Syllabus of

UNDERGRADUATE DEGREE COURSE

B.Tech. VI Semester

Civil Engineering

Rajasthan Technical University, Kota

Effective from session: 2025-26

6CE3-01: WIND AND SEISMIC ANALYSIS

Credit: 2 **Max. Marks: 100(IA:30, ETE:70)**
2L+0T+0P **End Term Exam: 3 Hours**

SN	CONTENTS	Hours
1	**Introduction:** Objective, scope and outcome of the course.	1
2	**Structural Systems:** Types of structures and Structure's forms, Symmetry and Asymmetry in building forms, Vertical and lateral loadresting elements, shear walls, framed tubes and various multi-storey configurations.	4
3	**Design Loads:** various types of loads and relevant codes. Design loads for different types of buildings. (IS-875 part 1 & 2) & Load Flow Concept	3
4	**Wind Loads Analysis:** Wind loads & calculation of wind load on flat roof, pitched roof and single sloped roof buildings (IS: 875-Part 3).	8
5	**Earthquake Load Analysis:** Earthquake loads & calculations of earthquake loads on framed structures. (IS: 1893 – Part 1).	6
6	**Earthquake Resistant Construction:** Typical seismic failure of masonry and RCC structures.Earthquake resistant construction of buildings, and various provisions as per IS codes; IS-4326,IS-13827, IS-13828, IS-13920, IS-13935.	6
	TOTAL	28

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6CE4-02: STRUCTURAL ANALYSIS-II

Credit: 3 **Max. Marks: 100(IA:30, ETE:70)**
3L+0T+0P **End Term Exam: 3 Hours**

SN	CONTENTS	Hours
1	**Introduction:** Objective, scope and outcome of the course.	1
2	Unit load method & their applications: deflection of determinate beams and frames, analysis of determinate and redundant frames up to two degree of redundancy, lack of fit in redundant frames. Introduction to Energy Methods: Strain energy for gradually applied, suddenly applied and impact loads, Strain energy due to axial loads, bending, shear and torsion;. Castiglione's theorems & their applications in analysis of determinate and redundant frames up to two degree of redundancy and trussed beams; Stresses due to temperature & lack of fit in redundant frames; deflection of determinate beams, frames using energy methods	12
3	**Influence line diagram & Rolling load:** ILD for beams & frames, Muller-Breslau principle and its application for drawing ILD, Rolling load, maximum stress resultants in a member/section, absolute maximum stress resultant in a structure.	10
4	**Arches:** analysis of three hinged two hinged and fixed type parabolic arches with supports at the same level and at different levels.	7
5	**Unsymmetrical bending:** Definition, location of NA, computation of stresses and deflection, shear centre and its location,	6
6	**Approximate methods for lateral loads:** Analysis of multistory frames by portal method, cantilever method & factor method. Analysis of determinate space trusses by tension coefficient method.	6
	TOTAL	42

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6CE4-03: ENVIRONMENTAL ENGINEERING

Credit: 3 **Max. Marks: 100(IA:30, ETE:70)**
3L+0T+0P **End Term Exam: 3 Hours**

SN	CONTENTS	Hours
1	**Introduction:** Objective, scope and outcome of the course.	1
2	*Water:* -Sources of Water and quality issues, water quality requirement for different beneficial uses, Water quality standards, water quality indices. Water Supply systems, Need for planned water supply schemes, Water demand industrial and agricultural water requirements, Components of water supply system; Transmission of water, Distribution system, Various valves used in W/S systems, service reservoirs and design. Water Treatment: aeration, sedimentation, coagulation flocculation, filtration, disinfection, advanced treatments like adsorption, ion exchange, membrane processes.	4 5 6
3	*Sewage*- Domestic and Storm water, Quantity of Sewage, Sewage flow variations. Conveyance of sewage- Sewers, shapes design parameters, operation and maintenance of sewers, Sewage pumping; Sewerage, Sewer appurtenances, Design of sewerage systems. Small bore systems, Storm Water- Quantification and design of Storm water. Sewage characteristics: Quality parameters: BOD, COD, TOC, Solids, DO, Nitrogen, Phosphorus, Standards of disposal into natural watercourses and on land, Indian standards. Sewage and Sullage, Pollution due to improper disposal of sewage, Wastewater treatment, aerobic and anaerobic treatment systems, suspended and attached growth systems, recycling of sewage – quality requirements for various purposes. Wastewater Disposal and Refuse: Disposal of sewage by dilution, Self-purification of streams, sewage disposal by irrigation sewage farming, waste water reuse.	5 4 7 5
4	*Air* - Composition and properties of air, Quantification of air pollutants, Monitoring of air pollutants, Air quality standards, Control measures for Air pollution	3
5	*Noise*- Basic concept, measurement and various control methods.	2
	Total	42

