

SYLLABUS FOR THE POST OF DEPUTY MANAGER (DATABASE)

Scheme of Examination:

MCQ Type	Test Component	Duration: 120 Minutes	
		No. of Questions	Marks
(i)	General Intelligence & Reasoning	15	15
(ii)	General Awareness	15	15
(iii)	Database related	70	70
	Total	100	100

Syllabus:

(i) General Intelligence & Reasoning:

The Syllabus for General Intelligence would include questions of both verbal and non-verbal type. The test may include questions on analogies, similarities, differences, space visualization, problem solving, analysis, judgement, decision making, visual memory, discrimination, observation, relationship concepts, arithmetical reasoning, verbal and figure classification, arithmetical number series etc. The test will also include questions designed to test the candidate's abilities to deal with abstract ideas and symbols and their relationships, arithmetical computations and other analytical functions.

(ii) General Awareness:

Questions will be aimed at testing the candidate's general awareness of the environment around him/her and its application to society. Questions will also be designed to test knowledge of current events and of such matters of everyday observations and experience in their scientific aspect as may be expected of any educated person. The test will also include questions relating to India and its neighbouring countries especially pertaining to History, Culture, Geography, Economic Scene, General Polity and Scientific Research, etc. These questions will be such that they do not require a special study of any discipline.

(iii) **Computer Fundamentals, Programming and Databases:**

Fundamentals of Computer:

Basic of computers, network & Internet, email, use of office productivity tools like Word, spreadsheets & presentations.

Programming Skills and C Programming:

Basics of problem solving, providing solution to problem using flowchart, algorithm and pseudocode.

Basic of C, data types, variables and their scope, Storage classes, I/O operations, Operators, control structures, looping structures, Array, strings, Functions, pointers, Enum, struct, union, memory management, File handling.

Database Management System:

Introduction to Database Management System (DBMS). Database versus conventional flat file. Database system, advantages of DBMS, Data abstraction, Data independence, Schemas, Architecture of the Database system, three levels of architecture, Logical View, Physical View, Conceptual View, Logical data independence, Physical Data Independence.

Data Models:

Relational Model, Network Model, Hierarchical Model, ER Model: Entities, Attributes and Entity Sets, Relationships and Relationship Sets, Constraints, Weak Entities, Class Hierarchies, Aggregation, Conceptual Database Design with the ER Model, Comparison of Models.

Relational Database Management System (RDBMS):

Introduction, RDBMS terminology, relational model, base tables, different keys, primary key, foreign key, constraints, Codd Rules, integrity constraints. ER to Data model conversion, Data Definition Language, Data Control Language, Data Manipulation language.

Database Design:

Normal forms-1NF, 2NF, 3NF, BCNF, Multi-valued Dependency, Join Dependency, Fourth and Fifth Normal Forms, Domain Key Normal Forms, Decompositions.

Relational Query Languages:

SQL: Basic SQL Query, Creating database, Table, indexes and Views, SQL as DML, DDL and DCL, Joins, inner join, outer join, self-join, Nested Queries, Aggregate Operations, Cursors, Dynamic SQL, Integrity Constraints in SQL, Triggers and Active Database, Relational Completeness, Basic Query Optimization Strategies, View, advantages of views.

Transaction, Concurrency and Backup Recovery:

Introduction to concurrency control and transactions. Need for concurrency controls and transaction, ACID properties, serialization, locking techniques, types of locks, deadlocks, states of transaction: active, committed, partially committed, failed & aborted.

Reasons of failure in database, backup techniques: Full, transactional, differential backups.

Database Administration:

DBA Roles and Responsibilities; Backup and Recovery: Types of Database Failures, Types of Database Recovery, Recovery Techniques: Deferred Update, Immediate Update, Shadow Paging, Checkpoints, Buffer Management.

Stored Procedure and Functions:

Introductions to stored procedures and functions, benefits, in-built functions available in SQL Server, creating, modifying and dropping user defined stored procedures and functions. Types of user defined functions, data types, looping control, conditional controls.

