5CE3-01: CONSTRUCTION TECHNOLOGY AND EQUIPMENT

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 Economy** Principle of Engineering Economy, Minimum cost point analysis, Breakeven point analysis, Depreciation and depletion.	6
3	**Safety in construction** Causes, classification, cost and measurement of an accident, safety programme for construction, protective equipment, accident report, safety measure: (a) For storage and handling of building materials. (b) Construction of elements of a building (c) In demolition of buildings; Safety lacuna in Indian scenario. Fire safety provisions as per NBC.	8
4	**Construction Planning** Need of construction planning, Constructional Resources, construction team, stages in construction, preparation of construction schedule, Job layout, inspection and quality control; **Materials Management:** Objective and functions of material management.	7
5	**Construction Equipment and Management** Earth Moving Equipment-Bull dozers tractor pulled scrapers Power shovels Draglines clamshells; cranes; Hoes, Trenching machine types Hauling Equipment; Drilling, Blasting and Tunnelling Equipment; Pile Driving Equipment.	6
	TOTAL	28

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5CE4-02: STRUCTURE ANALYSIS-I

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 Indeterminate structures, Degrees of freedom per node, Static and Kinematic indeterminacy (i.e. for beams, frames & portal with & without sway etc.), Releases in structures, Maxwell's reciprocal theorem and Betti's theorem. Analysis of prop cantilever structures, Analysis of Indeterminate Structure (fixed and continues beams) using Area moment method, Conjugate beam method, Three moments Theorem.	11
3	Analysis of Statically Indeterminate Structures using Slope-deflection method and Moment-distribution method applied to continuous beams and portal frames with and without inclined members.	11
4	**Vibrations:** Elementary concepts of structural vibration, Mathematical models, basic elements of vibratory system. Degree of freedom. Equivalent Spring stiffness of springs in parallel and in series. **Simple Harmonic Motion**: vector representation, characteristic, addition of harmonic motions, Angular oscillation. **Undamped free vibration of SDOF system**: Newton's law of motion, D Almbert's principle, deriving equation of motions, solution of differential equation of motion, frequency & period of vibration, amplitude of motion; Introduction to damped and forced vibration.	5
	TOTAL	28

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5CE4-03: DESIGN OF CONCRETE 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	Fundamental concepts of design of RC members, assumptions. Types and function of reinforcement. Introduction to various related IS codes, Characteristic load and characteristic strength. **Working Stress Method:** Working stress design philosophy. Analysis and Design of singly reinforced rectangular beam section for flexure.	5
3	**Limit State Design:** Limit state design philosophy. Assumptions, Analysis and design of singly reinforced, doubly reinforced rectangular beams and flanged beams for flexure using codal provisions for simply supported, cantilever, fixed and continuous beams.	10
4	**Limit state of serviceability for deflection**: control of deflection as per codal provisions of empirical coefficients. **Limit state of collapse in shear**: Types of shear reinforcement and its detailing, analysis and design of shear reinforcement for prismatic sections. **Limit state of collapse in bond**: concept of bond stress, anchorage length and development length. Detailing and curtailment of reinforcement as per codal provisions.	6
5	**Slabs:** Analysis and design of one way and two way slabs using LSM, Detailing of reinforcement. Check for shear and deflection.	6
6	**Columns:** Short and long columns, their structural behaviour. Analysis and design of axially loaded short columns, using LSM. Analysis of eccentrically loaded short columns. Introduction to Pu-Mu interaction curves and their use for eccentrically loaded columns. **Footings:** Analysis and design of Isolated column footing for axial load. Introduction to combined footing for two columns (without central beam) for axial loads using LSM.	5 4
7	**Torsion:** Analysis and Design of beams for torsion as per codal method.	3
	TOTAL	40

5CE4-04: GEOTECHNICAL 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	Soil and soil-mass constituents, water content, specific gravity, void ratio, porosity, degree of saturation, air void and air content, unit weights, density index etc. Inter-relationships of the above. Determination of index properties of soil: water content, specific gravity, particle size distribution, sieve and sedimentation analysis, consistency limits, void ratio and density index. Mineral structures, structures of Illite Montmorillonites and kaolinite and their characteristics. Darcy's law of permeability of soil and its determination in laboratory. Stresses in soil mass: total, effective and neutral pressure, calculation of stresses, influence of water table on effective stress, quicksand phenomenon. Classification of soil for general engineering purposes: particle size and I.S. Classification systems.	8
3	Mohr's circle of stress, shearing strength of soil, parameters of shear strength, Coulomb's failure envelope, determination of shear parameters by Direct Shear Box. Tri-axial and unconfined compression test apparatuses. Principles of soil compaction, laboratory compaction tests; Proctor's test, Stresses in Soil under surface loading: Bossinesq's and Westergaard's analysis for vertical pressure and its distribution in a soil mass. Vertical stresses due to concentrated loads, Isobar diagram, Vertical stress distribution on a horizontal plane. Influence diagram, Vertical stresses at a point under circular and rectangular loaded area. Approximate methods of obtaining vertical pressure due to surface loading. Newmark's chart,	8

