



Government of Karnataka

DEPARTMENT OF COLLEGIATE AND TECHNICAL EDUCATION

Programme	Civil Engineering	Semester	5th
Course Code	20CE51I	Type of Course	Specialization Pathway
Course Name	Structural Engineering	Contact Hours	36 hours per week
L: T:P	104: 52: 312	Credits	24
CIE Marks	240	SEE Marks	160

Introduction: Welcome to the curriculum for Structural Engineering Specialization. This specialization course is taught in Bootcamp mode. Bootcamps are 12 weeks, intense learning sessions designed to prepare you for the practical world – ready for either industry or becoming an entrepreneur. You will be assisted through the course, with development-based assessments to enable progressive learning. In this course, you'll learn how to plan, analyse, design, drafting, estimation and costing. Additionally, it considers the technical, economic, environmental, aesthetic, and social aspects of the structures. Structural engineering is a profession that offers a great opportunity to make a real difference in the lives of people and their environment.

Leading to the successful completion of this bootcamp, you shall be equipped to either do an internship at an organization working in Structural Engineering related industry or do a project in Structural Engineering related sectors. After the completion of your Diploma, you shall be ready to take up roles like Junior Engineer, Assistant design engineer, Draftsman, Site Engineer, Quality controller, Auditor.

This course will teach you Fundamentals of referring IS Codes, understanding details, analysis of data, design, drafting, cost estimation, transportation, erection and assembly of steel structures. Details of the curriculum is presented in the sections below.

Instruction to course coordinator:

1. Each Pathway is restricted to a Cohort of 20 students which could include students from other relevant programs.
2. Single faculty shall be the Cohort Owner.
3. This course shall be delivered in boot camp mode.
4. The industry session shall be addressed experts (in contact mode/online / recorded video mode) by industry experts only.

5. The cohort owner shall identify experts from the relevant field and organize industry sessions as per schedule.
6. Cohort owner shall plan and accompany the cohort for industrial visits.
7. Cohort owners shall maintain and document the industrial assignments and weekly assessments, practices and mini projects.
8. The cohort owner shall coordinate with faculties across programs needed for their course to ensure seamless delivery as per time table.
9. The cohort owner along with the classroom can augment or use for supplementally teaching online courses available although reliable and good quality online platforms like Karnataka LMS, Infosys Springboard, NPTEL, Unacademy, SWAYAM, etc.
10. Cohort owner shall guide the cohorts for the execution of mini project.

Course outcome: At the end of the semester students will be able to,

C01	Collect necessary data, analyze, refer relevant IS codes, design simple indeterminate structural elements, portal frames, steel structures and masonry structures.
C02	Prepare working drawings, design drawings, fabrication drawings, erection drawings, estimates, BOQ, BOM, MTO.
C03	Monitor transportation, lifting, erection, connection processes of steel and PSC structures
C04	Use appropriate modern tools and design software's

Detailed course plan

Week	CO	PO	Days	1 st session (9am to 1 pm)	L	T	P	2 nd session (1.30pm to 4.30pm)	L	T	P
1	1	1,2	1	Introduction <ul style="list-style-type: none"> Structural Engineering as a responsible career. Role of structural Engineer. Need of structural analysis and design. Introduction to analysis and design software's. Prevailing Codes of practice. <p>Present roles of structural engineer at site by showing videos, images.</p> <p>Identify the various sectors of civil engineering where structural engineers plays a role.</p>	2	2		Structural analysis <ul style="list-style-type: none"> Types of structure Conditions of equilibrium, Degrees of Freedom Determinate and indeterminate structures-examples. Static determinacy and kinematic determinacy Stable and Unstable structures – examples. Degree of indeterminacy Concept of Analysis of Indeterminate beams. <p>Prepare models/prototypes to present determinate and indeterminate structures using any available materials</p>	1		2
	1	1,2	2	Analysis of Fixed beams <ul style="list-style-type: none"> Fixed beam, Degree of indeterminacy of fixed beam- Sagging and Hogging bending moments Determination of fixed end/support moments by Area Moment method Drawing SF and BM diagrams for Fixed beams subjected to UDL, point load- simple problems 	2		2	<ul style="list-style-type: none"> Determination of Slope and Deflection of fixed beams subjected to UDL, point load by area moment method. Simple Problems. 			3
	1	1,2	3	Analysis of Continuous beams <ul style="list-style-type: none"> Continuous beams, applications. Introduction to Carry over factor, Stiffness factor and Distribution factor –Stiffness Ratio or Relative Stiffness. 							

