Bharatiya Vidya Bhavan's

Sardar Patel College of Engineering

(A Government Aided Autonomous Institute)

Munshi Nagar, Andheri (West), Mumbai – 400058.

End Semester Exam, DEC2023

Max. Marks:100 M.Tech (Str. Engg) Sem I **Duration: 3hrs**

MTech Programme SEM-1	Construction Management	Structural Engineering	Power Electronics and Power Systems
Course Code of Research Methodology	PC-MTCM103	PC-MTSE103	PC-MTPX103

Instructions:

1. Question No 1 is compulsory.
2. Attempt any four questions out of remaining six.
3. Draw neat diagrams
4. Assume suitable data if necessary
5. Use of Standard Tables permitted

Question No		Max Marks	CO	Module
Q1A	What are the research avenues in your branch of engineering? What may be research approach and methodology to deal with those? Draw research methodology flowchart to showcase. Explain how to conduct the literature survey in carrying out research? What is the difference between Invention, Discovery and Research?	10	CO1	M1
Q1B	Explain the Mechanics of Writing a Research Report with appropriate examples. What are the contents of research report? What precautions are to be taken while writing the research report? What ethical practices are expected to be adopted? State different research approaches utilized in industries and Conceptualize the research process.	10	CO1	M2
Q2A	The following are the number of departmental stores in 15 cities: 35, 17, 10, 32, 70, 28, 26, 19, 26, 66, 37, 44, 33, 29 and 28. If we want to select a sample of 25 stores, using cities as clusters and selecting within clusters proportional to size, how many stores from each city should be chosen?(Use a starting point of 5).	10	CO2 CO3	M4
Q2B	A population is divided into three strata so that N1 = 6000, N2 = 3000 and N3 = 4000. Respective standard deviations are: s1=13, s2=15 and s3=9. How should a sample of size n = 82 be allocated to the three strata, if we want optimum allocation using disproportionate sampling design? If the cost for strata is 2500, 1500, 1800 what can be cost disproportionate sampling design?	10	CO2 CO3	M4
Q3A	Researcher conducted experimental investigations on concrete cubes, to study the influence of fly ash, GGBS and glass waste powder (GWP) individually, on the compressive strength of concrete. The cubes were casted for M30 grade of concrete and by random sampling method, tested after 28 days curing. For cubes in Group I, 30% fly ash was added, for Group II, 30% GGBS was added and in Group III, 30% GWP was added. The 28 days compressive strengths of cubes in N/mm^2 are given below. Check whether the mean compressive strength of the 3 different groups is same or not. Group I – 31, 32, 31, 35, 29, 27 Group II – 36, 29, 33, 29, 34 Group III – 33, 34, 29, 32, 33, 36, 26	10	CO2 CO3	M5
Q3B	We want to test on the basis of sample size 35 determinations and at 0.05 level of significance whether the thermal conductivity of a certain kind of plate is 0.34 units, as has been claimed. The mean of sample is 0.343. From the information gathered in similar studies, we can expect that the variability of such determinations is given by $\sigma = 0.01$.	10	CO2 CO3	M4 M5

Q4A	What do you mean by stratification? Why it is to be done? Explain How do you carry out stratification using computer? Refer the given data, Identify the vital factor to control defects. Staff | No.of Defects | Shift | Machine | Temp. A | 46 | I | 102 | High B | 22 | II | 103 | Low C | 5 | III | 104 | High D | 9 | I | 102 | Medium E | 10 | II | 103 | Low F | 26 | III | 104 | High G | 188 | I | 102 | Medium H | 130 | II | 103 | Low I | 7 | III | 104 | High E | 12 | I | 102 | High F | 2 | II | 103 | Low G | 2 | III | 104 | High A | 22 | I | 102 | High F | 12 | II | 103 | Low D | 10 | III | 104 | High A | 11 | I | 101 | Low	10	CO1 CO2	M3 M5 M7
Q4B	A data of 350 Life Cycle Test machines was collected and analysed to know association between type of machines and acceptability of Guage R and R . The response by Type of machine are as follows. At alpha =0.05 do these data suggest an association between Type of machine and acceptability of Guage R and R? | | Automatic machines | SemiAutomatic machines | Total | | Acceptable Guage R&R | 19 | 31 | 50 | | Not Acceptable Guage R&R | 171 | 131 | 302 | | Total | 190 | 162 | 352 |	10	CO2 CO3	M1 M3
Q5A	What do you mean by Causal Relationship? Explain the usage of the tools with appropriate examples for depicting causal relationships. What do you mean by regression analysis? Explain coefficient of correlation, scatter diagram, R^2, R^2 adj.	10	CO2 CO3	M1 M5
Q5B	Write short note on the following terms. I. Normal Distribution II. Type I error III. Type II error IV. Confidence Interval V. Level of Significance VI. Test Statistic VII. T distribution VIII. F distribution IX. Census X. Sampling	10	CO2 CO3	M4 M5
Q6A	A flow chart describing copyright registration process in India.	10	CO2 CO3	M5
Q6B	Differentiate among Patent Trademark and Copyright.	10	CO2 CO3	M6 M7
Q7A	Prepare the process flow chart for obtaining patent in India	10	CO2 CO3	M6 M7
Q7B	Prepare a note on Trademark based on following points 1.Meaning 2.Examples 3.Period 4.Specific rules in India 5.Procedure to get the trademark registered and approved.	10	CO2 CO3	M6 M7

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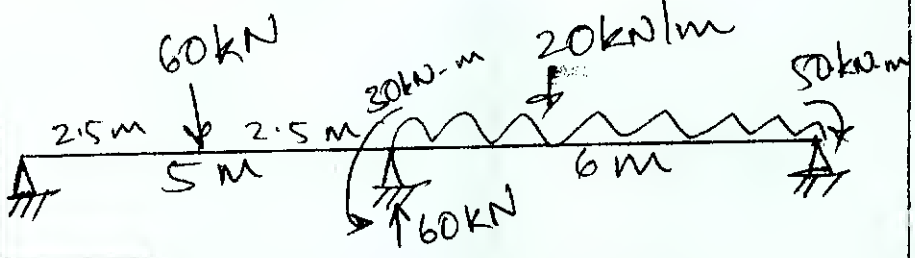
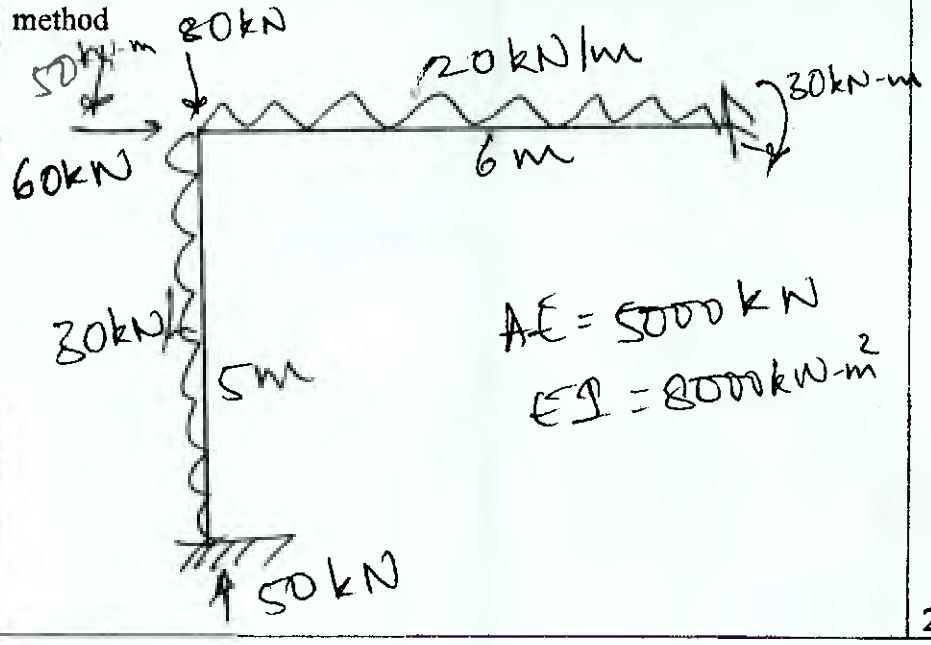
END SEM EXAMINATION December 2023

