

COMBINED FIRST AND SECOND SEMESTER

EN2K 101 : MATHEMATICS I

Module I: Differential Calculus (15 hOurs)

Indeterminate forms - L' hospital's rule - Radius of curvature - Centre of curvature - Evolute
Functions of more than one variable - Idea of partial differentiation - Euler's theorem for
homogeneous functions - Chain rule of partial differentiation - Applications in errors and
approximations - Change of variables - Jacobians - Maxima and minima of functions of two or
more variables - Method of Lagrange multipliers

Module II: Infinite Series (15 hours)

Notion of convergence and divergence of infinite series - Ratio test - Comparison test
Raabe's test- Root test - Series of positive and negative terms - Idea of absolute convergence
- Test for alternating series - Power series - Interval of convergence - Taylors and Maclaurins
series representation of functions - Leibnitz formula for the nth derivative of the product of
two functions - Use of Leibnitz formula in the Taylor and Maclaurin expansions

Module III: Matrices (21 hours)

Concept of rank of a matrix -Reduction of a matrix to echelon and normal forms - System of
linear equations - Consistency of linear equations - Gauss' elimination - Homogeneous linear
equations - Fundamental system of solutions- Inverse of a matrix - Solution of a system of
equations using matrix inversion - Eigen values and eigen vectors - Cayley-Hamilton theorem
Eigen, values of Hermitian, skew-Hermitian and unitary matrices - quadratic forms - Matrix
associated with a quadratic form - Technique of diagonalization using, row and column
transformations on the matrix - Definite, semidefinite and indefinite forms - Their identification
using toe eigen values of the matrix of the quadratic form

Module IV: Fourier series and harmonic analysis (15 hours)

Periodic functions - Trigonometric series - Fourier series - Euler formulae - Even and odd functions -
Functions having arbitrary period - Half range expansions - Approximation by
trigonometric polynomials - Minimum square error - Numerical method for determining Fourier
coefficients - Harmonic analysis

EN2K 102: MATHEMATICS II

Module I: Ordinary differential equations (21 hours)

A brief review of the methods of solutions of first order equations - Separable, homogeneous and linear types - Exact equations - Orthogonal trajectories - General linear second order equations - Homogeneous linear equation of the second order with constant coefficients - Fundamental system of solutions - Method of variation of parameters - Cauchy's equation - Simple applications of differential equations in engineering problems, including problems in mechanical vibrations, electric circuits and bending of beams

Module II: Laplace transforms (15 hours)

Gamma and Beta functions - Definitions and simple properties - Laplace transform - Inverse transform - Laplace transform of derivatives and integrals - Shifting theorems - Differentiation and integration of transforms - Transforms of unit step function and impulse function Transform of periodic functions - Solution of ordinary differential-equations using Laplace transforms

Module III: Vector differential calculus (15 hours)

Vector function of single variable - Differentiation of vector functions - Scalar and vector fields - Gradient of a scalar field - Divergence and curl of vector fields - Their physical meanings - Relations between the vector differential operators

Module IV: Vector integral calculus (15 hours)

Double and triple integrals and their evaluation - Line, surface and volume integrals - Green's theorem - Gauss' divergence theorem - Stokes' theorem (proofs of these theorems not expected) - Line integrals independent of the path

EN2K 103B: ENGINEERING PHYSICS(B)

Module I (11 hours)

Interference of light - Interference from plane parallel thin films - Colours of thin films by reflected light - Newton's rings - Measurement of wavelength of light Thin wedge shaped airfilm - Air wedge - Testing of optical planeness of surfaces Diffraction of light - Introduction to Fresnel and Fraunhofer diffraction - Distinction between the two diffraction- Simple theory of plane transmission grating Polarisation of light -Double refraction - Nicol prism - Quarter and half wave plates - Production and detection of elliptically and circularly polarised light - Rotatory polarisation - Lawrent's half shade polarimeter - Applications of polarised light

Module II (11 hours)

Photo elasticity - Definition of stress and strains at a point - Stress optic relations Two dimensional case -

isochromatics and isoclinics - ' Mathematical analysis of isoclines and isochromatics- Moire fringes - Laser physics - Basic concepts of laser - Spontaneous and stimulated emission - Absorption - Population inversion - Optical pumping - Construction and componen~ of laser - Ruby laser, helium-neon laser and semiconductor laser - Applications - Basic principle of holography and its applications

Module III (11 hours) ,

X-ray Physics - X-ray diffraction - Braggs X-ray spectrometer - Determination of lattice constant - Crystal structure using X-rays - Applications - Ultrasonics -Piezo electric effect- Piezo electric crystal - Production and detection of ,ultrasonics Applications - Acoustics - Reverberation - Sabine's formula for reverberation time Unit of loudness-decibel and Phon - Conditions for good acoustics - Determination of absorption coefficient - Nondestructive testing - Radi~graph~c method - Magnetic method - Electrical method - Ultrasonic method ~