			<ul style="list-style-type: none"> • Concept of distribution of unbalanced moments at joints - Sign conventions. • Application of Moment Distribution method to Continuous beams of two spans only (Maximum of three cycles of distribution) • Finding Support Reactions- Problems • Sketch SFD and BMD for two span beams 	2	2	<ul style="list-style-type: none"> • Continuation 			3
1	1,2	4	Analysis of Portal frames <ul style="list-style-type: none"> • Portal Frames, Types, Bays and Storey • Sketch Single and Multi Storey Frames, Single and Multi Bay Frames • Portal Frame – Sway and Non-Sway Frames • Analysis of Non sway Symmetrical Portal Frames-single Bay and single Storey- for Joint moments by Moment Distribution Method and draw SFD and BMD. 	1	3	<ul style="list-style-type: none"> • Continuation 	1		2
		5	Developmental Assessment			Assessment Review and corrective action			3
		6	Industry Session	2	3	Industry assignment			
4	4,7	1	Peer review on industry class.	4		<ul style="list-style-type: none"> • Introduction to Modelling of structural elements using any <i>Open Source (STAAD Pro/Ansys)</i> analysis software. • Recall from EM & SOM 	1		2
4	4,7	2	<ul style="list-style-type: none"> • Model and analyze fixed beam, Continuous beam and Portal frame using any <i>Open Source (STAAD Pro/Ansys)</i> analysis software. • Compare the results with manual calculations. 		4	<ul style="list-style-type: none"> • Continuation 			3
1	1,2	3	Buildings and By-laws <ul style="list-style-type: none"> • Types of building and purpose 	2	2	RCC structures	2		1

2				<ul style="list-style-type: none"> • Building by-laws, floor area ratio (FAR), Set back, Height limitations of building, Fire safety. Types of Drawings. • Plan approval procedure. <p><i>Collect, Study and prepare a report on local municipal or city corporation building by-laws.</i></p>			<ul style="list-style-type: none"> • Types of structures, structural components- Definition and their role in structural system • Tensile and compression members, Zones of tension and compression in a Beam • Role of concrete and reinforcement in RC structures, • Loads on structures, types, selection of load and load combination, • Effective span, Breadth and depth requirements of beam, thickness of slab, Column size and orientation, Footing size, depth of footing, selection of footing type. <p><i>Study IS 875-2016 and prepare a report on selection of load and load combination.</i></p>		
	1	1,3	4	<p>Design specifications of RC structures</p> <ul style="list-style-type: none"> • Reinforcement – types, percentage of reinforcement, Spacing requirements, Selection of suitable diameter • Development length and its calculation. • Anchorage bends and hooks and their values. • Curtailment of reinforcement. • Lapping/Splicing, Spacer bars, Chairs • Cover requirements <p><i>Collect and read existing Blue Print drawings of any type of building and prepare report.</i></p>	2	2	<p>Ductile detailing</p> <ul style="list-style-type: none"> • Introduction to ductile detailing of RC structures as per IS 13920-2016 • Salient features of Ductile detailing • Difference between RC detailing and Ductile detailing using SP-34 and IS 13920-2016 <p><i>Read IS 456-2000, SP-34, IS 13920-2016 and prepare typical RC detailing drawings</i></p>	2	1
			5	Developmental Assessment			Assessment Review and corrective action		3

			6	Industry Session		5	Weekly industry assignment.			
3	1,4	2,7	1	Peer review on industry class.		4	Planning of a Residential (2BHK)/School/Commercial building with staircase Ask students to prepare their own <ul style="list-style-type: none"> • Site plan • Single line diagram • Architectural plan • Elevation (From all four directions) • Sectional elevation Using AutoCAD. Follow building by-laws.	2		1
			2	<ul style="list-style-type: none"> • Continuation 	1	3	<ul style="list-style-type: none"> • Continuation 			3
	1,4	2,7	3	Design of a Residential (2BHK)/School/Commercial building with staircase Design the structural members of the above planned building manually as per IS 456:2000 <ul style="list-style-type: none"> • Slab • Beam • Column • Lintel with chejja • Footing • Staircase 	1	3	<ul style="list-style-type: none"> • Continuation 			3
	1,4	7	4	<ul style="list-style-type: none"> • Introduction to use of Design software like STAAD Pro/ETABS and SAFE (Footing design) 	2	2	<ul style="list-style-type: none"> • Practice of Design software like STAAD Pro/ETABS and SAFE (Footing design) 	1		2
			5	CIE 1- Written and practice test			Assessment Review and corrective action			3

