Bharatiya Vidya Bhavan's

SARDAR PATEL COLLEGE OF ENGINEERING

(Government Aided Autonomous Institute)
Munshi Nagar, Andheri (W) Mumbai – 400058

END SEM / [redacted] EXAMINATION NOVEMBER 2025 / JANUARY 2026

Program: Final Year B. Tech. Civil Engineering | **Duration: 3 Hrs.**

Course Code: PC-BTC701 Semester - VII | **Maximum Points: 100**

Course Name: Design of Concrete Structures | **Semester: VII**

21/11/25

Instructions for the Students:

1. **Question No. 1 is compulsory and attempt any 04 questions from remaining.**
2. **Assume suitable data if necessary and state it clearly.**
3. **Illustrate your answers with neat sketches wherever required.**
4. **Use of IS 456 – 2000 is permitted in examination.**

Q. No.	Questions	Points	CO	BL	Module No.
1	Figure 1 shows a **flooring system** of an industrial floor. Live load on the floor is 5 kN/m^2 and floor finish load is 2 kN/m^2. Grade of concrete and steel is M20 & Fe415. Design the slab panel S1 and S2. Sketch the reinforcement details.	20	1&2	5	3&4
	OR				
	A **counterfort retaining wall** has to retain horizontal backfill of height 8 m above existing ground level. The foundation strata is available at a depth of 2 m below existing ground level where SBC of soil is found to be 250 kN/m^2. The soil has a density of 18 kN/m^3 and angle of shearing resistance is 30^0. The coefficient of friction between soil and the concrete is 0.55. Grade of concrete and steel is M20 & Fe415. Determine the preliminary sizes of the retaining wall components and show that the retaining wall is stable in sliding, overturning and against base pressure. Also design the toe slab. Sketch the finalized cross section of the retaining wall and also sketch the reinforcement details in toe slab.	20	1	5	5
2	For the **flooring system** in Q1, design a continuous beam B3-B4-B3 and B5-B5. Assume the width of the beam as 300 mm. Sketch the reinforcement details.	20	1&2	5	3&4
	OR				
	For a **counterfort retaining wall** in Q1, design the stem slab and counterfort. Sketch the reinforcement details in counterfort and stem slab.	20	1	5	5

END SEM / [redacted] EXAMINATION NOVEMBER 2025 / JANUARY 2026

3	A **staircase** block for a residential building measures 2.80 m x 4.75 m internally. The floor-to-floor height is 3.0 m. Finalize the dimensions of the dog legged staircase case. Grade of concrete and steel is M20 & Fe415. Live load on the floor is 3 kN/m^2 and floor finish load is 1 kN/m^2. Design a typical flight of the staircase and sketch the reinforcement details in typical flight.	20	1&2	5	1
4	Design an interior panel of **flat slab** with drop panel, having c/c distance between columns grids as 8.0 m X 6.0 in X and Y directions. Live load on the floor is 4 kN/m^2 and floor finish load is 1 kN/m^2. Size of column 600 mm x 600 mm. Use M40 concrete and Fe 415 steel. Use direct design method. Sketch the reinforcement details in plan clearly marking bottom and top reinforcement.	20	1&2	5	2
5	A **cantilever retaining wall** has to retain horizontal backfill with surcharge load of 30 kN/m^2. of height 5 m above existing ground level. The foundation strata is available at a depth of 1.5 m below existing ground level where SBC of soil is found to be 200 kN/m^2. The soil has a density of 18 kN/m^3 and angle of shearing resistance is 30^0. The coefficient of friction between soil and the concrete is 0.5. Grade of concrete and steel is M20 & Fe415. Determine the preliminary sizes of the retaining wall components and show that the retaining wall is stable in sliding, overturning and against base pressure. Also design the stem slab. Sketch the finalized cross section of the retaining wall and also sketch the reinforcement details in stem slab.	20	1	5	5
6a	Explain the IS 3370 requirements for detailing of **joints in RCC water tank** with neat sketches.	10	4	3	6&7
6b	Explain the provisions of IS 13920 for **ductile detailing** of RCC columns. Illustrate your answers with neat sketches.	10	3	3	4
7	Design a **circular water tank** resting on ground of capacity 250 m^3. Assume that the base slab and the walls of the tank is provided with a sliding joint. Maximum bearing pressure that can be supported by the ground is 150 kN/m^2. Grade of concrete and steel is M20 & Fe415. Sketch the reinforcement details in tank walls and base slab.	20	4	5	6&7

END SEM / [redacted] EXAMINATION NOVEMBER 2025 / JANUARY 2026

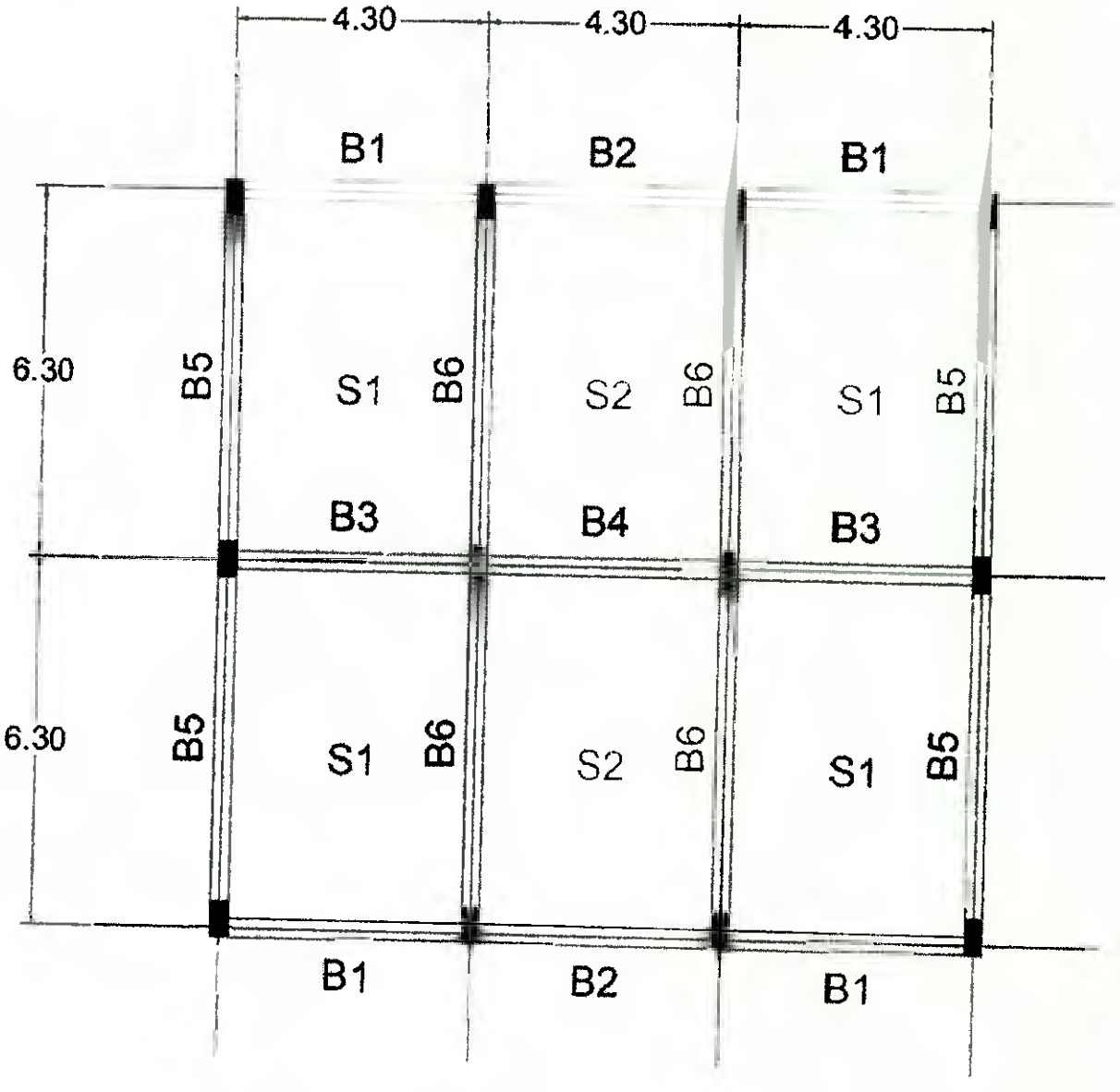

Fig.1: Plan of Flooring System (Note that the beam width is 300 mm)

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~~END SEM~~ / RE-EXAM EXAMINATION ~~NOVEMBER 2025~~ / JANUARY 2026

Program: Final Year B. Tech. Civil Engineering Sem VII **Duration: 3 Hrs.**

Course Code: PC-BTC701 **Maximum Points: 100**

Course Name: Design of Concrete Structures **Semester: VII**

6/1/26

Instructions for the Students:

1. **Question No. 1 is compulsory and attempt any 04 questions from remaining.**
2. **Assume suitable data if necessary and state it clearly.**
3. **Illustrate your answers with neat sketches wherever required.**
4. **Use of IS 456 – 2000 is permitted in examination.**

Q. No.	Questions	Points	CO	BL	Module No.
1	Figure 1 shows a **flooring system** of an industrial floor. Live load on the floor is 4 kN/m^2 and floor finish load is 1 kN/m^2. Grade of concrete and steel is M30 & Fe415. Design the slab panel S1 and S2. Sketch the reinforcement details. **OR** A **cantilever retaining wall** has to retain horizontal backfill of height 4.5 m above existing ground level. The foundation strata is available at a depth of 1.5 m below existing ground level where SBC of soil is found to be 200 kN/m^2. The soil has a density of 18 kN/m^3 and angle of shearing resistance is 30^0. The coefficient of friction between soil and the concrete is 0.55. Grade of concrete and steel is M30 & Fe415. Determine the preliminary sizes of the retaining wall components and show that the retaining wall is stable in sliding, overturning and against base pressure. Also design the stem slab. Sketch the finalized cross section of the retaining wall and also sketch the reinforcement details in stem slab.	20 20	1&2 1	5 5	3&4 5
2	For the **flooring system** in Q1. design a continuous beam B1-B2-B1 and B6-B6. Assume the width of the beam as 300 mm. Sketch the reinforcement details. **OR** For a **cantilever retaining wall** in Q1, design the heel slab and toe slab. Sketch the reinforcement details in toe slab and heel slab.	20 20	1&2 1	5 5	3&4 5

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~~END SEM~~ / RE-EXAM EXAMINATION ~~NOVEMBER 2025~~ / JANUARY 2026

3	A **staircase** block for a commercial building measures 3.30 m x 6.30 m internally. The floor-to-floor height is 3.6 m. Finalize the dimensions of the dog legged staircase case. Grade of concrete and steel is M30 & Fe415. Live load on the floor is 5 kN/m^2 and floor finish load is 2 kN/m^2. Design a typical flight of the staircase and sketch the reinforcement details in typical flight.	20	1&2	5	1
4	Design an interior panel of **flat slab** with drop panel, having c/c distance between columns grids as 10.0 m X 8.0 in X and Y directions. Live load on the floor is 3 kN/m^2 and floor finish load is 2 kN/m^2. Size of column 700 mm x 700 mm. Use M40 concrete and Fe 500 steel. Use direct design method. Sketch the reinforcement details in plan clearly marking bottom and top reinforcement.	20	1&2	5	2
5	A **counterfort retaining wall** has to retain horizontal backfill with surcharge load of 20 kN/m^2 having height 7.5 m above existing ground level. The foundation strata is available at a depth of 1.5 m below existing ground level where SBC of soil is found to be 200 kN/m^2. The soil has a density of 18 kN/m^3 and angle of shearing resistance is 30^0. The coefficient of friction between soil and the concrete is 0.5. Grade of concrete and steel is M30 & Fe415. Determine the preliminary sizes of the retaining wall components and show that the retaining wall is stable in sliding, overturning and against base pressure. Also design the toe slab. Sketch the finalized cross section of the retaining wall and also sketch the reinforcement details in toe slab.	20	1	5	5
6a	Explain the IS 3370 requirements for detailing of Expansion, contraction, movement or sliding and construction **joints in RCC water tank** with neat sketches.	10	4	3	6&7
6b	Explain the provisions of IS 13920 for **ductile detailing** of RCC beams. Illustrate your answers with neat sketches.	10	3	3	4
7	Design a **circular water tank** resting on ground of capacity 350 m^3. Assume that the base slab and the walls of the tank is provided with a sliding joint. Maximum bearing pressure that can be supported by the ground is 150 kN/m^2. Grade of concrete and steel is M30 & Fe415. Sketch the reinforcement details in tank walls and base slab.	20	4	5	6&7

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~~END SEM~~ / RE-EXAM EXAMINATION ~~NOVEMBER 2025~~ / JANUARY 2026

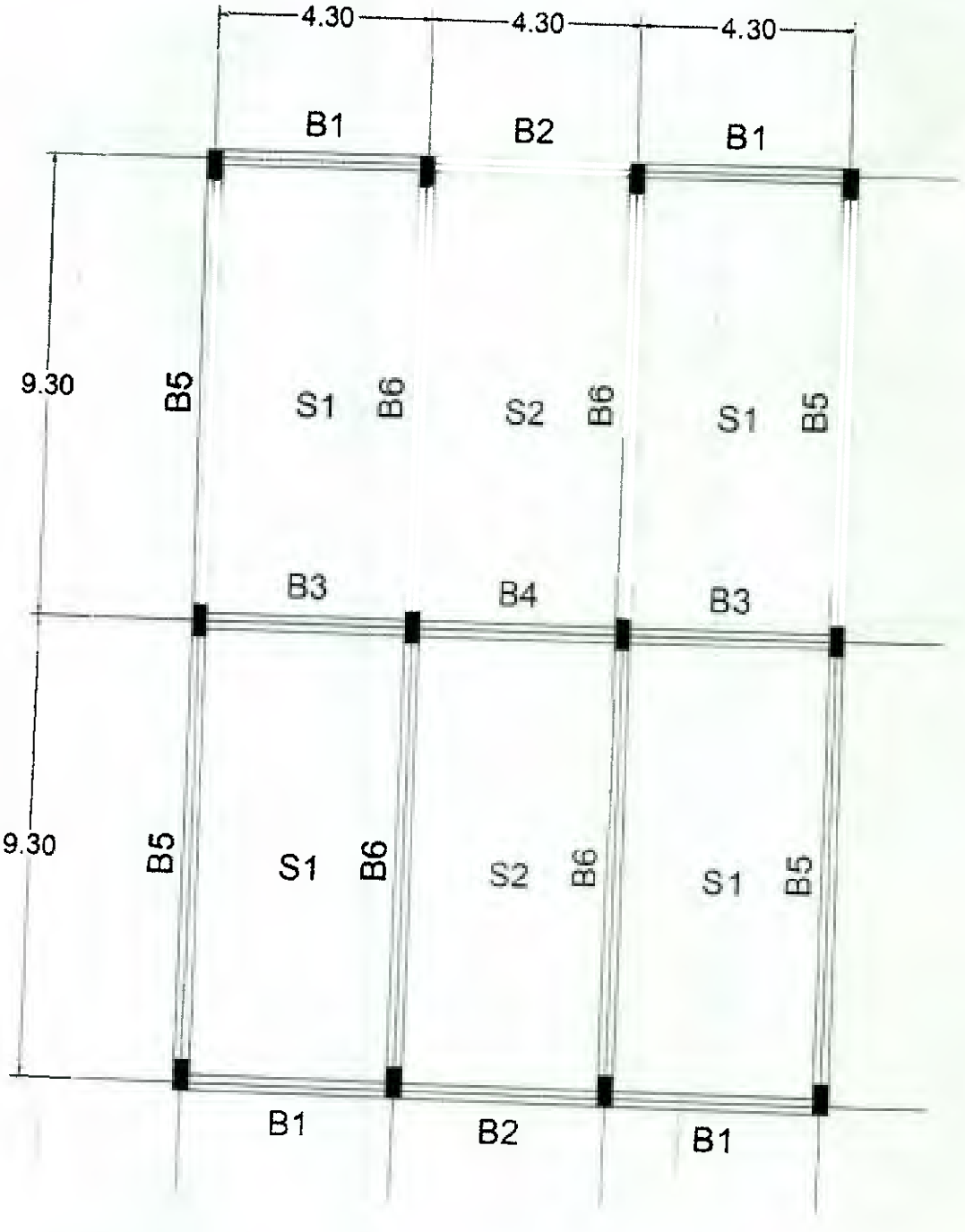

Fig.1: Plan of Flooring System (Note that the beam width is 300 mm)

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END SEMESTER EXAMINATION NOV 2025/ RE Examination JAN 2026

Program: Civil Engineering Final Year B.Tech Civil **Duration: 3 hr.**

Course Code: PC-BTC 702 Sem – VII **Maximum Points: 100**

Course Name: Engineering Economics, Estimation & Costing 24/11/25

Semester: VII

Notes:

1. **Q.1 is compulsory & attempt any four out of six remaining questions**
2. **Illustrate answer with neat sketches wherever required.**
3. **Make suitable assumptions where necessary and state them clearly.**

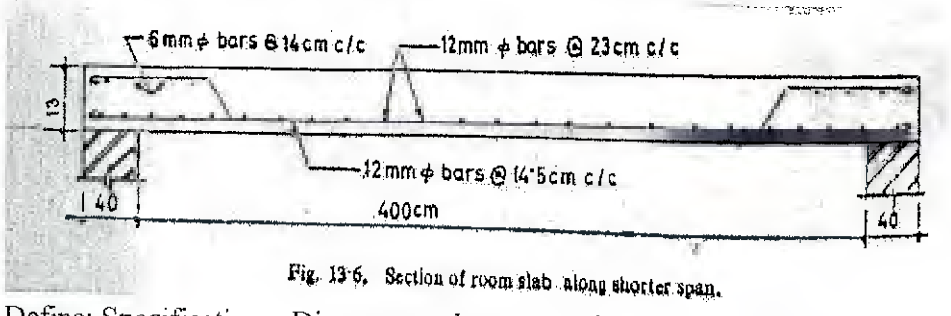
Q. No.	Questions	Pts	BL	CO	M
1.	A. Prepare detailed & abstract estimate of the following items from the given fig.1 1. Excavation for foundation 2. Sand filling in plinth 3. PCC in foundations (1:4:8) 4. 1st class Brick work in foundation & plinth in cement mortar (1:6) 5. 1st class Brick work in superstrcture (1:6) 6. 12 mm thick sagole cement plaster cm (1:4) 7. 2.5 cm thick damp proof coarse 8. R.C.C work (Chajja & Slab) 9. Teak wood doors & windows & ventilators 10. Mosaic tiles flooring	20	III	4, 5	3,
2	A. A glass factory specializing in crystal is developing a substantial backlog and the firm's management is considering three courses of action: Arrange for subcontracting (S1),begin overtime production (S2), and construct new facilities (S3). The correct choice depends largely upon future demand which may be low, medium, or high. By consensus, management ranks the respective probabilities as 0.10, 0.50, and 0.40. A cost analysis reveals the effect upon the profits that is shown in the table below.	10 + 10	II	1, 2	1

Demand	Probability	Course of Action		
		S_1 (Subcontracting)	S_2 (Begin Overtime)	S_3 (Construct Facilities)
Low (L)	0.10	10	20	150
Medium (M)	0.50	50	60	20
High (H)	0.40	50	100	200

Show this decision situation in the form of a decision tree and indicate the most preferred decision and the corresponding expected value.

