Civil Engg - I

5 Ques (Q.1 Comp.)

1- a-f- 10×4 =40

2- a-10
b-15
c-15] =40

3- a-10
b-15
c-15] =40

4- a-20
b-10
c-10] =40

5. a-15
b-10
c-15] =40

6- a-15
b-15
c-10] 40

7- a+b- 20×2=40

8. a-10
b-8+7=15
c-15] =40

9. a-10
b-15
c-15] =40

10. a-f- 10×4=40

4CCSME

CIVIL ENGINEERING

PAPER—I

Full Marks : 200 *Time* : 3 hours

The figures in the margin indicate full marks

Candidates should attempt **five** questions out of **ten** questions. Question No. **1** is compulsory

1. Answer any *four* of the following : 10×4=40

(a) Explain and differentiate between compressibility, compaction and consolidation with reference to soil data.

(b) How will you determine the bearing capacity of soil by plate load test?

(c) Explain IF and DO statements used in computer programming. Illustrate with an example.

(d) Two plates of 10 mm and 18 mm thick are to be joined by double-cover butt joint. The joint is double riveted with cover plates 8 mm thick. The load to be transferred to the joint is 500 kN. Design the joint.

(e) An annular plate 4 m external diameter and 2 m internal diameter with its greatest and least depths below the surface being 3 m and 1·5 m respectively. Calculate magnitude and location of the force acting upon one side of the plate due to water pressure.

(f) A two-dimensional flow is described by the velocity components $u = 5x^3$ and $v = -15x^2y$. Evaluate the stream function and acceleration at point $P(x = 1$ m and $y = 2$ m).

2. (a) What do you mean by vibration isolation? Explain the different types. 10

(b) What is the meaning of tilt and shift in relation to well foundation? How would you control them in sinking of wells? 15

(c) A retaining wall 8 m high retains sand with angle of internal friction 30° and unit weight 24 kN/m^3 up to a depth of 4 m from the top. From 4 m to 8 m, material is cohesive soil with cohesion 20 kN/m^2 and angle of internal friction 20°. Unit weight of cohesive soil is 18 kN/m^3. A uniform surcharge of 100 kN/m^2 acts on the top of soil. Determine the total lateral pressure acting on the wall and its point of application. 15

(c) A hydraulic jump occurs in a 0·5 m wide rectangular channel and the depth of water flow is 0·15 m before the jump and Froude number is 2·5. Make calculations for the specific energy, critical and sequent depths. 15

10. Answer any *four* of the following : 10×4=40

(a) Describe flow nets.

(b) Explain different types of similarities in model study.

(c) Derive the equation for discharge between two fixed parallel plates.

(d) Explain boundary layer concept.

(e) Define and explain hydraulic grade line and total energy line.

(f) Derive gradually varied flow equation and write the assumptions made.

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8. *(a)* Derive Bernoulli's equation and write the assumptions made in deriving it. 10

(b) A pipeline carrying oil of sp. gr. 0·87 changes in diameter from 200 mm at a position A to 500 mm at another position B which is 4 m at a higher level than A. If A and B are at pressures 1 bar and 0·6 bar respectively, and the discharge is 0·2 m^3/s, determine the loss of head and direction of flow. 8+7=15

(c) A sharp-edged rectangular notch 50 cm broad has been used to measure the discharge estimated to be about 20 L per second. Find the percentage error in computing the discharge that would be introduced by an error of 2 mm in observing the head over the notch. Take $C_d = 0 \cdot 63$ for the notch. 15

9. *(a)* Derive Chezy's equation for steady uniform flow in open channel. 10

(b) A triangular gutter, whose sides make an angle of 60°, conveys water at a uniform depth of 25 cm. If the discharge is 0·04 m^3/s, work out the bed slope of the trough. Take $C = 52$. 15

3. *(a)* Define coefficient of permeability. Explain the various factors on which permeability of a soil depends. 10

(b) Soil is to be excavated from a borrow pit which has density of 1·75 gm/cc and water content 12%. The specific gravity of soil particles is 2·7. The soil is compacted so that the water content is 18% and dry density is 1·65 gm/cc. For 1000 cu. m of soil in fill, estimate *(i)* quantity of soil to be excavated from the pit in cu. m, *(ii)* amount of water to be added and void's ratio of the soil in borrow pit and fill. 15

(c) What do you mean by Alterberg limits? How will you determine liquid limit of a soil in the laboratory? 15

4. *(a)* Design a steel built-up beam with 6·5 m effective span carrying a uniform load of 40 kN/m inclusive of self-weight over the entire span. The overall depth of the beam is restricted to 350 mm. The compression flange of the beam is laterally supported ($f_y = 250\ N/mm^2$). 20

(b) Find the shape factor for the Tee-section whose dimensions are

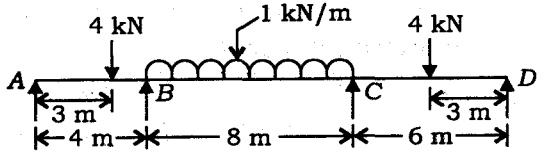
web→150 mm×10 mm
flange→100 mm×10 mm 10

(c) Sketch a gussetted base (plan and elevation) and label its parts. 10

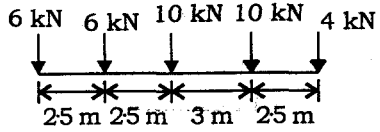
5. *(a)* A propped cantilever beam of span l is loaded by a concentrated load W at its mid-point. Using method of consistent deformation, draw the bending moment diagram for the beam. 15

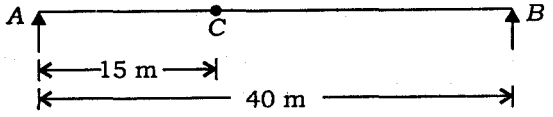
(b) Explain 'stiffness factor' and 'carry-over factor' in connection to moment distribution method of analysis. 10

(c) A continuous beam *ABCD* 18 m long is loaded as shown below. During loading, support *B* sinks by 10 mm. Find support moments. 15



6. *(a)* A system of concentrated loads shown below rolls from left to right across a beam simply supported over a span of 40 m; the 4 kN load is leading. For a section 15 m from the left-hand support, determine *(i)* the maximum bending moment, *(ii)* the maximum shear force. 15





(b) A two-hinged parabolic arch has a span of 30 m and a central rise of 5 m. Calculate the maximum positive and negative bending moments at a section distant 10 m from the left support, due to a single point load of 10 kN rolling from left to right. 15

(c) Explain the merits of limit state method of design over working stress method of design of reinforced concrete structures. 10

7. *(a)* Determine the expected completion time, the variance and the critical path for the following project : 20

Activity	*A*	*B*	*C*	*D*	*E*	*F*	*G*	*H*
Predecessors	—	—	*A*	*B*	*A*	*C*, *D*	*C*, *D*, *E*	*F*
Optimistic time (days)	1	1	3	1	1	2	2	6
Most likely time (days)	4	5	6	2	2	4	9	6
Pessimistic time (days)	7	9	9	3	9	6	10	6

(b) Determine total, free and independent floats for the following network. Number written on the arrow shows the duration of the activity. 20