DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY,

LONERE – RAIGAD – 402 103

Winter Semester Examination – December – 2017

Branch: M. Tech. (Structural Engineering) **Semester: I**

Subject with Subject Code: Theory of Elasticity & Plasticity (CVSE 101) **Marks: 60**

Date: 12 / 12 / 2017 **Time: 3 Hrs.**

Instructions to the Students

1. Each question carries 12 marks.
2. Attempt any five questions of the following.
3. Illustrate your answers with neat sketches, diagram etc., wherever necessary.
4. If some part or parameter is noticed to be missing, you may appropriately assume it and should mention it clearly.

(Marks)

Q.1. Solve any Two of the following Three Sub-Questions. **(12)**

a) Describe the Saint Venant's equations of Compatibility. (06)

b) The state of stress at a point is given by

$$[\sigma]=\begin{bmatrix}100 & -20 & 50\\ -20 & 30 & 10\\ 50 & 10 & 20\end{bmatrix} MPa$$

Determine the magnitudes of the Principal Stresses and hence draw Mohr's Circle and Mohr's stress plane π. (06)

c) The displacement field for a body is given by $u=\{(x^2+y^2+2)i+(3x+4y^2)j+(2x^3+4z)k\}\times 10^{-4}$. What are the strain components at $(2,3,4)$? Use only linear terms. (06)

Q.2. Solve any Two of the following Three Sub-Questions. **(12)**

a) Explain Constitutive relation for Linearly Elastic, Orthotropic material. (06)

b) A cubic element is subjected to the following state of stress:

$$[\sigma]=\begin{bmatrix}120 & 0 & 0\\ 0 & 30 & 0\\ 0 & 0 & -20\end{bmatrix} MPa$$

Assuming the material to be homogeneous and isotropic, determine the Principal Shear Strains and the Octahedral Shear Strain if $E=200GPa$ and $\upsilon=0.26$.

c) Write short notes on: (06)

1) Uniqueness Theorem

2) Principal of Superposition

Q.3. Solve any One of the following Two Sub-Questions. **(12)**

a) A thick walled tube is subjected to an external pressure p_2. Its internal and external radii are 0.15 cm and 20 cm respectively, $\upsilon = 0.3$, $E = 200GPa$. If the maximum shear stress is limited to $E = 200MPa$, determine the value of p_2 and the change in the external radius. (12)

b) Discuss in details, the concentrated load acting on the free surface of plate (Flemant's Problem). (12)

Q.4. Solve any Two of the following Three Sub-Questions. **(12)**

a) What are the basic assumptions for the torsion of circular shafts do not hold good for non circular shafts? What is warping and Saint Venant's warping function? (06)

b) What is membrane analogy for Torsion? Describe the experimental set up and some typical contour diagrams of the deflected membrane. (06)

c) A thin walled box section of dimension $2a \times a \times t$ is to be compared with a solid section of diameter a. Find the thickness t so that the two sections have the same maximum stress for the same torque. (06)

Q.5. Solve any Two of the following Three Sub-Questions. **(12)**

a) Explain maximum Shear theory of failure along with limitations and applications of the same. (06)

b) Explain Beltrami's Energy criteria/ theory with limitations. (06)

c) Determine the diameter of a cold rolled steel shaft, 0.8 m long used to transmit 60 hp at 500 rpm. The shaft is simply supported at its ends in bearings. The shaft experiences bending owning to its own weight also. Use the factor of safety 2. The tensile yield limit is 290 MPa and the shear yield limit is 150 MPa. Use the maximum Shear Stress theory. (06)

Q.6. Solve any Two of the following Three Sub-Questions. **(12)**

a) Explain Stress Space and Yield Surface of Von Mises and Tresca. (06)

b) Explain Drucker Prager Yield Criteria. (06)

c) Draw and Explain simple Visco-Elastic models and Visco-Plastic models for –D Solids. (06)

Q.6. (i) Write a short note on geometrical nonlinearity in the system. (06)

(ii) Write a short note on material nonlinearity in the system. (06)

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LONERE - RAIGAD - 402 103
Winter Semester Examination - December - 2017

Branch: M.Tech. (Structural Engineering) Semester: I

Subject with Subject Code: Matrix Method of Structural Analysis [CVSE102] Marks: 60

Date: 14 / 12 / 2017 Time: 3 Hrs.

