BharatiyaVidya Bhavan's
SARDAR PATEL COLLEGE OF ENGINEERING
(An Autonomous Institution Affiliated to University of Mumbai)
Munshi Nagar Andheri (W) Mumbai 400058
Endsem/[redacted] Paper R-23
May 2025

Max. Marks: 100 Civil Sem IV **Duration: 3 Hrs**
Class: S.Y.B.Tech **Semester: IV**
Name of the Course: Water Supply Engineering **Program: B. Tech CIVIL**
Course Code: PC BTC-406

16/5/25

Instructions:
- **Question 1 is compulsory. Attempt any 4 of remaining 6**
- **Draw neat sketches/diagrams wherever required in the answer sheet and upload**
- **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 **modules of the given questions**

Q1	**Answer the following Questions**	(20)	CO	BL
(a)	**Classify water quality parameters**. Also give a flowsheet to treat surface water with explanation of each unit and reductions	(10)	CO1 - CO4	3
(b)	**Select the closest answers and show calculations for following questions**	(10)	CO3	3
i	The surface loading rate ($m^3/m^2/d$) of 5 tanks with Length= 40 m , width= 8 m and height 3 m with a flow of 30 MLD is (i) 18.75$m^3/d/m^2$ (ii) 37.5m^3/d (iii)93.75$m^3/d/m^2$(iv) 24.5$m^3/d/m^2$	(03)		
ii	The quantity of 75% pure alum required (per year in kgs) for treating 60 MLD of water if alum required is 30 mg/L (i) 10300 kg/year (ii) 772.9 kg/yr (ii) $7.73*10^5$kg/yr (iv) $1.03*10^6$kg/yr	(03)		
iii	Calculate lime and soda ash required to remove 138 mg/L of $MgCl_2$ (i) 49.2 mg/L; 66 mg/L (ii) 107 mg/L, 153.9 mg/L (iii) 35.5 mg/L, 106 mg/L (iv) 162 mg/L, 109 mg/L	(04)		
Q2	**Answer the following questions**	(20)		
(a)	A story in London times on 28th April 2025 quoted "Boat Race Crews were warned not to throw each other into the Thames for a celebratory, or commiseratory, dip. This is because levels of pollution are at a staggering level. Testing showed levels of E coli almost three times the Environment Agency's threshold for "poor" bathing waters. Any level of E coli, given that it is a bacteria traced to sewage, is hardly welcome. It's the second year in a row there were significant such warnings. Thames Water, not exactly a trusted paragon of quality, said £1.8 billion would be committed to improve the rivers around London.**Is E.Coli standard for drinking water quality as per your knowledge. If yes**	(10)	CO1	3,4

	how is it used to decide the quality? Explain ways to improve quality of river water?			
(b)	The industrial development does not happen in rural areas. Explain it in context of need of water supply schemes	**(05)**	**CO1**	**4**
(c)	Explain the following terms (i) Population forecasting (2) Design period	**(05)**	**CO1**	**4**
Q3	**Answer the following questions**	**(20)**		
(a)	Forecast population for Chamba region for 2040 using arithmetic increase, geometric increase and incremental increase methods **Year** | **1970** | **1980** | **1990** | **2000** | **2010** Population | 20000 | 32000 | 41000 | 50000 | 65000	**(10)**	**CO2**	**4**
(b)	A **bell mouth canal intake is to be designed for Chamba** considering population of 60,000 and water demand of 180 lpcd (a) drawing water from a canal which runs for 9 hrs a day with a depth of 2 m. Calculate head loss in intake conduit if treatment works are 0.75 km away. Consumption of the town is to be considered 130 lpcd. Assume velocity through screens and bell mouth to be less than 16cm/sec and 32 m/sec. Also draw a neat sketch of design. **$v=0.85\ C_H R^{0.63} S^{0.54}$ (C_H= 130 dependent on pipe material, R is hydraulic mean depth and for circular section it is d/4; and S is slope of energy line or Hl/L)**	**(10)**	**CO1**	
Q4	**Answer the following questions**	**(20)**		
(a)	You are an engineer at the Chamba Municipality. Your responsibility is to plan and design a water distribution network for a greenfield project in the region. Explain the process adopted.	**(10)**	**CO4**	**4**
(b)	Design a **mechanical rapid mix unit for a design flow to be treated as 500 m^3/hr.** Take value of μ as $1.0087E^{-03} Ns/m^2$. Assume DT find volume. Find depth and diameter. Compute power requirements	**(5)**	**CO2**	**2**
(c)	Explain with short notes (i) Ion Exchange (ii) Coagulants	**(5)**	**CO3**	**2**
Q5	**Answer the following questions**	**(20)**		
(a)	Explain coagulation and flocculation. Design water depth for a slow mixing basin (gravity flocculator) having around the end baffles in order to treat 50 MLD. Tank is divided in two compartments by providing longitudinal partition wall and each half has a width of 8 m. Assume suitable detention times and flow velocities. Clear distance between baffles may be kept min permissible. Mention number of channels and overall length.	**(10)**	**CO2**	**2-3**
(b)	**Explain any <u>two</u> (i) tube settlers and (ii) Filter troubles (iii) Reverse osmosis**	**(10)**	**CO2**	**3-4**
Q6	**Answer the following questions**	**(20)**		
(a)	**Design rapid sand filter for (size and underdrainage system)** for the population of 60,000 for Chamba town having water demand **180 lpcd. Design wash water system too**	**(15)**	**CO3**	**3-5**

(b)	Ennumerate factors affecting disinfectant use and dose. Draw and explain the graph of chlorine utilization. Find chlorine consumed (chlorine dose) in kg/day and chlorine dosage in mg/L for the city of Chamba in if the residual chlorine **is 1 mg/L** and a **chlorine demand is 40 kg/day for average flow and average water demand of 180 lpcd and population 60,000.**	**(05)**	**CO3 ,CO 4**	**2-4**
Q7	**Give solutions to the following problems encountered in Rural India**	**(20)**	**CO2 - CO3**	**3-4**
(a)	The content of fluoride is 6 mg/L. What are the typical values expected for drinking water and what are the implications? Explain how will you solve this problem in remote village	**(05)**		
(b)	It was observed that very high odor and color is visible in one of the sources in remote village in West Bengal. How this problem could be solved in the village. Explain the processes that can be adopted for the same	**(05)**		
(c)	A rural well is to be disinfected. Explain the process for the same in detail	**(05)**		
(d)	In a far flung small town in India the only water available in sea water and ground water also has high amount of salt ingress. Which technique can be used in this town for generating drinkable water. Explain in detail with figures	**(05)**		

