

Seventh Semester B.E. Degree Examination, June/July 2018
Design of Steel Structures

Time: 3 hrs.

Max. Marks:100

Note: Answer any FIVE full questions, selecting at least TWO questions from each part.

PART - A

- 1 a. What are the advantages and disadvantages of steel structures? (08 Marks)
 b. Mention different types of loads and load combination. (04 Marks)
 c. Explain design consideration of steel structures. (08 Marks)

- 2 a. Explain with neat sketch on modes of failures in bolted joint. (06 Marks)
 b. Determine the strength and efficiency of lap joint consist of 10 mm and 8 mm thick plates. Use M18 grade 5.6 black bolt and Fe440 grade plate. Edge distance = 40 mm, Pitch = 50 mm of Fig. Q2 (b). Assume fully threaded bolt. (14 Marks)

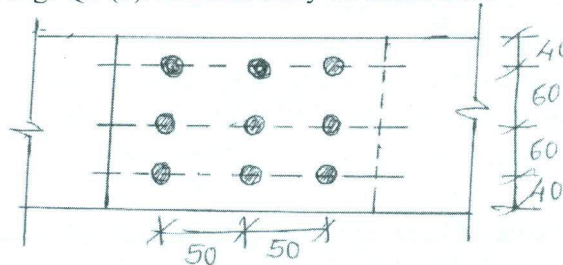


Fig. Q2 (b)

- 3 a. What are the advantages and disadvantages of welding? (06 Marks)
 b. Determine the Bracket load 'P' the column can carry as shown in Fig. Q3 (b). Take size of weld as 8 mm, $f_u = 410 \text{ N/mm}^2$. (14 Marks)

All dimensions are in mm

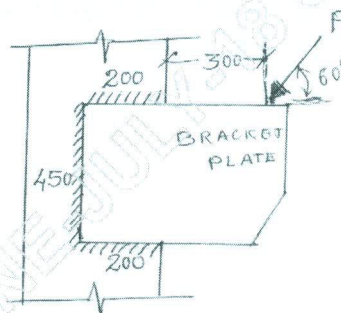


Fig. Q3 (b)

- 4 a. Calculate the shape factor of a T section having a flange of 200 mm and 20 mm thickness, web of 180 mm depth and 10 mm thickness. (08 Marks)
 b. Calculate plastic moment for the beam shown in Fig. Q4 (b), Use load factor 2. (12 Marks)

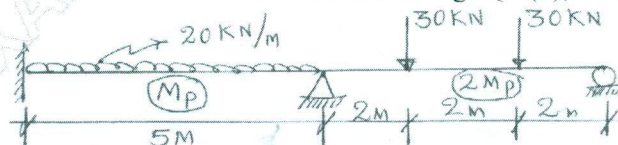


Fig. Q4 (b)

PART – B

- 5 a. Explain the different modes of failure of tension members. (06 Marks)
- b. Determine the strength of the plate 160mm × 10mm thick, connected with bolts subjected to a force as shown in Fig. Q5 (b). Use M18 dia bolts, take $f_y = 250 \text{ N/mm}^2$, $f_u = 410 \text{ N/mm}^2$. (14 Marks)

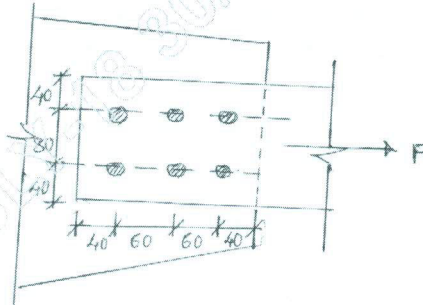


Fig. Q5 (b)

- 6 a. Design a compression member using double channel section to carry a load of 1500 kN, the height of column is 6 m and both ends are fixed, channels are arranged back to back. Assume $f_{cd} = 150 \text{ N/mm}^2$. (10 Marks)
- b. Design a compression member using four angle sections arranged in a box shape of size 400mm × 400mm to carry a load of 2500 kN. The height of the column is 5 m with one end fixed and other end hinged. Assume $f_{cd} = 180 \text{ N/mm}^2$. (10 Marks)
- 7 a. Mention type of column base. Explain the terms with a neat sketch. (06 Marks)
- b. Design a column base (slab base) and concrete base for a column ISHB400 subjected to an axial load of 1000 kN. Use M20 grade concrete, safe bearing capacity of soil is 200 kN/m². Draw neat sketch with bolted connection (M22 grade 9.8 HSFG Bolt). (14 Marks)
- 8 The RCC floor of a class room 6m × 12m is supported on beam kept @ 3 m C/C. The beams are simply supported at ends over a span of 6 m, and rest on 300 mm thick masonry walls. Assuming the thickness of slab = 125 mm, Live Load on slab = 4 kN/m². Design an interior beam using IS specification. Apply all the necessary checks. (20 Marks)

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Seventh Semester B.E. Degree Examination, June/July 2018
Design of Prestressed Concrete Structures

Time: 3 hrs.

