Bharatiya Vidya Bhavan's

SARDAR PATEL COLLEGE OF ENGINEERING

(Government Aided Autonomous Institute)

Munshi Nagar, Andheri (W) Mumbai – 400058

End Semester/~~Re-Examination~~: December 2024/~~January~~ 2025

T.Y. B.Tech Sem V 21/12/24

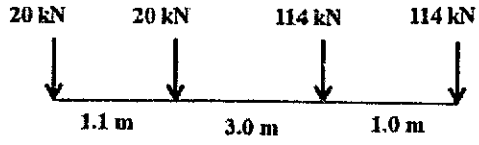
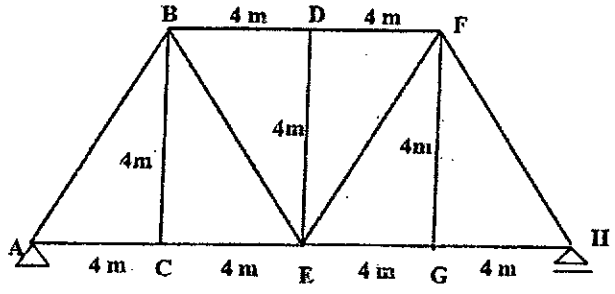
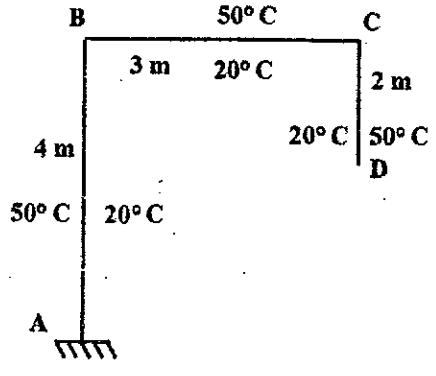
Program: B.Tech. in Civil Engineering **Duration: 3 Hours**

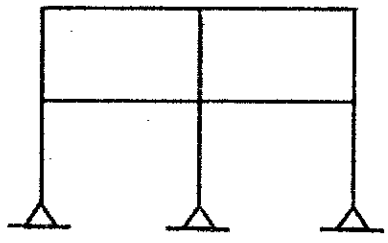
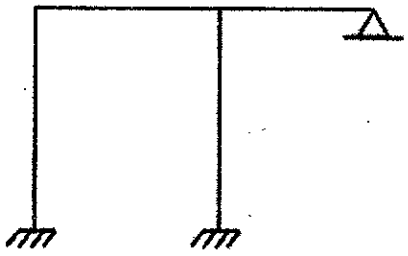
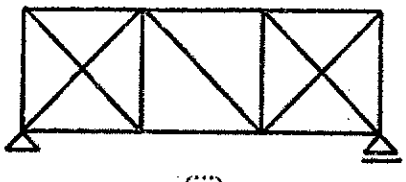
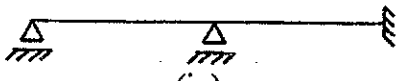
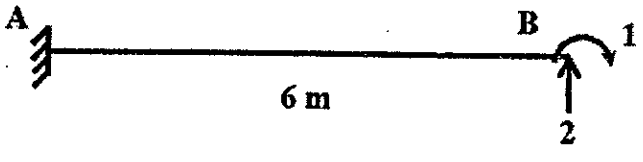
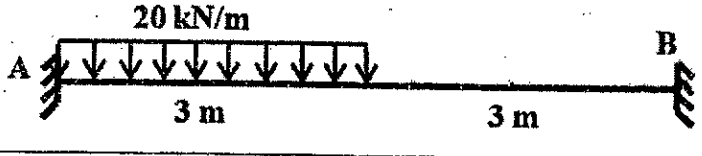
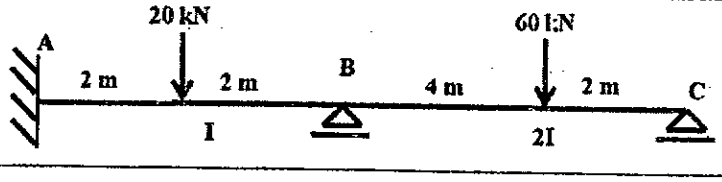
Course Code: PC-BTC 501 **Maximum Points: 100**

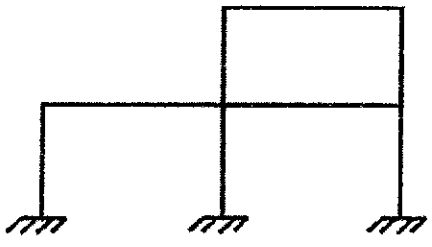
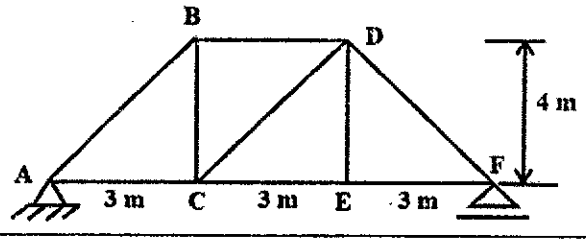
Course Name: Structural Engineering **Semester: V**

1. Attempt any FIVE questions out of SEVEN questions.
2. **Answers to all sub questions should be grouped together.**
3. Figures to the right indicate full marks.
4. Assume suitable data if necessary and state the same clearly.

Q.No.	Questions	Points	CO	BL	Module
Q.1(a)	**A symmetrical three hinged segmental arch of span 30 m and central rise of 5 m is subjected to a concentrated load of 120 kN at 8 m from the left support. Determine** **(a) the support reactions** **(b) radial shear, normal thrust and BM just to the left of 120 kN load** **(c) draw BMD**	15	1	4	1
Q.1(b)	**Name different types of arches based on (i) supports and (ii) shape.**	05	1	2	1
Q.2(a)	**In the case of a suspension cable with three hinged stiffening girder what are the internal forces carried by** **(i) the cable** **(ii) suspenders** **(iii) girder** **(iv) anchor cable**	04	1	2	2
Q.2(b)	**A suspension cable of span 50 m and a central dip of 6 m is supporting a three hinged stiffening girder. The dead load of the girder is 10 kN/m. The girder is subjected to a point load of 150 kN at a distance of 10 m from the left support A and another point load of 180 kN at a distance of 35 m from the left support A.** **(a) Determine the maximum and minimum tension in the cahle** **(b) Draw SFD and BMD for the girder** **If the suspension cable passes over a smooth pulley on the top of a pier of height 12m and the anchor cable is at 45° to the horizontal, find the forces transmitted to the base of the pier.**	16	1	3,4	2

Q.3(a)	**The load system shown in figure below crosses a simply supported girder of span 18 m. Determine the value of absolute maximum bending moment anywhere in the girder.**	10	2	3,4	3
					
Q.3(b)	**For the pin jointed frame shown in figure below draw influence line diagram for axial force in members BD, BE and CE.**	10	2	3,4	4
					
Q.4(a)	**For the frame shown in the figure below, calculate the vertical deflection at D due to change in temperature as indicated in the figure. Take $\alpha = 12x10^{-6}/°C$ and depth of all members as 300 mm.**	12	3	3,4	5
					

Q.4(b)	**Determine the static and kinematic indeterminacy of the structures shown in figures below.**	08	3	3,4	5
	 (i)  (ii)				
	 (iii)  (iv)				
Q.5(a)	**Calculate the flexibility coefficients for the beam shown in figure w.r. to the coordinates indicated in figure.**	08	4	3,4	6
					
Q.5(b)	**Using the calculations made in Q No 5(a) above OR otherwise, find the reactions at B for the beam loaded as shown in figure below. Use force method of analysis only.**	12	4	3,4	6
					
Q.6(a)	**Analyse the beam shown in figure by slope deflection method only and find the end moments.**	14	4	3,4	7
					

Q.6(b)	**Differentiate between determinate structures and indeterminate structures in terms of definition and with respect to their behavior when subjected to temperature variation, settlement of supports, lack of fit and change in EI along the span.**	06	4	2	5,6,7
Q.7(a)	**For the structure shown in figures below determine the degree of static external and internal indeterminacy.**	02	3	3,4	1.3.1 2.1.3
					
Q.7(b)	**The members of the truss shown in figure are subjected to temperature increase of 30^0 C. Calculate the vertical deflection of E due to the increase in temperature. Take $\alpha = 12x10^{-6}/°C$.**	14	4	3,4	5
					
Q.7(c)	**How is the information about the degree of static and kinematic indeterminacy useful in analyzing an indeterminate structure? Explain.**	04	4	2	1.3.1

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END SEM/~~RE-EXAM~~. EXAMINATION DEC/~~JAN~~ 2024-25 4/12/24

Program: T.Y. Civil Engineering (UG) Sem V

Course Code: PC-BTC502

Course Name: Hydrology and Water Resource Engineering

Duration: 03 Hrs.

Maximum Points: 100

Semester: V

Notes:

- Attempt ***any five*** questions.
- Answer to all sub questions should be grouped together.
- **Figure** to right indicates full marks.
- Assume suitable data wherever necessary and state it **clearly**.