Program: M.Tech- Structures Sem I **Duration: 3 Hrs**

Course Code: PC-MST 102 **Maximum Points: 100**

Course Name: Advanced Theory of Structures

Semester:I

Q.No.	Questions	Points	CO	BL	Module No.
Q1	Analyse the following continuous beam using conventional stiffness method $EI = 8000\ kN\text{-}m^2$ 	20	2	3	
Q2	Analyse the following plane frame using conventional stiffness method 	20	2	3	

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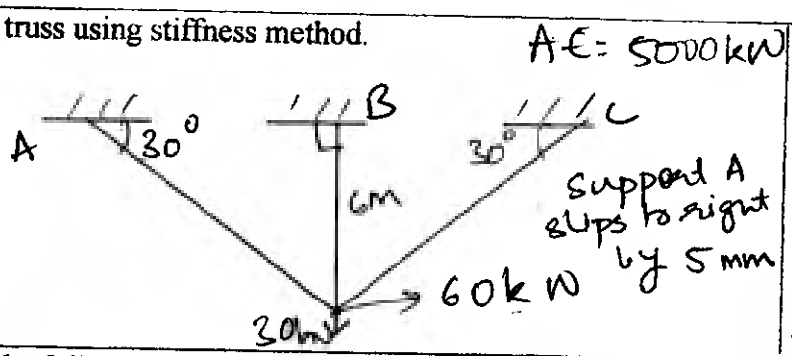
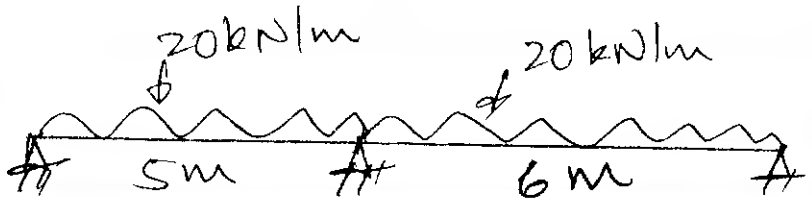
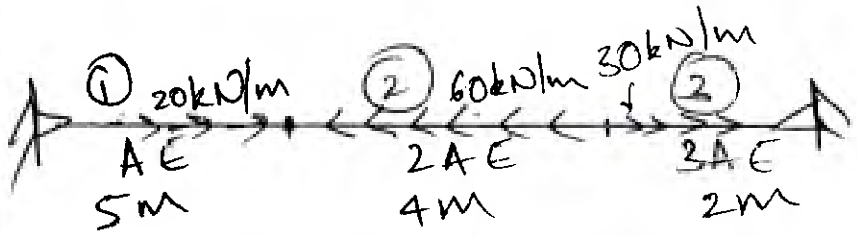
END SEM EXAMINATION December 2023

Q3	Analyze truss using stiffness method. 	20	1	3	
Q4	Analyse the following beam using Flexibility method. 	20	1	3	
Q5	Derive the expression of deflection for the infinite beam on elastic foundation subjected to a concentrated load at midspan	20	4	3	
Q6	A hook carries a load of 7.5kN and the load line is at a distance of 20mm from the inner edge of the section which is trapezoidal. The load line also passes through the centre of curvature of the hook. The dimensions of the central horizontal trapezoidal section are: inner width= 30mm;outer width=15mm;depth=30mm. Calculate the maximum and minimum stresses. Also plot the variation of stress across the section.	20	3	3	
Q7	Analyse by stiffness method the pin jointed frame as shown in figure due to applied direct loads as well as due to lack of fit caused by bars 1 and 2 being too short by 5mm. Find complete force and displacement response. 	20	2	3	

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End Semester Examination – December 2023

Program: M.Tech Civil Engineering - Structures Sem I **Duration: 3 Hours**

Course Code: PE-MTSE113 **Maximum Points: 100**

Course Name: Design of Prestressed Concrete Structures **Semester: 1**

Notes:

- *Attempt any 5 main questions.*
- *Answers to all sub-questions should be grouped together*
- *Draw neat sketches wherever possible*
- *Assume suitable data if missing and state the same clearly.*
- *Use of IS 1343 is allowed*

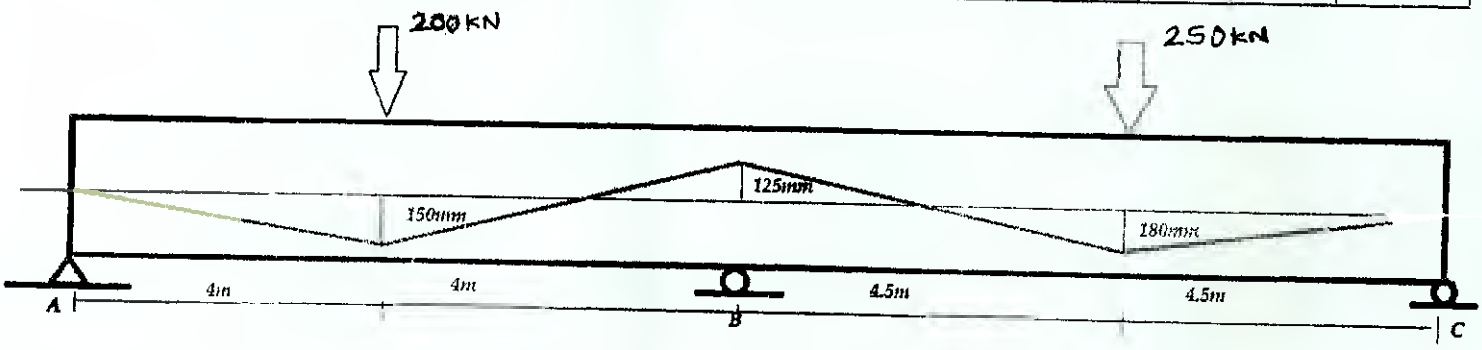
Q.No.	Questions	Points	CO	BL	Module
1.a)	A prestressed concrete beam ABC has cross section dimensions 350x800mm and effective prestressing force of 1000kN. The beam has a simply supported span(i.e.BC) of 7m and it has 2.5m overhang on one side (i.e. AB).It carries a live load of 10kN/m on entire span. Using load balancing concept, determine the eccentricities at critical points to balance the dead load and live load and sketch the cable profile. (*Consider density of concrete as 25kN/m^3*)	10	1	3	02
1.b)	Explain in detail – Full, limited and partial prestressing	05	1	1,2	01
1.c)	Explain the need of high strength materials in prestressed concrete structures	05	1	1,2	01
2.a)	Calculate the flexural capacity of a post-tensioned (bonded) I girder having the following properties: Flange = (1200x250)mm Web = (300x1800)mm Area of cables = 2500mm^2 fp = 1600MPa Effective depth = 2050mm fck = 40MPa	10	1	3	03
2.b)	Design the shear reinforcement ***at quarter span*** for a simply supported beam of rectangular cross section 300mmx900mm and span 12.5m. It carries a live load UDL of 7kN/m(unfactored). It is prestressed by a straight cable that is having eccentricity of 250mm	10	2	4	03

