

B. Tech. in CIVIL & ARCHITECTURAL ENGINEERING

Syllabus of Paper – 1

MECHANICS OF STRUCTURES

Study of Force-definition, cause, effect and units. Understanding Force through vector. Study of Coplanar, Concurrent, Non-concurrent forces, Triangle of forces, Parallelogram of forces and Conditions of Equilibrium – analytical methods. Study of Moments, Moment of forces, Moment of couples and Static equilibrium of rigid bodies. Introduction to types of loads and supports. Study of Structural system design such as Fundamental characteristics, Strength, Stability, Ability, Rigidity, Economy and Aesthetics. Determination of Center of gravity, Moment of Inertia of square, rectangle, and I shaped cross-sections. Stress, strain, Hooke's Law, stress-strain curve, stressed streams in simple and composite sections, temperature stresses, Poisson's ratio, state of simple shear, shear strain. Basic concepts of Bending moment and shear force, bending moment and shear force diagram for simple beams and frames for various types of loadings and support conditions

ANALYSIS OF STRUCTURES

Bending Stress in Beams, Theory of simple bending, section modulus, design criterion, bending stresses in symmetrical and unsymmetrical sections, strength of sections. Shear Stress In Beams and Torsion, Shear stress in beams and torsion in symmetrical and unsymmetrical sections, Fixed And Continuous Beams, Review of shear force and Bending Moment diagram for simply supported beam, Effect of continuity, its advantages and disadvantages. Analysis of Continuous beams for two to four spans, conceptual idea about full and partial loading and fixed end moment using moment distribution method and Theorem of three moments. Trusses, Definition of Truss, Perfect Truss, Imperfect truss, Types of Trusses and Suitability, Analysis of simple Trusses by Analytical method. Arches, Types and behaviour of arches with history. Introduction to three hinged arches. Frames, Indeterminacy of frames with different end conditions, Analysis of frame by portal & cantilever method. Introduction of basic structural systems in architecture- Tensile structures, Compressive structures, Trusses, Shear structures, Bending structures.

THEORY OF DESIGN – I

Introduction to the beginning of modern architecture through Neoclassicism in the 18th century. Introduction to Industrial revolution and its impact on new towns. Study of Eclecticism and the architectural predicament in the 19th century. Introduction to Colonial architecture in India: New Delhi, Calcutta & Madras. Role of Louis Sullivan and Peter Behrene. Emergence of different Architectural movement after industrial revolution such as Art Nouveau-reaction against Eclecticism, morphed form, Plastic treatment of plans and Chicago School-evolution of the high rise office buildings. Study of the works of Master Architects to understand the trends in post modern Architecture. Study of Walter Gropius and Bauhaus, Frank Lloyd Wright and Organic Architecture, Le Corbusier-The Domino System and point of new architecture, Mies Van der Rohe –Minimalism, long span and Tall buildings in steel and Glass. Role of Adolf Loos-Internationalism, G.T.Reitveld-De Stijl Architecture and Alvar Aalto-Scandinavian Regionalism.

DESIGN OF RCC STRUCTURES

Introduction:- Materials, basic properties of concrete and steel, Reinforcement, standard loading, characteristics strength, permissible stresses in Concrete and steel as per Indian Standard, Design

Philosophies- Working Method, Ultimate Load, Method and Limit state Method. Limit State Design Method: Safety and serviceability requirements, limit states, characteristics material strength and loads and Partial safety factors. Design of Beams: Design of singly and doubly reinforced beams including L & T beams for flexure shear, bond and torsion. Design of Compression members: Design of short and slender columns. Design of RCC one way & two way slab. Proportioning of footings: - Square, Rectangular, Circular, Trapezoidal and combined. Introduction to Earthquake Resistant Construction. Introduction to various IS codes, Concept of Seismic design. Various types and construction details of Foundation, staircases and isolation of structures. Methodologies for seismic retrofitting.

THEORY OF DESIGN – II

Study of work of the early 20th century architects like Richard Neutra, Philip Johnson, Eero Saarinen, Oscar Niemeyer, Jorn Utzon, Bruce Goff, P.L. Nervi and other architects. Study of Late and Post Modernism through the work of Richard Meier, Arata Isozaki, Michael Graves, Robert Venturi, Norman Foster, Richard Rogers, Renzo Piano etc. Introduction to Post Independence (Modern) architecture in India. Contribution of Le Corbusier and Louis Khan Study of the works done by the pioneers in Indian Architecture Raj Rewal, Charles Correa, B.V.Doshi, A.P. Kanvinde, Ananth Raje, Louis Kahn, Joseph Allen Stein, U.C Jain, Lauri Baker etc. Study of the works done by Dean D Cruze, Hafeez Contractor, Nari Gandhi, Hasmukh Patel, & Chandravarkar & Thacker, Study of the works done by Contemporary western architects Norman Foster, Frank-O-Gehry, Zahahadid, Moshe Safdie.