SYLLABUS FOR THE POST OF ELECTRICIAN

Scheme of Examination:

MCQ Type	Test Component	Duration: 120 Minutes	
		No. of Questions	Marks
(i)	General Intelligence & Reasoning	20	20
(ii)	General Awareness	20	20
(iii)	General Engineering (Electrical)	60	60
	Total	100	100

(i) **General Intelligence & Reasoning:** The Syllabus for General Intelligence would include questions of both verbal and non-verbal type. The test may include questions on analogies, similarities, differences, space visualization, problem solving, analysis, judgement, decision making, visual memory, discrimination, observation, relationship concepts, arithmetical reasoning, verbal and figure classification, arithmetical number series etc. The test will also include questions designed to test the candidate's abilities to deal with abstract ideas and symbols and their relationships, arithmetical computations and other analytical functions.

(ii) **General Awareness:** Questions will be aimed at testing the candidate's general awareness of the environment around him/her and its application to society. Questions will also be designed to test knowledge of current events and of such matters of everyday observations and experience in their scientific aspect as may be expected of any educated person. The test will also include questions relating to India and its neighboring countries especially pertaining to History, Culture, Geography, Economic Scene, General Polity and Scientific Research, etc. These questions will be such that they do not require a special study of any discipline.

(iii) **General Engineering (Electrical):**

- **Electrician Trade:** Safety Rules & safety signs, Types and working of fire extinguisher, First aid safety practice, Hazard identification and prevention, Personal safety and factory safety, Response to emergencies, Power Failure, system failure and fire etc. Concept of standards and advantages of BIS/ISI- Trade tools specifications, Introduction to National electrical code-2011

- **Allied trades:** Introduction to fitting tools, safety-preventions, Description of files, Hammers, Chisels, Hacksaw frames, Blades and their specifications and grades, Marking tools description and use. Types of drills, description drilling machines, Various wooden joints, Marking Tools, calipers, dividers, surface plates, Angle plates, scribes, punches, surface gauges types, use case and maintenance, Sheet metal tools, description of marking & cutting tools, Types of rivets and riveted joints use of thread gauge. Description of carpenter's tools care and maintenance of tools

- **Fundamentals of electricity** definitions, units. Effects of electric current. Conductors and insulators. Conducting materials and their comparison. Joints in electrical conductors. Techniques of soldering. Types of solders and flux.
- **Underground cables:** Description types. Various Joints and testing procedure. Cable insulation & voltage grades. Precautions in using various types of cables. Ohm's law, simple electrical circuits and problems. Kirchoff's law, simple electrical circuits and problems. Series and parallel circuits. Open and short circuits, in series and parallel networks. Law of resistance. Types of resistors. Wheatstone bridge, principle and its applications. Effects of variation of temperature on resistance. Different methods of measuring the values of resistance. Series and parallel combination of resistors. Magnetic terms, magnetic materials. Properties of magnet. Principles and laws of electromagnetism. Self and mutually induced EMFs
- **Electrostatics:** Capacitor- Different types, functions, grouping and uses. Inductive and capacitive reactance, their effect on AC circuit and related vector concepts. Comparison and Advantages of DC and AC systems. Related terms frequency, Instantaneous value, R.M.S. value, Average value, Peak factor, form factor, power factor and impedance etc. Sine wave, phase and phase difference. Active and Reactive power. Single Phase and three-phase system. Problems on A.C. circuits. Advantages of AC poly-phase system. Concept of three-phase Star and Delta connection. Line and phase voltage, current and power in a 3 phase circuits balanced and unbalanced load. Phase sequence meter. Measure current and voltage of two phases in case of one phase is short-circuited in three phase three phase four wire system and compare with healthy system.
- **Chemical effect of electric current and Laws of electrolysis:** Explanation of Anodes and cathodes. Types of cells advantages / disadvantages and their applications. Lead acid cell. Principle of operation and components. Types of battery charging, Safety precautions. Test equipment and maintenance. Basic principles of Electro-plating and cathodic protection Grouping of cells for specified voltage and current. Principle and operation of solar cell. I.E. rules on electrical wiring. Types of domestic and industrial wirings. Study of wiring accessories e.g. switches, fuses, relays, MCB, ELCB, MCCB etc. Grading of cables and current ratings. Principle of laying out of domestic wiring. Voltage drop concept. PMMC and Moving iron Instruments
- **PVC conduit and Casing-capping wiring system-** Different types of wiring. Power, control, Communication and entertainment wiring. Wiring circuits planning permissible load in sub-circuit and main circuit. Estimation of load, cable size, bill of material and cost Inspection and testing of wiring installations. Special wiring circuit e.g. godown, tunnel and workshop etc. Importance of Earthing. Plate earthing and pipe earthing. Methods and IEE regulations. Earth resistance and earth leakage circuit breaker. Laws of Illuminations. Types of illumination system. Illumination factors, intensity of light. Type of lamps, advantages/ disadvantages. Their applications. Calculations of lumens and efficiency. Classification of electrical instruments essential forces required in indicating instruments.
- **Measurement of various electrical parameters:** different analog and digital instruments: Measurement of energy in three phase circuit. Errors and corrections in measurement. Loading effect of voltmeter and voltage drop effect ammeter in circuits. Extension of range and calibration measuring instruments. Working principles and circuits. Common domestic equipment and appliances. Concept of Neutral and Earth. Working principle, construction and classification of transformer. Single phase and three phase transformers. Single phase and three phase transformers. Turn ratio and e.m.f. equation. Series and parallel operation of transformer. Voltage Regulation and efficiency
- Auto Transformer and instrument transformers (CT & PT). Method of connecting three single phase transformers for three phase operation. Types of Cooling, protective devices, bushings and termination etc. Testing of transformer oil. Materials used for winding and winding wires in small transformer.

