Compulsory Subjects

IC 402 Engineering Management

CV 403 Civil Engineering Materials and Construction Practices

CV 404 Geo-technical and Foundation Engineering

CV 405 Water Resources Systems

CV 406 Principles of Geo-informatics

CV 407 Analysis and Design of Structures

Optional Subjects

(Any three from any one Group)

Group I Structural Engineering

CV 411 Advanced Structural Analysis

CV 412 Design of RCC and Pre-stressed Concrete Structures

CV 413 Design of Steel Structures

CV 414 Structural Dynamics

CV 415 Seismic Design of Structures

Group II Environmental Engineering

CV 421 Principles of Environmental Engineering

CV 422 Environmental Engineering — Processes and Management

CV 423 Air Pollution and Its Control

CV 424 Design of Water and Wastewater Treatment Systems

CV 425 Waste Management and Environmental Impact Assessment

Group III Infrastructure and Urban Development

CV 431 Transportation Engineering

CV 432 Traffic and Transportation Systems

CV 433 Town Planning and Urban Development

CV 434 Design of Water and Wastewater Treatment Systems

CV 435 Construction Management Systems

ENGINEERING MANAGEMENT

Group A

Management and Organisations

Management process: Definition, planning organizing, directing, controlling, coordinating, types of management.

Organisation Definition, planning, design and development, types of organizations.

Management planning and control: Classical, new classical and modern principles. General Management, scientific management, engineering, management, systems management.

Planning: Procedures, resources and constraints, objectives, goals, policies and procedures.

Control: Setting of reference or standards, appraisal or evaluation, monitoring and controlling, types of control.

Human resource planning and management, selection, recruitment, training, retraining, skill development, competence development, promotion and career development, participative management, trade unions, and collective bargaining,

Management of Physical Resources

Plant: site selection procedures, factors affecting selection. Layout-types and relative merits and demerits, Maintenance-Objectives, different types of associated decisions, strategies for effective maintenance, computer applications.

Material : Functions, objectives, planning and control including inventory models with or without storage costs, price break (excluding dynamic and probabilistic considerations). Different classes of inventory. Material Requirement Planning (MRP).

Group B

Financial management: Introduction to standard forms of financial statements, ie., balance-sheet, profit and loss, and income statement. Fixed and current asset items. Fixed and current liability items. Linkage of two successive balance-sheets through income or profit and loss statement. Funds flow statement. Financial ratios and their implications.

Managerial economics: Concepts, theory of production, marginal productivity and cost. Introduction to theory of firm.

Quality management: Quality definition, quality planning, quality control and quality management, Total quality management, ISO 9000 systems, simple quality control techniques like control charts and acceptance sampling.

Marketing management consumer behaviour, market research, product design and development pricing and promotion.

Project management: Introduction. Concept of a project, project management concepts, project simulation, cost or project and means of financing, economic evaluation criteria of the project, project implementation, project planning, scheduling and monitoring, project control (PERT, CPM techniques including crashing). Project evaluation.

Information technology and management. Role of information, management information system and decision support system, Information technology-introduction to e-business, e-commerce and integration tools like enterprise resource planning (ERP).

CIVIL ENGINEERING MATERIALS & CONSTRUCTION PRACTICES

Group A

Introduction to civil engineering materials-stone, timber, cement, steel, plastics, concrete. Engineering properties of materials-density, strength (compressive, tensile, flexural, shear, etc.), modulus of elasticity, fatigue, limit, creep, shrinkage, relaxation, permeability, fire resistance. Materials and environment-effect of environment on materials. Classification of environ-ment-temperature, humidity, rain, fire.

Steel: Manufacture, rolled sections, properties, classifications.

Cement: Manufacture-wet and dry processes, constituents and constitution, properties-setting, strength, durability, classification-high early strength, low alkali, rapid hardening.

