QTO

100083

2009
CIVIL ENGINEERING - I (OPTIONAL)

Standard : Degree **Total Marks : 200**

Nature : Conventional **Duration : 3 Hours**

Note :

(i) *Answers must be written in* ***English.***

(ii) *Question* ***No. 1*** *is* ***Compulsory.*** *Of the remaining questions, attempt* ***any Four*** *selecting one question from* ***each section.***

(iii) *Figures to the* ***RIGHT*** *indicate marks of the respective question.*

(iv) *Use of log table, non-programmable calculator is permitted, but any other table/code/reference book are not permitted.*

(v) *Make suitable assumptions, wherever be necessary and state the same.*

(vi) *Number of optional questions upto the prescribed number in the order in which they have been solved will only be assessed. Excess answers will not be assessed.*

(vii) *Credit will be given for orderly, concise and effective writing.*

(viii) *Candidates should not write roll number, any name (including their own), signature, address or any indication of their identity anywhere inside the answer book otherwise he/she will be penalised.*

1. Answer **any four** of the following questions :

(a) Draw the Bending Moment and Shear Force Diagrams for the beam shown in Fig. 1 showing the salient values. **10**

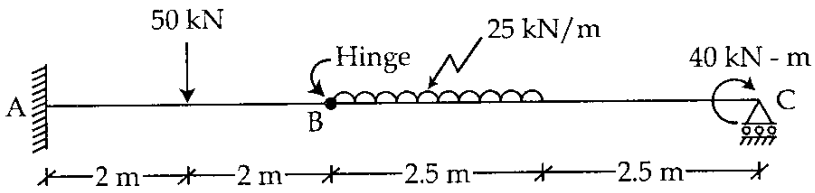

Fig. 1

P.T.O.

Marks

(b) Find the moment of resistance of a T - beam using Limit state design approach for the following data : **10**

(i) Width of flange = 740 mm

(ii) Effective depth = 400 mm

(iii) Width of web = 240 mm

(iv) Depth of flange = 80 mm

(v) Tensile steel = 5 – 20 mm M.S. bars

(vi) Grade of concrete M 15

(c) Define bearing capacity and explain the effect of the size of the plate on bearing capacity. **10**

Plate load tests were conducted in a c–ϕ soil on plates of two different sizes and following results were obtained :

(i) Load = 50 kN, size of plate 0.4 m × 0.4 m, settlement = 25 mm

(ii) Load = 100 kN, size of plate 0.6 m × 0.6 m, settlement = 25 mm.

Find the size of square footing to carry a load of 800 kN at the same specified settlement of 25 mm.

(d) (i) Explain in brief light weight concrete. **5**

(ii) Differentiate between English and Flemish bond in brick masonary work. **5**

(e) (i) What important aspects are covered in "National Building Code" of India ? **5**

(ii) What are the different principles of planning to be considered while planning and designing building ? **5**

SECTION - A

2. Answer the following sub-questions :

(a) Find the reactions at A and C for the rigid body shown in Fig. 2 if the system is in equilibrium. **10**

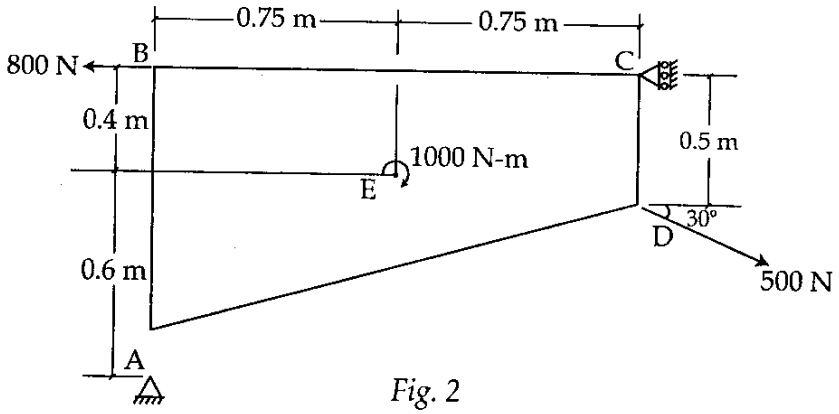

Fig. 2

Marks

(b) Using the consistency of deformation method of analysis determine the horizontal reactions for the frame shown in Fig. 3. **10**

