USN ☐☐☐☐☐☐☐☐☐☐ 　　　　　　17CV71

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

Time: 3 hrs. 　　　　　　　　　　　　　　　　　　　　Max. Marks: 100

Note: *Answer any FIVE full questions.*

1　a. Name different types of sewerage system with their advantages and disadvantages.
　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　(10 Marks)
　b. List and explain factors affecting Dry Weather Flow (DWF). 　　**(10 Marks)**

2　a. Define Sewer appurtenance and explain with neat sketch, construction and working of manhole. 　　　　　　　　　　　　　　　　　　　　　　　**(10 Marks)**
　b. Explain the following with sketches Septic tank and Oxidation pond. 　**(10 Marks)**

3　a. What is Self purification of stream? With neat sketch, explain Oxygen Sag Curve. **(10 Marks)**
　b. With neat sketch, explain Zones of purification. 　　　　　　　**(10 Marks)**

4　a. Disposal by dilution is adopted for a city which discharges $100 m^3/sec$ of sewage into a river which is fully saturated with oxygen and is flowing at the rate of $1500 m^3/sec$ during its lean period with a velocity of 10m/min. the BOD_5 of the sewage is 350 mg/lit. Find when and where the critical dissolved oxygen deficit will occur in the downstream and what is its amount? Assume self purification factor as 4.0 and deoxygenation constant as 0.1/day. Assume saturation D.O at given temperature as 9.2mg/lit. 　　　　**(10 Marks)**
　b. Write short notes on sewage sickness and sewage farming. 　　**(10 Marks)**

5　a. Draw a flow diagram of municipal waste water treatment plant with their operation units.
　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　(10 Marks)
　b. Briefly explain characteristic of Domestic waste water. 　　　　**(10 Marks)**

6　a. Explain with neat sketch, the working principles of trickling filter. 　**(10 Marks)**
　b. Design sludge digestion tank for one lakhs population. The sludge content per capita per day is 0.07kg. The moisture of sludge is 94% to specific gravity of wet sludge is 1.02 and 3.5% of fresh sludge is being mixed with digested sludge. 　　　　　**(10 Marks)**

7　a. Mention the difference between Domestic waste water and Industrial waste water. **(10 Marks)**
　b. Write a note on Volume reduction and Strength reduction. 　　**(10 Marks)**

8　a. Explain the methods used for neutralizing of acidic and alkaline water. 　**(10 Marks)**
　b. What are the merits and demerits of Municipal and Industrial waste water combined treatment methods? 　　　　　　　　　　　　　　　　　　**(10 Marks)**

9　a. Explain with flow diagram, treatment option for sugar mills. 　　**(10 Marks)**
　b. With the help of flow chart, mention sources and characteristics of waste water from cotton textile mill. 　　　　　　　　　　　　　　　　　　　　　**(10 Marks)**

10　a. With process flow diagram, explain the origin of wastes from Distilleries plant. **(10 Marks)**
　b. Enumerate the effects of discharging paper and pulp industrial wastes into water bodies or sewers. 　　　　　　　　　　　　　　　　　　　　　　　**(10 Marks)**

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17CV72

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

Time: 3 hrs.

Max. Marks: 100

Note: 1. Answer any TWO full questions.
2. Use of IS456, IS800, SP(6), Steel tables are permitted.
3. Assume any Missing data suitably.

1   Two columns 230 × 300mm and 300mm × 230mm are spaced 2m apart and carry service loads of 280 kN and 350kN respectively. If the SBC of soil is 140 kN/m^2 design a Rectangular slab type RCC combined footing. The projection of the footing beyond the centre line of column measuring 230mm × 300mm is limited to 500mm. Use M$_{20}$ grade of concrete and Fe – 415 grade steel.   **(50 Marks)**

2   Design a Cantilever Retaining Wall to retain Earthen embankment of 3.5m high. The density of earth is 18 kN/m^3. And its angle of repose is 30°. The Embankment is horizontal at its top. The SBC of soil is 200 kN/m^2. The Coefficient of friction between soil and concrete is 0.5. Adopt M$_{20}$ grade concrete and Fe-415 grade steel.   **(50 Marks)**

3   Design a Bolted Roof truss, for an Industrial building as shown in Fig. Q3. The forces in the members of the truss due to dead load, live load and wind load are given in the table below. Consider M16 bolts of property class 4.6.   **(50 Marks)**

Fig. Q3
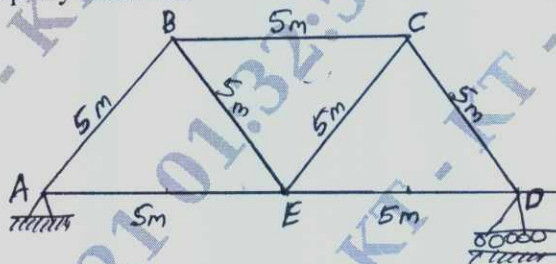
Member	D.L (KN)	L.L (KN)	W.L (KN)
AB	+ 9.2	+ 8.2	- 37
BC	+ 9.2	+ 8.2	- 32.6
CD	+ 9.2	+ 8.2	- 37
AE	+ 7.4	+ 6.6	- 32.6
BE	- 7.9	- 7.0	+ 26.6
CE	- 7.9	- 7.0	+ 26.6
DE	+ 7.4	+ 6.6	- 32.3

NOTE : Sign : + Compression
- Tension.