Concrete: Constituents-coarse and fine aggregates, cement, water. Mineral admixtures-fly ash, blast furnace, slag, silica fume. Chemical admixtures-air entraining, set retarding and accelerating, super plasticising. Fresh concrete-workability, air content, segregation. Hardened concrete-strength, hardness, modulus of elasticity, modulus of rupture. Special concretes-fibre, reinforced, shortcrete, underwater, high strength. Deterioration and durability-reinforcement, corrosion, carbonation, alkali -aggregate reaction.

Group B

Bricks: Manufacture, classification. Other materials. Standardization and standards-need to have standards and some common international standards. Relevant Indian standards (commonly used standards to be listed with brief description). Quality control. Non-destructive testing and evaluation.

Construction practices: Standards relevant to quality control at site. Safety issues. Quantities and estimation. Tender document. Contracts-unit rate, lumpsum, turnkey. Project management-CPM, PERT, bar charts, pie diagrams, escalation, depreciation. -

GEOTECHNICAL AND FOUNDATION ENGINEERING

Group A

Introduction to soil mechanic, examples of geotechnical engineering applications. Description of assemblage and individual particles, classification, etc. Soil types.

Geostatic stresses, stresses due to applied loads, stress point, stress paths, principle of effective stress. Soil-water systems, capillarity, flow through soils. Darcy's law, tests to determine the coefficient of permeability in the lab and in situ, one-dimensional flow, total elevation and pressure heads, piping/quicksand condition.

Two-dimensional flow, seepage, continuity condition, methods of solution, confined and unconfined flows, flow nets, etc. Tests for strength and stress strain relations, stress paths.

One-dimensional compression test, compressibility parameters, maximum past consolidation pressure, OCR, phenomenon of consolidation, Terzaghi theory, coefficients of consolidation and secondary compression (creep), consolidation under construction loading, vertical drains, radial flow consolidation, etc.

Strength and triaxial testing, Mohr-Coulomb strength criterion, drained, consolidated, undrained and undrained tests, strength of sands loose and dense) and fine grained (NC and OC) soils, partially saturated soils, volume changes (dilation and contraction) due to shear stresses.

Group B

Characterization of ground, site investigations, methods of drilling/boring, sampling and in situ tests- SPT, CPT, plate load test and its limitations, groundwater levels, etc.

Bearing capacity of foundations, general, local and punching shear modes, theories, corrections for different conditions, ultimate and allowable pressures, methods based on in situ tests.

Settlement of foundations, one- two- and three- dimensional approaches, immediate consolidation and creep settlements, stress path method, methods based on III Situ tests, etc.

Choice of type of foundations, shallow/deep, isolated, combined, strap, trapezoidal or mat foundations, contact pressure, distribution, basics of footing design. Ground improvement methods, preloading, vertical drains, vibrocompaction, stone columns, heavy tamping, etc.

Earth pressure theories, Coulomb and Rankine theories, effect of, layering, water level, etc. Retaining walls, types-gravity, cantilever, counterfort, reinforced. earth, etc. Design methods, checking for stability.

WATER RESOURCES SYSTEMS

Group A

Introduction to Water Resources Systems. Elements of a water system, concept of a system, systems analysis techniques, issues in systems approach, advantages and limitations of systems approach, challenges in water sector.

Acquisition and Processing of Water Resources Data. Types of data, design of hydromet networks, data validation, acquisition and processing of precipitation and other meteorological data, acquisition and processing of stream flow data, water quality and other data, water resource information system.

Emerging Techniques for Data Acquisition and Systems Modelling Remote sensing, geographic information systems.

Statistical Techniques for Data Analysis. Random variable, cumulative distribution function, probability distribution function, distribution characteristics. Normal distribution, Extreme value type I distribution, Gamma distribution, Pearson type HI distribution, Discrete probability distributions, method of moments for continuous and discrete systems, problems of parameter estimation, hypothesis testing; t-test, Chi-square distribution, linear regression, correlation analysis. Frequency analysis; Frequency factor method, time-series analysis, auto regression and moving average models.