Formula sheet

$P_n = P_o\left[1+\frac{r}{100}\right]^n$ $P_n = P_o + n\bar{x} + \frac{n(n+1)}{2}\bar{y}$ $\log_e\left[\frac{P_s - P}{P}\right] - \left[\frac{P_s - P_o}{P_o}\right] = -kP_s * t$ $P_n = (P_o + n\bar{x})$ $r = \sqrt[t]{r_1 * r_2 * r_3 * \ldots\ldots * r_n}$ 100-160m³/m/d (max=200m³/m/d) Width of tank = max 12 m Length should not be greater than 4 B For circular tanks max diameter allowed is 60 m	Al=27; Ca=40; C=12; O=16; S=32; Cl=35.5; H=1; Na=23; Fe= 55.5; Mg=24; Si=14 $G = \sqrt{\frac{P}{\mu * V}}$ μ=1.0087*10^{-3}Ns/m² Q=Av	WLR=Q/B WLR= Q/2πR DT= V/Q SOR= 12-20 m³/d/m² V= 0.849 C R $^{0.63}$ S $^{0.54}$ SOR= 24-30m³/d/m² SA=volume/SOR G =300-700s^{-1} 0.5 min to 1 min $G * t = \frac{V_s}{Q} * \sqrt{\frac{P}{\mu V}} = \frac{\sqrt{PV/\mu}}{Q}$
Ratio of length to diameter of lateral ≤ 60 Spacing of laterals= spacing of orifices= 150 to 300 mm Dia of perforations 5 to 12 mm (spacing 80 mm for 5 and 200 mm for 12mm) Total area of perforations≤ 0.5 Total c/s area of laterals Total area of perforation = 0.002 to 0.003 Total area of filter	$v_s = \frac{1}{18}\frac{g}{v}(S_s - 1) * d^2$ Value of υ=1.002X10^{-6} m²/sec $v_d = \sqrt{\left(\frac{8\beta}{f'}\right)(S_s - 1)dg}$ $f' = 0.025 - 0.03$ g=9.8m/s² $v_d = \sqrt{\frac{8\beta g(S_s - 1)d}{f'}}$	Q/A; Q/perimeter; Q/b; V/Q V= D² (0.011D+0.785H) Entire filter area Area of manifold= 1.5 to 2 times laterals Rate of filtration = 300 to 500l/hr/m² Rate of filtration = 3000-6000l/hr/m² Max. demand= 1.8 Q

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END SEM/RE-EXAM EXAMINATION -MAY / ~~JUNE~~ 2025

Total points: 100

Duration: *Total Time allotted will be 3Hr.*

Class: S.Y.B.TECH(CIVIL)_WP Sem IV Semester: IV Program: Civil

Name of the Course: **Surveying & Geomatics** Course Code : **PC-BTC403**

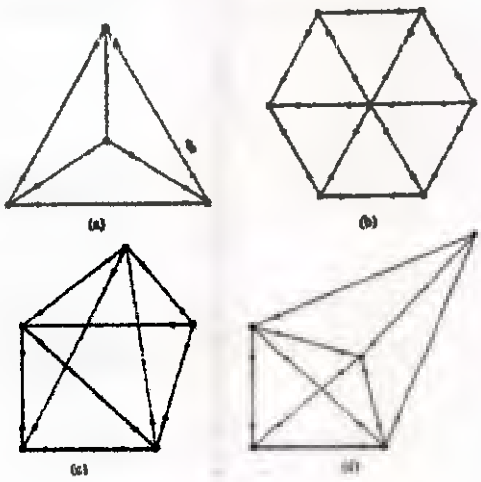
Instructions:

1. Assume suitable data if necessary and state the clearly.

28/5/25

Que. No		Points	CO	BL	Module no
1	A. Explain procedure for setting out of culverts.	10	1,2	1	7
	B. Write short note on following- 1. Boning rods 2. Sight rails	10	1,2	1	7
2	A. In order to ascertain the elevation of the top of the (Q) of the signal on him observations were made from 2 instruments stations P and R at the horizontal distance 1000 metres apart the stations P and R being in a line with Q. The angle of elevation of Q at P and R were $28^0 42'$ and $18^0 6'$ respectively. The staff readings upon the benchmark of elevation 287.28 where respectively 2.870 and 3.750. When the instrument was at P and at R the telescope being horizontal. Determine the elevation of the foot of the signal if the height of the signal above its base is 3 meters.	10	1,3	3	2
	B. Explain two plane method in detail.	10	1,3	1	2
3	A. the ground length of a line AB is 545 metres. The elevations of A and B are 500 meters and 300 meters respectively. the photo coordinates of A	10	1,4	3	4

	and B imaged as a and b respectively are as below Point / Photo coordinates: x (cm), y (cm) a: +2.65, +1.36 b: -1.92, +3.65 if ab measures as 5.112 centimetres and focal length of the camera is 20 centimetres calculate the flying height. B. An area 40 kilometre in north-South direction and 36 kilometre in east-West direction is to be photographically surveyed. For this aerial photography is to be made with the following data- Photograph size: 20 cm X 20 cm average scale of photographs: 1:15,000 average elevation of terrain: 450 metres end lap: 60% side lab: 30% ground speed of aircraft: 220 km/hr focal length of the camera lens: 30 cm Calculate the following- flying height of the aircraft, number of photographs in each flight, number of flights, total number of photographs, spacing of flight lines, ground distance between exposures, exposure interval.	10	1,4	3	4
4	A. Explain GIS data types. B. Write note on geodetic control networks	10 10	1,3 1,3	2 2	5 3
5	Write note on following- A. Elements of remote sensing B. Types of remote sensing	20	1,3	2	4
6	A. Determine the value of D-C/D for the triangulation nets shown in following figure. The	10	1,4	2	2

	arrow indicates the direction of measurements and heavy line indicates the starting line.  B. In a triangulation survey the attitudes of 2 proposed stations A and B 100 kilometre apart are respectively 425 metres and 750 metres. The intervening ground situated at C, 60 kilometre from A, has an elevation of 435 metres. Ascertain if A and B are intervisible and if necessary find by how much B should be raised so that the line of sight must now nowhere be less than 3m above the surface of the ground. Take R is equal to 6400 kilometres and m is equal to 0.07	10	1,2	3	2
7	A. A circular curve is to be set out to connect two straights with a deflection angle of 30° and a radius of 300 meters. Pegs are to be placed at 20-meter intervals. Calculate the tangential angles and prepare the setting out data using Rankine's method.	10	1,2	2	1
	B. Explain Field Procedure for Measuring Ordinates by Long Chord Method.	10	1,2	2	1

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END SEM/RE-EXAM/EXAMINATION -MAY / JUNE 2025

Working Professional

Program: Civil Engineering **Duration: 3 hours**

Course Code: MI-BT031 **Maximum Points: 100**

Course Name: Introduction to Sust. & Sust. Development **Semester: IV**

Notes:

1. **Question no.1 is compulsory**
2. **Attempt any FOUR Questions from remaining SIX questions.**
3. **Start every MAIN question from a new page.**
4. **Answers should be accompanied with proper figures and tables, wherever necessary.**

Q.no.	Question	Points	CO	BL
1	Answer the following: (Any 5) – 4 points each a) What is sustainable development? Explain briefly how the Brundtland Report and Rio Summit contributed to this idea. b) What are greenhouse gases? What is meant by Global Warming Potential (GWP)? c) How are the Kyoto Protocol and Paris Agreement different from each other? d) What are the main difficulties faced when applying eco-development ideas? Explain. e) How do the Sustainable Development Goals (SDGs) help countries work together for sustainability? Give one example of how a specific SDG can be applied in a country. f) What is a net zero energy building? How is it different from a green building?	20	1	1,2
2	a) How do democratic systems like voting and local governance support social sustainability? Give examples. (10) b) Explain the terms: (2.5 points each) i. Embodied Carbon ii. Global Warming Potential (GWP) iii. Greenhouse Gases iv. CO_2 Equivalent (CO_2e)	20	1,2,3	2,3