Q. No.	Questions	Points	CO	BL	Module
1	(a) Explain depth area-duration relationships, maximum intensity/depth-duration-frequency relationship and Probable Maximum Precipitation (PMP).	10	1	2	1
	(b) For a drainage basin of 640 km^2, isohyetals based on a storm event yield the following data: Estimate the average depth of precipitation over the basin.	10	1	3	1

Isohyetal Intervals (cm)	Inter-isohyetal area (km^2)
14-12	90
12-10	140
10-8	125
8-6	140
6-4	85
4-2	40
2-0	20

2	(a)Explain Infiltration process, Horton's equation and infiltration indices.	10	1	2	2
	(b) Explain Dalton's law and evaporation process and factors affection evaporation.	10	2	2	2
3	(a) What is runoff? Explain factors affecting runoff and discuss methods of runoff estimation.	10	1	4	3
	(b) What is hydrograph? Discuss factors affecting runoff hydrograph, components of hydrograph and base flow separation.	10	1	5	3
4	(a) Explain: well hydraulics and derive an equation for a steady state discharge from a well in an unconfined aquifer.	10	3	3	4
	(b) A well penetrating an unconfined aquifer 20 m thick below water table is pumped at a uniform rate of 600 liter/minute, till the water level in the well becomes steady. Two observation wells drilled radially at a distance of 20 and 80 m from the centre of the well show depression of 3.2 m and 1.10 m. Determine the coefficient of permeability.	10	3	4	4

END SEM/~~RE-EXAM.~~ EXAMINATION DEC/~~JAN~~ 2024-25

5	(a)Define and explain: (i) Consumptive use of water, (ii) field capacity, (iii) frequency of irrigation, (iv) time factor, and (v) Capacity factor.	10	2	2	5
	(b) An irrigation canal has gross commanded area of 90,000 hectares, out of which 88% is culturable irrigable. The intensity of irrigation for Kharif season is 30% and for Rabi season 60%. Find the discharge required at the head of the canal if the duty at its head is 850 hectares/cumecs for Kharif season and 1750 hectares/cumecs for Rabi season.	10	2	3	5
6	(a)Explain Kennedy's and Lacey's theory of regime channels and highlight the difference.	10	4	2	5
	(b) Design a regime channel for a discharge of 45 cumecs and silt factor 1.10 using Lacey's theory.	10	4	4	5
7	(a) List the forces acting on a gravity dam and explain with neat sketches its magnitude and effects.	10	4	3	6
	(b) Write short notes on: (i) Spillway; (ii) Earth Dam	10	4	3	6 7

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END SEMESTER EXAMINATION/RE-EXAM DEC/JAN 2024-25

7/12/24

Program: T. Y. B. Tech. Civil Engineering Sem V
Course Code: PC-BTC503
Course Name: Soil Mechanics

Duration: 3 Hrs.
Maximum Points: 100
Semester: V

Notes:

1. Question 1 is compulsory.
2. Solve any four out of remaining six questions.
3. Please write units everywhere. Marks will be deducted where no/incorrect units are written.
4. Make assumptions where necessary but state them very clearly.
5. Use $\gamma_w = 9.81$ kN/m^3

Q. No.		Questions	Points	CO	BL
1.	a	A clay layer 5 m thick at a construction site takes 300 days to attain 50% consolidation under double drainage. If the same clay layer is underlain by hard rock then calculate the time taken to attain 50% consolidation.	5	3	3
	b	A 12 m thick sandy silt is underlain by intact impermeable rock. The water table is at 3 m below existing ground surface. During a pumping out test, at steady state, water is being pumped out of a 450 mm diameter well at the rate of 540 liters per minute. Two observation wells at a distance of 18 and 36 m noted a drop in water levels by 1.8 m and 1.5 m respectively. Determine the coefficient of permeability of the soil.	5	3	3
	c	State the advantages and disadvantages of direct shear test on soil	5	3	1
	d	Discuss the advantages and disadvantages of SPT test conducted for soil investigations	5	4	2
2	a	A slope is constructed at an angle of 25° to the horizontal and with height of 12 m. If the soil has c'= 10 kPa, ϕ'=15° and γ = 20 kN/m^3, calculate the factor of safety assuming full friction is mobilized and SN=0.03. Comment if this slope design is recommended.	5	3	3
	b	How does moisture affect the compaction of soil? Draw a typical curve and show OMC, MDD, wet of optimum and dry of optimum	5	2	2,3
	c	Draw the grain size distribution curve and classify the soil. Sample taken was 1475 g.	10	2	3

END SEMESTER EXAMINATION/RE-EXAM DEC/JAN 2024-25

sieve size (mm)	mass retained (g)
4.75	418
2.36	319
1.18	338
0.6	205
0.425	98
0.3	47
0.15	33
0.075	15

3	a	Illustrate with a neat sketch the volume of soil changes with moisture content. Mark the LL, PL and SL on it.	5	1, 2	2
	b	Draw a typical e-log p curve and discuss the procedure to obtain the preconsolidation pressure.	5	3	2
	c	An undrained Triaxial test was conducted on s sample of clayey sand, the following results were obtained. Determine the shear parameters of the soil considering total stresses.	10	3	3

Sample No.	**1**	**2**	**3**
σ_3 (kN/m^2)	17	44	56
σ_1 (kN/m^2)	157	204	225
u (kN/m^2)	12	20	22

4	a	At a site, clay extends to 25 m below GS. Lab testing shows specific gravity =2.6, void ratio = 0.8 and moisture content as 15.5%. GWT is located at 5 m below GS and capillary rise is 3 m. Assuming unit weight of water as 10kN/m^3, draw the total, neutral and effective stress distribution up to a depth of 12 m below GS.	10	2	3
	b	A transmission tower with total weight of 10,000 kN is supported on 4 legs. These legs rest on footings located at the corners of a square having sides of 6 m on each side. What is the vertical stress increase due to the loading at a point 7 m below GS at the center of the structure?	10	3	3
5	a	Discuss in detail the UU Triaxial test.	10	3	2

END SEMESTER EXAMINATION/RE-EXAM DEC/JAN 2024-25

	b	Proctor test was conducted on a soil sample and following observations were made. Draw the compaction curve if the volume of the mould was 950 cc and G = 2.72, determine the OMC and MDD and show the ZAV line.	10	2, 3	3

%m	7.7	11.5	14.6	17.5	19.5
Mass of wet soil (kg)	1.7	1.89	2.03	1.99	1.96

6	a	A soil mass has water content of 17.5 % and void ratio of 0.87. Determine the degree of saturation, bulk unit weight and dry unit weight. If G = 2.69, calculate the weight of water (in kN) required to be added to 10 m^3 of soil to make it saturated	5	1,2	3
	b	What are flow nets? Describe their characteristics and how they are useful to a geotechnical engineer	5	2	2
	c	The natural void ratio of a saturated clay stratum 3 m thick is 0.9. The final void ratio of the clay at the end of primary consolidation is expected to be 0.71. Calculate the total consolidation settlement of the clay layer.	5	3	3
	d	The average effective overburden pressure on a 10 m thick homogeneous saturated clay layer is 150 kPa. Consolidation test on this soil showed that the void ratio decreased from 0.6 to 0.5 when stress was increased from 100 kPa to 300 kPa. Calculate the initial void ratio of the clay layer.	5	3	3
7	a	Why does soil need to be classified? Discuss why classification of soil as per only grain size is not suitable.	5	2	2
	b	Draw a typical borelog and show clearly all information obtained from the field.	5	4	2
	c	What is factor of safety with reference to a soil slope? What are the causes of slope instability? Discuss various remedial and mitigation measures for the same.	10	3	3

Equations:

For point load:

$$\sigma_z = \frac{3Qz^3}{2\pi(r^2+z^2)^{5/2}}$$

For strip load

$$\sigma_z = \sigma_1 = \frac{q}{\pi}(\theta_0 + \sin\theta_0)$$

For line load

$$\sigma_z = \frac{2qz^3}{\pi(x^2+z^2)^2}$$

For uniform load on circular area

$$\sigma_z = q\left[1 - \frac{1}{(1+(a/z)^2)^{3/2}}\right]$$

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END SEMESTER EXAMINATION/ ~~RE-~~EXAMINATION,

DECEMBER - 2024

9/12/24

T.Y. B.Tech Sem V

Program: Civil Engineering — **Duration: 3 Hr.**

Course Code: PC – BTC - 504 — **Maximum Points: 100**

Course Name: HIGHWAY ENGINEERING — **Semester: V**

Note :

(i) **Question 1 is compulsory**

(ii) **Solve any four questions out of remaining six questions**

(iii) **Assume suitable data if required**

Q.No.	Questions	Points	Modul	BL	CO
Q.1.					
a	Discuss with sketch the process of marking alternative alignment on topographic map in hilly area.	07	01	02	01
b	Define road geometric. Enlist the element of road geometric.	07	02	02	01
c	Explain about warning sign. Enlist at least 10 warning signs.	06	03	01	01
Q.2.					
a	Classification of terrain	04	02	02	01
b	Discuss the silent feature of IIIrd- 20 Year's Road Development Plan	06	01	02	01
b	The area of the state is 1,80,000 km^2, the number of towns as per 2021 census is 122. For a road density of 142 km per 100 km^2 area, calculate the length of various categories of roads as per third 20 year's road development plan. Also, If the existing length of different category road in that area under consideration is as National Highway = 1600 km, state highway = 5400 km, Major District Road = 11,000 km and Other District Road and Village road = 1,25,000 km. calculate the additional length of road required to be construct as per Third 20 year's road development plan.	10	01	03	01

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Q.3.					
a	How will you carry out preliminary survey for marking final alignment of road on ground (Explain in detail). Enlist the different drawing need to be prepare	10	01	02	01
b	How will you estimate perception time and break reaction time for calculation of stopping sight distance	05	02	02	01
c	Enlist the different layers of flexible pavement and rigid pavement	05	04	01	02
Q.4.					
a	Draw the typical cross section of road in embankment and show its elements.	05	01	02	01
b	What is formation width? State the recommended value of formation width for single lane and two lane national highway passing through plain area	05	02	02	01
c	Define Overtaking sight Distance. Derive the Expression for Overtaking sight Distance (OSD). State the assumptions made while deriving the expression for (OSD). Also, draw a sketch showing overtaking zone and position of sign post.	10	02	02	01
Q.5.					
a	Discuss different types of gradient	08	02	02	01
b	Explain the procedure for construction of penetration macadam layer in flexible pavement construction	05	05	02	02
c	Discuss the equations for calculation of warping stress at interior, edge and corner region of the rigid pavement slab.	07	03	02	02
Q.6.					
a	Discuss the procedure for construction of subgrade of the flexible pavement.	07	05	02	02
b	Discuss the factor affecting alignment of roads.	05	01	02	01

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END SEMESTER EXAMINATION/ ~~RE-EXAM~~INATION,

