

ANNEXURE I
SYLLABUS FOR DIPLOMA AND D. VOC STUDENTS

MATHEMATICS (ANNEXURE I (i))

Total 20 questions from 6 Modules - 4 questions each from module I to IV and 2 questions each from module V and VI.

Module I

Single Variable Calculus and Infinite series, Basic ideas of infinite series and convergence - Geometric series- Harmonic series-Convergence tests - comparison, ratio, root tests. Alternating series - Leibnitz Test- Absolute convergence, Maclaurin's series - Taylor series - radius of convergence.

Module II

Partial derivatives and its applications - Partial derivatives of functions of more than two variables – higher order partial derivatives - differentiability, differentials and local linearity The chain rule – Maxima and Minima of functions of two variables - extreme value theorem - relative extrema.

Module III

Calculus of vector valued functions, Introduction to vector valued functions - parametric curves in 3-space
Limits and continuity – derivatives – tangent lines – derivative of dot and cross product - definite integrals of vector valued functions - unit tangent-normal- velocity-acceleration and speed- Normal and tangential components of acceleration.
Directional derivatives and gradients-tangent planes and normal vectors

Module IV

Multiple integrals - Double integrals- Evaluation of double integrals – Double integrals in non-rectangular coordinates- reversing the order of integration- Area calculated as a double integral- Triple integrals (Cartesian co-ordinates only) - volume calculated as a triple integral.

Module V

Topics in vector calculus -Vector and scalar fields- Gradient fields – conservative fields and potential functions – divergence and curl - the ∇ operator – the Laplacian ∇^2 , Line integrals - work as a line integral- independence of path-conservative vector field.

Module VI

Topics in vector calculus, Green's Theorem, surface integrals – Divergence Theorem - Stokes' Theorem.

ENGINEERING MECHANICS (ANNEXURE I (ii))

Total 15 questions from 6 Modules -3 questions each from module I to IV and 2 questions from module V and 1 question from module VI.

Module I

Statics: Fundamental concepts and laws of mechanics - Rigid body – Principle of transmissibility of forces. Coplanar force systems – Moment of force – Principle of moments. Resultant of force and couple system. Equilibrium of rigid body – Free body diagram – Conditions of equilibrium in two dimensions – Two force and three force members.

Module II

Types of supports – problems involving point loads and uniformly distributed loads only. Force systems in space – Degree of freedom – Free body diagram – Equations of equilibrium – Simple resultant and Equilibrium problems.

Module III

Properties of planar surfaces - Centroid and second moment of area - Parallel and perpendicular axis theorem – Centroid and Moment of Inertia of composite area. Polar Moment of Inertia – Radius of gyration - Mass moment of Inertia of cylinder and thin disc. Product of Inertia – Principle Moment Of Inertia. Theorems of Pappus and Guldinus.

Module IV

Friction – Characteristics of dry friction – Problems involving friction of ladder, wedges and connected bodies. Definition of work and virtual work – Principle of virtual work for a system of connection bodies – problems of determinate beams only.

Module V

Dynamics: Rectangular and Cylindrical co-ordinate system. Combined motion of rotation and translation – Concepts of instantaneous centre – Motion of connecting rod of piston and crank of reciprocating pump. Rectilinear translation – Newton's second law – D'Alembert's Principle – Application to connected bodies.

Module VI

Mechanical vibrations – free and forced vibrations – degree of freedom. Simple and harmonic motion – Spring-mass model – Period – Stiffness – Frequency – Simple numerical problems of single degree of freedom.

IT AND COMPUTER SCIENCE (ANNEXURE I (iii))

Total 15 questions from 6 Modules -3 questions each from module I to IV and 2 questions from module V and 1 question from module VI.

Module I

Introduction to digital computer - Von Neumann concept - A simple model of computer, acquisition of data, storage of data, processing of data, output of processed data. Details of functional units of a computer. Storage - primary storage and secondary storage

Introduction to programming languages: types of programming languages - high level language, assembly language and machine language - System software - Operating systems - objectives of operating systems, compiler, assembler and interpreter.

Module II

Problem Solving strategies - Problem analysis - formal definition of problem - Solution - top-down design - breaking a problem into sub problems- overview of the solution to the sub problems by writing step by step procedure (algorithm) - representation of procedure by flowchart - Implementation of algorithms - use of procedures to achieve modularity.