4	Compressibility and Consolidation: Introduction to consolidation, comparison of compaction and consolidation, Spring Analogy Terzaghis one dimensional consolidation theory, Degree of consolidation, consolidation test, Compressibility parameters, co-efficient of consolidation. Pre-consolidation pressure and its determination. Normally, over and under consolidated soils. Methods of predicting Settlement and its rate. Total and differential Settlement.	**8**
5	Stability of Slopes: Classifications of slopes, Stability analysis of infinite slopes. Stability of finite slopes by Swedish and Friction circle method. Stability analysis by Taylor's stability number , Taylor's stability number curves. . Bishop's method of stability analysis. Earth Pressure: Active, passive and earth pressure at rest. Rankine's and Coulomb's theories. Rebhann's and Culman's graphical methods for active earth pressure for vertical and inclined back retaining walls, horizontal and inclined cohesion less back fill.	**8**
6	Bearing Capacity of Soils: Terminology related to bearing capacity, Common types of foundations. Terzaghi and Meyehoff's theory for bearing capacity. Rankine's method for minimum depth of foundation. Skempton's method. Effect of eccentricity and water table on bearing capacity. IS code method, Plate load and penetration tests for determining bearing capacity. Introduction to pile, Site Investigations: Methods of explorations. Planning of Investigations, Depth of exploration, Number of boreholes, Undisturbed and Disturbed samples. Types of samplers. Brief description of procedures of sampling, Transportation and Storage of samples.	**9**
	TOTAL	**42**

5CE4-05: WATER RESOURCE 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**: Definitions, functions and advantages of irrigation, present status of irrigation in India, classification for agriculture, soil moisture and crop water relations, Irrigation water quality. Consumptive use of water, principal Indian crop seasons and water requirements.	5
3	**Canal Irrigation:** Types of canals, design of channels, regime and semi theoretical approaches (Kennedy's Theory, Lacey's Theory) **Diversion Head works:** Design for surface and subsurface flows, Bligh's and Khosla's methods.	6
4	**Embankment Dams:** Suitable sites, causes of failures, stability and seepage analysis, flow net, principles of design of earth dams. **Gravity Dams:** Force acting on a gravity dam, stability requirements.	5
5	**Well Irrigation:** Open wells and tube wells, types of tube wells, duty of tube well water. **Cross-Drainage Structure**: Necessity of Cross-drainage structures, their types and selection, comparative merits and demerits.	5
6	**Hydrology:** Definition, Hydrologic cycle, measurement of rainfall, Flood hydrograph, Rainfall analysis, Infiltration, Run off, Unit hydrograph and its determination.	6
		28

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5CE5-11: AIR & NOISE POLLUTION AND CONTROL

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	*Air Pollution:* Air pollutants, Sources, classification, Combustion Processes and pollutant emission, Effects on Health, vegetation, materials and atmosphere, Reactions of pollutants in the atmosphere and their effects-Smoke, smog and ozone layer disturbance, Greenhouse effect.	7
	Air sampling and pollution measurement methods, principles and instruments, Ambient air quality and emission standards, Air pollution indices, Air Act, legislation and regulations, control principles,	6
	Removal of gaseous pollutants by adsorption, absorption, reaction and other methods. Particulate emission control, settling chambers, cyclone separation, Wet collectors, fabric filters, electrostatic precipitators and other removal methods like absorption, adsorption, precipitation etc. Biological air pollution control technologies, Indoor air quality.	7
3	*Noise pollution:* Basics of acoustics and specification of sound; sound power, sound intensity and sound pressure levels; plane, point and line sources, multiple sources; outdoor and indoor noise propagation; psychoacoustics and noise criteria,	4
	Effects of noise on health, annoyance rating schemes; special noise environments: Infrasound, ultrasound, impulsive sound and sonic boom; noise standards and limit values; noise instrumentation and monitoring procedure. Noise indices. Noise control methods.	3
	TOTAL	28

