

Note: Syllabus for the First Semester of Academic Year 2020-21 only.

Unit 1: Linear Algebra- Matrices

[05 Hours]

Rank of a matrix; Consistency of non- homogeneous and homogeneous system of linear equations; Eigen values and Eigenvectors; Properties of Eigen values and Eigen vectors (without proofs); Cayley-Hamilton's theorem (without proof) and its applications.

[Topics for Self-study Mode: *Inverse of a matrix by Gauss-Jordan method; Normal form of a matrix.*]

Unit 2: Partial Differentiation

[05 Hours]

Partial derivatives of first and higher orders; Homogeneous functions – Euler's Theorem for functions containing two and three variables (with proofs); Total derivatives.

[Topics for Self-study Mode: *Change of variables*]

Unit 3: Applications of Partial differentiation

[05 Hours]

Jacobians - properties; Taylor's and Maclaurin's theorems (without proofs) for functions of two variables.

[Topics for Self-study Mode: *Maxima and minima of functions of two variables; Lagrange's method of undetermined multipliers.*]

Unit 4: Reduction Formulae and Curve Tracing

[05 Hours]

Tracing of the curves given in Cartesian & polar forms.

[Topics for Self-study Mode: *Tracing of the parametric curves and Reduction formulae for*

$$\int_0^{\frac{\pi}{2}} \sin^n x \, dx, \int_0^{\frac{\pi}{2}} \cos^n x \, dx, \int_0^{\frac{\pi}{2}} \sin^m x \cos^n x \, dx]$$

Unit 5: Multiple Integrals

[06 Hours]

Double integration in Cartesian and polar co-ordinates; Evaluation of double integrals by changing the order of integration and changing to polar form; Triple integral;

[Topics for Self-study Mode: *Applications of multiple integrals to find area as double integral, volume as triple integral and surface area.*]

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Unit I: Oscillation and Ultrasonics: (05 Hrs)

Ultrasonic waves, production of ultrasonics (Piezoelectric effect, Magnetostriction effect) and its applications.

[Topics for self study mode:-*Free oscillation, damped oscillation, Forced oscillation and Resonance, differential wave equation*]

Unit II: Optics, Fibre Optics and Laser: (05 Hrs)

Principle and structure of optical fibre, acceptance angle, acceptance cone, numerical aperture. Principle of laser, Types of laser – Ruby and He-Ne laser and their applications.

[Topics for self study mode:- *Interference of light in thin film, wedge shaped film, Newton's rings, polarization of light, methods for production of polarized light(Reflection, Refraction & Double refraction), Huygen's theory of double refraction*]

Unit III: Electron Optics, Nuclear Physics and Quantum Mechanics: (06 Hrs)

Motion of electron in Electric field (parallel and perpendicular), Motion of electron in magnetic field, motion of electron in combined effect, Bainbridge mass spectrograph, Schrödinger's time dependent and time independent wave equations, physical significance of wave function.

[Topics for self study mode:-*G. M counter, Heisenberg's uncertainty principle.*]

Unit IV: Crystal Structure, X-rays and Electrodynamics: (05 Hrs)

Unit cell, Bravais lattice, cubic system, number of atoms per unit cell, coordination number, atomic radius, packing density, X-ray diffraction, Line and Continuous Spectrum of X-ray.

[Topics for self study mode:- *relation between lattice constant and density, lattice planes and Miller indices. Introduction of Maxwell equations (no derivation)*]

Unit V: Magnetic, Superconducting and Semiconducting materials: (06 Hrs)

Types of magnetic materials (Diamagnetic, Paramagnetic and Ferromagnetic), B-H curve, Meissner effect, properties and applications of superconductor, Band theory of solids, conductivity of semiconductors.

[Topics for self study mode:- *Superconductivity, types of superconductors, Halleffect.*]

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Unit 1: Conventional Power Generation:

(4 hours)

Steam power station, Nuclear power plant – Gas turbine power plant- Hydro power station:
Schematic arrangement, advantages and disadvantages.

[Topics for self study mode:- *Thermo electric and thermionic generators, Environmental aspects for selecting the sites and locations of power plants.*]

Unit 2: Renewable Power Generation:

(4 hours)

Solar, Wind, Biogas and Biomass, Ocean Thermal energy conversion (OTEC), Tidal,

[Topics for self study mode:- *Fuel cell, Magneto Hydro Dynamics (MHD): Schematic arrangement, advantages and disadvantages.*]

Unit 3: Energy conservation

(4 hours)

Scope for energy conservation and its benefits Energy conservation Principle– Maximum energy efficiency, Maximum cost effectiveness, Energy conservation in electric furnaces, ovens and boilers, lighting techniques.

