

CBCS SCHEME

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15CV71

Seventh Semester B.E. Degree Examination, July/August 2021 Municipal and Industrial Wastewater Engineering

Time: 3 hrs.

Max. Marks: 80

Note: Answer any FIVE full questions.

- 1 a. Define Sewage. Explain Combined Sewerage system, with its merits and demerits. (08 Marks)

- b. Using Rational method, determine the discharge for a storm water drain.

Area of catchment = 100 hectare ; Intensity of rainfall = 50mm/hr.

Details of catchment area as follow :

Type of Area	Percentage area	Impermeability Coefficient
Roots	15	0.9
Pavements	20	0.8
Lawns and Gardens	40	0.15
Unpaved	15	0.20
Wooded	10	0.05

Also, if the population density in the area is 350 persons per hectare and rate of water supply is 200 lpcd. Calculate design discharge for combined system. Take Q_{peak} flow = 2.0.

(08 Marks)

- 2 a. Define Sewer Appurtenances. List out the various types of appurtenances provided in the sewerage system. (05 Marks)
- b. What are the basic principles of house drainage system? (05 Marks)
- c. Explain with a neat sketch, construction and working function of a septic tank. (06 Marks)

- 3 a. Briefly explain the factors affecting the self purification of stream water. (10 Marks)
- b. A town has a population of one lakh with a per capita sewage flow as 300 lpcd. Design a sewer running full depth at peak discharge. The sewer is to be laid at a slope of 1 in 625. Take Manning's constant N as 0.013 and peak factor as 3. (06 Marks)

- 4 a. Discuss in detail the process of deoxygenation and reoxygenation, with respect to self purification of natural water bodies with a neat sketch of oxygen sag curve. (08 Marks)
- b. A city with a population of one lakh and a sewage flow of 125 lpcd is located on a stream with a rate of flow of $0.7\text{m}^3/\text{sec}$. The BOD of sewage is 200 mg/l. The DO and BOD content of the stream above the outfall sewer are 7mg/l and 1mg/l respectively.
- i) How many kg of oxygen per day are available above the outfall?
- ii) What is the total kg of BOD per day in the stream just below the outfall (assume no oxidation). Express the total BOD in mg/l. (08 Marks)

- 5 a. Explain with a flow diagram, a conventional sewage treatment plant. Discuss the function of each component. (08 Marks)
- b. Design a continuous flow rectangular primary sedimentation tank fitted with mechanical sludge cleaning equipment for treating the sewage from a city having a population of 80,000 persons which has an assumed water supply rate of 100 lpcd. Assume the maximum flow to be 1.4 times the average flow. The necessary design parameters may be suitably assumed. (08 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and/or equations written eg. 42+8 = 50, will be treated as malpractice.

- 6 a. Determine the size of a high rate trickling filter for the following data :
Sewage flow = 4.5 MLD ; Recirculation ratio = 1.4 ; BOD of raw sewage = 250mg/l
BOD removal in primary classifier = 25% ; Final effluent BOD desired = 50mg/l.
Also calculate size of the standard rate trickling filter to accomplish the above requirement. (08 Marks)
- b. With a neat sketch, explain the construction details and working of sludge digestion tank. (08 Marks)
- 7 a. Discuss the effect of Industrial Wastewater on water bodies. (08 Marks)
- b. What is meant by Strength Reduction? Explain various methods of strength reduction of Industrial wastewater. (08 Marks)
- 8 a. Explain briefly the method for the removal of inorganic solids from Industrial wastewater. (08 Marks)
- b. Explain the methods used for Neutralization and Equalization of Industrial wastewater. (08 Marks)
- 9 a. With a flow diagram, explain the treatment of Tannery waste. (08 Marks)
- b. Enumerate the effect of discharging paper and pulp Industrial waste into water bodies or sewage. (08 Marks)
- 10 a. With process flow diagram, explain the origin of wastewater from cane sugar mill. List its characteristics. (08 Marks)
- b. With the help of flow diagram, explain different treatment alternatives for pharmaceutical industrial wastewater. (08 Marks)

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15CV72

Seventh Semester B.E. Degree Examination, July/August 2021 Design of RCC and Steel Structures

Time: 3 hrs.

Max. Marks: 80

Note: 1. Answer any TWO full questions.