B. Compare the project A & B by NPV & IRR Methods. (Assume discount rate 11%)

Year	Project A	Project B
0	-10,00,000	-10,00,000
1	8,00,000	4,00,000
2	6,00,000	4,00,000
3		3,00,000
4		3,00,000
5		2,00,000

3	A. Prepare an detailed estimate & abstract estimate of steps.(Fig.2) Specifications: 1. the foundation concrete BBCC 2. 1st class brick work , 3. risers of steps to be finished with 12 mm thick sagol cement plaster 4. treads of the steps with polished kotah stone flooring B. Prepare an detailed estimate & abstract estimate of Septic tank.(Fig.4) Specifications: 1. the foundation concrete BBCC 2. 1st class brick work in tank 3. Concreting at slope 4. 12 mm thick plastering on walls 5. RCC Slab cover at top of tank	10 + 10	II	4 , 5	3,5
4	A. Prepare detailed & abstract estimate of the following items from the given fig.3. 1. Excavation for foundation 2. Concrete in foundation 3. 1st class Brick work in foundation & plinth in cement mortar (1:6) 4. 1st class Brick work in superstrcture (1:6) 5. 2.5 cm thick damp proof coarse 6. 2.5 cm cc over 7.5 cm over LC floor. B. Define: Rate analysis. Prepare a detailed rate analysis for 1 m^3 of First class brick masonry in cement mortar 1:6	12 + 08	II	4 , 5	3,4,5
5	A. Prepare detailed, & abstract estimate & Bar Bending Schedule for RCC Slab (4 m x 5.5 m) shown in fig. Also workout the percentage volume of reinforcement.  Fig. 13·6. Section of room slab along shorter span. B. Define: Specifications. Discuss any three necessities for specifications.	16 + 04	II	4 , 5	3,4,5

6	A. MMRDA wish to construct coastal road bandra to dahisar, estimated cost is of Rs. 8500 Cr. & duration is 3 years. Prepare tender notice B. Explain the concept of unbalanced tender with suitable examples. C. Write a note on: liquidated damages.	10 + 6 + 4	I,II	5	
7	A. Discuss the objectives & provisions of workmen's Compensation Act, 1923. B. Define: Mass Haul Diagram. Reduced level (RL) of ground along the center line of a proposed road from chainage 10 to 20 are given below. The formation level at 10th chainage is 106 m and the road is downward gradient of 1 in 100 up to the chainage 14 and then the gradient changes to 1 in 150 downward. Formation width of road is 10m and the side slope of banking are 2:1 of the chain is 30m. Draw a mass haul diagram and Prepare an estimate of earthwork at the rate of Rs350/cum. Find the area of side slope & cost of turfing & pitching at the rate of Rs. 260/sq.m	08 + 12	III	4	3

Chainage	10	11	12	13	14	15
RL on GL	105	105.60	105.44	105.90	105.42	104.30

Chainage	16	17	18	19	20
RL on GL	105.00	104.10	104.62	104.00	103.30

Rate Analysis Chart

Sr. No.	Item	Per	Rate
1	Excavation	Cu.m	200.00
2	BBCC	Cu.m	3000.00
3	1st class brickwork	Cu.m	3500.00
4	2nd class brickwork	Cu.m	2500.00
5	Cut cement pointing, plastering, centering work for beam/column, DPC	Sq.m	200.00
6	Teak wood door/window	Sq.m	5500.00
7	Mosaic tile flooring	Sq.m	500.00
8	RCC	Sq.m	1500.00
9	HYSD steel bars & Mild steel	Kg	65.00
10	Head mason	day	450
11	Mason	day	350
12	Majdoor	day	200
13	Bhisti	day	200
14	Assume water charges & Contractor profit (5%)		

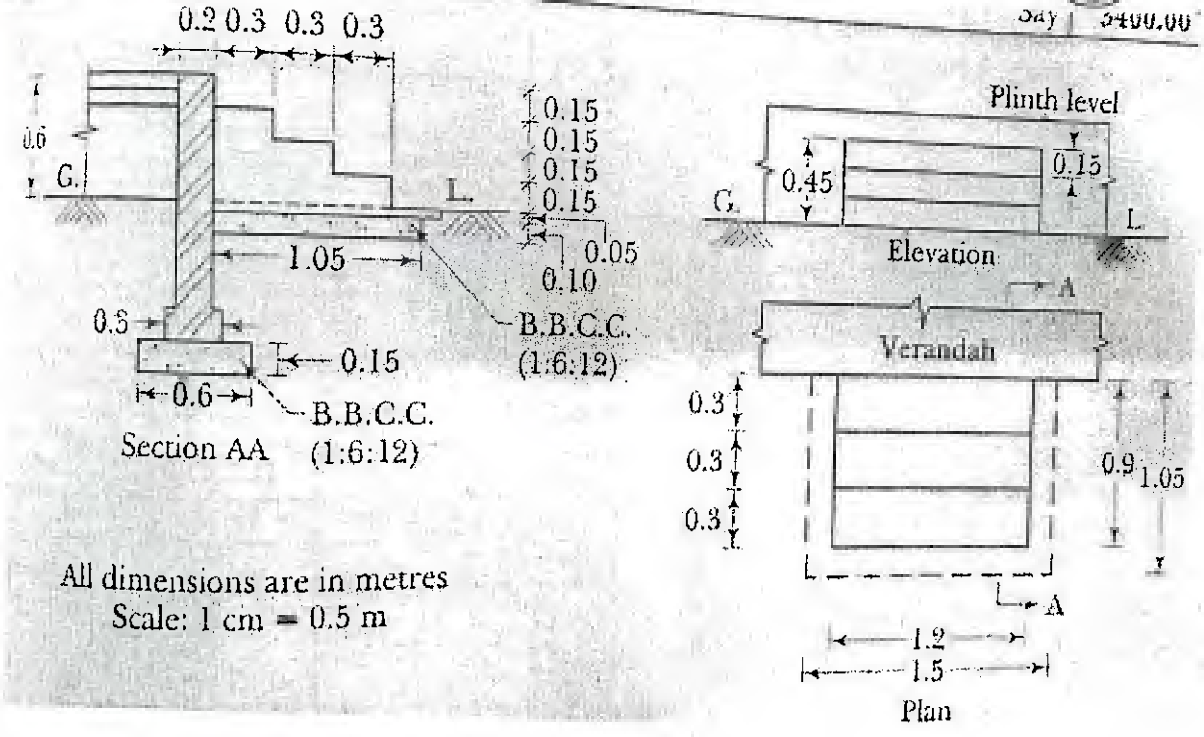

0.2 0.3 0.3 0.3
0.6
G.
L
0.15
0.15
0.15
0.15
0.05
0.10
1.05
B.B.C.C.
(1:6:12)
0.3
0.15
0.6
B.B.C.C.
(1:6:12)
Section AA
All dimensions are in metres
Scale: 1 cm = 0.5 m
Plinth level
0.45
0.15
G.
L
Elevation
A
Verandah
0.3
0.3
0.3
0.9
1.05
A
1.2
1.5
Plan

Fig: 2

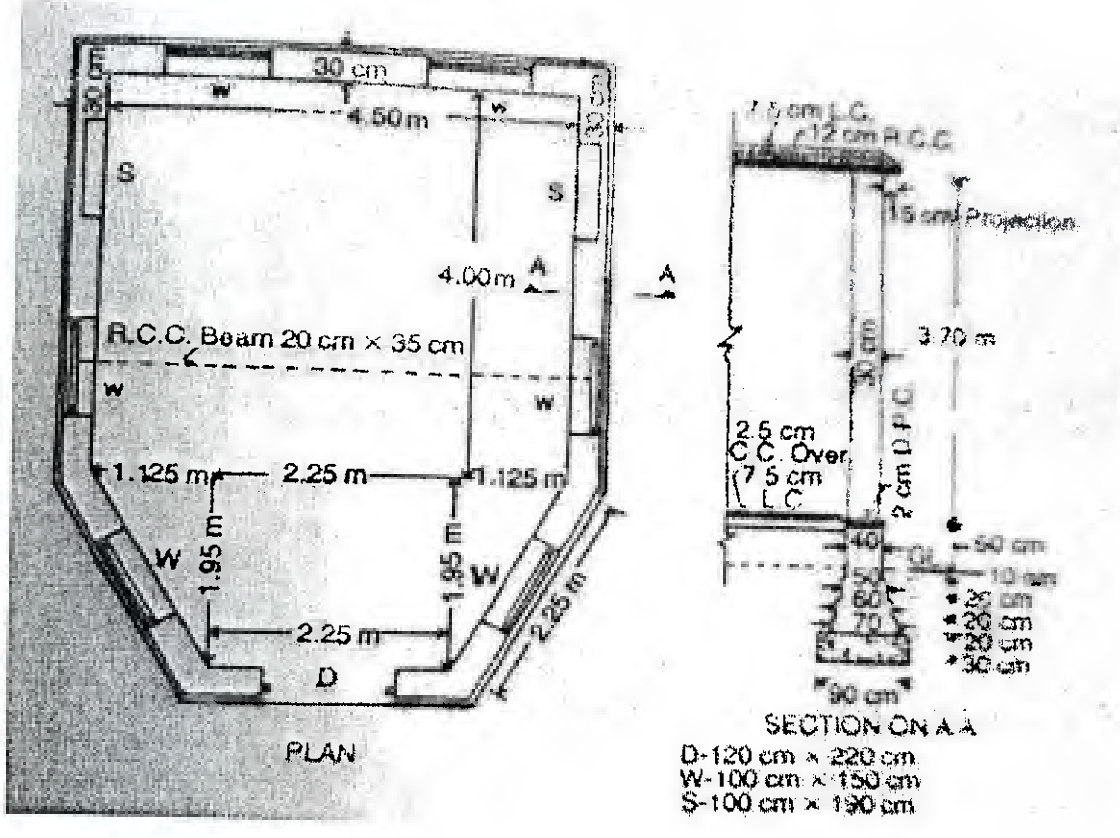
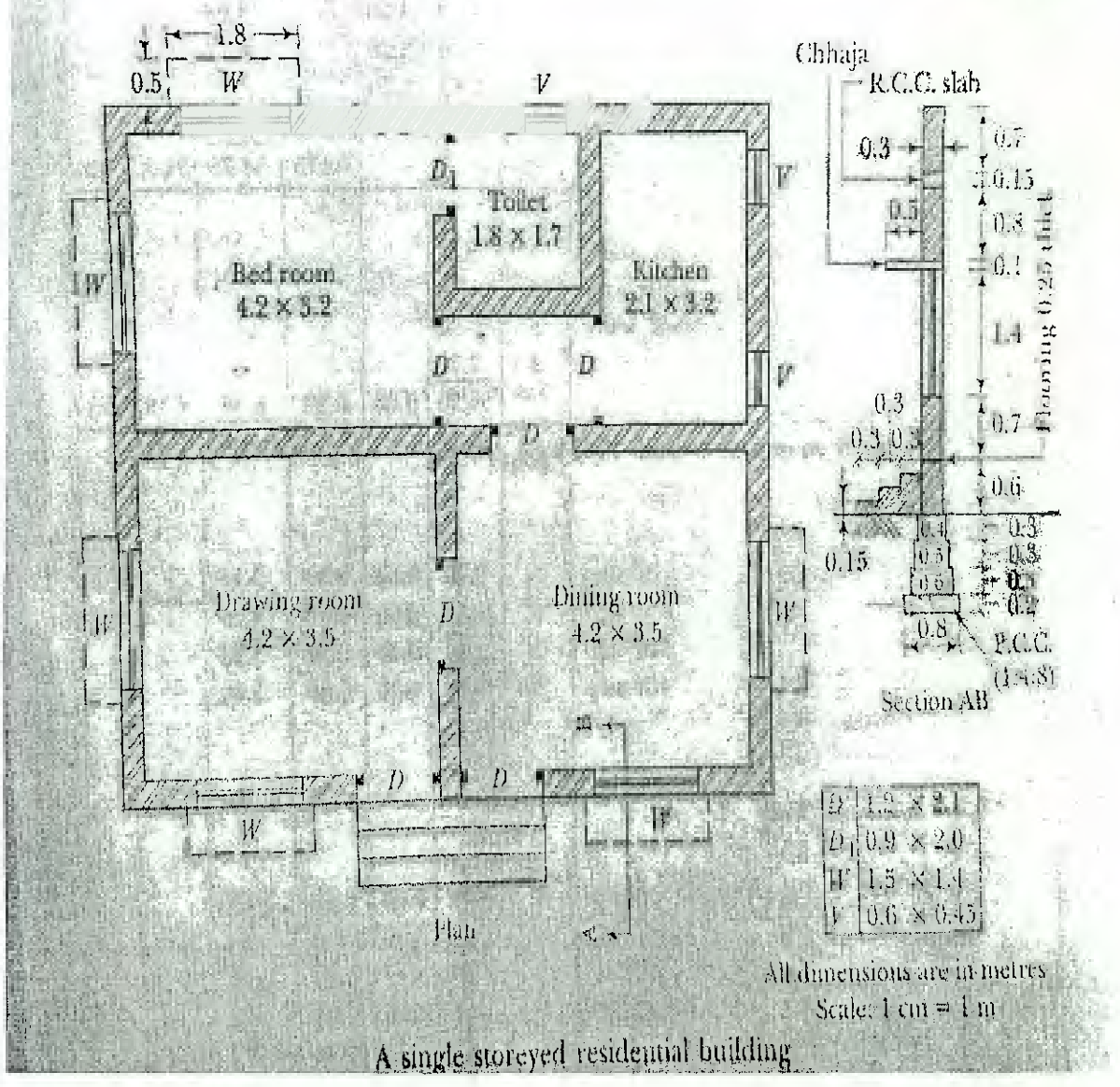

30 cm
4.50 m
S
S
4.00 m
A
A
R.C.C. Beam 20 cm × 35 cm
W
W
1.125 m
2.25 m
1.125 m
1.95 m
E
W
W
1.95 m
2.25 m
2.25 m
D
PLAN
15 cm Projection
3.70 m
2.5 cm
C.C. Over
(7.5 cm
L.C.
2 cm D.P.C.
90 cm
10 cm
90 cm
SECTION ON A-A
D-120 cm × 220 cm
W-100 cm × 150 cm
S-100 cm × 190 cm

Fig: 3



A single storeyed residential building

FIG:1

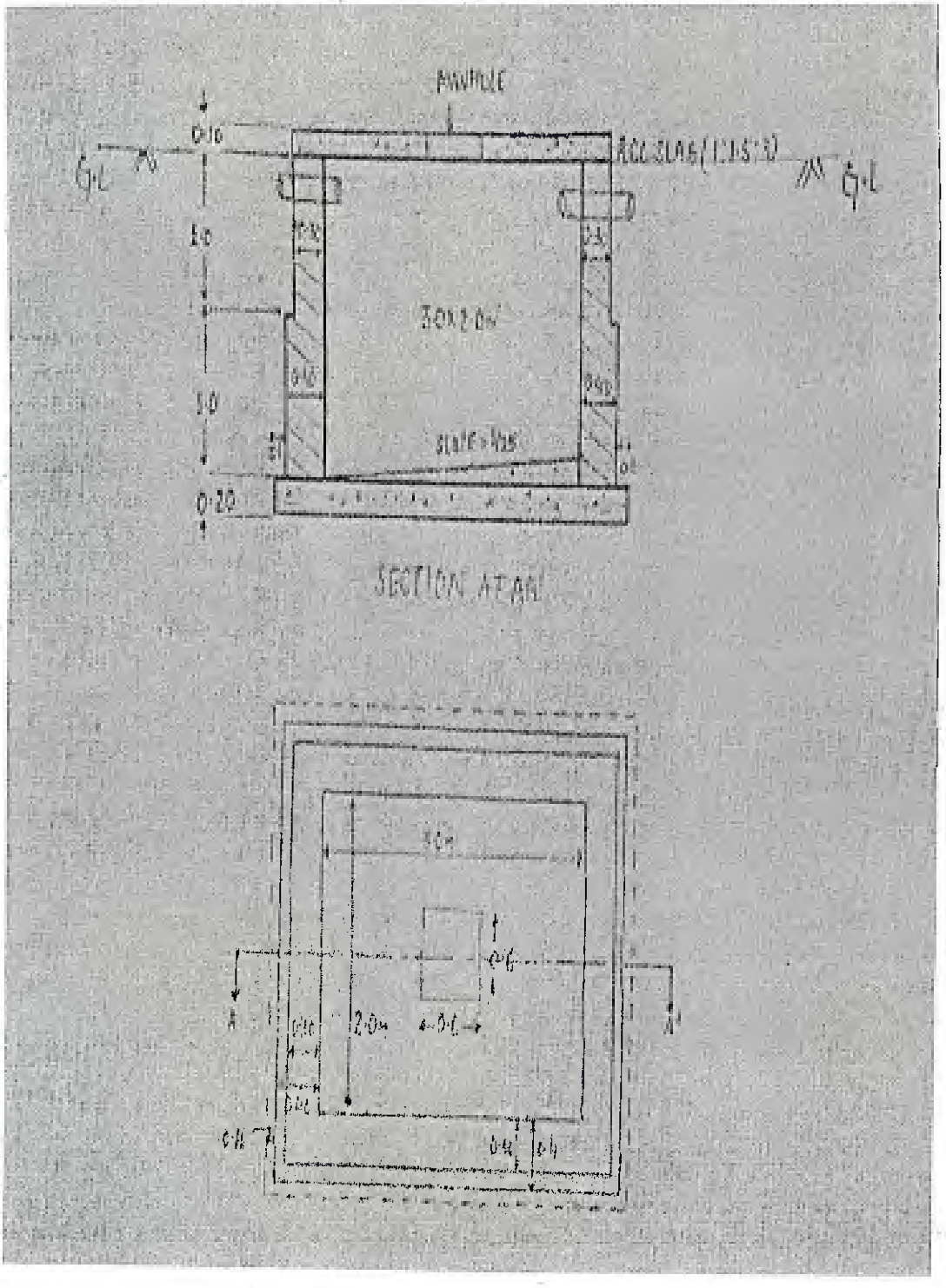

RAINHOLE
G.L
RCC SLAB (1:1.5:3)
G.L
3.0 x 2.0m
SLOPE 1:25
SECTION AT BB'
A
A'
2.0m

Fig:4

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~~END SEMESTER EXAMINATION NOV 2025~~/ RE Examination JAN 2026

Program: Civil Engineering — Final Year BTech Civil Sem VII

Duration: 3 hr.

Course Code: PC-BTC 702

Maximum Points: 100

Course Name: Engineering Economics, Estimation & Costing

Semester: VII

12/11/25

Notes:

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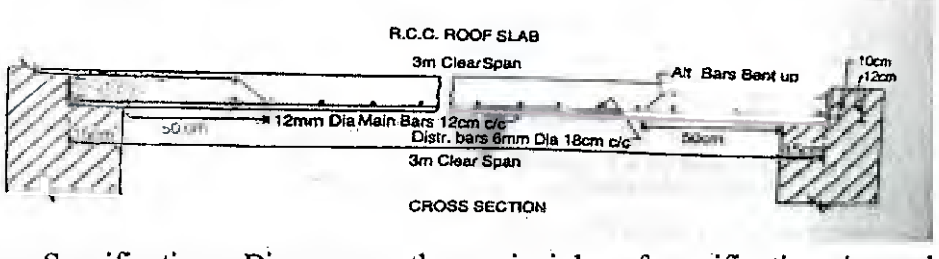
2. Illustrate answer with neat sketches wherever required.
3. Make suitable assumptions where necessary and state them clearly.

Q. No.	Questions	Marks	BL	CO	Mod N
1.	A. Prepare detailed & abstract estimate of the following items from the given fig.1. 1. Excavation for foundation 2. Sand filling in plinth 3. BBCC in foundations (1:4:8) 4. 1st class Brick work in foundation & plinth in cement mortar (1:6) 5. 1st class Brick work in superstructure (1:6) 6. 12 mm thick sagole cement plaster cm (1:4) 7. 2.5 cm thick damp proof coarse 8. R.C.C work (Chajja & Slab) 9. Teak wood doors & windows & ventilator 10. Mosaic tiles flooring	20	III	4,5	3,4
	A. The oil India is considering whether to go for an offshore oil drilling contract to be awarded in Mumbai High. If they Bid value would be Rs 600 million with 65% chance of gaining the contract. They may set up a new drilling operation or move already existing operation which has proved successful to new site. The Probability of success and expected returns are as follows.	10+10	II	1,2	1

Outcome	New Drilling Operation		Existing Drilling Operation	
	Probability	Expected Revenue in Rs millions	Probability	Expected Revenue in Rs millions
SUCCESS	0.75	800	0.85	700
FAILURE	0.25	200	0.15	350

If the corporation do not bid or lose the contract they can use Rs 600 million to modernise their operations.This would result in return of 5% or 8% on sum invested with probabilities 0.45 and 0.55. Construct the Decision Tree and Give your recommendation to Oil India Corporation.