Module III

Introduction to Python - variables, expressions and statements, evaluation of expressions, precedence, string operations.

Module IV

Functions, calling functions, type conversion and coercion, composition of functions, mathematical functions, user-defined functions, parameters and arguments.

Module V

Strings and lists - string traversal and comparison with examples. Tuples and dictionaries - operations and examples

Module VI

Files and exceptions - text files, directories. Introduction to classes and objects - attributes, instances.

BASIC CIVIL ENGINEERING (ANNEXURE I (iv))

Total 15 questions from 6 Modules -3 questions each from module I to IV and 2 questions from module V and 1 question from module VI.

Module I

General introduction to Civil Engineering- History of civil Engineering - Relevance of civil Engineering in the overall infrastructural development of the country. Types and classification of structures - buildings, towers, chimneys, bridges, dams, retaining walls, water tanks, silos, roads, railways, runways and pipelines. Definition and types of buildings as per National Building Code of India. Selection of site-Components of a building and their functions- setting out of a building.

Module II

Stones: Classification of stones-Qualities of good building stones-Quarrying-Dressing-Tests-Specifications-Uses of common building stones. Bricks: Composition of good brick earth - Classification-Qualities of good bricks -Field and laboratory tests-specifications. Tiles: Classification-Manufacture-properties-Tests-Specifications.

Module III

Cement: Basic Ingredients- Manufacturing process- Grades- Properties-Tests Specifications. Aggregates: Fine and coarse aggregate- Properties - uses-Tests. Cement Mortar: Types and preparation.

Module IV

Stone Masonry: Types-Details of Ashlars, Random Rubble, Coarse Rubble and Dry Rubble Masonry. Brick Masonry: Types - Bond-Introduction to all types of Bonds - English bond in detail - Comparison of stone and brick masonry.

Module V

Timber : Properties-Uses-Classification-Seasoning-Defects-Preservation-Tests; Hard board and particle board -Manufacture and use.
Steel: structural steel and steel as reinforcement-Types-Properties-Uses - Market forms

Module VI

Floors and Flooring materials: Different types and selection of floors and floor coverings. Roofs and roof coverings: Different types of roofs -Suitability-Types and selection of roofing materials

MECHANICAL ENGINEERING (ANNEXURE I (v))

Total 15 questions from 6 Modules -3 questions each from module I to IV and 2 questions from module V and 1 question from module VI.

Module I

Thermodynamics: Nature and scope of thermodynamics; basic concept; Laws of Thermodynamics, Discovery Significance and Applications; Qualitative ideas on Entropy, Available Energy ,Irreversibility, Principle of increase of Entropy& Carnot engine; Limitations of Thermodynamics; Source of power; history of power production; power production in the future.

Module II

Thermal Engineering: Historical development of steam engine ,steam turbines, gas turbines and hydraulic turbines; Principle of turbomachinery; History of IC engines; two stroke and four stroke engines-working, applications; Air compressors-types and uses; Principles of Rocket propulsion, chemical rockets, Indian space programme.

Module III

Refrigeration and air conditioning: History & Scope of refrigeration; applications of refrigeration; Food preservation, refrigerated storage; applications in chemical and process industries; special applications; Air conditioning – Principles & system; scope of air conditioning; Psychometric properties of air; Human comfort standards.

Module IV

Automobiles & Aeronautical Engineering: Introduction to an Automobile; history of the automobile; Indian automobiles; Types of automobiles; Major components and their functions; Manufactures of motor vehicles in India; Fundamentals of aerodynamics; drag force and lift force; jet engines types and applications.

Module V

Engineering and Materials: Introduction and history of materials: Basic crystallography; metals, alloys composites, ceramic, polymers; mechanical properties and testing of engineering materials.

Module VI

Manufacturing Engineering: Methods of manufacturing; casting, forging, rolling extrusion; machining operations-turning, milling, drilling, grinding, shaping, planning; Joining operations-soldering, brazing& welding; Introduction to CNC machines; examples of typical products manufactured by above methods.

ELECTRICAL ENGINEERING (ANNEXURE I (vi))

Total 15 questions from 6 Modules -3 questions each from module I to IV and 2 questions from module V and 1 question from module VI.

