

## CIVIL ENGINEERING

## Paper II

Time Allowed : Three Hours

Maximum Marks : 200

## QUESTION PAPER SPECIFIC INSTRUCTIONS

Please read each of the following instructions carefully before attempting questions.

There are **EIGHT** questions in all, out of which **FIVE** are to be attempted.

Question Nos. **1** and **5** are compulsory. Out of the remaining **SIX** questions, **THREE** are to be attempted selecting at least **ONE** question from each of the two **Sections A** and **B**.

Attempts of questions shall be counted in sequential 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.

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

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

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

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

Neat sketches may be drawn, wherever required.

## SECTION 'A'

- 1.(a) A 9 degree curve branches off from a 8 degree main curve in an opposite direction in the layout of a M.G. yard. If the speed restriction on main line is 40 km/hr., what would be the speed restriction on branch line ? Assume permissible cant deficiency as 50 mm. 8
- 1.(b) A two lane undivided State Highway with thick bituminous pavement surface in high rainfall region has horizontal curve of radius 2950 m. If design speed is 100 km/hr., what is the superelevation requirement ? Also draw the cross-section at curved portion. 8
- 1.(c) A line of levels was run from *A* to *B*. The levelling was then continued to a B.M. of elevation 40.0 m. The readings obtained are as under. Obtain the reduced level of *A* and *B*. 8

B.S	I.S	F.S	R.L	Remarks
1.195				<i>A</i>
0.445		2.370		
2.150		0.995		
	0.720			<i>B</i>
1.465		0.260		
2.630		0.905		
		1.305	40.0	<i>B.M</i>

- 1.(d) Explain in brief the important factors that affect the selection of Construction Equipment. 8

- 1.(e) Write short note on the following :

- (i) Light weight aggregate concrete. 8
- (ii) Types of rollers commonly used in construction projects for compacting soil. 8

2.(a) What do you understand by the term “segregation” of concrete ? What are the common causes of segregation ? What are the methods of prevention of segregation ? How bleeding is different from segregation ? What are the causes and how it can be prevented ? 15

2.(b) For the following traverse, compute the length of line  $CD$  so that  $A, D$  and  $E$  may be in one straight line : 15

Line	Length(m)	Bearing
$AB$	110	$83^{\circ}12'$
$BC$	165	$30^{\circ}42'$
$CD$	?	$346^{\circ}06'$
$DE$	212	$16^{\circ}18'$

2.(c) Draw a labelled sketch of Right hand turnout, clearly highlighting the movement of train on both the routes i.e. main and diverted. 10

3.(a) Draw a network diagram to represent the following project. Calculate the occurrence times of the events and activity times. Also determine the critical path. 10

Activity Id	Predecessor	Description	Time (weeks)
$A$	–	Prepare site	1
$B$	$A$	Pour foundation	6
$C$	$B$	Buy shrubs etc.	3
$D$	$B$	Roof	2
$E$	$D$	Do interior work	3
$F$	$C$	Landscape	4
$G$	$E, F$	Move in	1

3.(b) What are the approximate oxide composition limits found in ordinary portland cement ? Briefly explain the functions of following oxides : 10

(i) Lime (ii) Silica (iii) Alumina (iv) Iron oxide

3.(c) Calculate stopping sight distance on a highway at level stretch for a design speed of 80 km/hr. Also calculate the effect of 2% descending gradient on the SSD. Assume other data as per IRC recommendations. 10

3.(d) A flexible pavement is designed for a 7.0 m wide carriage way with following data :

Commercial traffic per day = 600 (As on 1.1.2012)

Planning and construction period = 1 year

Rate of traffic growth per annum = 10%

Design life = 15 years

Vehicle damage factor = 2.0

Because of some legal issues project could not be completed in time and it got delayed by 4 years. However pavement design remains the same. Will it have some implications on design life of the project ? What will be the new design life of the road ? 10

- 4.(a) What is seasoning of Timber ? Write in brief the various methods of seasoning of timber. 10
- 4.(b) Write a short note on the following. Wherever necessary explain the questions. 10
- Slack
  - CPM vs PERT
  - What does a positive slack, a zero slack and a negative slack indicate in a real life project scenario ?
  - Bar chart
- 4.(c) The maximum increase in temperature is expected to be  $24^{\circ}\text{C}$  after the construction of cement concrete pavement. If the expansion gap is of 2.0 cm design the spacing between the expansion and contraction joints. Assume allowable stress in concrete (tension) during initial period of curing =  $0.8 \text{ kg/cm}^2$ ; coeff. of thermal expansion of cement concrete  $10 \times 10^{-6}$  per  $^{\circ}\text{C}$ , unit wt. of concrete =  $2400 \text{ kg/m}^3$  and coeff. of friction at interface as 1.3. 10
- 4.(d) A vehicle moving at 40 km/hr was stopped by applying the brakes and the length of skid mark was 12.2 m. If the average skid resistance of the pavement is known to be 0.70, determine the brake efficiency of the test vehicle. 10

