MAHATMA GANDHI INSTITUTE OF TECHNOLOGY
(Autonomous)
M.Tech. I Semester End Examinations
(Model Question Paper)

MR-22

Course Title: Theory of Elasticity and Plasticity **Course Code: CE101PC**

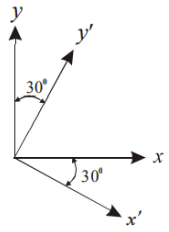
Time: 3 hours Max. Marks : 60

Note: Answer ALL Questions

Part-A (10 x 1 = 10 Marks)

Q. No.	Stem of the Question	M	L	CO	PO
	Unit-I				
1. a)	Define Kinematics.	1	1	1	1,3
1. b)	Define Force. List the characteristics of force.	1	1	1	1,3
	Unit-II				
1. c)	Express the 3 dimensional strain tensor.	1	2	2	2,5
1. d)	Define Octahedral stress.	1	1	2	2,5
	Unit-III				
1. e)	Write the relation between Young's modulus and Rigidity modulus.	1	3	3	3,5
1. f)	Define plane stress with suitable example.	1	1	3	3,5
	Unit-IV				
1. g)	Explain Airy's stress function.	1	2	4	1,3,5
1. h)	State St,Venant's Principle	1	1	4	1,3,5
	Unit-V				
1. i)	State Von-Mises criterion	1	1	5	3,5
1. j)	Write the final equation for plastic stress-strain relationship.	1	3	5	3,5

Part-B (5 x 10=50 Marks)

Q. No.	Stem of the Question	M	L	CO	PO
	Unit-I				
2. a)	Formulate the differential equations of equilibrium in 3 Dimensions.	5	5	1	1,3
2. b)	Discuss the stress invariants. Formulate the expressions for I1, I2, I3	5	3	1	1,3
	OR				
2. c)	Write in detail the derivation of differential equations of equilibrium in polar coordinates.	5	3	1	1,3
2. d)	Calculate the principal stresses and principal strains for the state of stress at a point given below in kg/cm2 $\tau_{ij} = \begin{bmatrix} 200 & 30 & 40 \\ 30 & 100 & 20 \\ 40 & 20 & 50 \end{bmatrix}$	5	4	1	1,3
	Unit-II				
3. a)	Formulate the expressions for 6 compatibility equations for strain.	5	5	2	2,5
3. b)	Data taken from a 450 strain rosette reads as follows: ε_0 = 750 micrometres/m ε_{45} = -110 micrometres/m ε_{90} = 210 micrometres/m Calculate the magnitudes and directions of principal strains.	5	4	2	2,5
	OR				
3. c)	Write in detail the derivation of strain invariants I1,I2,I3.	5	2	2	2,5
3. d)	A sheet of metal is deformed uniformly in its own plane that the strain components related to a set of axes xy are $\varepsilon_x = -200X10^{-6}$ $\varepsilon_y = 1000X10^{-6}$ $\gamma_{xy} = 900X10^{-6}$ Calculate the strain components associated with a set of axes x¢y¢ inclined at an angle of 30o clockwise to the x y set as shown in the Figure below. Also find the principal strains and the direction of the axes on which they act.  	5	4	2	2,5
	Unit-III				
4. a)	Analyze if the following are Airy's stress function and examine the stress distribution represented by them (i) φ=Cy2 (ii)φ=Ax2+Bxy+Cy2 (iii)φ=Ax3+Bx2y+Cxy2+Dy3	5	4	3	3,5
4. b)	Define plane stress with suitable examples. Derive the stress stain and strain stress relations for the given plane stress condition.	5	1	3	3,5
	OR				
4. c)	Define plane strain. Derive the strain stress relationship for plane strain condition.	5	1	3	3,5

