



Government of Karnataka
DEPARTMENT OF COLLEGIATE AND TECHNICAL EDUCATION

Programme	Civil Engineering	Semester	Third Semester
Course Code	20CE33P	Type of Course	Programme Core
Course Name	Construction Techniques	Contact Hours	8 hours/week 104 hours/semester
Teaching Scheme	L:T:P :: 3:1:4	Credits	6
CIE Marks	60	SEE Marks	40

1. Rationale: Civil engineering is the oldest discipline of engineering. Since the very beginning of human existence, it has been an aspect of life. Construction is an important sector of civil engineering that contributes greatly in the economic growth of a nation. Civil engineers design, construct, supervise, operate, and maintain large construction projects and systems. It is expected that the students should know the basics of the same to apply it in the field. Through this course students will develop the desired skills and competencies which are expected from them for construction related works.

2. Course Outcomes/Skill Sets: At the end of this course students will be able to

CO-01	Select the type of building suitable for construction for a given climatic conditions and justify the reasons for such a selection.
CO-02	Identify the type of soil, test it to confirm properties and strength, recommend suitable excavation methods and type of foundations.
CO-03	Select a suitable type of superstructure, list the various components to be built and recommend the appropriate construction techniques and services to be used for a required building structure.
CO-04	Identify the reasons for deterioration of a given structure using the appropriate diagnostic methods and tools, record the levels of distress and recommend corrective action plans for repair and rehabilitation of that structure.

3. Course Content

Week	CO	PO	Lecture (Knowledge Criteria)	Tutorial (Activity Criteria)	Practice (Performance Criteria)
			3 hours/week	1 hour/week	4 hours/week (2 hours/batch twice in a week)
1	1	1,2,4	1. Climatic factors: Tropical climate, solar & wind flow pattern, Time lag & decrement factor, Periodic heat flow.	1. Study the Standard Penetration test	1. Field Identification of type of soil based

			<p>2. Classification of soils and their suitability for the construction of different structures. Bearing capacity of soil, Safe bearing capacity of soil.</p> <p>3. Determination of Bearing capacity by Standard penetration test (SPT), Method of improving the safe bearing capacity</p>	<p>and Plate load test.</p> <p>2. Study and prepare a report on local rainfall data and type of soil strata available.</p>	<p>on visualization and validate the type of soil by conducting sieve analysis test - Particle size distribution using semi-log graph.</p> <p>2. Test on soil: a) Liquid limit b) Plastic limit c) Shrinkage limit.</p>
2	2	2,4,7	<p>1. Site clearance, Process of general & deep excavation, Necessity of shoring, Soil nailing and strutting in foundation, excavation and process of dewatering, purpose of anti-termite treatment, type of chemical used & laying method.</p> <p>2. Foundation: Purpose and classification of foundation. Shallow foundation: Isolated footing, Spread footing, combined footing, Strap footing and Raft foundation.</p> <p>3. Deep foundation: Pile foundation and its types and Caisson foundation. Selection of foundation for different types of structures.</p>	<p>1. List the tools and equipments used for site clearance and excavation work</p> <p>2. Study and prepare a report on advanced techniques in laying foundation.</p>	<p>1 Tests on Moisture content of soil (Oven drying method and Field density of soil by core cutter and rapid moisture meter.</p> <p>2. Conduct Standard Proctor test on soil compaction.</p>
3	2	1,2,4,7	<p>1. Foundation in Black Cotton Soil. Causes for failure of foundation and preventive measures.</p> <p>2. Plinth beam or Plinth slab / grade beams. Superstructure-Column, Beams and their suitability for different structures.</p> <p>3. Load bearing walls, non-load bearing walls & framed structure. Main attributes of masonry work, Technique used in masonry work.</p>	<p>1. Study the construction methodology of basement and Retaining wall.</p> <p>2. Study & prepare a report on Advanced techniques in masonry work.</p>	<p>1. Free swell Index of Black cotton soil.</p> <p>2. Water Absorption test & other field test on brick.</p> <p>3. Compression test on bricks, Dimensionality tolerance test.</p>
4	3	2,4,7	<p>1 & 2. Types of masonry work and their suitability. Stone masonry, Brick masonry, Concrete Block masonry and their types.</p>	<p>1. Study & prepare a report on various Precast concrete partition walls.</p> <p>2. Prepare a report on Autoclave</p>	<p>1. Construction of English bond & Flemish bond, also prepare a masonry checklist for</p>