DESIGN OF STEEL STRUCTURES

Design of connections in steel Structures :- Bolted and welded connections, assumptions, different types of joints, design of various types of welded connections subjected to direct loads and moments. Design of Tension Members: Selection of sections, IS specifications, design of axially loaded tension members, design of members for axial tension & bending, end connections, IS code provisions for Lug angles and tension splices. Design of Compression Members: Theory of buckling, design of column cross sections (single & built up sections); design of angle struts, eccentrically loaded columns. IS code provisions for column splices, lacing & battens. Design of Beams: Lateral stability, design of single & built up beams, plated beams and curtailment of flange plates. Design of Roof Trusses: Types of trusses, roofs & side coverage, types of loading and load combinations, design of members & connections. Case studies of modern steel structures.

ESTIMATION, COSTING , SPECIFICATION & PROJECT MANAGEMENT

Introduction to different types of specification and their uses. Writing specification for civil works of the design project done during the previous. Importance of specification as part of contract documents. Introduction to cost estimation and definitions of related to estimate. Introduction to the types of Preliminary Estimates and their preparation. Introduction to the types of Detail Estimates, methods of details of measurement and their application, item of work , measurement of typical elements, viz., arches, steps, and polygonal rooms. Introduction to Bill of Quantities of Materials for RCC work in slab, beam, column, stair cases etc. Detailed studies to preparation of estimated cost/bill of quantities use of schedule of rates, analysis of rates and break up of material required. Illustrative examples for the same. Introduction to Standard rates and their derivation from given rates. Case studies/practical expertise in preparing detailed estimates of quantities of materials and analysis of rates of materials and labor for a small residential building. Aims objectives and functions of Construction Management, Construction stages. Bar

charts and limitations of bar charts. Program Evaluation and Review Techniques (PERT), Critical Path Method (CPM) for project management, Development and analysis of CPM network Cost time analysis in network planning. Scientific methods of construction management. Resources scheduling methods through Bar charts, CPM and Line of Balance method.

BUILDING MATERIALS AND CONSTRUCTION

Stones: classification of stones; common building stones used in India; characteristics and use of stones; dressing of stone; Timber – classification; qualities of timber for construction; defects, seasoning, storage and preservation of timber. Plastics and polymers: General properties of plastics, fillers and plasticizers, molding and fabricating methods for plastics, thermosetting plastics, thermoplastics resins, elastomers or synthetic rubbers, combination of plastic and other materials. Asphalt and bituminous products. Special concretes and admixtures: Admixtures -water repellent, waterproofing compounds, accelerators, air entraining agents, hardeners, plasticizers ; Special concretes -light weight concrete, ready-mix concrete, pre-stressed concrete ,fibre reinforced concrete and precast concrete

Varnishes, paints : Characteristics and process of varnishing, types and compositions of paints, their selection criteria. Misc. materials: cork, rubber, gypsum, sealants, asbestos, their trade names and uses; Recycled and ecological materials. Masonry construction: Stone construction – types of walls, bonds; Brick construction – types of brick, their dimensions and definitions, types of bonds in brickwork; Timber work- simple carpentry joineries and their uses; Different types of timber doors and windows, fixing details of frame, style, rail, panel, glazing including fixtures and fastenings. Foundations: study of principles and methods of construction of foundations and columns, types of foundations – Shallow and deep foundations; raft foundations, grillage foundations and combination; pile foundation – precast piles, cast-in-situ piles, types of piles, method of driving piles, pile caps etc. Roof trusses - timber and steel trusses, types, fixing details showing purlin, rafter, tie, strut, cleat etc. different types of roof coverings: for flat and sloped roof with fixing details