	fck = 40MPa Effective prestress in cable = 1100MPa Characteristic strength of PT steel = 1600MPa Use Fe415 grade steel for reinforcement.				
3.a)	A simply supported post tensioned beam of span 18m with 2 cables having a cross section of 300mmX 1000mm is successively tensioned from a single end in the order of cables 1-2. Each cable has a cross section area of 300mm^2 and an initial tension of 1200MPa. Co-efficient for friction = 0.5; co-efficient for wave effect = 0.0015/m. Age of concrete at transfer of prestress = 28days. Anchorage slip = 4.2mm. Es = 210kN/mm^2, Ec = 30kN/mm^2. Calculate the % losses due to elastic shortening, friction and anchorage slip	12	1	3	02

	Profile	Eccentricity at midspan	Eccentricity at support
Cable 1	Parabolic	250mm (below N.A.)	50mm (above N.A)
Cable 2	Straight	350mm(below NA)	350mm(below NA)

3.b)	The end block of a post-tensioned beam has two anchorages with 300x300 mm - square bearing plates located at 350mm from top and bottom respectively. The size of end block is 300x600mm. An initial pre-stressing force of 800 kN is applied to each anchorage. Design the end zone reinforcement.	08	3	3,5	04
4.	Design a Type 1 post tensioned bonded girder (simply supported) for the following data : Effective span = 15m Live load = 10kN/m fck = 45MPa fci = 30MPa Es = 210kN/mm^2 Ec = 31.6 kN/mm^2 Assumed loss % = 25% Use 8mmϕ strands for cables. The characteristic strength of cables is 1500MPa. Calculate the size of section required, prestressing force, eccentricity. Draw neat sketch of the cable profile	20	2	4	05
5.a)	A 15m span simply supported composite beam consists of 250mmX750mm precast stem and a cast-in-situ flange of 900mmX200mm. The stem is a post tensioned unit subjected to a prestressing force of 1000kN. The tendons	15	1	3	06

	are provided at 150mm from the soffit of stem. The beam has to support a live load of 10kN/m. Determine the resultant stress distribution in the beam if the beam is a) unpropped; b) propped				
5.b)	Explain the effect of prestressing on shear resistance of sections using principal stress concept.	05	1,3	2	03
6.	a) Derive the expression for deflection in a simply supported beam due to parabolic prestressing profile having eccentricities at end = e_1 and at midspan =e_2 (Above CG) (Below CG) b) A simply supported prestressed beam of cross section 450mmX1000mm and span 14m has the following cable profile: Cable 1: Parabolic; Eccentricity at midspan 250mm (below N.A.); Eccentricity at support 50mm (above N.A) Cable 2: Straight; Eccentricity at midspan 350mm(below NA); Eccentricity at support 350mm(below NA) It carries a live load of 10kN/m. The area of each cable is 500mm^2 and it is initially tensioned to 1250N/mm^2. Losses = 25% 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	20	1	3	03
7.	The cable profile for a two span continuous beam is as shown in figure below. The prestressing force is 1500kN. Locate the pressure line due to prestressing force and the shown loads only	20	3	4	07



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Re-exam - Feb 2024

Program: M.Tech Civil Engineering - Structures Sem I **Duration: 3 Hours**

Course Code: PE-MTSE113 **Maximum Points: 100**

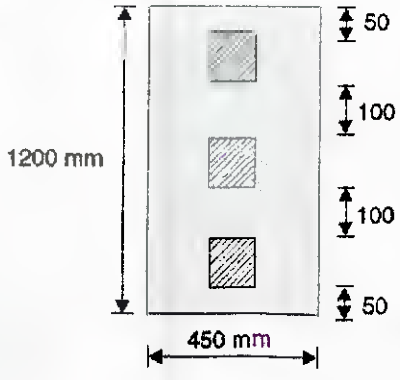
Course Name: Design of Prestressed Concrete Structures **Semester: 1**

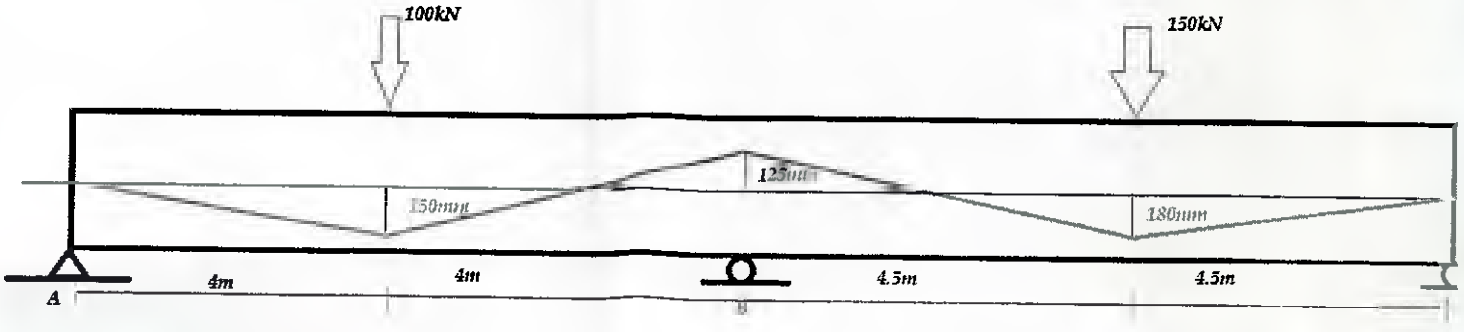
Notes:

- **Attempt any 5 main questions.**
- **Answers to all sub-questions should be grouped together**
- **Draw neat sketches wherever possible**
- **Assume suitable data if missing and state the same clearly.**
- **Use of IS 1343 is allowed**

Q.No.	Questions	Points	CO	BL	PI
1	a) What is pretensioning and post-tensioning? b) Explain how prestressing affects deflection of beams. What are the factors affecting long term deflection? c) Explain what do you mean by full prestressing, limited prestressing and partial prestressing d) Calculate the stress in extreme fibres at support for a cantilever beam having 5m span, (250x500)mm cross section and supporting a UDL of 15kN/m on full span. It is prestressed with a straight cable having eccentricity 250mm above the CG.	20	1	1,2	2.2.4
2.a)	A pretensioned concrete beam of size 250 mm X 600 mm has an effective cover to tendon 200 mm. Area of prestressing steel is 565 mm2, fck = 40 N/mm2, fp = 1600 N/mm^2. Calculate the ultimate flexural strength of the section. fck = 40MPa	10	1	3	3.1.4
2.b)	Design the shear reinforcement ***at one third span*** for a simply supported beam of rectangular cross section 300mmx700mm and span 10m. It carries a live load UDL of 8kN/m(unfactored). It is prestressed by a straight cable that is having eccentricity of 250mm fck = 40MPa Effective prestress in cable = 1100MPa Characteristic strength of PT steel = 1600MPa Use Fe415 grade steel for reinforcement.	10	2	4	3.1.4