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END SEM/RE-EXAM EXAMINATION -MAY / JUNE 2025

Working Professional

3	a) Name different tools used to measure sustainability. Explain any three tools you think are the most useful and why. (10) b) How effective is integrated resource management in achieving long-term sustainability? Explain with reasons. (10)	20	1,2,3	2,3
4	a) Explain the concept of green buildings using a case study based on GRIHA, IGBC, or LEED rating systems. (10) b) Why are international environmental agreements important for economic sustainability? Give examples. (10)	20	2,3,4	2, 3
5	a) Explain what is Life Cycle Assessment (LCA) and how does it support sustainable thinking and decisions. (10) b) Describe some global action plans for sustainable development and explain their goals and main tools. (10).	20	2,3	2,3
6	a) Discuss the role of developed countries in promoting sustainable development through their policies. Give examples. (10) b) Describe a real case of wastewater reuse and recycling. Show the flow process and discuss how effective the system is. (10)	20	3,4	1,2
7	Write a report on a case study related to material, food, water, energy, or building sustainability. Identify the key practices used and suggest ways they can be improved or applied in other places. OR Choose one of the following real-life topics and analyze the interconnected challenges of social and economic sustainability in today's world: 1. Urban slum development and social cohesion 2. Industrial expansion vs. environmental sustainability 3. Renewable energy investments and economic trade-offs 4. Gender-inclusive economic policies 5. International trade agreements and poverty reduction	20	3,4	2,3

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Working Professional

SET I

~~RE~~/END SEMESTER EXAM – MAY/~~JUNE~~ 2025

- May 2025

Program: Civil Engineering **Duration: 3hr**

Course Code: PC-BTC404 **Maximum Points: 100**

Course Name: Hydraulic Engineering **Semester: IV**

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
1 a	Derive the dimensions of Discharge, Momentum, Energy, Power and Pressure.	5	CO3	BL3	1
1 b	Discuss the classification of flow in the open channel.	8	CO3	BL2	6
1c	In pipe of 400 mm diameter and 800m length an oil of specific gravity 0.8 is flowing at the rate of 0.45 m^3/sec. Find Head lost due to friction and Power required to maintain the flow. Take kinematic viscosity of oil as 0.3 stokes.	7	CO1	BL2	2
2a	Explain the various dimensionless numbers in detail.	6	CO3	BL2	1
2 b	A 8 m wide channel conveys 15 m^3/sec of water at a depth of 1.2 m. Calculate (i) Specific energy of flowing water. (ii) Critical depth, critical velocity and minimum specific energy. (iii) Froude number and state whether flow is subcritical or supercritical.	8	CO3	BL2	6
2 c	At a sudden enlargement of a water main from 240mm to 480 mm diameter the hydraulic gradient rises by 10 mm calculate the rate of flow.	6	CO1	BL2	2

3 a	A sluice gate discharges water into horizontal rectangular channel with a velocity of 10 m/s and depth of flow of 1 m. Determine the depth of flow of water after the jump and consequent loss in total head.	6	CO3	BL1	6
3 b	Discuss the major and minor losses in flow through pipe along with their expressions.	8	CO1	BL1	2
3 c	Explain critical, subcritical flow and supercritical flow in an open channel flow.	6	CO3	BL1	6
4 a	A centrifugal pump rotating at 1500 r.p.m. delivers 0.2 m^3 /s at a head of 15 m. Calculate the specific speed of the pump and the power input. Assume overall efficiency of the pump as 0.68. If this pump were to operate at 900 r.p.m. what would be the head, discharge and power required for homologous conditions? Assume overall efficiency remains unchanged at new r.p.m.	6	CO2	BL2	1,5
4 b	State Buckingham's π theorem and explain Buckingham's π method of dimensional analysis.	6	CO1	BL1	1
4 c	Explain the specific energy, specific force diagram and discuss the importance of critical depth in channel section.	8	CO3	BL1	6
5 a	What is meant by centrifugal pumps? Discuss the working principle and applications and Characteristics of a Centrifugal pumps.	8	CO1	BL1	5
5 b	A horizontal pipe 150mm in diameter is joined by sudden enlargement to a 225mm diameter. Water flowing through it at the rate of 0.05m3/sec. Find: Loss of head due to abrupt expansion. Pressure difference in the two pipes and Change in pressure if the change of section is gradual without any loss.	8	CO1	BL2	2
5 c	Discuss the afflux and backwater curve.	4	CO1	BL1	6
6	A. Derive an expression for force exerted by jet on a fixed stationary vertical plate. B. What do you mean by Impulse-Momentum Principle? Find the force exerted by a jet of water of diameter 70 mm on a stationary flat plate, when the jet strikes the plate normally with velocity of 18 m/s. C. Derive an expression for force exerted by jet on a fixed stationary curved plate. (jet strikes at the center)	05+05 05+05	CO2	BL3	3

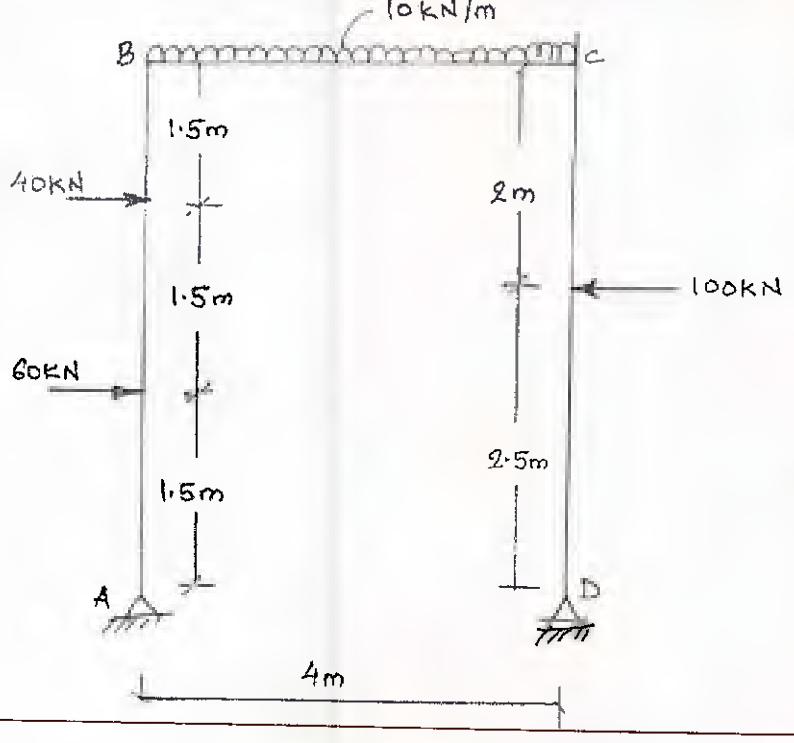
	D. Write a short note on Jet Propulsion of ships				
7	A. Discuss the specifications, components, & working of Kaplan Turbine with neat sketch. B. What is the surge tank? Discuss classifications of hydraulic turbines. C. Explain in detail about the working Principle of Pelton wheel.	10+ 05+05	CO2	BL2	4