			3. Partition walls and its types based on materials. Dry wall construction Structural Glazing, Aluminium Panelling, Infill walls and Envelopes.	brick masonry, Stabilized mud block masonry, Poro Thermo Block masonry. Laterite brick masonry.	before & after construction. 2. Construct concrete block masonry wall of height 1metre.
5	3	1,2,3,7	1. Ventilation requirements for health mechanisms, natural ventilation, cross ventilation and artificial ventilation, Airflow patterns in building. Purpose of providing doors, windows and ventilators and its suitability. 2.Lintels, sunshades, sun breakers and canopy, portico and their suitability. 3.Arch-Terms used, Types of arches-Flat, Segmental, and Semi-circular and their suitability.	1. Study & present the Standard size of doors, windows & ventilators for different types of building as per I.S codes.	1.Study and present important types of doors, windows and ventilators in general use. 2. Prepare process manual for installation of doors, windows and ventilators.
6	3	1,2,3,7	1. Stairs: Technical terms, Requirements of a stair, Indian Standards for dimensions of stairs, Construction method of staircase and its headroom. 2.Elevators: Lift pit - Foundation for Lift and concrete or Block work with intermediate column beam structure around the lift and lift headroom 3.Ramps and escalators and their importance as per Indian Standards	1. Study the Suitability of staircases, ramps, elevators and escalators in different typologies of buildings	1. Study & present different types of stairs 2.Prepare process manuals for construction of staircases, ramps and lift pit.
7	3	1,3	1.Introduction to Formwork, shuttering, centring, staging, scaffolding and its applications. 2. Scaffolding: Component parts, types of scaffolding and props, Materials used for scaffoldings. 3. Types of shoring-Raking, Flying & Dead shores. Safety precautions while using scaffolding.	1. Visit the construction site and collect details of the advanced types of scaffoldings and prepare a report.	1.Prepare a checklist (before, during after the work) & process manual for different types of scaffolding. 2. Draw different types of scaffolding using BIM software (3D using

					AutoCAD, Revit, Sketch etc.)
8	3	2,3,7	<p>1. Formwork: Purpose of providing formwork. Types of formworks based on material.</p> <p>2. Requirements and Codal provisions for Standard formwork. Monolithic Construction Formwork.</p> <p>3. Method of shuttering and centring & removal of formwork. Formwork Failures and Remedies.</p>	<p>1. Visit construction site and prepare a photo gallery of different formworks adopted for various construction activities.</p>	<p>1. Study and present the tools and components used for formwork.</p> <p>2. Prepare a checklist & process manual for different types of form work.</p>
9	3	1,2,5,7	<p>1. Roof: Types of roofs, common types of Roofing materials.</p> <p>2. Pitched roof, its basic components and its suitability. Flat roof-advantages and disadvantages</p> <p>3. Weather proof course for flat roofs. False ceiling and its suitability.</p>	<p>1. Study & compare different types of roofs considering typology of building and atmospheric conditions.</p>	<p>1. Prepare a checklist & process manual for construction of different types of roofs & trusses.</p> <p>2. Study and present the technique of laying different types of roofs & trusses.</p>
10	3	1,2,4,7	<p>1. Objectives of plastering and requirements of good plaster. Method of cement plastering,</p> <p>2. Types of plaster and surface finishes- Smooth, sand faced, rough cast, pebble dash, debtor, scrapped, textured finish.</p> <p>3. Pointing- Method of pointing & types. Fixing of doors and windows using different fixtures.</p>	<p>1. Study & present advanced plastering and surface finishing techniques and its suitability.</p>	<p>1. Visit a construction site during Plastering Activity-Prepare check list & process manual for cement plastering.</p>

