T.Y. B. Tech (C) Sem V WP

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Sardar Patel College of Engineering

(A Government Aided Autonomous Institute)

Munshi Nagar, Andheri (West), Mumbai – 400058

END SEM/~~RE-EXAM~~ EXAMINATION NOV/DEC 2025-26 (WP)

Program: Civil Engineering Third Year B.Tech Civil Engg **Duration:3hr**

Course Code: PC-BTC502 Working Prof. **Maximum Points: 100**

Course Name: Hydrology & Water Resources Engineering **Semester: V**

21/11/2025

Instructions:

1. Attempt any 5 questions.
2. Neat diagrams must be drawn wherever necessary.
3. Assume Suitable data if necessary and state it clearly.

Q no.	Questions	Points	CO	BL	Mod
1a	Explain in detail hydrological cycle along with different types of precipitations	10	1	1	1
1b	Draw neat and labelled diagram of unconfined aquifer.	10	3	2&3	4
	A tube well of 300 mm diameter penetrates fully a confined aquifer. The length of strainer is 25m. Calculate the yield from the well under a drawdown of 4 m. the coefficient of permeability of aquifer is 50m/day. Assume radius of influence is equal to 200m.				
2a	Design a regime channel for a discharge of 70 cumecs and silt factor of 1.1 use Lacey's theory.	10	4	4	5
2b	Discuss the causes of failure of earth dam and their precautionary measures	10	4	3	6
3a	What is hydrograph? Discuss components of hydrograph. Discuss the factors affecting shape of a hydrograph.	10	1	2	3
3b	Estimate the storm precipitation at station S	5	1	4	1
	A 3-hour storm occurred at a location, and the precipitation measurements at neighboring rain-gauge stations were recorded as follows: Station P: 3.8 cm, Q: 4.1 cm, Station R: 4.5 cm. The precipitation at Station S could not be measured due to a broken rain-gauge bottle. The normal annual precipitation values for the four stations, as per the IMD Bulletin, are: Station P=45 cm, Station Q=48cm Station R=53cm and Station S=50 cm.				
3c	It was found that the rate of evaporation from a 1.6m pan having a pan coefficient of 0.9 was 1.6 mm/m2/hr.	5	1	3	2
	Compute the total evaporation from a reservoir in a week having water so read of 3 ha.				
4a	A catchment of area 300 km2 receives a uniform rainfall of 30 mm in one day.	10	1	3	3
	During the next few days, the discharge is observed in the river that drains the catchment. The readings are given below:				

T (days)	0	1	2	3	4	5
Q m3/sec	2	5	10	8	4	2

The base flow is constant equal to 2 m3/sec during the discharge period.

(a) How much was the direct runoff during the period (answer in m3/sec)

(b) How much was the total direct runoff during the period (answer in mm)

(c) How much was the total losses for the rainfall (mm).

	(d) What was the maximum discharge in the water course during the period?				
4b	Define and explain evaporation. Discuss the various types of evaporimeters along with sketch.	10	1	2	2
5a	Draw labelled diagram of concrete gravity dam. Brief about various forces acting on the concrete gravity dam. Explain elementary profile and practical profile of concrete gravity dam.	10	4	3	6
5 b	A storm over a catchment of area 5 km2 had a duration of 14 hours. The mass curve of rainfall of the storm is as follows:	10	1	4	3

Time from start of storm (hr)	0	2	4	6	8	10	12	14
Accumulated rainfall (cm)	0	0.6	2.8	5.2	6.7	7.5	9.2	9.6

If ϕ index for the catchment is 0.4 cm/hr, determine the effective rainfall hyetograph and the volume of direct runoff from the catchment due to the storm.

6 a	Discuss the factors to be considered while selecting a site for a dam. Define spillway and brief about their classification	10	4	3	6
6 b	The following is the set of observed data for successive 15 minutes period of 105 minutes storm in a catchment	10	1	3	2

Duration (min)	Rainfall (cm/hr)
15	3.0
30	3.0
45	9.0
60	8.0
75	2.25
90	2.25
105	5.5

If the value of ϕ-index is 4 cm/hr, estimate the net runoff, total rainfall and the value of W- index

7 a	For the given data, find the reservoir capacity if the canal losses are 25% and reservoir losses are 15%	10	2	4	5

Crop	Base period (days)	Duty at the field (hectares/cumec)	Area under the crop (hectares)
Wheat	120	1800	4800
Sugar-cane	360	800	5600
Cotton	200	1400	2400
Rice	120	900	3200
Vegetables	120	700	1400