Systems Analysis Techniques. Optimization, Kuhn-Tucker conditions. Linear programming: Standard form, graphical solution, simplex method, duality, piecewise linearization, simulation.

Group B

Economic Considerations. Basic principles of project economics, demand utility of water, project economics and evaluation, discounting techniques, benefit-cost ratio method, present worth and rate-of-return and annual cost methods, project-feasibility and optimality.

Environmental and Social Considerations. Water in environment, environmental impact of water resources projects, environmental impact of reservoirs, environmental problems in command areas, environmental impact assessment, sustainable development. Social impacts.

Water Resources Planning. Stages in water resources planning, data collection and processing, estimation of future water demands, preliminary planning, institutional set-up, public involvement, formulation and screening of alternatives, models for water resources planning, sensitivity analysis.

Reservoir Sizing. Need for reservoirs, classification of reservoirs, water uses, reservoir planning, estimation of water yield, hydro-power generation, reservoir losses, water balance of a reservoir, storage requirement for conservation purpose. Mass curve method, sequent peak algorithm, flood control storage capacity, reservoir routing.

Principles of Geoinformatics

Group A

Introduction to surveying: Objectives, classification of surveys, Indian topographic series, map reading.

Linear measurements: Distance measurements with chain and tapes, corrections to measured length, field survey by chains/tapes.

Compass surveying: True and magnetic bearings, local attraction, fore and back bearing, various types of compasses and applications, detail plotting, adjustment of compass traverse using graphical approach.

Levelling: Concepts of Geold, ellipsoid, MSL and level surface, methods of levelling, determination of height, booking of levelling operation, types of levels, sensitivity. of the bubble, trigonometric levelling, curvature and refraction effects.

Contouring: Guidelines for preparation of contour m;1ps, methods of contouring.

Plane Tabling (PT): Accessories in PT, methods of PT, re-section method , preparation of map.

Theodolites: Measurements of horizontal and vertical angles, differences in Vernier and microplic theodolites, methods of recording angles.

Errors and adjustments: Accuracy and precision, propagation of variance/covariance and adjustment of errors using observation equation and condition equation approach (matrix based solution).

Tacheometric surveys: Principle and basic system, subtense bar, various types of tachometers, plotting with tacheometers.

Curves: Classification, elements of simple circular, compound, reverse, transition, vertical curves, setting of curves.

Group B

Triangulation: Purpose of triangulation and trilateration, classification, strength of figure, well conditioned triangle, triangulation figures, reconnaissance and station selection, intervisibility of stations, signal and towers, base lining, computation and adjustment in triangulation, satellite station.

EDM: Principles and applications, instruments: Geodimeter, Tellurometer, Distomat, etc.

Digital Theodolites/Total Station/GPS: Principles and applications.

Introduction to photogrammetry: Comparison of serial photographs and topographic maps, definition of basic terms, perspective of near-vertical photograph, scale and coordinates from photographs, stereoscopy, parallel bar measurements, determination of heights, principle of radial line triangulation, assumption, limitations and errors.

Introduction to remote sensing: Remote sensing system, data-acquisition and processing, EMR and spectrum, atmospheric windows, Interaction mechanisms, multi-concept, sensors and platforms. Interpolation of aerial photographs and satellite imagery and their interaction.

Analysis and Design of Structures

Group A

Analysis

Stability and determinacy of structures.

Review of shear force and bending moment diagrams in beams and frames.

Plane trusses.: Method of joints and method of sections. Deflection of trusses (virtual work method). Deflection of beams and frames.

Method of virtual work by Castigliano's theorem;

Moment-area method and conjugate beam method. Influence line diagrams and moving loads. Three-hinged arches and cables.

Analysis of statically indeterminate structures. Force and stiffness method of analysis.

Plane truss using method of consistent deformation. Beams and frames.-

Method of consistent deformation, three-moment equation, slope-deflection equations, moment distribution method, Kani's method.