4   Design a welded plate girder for a supply supported span of 36m. Factored UDL load on the girder is 79.5 kN/m. In addition of two concentrated factored loads of each 870 kN placed at a distance of 9m on either side of the support of the girder.   **(50 Marks)**

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17CV741

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

Time: 3 hrs.

Max. Marks: 100

Note: 1. Answer any FIVE full questions.
2. Use of codes IRC-6, IRC-21, IRC-112, IS-456, SP-16 and Pigeaud's curves are permitted.

1 a. How are bridges classified? Briefly explain. **(12 Marks)**
   b. Define :
       (i) Linear Water Way   (ii) Scour   (iii) Afflux   (iv) Economic span of bridge. **(08 Marks)**

2 a. Determine the linear water way at the bridge location for a River with a flood discharge of 225 m^3/s. Width of river is 60m. Velocity is 1.5 m/s. Maximum velocity allowable under bridge is 1.8 m/s **(08 Marks)**
   b. The design data available for bridge site is as follows:
       (i)   Catchment area is 160 km^2
       (ii) Distance of site from coast is 12 km.
       (iii) Distance of the critical point from the bridge site is 16 km.
       (iv) Difference in elevation between the critical point and bridge site is 96m.
       (v)   Peak intensity of Rainfall is 60mm/hr.
       (vi) The surface of catchment is largely cultivated.
       (vii) The cross section area of stream at a section is 120 m^2.
       (viii)Wetted perimeter at that section is 90m.
       (ix) Slope of the stream is 1 in 500.
       (x)   Run off coefficient for largely cultivated land is 0.3.
       (xi) 'f' correction factor is 1 for a km^2 and 0.6 for 2000 km^2 catchment area.
       Determine discharge by
       (i) Empirical method   (ii) Rational method   (iii) Area velocity method. **(12 Marks)**

3 Design a reinforced concrete slab bridge that has a clear span of 5.5m and with following data clear width of carriage way is 7.5m width of bearing on either side is 0.5m each.
   Footpath width on either side is 0.6m wearing coat thickness is 80mm.
   Grade of concrete is M30.
   Grade of steel is Fe415.
   Live load expected is class AA tracked vehicle. **(20 Marks)**

4 a. Sketch typical reinforcement detailing of skew slab bridge. **(08 Marks)**
   b. What is meant by a skew slab bridge and briefly explain the analysis and design of same. **(12 Marks)**

5 Design the cross girder of a T-beam bridge where longitudinal girders are spaced 2.5m c/c, cross girders are spaced @ 4m c/c, the deck slab thickness is 200mm, thickness of wearing coat is 80mm. Vehicle class AA tracked is expected use M25 and Fe415. Assume cross girder dimension as 300mm × 1500mm. **(20 Marks)**

6   Design the interior deck slab of a T-beam bridge where longitudinal girders are at 2.5 m c/c and the cross girders are at 3.5m c/c. The thickness of the slab is 200mm. Thickness of wearing coat is 80mm. Assume M25 grade of concrete and Fe415 grade of steel. The bridge is subjected to class AA tracked loading.   (20 Marks)

7   Design box culvert with an internal dimension of 3m × 3m subjected to a superimposed dead load of 14 kN/m² and a live load including impact of 50 kN/m². Assume the density of soil around is 18 kN/m³, with angle of internal friction as 30°. Use M25 and Fe415 grade.   (20 Marks)

8   In a catchment area of 22 km² with a rainfall intensity of 25mm/day and a runoff coefficient of 0.8 a pipe culvert is required with a safe velocity of flow 3m/sec. Carriage way width is 7.5m. Footpath on either side is 1.25m each. Embankment is 6m height with a side slope of 1.5 H to 1V. Live load expected is class AA tracked vehicle. Assume bell mouthed entry. Coefficient for filling C_e is 1.5, influence coefficient C_s is 0.01, unit weight of soil is 20 kN/m³. Impact factor is 1.5, Use MP_3 grade pipe with internal diameter of 1.0m and external diameter of 1.23m. The 3 EBS of the pipe is 72 kN/m with a minimum spiral reinforcement requirement 21.52 kg/m and longitudinal reinforcement of 2.66 kg/m. Design and detail pipe culvert.   (20 Marks)

9   a. List any four types of bearing along with sketches.   (10 Marks)
     b. A pier for a bridge is subjected to the loads as given in the drawing. The total height of pier is 10m. Top width is 2m. Bottom width is 3m. HFL is 1m below the top. Dead load from either span is 2000 kN. Live load is 1000 kN. The longitudinal force due to breaking is 140 kN. Wind force is 2.4 kN/m². Check for stresses induced at the bottom of pier if it is constructed with PCC with permissible stress 2 N/mm² in compression with no tension allowed length of pier is 8.5m. Refer Fig.Q9(b).   (10 Marks)
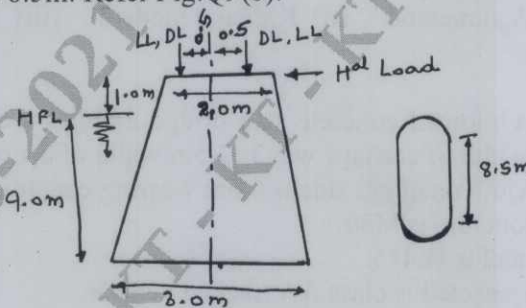
Fig.Q9(b)

10   a. Discuss on force acting on piers.   (06 Marks)
     b. Write a note on Abutments.   (06 Marks)
     c. Write a note on Stability of Abutments.   (08 Marks)

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