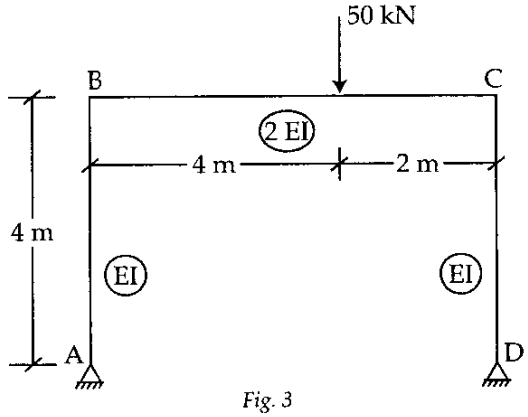

Fig. 3

(c) (i) Prove that the horizontal reaction of a two hinged parabolic arch of span 'L' and rise 'h' subjected to a uniformly distributed load of 'w' per unit length over the entire span is given by $H = \frac{wL^2}{8h}$. **5**

(ii) Explain the virtual work approach of plastic analysis for finding the collapse load with suitable examples. **5**

(d) Determine the forces in the members of the three bar truss shown is Fig. 4 in terms of the forces P_1 and P_2. Use flexibility approach of analysis considering the bar 2 as redundant. Assume same cross-sectional area for all members. **10**

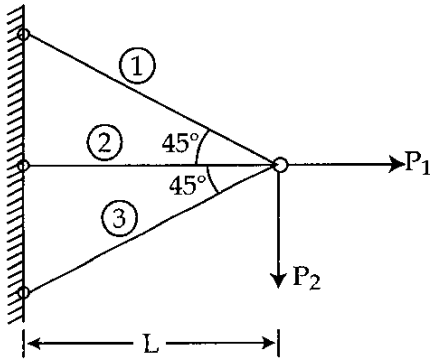

Fig. 4

3. Answer the following sub-questions :

(a) An object is thrown upwards at an angle of 30° with the horizontal with a velocity of 15 m/s from a height of 15m from the ground level. Neglecting air resistance determine **10**

(i) time at which it will reach the same level

(ii) horizontal distance at which it will touch the ground.

Marks

(b) Draw the BMD and SFD for the beam shown in Fig. 5. Analyse using slope-deflection method. **10**

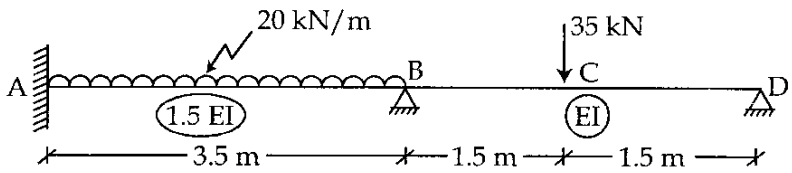

Fig. 5

(c) (i) A semi circular two hinged arch has a span of 12m with the hinged supports at the same horizontal level. A concentrated load of 20 kN acts at the central crown point. Find the horizontal thrust developed at the hinged supports by using principle of minimum strain energy. **5**

(ii) Determine the collapse load Wc for a fixed beam of uniform plastic moment capacity Mp, if the load acts at any point over the span. **5**

(d) Develop the stiffness martrix for the bent cantilever shown in Fig. 6 with respect to the co-ordinates 1, 2 and 3. **10**

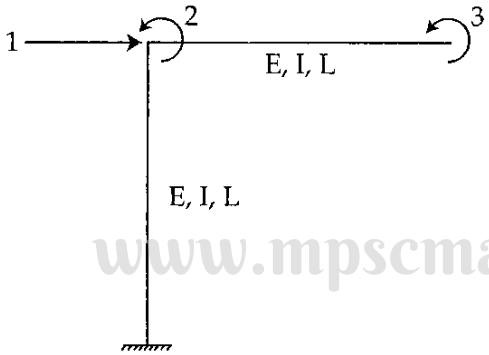

Fig. 6

SECTION – B

4. Answer the following sub-questions :

(a) (i) Explain the procedure of designing a steel compression member. **5**

(ii) A laterally supported beam having an effective span of 8m consists of ISMB 550 @ 103.7 kg/m and cover plate of 250 mm × 16 mm connected to each flange by 20 mm dia rivets. Determine the maximum UDL which the beam can carry in addition to its own weight given the following data for ISMB 550 @ 103.7 kg/m. **10**

$Ixx = 64893.6$ mm^4, $Iyy = 1833.8 \times 10^4$ mm^4,
$h = 550$ mm, $b = 190$ mm, $t_f = 19.3$ mm, $t_w = 11.2$ mm,
$a = 13211$ mm^2.