Syllabus for the Post of Senior Technical Assistant (Store)

Scheme of Examination:

MCQ Type	Test Component	Duration: 120 Minutes	
		No. of Questions	Marks
(i)	General Intelligence & Reasoning	20	20
(ii)	General Awareness	20	20
(iii)	Subject / Domain Related (Material Management and Computer Concepts)	60	60
	Total	100	100

Syllabus:

(i) **General Intelligence & Reasoning:** The Syllabus for General Intelligence would include questions of both verbal and non-verbal type. The test may include questions on analogies, similarities, differences, space visualization, problem solving, analysis, judgement, decision making, visual memory, discrimination, observation, relationship concepts, arithmetical reasoning, verbal and figure classification, arithmetical number series etc. The test will also include questions designed to test the candidate's abilities to deal with abstract ideas and symbols and their relationships, arithmetical computations and other analytical functions.

(ii) **General Awareness:** Questions will be aimed at testing the candidate's general awareness of the environment around him/her and its application to society. Questions will also be designed to test knowledge of current events and of such matters of everyday observations and experience in their scientific aspect as may be expected of any educated person. The test will also include questions relating to India and its neighbouring countries especially pertaining to History, Culture, Geography, Economic Scene, General Polity and Scientific Research, etc. These questions will be such that they do not require a special study of any discipline.

(iii) **Subject / Domain Related (Material Management and Computer Concepts):**

A. Materials Management: An Overview

1. Introduction to Materials Management: Meaning, definition, scope and functions of Materials Management, Objectives and Advantages. Interfaces: Internal and external interfaces. Organisation for Material Management.
2. Supply Chain Management: Concept, objectives of supply – production and distribution system, Role and Management of flow of material in supply chain management.
3. Material Management Linkages: Linkages with other functional areas of Management i.e. Production, Accounting and Finance, Marketing, HRM, IT, TQM. A Brief discussion on the functions of each functional area of Management.
4. Elements of Production Processes: Familiarity with broad categories of production processes used in industries. Commonly used machines and tools in industries.
5. Cost Involved in material management: General discussion on concept of costs and cost classification, specific costs associated with Material Management.

B. Stores Keeping and Stores Accounting

1. Storekeeping: Introduction, objectives, functions, types. Location and layout of stores.
2. Receipt of Materials: Receipt procedure, inspection and testing of materials, Rejection and Returns of materials. Forms used in receiving of materials like Material Received Note, Inspection Report, Rejection Report etc. Passing of Bills/invoices for payment.
3. Codification of Materials: Need for codifications, different methods, suitability criteria.
4. Issue of Materials: Issue procedure and documents used, store records like bincard and store ledger, pricing of material issues – different methods like FIFO, LIFO, Simple average, weighted average, standard price, Replacement / market price etc.
5. Material losses: Meaning, accounting treatment and control of different type of material losses (waste, scrap, spoilage, defectives, obsolescence etc.).
6. Store Handling Equipment: Advantages, Types: manual and mechanical devices.
7. Inventory Management Rules in GFR 2017 with latest amendments.

