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HPAS (Main)—2017
CIVIL ENGINEERING
Paper II

Time : 3 Hours

Maximum Marks : 100

Note :— (i) Question No. 1 is compulsory. Attempt any four questions from the remaining questions.

In all Five questions are to be attempted.

(ii) Assume suitable missing Data, if any.

1. (a) Two tangents intersect at chainage 1200 m, the deflection angle being 40° . Compute the data for setting out a 400 m radius curve by deflection angles and offsets. Take 30 m chord lengths in the general reach. 14

(b) Explain the basic principles of remote sensing. Describe briefly different types of remote sensing techniques. 6

P.T.O.

2. Traffic flow in an urban area at right angle intersection of two major roads is given as below. Both roads have a carriage width of 15 m.

Approach	Traffic on Road (PCU/hr)			
	Road	L.T	S.T	R.T
North		415	650	300
East		300	550	250
South		350	400	225
West		400	500	300

Design and draw a rotary intersection and check for its practical capacity. Make suitable assumption as per IRC recommendation.

20

3. A lined channel of trapezoidal section has one side vertical and the other side having a slope 1 H : 1 V. The channel has to deliver $8 \text{ m}^3/\text{sec}$ when laid on a slope of 0.0002. What would be the dimensions of the efficient section which requires

minimum lining ? Also calculate the corresponding mean velocity if Manning's n is 0.015. 20

4. (a) Discuss different types of rail-joints with the help of neat sketches and give their merits and limitations. 10
- (b) A town of 2,00,000 population is to be supplied water from a source 2500 m away. The lowest water level in the sources is 15 m below the water works of the town. The demand of water is estimated as 150 litres/capita/day. A pump of 300 HP is operated for 15 hours. If the maximum demand is 1.5 times the average demand, the velocity of flow through the rising main is 1.3 m/s and the pump efficiency is 70%, determine :
- (i) Hydraulic gradient
- (ii) Friction factor for the pipe. 10

5. (a) A Venturimeter is installed in a pipeline 400 mm in diameter. The Throat Pipe Diameter ratio is $1/3$. Water flows through the installation. The Pressure in the pipeline is 1.405 kg/cm^2 and the vacuum in the throat is 37.5 cm of Mercury. If 4% of the differential head is lost between the gauges, find the flow in the pipeline. 10
- (b) Derive the equation of stream function and velocity potential for a uniform stream of velocity v in a two-dimensional field, the velocity v being inclined to the x -axis at a positive angle α . 10
6. Given that the Unit Discharge in a rectangular channel is $18 \text{ m}^3/\text{sec}$ and that the head loss across a hydraulic jump that forms in this channel is 1.1 m. Estimate the Pre-jump and Post-jump depths. 20

7. (a) Discuss a procedure of Stability Analysis for an earth dam having sudden drawdown conditions. Why is sudden drawdown of water level considered harmful ? How can damage be prevented ? 15
- (b) How will you reclaim a water-logged and salt affected area and make it suitable for agriculture purpose. 5
8. (a) Design a Rapid Sand Filter System for a water supply of 9.0 m.l.d to a Township. All the principal components shall be designed. Enumerate your assumptions during the design steps. 10
- (b) Design an outfall circular sewer of the separate system for a town with a population of

1,50,000 persons with a water supply at 200 Litres per head per day. The sewer is to be laid at a slope of 1 in 800 with $N = 0.012$. A self cleansing velocity of 0.75 m/sec is to be developed. The dry weather flow may be taken as $1/3$ of the maximum discharge. Given the following table for Partial Flow Conditions.

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Proportionate	Proportionate	Proportionate
Depth	Velocity	Discharge
0.37	0.8675	0.2981
0.39	0.8909	0.3217
0.40	0.9022	0.3370
0.42	0.9299	0.3682