Module IV (11 hours)

Semiconductor physics - Band structure of semiconductor - Classification of niconductors on the basis of Fermi level and Fermi energy - Impurity level in N and P-type semiconductors - Applications of semiconductors - Light emitting diode, solar cell, zener and photo diode - Super conductivity - Properties of super onductors ... The critical field - Current density - Meissner effect - Type I and type r superconductors - Josephson effect and tun~elling (qualitative) -' B.C.S theory qualitative) - Applications of superconductors

EN2K 104B: ENGINEERINGCHEMISTRY(B)

Module I (9 hours)

Phase equilibria - Definition of terms - One component systems (H₂O and S) - Two component systems - Continuous series of solid solutions -Thermal analysis - Simple eutectics - Compound . formation - Freezing mixtures - Liquid - Liquid systems - Critical solution temperature – Solvent extraction - Steam' distillation

Module II (13 hours)

Water and its treatment -,Specifications for water - Analysis of water - Hardness and alkalinity (prQblems) - Water for domestic use - Water softening - The lime soda process - .By ion exchangers - Theory of ion - Exchange process - Boiler feed water - Carbonate treatment Phosphate treatment - Desalination - Freezing - Solvent extraction - Reverse osmosis - Electrodialys'c, - Pollution - Water pollution - Sewage treatment anddjsposal - BOD and COD - Soil pollution - Sources- Remedial measures - Cements - Introduction - Raw material - Portland cement - Manufactur~ - Analysis of cement - Setting and hardening of Portland cement Weathering of cement and concrete

Module III (9 hours)

Corrosion - Protective coatings and pollution - Dry corrosion - Oxidation processes – Wet corrosion - Electrochemical theory- Different forms of corrosion - Prevention' and control Protective coating - Pretreatment of surface - Metallic and ,nonmetallic coatings - Electrodeposition - Cementation - Metal spraying -Air pollution - Types - Causes - Power generation pollution - Thermal pollution - Petrochemical smog - Methods of control

Module IV (13 hours)

High Polymers and lubricants - Polymerisation and functionality" Chain, condensation and copolymerisation - Mechanism - Coordination' polymerisation - Polymerisation processes Structure, properties and molecular weight of polymers - Thermosetting and thermoplastic materials - Elastomers - Vulcanization - synthetic rubbers - Lubricants - Theory of friction Mechanisms of lubrication - Classification and properties of lubricants - Additives ~ Synthetic lubricants - Solid lubricants

EN2K 105 : HUMANITIES

Module I (10 hours)

Introduction to English usage and grammar

Review of grammar - Affixes, prefixes, suffixes, participles and gerunds - Transformation of sentences - Commonly misspelt words - Correction of mistakes - Punctuation - Idioms - Style Vocabulary building

Reading comprehension

Exposure to a variety of reading materials, articles, essays, graphic representation, journalistic articles, etc. .

Writing comprehension

Skills to express ideas in sentences, paragraphs and essays

Module II (10 hours)

Technical communication and report writing

Growing need and importance of technical communication - aspects of technical description of machinery, equipment and 'tJrocesses - Giving instructions in an industrial situation – Note taking and note making - Correspondence on technical topics - Different types of technical reports

Module III (10 hours)

Humanities in a technological age

Importance of hIManitiesto technology, education and society - Relation of career interests of engineers to humanities - Relevance of a scientific temper - Science, society and culture Introduction to writings of modern thinkers on society and culture

Technology .

Historical concepts and current usage (*This module should be a window to the world of western and eastern mind with an emphasis on exposition of topical ideas through coherent language*).

Module IV (14 hours)

History of science and technology

Science and technology in the primitive society - Development of science and technology in early civilized societies - Science and classical Greece - The rise and development of early Indian science - Contributions of the Arabs to science and technology - European science and the revolutionary (industrial, American and French revolutions) era - Recent advances in Indian science.

EN2K 106B: ENGINEERING GRAPHICS (CB)

Module 0 (12 hours - 1 drawing exercise)

Introduction to engineering graphics - Drawing instruments and their uses - Different types of lines - Lettering and dimensioning - Familiarisation with current Indian standard code of practice for general engineering drawing - Construction of ellipse, parabola and hyperbola. Construction of cycloid, involute and helix (only practice, no University examination)

Module I (20 hours - 3 drawing exercises)

a) Introduction to orthographic projections - Vertical, horizontal and profile planes - Principles of first angle and third angle projections - Projections of points in different quadrants Orthographic projections of straight lines parallel to one plane and inclined to the other plane Straight lines inclined to both the planes - True length and inclination of lines with reference planes - Traces of lines'

b) Projections of plane laminae of geometrical shapes parallel to one plane and inclined to the other plane - Plane laminae inclined to both the planes - Auxiliary projections of plane laminae

