

This question paper contains 8 printed pages]

HPAS (Main)—2016
CIVIL ENGINEERING
Paper II

Time : 3 Hours

Maximum Marks : 100

Note :— (i) Question No. 1 is compulsory. Attempt any four questions out of the remaining questions. In all, five questions are to be attempted.

(ii) Assume suitable missing data, if any.

1. (a) The following traverse-angles are measured clockwise from back station :

$$\angle MAB = 136^{\circ}14', \angle ABC = 172^{\circ}16', \angle BCD = 96^{\circ}37'$$

What is the bearing of CD if that of MA is $327^{\circ}18'$? 10

- (b) In a two-peg test of a dumpy level, the following readings were taken :

Level at	Reading on		Remarks
	A	B	
O	1.555	1.250	O is exactly midway between A & B and distance between pegs A and B is 80 m
A	1.325	1.012	

P.T.O.

Find the staff reading on B so that the line of collimation should be horizontal when the instrument was at A. 10

2. (a) The speed of overtaking and overtaken vehicles are 70 kmph and 40 kmph respectively on a two way traffic road. If the acceleration of overtaking vehicle is 0.99 m/s^2 :
- (i) Calculate safe overtaking distance,
 - (ii) Mention the minimum length of overtaking zone and
 - (iii) Draw a neat sketch of the overtaking zone and show the position of sign posts. 10
- (b) A vehicle moving at 40 kmph speed was stopped by applying the brake and the length of skid mark was 12.2 m. If the average skid resistance of the pavement is 0.70, determine the brake efficiency of the test vehicle. 10

3. (a) If a 8° curve track diverges from a main curve of 5° in an opposite direction in the layout of a B.G. yard, calculate the super elevation and speed on the branch line, if the maximum speed permitted on the main line is 45 kmph. 10
- (b) Calculate all the necessary elements required to set out a 1 in $8\frac{1}{2}$ turnout, taking off from a straight B.G. track with its curve starting from the toe of the switch i.e. tangential to the gauge face of the outer main rail and passes through theoretical nose of crossing i.e. TNC. Given, heel divergence = 11.4 cm. 10
4. (a) Oil of specific weight 910 kg/cum and kinematic viscosity of $0.002 \text{ m}^2/\text{s}$ is pumped through a 15 cm diameter 300 m long pipe at the rate of 20 tonnes per hour. Show that the flow is viscous and find the horse power required. 10

- (b) Two reservoirs whose surface levels differ by 30 m are connected by a pipe of 60 cm diameter and 3000 m long. The pipe line crosses a ridge whose summit is 9 m above the level of, and 300 m distant from the higher reservoir. Find the minimum depth below the ridge at which pipe must be laid if the absolute pressure head in the pipe is not to fall below 2.5 m of water and calculate the discharge. Take atmospheric pressure head = 10.3 m of water and $f = 0.0075$. 10
5. (a) The depth of water in a circular brick lined conduit 1.8 m in a diameter, is to be 1.5 m and its capacity is 2.16×10^5 cum per day. Find the gradient of the conduit. Take $C = 67$. 10
- (b) A sluice spans a channel of rectangular section 18 m wide and has an opening of 0.75 m deep and discharges 46.44 cumec of water. If a standing

wave is formed on the downstream side of the sluice, determine the probable height of the crest above the upper edge of the sluice. Find also the loss of energy head due to the jump. 10

6. The discharge coming out from a catchment is given below :

Time (Hours)	Discharge (Cumec)
0	6
2	8
4	10
6	16
8	28
10	42
12	60
14	80
16	110

18	100
20	90
22	80
24	68
26	56
28	45
30	35
32	26
34	18
36	11
38	9
40	8
42	7
44	6

Determine the ordinates of unit hydrograph for the given rainfall duration.

7. (a) A 30 cm diameter well penetrates 25 m below the static water table. After 24 hours of pumping at 5400 litres/minute, the water level in a test well at 90 m is lowered by 0.53 m, and in a well 30 m away, the drawdown is 1.11 m. what is the transmissibility of the aquifer ? 10
- (b) Determine the quantity of alum required in order to treat 13 million litres of water per day at a treatment plant, where 12 ppm of alum dose is required. Also determine the amount of carbon dioxide gas which will be released per litre of water treated. 10
8. (a) Calculate the area of land required for drying the sludge coming at $44.4 \text{ m}^3/\text{day}$ from a digestion tank constructed for 40,000 population. Also design the dimensions of beds. 10

- (b) A rectangular sewer with width 1.5 times its depth is hydraulically equivalent to a circular one. Find the relation between the width of the rectangular sewer and diameter of the circular sewer.

10