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6CE-04: DESIGN OF STEEL STRUCTURES

Credit: 3 **Max. Marks: 100(IA:30, ETE:70)**
3L+0T+0P **End Term Exam: 3 Hours**

SN	CONTENTS	Hours
1	**Introduction:** Objective, scope and outcome of the course.	1
2	Types of Steels and their broad specifications. Structural steel forms- hot rolled, tubular, light gauge etc and their applicability. Classification of cross sections as per IS 800-2007- Plastic, compact, semi compact and slender- characteristics	2
3	Plastic analysis of steel structures, fundamentals, shape factor, static and mechanism method of analysis, bending of beams of uniform cross sections (any shape)	3
4	Connections: Types of bolts, load transfer mechanism, prying action. Design of bolted and welded connections under axial and eccentric loadings with IS provisions	3
5	Tension Members: Design strength in gross section yielding, net section rupture and block shear. Design of axially loaded members.	3
6	Compression Members: Types of buckling, Imperfection factor, Buckling curves for different cross sections as per IS. Design of compression members: Axially loaded members including made up of angle section: single and in pair; built up columns including design of lacings and battens as per IS.	6
7	Beams: Design of beams: simple and compound sections. Design of laterally supported and unsupported beams including for web buckling, web crippling, lateral torsional buckling.	6
8	Member design under combined forces: Compressive load and uniaxial moment. tension and uniaxial moment	3
9	Column Bases: Design of column bases for axial and eccentric compressive loads: Slab and gusseted base.	2

10	Design of plate girder: Design of welded and bolted sections including web and flange splicing, horizontal, intermediate and bearing stiffeners. Shear strength determination by post critical and tension field action methods. End panel design options and procedure as per IS 800. Curtailment of flange plates. Connections for flange plate to flange angles and flange angles to web, etc. Design of welded connections	**7**
11	Design of gantry girder	**2**
12	Design of roof trusses members for combined forces, wind loading etc. Purlin design	**2**
13	Introduction to Pre Engineered Buildings , characteristics and their applications.	**1**
14	Introduction of truss girder bridges-its members including portal and sway bracings etc. Design aspects of foot over bridges.	**1**
	TOTAL	**42**

6CE4-05: ESTIMATING & COSTING

Credit: 2 **Max. Marks: 100(IA:30, ETE:70)**
2L+0T+0P **End Term Exam: 3 Hours**

SN	CONTENTS	Hours
1	**Introduction:** Objective, scope and outcome of the course.	1
2	Purpose and importance of estimates, principles of estimating, Methods of taking out quantities of items of work. Mode of measurement, measurement sheet and abstract sheet; bill of quantities.	4
3	**Estimating:** Types of estimate, plinth area rate, cubical content rate, preliminary, original, revised and supplementary estimates for different projects.	6
4	**Rate Analysis:** Task for average artisan, various factors involved in the rate of an item, material and labour requirement for various trades; preparation for rates of important items of work. Current schedule of rates. (C.S.R.)	6
5	**Detailed Estimates:** Preparing detailed estimates of various types of buildings, R.C.C. works, earth work calculations for roads and estimating of culverts Services for building such as water supply, drainage and electrification.	6
6	**Valuation:** Purposes, depreciation, sinking fund, scrap value, year's purchase, gross and net income, dual rate interest, methods of valuation, rent fixation of buildings.	5
	TOTAL	28

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6CE5-11: PRE-STRESSED CONCRETE