Module II (14 hours - 3 drawing exercises.)

a) Projections of polyhedra and solids of revolution - Frustums - Projections of solids with axis parallel to one plane and parallel to or perpendicular to the other plane - Projections of solids with the axis inclined to both the planes (Solids to be drawn: - Cube, prism, pyramid, tetrahedron, cone and cylinder)

b) Projections of solids on auxiliary planes - Primary and secondary auxiliary views - Projections of combinations of solids (Solids to be drawn :- prism, pyramid, cone, cylinder and sphere)

Module III (14 hours - 3 drawing exercises)

a) Sections of solids - Sections by planes parallel to the horizontal or vertical planes and by planes inclined to the horizontal or vertical planes - True shape of section by projecting on auxiliary plane

(Solids to be drawn: - Cube, prism, pyramid, tetrahedron, cone and cylinder) b) Intersection of surfaces - Methods of determining lines intersecting - Intersection of prism in prism, cylinder in cylinder and cylinder in cone

Module IV (14 hours - 3 drawing exercises)

a) Development of surfaces of solids - Method of parallel line, radial line, triangulation and approximate developments - Development of polyhedra, cylinder, cone and sectional solids Development of solids having hole or cut

b) Development of surfaces of objects - Transition pieces, pipe elbow, bent, funnel, trays and, hoods - Development of spherical dishes and tanks using lune and zone methods

Module V (14 hours - 3 drawing exercises)

a) Introduction to isometric projection - Isometric scale - Isometric views - Isometric projections of prisms, pyramids, cylinders, cones, spheres, sectioned solids and their combinations - Principle of oblique projection - Cavalier, cabinet and general oblique projections of solids and simple objects b) Introduction to perspective projections - Classification of perspective views – Parallel angular and oblique perspectives - Visual ray method and vanishing point method of drawing perspective projection - Perspective views of prisms, pyramids and circles

EN2K 107A: ENGINEERING MECHANICS (SCA)

Module I (17 hours)

Principles of statics - Freebody diagrams - Composition and resolution of forces - Resultant and equilibrant- Concurrent forces - Triangle of forces - Lami's theorem - Method of projections Method of moments-Theorem of Varignon - Parallel forces - Couples - Centre of parallel forces and- centre of gravity - Conditions of equilibrium for general system of coplanar forces - Polygon of forces - Resultant of a system of coplanar forces - Friction - Laws of friction - Angle of friction - Equilibrium of a body on a rough inclined plane

Module II (17 hours)

Plane trusses - Different types of supports - Reactions at supports - Method of joints - Method of sections -Graphical method - Funicular polygon - Maxwell diagrams - Distributed forces in a plane - Flexible suspension cables - Introduction to vector approach - Concurrent and parallel forces in space - Couples in space - Equilibrium of general system of forces in space – Solution of problems by scalar and vector approach

Module III (16 hours)

Principle of virtual work - Application to practical problems - Stable and unstable equilibrium - Simple machines - Centroids and moments of inertia of plane figures of various shapes-rectangle, triangle, circle,

semicircle and built-up sections Parallel' and perpendicular axes theorems - Product of inertia - Principal axes and principal moments of inertia - Moment of inertia of a rigid body - Moment of inertia of a lamina ~Moment of inertia of three dimensional bodies '

Module IV (16 hours) I

Principles of dynamics - Differentiill equation of rectilinea-: motion - Motion of a particle acted upon by a constant force - Force as a function of time - Force proportional to displacement -Free vibrations- D'Alembert's principle - Momentum and impulse - Work and energy - Ideal systems - Conservation of energy - Impact Plastic, semi elastic and elastic - Curvilinear motion - Differential equation - D' Alembert's, principle - Work and energy - MO!1lent of momentum - Projectiles Rotation - Equation of motion - D' Alembert's principle - Rotation under the action of constant moment- Torsional vibration - Compound pendulum

EN2K 108: COMPUTER PROGRAMMING IN C

Module I (11 hours)

Programming and problem solving - Computer organisation - High level and low level languages - Steps involved in computer programming - Developing algorithms and flow charts Efficiency of algorithms - Running - Debugging and testing of programs - Program design methods - Top-down modular programming - Measures of program performance

Module II (20 hours)

Basics of C - Overview of C - Lexical elements - Operators and the C system – Fundamental data types - Flow of control - Functions

Module III (20 hours)

More on C " Arrays - Pointers and strings - Bit-wise operators and enumeration types Structures and unions - Linear linked lists and list operations - Basic I/O functions.

Module IV (15 hours)

Introduction to object oriented programming - Principles of OOP - Object oriented programming paradigm - Basic concepts of OOP - Benefits of OOP - Object-oriented languages - Applications of OOP . Moving from eto C++ - Input /output functions - Classes and abstract data types - Overloading - Constructors and destructors - Inheritance - Polymorphism Templates