This question paper contains **15** printed pages]

Code No. : 06(II) *Roll No. .....*

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CIVIL ENGINEERING

Paper : II

Time Allowed : 3 hours] *[Maximum Marks : 300*

Note : *(i) Answers must be written in* ***English.***

(ii) Number of marks carried by each question are indicated at the end of the question.

(iii) Part/Parts of the same question must be answered together and should not be interposed between answers to other questions.

(iv) ***The answer to each question or part thereof should begin on a fresh page.***

(v) ***Your answers should be precise and coherent.***

(vi) Candidates should attempt any ***two*** *Sections out of* ***four*** *Sections, selecting any* ***two*** *questions from each Section.*

(vii) Assume missing data suitably.

P. T. O.

SECTION – A

(Building Construction)

1. Answer any ***three*** of the subdivisions :

(a) Explain the difference between brick masonry and stone masonry with reference to their suitability, cost and method of construction. 25

(b) Describe briefly the type of floors used for different types of buildings and state the reasons for their choice. Give detailed specification for coloured terrazzo flooring. 25

(c) What do you understand by designing of a concrete mix ? How it is done ? Explain the design of such a mix for an R. C. C. underground water tank. 25

(d) What are permissible direct compressive stresses in M15 (1 : 2 : 4) cement concrete mix allowed in the design of plain cement concrete columns of short length and in the design of R. C. C. column ? State the reasons for the difference in the permissible stresses. 25

2. (a) Write short notes on : 30

(i) Water cement ratio,

(ii) Slump test,

(iii) Plywood form work,

(iv) Rubble masonry.

(b) The main stair of an office building is to be located in a staircase hall measuring 3.5 m x 5.5 m. If the vertical distance between the floors is 3.0 m, draw a dimensional plan and section of the proposed R. C. C. stair showing details of construction. Assume the weight of R. C. C. = 2400 kg/m^3. 30

(c) State the different classifications of stone masonry. State also the general principles to be observed and the precautions to be taken in constructing stone masonry. 15

3. (a) What are the various types of roofs commonly used in India ? Describe each stating clearly the distinction between the different types. 20

(b) Draw a neat plan view a building required for running a hospital building in a city. 25

(c) The three time estimates optimistic time (t_o), most probable activity time (t_m) and pessimistic activity time (t_p) of each activities of a project are given below :

Activity	t_o *(days)*	t_m *(days)*	t_p *(days)*
1 - 2	2	5	14
1 - 3	3	12	21
2 - 4	5	14	17
3 - 4	2	5	8
4 - 5	1	4	7
3 - 5	6	15	30

(i) Draw the network diagram.

(ii) Find the expected duration and variance of ea activity.

(iii) Calculate the early and late occurrence times each event.

SECTION – B
(Transportation Engineering)

4. Answer any ***three*** of the subdivisions :

(a) What do you understand by points and cross of railway track ? Explain with the help diagrams the various type of crossings used Indian Railway Tracks.

(b) What are the functions of a railway stat Classify and discuss the various requirements railway station and draw neat sketche Junction and Terminal station.

(c) Calculate the stresses at interior, edge and c of a cement concrete pavement by Westerga stress equations :

- Modulus of elasticity of concrete = 3.0 × kg/cm
- Poisson's ratio of concrete = 0.15
- Thickness of concrete = 18 cm
- Modulus of sub grade reaction = 8.5 kg
- Wheel load = 5100
- Radius of loaded area = 15 cm

(d) Determine the overtaking sight distance as per AASHTO practice for a design speed of 120 km/hr, making suitable assumptions. Calculate as per IRC practice. 25

(e) Calculate the equivalent C-value of a three layered pavement section having individual C-values as given below : 25

Materials	*Thickness (cm)*	*C - Values*
Bituminous concrete	10	60
Cement treated base	20	225
Gravel sub-base	10	15

5. (a) What do you understand by points and crossings? Explain with the help of diagrams the various types of crossing used on Indian Railway Tracks. 20

(b) Explain and discuss the following by means of sketches :

(i) Wayside stations,

(ii) Junction stations,

(iii) Terminal stations. 20

(c) A broad gauge mainline is required to be diverted for carrying out long duration repair works. Design an economical semi-permanent diversion 15 m away from the main track. The diversion should be laid with a radius of 450 m and gradient of 1 in 100. 20

(d) Briefly explain various types of train resistanc and determine the mean tractive effort develop by an engine and also check whether the worki of engine is satisfactory or unsatisfactory from t following data :

(i) Wheel load = 5.5 tonnes;

(ii) Difference in steam pressure = 3.5 kg/cm^2;

(iii) Diameter of piston = 30 cm;

(iv) Length of stroke = 40 cm;

(v) Diameter of wheel = 1.5m.