Max. Marks:100

- Note: 1. Answer any FIVE full questions, selecting at least TWO questions from each part.**
2. Use of IS1343 code is permitted.

PART – A

- 1 a. What is the necessity of using high strength concrete in P.S.C. work? (06 Marks)
 b. What is the necessity of using high strength steel in P.S.C. construction? (04 Marks)
 c. List the advantages and disadvantages of prestressed concrete over reinforced cement concrete. (10 Marks)

- 2 A prestressed concrete T-beam is to be designed to support a superimposed load of 4.4 kN/m over a span of 5 m. The 'T' beam is made up of a flange 400 mm 40 mm thick. The rib is 100 mm wide and 200 mm deep. The stress in concrete must not exceed 15 N/mm² at the bottom fibre and zero at the top fibre, due to self weight and prestressing force. Evaluate the prestressing force and its eccentricity. Evaluate the resulting stresses after L.L is applied. Assume the density of concrete is 24 kN/m³ and the loss of prestress at 20%. (20 Marks)

- 3 a. List the various losses of prestress in tensioned steel. (03 Marks)
 b. A post tensioned concrete beam 100 mm wide and 300 mm deep, spanning over 10 m is stressed by stresses by (17 Marks)

- 4 a. Discuss the various factors affecting deflections in P.S.C. beams. (06 Marks)
 b. The beam of uniform section is prestressed with a bent cable as shown below Fig.Q4(b), in which the initial prestress is 300 kN. Taking the loss ratio as 80%. Determine
 (i) Maximum deflection at transfer of prestress
 (ii) Maximum deflection at working load 8 kN/m. Assume M₄₀ concrete. (14 Marks)

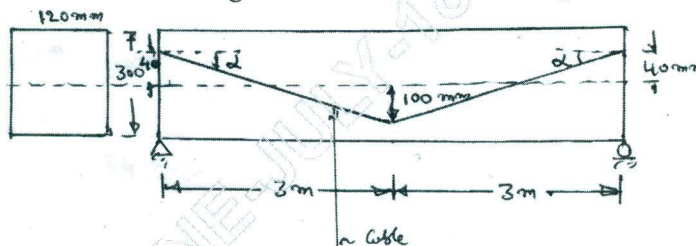


Fig.Q4(b)

PART – B

- 5 a. What are the different types of failure observed in a prestressed concrete beam? Explain with sketches. (08 Marks)
 b. A post tensioned bridge girder with unbounded tendons is of base section of overall dimensions 1200 mm wide by 1800 mm deep with wall thickness of 150 mm. The high tensile steel has an area of 4000 mm² and its located at an effective depth of 1600 mm. The effective prestress in steel after losses is 1000 N/mm², and the effective span of the girder is 24 m. If $f_{ck} = 40$ N/mm² and $f_p = 1600$ N/mm². Estimate the ultimate flexural strength of the section. (12 Marks)

- 6 a. Discuss briefly the modes of failure due to shear. (04 Marks)
b. List the methods of improving resistance in P.S.C beams. (02 Marks)
c. A simply supported beam of span 6 m is 120×300 mm in section. It is prestressed with a parabolic cable which carries an effective prestress of 200 kN. The cable has a maximum eccentricity of 100 mm at mid span section and minimum eccentricity of 50 mm at the support section. Determine the principal tension at 20 mm above the centroidal fibre in a section which lies at 0.6 m from the left support. The beam carries an all inclusive load of 15 kN/m. (14 Marks)
- 7 a. Explain the stress distribution in end block of a post tensioned prestressed concrete member with neat sketch. (06 Marks)
b. The end block of a prestressed concrete girder is 200 mm wide by 300 deep. The beam is post tensioned by two Freyssinet anchorages each of 100 mm diameter with their centres located at 75 mm from the top and bottom of the beam. The force transmitted by each anchorage being 2000 kN. Compute the bursting force and design suitable reinforcements according to Indian standard IS1343 code provisions. Sketch the arrangement of anchorage zone reinforcement. (14 Marks)
- 8 A post tensioned prestressed concrete beam of rectangular section 300 mm wide is to be designed to resist a live load moment of 360 kN-m on a span of 12m. Assuming 10% loss and limiting tensile and compressive stress to 1.5 N/mm^2 and 18 N/mm^2 respectively. Calculate the minimum possible depth and the prestressing force and corresponding eccentricity. Take density of concrete as 24 kN/m^3 . (20 Marks)

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Seventh Semester B.E. Degree Examination, June/July 2018
Pavement Material & Construction

Time: 3 hrs.