END SEM/~~RE-EXAM~~ EXAMINATION MAY / ~~JUNE~~ 2025

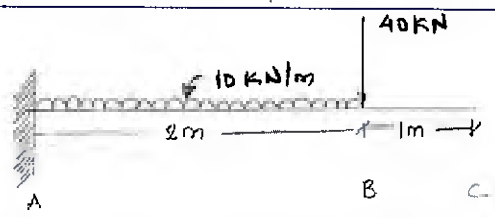
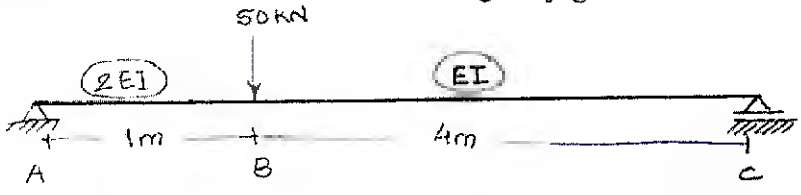
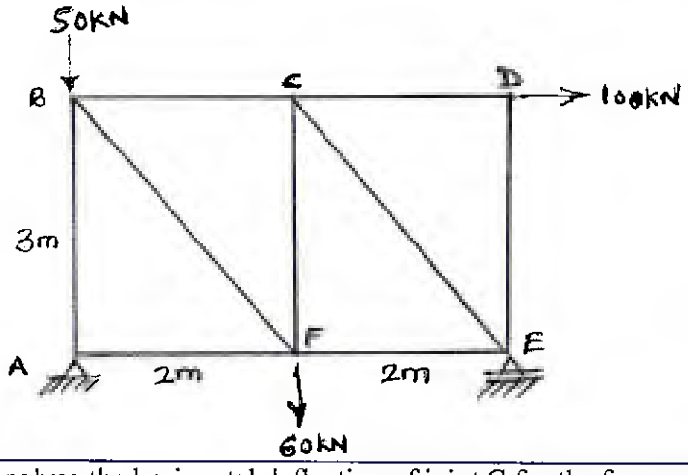
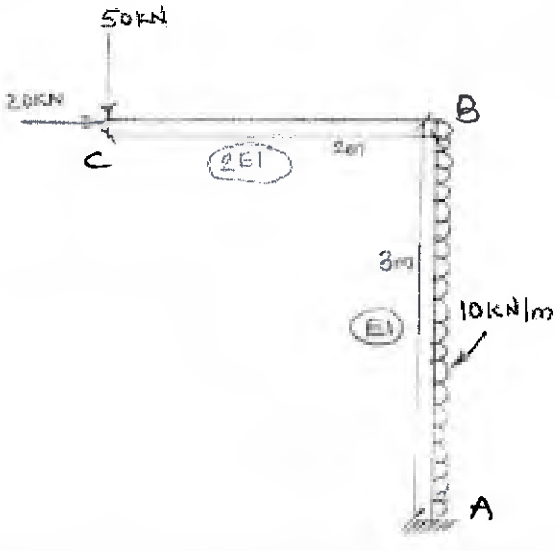
Program: S.Y.BTech Civil Sem IV
Course Code: PC-BTC402
Course Name: Structural Mechanics
Notes: Attempt any 5 questions out of 7

Duration: 3 hours
Maximum Points: 100
Semester: IV

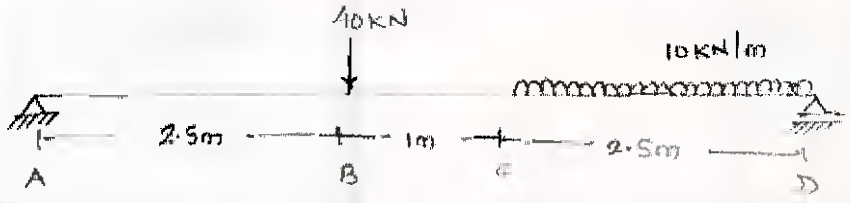
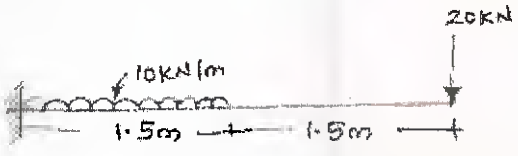
19/5/25

Q.No.	Questions	Points	CO	BL	Module No.
1.a)	Evaluate the maximum and minimum stress developed at the base for a hollow circular chimney, of internal diameter 2 m, thickness 500mm and height 20 m,. The wind pressure is 3 kN/m^2 on the projected area. The density of masonry may be taken as 20 kN/m^3	10	1	4	1
1.b)	A simply supported beam of span 5m, is subjected to a point load of 90 kN at midspan at an angle of 30° with Y axis (clockwise). The cross section of the beam is a rectangle of 250x400mm. Find the maximum bending moment and state its location. Find the location of the neutral axis and show it in the cross section. Find the bending stresses at all four corners of the beam.	10	1	3	2
2.	For the frame shown below, obtain the support reactions and draw the shear force diagram, bending moment diagram and axial force diagram 	20	2	3	3
3.a)	Find the slope and vertical deflection at C for the beam shown below using **moment area method**	10	3	3	5

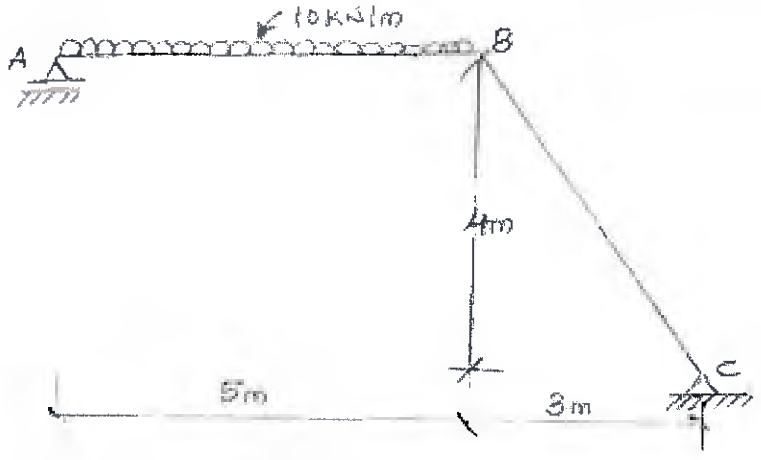
END SEM/~~RE-EXAM~~ EXAMINATION MAY / ~~JUNE~~ 2025

					
3.b)	Find the slope and vertical deflection at B and the slope at both supports for the beam shown below using **conjugate beam method** 	10	3	3	5
4.a)	For the pin-jointed frame shown, find the horizontal deflection at D 	10	3	3	6
4.b)	Analyse the horizontal deflection of joint C for the frame shown below 	10	3	3	6