7 b	Define reservoir sedimentation, discuss its effect and sedimentation control.	10	1	2	7

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END SEM / ~~RE-EXAM~~ EXAMINATION NOVEMBER 2025 / JANUARY 2026

Program: Third Year B. Tech Civil Engineering (Working Professional) **Semester:** V

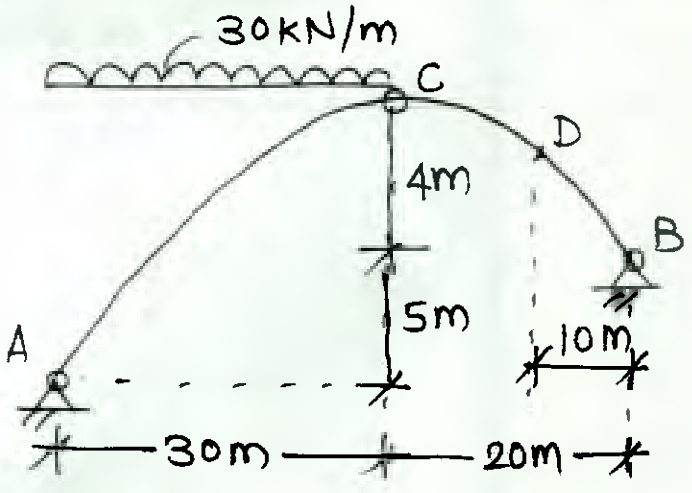
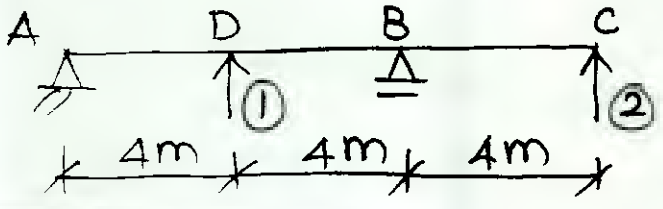
Course Code: PC-BTC501 **Maximum Points:** 100

Course Name: Structural Analysis **Duration:** 3 Hrs.

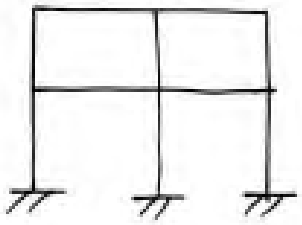
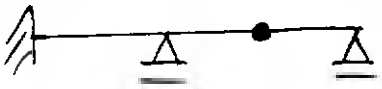
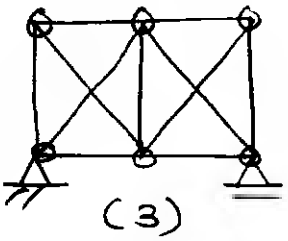
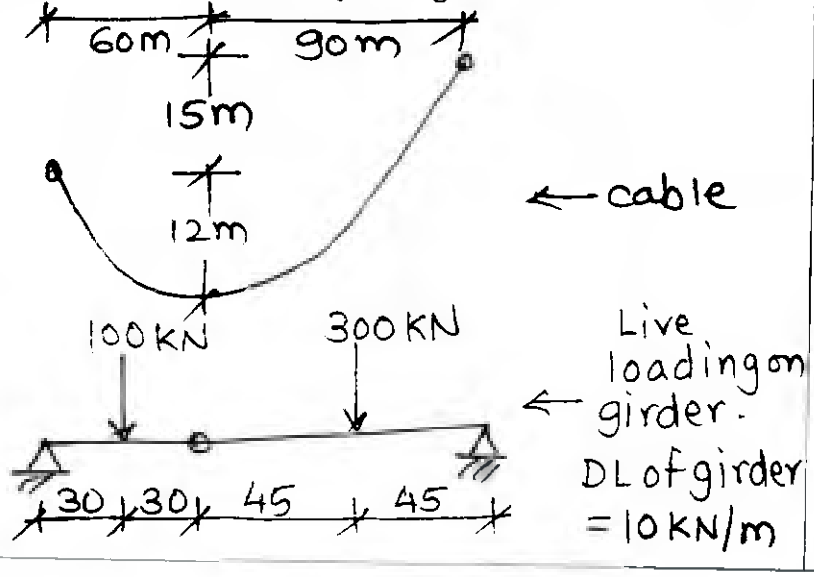
24/11/2025

Instructions for the Students:

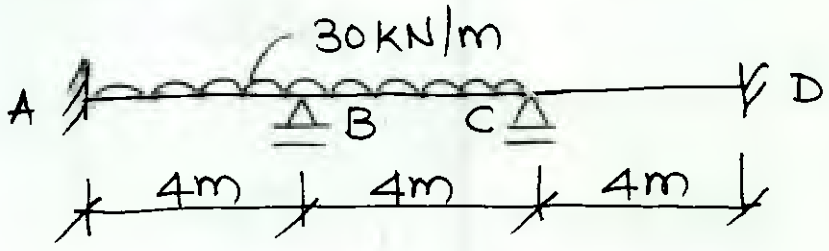
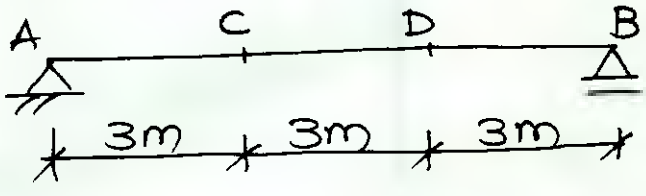
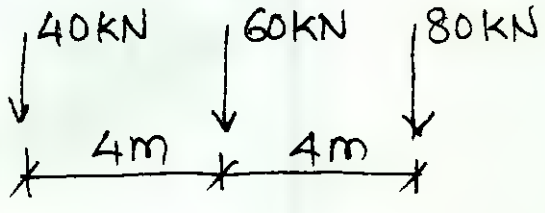
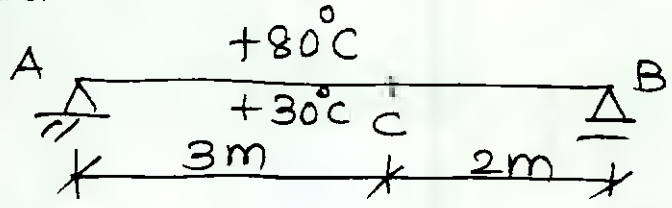
1. **Attempt any 05 (FIVE) questions**
2. **Assume suitable data if necessary and state it clearly.**
3. **Illustrate your answers with neat sketches wherever required.**

Q. No.	Questions	Points	CO	BL	Module No.
1	For the arch shown in figure below, determine i. Support reactions ii. Radial shear and normal thrust at point D iii. Maximum bending moment between part AC and part BC 	8 6 6	1	4	1
2 a	Determine the flexibility coefficients for the beam shown in figure below. 	10	4	4	6

END SEM / ~~RE-EXAM~~ EXAMINATION NOVEMBER 2025 / JANUARY 2026

2 b	Determine the static and kinematic indeterminacy of the structures shown below.  (1)  (2)  (3)	10	3	2	5
3	An unsymmetrical cable and three hinged stiffening girder with live load is shown in figure below. Determine i. Maximum superimposed uniformly distributed load transferred on the cable ii. Maximum and minimum tension developed in the cable iii. Tension developed in the anchor cable at both ends if the cable is supported on saddle support at the top of the pier and back anchored at an angle of 30^0 with horizontal iv. Forces developed in pier if pier height is 40 m 	8 4 4 4	1	4	2

END SEM / ~~RE-EXAM~~ EXAMINATION NOVEMBER 2025 / JANUARY 2026

4	Using slope deflection method, analyse the beam shown below and draw BMD  EI = Constant.	20	4	4	7
5 a	For the beam shown below, draw ILD for support reaction at A and bending moment at point D 	10	2	4	3,4
5 b	A Simply supported girder of span 30 m carries a series of loads as shown in figure below. Determine absolute maximum bending moment developed anywhere in the girder. 	10	2	4	3,4
6 a	For the beam shown in figure below, determine the vertical deflection of point C.  d = 400 mm $\alpha = 12 \times 10^{-6} / {}^{\circ}C$	10	3	4	5

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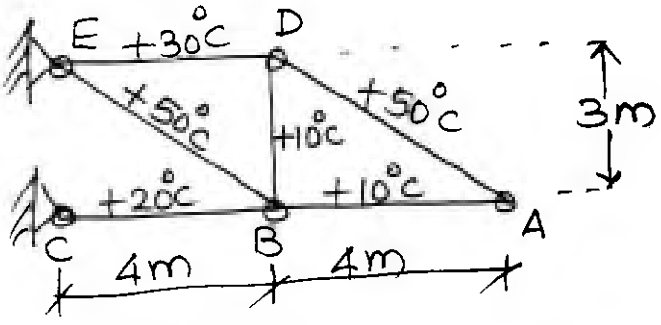
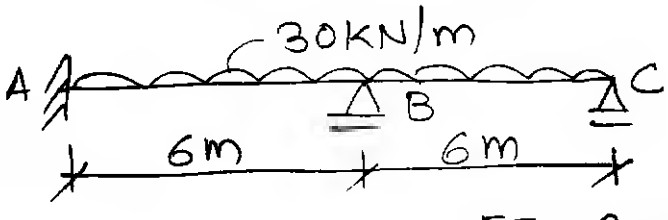
6 b	For the truss shown in figure below, determine the vertical deflection of point A.  $\alpha = 12 \times 10^{-6} / °C$ A = Constant for all members.	10	3	4	5
7	Using flexibility coefficient method, analyse the beam shown below and draw BMD  EI = Constant.	20	4	4	7