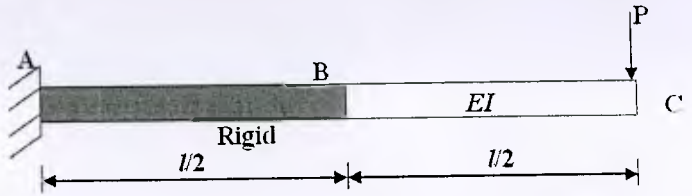
Instructions to the Students:

1. Each question carries 12 marks.
2. Attempt any five questions of the following.
3. Illustrate your answers with neat sketches, diagram etc., wherever necessary.
4. If some part or parameter is noticed to be missing, you may appropriately assume it and should mention it clearly.

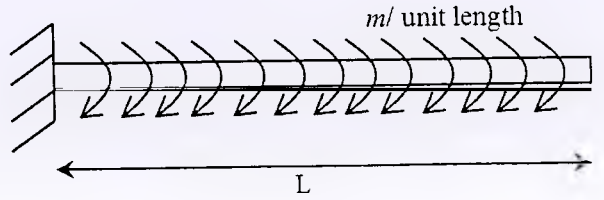
(Marks)

Q.1. (i) State and Explain moment area method of structural analysis (04)

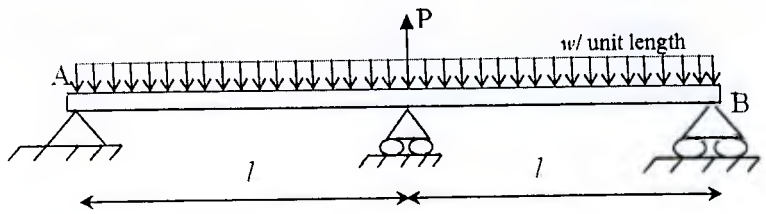
(ii) Find slope and deflection of point C in the following beam setup. (04)



(iii) Use virtual work method to get slope at point B in the beam shown below when subjected to uniformly distributed moment *m*. Assume beam is having uniform flexural rigidity *EI*. (04)

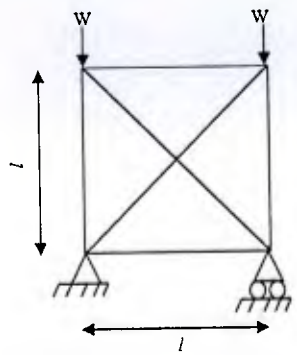


Q.2. Draw bending moment diagram for the beam setup shown below. Support B sinks down by 20 mm. Use direct flexibility matrix method to get unknown reaction at point B. (12)



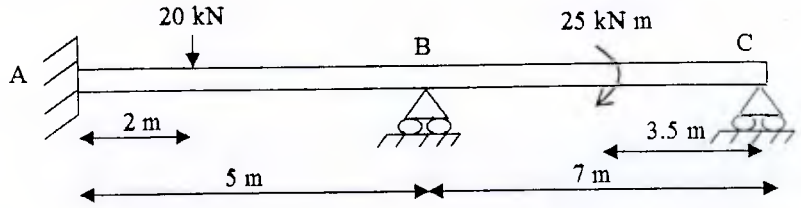
Assume beam is having uniform flexural rigidity EI = $20x10^5$ Nm^2 L=5 m; w = 10 kN/m; P=20 kN.

Q.3. Determine deflection of point B in vertically downward direction using generalized flexibility matrix method in the truss shown in figure below. Assume uniform axial rigidity *AE* for each member. (12)



OR

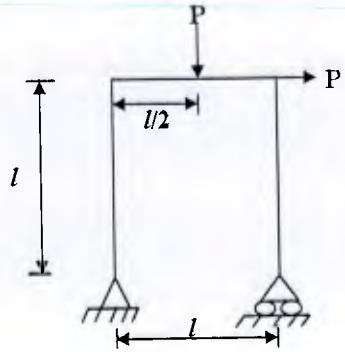
Q.3. Determine slope at point B and C in the beam setup shown in figure below using generalized flexibility matrix method. Assume flexural rigidity *EI* for part 'AB' and 2*EI* for part 'BC'. (12)



