HPAS (M)—2015

CIVIL ENGINEERING

Paper II

Time : 3 Hours   Maximum Marks : 150

Note :— (i)   Question No. **1** is compulsory. Attempt any

four questions out of remaining questions. In

all *five* questions are to be attempted.

(ii)   Assume suitable data, if required.

1.   (a)   Differentiate between the following :   10

(i)   Close and open traverses

(ii)   Bowditch and transit rules

(iii)   Consecutive and independent coordinates.

P.T.O.

(b) The following readings have been taken from a page of old level book. It is required to reconstruct the page; fill up the missing quantities and apply the usual check. 10

Station	B.S.	I.S.	F.S.	Rise	Fall	R.L.	Remarks
1	3.125					?	B.M.
2	?		?	1.325		125.505	T.P.
3		2.320			0.055	?	
4		?		?		125.850	
5	?		2.655		?	?	T.P.
6	1.620		3.205		2.165	?	T.P.
7		3.625			?	?	
8			?			123.090	T.B.M.

(c) A circular curve has a 200 m radius and 65° deflection angle. What is its degree :

(i) by arc definition

(ii) by chord definition.

Calculate : Length of curve, tangent length, length of long chord, apex distance, and mid ordinate.   10

2. (a) With neat sketches show few typical patterns of unchannelized and channelized intersections. What are the advantages and limitations of unchannelized and channelized intersection ? 15

(b) A national highway passing through rolling terrain in heavy rainfall area has a horizontal curve of radius 500 m. Design the length of transition curve assuming suitable data. Ruling design speed 'V' be taken as 80 kmph and width of pavement is 7.0 m. Pavement is rotated about the edge.   15

3. (a) Calculate the superelevation, maximum permissible speed and transition length for a 3° curve on a high speed railway BG section with a maximum sanctioned speed of 110 kmph. Assume the equilibrium speed of 80 kmph and the booked speed of goods train to be 50 kmph.　　　　　　　　　　　　15

(b) Differentiate between the following with neat sketches :　　　　　　　　　　　　15

(i) Stock rail and tongue rail

(ii) Flangeway clearance and heel divergence

(iii) Flat bearing plate and anticreep bearing plate.

4. (a) Explain the principle of venturimeter, with a neat sketch. Derive the expression for the rate of flow of fluid through it.　　　　　　　　　　　　10

(b)   What is Euler's equation of motion ? How will you obtain the Bernoulli's equation from it ?   10

(c)   Prove that the maximum velocity in a circular pipe for viscous flow is equal to two times the average velocity of flow.   10

5.   (a)   Show that in a horizontal rectangular channel to create hydraulic jump is :

$$y_c^3 = y_1 y_2 \left(\frac{y_1 + y_2}{2} \right)$$

where y_1, y_2 and y_c are depths before the jump, after the jump and critical depth respectively.   10

(b)   A trapezoidal channel is 6 m wide and has a bed slope of 0.0004 and $n = 0.002$. If the side slope is 0.5 H : 1 V, determine the discharge which makes the channel economic.   10

(c)   Differentiate between dynamic and kinematic viscosity.   10

6. (a) The unit hydrographs derived from different storms for a catchment are as follows.

Derive the average unit hydrograph and show on a graph sheet : 15

Time (h)	0	1	2	3	4	5	6	7	8	9	10	Total
First set	0	7	18	23	17	9	7	1	0	—	—	82
Second set	0	11	22	22	13	7	4	2	1	1	0	83
Third set	0	6	14	21	21	11	4	3	2	0	—	82
Total	0	24	54	66	51	27	15	6	3	1	—	247
Average	0	8	18	22	17	9	5	2	1	0	—	82

(b) Explain the objectives and methods of river training, giving two training methods with neat sketches for each method. Distinguish between "spur" and "levee", with simple sketch. 15

7. (a) A water supply scheme has to be designed for a city having a population of 1,00,000. Estimate the important kinds of drafts which may be required to be recorded for an average water consumption of 250 lpcd. Also record the required capacities of the major components of the proposed water works system for the city using river as the source of supply. Assume suitable figures and data where needed. 15

(b) Explain the sedimentation process used in a water treatment plant. Draw a neat sketch of sedimentation tank in which coagulant is used. 15

8. (a) A 300 mm dia. sewer is to flow at 0.3 depth on a grade ensuring a degree of self cleaning equivalent to that obtained at full depth at a velocity of 0.90 m/sec. Find the required grade and associated velocity and rate of discharge at this depth.

Assume Manning's rugosity coefficient 'n' as 0.013. The variations of n with depth may be neglected. 15

(b) Give the flow diagram for 'the activated sludge process' and describe the working of activated sludge plant. 15