6. (a) Explain Burmister's two layer theory for design pavements. What are its limitations ?

(b) What are the various types of bitumino construction in use ? Discuss the advantages a limitations of each.

(c) Calculate the safe driving speed on a curve w radius 200 m, the super-elevation being 0.07 the curve meeting the standards of major dist roads in plain terrain? If the pavement widt 7.0 m, how much should the pavement edges raised or depressed about the crown if the su elevation is provided by rotating about the ce line ?

(d) What are the methods of achieving good highway drainage ? Specify the design approach for surface drainage system of a highway. 20

SECTION – C
(Water Resource & Irrigation Engineering)

7. (a) The isohyetal map for 24 hours storm gave the areas enclosed between different isohyets as follows :

Isohyets in mm	21	20	19	18	17	16	15	14	13	12
Enclosed area in sq. km	543	1345	2030	2545	2955	3280	3635	3710	3880	3915

Determine the average depth of rainfall over the basin. 10

(b) A catchment has an area of 5 sq. km the average slope of the land surface is 0.006 and the maximum travel depth of rainfall in the catchment is approximately 1.95 km. The maximum depth of rainfall in the area with a return period of 25 years is as tabulated below :

Time duration (min)	5	10	15	20	25	30	40	60
Rainfall depth (mm)	15	25	32	45	50	53	60	65

Consider that 2 sq. km of the catchment area has cultivated sandy loam soil (C = 0.2) and 3 sq. km has light clay cultivated soil (C = 0.7). Determine the peak flow rate of runoff by using the Rational method. 15

(c) The flood frequency for a stream has been found to be as follows :

Return Period (Years)	*Peak Discharge (cumec)*
10	109.00
200	244.00

Estimate the peak discharge for the return period of 400 and years using the Gumbel method 15

(d) Differentiate between

(i) Runoff and yield of drainage basin

(ii) Direct runoff and interflow 10

(e) A dam has spillway whose cross-section is 1 m high and 4 m wide. The tail water elevation at design flow is 6 m below the summit of the siphon and the head water elevation is 1.5 m above the summit. Assuming a coefficient of discharge of 0.6, what is the capacity of the siphon? What head would be required on an ogee spillway (C=2.25) 4m long to discharge this flow? What length of ogee weir would be required to discharge the same flow as the siphon with a head of 1.5 m on the weir crest ? 25

8. (a) The ordinate of unit hydrograph of a 6 hr. unit duration for a catchment of 542 sq. km are given below :

Time from beginning of rain fall (hr.)	0	6	12	18	24	30	36	42	48	54	60	66
Ordinate of unit hydrograph (Cumec)	0	20	50	150	120	90	70	50	30	20	10	0

Compute the ordinates of a 3 hr. unit hydrograph from that 6 hr. unit hydrograph, using S-Curve method. 25

(b) The design annual rainfall for the catchment of a proposed reservoir has been computed to be 99 cm. The catchment area has been estimated to have the mean annual temperature of 20° C. The catchment area contributing to the proposed reservoir is 1000 sq. km. Calculate the annual design catchment yield for this reservoir. 15

(c) The yield of water in Mm^3 from a catchment area during each successive month is given below : 1.4, 2.1, 2.8, 8.4, 11.9, 7.7, 2.8, 2.52, 2.24, 1.96 and 1.68

Determine the minimum capacity of a reservoir required to allow the above volume of water to be drawn off at a uniform rate assuming that there is no loss of water over the spillway. 10

(d) There are four rain gauge stations existing in the catchment of a river. The average annual rainfall values at these stations are 800, 620, 400 and 540 mm respectively. Determine the optimum number of rain gauges in the catchment, if it is desired to limit the error in the mean value of rainfall in this catchment to 10%. How many more rain gauges will then be required to be installed ? 25

9. (a) Explain : 10

(i) Bed load,

(ii) Suspended load,

(iii) Total load,

(iv) Critical shear stress.