Max. Marks: 100

**Note: Answer FIVE full questions, selecting
at least TWO questions from each part.**

PART – A

- 1 a. Explain the desirable properties of aggregates to be used in different types of pavement construction. State the tests conducted for each property. (08 Marks)
- b. Explain the following tests on aggregates and state the permissible limits as per MORTH guidelines for flexible pavements :
 - (i) Crushing test.
 - (ii) Impact test. (12 Marks)
- 2 a. Compare bitumen and tar. What are the requirements of bitumen used for road works? (10 Marks)
- b. Explain with neat sketch manufacturing process of bitumen. (10 Marks)
- 3 a. Compare the salient features / characteristics of outback and emulsions. Under what condition each one is used. (10 Marks)
- b. What is stripping? What are its adverse effects? Explain any one test on bitumen adhesion. (10 Marks)
- 4 a. Explain proportioning of aggregates by Rothfutch's method. (08 Marks)
- b. Explain the step by step procedure of Marshall method of mix design. (12 Marks)

PART – B

- 5 a. What is a power Shovel? With a neat sketch, explain its operation and applications. (10 Marks)
- b. What are the different types of compacting equipments used for pavement construction? Write an explanatory note on rollers in road construction. (10 Marks)
- 6 a. What are the desirable properties of subgrade soil? Enumerate the steps in preparation of subgrade. How do you evaluate adequacy of compaction. (12 Marks)
- b. Explain the circumstances in which construction of embankment becomes necessary. (08 Marks)
- 7 a. Explain the material specification and construction steps for Bituminous surface dressing. (10 Marks)
- b. Explain the objectives, type of material and method of application for (i) Prime coat (ii) Tack coat. (10 Marks)
- 8 a. Explain with a neat sketch, different joints in rigid pavement. (10 Marks)
- b. Enumerate the steps involved in the construction of cement concrete pavements. (10 Marks)

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15CV71

Seventh Semester B.E. Degree Examination, Dec.2019/Jan.2020 Municipal and Industrial Wastewater Engineering

Time: 3 hrs.

Max. Marks: 80

- Note:** 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. Assume any suitable missing data.

Module-1

- 1 a. Explain briefly the different types of sewerage system. (06 Marks)
b. Explain the various factors affecting the dry weather flow. (04 Marks)
c. The drainage area of one sector of a town is 20 hectares. The classification of the surface of this area is as follows :

% Total surface area	Type of surface	Run – off coefficient
25	Hard pavements	0.85
25	Roof surface	0.80
15	Unpaved street	0.30
25	Gardens and Lawns	0.15
10	Wooded area	0.10

If the time of concentration for the area is 30 minutes. Find the maximum run off. Use the following formula for intensity of rainfall $R = 900/(t + 60)$. (06 Marks)

OR

- 2 a. Briefly explain the essential requirements of a good sewer material. (04 Marks)
b. Explain with a neat sketch, working of an “oxidation pond”. (06 Marks)
c. Explain with a neat sketch, construction and working of a manhole. (06 Marks)

Module-2

- 3 a. Briefly explain self cleaning velocity and non scouring velocity. (04 Marks)
b. State the hydraulic formulas for velocity which are commonly adopted in the design of sewers. Explain any one in brief. (06 Marks)
c. A stone – ware sewer having 30cm in diameter is laid at a gradient of 1 in 100 use $N = 0.013$ in Manning’s formula. Calculate the velocity, discharge and Chezy’s co-efficient when the sewer is running full. (06 Marks)

OR

- 4 a. Explain the phenomenon of self – purification of natural streams subjected to pollution with the help of oxygen – sag curve indicating the salient features. (10 Marks)
b. The sewage of a town is to be discharged into a river. The quantity of sewage produced per day is 8 million liters and its BOD is 250 mg/ℓ. If the discharge in the river is 200 ℓ/s and if its BOD is 6mg/ℓ, find the B.O.D of the diluted water. (06 Marks)

Module-3

- 5 a. Write the flow diagram employed to treat municipal waste water and indicate the importance of each treatment unit. (08 Marks)
b. With a neat sketch, explain the working of a grit chamber and skimming tank. (08 Marks)

OR

- 6 a. Explain with a neat sketch, the working principles of a trickling filter. (08 Marks)
b. Briefly explain the terms : i) Suspended growth ii) Activated sludge
iii) Sludge digester iv) Sequential batch reactors. (08 Marks)

Module-4

- 7 a. Explain the effects of effluent discharge on the stream water quality. (08 Marks)
b. What is meant by strength reduction? Explain the various methods of strength reduction being adopted in the industries. (08 Marks)

OR

- 8 a. List and explain the methods of removal of colloidal solids from wastewater. (08 Marks)
b. Explain the principles of raw and partially treated wastes before discharged into streams. (08 Marks)

Module-5

- 9 a. With the help of a flow diagram, explain the treatment units suggested to treat wastewater from a tanning industry along with wastewater characteristics. (08 Marks)
b. State the sources and characteristics of the wastewater from dairy industry. (08 Marks)

OR

- 10 a. With the help of a line diagram, explain the process of paper and pulp industry highlighting the sources of wastewater generation. (08 Marks)
b. Discuss the characteristics and treatment of waste water from a pharmaceutical industry. (08 Marks)

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Seventh Semester B.E. Degree Examination, Dec.2019/Jan.2020 Design of RCC and Steel Structures

Time: 3 hrs.