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c	Design the single lane undivided carriageway flexible pavement passing through plain area. Total numbers of commercial vehicles in both directions for undivided lane carriageway are 700 cvpd, if rate of growth of traffic is 6 %, the CBR value of subgrade soil is 4 % and time required for construction of road after last count is 3 years. Use IRC 37- 1984 Guideline. (use indicative value of vehicle damage factor) refer chart and table for the design.	08	04	03	02
Q.7.					
a	Discuss original California Bearing Ratio (CBR) Method for Pavement Design	07	04	02	02
b	Discuss an equations for calculation of Length of Summit Curve for Stopping Sight Distance (SSD)	05	02	02	02
c	A vertical summit curve is formed at the intersection of two gradients, + 3.0 % and – 5.0 %, design the length of summit curve to provide a stopping sight distance for a design speed of 80 km/hr. assumes suitable date.	08	02	02	02

Q.6. C

Design traffic in msa	Minimum thickness of layers in mm		
	Surface	Base	Subbase
0.50	20 mm PC or 2 coats of SD	150 mm	T – 50, minimum thickness of 100 mm on subgrade of CBR less than 20 %
0.5 – 2	20 mm PC or MS	225 mm	T – 225, minimum thickness of 150 mm on subgrade of CBR less than 20 %
2 – 5	20 mm PC/MS/SDC over 50 mm/75 mm BM	250 mm	T – 300/325, minimum thickness of 750 mm on subgrade of CBR less than 30 %
5 – 10	20 mm BC/SDC over 60 – 80 DBM	250 mm	T – 335 to 355, minimum thickness of 750 mm on subgrade of CBR less than 30 %
10 – 15	40 mm BC over 65 – 80 DBM	250 mm	T – 335 to 370, minimum thickness of 750 mm on subgrade of CBR less than 30 %
15 – 20	40 mm BC over 80 – 100 DBM	250 mm	T – 370 to 390, minimum thickness of 750 mm on subgrade of CBR less than 30 %
20 – 30	40 mm BC over 100 – 115 DBM	250 mm	T – 390 to 405, minimum thickness of 750 mm on subgrade of CBR less than 30 %

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Q.6. C

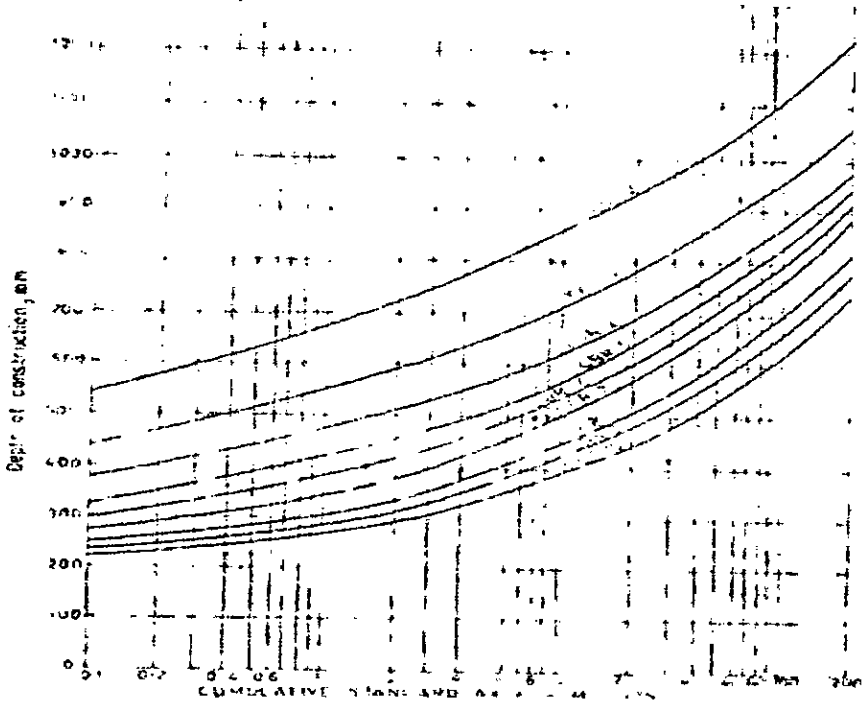

Fig. 10.13. Pavement design chart as per IRC : 37-1984.

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End Semester/Reexam Examination Regulation - 22
December 2024/January 2025

11/12/24

Max. Marks: 100 **Duration: 3 hrs**

Class: B. Tech T.Y. B.Tech Civil Sem V **Semester: V**

Name of the Course: Environmental Engineering II **Program: TY BTech Civil**

Course Code: PCBTC506

Instructions:

- **Question 1 is compulsory. Solve any 4 of remaining 6.**
- **Draw neat sketches/diagrams wherever required**
- **Assume suitable data if necessary and state them clearly**
- Figure on right indicate **maximum points** for the given question, **course outcomes attained and Bloom's Level**

Q1	**Answer the following questions:**	(20)	CO	BL
(a)	Explain sewage disposal on land specifically constructed wetland technology with figure. Discuss other biological treatments available for adoption from **smaller towns and villages.**	(05)	2	1
(b)	Design a combined system serving population of 80000 with rate of supply of 120 lpcd (conversion ratio is 0.8) and peak factor is 2.5. The catchment area is 30 hectares and overall runoff coefficient is 0.7. The time of concentration for the design is 30 min and the relation between intensity of rainfall and duration is I = 1020/ (t+20). (n= 0.013; S= 1/1500)	(05)	2	3
(c)	As a city engineer, you are asked to plan and design a sewerage system for a city. In modern times, how would you undertake this assignment.	(05)	3	4
(d)	Explain the need of wastewater management Discuss methods of reuse and resource recovery in wastewater management	(05)	3	1
Q2	**Answer the following questions:**	(20)	2	3
(a)	As the city engineer, enlist the parameters to be used for sewage classification and explain any three most important parameters in detail.	(10)		
(b)	The BOD_5 at 20 degree test was conducted. The DO of dilution water is 8 mg/L. The DO of sample is 0.1 mg/L. Dilution given is 5%. The final DO of diluted sample is 2 mg/L. The DO of control remains the same. Find BOD_5 at 20 °C. K_{10} value at 20°C is 0.1/day. Find the value of BOD_5 at 30° C if Θ is 1.056.	(5)		
(c)	Explain population equivalent and Relative stability of domestic sewage	(5)		
Q3	**Answer the following questions:**	(20)	1-4	4
(a)	Design engineer of Thane city needs to design a wastewater treatment plant for a sewage generating from population of 10,00,000 and water demand of 135 lpcd . The domestic wastewater to be treated has initial BOD of 150 mg/L and S.S. concentration of 210 mg/L. Find the BOD loading and Suspended solids loading. Illustrate the basic flowsheet of wastewater treatment plant that can be proposed with function of each unit and expected reduction in BOD. Explain functions in detail and as an environmental engineer which additional units will be required if you want to reuse the wastewater.	(20)		

Q4	**Answer the questions**	**(20)**		
(a)	Explain the need of screens and types of screens. Estimate the screen area requirement for a plant treating a peak flow of 50 MLD of sewage and bars required. Also provide relevant checks.	**(10)**	**3-4**	**3**
(b)	Explain types of grit chambers. Design a grit chamber to remove particle of size 0.2 mm and sp gr 2.6. Wastewater flow rate is 10000 m^3/d and settling velocity of particles is to be taken 0.016 - 0.02 m/s. Take detention time as 30 sec. Horizontal velocity given is 0.3 m/sec (0.15-0.4 m/sec)	**(10)**	**3-4**	**3**
Q5	**Answer the questions**	**(20)**		
(a)	In the wastewater treatment plant of Thane area , trickling filter is used as the secondary treatment. Explain the advantages of trickling filter over activated sludge process. Determine the size (dia and depth) and numbers of high rate trickling filter to be provided for the following data. (i) Sewage flow = 8 MLD (ii) Recirculation ratio = 2 (iii) BOD_5 of raw sewage = 200 mg/lit (iv) BOD_5 removal in PST = 30% (v) Final effluent BOD_5 desired =30 mg/lit Also calculate hydraulic loading and organic loading.	**(10)**	**3-4**	**3**
(b)	In an alternative treatment plant activated sludge treatment is provided as biological treatment. Design a continuous flow completely mixed activated sludge process with following data. Population =6,00,000 water supply rate = 100 lpcd; Influent BOD to aeration tank =140 mg/L; Effluent BOD= 20 mg/L; Effluent SS 20; MLSS= 3500mg/L; MLVSS/MLSS=0.8; Return sludge concentration as SS= 15000mg/L; Y=0.7; $k_d=0.05d^{-1}$; Θ_c=10days. Compute oxygen requirement also. Give all checks and compute r, f/m, VLR and other important parameters in design	**(10)**	**3-4**	**3**
Q6	**Answer the following questions:**	**(20)**		
(a)	A hostel is provided near Thane and has population as mentioned in 200 residential graduates (detention time or rational method). Design septic tank with Sewage disposal rate as 120 lpcd. Initial BOD is 120 mg/L. Design and draw dispersion trenches (no and size) considering percolation rate as 20 min per cm. (simultaneous use of fixtures generates 270lpm)	**(10)**	**3-4**	**3**
(b)	Determine sludge volume before and after digestion and percentage reduction of 750 kg (dry basis) of primary sludge with following characteristics (suitable parameters as required)	**(10)**	**3-4**	**3**

Characteristics	**Primary sludge**	**Digested sludge**
Solids	6%	12%
Volatile solids	60%	60%(destroyed)
Sp. Gr. Of fixed solids	2.5	2.5
Sp. Gravity of volatile solids	1	1

Q7	**Answer the following questions**	**(20)**		
(a)	Explain the process of (a) Sludge Digestion (b) Activated sludge process	**(10)**	**3-4**	**3**
(b)	Explain unit operations and unit processes. Explain where sedimentation occurs in wastewater treatment. Design circular SST for a town with average sewage flow of 25 MLD. Check for weir loading Assume DT of 3 hrs for SST. Assume appropriate loading as required	**(10)**	**2-4**	**3**