Module I

Fundamental Concepts of Circuit Elements and Circuit variables: Electromotive force, potential and voltage. Resistors, Capacitors Inductors- terminal V-I relations. Electromagnetic Induction: Faraday's laws, I Lenz's law, statically and dynamically induced EMF, self and mutual inductance, coupling coefficient-energy stored in inductance. Real and Ideal independent voltage and current sources, V-I relations. Passive sign convention.

Module II

Basic Circuit Laws: Kirchhoff's current and voltage laws, analysis of resistive circuits-mesh analysis super mesh analysis. Node analysis-super node analysis, star delta transformation.

Module III

Magnetic Circuits: Magneto motive force, flux, reluctance, permeability -comparison of electric and magnetic circuits, analysis of series magnetic circuits. Parallel magnetic circuits, magnetic circuits with air-gaps.

Module IV

Alternating current fundamentals:-Generation of Alternating voltages-waveforms, Frequency, Period, RMS and average values, peak factor and form factor of periodic waveforms and composite waveforms. Phasor Concepts, Complex representation (exponential, polar and rectangular forms) of sinusoidal voltages and currents phasor diagrams. Complex impedance - series and parallel impedances and admittances, Phasor analysis of RL, RC, RLC circuits.

Module V

Complex Power: Concept of Power factor: active, reactive and apparent power.

Resonance in series and parallel circuits

Energy, bandwidth and quality factor, variation of impedance and admittance in series and parallel resonant circuits.

Module VI

Three phase systems: Star and delta connections, three-phase three wires and three- 2 phase four-wire systems. Analysis of balanced and unbalanced star and delta connected loads. Power in three-phase circuits. Active and Reactive power measurement by one, two, and three wattmeter methods.

ELECTRONICS & COMMUNICATION ENGINEERING (ANNEXURE I (vii))

Total 15 questions with 6 Modules -3 questions each from module I to IV and 2 questions from module V and 1 question from module VI.

Module I

Evolution of electronics, impact of electronics in industry and in society. Resistors Capacitors: Types, Specifications, Standard values, marking colour coding Inductors and Transformers: Types, Specifications, and Principles of working. Electro mechanical components: relays and contactors.

Module II

Diodes: Intrinsic and extrinsic semiconductors, PN junction diode, barrier potential, V-I characteristics, Effect of temperature. Equivalent circuit of a diode. Piece wise linear model. Specification parameters of diodes and numbering.

Zener diode, Varactor diodes, characteristics, working principle of LED, photo diode, solar cell.

Module III

Bipolar Junction Transistors: Structure, typical doping, Principle of operation, concept of different configurations. Detailed study of input and output characteristics of common base and common emitter configuration, current gain, comparison of three configurations. Concept of load line and operating point. Need for biasing and stabilization, voltage divider biasing, Transistor as amplifier, switch, RC coupled amplifier and frequency response. Specification parameters of transistors and type numbering

Module IV

Junction Field Effect Transistors: Structure, principle of operation, characteristics, comparison with BJT. MOSFET: Structure, principle of operation of Enhancement type MOSFET, Current voltage characteristics, Depletion-type MOSFET. Principle of operation of Photo transistor, UJT, SCR

Module V

Diode circuits and power supplies: Series and parallel diode circuits, Clippers, Clampers, Voltage multipliers. Half-wave and full wave (including bridge) rectifiers, Derivation of V_{rms} , V_{dc} , ripple factor, peak inverse voltage, rectification efficiency in each case, capacitor filter, working and design of a simple Zener voltage regulator. Block diagram description of a DC Power supply, Principle of SMPS.

Module VI

Electronic Measurements and measuring Instruments. Generalized performance parameters of instruments: error, accuracy, sensitivity, precision and resolution. Principle and block diagram of analog and digital multimeter, Block diagram of CRO, Measurements using CRO, Lissajous patterns, Principle and block diagram of DSO, function generator. Testing of Electronic components.

ENGLISH (ANNEXURE I (viii))

For English, out of the 10 marks to be awarded, 5 marks will be for questions based on a given passage and remaining 5 marks for basic Grammar and General English of plus 2 standards.

SYLLABUS FOR B.SC STUDENTS

MATHEMATICS (ANNEXURE I (ix))

Total 40 questions from 6 Modules -7 questions each from module I to V and 5 questions from module VI.