Max. Marks: 80

- Note: 1. Answer any TWO full questions, choosing ONE full question from each module.
2. Use of IS456, IS800, SP(6)-Steel Table is permitted.
3. Assume any missing data suitably.*

Module-1

- 1 Design a reinforced concrete combined rectangular slab footing for two columns located at 4.5 m apart. The overall sizes of the columns are 400mm × 400mm and 600mm × 600mm and they are transferring 600 kN and 1000 kN respectively. The centre of the lighter column in 0.4m from the property line. The safe bearing capacity of the soil 150 kN/m². Use M20 concrete and Fe 415 steel. Sketch the reinforcement details. (40 Marks)

OR

- 2 Design a cantilever retaining wall to retain an earth embankment with a horizontal top 3.5m above ground level. Density of earth 18 kN/m³, angle of internal friction $\phi = 30^\circ$. SBC of soil is 200 kN/m³. Take coefficient of friction between soil and concrete 0.5, Adopt M20 grade concrete and Fe 415 steel. (40 Marks)

Module-2

- 3 The centre line of a roof truss is as shown in the Fig.Q3. The forces in the members of the truss due to dead load, live load and wind load is given below: Design the roof truss member using M16 bolts of property class 4.6. Also design a bearing plate and anchor bolts for a pull of 40 kN. Use M20 grade concrete. Draw to suitable
(i) Elevation of truss greater than half space (ii) Support details.

Member	DL (kN)	LL (kN)	WL (kN)
AB	+ 14.37	+ 21.80	- 37.32
BC	+ 11.64	+ 17.60	- 32.08
CD	+ 12.05	+ 18.26	- 35.90
DE	- 5.13	- 7.70	+ 14.70
EC	+ 2.77	+ 4.18	- 8.42
EB	+ 2.77	+ 4.18	- 9.15
EA	- 12.85	- 19.36	+ 31.69
EF	- 7.69	- 11.61	+ 15.63

Sign :- + ⇒ Compression
- ⇒ Tension

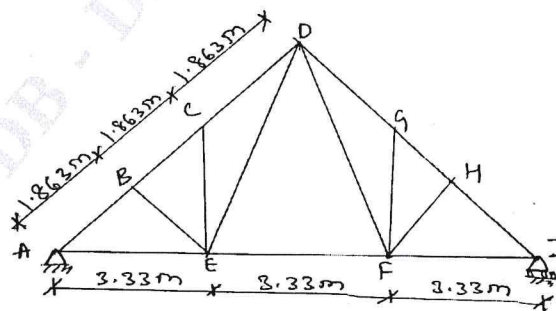


Fig.Q3

(40 Marks)

OR

4 Design a simply supported gantry girder to carry an electrically operated travelling crane with the following details:

- (i) Span of the crane bridge \Rightarrow 25 m
- (ii) Span of the gantry girder \Rightarrow 8 m
- (iii) Wheel base \Rightarrow 3.5 m
- (iv) Crane capacity \Rightarrow 200 kN
- (v) Weight of crane bridge \Rightarrow 150 kN
- (vi) Weight of trolley (crab) \Rightarrow 75 kN
- (vii) Minimum hook distance \Rightarrow 1.0 m
- (viii) Weight of rail \Rightarrow 0.30 kN/m
- (ix) Height of rail \Rightarrow 105 mm

Draw neatly cross section of gantry girder showing all details. Also draw side view.

(40 Marks)

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15CV73

Seventh Semester B.E. Degree Examination, Dec.2019/Jan.2020 Hydrology and Irrigation Engineering

Time: 3 hrs.