END SEM/~~RE-EXAM~~ EXAMINATION MAY / ~~JUNE~~ 2025

5.a)	Analyse the slope and deflection at point B and C using **Macaulay's method** 	10	3	3	5
5.b)	Calculate the crippling loads given by Euler's and Rankine's formulae for a steel column 4.0 m long with one end fixed and the other end hinged (pinned). The cross section of the column is an I section with the following dimensions. Top and bottom Flange width = 250 mm, Top and bottom Flange thickness = 18mm, Depth of web = 350 mm, Thickness of web = 25 mm. Take E = $2x10^5$ N/mm^2, σ_c= 350 MPa and Rankine's constant = 1/7000.	10	4	3	7
6.a)	Locate the principal axes and find the principal moments of inertia for the angle section of thickness 12 mm and length of both legs as 130mm each.	10	1	3	2
6.b)	Find the strain energy stored due to bending moment only for the beam shown below 	05	2	4	3
6.c)	State and explain Maxwell's reciprocal theorem	05	2	2	4
7.a)	Write the expression for the strain energy stored in a member due to a) Bending Moment b) Shear force c) Axial force Explain the terms involved in each expression	03	2	2	4
7.b)	A cantilever beam of a certain cross section and material undergoes 8mm deflection for a 4m span when loaded by a UDL of 15kN/m. If the same cross section is used as a simply supported beam of 4m span loaded by a UDL of 20kN/m, evaluate the deflection at midspan.	05	3	3	5
7.c)	Determine the support reactions and draw the SFD,BMD and SFD for member BC only	12	2	3	3

END SEM/~~RE-EXAM~~ EXAMINATION MAY / ~~JUNE~~ 2025



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~~RE~~/END SEMESTER EXAMINATION MAY/~~JUNE~~ 2025

Program: B.Tech. Working Professional Civil Sem IV **Duration: 3 hr**

Course Code: PC-BTC405 **Maximum Points: 100**

Course Name: Transportation Engineering **Semester: IV**

Notes:

21/5/25

i. **All questions are compulsory**

ii. **Figure on right indicate maximum marks for the given question, course outcome attained and module no. of questions.**

Q. No.	Questions	Points	CO	BL	Module No.
Q1					
(a)	Describe the term Infrastructure and explain its classification	4	1	L2	1
(b)	From the case study of Mumbai metro line-3, List the causes of delays and learning to prevent such delays in future projects	6	1	L3	1
(c)	Elaborate in detail the objectives of Transportation system and their impact on the society	10	1	L3	1
Q.2					
(a)	Describe the important criteria of affecting selection of air port site	6	2	L2	2
(b)	Elaborate the necessary data for Runway orientation	7	2	L3	2
(c)	Explain the objectives and steps in airport planning	7	2	L3	2
Q.3					
(a)	Write a note on wind rose diagram and explain its importance in airport design	4	1	L3	3
(b)	Describe aircraft characteristics and their impact on design of an airport	6	3	L2	3
(c)	How would you plan and co-ordinate multimodal transport facilities for Indian conditions	10	3	L4	3
Q.4					
(a)	Describe the role of Railways in the country's development	4	4	L2	4
(b)	Compare the types of railway gauges and suggest most appropriate type for connecting two cities by a rail line in India.	6	4	L4	4
(c)	Explain the types of wear of rails and suggest measures to reduce the same.	10	4	L3	4

Bharatiya Vidya Bhavan's

SARDAR PATEL COLLEGE OF ENGINEERING

(Government Aided Autonomous Institute)

Munshi Nagar, Andheri (W) Mumbai – 400058

RE/END SEMESTER EXAMINATION MAY/JUNE 2025

Q.5					
(a)	Explain the significance of geometric design of a railway track	5	5	L2	5
(b)	Describe the various types of gradients in railway alignment with a neat sketch	7	5	L3	5
(c)	Draw a neat sketch of a Turnout and explain its components	8	5	L3	5
Q.6					
(a)	For a Broad gauge line with a ruling gradient of 1 in 200, find the steepest gradient on a 2° curve	5	5	L4	5
(b)	Explain the effect of size of an aircraft on the design of an airport	7	2	L3	2
(c)	Write a note on Yards and explain its types	8	4	L3	4
Q.7					
(a)	Suggest measures which can be taken to reduce wearing of railway tracks	5	4	L4	4
(b)	Draw a neat layout of a small airport with a single runway, label each component.	5	2	L3	2
(c)	Summarize Niti aayog's action plan for economic development of the country	10	1	L4	1

Bharatiya Vidya Bhavan's

SARDAR PATEL COLLEGE OF ENGINEERING

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End Semester Examination/ ~~Re-Examination~~ – ~~May/June~~ 2025

Program: S.Y.B.Tech (Civil)_Working Professionals **Duration: 3 Hours**

Course Code: BS-BTC401 **Maximum Points: 100**

Course Name: Probability Statistics and OR **Semester: IV**

Note:

1. **Attempt Any Five Questions**
2. **Answers to the sub questions should be grouped together**

		Questions	Points	CO	BL	Module
1	a	Out of 800 families with 4 children each, how many families would be expected to have (i) 2 boys and 2 girls (ii) at least one girl (iii) at most two boys? Assume equal probability for boys and girls.	6	CO2	BL5	2
	b	The equations of the lines of regression are $3x+2y=26$ and $6x+y=31$ Find $\bar{x}, \bar{y}$ and r. Also, find the variance of y if the variance of x is 25.	6	CO1	BL5	1
	c	A random variable X has the following probability distribution: X: 1 | 2 | 3 | 4 | 5 | 6 | 7 P(X): k | 2k | 2k | 3k | k^2 | $2k^2$ | $7k^2+k$ Determine (i) k (ii) $P(3<X\leq 6)$ (iii) $P(X<5)$ (iii) *Mean*	8	CO1	BL3	2
2	a	The mean height and the S.D of the height of eight randomly chosen soldiers are 166.9 cm and 8.29 cm respectively. The corresponding values of six randomly chosen sailors are 170.3 cm and 8.50 cm respectively. Based on this data, can we conclude that soldiers are, in general, shorter than sailors?	6	CO3	BL5	5
	b	A sample of 25 pairs of values x and y gave following results $\sum x=127$, $\sum y=100$, $\sum x^2=760$, $\sum y^2-449$, $\sum xy=500$. Later on it was found that two pairs of values were taken as	6	CO1	BL2	1

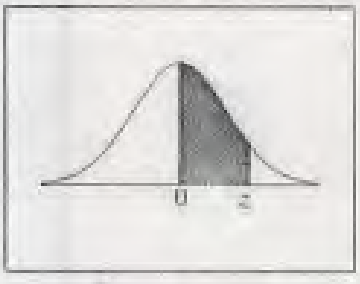
		$(8,14)$ and $(8,6)$ instead of correct values $(8,12)$ and $(6,8)$. Find correct correlation coefficient between x and y.				
	c	Given the following information about the marks of 60 students Mathematics: Mean 80, Standard Deviation 15 Physics: Mean 50, Standard Deviation 10 Correlation coefficient = 0.3 Estimate (i) The marks of a student in mathematics who scored 60 in physics (ii) The marks of a student in physics who scored 65 in mathematics.	8	CO1	BL3	1
3	a	An automatic machine makes paper clip from coils of wire. On an average 1 in 400 clips is defective. If the paperclips are packed in boxes of 100, what is the probability that any given box of clips will contain (i) no defective (ii) one or more defective (iii) less than two defective clips?	6	CO1	BL4	2
	b	A potential buyer of light bulbs bought 50 bulbs each of 2 brands. Upon testing the bulbs, he found that brand A had a mean life of 1282 hours with S.D of 80 hours, brand B had a mean life of 1208 hours with S.D of 94 hours. Can the buyer be quite certain that the mean of the two brands differ?	6	CO3	BL5	4
	c	Find Mean and Variance of Binomial Distribution	8	CO1	BL5	2
4	a	Compute spearman's rank correlation coefficient for the following data X: 36, 56, 20, 42, 33, 44, 50, 15, 60 Y: 50, 35, 70, 58, 75, 60, 45, 80, 38	6	CO1	BL5	1