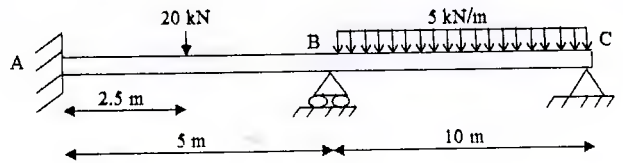
Q.4. (i) State assumptions made while analyzing structure with matrix stiffness method. (04)

(ii) Construct element stiffness matrix (only for end rotation) for a beam with length L and flexural rigidity EI. (04)

(iii) Draw bending moment diagram for frame setup shown in the figure below. (04)



Q.5. Solve for all the unknown reactions in the following continuous beam setup EI=10 x 10^5 N m^2. Use generalized stiffness matrix method. Neglect axial deformation. (12)



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Winter Semester Examination – December – 2017

Branch: M.Tech. (Structural Engineering) **Semester: I**

Subject with Subject Code: Structural Dynamics (CVSE103) **Marks: 60**

Date: 16 / 12 /2017 **Time: 3 Hrs.**

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Instructions to the Students

1. Each question carries 12 marks.
2. Attempt any five questions of the following.
3. Illustrate your answers with neat sketches, diagram etc., wherever necessary.
4. If some part or parameter is noticed to be missing, you may appropriately assume it and should mention it clearly.

Q.1. a) Derive the equation for the displacement response of a viscously damped SDoF system due to initial velocity $\dot{u}(0)$ for three cases:

(a) Underdamped system
(b) Critically damped system and
(c) Overdamped system. **(8)**

b) Explain SDoF and MDoF with neat sketch. **(4)**

Q.2. a) Using Duhamel's Integral, determine the response of an undamped system to a rectangular pulse force of amplitude p_o and duration t_d. **(8)**

b) Describe in brief methods of numerical evaluation of dynamic response. **(4)**

Q.3. Solve the following.

i) A uniform cantilever tower of length L has a mass per unit length = m and flexural rigidity EI is shown in fig.3(i). Assuming that the shape function $\psi(x) = 1 - \cos(\pi x/2L)$, formulate the equation of motion for the system excited by ground motion and determine its natural frequency. **(12)**

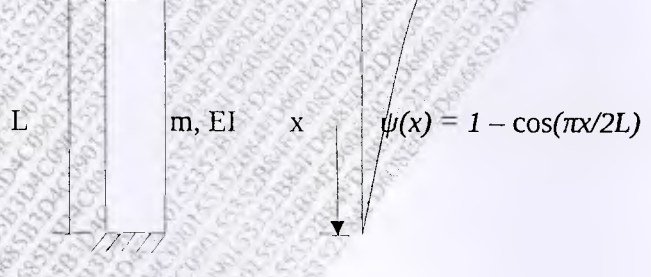

Fig. 3(i)

Q.4. Solve the following.

i) For lumped mass MDoF system explain how the response is obtained using modal super position method. **(12)**

Q.5. Solve any ONE of the following.

i) Figure 5(i) shows a shear frame and it's floor masses and story stiffnesses. This structure is subjected to harmonic horizontal force $p(t) = p_0 \sin \omega t$ at top floor. Derive equations for steady – state displacements of the structure by direct solution of coupled equations. **(12)**

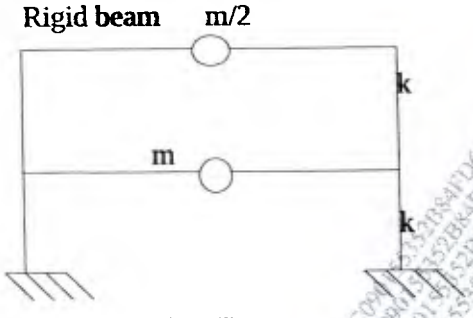

Fig.5(i)

ii) Consider the system as shown in fig.5 (ii) subjected to harmonic force $p_1(t) = p_0 \sin \omega t$ as shown in fig. By modal analysis determine the steady – state response of the system. **(12)**