Group B

Design

Introduction.

Structural fasteners (rivets, welds, bolts).

Design of tension members.

Design of compression members.

Design of beams (rolled section, build-up sections). Design of bolted (eccentric) connections.

Design of welded plate girder.

Design of industrial buildings (gantry girder, roof trusses etc).

Design of beam-columns and column bases. Design of RCC beams, columns, slabs and footings by working stress method of design.

ADVANCED STRUCTURAL ANALYSIS

Group A

Matrix analysis, displacement and force method: Computers and structural analysis; brief discussion on analysis procedures with introduction to displacement and force methods; basic structural system and mathematical model; coordinate systems, joint displacement and joint loads; statically determinate and indeterminate structures; kinematically determinate and indeterminate structures.

Member end load matrix: Member deformation matrix; influence coefficients; global flexibility matrix; global stiffness matrix; local member flexibility and stiffness matrices; plane frame members; space frame members.

Flexibility analysis of statically determinate structures; computer program for flexibility analysis; flexibility analysis of statically indeterminate structures; computer program for flexibility analysis for statically indeterminate structures.

Stiffness analysis method; computer program for stiffness analysis of kinematically determinate systems; stiffness analysis of kinematically determinate plain frame; stiffness analysis of kinematically indeterminate systems; assembly process for obtaining global stiffness matrix from member stiffness matrices for plane truss, space truss, plane frame and space frame.

Group B

Stress analysis and failure criteria. Analysis of stress and strain—principal stresses and Strains, deviaioric stress and strain, stress and strain invariants; compatibility conditions; and equilibrium equations. Failure criteria stress-strain relations for anisotropic and isotropic elastic materials; yield (failure) criteria.

Stress concern ration. Fatigue failure.

Plates and shells; thin plate bending theory, thin plate bending solutions; membrane theory of shells; bending theory—circular cylindrical shells.

DESIGN OF RCC AND PRESTRESSED CONCRETE STRUCTURES

Group A

Introduction to working stress and limit states/design. Working stress design of rectangular beams.

Working stress design of T-beams. Design of tension members and compression members.

Limit states, design of beams.

Design of two-way slabs, design of circular slabs, and design of flat slabs.

Design of miscellaneous structures—staircase, curved beam, lintel, etc.

Group B

Limit state, design of columns. Design of members under combined bending and direct stresses.

Design of footings and design of bridges.

Design of liquid retaining structures.

Design of prestressed concrete structures. Design of masonry structures.

DESIGN OF STEEL STRUCTURES

Group A

Industrial buildings: Loads, classification and types of buildings, braced and unbraced buildings.

Steel towers: Transmission line towers; microwave towers; guyed towers.

Group B

Multistoried buildings: Analysis, types of loads, and design.

Other miscellaneous topics: Steel bridges; pressure vessels; water tanks, chimneys, etc.

STRUCTURAL DYNAMICS

Group A

Single degree of freedom systems: Equations oF motion. Free vibrations, damping. Response to harmonic excitation. Response to general dynamic loading. Duhamel's integral. Numerical methods.

Response spectrum: Concept. Deformation, pseudo-velocity and pseudo-acceleration response spectra. Analysis of SDOF systems using response spectrum. Difference between response spectrum and design spectrum.

Group B

Multi degree of freedom systems: Equations of motion. Free vibrations, natural frequencies and modes. Free vibration analysis for classically damped systems. Damped matrix. Rayleigh damping. Modal analysis. Earthquake analysis of linear systems by response spectrum method.

Continuous systems: Equations of motion. Natural frequencies and modes. Modal orthogonality. Earthquake response spectrum analysis.

SEISMIC DESIGN OF STRUCTURES

Group A

Characteristics of earthquake: Earthquake terminology. Magnitude. Intensity. Measurement of ground motion. Frequency-magnitude relationship. Liquefaction.