					2. Prepare checklist & process manual for Gypsum/ POP plastering.
11	3	1,2,5,7	<p>1. Definition and causes of dampness. Effects of dampness and prevention of dampness. Materials used for the damp proof course.</p> <p>2. Method of Terrace waterproofing, Water tank waterproofing Methods & types of expansion joint treatment. Roof slab leakages or dampness and arresting it.</p> <p>3. Waterproofing technique for swimming pools, sump, podium, bathroom sunken slabs, water closets, retaining wall.</p>	<p>1. Study on advanced waterproofing techniques and grouting techniques.</p> <p>2. Study and Collect working procedure for pressure grouting application for roof slab leakage or dampness</p>	<p>1. Prepare checklist & process manual for Waterproofing and laying procedure for different areas of building.</p> <p>2. Types & laying procedure of grouts.</p>
12	3	1,2,5,7	<p>1. Types of floors, Suitability of flooring material, Process of laying Cement concrete floorings.</p> <p>2. Process of laying Oxide flooring. Ceramic tile flooring, Vitrified flooring, granite flooring, Marble flooring.</p> <p>3. Wooden flooring, Vinyl flooring, Vacuum dewatered flooring, IPF flooring, epoxy flooring, False flooring. Cladding Work and its types, Importance and suitability of cladding work</p>	<p>1. Collect samples and prepare a report on the grouting process for flooring works.</p> <p>2. Study on advanced techniques in flooring.</p> <p>3. Collect & present different types of flooring materials.</p>	<p>1. Prepare checklist & process manual for different types of flooring.</p> <p>2. Prepare checklist & process manual for different types of cladding work.</p>
13	4	2,3,5,7	<p>1. Methods of painting, Types of paints distempering & varnishing on different surfaces. VOC paints & its importance.</p> <p>2. Introduction, Cause of deterioration of concrete structures, Diagnostic methods & analysis, preliminary investigations, experimental investigations using NDT.</p> <p>3. Techniques for Repair: (Corrosion) Rust eliminators and polymer coating for rebar during repair, foamed concrete,</p>	<p>1. Study & present advanced technique in painting.</p> <p>2. Prepare a report on method of application of external texture painting works.</p>	<p>1. Visit a construction site during Painting activity, Prepare check list & process manual for painting on different surfaces (Any one method)</p>

			mortar and dry pack, vacuum concrete, Gunite and Shotcrete, Epoxy injection, Mortar repair for cracks, shoring and underpinning.		2. Site visit, investigate the problem using NDT, analyse, adopt suitable method of repair & prepare check list & process manual for repair work.
Total in hours			39	13	52

NOTE 1: The course content shall be delivered through lectures, PowerPoint presentations, video demonstrations and field visits.

NOTE 2: The TUTORIAL (Activity criteria) shall be conducted / executed by the student (Minimum ONE suggested activity from each week) and to be submitted in portfolio evaluation of activities through rubrics to the faculty.

NOTE 3: The PRACTICE (Performance criteria) shall be conducted by the student and observations and report to be submitted at the end of each session to the faculty.

4. CIE and SEE Assessment Methodologies

Sl. No	Assessment	Test Week	Duration In minutes	Max marks	Conversion
1.	CIE-1 Written Test	5	80	30	Average of three tests 30
2.	CIE-2 Written Test	9	80	30	
3	CIE-3 Written Test	13	80	30	
4.	CIE-4 Skill Test-Practice	6	180	100	Average of two skill test reduced to 20
5	CIE-5 Skill Test-Practice	12	180	100	
6	CIE-6 Portfolio continuous evaluation of Tutorial sessions through Rubrics	1-13		10	10
Total CIE Marks					60
Semester End Examination (Practice)			180	100	40
Total Marks					100

5. Format for CIE written Test

Course Name	Construction Techniques	Test	I/II/III	Sem	III/IV
Course Code	20CE33P	Duration	80 Min	Marks	30
Note: Answer any one full question from each section. Each full question carries 10 marks.					
Section	Assessment Questions		Cognitive Levels	Course Outcome	Marks
I	1				

	2			
II	3			
	4			
III	5			
	6			
Note for the Course coordinator: Each question may have one, two or three subdivisions. Optional questions in each section carry the same weightage of marks, Cognitive level and course outcomes.				

