

This question paper contains 8+2 printed pages]

CODE : FS-17

CIVIL ENGINEERING

Time : 3 Hours

Maximum Marks : 200

Note :— (1) Attempt *five* questions in all including compulsory questions. Q. No. 1 of Section A and Q. No. 5 of Section B are compulsory. From the remaining six questions attempt any *three* more questions, selecting at least *one* question from each section i.e. *one* compulsory question plus *one* more.

(2) Parts of same questions must be attempted together and not to be attempted in between the answers to other questions.

(3) Use of IS : 456 and IS : 800 is permitted.

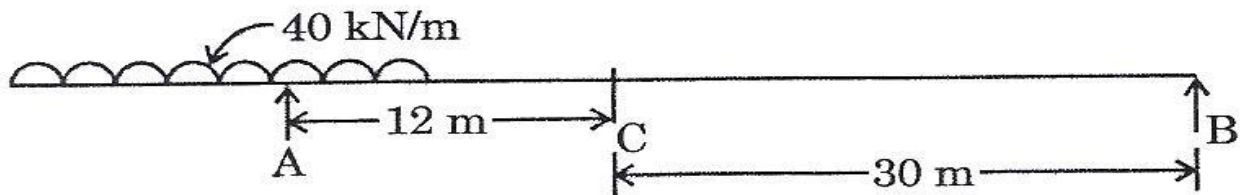
(4) Use of structural steel tables is allowed.

P.T.O.

Section A

1. (a) A simply supported beam of span L carries a central point load. Calculate the value of load at collapse in terms of the plastic moment of resistance M_p ? 10
- (b) An old water supply distribution pipe of 300 mm diameter of a city is to be replaced by two parallel Pipes of smaller equal diameter having equal lengths and identical friction factor values. Find out new diameter required. 15
- (c) A cubic meter of wet soil weighs 19.80 kN. If the specific gravity of soil particle is 2.70 and water content is 11%, find the void ratio, dry density and degree of saturation. 15

2. (a) A uniformly distributed load of 40 kN/m longer than the span rolls over a girder of 30 m span. Using Influence Line diagram for Shear Force and Bending Moment, determine the maximum shear force and bending moment at an action 12 m from left hand support A.



- (b) A tension member 0.95 m long is to resist a service dead load of 20 kN and a service live load of 60 kN. Design a rectangular bar of standard structural steel of grade Fe410. Assume that the member is connected by one line of 16 mm bolt of grade 4.6.

- (c) A column $300 \text{ mm} \times 300 \text{ mm}$ has an effective length of 3.5 m. It is reinforced with 4 bars of 20 mm diameter at a clear cover of 40 mm. Determine the safe axial load the column can carry. Assume concrete grade M20 and steel grade Fe250. 10
3. (a) An open circular cylinder of 15 cm diameter and 100 cm long contains water up to a height of 80 cm. Find the maximum speed at which the cylinder is to be rotated about its vertical axis so that no water spills. 10
- (b) Enumerate and explain by neat sketches the different ways by which earthen dam may fail. Also suggest suitable precautions that should be undertaken to avoid such type of failure. 15

(c) An impervious floor of a weir on permeable soil is 16 m long and has sheet piles at both ends. The upstream pile is 4 m deep and downstream pile 5 m deep. The weir creates a net head of 2.5 m. Neglecting the thickness of the weir floor, calculate uplift pressure at the junction of the inner faces of the pile with weir floor by using Khosla's theory. 10

4. (a) The void ratio of clay A decreased from 0.572 to 0.505 under a change in pressure from 120 to 180 kg/cm². The void ratio of clay B decreased from 0.612 to 0.597 under the same increment of pressure. The thickness of sample A was 1.5 times that of B. Nevertheless the time required for 50% consolidation was three times longer for sample B than for sample A. What is the ratio of coefficient of permeability of clay A to that of clay B ? 20

- (b) Two identical soil sample A and B of normally consolidate clay were tested. Sample A was subjected to an unconfined compression test UU test with zero cell pressure. Deviator stress was 200 kN/m^2 . Sample B was tested under UU conditions with a cell pressure of 300 kN/m^2 . Prior to shear, sample B had no pore pressure but during shear pore pressure built up to 200 kN/m^2 . What is the pore pressure at failure in sample A ? What is ' ϕ ' (effective angle of internal friction) for this clay ? 20

Section B

5. (a) Explain the method of times-cost optimization of project network. 10

- (b) Calculate the minimum sight distance required to avoid a head on collision of two cars approaching from opposite directions at 90 and 60 kmph. Assume a reaction time of 2.5 seconds, coefficient of friction 0.7 and a brake efficiency of 50% in both cases. 15

- (c) A 12-hour storm rainfall with the following depths in cm occurred over a basin :

2.0, 2.5, 7.6, 3.8, 10.6, 5.0, 7.0, 10.0, 6.4, 3.8, 1.4
and 1.4.

The surface runoff resulting from above storm is equivalent to 25.5 cm of depth over the basin.

Determine the average infiltration index for the basin. 15

6. (a) Calculate the maximum permissible speed and a curve of high speed B.G. track having the following particulars :
- (1) Degree of curve = 1°
 - (2) Amount of superelevation = 8 cm
 - (3) Length of transition curve = 130 meters
 - (4) Maximum speed of section likely to be reached = 153 kmph 20
- (b) While aligning a highway in a built up area, it was necessary to provide a horizontal circular curve of radius 325 meters. The design speed is 65 kmph. Length of wheel base of longest — truck = 6.0 m and width of pavement 10.5 m. Design the following :
- (i) Superelevation
 - (ii) Length and transition curve. 20

7. (a) What is meant by segregation of concrete ? If the concrete is too harsh for slump test, then what alternative test could be prescribed ? 10
- (b) Explain preservative treatment of timber. 10
- (c) What type of floors would be recommended for the following ? Give reason also. 20
- (1) A low cost house
 - (2) A middle class residence
 - (3) A high class residence
 - (4) Assembly hall of a school.
8. (a) The base period, intensity of irrigation and duty of various crops under a canal system are as given in the table below. Find the reservoir capacity if the canal losses are 20% and reservoir losses are 12% ? 20

Crop	Base period (days)	Duty at field (hectares/cumec)	Area under the crop (hectares)
Wheat	120	1800	4800
Sugar cane	360	800	5600
Cotton	200	1400	2400
Rice	120	900	3200
Vegetables	120	700	1400

(b) A sedimentation tank and treating 4.5 million liters of sewage per day containing 275 ppm of suspended solids. The tank removes 50% of the suspended solids. Calculate the quantity of sludge produced per day in bulk and weight if :

(1) moisture content of sludge is 98%

(2) moisture content of sludge is 96%.

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