End Semester Examination/ ~~Re-Examination~~ – May/~~June~~ 2025

	b	An aptitude test for selecting officers in a bank is conducted on 1000 candidates. The average score is 42 and standard deviation of score is 24. Assuming normal distribution for the scores, find (i) The numbers of candidates whose scores exceed 60. (ii) The numbers of candidates whose score lie between 30 and 60.	6	CO2	BL3	3
	c	Find constant k such that the function $f(x)=\begin{cases}k(1-x^2), & \text{if } 0\le x\le 1\\ 0 & \text{elsewhere}\end{cases}$ is a density function. Also find $P(0.1\le X\le 0.2)$ and $P(X\ge 0.5)$	8	CO1	BL3	3
5	a	Certain pesticide is packed into bags by a machine. A random sample of 10 bags is drawn and their contents are found to weigh (in kg) as follows 50, 49, 52, 44, 45, 48, 46, 45, 49, 45 Test if average packing can be taken to be 50 kg at 5% LOS.	6	CO3	BL4,5	5
	b	With usual notation, find p of binomial distribution if $n=6,\ 9P(X=4)=P(X=2)$	6	CO2	BL4	2
	c	Calculate the correlation coefficient between x and y from the following data $n=10$, $\sum x=140$, $\sum y=150$, $\sum(x-10)^2=180$, $\sum(y-15)^2=215$, $\sum(x-10)(y-15)=60$.	8	CO1	BL2, BL4	1
6	a	The coefficient of rank correlation of marks obtained by 10 students in Physics and Chemistry was found 0.5. It was later discovered that the difference of ranks in the two subjects obtained by one of the students was wrongly taken as 3 instead of 7, find the correct coefficient of rank correlation.	6	CO1	BL5	1
	b	A machine is set to produce metal plates of thickness 1.5 cm with standard deviation 0.2 cm. A sample of 100 plates produced by the machine gave an average thickness of 1.2 cm. Is the machine fulfilling the purpose?	6	CO3	BL3	4

	c	In a certain factory producing certain articles the probability that an article is defective is $1/500$. The articles are supplied in packets of 20. Find approximately the number of packets containing (i) no defective, (ii) one defective, (iii) two defective articles in a consignment of 20000 packets.	8	CO2	BL3, BL5	2
7	a	Two random sample gave the following data Sample No | Size | Mean | Variance 1 | 1500 | 67.42 | 2.58 2. | 2000 | 67.25 | 2.5 Is the difference between standard deviation significant?	6	CO3	BL2, BL3	4
	b	The marks obtained by students in a certain examination follow a normal distribution with mean 45 and standard deviation 10. If 1000 students appeared at an examination, calculate the number of students scoring (i) less than 40 marks (ii) more than 60 marks.	6	CO2	BL5	3
	c	If x and y are two correlated variables with the same standard deviation and having coefficient of correlation r. Show that the correlation coefficient between x and $x+y$ is $\sqrt{\frac{1+r}{2}}$.	8	CO1	BL1, BL3	

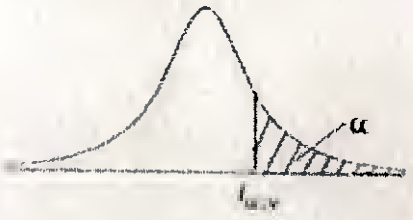
Standard Normal Distribution Table



z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
0.0	.0000	.0040	.0080	.0120	.0160	.0199	.0239	.0279	.0319	.0359
0.1	.0398	.0438	.0478	.0517	.0557	.0596	.0636	.0675	.0714	.0753
0.2	.0793	.0832	.0871	.0910	.0948	.0987	.1026	.1064	.1103	.1141
0.3	.1179	.1217	.1255	.1293	.1331	.1368	.1406	.1443	.1480	.1517
0.4	.1554	.1591	.1628	.1664	.1700	.1736	.1772	.1808	.1844	.1879
0.5	.1915	.1950	.1985	.2019	.2054	.2088	.2123	.2157	.2190	.2224
0.6	.2257	.2291	.2324	.2357	.2389	.2422	.2454	.2486	.2517	.2549
0.7	.2580	.2611	.2642	.2673	.2704	.2734	.2764	.2794	.2823	.2852
0.8	.2881	.2910	.2939	.2967	.2995	.3023	.3051	.3078	.3106	.3133
0.9	.3159	.3186	.3212	.3238	.3264	.3289	.3315	.3340	.3365	.3389
1.0	.3413	.3438	.3461	.3485	.3508	.3531	.3554	.3577	.3599	.3621
1.1	.3643	.3665	.3686	.3708	.3729	.3749	.3770	.3790	.3810	.3830
1.2	.3849	.3869	.3888	.3907	.3925	.3944	.3962	.3980	.3997	.4015
1.3	.4032	.4049	.4066	.4082	.4099	.4115	.4131	.4147	.4162	.4177
1.4	.4192	.4207	.4222	.4236	.4251	.4265	.4279	.4292	.4306	.4319
1.5	.4332	.4345	.4357	.4370	.4382	.4394	.4406	.4418	.4429	.4441
1.6	.4452	.4463	.4474	.4484	.4495	.4505	.4515	.4525	.4535	.4545
1.7	.4554	.4564	.4573	.4582	.4591	.4599	.4608	.4616	.4625	.4633
1.8	.4641	.4649	.4656	.4664	.4671	.4678	.4686	.4693	.4699	.4706
1.9	.4713	.4719	.4726	.4732	.4738	.4744	.4750	.4756	.4761	.4767
2.0	.4772	.4778	.4783	.4788	.4793	.4798	.4803	.4808	.4812	.4817
2.1	.4821	.4826	.4830	.4834	.4838	.4842	.4846	.4850	.4854	.4857
2.2	.4861	.4864	.4868	.4871	.4875	.4878	.4881	.4884	.4887	.4890
2.3	.4893	.4896	.4898	.4901	.4904	.4906	.4909	.4911	.4913	.4916
2.4	.4918	.4920	.4922	.4925	.4927	.4929	.4931	.4932	.4934	.4936
2.5	.4938	.4940	.4941	.4943	.4945	.4946	.4948	.4949	.4951	.4952
2.6	.4953	.4955	.4956	.4957	.4959	.4960	.4961	.4962	.4963	.4964
2.7	.4965	.4966	.4967	.4968	.4969	.4970	.4971	.4972	.4973	.4974
2.8	.4974	.4975	.4976	.4977	.4977	.4978	.4979	.4979	.4980	.4981
2.9	.4981	.4982	.4982	.4983	.4984	.4984	.4985	.4985	.4986	.4986
3.0	.4987	.4987	.4987	.4988	.4988	.4989	.4989	.4989	.4990	.4990
3.1	.4990	.4991	.4991	.4991	.4992	.4992	.4992	.4992	.4993	.4993
3.2	.4993	.4993	.4994	.4994	.4994	.4994	.4994	.4995	.4995	.4995
3.3	.4995	.4995	.4995	.4996	.4996	.4996	.4996	.4996	.4996	.4997
3.4	.4997	.4997	.4997	.4997	.4997	.4997	.4997	.4997	.4997	.4998
3.5	.4998	.4998	.4998	.4998	.4998	.4998	.4998	.4998	.4998	.4998

Oxford Cardinal Typeset with LaTeX on April 20, 2006.