B. Discuss: NPV Vs IRR.

	1. A project with a 4 year life and a cost of Rs. 235,000 generates revenue of Rs. 50,000 in year 1, Rs. 60,000 in year 2, Rs. 90, 000 in year 3 and Rs. 120,000 in year 4. If the discount rate is 15%, Can we accept the project? 2. Mr. Nitin is considering to invest Rs. 350,000 in a Hardware business. The cash inflows during the first, second and third years are expected to be Rs. 125,000, Rs. 150,000 and Rs, 170,000 respectively. Cost of capital is 12% calculate the IRR for the proposed investment and interpret your answer.				
	A. Prepare an detailed estimate & abstract estimate of steps.(Fig.2) Specifications: 1. The foundation concrete BBCC 2. 1st class brick work , 3. Risers of steps to be finished with 12 mm thick sagol cement plaster 4. Treads of the steps with polished kotah stone flooring A. Discuss the factors deciding the rate of items in rate analysis. Prepare a detailed rate analysis for 12 mm thick plaster with cement mortar 1:6.	12+08	II	4,5	3,5
	A. Prepare and detailed & abstract estimate of pier of culvert as shown in Fig.3. The general specification as follows, 1. BBCC. 2. 1st class brickwork in CM (1:6) 3. Pointing to exposed surface B. Prepare an detailed estimate & abstract estimate of Septic tank. (Fig.4) Specifications: 1. the foundation concrete BBCC 2. 1st class brick work in tank 3. Concreting at slope 4. 12 mm thick plastering on walls 5. RCC Slab cover at top of tank	12+08	II	4,5	3,5
	A. Prepare and detailed, abstract estimate & Bar Bending Schedule for RCC slab (3 M X 6 M) shown in fig. Also workout the percentage volume of reinforcement.  B. Define: Specifications. Discuss any three principles of specifications in tender documents.	16+04	II	4,5	3,5
	A. What are the qualities of Good arbitrator? B. Explain in brief general & special conditions of contract. C. Write a note on: Extra item clause. D. Explain different types of tender with their suitability.	05+07 +04+ 04	I,II	5	6

7	A. PWD wish to construct Flyover Bridge near Panvel of length 600m. Prepare tender notice specifying the cost of the project Rs.30 Cr. And 12 months duration. B. Define: Mass Haul Diagram. Reduced level (RL) of ground along the center line of a proposed road from chainage 320 to 560 are given below. Formation width of road is 12m and the side slope of filling are 2:1 and 1.5:1 for cutting. The road formation has a uniform falling gradient is 1 in 200 at 320 chainage. Draw a mass haul diagram and Prepare an estimate of earthwork at the rate of Rs350/cum. Find the area of side slope & cost of turfing & pitching at the rate of Rs. 260/sq.m	08+12	III	04	4

Chainage	320	350	380	410	440	470
RL on GL	115.60	116.25	116.40	115.85	115.50	114.25

Chainage	500	530	560
RL on GL	113.80	114.15	114.20

Rate Analysis Chart

Sr. No.	Item	Per	Rate
1	Excavation	Cu.m	200.00
2	BBCC	Cu.m	3000.00
3	1st class brickwork	Cu.m	3500.00
4	2nd class brickwork	Cu.m	2500.00
5	Cut cement pointing, plastering, centering work for beam/column, DPC	Sq.m	200.00
6	Teak wood door/window	Sq.m	5500.00
7	Mosaic tile flooring	Sq.m	500.00
8	RCC	Sq.m	1500.00
9	HYSD steel bars & Mild steel	Kg	65.00
10	Head mason	day	450
11	Mason	day	350
12	Majdoor	day	200
13	Bhisti	day	200
14	Assume water charges & Contractor profit (5%)		

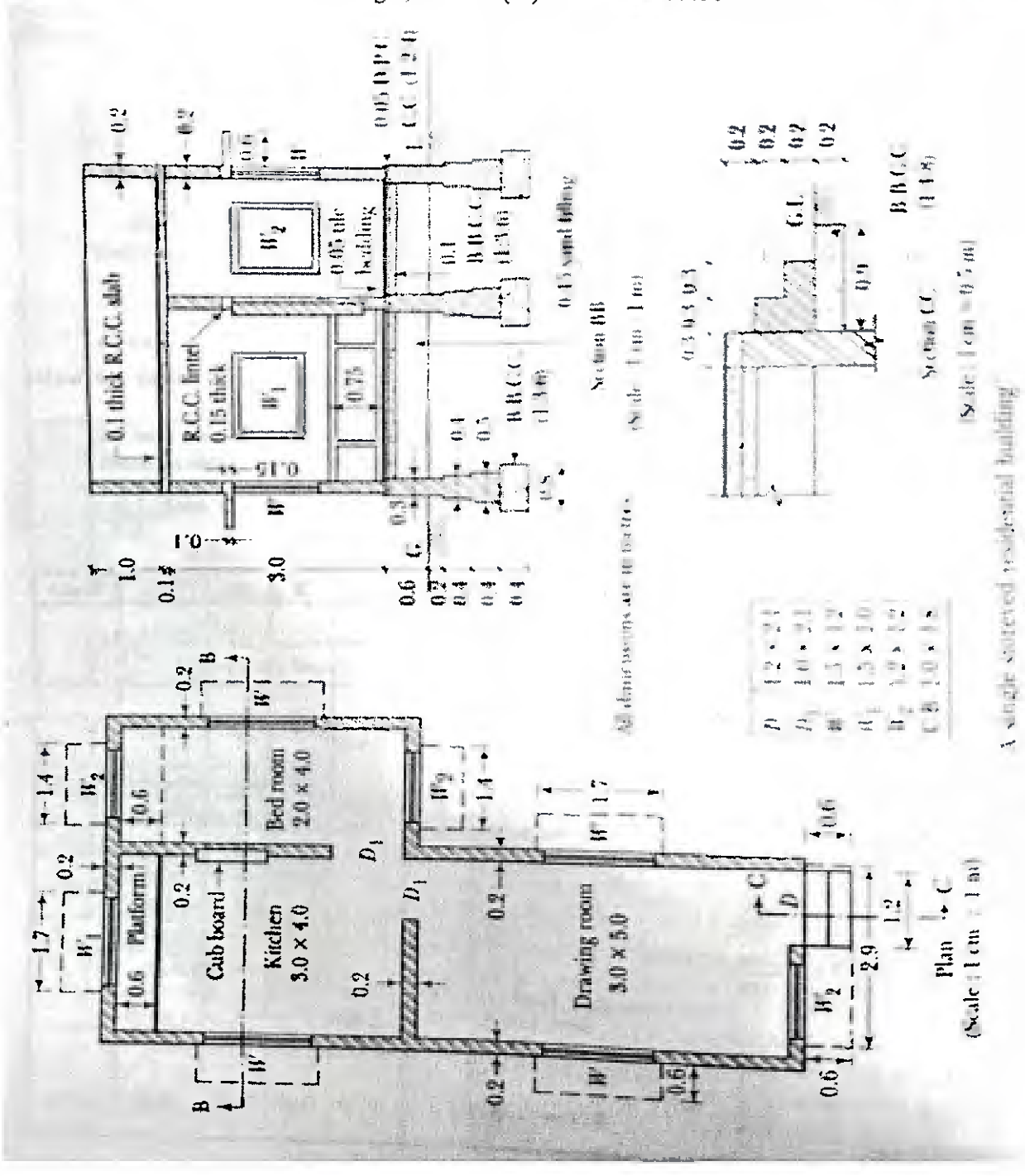

0.1 thick R.C.C. slab
R.C.C. lintel
0.15 thick
Bed room
2.0 × 4.0
Kitchen
3.0 × 4.0
Cub board
Platform
Drawing room
3.0 × 5.0
Plan
Section BB
Section CC
G.L.

FIG: 1

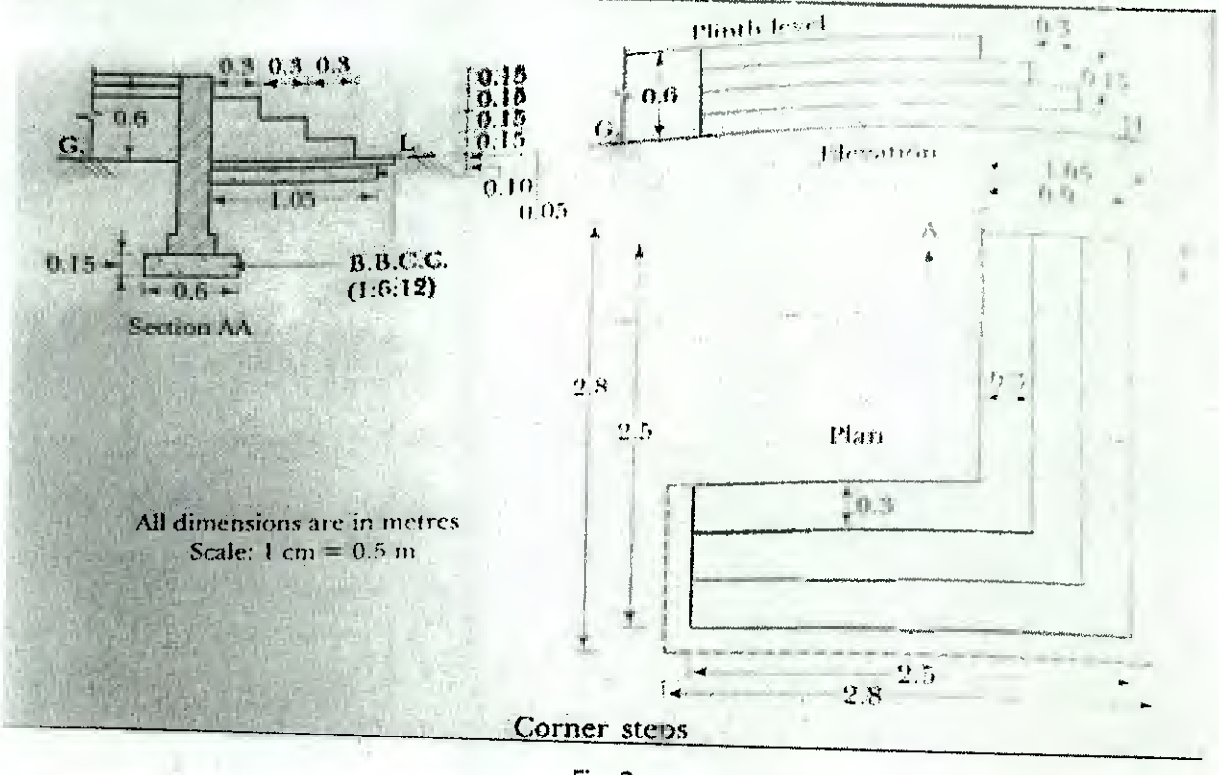

0.3 0.3 0.3
0.6
G.
L
1.05
0.15
0.6
B.B.C.C.
(1:6:12)
Section AA
0.15
0.15
0.15
0.15
0.10
0.05
Plinth level
0.6
G.
Elevation
0.3
0.15
1.05
0.9
A
A
2.8
2.5
Plan
0.3
2.5
2.8
All dimensions are in metres
Scale: 1 cm = 0.5 m
Corner steps

Fig: 2

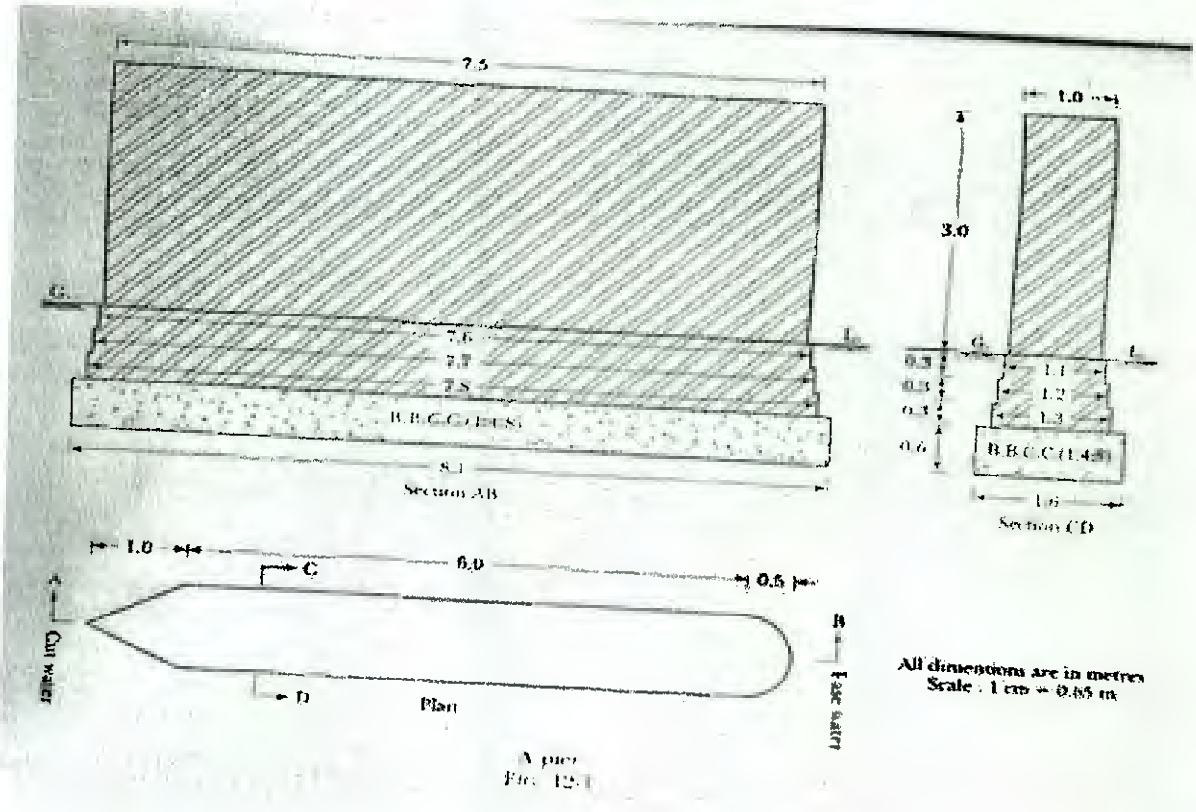

2.5
G.
L
7.6
7.7
7.8
B.B.C.C. (1:6:8)
8.1
Section AB
1.0
3.0
G.
L
0.3
0.3
0.3
0.6
1.1
1.2
1.3
B.B.C.C. (1:4:8)
1.6
Section CD
1.0
C
6.0
0.5
Cut water
B
Face stone
D
Plan
All dimensions are in metres
Scale : 1 cm = 0.65 m

Fig: 3

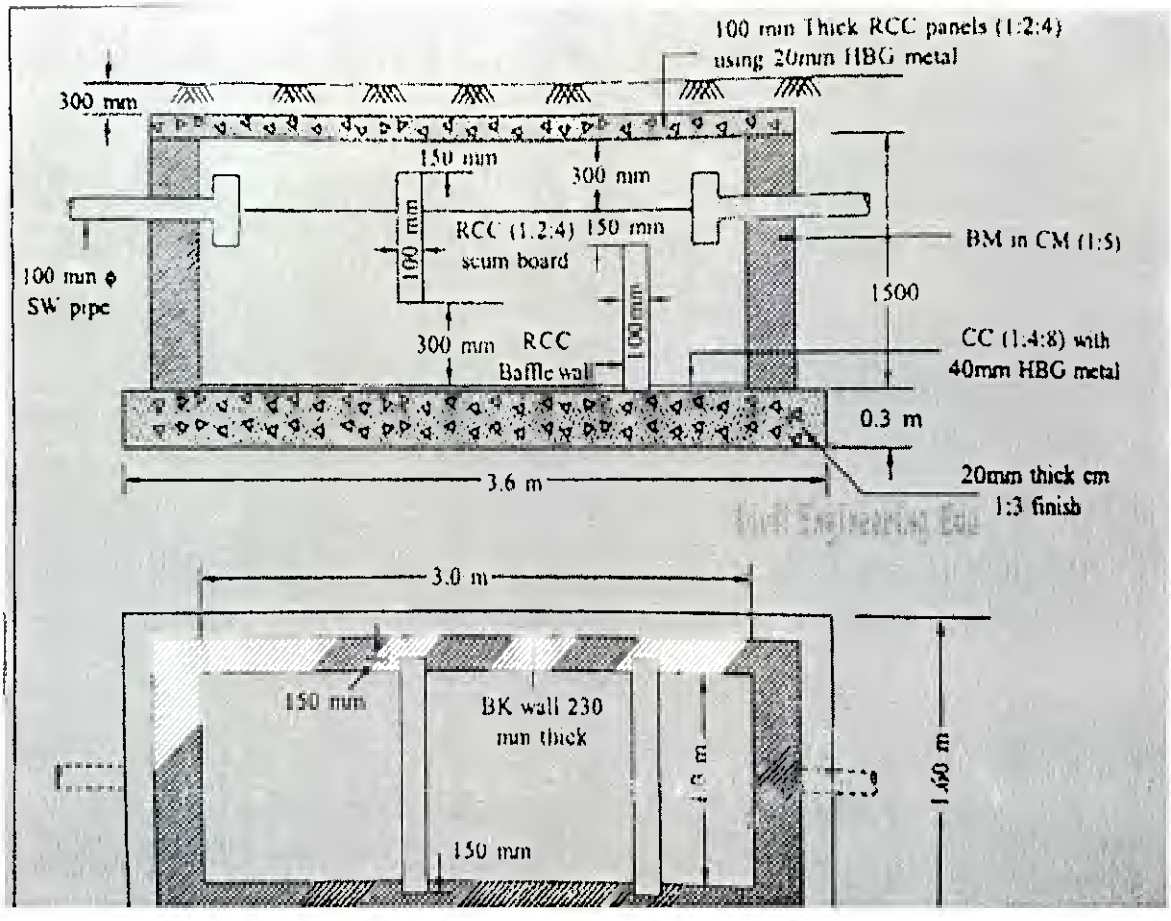

100 mm Thick RCC panels (1:2:4)
using 20mm HBG metal
300 mm
150 mm
300 mm
RCC (1:2:4) 150 mm
scum board
100 mm
BM in CM (1:5)
100 mm ϕ
SW pipe
1500
300 mm RCC
Baffle wall
100mm
CC (1:4:8) with
40mm HBG metal
0.3 m
3.6 m
20mm thick cm
1:3 finish
3.0 m
150 mm
BK wall 230
mm thick
1.60 m
150 mm

Fig:4

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End Semester Examination

November - 2025

Final Year B.Tech Civil

Max. Marks: 100 Duration: 3Hours

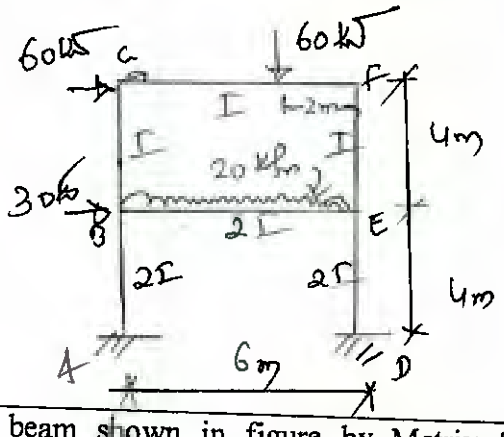
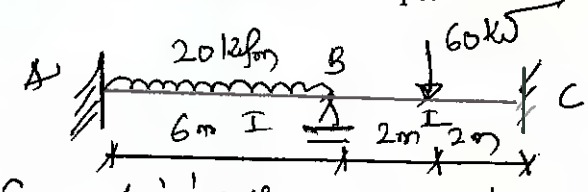
Class: B.Tech. Semester: VII Program: Civil Engineering

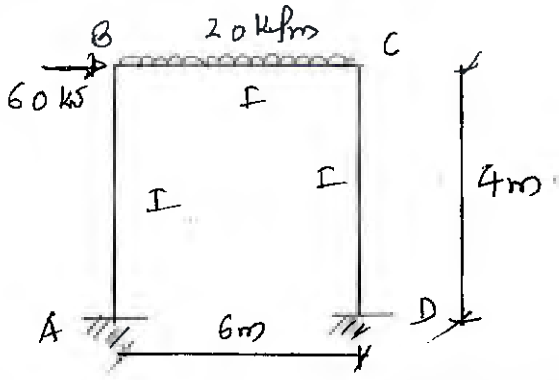
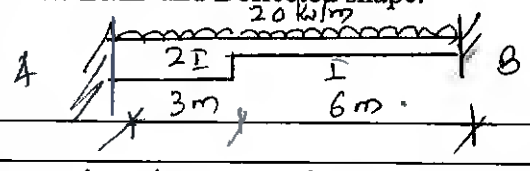
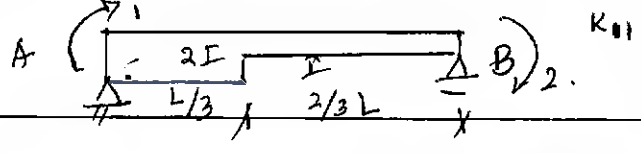
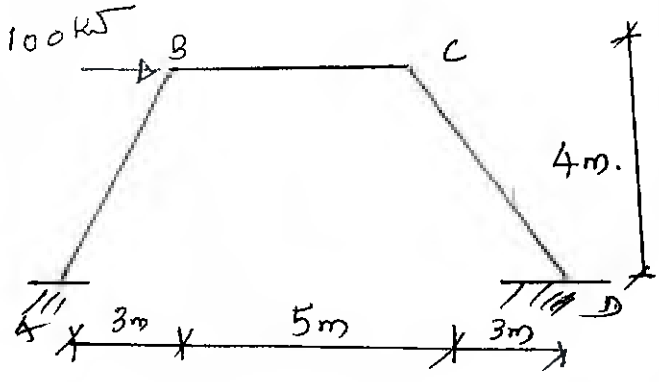
Name of the Course: Advanced Structural Analysis Course Code : PEC- BTC721

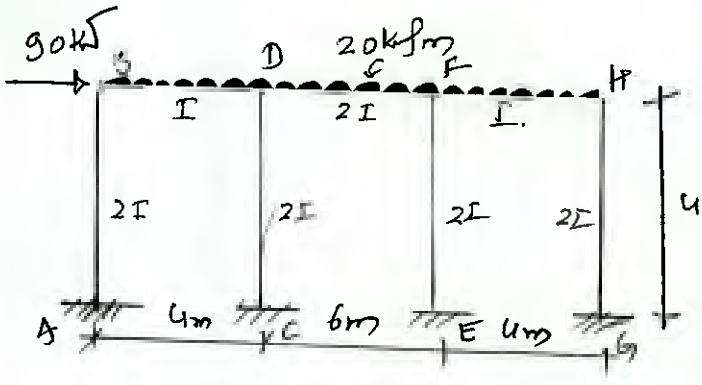
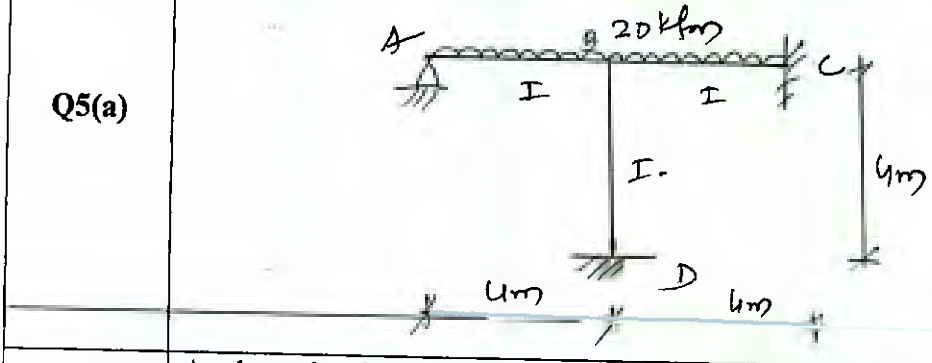
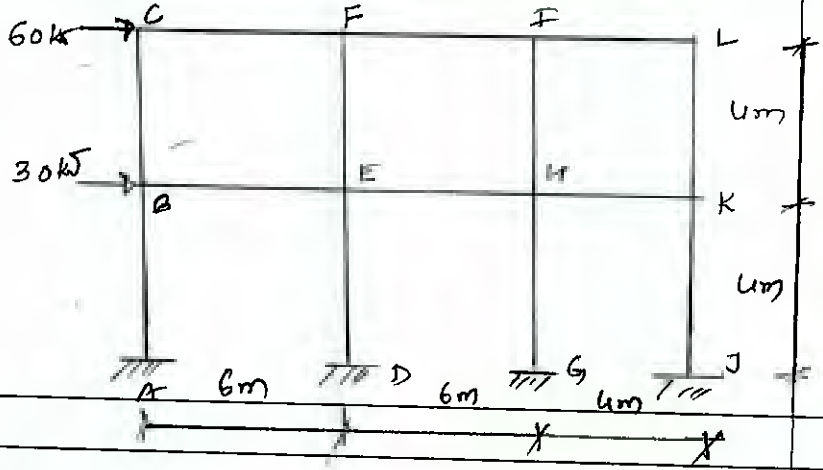
Sem VII 26/11/25

