MAHATMA GANDHI INSTITUTE OF TECHNOLOGY (Autonomous)

M.Tech. II Semester End Examinations

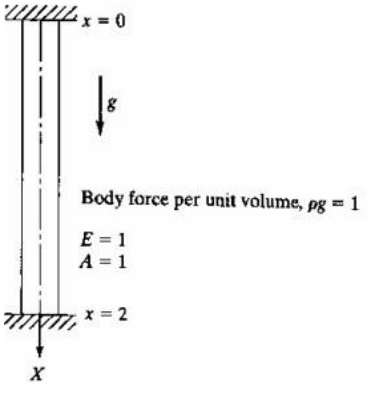
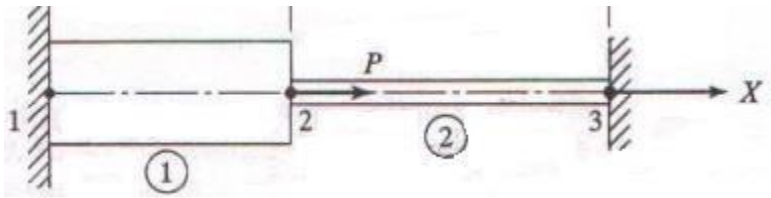
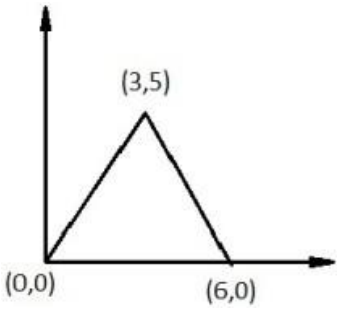
Model Question Paper

Course Title: FEM in Structural Engineering **Course Code: CE201PC**

Time : 3 hours Max. Marks : 70

Answer any FIVE Questions

(Each question carries 14 marks)

Q. No.	Stem of the question	M	L	CO	PO
	Unit-I				
1. a)	Explain in detail the various steps involved in Finite Element Analysis.	5	1	1	5
b)	Apply the Rayleigh-Ritz method to find the displacement of the midpoint of the rod shown inthe figure.1	9	3	1	5
					
	Fig.1				
	Unit-II				
2. a	Consider the following fig. 2. An axial load P=200 KN is applied as shown. Using penaltyapproach for handling boundary conditions, do the following i) Determine the nodal displacements. ii) Determine the stress in each material. iii) Determine the reaction forces.	9	5	2	2
					
	Fig.2				
	A1=2400mm^2 , A2=600mm^2 , E1= 70 x 10^{9}N/m^2 , E2=200 x 10^{9}N/m^2				
b)	Applying variational approach (potential energy), describe Finite Element formulation for 1D bar element.	5	5	2	2
	Unit-III				
3. a)	Evaluate the element stiffness matrix for the triangular element shown in fig.3. under planestrain condition. Assume the following values. E=200 GPa , μ=0.25, t=1 mm.	7	4	3	2,5
					
	Fig.3				

b)	Evaluate the shape functions N_1,N_2,N_3 at the interior point for the triangular element Shown in fig.4.	7	4	3	2,5

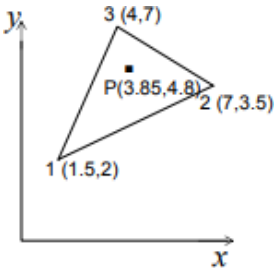


Fig. 4

Unit-IV

4. a)	Derive the formulation of 6-nodeded triangular element.	5	5	4	5
b)	In the fig. 5, a long cylinder of inside diameter 80mm and outside diameter 120mm snugly fits in a hole over its full length. The cylinder is then subjected to an internal pressure of 2MPa.Using two elements on the 10-mm length shown; find the displacements at the inner radius.	9	5	4	5

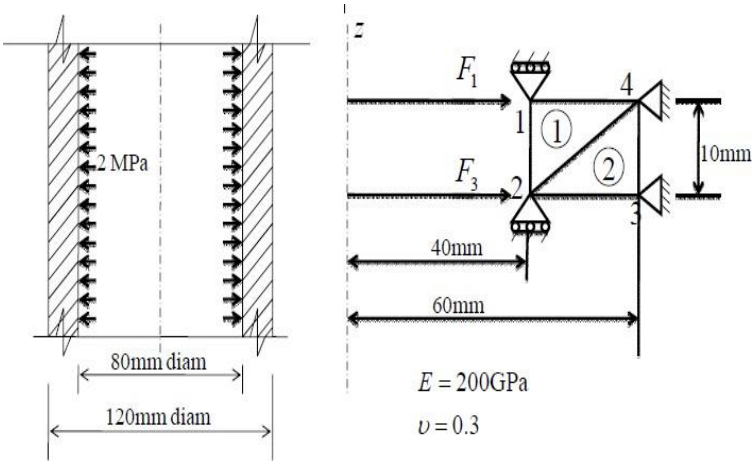


Fig. 5

Unit-V

5. a)	Describe the structure of a FEA software in detail.	7	2	5	1,6
b)	Explain the functions of preprocessor in detail.	7	1	5	1,6