4. d)	Describe Airy's stress function. Enumerate the solutions of 2D problems in Cartesian coordinate system by use of polynomials of 1st, 2nd, 3rd, and 4th degree.	5	2	3	3,5
Unit-IV					
5. a)	Compute the stress components for a cantilever beam loaded by point load P at the free end.	5	3	4	1,3,5
5. b)	Solve the expression for torque of an elliptical shaft subjected to uniform torsion.	5	4	4	1,3,5
OR					
5. c)	Compute the stress components for simply supported loaded at the midpoint.	5	3	4	1,3,5
5. d)	Write the equations for torsion of circular cross section with the usual notations also enlist the applications of torsional equations.	5	2	4	1,3,5
Unit-V					
6. a)	Discuss the yield criteria and the flow rules for perfectly plastic and strain hardening materials.	5	2	5	3,5
6. b)	A bolt of 25mm diameter is subjected to an axial force of 50kN. Calculate the maximum shear force the bolt can sustain according to various theories of failure. Assume the yield stress of 300MPa and factor of safety = 2.	5	4	5	3,5
OR					
6. c)	Write Short notes on: 1. Tresca's criterion 2. Von mises criterion	5	1	5	3,5
6. d)	Explain in detail about Yield criteria for pressure dependent and independent materials.	5	2	5	3,5

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

MAHATMA GANDHI INSTITUTE OF TECHNOLOGY
(Autonomous)
M.Tech. I Semester End Examinations
(Model Question Paper)

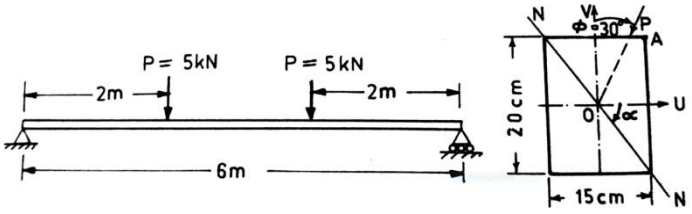
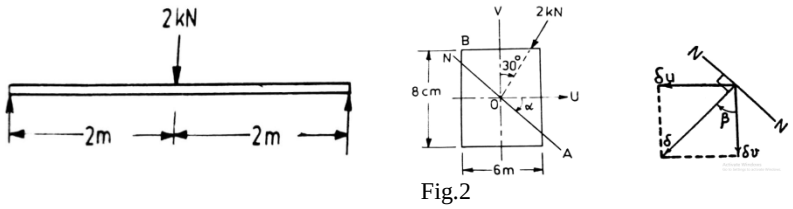
MR-22

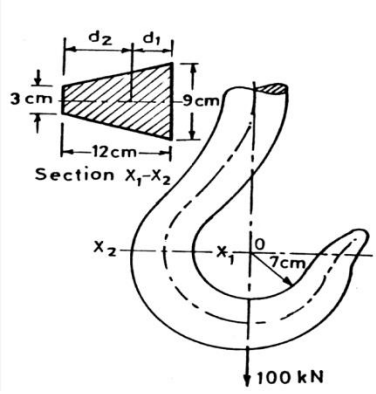
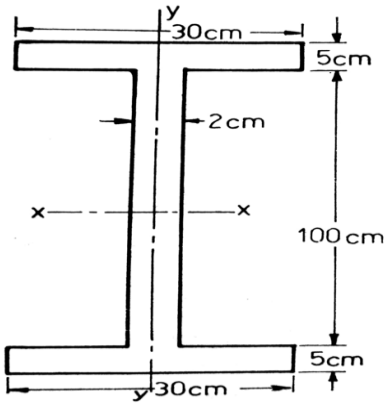
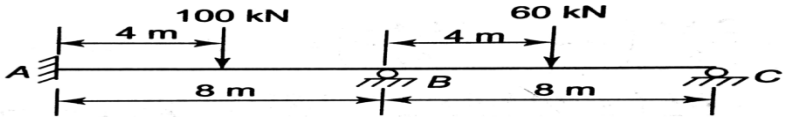
Course Title: Advanced Structural Mechanics **Course Code: CE102PC**
Time: 3 hours Max. Marks : 60