<table>
<tr><td>3.a)</td><td>a) A simply supported post tensioned beam of span 18m with 2 cables having a cross section of 300mmX 900mm is successively tensioned from a single end in the order of cables 1-2.
<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>25mm (below N.A.)</td><td>0mm</td></tr>
<tr><td>Cable 2</td><td>Straight</td><td>350mm(below NA)</td><td>350mm(below NA)</td></tr>
</table>
Each cable has a cross section area of 350mm^2 and an initial tension of 1200MPa. Co-efficient for friction = 0.5; co-efficient for wave effect = 0.0015/m. Age of concrete at transfer of prestress = 28days. Anchorage slip = 4mm. Es = 210kN/mm^2,Ec = 30kN/mm^2.
Calculate the % losses due to elastic shortening, friction and anchorage slip
b) Calculate the stress in extreme fibres at mid span and support due to prestress and an imposed load of 10kN/m on full span</td><td>15</td><td>1</td><td>3</td><td>2.2.1</td></tr>
<tr><td></td><td>c)Explain the difference between shear resistance of a PSC beam as compared to that of an RCC beam</td><td>05</td><td>1,3</td><td>2</td><td>1.4.1</td></tr>
<tr><td>4.</td><td>Design a Type 1 pretensioned bonded girder (simply supported) for the following data :
Effective span = 14m
Live load = 18kN/m
fck = 40MPa
fci = 30MPa
Es = 210kN/mm^2
Ec = 31.6 kN/mm^2
Assumed loss % = 30%
Use 8mmϕ strands for cables. The characteristic strength of cables is 1300MPa. 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>3.1.4
3.2.1</td></tr>
<tr><td>5.a)</td><td>A 14m span simply supported composite beam consists of 250mmX600mm precast stem and a cast-in-situ flange of 500mmX300mm. The stem is a post tensioned unit subjected to an initial prestressing force of 800kN. %loss = 26.5%. The tendons are provided at 150mm from the soffit of stem. The beam has to support a live load of 10kN/m. Determine the resultant stress distribution in the beam if the beam is a) unpropped; b) propped</td><td>20</td><td>1</td><td>3</td><td>2.2.1
1.4.1</td></tr>
</table>

	Draw neat sketches to show the variations of stresses at each stage				
6.a)	Derive the expression for deflection due to prestress when the profile is parabolic having zero eccentricity at ends and "e" at mid span for a simply supported beam A simply supported prestressed beam of cross section 450mmX1100mm and span 15m has a straight profile of cable with eccentricity of 400mm below N.A. It carries a live load of 5kN/m. The area of cable is 400mm^2 and it is initially tensioned to 1350N/mm^2. % loss = 28% 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	10	1	3	2.2.1 1.4.1
6.b)	The end block of a post-tensioned beam has three anchorages with 300 mm square bearing plates as shown in figure. An initial pre-stressing force of 900 kN is applied to each anchorage. Design the end zone reinforcement.  	10	2	4	3.1.4 3.1.6
7.a)	The cable profile for a two span continuous beam is as shown in figure below. The prestressing force is 1250kN. Locate the pressure line due to prestressing force and the shown loads	20	3	4	2.3.2 1.4.1



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End Semester Examinations- December 2023

Program: M.Tech. (Structural Engineering) Sem I **Duration: 3 Hours**

Course Code: PE-MTSE121 **Maximum Points: 100**

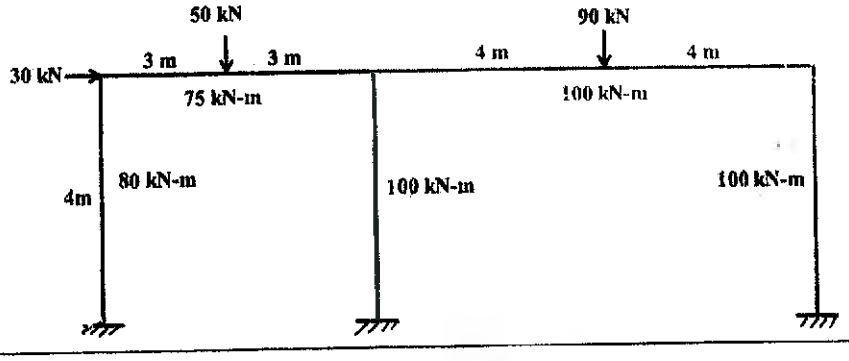
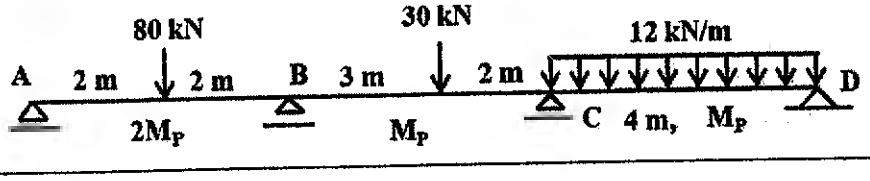
Course Name: Program Elective-II: Non Linear Analysis **Semester: I**

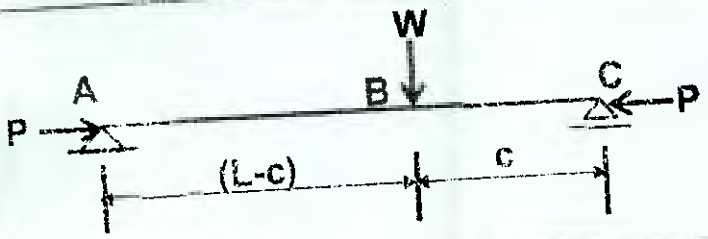
3/11/24

Instructions:

- Attempt any FIVE questions out of SEVEN 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.

Q.No	Questions	Points	CO	BL	PI
Q1(a)	**State and explain uniqueness theorem used in plastic analysis.**	(05)	1	1,2	1.3.1 2.1.3
Q1(b)	**What are the secondary design problems to be considered while using the plastic theory of bending?**	(05)	2	2	2.1.2 2.2.3
Q1(c)	**What is a beam column? How is it different from a beam and a column?**	(05)	3	2	1.3.1
Q1(d)	**Write a note on the modes of buckling of a member having thin walled symmetrical cross section.**	(05)	4	2	1.3.1
Q2(a)	**Find the length of the plastic hinge for a simply supported beam of rectangular cross section and span L, subjected to a central point load of W. Also show that the shape/variation of plastic hinge in the above case is a parabola.**	(10)	1	3,4	2.1.2
Q2(c)	**Find the shape factor of an unsymmetrical I section with following details:** **Top flange width = 250 mm & thickness = 25 mm** **Bottom flange width = 350 mm & thickness = 35 mm** **Depth of web = 300 mm and thickness of web = 30 mm**	(10)	1	3,4	2.1.3 2.2.3

Q3(a)	**For the frame shown in figure below, find the collapse load factor. Loads shown in the figure are working loads and the plastic moment capacity of each member in kN-m is also shown in the figure.**	(15)	1	3,4	2.1.3 2.2.3
					