Max. Marks: 80

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

- 1 a. With a neat sketch, explain the Engineering representation of the Hydrologic cycle. (08 Marks)
- b. Briefly explain with a neat sketch, the i) Moving average curve ii) Mass curve
iii) Rainfall hyetograph iv) Forms of precipitation. (08 Marks)

OR

- 2 a. With a Table, explain Global and Indian water availability. (05 Marks)
- b. Write a note on optimum number of rain gauge stations. (05 Marks)
- c. The average annual rainfall of 8 rain gauge stations in a basin are 1000, 950, 900, 850, 800, 700, 600, 400 mm. If the permissible error is 6%. Determine the optimum number of rain gauges required in the basin. (06 Marks)

Module-2

- 3 a. Explain what is evapo – transpiration and also factors affecting evapo – transpiration. (08 Marks)
- b. Describe how the estimation of evaporation is carried by
i) Meyer's equation ii) Rohwer's equation. (08 Marks)

OR

- 4 a. Describe the method of determining infiltration capacity using a double ring infiltrometer. (06 Marks)
- b. A reservoir with average surface spread of 4.8 km² in the first week of November has the water surface temperature of 30⁰C and relative humidity of 40%. Wind velocity measured at 3.0m above the ground is 18km/h. The mean barometer reading is 760mm of Hg. Calculate the average evaporation loss from the reservoir in mm/day and the total depth and volume of evaporation loss in the first week of November. Use both Meyer's equation as well as Rohwer's equation. Take saturation vapour pressure at 30⁰C as 31.81mm of Hg. (10 Marks)

Module-3

- 5 a. Define Runoff. Explain the factors affecting Runoff. (05 Marks)
- b. Explain with a neat sketch, components of storm hydrograph. (05 Marks)
- c. Find the ordinates of a flood hydrograph resulting from a storm with rainfalls of 2.50 , 6.85 and 3.75cm each during success –ve 3 hours. The ordinates of a 3 hour UHG are given below. Assume an initial loss of 5mm – infiltration index , $\phi = 2.5$ mm/hr , Base flow = 12 cumec.

Time (hours)	3	6	9	12	15	18	21	24	3	6	9	12	15	18	21	24
UHG ordinates (cumec)	0	115	370	510	395	315	252	231	112	127	96	64	43	25	12	0

(06 Marks)

OR

- 6 a. Explain Rainfall – Runoff correlation analysis. (04 Marks)
 b. Define Unit Hydrograph. Explain with a neat sketch, the derivation of unit Hydrograph. State its assumption, application and limitations. (08 Marks)
 c. Given the ordinates of a 4 – h unit hydrograph as below derive the ordinates of a 12 – h unit hydrograph for the same catchment. (04 Marks)

Time (hr)	0	4	8	12	16	20	24	28	32	36	40	44
Ordinates of 4h UH (m ³ /sec)	0	20	80	130	150	130	90	52	27	15	05	0

Module-4

- 7 a. with neat sketches. Explain Band hara Irrigation. List its advantages and disadvantages. (06 Marks)
 b. Define Irrigation. What are the necessity of irrigation? (05 Marks)
 c. Explain the various irrigation efficiencies. (05 Marks)

OR

- 8 a. Explain with neat sketch, the variation of Duty with the places of its measurement. (06 Marks)
 b. What are the different methods adopted to improve duty of water? (05 Marks)
 c. With a neat sketch, explain different systems of irrigation. (05 Marks)

Module-5

- 9 a. Write a note on Canal classification. (04 Marks)
 b. Briefly explain the Lacey's Regime theory. (06 Marks)
 c. Write with a neat sketch, the calculation of Reservoir capacity for a specified yield from the mass inflow curve. (06 Marks)

OR

- 10 a. Define the following : i) Gross command area ii) Cultural command area
 iii) Crop factor iv) Time factor. (04 Marks)
 b. Explain with a neat sketch, zones of storage in a Reservoir. (04 Marks)
 c. A channel section has to be designed for the following data :

Discharge $Q = 30$ cumes ; Silt factor $f = 1.00$; Side slope = $\frac{1}{2} : 1$.

Find also the longitudinal slope. (08 Marks)

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15CV742

Seventh Semester B.E. Degree Examination, Dec.2019/Jan.2020 Groundwater and Hydraulics

Time: 3 hrs.

Max. Marks: 80

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

- 1 a. With a neat sketch, explain the vertical distribution of Ground water. (08 Marks)
b. Explain in brief the occurrence of Ground water in different types of rocks and soils. (08 Marks)

OR

- 2 a. Explain the importance of Ground water. (08 Marks)
b. What is an aquifer? Explain different types of Aquifers, with a neat sketch. (08 Marks)

Module-2

- 3 a. Define Specific yield, Specific retention and Porosity. Derive a relationship between them. (08 Marks)
b. It is observed in a field test that 3 hr 20 min was required for a tracer to travel from one well to another 20m apart and the difference in their water surface elevations was 0.5m. Samples of the aquifer between the wells indicated a porosity of 15%. Determine the permeability of the aquifer, seepage velocity and the Reynolds number for the flow assuming an average grain size of 1mm and kinematic viscosity of water at 27°C is 0.008 stoke. (08 Marks)

OR

- 4 a. With a neat sketch, explain Darcy's law, discuss its validity and limitations. (08 Marks)
b. Derive an expression for one dimensional steady flow in a homogeneous unconfined aquifer. (08 Marks)

