H.T No: | | | | | | | | | | | R18 | Course Code: B30411

CMR COLLEGE OF ENGINEERING & TECHNOLOGY
(UGC AUTONOMOUS)

M.Tech II Semester Supplementary Examinations March/April-2023

Course Name: FINITE ELEMENTS METHODS IN STRUCTURAL ENGINEERING
(Structural Engineering)

Date: 21.03.2023 FN **Time: 3 hours** **Max.Marks: 70**

(Note: Assume suitable data if necessary)

PART-A

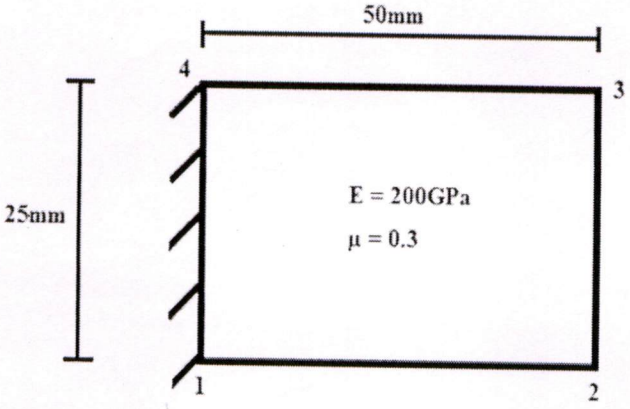
Answer all FIVE questions (Compulsory)
Each question carries FOUR marks. **5x4=20M**

1. Discuss about the energy principles involved in Finite element analysis. 4M
2. Define shape function, what are the characteristics of interpolation function and shape function. 4M
3. Write short notes on three-dimensional elements. 4M
4. Write the steps involved in obtaining strain displacement relation matrix for 4 noded shell elements. 4M
5. What are the basic methods for non-linear analysis? 4M

PART-B

Answer the following. Each question carries TEN Marks. **5x10=50M**

6. A). Obtain an expression for strain displacement matrix for a rectangular element shown in Figure 1. Assuming plane stress condition with displacement matrix as [0, 0, 0.051, 0.076, 0.0152, 0.081, 0, 0] T, determine the stresses at the centre of the rectangle shown. 10M



OR

6. B). Derive expressions for natural coordinates in a Constant Strain Triangular element. Show that they are nothing but area coordinates. 10M

7. A). What is displacement and shape function? Derive the element stiffness matrix for beam elements. 10M

OR

7. B). Explain the concept of element load vector for beam elements. Write the shape function for constant strain triangle by using polynomial function? 10M

(P.T.O..)

8. A). Write a note on isoparametric formulations and how the geometric as well as field variables are taken in to account. 10M

OR

8. B). Explain various axi-symmetric elements. Obtain Generate stiffness matrix for 4 noded Qudrilateral element. 10M

9. A). What are the assumptions in thin plate theory? Write the relation between forces and stresses action on a thin plate. 10M

OR

9. B). Explain about the formulation of 4 noded isoparametric quadrilateral plate element. 10M

10. A). Discuss briefly about the modified iterative procedure for the non-linear analysis of structures. 10M

OR

10. B). Explain about the applications of non-linear analysis to special structures. 10M

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H.T No: | | | | | | | | | | | **R18** **Course Code: B30412**

CMR COLLEGE OF ENGINEERING & TECHNOLOGY
(UGC AUTONOMOUS)

M.Tech II Semester Supplementary Examinations March/April-2023

Course Name: STRUCTURAL DYNAMICS

(Structural Engineering)

Date: 24.03.2023 FN **Time: 3 hours** **Max.Marks: 70**

(Note: Assume suitable data if necessary)

PART-A

Answer all FIVE questions (Compulsory)

Each question carries FOUR marks. **5x4=20M**

1. Derive the expression for logarithmic decrement. 4M
2. Derive the expression for the Duhmal's Integral. 4M
3. Write a short notes on forced vibration of MDOF system. 4M
4. What is meant by mode shape and base isolation. 4M
5. Write a short notes on rigid base excitation. 4M