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26/11/2025

END SEMESTER December 2025 / ~~RE - EXAM~~ February 2026

Program: T.Y. B.Tech. Working Professionals **Duration:**

Course Code: PC-BTC504 **Maximum Points: 100**

Course Name: Highway Engineering **Semester: V**

Notes: Question no 1 is compulsory, answer any four out of the remaining questions

Q.No.	Questions	Points	CO	BL	Module No.
I	a) List the fundamental parameters of a traffic stream. b) What are the different speed studies? c) Explain Level of Service (LOS) d) What are the types of traffic control devices?	5 5 5 5	1 2 3 4	2 3 1 2	1 2 3 4
2 (a)	Discuss the 20-year road development plans and post-2001 programs.	10	1	2	1
2 (b)	Explain engineering surveys for highway location with neat sketches.	10	1	2	1
3 (a)	Discuss the factors controlling highway alignment with examples.	10	2	2	2
3 (b)	Explain geometric design elements and their controlling factors.	10	2	2	2
4 (a)	Discuss pavement surface characteristics and their influence on safety.	10	3	2	3
4 (b)	Describe accident studies and preventive measures.	10	3	4	3
5 (a)	Define and explain Level of Service (LOS) with reference to capacity.	10	4	4	4
5 (b)	Explain the design of flexible pavements as per IRC 37-2018.	10	4	3	4
6 (a)	Describe the plate load test and its interpretation.	10	5	3	5
6 (b)	Explain the causes of pavement failures and maintenance measures.	10	2	2	2
7 (a)	Discuss the design of joints in rigid pavements.	10	1	2	1
7 (b)	Explain the concept of subgrade stabilization.	10	2	3	2

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END SEMESTER EXAM NOV-DEC 2025-SET-B

Program: Civil/Mech./Elect. [Minor] WP **Duration: 3 hrs.**

Course Code: MI-BT032 **Maximum Points: 100 points**

Course Name: Sustainable Design in Engineering **Semester: V** 28/11/2025

- **Notes: Question 1 is compulsory. Solve any four of remaining six**
- **Use illustrations wherever required**
- **Draw neat sketches/diagrams wherever required and give reasoning wherever required**
- **Assume suitable data if necessary and state them clearly**
- Figure on right indicate **maximum points** for the given question, **course outcomes attained , Bloom's Level and Module Number**

Q.no	Question	Points	CO	BL	Mo. N
1(a)	Compare the GRI and BRSR frameworks used for corporate sustainability reporting in India. How do they align with the UN Sustainable Development Goals (SDGs)?	5	3	3	2
1(b)	Compare sustainability outcomes of Ralegan Siddhi and Amul models and SDGs aligning with these models	5	3	4	5
1(c)	Compare renewable and conventional energy systems based on efficiency, cost, and life-cycle environmental impacts.	5	2	3	4
1(d)	Identify the following as cash inflows or outflows for a recycling company: a. Sale of recycled paper and plastic b. Purchase of sorting equipment c. Wages paid to workers d. Electricity bill for recycling plant e. Collection fees received from households f. Transport fuel cost g. Maintenance of the recycling machine h. Government subsidy for recycling activities	3	3	4	1
	A family that won a ₹1,00,000 prize on a TV show decided to put one-half of the money in a college fund for their child, who was responsible for the prize. If the fund earned interest at 6% per year, how much was in the account 14 years after it was started?	2			
2 (a)	An office of 200 employees consumes 30 m³/day of potable water. •Compute L/p/d and compare with the target of 45 L/p/d. Suggest three design interventions.	5	4	3	5