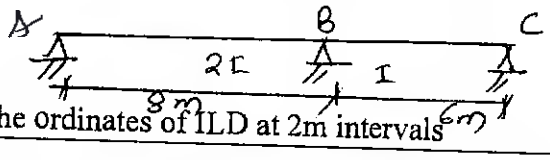
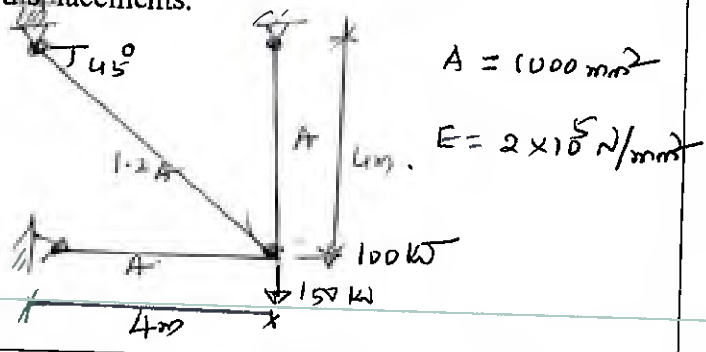
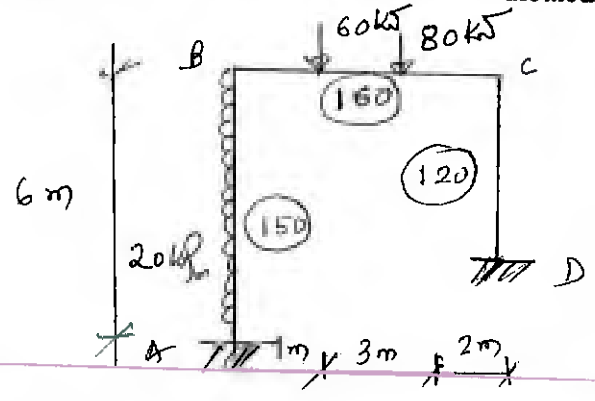
Instructions:

- Answer to any five questions
- Answers to all sub questions should be grouped together.
- Figures to the right indicate full marks.
- Assume suitable data if necessary and state the same clearly.

Question No		Max. Marks	Course outcome	Module No.
Q 1 (a)	For the frame shown in figure, (i) Divide the loads into symmetric and anti-symmetric loads. (ii) Calculate distribution factors for both loading cases 	04	2	4
Q1 (b)	Analyse the beam shown in figure by Matrix Stiffness method and draw BMD & deflected shape.  Support 'C' settles by 5mm ↓ EI = 20,000 kN m².	08	1,6	2

Q1 (c)	Analyse the rigid jointed frame shown in Figure by flexibility method and draw BMD and deflected shape. Note that A settles down by 10 mm. EI = 1 X 104 KN-m2 	**8**	**2**	**4**
Q 2 (a)	Using Column Analogy Method, analyse the beam shown in figure and draw BMD and Deflected shape. 	**10**	**2**	**4**
Q2 (b)	For the non-prismatic beam element shown in figure calculate the rotational stiffness at A and COF from A to B. 	**10**	**2**	**4**
Q 3(a)	Derive the modified stiffness and carry over factor for a column with fixed support of a single storey, single bay symmetric frame subjected to Anti -symmetric loads	**3**	**1**	**3**
Q3 (b)	Analyse the frame shown in figure by Elastic Centre Method and draw BMD and deflected shape. 	**17**	**2**	**4**

Q4	Analyse the frame shown in figure by Modified Moment Distribution Method and draw SFD, BMD & deflected shape 	20	1	3
Q5(a)	Analyse rigid jointed plane frame shown in figure by Matrix Stiffness Method and draw BMD and deflected shape. 	10	1,6	2
Q5(b)	Analyse the frame shown in figure by Portal Method and draw SFD, BMD and deflected shape. 	10	3	6
Q6(a)	(ii) State Muller Breslau's Principle	1	5	5

Q6(b)	For the beam shown in figure, construct the ILD for: (i) Reaction at 'A' R_A (ii) Bending Moment at B 'M_B'  Show the ordinates of ILD at 2m intervals	**10**	**4**	**5**
Q6(c)	Analyse pin jointed plane frame shown in figure by Matrix Stiffness Method and calculate the member forces and member displacements.  	**9**	**1, 6**	**2**
Q7(a)	Using plastic analysis, determine the load factor for the frame loaded as shown in figure. The Plastic Moment capacity of each member in KN-m is indicated in the figure.  	**16**	**5**	**7**
Q7(b)	i) Explain the need of approximate methods of Analysis (ii) State the various approximate methods analysis for vertical and horizontal loads	**2** **2**	**3** **1**	**6** **1**

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RE – ~~End Semester~~ Examination

~~November~~ - ~~2025~~ Jan-26

7/11/26

Max. Marks: 100 Duration: 3Hours

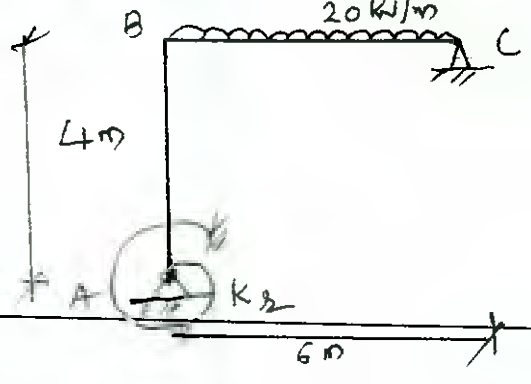
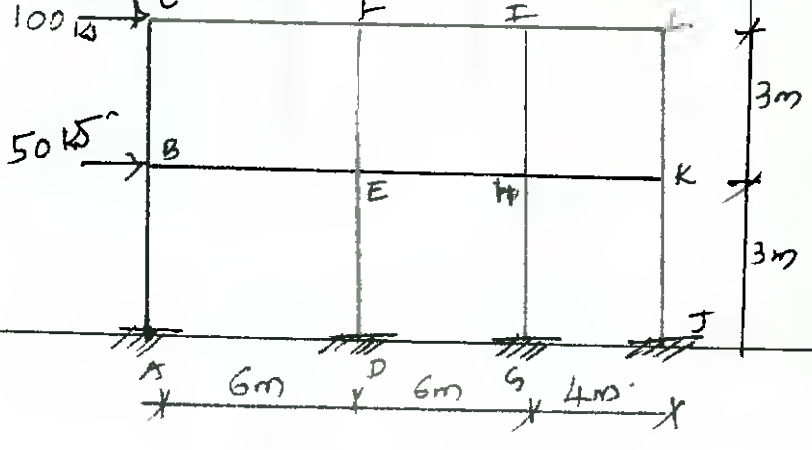
Class: B.Tech. Semester: VII

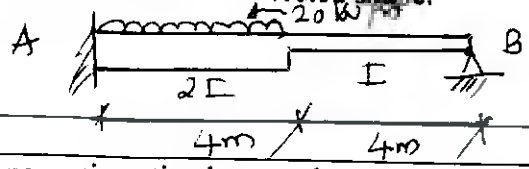
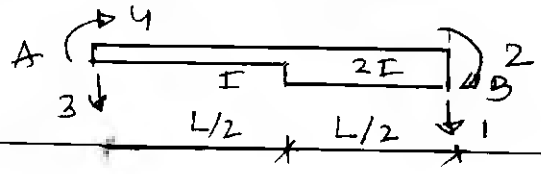
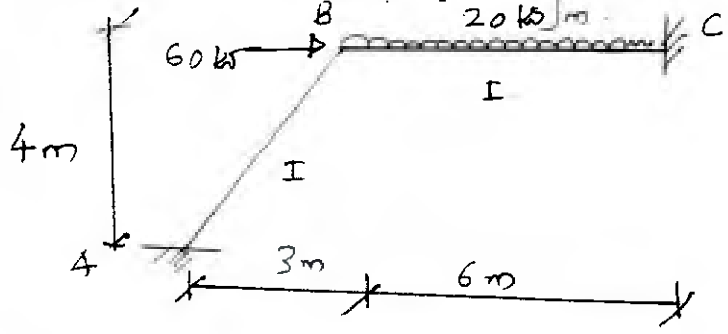
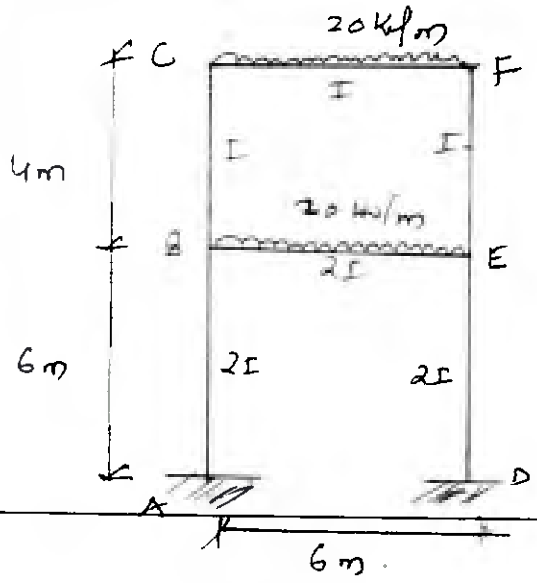
Name of the Course: Advanced Structural Analysis Program: Civil Engineering

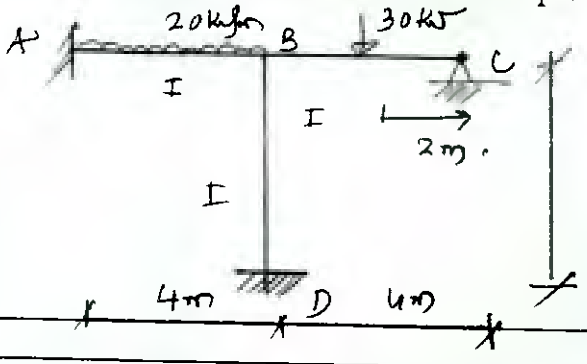
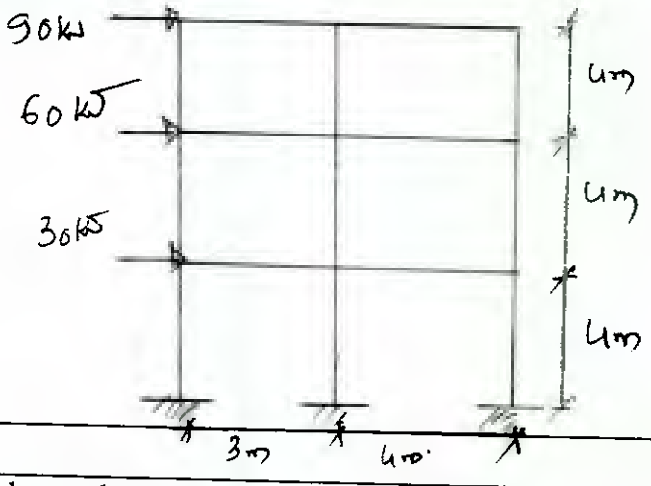
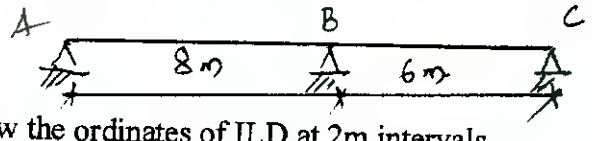
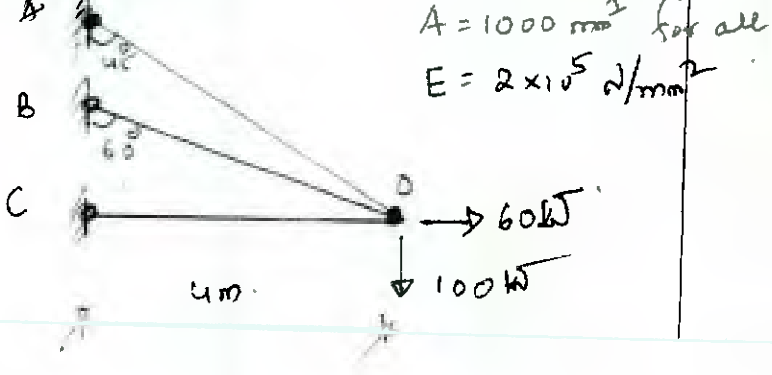
Course Code : PEC- BTC721

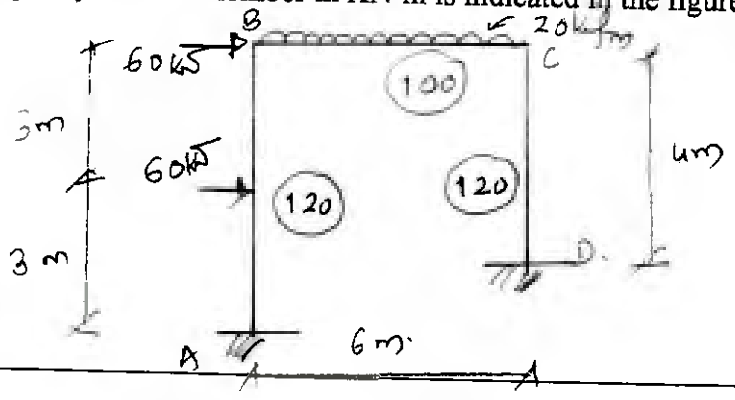
Instructions:

- Answer to any five questions
- Answers to all sub questions should be grouped together.
- Figures to the right indicate full marks.
- Assume suitable data if necessary and state the same clearly.

Question No		Max. Marks	Course outcome	Module No.
Q1 (a)	Analyse the rigid jointed frame shown in Figure by flexibility method and draw BMD and deflected shape. Note that A supported on elastic foundation, which is restrained against vertical and horizontal deflection and can rotate partially. EI = 1 X 10^4 KN-m^2 and K_θ = 10^4 Kn-m/rad. 	10	2	4
Q1 (b)	Analyse the frame shown in figure by Portal Method and draw SFD, BMD and deflected shape. 	10	3	6

Q 2 (a)	Using Column Analogy Method, analyse the beam shown in figure and draw BMD and Deflected shape. 	**10**	**2**	**4**
Q2 (b)	For the non-prismatic beam element shown in figure calculate the transverse stiffness at B i.e, K_{11}. 	**10**	**2**	**4**
Q 3 (a)	Derive the modified stiffness and carry over factor for a column with fixed support of a single storey, single bay symmetric frame subjected to Anti -symmetric loads	**3**	**1**	**3**
Q3 (b)	Analyse the frame shown in figure by Elastic Centre Method and draw BMD and deflected shape. 	**17**	**2**	**4**
Q4	Analyse the frame shown in figure by Modified Moment Distribution Method and draw SFD, BMD & deflected shape 	**20**	**1**	**3**

Q5 (a)	Analyse rigid jointed plane frame shown in figure by Matrix Stiffness Method and draw BMD and deflected shape. 	**10**	**1,6**	**2**
Q5 (b)	Analyse the frame shown in figure by Cantilever Method and draw SFD, BMD and deflected shape. 	**10**	**3**	**6**
Q6 (a)	For the beam shown in figure, construct the ILD for: (i) Reaction at 'C' R_C (ii) Bending Moment at B 'M_B'  Show the ordinates of ILD at 2m intervals	**10**	**4**	**5**
Q6 (b)	Analyse pin jointed plane frame shown in figure by Matrix Stiffness Method and calculate the member forces and member displacements. 	**10**	**1, 6**	**2**

Q7 (a)	Using plastic analysis, determine the load factor for the frame loaded as shown in figure. The Plastic Moment capacity of each member in KN-m is indicated in the figure.  	**16**	**5**	**7**
Q7 (b)	i) Explain the need of approximate methods of Analysis (ii) State the various approximate methods of analysis for vertical and lateral loads.	**2** **2**	**3** **3**	**6** **6**

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END SEM / [redacted] EXAMINATION NOVEMBER 2025 / JANUARY 2026

Program: Final Year B. Tech Civil Engineering | **Duration: 3 Hrs.**

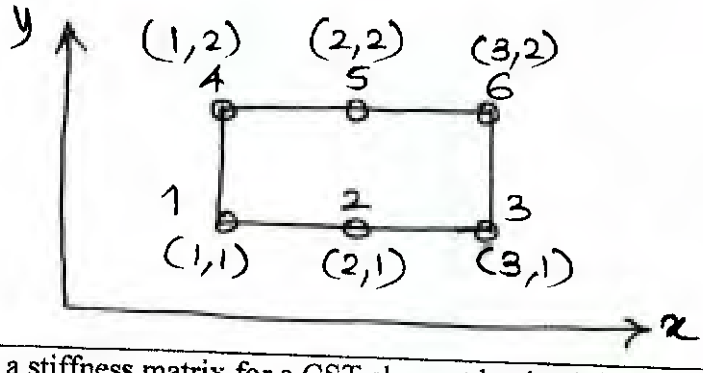
Course Code: PE-BTC722 | **Maximum Points: 100**

Course Name: Finite Element Analysis | **Semester: VII**

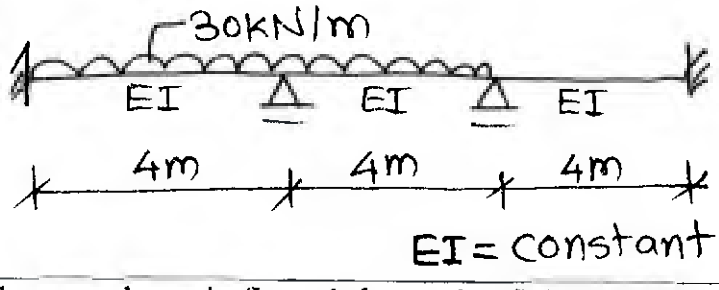
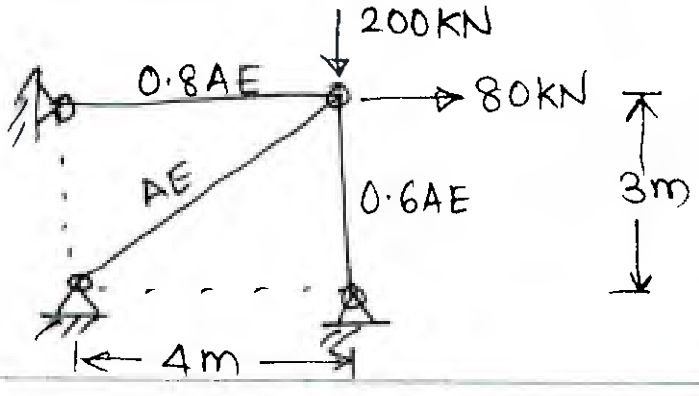
26/11/25

Instructions for the Students:

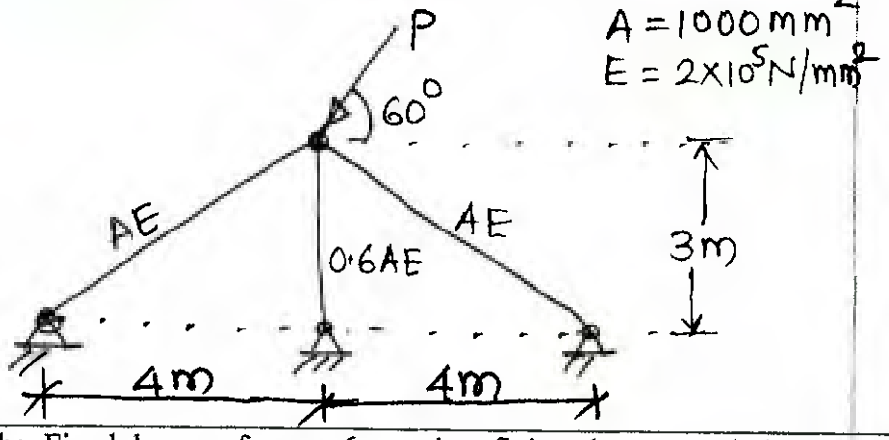
1. **Attempt any 05 (FIVE) questions**
2. **Assume suitable data if necessary and state it clearly.**
3. **Illustrate your answers with neat sketches wherever required.**