Credit: 2 **Max. Marks: 100(IA:30, ETE:70)**
2L+0T+0P **End Term Exam: 3 Hours**

SN	CONTENTS	Hours
1	**Introduction:** Objective, scope and outcome of the course.	1
2	**Introduction:** Basic concepts of Pre-stressing and its advantages. Materials for pre-stressed concrete. Tensioning devices. Pre-tensioning and post tensioning systems.	4
3	**Analysis of Pre-stress and Bending Stresses:** Assumptions, Flexural analysis of pre-stressed rectangular and unsymmetrical T section. Concept of load balancing.	6
4	**Losses of Pre-stress:** Losses due to - elastic deformation of concrete, successive tensioning of curved cable, shrinkage of concrete, creep of concrete, relaxation of stress in steel, friction and anchorage slip.	4
5	**Deflection of Pre-stressed Concrete Members:** Effect of tendon profileand associated factors incontinuous members.Computation of deflection in pre-stressed concrete members.	6
6	**Design of Pre-stressed Concrete Sections:** Flexural Shear and Torsional strengthusing simplified code procedure (IS-1343-2012). Design of simply supported Pre-stressed Concrete Sections forflexure.	7
	TOTAL	28

6CE5-12: SOLID AND HAZARDOUS WASTE MANAGEMENT

Credit: 2 **Max. Marks: 100(IA:30, ETE:70)**
2L+0T+0P **End Term Exam: 3 Hours**

SN	CONTENTS	Hours
1	**Introduction:** Objective, scope and outcome of the course.	**1**
2	**Introduction to SWM:** Definition of waste and solid waste, classification solid waste, sources of solid waste, its composition, factors affecting waste generation, traditional methods of waste collection and disposal	**4**
3	**Waste Collection:** Components of waste collection, waste collection containers, their characteristics, types, waste collection vehicles, collection frequency, collection route, transfer stations	**4**
4	**Solid Waste Characterization:** Physical characteristics, chemical characteristics and biological characteristics of solid wastes **Waste Processing**: Size reduction, factors affecting size reduction, size reducing equipment, volume reduction, equipment for volume reduction, waste minimization, waste hierarchy, 3 R principle	**5**
5	**Hazardous Waste:** Definition, sources, classification, collection, segregation, treatment and disposal methods **Radioactive Waste, E-Waste, Biomedical Waste:** Definition, sources, classification, segregation, management and disposal methods	**6**
6	**Treatment and Disposal of Solid Waste:** Composting, vermicomposting, biogas production, thermal treatment, incineration, pyrolysis, gasification, biological treatment, Sanitary land filling, land fill leachate and gas management **Latest Advances and Rules** related to SWM, Hazardous Waste, Plastic Waste and E-Waste Management	**5** **3**
	TOTAL	**28**

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6CE5-13: TRAFFIC ENGINEERING AND MANAGEMENT

Credit: 2 **Max. Marks: 100(IA:30, ETE:70)**
2L+0T+0P **End Term Exam: 3 Hours**

SN	CONTENTS	Hours
1	**Introduction:** Objective, scope and outcome of the course.	**1**
2	**Traffic Planning and Characteristics:** Road Characteristics – Road user characteristics – PIEV theory – Vehicle – Performance characteristics – Fundamentals of Traffic Flow .	**4**
3	**Traffic Surveys**: Traffic Surveys – Speed, journey time and delay surveys – Vehicles Volume Survey including nonmotorized transports – Methods and interpretation – Origin Destination Survey – Methods and presentation – Parking Survey – Accident analyses -Methods, interpretation and presentation –Level of service – Concept, applications and significance.	**6**
4	**Traffic Design and Visual Aids:** Intersection Design – channelization, Rotary intersection design – Signal design – Coordination of signals — Grade separation – Traffic signs including VMS and road markings – Significant roles of traffic control personnel – Networking pedestrian facilities & cycle tracks.	**6**
5	**Traffic Safety and Environment**: Road accidents – Causes, effect, prevention, and cost – Street lighting – Traffic and environment hazards –	**4**
6	**Traffic Management:** Area Traffic Management System – Traffic System Management (TSM) with IRC standards –- Traffic Regulatory Measures-Travel Demand Management (TDM) – Direct and indirect methods – Congestion and parking pricing – All segregation methods-Coordination among different agencies – Intelligent Transport System for traffic management, enforcement and education.	**7**
	TOTAL	**28**