6. Rubrics for Assessment of Activity (Qualitative Assessment)

Sl. No.	Dimension	Beginner	Intermediate	Good	Advanced	Expert	Students Score
		2	4	6	8	10	
1		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	8
2		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	6
3		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	2
4		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	2
	Average Marks= (8+6+2+2)/4=4.5						5

Note: Dimension and Descriptor shall be defined by the respective course coordinator as per the activities

7. Reference:

Sl. No.	Description
1	Koenigsberger, O.H. et al, " Manual of Tropical Housing and Building Part-I Climatic Design ", Orient Longman. 1973
2	Hvorslev MJ, " Subsurface Exploration and Sampling of Soils for Civil Engg. Purposes " Elsevier Pub. Co,
3	Manfredd RH, " Engineering Principles of Ground Modification ", McGraw Hill
4	Purushotham Raj, " Ground Improvement Techniques ".
5	Bureau of Indian Standards, " HandBook of Functional Requirements of Buildings, (Sp-41 &Sp- 32) ", BIS 1987 and 1989.
6	B C Punmia, " Building Construction ", Laxmi Publications
7	www.nptel.ac.in

8. a. CIE Skill Test1 Scheme of Evaluation

SL. No.	Particulars/Dimension	Marks
1	Portfolio evaluation for practice sessions -Performance criteria (Observations and report)	10
2	Test on soil. a. Field identification of soil- 05 marks. b. Conduct sieve analysis test and determine type of soil by Particle size distribution using semi-log graph / Determination of Atterberg Limits a) Liquid limit / b) Plastic limit / c) Shrinkage limit/Field density of soil by core cutter / Standard Proctor Compaction Test on soil. i. Procedure with tabular columns - 10 marks ii. Conduction of experiment - 15 marks iii. Result and Conclusion - 05 marks	35
3	Test on Bricks. a. Field test on Bricks (Any 5 test)- 05 marks. b. Compression test on bricks and Dimensionality tolerance test / Free swell Index of Black cotton soil / Construction of English bond masonry /Flemish bond masonry/Construct block masonry wall using suitable infills i. Procedure with tabular columns and check lists if any - 10 marks ii. Conduction of experiment - 15 marks iii. Result and Conclusion - 05 marks	35
4	Prepare process manual for. Doors/ Windows / Ventilators/ Staircases / Ramps / Lift pit	10
5	Viva-Voce	10
Total Marks		100

8. b. CIE Skill Test 2 Scheme of Evaluation

SL. No.	Particulars/Dimension	Marks
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1	Portfolio evaluation for practice sessions -Performance criteria (Observations and report)	10
2	Scaffolding: Prepare a checklist (before, during and after) Prepare process manual for form work. Draw 3D elevation of scaffolding using BIM software like AutoCAD / Revit / Sketch up/ 3D max	20
3	Formwork: Prepare a checklist (before, during and after) Prepare process manual for form work.	10
4	a. Roof construction: Prepare a checklist (before, during and after) Prepare process manual for roof construction. OR b. Truss Installation: Prepare a checklist (before, during and after) Prepare process manual for Truss Installation.	10
5	a. Cement plastering: Prepare a checklist (before, during and after) Prepare process manual for Cement plastering. OR b. Gypsum/ POP plastering: Prepare a checklist (before, during and after) Prepare process manual for Gypsum/ POP plastering.	10
6	Waterproofing and joint filler: Prepare a checklist (before, during and after) Prepare process manual for Waterproofing and joint filler work (grouting).	10
7	Flooring: Prepare a checklist (before, during and after) Prepare process manual for Floor construction.	10
8	Wall cladding: Prepare a checklist (before, during and after) Prepare process manual for Wall cladding.	10
9	Viva-Voce	10
Total Marks		100

Note for the Examiner:

1. The choice between the questions 4a and 4b shall be done by the examiner.
2. The choice between the questions 5a and 5b shall be done by the examiner.