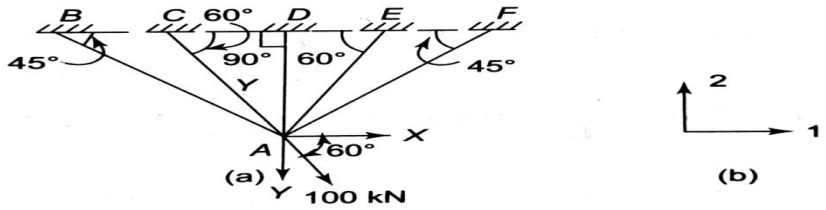
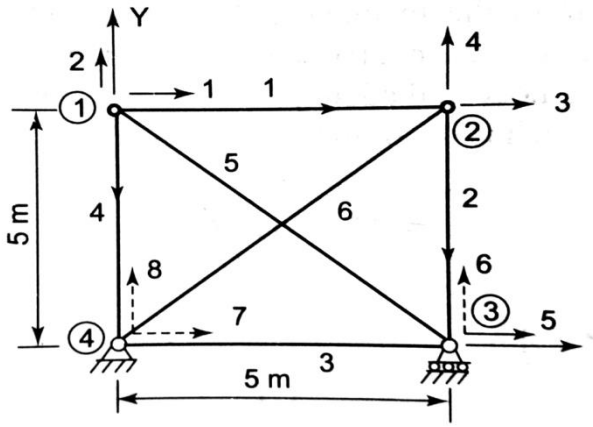
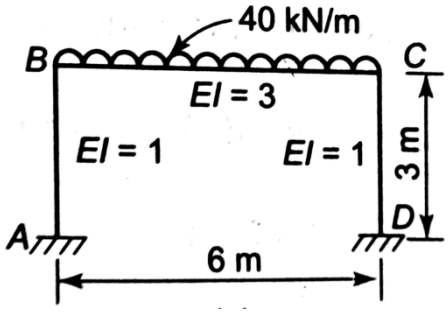
Note: Answer ALL Questions
Part-A (10 x 1 = 10 Marks)

Q. No.	Stem of the Question	M	L	CO	PO
	Unit-I				
1. a)	Define shear centre.	1	1	1	3
1. b)	Differentiate symmetrical and unsymmetrical bending.	1	2	1	3
	Unit-II				
1. c)	Express the formula for stresses in a curved beam.	1	2	2	3
1. d)	Mention the differential equations for Bending moment and Shear force for an infinite beam carrying concentrated load.	1	2	2	3
	Unit-III				
1. e)	Express the Euler's formula for a column with both ends hinged.	1	2	3	3
1. f)	When the local buckling of columns occur.	1	1	3	3
	Unit-IV				
1. g)	What is static indeterminacy for a structure?	1	1	4	3
1. h)	Write a short note on structural idealization.	1	1	4	3
	Unit-V				
1. i)	Write a short note on banded matrix.	1	1	5	3, 6
1. j)	What is semi-band width.	1	1	5	3, 6

Part-B (5 x 10=50 Marks)

Q. No.	Stem of the Question	M	L	CO	PO
	Unit-I				
2. a)	Derive the equation to find the stresses due to unsymmetrical bending.	5	3	1	3
2. b)	A rectangular beam shown in Fig.1 is 15 cm wide and 20 cm deep. It is used as a simply supported beam on a span of 6 m. Two loads of 5 kN each are applied to the beam, each load being 2 m from a support. The plane of the loads makes an angle of 30^o with the vertical plane of symmetry. Find the direction of neutral axis and bending stress at the Point A.  Fig.1	5	2	1	3
	OR				
2. c)	Derive the equation to find the deflections of straight beams subjected to unsymmetrical bending.	5	3	1	3
2. d)	A beam is loaded as shown in Fig.2. Find the maximum deflection.  Fig.2	5	2	1	3
	Unit-II				
3. a)	The dimensions of a 100kN carne hook are shown in Fig.3. Find the stresses at the inside and outside fibres of the hook on a horizontal diameter passing through the centre of curvature.	5	2	2	3