Formula Sheet

4-8 hrs	n=0,1/8,1/4,1/2,1	1.8-3m; 1 to 4 $m^3/d/m^2$; 0.08-0.32kg/m^3/d
50 – 150 ml/gm	ML= 90 m MW= 30 m L:W= 1.5:1 to 7.5:1 L:D= 5:1 to 25:1 D= 3 to 50 m 7.5-10%; D= 2.5 or 3.5	0.9-2.5m; 10-40$m^3/m^2/d$; 0.32-1 kg/m^3/d 0.6-1.6kg/d/m^2 6-35 m 1.6-6.4 kg/d/m^2 1 in 6 to 1 in 10 10-20 days 1.2 to 2 m 30- 40 days 4.5 to 6 m and maximum 9m 0.9 m^3
0.7-1.2 m/s	125m^3/d/m 185m^3/d/m	0.1 to 0.15per capita with dry solid loading of 80 to 120 kg/m^2/year 0.2 0.175 -0.2 m^2/c/yr area or 60-120 kg/m^2/yr
0.2-0.4/day	25-35 $m^3/m^2/d$; 50-60$m^3/m^2/d$	$Q\max = \frac{5Q_{av}}{P^{0.2}}$ $Q_{max} = \left(1+\frac{14}{4+P^{0.5}}\right)Q_{av}$
5-15 days	15-35 $m^3/m^2/d$; 40-50$m^3/m^2/d$	$Q = 10^4 A * I * \frac{Ri}{1000*3600}$
0.3-0.6kg/m^3/d	25-50%	12 to 25 min/cm Q= 130/Vt (lpd/m^2)

$V_S = \frac{\rho_w g (Ss-1) d^2}{18\mu}$

Or $V_S = \frac{g (Ss-1) d^2}{18\upsilon}$

Or $V_S = 418(Ss-1)d^2 (T+10)/60$

$V_c = 3$ To $4.5 \sqrt{(g\, d\, (Ss-1))}$

$v_c = \sqrt{\frac{8\beta g(S_s-1)d}{f}}$ $E_2 = \frac{100}{1+\frac{0.4432}{1-E_1}\sqrt{\frac{W_2}{VF}}}$

$\cos\frac{\theta}{2} = \left(1-\frac{2d}{D}\right)$

I=a/t^n; I=a/(t+b)

Y=0.5$\sqrt{}$ B

R=A/P

Q=A.V

$\frac{W_s}{S_s} = \frac{W_f}{S_f} + \frac{W_w}{S_w}$

$Vs = [0.707(Ss-1)d^{1.6}\upsilon^{-0.6}]^{0.714}$

$\eta = 1-\left(1+\frac{n(v_s)}{Q/A}\right)^{-\frac{1}{n}}$ $q = \frac{Q}{A}$

BHP = (w.Q.H)/(75.η_p. η_m)

$\frac{Qr}{Q} = \frac{x_t}{\left(\frac{10^6}{svi} - x_t\right)}$

$\theta_C = \frac{V.x}{(Q+Q_r)x - Q_r x_r}$

$Volume = \left[Vf - \frac{2}{3}\left[V_f - V_d\right]\right]T_1 + V_d T_2$

$Volume = \frac{1}{2}\left[V_f + V_d\right]T_1 + V_d T_2$

$Q_{max} = \left(1+\frac{14}{4+P^{0.5}}\right)Q_{av}$ $F = \frac{1+R}{(1+R/10)^2}$ $Qw = \frac{VX}{\theta_c Xr}$

$\frac{1}{\theta_c} = \frac{Q}{V}(1+r-r\frac{Xr}{X})$ $U = \frac{Q*(So-S)}{V*X}$ $T = \frac{La}{20}$-1

A=0.00622.q/V_r; h_L=0.0729(V^2-v^2) v=Q/W*d $\frac{W_s}{S_s} = \frac{W_f}{S_f} + \frac{W_w}{S_w}$

Q = C.I.A / 360

I = 760 / (t + 10) $V = \frac{1}{n} * R^{\frac{2}{3}} * S^{\frac{1}{2}}$

I = 1 020 / (t + 10)

$V = 0.849 C_H R^{0.63} S^{0.54}$ $\frac{F}{M} = \frac{S}{\theta * X}$ $S_R = 100(1 - 0.605^{t_{37}})$

$t_0 = \frac{d^2(0.011d + 0.785H)}{Q}$ $U = \left(\frac{F}{M}\right)*\left(\frac{E}{100}\right)$ $Ns = \frac{3.65n\sqrt{Q}}{H^{0.75}}$

$E = \left(\frac{S_o - S}{S_o}\right)*100$ $PE = \frac{BOD\ load\ from\ industry\ \left[\frac{kg}{day}\right]}{0.054\ \left[\frac{kg}{inhab\cdot day}\right]}$

$L_t = L_o(10^{-Kt})$ x=xa+xe+xi

$E_1 = \frac{100}{1+0.4432\sqrt{\frac{W_1}{VF}}}$

$\theta_c = \frac{V*x}{Q_w x_w + Q_e x_e}$

$h_f = f l v^2/(2gD)$

$V_{sl} = \frac{W_s}{\gamma_w S_{sl} P_s}$

$U = \frac{Q*(So-S)}{V*X}$ O_2 (g/d) = Q(So - S) - 1.42 $Q_w X_r$

$\theta_s = \frac{V_s}{Q}$ $xV = \frac{YQ(So-S)*\theta_c}{1+Kd*\theta_c}$ $\frac{f}{m} = \frac{So*Q}{V*X} = \frac{So}{\theta*X}$

$y_t = L_a(1-10^{-Kt})$

$BOD5 = (DO_{1s} - DO_{5s}) * dilutionfactor - (DO_{1b} - DO_{5b})$

T. Y. sem V Civil
END Sem

Bharatiya Vidya Bhavan's

Sardar Patel College of Engineering

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Munshi Nagar, Andheri (West), Mumbai – 400058

END SEMESTER

December 2024

Organizational Communication and Interpersonal Skills 13/12/24

Program: T.Y.BTech Civil Sem V
Semester: V

Course code: HSM BTC 507
Duration: 3 hour
Maximum Marks: 100

Instructions:
1. Question one and two is compulsory
2. Out of remaining 06 questions attempt any four
3. Start new question from fresh page.
4. Attempt sub questions with main questions.

Sr.No	*Questions*	*Points*	*Co*	*BL*
Q.1.	"Mumbai a city with 603 Sq. Kms. area and India's financial capital, and with a booming Bollywood Industry, Increasing immigration from other states, rapid growth and urbanization, leading to innumerable problems for the citizens of Mumbai". **Draft a letter report in capacity of a reporter of Times of India to the Hon'ble Municipal Commissioner bringing to his notice the problems faced by Citizens in Mumbai. Analyze the primary causes of Mumbai's urban challenges and categorize them into social, economic, and infrastructural issues. Please provide five recommendations to improve the situation.**	*20* *10 each*	*1,2,3, 4*	*2.3 .4.*
Q.2.	**Job description** ***Be part of a company where talent and excellence thrive!*** We are looking for passionate professionals from diverse backgrounds who are committed to growth and making a difference. Lodha has been recognized with two prestigious accolades by the **Great Place to Work** : earning the #64th rank among **India's Best Companies to Work For** out of 2000+ large companies, and recognized as the **Best in the Real Estate Industry.** We offer an environment where you can make a significant impact. **Lodha is hiring for multiple positions across Mumbai sites.(Palava II & Premier)**	*10 Job Application* *10 CV*	*04*	*3,6*

	Designation: Manager/Deputy Manager/Associate Manager **Hiring eligibility:** • BE/ BTech/ Diploma in Civil Engineering (Full time) with 6 months of internship experience in Real Estate/Construction/ Site junior engineer • Minimum 60% in SSC, HSC and Graduation. **Q.1. Draft a job application for the above position in Lodha.** **Q.2. Prepare a detailed CV for the position.**			
Q.3.	**Answer any Two:** A. Explain the Eisenhower Matrix and evaluate its effectiveness in time management and prioritization. [10] B. Define Negotiation Skills. Explain in detail any two types of negotiation strategies adapted for effective negation and persuasion skills. C. What are some signs that indicate stress is becoming overwhelming? What are some effective techniques for managing stress in daily life? D. "Leadership styles has been growing in number and different styles of leadership are highlighted, it has been understood that a single style of leadership cannot suit different situations. As and when the need arises, based on the situation and needs of the employee and organization, a leader can combine one or more styles of leadership in influencing people towards the goals of the organization. Thus, choosing the right style, in the right situation, at the right time is the key to the success of a leader". E. With Reference to the above statement describe two leadership styles with examples of leaders. F. Explain the importance of working in teams. Describe the relationships maintained in teams.	***10 Each***	***05***	***1,4***
Q.4.	A reputed construction company in Mumbai has been experiencing a concerning increase in accidents at several of its construction sites across the city. These incidents, ranging from minor injuries to some serious mishaps, have raised red flags with regard to safety standards and practices on-site. The management has decided to address this issue urgently and has called for a team meeting to identify the root causes and devise actionable solutions to improve site safety. • **Objective**: To discuss the root causes of frequent accidents and develop a strategy for implementing better safety protocols on-site. • **Attendees**: Project Managers, Site Engineers, Safety Officers,	***20***	***03***	***03***

	Civil Engineers, and representatives from the Human Resources and Compliance Departments. • **Location**: Conference room 2nd Floor at the main office of Lodha Groups • **Time**: 10:00 AM **Agenda**: 1. **Opening Remarks (5 minutes)** 2. **Overview of Recent Accidents (10 minutes)** 3. **Site Engineers' Observations (15 minutes)** 4. **Root Cause Analysis (20 minutes)** ▪ **Training and Skill Levels** ▪ **Equipment and Materials** ▪ **Work Environment** ▪ **Scheduling and Fatigue** 5. **Brainstorming Safety Improvements (20 minutes)** 6. **Budget Considerations (10 minutes)** 7. **Assignment of Responsibilities and Timeline (10 minutes)** Q1. Draft the Notice and Agenda for the above meeting. 10 marks Q.2. Imagine the meeting to be completed prepare the minutes of meeting for the same. 10 marks			
Q.5.	A team of young civil engineers at ABC Constructions was tasked with presenting a new project proposal to the company's senior management and potential investors. Despite being technically proficient, they faced challenges in delivering a compelling and engaging presentation. During a previous presentation, they struggled with clearly conveying technical details, managing time, and keeping the audience engaged, leading to a lack of confidence from management. Q.1. Provide tips and strategies to help the team improve their presentation skills, in relation to content, time, preparation, structuring ensuring they can communicate effectively, engage their audience, and create a memorable impact. 15 marks Q.2. Provide tips to prepare their visuals (power point Slides). 05 Marks	***20***	***04***	***03***
Q.6.	A. Explain in detail the interview process. Describe any five types of interviews. [10] B. Describe the evaluation criteria for a group discussion and explain the three types of GD's. [10]	***20***	***01***	***01***