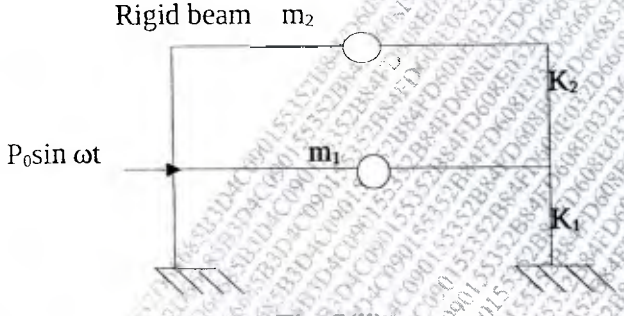

Fig. 5(ii)

Q.6. Solve the following.

i) Derive an equation for numerical evaluation of dynamic response by time- steping method. **(12)**

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Winter Semester Examination – December – 2017

Branch: M.Tech. (Structural Engineering) **Semester: I**

Subject with Subject Code: Numerical Methods [CVSE-E1-02] **Marks: 60**

Date: 18 / 12 / 2017 **Time: 3 Hrs.**

Instructions to the Students

1. Each question carries 12 marks.
2. Attempt any five questions of the following.
3. Illustrate your answers with neat sketches, diagram etc., wherever necessary.
4. If some part or parameter is noticed to be missing, you may appropriately assume it and should mention it clearly.
5. Show all computations up to the fourth place of decimal.

Q1 (a) Write a short note on the use of Numerical Methods. 4

(b) The numerical representation in the hexadecimal system for a certain number is ABCD.ABEF. However, in a certain computer, the limitation for storage of numbers is only upto the fourth place after the floating point. Find the percentage error. 4

(c) Write short notes on (i) mantissa and (ii) exponent. 4

Q2 (a) Use the Gaussian Elimination method to solve the following system of equations. 4

$$\begin{aligned} 3x + 5y + 4z + 5w &= 17 \\ 7x + 2y - 3z + 8w &= 14 \\ 3x + 8y - 2z - 2w &= 7 \\ 5x + 7y - 3z - 3w &= 6 \end{aligned}$$

(b) What is the requirement of the Gauss Siedel method for convergence? 4

(c) Explain the Newton Raphson Method with a diagram. Explain the mathematical theory behind the method. 4

Q3 (a) Use the following data to create the Lagrange interpolant polynomial to determine the value of the interpolant at x=1: 6

x	-5	-2	0	2	5
y	0.0385	0.2000	1.0000	0.2000	0.0385

(b) Find the exponential regression $y = ae^{bx}$, which fits the following data, using the least squares method: 6

x	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
y	4.1043	3.7541	3.8466	2.9858	3.5455	2.5463	2.5849	2.8749	2.9105	2.8051	2.3001

Q4 (a) Use the trapezoidal rule to compute the value of the following integral 6

$$\int_5^6 \frac{3x^2+10x}{x^3+5x^2-6}\,dx.$$

Find the percentage error with respect to the value calculated using classical methods. Use a step size of 0.1.

(b) Use appropriate Gaussian Quadrature to solve the integral: 6

$$\int_0^{\infty} e^{-x}\left(\frac{3x^2+10x}{x^3+5x^2-6}\right)dx$$

Q5 (a) Solve the following differential equation with the Runge-Kutta method of fourth order. 6

$$\frac{dy}{dx} = y^2 + xy + 1, \qquad y(x=0) = 0.1$$

Find the value of y at x = 1. Use a step size of 0.1

(b) Write a short note on the Newmark Beta method. 6

Q6 (a) What is a boundary value problem? 6

(b) Solve the boundary value problem using the finite difference method: 6

$$\frac{d^2y}{dx^2} + (x^2-3)\frac{dy}{dx} + xy = 0,$$

with the boundary conditions $y(x=0) = 0$, and $y(x=1) = 1$.