	 Fig.3				
3. b)	Derive the equation to find the deflection of a closed ring.	5	3	2	3
	OR				
3. c)	Determine the maximum bending moment and the maximum deflection for a rail road rail subjected to a single wheel load of 125 kN. The elastic support for the rail has a spring constant of k = 14 MN/m2. The moment of inertia of rail is 3700 x 10^{-8} m^4, E = 200 GN/m^2. Also calculate the maximum stress in the rail assuming that the depth of the rail is 200mm and that the distance of the centroidal axis of the cross-section of the rail from the top surface is 120 mm.	5	3	2	3
3. d)	Derive the equation to find bending moment and shear force in a infinite beam subjected to distributed load segment.	5	3	2	3
	Unit-III				
4. a)	Determine the critical load for an Euler's column with both ends hinged.	5	3	3	3
4. b)	A built up beam as shown in Fig.4 is simply supported at its ends. Compute its length given that when it is subjected to a load of 40kN/m length, it deflects by 1 cm. Find out the safe load if this beam is used in a column with both ends fixed. Assume a factor of safety of 4. Use Euler's formula. Take E = 210GPa.  Fig.4	5	2	3	3
	OR				
4. c)	Explain local buckling of columns.	5	2	3	3
4. d)	Explain inelastic buckling of columns using double modulus theory.	5	2	3	3
	Unit-IV				
5. a)	Explain the flexibility method of matrix analysis.	5	2	4	3
5. b)	Analyze the continuous beam shown in Fig.5 using stiffness matrix method.  Fig.5	5	4	4	3
	OR				
5. c)	Explain the following. a) Element stiffness matrix b) Local and Global coordinates c) Load Vector	5	2	4	3

5. d)	Determine the displacements of the joint A of the pin jointed plane frame shown in Fig.6 using stiffness matrix method. Also determine the bar forces for the given loading.  Fig.6	5	4	4	3
	Unit-V				
6. a)	Explain the procedure for constructing the direct stiffness matrix of a continuous beam.	5	2	5	3, 6
6. b)	Construct the direct stiffness matrix, K for the truss shown in Fig.7  Fig.7	5	6	5	3, 6
	OR				
6. c)	Explain the following a) Semi band width b) Banded matrix	5	2	5	3, 6
6. d)	Construct the direct stiffness matrix, K for the frame shown in Fig.8  	5	6	5	3, 6

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

MAHATMA GANDHI INSTITUTE OF TECHNOLOGY
(Autonomous)
M.Tech. I Semester End Examinations
(Model Question Paper)

MR-22

Course Title: Special Concretes **Course Code: CE112PE**
Time: 3 hours Max. Marks : 60

Note: Answer ALL Questions
Part-A (10 x 1 = 10 Marks)

Q. No.	Stem of the Question	M	L	CO	PO
	Unit-I				
1. a)	Define workability.	1	1	1	1,6
1. b)	What are the methods adopted to avoid segregations of concrete?	1	1	1	1,6
	Unit-II				
1. c)	Differentiate between the high performance concrete and high strength concrete.	1	1	2	1,3,5,6
1. d)	List the properties of high strength concrete.	1	1	2	1,3,5,6
	Unit-III				
1. e)	Define Light weight concrete	1	1	3	1,3,5,6
1. f)	State the requirements of reactive powder concrete.	1	1	3	1,3,5,6
	Unit-IV				
1. g)	What are the Factors affecting the choice of mix proportions	1	1	4	1,3,5,6
1. h)	Define concrete mix design	1	1	4	1,3,5,6
	Unit-V				
1. i)	List the Non-destructive test on concrete structures.	1	1	5	1,3,5,6
1. j)	Discuss ultrasonic pulse velocity test.	1	1	5	1,3,5,6

Part-B (5 x 10=50 Marks)