2 (b)	Determine the difference in the present worth values of the following two commodity contracts at an interest rate of 8% per year. a. Contract 1 has a cost of ₹10,000 in year 1; costs will escalate at a rate of 4% per year for 10 years. b. Contract 2 has the same cost in year 1, but costs will escalate at 6% per year for 11 years.	5	3	3	2
2(c)	Compare renewable and conventional energy systems based on efficiency, cost, and life-cycle environmental impacts. Discuss the advantages and disadvantages of rooftop solar energy systems in urban India.	10	2	2	4
3(a)	Develop a roadmap for a village transitioning to net-zero energy by 2050	10	1	3	
3(b)	Discuss the challenges, feasibility considerations, and limitations in integrating SDGs into engineering design.	10	1	3	2
4(a)	Reflect on a product of daily use and propose sustainable redesign. Take a case study or an example to demonstrate the same	10	4	4	5
4(b)	Evaluate the Eastgate Centre (Harare, Zimbabwe) as a landmark example of biomimetic and sustainable building design. Discuss: Biological inspiration (termite mounds and passive cooling) How the building reduces HVAC energy use. Design methods used (form, process, system levels). Overall sustainability benefits Lessons for future civil/environmental engineering projects	10	2	2	3
5 (a)	Describe Nature-Based Design Solutions in engineering. Explain how wetlands, mangroves, root systems, and other natural systems inspire solutions for climate resilience, disaster mitigation, and resource efficiency. Discuss relevance to SDGs and sustainable cities.	10	4	4	
5(b)	How do climate and orientation affect sustainable building performance?	05	2	4	2
5(c)	Describe BMW's approach to circular economy in manufacturing.	05	3	4	5
6(a)	Discuss the role of morphology and biological analogues in sustainable design innovation. Explain: Morphological analysis as a method How nature-inspired forms improve efficiency Engineering examples such as the kingfisher-inspired Shinkansen nose, plant-tropism facades, self-healing processes, etc.	10	4	3	4

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END SEMESTER EXAM NOV-DEC 2025-SET-B

6(b)	Discuss the challenges, feasibility considerations, and limitations in integrating SDGs into engineering design. (10 marks)	10	3	2	4
7 (a)	Discuss any one real life sustainable design project in detail. Your answer should include the background and importance of the project, the underlying scientific, engineering, or design principles, and the specific sustainable design concept it aligns with. Further describe the project's objectives, methodology or design approach, implementation process, outcomes, and overall sustainability impact. Finally, explain how similar strategies can be adapted or scaled in the Indian and global context, identify the Sustainable Development Goals (SDGs) that the project supports, and list suitable indicators that can be used to measure the project's impact. (Hint: Use your mini-project)	20	4	3	4

ALL THE BEST

Formulae:

Factor	Formula
F/P	$F = P(1+i)^n$
P/F	$P = \frac{F}{(1+i)^n}$
P/A	$P = A\left[\frac{(1+i)^n - 1}{i(1+i)^n}\right]$
A/P	$A = P\left[\frac{i(1+i)^n}{(1+i)^n - 1}\right]$
F/A	$F = A\left[\frac{(1+i)^n - 1}{i}\right]$
A/F	$A = F\left[\frac{i}{(1+i)^n - 1}\right]$
P/G (Arithmetic Gradient)	$P_G = G\left[\frac{(1+i)^n - in - 1}{i^2(1+i)^n}\right]$
A/G (Arithmetic Gradient)	$A_G = G\left[\frac{1}{i} - \frac{n}{(1+i)^n - 1}\right]$
F/G (Arithmetic Gradient)	$F_G = G\left[\left(\frac{1}{i}\right)\left(\frac{(1+i)^n - 1}{i}\right) - n\right]$
P/G (Geometric Gradient)	$P_G = A_1\left[\frac{1 - \left(\frac{1+g}{1+i}\right)^n}{i-g}\right], g \neq i$ $P_G = \frac{nA_1}{(1+i)}, g = i$

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End Semester Exam- Set B
Nov-Dec 2025

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

Class: T.Y B. Tech (WP) **Semester: V**

Name of the Course: Wastewater Engineering and Air Pollution Control **Program: Civil WP**

Course Code: BTC505

01/12/2025

Instructions:

- **Solve any 5 questions of 7 questions**
- **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 and Module number