Strong ground motion: Acceleration time histories. Peak parameters (peak ground acceleration/velocity/ displacement). Response spectrum. Site effects.

Earthquake analysis of structures: Idealisation on structures. Response spectrum analysis. Equivalent force concepts. Torsionally coupled systems.

Group B

Concepts of earthquake-resistant design: Objectives. Ductility, ductility reduction factor, over strength, response reduction factor. Design response spectrum. Lateral stiffness. Building configuration. Base isolation. Concept of structural control.

Building codes: Performance of buildings in past earthquakes. Historical perspective on code development-Indian code (IS 1893) provisions for buildings.

Detailing of reinforced concrete and masonry buildings: Provisions of IS 13920, IS 4326, IS 13827. Retrofitting and strengthening of buildings (IS 13935).

Other structures: Introduction to concept of seismic design for bridges and liquid retaining tanks.

PRINCIPLES OF ENVIRONMENTAL ENGINEERING

Group A

Environmental engineering: Introduction and scope. Ecology and environment—definitions and interactions, anthropogenic effects.

Pollution and environmental quality: Air and water quality parameters, variation of water quality in the hydrogeologic cycle, beneficial uses of water, water ity criteria and standards for various beneficial uses, air quality criteria, ambient air standards.

Pollutants: Definition, significance, measurement (both air and water).

Wastes: Solid, liquid and gaseous, and their sources and characteristics.

Water and wastewater quality estimation: Population forecast, water demand for various purposes, variation in quantity of water and wastewater.

Overview and elements of water supply scheme.

Group B

Water/wastewater quality enhancement: Unit operations and processes, physico-chemical vs. biological methods, solid-liquid separation, grit removal, screening, commutation, mixing, equalization, coagulation, flocculation, filtration, disinfection, aeration and gas transfer, precipitation, softening, adsorption and ion exchange.

Surface and groundwater treatment: Sequencing of unit operations and processes, plant layout, hydraulic considerations-Rural water supply and sanitation.

Wastewater collection system and water distribution system: Review of analysis, design and appurtenances.

ENVIRONMENTAL ENGINEERING - PROCESS & MANAGEMENT

Group A

Introduction: Review of environmental engineering.

Biological processes for water and wastewater quality enhancement. Microbiological aspects, classification of bioprocesses, aerobic and anaerobic processes, dispersed and immobilized growth systems, reactor analysis, unit operations and processes, aerobic dispersed growth systems—activated sludge process and its modifications, aerobic immobilized growth systems-trickling filters, rotating biological contactors, anaerobic processes-conventional, stationary and mobile, fixed film, sludge blanket, ponds and lagoons, septic tanks.

Overview and elements of wastewater disposal scheme: Primary, secondary and tertiary treatment, sequencing of unit operations and processes, plant layout, hydraulic considerations.

Disposal of wastes: Liquid—inland waters, on land, ocean; disposal standards—effluent and stream, gaseous-atmospheric dispersion, meteorological and stack factors, emission standards.

Group B

Air pollution control; Stack height estimation, particulate removal mechanisms and processes, reduction of gaseous pollutants—adsorption, absorption, neutralization, incineration.

Solid waste management: Collection, classification, reduction—quantity and hazard potential, composting. land filling, incineration, ground water pollution.

Noise pollution and hazardous waste management: Definition, measurement, control measures.

Environmental impact and auditing: Environmental impact and assessment—statements and methodologies, environmental laws—special constitutional provisions, role of federal and state governments and NGOs in monitoring and control of environmental pollution and resources, environmental auditing.

AIR POLLUTION AND ITS CONTROL

Group A

Introduction: History of air pollution, air pollution systems, concepts of air quality, air quality criteria and standards, atmospheric chemistry and philosophy of air

pollution control.

Air Pollution sources: Stationary—industrial, domestic, non-point Mobile: Petrol and diesel-driven vehicles.

Assessment of air pollution: Preparation of emission inventory, emission factors, pollution loads.