2. Use of IS456:2000, SP(16), IS800:2007, Steel tables are permitted.

- 1 Design a portal frame for an effective span of 8 m and effective height of 4m. The portal frames are spaced at 3.5m c/c. The live load on the roof is 2 kN/m². SBC of soil is 150 kN/m². Take M20 grade of concrete and Fe-415 steel. Assume the frame is fixed. Sketch the reinforcement details. Design the beam, column and footing only. (40 Marks)

- 2 Design a Cantilever Retaining Wall for a height of 4m above ground level. Density of earth is 18 kN/m³. Angle of internal friction/repose is 30°. Take SBC as 200 kN/m². Coefficient of friction between soil and concrete is 0.5. Use M20 grade concrete and Fe-415 steel. Sketch the reinforcement details. (40 Marks)

- 3 Design a simply supported gantry girder manually operated with following data:
 - i) Span of crane = 20m
 - ii) Span of gantry = 7m
 - iii) Weight of crane excluding crab = 220 kN
 - iv) Capacity of crane = 250 kN
 - v) Weight of crab = 60 kN
 - vi) Wheel base distance = 3.5m
 - vii) Minimum hook approach = 1.1m
 - viii) Height of Rail = 60mm
 Draw the C/S and L/S of the gantry. (40 Marks)

- 4 Design a Roof truss, for the forces given in the table. Design the Anchor bolt for an uplift force of 15 kN and bearing plate for reaction of 50 kN. Design all the critical components of truss. [Refer Fig.Q4]

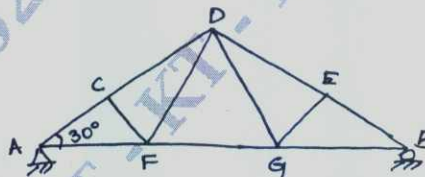


Fig.Q4

Sl.No.	Member	Force (kN) in member	Nature of Force	Length of member 'm'
1	AC, BE	80	Compression	3.46
2	CD, DE	70	Compression	3.46
3	AF, BG	70	Tension	4
4	FG	50	Tension	4
5	DF, DG	24	Tension	4
6	CF, EF	24	Compression	2

Draw the Elevation of Roof truss showing detail of Angles and connection. (40 Marks)

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15CV741

Seventh Semester B.E. Degree Examination, July/August 2021

Design of Bridges

Time: 3 hrs.

Max. Marks: 80

- Note: 1. Answer any FIVE full questions.
2. Use of IRC-21-2000 and pigeauds curves are permitted.
3. Assume missing data, if any suitably.

- 1 a. With a net sketch, explain term afflux. (06 Marks)
b. Derive an expression for economic span of bridge and list out the assumptions made economic span. (10 Marks)
- 2 a. Critically review the methods normally used for the estimation of the design discharge of a bridge site. (06 Marks)
b. Determine the waterway for a bridge across a stream with a flood discharge $225 \text{ m}^3/\text{s}$, velocity 1.5 m/s and width of flow at high flood level 60 m , if allowable velocity under the bridge is 1.80 m/sec . Take safe velocity is 90% of allowable velocity. (10 Marks)
- 3 Across a stream R.C.C slab culvert of single span 6 m clear length is proposed for NH for two-lane traffic following particulars are available.
Kerbs : 60 mm wide and 30 mm high.
Wearing course : 80 mm thick
Loading : IRC class AA (Tracked)
Materials : M20 concrete, Fe415 steel.
Design deck slab (check for shear is not necessary) (16 Marks)
- 4 Design a deck slab for the following particulars:
Clear span : 5.5 m
Width of footpath : 1 m on either side
Wearing coat : 100 mm
Loading : IRC class AA (Tracked)
Materials : M35 concrete and Fe415 steel.
Design the slab only for flexure. (16 Marks)
- 5 An R.C.C T-beam bridge is proposed across a stream of bed width 15 m and side slopes $1 : 1$. Following data are available.
Clear roadway : 7.5 m
Effective span : 16 m
Loading : IRC class AA (Tracked)
Materials : M20 concrete, Fe415 steel.
Spacing of three number of longitudinal beams : 2.5 m centre to centre
Spacing of five number of cross beams : 4 m centre to centre
Design:
(i) An intermediate panel of deck slab using pigeauds theory (shear need not to be checked)
(ii) An interior longitudinal beam using Kourbons theory. (16 Marks)