Module-3

- 5 a. What are the assumptions made in their method? Explain Theis's method to determine formation constants T and S for unsteady radial flow towards a well. (06 Marks)
b. Derive the discharge equation for steady radial flow into a well in a confined aquifer. (06 Marks)
c. A tube well of 30cm diameter penetrates fully in an artesian aquifer. The strainer length is 15m. Calculate the yield from the well under a drawdown of 3m. The aquifer consists of sand of effective size of 0.2mm having coefficient of permeability equal to 50m/day. Assume radius of drawdown equal to 150 meters. (04 Marks)

OR

- 6 a. Explain Cooper Jacob methods of solutions for unsteady radial flow in a confined aquifer. (08 Marks)
b. A 30 cm well penetrates 49.99m below the static water table. After a long period of pumping at a rate of 1799 lpm, the drawdown in the wells at 15 and 44.99m from the pumped well were 1.69 and 0.79m respectively. Determine the transmissibility of the aquifer. What is the drawdown in the pumped well? (08 Marks)

Module-4

- 7 a. Explain with a neat sketch, the Electrical resistivity (surface) method for ground water exploration. (08 Marks)
b. Explain the Sonic logging with equation. (08 Marks)

OR

- 8 a. Explain with a neat sketch the Seismic Refraction method for Ground water exploration. (08 Marks)
b. With a neat sketch, Electric logging for Ground water Exploration. (08 Marks)

Module-5

- 9 a. Explain the different types of wells also give the method of construction for any one of the well. (08 Marks)
b. With the neat sketches, explain the various methods of Ground water recharge. (08 Marks)

OR

- 10 a. Explain what is conjunctive use of water also explain its necessity , technique involved of economics. (08 Marks)
b. Describe what are the pumps used for lifting water from wells, also explain the working principle of centrifugal pump. (08 Marks)

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Seventh Semester B.E. Degree Examination, Dec.2019/Jan.2020 Rehabilitation and Retrofitting of Structures

Time: 3 hrs.

Max. Marks: 80

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

- 1 Write a short note on:
- a) Freeze and Thaw on concrete b) Thermal movement in concrete (16 Marks)

OR

- 2 Write a short note on:
- a) Chloride attack on the concrete b) Alkali silica reaction. (16 Marks)

Module-2

- 3 a. Briefly explain the purpose of assessment. (06 Marks)
b. Explain briefly the investigation of damage. (10 Marks)

OR

- 4 Write short note on:
- a. Ultrasonic pulse velocity method
b. Windsor HP probe system. (16 Marks)

Module-3

- 5 a. Briefly explain the effect of temperature on concrete. (08 Marks)
b. Briefly explain the effect of wear and erosion on concrete. (08 Marks)

OR

- 6 a. List the factors influencing the corrosion process. (03 Marks)
b. List the corrosion protection techniques and explain any three of them. (13 Marks)

Module-4

- 7 a. Define maintenance engineering. Explain the classification of maintenance. (10 Marks)
b. Give the importance of maintenance. (06 Marks)

OR

- 8 a. Give the factors or reasons which are needed for strengthening of concrete structures (any 04). (04 Marks)
b. With neat figure explain: i) Jacking technique ii) Externally bonding technique. (12 Marks)

Module-5

- 9 Write a short note on:
- a. Aramid fibers
b. Carbon fibers
c. Natural fibers
d. Rust eliminators. (16 Marks)

OR

- 10 Write short note on:
- a. Shot Crete
b. Epoxy Injection. (16 Marks)

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15CV72

Seventh Semester B.E. Degree Examination, Aug./Sept.2020 Design of RCC and Steel Structures

Time: 3 hrs.

Max. Marks: 80

*Note: 1. Answer any TWO full questions, choosing ONE full question from each module.
2. Use of IS-456, IS-800, SP(16), SP(6) and steel tables are permitted.*

Module-1

- 1 Design a slab type rectangular combined footing for two columns, A = 350 mm × 350 mm and B = 400 mm and 400 mm in size to carry axial service load of 600 kN and 900 kN respectively. The columns are spaced at 3.6 m centre to centre. SBC of soil is 175 kN/m². The property line is 0.74m from centre of column A. Use M20 grade concrete and Fe-415 grade steel. (40 Marks)

OR

- 2 Design a single bay portal frame, fixed at the base for the following data:
 Effective span of portal frame = 10 m
 Spacing of portal frame = 4 m
 Height of column above footing = 5.5 m (effective)
 Thickness of slab to be adopted = 150 mm
 Live load on slab = 1.6 kN/m²
 Floor finish = 0.75 kN/m²
 SBC of soil = 200 kN/m²
 Use M20 grade concrete and Fe 415 steel. Design the slab, beam, column and footing. (40 Marks)

Module-2

- 3 The centre line of a roof truss is as shown in Fig.Q3. The magnitude and nature of forces under service conditions are :
 Top Chord members = 120 kN Compression
 Bottom Chord members = 100 kN Tension
 Interior members = 60 kN Tension and 50 kN Compression
 For all the interior members use similar single angle sections. Design all the members and joints using M₁₆ turned bolts of grade 4.6. Also design bearing plate, base plate and anchor bolts to connect the truss to an RCC column 300 mm × 300 mm of M₂₀ grade concrete.