PART-B

Answer the following. Each question carries TEN Marks. **5x10=50M**

6. A). Explain critical damping, over damping and derive an expression for equation of motion for free under damped SDOF system. 10M

OR

6. B). i) A vibrating system consists of a mass of 5 kg, spring of stiffness 120 N/m and a damper with a damping co-efficient of 5 N-s/m. Calculate: a) Damping factor, b) Natural frequency of the system, c) Logarithmic decrement, d) The ratio of two successive amplitude and e) The number of cycles after which the initial amplitude reduces to 25%. 5M

ii) Briefly explain the types of vibration 5M

7. A). Derive the expression for Force Transmitted to the base subjected to harmonic Excitation. 10M

OR

7. B). A one storey building idealised as 3.65 m high frame with two columns hinged at the base and a rigid beam, has a natural period of 0.5 sec. Each column is wide –flange steel section W8X 18. The properties for bending about its major axis are I_x= 2576 cm^4, Section modulus = 249 cm^3 and E= $2x10^5$ N/mm^2. Neglecting damping, determine the response of this frame due to a rectangular pulse force of amplitude of 17.8 kN and duration t_d=0.2 sec. the response quantities of interest are displacement at the top of the frame and maximum bending stress in columns. 10M

8. A). Derive the expression for maximum displacement for a forced system by using modal superposition system. 10M

(P.T.O..)

OR

8. B). Predict natural frequencies and mode shapes of a MDOF system. The mass and stiffness matrix of a MDOF system given below 10M

$$[M]=m\begin{bmatrix}1&0&0\\0&1&0\\0&0&2\end{bmatrix},\ [K]=K\begin{bmatrix}2&-1&0\\-1&3&-2\\0&-2&2\end{bmatrix}.$$

9. A). The line diagram of multi-storeyed building as shown in Fig. 2. Obtain the frequencies and modes of vibration using Stodola method. Given m = $4x10^4$ kg and k = 5 $x10^4$kN/cm 10M

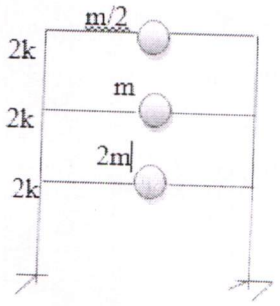

Fig.2

OR

9. B). Find the first three natural vibration frequencies and modes of uniform beam clamped at one end and simply supported at other end. Sketch the mode shapes. 10M

10. A). Formulate the free vibration for the two element frame as shown in Fig.3 Determine the natural frequencies and modes of vibration of the system. 10M

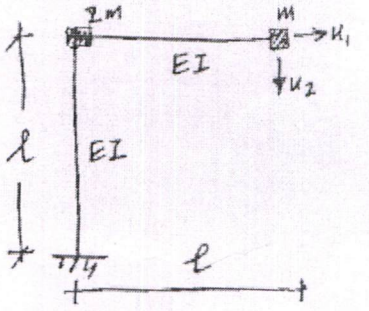

Fig.3

OR

10. B). Discuss in detail the IS code method of seismic analysis. 10M

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H.T No: | | | | | | | | | | | **R18** **Course Code: B30414**

CMR COLLEGE OF ENGINEERING & TECHNOLOGY
(UGC AUTONOMOUS)

M.Tech II Semester Supplementary Examinations March/April-2023

Course Name: DESIGN OF PRESTRESSED CONCRETE STRUCTURES

(Structural Engineering)

Date: 28.03.2023 FN **Time: 3 hours** **Max.Marks: 70**

(Note: Assume suitable data if necessary)

PART-A

Answer all FIVE questions (Compulsory)

Each question carries FOUR marks. **5x4=20M**

1. Discuss the various losses of pre-stress. 4M
2. Explain the cable profile and cable layout and its importance. 4M
3. Distinguish between short term and long term deflections. 4M
4. Write a brief note on anchorage zone reinforcement and its merits. 4M
5. Enumerate the various merits and demerits of PSC beams. 4M