			6	Industry class	2	3	Industry weekly assignment			
4	1,4	7	1	Peer review on industry class		4	<ul style="list-style-type: none"> Model, Analyze and Design the above planned building using STAAD Pro/ETABS and SAFE (Footing design) software. Compare with manual design values. 	1		2
	1,4	7	2	<ul style="list-style-type: none"> Continuation 	1	3	<ul style="list-style-type: none"> Prepare Detailed reinforcement drawings for the above designed building using AutoCAD 	1		2
	1,4	7	3	<ul style="list-style-type: none"> Continuation 	1	3	<ul style="list-style-type: none"> Continuation 			3
	1,4	7	4	Prepare drawings of <ul style="list-style-type: none"> Column layout Beam layout Sectional details Structural drawings General notes Using AutoCAD	2	2	<ul style="list-style-type: none"> Continuation Print "GOOD FOR CONSTRUCTION" drawings. 			3
			5	Developmental Assessment			Assessment Review and corrective action			3
			6	Industry class	3	2	Industry weekly assignment			
5	1,2	3	1	Peer review on industry class		4	<ul style="list-style-type: none"> Estimate the quantities and Prepare BOQ making use of local Schedule of rates (SR) for the above designed 2BHK residential building 	1		2
	1,2	3	2	<ul style="list-style-type: none"> Continuation 	1	3	<ul style="list-style-type: none"> Continuation 			3

	1		3	<ul style="list-style-type: none"> Visit nearby construction site and expose students to different construction activities 	1		3	<ul style="list-style-type: none"> Visit nearby construction site and expose students to different construction activities 	1	2
	1	3	4	Design of T-beam <ul style="list-style-type: none"> Definition, where and when T-beams are provided Structural behavior of T-beam, Cross section of T-beam and L-beam, Effective width of flange, Neutral axis Design of Singly reinforced T-beam for flexure. Sketch reinforcement details. 	2		2	Design of Combined footing <ul style="list-style-type: none"> Definition, necessity, design concept Design a combined footing to carry equal loads from two columns. Sketch reinforcement details 	1	2
			5	CIE 2- Written and practice test				Assessment Review and corrective action		3
			6	Industry class	2		3	Industry weekly assignment		
6	1,3	3	1	Peer review on industry class			4	Pre-stressed concrete (PSC) <ul style="list-style-type: none"> Principle of pre-stressing Advantages and disadvantages of PSC Difference b/w RCC and PSC Applications of PSC Materials used and their characteristics, Stress-strain curve. Methods of pre-stressing Pre-tensioning, Post tensioning Show images and videos of pre-stressing and materials used.	2	1
	1,3	3	2	<ul style="list-style-type: none"> Loss of pre-stress- Types, total loss and measures to minimize pre-stress loss Anchoring devices Step by step procedure of Pre-tensioning Prepare a report on stages of Pre-tensioning	1		3	<ul style="list-style-type: none"> Form work for PSC at site as well as pre-casting plants – types, materials, selection of type of form work Step by step procedure of post-tensioning 	1	2

							Prepare a report on stages of post-tensioning			
1,3	3	3	<ul style="list-style-type: none">• Concreting of PSC elements• Grouting of ducts -Definition, properties, types, materials, proportion and testing.• Curing methods- latest• Transportation of PSC members <p>Prepare a report on grouting, curing and transportation of PSC members.</p>	2	2	<ul style="list-style-type: none">• Lifting and erection of PSC members, machineries involved, standard practice, safety precautions• Bearings- Definition, necessity, properties, types of bearings, materials, selection of bearings, installation and maintenance <p>Prepare checklist for lifting and erection of PSC members</p>	2	1		
1,3	3	4	<ul style="list-style-type: none">• Visit nearest PSC elements manufacturing plant and prepare a report. (Accompanied by cohort owner)		4	<ul style="list-style-type: none">• Visit nearest precast concrete elements manufacturing plant and prepare a report. (Accompanied by cohort owner)		3		
		5	Developmental Assessment			Assessment Review and corrective action		3		
		6	Industry Class	1	4	Industry weekly assignment				
1	3	1	Peer review on industry class		4	Introduction to Limit state design of steel structures: <ul style="list-style-type: none">• Advantages and disadvantages of Steel structures• Structural steel sections• Loads and load combinations.• Limit state design- Design considerations, Failure criteria for steel, specifications and section classifications as per IS 800-2007. <p>Collect and Read IS 800-2007</p>	2	1		

7	1,3	3	2	Bolted Connections: <ul style="list-style-type: none"> • Introduction • Advantages and disadvantages of bolted connections • Difference between unfinished bolts and High strength friction grip bolts (HSFG) • Behavior of bolted joints • Failure of bolted joints. <p>Prepare a report on types of bolts, behavior and suitability.</p>	2	2	<ul style="list-style-type: none"> • Simple problems on finding <ul style="list-style-type: none"> • Shear strength • Bearing strength • Tensile strength of bolts (bearing type only). • Tensile strength of plate • Efficiency of joints. • Simple Lap joint design problems. 			3
	1,3	3	3	<ul style="list-style-type: none"> • For the given bolted connection snap, identify the possible joint failures. Propose an alternative type of joint to increase the connection strength. <p>Prepare a lap joint using card board and nail. Apply the tension force and prepare a report on the failure mode.</p>	1	3	Welded Connections <ul style="list-style-type: none"> • Introduction • Advantages and disadvantages • Types of welding • Weld symbols, specifications, effective area of weld • Design strength of fillet weld, simple problems on welded joints (fillet weld only). 	1		2
	1,3	3	4	<ul style="list-style-type: none"> • Introduction to welding process and welding machine and accessories. • Practice welding for the above designed fillet weld. 	1	3	<ul style="list-style-type: none"> • Visit the nearest construction site/railway station/any steel structure and identify the various types of connections used in steel structure. For the identified connections, list out the possible failure criteria and prepare a report. 			3
			5	CIE 3- Written and practice test			Assessment Review and corrective action			3