Q. No.	Questions	Points	CO	BL	Module No.
1 a	Explain the following terms: i. Convergence, ii. Compatibility requirements iii. Geometric invariance.	10	1	2	2
1 b	Determine the interpolation functions for the element as shown in the figure below 	10	2	4	3
2 a	Derive a stiffness matrix for a CST element having joint coordinates as follows: Node 1 (1m, 1m), Node 2 (2m, 1m), Node 3 (1m, 2 m). Assume the element as plane stress element with thickness of 0.020 m, E = 200 GPa and ν = 0.2.	10	2	4	3,5
2 b	For the simply supported beam subjected to uniformly distributed load acting over entire span, determine the maximum displacement using variational approach.	10	1,2	4	1

END SEM / [redacted] EXAMINATION NOVEMBER 2025 / JANUARY 2026

3 a	Determine the nodal load vector for a four noded rectangular element of size 2 m in X direction and 1 m in Y direction. Note that the element is subjected to a concentrated load of 50 kN in X direction and 30 kN in Y direction, both loads acting at point B. Note that distance of point B measured from left bottom corner node is 0.5 m along X direction and 0.3 m along Y direction.	10	2	4	3,5
3 b	For the element shown in Q3a, if the joint displacements for the top left and top right nodes are 0.005m, 0.002m in x direction respectively and 0.008m, -0.001m in y direction respectively, determine element stresses and element strains at a point (0.2m, 0.2m). Take E = 200 GPa and ν = 0.2 and assume element in plane strain. Note that displacement at all other joints is zero.	10	2	4	3,6
4	For the continuous beam shown in figure below, using finite element techniques, determine element stiffness matrix, structure stiffness matrix, effective structure stiffness matrix, loading vector, displacement vector and member forces. 	20	1,2	4	3,4
5	For the truss shown in figure below, using finite element techniques, determine member stiffness matrix, structure stiffness matrix, effective structure stiffness matrix, loading vector, displacement vector, element forces and vector of element stresses and strains. 	20	1,2	4	3,4

END SEM / [redacted] EXAMINATION NOVEMBER 2025 / JANUARY 2026

6	For the truss shown in figure 7, using finite element techniques, determine member stiffness matrix, structure stiffness matrix, geometric stiffness matrix and buckling load for the truss. 	20	1,2	4	3,6
7	For the Fixed beam of span 6m, using finite element techniques, determine member stiffness matrix, structure stiffness matrix, consistent mass matrix and first two natural frequencies. Take the density of material as 7850 kg/m^3 and EI value as 50000 kN-m^2. Consider 2 elements for modelling of a fixed beam.	20	1,2	4	3,7

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~~END SEM~~ / RE-EXAM EXAMINATION ~~NOVEMBER 2025~~ / JANUARY 2026

Program: Final Year B. Tech Civil Engineering Sem VII **Duration: 3 Hrs.**

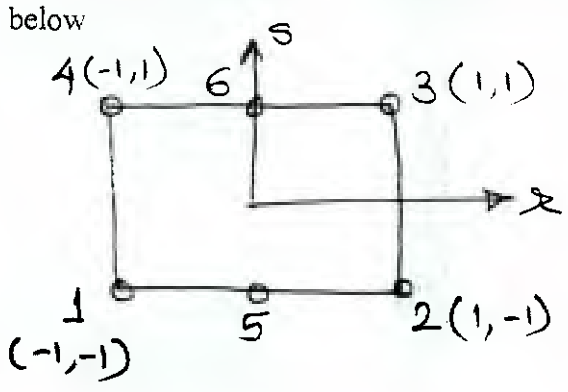
Course Code: PE-BTC722 **Maximum Points: 100**

Course Name: Finite Element Analysis **Semester: VII**

7/1/26

Instructions for the Students:

1. **Attempt any 05 (FIVE) questions**
2. **Assume suitable data if necessary and state it clearly.**
3. **Illustrate your answers with neat sketches wherever required.**

Q. No.	Questions	Points	CO	BL	Module No.
1 a	Explain different elements used in FEM with their displacement models	10	1	2	2
1 b	Determine the interpolation functions for the element as shown in the figure below 	10	2	4	3
2 a	Derive a stiffness matrix for a CST element having joint coordinates as follows: Node 1 (2m, 2m), Node 2 (1m, 2m), Node 3 (2m, 1 m). Assume the element as plane stress element with thickness of 0.010 m, E = 200 GPa and ν = 0.25.	10	2	4	3,5
2 b	For the simply supported beam subjected to uniformly distributed load acting over entire span and a concentrated load acting at center, determine the maximum displacement using variational approach.	10	1,2	4	1

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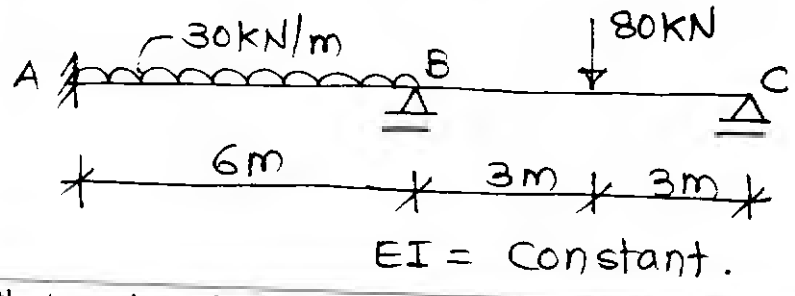
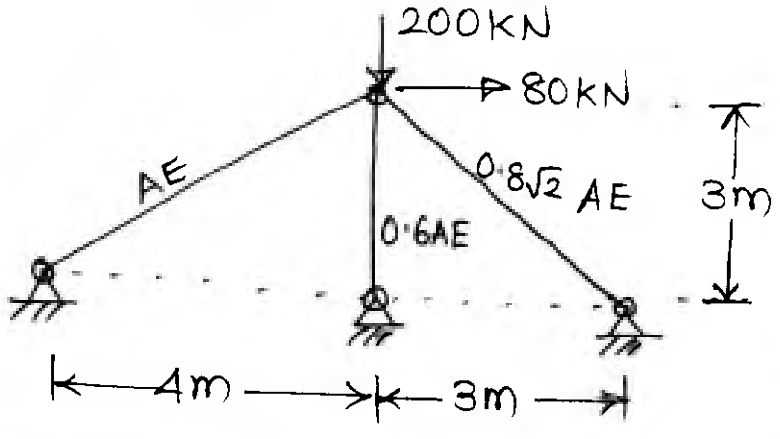
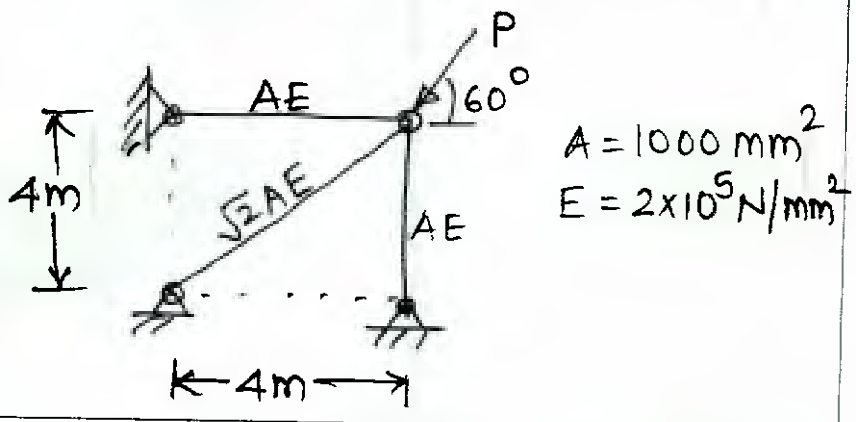
~~END SEM~~ / RE-EXAM EXAMINATION ~~NOVEMBER 2025~~ / JANUARY 2026

3 a	Determine the nodal load vector for a four noded rectangular element having nodes located as follows: Node 1 (0m, 0m), Node 2 (2m, 0m), Node 3 (2m, 1m), Node 4 (0m, 1m). Note that the element is subjected to a concentrated load of 30 kN in X direction acting at a point (0.3m, 0.5m) and 40 kN in Y direction acting at a point (0.5m, 0.5m).	10	2	4	3,5
3 b	For the element shown in Q3a, if the joint displacements for the nodes 1, 2, 3, 4 are 0.001, 0.002, 0.003, 0.002 in x direction and 0.002, 0.002, 0.001, 0.003in y direction respectively, determine element stresses and element strains at a point (0.5m, 0.7m). Take E = 200 GPa and $\nu = 0.2$ and assume element in plane stress.	10	2	4	3,6
4	For the continuous beam shown in figure below, using finite element techniques, determine element stiffness matrix, structure stiffness matrix, effective structure stiffness matrix, loading vector, displacement vector and member forces. 	20	1,2	4	3,4
5	For the truss shown in figure below, using finite element techniques, determine member stiffness matrix, structure stiffness matrix, effective structure stiffness matrix, loading vector, displacement vector, element forces and vector of element stresses and strains. 	20	1,2	4	3,4

~~END SEM~~ / RE-EXAM EXAMINATION ~~NOVEMBER 2025~~ / JANUARY 2026

6	For the truss shown in figure 7, using finite element techniques, determine member stiffness matrix, structure stiffness matrix, geometric stiffness matrix and buckling load for the truss. 	20	1,2	4	3,6
7	For the Fixed beam of span 10m, using finite element techniques, determine member stiffness matrix, structure stiffness matrix, consistent mass matrix and first two natural frequencies. Take the density of material as 2400 kg/m^3 and E = 25000 N/mm^2 and cross section of the beam as 300 mm X 750 mm. Consider 2 elements for modelling of a fixed beam.	20	1,2	4	3,7

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END SEMESTER November 2025 / ~~RE - EXAM~~ January 2026

Program: B.Tech. Civil Engineering (UG) – Sem VII (final year) **Duration: 03 Hrs.**

Course Code: PE-BTC-731 **Maximum Points: 100**

Course Name: Surface Hydrology **Semester: VII**

26/11/25

Notes:

- Attempt ***any five*** questions.
- Answer to all sub questions should be grouped together.
- **Figure** to right indicates full marks.
- Assume suitable data wherever necessary and state it **clearly**.

Q.No.	Questions	Points	CO	BL	Module No.
1.	(a) Explain water budget equation for a catchment and probable maximum precipitation (PMP) over a basin. How PMP is estimated?	10	1	2	1
	(b) Following observations were observed for lake: Water surface elevation at the start of June = 105.250 m above the datum, Average inflow to lake from surface runoff = 6.50 m^3/sec., Rainfall for a month (June) = 155 mm, Evaporation from a lake surface = 6.20 cm, Average lake surface area = 5575 Ha., Write water budget equation for the lake and estimate the water surface elevation of the lake at the end of the month.	10	1	3	1
2.	(a)Write short notes on: DAD curves, IDF curves and Maximum depth-Area-Duration Curves. Discuss its significance in the hydrology.	10	2	3	2
	(b) Explain a procedure for checking a rainfall data for consistency.	10	2	3	2
3.	(a)Describe the factors affecting evapotranspiration process and list the data needed to use Penman's equation for estimating the potential evapotranspiration from the given area.	10	2	3	2
	(b) For a reservoir surface area = 375 Ha, water temperature = 20^0 C, relative humidity = 42%, wind velocity at 1 m above ground level = 21 kmph. Using Meyer's formula and assuming reservoir as a large and Km= 0.36; Estimate; (i) Average daily evaporation from the lake; and (ii) Volume of water evaporated from the lake in one week.	10	2	4	2

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END SEMESTER November 2025 / ~~RE – EXAM~~ January 2026

4.	(a)What is infiltration loss? Explain infiltration model, infiltration capacity curve, Horton's equation and Ø index.	10	2	3	3
	(b) During flood flow at two sections of a channel Y1= 3m, Y2 = 2.85m, width (B) = 11 m, length between two sections (L) = 210m, drop in water surface elevation = 0.13 m, Manning's constant (n) = 0.024. Estimate the flood discharge by slope area method.	10	2	4	2
5.	(a)What is flood hydrograph? Explain its components and factors affecting flood hydrograph and methods of base flow separation.	10	3	3	4
	(b)The flood data and base flow in a storm are estimated for a storm in a catchment area of 615 km². Estimate the rainfall excess.	10	3	4	7

Time is days	0	1	2	3	4	5	6	7	8	9
Discharge Cum/sec.	21	65	155	135	92	65	48	30	21	20
Base flow (cum/sec.	21	25	28	30	27	24	23	22	21	20

6.	(a)Define the terms: Design flood, Standard project flood, probable maximum flood and risk, reliability and safety margin with respect to design of hydraulic structure.	10	4	3	6
	(b) Annual flood data for a certain river covering a period of 30 years yielded for the annual flood discharge having mean = 30,000 cum/sec. and Standard deviation = 14,800 cum/sec. For a certain structure to be constructed on this river, for assuming 11% risk and 50 years expected life. (i)Estimate the flood discharge by Gumbel's method, (ii) If the actual flood adopted in the design is 131,000 cum/sec. What are the safety factors and safety margin relating to maximum flood discharge?	10	4	4	7
7.	(a)What is flood routing? Explain modified Pul's method of flood routing.	10	4	3	6
	(b)Route the hydrograph through a river reach for which K = 12.0h and x = 0.20. At the start of the inflow flood, the outflow is 10 cum/sec.	10	4	4	5

Time (Hr.)	0	6	12	18	24	30	36	42	48	54	60
Inflow Cum/sec.	10	21	49	62	57	48	39	28	22	15	12

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7/1/26

~~END SEM~~ ~~Oct 2025~~ / RE - EXAM January 2026

Program: B.Tech. Civil Engineering (UG) Sem VII **Duration: 03 Hrs.**

Course Code: PE-BTC-731 **Maximum Points: 100**

Course Name: Surface Hydrology **Semester: VII**

Notes:

- Attempt ***any five*** questions.
- Answer to all sub questions should be grouped together.
- **Figure** to right indicates full marks.
- Assume suitable data wherever necessary and state it **clearly**.

Q.No.	Questions	Points	CO	BL	Module No.
1.	(a) Explain hydrologic cycle with a neat sketch and water budget equation for a catchment.	10	1	2	1
	(b) Differentiate between climate and weather. What is climate change? How it affects the rainfall pattern? Explain.	10	1	3	1
2.	(a)Write short notes on: DAD curves, IDF curves and Maximum depth-Area-Duration Curves. Discuss its significance in the hydrology.	10	2	3	2
	(b)Explain causes of inconsistency in precipitation records and discuss double mass curve technique of test for consistency of record.	10	2	3	2
3.	(a) Explain the energy budget method of estimating evaporation from a lake.	10	2	3	2
	(b)A catchment has eight rain gauge stations. In a year the annual rainfall recorded by the gauges are as follows: Station: A B C D E F G H Rainfall (cm): 92 105 185 120 95 130 100 110 For a 10 % error in the estimate of the mean rainfall, calculate the optimum number of stations in the catchment.	10	2	3	2
4.	(a) write short notes on: (i) Stage-discharge relationships; and (ii) Dilution technique of stream flow measurement.	10	2	3	3

~~END SEMESTER November 2025~~ / RE - EXAM January 2026

	(b) Calculate the potential evapotranspiration in the month of November for the area having Latitude: 28°5'N, Elevation= 235 m above sea level, Saturation vapour pressure (e_w)=17.55 mm of Hg, A= 1.05 mm/°C, mean monthly solar radiation (Ha)= 9.55 mm of water/day, mean monthly temperature = 20°C, mean relative humidity= 76%, mean observed sunshine hours= 9h, wind velocity at 2 m height= 85km/day, constant (b)=0.52, Stefan-Boltzman constant = 2.01×10^{-9} mm/day.	10	2	4	2
5.	(a)What is flood hydrograph? Explain its components and factors affecting flood hydrograph and methods of base flow separation.	10	3	3	4
	(b)The following are the ordinates for a flood hydrograph resulting from a isolated storm of 6 hrs. Duration. Determine the ordinates of 1 cm-6hr. unit hydrograph, if the catchment area is 475 km². Assume constant base of 5 m³/sec.	10	3	4	7
6.	(a)Define the terms: Design flood, Standard project flood, probable maximum flood and risk, reliability and safety margin with respect to design of hydraulic structure.	10	4	3	6
	(b)For an annual flood of N= 90 years, mean = 6550m³/sec., standard deviation = 2900 m³/sec., with Gumbel's method of flood discharge with a return period of 275 years, what are the (1) 95% and (2) 80% confidence limits for this estimates? Take: $\overline{Yn}$= 0.5588, Sn = 1.21, fc = 1.96 for 95% confidence and fc= 1.282 for 80% confidence.	10	4	4	7
7.	(a)What is flood routing? Explain the procedure for hydrologic reservoir routing.	10	4	3	6
	(b)An inflow hydrograph is measured for a cross section of a stream channel. Compute the outflow hydrograph at a point 5 km downstream using Muskingum method. Assume K = 12 h, x = 0.10 and that outflow equals inflow initially.	10	4	4	5

Time (Hr.)	0	12	24	36	48	60	72	84	96
Ordinate of flood hydrograph (cumec)	5	16	42	78	62	55	28	24	5

Time (Hr.)	6	12	18	24	30	36	42	48	54	60	66
Inflow (I) (cum/sec)	50	75	150	450	1000	840	750	600	300	100	50

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END SEMESTER November 2025 / ~~RE - EXAM~~ January 2026

Program: B.Tech Civil Engineering — Final Year Sem VII

Duration: 3 Hrs.

Course Code: PE-BTC752

Maximum Points: 100

Course Name: PE-III Contracts Management

Semester: VII

26/11/25

1. **Notes:** Attempt any 5 question out of 7 questions.
2. Answers to all sub questions should be grouped together.
3. Assume Suitable data if necessary and state it clearly.

Q.No.	Questions	Points	CO	BL	Module No.
1.	a. Explain the concept of a Notice to Proceed (NTP) in construction contracts. Discuss its purpose, essential components, legal implications, and the responsibilities it places on the contracting parties.	10	2	2	2
	b. A contractor entered into a contract with a supplier to deliver cement and steel for a bridge construction project within 15 days. Due to transportation issues, the supplier delivered the goods 20 days late, causing a delay in the concreting schedule. As the Contract Manager, explain the rights and remedies available to the contractor under the Contract of Supply of Goods for delayed delivery.	10	4	2,3	4
2.	a. List types of Injunctions and explain how injunction principles can be used when land acquisition is legally challenged by affected villagers.	10	4	1,3	6
	b. List the major FIDIC contract types. Discuss how FIDIC Conditions of Contract help resolve disputes in international bridge construction projects.	10	4	1,3	4
3.	a. What is a Post-Implementation Review (PIR) in contract management? Describe the steps involved in post-implementation review of a construction contract.	10	4	1,2	5

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	b. Describe how lack of integrity can lead to project cost overruns.	10	4	2	6
4.	a. During a bridge construction project, the client requests design modifications midway through execution, which will affect both cost and schedule. I. What contractual procedures should be followed to manage this change request? II. What risks can arise if change orders are not managed properly?	10	4	2,3	5
	b. What are the different types of claims in civil engineering? Explain each with suitable examples.	10	3	1,2	3
5.	a. A tunnel construction project under EPC mode was halted for 6 months due to unexpected landslides and flooding. The contractor invoked the Force Majeure clause seeking time and cost compensation. i. What steps should the Engineer take to assess the validity of the claim? ii. Discuss whether Force Majeure allows cost recovery or only time extension iii. What documentation must the contractor submit?	10	3	2,3	3
	b. Explain the suitability of a cost-plus fixed fee contract for construction projects. Also describe the merits and demerits of using a cost-plus fixed fee contract from the client's perspective.	10	1	1,2	1
6.	a. Describe the respective roles of the Employer, Contractor, and Engineer in a construction contract. Compare their responsibilities and illustrate how coordination among the three parties ensures effective contract administration.	10	2	2,3	2
	b. Explain Penalty and describe how the Engineer-in-Charge can impose penalties for non-compliance with safety regulations at a construction site.	10	3	1,2	3

END SEMESTER November 2025 / ~~RE – EXAM~~ January 2026

7.	a. Explain the various types of contracts based on their formation, validity, performance, and nature of consideration, as per the Indian Contract Act. Provide suitable examples.	10	1	2,3	1
	b. In a construction project, contractors frequently hire machinery such as cranes, concrete mixers, and formwork systems. Explain the bailor–bailee relationship in such equipment-hire arrangements and discuss the rights, duties, and liabilities of both parties under the Indian Contract Act	10	4	2,3	6

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END SEMESTER November 2025 / ~~RE - EXAM~~ January 2026

Program: Civil Engineering Final Year B.tech **Duration: 3 Hours**

Course Code: PE – BTC - 761 Civil Engineering Sem VII **Maximum Points: 1000**

Course Name: Pavement Design and Construction (Elective) **Semester: VII**

26/11/25

Notes:

(i) Question 1 is Compulsory,
(ii) Solve any 4 Questions from remaining 6, Questions,
(iii) Assume suitable data if required