a. Unit-I b. Unit-II

6. a)	A rod shown in fig. 6 is fixed at its ends is subjected to a varying body force as shown. use the rayleigh-ritz method with an assumed displacement field u=a1+a2.x+a3.x2+a4.x3 to determine the displacement u(x) and stress σx .	9	3	1	5

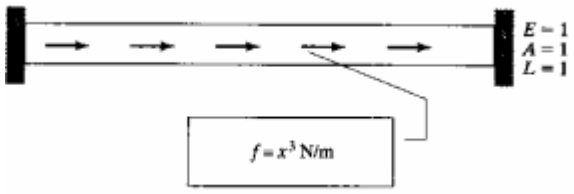


Fig. 6

b)	Derive stiffness matrix and load vector for a bar element using Galerkins Approach.	5	5	2	2

a. Unit-III b. Unit-IV

7. a)	Formulate the stress- strain and strain- stress relationship matrix for a plane stress case.	7	4	3	2,5
b)	Derive the shape functions for a 8 noded quadrilateral element in natural coordinates.	7	5	4	2

a. Unit-V b. Unit-I/II/III/IV/V

8. a)	Elaborate in detail the steps of a processor in FEA software.	7	1	5	1,6
b)	Write the postprocessor steps in detail	7	1	5	1,6

M: Marks; L: Bloom's Taxonomy Level; CO: Course Outcome; PO: Programme Outcome

MAHATMA GANDHI INSTITUTE OF TECHNOLOGY (Autonomous)

M.Tech. II Semester End Examinations

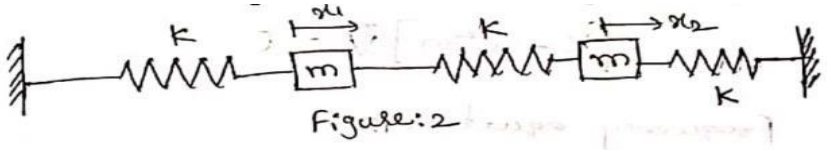
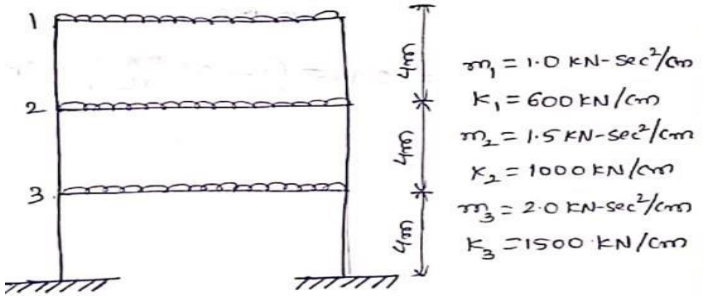
Model Question Paper

Course Title: Structural Dynamics **Course Code: CE202PC**

Time : 3 hours Max. Marks : 70

Answer any FIVE Questions

(Each question carries 14 marks)