Effects of air pollution: Human health, vegetation and property.

Air quality surveillance: Design of air quality monitoring network.

Meteorology: Physics of atmosphere—sun atmosphere, heat balance, wind speed, direction, ventilation, mixing height, stability, class.

Group B

Transport and dispersion of pollutants: Turbulence, advection, diffusion equation, Gaussian model and its variation, plume rise, fate process and migration pathways, dry and wet deposition.

Engineering control: Setting chambers, inertial devices, bagfihers, dry and wet scrubbers, mobile source control, two- and three-way catalytic converters.

Source sampling and monitoring: Isokinetic sampling. Air pollution legislations, international treaties, emission standards. Global and regional air pollution issues.

DESIGN OF WATER AND WASTE WATER TREATMENT SYSTEMS

Group A

Environmental engineering; Introduction and scope.

Design consideration.

Environment quality and pollution: Water quality and its parameters; variation of water quality in hydrogeologic cycle, beneficial uses of water, water quality criteria and ambient water standards.

Water quality and health.

Consideration in water supply scheme.

Water and wastewater quantity estimation: Population forecast; water demand for various purposes, variation in quantity of water and wastewater.

Design of grit removal, equalisation, coagulation— flocculation, filtration, disinfection; aeration and gas transfer, and distribution system.

Group B

Wastewater characterisation, wastewater quality parameters, BOD, COD, various types of solids, physicochemical, biological methods, solid-liquid separation, grit removal, screening, commutation, mixing equalization.

Design of activated sludge process, trickling filters, oxidation ponds, oxidation ditch.

Water quality modelling: DO-BOD Streeter-Phelphs equation.

Wastewater collection system: Analysis, design and appurtenances.

WASTE MANAGEMENT AND ENVIRONMENT IMPACT ASSESSMENT

Group A

Sources and types of wastes. Solid, liquid and gaseous wastes from various industries. Water use in industry, industrial water quality requirements.

Control and removal of specific pollutants in industrial wastewater, e.g., oil and grease, cyanide, fluoride, toxic organics, heavy metals, radioactivity, etc. Solid and hazardous wastes—definitions, concept and management aspects.

Recent trends in industrial waste management, cradle to grave concept, life cycle analysis, clean technologies. Case studies of various industries.

Environment audit, accounts audit, relevant methodologies, regulations. Introduction to ISO and ISO 14000.

Environmental management, problems and strategies. Review of political, ecological and remedial actions.

Group B

Multi disciplinary environmental strategies, the management dimensions. Environmental impact Assessment (EIA)—an overview.

Definitions and concepts of sustainable development.

Initial environmental examination, environmental appraisal, environmental audit-Environmental impact factors and areas of consideration, measurement of environment impact, scope and methodologies of EIA. Case studies stressing physical aspects of EIA.

TRANSPORTATION ENGINEERING

Group A

Components of transportation.

Vehicle and driver characteristics.

Resistance to vehicles and power requirements; Perception-Reaction time of drivers; Visual acquity of drivers; Driver comfort.

Pavement materials; Aggregates; Bitumen; Concrete.

Pavement design; Flexible pavements; Rigid pavements.

Railway track and structures; Design of formation, sleeper density, rail joints, long welded rails; Properties of sleeper material, ballast, points and crossing, railway signalling, interlocking of signals and points.

Geometric design; Horizontal alignment; Vertical i alignment; Sight distance.

Group B

Airport planning and design; Regional -planning; Airport site selection; Airport capacity; Airport design; Runway orientation; Basic runway length and its corrections; Taxiway system; Aircraft parking; Terminal building.

Public transportation, different alternatives and their usefulness.

Traffic flow fundamentals, traffic stream variables, relation between traffic stream variables.

Traffic studies: Traffic volume studies, speed studies, Origin and destination studies, traffic flow characteristics, traffic capacity study, parking study, accident studies.

Capacity and level of service analysis; Level of service analysis, capacity of various traffic facilities like highways, freeways, signalized intersections.