Q.No.	Questions	Points	CO	BL	Mod No.
Q.1	Solve any four (5 x 4 = 20)				
a	Equivalent Single Wheel load (ESWL)	05	01	01	01
b	Classification of Pavement Design Methods	05	02	01	01
c	Revised PRA system for soil classification	05	02	01	02
d	Preparation of subgrade	05	02	01	04
e	Layer system concept in flexible pavement design	05	01	02	07
Q.2.					
a	Explain the procedure for conducting plate bearing test in the field. Also, apply the correction for plate size and moisture contents.	10	0.3	02	02
b	The plate bearing test were conducted on subgrade soil and on subgrade soil with 15 cm thick base course. The pressure yield at 0.50 cm deflection are 1.25 kg/cm^2 and 4.0 kg/cm^2 respectively. Design the pavement section for a wheel load of 4100 kg, tyre pressure of 7.5 kg/cm^2 and design deflection of 0.50 cm. If the bituminous concrete layer of 5 cm thick having modulus of elasticity 3000 kg/cm^2 is to be provided above the base course. Design the three layer pavement using Burmister Layer theory. Also draw a neat sketch showing three layer pavement system.	10	02	03	02
Q.3.					
a	Compare flexible pavement with rigid pavement	05	02	01	03
b	Discuss joints in rigid pavement	05	02	01	03

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c	Calculate the wheel load stress at edge and corner using modified Westergard approach for k = 8 kg/cm², k = 10 kg/cm² and k = 12 kg/cm² and tabulate the results. Also, calculate the temperature stress and edge and corner for k = 8 kg/cm², k = 10 kg/cm² and k = 12 kg/cm² using following data; Design wheel load = 5100 kg Tyre pressure = 7 kg/cm² Spacing of longitudinal joint = 3.5 m Spacing of transverse joint = 5.0 m Poisons ratio = 0.15 Radius of contact area of wheel with surface = 15 cm Coefficient of thermal expansion = 10 x 10^{-6} per degree Thickness of slab = 20 cm	10	02	03	03
Q 4.					
a	Discuss the field procedure for construction of WBM type base course. How will you insure the quality during construction?	10	02	02	04 &07
b	Discuss the laboratory procedure for CBR test. How will you apply the correction?	10	02	02	02 &07
Q.5.					
a	How will you carry out the condition survey for Benkelman Beam study	05	03	02	05
b	The Benkelman beam study is conducted on a stretch of 5 km long national highway and 10 sets of observations are shown in table below. If the least count of dial gauge is 0.01 calculate the rebound deflection.	15	03	03	05

Sets of observations	Dial gauge reading		
	D_0	D_i	D_r
1	0	33	30
2	0	37	32
3	103	41	38
4	104	36	33
5	105	35	33
6	101	42	39
7	101	43	40
8	0	41	38
9	0	42	40
10	0	29	26

The traffic survey is carried out on the same road. The study shows that on the last count the traffic is 2000 cvpd. The

END SEMESTER November 2025 / ~~RE – EXAM~~ January 2026

	average temperature at the time of study was 31^{0}C and subgrade moisture content was 13 %. If 3 years required for construction after last count. Design the Bituminous macadam type overlay thickness for a design period of 10 years. Assume VDF = 2.5 and LDF = 1. Also, suggest the alternative overlay thickness of WBM.				
Q.6					
a	Discuss the steps for design of surface drainage system	08	02	02	06
b	the grain size distribution of foundation soil indicates that the percentage of partials finer than 0.30 mm, 0.20 mm, 0.08 mm, 0.04 mm, 0.02 mm and 0.01 mm are 95 %, 85 %, 65 %, 45 %, 15 %, and 5 % respectively. If the diameter of hole in the perforated pipe is 5 mm. Draw the grain size distribution curve for foundation soil. Also, draw the grain size distribution curve for filter material to be used around the perforated pipe.	12	02	02	06
Q.7.					
a	What is prime coat and tack coat, explain its construction procedure and material requirement.	06	03	02	04 & 0
b	Discuss the procedure for construction of stabilized earth road	06	03	02	04
c	The wheel load of 5100 kg acting on a single layer pavement. if the radius of contact area of wheel of vehicle with pavement surface is 15 cm, calculate the vertical compressive stress at a depth of 20 cm, 25 cm, 30 cm, 35 cm and 40 cm from the pavement surface. Also draw a neat sketch showing vertical compressive stress distribution.	08	01	03	02

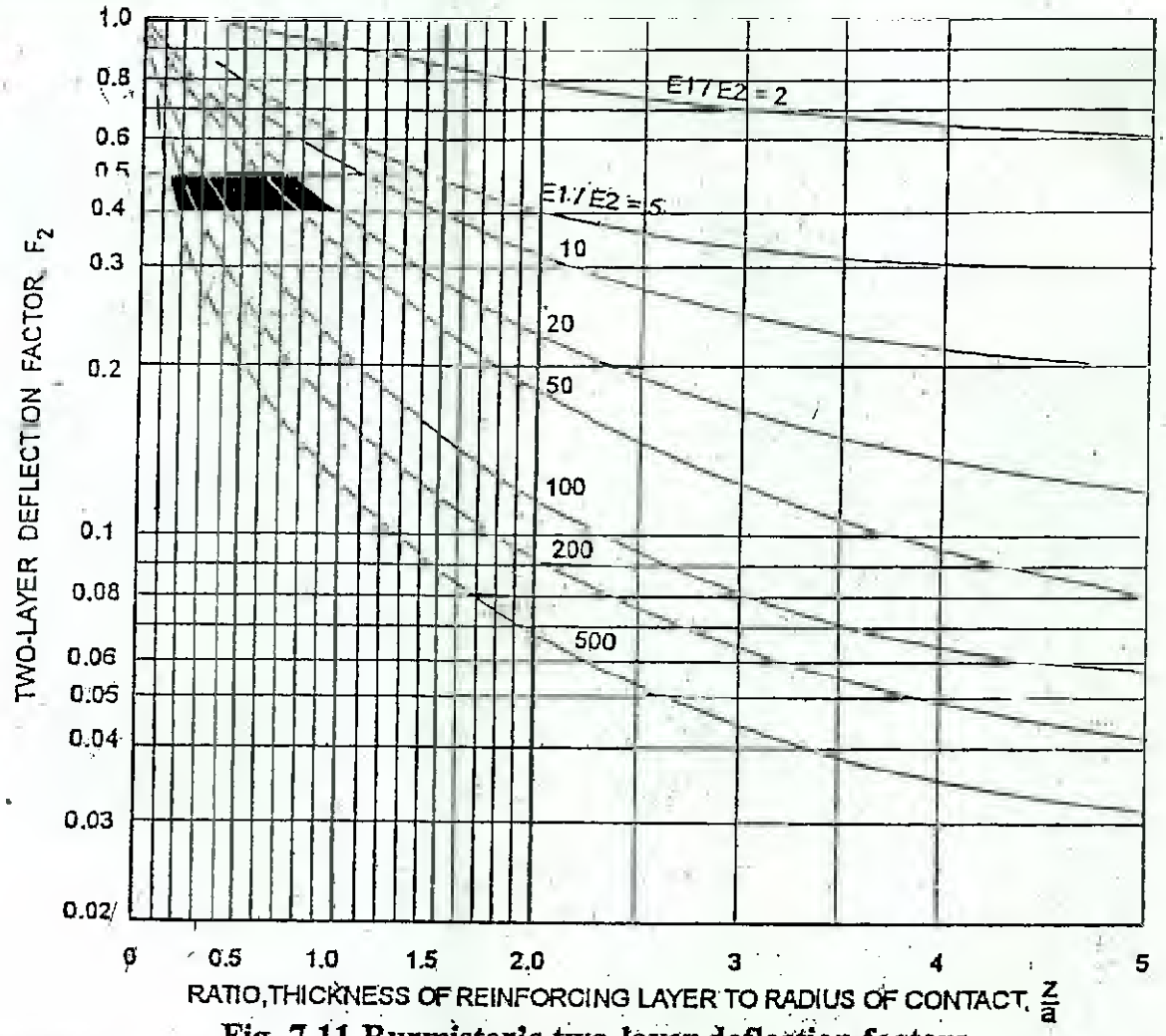


Fig. 7.11 Burmister's two-layer deflection factors

figure 1 Q. 2(b).

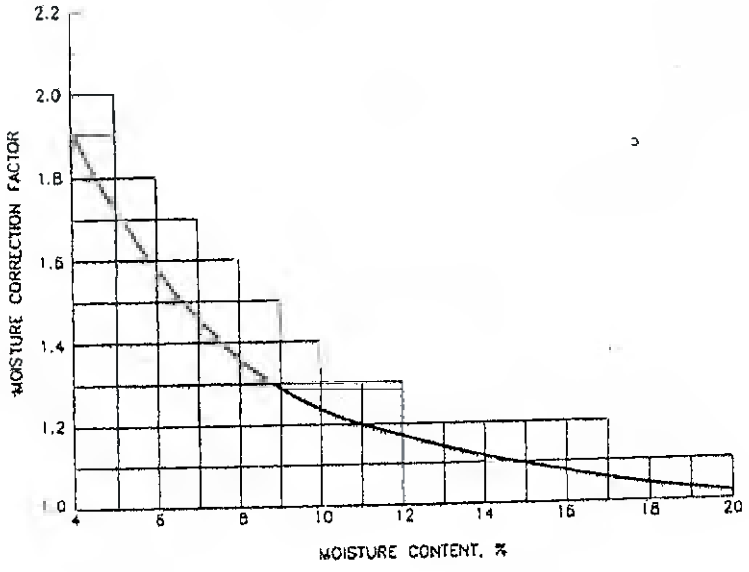
Table 1 Value of Constant C based on Bradbury chart

L/l or W/l	C	L/l or W/l	C
1	0	7	1.030
2	0.040	8	1.077
3	0.175	9	1.080
4	0.440	10	1.075
5	0.720	11	1.050
6	0.920	12	1.00

Table 2 Value of temperature difference between top and bottom of concrete slab

zone	state	Temperature difference between top and bottom fibre		
Thickness of slab		150 mm	200 mm	250 mm
I	Panjab, UP, Uttarakhand, Rajasthan, Hariyana, Gujrat, MP excluding Hilly region	12.5	13.1	14.3
II	Bihar, Jharkhand, WB, Assam, Odisha Excluding Coastal area	15.6	16.4	16.6
III	Maharashtra, Karnataka, South MP, AP, West Odisha, North Tamil Nadu	17.3	19.0	20.3
IV	Kerala, South Tamil Nadu, excluding Hilly and Coastal region	15.0	16.4	17.6
V	Coastal Area Bounded by Hills	14.6	15.8	16.2
VI	Coastal Area Unbounded by Hills	15.5	17.0	19.0

Table (1) and (2) Q. 2(b)



Moisture correction factor for clayey subgrade with high plasticity (PI > 15) for low rainfall areas (Annual rainfall ≤ 1300 mm)

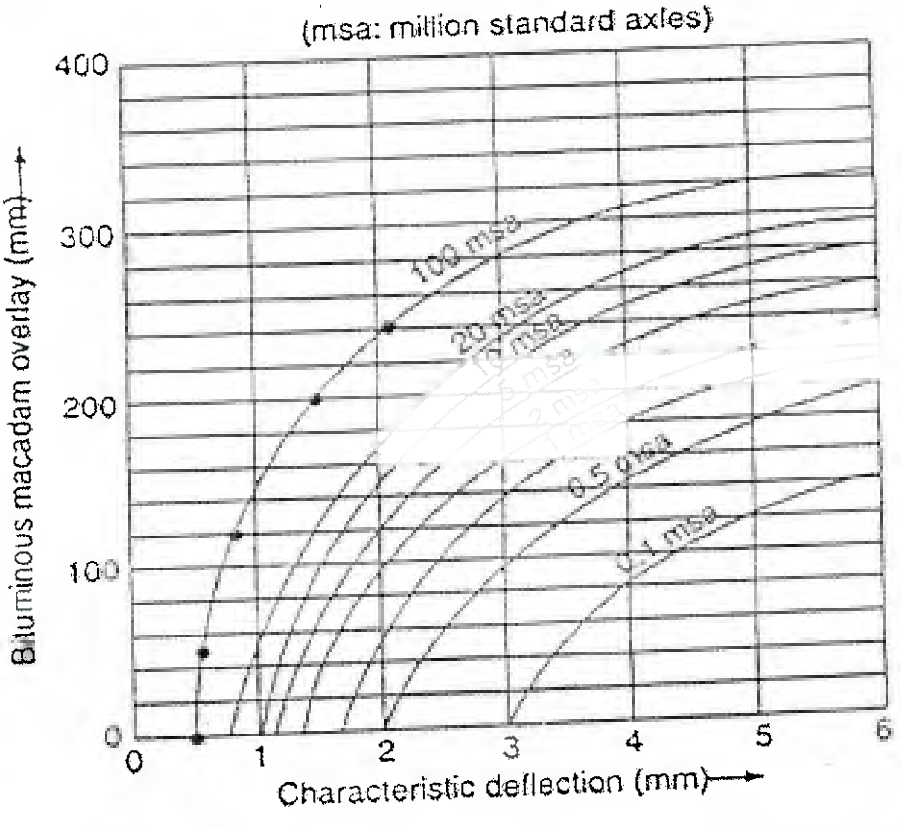


FIG ~~10~~ 2 & 3 *Overlay thickness design curves (IRC: 81–1997)*

Q. 5. (b).

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~~END SEMESTER November 2025~~ / RE - EXAM January 2026

B.E. Civil Sem VII

Program: Civil Engineering **Duration: 3 Hours**

Course Code: PE – BTC - 761 **Maximum Points: 1000**

Course Name: Pavement Design and Construction (Elective) **Semester: VII**

Notes: (i) Question 1 is Compulsory , (ii) Solve any 4 Questions from remaining 6, Questions, (iii) Assume suitable data if required

Q.No.	Questions	Points	CO	BL	Mod. No.
Q.1	Solve any four (5 x 4 = 20)				
a	Draw the neat sketch of different wheel configuration of vehicles plying on road	05	01	01	01
b	Write short notes on vehicle damage factor. State the indicative value of VDF as per IRC guideline.	05	02	01	01
c	State the deflection equation suggested by Burmister for flexible and rigid plate.	05	02	01	02
d	Discuss desirable properties of subgrade soils.	05	02	01	04
e	Enlist at least 10 types of distresses observed in flexible pavements.	05	01	02	07
Q.2.					
a	Discuss original CBR Method (1928) developed by California Division of Highway for flexible pavement design	07	02	02	02
b	Design the tie bar in longitudinal joint of cement concrete pavement having thickness 25 cm and width 3.5 m using the following Density of concrete = 2400 kg/cm^3, Allowable working stress in plain steel bar = 1250 kg/cm^2, Permissible bond stress in concrete = 17.5 kg/cm^2, Coefficient of friction = 1.2	08	03	03	03
c	State advantage of flexible pavement over rigid pavement	05	02	01	03
Q.3.					
a	Discuss the steps involve for construction of lime stabilized subgrade. How will you decide the optimum percentage of lime for stabilization of subgrade.	10	02	02	04
b	Discuss the term Fatigue Failure Criteria and Rutting Failure Criteria. Also, state the equations suggested by IRC for calculation of Fatigue and Rutting life of flexible pavements.	10	02	02	02
Q.4.					
a	What is the necessity of surface drainage system?	08	02	02	06

~~END SEMESTER November 2025~~ / RE - EXAM January 2026

	The surface water from road side is drained to the longitudinal side drain from across half of the bituminous surface of total width 7.0 m. the shoulder and adjoining land on one side of drain is 10 m and on other side of drain the water flow across from the reserved land covered with thin turf having cross slope of 2 %. The width of strip of reserved land from which water contributing to the drainage system is 40 m. The runoff coefficient for pavement surface, shoulder and adjoining land and thin terf is 0.80, 0.30 and 0.38 respectively. The length of stretch of land parallel to road from where water is expected to flow to the side drain is 500 m. Estimate the quantity of runoff discharge. Also, design the longitudinal drainage system. Assume velocity of flow = 0.90 m/sec^2, roughness coefficient (n) = 0.022, period of frequency = 25 years.				
b	Refer graph	12	02	03	06
Q.5.					
a	How will you repair the following types of distresses observed in flexible pavements (i) Pot holes, (ii) Longitudinal cracks	10	03	02	04
b	Discuss desirable properties and gradation of course aggregate and screening material to be use for WBM Type base course construction.	10	03	02	04
Q.6.					
a	Discuss the factors affecting pavement design	08	01	02	01
b	Design the cement concrete pavement for rural road in one of the district of Maharashtra. The road carries atraffic of 120 cvpd. Assume, the modulus of subgrade reaction = 6 kg/cm^3, maximum wheel load expected to pass on the road = 5100 kg and tyre pressure = 7 kg/cm^2	12	02	03	03
Q.7.					
a	Explain the procedure for construction of penetration macadam type base course.	06	03	01	04
b	Classification of pavement design methods	06	02	02	01
c	The total number of commercial vehicles in both the direction for undivided carriageway on last count are 1500. The rate of growth of traffic is 7 % and 3 years required for construction after last count. If the design life of the pavement is 15 years calculate the cumulative number of standard axle during design life Use indicative value of VDF and LDF as per IRC guideline.	08	01	03	02

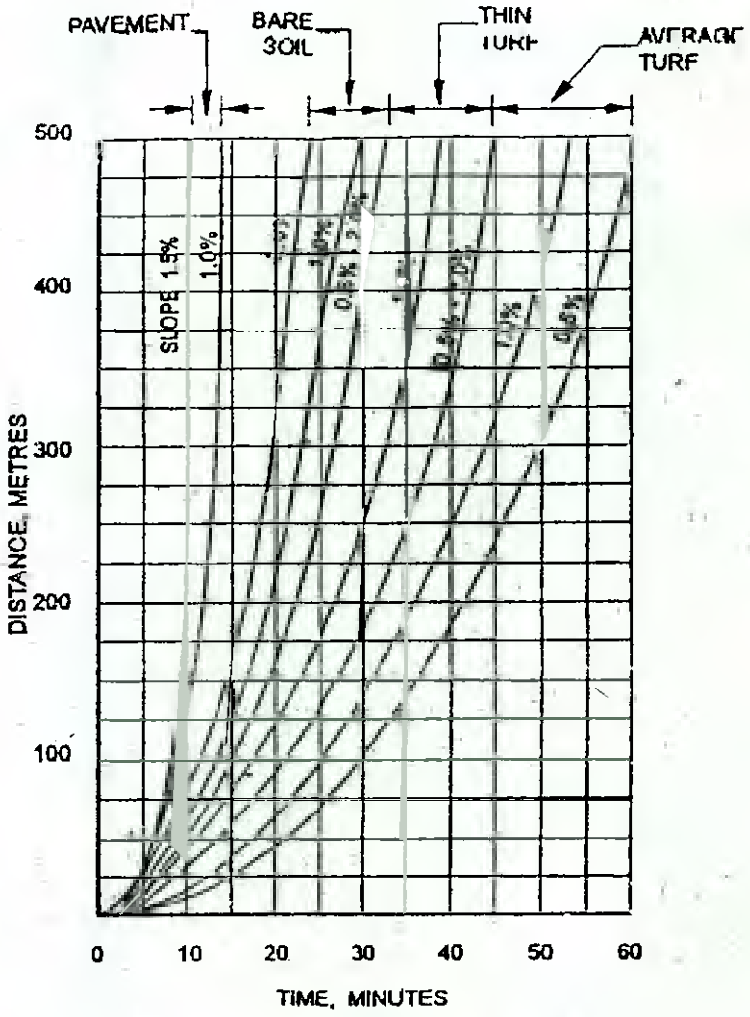
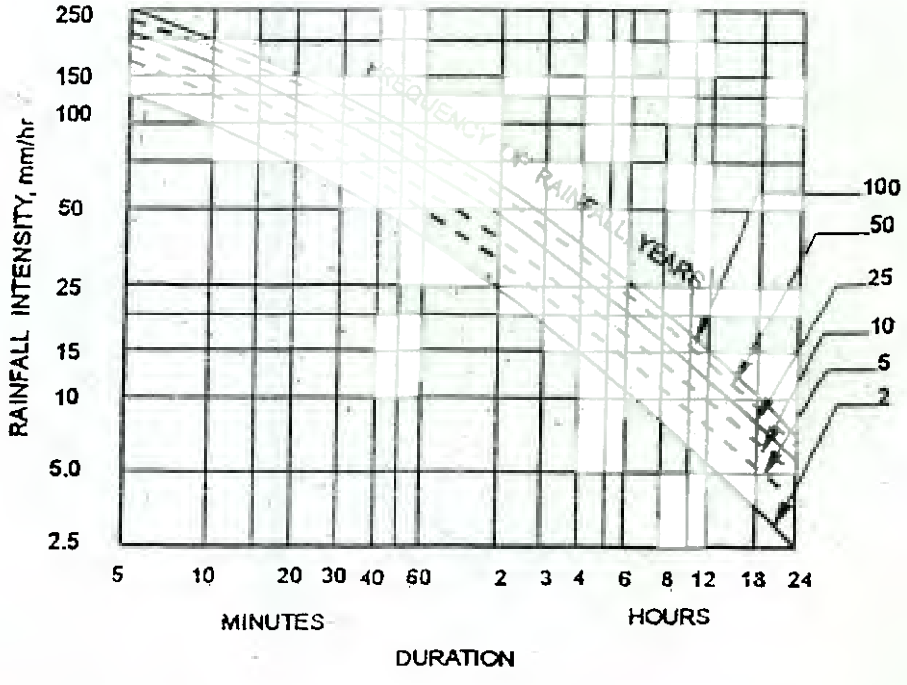