			6	Industry Class	2	3	Industry weekly assignment			
8	1,3	3	1	Weekly assignment review		4	Flexural Members: <ul style="list-style-type: none"> • Introduction, • Lateral buckling, Web buckling and crippling • Difference between laterally restrained and unrestrained beams • Determination of the moment capacity of laterally restrained beams List different types of failures in beam sections with sketches	2		1
	1,3	3	2	<ul style="list-style-type: none"> • Design of laterally restrained simple beams using standard rolled steel sections only. • Problems on design of simple beam shear connection. 	1	3	<ul style="list-style-type: none"> • Design and analyze a simply supported beam carrying UDL, point load at center, calculate the end reactions and design the fin plate connection for end reaction. • Draw respective sketches in AutoCAD. 	1		2
	1,3	3	3	<ul style="list-style-type: none"> • Continuation 		4	Tension Members <ul style="list-style-type: none"> • Introduction, types of tension members, slenderness ratio and net area. • Behavior of tension members. • Modes of failure. • Factors affecting the strength of tension member. Show images and videos of tension members and their failure modes.	2		1
	1,3	3	4		1	3	Compression Members	1		2

				<ul style="list-style-type: none"> Design strength of tension member due to yielding of gross section, due to rupture of critical sections and block shear. Design of tension members. 			<ul style="list-style-type: none"> Columns – Classification, Boundary conditions, effective length, slenderness ratio. Design strength of Columns. Design of axially loaded Columns (Excluding Built up sections) 			
			5	Developmental Assessment			Assessment Review and corrective action			3
			6	Industry Class	1	4	Industry weekly assignment			
9	1,3	3	1	Peer review on industry class		4	Struts <ul style="list-style-type: none"> Design of Continuous and Discontinuous strut for given end conditions for axial load only. 	1		2
	1,3	3	2	<ul style="list-style-type: none"> Practice design of Columns and struts 	1	3	Column Bases <ul style="list-style-type: none"> Introduction Types of Column Bases, Slab base, Gusseted Base. Design of Slab base for axial Load. 	1		2
	1,3	3	3	Design connections and members of a steel truss for vehicle parking in your college campus	1	3	<ul style="list-style-type: none"> Continuation 			3
	1,3	3	4	Introduction to steel detailing and fabrication <ul style="list-style-type: none"> Basic information on steel detailing. Importance of detailing Process involved in detailing Structural drawing review, preliminary questions/ RFI's. <p>Tutorial video to be shown to students to show sample design drawings, sample RFI's and how to find missing information's.</p>	2	2	<ul style="list-style-type: none"> Based on the tutorial video, students to review the design drawings and find out the missing information and prepare relevant RFI's (Request for Information). 	1		2
			5	CIE 4– Written and practice test			Assessment Review and corrective action			3

			6	Industry Class	2	3	Industry weekly assignment			
10	1,3	3	1	Peer review on industry class	4		Introduction to fabrication and erection drawings <ul style="list-style-type: none"> • Basic requirement in fabrication drawings • Basic terminologies used in fabrication drawings • Title, Symbols used in fabrication drawings. • Difference between approval drawings and fabrication drawings. • Present and explain existing fabrication drawings of any steel structure, images and videos. 	1		2
	1,3	3	2	<ul style="list-style-type: none"> • Assembly drawings, part drawings and general arrangement (GA) drawings. • Fabrication process • Importance of coordination between fabricator and detailer. • Real time problems during fabrication. • Shop queries. Present and explain existing Assembly drawings, Part drawings and General arrangement drawings.	2	2	<ul style="list-style-type: none"> • Erection process • Requirements in erection drawings • Co-ordination between the fabrication drawings and erection drawings • Sequence of erection • Real time problems during erection. Present and explain existing Erection drawings.	1		2
	1,3	3	3	Visit nearby steel fabrication shops and prepare a report on real time problems of fabrication.	1	3	Visit to nearby steel structures construction site and prepare a report on erection process			3