Module I

Single Variable Calculus and Infinite series, Basic ideas of infinite series and convergence - Geometric series- Harmonic series-Convergence tests - comparison, ratio, root tests. Alternating series - Leibnitz Test- Absolute convergence, Maclaurins series - Taylor series - radius of convergence.

Module II

Partial derivatives and its applications - Partial derivatives of functions of more than two variables – higher order partial derivatives - differentiability, differentials and local linearity The chain rule – Maxima and Minima of functions of two variables - extreme value theorem - relative extrema.

Module III

Calculus of vector valued functions, Introduction to vector valued functions - parametric curves in 3-space

Limits and continuity – derivatives – tangent lines – derivative of dot and cross product - definite integrals of vector valued functions - unit tangent-normal- velocity-acceleration and speed– Normal and tangential components of acceleration.

Directional derivatives and gradients-tangent planes and normal vectors

Module IV

Multiple integrals - Double integrals- Evaluation of double integrals – Double integrals in non-rectangular coordinates- reversing the order of integration- Area calculated as a double integral- Triple integrals (Cartesian co-ordinates only) - volume calculated as a triple integral.

Module V

Topics in vector calculus -Vector and scalar fields- Gradient fields – conservative fields and potential functions – divergence and curl - the ∇ operator – the Laplacian ∇^2 , Line integrals - work as a line integral- independence of path-conservative vector field.

Module VI

Topics in vector calculus, Green's Theorem, surface integrals – Divergence Theorem - Stokes' Theorem.

PHYSICS (Annexure I (x))

Total 30 questions from 6 Modules -5 questions from each module.

Module I

Harmonic Oscillations: Differential equation of damped harmonic oscillation, forced harmonic oscillation and their solutions -Resonance, Qfactor, Sharpness of resonance-LCR circuit as an electrical analogue of mechanical Oscillator.

Waves: One dimensional waves-Differential equation & its solution. Transverse vibration of stretched string.

Module II

Interference: Coherence, Interference in thin films and wedge shaped films (Reflected System), Newton's rings-measurement of wavelength and refractive index of liquid interference filters. Antireflection coating.

Diffraction Fresnel and Fraunhofer diffraction. Fraunhofer diffraction at single slit. Plane transmission grating. Grating equation-measurement of wavelength, Rayleigh's criterion for resolution of grating-Resolving power and dispersive power of grating.

Module III

Polarization of Light: Types of polarized light. Double refraction. Nicol Prism. Quarter wave plate and half wave plate, production and detection of circularly and elliptically polarized light. Induced birefringence-Kerr Cell-Polaroid & applications.

Super conductivity: Superconducting phenomena. Meissner effect. Type-I and Type II superconductors. BCS theory. High temperature superconductors-Application of superconductors.

Module IV

Quantum Mechanics: Uncertainty principle and its applications-formulation of Time dependent and Time dependent Schrodinger equations-physical meaning of wave function-Energy and momentum Operators-Eigen values functions-One dimensional infinite square well potential. Quantum mechanical Tunneling.

Statistical Mechanics: Microstates and Macrostates. Phase space. Basic postulates of Maxwell-Boltzmann. Boltzmann, Bose-Einstein and Fermi-Dirac statistics. Distribution equation in the three cases. Fermi Level and its significance.

Module V

Acoustics: Intensity of sound-Loudness-Absorption coefficient-Reverberation and reverberation time-Significance of reverberation time-Sabine's formula-Factors affecting acoustics of a building.

Ultrasonic's: Production of Ultrasonic waves- Magnetostriction effect and Piezoelectric effect- Magnetostrictionj oscillator and Piezoelectric oscillator-Detection of ultrasonic's-Thermal and piezoelectric methods-Applications of ultrasonics - -NDT and medical.

Module VI

Laser : properties of lasers, absorption, spontaneous and stimulated emissions, population inversion, Einstein's coefficients, Working principle of laser, Optical resonant cavity. Ruby Laser, Helium-Neon Laser, Semiconductor Laser, Application of Laser, holography (recording and reconstruction).

Photonics: Basics of solid state lighting-LED-Photo detectors-photo voltaic cell, junction &avalanche photo diodes, photo transistors, thermal; detectors, Solar cells-I-V characteristics- Optic fiber-Principle of propagation-numerical aperture-optic communication system-Industrial, medical and technological applications of optical fiber. Fiber optic sensors-Basics of Intensity modulated and phase modulated sensors.