Fig. 11.3 Time of flow to in-let

Q. 4 (b)

Q. 4 (b)



Q. 6. (a).

Table 7.4 Value of Constant C based on Bradbury chart

L/l or W/l	C	L/l or W/l	C
1	0	7	1.030
2	0.040	8	1.077
3	0.175	9	1.080
4	0.440	10	1.075
5	0.720	11	1.050
6	0.920	12	1.00

Table 7.5 Value of temperature difference between top and bottom of concrete slab

zone	state	Temperature difference between top and bottom fibre		
Thickness of slab		150 mm	200 mm	250 mm
I	Panjab, UP, Uttarakhand, Rajasthan, Hariyana, Gujrat, MP excluding Hilly region	12.5	13.1	14.3
II	Bihar, Jharkhand, WB, Assam, Odisha Excluding Coastal area	15.6	16.4	16.6
III	Maharashtra, Karnataka, South MP, AP, West Odisha, North Tamil Nadu	17.3	19.0	20.3
IV	Kerala, South Tamil Nadu, excluding Hilly and Coastal region	15.0	16.4	17.6
V	Coastal Area Bounded by Hills	14.6	15.8	16.2
VI	Coastal Area Unbounded by Hills	15.5	17.0	19.0

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Munshi Nagar Andheri (W) Mumbai 400058
End Semester Exam-SETA
Nov-December 2025 28/11/25

Max. Marks: 50+50 (project+report) **Duration: 2 Hrs**
Class: B. Tech Final Year B.tech Civil Sem VII **Semester: VII**
Name of the Course: Entrepreneurship Innovation and Design thinking Program: B. Tech
Course Code: OE BTC 712

Instructions:

- **Attempt any Five questions out of Seven**
- **Draw neat sketches/diagrams wherever required in the answer sheet and upload**
- **Assume suitable data if necessary and state them clearly**
- Figure on right indicate **maximum points** for the given question, **course outcomes attained, Bloom's Level** and **Performance Indicators**

	Answer the questions	**Pts**	**CO**	**BL**	**M. N**
Q1	Design an MVP for a community-based waste-segregation start-up or cafetaria management or any other startup using design thinking. Your answer should include: • User personas • Empathy findings • MVP description • Metrics to test • Risks/assumptions • How you will iterate after the first test cycle	10	1-2	4	3
Q2	Explain the S-Curve of innovation using the examples of: a) Smartphones replacing feature phones b) Electric vehicles replacing internal combustion vehicles c) Laptops replacing the Desktops d) any other	10	2	3	1-2
Q3	A municipal corporation wants to redesign its public parks to increase usage by senior citizens. Based on the Design thinking (empathize to prototype) cycle: a) Describe an empathy activity you would conduct (e.g., interviews, observation, journey mapping). b) State a clear POV statement. c) Give five ideas generated using any ideation tool (SCAMPER, Mindmap, Brainwrite, etc.). d) Suggest a low-fidelity prototype and how you will test it.	10	3	4	4

Q4	Using the Business Model Canvas, create a model for a start-up offering AI-driven personal health monitoring for college students. Include: • Value proposition • Customer segments • Channels • Revenue streams • Key partners & key activities • Risks & assumptions	10	4	4	5
Q(5)	**Explain in short**	**10**	2,3	4	6
(i)	What are assets, liabilities and equity and where are they used ?Give an equation linking them	05			
(ii)	Consider two companies (a) Screw manufacturer (b) nanoparticle manufacturing for paints. Which of the two is a start up? Which of the two is most likely to be invested by a bank loan and which one will be invested by venture capitalist and why?	05			
Q6	A mobility start-up is developing an app for shared e-bikes in a Tier-2 Indian city. The founders are inspired by Eric Ries' Lean Startup method but are unsure how to apply it in a real-world setting. Using concepts directly from **The Lean Startup**, answer the following: a) Explain how the start-up can use validated learning instead of traditional market research. b) Propose a Minimum Viable Product (MVP) for this e-bike service, ensuring it follows Ries' principles of minimum and viable. c) Define two innovation accounting metrics they should track in the early stage (e.g., actionable metrics vs vanity metrics). d) Suggest one situation in which the company should pivot, and one situation where it should persevere, using the Build–Measure–Learn loop.	10	4	4	7
Q7	[illegible]	10	2,3	4	6
(a)	Explain the meaning of: i) Bootstrapping ii) Sweat equity iii) Crowdfunding				
(b)	The CEO of a mid-sized company is considering an Initial Public Offering (IPO). Discuss: a) Advantages of going public b) Disadvantages and risks c) How going public affects corporate governance and transparency requirements				

ALL THE BEST

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November 28/11/25

END SEMESTER December 2025 / ~~RE - EXAM~~ February 2026

Program: Civil/Mechanical/Electrical Final Year B.Tech

Course Code: OE-BTC713 Sem - VII

Course Name: Disaster Management& Preparedness

Duration: 03 hrs.

Maximum Points: 100

Semester: VII

Notes:

1. Question 1 is compulsory
2. Solve any FOUR from the remaining SIX Questions
3. Accompany your answers with suitable sketches, examples, facts and figures, wherever necessary.
4. Start each main question from new page.

Q.no	Question	Points	CO	BL	Module
1	**Answer the following: [Any 4]**	20	1,2,3,4	1,2	
a	Explain the concepts of hazard, vulnerability and capacity with suitable examples.	5			1
b	Discuss the environmental impacts of cyclones on coastal ecosystems.	5			2
c	Describe the phases of the Disaster Management Cycle with a neat diagram.	5			3
d	Explain how urbanisation increases vulnerability to disasters.	5			4
e	Define hazard probability and explain its significance in Hazard, Vulnerability and Risk Assessment (HVRA).	5			5
2.	**Answer the following:**	20	1,2,3,4	1,2	
	Based on any ONE of the case studies: 1. Dharali floods (Uttarakhand) 2. Kishtwar flash floods (Jammu & Kashmir) 3. Himachal Pradesh floods 4. North-East India floods 5. Punjab floods Answer the following four sub-questions: a. Describe the major causes of the selected flood event. (5) b. Discuss the immediate physical and socio-economic impacts. (5) c. Identify preparedness and early warning measures that could have reduced the losses. (5) d. Suggest sustainable mitigation and long-term recovery strategies. (5)				
3.	**Answer the following:**	20	1,2,3,4	1,2	
a	Explain the classification of natural disasters as per the Peril Classification and hazard Glossary report by Integrated Research on Disaster Risk [IRDR]. Give suitable examples	10			
b	Explain the 'Earth System' and its endogenic and exogenic processes that may lead to hazards / disasters.	10			

END SEMESTER December 2025 / ~~RE - EXAM~~ February 2026

4	**Answer the following:**	**20**	**1,2,3,4**	**1,2**	
a	Define 'Impact Assessment'. State the importance or need to study the disaster impact assessment.	10			2
b	Explain *structural* and *non-structural* mitigation measures for disaster risk reduction with examples	10			3
5	**Answer the following:**	**20**	**1,2,3,4**	**1,2**	
a	Explain how in general disaster impact is measured. Explain the DALYs method of impact assessment.	10			2
b	Explain the impact (physical, psychological, economical, social) of floods on women in a community.	10			3
6	**Answer the following:**	**20**	**1,2,3,4**	**1,2**	
a	State the qualitative methods of risk assessment and explain any one method with a proper example.	10			4
b	Explain the process of hazard mapping and its importance in HVRA	10			5
7	**Answer the following: [Any one]**	**20**	**1,2,3,4**	**1,2**	
a	With reference to the recent cyclones affecting India, explain the causes, structure, consequences, and mitigation measures of tropical cyclones.				1,2,3,4,5
b	Considering the vulnerability of India to earthquakes, explain the causes, structure, consequences, and mitigation measures of tropical cyclones.				1,2,3,4,5

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END SEMESTER December 2025 / ~~RE - EXAM~~ February 2026

Final Year

Program: B.Tech in Civil Engineering - Sem VII

Duration: 3Hours

Course Code: PE-BTC724

Maximum Points:100

Course Name: Prestressed Concrete

Semester: VII

01/12/25

Notes: Use of IS 1343-2012 is allowed. Attempt any 5 main questions.

Q.No.	Questions	Points	CO	BL	Modul No.
1.a)	A prestressed post tensioned beam of cross sectional dimensions as 400mm X 1350mm is subjected to the following design forces at a section: Bending moment : 2200kN-m Shear force : 300kN Design suitable shear reinforcement at the section using following data : Effective depth = 1150mm, fck = 35MPa Area of prestressing steel = 1800mm^2 Characteristic strength of prestressing steel = 1500MPa Effective stress in prestressing steel = 1200MPa The prestressing cable has a straight profile with a constant eccentricity of 500mm. Use Fe415 for untensioned reinforcement. Draw cross sectional details showing all reinforcements.	10	2	4	03
1.b)	Pretensioned box girder of overall section 1.55mX1.55m and a uniform wall thickness of 350mm is pretensioned by wires of area 2500mm^2 located at an effective depth of 1250mm. If fck = 40MPa, characteristic strength of wires = 1600MPa, calculate the ultimate flexural strength of the box girder.	10	2	3	03
2.a)	Design the end block reinforcement for a post tensioned beam, prestressed using 3 cables each carrying a force of 1600kN with following data : Cross section dimensions = 300mmX900mm Side of anchor plate = 150mm Strength of concrete at transfer = 40MPa fck = 50MPa The anchor plate centres are located at 150mm, 450mm, 750mm from the top edge of the beam respectively. Design suitable reinforcement for the end zone using Fe415. Sketch the reinforcement details	10	03,04	4	04
2.b)	Evaluate the stresses in a prestressed section having cross section 400x800mm size and span = 5m. The beam is a cantilever and has effective prestressing force 700kN. The eccentricity of prestressing is is 250mm above the centroid at support and concentric at free end. Evaluate the stresses using : Stress approach and force approach	10	1	2	02

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END SEMESTER December 2025 / ~~RE – EXAM~~ February 2026

<table>
<tr><td>3.a)</td><td>A simply supported post tensioned beam of span 20m with 3 cables having a cross section of 320mmX 850mm is successively tensioned from a single end in the order of cables 1-2-3.
<table>
<tr><td></td><td>Profile</td><td>Eccentricity at midspan</td><td>Eccentricity at support</td></tr>
<tr><td>Cable 1</td><td>Parabolic</td><td>125mm (below N.A.)</td><td>125mm (above N.A)</td></tr>
<tr><td>Cable 2</td><td>Parabolic</td><td>250mm(below N.A.)</td><td>0mm</td></tr>
<tr><td>Cable 3</td><td>Straight</td><td>300mm(below NA)</td><td>300mm(below NA)</td></tr>
</table>
Each cable has a cross section area of 250mm^2 and an initial tension of 1000MPa. Co-efficient for friction = 0.25; co-efficient for wave effect = 0.0015/m. Age of concrete at transfer of prestress = 28days. Anchorage slip = 2mm. Es = 210kN/mm^2,Ec = 30kN/mm^2.Relative humidity = 50% Calculate the % losses due to elastic shortening, creep, friction and anchorage slip</td><td>15</td><td>1</td><td>3</td><td>02</td></tr>
<tr><td>3.b)</td><td>Explain the in detail the need of high strength materials in prestressed concrete structures.</td><td>5</td><td>1</td><td>2</td><td>01</td></tr>
<tr><td>4.</td><td>Design a Type 1 post tensioned girder (simply supported) for the following data :
Effective span = 10m
Live load = 20kN/m
fck = 40MPa
fci = 35MPa
Es = 210kN/mm^2
Ec = 31.6 kN/mm^2
Loss = 20%
Calculate the size of section required, prestressing force, eccentricity with safe cable zone. Draw neat sketch of the cable profile</td><td>20</td><td>2</td><td>4</td><td>05</td></tr>
<tr><td>5.a)</td><td>A 12m span simply supported composite beam consists of 300mmX600mm precast stem and a cast-in-situ flange of 600mmX250mm. The stem is a post tensioned unit subjected to an initial prestressing force of 850kN. Loss =20%. The tendons are provided at 125mm from the soffit of stem. The beam has to support a live load of 15kN/m. Determine the resultant stress distribution in the beam if the beam is i) Propped ii)Unpropped. Sketch the stress variations.</td><td>15</td><td>1</td><td>3</td><td>06</td></tr>
<tr><td>5.b)</td><td>Explain propped and unpropped method of composite construction with sketches. Explain the suitability of each method</td><td>05</td><td>1</td><td>2</td><td>06</td></tr>
</table>

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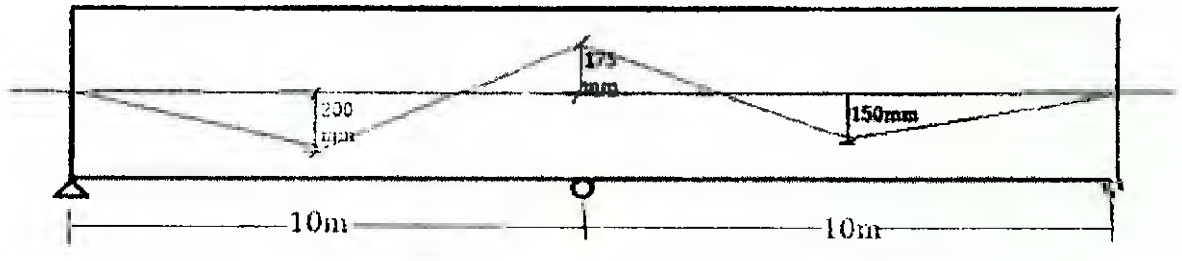
END SEMESTER December 2025 / ~~RE – EXAM~~ February 2026

6.a)	A simply supported prestressed beam of cross section 450mmX700mm has a parabolic cable with eccentric 50mm above N.A at supports and 200mm below N.A at midspan. It carries a live load of 5kN/m. The area of cable is 400mm^2 and it is initially tensioned to 1250N/mm^2. Loss =20% Calculate the : i) Instantaneous deflection due to dead load + prestressing force ii) Long term deflection if the creep coefficient is 1.6 Es=210kN/mm^2; Ec =35kN/mm^2	12	1	3	03
6.b)	Explain the following in detail : i) Internal and external prestressing ii) Uniaxial, biaxial and multi-axial prestressing	08	01	02	01
7.	The cable profile for a two span continuous beam is as shown in figure below. The prestressing force is 800kN. The beam carries a UDL of 20kN/m on full span and point loads = 60kN at midspan of each span respectively. If the cross section of beam is 400x1000mm, calculate the stresses at the continuous support.	20	3	4	07



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END SEMESTER NOV- 2025/~~RE-EXAM~~ JAN 2026

Final Year B. tech **SET-II**

Program: Civil Engineering Sem VII **Duration: 3 hrs.**

Course Code: PE-BTC-743 **Maximum Points: 100**

Course Name: Industrial Wastewater Treatment **Semester: VII**

01/12/25

Notes:

1. Q.1 is compulsory and attempt any 4 out of remaining
2. Illustrate answer with neat sketches wherever required.
3. Make suitable assumptions where necessary and state them clearly.

Q.No.	Questions	Points	BL	CO	Module No
1.	Write a short note on : (Any four) 1. Factors affecting to stream purification process. 2. Types of neutralization process in Industrial wastewater treatment. 3. Benefits of Industrial wastewater treatment. 4. Free Water Surface (FWS) Vs Vegetated Submerged Bed (VSB) 5. Production process of Paper & Pulp Industry 6. Dewatering of Industrial sludge.	20	1	1-3	1-7
2	*A.* What is Minimata incident? Mention steps taken by Japan to control mercury pollution after Minamata. B. Define: Equalization. Also discuss the purpose and flow equalization of processes for industrial waste in detail. A city has population of 2 lakh and it has to be supplied at the rate of 240 liters per person per day. The hourly variation in demand is given in the table. Find out the capacity of the distribution reservoir to be provided for balancing the variable demand against a constant rate of pumping: i. When the pumping is done for all 24 hours. ii. When pumping is done from 6 am to 11 am and then 2 pm to 9 pm.	08+12	2	1-3	1,4

		Period of days in hours	0 to 4	4 to 8	8 to 12	12 to 16	16 to 20	20 to 24				
		% of average hourly flow	16	70	190	88	166	70				
3	A. Define: Sampling Analysis of Wastewater. Explain in detail the methods of wastewater sampling. Make a list of records included in sampler logs and sample label. B. Discuss: Stream sanitation and Determine D.O. deficit profile for 80 km from the following data: Velocity of mix = 0.2 m/sec, R'=0.4, K' = 0.23. River: Q=0.7m3/s; BOD5@20°C =2 mg/l; T=21 °C; DO=8mg/l Flow from STP: Q=11000m3/d; BOD5@20°C =40 mg/l; T=26°C; DO=2mg/l							12+ 08	3	1-3	2,3
4	A. Define neutralization in industrial wastewater treatment. Also discuss the necessity and processes for industrial waste in detail. Make a list of chemicals used in neutralization of industrial wastewater treatment in ETP. B. Why industrial wastewater is considered more harmful than domestic wastewater?							12+ 08	2	1,2	3,5
5	A. Explain eutrophication and describe its causes, types, and ecological impacts & control with a neat diagram. B. Discuss biological treatment of industrial wastewater using Moving Bed Biofilm Reactor (MBBR).							12+ 08	3	2,4	4
6	A. Define: Membrane Bioreactor (MBR). Explain the working principle & characteristics of a Membrane Bioreactor (MBR) with advantages and disadvantages. Describe membrane fouling, its causes, and methods of fouling control. B. Discuss any four types of membrane filtration techniques on the basis of their pore size, pressure, and types of material removed.							12+ 08	2	2,4	4
7	A. Explain the complete flow diagram of Textile industry manufacturing process, wastewater characteristics, and wastewater sources & process flow chart of ETP for reuse and land application. B. Discuss the manufacturing process, wastewater sources, and wastewater characteristics for tannery industry in detail.							12+ 08	2	1-3	6

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~~END SEMESTER NOV- 2025~~/RE-EXAM JAN 2026 8/1/26

SET-I

Program: Civil Engineering B. Tech Sem VII

Course Code: PE-BTC-743

Course Name: Industrial Wastewater Treatment

Duration: 3 hrs.

Maximum Points: 100

Semester: VII

Notes:

1. Q.1 is compulsory and attempt any 4 out of remaining
2. Illustrate answer with neat sketches wherever required.
3. Make suitable assumptions where necessary and state them clearly.

Q.No.	Questions	Points	BL	CO	Module No
1.	Write a short note on : (Any four) 1. Importance of flow equalization of Industrial waste. 2. Sample Label for industrial wastewater. 3. Make a list of chemicals required in neutralization tank. 4. Treatment Flow sheet for Paper & Pulp Industry. 5. Constructed Wetlands system for Industrial waste. 6. Digestion of Industrial sludge.	20	1	1-3	1-7
2	A. What do you mean by wastewater & its types? Analyze the government and industry response to the Minamata incident. Discuss the lessons learnt from the Minamata Tragedy. B. Explain in detail the methods of wastewater sampling with various physical, chemical, and biological characteristics of wastewater.	12+08	2	1-3	1
3	A. Define: Treatability Study. Also discuss the types and phases of treatability Study in industrial wastewater treatment. B. Discuss the self-purification of stream and Determine D.O. deficit profile for 60 km from the following data: Velocity of mix = 0.3 m/sec, R'=0.4, K' = 0.23. River | Flow from STP Q=0.8m3/s | Q=14000m3/d BOD5@20°C =3.5 mg/l | BOD5@20°C =22 mg/l T=19 °C | T=24°C DO=9mg/l | DO=1.5mg/l	12 +08	3	1-3	2,3
4	A. Discuss the differences between domestic and industrial wastewater in detail. B. Define: Equalization of industrial waste. The hourly flow	8+12	2	1-3	2,5

<table>
<tr><td></td><td>of wastewater flow at ETP is tabulated below, determine the required volume of equalization tank using graphical and analytical method.
<table>
<tr><th>Time (Hr)</th><th>Q (m3/s)</th><th>X (BOD) mg/l</th><th>Time (Hr)</th><th>Q (m3/s)</th><th>X (BOD) mg/l</th></tr>
<tr><td>1</td><td>0.270</td><td>175</td><td>13</td><td>0.420</td><td>280</td></tr>
<tr><td>2</td><td>0.22</td><td>200</td><td>14</td><td>0.405</td><td>305</td></tr>
<tr><td>3</td><td>0.164</td><td>215</td><td>15</td><td>0.380</td><td>245</td></tr>
<tr><td>4</td><td>0.12</td><td>220</td><td>16</td><td>0.35</td><td>180</td></tr>
<tr><td>5</td><td>0.105</td><td>220</td><td>17</td><td>0.325</td><td>150</td></tr>
<tr><td>6</td><td>0.1</td><td>210</td><td>18</td><td>0.325</td><td>115</td></tr>
<tr><td>7</td><td>0.12</td><td>200</td><td>19</td><td>0.33</td><td>75</td></tr>
<tr><td>8</td><td>0.205</td><td>190</td><td>20</td><td>0.365</td><td>50</td></tr>
<tr><td>9</td><td>0.355</td><td>180</td><td>21</td><td>0.4</td><td>45</td></tr>
<tr><td>10</td><td>0.41</td><td>170</td><td>22</td><td>0.345</td><td>125</td></tr>
<tr><td>11</td><td>0.425</td><td>160</td><td>23</td><td>0.35</td><td>130</td></tr>
<tr><td>12</td><td>0.40</td><td>210</td><td>24</td><td>0.34</td><td>135</td></tr>
</table></td><td></td><td></td><td></td><td></td></tr>
<tr><td>5</td><td>A. Define: Stream Sanitation. Describe in detail the zones of pollution. Explain the factors affecting self-purification of river (any two)
B. Discuss the working principle of rotating biological contactor (RBC) with advantages & disadvantages.</td><td>12 +08</td><td>3</td><td>1,2</td><td>2,3,4</td></tr>
<tr><td>6</td><td>A. Discuss the methods that help in reducing the strength of industrial wastewater, with suitable examples
B. Explain the working principle, advantages, and limitations of the SBR reactor.</td><td>12 +08</td><td>2</td><td>2,4</td><td>2,4</td></tr>
<tr><td>7</td><td>A. Explain the complete flow diagram of sugar industry manufacturing process, wastewater sources, wastewater characteristics & process flow chart of ETP for reuse and land application.
B. Discuss the manufacturing process, and treatment flow sheet for tannery industry in detail.</td><td>12 +08</td><td>2</td><td>1-3</td><td>6</td></tr>
</table>

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END SEMESTER November 2025 / ~~RE – EXAM~~ January 2026 (R22)

Program: Civil Engineering Final Year B.tech Civil – Sem VII **Duration: 3 Hours**

Course Code: PE-BTE773 **Maximum Points: 100**

Course Name: PE-IV: Ground Improvement Techniques **Semester: VII**

01/12/25

Note:

1. **Question 1 is compulsory.**
2. **Attempt any four out of remaining six questions**
3. Write units everywhere.
4. Make reasonable assumptions where required and state them clearly.