Q3(b)	**Calculate the plastic moment capacity of a beam of rectangular cross section 100 mm x 200 mm if σ_y = 250 N/mm^2. If the cross section is subjected to an axial force such that P/P$_P$ = 0.5, find the reduced plastic moment capacity of the section. Also state the percentage loss in the plastic moment capacity of the section due to the axial force.**	(05)	2	2	2.1.2 2.2.3
Q4(a)	**A continuous beam is subjected to working loads as shown in figure below. If M$_P$ = 75 kN-m, calculate the (true) load factor for the beam.**	(10)	1	3,4	2.1.3 2.2.3
					
Q4(b)	**Write a note on effect of shear force on plastic moment capacity of a flexural member.**	(10)	2	1,2, 3	1.3.1 2.1.3
Q5(a)	**A column of length L and pinned at both the ends is under the action of an axial compressive load P. Find the eritical load by <u>finite difference method</u> if the flexural stiffness of the member varies aceording to** **EI(x)= EI$_0$ $0 \le x \le L/4$** **= 2EI$_0$ $L/4 \le x \le 3L/4$** **= EI$_0$ $3L/4 \le x \le L$**	(10)	3	3,4	2.2.3 2.4.1

Q5(b)	**A column of length L and pinned at both the ends is under the action of an axial compressive load P. Find the critical load by <u>energy method</u> if the flexural stiffness of the member varies according to** **$EI(x) = EI_0 \quad 0 \le x \le L/4$** **$= 2EI_0 \quad L/4 \le x \le 3L/4$** **$= EI_0 \quad 3L/4 \le x \le L$**	(10)	3	3,4	2.2.3 2.4.1
Q6(a)	**A beam column is subjected to loads as shown in the figure below. Derive the expression for the deflection at a point between A and B at a distance of 'x' from support A.**  	(10)	3	3,4	2.2.3 2.4.1
Q6(b)	**How is the structural behavior of member having a solid cross section different from that of a thin walled open cross section when subjected to axial load? Explain**	(04)	4	2	1.3.1
Q6(c)	**Write a note on St. Venant's torsion and warping torsion.**	(06)	4	2	1.3.1
Q7(a)	**Derive the governing differential equation for the torsional buckling of column with symmetrical cross- section.**	(14)	4	1,2, 3	1.3.1 2.1.3
Q7(b)	**Write a note lateral buckling of beams**	(06)	4	1,2	1.3.1 2.1.3

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Re-Examinations- February 2024

Program: M.Tech. (Structural Engineering) Sem I — **Duration: 3 Hours**

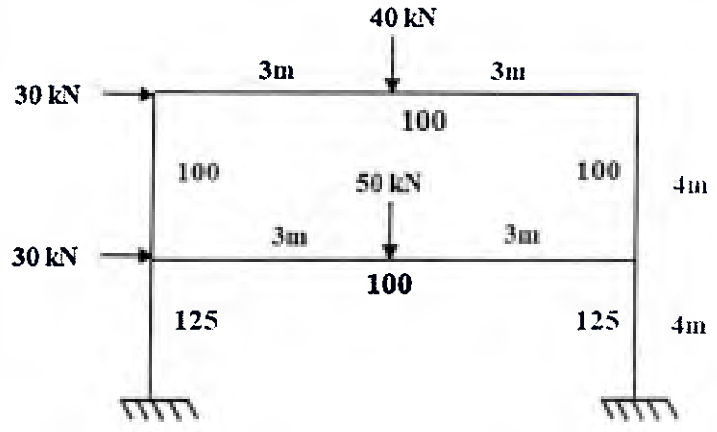
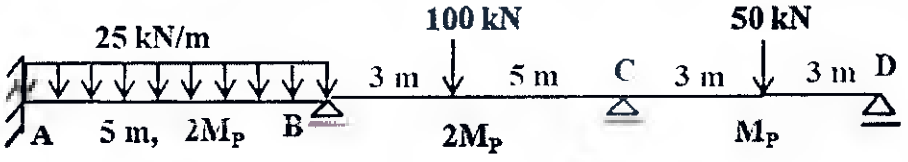
Course Code: PE-MTSE121 — **Maximum Points: 100**

Course Name: Program Elective-II: Non Linear Analysis — **Semester: I**

Instructions:

- Attempt any FIVE questions out of SEVEN 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.

Q.No	Questions	Points	CO	BL	PI
Q1(a)	**What are the advantages and disadvantages of plastic analysis over elastic analysis?**	(05)	1	1,2	1.3.1 2.1.3
Q1(b)	**State and explain lower bound theorem.**	(05)	1	2	2.1.2 2.2.3
Q1(c)	**Write a note on different approaches for the buckling analysis of a column.**	(05)	3	2	1.3.1
Q1(d)	**In case of lateral buckling of rectangular beam in pure bending, write the expression for critical stress and explain the terms involved in the expression.**	(05)	4	2	1.3.1
Q2(a)	**A propped cantilever of span 5m is subjected to a uniformly distributed load of 12kN/m on the entire span of the beam. Find the load factor at failure if the plastic moment capacity of the beam is 60kN-m.**	(10)	1	3,4	2.1.2
Q2(c)	**Find the shape factor of an unsymmetrical I section with following details:** **Top flange width = 350 mm & thickness = 30 mm** **Bottom flange width = 250 mm & thickness = 25 mm** **Depth of web = 250 mm and thickness of web = 25 mm**	(10)	1	3,4	2.1.3 2.2.3

Q3	**For the frame shown in figure below, find the collapse load factor. Loads shown in the figure are working loads and the plastic moment capacity of each member in kN-m is also shown in the figure.**	(20)	1	3,4	2.1.3 2.2.3
					
Q4(a)	**A continuous beam is subjected to working loads as shown in figure below. If M_P = 80 kN-m, calculate the (true) load factor for the beam.**	(10)	1	3,4	2.1.3 2.2.3
					
Q4(b)	**Write a note on effect of axial force on plastic moment capacity of a flexural member.**	(10)	2	1,2, 3	1.3.1 2.1.3
Q5(a)	**A column of length L and pinned at both the ends is under the action of an axial compressive load P. The flexural rigidity of the column varies uniformly from EI at either end to 2EI at the centre. Find the critical load by finite difference method.**	(10)	3	3,4	2.2.3 2.4.1
Q5(b)	**A column of length L and pinned at both the ends is under the action of an axial compressive load P. Find the critical load by energy method if the flexural stiffness of the member varies according to** **$EI(x) = EI_0$ $0 \le x \le L/3$** **$= 2EI_0$ $L/3 \le x \le 2L/3$** **$= EI_0$ $2L/3 \le x \le L$**	(10)	3	3,4	2.2.3 2.4.1

Q6(a)	**For a beam column with simple supports at the end, derive the expression for transverse deflection at any section when subjected to a transverse load of w/m (udl) and an axial load of P at its both ends. Also determine the maximum deflection and maximum bending moment.**	(12)	3	3,4	2.2.3 2.4.1
Q6(b)	**What are the factors on which the lateral buckling of a beam depends?**	(04)	4	2	1.3.1
Q6(c)	**Write the expression for the warping torsion and explain the terms involved.**	(04)	4	2	1.3.1
Q7(a)	**Derive the governing differential equation for the torsional buckling of column with symmetrical cross- section.**	(14)	4	1,2, 3	1.3.1 2.1.3
Q7(b)	**Explain in case of a thin walled open cross section subjected to axial load, what are the possible modes of buckling if the cross section is** **(i) symmetrical about two perpendicular axes** **(ii) symmetrical about one axis** **(iii) unsymmetrical**	(06)	4	1,2	1.3.1 2.1.3

