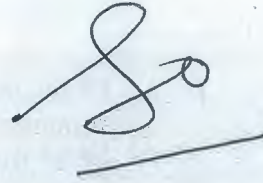


# Civil Engineering



## Paper-II

**Time allowed : Three hours**

**Maximum Marks: 300**

### INSTRUCTIONS

**Please read each of the following instruction carefully before attempting questions:**

There are total **SEVEN** questions. Candidates should attempt any **FIVE** questions.

All questions carry equal marks. The number of marks carried by a part of question is indicated against it.

Answer must be written in **ENGLISH** only.

Unless otherwise mentioned, symbols and notations have their usual standard meanings.

Assume suitable missing data, if necessary and indicate the same clearly.

Neat sketch may be drawn, wherever required.

All parts and sub-parts of a question are to be attempted together in the answer book.

Any page left blank in the answer book must be clearly struck out.

1. a Draw bending moment and shear force diagrams for a simply supported beam subjected to a couple of 'M' acting at a distance of 'a' from left support and 'b' from right support. 20
- b The modulus of rigidity for a material is  $0.51 \times 10^5 \text{ N/mm}^2$ . A 10 mm diameter rod of this material was subjected to an axial pull of 10 kN and the change in diameter was observed to be  $3 \times 10^{-3} \text{ mm}$ . Calculate Poisson's ratio and the modulus of Elasticity. 40
2. a. The plates of a boiler are 6 mm thick connected by a single riveted lap joint with 16 mm diameter rivets at 50 mm pitch. Calculate the efficiency of the joint. The design strengths for plates and rivets are 130 MPa, 328 MPa and 328 MPa in shearing, bearing and tension (rupture) respectively. The yield strength of plate material may be taken as 250 MPa. 20
- b. Determine the minimum net section of 36 cm x 10 mm plate. The 4 holes of 20 mm diameter have been made in this plate for connection. Across the plate, the rivets are at 6 cm from edges in one row while in other row they are at 12 cm from the edges. The pitch of the rivets is 5 cm. 20
- c. A Member consisting of two tees, ISNT 150 back to back is connected to a gusset plate of 14 mm thickness. Design the connection to transmit an axial load of 680 kN. The length of connection is limited to 150 mm. The thickness of flange is 10 mm. 20
3. a. Design a cantilever slab projecting for a length of 1 m beyond a 230 mm x 230 mm lintel. The live load on the slab is  $750 \text{ N/m}^2$ . Use Working Stress method of design with M20 concrete and Fe 415 steel. 30
- b. Design a reinforced concrete column of 2.75 m effective length using Limit State design approach. The column carries an axial load of 1600 kN. Use M20 concrete and Fe 250 as materials of construction. 30

4. a. Differentiate among super passage, level crossing and aqueduct. 20
- b. Explain necessity, advantage and disadvantage of canal lining along with suitability of canal lining materials. 20
- c. Why do we provide falls in canal? 20
5. a. Calculate the safe stopping sight distance for design speed of 50 kmph for (a) two-way traffic on a two lane road and (b) two-way traffic on a single lane road. Assume co-efficient of friction as 0.37 and reaction time of driver as 2.5 seconds. 20
- b. Why do we provide extra width of pavement on horizontal curves? 20
- c. Differentiate between 'Cutback Bitumen' and 'Bitumen Emulsion'. 20
6. a. Chlorine usage in the treatment of 20000 m<sup>3</sup> water per day is 8 kg/day. The residual after 10 minute contact is 0.2 mg/l. Calculate the dosage in milligrams per litre and chlorine demand of the water. 20
- b. The moisture content of a sludge has been reduced from 95 to 90% in a sludge digestion tank. Find out percentage decrease in the volume of sludge. 20
- c. Name the various devices which are used to control particulate pollutants in Industries. 20
7. The hourly ordinates of a two hour unit hydrograph are given below. Draw a 6-hour unit hydrograph for the same catchment. 60

Time (hours)	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15
Discharge (cumec)	0.0	1.0	2.7	5.0	8.0	9.8	9.0	7.5	6.3	5.0	4.0	2.9	2.1	1.3	0.5	0.0