[Topics for self study mode: *Methods and techniques of energy conservation in ventilation and air conditioners, compressors, pumps, fans and blowers.*]

Unit 4: Air Pollution

(4 hours)

Environment and Human health - Air pollution: sources- effects- control measures - Particulate emission.

[Topics for self study mode: *air quality standards, and measurement of air pollution.*]

Unit 5: Water Pollution

(4 hours)

Water pollution- effects- control measures- Noise pollution –effects and control measures, Thermal pollution.

[Topics for self study mode: *Disposal of solid wastes, Bio-medical wastes, Soil pollution, Nuclear hazard.*]

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BTHM104/204

Communication Skills

(2 Credits)

Note: - Syllabus for the Ist Semester of Academic Year 2020-21

Unit 1: Communication and Communication Processes (04hrs)

Introduction to Communication, Forms and functions of Communication, Barriers to Communication and overcoming them, Verbal and Non-verbal Communication Reading: Introduction to Reading, Barriers to Reading, Listening: Importance of Listening, Types of Listening, and Barriers to Listening.

(Topics for Self Study Mode:- *Types of Reading: Skimming, Scanning, Fast Reading, Strategies for Reading, Comprehension.*)

Unit 2: Verbal & Non-verbal Communication

(04 hrs)

Principles and Practice of Group Discussion, Public Speaking (Addressing Small Groups and Making Presentation), Interview Techniques, Appropriate Use of Non-verbal Communication, Presentation Skills.

(Topics for Self Study Mode:- *Use of Language in Spoken Communication, Extempore, Elocution.*)

Unit 3: Study of Sounds in English (02 hrs)

Introduction to phonetics, Study of Speech Organs, Articulation of Different Sounds in English.

(Topics for Self Study Mode:- *Study of Phonemic Script*)

Unit 4: English Grammar (05 hrs)

Grammar: Forms of Tenses, Articles, Prepositions, Use of Auxiliaries and Modal Auxiliaries,

(Topics for Self Study Mode:- *Synonyms and Antonyms, Common Errors.*)

Unit 5: Writing Skills, Reading Skills & Listening Skills (04 hrs)

Writing Emails, Formal and Informal English, Letter Writing: Types, Parts, Layouts, Letters and Applications, Use of Different Expressions and Style, Writing Job Application Letter and Resume.

(Topics for Self Study Mode:- *Features of Good Language, Difference between Technical Style and Literary Style, Technical Reports: Report Writing: Format, Structure and Types*)

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Unit 1:Water Treatment

(05 Hours)

Introduction , hard and soft water, softening of water – Zeolite process, Ion exchange process, Hot Lime –Soda process.

(Topics for self study mode:- *water characteristics- Hardness and its determination by EDTA method, Dissolve oxygen (DO) and its determination by Winkler's method.*)

Unit 2:Phase Rule

(05 Hours)

Phase Rule, statement, Explanation of the terms – Phase, Components, Degrees of freedom. One component system – Water and Sulphur.

(Topics for self study mode:- *Reduced phase rule equation, Two components alloy system- Phase diagram of Silver- Lead alloy system.*)

Unit3:Metallurgy

(05 Hours)

Introduction, Occurrence of metals, types of ores, concentration of ores by physical methods- Crushing and Sizing, Froth- Flotation, Magnetic Separation, Gravity separation method. Chemical methods- Calcination, Roasting,

(Topics for self study mode:- *Reduction of Ore- by Pyrolysis, Chemical reductions, Electrolytic Refining of Metals.*)

Unit 4: Fuels and Lubricants

(06 Hours)

Fuels: Introduction, classification of fuel, Calorific value of a fuel, characteristics of a good fuel, solid fuel- Coal Analysis of coal- Proximate and Ultimate analysis, liquid fuel- Refining of Petroleum

(Topics for self study mode:- *Various types of Coal.*)

Lubricants: Introduction, classification of lubricants - Solid, Semi –solid and Liquid Lubricants , properties of lubricants ,Physical properties – Viscosity, Viscosity index.

(Topics for self study mode:- *surface tension, Flash point and Fire point. Chemical properties – Acidity, Saponification.*)

Unit5:Electrochemistry

(05 Hours)

Introduction - Conductometric titrations, Ostwald's theory of acid- base indicator, Quinonoid theory, Glass electrode.

(Topics for self study mode:- *Basic concepts: Definition and units of Ohm's law, Specific resistance, Specific Conductance, Equivalent conductance, Molecular conductance, Method of conductance measurement by Wheatstone bridge method, Cell constant, Debye- Huckel theory of strong electrolyte.*)

Unit 1: Process of programming: (4 Lectures)

Editing, Compiling, Error Checking, executing, testing and debugging of programs, Flowcharts, Algorithms.

