methods. Storage of solar energy.

UNIT-V
Wind energy utilization: introduction – types of wind mills – elementary design.
Elementary ideas of Tidal and ocean thermal energy ad geothermal energy: biomass as a source of energy – production of fuel from agricultural waste – Biogas – generation and utilization.

DME603 MAINTENANCE AND SAFETY ENGINEERING

UNIT-I
Need for maintenance – types – maintenance organization charts for large, medium and small size plants – basic functions of maintenance.

UNIT-II
Maintenance of ball, roller and tapered bearing – maintenance of belt, chain, gears, pulleys, shafting and fasteners.

UNIT-III


UNIT-IV

Devices and methods for safeguarding machines – points to be considered in designing the guards – Enclosures, covers and Barricades – safeguarding of fast and loose pulleys, chain and rope drives, revolving machines, pressure plates and self acting machines – Remote tripping and starting devices.

UNIT-V


Text Books:

1. Morrow, Industrial Maintenance

DME604 AUTOMOBILE ENGINEERING

UNIT-I


UNIT-II


UNIT-III


Brakes – Mechanical, disc, hydraulic and pneumatic brakes – servo brakes.
UNIT-IV


UNIT-V

Sources of automobile pollution – Petrol engine pollution and Diesel engine pollution – formation of oxides of nitrogen, carbon monoxide, hydrocarbon and smoke, particulate emission – evaporative emission control, crankcase emission, Air fuel mixture, EGR, air injection, thermal reactors in cylinder control of pollution, catalyst converters. Use of driving cycles for emission measurements. National and international standards. Non dispersive infrared gas analyser, Smoke measurements and smoke meters.

DME605 Mechanical Engineering Laboratory – II

Experiments in I.C. Engines, Steam and Dynamic Laboratories.

The syllabi for the above will be framed by the Head of the Department from time to time depending on textual background, availability of machines and any future infrastructural development.

DME 606: CAD LABORATORY

PRACTICES OF:

1. AUTOCAD
2. PRO-E
3. CATIA V5
4. SOLIDWORKS

DME-607 PROJECT WORK & VIVA VOICE