(b) Design an isolated footing for a reinforced concrete column of size 300 mm × 350 mm carrying an axial load of 750 kN. The safe capacity of the soil is 175 kN/m^2 with an angle of repose of 30° and the unit weight of soil is 19.5 kN/m^3. Use M20 concrete and Fe 415 steel. **10**

Marks

(c) (i) Discuss the difference in structural behaviour of circular water tanks with flexible base and rigid base, resting on ground. 5

(ii) Discuss the different post-tensioning systems of prestressing with neat sketches. 5

(iii) Write a detailed note on RC bands provided in masonry construction for earthquake resistance. 5

5. Answer the following sub-questions :

(a) A bracket of I-section is welded to a steel stanchion by using flange welds as well as web welds as shown in Fig 7. The size of flange welds is double the size of web welds. Determine the suitable weld size, taking a permissible shear stress of 110 N/mm^2 in the welds. 15

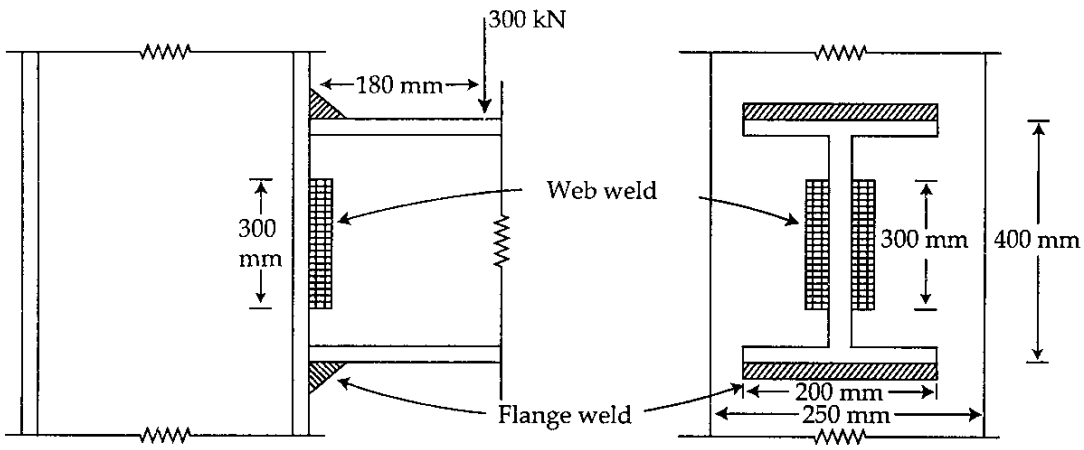

Fig. 7

(b) A doubly reinforced beam 300 mm × 550mm effective depth has 4 − 22 mm ϕ bars on tension side and 4 − 16 mm bars on compression side with a cover of 50 mm. Using M15 concrete and Fe 415 steel determine the moment of resistance of the beam. Assume fsc = 0.83fy. 10

(c) (i) Explain how wind-load analysis is carried out on an elevated water tank. 5

(ii) Discuss the effect of cable profile on the behaviour of a prestressed concrete beam. 5

(iii) Explain the significance of vertical reinforcement in masonry for achieving earthquake resistance. Illustrate with sketches how this reinforcement is provided ? 5

SECTION - C

6. (a) (i) Explain hydrometer analysis of grain-size distribution. 5

(ii) For a homogeneous earth dam 50m high and 2m free board, a flow net was constructed and following results were obtained : Number of potential drops = 25, Number of flow channels = 4. The dam has a horizontal filter of 38m length at its downstream end. Calculate discharge per metre length of dam if the coefficient of permeability of the dam material is 3×10^{-3} cm/sec. 5

Marks

(b) State the types of tests to determine the shear strength of a soil. Explain Mohr-Coulomb failure theory. Two clay specimens A and B of thickness 2 cm and 3 cm have equilibrium voids ratios 0.68 and 0.72 respectively under a pressure of 200 kN/m^2. If the equilibrium voids ratios of the two soils reduced to 0.50 and 0.62 respectively, when the pressure was increased to 400 kN/m^2, find the ratio of coefficients of permeability of the two specimens. The time required by the specimen A to reach 40% degree of consolidation is 1/4 of that required by specimen B for reaching 40% degree of consolidation. **10**