PART-B

Answer the following. Each question carries TEN Marks. **5x10=50M**

6. A). A PSC beam of section 120 mm wide and 300 mm deep is used over an effective span of 6 m to support a UDL of 4 KN/m which includes self weight of the beam. The beam is prestresses by a straight cable carrying a force of 180 KN and located at an eccentricity of 50 mm. Determine the location of the thrust line in the beam and plot its position. 10M

OR

6. B). Calculate the loss of prestress due to elastic shortening for a post tensioned beam of size 250mm x 300mm subjected to a prestressing of 1200 N/mm^2. The prestressing cable is located at the centroid and consists of 4 cables each having 7 numbers of 5mm diameter wires. Take m = 6. 10M

7. A). A pre tensioned T section has a flange 1200 mm wide and 150 mm thick width and depth of the rib are 300 mm and 1500 m respectively. The HTS bars has an area of 4700mm^2 and is located at an effective depth of 1600 mm. If the characteristic cube compressive strength of concrete and tensile of steel are 40 N/mm^2 and 1600 N/mm^2 respectively. Calculate the flexural strength of the T section. 10M

OR

7. B). Discuss about the improvement of shear resistance by various techniques. 10M

8. A). A concrete beam having a rectangular section 150 mm wide and 300 mm deep is prestressed by a parabolic cable having an eccentiricty of 75 mm at centre of span towards the soffit and an eccentiricty of 25 mm towards the top at support section. The effective force in the cable is 350KN. The beam supports a concentrated load of 20 Kn at the centre of span in addition to the self weight . If the modulus of elasticity of concrete is 38KN/m^2 and span is 8 m. 10M

Calculate:

i) Short term deflection at centre of span under prestress, self weight and live load.

ii) Long term deflection assuming the loss ratio as 0.8 and creep coefficient as 1.6.

(P.T.O..)

OR

8. B). A simply supported beam of 6 m span and trectangular section 125 mm x 250 mm is presttessed by a cable in which the total stress tensile force is 220 KN. The cable is located at a constant eccentricity of 75 mm above the soffit at the middle third of the beam and the cable is curved towards the extreme ends and the eccentricity of the cable at both ends are 50 mm above the centre line. Consider concrete weight as 24 KN/m^3 and Ec as 40 KN/mm^2. Calculate the deflection of the beam i) When it is supporting its own weight ii) When the beam carries an imposed load of 4.5KN/m. 10M

9. A). The end block of a post tensioned prestressed concrete beam of 300 mm wide and 300 mm deep is subjected to a concentric anchorage force of 832.8 KN by Freyssinet anchorage of area 11720 mm^2. Design and detail the anchorage reinforcement for the end block. 10M

OR

9. B). The end block of a prestresed concrete beam, rectangular in section is 100 mm x 200 mm. The prestressing force of 100 KN is transmitted by a distribution plate, 100 mm x 50 mm, concentrically located at the ends. Calculate the position and magnitude of the maximum tensile stress and the horizontal section through the centre and edge of anchor plate. Compute the bursting tension on these horizontal planes. 10M

10. A). Design a continuous pre-stressed concrete beam of two spans (AB = BC = 12 M) to support a uniformly distributed load of 10KN/m . The tensile stresses are not permitted in the concrete and compressive stress in concrete is not to exceed 13 N/mm^2 . Sketch the details of the cable profile and check the stresses developed at the support and critical span sections. 10M

OR

10. B). Write short notes on i) Concept of linear transformation and ii) Concordant cable profiles. 10M

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H.T No: | | | | | | | | | | | **R18** Course Code: B30417

CMR COLLEGE OF ENGINEERING & TECHNOLOGY
(UGC AUTONOMOUS)

M.Tech II Semester Supplementary Examinations March/April-2023

Course Name: ADVANCED DESIGN OF FOUNDATIONS

(Structural Engineering)

Date: 01.04.2023 FN **Time: 3 hours** **Max.Marks: 70**

(Note: Assume suitable data if necessary)

PART-A

Answer all FIVE questions (Compulsory)