QN	Questions	Marks	BL	CO	M.N
Q1	**Answer the following questions:**	**(20)**			
(a)	Explain the fundamental of BOD and COD. What is importance of BOD/COD ratio? The dilution water (CONTROL) has initial DO of 7.5 mg/L and the diluted sample from a river from Maharashtra has DO 7.0 mg/L. The dilution for BOD sample 5%. After 5 days at 20°C DO in diluted sample falls to 4 mg/L and that of Control is 7.3 mg/L. Find BOD_5 of sample at 20°C. The K_{10} value is 0.1/days. Find the BOD of same sample at 40°C at the end of 2 days. Θ= 1.056	**(10)**	**3**	**1**	**3**
(b)	Explain the following concepts (i) Self purification and factors (ii) Self cleansing velocity and its derivation	**(10)**	**3**	**2**	**4**
Q2	**Answer the following questions:**	**(20)**			
(a)	Design a grit chamber to remove particle of size 0.2 mm and sp gr 2.6. The population is 2,00,000 and water supply rate is 135 lpcd and settling velocity of particles is to be taken 0.016 - 0.02 m/s. Take detention time as 50 sec. Horizontal velocity given is 0.28 m/sec (0.15-0.4 m/sec)	**(10)**	**3**	**2**	**4**
(b)	Estimate the bar screen area requirement for a plant treating a peak 20 MLD. Velocity through screen to be assumed as 0.9 m/s. Screen is provided at 60 degree from horizontal. (take the width of bar as 1 cm and distance between two bars 5 cms). Give checks for head loss.	**(10)**	**3**	**3**	**3**
Q3	**Answer the following questions**	**(20)**			
(a)	In the wastewater treatment plant for your area, trickling filter/s is used as the secondary treatment. Explain the importance of recirculation and types of filters. Determine the size (dia and depth) and numbers of high-rate trickling filter to be provided for the following data. Give your take on disposal of wastewater (i) Sewage flow = 10 MLD (ii) Recirculation ratio = 1.5 (iii) BOD_5 of raw sewage = 220 mg/lit (iv) BOD_5 removal in PST = 30% (v) Final effluent BOD_5 desired = 30 mg/lit	**(10)**	**3**	**4**	**5**

	Also calculate hydraulic loading and organic loading.				
(b)	Explain the following (any two) (i) 1st and 2nd stage BOD (2) Crown Corrosion (3) Population Equivalent	**(10)**	**1**	**2**	**2**
Q4	**Answer the following questions:**	**(20)**	**3**	**3**	**5**
(a)	Explain activated sludge process and state the differences between trickling filter and activated sludge process. Design a continuous flow completely mixed activated sludge process with following data. Sewage flow is 500m^3/d; Influent BOD to aeration tank =220mg/L; Effluent BOD= 10 mg/L; Effluent SS =20 mg/L; MLSS= 3000mg/L; MLVSS/MLSS=0.8; Return sludge concentration as SS= 18000mg/L; Y=0.75; k_d=0.05d^{-1}; Θ_c=10 days. Compute oxygen requirement also. Give all checks with air requirement for the aeration units				
Q5	**Answer the following questions:**	**(20)**	**3-4**		**4-5**
(a)	Design a conventional digester for mixed primary and activated sludge where sewage flow is 20 MLD and initial BOD is 200 mg/L Data given is Raw effluent SS= 220 mg/L SS removal efficiency = 80% SS concentration in primary sludge = 35 kg/m^3 Excess activated sludge = 6000 kg/day SS concentration in activated sludge = 15 kg/m^3 VM in Mixed sludge = 65%	**(15)**	**3-4**	**3**	**6**
(b)	Explain methodology for wastewater treatment you would recommend for rural areas and give reasoning for the same	**(05)**	**3**	**3**	
Q6	Answer the following questions (any 2)				
A	Deliberate impact of ambient air pollution on humans, material and vegetation in short	**(10)**	**3**	**4**	**7**
B	Explain procedure to find PM10 and PM2.5 in air	**(10)**	**2**	**4**	
C	Ennumerate control methods for air pollution. Explain any 4 methods in detail with typical industries where they will be used	**(10)**	**3**	**4**	
Q7	**Answer the following questions:**	**(20)**			
(a)	Convert the Air Pollutant values as asked	**(04)**	**2**	**4**	**7**
	Convert 60µg/m^3 of SO_2 to ppm at 30 degree Celsius and 1 atm				
	Convert 40 ppm of HC to µg/m^3 at STP				
(b)	The area for which sewer line is designed is 100 hectares. The Run off coefficient is 0.7 on an average for various areas. The time of concentration is 30 min, find max runoff using intensity of rainfall as I= {900/(t+60)}. The population is 80,000 and water supply rate is 180lpcd. Design the sewer line flowing full giving checks.	**(06)**	**3**	**2**	**2**
(c)	Design engineers need to design wastewater treatment plant for a sewage flow rate as 130 lpcd and population is 80000. The domestic wastewater to be treated has initial BOD of 220mg/L and S.S. concentration of 220 mg/L. Find the BOD loading and Suspended solids loading considering water supply rate as mentioned in table 1. Illustrate the basic flowsheet of wastewater treatment plant that can be proposed with function of each unit and expected reduction in BOD. Will the efficiency of the plant be as required.	**(10)**	**3**	**3**	**1**
	ALL THE BEST				

