[3hrs] **[Marks: 80]**

N.B. 1 Question No. 1 is Compulsory.
2 Solve any three questions from remaining questions.
3 Assume suitable data wherever required and state them clearly.

Q.1	a	Explain different types of flat slab with sketch.	6
	b	Explain different types of foundation with sketch	6
	c	Explain different types of Transverse and Longitudinal joint in cement concrete, Pavement.	8
Q.2		Design a Bunker to store 300KN coal using M20 concrete and Fe415 steel. Take unit weight of coal as 8KN/m^3. Assume angle of repose is Ø25° coefficient of friction between coal and concrete μ´=0.444	20
Q.3		Design and Interior panel of flat slab with panel size 6m x 6m supported by columns of size 500mm x500mm. Provide suitable drop take live load as 4KN/m^2 .Use M20 / Fe415	20
Q.4		Design a strip footing for a row of 4 columns of size 400mm square. Center to centre distance between the two adjacent columns is 4. 5m. The two exterior columns carry a load of 1200 KN each and two interior columns carry a load of 1800KN, each. SBC of soil is 180KN/M^2. Use M20 concrete and Fe415 steel.	20
Q.5		A portal frame with ends hinged is to be analysed for the following data. Spacing of portal frames = 4m Height of columns = 4.5m Distance between column centre = 9m Live load on the roof =1.5KN/m^2 RCC slab is provided over the portal frames. Analyse the portal frame and find design moments and shear force at critical sections.	20
Q.6	a	Design a corbel to carry an ultimate load of 400 kN at a distance of 200mm from the face of column of size 400mm x 400mm. Draw the reinforcement details. Use M20/Fe415	10
	b	Explain Airy's theory for design of silos	10

****

(Time: 4 Hours) **Total Marks – 80**

Note – 1. Question Number 1 is compulsory. Attempt any three out of remaining questions.
2. Figures to the right indicate full marks.
3. Assume any suitable data if needed and justify the same.
4. Use of relevant IS and IRC codes is permitted.

Q.1. A box girder of a prestressed concrete bridge is of span 50 m has overall dimensions of width 1500 mm and a depth of 2000 mm, the uniform thickness of the walls being 25 mm. It is subjected to a maximum live load moment of 2200 kN-m. Design a box girder as class 1 type structure and find the number of cables required at mid span section with their position from centroidal axis. Cable consisting of 12 high tensile wires of 8 mm diameter are initially prestressed to 1000 MPa. Assume the compressive strength of concrete at transfer as 16 MPa and loss ratio as 0.8. **(32)**

OR

Design a post tensioned prestressed concrete bridge deck slab for a National highway crossing to suit the following data: **(32)**
Clear span = 10 m
Width of bearing = 400 mm
Live Load = IRC Class AA Tracked
Clear width of road = 7.5 m
Footpath 1.5 m on either sides
Kerb = 600 mm
Thickness of wearing coat = 100 mm
Types of structure = class 1 type
Grade of Concrete = M40
7 mm diameter high tensile wires with an ultimate tensile strength of 1500 MPa housed in cables with 12 wires and anchored by Freyssinet anchorages of 150 mm diameter. Adopt Fe 415 grade HYSD bars. Compressive stress at transfer, f_{ci} = 35 MPa, Loss ratio = 0.8. Take permissible compressive stresses in concrete at transfer and working loads, f_{ct} = 15 MPa and f_{tt} = 12 MPa respectively, f_{tt} = f_{tw} = 0

Q.2 (a) Explain the slab action and plate action with reference to folded plates subjected to transverse loading with neat sketches. (04)

(b) Design concrete cylindrical shell roof covering an area of 10 m x 30 m with prestressed edged beams using following data. Radius of the shell = 7.5 m, Semi central angle = 40^0 , chord width = 10 m, span of shell = 30 m, Thickness of shell = 75 mm, width of edge beam = 150 mm, depth of edge beam = 1500 mm. (12)

Q.3 Two span continuous prestressed concrete beam ABC (AB = BC= 15 m) has a uniform rectangular cross section of 250 mm x 600 mm. A cable carrying an effective prestressing force of 500 kN is parallel to the axis of the beam and located at an eccentricity of 200 mm. Determine the resultant and secondary moment developed at the mid support section B. Calculate the resultant stresses at top and bottom fibres at mid span support B. Also locate the resultant line of thrust through beam ABC. (12)

(b) What are the advantages of continuous members in prestressed concrete structures? (04)

Q.4 (a) Design an electric pole of height 10 m to support wire at its top which can exert a reversible horizontal force of 2800 N. The tendons are initially stressed to 1000 MPa and the loss of stress due to shrinkage and creep is 16%. Consider width of pole as 300 mm. Maximum compressive stress in concrete is limited to 12 MPa. Adopt Modular ratio, m = 6, and $\Phi = 30^0$, Soil weighs 18000 N/mm^2 (10)