	1,3	3	4	<ul style="list-style-type: none"> • Introduction to Pre-engineered Buildings • Advantages over Hot rolled steel structures • Light gauged members as structural and non-structural elements • Industrial Applications 	2	2	<ul style="list-style-type: none"> • Safety precautions in erection of steel structures • Maintenance of steel structures • Inspectional tests on steel structures 	1	2
			5	Study existing Pre-Engineered drawings. Developmental Assessment			Prepare a report on tests on steel structures and checklist Assessment Review and corrective action		3
			6	Industry Class	1	4	Industry weekly assignment		
11	1,2	2	1	Peer review on industry class		4	Pre-material take off <ul style="list-style-type: none"> • Introduction to Material Take Off (MTO) • Importance and use of MTO • Information to be included in MTO extraction • Special materials and available lengths in the market. • Extraction of MTO 	2	1
	1,2	2	2	<ul style="list-style-type: none"> • Based on the tutorial video shown, students to extract the MTO manually from existing design drawing. 	1	3	<ul style="list-style-type: none"> • Continuation 		3
	1,2,4	2,3,4	3	Model, Analyze and Design a simple Steel Truss required for vehicle parking in your college campus using STAAD Pro.	2	2	Prepare design and fabrication drawings.		3

	1	2,3	4	Design of Masonry structures <ul style="list-style-type: none"> • Permissible stresses- Types of walls, permissible compressive stress, stress reduction and shape modification factors, permissible tensile stress and shear stress. • Design Considerations: Effective height of walls, openings in walls, effective length, effective thickness, slenderness ratio, eccentricity, load dispersion, arching action in lintels. • Load considerations • Design criteria 	2	2	Design of Masonry solid walls subjected to axial UDL loads supported at the ends by cross wall, and walls with piers.	1	2
			5	CIE 5- Written and practice test			Assessment Review and corrective action		3
			6	Industry Class	1	4	Industry weekly assignment		
12			1	Peer review on industry class		4	<ul style="list-style-type: none"> • Continuation of Design of Masonry solid walls. 		3
	1	1,2,3	2	Design of Masonry & RC Retaining wall <ul style="list-style-type: none"> • Theory of earth pressure • Calculation of earth pressure by Rankine's method with and without surcharge • Conditions of stability for no tension • Middle one third rule • Distribution of pressure at foundation • Design of masonry retaining wall. 	2	2	<ul style="list-style-type: none"> • Design of RC retaining wall (Use appropriate code & Software) 		3
	1	2,3		Earthquake engineering					

			3	<ul style="list-style-type: none">• Classification of Earthquakes• Major past earthquakes and their effect• Types and characteristics of seismic waves• Magnitude and intensity of earthquakes• Local site effects• Richter Scale, Seismograph• Seismic zoning map of India <p>Study and prepare a report on any one previous earth quake in India or outside of India.</p>	2	2	<ul style="list-style-type: none">• Typical failures of RC frame structures• Types of damages to building observed during past Earthquakes• Classification of damages to buildings• Plan irregularities, mass irregularity, stiffness irregularity• Concept of soft and weak storey. <p>Prepare a PPT on failure and typical damages to buildings due to Earth quake.</p>	1		2
1,4	2,3	4	<ul style="list-style-type: none">• Torsional irregularity and their consequences.• Configuration problems, continuous load path.• Architectural aspects of earthquake resistant buildings• Lateral load resistant systems.• General guidelines for earthquake resistant design <p>Prepare models of irregularities in buildings as per IS 1893-2016 using card board and present</p>	2	2	<ul style="list-style-type: none">• Continuation			3	
		5	Developmental Assessment			Assessment Review and corrective action			3	
		6	Industry Class	2	3	Industry weekly assignment				

13			1	<p>Internship</p> <p>a) Secondary research on various industries and their operations to identify at least 3 companies along with the areas of work interest and develop an internship plan that clearly highlights expectations from the industry during the internship.</p> <p>b) Design and develop a cover letter for an internship request to all 3 identified companies and the resume to be submitted to potential companies.</p> <p>Prepare for an internship interview to highlight your interests, areas of study, career aspirations and personnel competence - including the areas of learning you expect to learn during internship.</p>	<p>Project</p> <p>a) Identification of the problem statement (from at least 3 known problems) the students would like to work as part of the project - either as provided by faculty or as identified by the student. Document the impact the project will have from a technical, social and business perspective.</p> <p>b) Design and develop the project solution or methodology to be used to solve at least one of the problems identified.</p> <p>Prepare a project plan that will include a schedule, WBS, Budget and known risks along with strategies to mitigate them to ensure the project achieves the desired outcome.</p>
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Note: Saturday session from 9 AM -2 PM