Q.7.	A. Prepare a SWOT analysis of **Sardar Patel College of Engineering**. [10] B. Case Study: At UP Institute of Technology & Science (UPITS), a number of professors in the engineering and science departments and a chief librarian from the Massachusetts Institute of Technology in the united states worked as visiting faculty under the MIT-Ford Foundation-UPITS collaboration for two years. The Indian faculty and their families were happy to have the guests on campus. There were frequent parties and family get-togethers, which resulted in many friendships among the hosts and visitors. One day, Professor and head of mechanical engineering department, Dr Mathur, went to the central Library to discuss the possibility of procuring certain international books and journals for UPITS with the visiting German library Chief, James Wandel. Dr Mathur reached about a half hour later than the prearranged time. The door was shut, but he opened it and walked in, pulled up a chair to move it closer, sat down, leaned over the desk, extended his hand and said. 'Hi! How are you Wandel? Dr Mathur was surprised to see a frown on Mr. Wandel's face and felt further confused to hear the question, By the way, are you my boss? 'No', said Dr Mathur 'Then, please know my name is James Wandel'. 'I am sorry. I did not mean to be impolite or rude to you. I just wanted to address you in a more friendly way. I am indeed very sorry Mr James. Mr Wandel was visibly annoyed. 'Yes, what do you want? He asked curtly 'No nothing. I am sorry' said Dr Mathur and left Mr Wandel's office completely puzzled and disappointed. Questions: A. What went wrong in this exchange" Was Mr James Wandel right in his reaction? (05) B. What can one learn from this case? Explain the right etiquettes to be followed about business and professional interactions. (05)	*20*	*02*	*03*

Bharatiya Vidya Bhavan's

SARDAR PATEL COLLEGE OF ENGINEERING

(Government Aided Autonomous Institute)

Munshi Nagar, Andheri (W) Mumbai 400058

~~End Semester~~/Re Examination: ~~December 2024~~/January 2025

Program: B.Tech. in Civil Engineering T.Y. Sem V 13/1/25 **Duration: 3 Hours**

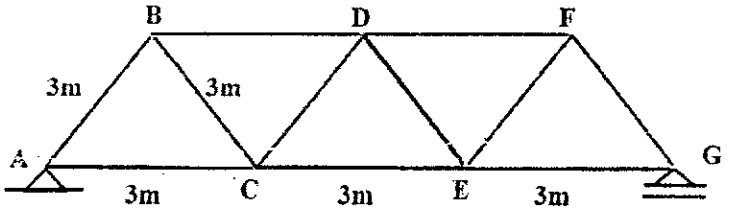
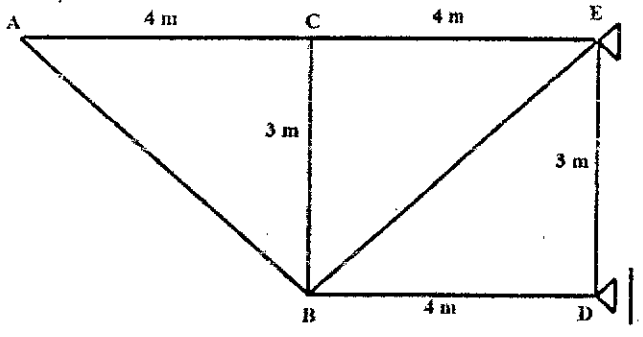
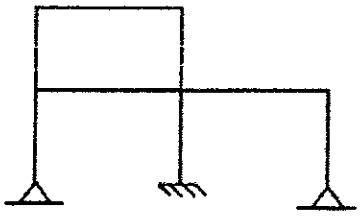
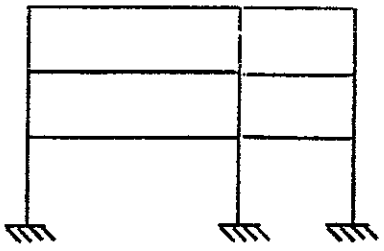
Course Code: PC-BTC 501 **Maximum Points: 100**

Course Name: Structural Engineering **Semester: V**

1. Attempt any FIVE questions out of SEVEN questions.
2. **Answers to all sub questions should be grouped together.**
3. Figures to the right indicate full marks.
4. Assume suitable data if necessary and state the same clearly.

Q.No.	Questions	Points	CO	BL	Module
Q.1(a)	**A symmetrical three hinged parabolic arch of span 36 m and central rise of 6 m is subjected to a udl of 10 kN/m on the left half horizontal span of the arch and a concentrated load of 100 kN at 10 m from the right support. Determine** **(a) the support reactions** **(b) radial shear, normal thrust and BM just to the right of 100 kN load** **(c) draw BMD**	15	1	4	1
Q.1(b)	**State the advantages and disadvantages of an arch over a beam of same span.**	05	1	2	1
Q.2(a)	**In the case of a suspension cable connected to a saddle support on the top of a pier and anchored at the other end of the saddle support, what forces are transmitted to the base of the pier? Explain.**	04	1	2	2
Q.2(b)	**A suspension cable of span 60 m is supported at A and B. The support A is 6m above the lowest point C of the cable and B is 5 m above C. The cable is connected to a three hinged stiffening girder. The third hinge of the girder is just below the lowest point C of the cable. The dead load of the girder is 12 kN/m. The girder is subjected to a point load of 140 kN at a distance of 15 m from support A and another point load of 100 kN at a distance of 10 m from support B.** **(a) Determine the intensity of the total udl transferred from the girder to the cable.** **(b) Determine the maximum and minimum tension in the cable.** **(c) Draw SFD and BMD for the girder.**	16	1	3,4	2

~~End Semester~~/Re Examination: ~~December 2024~~/January 2025

Q.3(a)	**For a cantilever beam of span 5 m, draw influence diagrams for** **a) reactive moment at support A** **b) shear force at a section C, 2 m from support A** **c) bending moment at a section C, 2 m from support A.**	**10**	**2**	3,4	3
Q.3(b)	**For the pin jointed frame shown in figure below draw influence line diagram for axial force in members BD, CD and CE.**	**10**	**2**	3,4	4
					
Q.4(a)	**The members of the truss shown in figure below are subjected to temperature increase of 30^0 C. Calculate the vertical deflection of joint A due to the increase in temperature. Take $\alpha = 12x10^{-6}/°C$.**	**12**	**3**	3,4	5
					
Q.4(b)	**Determine the static and kinematic indeterminacy of the structures shown in figures below.**	**08**	**3**	3,4	5
	 (i)  (ii)				

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~~END SEM~~/RE-EXAM. EXAMINATION ~~DEC~~/JAN 2024-25

14/1/25

Program: T.Y. Civil Engineering (UG) Sem V **Duration: 03 Hrs.**

Course Code: PC-BTC502 **Maximum Points: 100**

Course Name: Hydrology and Water Resource Engineering **Semester: V**

Notes:

- Attempt ***any five*** questions.
- Answer to all sub questions should be grouped together.
- **Figure** to right indicates full marks.
- Assume suitable data wherever necessary and state it **clearly**.

Q. No.	Questions	Points	CO	BL	Module
1	(a) Explain different forms of precipitation and characteristics of precipitation in India.	10	1	1	1
	(b) There are five rain gauge sections P, Q, R, S, T. Theisson polygon network details are given below. Estimate the equivalent uniform depth.	10	1	2	1

Rain gauge	Area (%)	Rainfall (mm)
P	24	45
Q	21	57
R	37	65
S	08	67
T	10	78

2	(a) Define evapotranspiration. Explain why estimation of evapotranspiration is important in hydrology? Explain AET and PET.	10	1	2	2
	(b) Explain Dalton's law and evaporation process and factors affection evaporation.	10	1	2	2
3	(a) What is runoff? Explain factors affecting runoff and discuss methods of runoff estimation.	10	1	3	3
	(b) Determine the ϕ index for a basin of 500 sq.km. The direct runoff of a flood was 5 cm. The time distribution of the rainfall was as under:	10	1	3	3

Time (hr.)	5 to 6	6 to 7	7 to 8	8 to 9	9 to 10
Rainfall (cm)	2	3	6	4	1

4	(a) Explain: the use of hydrograph in hydrology and water resources engineering. Discuss: factors affecting runoff hydrograph and its components.	10	1	2	3
	(b) Explain in brief: water requirement of crops, crop seasons in India,	10	2	3	5

	cropping pattern and duty and delta relationship.				
5	(a) Explain with a neat sketch: forms of ground water, confined and unconfined aquifer and aquifer properties.	10	3	3	4
	(b) A well penetrates fully confined aquifer 10 m thick (saturated thickness) having coefficient of permeability of 0.0005 m/sec. The radius of well is 10 cm. There is a drawdown of 4 m at the well face and its radius of influence is 300 m. Calculate the steady state discharge which can be withdrawn from this well. What will be the percentage increase in the discharge, if the radius of the well is doubled?	10	2	5	4
6	(a)Explain Kennedys and Lacey's Theory.	10	4	4	5
	(b) Design an irrigation channel to carry 55 cumecs, by Kennedy's method. Take m = 1, B/D = 2.50, Manning's n = 0.0225 and side slopes 1V: 0.50H.	10	4	5	5
7	(a) Classify dams and explain with a neat sketch forces acting on a gravity dams.	10	4	4	6
	(b)Write short notes on: (i) Earth Dam and its types; (ii) Spillway and its use.	10	4	3	6 7

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Munshi Nagar, Andheri (West), Mumbai – 400058

~~END SEMESTER~~ Re-Exam
~~December 2024~~ Jan - 2025

Organizational Communication and Interpersonal Skills

Program: T.Y.BTech Civil Sem V
Semester: V

Course code: HSM BTC 507
Duration: 3 hour
Maximum Marks: 100

Instructions:
1. Question one and two is compulsory
2. Out of remaining 06 questions attempt any four
3. Start new question from fresh page.
4. Attempt sub questions with main questions.