Formula sheet and Parameter Sheet

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

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

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

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

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

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

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

$Y=0.5\sqrt{B}$

$R=A/P$

$Q=A.V$

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

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

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

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

$Q = C.I.A / 360$

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

$I = 1\,020 / (t + 10)$

$V = 0.849 C_H R^{0.63} S^{0.54}$ $\frac{F}{M} = \frac{S}{\theta * X}$

$t_0 = \frac{d^2(0.011d + 0.785H)}{Q}$ $PE = \frac{BOD\ load\ from\ industry\ \left[\frac{kg}{day}\right]}{0.054\ \left[\frac{kg}{inhab \cdot day}\right]}$ $U = \left(\frac{F}{M}\right) * \left(\frac{E}{100}\right)$

$E = \left(\frac{S_o - S}{S_o}\right) * 100$

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

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

$BHP = (w.Q.H)/(75.\eta_p.\,\eta_m)$

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

Conc ($\mu g/m^3$) = $\frac{ppm*MW*1000}{22.4}$

$E_1 = \frac{100}{1+0.4432\sqrt{\frac{w_1}{VF}}}$ $L_t = L_o(10^{-Kt})$ x=xa+xe+xi

$\theta_c = \frac{V*x}{Q_w x_w + Q_e x_e}$ Q= 130/√t (lpd/m^2)

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

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

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

$\theta_C = \frac{V.x}{(Q+Q_r)x - Q_r x_r}$ $V = \frac{YQ(S_0-S)\theta_c}{x(1+k_d)\theta_c}$ $\theta_s = \frac{V_s}{Q}$ $\frac{f}{m} = \frac{So*Q}{V*X} = \frac{So}{\theta*X}$ $y_t = L_o(1 - 10^{-Kt})$

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

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

Concentration (ppb) = 22.4 x concentration (µg/m3) ÷ molecular weight at STP

P1V1/T1= P2V2/T2

4-8 hrs	n=0,1/8,1/4,1/2,1	1.8-3m; 1 to 4 $m^3/d/m^2$; 0.08-0.32$kg/m^3/d$
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 $kg/m^3/d$ 0.6-1.6$kg/d/m^2$ 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 day 4.5 to 6 m and maximum 9m 0.9 m^3
0.7-1.2 m/s 0.2-0.4/day 0.3-0.6$kg/m^3/d$ 5-15 days	125$m^3/d/m$ 185$m^3/d/m$ 25-35 $m^3/m^2/d$; 50-60$m^3/m^2/d$ 15-35 $m^3/m^2/d$; 40-50$m^3/m^2/d$	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

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Program: T.Y. B.Tech. Working Professionals Civil Engg. **Duration: 3 hr**

Course Code: PC-BTC503 **Maximum Points: 100**

Course Name: Soil Mechanics **Semester: V**

03/12/2025

Note :1) Q1 is compulsory
2) Attempt any Four out for remaining Six questions
3) Assume suitable data where ever required