Q. No.		Questions	Points	CO	BL	Module No.
1	a.	Road extension is planned along the crest of an existing slope. A geotechnical engineer has recommended the use of geosynthetics to reinforce the slope to make it steeper. Discuss the advantages and disadvantages of this ground improvement solution.	5	2, 4	2	5
	b.	Differentiate between compaction grouting and jet grouting	5	1	2	4
	c.	Discuss the possible reasons ground improvement techniques may be required for any project.	5	4	2	1
	d.	Site investigation at a proposed construction shows soil with 30% fines. The proposed construction requires compaction of the soil. Suggest a suitable equipment to compact the soil. Calculate the production rate of the equipment if its width is 0.8 m, rolling speed is 3 kmph, average efficiency factor is 0.8, lift thickness is 0.3 m, and 6 passes are recommended.	5	1, 3, 4	3	2, 7
2	a.	A hotel development project (G+8) requires a 10 m deep excavation for its foundation. Subsurface investigations show 5 m of cemented sand underlain by disintegrated rock. No groundwater table is encountered within the excavation depth. Trial excavations remain stable up to 3 m, but beyond that depth, the cut begins to collapse. Based on the site conditions, soil nails or ground anchors are being considered for excavation stabilization. Compare the two techniques and recommend which is suitable for the given site. Justify your answer by discussing advantages of the system used and limitations/challenges of the other.	10	1, 3, 4	3	6,7
2	b.	A storage tank foundation is planned on a soft clay deposit having the following soil profile and properties: Soft clay up to 12 m depth, GWT at GS, γ_{sat} = 17.6 kN/m^3, average undrained shear strength: 20 kPa, k_0 = 1, drained friction angle: 24°. Assume N_c = 9 for clay. The proposed stone columns are to be designed using the following data: ϕ_{agg} = 42°, diameter of 0.9m	10	1	3	3

END SEMESTER November 2025 / ~~RE - EXAM~~ January 2026 (R22)

2		with spacing of 2.25 m in triangular pattern. Determine the FOS if the tank exerts a load of 1000 kN on the soil. See page 3 for equations from IS 15284 (Part 1): 2003, R2018				
3	a.	What is shotcreting? Differentiate between wet mix and dry mix process of shotcreting. For the NHSRCL site, which method do you think was used for the tunnel crown? Justify your answer.	10	1, 3	2	6
	b.	An intern in your company is assigned the task of designing a reinforced earth wall. What are various checks you will ask him/her to do to ensure no internal failure takes place? Illustrate with neat sketches.	10	2	3	5
4	a.	Describe the advantages of a well point system.	5	1	2	3
	b.	Intelligent compaction is the emerging trend in compaction of soil. Explain briefly and discuss why it is not widely used in Indian construction industry	5	1, 3	3	2
	c.	A municipal water-supply project involves constructing a 60 million litre underground reservoir in a congested urban area. The subsurface profile consists of loose to medium-dense clean sand from 1.5 m to 6 m depth, underlain by stiff clay. Groundwater is encountered at 2.2 m below ground level. The excavation will be located within 3 m of a 40-year-old masonry pump house and an operational 600-mm water pipeline. Ground improvement is required to stabilize the loose sand layer and to minimize ground loss during excavation. As a geotechnical engineer, would you recommend permeation grouting or compaction grouting? Justify your answer based on the presence of groundwater, influence of nearby structures, and clear advantages of one method over the other for this site.	10	1, 4	3	4, 7
5	a.	What is pre-loading? Discuss its advantages and disadvantages. A 20 m thick NC clay layer having single drainage condition has existing effective overburden pressure of 360 kPa. The proposed construction is expected to further add 180 kPa to the centre of the clay. If it required to accelerate the rate of consolidation and restrict 50% consolidation to 6 months, determine the height of surcharge required if density of engineered fill is 18 kN/m^3. Is this solution acceptable from a practical perspective? If not, provide recommendations for a feasible solution. See page 4.	10	1	2, 3	3
	b.	Discuss the suitability of using dynamic compaction at a site for densification. Discuss the advantages and disadvantages of the technique. Explain the emerging trend of rapid impact dynamic compaction and challenges in its implementation.	10	3	2	2
6	a.	Explain Karst region and marine clays and why they are considered as problematic from perspective of construction.	5	3	2	1

END SEMESTER November 2025 / ~~RE – EXAM~~ January 2026 (R22)

6	b.	Discuss how ground improvement techniques can lead to sustainable solutions	5	3	2	1
	c.	Illustrate with a neat sketch the soil beneath a shallow footing reinforced using geosynthetics. Describe the various factors that affect the bearing capacity ratio. Enlist the possible modes of failure of the reinforced soil.	10	2	3	5
7	a.	Sketch a typical reinforced earth wall and label its important components. Prepare a step-wise plan for a contractor for its construction.	10	2	2	5
	c.	A proposed construction site has 18 m of clay which was tested in the lab. The vertical coefficient of consolidation was determined as 1.15×10^{-7} m^2/s and horizontal coefficient may be taken as an average of 1.55 times of vertical. Design the PVDs assuming 90% consolidation should be completed within 18 months. TECHDRAIN TD3520F: 4 mm x 100 mm is easily available in the market. Contractors assure these give soil disturbance factor as 1.04 and well resistance factor = 0.02. See equations below.	10	1, 4	3	3

Equations:

$$\sigma_v = (\sigma_{ro} + 4C_u)\,Kp_{col}$$

$$F(n) = \ln\left(\frac{d_e}{d_w}\right) - 0.75$$

$$Q_1 = (\sigma_v\, \pi/4\, D^2)/2$$

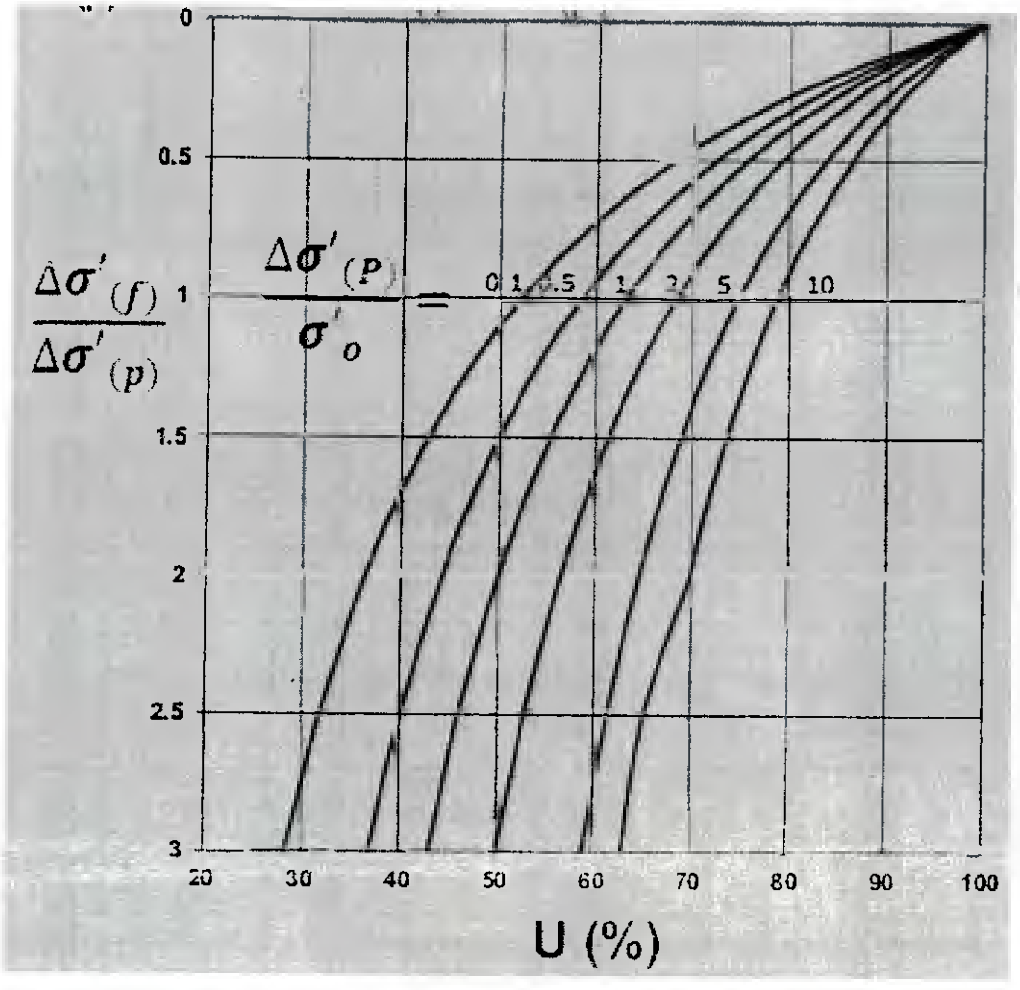
$$t = \frac{d_e^2}{8c_h}\left[F(n) + F_s + F_r\right]\ln\left[\frac{1}{1-\overline{U}_h}\right]$$

$$\Delta\sigma_{ro} = \frac{q_{safe}}{3}\,(1 + 2K_0)$$

$$Q_2 = \frac{Kp_{col}\,\Delta\sigma_{ro}\,A_s}{2}$$

$$Q_3 = q_{safe}\,A_g$$

END SEMESTER November 2025 / ~~RE – EXAM~~ January 2026 (R22)



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Sardar Patel College of Engineering

(A Government Aided Autonomous Institute)

Munshi Nagar, Andheri (West), Mumbai – 400058

END SEM/~~RE-EXAM EXA~~MINATION NOV/DEC 2025-26

Program: Civil Engineering Final Year B.Tech **Duration: 3 hr.**

Course Code: PE-BTC753 Civil - Sem VII **Maximum Points: 100**

Course Name: Engineering Risk and Uncertainty **Semester: VII**

01/12/25

Instructions:

1. **Question no. 1 is compulsory.**
2. Attempt any 4 questions out of remaining 6 questions
3. Neat diagrams must be drawn wherever necessary.
4. Assume Suitable data if necessary and state it clearly

Q. No.	Questions	Points	CO	BL	Mod
1	It is proposed to execute BOT highway project with investment of ₹ 600 cr	20	4	4	3,5 &7
	The concession period is 5 years. Annual gross toll revenue is ₹120 cr. ₹140 cr. ₹160 cr. ₹180 cr. ₹200 cr. From 1st to 5th year. Operation and maintenance cost is ₹21 cr. ₹23 cr. ₹25 cr. ₹27 cr. ₹29 cr. From 1st to 5th year. Discount rate is 10%. i) Compare the project based on Present value (PV), future value (FV), Net Present value (NPV) and Internal Rate of Return (IRR) methods. ii) Discuss the practical interpretation and risk management based on PV, FV, NPV and IRR.				
2a	It is proposed to construct a fly over in a Mumbai.	10	1&2	3	1,2
	Discuss in detail different risks likely to occur over the life cycle of a flyover construction.				
2b	Prepare a risk register for the flyover construction project.	10	2&3	3	2,3
3a	Jay Shankar plumbing and heating maintains a stock of 40 liter hot water heaters that it sells to and install for homeowners.	10	4	3	6
	Owner of Jay Shankar plumbing likes the idea of having a large supply at hand to meet customer demand, but he also recognizes that it is expensive to do so. He examines hot water heater sales over the past 50 weeks and notes the data given below				

Hot water heater sales per week	Number of weeks this number was sold
4	6
5	5
6	9
7	12
8	8
9	7
10	3
Total	50

a) If Jay Shankar plumbing maintains a constant supply of 8 hot water heaters in any given week, how many times will he be out of stock during a 20 week simulation? Use random numbers as:10,24,03,32,23,59,95,34,34,51,08,48,66,97,03,96,46,74,77,44.
b) What is the average number of sales per week (including stock outs) over the 20 weeks period?
c) Using an analytic non simulation technique, what is expected number of sales per week? Interpret the result.

3b	Discuss the role of insurance in the context of risk management.	10	1	2	2
4a	A construction chemical company is planning to introduce a	8	4	3	4 &5

new product with new compositions to replace existing product at a large increase in price (S1) or moderate change in composition of the existing product with new packaging at a small increase in price (S2) or a small change in composition of the existing product with a negligible increase in price (S3). The three states of the nature are: (i) high increase in sales (N1), (ii) no change in sales (N2) and (iii) decrease in sales (N3). The marketing department of the company worked out the payoffs in terms of yearly net profits for each course of action for these events as

State of nature	Courses of action		
	S1	S2	S3
N1	7,00,000	5,00,000	3,00,000
N2	3,00,000	4,50,000	3,00,000
N3	1,50,000	0,00,000	3,00,000

State which strategy should the company choose on the basis of

i) Maximin criterion
ii) Maximax criterion
iii) Equal likely decision (Laplace) criterion
iv) Minimax Regret Criterion

4b	It is proposed to carry out filling work for the construction of earthen dam embankment. Discuss FMEA process and prepare the template for the same along with activities.	12	2&3	3	3
5a	A financial advisor has recommended two possible mutual funds for investment: Fund A and Fund B.	10	3	3	5

The return that will be achieved by each of these depends on whether the economy is good, fair or poor.

	State of Nature (₹)		
Investment	Good Economy	Fair Economy	Poor Economy
Fund A	10,000	2000	-5000
Fund B	6,000	4000	0
Probability	0.2	0.3	0.5

(a) Draw decision tree to represent this situation.
(b) Perform the necessary calculations to determine which of two mutual funds is better. Which one should you choose to maximize the expected value?
(c) Suppose there is a question about the return of Fund A in a good economy. It could be higher or lower than ₹ 10,000. What value for this would cause a person to be indifferent between Fund A and Fund B.

5b	The transactions of two mutually exclusive projects are shown as below	10	3	4	4&5

Description	Project A	Project B
Initial cost ₹	₹ 4,00,000.0	₹ 8,00,000.0
Useful life in years	5	5
Salvage value at the end of life ₹	₹ 2,00,000.0	₹5,50,000.0
Annual maintenance cost ₹	₹ 80,000.0	Nil

At 15% interest rate and rate of inflation of 5% per year find the best project using future worth method of comparison.

6a	Differentiate a) Risk and uncertainty in the context of construction project. b) Implicit & Explicit Risks. c) FMEA and FMECA	12	1,2 &3	2	1,2 &3
6b	Discuss the advantages of HAM over PPP model. What is typical feature of HAM developed by Govt. of Maharashtra	8	2	2	7
7a	Discuss the typical risk in flexible pavement road construction work and their mitigation measures.	10	3	3	1,2 &3
7b	It is proposed to develop a crisis management plan for a 50 storied building construction project in a Mumbai city. Discuss it in detail.	10	2 &3	3	2

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~~END SEM~~/RE-EXAM EXAMINATION ~~NOV/DEC 2025~~-26

Program: Civil Engineering Sem VII **Duration: 3 hr.**

Course Code: PE-BTC752 **Maximum Points: 100**

Course Name: Engineering Risk and Uncertainty **Semester: VII**

8/11/26

Instructions:

1. **Question no. 1 is compulsory.**
2. Attempt any 4 questions out of remaining 6 questions
3. Neat diagrams must be drawn wherever necessary.
4. Assume Suitable data if necessary and state it clearly

Q. No.	Questions	Points	CO	BL	Mod
1	There are 3 BOT highway projects as Project A, Project B and Project C details are as mentioned below.	20	4	4	3,5 &7

Parameter	Project A	Project B	Project C
Initial Investment in lakhs ₹	1000.0	1200.0	1500.0
Annual net cash flows in lakhs ₹	300.0	360.0	420.0
Project life in (Years)	5	5	5
Discount Rate % (base rate)	10	10	10

i) Compare the above project based on NPV, IRR, BCR and PI method.
ii) Carry out the sensitivity analysis for 8% and 12% discount rate.
iii) If there is cost overrun by 10% and 20% check the sensitivity for NPV.
iv) If there is time overrun by 1 year and 2 year.

2a	It is proposed to construct a storm water drain on existing rigid pavement road in Andheri (West) Mumbai.	10	1&2	3	1,2
	Discuss in detail different risks likely to occur over the life cycle of a storm water drain construction.				
2b	Prepare a risk register for a storm water drain construction project.	10	2&3	3	2,3
3a	A company has received quotes for its recent advertisement for the purchase of a sophisticated paver block machine. The data are as per the estimate in today's rupee value.	10	CO1	BL3	2&3

	Machine X	Machine Y
Purchase price (Rs.)	18,00,000	23,00,000
Machine life (years)	8	8
Salvage value at the end of machine life (Rs.)	2,50,000	3,50,000
Annual operating & maintenance cost (Rs.)	3,00,000	2,50,000

Assuming an average annual inflation of 6% for the next five years, determine the best machine based on the present worth method. Interest rate is 16%, compounded annually

3b	It is proposed to carry out excavation work for storm water drain on existing rigid pavement road in Andheri (West) Mumbai. Discuss FMEA process and prepare the template for the same along with activities.	10	2&3	3	3
4a	Discuss in detail HAM over PPP model. Differentiate them in the context of risk management.	10	3	2	7
4b	If the annual maintenance cost of a major bridge is ₹ 20,000. What is the present worth of this cost incurred for 10 years after the opening of the bridge, if the discount rate is 12% per annum?	4	4	3	5
4c	Define a residual risk. Discuss the same in the context of high rise building construction project.	6	2	2	2
5a	Shri Krishna has been thinking about starting his own independent tile showroom.	10	4	3	5

The problem is to decide how large the tile show room should be. The annual returns will depend on both the size of tile showroom and number of marketing factors. After a careful analysis Shri Krishna developed the following table:

Size of Tile showroom	Good Market(₹)	Fair Market (₹)	Poor market (₹)
Small (S)	50,000.0	20,000.0	-10,000.0
Medium (M)	70,000.0	35,000.0	-25,000.0
Large (L)	90,000.0	35,000.0	-45,000.0
Very large (VL)	2,00,000.0	25,000.0	-1,20,000.0

a) What is the maximax decision?
b) What is the maximin decision?
c) What is equally likely decision?
d) What is the criterion of realism? Use α=0.8
e) Develop an opportunity loss table and determine the minmax decision.

5b	Describe the typical risk events in the highway construction project, discuss their impact on project and relevant insurance risk cover.	10	3	2	1&2
6a	A major rehabilitation of a pavement will be done 10 years from now at a cost of ₹ 75 lakhs.	10	4	4	4&5

(i) What should be the series of uniform payments that must be set apart to accumulate this amount, if the interest at is 9% per annum?

(ii) Check the sensitivity for interest rate at is 8% per annum and 10% per annum.

(iii) If the interest rate fluctuates between 7% and 11% over the next 10 years, what is the range of uniform annual payments required to ensure ₹75 lakhs is available?

6b	It is proposed to have construction of high rise building in a place like Mumbai along with basement, glass façade etc.2	10	2	3	1,2&3
	Enlist the various risks likely to occur during construction stage. Discuss risk response planning.				
7a	It is proposed to construct a bridge across Thane creek. (i) Identify the different risk likely to occur during construction stage.	10	3&4	4	1,2&3

	(ii) Develop risk response plan. (iii) Which insurance cover you consider in your plan.				
7b	A company keeps stocks of a plumbing fitting. Previous experience indicates the daily demand as given below	10	4	4	6

Daily Demand	0	10	20	30	40	50
Probability	0.01	0.20	0.15	0.50	0.12	0.02

Considering sequence of random numbers 48,78,19,51,56,77,15,14,68,09 simulate the demand for next 10 days.

Find out the stock situation if the owner of the company decides to make 30 fittings every day.

Also estimate the daily average demand for the fittings on basis of simulated data.