(b) How does uplift pressure endanger safety of a hydraulic structure on a permeable foundation? Discuss the measures for the safety of hydraulic structures against uplift pressure. 15

(c) Design a suitable cross drainage work with the following data : 25

Canal Data :

Discharge	= 30 cumecs
Bed width	= 20 m
Depth of water	= 1.50 m
F.S.L.	= 251.50 m

Drain Data :

High flood discharge	= 250 cumecs
High flood level	= 247.50 m
High flood dept	= 2.50 m

(d) Determine the crest level, cistern elements and length of impervious floor for a Sarda type fall with the following data : 25

Full Supply discharge	= 13 cumec
Drop	= 1.0 m
F.S.L Upstream /Downstream	= 101.5/100.5
Full supply depth Upstream/Downstream	= 1.7 m/1.7 m
Canal bed width	= 8.0 m
Bligh's Coefficient	= 7

SECTION – D

(Environmental Engineering)

10. Answer any *three* of the following subdivisions :

(a) (i) What is the significance of Gt factor in flocculation ? Give some typical values or range of Gt for achieving good flocculation. 10

(ii) What are the typical loading rates for various filters ? On what basis filters are classified ? 15

(b) (i) It is generally accepted that the average daily rate of water demand (consumption) is 100-200 litres per capita per day (lpcd). Assume that the maximum daily rate is 1.5 times the average daily rate, and the maximum hourly rate is approximately 2.0 times the maximum

daily rate, or 300% of the average daily rate. If a city has a population of 140,000 and its water consumption is 130 lpcd, what are the average and maximum daily rates and maximum hourly rate of water consumption in m^3 per day and MGD ? 10

(ii) What are the factors that should be considered while siting water treatment plant ? 15

(c) A sedimentation tank (clarifier) is designed to have a surface overflow rate of 26.5 $m^3/m^2.d$. Estimate the overall removal with the settling analysis data and particle size distribution in columns 1 and 2 as given in the Table below. The water temperature is 15°C and the specific gravity of the particles is 1.20. ($\mu = 0.113$ N.s/m^2). 25

Results of Settling Analysis Test :

Particle Size mm	*Weight Fraction <size, %*
0.10	12
0.08	18
0.07	35
0.06	72
0.05	86
0.04	94
0.02	99
0.01	100

(d) A baffled flocculation basin is divided into 16 channels by 15 around-the-end baffles. The velocities at the channels and at the slots are 0.18 and 0.6 m/s, respectively. The flow rate is 0.34 m^3/s.

Find :

(i) the total head loss neglecting channel friction;

(ii) the power dissipated;

(iii) the mean velocity gradient at 15.6°C ; the basin size is 6 m × 2.5 m × 24 m;

(iv) the Gt value, if the detention (displacement) time is 20 min, and

(v) loading rate in litres per day $/m^3$. $\mu = 0.113$ $N.s/m^2$ and $\gamma = 980\ N/m^3$. 25

(e) A filter unit has surface area of 4.88 m wide and 9.144 m long. After filtering 10,900 m^3 for 50 h, the filter is back-washed at a rate of 0.65 m/min for 15 min.

Find :

(i) the average filtration rate,

(ii) the quantity of washwater,

(iii) percent of washwater to treated water, and the flow rate to each of the four troughs. 25

11. (a) A watershed has a drainage area of 1000 ha (2470 acres). The annual rainfall is 927 mm. The expected evaporation loss is 292 mm per year. The estimated loss to groundwater is 89 mm annually. Estimate the amount of water that can be stored in a lake and how many people can be served, assuming 140 litres per capita per day is needed. 20

(b) What is the daily amount of chlorine needed to treat an 8 MGD of water to satisfy 2.8 mg/L chlorine demand and provide 0.5 mg/L residual chlorine ? 10

(c) An example of industrial waste has an average flow of 1.23 MGD with BOD_5 of 4468 kg/d. Calculate BOD concentration and the equivalent populations of hydraulic and BOD loadings. Assume BOD generation as 100 gm per capita per day. 20

(d) What are the major chemical constituents of domestic wastewater ? List their significance effects on environment health. 10

(e) A raw containing 45 mg/L of suspended solids enters into the sedimentation tank of the water treatment facility and removes 65%. Approximately how many kg of sludge containing 5.0 percent solids will be produced per million litres of water treated ? 15

12. (a) List some common technologies generally being used for domestic wastewater treatment based on aerobic & anaerobic processes. 20

(b) Determine the aeration basin dimensions for a town of 20,000 population. Assume the mixed liquor suspended solids is 2600 mg/L, BOD loading rate is 0.48 kg/d.m^3, SVI is 110 m L/g, and return sludge concentration is 10000 mg/L. 20

(c) What are the common disposal methods for municipal solid waste ? Discuss in brief at least *three* of these methods and their limitations. 20

(d) What are the risk factors associated with the reuse of treated sewage ? 15