Table of the Student's *t*-distribution



The table gives the values of $t_{\alpha,\nu}$ where
$\Pr(T_\nu > t_{\alpha,\nu}) = \alpha$, with ν degrees of freedom

ν \ α	0.1	0.05	0.025	0.01	0.005	0.001	0.0005
1	3.078	6.314	12.076	31.821	63.657	318.310	636.620
2	1.886	2.920	4.303	6.965	9.925	22.326	31.598
3	1.638	2.353	3.182	4.541	5.841	10.213	12.924
4	1.533	2.132	2.776	3.747	4.604	7.173	8.610
5	1.476	2.015	2.571	3.365	4.032	5.893	6.869
6	1.440	1.943	2.447	3.143	3.707	5.208	5.959
7	1.415	1.895	2.365	2.998	3.499	4.785	5.408
8	1.397	1.860	2.306	2.896	3.355	4.501	5.041
9	1.383	1.833	2.262	2.821	3.250	4.297	4.781
10	1.372	1.812	2.228	2.764	3.169	4.144	4.587
11	1.363	1.796	2.201	2.718	3.106	4.025	4.437
12	1.356	1.782	2.179	2.681	3.055	3.930	4.318
13	1.350	1.771	2.160	2.650	3.012	3.852	4.221
14	1.345	1.761	2.145	2.624	2.977	3.787	4.140
15	1.341	1.753	2.131	2.602	2.947	3.733	4.073
16	1.337	1.746	2.120	2.583	2.921	3.686	4.015
17	1.333	1.740	2.110	2.567	2.898	3.646	3.965
18	1.330	1.734	2.101	2.552	2.878	3.610	3.922
19	1.328	1.729	2.093	2.539	2.861	3.579	3.883
20	1.325	1.725	2.086	2.528	2.845	3.552	3.850
21	1.323	1.721	2.080	2.518	2.831	3.527	3.819
22	1.321	1.717	2.074	2.508	2.819	3.505	3.792
23	1.319	1.714	2.069	2.500	2.807	3.485	3.767
24	1.318	1.711	2.064	2.492	2.797	3.467	3.745
25	1.316	1.708	2.060	2.485	2.787	3.450	3.725
26	1.315	1.706	2.056	2.479	2.779	3.435	3.707
27	1.314	1.703	2.052	2.473	2.771	3.421	3.690
28	1.313	1.701	2.048	2.467	2.763	3.408	3.674
29	1.311	1.699	2.045	2.462	2.756	3.396	3.659
30	1.310	1.697	2.042	2.457	2.750	3.385	3.646
40	1.303	1.684	2.021	2.423	2.704	3.307	3.551
60	1.296	1.671	2.000	2.390	2.660	3.232	3.460
120	1.289	1.658	1.980	2.358	2.617	3.160	3.373
∞	1.282	1.645	1.960	2.326	2.576	3.090	3.291

Bharatiya Vidya Bhavan's

Sardar Patel College of Engineering

(A Government Aided Autonomous Institute)

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~~END SEM~~/RE-EXAM EXAMINATION -~~MAY~~ / JUNE 2025

Total points: 100 S.Y. (CC) Sem IV

Duration: *Total Time allotted will be 3Hr.*

Class B.TECH(CIVIL)_WP. Semester: IV Program: Civil

Name of the Course: **Surveying & Geomatics** Course Code : **PC-BTC403**

Instructions:

1. Assume suitable data if necessary and state the clearly.

11/7/25

Que. No		Points	CO	BL	Module no
1	A. Explain the procedure for surface surveys and tunnel alignments in tunnel survey.	10	1,3	2	7
	B. Explain methods for location of central points of piers in case of setting out a bridge.	10	1,2	2	7
2	A. The top (Q) of a chimney was sighted from 2 stations P and R at very different levels, the stations P and R being in a line with the top of the chimney. The angle of elevation from P to the top of chimney was $38^0 21'$ and that from R to the top of chimney was $21^0 18'$. The angle of elevation from R to a vane 2 metre above the foot of the staff held at P was $15^0 11'$ the heights of instrument at P and R where 1.87 meters and 1.64 metres respectively. The horizontal distance between P and R was 127 metre and the reduced level of R was 112.78 metres find the reduced level of the top of the chimney and horizontal distance from the P to the chimney.	10	1,4	2	2
	B. Derive the equations to calculate horizontal distance between 2 station and reduce level of a point when the base of the object is inaccessible, and instrument stations are in the same vertical plane as the elevated object.	10	1,2	3	2

3	A. the 2 points A and B which appear in a vertical photograph taken from a camera having focal length of 220 mm and from altitude of 2800 meters have their elevations as 400 meters and 600 meters respectively. Their corrected photo coordinates are as under <table><tr><td>Point</td><td colspan="2">Photo coordinates</td></tr><tr><td></td><td>x (mm)</td><td>y (mm)</td></tr><tr><td>a</td><td>+23.8</td><td>+16.4</td></tr><tr><td>b</td><td>-13.6</td><td>-29.7</td></tr></table> determine the length of the ground line AB.	10	1,3	3	4
	B. An area 40 kilometre in north-South direction and 36 kilometre in east-West direction is to be photographically surveyed. For this aerial photography is to be made with the following data- <table><tr><td>Photograph size</td><td>25 cm X 25 cm</td></tr><tr><td>average scale of photographs</td><td>1:15,000</td></tr><tr><td>average elevation of terrain</td><td>550 metres</td></tr><tr><td>end lap</td><td>60%</td></tr><tr><td>side lab</td><td>30%</td></tr><tr><td>ground speed of aircraft</td><td>200 km/hr</td></tr><tr><td>focal length of the camera lens</td><td>35 cm</td></tr></table> Calculate the following- flying height of the aircraft, number of photographs in each flight, number of flights, total number of photographs, spacing of flight lines, ground distance between exposures, exposure interval.	10	1,4	3	4
4	A. Explain Vector and raster datasets in GIS. B. Give difference between topographic surveying and geodetic surveying.	10 05	1,3 1,2	2 1	5 3

	C. What are GPS applications in surveying and geomatics.	05	2	2	6
5	Write note on following- A. Components of remote sensing B. Principles of remote sensing	20	2,4	2	4
6	A. Explain classification of signals with figures.	10	1,2	2	2
	B. There are 2 stations P and Q at elevations of 200 meters and 995 meters respectively. The distance of Q from P is 105 kilometres. If the elevation of peak M at a distance of 38 kilometres from P is 301 meters determine whether Q is visible from P or not. If not what would be the height of scaffolding required at cube so that Q becomes visible from P?	10	3	3	2
7	A. Two tangents AB and BC intersect at a point B at 155.5 m chainage. Let us calculate all the necessary data for setting out a circular curve of 300 m radius and deflection angle 20° by the method of offsets from the long chord.	10	1,3	3	1
	B. Explain field procedure for Rankines method.	10	1,3	2	1

