[This question paper contains 6 printed pages]

Roll No.	

ASME-24BC-CENG-I

CIVIL ENGINEERING (PAPER-I)

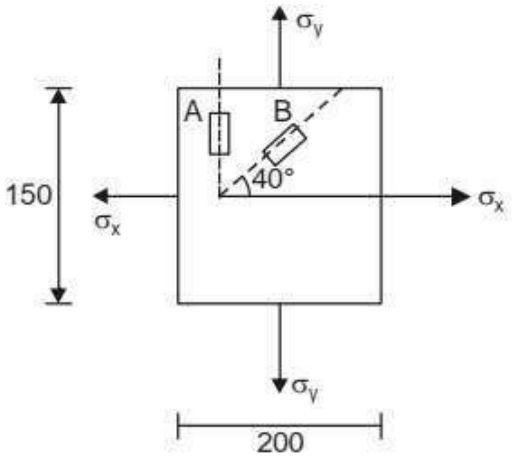
Time Allowed: 3 Hours [Maximum Marks: 100

QUESTION PAPER SPECIFIC INSTRUCTIONS

Please read each of the following instructions carefully before attempting questions.

1. There are EIGHT questions printed in English.
2. Candidate has to attempt **FIVE** questions in all.
3. Question No. 1 is compulsory. Out of remaining seven questions, **FOUR** are to be attempted.
4. All questions carry equal marks. The number of marks carried by a question/ part are indicated against it.
5. Write answers in legible handwriting. Each part of the question must be answered in sequence and in the same continuation.
6. Wherever assumptions are made for answering a question, they must be clearly indicated prior to their use.
7. Diagrams/ Figures, wherever required, shall be drawn neatly. All standard notations carry usual meaning. Any missing data can be suitably assumed.
8. Attempts of the questions shall be counted in sequential order. Unless struck off, attempt of a question shall be counted even if attempted partly. Any page or portion of the page left blank in answer book must be clearly struck off.
9. Re-evaluation/ re-checking of answer book of the candidate is not allowed.

1. (a) A 200 mm x 150 mm x 10 mm aluminium plate is subjected to uniform bi-axial stresses σ_x and σ_y. Two strain gauges A and B are attached to the surface of the plate as shown in the figure. If readings in strain gauges are $\varepsilon_A = 200 \times 10^{-6}$ and $\varepsilon_B = 285 \times 10^{-6}$, what are the values of σ_x and σ_y? What is the reduction in thickness of the plate as a result of stresses? Take Modulus of Elasticity, E=75 GPa and Poisson's ratio, $\mu = 0.33$. 5



(b) A tie member of a truss consisting of an angle section ISA 65 mm x 6 5mm x 6 mm is welded to a gusset plate of thickness 10 mm. Design a fillet weld to transmit a load equal to E 250 (Fe 410). Also sketch the welded length. A = 744 mm^2 and C_z = 18.1 mm. 5

(c) A pretensioned beam of width 225 mm and 300 mm deep is prestressed by 12 wires 5 mm diameter initially stressed at 1100 MPa. The centroid of the prestressing wires is located at 100 mm from the bottom. Estimate the loss of prestress due to elastic deformation, creep, shrinkage and relaxation for the stipulations as: 5

Grade of concrete – M40

Steel relaxation – 5 %

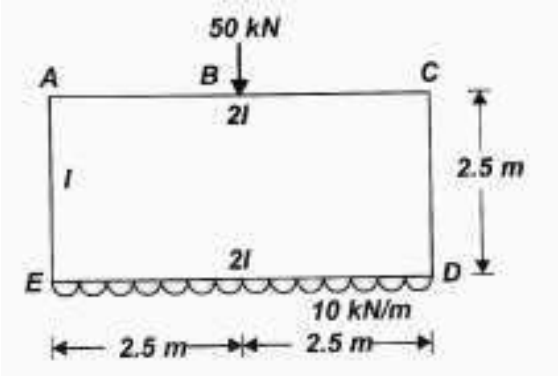
Elasticity of steel – 2×10^5 MPa

Creep coefficient – 1.6

Residual shrinkage strain – 3×10^{-4}

(d) A pile group of 9 piles of 30 cm diameter and 12 m long driven in a clay. The centre to centre spacing of piles is 0.9 m. The clay has unconfined compressive strength of 80 kN/m^2 and ϒ= 20 kN/m^3. Determine the efficiency of a pile group and the safe load for the pile group with FOS = 2.5. Take N_c = 9.0, Adhesion factor = 0.6. 5

2. (a) Analyse the plane box frame shown in figure using the moment distribution method and making use of symmetry. Also, draw the bending moment diagram. 7 + 3



(b) A 5 m effective span simply supported beam subjected to load of 40 kN/m including self-weight. The size of beam is 250 mm x 500 mm. The beam is reinforced with 4 bars of 20 mm diameter at bottom (out of which two are curtailed) and 2 bars of 12 mm diameter at top. Design the beam against shear force and show the reinforcement details. Use M20 and Fe415. Use limit state design. Following table is given for shear stress in the concrete. 10

% tension steel	0.15	0.25	0.50	0.75	1.00	1.25	2.0	2.5	3 & more
τ_c (MPa)	0.28	0.36	0.48	0.56	0.62	0.72	0.79	0.82	0.82

3. (a) Undisturbed soil sample 30 mm thick got 50% consolidated in 20 minutes with drainage allowed at top and bottom in the lab. If the clay layer from which the sample was obtained is 3 m thick in field conditions, estimate the time it will take to consolidate 50% with (i) double drainage (ii) single drainage if in both the cases consolidation pressure is uniform. 5 +5

(b) A mild steel T section has the following cross sectional dimensions: 10

Total depth = 200 mm

Width of flange = 120 mm

Thickness of flange = 20 mm

Thickness of web = 20 mm

If the yield stress f_y = 250 MPa, determine the plastic moment capacity of the section. Also calculate the shape factor of the section.