Q. No.	Stem of the question	M	L	CO	PO
	Unit-I				
1. a)	Derive velocity and acceleration of simple harmonic motion.	7	2	1	5
b)	Derive the equations for displacement and amplitude for a critically damped free SDOF system.	7	3	1	5
	Unit-II				
2. a)	Explain the methods of discretization.	6	2	2	5
b)	Determine the steady state response and dynamic magnification factor for a damped system subjected to harmonic loading.	8	4	2	5
	Unit-III				
3. a)	Discuss about lumped mass matrix and consistent mass matrix for a MDOF system.	7	2	3	5
b)	Determine the natural frequencies and mode shapes of the system shown in figure below.  Figure: 2	7	4	3	5
	Unit-IV				
4.	Using Stodola method determine the fundamental frequency of vibration and corresponding mode shapes for the idealized three storey shear building shown in figure below. 	14	4	4	5
	Unit-V				
5.	Explain in brief about the excitation by rigid base translation for generalized coordinate SDOF system.	14	2	5	4,5
	a. Unit-I b. Unit-II				
6. a)	A SDOF system having viscous damping has a spring of stiffness 500 N/m. When the weight is displaced and released, the period of vibration is 2 sec and the ratio of successive amplitudes is 4 to 1. Determine the amplitude of the motion and phase angle when a force F = 4sin4t is applied to the system.	7	4	1	5
b)	Explain Duhamel integral for general dynamic loading.	7	2	2	5
	a. Unit-III b. Unit-IV				
7. a)	Using normal mode theory, explain the method for uncoupling the equations of motion of MDOF system.	7	2	3	5
b)	Explain Holzer method to obtain fundamental frequency of vibration and corresponding mode shapes.	7	2	4	5
	a. Unit-V b. Unit-I/II/III/IV/V				
8. a)	What is design base shear? How can we calculate it?	7	1	5	4,5
b)	Explain the Normal coordinates in a MDOF system.	7	2	3	5

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MAHATMA GANDHI INSTITUTE OF TECHNOLOGY (Autonomous)

M.Tech. II Semester End Examinations

Model Question Paper

Course Title: Advanced Steel Design **Course Code: CE211PE**

Time : 3 hours Max. Marks : 70

Answer any FIVE Questions

(Each question carries 14 marks)

Q. No.	Stem of the question	M	L	CO	PO
	Unit-I				
1. a)	Explain the various types of failure of bolted connection.	4	1	1	3,4
b)	Two flats (Fe 410 grade steel), each 210 mm x 8 mm, are to be jointed using 20 mm diameter, 4.6 grade bolt, to form a lap joint. The joint is supposed to transfer a factored load of 250KN. Design the joint and determine suitable pitch for the bolts.	10	4	1	3,4,6
	Unit-II				
2. a)	Differentiate between stiffened seat connection and unstiffened seat connection	4	2	2	3,4,6
b)	In framed connection an ISLB 350 @485.6 N/m transmits an end reaction of 220 KN and a moment of 22 KNm, under factored loads to a column ISHB 300 @ 576.6 N/m. Design the connection.	10	4	2	3,4,6
	Unit-III				
3. a)	Briefly explain the various steps involved in the design of roof trusses.	4	1	3	3,4,6
b)	An industrial building is proposed to be built in Bangalore city where the basic wind pressure is 33m/s. Particulars of the building are: Length: 120m Width: 24m Roof truss: Fink Eaves height: 8m above GL Truss span: 24m Rise: 5m Truss spacing: 5m Purlin Spacing: 1.3 m Ground: Plain Land Roofing Sheet: AC Sheets Estimate the design of the purlin using channel section.	10	4	3	3,4,6
	Unit-IV				
4. a)	Explain the function of different types of brace of a bridge.	2	2	4	3,4,6
b)	A pratt truss for a single broad gauge trough type railway bridge consists of 6 panels @5 m. The height of the truss is 4 m and the spacing between main girder is 8 m. The chord members are of ISWM 500 @952 N/m, the inner web members are of ISHB 450@925 N/m and the end post are of ISMb 550@1037 N/m. Design the top lateral	12	4	4	3,4,6

	bracing if the wind pressure is 3 KN/m^2				
	Unit-V				
5. a)	Summarize the limitations of plastic analysis	2	1	5	3,4,6
b)	Find the shape factors for the following section: a) Square of side a with its diagonal parallel to the zz-axis b) Triangular section of base d and height h.	12	3	5	3,4,6
	a. Unit-I b. Unit-II				
6. a)	Explain the various types of failure of bolted connection with neat diagram.	7	1	1	3,4
b)	Discuss the design Procedure of unstiffened seat connection in detail.	7	2	2	3,4,6
	a. Unit-III b. Unit-IV				
7. a)	An industrial building is proposed to be built in Bangalore city where the basic wind pressure is 33m/s. Particulars of the buildingare: Length: 120m Width: 24mRoof truss: Fink Eaves height: 8m above GLTruss span: 24m Rise: 5m Truss spacing: 5m Purlin Spacing: 1.3 m Ground: Plain Land Roofing Sheet: AC Sheets Estimate the design of the purlin using channel section	10	5	3	3,4,6
b)	Discuss the wind effects on truss girder bridges.	4	2	4	3,4,6
	a. Unit-V b. Unit-I/II/III/IV/V				
8. a)	Find the shape factors for the following section: a) Square of side a with its diagonal parallel to the zz-axisTriangular section of base d and height h.	10	3	5	3,4,6
b)	List and discuss the various types of loads acting on the industrial building	4	1	3	3,4