(b) Write a short note on the maintenance of prestressed concrete structures. (06)

Q.5 (a)A deck slab of a bridge of span 10 m is to be designed as a one way prestressed concrete slab with parallel post tensioned cables in each of which the force at transfer is 480 kN. If the deck slab is required to support a uniformly distributed live load of 24 kN/m^2 with compressive and tensile stresses in concrete at any stage not to exceed 15 MPa and zero MPa respectively. Design the suitable thickeness of the slab and also calculate the maximum horizontal spacing of the cables and their position at the mid span section. Consider loss ratio as 0.8. (08)

(b) A simply supported concrete beam of span 7.5 m with a rectangular cross section of size 150 mm x 350 mm, is prestressed by the cables with parabolic profile having an eccentricity of 125 mm at mid span and concentric at the supports. The beam supports an imposed load of 2.5 kN/m. Find the effective force in the cable to balance the load and imposed load on the beam. Also calculate the principal tension at support section. (08)

Q.6 (a) A composite T-beam is made up of a pre-tensioned rib 120 mm wide and 240 mm deep and a cast in situ slab 450 mm wide and 50 mm thick having a modulus of elasticity of 28 kN/m^2. If the differential shrinkage is 100×10^{-6} units, determine the shrinkage stresses developed in the precast and cast in situ units. Also draw the stress distribution diagram. (12)

OR

A precast pre-tensioned beam of effective span 5m has a rectangular cross section 100 mm x 200 mm and is prestressed by tendons with their centroids coinciding with the bottom kern. The initial force in the tendons is 150 kN. The loss in prestress may be considered as 15%. The beam is incorporated in a composite T-beam by casting a top flange of width 400 mm and thickness of 40 mm. Calculate the resultant stresses developed in the precast and cast in situ concrete if the beam is (i) Un-propped and (ii) Propped during the casting of slab. Consider E_c for prestressed and cast in situ concrete as 35 kN/m^2 and 28 kN/m^2 respectively. (12)

(b) Explain various stages of prestressing. (04)

**** END****

(3 Hours) **Total Marks: 80**

Note:

1. **Question No. 1 is compulsory**.
2. Attempt any **THREE** out of the remaining **FIVE** questions.
3. Assume suitable data if necessary.

Q. 1. Answer **any FOUR** of the following: **(20)**

(a) What are the role of NGOs and Government organizations in financing relief measures? Give examples.

(b) What are the top ten terrifying disasters in history?

(c) What are the mitigation measures to be taken at the time of earthquakes?

(d) What are the objectives of Disaster Management Policy?

(e) Discuss in brief the Disaster Management Act 2005.

Q. 2. **(a)** Examine the types and characteristics of corporate social responsibility with respect to disaster management. **(10)**

(b) Discuss the paradigm shift in disaster management in India. **(10)**

Q. 3. **(a)** Elaborate on the various organizations which are involved in the research and mitigation of disasters **(10)**

(b) What is the scope and responsibilities of National Institute of Disaster Management? **(10)**

Q. 4. **(a)** How are cyclone prevention and mitigation taken in India? **(10)**

(b) Write short notes on: use of Internet and software for effective disaster management. **(10)**

Q. 5. **(a)** Discuss various methods for rescuing affected persons in a disaster situation

(b) Describe the structural mitigations and non- structural mitigations that should be restored to in case of floods **(10)**

Q. 6. **Attempt the following:-** **(20)**

(a) What are warning systems in Disaster Management?

(b) Define urbanization. Give the reasons for large scale migration to urban areas and the consequences of rapid urbanization.

(c) Write a brief note on floods as a serious environmental hazard

(d) Describe natural disasters and man-made disasters.

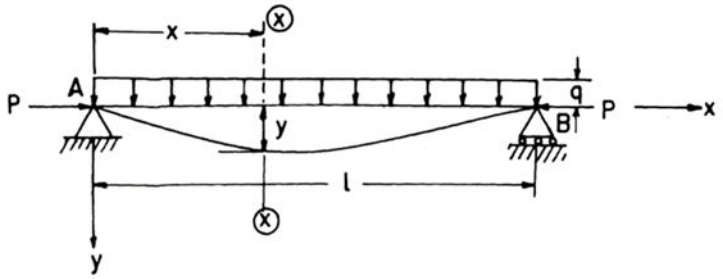
****

Duration: 3hrs **[Max Marks:80]**

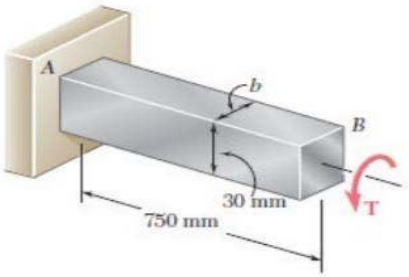
Instructions:

(1) Question No.1 is Compulsory.
(2) Attempt any **three** questions out of the remaining **five.**
(3) All questions carry equal marks.
(4) Assume suitable data, if required and state it clearly.
(5) Figures to the right indicate marks.