CHEMISTRY (ANNEXURE I (xi))

Total 20 questions from 6 Modules -4 questions each from module I to IV and 2 questions from module V and VI.

Module I

Spectroscopy: Introduction, Beer Lamberts Law.

UV-visible spectroscopy - Principle, Instrumentation and application.

IR spectroscopy- Principle and application.

HNMR spectroscopy-Principle, chemical shift-spin-spin splitting and application including MRI, Spectral Problems.

Module II

Electrochemistry: Different types of electrodes, SHE, Calomel electrodes, Glass electrode
Electrochemical series and its applications.

Nernst equation - Derivation, application & numericals.

Potentiometric titration - Acid-base and redox titration

Lithium ion cell and Fuel cell.

Module III

Instrumental Methods: Thermal analysis - Principle, instrumentation and applications of TGA and DTA

Chromatographic methods - Basic principles, column, TLC. Instrumentation and principles of GC and HPLC.

Conductivity - Measurement of conductivity

Module IV

Chemistry of Engineering Materials: Copolymers - BS, ABS -Structure and Properties.

Conducting Polymers - Polyaniline, Polypyrrole - Preparation, Structure and Properties.

OLED – An introduction

Advanced Polymers – Kevlar, Polybutadiene rubber and silicone rubber: Preparation, Structure and Properties.

Nanomaterials – Definition, Classification, chemical methods preparation- hydrolysis and reduction

Properties and Applications - Carbon Nano Tubes and fullerenes.

Module V

Fuels and Lubricants: Fuels - Calorific Value, HCV and LCV - Determination of calorific value of a solid and liquid fuel by Bomb calorimeter - Dulong's formula and Numerical.

Liquid fuel - Petrol and Diesel - Octane number & Cetane number

Biodiesel - Natural gas.

Lubricant - Introduction, solid, semisolid and liquid lubricants.

Properties of lubricants - Viscosity Index, Flash point, Fire point, Cloud point, Pour point and Aniline point.

Module VI

Water Technology: Types of hardness, Units of hardness, Estimation of Hardness – EDTA method.

Water softening methods - Ion exchange process - Principle. Polymer ion exchange.

Reverse Osmosis - Disinfection method by chlorination and UV

Dissolved oxygen, BOD and COD.

Sewage water Treatment - Trickling Filter and UASB process.

IT AND COMPUTER SCIENCE (ANNEXURE I (xii))

Total 15 questions from 6 Modules -3 questions each from module I to IV and 2 questions from module V and 1 question from VI.

Module I

Introduction to digital computer - Von Neumann concept - A simple model of computer, acquisition of data, storage of data, processing of data, output of processed data. Details of functional units of a computer. Storage - primary storage and secondary storage

Introduction to programming languages: types of programming languages - high level language , assembly language and machine language - System software - Operating systems - objectives of operating systems, compiler, assembler and interpreter.

Module II

Problem Solving strategies - Problem analysis - formal definition of problem - Solution - top- down design - breaking a problem into sub problems- overview of the solution to the sub problems by writing step by step procedure (algorithm) - representation of procedure by flowchart - Implementation of algorithms - use of procedures to achieve modularity.

Module III

Introduction to Python - variables, expressions and statements, evaluation of expressions, precedence, string operations.

Module IV

Functions, calling functions, type conversion and coercion, composition of functions, mathematical functions, user-defined functions, parameters and arguments.

Module V

Strings and lists - string traversal and comparison with examples. Tuples and dictionaries - operations and examples

Module VI

Files and exceptions - text files, directories. Introduction to classes and objects - attributes, instances.

ENGLISH (ANNEXURE I (xiii))

Total 15 questions for 15 marks based on the following topics

Vocabulary Building , The concept of Word Formation, Root words from foreign languages and their use in English, Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives. Synonyms, antonyms, and standard abbreviations. Basic Writing Skills, Sentence Structures, Use of phrases and clauses in sentences, Importance of proper punctuation, Creating coherence, Organizing principles of paragraphs in documents, Techniques for writing precisely Identifying common errors in writing, Subject-verb agreement, Noun-pronoun agreement, Misplaced modifiers, Articles Prepositions, Redundancies, Clichés, Nature and Style of sensible writing, Describing , Defining, Classifying, Providing examples or evidence, Writing introduction and conclusion.