### SECTION 'B'

- 5.(a) Define the infiltration indices  $\phi$ -index and  $\omega$ -index with sketches and determine the  $\phi$ -index and  $\omega$ -index when the half hourly rainfall rate for a period of 4 hours storm are 1.8, 2.7, 3.8, 5.5, 3.2, 2.6, 2.2 and 1.2 cm/hr. The corresponding run-off is 3.3 cm. The effective surface retention is zero. 8
- 5.(b)
  - Write the various losses in canals. 4
  - Explain Drainage and Pressure release arrangements behind canal lining. 4
- 5.(c) Explain the design considerations of earth dams in Earthquake regions. 8
- 5.(d) A small town with water demand as given below requires a storage reservoir. Assuming that the pumping is done uniformly @ constant rate for 24 hrs, estimate the storage capacity of the reservoir. Population of the town is 50000. Assume fire demand as 2 lpcd. 8

<i>Time</i>	0-4	4-8	8-12	12-16	16-20	20-24
<i>Demand (ML)</i>	0.48	0.87	1.33	1.00	0.82	0.54

- 5.(e) Explain the impacts of disposal of wastewater with following characteristics into fresh water : 8
- (i) Nutrients (ii) Heavy metals (iii) Oil and grease (iv) Suspended solids
- 6.(a) Three wells are situated forming an equilateral triangle with a side distance of 110 m. All the three wells are penetrated fully into a 10 m thick Aquifer with medium sand having coefficient of permeability of 50 m/day. The radius of wells are 15 cm and worked under a depression head of 3.5 m at well face. The radius of influence of each well is 240 m. All the wells have same characteristics. Compute the yield of each well. 10
- 6.(b)
  - What is the purpose of unit hydrograph and how it is derived from a simple flood hydrograph of isolated storms. 5
  - What is synthetic unit hydrograph and write the equations for standard duration, lag time and width of the synthetic unit hydrograph at various percentages of discharges. 5

- 6.(c) Specify permissible drinking water quality standard for the following parameters and explain the effects of these parameters on human health : 10  
 (i) Fluorides (ii) Nitrates (iii) Chlorides (iv) Total hardness (v) Total dissolved solids
- 6.(d) A river with saturation DO (@ 25°C) 8.4 mg/l and self purification ratio, (f) 2.4 receives treated wastewater. Find the permissible BOD in the treated wastewater if rate constant  $k_1$  (@ 25°C) is 0.1/day. 10
- 7.(a) The section of throat of saddle syphon spillway is width = 5 m and height = 2.5 m.  
 Full reservoir level = +252.00 m  
 Crest level of spillway = +248.00 m  
 Level of center of syphon outlet = +240.00  
 High flood level in the reservoir = +254.00  
 If the high flood discharge is 650 cumecs, determine the number of syphon units required to pass the high flood discharge safely. Coeff. of discharge = 0.85 and the syphon discharges freely into air. 10
- 7.(b) (i) Explain hygroscopic water in soil and permanent wilting point along with diagram. 5  
 (ii) What is consumptive use of water and write the factors affecting consumptive use of water in irrigation. 5
- 7.(c) (i) Give a flow chart indicating sequence of units in domestic wastewater treatment plant. Specify the objectives of each unit. 5  
 (ii) Differentiate between BOD and COD. Explain the importance of COD/BOD ratio in selection of treatment units. 5
- 7.(d) Explaining the environmental impacts of river valley projects, suggest environmental management plan to mitigate the negative impacts of the project. 10
- 8.(a) Explain the causes of failures of weirs and write the preventive measures. 10
- 8.(b) Explain the purpose and suitability of the following with diagrams :  
 (i) Aqueducts 4  
 (ii) Non modular pipe outlet 3  
 (iii) Groynes in river training 3
- 8.(c) Explaining the advantages of sanitary landfills over open dumps, discuss how landfill problems are addressed. 10
- 8.(d) With help of line sketch, explain the working principles of Electrostatic precipitators and fabric filters in air pollution control. 10