(c) (i) Define active and passive earth pressures. Explain Coloumb's wedge theory in brief. **5**

(ii) State methods of soil exploration and explain any two types of borings in brief. **5**

(d) What is pile ? Explain design of pile groups. A rectangular footing $2m \times 3m$ carries a column load of 600 kN at a depth of 1m. The footing rest on a $C-\phi$ soil strata 6 m thick, having poissons ratio of 0.25 and Young's modulus of elasticity as 20,000 kN/m^2. Calculate the immediate elastic settlement of the footing. Assume influence factor $I_w = 1.06$. **10**

7. (a) (i) Define seepage pressure and explain Quick Sand condition in brief. **5**

(ii) A granular soil (sand) was tested in the laboratory and found to have maximum and minimum void ratios of 0.84 and 0.38 respectively. The value of G was determined to be 2.65. A natural soil deposit of same sand has 9% moisture and its moist unit weight is 18.64 kN/m^3. Determine the relative density of the soil in the field. **5**

(b) What is consolidation ? Describe in brief laboratory one dimensional consolidation test. A laboratory compaction test on soil having specific gravity 2.60 gave a maximum dry density of 1.82 g/cm^3 and water content of 15 per cent. Determine the degree of saturation, air content and percentage air voids at the maximum dry density. What would be theoretical maximum dry density corresponding to zero air voids at the optimum water content ? **10**

(c) (i) What do you understand by earth pressure at rest ? Explain open drive sampler and Rotary samplers in brief. **5**

(ii) Compute the intensities of active and passive earth pressure at a depth of 7.5 m in dry cohesionless sand with an angle of internal friction of 30° and unit weight of 18 kN/m^3. What will be the intensities of active and passive earth pressure if the water level rises to the ground level ? Assume saturated unit weight of sand as 21 kN/m^3. **5**

Marks

(d) State the methods of ground improvement. Explain in brief soil stabilisation. A reinforced concrete pile weighing 30 kN (inclusive of helmet and dolly) is driven by a drop hammer weighing 38 kN and having an effective fall of 0.75 m. The average set per blow is 1.25 cm. The total temporary elastic compression is 1.6 cm. Assuming coefficient of restitution as 0.24 and a factor of safety as 2, determine the ultimate bearing capacity and allowable load for the pile. **10**

SECTION - D

8. Answer the following sub-questions :

(a) Draw an arrow diagram/network from the following data and find critical path and critical time (Project completion period) : **10**

Activity	Duration in days	Activities which immidiatly	
		Precede	follow
A	3	None	B, C
B	5	A	D, E
C	4	A	F, I
D	7	B	G
E	6	B	H
F	11	C	H
G	6	D	K
H	4	E, F	K
I	3	C	K, L
J	6	D	M
K	5	G, H, I	N
L	7	I	NONE
M	5	J	NONE
N	3	K	NONE

(b) (i) What factor should be considerd to design energy efficient building ? **5**

(ii) What do you mean by operating costs ? Discuss in brief each type of O.Cost. **5**

(c) What is valuation ? What are the different-types of valuation ? Explain each type with suitable example. **10**

(d) (i) What is Job layout ? Prepare Job layout for Multistoried R.C.C. building on 80 mt × 60 mt plot facing North and West. **5**

(ii) Discuss "Resource levelling". **5**

Marks

9. Answer the following sub-question :

(a) For the following data answer the following : **10**

Activity	A	B	C	D	E	F	G	H	J	K
Immediate Successor	C	D, E,	F	F	G, J	H	H	K	K	-
Durations	3	4	5	10	3	4	2	10	8	6

(i) Draw Network Diagram.

(ii) Identify Critical Path.

(iii) Find total float and free floats for Non Critical Activity.

(b) (i) Explain the importance of "specifications" in contract document. **5**

(ii) Mention the provisions of N.B.C. in respect of development control rules. **5**

(c) What do you mean by "B.O.T." and "B.O.O.T." ? Explain its significance in Public Works Deptt. **10**

(d) (i) Describe different types of mechanical systems of ventilations. **5**

(ii) Describe the various factors which affect selection of construction equipment. **5**

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