Sr.No	*Questions*	*Points*	*Co*	*BL*
Q.1.	You are part of a civil engineering consultancy team tasked with analyzing and improving the condition of a deteriorating bridge in a suburban area. The BMC senior officer has asked you to prepare a report. The bridge, constructed 30 years ago, is showing visible signs of wear, including cracks in the structure, water seepage, and rusting reinforcement bars. The local municipality has reported increasing traffic load due to urban expansion and has asked for a comprehensive report to decide on renovation or reconstruction. The report should address: 1. **Structural Assessment**: Evaluate the bridge's current condition, identifying critical damages and their likely causes. 2. **Safety Analysis**: Assess the risks posed to users and propose immediate safety measures to mitigate accidents. 3. **Feasibility Study**: Compare the cost and time implications of renovating versus reconstructing the bridge. 4. **Sustainability Considerations**: Suggest environmentally friendly materials and methods for repair or reconstruction. 5. **Conclusion** 6. **Recommendations**: Provide a clear, evidence-based recommendation to the	*20* *10 each*	*1,2,3, 4*	*6*

	municipality on the best course of action. **Draft a Memo report with the outline provided.**			
Q.2.	**We're Hiring! Civil Engineer (Entry-Level)** **Location:** Mumbai **Employment Type:** Full-Time **About Us:** At **Larsen and Toubro**, we pride ourselves on delivering innovative infrastructure solutions that shape the future. Join a dynamic team of professionals dedicated to excellence in construction, design, and sustainability As an entry-level Civil Engineer, you will collaborate with senior engineers on projects involving infrastructure design, site inspections, and construction management. This is an opportunity to kick-start your career in a supportive, growth-oriented environment. **Technical Proficiency:** Knowledge of engineering software like AutoCAD, STAAD.Pro, or Revit. Understanding of structural analysis and material mechanics. **Communication Skills,** **Problem-Solving:** **Teamwork and Collaboration** **Time Management:** **Apply Now** If you are a motivated, detail-oriented civil engineering graduate ready to build a career with purpose, send your resume and cover before 15 December, 2024	***10*** ***Job Application*** ***10*** ***CV***	***04***	***3,6***
Q.3.	**Answer any Two:** A. Explain any two strategies to be adopted for Time management [10] B. Define Negotiation Skills. Explain in detail any two types of negotiation strategies adapted for effective negation and persuasion skills.	***10*** ***Each***	***05***	***1,2 4,***

	C. What are some signs that indicate stress is becoming overwhelming? What are some effective techniques for managing stress in daily life? D. Define Emotional Intelligence. Explain the situations and strategies to be emotional intelligent. F. Describe the different types of leadership. Differentiate between Servant and Spiritual leadership with examples.			
Q.4.	A reputed construction company in Mumbai has been experiencing a concerning increase in accidents at several of its construction sites across the city. These incidents, ranging from minor injuries to some serious mishaps, have raised red flags with regard to safety standards and practices on-site. The management has decided to address this issue urgently and has called for a team meeting to identify the root causes and devise actionable solutions to improve site safety. • **Objective**: To discuss the root causes of frequent accidents and develop a strategy for implementing better safety protocols on-site. • **Attendees**: Project Managers, Site Engineers, Safety Officers, Civil Engineers, and representatives from the Human Resources and Compliance Departments. • **Location**: Conference room 2nd Floor at the main office of Lodha Groups • **Time**: 10:00 AM **Agenda**: 1. **Opening Remarks (5 minutes)** 2. **Overview of Recent Accidents (10 minutes)** 3. **Site Engineers' Observations (15 minutes)** 4. **Root Cause Analysis (20 minutes)** ▪ **Training and Skill Levels** ▪ **Equipment and Materials** ▪ **Work Environment** ▪ **Scheduling and Fatigue** 5. **Brainstorming Safety Improvements (20 minutes)** 6. **Budget Considerations (10 minutes)** 7. **Assignment of Responsibilities and Timeline (10 minutes)** Q1. Draft the Notice and Agenda for the above meeting. 10 marks Q.2. Imagine the meeting to be completed prepare the minutes of meeting for the same. 10 marks	***20***	***03***	***03***
Q.5.	A team of young civil engineers at ABC Constructions was tasked with presenting a new project proposal to the company's senior management	***20***	***04***	***03***

	and potential investors. Despite being technically proficient, they faced challenges in delivering a compelling and engaging presentation. During a previous presentation, they struggled with clearly conveying technical details, managing time, and keeping the audience engaged, leading to a lack of confidence from management. Q.1. Provide tips and strategies to help the team improve their presentation skills, in relation to content, time, preparation, structuring ensuring they can communicate effectively, engage their audience, and create a memorable impact. 15 marks Q.2. Provide tips to prepare their visuals (power point Slides). [05]			
Q.6.	A. Explain in detail the interview process. Describe any five types of interviews. [10] **B. Which of the following statements about job interview are true? [05]** 1. There is less competition in the job market today due to the lack of availability of qualified and experienced candidates. 2. A job interview is an important technique used for evaluating the suitability of a candidate for a particular position through an oral question –answer session 3. Interviewing can be practiced along with other screening methods such as group discussions and oral presentations. 4. A job interview is always a face-to-face meeting between a candidate and the members of the selection committee or representatives of the concerned employers. 5. Most recruitment experts believe that proper training can easily develop personal qualities and positive traits. C. Describe the evaluation criteria for a group discussion and explain the three types of GD's. [05]	***20***	***01***	***01***
Q.7.	A. Prepare a SWOT analysis of **Sardar Patel College of Engineering**. [10] B. What does the term business etiquette mean to you? "Social behaviour and manners in one country may be considered rude in another". Explain with suitable examples. [10]	***20***	***02,04***	***03, 06***

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SARDAR PATEL COLLEGE OF ENGINEERING

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Munshi Nagar, Andheri (W) Mumbai – 400058

16/11/25

~~END SEMESTER~~ EXAMINATION/RE-EXAM ~~DEC~~/JAN 2024-25

Program: T. Y. B. Tech. Civil Engineering
Course Code: PC-BTC503
Course Name: Soil Mechanics

Duration: 3 Hrs.
Maximum Points: 100
Semester: V

Notes:

1. Question 1 is compulsory.
2. Solve any four out of remaining six questions.
3. Please write units everywhere. Marks will be deducted where no/incorrect units are written.
4. Make assumptions where necessary but state them very clearly. Use $\gamma_w = 9.81$ kN/m^3

Q. No.		Questions	Points	CO	BL
1.	a	A developer of a high rise commercial building is refusing to conduct soil investigation stating it is waste of money. As a civil engineer how will you convince him/her?	5	4	4
	b	A 20 mm thick laboratory sample of saturated clay reaches 60% consolidation in 320 seconds under double drainage conditions. Determine the time required for a 10 m thick layer of the same soil to reach the same degree of consolidation if drainage is only permitted on one side.	5	3	3
	c	Discuss the difference between permeability and hydraulic conductivity of a soil. Explain the various factors that affect the coefficient of permeability.	5	2	3
	d	Draw the three phase diagram of soil and define void ratio and porosity. Derive the relationship between them using first principles	5	1	1,2
2	a	Discuss in detail various factors that affect the compaction of soil.	5	3	3
	b	The properties of soil at a construction site are obtained as below. Classify the soil based on IS1498 (1970) R2021. % Passing 75 μ: 65% LL: 55% and PL: 40%	5	2	3
	c	Based on soil investigation carried out at a site, the soil profile is as shown in Figure 1. An isolated footing is to be placed at a depth of 3.5 m below ground surface. To design the footing, shear strength of the soil needs to be determined. CU tests were performed on clay samples taken at a depth of 3.5 m. The tests were conducted with pore pressure measurement and the values of $c' = 25$ kPa and $\phi' = 28^o$ were obtained. Determine the shear strength of the clay at 3.5 m depth. Hint: normal stress = effective overburden stress. Assume no capillary rise.	10	3	3

~~END SEMESTER~~ EXAMINATION/RE-EXAM ~~DEC~~/JAN 2024-25

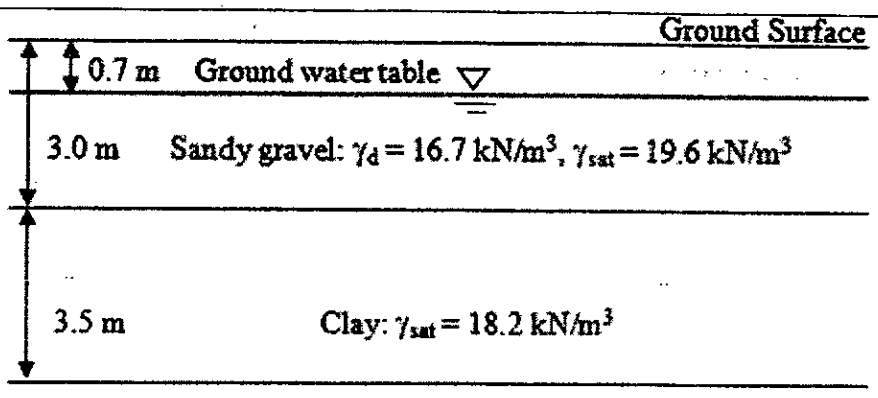

Figure 1.