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MAHATMA GANDHI INSTITUTE OF TECHNOLOGY (Autonomous)

M.Tech. II Semester End Examinations

Model Question Paper

Course Title: Design of Pre-stressed Concrete Structures **Course Code: CE215PE**

Time : 3 hours Max. Marks : 70

Answer any FIVE Questions

(Each question carries 14 marks)

Q. No.	Stem of the question	M	L	CO	PO
	Unit-I				
1. a)	A post tensioned prestressed beam of rectangular section 250 mm wide is to be designed for an imposed load of 12 kN/m, Uniformly distributed on a span of 12m. The stress in the concrete must not exceed 17 N/mm^2 in compression or 1.4 N/mm^2 in tension at any time and the loss of prestress may be assumed to be 15%. compute the min possible depth of the beam, minimum prestressing force andcorresponding eccentricity	7	2	1	3
b)	Derive the expressions for minimum prestressing force, corresponding maximum eccentricity in the design of prestressed concrete sections from first principles.	7	4	1	3
	Unit-II				
2. a)	A composite T beam is made up of a pretensioned rib 100 mm wide, 200 mm deep, a cast in situ slab 400 mm wide, 40mm thick having a modulus of elasticity of $28kN/mm^2$. If the differential shrinkage is 100×10^{-6} units, compute the shrinkage stresses developed in the precast & cast in situ units.	8	2	2	3
b)	Explain the Theorem of Three Moments for analyzing the secondary moments developed in a continuous prestressed concrete structure.	6	2	2	3
	Unit-III				
3. a)	A square tied prestressed bonded corner column of a multistory building frame is subjected to an ultimate load of 2142kN at an equal eccentricity of 70 mm along the x and y axis respectively. f'c=40 N/mm^2. Design a suitable column section and reinforcements for the column subjected to biaxial bending moments.	9	5	3	3
b)	Explain the practical design recommendations for prestressed concrete compression members	5	2	3	3
	Unit-IV				
4. a)	A highway bridge deck slab spanning of 10m is to be designed as a one way prestressed concrete slab with parallel post-tensioned cables carrying an effective force of 620kN. The deck slab is required to support a uniformly distributed live load of $25kN/m^2$. The permissible stresses in concrete should not exceed $15N/mm^2$ in compression and no tension is permitted at any stage. Determine the spacing of the cables and their position at mid- span section. Assume loss of prestress as 20%.	9	3	4	3
b)	Explain the design principles used in prestressed concrete one way slabs.	5	2	4	3
	Unit-V				
5. a)	The ground floor columns of an industrial shed are to be supported on prestressed piles of 10m length. Each piles is subjected to an axial load of 2500kN. The specified cylinder compressive strength of concrete is $35N/mm^2$. Design a suitable pile of square section. Also determine the number of strands (7-12.5mm) required for the piles if the ultimate tensile strength of the strand is 165kN.	9	3	5	3
b)	Explain the design considerations for prestressed concrete cylinder pipes	5	2	5	3

a. Unit-I b. Unit-II

6. a)	A pretensioned prestressed concrete beam of rectangular section is required to support a design ultimate moment of 100kNm. Determine the dimensions of section with fck=50N/mm^2, fp=1600 N/mm^2 if b, d are the breadth & effective depth of the section, respectively, assuming (xu/d) =0.5	9	3	1	3
b)	Explain the advantages and disadvantages in continuous prestressed concrete members.	5	2	2	3
	a. Unit-III b. Unit-IV				
7. a)	What are load moment interaction curves in columns? Explain with sketches the different types encountered in columns subjected to compression and bending.	9	2	3	3
b)	Explain the design principles used in prestressed concrete two way slabs.	5	2	4	3
	a. Unit-V b. Unit-I/II/III/IV/V				
8. a)	A non-cylinder prestressed concrete pipe of internal diameter 1000mm and thickness of concrete shell 75mm is required to convey water at a working pressure of 1.5N/mm^2. The length of each pipe is 6m. The maximum direct compressive stresses in concrete are 15 and 2 N/mm^2. The loss ratio is 0.8. Compute the circumferential wire winding using 5 mm diameter wires stressed to 1000 N/mm^2. Check for safety against longitudinal stresses developed considering the pipe as a hollow circular beam.	9	2	5	3
b)	Explain the design procedure for prestressed concrete circular tanks	5	2	5	3

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