5CE5-12: DISASTER 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:** Understanding the Concepts and definitions of Disaster, Hazard, Vulnerability, Risk, Natural and Manmade Disasters, Disaster and Development, and Climate Change.	2
3	**Types of Disasters, their occurrence/ causes, impact and preventive measures:** **Geological Disasters**: earthquakes, landslides, tsunami, mining;	4
	Hydro-Meteorological Disasters: floods, cyclones, lightning, thunder-storms, hail storms, avalanches, droughts, cold and heat waves.	3
	Biological Disasters: epidemics, pest attacks, forest fire.;	3
	Technological Disasters: chemical, industrial, radiological, nuclear.	3
	Manmade Disasters: building collapse, rural and urban fire, road and rail accidents.	2
	Disaster profile of Indian continent, Mega Disasters of India and Lessons Learnt. Risk mapping.	3
4	**Disaster Management Cycle**: Disaster Management Cycle and its components: Pre disaster and post disaster, Paradigm Shift in Disaster Management. Safety tips for various types of disasters.	3
5	**Disaster management system in India:** Disaster Management Act 2005, National Guidelines and Plans on Disaster Management; Role of Government (local, state and national),Non-Government and Inter-Governmental Agencies.	4
	TOTAL	28

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5CE5-13: TOWN PLANNING

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: Definition of town planning, Evolution of towns, Objects of town planning, Economic Justification for town planning, Principles of town planning, Necessity of town planning, Origin, Growth and patterns of town development, distribution of land use, site for ideal town, powers required to enforce T.P. scheme.	6
3	Civic Surveys: Definition, Necessity, collection of data, Types of surveys, methods adopted to collect data, Drawings, reports.	3
4	Zoning: Definition, Use of land, Objects of zoning, Principles of zoning, Aspects, Advantages & Importance zoning, Transition zone, Zoning powers, Maps for zoning.	3
5	Importance and Demand of housing, Classification, requirements and design of residential building, Housing agencies, Housing problems in India.	3
6	Slums: Causes, characteristics and effects of slums, Slum clearance.	2
7	Industries: Classification of industry, Concentration of industry, requirements of the industry, Industrial townships.	3
8	Public Buildings: Location, classification principle of design, town center, grouping of public buildings. Town Planning, CL-SPP/CL-DDU/Nadiad, Gujarat, INDIA 4.	3
9	Re-planning of existing towns: Objects of re-planning, defects of existing town, data required for re- planning, Urban Renewal projects, De-centralization and Re-centralized, Garden city concept overview.	5
	TOTAL	28

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5CE5-14: REPAIR AND REHABILITATION OF STRUCTURES

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	**Deterioration of Concrete Structures:** Penetrability of concrete- permeability, sorptivity, diffusion. Physical processes- abrasion, erosion. Chemical- carbonation, chloride and sulfate attack. Alkali – Aggregate Reaction. Corrosion- mechanism. **Factors affecting and Preventive measures** :for all the above, including water – proofing techniques for various conditions, sacrificial anode, corrosion resistant steel, corrosion inhibitors, protective coatings etc.	8
3	**Cracks in Concrete and Masonry Structures-** Types, patterns, measurement and preventive measures.	3
4	**Assessment of Risk/Damagein Structures:** *Preliminary investigation-* visual, history collection etc. *Detailed Investigation:* core cutting, rebar locator, corrosion meter, penetration resistance, pull out tests, half–cell potential, concrete resistivity etc. Interpretation of non destructive test data from all the above tests as well as rebound hammer number and ultra sonic pulse velocity. Destructive and chemical tests- on material samples from site.	5
5	**Materials for Repair:** polymers and resins, self curing compounds, FRP, ferro-cement- properties, selection criterion, cement based and polymer modified mortars etc.	4
6	**Repair Techniques:** Grouting, Jacketing, External bonded plates- processes, limitations, design computations etc. including numerical problems. **Under Water Repair:** Processes	6
7	**Case Studies:** related to rehabilitation of bridge piers, heritage structures, masonry structures etc.	2
	TOTAL	28

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5CE5-15: GROUND IMPROVEMENT TECHNIQUES

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**: Formation of soil- Mechanical Weathering, Chemical weathering, types of soil-Residual soil, Transported soil, Regional soil Deposit in India, Difficult soils- Expansive soil, Collapsible soil, organic soil etc. Purpose and Principles of Ground Improvements.	03
3	**Densification by Compaction Near Surface**: Theory of compaction, Laboratory compaction tests; compaction in field, Effect of compaction on different soil properties, Factor affecting compaction in field, Measurement of density in field.	03
4	**Densification by Deep Compaction:** (a) Vibration methods- Vibro compaction, Vibro floatation, Vibratory probes method, Blasting. (b) Displacement methods- Sand compaction piles; Dynamic compaction.	04
5	**Modification Using Stone Columns:** **Introduction**- Failure mechanism, load carrying capacity, settlement analysis, installation technique, Geo-synthetic -encased stone columns, Mechanism of encasement, field control of stone columns.	04
	Pre-Compression and Vertical Drain: Applicability and types of pre compression. Purpose and mechanism of pre-compression by pre loading. Design procedure of pre-compression by preloading. **Pre-compression by preloading with vertical drains**- Principles, Advantages, and disadvantages of Vertical drains, Type of Vertical drains, Installation, Monitoring and Instrumentation of Vertical drains.	03