			Marks
1		Attempt any **FOUR:**	
	a	Explain the component of stress and components of strain.	**05**
	b	A note on Airy's Stress functions.	**05**
	c	Explain the concept of differential equation of equilibrium for two-dimensional problem in Cartesian co-ordinate system.	**05**
	d	Explain the diff between plain stress problem and plain strain problem.	**05**
	e	Determine Lame's constant μ and λ. Assume E= 200 GPa and G = 80 GPa.	**05**
	f	Explain in brief Saint Venant's principal along with its importance.	**05**
2	**a**	The state of stress at appoint is given by, $\sigma_{(x)}$ = 60 MPa, $\sigma_{(y)}$ =30 MPa, $\sigma_{(z)}$ = 90 MPa, $\tau_{(xy)}$ = 50 MPa, $\tau_{(yz)}$ = 40 MPa, $\tau_{(xz)}$ =-20 MPa ; If new set of axes is formed by rotating xyz through 30° about x axis. Find the new stress tensor and stress invariant.	**12**
	b	Explain the significance of compatibility equations.	**08**
3	**a**	A prismatic beam column of length and flexural El rigidity carries an axial compressive force P kN and a transverse UDL w kN/m. Find the expression for the mid-span deflection and maximum bending stress, if one end of the beam column is hinged and the other end is on a roller.	**15**



	b	A bar of rectangular cross-section measuring 25 mm x 30 mm is subjected to a twisting moment of 40 kN.m. Determine the maximum shear stresses and the angle of twist, if G = 100 GPa and length of bar is 750mm.	**05**



4 a At a point in a stressed material, the stress tensor is given by **12**

$$\sigma(xyz) = \begin{bmatrix} 80 & 75 & 60 \\ 75 & 0 & -30 \\ 60 & -30 & 80 \end{bmatrix} \text{MPa}$$

Find.

i. Deviator stress tensor and spherical stress tensor

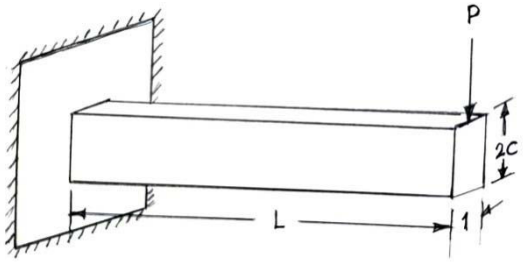
ii. Stress invariants for $\sigma_{(xyz)}$

iii. Normal stress, shear stress, resultant stress on a plane passing through the point P. If the plane has co-ordinate as (2/3,2/3,1/3)

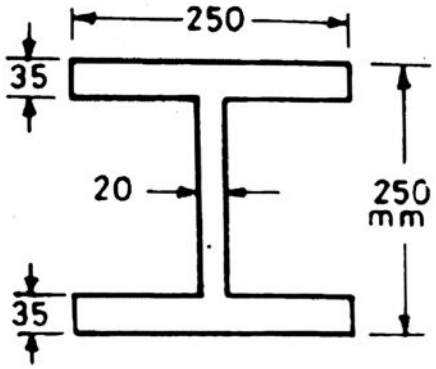
iv. The principal stress and its direction.

b What is lateral tortional buckling of beams? Also state factors affecting this type of buckling. **08**

5 C) A cantilever Isotropic beam is subjected to concentrated load P at the free end passing through the shear center. Cross-section is a rectangle of unit width and depth 2C; span of the beam is L. Calculate stresses $\boldsymbol{\sigma_x}$, $\boldsymbol{\sigma_y}$ and $\boldsymbol{\tau_{xy}}$. Find deflection at the free end of the cantilever. **20**



6 a D) A wide flange I-beam shown in fig. below is 5 m long. It is fixed at one end and free at the other. A twisting moment of 3 kN-m is applied at the free end. If E = 2 x 10^5 N/mm² and G = 0.84 x 10^5 N/mm², compute the maximum normal and shearing stresses due to bending and the maximum shearing stress due to twist. What is the angle of twist of the beam at the free end? **08**



b Derive Euler's expression for buckling load for a column of length L, with both ends hinged. **12**