Q. No.	Stem of the Question	M	L	CO	PO
	Unit-I				
2. a)	Define Abrams Law and Gel space ratio. State their major differences in determination of concrete strength.	5	2	1	1,6
2. b)	Explain in detail the test procedure of L-box test for self-compacting concrete.	5	3	1	1,6
	OR				
2. c)	Discuss in detail the stress strain behaviour of concrete with neat diagram.	5	2	1	1,6
2. d)	State the classification of shrinkage of concrete and explain one of them briefly.	5	2	1	1,6
	Unit-II				
3. a)	Write in detail the design consideration for high performance concrete.	5	3	2	1,3,5,6
3. b)	Discuss the characteristics of high performance concrete.	5	2	2	1,3,5,6
	OR				
3. c)	Explain in detail the properties of high strength concrete.	5	3	2	1,3,5,6
3. d)	List the materials used for high strength concrete and discuss in brief.	5	2	2	1,3,5,6
	Unit-III				
4. a)	What is FRC? State the importance of FRC over conventional concrete.	5	2	3	1,3,5,6
4. b)	Define Self compacting concrete and write in brief its benefits and characteristics.	5	2	3	1,3,5,6
	OR				
4. c)	Define roller compacted concrete and state the advantages and application of it.	7	2	3	1,3,5,6
4. d)	Write a short note on Bacterial concrete.	3	2	3	1,3,5,6
	Unit-IV				
5. a)	Design the concrete mix for M25 grade of concrete for the following data using DOE method a. Compressive strength for 28 days = 25 N/mm2 b. Standard deviation = 4 N/mm2 c. Nominal cover to steel reinforcement = 30mm d. Maximum size of Coarse Aggregates = 20mm e. Aggregates are Uncrushed type	7	6	4	1,3,5,6

	f. Degree of workability, Slump = 60mm g. Type of exposure : Moderate h. Cement : Sulphate Resisting Portland Cement (specific gravity - 3.15) i. Specific gravity of Fine aggregate and Coarse aggregate = 2.7 j. Fine aggregate is confined to Zone: II of Table 4: IS 383 -1970 k. Coarse Aggregates: 20mm MSA (78%) & 10mm MSA (22%)				
5. b)	Explain the step wise Procedure for IS mix design in detail	3	3	4	1,3,5,6
OR					
5. c)	Discuss the step-by-step procedure of ACI method of concrete mix design.	4	2	4	1,3,5,6
5. d)	Design the concrete mix for the following data by BIS method : characteristic compressive strength = 20MPa, maximum size of aggregate = 20mm (angular), Degree of workability = 0.9 CF, Degree of quality control = good type of exposure = severe. Water absorption by CA = 0.5% and Moisture content in FA = 2.0%. Assume any suitable missing data.	6	5	4	1,3,5,6
Unit-V					
6. a)	Define durability of concrete and discuss the factors affecting durability.	5	2	5	1,3,5,6
6. b)	Write the importance of resistivity of concrete and list the types resistivity testing.	5	3	5	1,3,5,6
OR					
6. c)	Write a short on how to prevent acid attack on concrete	5	2	5	1,3,5,6
6. d)	Briefly explain the evaluation procedure of dynamic shear and young's modulus.	5	4	5	1,3,5,6

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

MAHATMA GANDHI INSTITUTE OF TECHNOLOGY
(Autonomous)
M.Tech. I Semester End Examinations
(Model Question Paper)

MR-22

Course Title: Advanced Reinforced Concrete Design **Course Code: CE114PE**
Time: 3 hours Max. Marks : 60

Note: Answer ALL Questions
Part-A (10 x 1 = 10 Marks)

Q. No.	Stem of the Question	M	L	CO	PO
	Unit-I				
1. a)	Explain partial safety factors for materials in Limit State Method.	1	2	1	1,3
1. b)	Discuss different load combinations considered for design in limit state method.	1	2	1	1,3
	Unit-II				
1. c)	Explain conditions of loading pattern to obtain maximum positive bending moments in interior span of a continuous beam.	1	2	2	3,5, 6
1. d)	Define plastic hinge in RC members.	1	1	2	3,5, 6
	Unit-III				
1. e)	What are the limitations of yield line theory.	1	1	3	1,3. 5.6
1. f)	List the assumptions used in direct design method.	1	1	3	1,3. 5.6
	Unit-IV				
1. g)	How the shear span effects the shear behaviour of RC beam.	1	1	4	3,5
1. h)	List various factors affects the bond resistance	1	1	4	3,5
	Unit-V				
1. i)	Define slenderness ratio.	1	1	5	3,5, 6
1. j)	What is minimum eccentricity in RC columns?	1	1	5	3,5, 6