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6CE5-14: BRIDGE ENGINEERING

Credit: 2 **Max. Marks: 100(IA:30, ETE:70)**
2L+0T+0P **End Term Exam: 3 Hours**

SN	CONTENTS	Hours
1	**Introduction:** Objective, scope and outcome of the course.	**1**
2	**Introduction:** Type of bridges & classification of road & railways bridges. IRC & Railwayloadings for bridges, wind load & Earthquake forces. : Expansion joints.	**3**
3	**Steel bridges**: Introduction to Design of through type &deck type steel bridges for IRC loading. Design of through type truss bridges forrailway loadings.	**9**
4	**Reinforced concrete culverts & bridges:** Reinforced concrete slab culvert, T-beam bridges-courbons & Hendry-Jaegar methods.	**10**
5	**Bearings**: Bearings for slab bridges and girder bridges. Elastomeric bearings, design concepts as per IRC 83 (Part II).	**5**
	TOTAL	**28**

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6CE5-15: ROCK ENGINEERING

Credit: 2 **Max. Marks: 100(IA:30, ETE:70)**
2L+0T+0P **End Term Exam: 3 Hours**

SN	CONTENTS	Hours
1	**Introduction:** Objective, scope and outcome of the course.	**1**
2	**Engineering Classification of Rocks**: Objectives, Intact rock classification, Rock mass Classification. Terzaghi's, Rock load classification, Austrian classification, Deere's rock quality classification, rock structure rating concept, RMR classification, Q classification. Inter relation between Q and RMR.	**6**
3	**Engineering Properties and Laboratory Tests on Rocks:** Porosity, Density, Moisture content, Degree of saturation, Co-efficient of permeability, Durability, Compressive strength, Tensile strength, Shear strength, elasticity, Plasticity Deformability. Sampling and Samples Preparations, Uniaxial Compressive strength, Tensile Strength – Brazilian test, Shear strength test – Direct Shear test and Punch shear test, Triaxial Test, Flexural strength.	**7**
4	**In-situ Tests on Rocks**: Necessity of Insitu test, Plate load test for deformability, Field Shear test **Jointed Rocks:** Rocks Joint properties, Joint properties, Joint Roughness Co-efficient, Scale effects, Dilation, Orientation of Joints, Gouge, Joint Intensity, Uniaxial Compressive strength of Jointed Rocks.	**7**
5	**Strength of Rocks in Unconfined Condition**: Ramamurthy Strength Criteria, Singh and Rao Strength Criteria, Kulatilake Methodology, Barton Methodology. **Strength of Rocks in Confined Condition:** History of Hoek and Brown Failure Criterions, Parabolic Strength Criteria. **Bearing Capacity of Rocks:** Bearing capacity of intact rocks, jointed rocks,IS Code methodology, Singh and Rao Method and latest methodologies.	**7**
	TOTAL	**40**

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6CE5-16: GEOGRAPHIC INFORMATION SYSTEM & REMOTE SENSING

Credit: 2 **Max. Marks: 100(IA:30, ETE:70)**
2L+0T+0P **End Term Exam: 3 Hours**

SN	CONTENTS	Hours
1	**Introduction:** Objective, scope and outcome of the course.	**1**
2	**Photogrammetry:** Definition of Photogrammetric Terms, Geometry of aerial and terrestrial photographs,Aerial camera and photo-theodolite, Scale of a Photograph, Tilt and Height displacements, Stereoscopicvision and stereoscopes, Height determination from parallax measurements, Flight planning, Maps andMap substitutes and their uses.	**7**
3	**Remote Sensing:** Introduction and definition of remote sensing terms, Remote Sensing System, Electromagnetic radiation and spectrum, Spectral signature, Atmospheric windows.	**4/6**
4	Different types of platforms, sensors and their characteristics, Orbital parameters of a satellite, Multiconcept in Remote Sensing.	**4/4**
5	**Image Interpretation:** Principles of interpretation of aerial and satellite images, equipments and aidsrequired for interpretation, ground truth – collection and verification, advantages of multidate andmultiband images. Digital Image Processing concept.	**6/5**
6	**Geographic Information System (GIS) :** Introduction & applications of GIS in map revision, Land use,Agriculture, Forestry, Archaeology, Municipal, Geology, water resources, Soil Erosion, Land suitabilityanalysis, change detection.	**6/5**
	TOTAL	**28**