CIE and SEE Assessment Methodologies

CIE Assessment	Assessment Mode	Duration In hours	Max Marks
Week 3	CIE 1- Written and practice test	4	30
Week 5	CIE 2- Written and practice test	4	30
Week 7	CIE 3- Written and practice test	4	30
Week 9	CIE 4- Written and practice test	4	30
Week 11	CIE 5- Written and practice test	4	30
	On line Course work (Minimum 10 hours online course with certification from (SWAYAM/NPTEL/Infosys Springboard)		40
	Profile building for Internship / Submission of Synopsys for project work		20
Portfolio evaluation (Based on industrial assignments and weekly developmental assessment) *			30
TOTAL CIE MARKS (A)			240
SEE 1 - Theory exam (QP from BTE) Conducted for 100 marks 3 hrs duration reduced to 60 marks		3	60
SEE 2 - Practical		3	100
TOTAL SEE MARKS (B)			160
TOTAL MARKS (A+B)			400

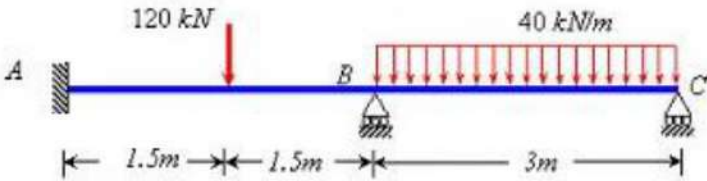
* The industrial assignment shall be based on peer-to-peer assessment for a total of 10 marks (on a scale of 1 to 10) and in the event of a group assignment the marks awarded will be the same for the entire group, the developmental assessment will be for a total of 20 marks and based on MCQ/case study/demonstration and such other assignment methods

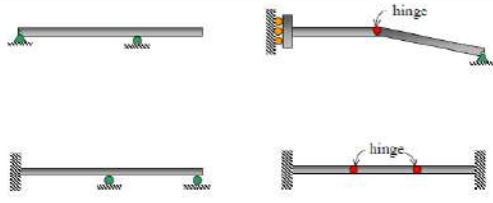
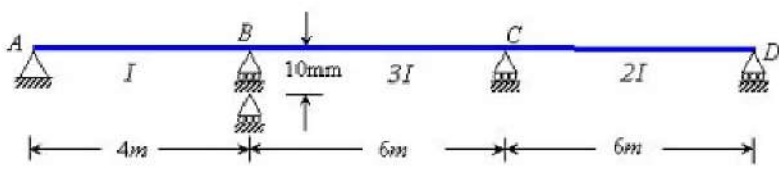
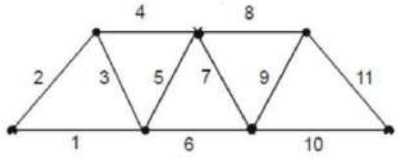
Assessment framework for CIE (1 to 5)

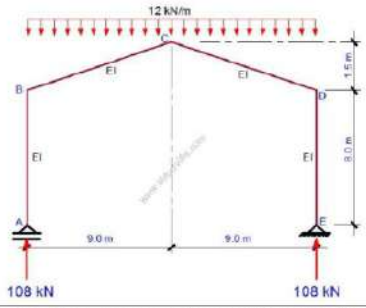
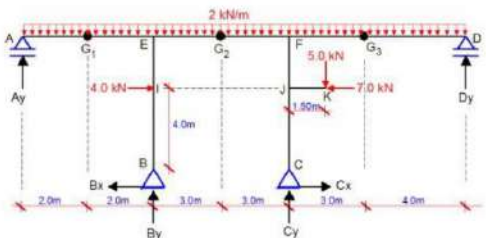
Note: Theory to be conducted for 1 hour and practice for 3 hours, total duration of exam – 4 hours

Programme	Civil Engineering	Semester	V
Course	Structural Engineering	Max Marks	30
Course Code	20CE51I	Duration	4 hours
Name of the course coordinator		CIE	1(3 RD WEEK)

Note: Answer one full question from each section.

Qn.No	Question	CL L3/L4	CO	PO	Marks
Section-1 (Theory) – 10 marks					
1.a)	Analyze the Continuous beam shown in figure by the three moment equation. Draw shear force and Bending Moment Diagram. 	3			6
b)	Classify if each of the following beams is determinate or indeterminate. If statically indeterminate, what is the number of degree of indeterminacy?	3			4

					
2.a)	<p>Analyze the Continuous beam shown in figure by the three moment equation method if support B sinks by an amount of 10mm. Draw shear force and bending moment diagram. Take flexural rigidity $EI=48000\text{KN.m}$</p> 	4			6
b)	<p>Classify the following frame is determinate or indeterminate Take $r=3$.</p>  <p>For the truss shown, determine if the truss is I-Stable II-Indeterminate III- Determinate A-I ONLY B-II ONLY</p>	4			4