Part-B (5 x 10=50 Marks)

Q. No.	Stem of the Question	M	L	CO	PO
	Unit-I				
2. a)	Deduce Stress block parameters?	5	3	1	1,3
2. b)	Compare Working stress method, Limit state method and Ultimate load method	5	2	1	1,3
	OR				
2. c)	Discuss Moment rotation characteristics of RC members?	5	2	1	1,3
2. d)	Explain redistribution of moments in statically determinate and indeterminate beams.	5	2	1	1,3
	Unit-II				
3. a)	Design a typical interior span of a continuous deep beam using following data: Span of beam 9m, over all depth 4.5m, support width 0.85m, beam width 0.35 m, uniformly distributed live load 100 kN/m^2, uniformly distributed dead load 95 kN/m^2. Use M25 concrete and Fe 415 steel.	7	4	2	3,5,6
3. b)	Sketch the reinforcement details of deep beam in Question 3 (a).	3	2	2	3,5,6
	OR				
3. c)	A continuous beam with simple supports has two spans each of 7m. the characteristic dead load is 12 kN/m and the characteristic live load is 15 kN/m. Design the critical sections of the beam and sketch the details of reinforcements using limit state method Adopt M20 grade concrete and Fe 500 grade steel.	7	4	2	3,5,6
3. d)	Detail the reinforcement and draw cross sections.	3	2	2	3,5,6
	Unit-III				
4.	Design an interior panel of a flab slab for a live load of 5 kN/m^2 and floor finish of 1.5kN/m^2. The panels are 6m ×6m. The panel is supported on a circular column of 475 mm diameter. Drops shall be provided. Use M25 grade Concrete and Fe415 grade Steel.	10	4	3	1,3.5.6
	OR				
4. c)	Using yield line theory, compute the reinforcement details the floor slab of a classroom of multi-storied structures for the given data. Size of classroom is 6m x 6m. the panel is continuous on all edges. Use M20 concrete and Fe 415 steel. Sketch the reinforcement details	7	3	3	1,3.5.6

4. d)	Discuss the limitations of Direct Design Method.	3	2	3	1,3.5.6
Unit-IV					
5. a)	A rectangular beam 300 mm wide and 450 mm deep is subjected to a bending moment 35 kN-m, shear force 25kN and torsional moment 40 kN-m. Design the beam by adopting M20 grade concrete and Fe415 steel.	7	4	4	3,5
5. b)	Discuss various cracks develop in a beam with neat sketches.	3	2	4	3,5
OR					
5. c)	A reinforced concrete beam 230 mm wide and 450 mm deep is reinforced with 3 nos 16 mm dia bars of grade Fe415, on tension side, with an effective cover of 50 mm. Design the shear reinforcement for ultimate design shear force 50 kN. Assume the grade of concrete is M20.	7	4	4	3,5
5. d)	Determine the minimum development length of 20 mm diameter of Fe 415 bar in tension. Assume the grade of concrete is M20.	3	3	4	3,5
Unit-V					
6. a)	A RC column 400 mm x 600 mm is subjected to an axial ultimate load of 3000 KN. The column is bent in single curvature about minor axis with ultimate moment My=110 kN-m length as 5.5 m on both axes, compute the design moments for the column. Assume reduction factor K_a=1	8	4	5	3,5,6
6. b)	Draw the Load Moment interaction curve and indicate salient features.	2	2	5	3,5,6
OR					
6. c)	A concrete column circular in section with diameter 300 mm and reinforcement with 8 bars of 20 mm diameter is braced and hinged at both ends 5.5 m apart. The column caries an axial ultimate load of Pu=850kN. Check the safety of section assuming concrete of grade M20 and steel of grade Fe415 and effective cover 60 mm.	8	4	5	3,5,6
6. d)	List the factors that affect behavior of slender column.	2	1	5	3,5,6

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