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6CE4-21: Environmental Engineering Design and Lab

Credit: 1.5 **Max. Marks: 100(IA:60, ETE:40)**
0L+0T+3P **End Term Exam: 3 Hours**

Design

1. Population forecasting and water demand
2. Water Quality parameters
3. Design of Sedimentation tanks, coagulation and flocculation tanks
4. Design of rapid and slow sand filters
5. Design of disinfection units and transmission systems
6. Design of Sewer lines and storm water systems
7. Design of aerobic and anaerobic treatment units
8. Design of suspended and attached growth systems

Lab.

1. Physical Characterization of water: Turbidity, Electrical Conductivity, pH
2. Analysis of solids content of water: Dissolved, Settleable, suspended, total, volatile, inorganic etc.
3. Alkalinity and acidity, Hardness: total hardness, calcium and magnesium hardness
4. Optimum coagulant dose
5. Chemical Oxygen Demand (COD)
6. Dissolved Oxygen (D.O) and Biochemical Oxygen Demand (BOD)
7. Break point Chlorination
8. Bacteriological quality measurement: MPN,

6CE4-22: Steel Structures Design

Credit: 1.5 **Max. Marks: 100(IA:60, ETE:40)**
0L+0T+3P **End Term Exam: 3 Hours**

Analysis and design Problems as per different topics of syllabus of theory 6CE4-05, with latest version of IS 800 and other relevant IS codes. In addition to numerical problems, following exercises:

1. Case study of foot over bridges/truss- girder bridge in vicinity /home town of the students, preferably in groups of 8-10 students. A report including photographs marked with names and section details of different members in it (maximum limit of words :1000).
2. Case study of a structure using tubular sections or light gauge sections in vicinity /home town of the students, preferably in groups of 8-10 students. A report including photographs marked with names, size and section details of different members in it (maximum limit of words: 1000).

6CE4-23: QUANTITY SURVEYING AND VALUATION

Credit: 1 **Max. Marks: 100(IA:60, ETE:40)**
0L+0T+2P **End Term Exam: 2 Hours**

Contents

1. Preliminary Estimate (Plinth Area and Cubic Content)
2. Detailed Estimate of buildings (Long wall-Short wall and Centre line method)
3. Rate Analysis of different Items of Works (Earthwork, Concrete Work, DPC, Stone masonry, Brickwork, RCC, Roofing, Flooring, and Finishing etc.)
4. Earthwork Calculation for Roads, Irrigation Canals and Channels (cutting and filling)
5. Valuation of Buildings and Properties

6CE4-24: WATER AND EARTH RETAINING STRUCTURES DESIGN

Credit: 1 **Max. Marks: 100(IA:60, ETE:40)**
0L+0T+2P **End Term Exam: 2 Hours**

Assignments/ Exercises on the following topics:		
SN	**CONTENTS**	**Hours**
1	**Continuous Beams:** Analysis andDesign of continuous beams using coefficients (IS Code), concept of moment redistribution	**4**
2	**Curved Beams:** Analysis and design of beams curved in plan.	**4**
3	**Circular Domes:** Analysisand design of Circular domes with u.d.l. & concentrated load at crown.	**4**
4	**Water Tanks and Towers:** Water Tanks and Water Towers-design of rectangular, circular and Intze type tanks, column brace type staging.	**10**
5	**Retaining walls:** Analysis and design of Cantilever Retaining Walls: Introduction to counterfort and buttress type retaining walls, their structural behaviour and stability analysis.	**6**
	TOTAL	**28**

6CE4-25: FOUNDATION ENGINEERING

Credit: 1 **Max. Marks: 100(IA:60, ETE:40)**
0L+0T+2P **End Term Exam: 2 Hours**

1. Design of isolated shallow footings, combined footings, raft foundations.
2. Design of pile foundations.
3. Design of wells and cassions.
4. Design of machine foundation.
5. Design of retaining structures etc

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