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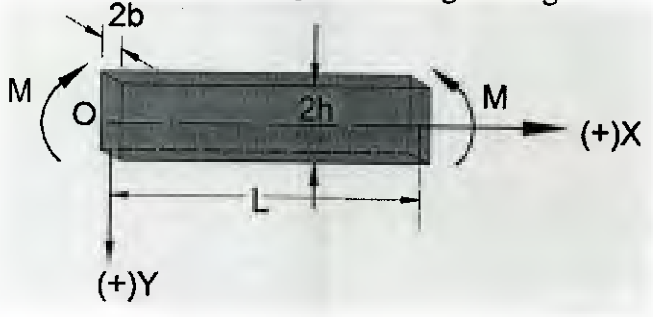
RE EXAMINATION FEBRUARY 2024

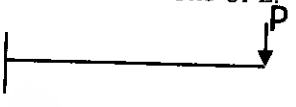
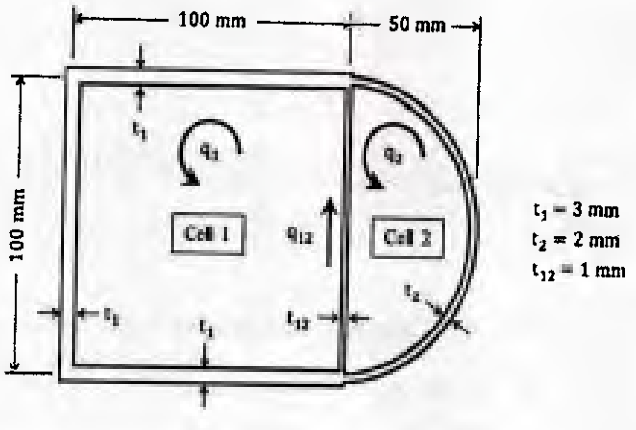
Program: M. TECH (STRUCTURES) Sem I
Course Code: EC-MST125
Course Name: Advanced solid Mechanics

Duration: 3 HR
Maximum Points: 100
Semester: I

16/2/24

Q.No.	Questions	Points	CO	BL	M
1 a	The state of strain at a point is given by $\varepsilon x = 0.003$, $\varepsilon y = -0.002$, $\varepsilon z = 0$, $\gamma xy = 0.002$, $\gamma yz = 0.003$, $\gamma zx = -0.004$. Determine the stress tensor at this point using material property matrix approach Take $E = 210 \times 10^6$ kN/m^2 Poisson's ratio = 0.28.	10	1	3	1
1 b	Explain various failure theories in brief.	10	1	3	7
2	The stress field at a point with respect to X, Y, Z coordinate system is given by the array in MPa as 6 8 2 8 6 5 2 5 10 Show that by transformation of axis by 45° about the Z axis in the anticlockwise direction, the stress invariants remain unchanged. Also find principal stresses also	20	1	3	1
3	For a rectangular beam, length L, width 2b, depth 2h, subjected to a pure couple M along its length  Consider a second order polynomial such that its any term	20	2	3	3

RE EXAMINATION FEBRUARY 2024

	gives only a constant state of stress /2 + b2 xy+ c2y^2 / 2 Calculate stresses in beam and show that σx =My / I				
4	For the cantilever beam shown determine the displacement field due to bending only. Consider the cross section of beam to be rectangular and thin so that deflections are not functions of z.  The stiffness of the beam is Elz and poisson's ratio υ. Span of beam = L m.	20	3	3	6
5 a	Determine the shear stress and angle of twist of the multi-cell given in figure subjected to torque 5 x 10 ^{5}Nm. E = 72 GPa. And υ =0.33 	14	3	3	5
5 b	Derive equation of shear stress for a solid circular section of diameter D subjected to torque T	06	2	3	5
6a	Determine the location of shear centre "e" for the cross section shown. All dimensions are in mm	12	3	3	5

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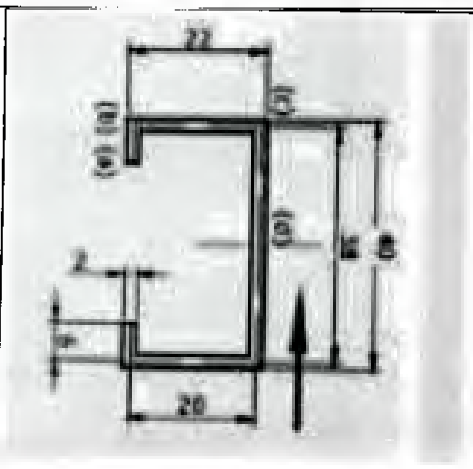
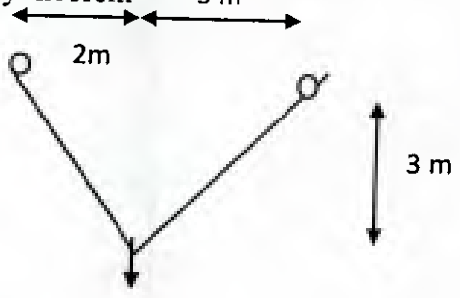
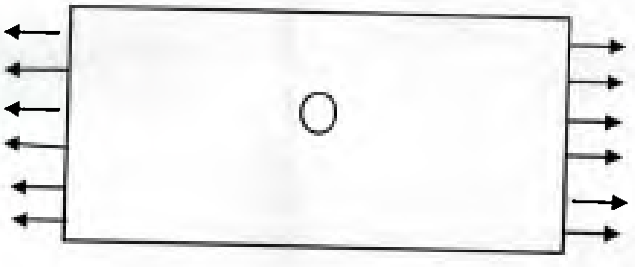
					
6 b	For the given cable arrangement calculate deflection of point B in vertical and horizontal direction using complementary theorem Area of bars = 80 mm2 **E= 210Gpa** 	08	3	3	7
7	For plate loaded in tension by force per unit area σ , is having circular hole at centre. Outer diameter of the plate is very large compared to diameter of hole 2a.  Derive equation for σr, σ and τ	20	2	3	4

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END SEMESTER EXAMINATION DECEMBER 2023

Program: M. TECH (STRUCTURES) Sem I

Course Code: EC-MST125 101

Course Name: Advanced solid Mechanics

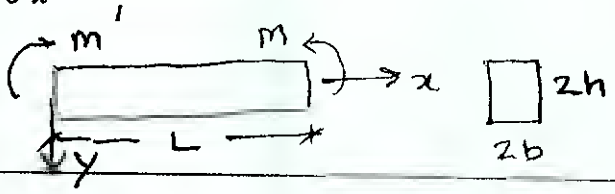
Duration: 3 HR

Maximum Points: 100

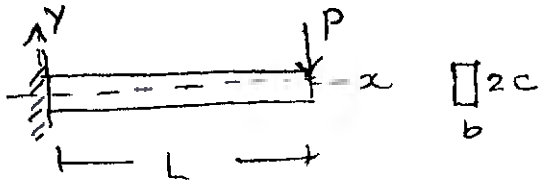
Semester: I

5/11/24

Notes: Solve any 5 questions.