4. (a) A cylindrical specimen of dry sand was tested in a triaxial test. Failure occurred under a cell pressure of 1.2 kg/cm^2 and at a deviator stress of 4.0 kg/cm^2.What is the angle of shearing resistance of the soil and what were the normal and shear stresses on the failure plane? Also calculate what angle did the failure plane makes with the minor principal plane? 10

(b) A small project consists of seven activities with following details: 10

Duration (weeks)				
Activity	Most Likely	Optimistic	Pessimistic	Immediate Predecessor
A	4	2	8	-
B	7	3	15	A
C	4	4	4	A
D	11	5	23	B, C
E	8	4	16	B
F	6	3	15	D, E
G	5	5	5	D

Draw the network, find critical path and expected completion time. Also calculate the project duration with 95% confidence of completion. Take Z = 1.64

5. (a) A symmetrical three hinged parabolic arch has 40 m span and 5 m rise. A vertical downward load of 30 kN and a horizontal load of 20 kN (acting in right hand side direction) both act at one quarter span from left hand support. Determine the reactions at support. 10

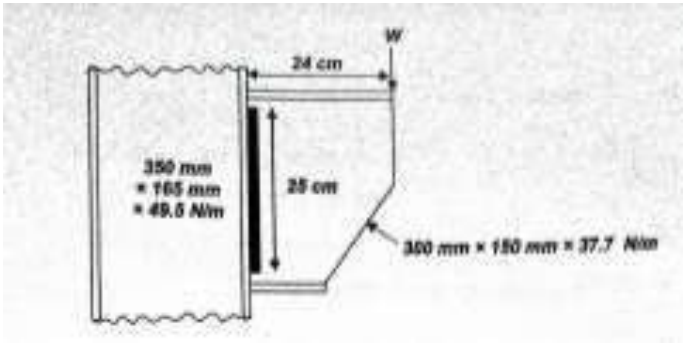
(b) A vertical tapered rod of length L has its diameter varying from d at lower end to D at the upper end which has fixed support. Young's modulus of material is E. Show that the elongation of the rod at its lower end when subjected to a longitudinal force F is given by 10

$$\delta = \frac{4FL}{\pi dDE}$$

6. (a) A solid shaft transmits 250 kW at 100 rpm. If the shear stress is not to exceed 75 N/mm^2, what should be the diameter of shaft? If this shaft is to be replaced by a hollow shaft whose diameter shall be 0.6 times the outer diameter, determine the size and % saving in weight, maximum stress being the same. 10

(b) A vertical steel storage tank has 30 m diameter and the same is filled up to a depth of 15 m with the gasoline of a relative density 0.74. If the yield stress for steel is 250 MPa, find the thickness required for the wall plate. Adopt a FOS of 2.5 and neglect localised bending effects if any. 10

7. (a) Calculate the maximum load that the bracket shown in figure can carry if the size of the weld on flange is 8 mm and that on web is 5 mm. The allowable shear stress is 102.5 N/mm^2. 10



(b) Design a square footing of uniform thickness for an axially loaded column of 400 mm x 400 mm in size. The safe bearing capacity of soil is 200 kN/m^2, load on column = 1000 kN. Use M20 grade and HYSD bars. Following table is given for shear stress in the concrete. 10

% tension steel	0.15	0.25	0.50	0.75	1.00	1.25	2.0	2.5	3 & more
τ_c (MPa)	0.28	0.36	0.48	0.56	0.62	0.72	0.79	0.82	0.82

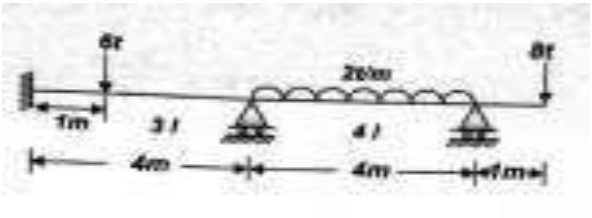
8. (a) A retaining wall with a smooth back is 9 m high and retains a two layer sand backfill with the following properties: 10

0 - 3 m depth : $c' = 0$, $\phi = 30^\circ$, $\Upsilon = 18$ kN/m^3

3 - 9 m depth : $c' = 0$, $\phi = 35^\circ$, $\Upsilon = 20$ kN/m^3

Show the active earth pressure distribution and determine the total active thrust on the wall. Assume the water table is well below the base of the wall.

(b) Analyse the beam of 9 m in length subjected to concentrated forces of 6 t at 1m distance from fixed end and 8 t at the free end, an udl of 2 t/m between roller supports as shown in figure. Determine the end moment at the fixed end. Plot the BMD on tension side. 10



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