CIVIL ENGINEERING

Time : 3 hours

Full Marks : 100+100=200

32045

Instructions :

- (1) The figures in the right-hand margin indicate full marks for the questions.
- (2) All questions are compulsory.

SECTION-A

1.	(a)	What are the different types of bricks? Discuss them briefly.	4		
	(b)	What are the constituents of ordinary Portland cement (OPC)? Why the OPC is so called?	4		
	(c)	How do you choose good stones for construction of a high-rise building?	3		
	(d)	Differentiate between surkhi and mortar.	3		
2.	(a)	Describe dog-legged staircase with the help of a neat sketch. 3+3	=6		
	(b)	What type of roof will you suggest for a house to be constructed in a rainfed area? Justify your answer.	3		
	(c)	What is the difference between painting and varnishing?	3		
	(d)	Why is DPC important in construction? Where is it provided?	3		
з.	Choose the correct answer from the following options available : $1 \times 4 = 4$				
	(a)	Compression members always tend to buckle in the direction of the (i) axis of load (ii) perpendicular to the axis of load (iii) minimum cross-section (iv) least radius of gyration			
	(b)	 When a thin cylindrical shell is subjected to an internal pressure, there will be (i) a decrease in diameter and length of the shell (ii) an increase in diameter and decrease in length of the shell 			

- (iii) a decrease in diameter and increase in length of the shell
- (iv) an increase in diameter and length of the shell

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(c) A beam of uniform strength has

(i) same cross-section throughout the beam

(ii) same bending stress at every section

- (iii) same bending moment at every section
- (iv) same shear stress at every section

(d) The polar modulus for a solid shaft of diameter (D) is



4. A metallic block of size 500 mm long, 150 mm breadth and 50 mm thick is subjected to 45 kN, 12 kN and 6 kN loads along X, Y and Z directions respectively. Assuming all the loads as tensile, determine the amount of change in volume of the block.

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Take, $E = 2 \times 105 \text{ N/mm}^2$

Poisson's ratio = 0.20

 Draw the shear force diagram and bending moment diagram for a beam as shown in Fig. 1. Also show the calculated values at the salient points. 10





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6. (a) A bearing plate of size 300 mm square settles by 20 mm in plate load test on a cohesionless soil under an intensity of loading 0.20 N/mm². The same intensity of loading is applied to a prototype shallow footing of size 1.2 m square. What will be the corresponding settlement for the prototype?

(b) What are the factors responsible for slope failure?

- 7. Write the units of measurements for the following quantities :
 - (a) DPC
 - (b) Plaster with 1 : 4 mortar
 - (c) Earthwork in excavation
 - (d) Steel in slab
 - (e) Floor tiles
 - (f) Cistern
- 8. Estimate the quantity of brickwork required for completion of a singlestorey RCC building as per the following line diagram (Fig. 2). The height of the storey may be assumed as 3.5 m and plinth height is 0.5 m. The size of column is 250 mm square. The building has no provision for staircase. Assume any other data if required.





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- 9. An isolated footing of size 1.2 m × 1.6 m is reinforced by 12 mm diameter bar @ 100 mm c/c along shorter direction and 10 mm diameter bar @ 150 mm c/c along the longer direction of the footing. The footing is designed to support a rectangular column of size 250 mm × 350 mm with 8 nos. of 16 mm diameter longitudinal reinforcement and 8 mm diameter @ 120 mm c/c transverse reinforcement. The overall depth of the footing is provided as 400 mm. Draw the design details for plan as well as sectional views.
- 10. An RCC beam is subjected to a u.d.l. of 12 kN/m over a clear span of 2.5 m and is simply supported between two walls of 300 mm thick each. The size of the beam is 225 mm wide and 400 mm overall depth. Using M-20 grades of concrete and Fe-415 grades of steel, design the beam for steel reinforcement.
- 11. A bracket connection is shown in the Fig. 3 with 4 nos. of 20 mm diameter rivet. For Fe-415 grade of steel, determine the safe load that can be transferred through the connection. Assume necessary data if required.