8. c. SEE Scheme of Evaluation

SL. No.	Particulars/Dimension	Marks
	a. Conduct sieve analysis test and determine type of soil by Particle size distribution using semi-log graph / Determination of Atterberg Limits a) Liquid limit / b) Plastic limit / c) Shrinkage limit/Field density of soil by core cutter / Standard Proctor Compaction Test on soil. i. Procedure with tabular columns - 10 marks	

1	ii. Conduction of experiment - 15 marks iii. Result and Conclusion - 10 marks OR b. Compression test on bricks and Dimensionality tolerance test / Free swell Index of Black cotton soil / Construction of English bond masonry /Flemish bond masonry/Construct block masonry wall using suitable infills i. Procedure with tabular columns and check lists if any - 10 marks ii. Conduction of experiment - 15 marks iii. Result and Conclusion - 10 marks	35
2	a. Draw 3D elevation of scaffolding using BIM software like AutoCAD / Revit / Sketch up/ 3D max. Prepare a checklist (before, after and during) and process manual for repair work. OR b. Investigate the problem using NDT, analyse and adopt a suitable method of repair. Prepare a checklist & process manual for repair work.	25
3	Prepare process manual and checklists for any TWO of the following construction activities. a. Earthwork Excavation b. Foundation / Footing and column c. SSM d. BBM e. Formwork f. Roof construction g. Truss Installation h. Cement plastering i. Gypsum/ POP plastering j. Waterproofing and joint filler k. Flooring l. Wall cladding	20
4	Viva-Voce	20
Total Marks		100

Note for the External Examiner:

1. The choice between the questions 1a and 1b shall be done by the external examiner.
2. The choice between the questions 2a and 2b shall be done by the external examiner.

9. Equipment/software list with Specification for a batch of 20 students

Sl. No.	Particulars	Specification	Quantity

1.	IS Sieve 20 mm , 10 mm 4.75 mm , 2.00 mm , 1.18 mm , 600 µm, 425 µm , 300 µm, 212 mm , 150 µm , 75 µm , Pan	IS sieve for soil testing	1 set
2.	Measuring Jars of 1000, 500, 100, 10ml	Plastic measuring JAR	1set
3	Digital weighing Balance 12 kg capacity with minimum 1 gm. accuracy	0.5gm accuracy	1no
4	Hot air Oven	Stainless Steel Member Lab Oven	1no
5	Core cutter with dolly	Soil Testing Machine	1set
6	Standard proctor compaction apparatus	Cylindrical Metal Mold, having internal diameter 4" or 6", the internal height of 4.6" and the mold should have detachable base plate & collar of 2 inches (5.08 cm), Rammer, weighing 5.5 lbs (2.5 kg) & having fall of 12 inches (30.5 cm), with a flat circular face of 2" diameter.	1set
7	Atterberg limits apparatus	Soil testing apparatus	1set
8	Ultrasonic pulse velocity kit	oscillation frequency in range of 40 kHz to 50 kHz	1set
9	Rebound Hammer	Measuring range from 10 to 130 N/mm ²	1no
10	Non-Destructive Half-Cell Potentiometer Testing on Concrete	As per ASTM C 876-91.	1set
11	Portable core drilling machine	350mm core cutting machine	1set
12	A complete assembly of point load tests.	capacity of the loading machine is usually 25kN or 50kN and typically utilizes a hydraulic pressure gauge	1set

13	AutoCAD	Ver. 2020 and above	1license/college
14	Sketch up/3Ds Max/Revit	Ver. 2018 and above	1license/college
15	Pick Axe	For digging soil	4nos
16	Spirit level	1mtr length	2nos
17	Trowel	Big	3nos
18	Trowel	Medium	3nos
19	Trowel	Small	3nos
20	Oil can	250ml (for pouring water)	5nos
21	Right angle 1*1.5m	1*1.5m	1no
22	Measuring tape	metal tape 3mtr	5nos
23	Safety goggle	Engineer's safety goggle	4nos
24	Wheelbarrow	Small	1no
25	Portable Air blower	Hand blower type power 600w	1no