----- END OF PAPER -----

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LONERE – RAIGAD – 402 103
Winter Semester Examination – December – 2017

Branch: M. Tech. Civil (Structural Engineering) **Semester: I**

Subject with Subject Code: Advanced Pre-strssed Concrete [CVSE-E2/01] **Marks: 60**

Date: 20 / 12 / 2017 **Time:3 Hrs.**

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Instructions to the Students:

1. Each question carries 12 marks.
2. Attempt any five questions of the following.
3. Illustrate your answers with neat sketches, diagram etc., wherever necessary.
4. If some part or parameter is noticed to be missing, you may appropriately assume it and should mention it clearly at proper location.
5. Use of IS 456-2000 and IS 1343 is allowed in the examination.

Q.1. Attempt the following: **(Marks)**

(a) What are the basic concept applied to explain and analyze prestressed concrete. Explain any one. **(4)**

(b) A rectangular concrete beam 250mm x 300mm is prestressed by a force of 540kN at a constant eccentricity of 60mm. The beam supports a concentrated load of 68kN at the center of the span of 3m. Determine the location of the pressure line at the centre, quarter span and support section of the beam. neglect the self weight of the beam. **(8)**

Q.2. **(a)** Explain magnel's method of end block design with neat sketch. **(4)**

(b) The end block of prestressed concrete beam, rectangular in section is 120mm wide and 300mm deep. The prestressing force of 250kN is transmitted to concrete by a distribution plate 120mm wide and 75mm deep, concentrically located at the ends. calculate the position and magnitude of the maximum tensile stress on the horizontal section through the centre of the end block using the method of (a) Magnel (b) Guyon. yield stress in steel=260 N/mm^2. [Coefficient of stresses given in Table 1 and Table 2] **(8)**

Table -1 Coefficient of stress in End blocks (Magnel)

Distance from far end, x/h	K1	K2	K3
0.4	-4.32	2.16	1.728
0.5	-5	2	1.25
0.6	-4.48	1.6	1.768

Table -2 Vertical stresses along axis at ends of prestressed beams (Guyon)

Distribution ratio (yp_0/y_0)	Position of zero stress($x/2y_0$)	Position of max. stress (x/2y0)	Ratio of max. tensile stress to average stress
0.2	0.14	0.3	0.3
0.3	0.16	0.36	0.33

Q.3. A small prestressed concrete beam is to be designed to cover a span of 12 m and to carry a super imposed load of 15 kN/m. The quantity of concrete proposed to be used is M45. The permissible stress is compression can be 14N/mm^2 and in tension 1.4 N/mm^2. force loss in prestressing cable can be assumed to be 15% of the initial force during service load conditions. Design the cross section dimensions, prestressing force and eccentricity. adopt stress range approach for arriving at the cross sectional dimensions. **(12)**

Q.4. Design a post tensioned prestressed concrete two way slab, 6m x 9m with discontinuous edges, to support an imposed load of 3 kN/m^2. Cables of four wires of 5 mm diameter carrying an effective force of 100kN are available for use. Design the spacing of cables in the two directions and check for the safety of the slab against collapse and excessive deflection at service loads. F_{ck} =40 N/mm^2, F_p=1600 N/mm^2 and E_c = 38kN/mm^2.[Take bending moment coefficient α_x for shorter span 0.089 and for longer span 0.056], [Assume $F_{pu}/0.87F_p$= 1] **(12)**

Q.5. **(a)** A prestrssed concrete pipe is to be designed to withstand a fluid pressure of 1.6 N/mm^2. The diameter of the pipe is 1200mm and shell thickness is 100mm. The maximum compressive stress in concrete at transfer is 16N/mm^2. A residual compression of 1N/mm^2 is expected to be maintained at service loads. Loss ratio is 0.8 high tensile wires of 5mm diameter initially stressed to 1kN/mm^2 are available for use. Determine (a) The number of turns of wire per meter length. (b) The pitch of wire winding. **(06)**

(b) write down step by step design procedure for circular tank. [Design equation for the computation of minimum wall thickness, circumferential prestress, spacing of wires and vertical prestress] **(06)**

Q.6. **(a)** What are the various causes of cracking of prestressed concrete, Explain types of cracks in concrete structures, common location of occurrence and suggest remedial measures. **(06)**

(b) When the grouting and sealing technique is economical to use. What are the types of sealants used for sealing technique. **(06)**

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