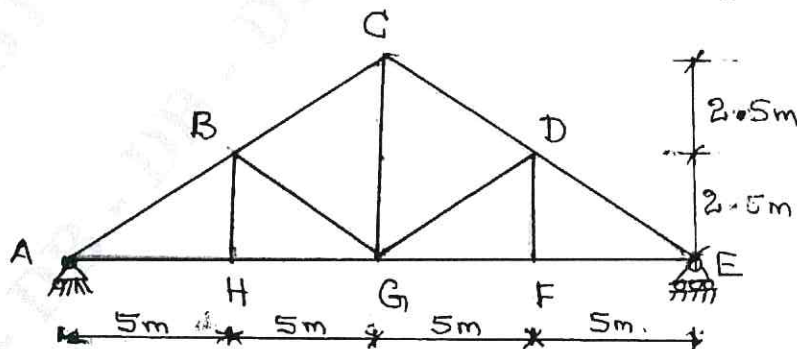


Fig.Q3

(40 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.

OR

- 4 Design a welded plate girder, effective span of 18 meters is simply supported at its ends. It carries a uniformly distributed load of 60 kN/m in addition to two point loads each of magnitude 400 kN placed at one third span points. Design:
- (i) Cross section of plate girder at midspan.
 - (ii) End and intermediate stiffeners
 - (iii) Welded connection between flange and web
 - (iv) Welded connection between web and stiffeners

(40 Marks)

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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/m^2 . SBC of soil is 150 kN/m^2 . 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/m^3 . Angle of internal friction/repose is 30° . Take SBC as 200 kN/m^2 . 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]

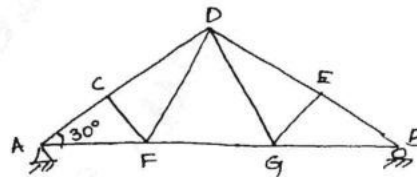


Fig.Q4

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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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 pignons curves are permitted.
3. Assume missing data, if any suitably.

- 1 a. With a neat 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 pignons theory (shear need not to be checked)
(ii) An interior longitudinal beam using Kourbons theory. (16 Marks)

- 6 Design and detail the cross girder in a T-beam bridge with the following data:
 Spacing of longitudinal girders = $2.5 \text{ m}^c/C$;
 Spacing of cross girders = $4.0 \text{ m}^c/C$;
 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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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 $100\text{m}^3/\text{sec}$ of sewage into a river which is fully saturated with oxygen and is flowing at the rate of $1500\text{ m}^3/\text{sec}$ during its lean period with a velocity of $10\text{m}/\text{min}$. the BOD_5 of the sewage is $350\text{ mg}/\text{lit}$. 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 $0.1/\text{day}$. Assume saturation D.O at given temperature as $9.2\text{mg}/\text{lit}$. (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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Seventh Semester B.E. Degree Examination, July/August 2021 Design of RCC and Steel Structures

Time: 3 hrs.

Max. Marks: 100

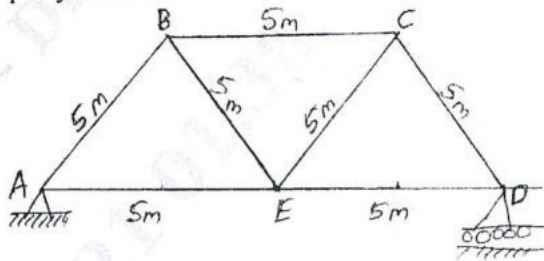
- Note:** 1. Answer any TWO full questions.
2. Use of IS456, IS800, SP(6), Steel tables are permitted.
3. Assume any Missing data suitably.

- 1 Two columns $230 \times 300\text{mm}$ and $300\text{mm} \times 230\text{mm}$ 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 $230\text{mm} \times 300\text{mm}$ 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 simply 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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CBCS SCHEME

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17CV73

Seventh Semester B.E. Degree Examination, July/August 2021 Hydrology and Irrigation Engineering

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions.