[IDE commands. Eclipse for C Program development - In Self Study Mode]

Unit 2: Types, Operators and Expressions: (4 Lectures)

Variable names, Data types, sizes, constants, declarations, arithmetic operators, relational and logical operators, type conversions, increment and decrement operators, bitwise operators, assignment operators and expressions, conditional expressions.

[Operator precedence and order of evaluation - In Self Study Mode]

Unit 3: Control Flow: (4 Lectures)

Statements and Blocks: If-else, else-if switch Loops while and for, do-while break and continue goto and Labels.

Functions and Program Structure: Basic of functions, functions returning non- integers

[External variables scope rules - In Self Study Mode]

Unit 4: Arrays in C: (4 Lectures)

Initializing arrays, initializing character arrays, multidimensional arrays

Unit 5: Structures C: (4 Lectures)

Basics of structures, structures and functions arrays of structures,

[Pointer in C. Pointers to integers, characters, floats, arrays, structures. - In Self Study Mode]

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Unit I: Drawing standards and geometrical construction: (02 Hrs)

Drawing standard SP: 46, Type of lines, lettering, dimensioning, scaling conventions.

Geometrical construction: Special methods of constructing a pentagon and a hexagon.

[Topics for self study mode:- *Dividing a given straight line into any number of equal parts, bisecting a given angle, drawing a regular polygon given one side.*]

Unit II: Orthographic Projections and Projections of Points: (03 Hrs)

Introduction to orthographic projection, drawing of orthographic views of objects from their isometric views.

[Topics for self study mode:- *Projection of points lying in four quadrants.*]

Unit III: Projections of Straight Lines and Planes and their Traces: (03 Hrs)

Projections of lines inclined to one or both planes. Traces of lines.

Projection of planes inclined to one or both planes.

[Topics for self study mode:- *Projections of lines parallel and perpendicular to one or both planes, Projections of planes parallel and perpendicular to one or both planes.*]

Unit IV: Projections of Solids: (03 Hrs)

Types of solids, solids with axis inclined to one or both the planes. Projections of spheres touching each other.

[Topics for self study mode:- *Projections of solids with axis perpendicular and parallel to HP and VP.*]

Unit V: Sectioning of Solids, Isometric Projections: (03 Hrs)

Sectioning of solids: Section planes perpendicular to one plane and inclined to other plane.

Isometric projections: Drawing of isometric projections from given orthographic views.

[Topics for self study mode:- *Section planes perpendicular to one plane and parallel to other plane, Isometric scale.*]

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Unit I: Basic Concepts:

(04 Hrs)

Objectives of Engineering Analysis and Design, Idealization of Engineering Problems, Simplification of real 3D problems to 2-D and 1-D domain, Basis of Assumptions, types of supports, types of load, free body diagram, Laws of Motion, Varignons theorem.

[Topics for self study mode:- *Fundamental principles, Resolution and composition of a forces, Resultant, couple, moment, , force systems. Ultrasonic waves, production of ultrasonics (Piezoelectric effect, Magnetostriction effect) and its applications.*]

Unit II: Equilibrium:

(04 Hrs)

Centroid of composite shapes, moment of inertia of planer sections, and radius of gyration. Static equilibrium, analytical and graphical conditions of equilibrium, Lami"s theorem,

[Topics for self study mode:- *Equilibrium of coplanar concurrent forces, coplanar non concurrent forces, parallel forces, beams reactions.*]

Unit III: Friction, and Analysis of trusses:

(03 Hrs)

Friction: Coulomb law, friction angles, wedge friction, sliding friction and rolling resistance.

[Topics for self study mode:- *Simple trusses (plane and space), method of joints for plane trusses, method of sections for plane trusses.*]

Unit IV: Kinematics:

(04 Hrs)

Types of motions, kinematics of particles, rectilinear motion, constant and variable acceleration, relative motion, motion under gravity, concept of instantaneous center of rotation, concept of relative velocity.

[Topics for self study mode:- *Study of motion diagrams, angular motion, tangential and radial acceleration, projectile motion, kinematics of rigid bodies.*]

Unit V: Kinetics, and Work, Power, Energy:

(04 Hrs)

Principle of virtual work, virtual displacements for particle and rigid bodies, , kinetic energy of linear motion and rotation, power, impulse momentum principle, collision of elastic bodies.

[Topics for self study mode:- *Work done by a force, spring, potential energy, work energy equation, conservation of energy.*]