Q.No.	Questions	Points	CO	BL	Module No.
1	Attempt **Any Four**				
a	Explain the scope of geotechnical engineering.	5	1,2	1	1
b	Explain what is stratified soil in both perpendicular and parallel conditions.	5	1,2	1	2
c	Enlist the difference between compaction and consolidation.	5	1,2	2	3
d	A line load of 130 kN/m is acting along the ground surface along y-axis. Determine the vertical stresses at point P which has x and z coordinates as 2.5m and 4.5m.	5	1,2	1	4
e	Enlist the Assumption made in Terzaghi one dimensional consolidation theory.	5	1,2	1	5
f	A sample of dry cohesionless soil was tested in a triaxial machine. If the angle of shearing resistance was 38° and the confining pressure is 110 kN/m^2, determine the deviator stress at which the sample failed.	5	1,2	1	6
g	Write a short note on types of slope failure.	5	1,2	2	7
h	Explain borehole logs.	5	1,2	1	8
2 (a)	An embankment having a total volume of 2000 m^3 is to be constructed having a bulk density of 1.98 gm/cm^3 and a placement water content of 18%. The soil is to be obtained either from borrow area A or B which has voids ratio of 0.78 and 0.69 respectively. Taking specific gravity of both the soil samples as 2.66, determine the volume of soil required to be excavated from each of the areas. If the cost of excavation is Rs. 35/m^3, but the cost of transportation is Rs 32/m^3 and Rs. 36/m^3 respectively, which of the borrow areas is more economical? If one truck can carry 130 m^3 of soil, how many trucks will be required for the transportation?	10	2,3	3	1
2 (b)	A soil sample has a compression index of 0.3. If the void ratio at a stress of 1.4kg/cm^2 is 0.5, compute (1) void ratio if the stress is increased to 2kg/cm^2 and (2) settlement of a soil strata 4m thick.	10	1,2	2	2
3 (a)	A granular soil deposit is 7 m deep over an impermeable layer. The groundwater table is 4 m below the ground surface. The deposit has a zone of capillary rise of 1 m. The unit weights of the soil in the dry zone, zone of capillary rise and saturated zone are 16.248 kN/m^3, 18.087 kN/m^3 and 19.927 kN/m^3. Plot the variation of total stress, pore water pressure and effective stress with the depth of the deposit.	10	2,3	3	2
3 (b)	In a falling head permeability test on a soil sample of length 100 mm, the head of water in the stand pipe takes 10 seconds to fall from 850 mm to 175 mm above the tail-water level. Then another soil of length 60 mm is placed on top of the first soil. The time taken for the head to fall between the same limit is 18 seconds. The permeameter has a cross-sectional area of 5000 mm^2 and a stand pipe area of 150 mm^2. Calculate the permeability of the 2nd soil.	10	1,2	1	1

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4 (a)	The following results were obtained from a standard proctor test on a sample of soil The volume of the mould used was 1000 ml. Find optimum moisture content and maximum dry density. Also, plot the zero air voids line if G = 2.70. Water content (%): 0.12, 0.14, 0.16, 0.18, 0.20, 0.22 Mass of wet soil (kg): 1.68, 1.85, 1.91, 1.87, 1.86, 1.85	**10**	2,3	3	3
4 (b)	Explain the uses of flow nets	**5**	1,2	3	5
4 (c)	Briefly explain any one of the fitting methods for finding coefficient of consolidation	**5**	2,3	3	5
5 (a)	Find the shear parameters of soil considering (i) total stress(ii) effective stress and comment on the result **Sample No.** / **Cell pressure (kg/cm²)** / **Deviator stress at failure (kg/cm²)** / **Pore pressure at failure (kg/cm²)** 1 / 1.0 / 2.02 / 0.41 2 / 1.5 / 2.18 / 0.62 3 / 2.0 / 2.37 / 0.7	**10**	2,3	3	6
5 (b)	Explain the shear strength characteristics of sand in respect to stress-strain and volumetric changes	**5**	1,2	1	7
5 (c)	Explain Agur boring in detail.	**5**	1,2	1	8
6 (a)	A 2m thick layer of saturated clay lies between two permeable layers. Clay has the following properties liquid limit =45%, K=2.8X10^{-7}cm/s ,e=1.25 and initial effective over burden pressure at the middle of clay layer is 2kg/cm^{2}and likely increases to 4kg/cm^{2}due to the construction of new building find 1) final void ratio of clay 2) settlement of proposed building 3) time required for 50% consolidation	**10**	2,3	3	5
6 (b)	In a drained triaxial compression test a saturated specimen of cohesionless sand fails at a deviator stress of 450kN/m^2. When cell pressure was 135kN/m^2. Find the effective angle of shearing resistance of sand and angle of inclination of the failure plane with the horizontal.	**10**	2,3	3	6
7 (a)	A 10 m high cut has been made at an angle of 38^0 to the horizontal. A possible circular failure surface has a radius of 22 m and is passing through the toe of the cut slope and through a point 5 m away on the top ground from the edge of the cut. The weight of the failure mass is 1500 kN and its centre of gravity is at a distance 10 m from the centre of the failure circle. The properties of soil are c = 40 kN/m^2, ϕ = 18^0 and Υ = 20 kN/m^3. Determine factor of safety that would be available on the said failure surface for the cut. Use friction circle method	**10**	2,3	3	1
7 (b)	The plastic limit of soil is 25% and its plasticity index is 8% when the soil is dried from its state at plastic limit the volume change is 25% of its volume at plastic limit. Similarly, the corresponding volume change from liquid limit to dry state is 34% of its volume at liquid limit find shrinkage limit and shrinkage ratio.	**10**	2,3	3	2