3	a	Discuss various factors that may cause instability in existing slopes. Discuss some remedial measures for the same	5	3	2
	b	Differentiate between compaction and consolidation.	5	2,3	2
	c	A light pole induces a load of 400kN on the ground surface. Using Boussinesq equation, determine the stress due to the light pole at a depth of 2 m away and 3 m deep below the ground surface. Also determine the stress at a depth of 2 m and distance of 3 m away from the pole. See Page 4 for equations.	10	3	3
4	a	What is the SPT test used for soil investigation? Discuss in detail how it is carried out. Discuss its disadvantages.	10	4	2
	b	A direct shear test is carried out on a dry cohesionless sand in a standard shear box. The observations are noted below. Determine the shear parameters of the soil.	10	2, 3	3

Normal load (kN)	Shear load at failure (kN)
110	95
225	195
340	294

5	a	Differentiate between light weight compaction test and heavy weight compaction tests conducted in the lab	5	3	2
	b	Discuss various factors that affect the compaction of soil in the field.	5	2	2
	c	A 10 m thick clay layer is sandwiched between two sand layers as shown in Figure 2 below. Calculate the settlement due to 1000 kN load at the ground surface. Use Boussinesq equation to estimate the vertical stress at the centre of the clay layer. For the clay layer, initial void ratio is 0.59 and compression index is 0.45, γ_{sat} of clay is 20 kN/m^3 and γ_d of sand is 16 kN/m^3. Assume no capillary action in sand.	10	3	3

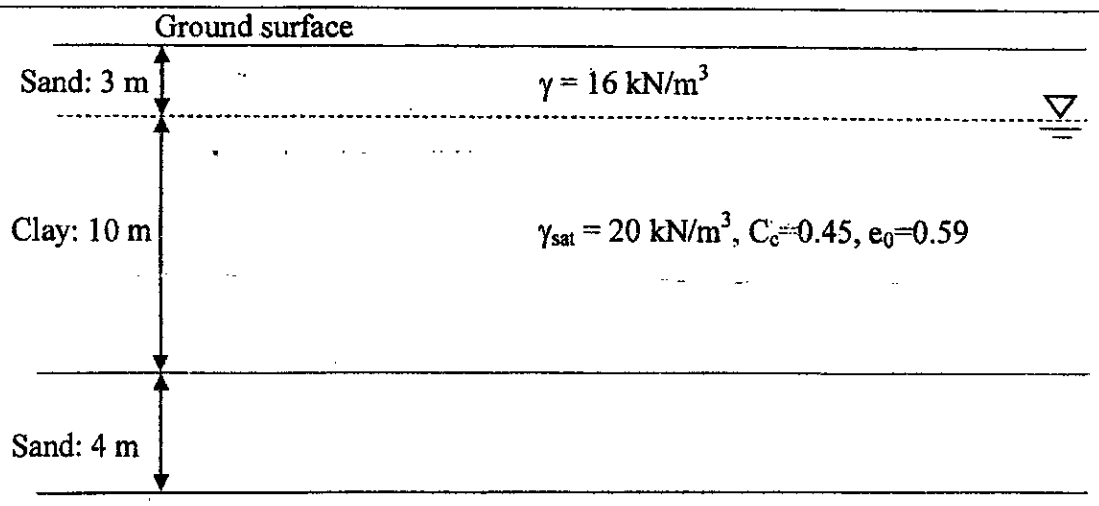

Figure 2

6	a	Illustrate with neat sketch and briefly explain the following Infinite slope, finite slope, toe failure, face failure and base failure	5	3	1,2
	b	The moist unit weight of a soil sample is 16.5 kN/m^3. If moisture content is 15% and specific gravity is 2.7, determine the dry unit weight, porosity and degree of saturation. Also draw the 3 phase diagram.	5	2	3
	c	For the soil profile shown in Figure 3, determine the effective pressure at a depth of 6.5 m below the ground surface if ground water table is at 2 m below GS. Assume capillary rise of 0.8 m, γ_{sat} of soil as 20 kN/m^3 and γ_d as 16 kN/m^3.	10	1, 2	3

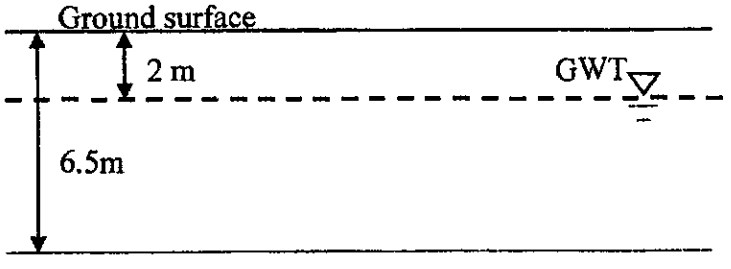

Figure 3

7	a	A thin layer of silt exists at a depth of 18 m below ground surface. The ground water table is at ground level and the saturated density of the soil up to 18 m is determined to be 2.1 g/cc. The shear parameters of undisturbed sample of silt were determined as follows: c_u = 45kN/m^2, ϕ_u = 18°, c' = 35kN/m^2 and ϕ' = 27°. Estimate the shearing resistance of the silt on a horizontal plane when (i) the shear stress builds up rapidly (ii) the shear stress builds up slowly.	10	3	3
	b	As per IS 11401 (1990, R2004), sand is to be used for a slow sand	10	2	2,3

filter. Clause 5.14 states: "Filter sand should be relatively fine with effective size (D10) of 0.15 to 0.30 mm and uniformity coefficient preferably below 3 and not exceeding 5. Most of the sample should pass through a sieve of about 1.0 mm opening and most of it will be retained on a sieve of about 0.15 mm opening with not more than 10 percent passing through."
A soil sample is brought to you. Determine whether you will recommend it as suitable for this use. Explain your reasons – specify which criteria the soils pass or fail.

Sieve size (mm)	% Finer
4.75	84.4
2	54.2
1.18	38.9
0.6	34.3
0.425	23.9
0.3	14.2
0.15	9.8
0.075	7.9

D_{10} (mm)	0.16
D_{30} (mm)	0.6
D_{60} (mm)	2

Equations:

For point load:

$$\sigma_z = \frac{3Qz^3}{2\pi(r^2+z^2)^{5/2}}$$

For line load

$$\sigma_z = \frac{2qz^3}{\pi(x^2+z^2)^2}$$

For strip load

$$\sigma_z = \sigma_1 = \frac{q}{\pi}(\theta_0 + \sin\theta_0)$$

For uniform load on circular area

$$\sigma_z = q\left[1 - \frac{1}{\{1+(a/z)^2\}^{3/2}}\right]$$

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~~END SEMESTER EXAMINATION~~/ RE EXAMINATION,

~~DECEMBER - 2024~~ Jan - 2025

Program: Civil Engineering T.Y. B. Tech Civil Sem V **Duration: 3 Hr.**

Course Code: PC – BTC - 504 **Maximum Points: 100**

Course Name: HIGHWAY ENGINEERING **Semester: V**

Note :

(i) **Question 1 is compulsory**

(ii) **Solve any four questions out of remaining six questions**

(iii) **Assume suitable data if required**

Q.No.	Questions	Points	Modul	BL	CO
Q.1.	Write short notes on (Solve any four, each carries five marks)	20			
a	Basic requirement of ideal alignment		01	02	01
b	Nagpur Plan		01	02	01
c	Carriageway for single and two lane roads		02	01	01
d	Classification of Terrain		02	01	01
e	Surface drainage system		05	01	01
Q.2.					
a	Construction of Surface dressing	05	05	02	02
b	Discus advantage and disadvantage of road transportation	07	01	02	01
c	Discuss the classification of roads with respect to location, importance, traffic and tonnage	08	01	02	01
Q.3.					
a	Explain about shoulders of road. What are the objectives of providing the shoulder?	07	02	02	01
b	Define Gradient. Also, enlist its objectives	07	02	02	01
c	What is design speed? State the design speed for different category of roads passing through plain area.	06	02	02	01

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~~DECEMBER - 2024~~ Jan - 2025

Q.4.					
a	What is sight distance? Derive the Expression for Stopping Sight Distance. How will you calculate the stopping sight distance on sloping road?	10	10	02	01
b	Determine the length of overtaking sight distance for undivided two lane highway. Assume following data Speed of overtaking vehicle = 80 km/hr Speed of overtaken vehicle = 60 km/hr. rate of change of acceleration = 1 m/sec^2 also, Also calculate (i) minimum length of overtaking zone (ii) desirable length of overtaking zone and (iii) Draw a neat sketch showing overtaking zone and position of sign post.	10	10	03	01
Q.5.					
a	Explain with sketch, various forces acting on the vehicle while entering from straight to curve portion of road. Also. Discuss about overturning effect and skidding effect.	10	02	02	01
b	Differentiate between flexible pavement and rigid pavement.	05	04	02	02
c	Draw a neat sketch of flexible pavement and rigid pavement and labeled each layers.	05	04	02	02
Q.6.					
a	Explain about Lane distribution factor and Vehicle Damage factor	07	04	02	02
b	Calculate the total thickness of pavement by CBR method for for light, medium and heavy traffic. Assume CBR value of subgrade = 5 % and tyre pressure = 7.5 kg/cm^2,	06	04	03	02
c	Calculate the cumulative number of standard axle for the design life 15 years using following data. Carriageway = single lane carriageway	07	04	03	02

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	Traffic = total traffic in both direction 700 cvpd Time required for construction of road after last count = 3 years. Rate of growth of traffic = 7 % Indicative value of VDF = 2.5 Use IRC 37- 1984 Guideline				
Q.7.					
a	Enlist at least 10 types of distresses observed in flexible pavements	05	05	02	02
b	Discuss at grade intersection	05	03	02	01
c	Construction of penetration macadam layer	05	05	02	02
d	Importance of Transition curve in road planing	05	02	02	01

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(An Autonomous Institution Affiliated to University of Mumbai)
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~~End Semester~~/Reexam Examination Regulation - 22
~~December2024~~/January2025

Max. Marks: 100 **Duration: 3 hrs** 20/1/25
Class: B. Tech T.Y. B.Tech Civil Sem V **Semester: V**
Name of the Course: Environmental Engineering II **Program: TY BTech Civil**
Course Code: PCBTC506

Instructions:

- **Question 1 is compulsory. Solve any 4 of remaining 6.**
- **Draw neat sketches/diagrams wherever required**
- **Assume suitable data if necessary and state them clearly**
- Figure on right indicate **maximum points** for the given question, **course outcomes attained and Bloom's Level**