TRAFFIC AND TRANSPORTATION SYSTEMS

Group A

Traffic engineering—introduction. Traffic Characteristics

— Road user characteristics

— Vehicular characteristics Traffic Studies

— Use of speed, journey time, and daily studies

— Method of measuring spot speeds.

— Methods for measurement of running speed and journey speed

— Vehicle volume counts

— Origin-destination studies

— Parking studies

— Statistical analysis for traffic studies Traffic Controls

— Traffic signs

— Traffic markings :— Traffic signals

— Traffic signs

— Traffic markings :— Traffic signals

— Design of traffic signals

— Types of traffic signals & traffic signal system Traffic Safety

— Road accidents—causes and prevention

— Traffic management measures and their influence on accident prevention

Traffic Regulations

— Basic principles of regulations

— Regulation of speed and vehicles

— General rules concerning traffic

— Parking regulations

— Enforcement of regulations.

Group B

Urban Transportation: Introduction

— Objectives and policies

— Urban transport problems

— Urban transport systems in India

— Issues (safety, congestion, pollution, land-use policy)

— Urban transport planning process Travel Demand Forecasting Models

— Trip generation

— Trip distribution

— Traffic assignment

— Model

Land Use and Transport Planning

— Lane use transport models

— Land use as an instrument of diffusing congestion

— Hierarchy of planning

Public Transport—Needs, modes and systems

— Model split and trip characteristics

— Road based systems

— Rail based systems

— Innovative transit systems

— Automation technology

— Intelligent vehicle highway systems (IVHS)

— Bus and railway stations

Economic Evaluation of Transportation Plans

— Costs and benefits of transport project

— Time horizon in economic evaluation

— Basic principles in economic evaluation Methods of economic evaluation.

TOWN PLANNING AND URBAN DEVELOPMENT

Group A

Planning thoughts through ages—early settlements-Roman, Greek, Medieval, Renaissance and industrial towns—urbanisation and settlement structure.

Garden City concept of E Howard, Geddesian trend and valley section green belts. Planning of new towns, evolution of planning concepts in India. Levels of plan-ning surveys for urban and regional planning. Contents of master plan, regional plan, structure plan, detailed development plan. Basic principles in planning different land uses.

Group B

Planning, legislation and administration, review of planning legislation and Acts relating to urban and regional planning. Building by-laws, planning agencies and their functions. Fiscal policies and resource management in the context of urban development. 73rd and 741'1 CAA and its implication to planning.

Slum clearance, urban renewal, conservation, rehabilitation and redevelopment. Decentralisation policies. Review of various urban development schemes and projects.

CONSTRUCTION MANAGEMENT

Group A

Introduction to construction management. Construction industry and its practices. Problems of construction industry. Management problems in construction. Methodology of system design and techniques in construction. Elements of engineering economies. Probability and statistics. Allocation models, coordination and inventory model. Queuing model. Uncertainty principles. Simulation.

Engineering economics in construction management. Time value of money, interest tables and rates of payment and return. Depreciation of capital assets. Evaluation of

feasibility. Public project analysis and evaluation. Case study modules.

Use of elementary statistics and probability theory. Statistical approach, probability distributions, expected value analysis, parameter estimation, statistical inference, quality control using statistical tools, regression and correlation analysis. Case study modules.

Allocation models in construction. Transportation model and its solution. Assignment model. Sequencing. Case study modules.

Group B

CPM and PERT network in construction. Applications in the field of construction, planning of scheduling phase and control phase, optimisation studies, case study modules.

Inventory management. Inventory costs, lead and economic order quantity, inventory models, ABC analysis, inventory management.

Queuing models and applications in construction technology. Queues and queuing theory, models of queues, case study modules.

Construction projects management. Organisational aspects of sectors such as housing, institutional and commercial, industrial and heavy engineering. Contracts-theory and practice. Human resources development and construction industry.