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6	**Modification by Grouting**: Purpose, principles and classification of grouts and their properties. Desirable characteristics of grout, Grouting methods, Planning and operation of grouting, control of grouting operations and monitoring.	**4**
	Modification by Soil Reinforcement: Purpose of reinforced earth, Mechanism of reinforced soil, Failure mechanism of reinforced earth, Advantages of reinforced earth. Application of Reinforced Earth, Design methods of reinforced earth wall- (a) Check for External stability. Check for Internal stability.	**4**
7	**Miscellaneous Methods of Soil stabilization:** Lime stabilization, cement stabilization, bituminous stabilization, chemical stabilization.	**02**
	TOTAL	**28**

5CE5-16: ENERGY SCIENCE AND 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 to Energy Science: Scientific principles and historical interpretation to place energy use in the context of pressing societal, environmental and climate issues; Introduction to energy systems and resources; Introduction to Energy, sustainability & the environment.	5
3	Energy Sources: Overview of energy systems, sources, transformations, efficiency, and storage. Fossil fuels (coal, oil, oil-bearing shale and sands, coal gasification) - past, present & future, Remedies & alternatives for fossil fuels - biomass, wind, solar, nuclear, wave, tidal and hydrogen; Sustainability and environmental trade-offs of different energy systems.	6
4	Energy & Environment: Energy efficiency and conservation; introduction to clean energy technologies and its importance in sustainable development; Carbon footprint, energy consumption and sustainability.	5
5	Civil Engineering Projects connected with the Energy Sources: Coal mining technologies, Oil exploration offshore platforms, Underground and under-sea oil pipelines, solar chimney project, wave energy caissons, coastal installations for tidal power, wind mill towers; hydro power stations above-ground and underground along with associated dams, tunnels, penstocks, etc.	7
6	Engineering for Energy conservation: Concept of Green Building and Green Architecture; Green building concepts; LEED ratings; Identification of energy related enterprises.	4
	TOTAL	28

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5CE4-21 : CONCRETE STRUCTURES DESIGN

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

SN	Contents	Hours
1	Revision of Typical problems of BMD and SFD	3
2	Analysis and Design of singly reinforced rectangular beam section for flexure, based on Working stress design philosophy.	3
3	Analysis and Design of singly reinforced rectangular beam section for flexure, based on Limit State design philosophy.	3
4	Analysis and Design of doubly reinforced rectangular beam section for flexure, based on Limit State design philosophy.	3
5	Analysis and Design of flanged beam section for flexure, based on Limit State design philosophy.	3
6	Problems on Limit state of serviceability for deflection as per codal provisions of empirical coefficients.	3
7	Analysis and design of prismatic sections for shear using LSD	3
8	Problems on limit state of collapse in bond	3
9	Analysis and design of one way slabs using LSM,	3
10	Analysis and design of two way slabs using LSM,	3
11	Analysis and design of short axially loaded columns	3
12	Analysis and design of footing	3
13	Analysis and Design of beams for torsion as per codal method.	3
	TOTAL	**39**

5CE4-22 : GEOTECHNICAL ENGINEERDING LAB

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

1	Grain size distribution by sieve Analysis and Hydrometer
2	Determination of specific Gravity by Pycnometer.
3	Determination of liquid limit by Casagrande's apparatus and cone penetrometer.
4	Determination of plastic limit and shrinkage limit
5	Determination of field density by core-cutter and sand replacement method
6	Determination of compaction properties by standard Proctor Test Apparatus.
7	Determination of C-Ø values by unconfined compression Test Apparatus, Direct Shear Test Apparatus and Triaxial Test.
8	To determine the differential free swell index of soil and swelling pressure of soil.
9	To determine the CBR of soil.
10	To determine the compressibility parameters of soil by consolidation test.
11	To determine the permeability of soil by constant and falling head methods. Design as per syllabus of theory.

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5CE4-23: WATER RESOURCES ENGINEERING DESIGN LAB

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

Design as per syllabus of theory.

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