Q1	**Answer the following questions:**	(20)	CO	BL
(a)	Answer the following questions (any 4) (a)Explain BOD and COD. Explain the reason for BOD to be measured at 20°C for 5 days. (b)Explain the difference between sewage collection system and water distribution system (c) Draw the treatment unit essential to remove dissolved organics in wastewater treatment plant and explain the fundamentals of the unit (d)Explain population equivalence and relative stability and their importance. (e) Explain the concept of non-scouring and non-silting velocity and what should be the typical values in sewerage system.	(10)	2	3
(b)	Explain pumping station with figure and the need of the pumping station in wastewater management	(05)	3	4
(c)	Design a combined circular sewer serving population of 300/hectare with rate of supply of 100 lpcd. The catchment area is 100 hectares and overall runoff coefficient is 0.7. The time of concentration for the design is 30 min and the relation between intensity of rainfall and duration is I= 1020/ (t+20). (n= 0.012; S= 1/1000)	(05)	3	1
Q2	**Answer the following questions:**	(20)		
(a)	Illustrate and explain the flowsheet of wastewater treatment plant with functions of each unit	(10)	2	3
(b)	Define the following terms for biological treatment: 1) f/m 3) SLR 5) Anoxic 2) MCRT 4) VLR	(5)	2	3
(c)	Explain types of settling. Where does settling occur in wastewater treatment.	(5)	2	3
Q3	**Answer the following questions:**	(20)		
(a)	Explain the concept of carbonaceous, nitrogenous and ultimate BOD. The BOD_5 of waste is 500 mg/L. If K to base e is 0.23/day what is ultimate BOD. What proportion of ultimate BOD will be unoxidised after 20 days.	(10)	3	4

(b)	Explain types of bar screens. Design a screen channel and give checks for peak sewage flow of 30 MLD; Size of bars- 15mm*40 mm; Spacing 30 mm; Angle of inclination – 60°	(10)	3	4
Q4	**Answer the questions**	(20)		
(a)	Explain types of grit chambers. Design a grit chamber to remove particle of size 0.2 mm and sp gr 2.6. Wastewater flow rate is 10000 m^3/d and settling velocity of particles is to be taken 0.016 - 0.02 m/s. Take detention time as 30 sec. Horizontal velocity given is 0.3 m/sec (0.15-0.4 m/sec)	(10)	3-4	3
(b)	Determine size of sump well , check for min duration of pumping for pump designed for max flow, HP of pump, diameter of rising main for following data: Water demand 200 lpcd, Population 50000; Lift required= 8m; Distance of pipeline = 200m; Loss of head at bends =0.3 m. ■ Assume velocity in mains as 1m/sec ■ Take efficiency of pump 65% and motor as 75%	(10)	3-4	3
Q5	**Answer the questions**	(20)		
(a)	A single stage filter is to treat a flow of 4 MLD with inlet BOD of 220 mg/L it is designed for loading of 11000 kg of BOD/ha.m and recirculation ratio as 1. What will be strength of effluent according to NRC USA. If proposed filter is 2 stage plant instead of one filter and each filter is to contain half the volume . Determine effluent of the plant RR is 1 for both stages	(10)	3-4	3
(b)	In an alternative treatment, conventional activated sludge process was designed. Design the volume and give ratio of recycled sludge with Q of conventional aeration tank for a population of 35000 with average sewage rate as 200 lpcd. The initial BOD is 220 mg/L for wastewater and 30% is removed in PST and overall BOD removal as 85%. Give relevant checks for volumetric loading , Aeration period .Assume suitable parameters and mention them	(10)	3-4	3
Q6	**Answer the following questions:**	(20)		
(a)	A hostel is provided near Thane and has population as mentioned in 300 residential graduates(either by rational or detention time method). Design septic tank with water demand of 120 lpcd. Initial BOD is 100 mg/L. Design and draw dispersion trenches (no and size) considering percolation rate as 20 min per cm.(peak flow is 400 lpm	(10)	3-4	3
(b)	Design a high rate digestor digesting mixed primary and activated sludge from a 60000 m3/day plant (don't show gas production calculations). Following data is used • Raw SS concentration is 400 mg/L • SS removal efficiency in PST = 70% • SS concentration of Primary sludge= 40 kg/M^3 • Excess activated sludge generated =2630 kg/Day • SS conc of activated sludge (excess)= 10 kg/m^3 • Percentage of Volatile matter in mixed sludge = 70% • Destruction of Volatile matter in digestor =50% • The SS conc in digested sludge 50 kg/m3	(10)	3-4	3
Q7	Answer the following questions	(20)		
(a)	Explain the process of (a) Sludge thickening (b) Trickling filter	(10)	3-4	3
(b)	Explain aerobic,facultative, attached growth, suspended growth and anaerobic process in detail. Give equations for aerobic and anaerobic process and Give examples of each type of process	(10)	2-4	3

FORMULA SHEET

4-8 hrs	n=0,1/8,1/4,1/2,1	1.8-3m; 1 to 4 $m^3/d/m^2$; 0.08-0.32kg/m^3/d
50 – 150 ml/gm	ML= 90 m MW= 30 m L:W= 1.5:1 to 7.5:1 L:D= 5:1 to 25:1 D= 3 to 50 m 7.5-10%; D= 2.5 or 3.5	0.9-2.5m; 10-40$m^3/m^2/d$; 0.32-1 kg/m^3/d 0.6-1.6kg/d/m^2 6-35 m 1.6-6.4 kg/d/m^2 1 in 6 to 1 in 10 10-20 days 1.2 to 2 m 30- 40 days 4.5 to 6 m and maximum 9m 0.9 m^3
0.7-1.2 m/s	125m^3/d/m 185m^3/d/m	0.1 to 0.15per capita with dry solid loading of 80 to 120 kg/m^2/year 0.2 0.175 -0.2 m^2/c/yr area or 60-120 kg/m^2/yr
0.2-0.4/day	25-35 $m^3/m^2/d$; 50-60$m^3/m^2/d$	$Q_{max} = \left(1 + \frac{14}{4 + P^{0.5}}\right) Q_{av}$
5-15 days	15-35 $m^3/m^2/d$; 40-50$m^3/m^2/d$	$Q = 10^4 A * I * \frac{Ri}{1000 * 3600}$
0.3-0.6kg/m^3/d	25-50%	12 to 25 min/cm Q= 130/√t (lpd/m^2)

$V_S = \frac{p_w g (Ss-1) d^2}{18\mu}$

Or $V_S = \frac{g (Ss-1) d^2}{18\upsilon}$

Or $V_S = 418(Ss-1)d^2(T+10)/60$

$V_c = 3$ To $4.5 \sqrt{(g\, d\, (Ss-1))}$

$v_c = \sqrt{\frac{8\beta g(S_s - 1)d}{f}}$ $E_2 = \frac{100}{1 + \frac{0.4432}{1 - E_1}\sqrt{\frac{w_2}{VF}}}$

$\cos\frac{\theta}{2} = \left(1 - \frac{2d}{D}\right)$

I=a/t^n; I=a/(t+b)

Y=0.5√ B

R=A/P

Q=A.V

$\frac{W_s}{S_s} = \frac{W_f}{S_f} + \frac{W_w}{S_w}$

$Vs = [0.707(Ss-1)d^{1.6}\, \upsilon^{-0.6}]^{0.714}$

$\eta = 1 - \left(1 + \frac{n(v_s)}{Q/A}\right)^{-\frac{1}{n}}$ $q = \frac{Q}{A}$

BHP = (w.Q.H)/(75.η_p. η_m)

$\frac{Qr}{Q} = \frac{x_t}{\left(\frac{10^6}{svi} - x_t\right)}$

$\theta_C = \frac{V.x}{(Q + Q_r)x - Q_r x_r}$

$Volume = \left[Vf - \frac{2}{3}\left[V_f - V_d\right]\right]T_1 + V_d T_2$

$Volume = \frac{1}{2}\left[V_f + V_d\right]T_1 + V_d T_2$

$Q_{max} = \left(1 + \frac{14}{4 + P^{0.5}}\right) Q_{av}$ $F = \frac{1+R}{(1 + R/10)^2}$ $Qw = \frac{VX}{\theta_c Xr}$

$\frac{1}{\theta_c} = \frac{Q}{V}(1 + r - r\frac{Xr}{X})$ $U = \frac{Q*(So-S)}{V*X}$ $T = \frac{La}{20} - 1$

A=0.00622.q/V_r; h_L=0.0729(V^2-v^2) v=Q/W*d $\frac{W_s}{S_s} = \frac{W_f}{S_f} + \frac{W_w}{S_w}$

Q = C.I.A / 360

I = 760 / (t + 10) $V = \frac{1}{n} * R^{\frac{2}{3}} * S^{\frac{1}{2}}$

I = 1 020 / (t + 10)

$V = 0.849 C_H R^{0.63} S^{0.54}$ $\frac{F}{M} = \frac{S}{\theta * X}$ $S_R = 100(1 - 0.605\, t_{37})$

$t_0 = \frac{d^2(0.011d + 0.785H)}{Q}$ $U = \left(\frac{F}{M}\right) * \left(\frac{E}{100}\right)$ $Ns = \frac{3.65n\sqrt{Q}}{H^{0.75}}$

$E = \left(\frac{S_o - S}{S_o}\right) * 100$ $PE = \frac{\text{BOD load from industry } \left[\frac{kg}{day}\right]}{0.054 \left[\frac{kg}{inhab \cdot day}\right]}$

$L_t = L_o(10^{-Kt})$ x=xa+xe+xi

$E_1 = \frac{100}{1 + 0.4432\sqrt{\frac{w_1}{VF}}}$

$\theta_C = \frac{V*x}{Q_w x_w + Q_e x_e}$

h_f=flv²/(2gD) $BOD5 = (DO_{1s} - DO_{5s}) * dilutionfactor - (DO_{1b} - DO_{5b})$

$V_{sl} = \frac{W_s}{\gamma_w S_{sl} P_s}$

$U = \frac{Q*(So-S)}{V*X}$ O_2 (g/d) = Q(So - S) - 1.42 $Q_w X_r$

$\theta_s = \frac{V_s}{Q}$ $xV = \frac{YQ(So-S)*\theta_C}{1 + Kd*\theta_C}$ $\frac{f}{m} = \frac{So*Q}{V*X} = \frac{So}{\theta*X}$

$y_t = L_o(1 - 10^{-Kt})$