C. Purchase Management

1. Purchase Management: Introduction, importance, functions, objectives (6Rs of purchasing), Organisation for purchase function, centralized / decentralised purchasing.
2. Purchase Procedure: Pre-purchase considerations, standard purchase procedure, post-purchase issues. Standard forms used in purchasing like purchase requisition, tender / quotation documents, schedule of quotations, purchase order, follow-up order, cancellation of order, Bill of Materials etc.
3. Special Purchase Systems – Forward Purchase, Tender purchase, Blanket order, zero stock, Rate contract etc. Price Forecasting: Price and Pricing impact, price negotiations and fixing. Purchasing under fluctuating prices, purchasing under uncertainty, Negotiations regarding quality, terms of contract, delivery, payment schedule, cash discount, quality considerations, etc.
4. Public Buying: Procurement Rules in GFR 2017 with latest amendments, Government e-Marketplace(GeM), DGS&D Rate contract, Buying from Kendriya Bhandars NICSI etc.
5. Online Purchasing: Concept, advantages, procedure and online purchase practices.
6. Buyer- seller Relationship: Importance of good buyer-seller relationship, Relation with supplier-policies and issues in relationship, Ethical issues in purchasing.

7. Legal issues in Purchasing: Law of Contract, Contract of Sale of Goods, Conditions and Warranties, Rules Regarding Transfer of Property. Negotiable Instrument Act, IT Act 2000
8. Insurance Buying: Arranging adequate insurance cover and claim management. Quality Control in Purchasing: Concept of Total Quality Management (TQM), Certification, Role of Material Management in TQM. Value Analysis and Value Engineering.
9. International Purchasing: Need, Direct and Indirect Buying. Procedure, Documentation and Legal-Framework of International Purchasing.

D. Indian Economy – Sectoral Issues

1. Agriculture: Trends in production and productivity, land reforms, land tenure system, land distribution. Agricultural labour, wages and employment and issue of under-employment. Capital investment, credit, Irrigation and supply of other inputs. Agricultural Policies- Green revolution, pricing and procurement policies, PDS and MSP.
2. Industry: Growth & Structure. Industrial & licensing policies, large, small, cottage industries. Industrial finance, capital and multinationals. Cost of each source of finance.
3. Service Sector: Growth and Structure of service sector – major components, linkages with other sectors, and importance in the national economy, informal sector.

E. Computer concepts and software packages

1. Basic Concepts: Meaning, characteristics and applications of a Computer, Advantages and limitations of a computer, Meaning of Data, Information and Knowledge, Data types, data storage, data representation such as ASCII.
2. Components of Computers: Hardware components: input & output devices, system unit. Software components: Application software: general purpose packaged and tailor – made, System software: operating system, interpreter, compiler, linker, loader.
3. Operating System: Need and functions, Graphic user interface and character user interface. Windows environment: application and document, Windows interface such as icons, lists, menus, dialog box, etc. Desktop, control panel, system tools, utilities. Explorer: file types, attributes, names, folders, drives, devices. File functions.
4. Introduction to Networks and Internet: Meaning and types of networks - LAN, MAN and WAN, Internet, difference between internet and intranet. Basics: functions, growth, anatomy, Uses, Wireless and wifi, Internet services: ISP, types of accounts, World Wide Web: websites file transfer, browsing, searching.
5. Office Applications: Meaning and applications of word processing, Features of MS-Word, Meaning and applications of spreadsheets, Features of MS-Excel, Meaning and applications of presentation. Features of MS-PowerPoint.

F. Inventory Systems and Control Techniques

1. Inventories: Meaning, types, definition as per relevant accounting standard, Need and benefit of holding inventories, objectives of inventory management.
2. Inventory systems and Valuation of Inventories: Periodic inventory system, Perpetual inventory system including continuous stock taking. Valuation of inventories as per relevant accounting standard under different methods and systems, valuation as per LIFO Method also. Inventory methods with specific reference to different industries
3. Inventory Decisions: Types of inventory decisions, relevant costs involved. Quantity order decision – Economic Order Quantity and its calculation as per tabular, graphical and mathematical approaches, EOQ with quantity discount, Re-order decision : Fixation of Various levels and determination of re-order point, safety stock etc. Q System, P system.