Syllabus of Paper - 2

HISTORY OF ARCHITECTURE – I

Introduction to Indus Valley civilization. Study of architectural characteristics, building materials and construction techniques adopted. Introduction to the Vedic village. Study of its building typology and construction. Introduction to Buddhist settlement in India. Detailed studies of Architectural characteristics of various building types such as Stupas, Chaityas, rock-cut caves and Viharas through suitable examples from each geographical context to illustrate differences in Form, Construction methods and Ornamentation. Study of evolution of Hindu architecture, Rock-cut and structural forms and comparison of Temple forms in various regions of India. Study of various styles of temples-Dravidian architecture of Pallavas, Cholas, Chalukyas, Pandyas, Madura and Vijayanagar dynasties, Indo-Aryan architecture –North Indian and Orissan, Jain with respect to functional components, architectural Form, construction and ornamentation. Indo-Islamic architecture and its context, major building types (tombs and mosques) and their architectural features. Classification of Indo-Islamic architecture of Sultanate period –Delhi or Imperial Style :Slave, Khilji, Tughlaq, Sayyed, Lodhi Provincial Style -Bengal , Jaunpur, Deccan, Malwa, Bijapur

Moghul period-Architecture in North India under : Humayun, Jehangir, Akbar, Shahjehan

HISTORY OF ARCHITECTURE – II

Introduction to examples of early shelter, Stone Age as an expression of man's physical and spiritual needs. Introduction to Egyptian civilization. Study of local context and architectural characteristics of public buildings such as mastabas, pyramids and temples (cult and mortuary) to be explained with examples. Introduction to Mesopotamian civilization. Study of urban context, building materials used, building types(temples, forts),town planning(Babylonia) and architecture of Public buildings such as Ziggurat of Ur city and Palace of Khorsabad. Introduction to Greek civilization. Architectural characteristics of typical civic spaces such as Agora, Acropolis, theatres. Systems of proportioning, Greek orders, optical corrections etc. through illustrative examples such as Parthenon etc. Study of Roman town with respect to location, Architectural characteristics of typical civic spaces such as Forum, theatres etc. Detailed studies of monuments/temples of Roman period with reference to materials, construction systems, Roman orders through illustrative examples.

HISTORY OF ARCHITECTURE– III

Study of Early Christian Architecture- evaluation of church architecture. Study of development of Church plans during the early Christian period with respect to architectural character. Study of Byzantine churches with respect to architectural forms, structural systems, techniques of construction etc- Hagia Sophia. Study of evolution of Romanesque architecture with respect to changes in church plans, Elevation features, techniques of construction and structural systems-Pisa cathedral complex. Study of architectural characteristics of Romanesque churches in Italy, France and Germany. Detailed studies of Gothic Cathedral of Medieval European towns with reference to Architectural characteristics and their comparison to Romanesque period- Notre Dame. Comparison of Architectural characteristics of Gothic churches in France and England. Introduction to the basis of Renaissance Movement and its effect on the built environment. Study of the works of Architects of Early Renaissance and High Renaissance. Study of Cathedral- St. Peter and St. Paul. Introduction to the basis of Baroque or Rococo Movement and its effect on the built environment. Detailed studies of Baroque Architecture such as its Development,

Characteristics of Baroque Architecture-Piazza of St. Peter. Study of works Architects of Baroque period such as Bernini and Borromini.

CLIMATE AND BUILT ENVIRONMENT

Climatology: Role of climate with respect to shelter and importance of Building climatology, Tropics, climatic zones, macro and micro-climate, Elements of climate and climatology data needed for planning of buildings, change of seasons, distribution of global pressure belts & wind movements. Human Comfort: Human heat balance and thermal comfort, Thermal stress index, effective temperature and bio climatic analysis, Interrelationship of climatic elements and psychometric chart. Air Temperature: Factors that influence air-temperature – latitude, altitude, seasons, water, trees, areas etc.; thermal conductivity and heat exchange between building and environment, thermal properties of material. Solar Radiation: Calculation of solar radiation on building surfaces, solar charts; Design and application of shading devices, sun machines and their uses; Opaque building elements and heat transfer through this elements, solar gain factor and solar air temperature. Wind: study of diurnal and seasonal variations, heating and cooling, effect of topography: effect of wind on location of industrial areas, airports and other land-uses and road patterns, Air movement in and around buildings, wind eddies, size and position, effect of wind on design and siting of buildings. Precipitation: Water-vapor. Relative-humidity, condensation, rain, fog, snow and architectural responses. Day-light: glare, amount of light, sky as a source of light and day-light factor, effect of size and shape of openings in different planes with and without obstructions. Orientation and Application of Climatic Principles: Siting of buildings with respect of sun, wind and view; Climatic design of indigenous shelters in response to different climatic zones in India; Use of landscape elements, evaporative cooling, ground cooling, cavity walls, topography; Ventilation of roof spaces and controlled ventilation. Example of climate-responsive building-projects from India and abroad. Case studies-Case study of climate responsive architecture in hot-dry, warm-humid, cold-sunny, cold-cloudy and composite climate. Introduction to climatic design analysis and building simulation software.