Q.No.	Questions	Points	CO	BL	PI
1 (a)	The state of stress in Mpa at a point is given by $\begin{bmatrix} 12 & -10 & 08 \\ -10 & 08 & 04 \\ 08 & 04 & 15 \end{bmatrix}$ Determine the strain tensor at this point. **Using material constant matrix.** Take E = 2 x 10^5 N/ mm^2 Poisson's ratio = 0.28.	08	1	3	
1(b)	A Plane Stress element in a part made of the 6061-T6 is found to have the following stress: σ_x = 39 Mpa ; σ_y = 68.2Mpa, and τ_{xy} = 34.5 Mpa. The Axial Yield Strength, S_Y, of 6061-T6 aluminum is 241 Mpa , and its Shear Yield Stress, τ_Y, is 165 Mpa. Determine (a) Factor of Safety using Tresca Criterion. (b) Factor of Safety using von Mises Criterion.	12	3	3	
2(a)	Consider a rectangular beam, length L, width 2b, depth 2h, subjected to a pure couple M along its length as shown in the Figure. If Airy's stress function used is $\emptyset = a2\frac{x2}{2} + b2\ xy + c2\frac{y2}{2}$ Show that $\sigma x = \frac{My}{I}$ 	12	2	3	

END SEMESTER EXAMINATION DEC 2023

2(b)	If a displacement field is described by $u = (-x^2 + 2y^2 + 6xy)10^{-4}$ $v = (3x + 6y - y^2)10^{-4}$ Determine εx, εy, γxy at the point $x = 1$, $y = 0$.	08	1	3	
3	The stress field at a point with respect to X, Y, Z coordinate system is given by the array in MPa as $\begin{bmatrix} 45 & 16 & 18 \\ 16 & 12 & -15 \\ 18 & -15 & 10 \end{bmatrix}$ Calculate principal stresses and direction cosine associated with maximum value of stress	20	1	3	
4(a)	Prove that to convert a plane strain solution to a plane stress solution you substitute $\frac{1+2\nu}{(1+\nu)^2}E$ & $\frac{\nu}{1+\nu}$ For E and ν respectively.	08	2	3	
4(b)	For the beam shown determine the displacement field due to bending only. Consider the cross section of beam to be rectangular and thin so that deflections are not functions of z. The stiffness of the beam is EIz and poisson's ratio υ. 	12	2	3	

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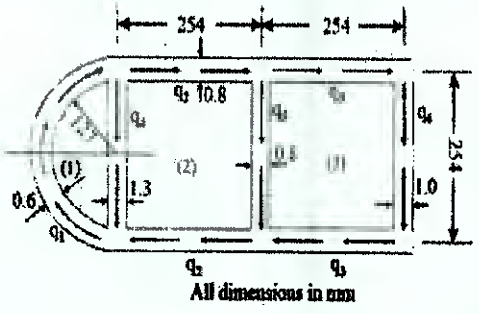
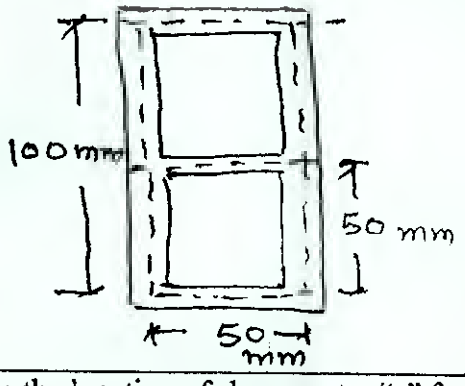
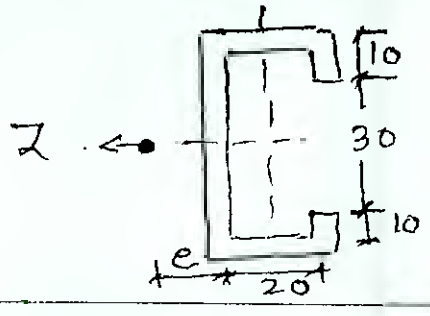
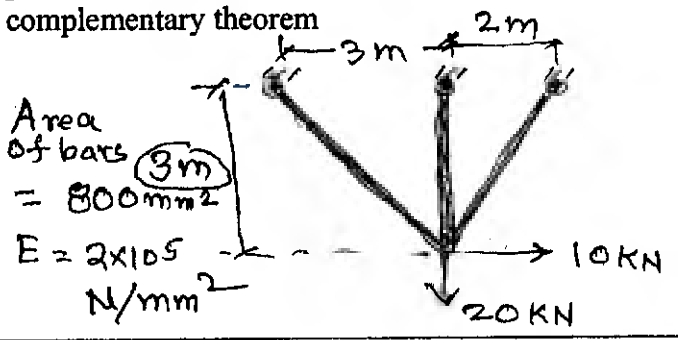
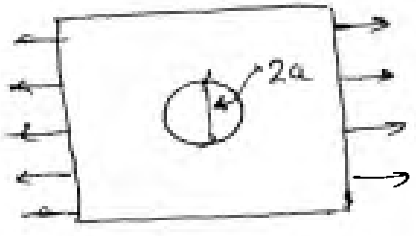
END SEMESTER EXAMINATION . DEC 2023

5 (a)	A tubular section having three cells as shown in the figure is subjected to a torque of 121 kN-m. Determine the shear stresses developed in the walls of the section 	08	3	3	
5 (b)	The cross section of a beam is bending about Z axis and transmitting transverse shear force Vy=2 kn. If the transverse shear force is acting through shear centre , determine the shear distribution in walls and location of shear centre "e". wall thick ness t= 3mm for all walls 	12	3	3	
6(a)	Determine the location of shear centre "e" for the cross section shown from first principle. All dimensions are in mm and thickness of walls is 4 mm. 	12	3	3	

6 (b)	For the given cable arrangement calculate deflection of point B in vertical and horizontal direction using complementary theorem 	08	3	3	
7	For plate loaded in tension by force per unit area σ , is having circular hole at centre. Outer diameter of the plate is very large compared to diameter of hole 2a. Use  Derive equation for σr, σ and τ	20	2	4	

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End semester exam – December 2023 Examinations