- 1 a. Explain the storage and transportation components and their relative positions using Horton's Hydrological cycle. (10 Marks)
 b. The average annual rainfall of 8 rain gauge stations in a basin are 1000, 950, 900, 850, 800, 700, 600 and 400mm. Find out the optimum number of raingauges required in the basin if the permissible error is 6%. Also state additional raingauge required if any. (10 Marks)

- 3 a. Explain what is Evapo-transpiration and also factors affecting evapo-transpiration. (10 Marks)
 b. A 6 hour storm produce rainfall intensities of 7, 18, 25, 12, 10 and 3mm/hour in successive one hour intervals over a basin of 800 sq. km. If the resulting run-off is observed to be 2500 Hectare – meters. Find the ϕ index for the basin. (10 Marks)

- 4 a. Describe the method of determining infiltration capacity using a double ring infiltrometers. (10 Marks)
 b. A reservoir with surface area of 250 hectares had the following average values of climate parameters during a week : Water temperature = 20°C ; Relative Humidity = 40%. Wind velocity at 1.0m above ground surface = 16km/h. Estimate the average daily evaporation from the lake using Meyer's formula and also compute the volume of water evaporated from the lake in that week. (10 Marks)

- 5 a. Explain with neat sketches : i) Influent stream ii) Effluent stream iii) Catchment
 iv) Ephemeral stream v) Windex. (10 Marks)
 b. Annual rainfall and runoff value (in cm) of a catchment are given. Develop a linear co-relation equation to estimate annual runoff volume for a given annual rainfall value. (10 Marks)

Year	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
Rainfall	118	58	112	97	84	91	138	89	104	80	97
Run off	54	45	51	41	21	32	66	25	42	11	32

Year	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
Rainfall	75	107	75	93	129	153	92	84	121	95
Run off	17	32	15	28	48	76	27	18	52	26

- 6 a. Explain with a neat sketch, three methods of separating the base flow from the hydrograph. Give applications and limitations of unit hydrograph. (10 Marks)
 b. Rainfall of magnitude 3.8cm and 2.8cm occurs on two consecutive 4h durations on a catchment of area 27km² produced the following hydrograph of flow at the outlet of the catchment. Find the rainfall excess and Phi (ϕ) index.

Time (hr)	-6	0	6	12	18	24	30	36	42	48	54	60	66
Flow (cumes)	6	5	13	26	21	16	12	9	7	5	5	4.5	4.5

(10 Marks)

- 7 a. Explain benefits and ill effects of Irrigation. (10 Marks)
b. Explain Bandhara Irrigation. Explain the various Irrigation efficiencies. (10 Marks)
- 8 a. Explain with neat sketch the variation of duty with the places of its measurement. Also explain different methods to improve duty of water. (08 Marks)
b. Differentiate between Duty, Delta and Base period. (06 Marks)
c. The left canal of tank irrigation carries a discharge of 10 cumecs and has a culturable commanded area of 8000ha. The intensity of irrigation of Rabi crops is 70 percent and base period is 110 days. The right canal scheme carries a discharge of 24 cumecs and has a culturable commanded area of 1500ha. The intensity of Rabi crops is 80 percent and base period is 110 days. Give your comment on efficiency of both canals. (06 Marks)
- 9 a. Define the following : i) GCA ii) CCA iii) Intensity of irrigation
iv) Crop rotation v) Time factor vi) Crop factor vi) Economical height of a dam. (06 Marks)
b. With a neat sketch, explain the computation of reservoir capacity for a specified yield from mass inflow curve. (08 Marks)
c. Explain Lacy's regime theory. (06 Marks)
- 10 a. Explain with a neat sketch, Zones of Storage Reservoir. (06 Marks)
b. Write a note on Canal classification. (06 Marks)
c. Design an irrigation channel to carry 50 cumecs of discharge. The channel is to be laid at a slope of 1 in 4000. The critical velocity ratio for the soil is 1.1. Use $n = 0.023$ in Katter's equation. (08 Marks)

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CBCS SCHEME

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17CV741

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

Design of Bridges

Time: 3 hrs.

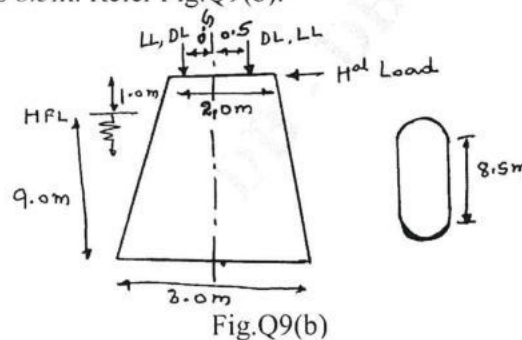
Max. Marks: 100

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 $225 \text{ m}^3/\text{s}$. 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 $300\text{mm} \times 1500\text{mm}$. (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 3.5 m 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_c is 1.5, influence coefficient C_s is 0.01, unit weight of soil is 20 kN/m³. Impact factor is 1.5, Use MP₃ 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 braking 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)



- 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)