	C-I and III D-I and II				
Section-2 (Practical) - 20 marks					
3)	Model and Analyze frame with suitable software for stress, Deflection and stability. Tabulate the results and draw inferences from the results	4	4		20
					
4)	Model and Analyze frame with suitable software for stress, Deflection. Tabulate the results and draw inferences from the results	4	4		20
					

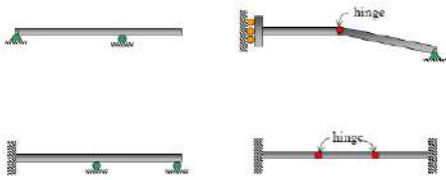
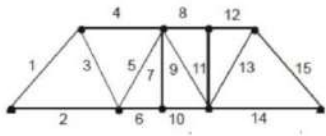
Note : Theory questions shall be aligned to practical questions

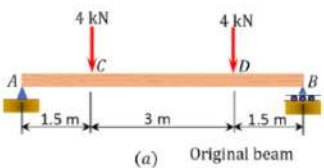
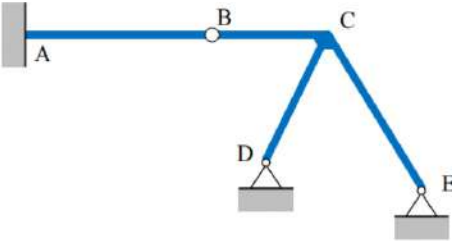
Assessment framework for SEE 1 (Theory) – 100 Marks / 3 hours (Reduced to 60 marks)

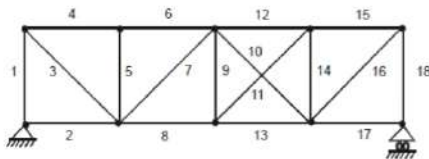
Program : Civil Engineering
 Course : STRUCTURAL ENGINEERING
 Course Code : 20CE54I

Semester: Vth
 Max Marks : 100
 Duration: 3 Hrs

Instruction to the Candidate: Answer one full question from each section.

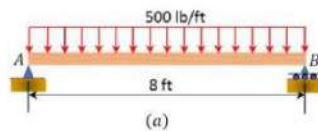
Q. No	Question	CL	CO	Marks
Section-1				
1.a)	Classify if each of the following beams is determinate or indeterminate. If statically indeterminate, what is the number of degree of indeterminacy? 	3	1	5
b)	Classify the following frame is determinate or indeterminate Take $r=3$. 	3		5

1C	<p>A prismatic timber beam is subjected to two concentrated loads of equal magnitude, as shown in Figure. Using the moment-area method, determine the slope at AA and the deflection at point C.</p>  <p style="text-align: center;">(a) Original beam</p>	3		10
2.a)	<p>1. Find weather the structure/frame statically determinate or Indeterminate</p> 	3		4
b)	<p>1. Classify the following frame is determinate or indeterminate Take $r=3$.</p>	4		6



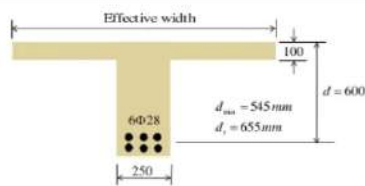
2C

A simply supported timber beam with a length of 8 ft will carry a distributed floor load of 500 lb/ft over its entire length, as shown Figure (a) Using the moment area theorem; determine the slope at end B and the maximum deflection.



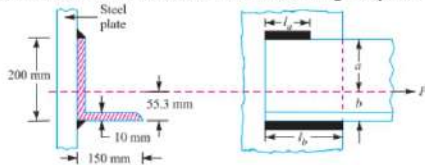
Section-2

3.a	Two Columns having Cross section of 250 x 250 mm and 300 x 300 mm are loaded 300kn and 500kn respectively. The c/c distance between the columns is 4m and the bearing capacity of soil 100kn/m ² . Design rectangular combined footing without beam.	3	1	10
3.b	A T-beam has a flanged width of 1200 mm and flanged thickness being 100 mm. Steel reinforcement of area 1272 mm ² is placed at an effective depth of 400 mm. The stresses in concrete and steel shall not exceed 5 N/mm ² . Find moment of resistance of beam. Take $m = 18.67$	3		10
4.a	Draw Pre engineered structural shapes RC frames and Steel frames and elaborate on their performance during earth quakes.	3		10
4.b	Determine design moment of interior T beam shown in the figure $f'_c = 30$ Mpa and $f_y = 420$ Mpa. The beam with 9m span cast integrally with a floor slab that is 100mm thick beam tributary width is 1.5m.	3		10