4. Other Inventory Control Techniques: Selective Inventory Control – ABC Analysis, Material, Turnover Ratio: Calculation and Importance, FSN Analysis, JIT Approach, VED Analysis. Management of Process Inventories (WIP). Spares Parts Management.

G. Material Logistics and Distribution Management

1. Material Logistics: Concept and Importance. Logistic Tasks: Followup of Order, Transportation, Warehousing, Inventory Control, Information Monitoring. Logistic Planning: Major Aspects and Factors.
2. Transportation: Different modes, their relative advantages, disadvantages and suitability. Road Transport: Role and limitations of Road Transport in Movement of Materials, Role of NHAI, Consignment Note. Rail transport: India Railway Network and Role in Transportation of Materials and Cargo, Consignment Note. Air transport and its Role in Domestic & International Transportation of Goods. Role of Ministry of Civil Aviation, Airport Authority of India and Directorate General of Civil Aviation. Air Waybill, Contract of Affraightment. Water transport: Inland Water Transport and its role, Inland Waterways Authority of India. Ocean transport: Role of Ocean Transport in International Trade, Structure of Shipping Services - Liner and Tramp/Charter, Conference System and Determination of Rates, Bill of Lading and Charter Party.
3. Multi-Model Transport System: Concept and advantages. Containerization: Need and Advantages of Containerization, Inland Container Depots (ICDs) and Container Freight Stations (CFSs). B.A. (Vocational Studies) Materials Management, CBCS.
4. Warehousing: Concept (Warehouse, Depositor and Warehouseman), Elements and Functions. Role in Economic Development, Types, Advantages of a Public Warehouse, Costs Associated with Warehousing, Warehousing Corporations in India, Objectives and Functions of Warehousing Corporations.

H. Supply Chain Management

1. Statistical Presentation: Elements of data representation for (i) Tabulation and cumulative frequency, (ii) histogram, (iii) measures of central Tendency, (iv) Probability Theory (Basic concepts excluding non-conditional and Bayes Theorem).
2. Quality Management Concepts: ISO Certification, Methods of Control: Product, Process, Risk, Evolution, Management Approaches, Quality Management Support System. R Chart, P Chart and X charts; Acceptance Sampling & OC Curve in production Control.
3. Supply Chain Management: How purchasing becomes supply management? Supply Management and the Bottom line. Four phases of supply management. Supply management systems: B2B, Strategic Supply Management.
4. Enabling Concepts in Supply: Buyer-supplier relationship: Developing and Managing collaboration and Alliance relationship. Cross-functional teams and supply-Management Activities. Challenges and problems with cross functional approach, ERP Systems, Negotiations and Bidding, Information sharing.

I. Business Law

1. The Indian Contract Act, 1872, Contract – meaning, characteristics and kinds, Essentials of valid contract - Offer and acceptance, consideration, contractual capacity, free consent, legality of objects, Void agreements, Discharge of contract – modes of discharge including breach and its remedies, Contingent contracts, Quasi contracts.
2. The Indian Contract Act, 1872: Specific Contracts, Contract of Indemnity and Guarantee, Contract of Bailment, Contract of Agency.

3. The Sale of Goods Act, 1930, Contract of sale, meaning and difference between sale and agreement to sell, Conditions and warranties, Transfer of ownership in goods including sale by non-owners, Performance of contract of sale, Unpaid seller – meaning and rights of an unpaid seller against the goods and the buyer.
4. Partnership Law, The Partnership Act, 1932: Nature and Characteristics of Partnership, Registration of Firms, Types of Partners, Rights and Duties of Partners, Implied Authority of a Partner, Incoming and outgoing Partners, Mode of Dissolution of Partnership, The Limited Liability Partnership Act, 2008: Salient Features of LLP, Difference between LLP and Partnership, LLP and Company, LLP Agreement, Partners and Designated Partners, Incorporation Document, Incorporation by Registration, Partners and their Relations, winding up B.A. (Vocational Studies) Materials Management, CBCS.
5. The Negotiable Instruments Act, 1881, Meaning and Characteristics of Negotiable Instruments: Promissory Note, Bill of Exchange, Cheque, Holder and Holder in due Course, Privileges of Holder in Due Course, Negotiation: Types of Endorsements, Crossing of Cheque, Bouncing of Cheques.