Each question carries FOUR marks. **5x4=20M**

1. Discuss the terms gross, net and safe bearing capacities with associated equations. 4M
2. Explain skin friction and end point resistance of pile foundations with necessary equations. 4M
3. Elucidate the terms (i) Cutting edge, (ii) Well curb, (iii) Bottom plug, (iv) Well steining and (v) Top plug. 4M
4. Sketch anchor bulkhead with a necessary pressure diagram. 4M
5. Describe CNS cushion with an application in design of foundations. 4M

PART-B

Answer the following. Each question carries TEN Marks. **5x10=50M**

6. A). The square footing shown in the below figure 1 of width 0.65 m is designed to carry a load of 294 kN. Find the ultimate bearing capacity of soil using Meyrhoff bearing capacity equation. Unit weight of soil = 18.15 kN/m^3, $\phi = 35^0$, C= 0, depth of footing = 1m. 10M

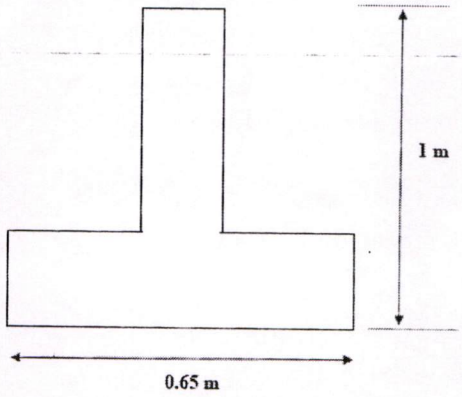

Figure 1

OR

6. B). The square footing shown in the above figure 1 of width 0.65 m is designed to carry a load of 294 kN. Find the ultimate bearing capacity of soil using Hasen's bearing capacity equation. Unit weight of soil = 18.15 kN/m^3, $\phi = 35^0$, C= 0, and depth of footing = 1m. 10M

(P.T.O..)

7. A). A square pile group of 9 piles passes through a recently filled up material of 4.5 m depth. The diameter of the pile is 30 cm and pile spacing is 90 cm centre to centre. If the unconfined compression strength of the cohesive material is 60 kN/m^2 and unit weight is 15 kN/m^3, compute the negative skin friction of the pile group. 10M

OR

7. B). A reinforced cement concrete pile weighing 30 kN (including helmet and dolly) is driven by a drop hammer weighing 30 kN with an effective fall of 0.9 m. The average penetration per blow is 15 mm. The total temporary elastic compression of the pile, pile cap and soil may be taken as 18 m with coefficient of restitution 0.36. What is the allowable load on the pile with a factor of safety of 2? Use Hiley's formula. 10M

8. A). A circular well has an external diameter of 7.5 m and is sunk into a sandy soil to a depth of 20 m below the maximum scour level. The resultant horizontal force is 1800 kN. The well is subjected to a moment of 36,000 kN.m about the maximum scour level due to the lateral force. Determine whether the well is safe against lateral forces, assuming the well to rotate (i) about a point above the base, and (ii) about the base, Assume $\gamma' = 10$ kN/m^3, and $f = 36°$. Use Terzaghi's analysis, and a factor of safety of 2 against passive resistance. 10M

OR

8. B). Discuss in detail about various design steps involved in design of well foundations with a neat sketch and appropriate equations. 10M

9. A). Discuss in detail about the design of sheet pile as per IS code along with an earth pressure diagram. 10M

OR

9. B). Design Cantilever sheet pile in cohesive soil, depth of excavation, h = 10 m, Unit weight of soil, g = 14.8 kN/m^3, cohesion of soil, C = 500 kPa, internal friction angle, f = 0 degree allowable design stress of sheet pile, $F_b = 32$ kPa. Design length of sheet pile and select appropriate sheet pile section. 10M

10. A). Explain the mechanism involved in the swelling of black cotton soils with a neat sketch. Also discuss the procedure for determining the swelling procedure. 10M

OR

10. B). Elucidate the principle of granular piles with a supporting sketch, also mention few applications in field practice. 10M

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