Section- 3

5.a)	Explain the Erection procedure for Post tensioning in Pre-stressing	2	1,3	8
b)	Design a lap joint to connect two plates each of width 100 mm, if the thickness of one plate is 12 mm and the other is 10 mm. The joint has to transfer a working load of 100 kN. The plates are of fe 410 grade. Use bearing type of bolts and draw connection details.	4		12
6.a)	What are the losses in pre-stress & How Losses in pre-stress can be reduced.	2		10
b)	A 200 x 150 x 10 mm angle is to be welded to a steel plate by a fillet welds as shown in figure. If the angle is subjected to a static load of 200Kn, find the length of weld at the top and bottom. The allowable shear stress for static loading may be taken as 75 MPa	3		10



Section-4

7.a)	A single unequal angle 100 x 75 x 8 mm is connected to a 12 mm thick gusset plate at the ends with 6 numbers of 20 mm diameter bolts to transfer tension as shown in Fig. 13. Determine the design tensile strength of the angle if the gusset is connected to the 100 mm leg. The yield strength and ultimate strength of the steel used are 250 MPa and 400 MPa. The diameter of the bolts used is 20 mm	3	1	8
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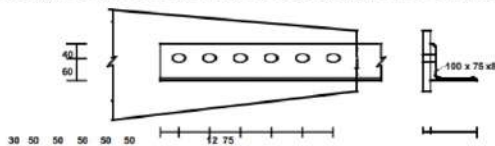
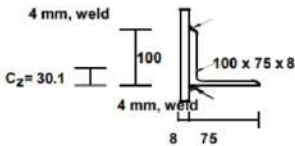


Fig. 13 Details of end connection

b)	Design a suitable 'I' beam for a simply supported span of 3 m and carrying a dead or permanent load of 17.78 kN/m and an imposed load of 40 kN/m. Assume full lateral restraint and stiff support bearing of 100 mm.	4		12
8.a)	<p>A single unequal angle 100 x 75 x 6 mm is connected to a 8 mm thick gusset plate at the ends by 4 mm welds as shown in Fig. The average length of the weld is 225 mm. Determine the design tensile strength of the angle if the gusset is connected to the 100 mm leg. The yield strength and ultimate strength of the steel used are 250 MPa and 400 MPa</p>  <p>Fig. 17 Details of connection at end</p>	3		8
b)	A simply supported beam has an effective span of 7m and carries a uniformly distributed load of 50 kN/m (i.e DL = 25kN/m and LL = 25 kN/m) . Taking $f_y = 250 \text{ N/mm}^2$ and $E = 2 \times 10^5 \text{ N/mm}^2$, design the beam, if it is laterally supported.	4		12
Section-5				
9.	Design a wall of a room with openings. The wall is of 1 brick thick. The height of floor to ceiling is 2.8 m and height of plinth is 1.2 m. The RCC roof slab is 100 mm thick with clear span of 3.0 m. Height of 100 mm thick parapet above roof slab is 0.8 m. Height of taller door opening is 2.0 m. Unit weight of masonry and concrete may be taken as 20 kN/m ³ and 25 kN/m ³ respectively. Assume live load as 1.5 kN/m ² .	4	1	20
10.	Design a cantilever retaining wall (T type) to retain earth for a height of 4m. The backfill is horizontal. The density of soil is 18kN/m ³ . Safe bearing capacity of soil is 200 kN/m ² . Take the co-efficient of friction between concrete and soil as 0.6. The angle of repose is 30°. Use M20 concrete and Fe415 steel.	4		20

Scheme of Evaluation for SEE 2

Programme	Civil Engineering	Semester	V		
Course	Structural Engineering	Max Marks	100		
Course Code	20CE511	Duration	3 hours		
Name of the course coordinator					
Note: Answer one full question from each section.					
Qn.No	Question	CL L3/L4	CO	PO	Marks
NOTE: 1. Use suitable Software and codal Provisions 2. Relevant Code books and Handbooks can be provided					
1.	Problem statement A Client who residing in Bangalore wanted to build a residential apartment in his site 9 x 12 m, G+2, with satisfying to local body bye laws and Seismic Zone factor	3,4	1,4,2	1,3,4	
	1. Prepare bubble diagram & Prepare working plan				20
	2. Provide column layout				10
	3. Analyze the frame & provide Details with column and beam details				20
	4. Check safety for seismic zone factor				10
	5. Provide Steel details for structural elements using Appropriate tools				40
	OR			Total	100
2.	Problem statement A Client require to build a small logistic shed within a month in an area 20m x 30m in Gujarat of using Steel sections without any RCC , with satisfying to local body bye laws and Seismic Zone factor	3,4	1,4,2	2,4,5	
	1. Prepare a layout plan				20
	2. Model and analyze the frame				20

	3. Check the safety of structure/frame for seismic zone factor				20
	4. Provide structural details of Columns , perlins and joints				30
	5. Provide approximate quantity of steel to be procured				10
				Toatl	100