J. Material Planning and Control

1. Budgetary Control: Meaning and types of Budget, Budgetary Control System, Material Requirement Planning, Principal Budget Factor, Budget Manual, Preparation of Different Types of Budgets. Fixed and Flexible Budget.
2. Standard Costing: Meaning, Standard Costing System, Material Cost Variance Analysis.
3. Elements of Marginal costing and Decision making : Marginal Cost, Fixed and Variable Costs (Period and Product Costs), Marginal Costing System, Marginal Cost Equation, Profit – Volume Ratio, Break Even Point, Break Even Chart, Margin of Safety, Cost-Volume Profit Analysis and its Uses, Relevant Costs in Decision Making. Simple Decision Making Problems including Make or Buy Decision, Domestic versus International Purchase.
4. Computers in Material Management: Use of Computers in Material Planning, Purchase, Store, Issue, Inventory Control. Integrated Information System for Material Management.
5. Evaluation of Material Management Function: Meaning and Procedure. Evaluation Tools and Techniques.

Note: The above syllabus is indicative and the questions in the test may include similar other topics pertaining to the level and content of essential qualification.

SYLLABUS FOR THE POST OF SENIOR TECHNICAL ASSISTANT (CIVIL)

Scheme of Examination:

MCQ Type	Test Component	Duration: 120 Minutes	
		No. of Questions	Marks
(i)	General Intelligence & Reasoning	20	20
(ii)	General Awareness	20	20
(iii)	General Engineering (Civil and Structural)	60	60
	Total	100	100

Syllabus:

(i) **General Intelligence & Reasoning:** The Syllabus for General Intelligence would include questions of both verbal and non-verbal type. The test may include questions on analogies, similarities, differences, space visualization, problem solving, analysis, judgement, decision making, visual memory, discrimination, observation, relationship concepts, arithmetical reasoning, verbal and figure classification, arithmetical number series etc. The test will also include questions designed to test the candidate's abilities to deal with abstract ideas and symbols and their relationships, arithmetical computations and other analytical functions.

(ii) **General Awareness:** Questions will be aimed at testing the candidate's general awareness of the environment around him/her and its application to society. Questions will also be designed to test knowledge of current events and of such matters of everyday observations and experience in their scientific aspect as may be expected of any educated person. The test will also include questions relating to India and its neighbouring countries especially pertaining to History, Culture, Geography, Economic Scene, General Polity and Scientific Research, etc. These questions will be such that they do not require a special study of any discipline.

(iii) **General Engineering (Civil and Structural):**

Civil Engineering

Building Materials: Physical and Chemical properties, classification, standard tests, uses and manufacture/quarrying of materials e.g. building stones, silicate-based materials, cement (Portland), asbestos products, timber and wood based products, laminates, bituminous materials, paints, varnishes.

Estimating, Costing and Valuation: estimate, glossary of technical terms, analysis of rates, methods and unit of measurement, Items of work – earthwork, Brick work (Modular & Traditional bricks), RCC work, Shuttering, Timber work, Painting, Flooring, Plastering. Boundary wall, Brick building, Water Tank, Septic tank, Bar bending schedule, Centre line method, Mid-section formula, Trapezoidal formula, Simpson's rule. Cost estimate of Septic tank, flexible pavements, Tube well, isolates and combined footings, Steel Truss, Piles and pile-caps. Valuation – Value and cost, scrap value, salvage value, assessed value, sinking fund, depreciation and obsolescence, methods of valuation.

Surveying : Principles of surveying, measurement of distance, chain surveying, working of prismatic compass, compass traversing, bearings, local attraction, plane table surveying, theodolite traversing, adjustment of theodolite, Levelling, Definition of terms used in levelling, contouring, curvature and refraction corrections, temporary and permanent adjustments of dumpy level, methods of contouring, uses of contour map, tachometric survey, curve setting, earth work calculation, advanced surveying equipment.