Fig. 3

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SECTION-B

12. Choose the correct answer :

 $1 \times 10 = 10$

- (a) Which of the following values of pH represents a stronger acid?
 - (i) 3
 - (ii) 6
 - (iii) 7
 - (iv) 10
- (b) The maximum permissible limit for fluoride in drinking water is
 - (i) 0.1 mg/lit
 - (ii) 1.5 mg/lit
 - (iii) 5.0 mg/lit
 - (*iv*) 10.0 mg/lit
- (c) If the depletion of oxygen is found to be 2.5 mg/litre after incubating 2.5 ml of sewage diluted to 250 ml for 5 days at 20 °C, BOD of the sewage is
 - (i) 50 mg/lit
 - (ii) 150 mg/lit
 - (iii) 250 mg/lit
 - (iv) 350 mg/lit
- (d) The dropman holes are generally provided in sewers for
 - (i) industrial area
 - (ii) large township
 - (iii) plain cities
 - (iv) hilly cities
- (e) The recommended value of camber for WBM road in heavy rainfall area is
 - (i) 1 in 36
 - (ii) 1 in 30
 - (iii) 1 in 48
 - (iv) 1 in 40

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- (f) Which of the following shapes is preferred for a valley curve?
 - (i) Simple parabola
 - (ii) Cubic parabola
 - (iii) Lemniscate
 - (iv) Spiral

(g) Bearings are provided in bridge to

- (i) allow translation and rotation in bridges
- (ii) isolate superstructure from substructure
- (iii) transfer loads from superstructure to substructure
- (iv) None of the above
- (h) The difference in heights of the tunnels above the rail tops of BG and MG track is
 - (i) 0.45 m
 - (ii) 0.60 m
 - (iii) 0·20 m
 - (iv) 0.75 m

(i) While preparing a detailed estimate

- (i) dimension should be measured correct to 0.01 m
- (ii) area should be measured correct to 0.01 sq. m
- (iii) volume should be measured correct to 0.01 cu. m
- (iv) All of the above
- (j) For 12 mm thick cement plastering with 1 : 6 mix on 100 sq. m new brickwork, the quantity of cement required, is
 - (*i*) 0.200 m^3
 - (*ii*) 0.247 m^3
 - (*iii*) 0.274 m^3
 - (iv) None of the above

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 Calculate the total expenditure to be incurred for construction of 4.75 km long earthen embankment in filling with the following data :

> Top width of the embankment = 1.8 km Side slope = 1 vertical : 2 horizontal Height of filling = 5 m Unit cost of construction = Rs 425 per cubic metre

- 14. During recuperation test, the water in an open well was depressed by 3.1 m due to pumping and the well recuperated 2.05 m in 60 minutes. Find the yield from the well of 2.5 m diameter under depression head of 3.5 m.
- **15.** Describe the characteristics of drinking water with relevance to Bureau of Indian Standard Code IS 10500–1991.
- 16. Name the sewer appurtenances. Describe the construction and operation of manhole with sketches.
- The rainfall intensity of 5.5 cm/hr falls over an area of 40 hectares. The area consists as follows :

Types of area	Percentage of total area	Runoff co-efficient
Roof	20	0.88
Pavements	15	0.82
Paved yards	10	0.80
Macadam roads	15	0.40
Lawns	35	0.18
Forest	5	0.12

Calculate-

- (a) runoff factor for the entire area;
- (b) runoff for the area.
- What are the different components of expansion joint in bridge? List out the functions of each component. 3+5=8

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4+4=8

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- What are the factors considered in foundation design of a bridge? Draw a typical bridge foundation showing labels.
- 20. The following traffic counts were made for a urban freeway :

Day 1 = 1860 vehicles Day 2 = 2325 vehicles Day 3 = 1912 vehicles Day 4 = 1599 vehicles Day 5 = 2253 vehicles

Find—

- (a) average daily traffic (ADT);
- (b) design hourly volume (DHV);
- (c) directional design hourly volume (DDHV). Assume :

Design hourly volume factor = 0.12%Directional movement factor = 0.60

 Describe the detailed procedure for construction of a highway in a hilly terrain.
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22. Write short notes on the following :

- (a) BOD
- (b) Stopping sight distance
- (c) Population forecasting

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5×3=15