Program: ***M.Tech Civil Engineering - Structures*** Sem III

Course Code: ***VA-MST01***

Course Name: Adv. Earthquake Resistant design

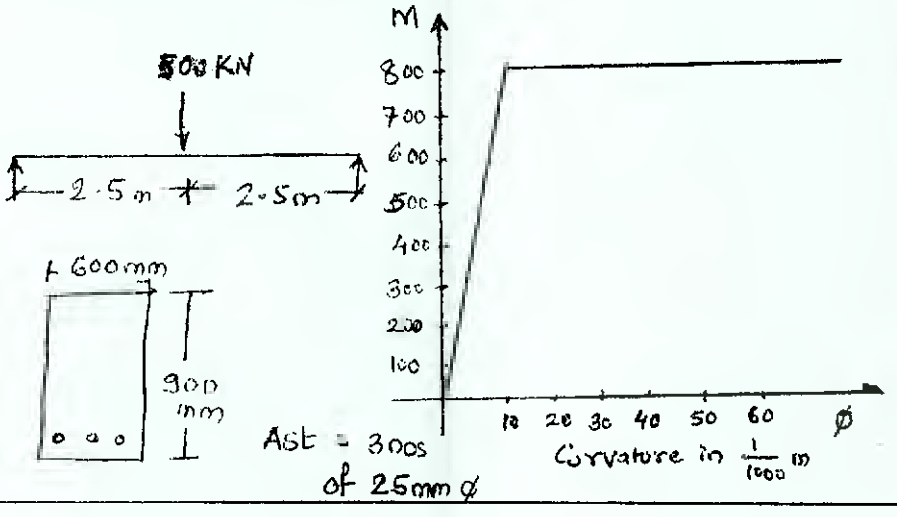
Duration: ***3 Hours***

Maximum Points: ***100***

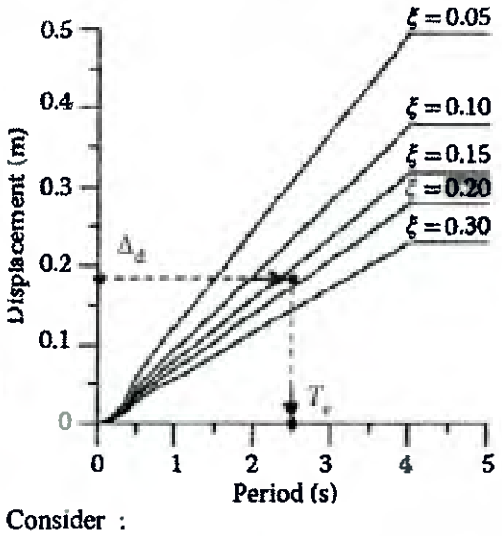
Semester: 3

Notes:*Draw neat sketches to support your answers;*

Assume suitable data if missing and state the same clearly.

Q.No.	Questions	Points	CO	BL	Module
1	Explain the differences in force based design, capacity based design and performance based design	20	01	02	01
2.a	The moment curvature curve of beam shown in Fig. below determine the following quantities 1. Flexural Stiffness 2. Deflection at the mid span and quarter span on the beam along the length 3. Strain in the bottom of steel 4. Crack Spacing It is given that : fck= 40 MPa, fy = 500 MPa, and crack width of 0:50 mm. 	12	02	04	02
2.b	Explain the concept of modeling hinges for non-linear analysis	08	02	02	02
3.	Explain in detail the material ductility, sectional ductility and structural ductility and their impact on pushover analysis results. What are the structural properties that can be understood from Pushover curve?	20	03	03	03
4	A cantilever bridge column that is 11.5 m tall to the center of the superstructure mass is to be designed for a region of PGA = 0.36 g using DDBD principles. The bridge is founded on firm ground and the spectral shape for the 5%	20	2 3	04	04

damping displacement spectrum can be scaled from Figure as shown. On the basis of preliminary design, a circular column of 2.45 m has been selected, and the reinforcement yield strength is fy = 500 MPa . The design limit state is represented by the more critical of a displacement ductility of $\mu = 3$, or a drift of $\theta_d = 0.035$. The tributary weight contributing to seismic inertia of the column is 5400 kN. E_s = 200 GPa. Determine the base shear attracted using DDBD principles



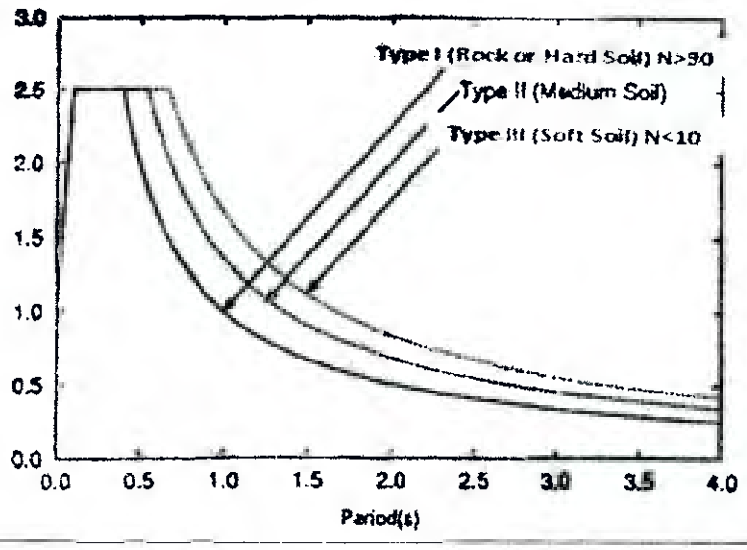
$$R_\xi = \left(\frac{0.07}{0.02+\xi}\right)^{0.5}$$

$$K_e = \frac{4\pi^2 m_e}{T_e^2}$$

Consider :

Concrete Bridge Columns and Walls: $\xi_{eq} = 0.05 + 0.444\left(\frac{\mu-1}{\mu\pi}\right)$

Also determine the Base shear attracted using Force based design principles for the response spectrum shown below –



5	Explain the need for P-delta analysis and its impact on slender structures	20	03	03	04
6.a	Explain the various performance limits IO,LS and CP	10	03	03	05
6.b	Explain the impact of considering infill walls in dynamic analysis of structures	10	03	03	06
7	Write short notes on : A) Base isolation systems B) Dampers	20	03	03	07

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Term End EXAMINATIONS – JAN 2024

M.Tech (SE) Sem I 8/1/2024

Program: F.Y.M.Tech (SE/PE) **Duration: 2 Hrs**

Course Code-IK-MTSE101. **Maximum Points: 50**

Course Name: Indian Knowledge System Course **Sem-I**

Instructions: Attempt Any Five Questions **Date : 8/01/2024**

Q.No.	Questions	Points	CO	BL	PI
1 (A)	Choose the correct alternatives from the following: 1) The objective resolution was put up before constituent assembly by- a) Dr .B.R Ambedkar b) Sardar Patel c) Jawaharlal Nehru d) K.M Munshi. 2) The provisions of fundamental rights are influenced by the constitution of- a) England b) USA c) Canada d) Australia 3) The chairman of drafting committee of Constituent Assembly was : a) K.T Shah b) Sir B.N Rao c) Dr. Ambedkar d) C. Rajgopalachari 4) The words socialist, secular and integrity are inserted into preamble by _____ amendment. a) 44th b) 38th c) 24th d) 42nd 5) Constituent assembly adopted and enacted the constitution on _____1949. a) 26th January b) 26th November c) 26th July d) 26th October.	05	3	5	6.1.1

(B)	Attempt the following: 1) Define the term secular. 2) What is the preamble to the constitution? 3) Justify the concept Judicial review. 4) Explain the term constitution. 5) What is meant by Welfare state?	05	2	4	6.2.1
Q2	Discuss the keywords enshrined in the preamble.	10	1	2	6.1.1
Q3	Analyse the features and provisions of fundamental rights.	10	3	4	6.1.1
Q4	Explain the multifunctional role of Indian Parliament.	10	3	1	8.2.2
Q5	Describe the salient features of Indian constitution.	10	2	1	6.2.1
Q6	Narrate the classification of directive principles of state policy.	10	1	3	8.1.1
Q7	Write a note on the following (Any One) a. Reservation Policy in India b. Uniform Civil Code	10	2	4	6.1.2