Soil Mechanics: Origin of soil, phase diagram, Definitions-void ratio, porosity, degree of saturation, water content, specific gravity of soil grains, unit weights, density index and interrelationship of different parameters, Grain size distribution curves and their uses. Index properties of soils, Atterberg's limits, ISI soil classification and plasticity chart. Permeability of soil, coefficient of permeability, determination of coefficient of permeability, Unconfined and confined aquifers, effective stress, quick sand, consolidation of soils, Principles of consolidation, degree of consolidation, pre-consolidation pressure, normally consolidated soil, e-log p curve, computation of ultimate settlement. Shear strength of soils, direct shear test, Vane shear test, Triaxial test. Soil compaction, Laboratory compaction test, Maximum dry density and optimum moisture content, earth pressure theories, active and passive earth pressures, Bearing capacity of soils, plate load test, standard penetration test.

Hydraulics: Fluid properties, hydrostatics, measurements of flow, Bernoulli's theorem and its application, flow through pipes, flow in open channels, weirs, flumes, spillways, pumps and turbines.

Irrigation Engineering: Definition, necessity, benefits, 2II effects of irrigation, types and methods of irrigation, Hydrology – Measurement of rainfall, run off coefficient, rain gauge, losses from precipitation – evaporation, infiltration, etc. Water requirement of crops, duty, delta and base period, Kharif and Rabi Crops, Command area, Time factor, Crop ratio, Overlap allowance, Irrigation efficiencies. Different type of canals, types of canal irrigation, loss of water in canals. Canal lining – types and advantages. Shallow and deep to wells, yield from a well. Weir and barrage, Failure of weirs and permeable foundation, Slit and Scour, Kennedy's theory of critical velocity. Lacey's theory of uniform flow. Definition of flood, causes and effects, methods of flood control, water logging, preventive measure. Land reclamation, Characteristics of affecting fertility of soils, purposes, methods, description of land and reclamation processes. Major irrigation projects in India.

Transportation Engineering: Highway Engineering – cross sectional elements, geometric design, types of pavements, pavement materials – aggregates and bitumen, different tests, Design of flexible and rigid pavements – Water Bound Macadam (WBM) and Wet Mix Macadam (WMM), Gravel Road, Bituminous construction, Rigid pavement joint, pavement maintenance, Highway drainage, Railway Engineering- Components of permanent way – sleepers, ballast, fixtures and fastening, track geometry, points and crossings, track junction, stations and yards. Traffic Engineering – Different traffic survey, speed-flow-density and their interrelationships, intersections and interchanges, traffic signals, traffic operation, traffic signs and markings, road safety.

Environmental Engineering: Quality of water, source of water supply, purification of water, distribution of water, need of sanitation, sewerage systems, circular sewer, oval sewer, sewer appurtenances, sewage treatments. Surface water drainage. Solid waste management – types, effects, engineered management system. Air pollution – pollutants, causes, effects, control. Noise pollution – cause, health effects, control.

Structural Engineering

Theory of structures: Elasticity constants, types of beams – determinate and indeterminate, bending moment and shear force diagrams of simply supported, cantilever and over hanging beams. Moment of area and moment of inertia for rectangular & circular sections, bending moment and shear stress fortee, channel and compound sections, chimneys, dams and retaining walls, eccentric loads, slope deflection of simply supported and cantilever beams, critical load and columns, Torsion of circular section.

Concrete Technology: Properties, Advantages and uses of concrete, cement aggregates, importance of water quality, water cement ratio, workability, mix design, storage, batching, mixing, placement, compaction, finishing and curing of concrete, quality control of concrete, hot weather and cold weather concreting, repair and maintenance of concrete structures.

RCC Design: RCC beams-flexural strength, shear strength, bond strength, design of singly reinforced and double reinforced beams, cantilever beams. T-beams, lintels. One way and two-way slabs, isolated footings. Reinforced brick works, columns, staircases, retaining wall, water tanks (RCC design questions may be based on both Limit State and Working Stress methods).

Steel Design: Steel design and construction of steel columns, beams roof trusses plate girders.