BUILDING SERVICES – I

Water Supply: Detailed studies such as Sources and Treatment of water. Water demand & calculations, Storage & conveyance of water at municipal level. Water supply systems and various fittings. Hot and Cold water supply layouts. Water supply design of a residence: Connection with water mains, design of Underground & Overhead water tanks, pump capacity, calculations for diameter of pipe. Introduction to water supply in a multistoried building. Wastewater: Definition of Refuse, garbage, rubbish, sullage, sub soil water, storm water, night soil, sewage-sanitary, domestic & industrial, sewer, sewerage & waste water. Various drainage & sanitary fixtures & fittings, traps - role of water seal, sizes, materials and their space requirements, Water efficient and waterless fixtures. Types of pipes and drains in different materials and their usage, diameter of pipes, slope standards Inspection and Intercepting chambers, manholes etc. Sewage and Effluent treatment- Innovative and cost effective sanitation concepts e.g. EcoSAN. Sewage systems for a small project, Wastewater recycling methods e.g. DEWATS etc. Introduction to STP's & ETP's, Design calculations of septic tank & soak pit. Storm water design calculations for roof top & for surface drains, Rainwater Harvesting & Groundwater Recharge. Exercise: Design a layout for a residence for water supply, drainage, sewage and storm water Zero discharge concepts. Solid Waste management: Waste production in India and Global .Waste management techniques at urban level, Refuse disposal- sources, types of collection, storage and transport, provisions for refuse disposal at individual building level, refuse chutes; Solid waste treatment

BUILDING SERVICES – II

Electrical services: Thermal, Mechanical & Electrical energy and its generation. Electrical distribution systems and safety devices. Types of wiring systems, advantages and disadvantages, safety and precautions, Internal wiring, loads, demand, tariffs and rules. Types of electrical equipments used in a building such as motors, fuses, switchboards etc. Introduction to Indian Electricity rules related to buildings. Introduction to wiring system in a multistoried building. Detailed studies of the electrical Fittings such as MCB's, ELCB's, fuse units, control panels etc. Standard symbols for various fixtures as per National Building Code 2005. Illumination & Lighting Design: Introduction to Illumination, studies of the same such as various types of artificial lighting. Various Terms in lighting, standards of illumination for illumination levels, Types of artificial lighting sources, types of luminaires & fixtures, Comparative efficiency of lighting fixtures. Methods and calculation for lighting design- Inverse Square Law, Cosine Law & Coefficient of Utilization Method. Acoustics: Introduction to general principles of sound such as Reverberation, Absorption, Reflection, etc. Introduction to Building acoustics with reference to various building types such as studios, auditoriums etc. Detailed studies of various types of Acoustical materials and their application.

BUILDING SERVICES – III

Air-conditioning: Detailed studies of Natural and Artificial ventilation. Introduction to the concept of Air-conditioning and detailed studies regarding different types of Air-conditioning systems, their applicability and their working- window, split, Central systems etc.; Components of AC's systems such as chilling plants; cooling towers; air handling units; calculation of Ac loads; air distribution systems; ducts and ducting layouts. Fire fighting: Introduction to fire fighting systems in buildings. Fire detection, Fire sprinklers, Fire extinguishers and Fire Hydrants system, Their system of working and design calculations, fire escape, stairway and escape routes; fire fighting regulations with reference to National Building Code; fire safety and preventive measures. Vertical Transport Systems: Lifts- Types, Parts, Dimensions and design of lift system in a building. Escalators- Types, Parts, Dimensions and design of lift system in a building. Elevators-study of elevators and various components ,standard space requirements, types and architectural implications.

LANDSCAPE DESIGN

Introduction to the elements of landscape such as Earth form, Water and Vegetation and their effect in relation to the built environment. Plant types, characteristics, structure and color of foliage. History, nature and scope Purpose of designed open space. Exposure to historical landscape (English, French, Italian, Chinese, Japanese, Mughal, Ancient India) and their relevance in their time, context and social needs. Introduction to ecology and its importance to Landscape designers. Site analysis and site structure unity. Advanced knowledge of basic elements of Landscape Design and their effects in context to the environmental concerns. Basic knowledge of contour/mapping and various methods of documentation of physical features, topography and landscape elements. Case studies of varied urban situations with typical different landscape characters in Chandigarh, Delhi region to analyze and assess their present landscape status by applying knowledge and techniques acquired as above. Landscape design proposal based on above mentioned analysis as a studio exercise.