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- 6 Design and detail the cross girder in a T-beam bridge with the following data:
 Spacing of longitudinal girders = $2.5 \text{ m}^{\text{C/C}}$;
 Spacing of cross girders = $4.0 \text{ m}^{\text{C/C}}$;
 Thickness of deck slab = 200 mm
 Thickness of wearing course = 80 mm
 Live load = Class AA (Tracked)
 Material = M₃₀ concrete and Fe415 steel. (16 Marks)
- 7 A box culvert has internal dimensions $3.00 \times 3.00 \text{ m}$ with the following data:
 Super imposed dead load = 16 kN/m^2 ;
 Live load including impact allowance = 52 kN/m^2 .
 Insitu density of soil = 18 kN/m^3 ;
 Angle of internal friction = 30 degrees ;
 Concrete grade = M30 ;
 Steel grade = Fe415
 Considering empty condition, design and detail the box culvert. (16 Marks)
- 8 Design a pipe culvert through a road embankment of height 6 m. The width of the road is 7.5 m and the formation width is 10 m. The side slop of the embankment is 1.5 : 1. The maximum discharge is $5 \text{ m}^3/\text{sec}$. The safe velocity is 3 m/sec. Class AA tracked vehicle is to be considered as live load. Assume bell mouthed entry. Given $C_e = 1.5$, $C_s = 0.010$ and the unit weight of the soil is 20 kN/m^3 . Draw cross section of pipe showing reinforcement details. (16 Marks)
- 9 Verify the adequacy of the dimensions of the pier of a bridge with the following details :
 Top width of the pier : 1.6 m
 Height of the pier up to springing level : 10 m
 C/C of bearing on either side : 1 m
 Side batter : 1 in 12
 High flood level : 1 m below the bearing level.
 Span of the bridge : 16 m
 Loading on span : IRC class AA
 Road : Two-lane with 1 m wide footpath.
 Superstructure : Three longitudinal beams of 1.4 m depth with a deck slab of 200 mm depth.
 Rib width : 300 mm
 Material : Concrete M₁₅. (16 Marks)
- 10 a. With a neat sketch, explain rocker and roller bearing. (08 Marks)
 b. What are the requirements of expansion joint in a bridge? Explain them briefly. (08 Marks)

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15CV751

Seventh Semester B.E. Degree Examination, July/August 2021 Urban Transportation and Planning

Time: 3 hrs.

Max. Marks: 80

Note: Answer any FIVE full questions.

- 1 a. Define Urbanization. What are the causes of urbanization? (08 Marks)
b. With the aid of flow diagram explain the details of urban transport system planning process. (08 Marks)
- 2 a. With the aid of sketch describe the details of mass transport system. (08 Marks)
b. Distinguish between BRTS and Metro rails. (05 Marks)
c. Briefly explain the modeling technique in transport planning. (03 Marks)
- 3 a. Define study area. What are the factors to be considered for external urban line? (06 Marks)
b. In detail explain the concept of road interview survey. (10 Marks)
- 4 a. Define zone. What are the factors to be considered for making zones? (08 Marks)
b. Explain the details of home interview survey. (08 Marks)
- 5 a. Briefly explain the details of UTPS approach. (05 Marks)
b. What are the disadvantages of zonal least square regression model? (05 Marks)
c. Determine the trip distribution between the zones for the following data by using uniform growth factor method. Assume initial growth factors as 1, 3 and 6.

O \ D	1	2	3
1	60	100	200
2	100	20	300
3	200	300	20

(06 Marks)

- 6 a. With the assumptions explain the concept of category analysis. (08 Marks)
b. Find the trip interchange between the zones for the following data by using Furness method. Assume initial origin growth factor of zone 1, 2, 3, 4 as 3.5, and 1.5, 1.1, 1.2 and initial destination growth factor of zone 1, 2, 3, 4 as 1.5, 1.0, 2.0, 3.0 respectively.

O \ D	1	2	3	4
1	8	3	16	15
2	6	9	8	5
3	10	8	3	8
4	2	4	7	12

(08 Marks)

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- 7 a. The total trips produced in and attracted to the three zones A, B and C of a survey area in the design year are tabulated as :

Zone	Trips Produced	Trips Attracted
A	2000	3000
B	3000	4000
C	4000	2000

It is known that the trip between the two zones are inversely proportional to the second power of the travel time between zones, which is 20 minutes. If the trip interchange between zones B and C is known to be 600, calculate the trip interchange between zones A to B, A to C, B to A and C to B.

- (08 Marks)
- b. Explain the concept of Intervening Opportunities model. (08 Marks)
- 8 a. Write the various phases calibration of gravity model. (05 Marks)
- b. With the aid of flow diagram explain
- (i) Modal split after trip generation but before trip distribution. (08 Marks)
- (ii) Modal split after trip distribution. (03 Marks)
- c. Briefly explain the details of Tanner's model.
- 9 a. What are the applications of traffic assignment? (05 Marks)
- b. Explain the concept of all or nothing assignment. (08 Marks)
- c. Write a brief note on minimum path tree. (03 Marks)
- 10 Write a short notes on :
- a. Diversion curves
- b. Capacity restraint techniques
- c. Reallocation of assigned volumes
- d. Land use planning models. (16 Marks)

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