INSTRUCTIONS

(Please read each of the following instructions carefully before attempting questions)

There are EIGHT questions divided in two sections and printed both in KANNADA and in ENGLISH.

Candidate has to attempt FIVE questions in all.

Question No. 1 and 5 are compulsory and out of the remaining, THREE are to be attempted choosing at least ONE question from each Section.

The number of marks carried by a question/part is indicated against it.

Answer must be written in the medium authorized in the Admission Certificate which must be stated clearly on the cover of this Question-cum-Answer (QCA) Booklet in the space provided. No marks will be given for answers written in a medium other than the authorized one.

Word limit in questions, wherever specified, should be adhered to.

Attempts of questions shall be counted in chronological 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 the Question-cum-Answer Booklet must be clearly struck off.
1. (a) A two hinged parabolic arch AB of span 40m and rise 8m, carries a point load of 60kN at a distance 9m from the left support, A. Find the horizontal thrust at each support. Find also the maximum bending moment and draw bending moment diagram.

(b) A column with two channels placed back to back of 10m long to carry an axial load of 1000kN. The column is restrained in position but not in direction at both the ends. Provide single lacing system with bolted connection or welded connection.

2. Derive an expression for total pressure and centre of pressure for Vertical plane surface, inclined plane surface and curved plane surface immersed in a liquid of specific weight(W).

3. (a) Define the term hydraulic jump. Derive an expression for depth of hydraulic jump in terms of upstream Froude's number.

(b) Derive an expression for head loss during a hydraulic jump.

Give the application of hydraulic jump.
4. Design a simply supported slab to cover a room with internal dimensions of 3m x 4m and 250mm thick brick walls all-round. Assume a live load of 3kN/m² and a finish load of 1kN/m². Use M20 concrete and Fe 415 steel. Assume that the slab corners are prevented from lifting up. Assume mild exposure condition and fire resistance of 1 hr.

5. (a) Explain the salient features of determining the bearing capacity of a shallow footing according to Terzaghi. List the assumptions made in this theory.

(b) A circular area on the surface of an elastic mass of great extent carries a u.d. of 150 kN/m³. The radius of circle is 3.5m. Boussinesq's equation gives a deflection 3.5 m beneath at 5 m radius. Use Boussinesq's equation to find the deflection.
6. (a) The natural dry unit weight of a sand deposit is 17.5 kN/m². If the minimum and maximum dry unit weight as determined from laboratory tests are 15 and 20 kN/m², determine the density index of the sand deposit. Derive the expression for density index in terms of \( \gamma_d \), \( (\gamma_d)_{\text{min}} \) and \( (\gamma_d)_{\text{max}} \).

(b) What is Stoke's Law. Explain how Stoke's law is made use in sedimentation analysis.

7. Explain the types of computers in detail and also explain the application of computers to simple problems in Civil engineering with a neat flow chart.

8. (a) A square footing of side 2m rests on top of 3.0m thick sand layer which is underlain by 1.5 m thick clay layer. The void ratio of clay is 0.8 and liquid limit is 40%. The unit weights of sand and clay are 19 kN/m² and 18 kN/m² respectively. The water table is at the base of the footing. Calculate the consolidation settlement of the clay layer.
Explain in detail about the methods of site exploration and its types with neat sketches.
INSTRUCTIONS

(i) All Sections carry 2 marks each.
(ii) Answer each question in Kannada.
(iii) Questions 1 carry 5 marks each.
(iv) Questions 2 to 3 carry 3 marks each. You may choose any 1 question from each.

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1. (a) Discuss briefly arterial road improvement techniques for traffic management and also describe existing traffic management schemes in Indian cities.

(b) If a 8 degree curve track diverges from a main curve of 5 degree in an opposite direction in the BG layout. Calculate the superElevation and speed on the branch line assuming maximum speed permitted on main line is 45 kmph.

2. (a) Briefly describe the following:

(i) Tramways

(ii) LRT's

(iii) RRT's

(b) Discuss the criteria's for road and junction improvements.
3. (a) List the requirements of permanent way.
(b) Discuss functions of sleepers.
(c) Explain PSC sleepers and steel sleepers.
(d) Discuss the function and requirements of fish plates.
(e) Explain the necessity of bearing plates.

4. (a) List various types of traffic studies and discuss the objects and uses of traffic volume study.

(b) Calculate minimum clearances required to avoid an accident of two vehicles approaching from opposite directions at 100 kmph and 80 kmph. Assume a reaction time of 2.5 seconds, coefficient of friction 0.70 and brake efficiency of 50 percent.
5. (a) Illustrate with the help of a neat flow diagram the hydrological processes that characterise of typical catchment in a sub-humid region. Show the components of stream flow also.

(b) Illustrate using a free-hand drawn diagram the distribution of annual rainfall over Karnataka. Mark the highly wet and semi-arid zones. Write down the normal annual rainfall at six important places, one in each climate zone of the state.

6. (a) Briefly explain (with sketches) the four types of subsurface formation (rocks and soils) that become good aquifers.
(b) Defining K and T for a aquifer. A 30 cm well completely penetrates an unconfined aquifer of depth 40 m. At a steady state of pumping of 1500 lpm, drawdown in two wells 25 m and 75 m away from the pumping well none measured to be 3.5 m and 2.0 m respectively. Determine the well parameters and the draw down in the pumping well. Recall that the steady state discharge equation is \[ Q = \pi k \left( h_2 - h_1 \right) / \ln(r_2 / r_1) \].

(c) Describe the "Recuperation test" for an open well. Describe its use and derive the equation used.

7. (a) A city has a population of 1,50,000. Water is to be supplied at the rate of 160 litres per head per day. If the static lift of the pump is 40 meters, calculate the B.H.O of motor. The rising main is 300 m long and motor efficiency is 85%, pump efficiency is 60%, f=0.04 and the peak hour demand is 1.5 times the average demand.
Discuss the various methods which are adopted for treating public water supplies in order to remove colour and taste from it.

8. (a) Explain the types of solid waste collection systems with diagram and explain the treatment and disposal of low level radioactive wastes. What are the effects of thermal power plants on environment.

(b) Compare conservancy and water-carriage system of waste disposal. Write short rates on fair essentials of rural sanitation.