~~END SEM~~/RE-EXAM EXAMINATION ~~MAY~~/ JUNE 2025

Program: S.Y.BTech Civil Sem IV

Course Code: PC-BTC402

Course Name: Structural Mechanics

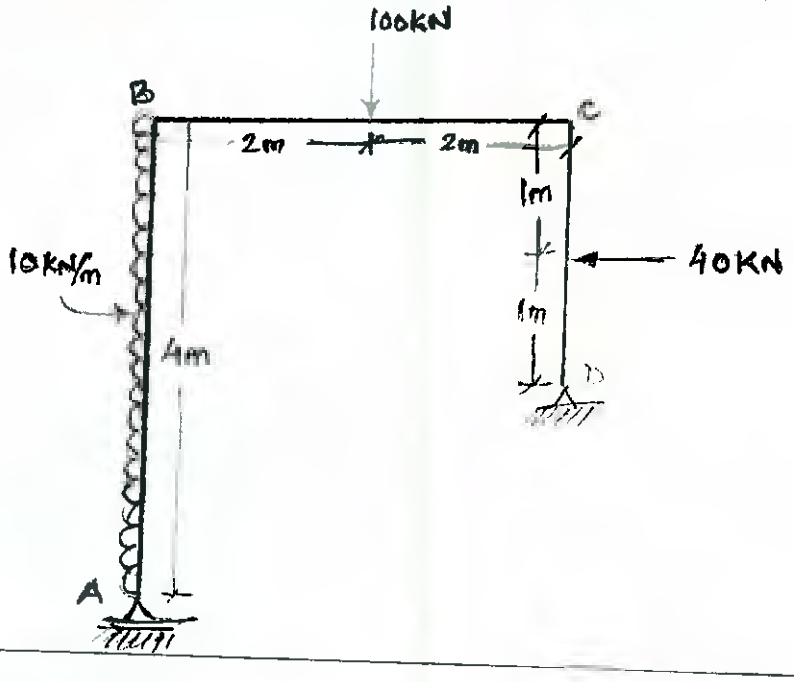
Notes: Attempt any 5 questions out of 7

Duration: 3 hours

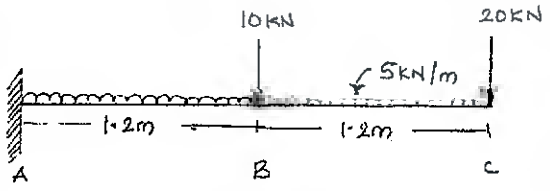
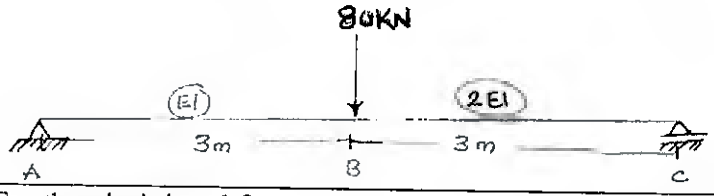
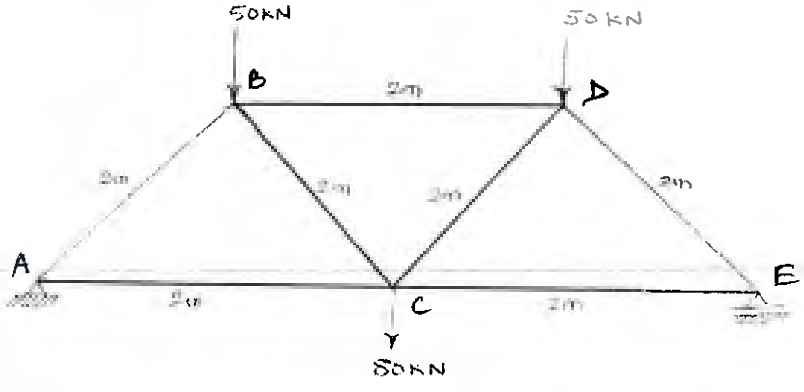
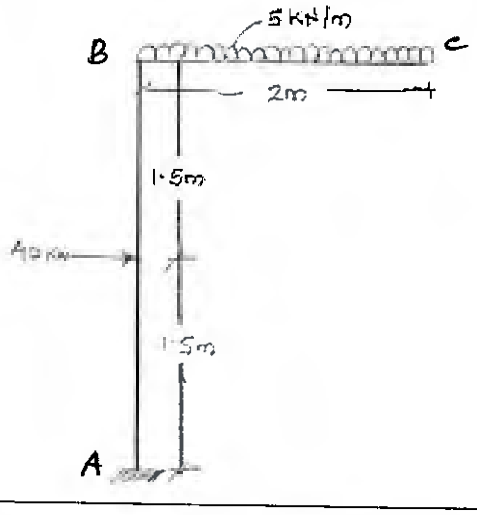
Maximum Points: 100

Semester: IV

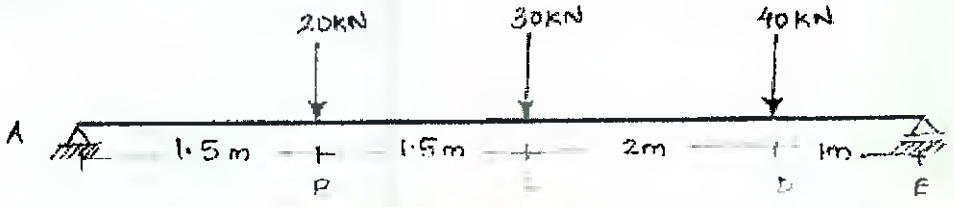
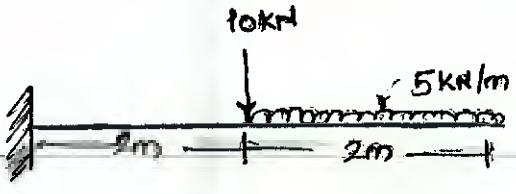
25/6/25

Q.No.	Questions	Points	CO	BL
1.a)	A pier of 3 m × 4 m supports a vertical load of 80 kN with 1m eccentricity along positive X axis and 0.5m eccentricity along positive Y axis (a) Find the stresses developed at each corner of the pier. (b) What additional load should be placed at the centre of the pier, so that there is no tension anywhere in the pier section ? (c) What are the stresses at the corners with the additional load in the centre?	10	1	4
1.b)	A cantilever beam of span 3m, is subjected to a point load of 40 kN at an angle of 30° with Y axis (clockwise). The cross section of the beam is a rectangle of 150x300mm. Find the maximum bending moment and state its location. Find the location of the neutral axis and show it in the cross section. Find the bending stresses at all four corners of the beam.	10	1	3
2.	For the frame shown below, obtain the support reactions and draw the shear force diagram, bending moment diagram and axial force diagram 	20	2	3

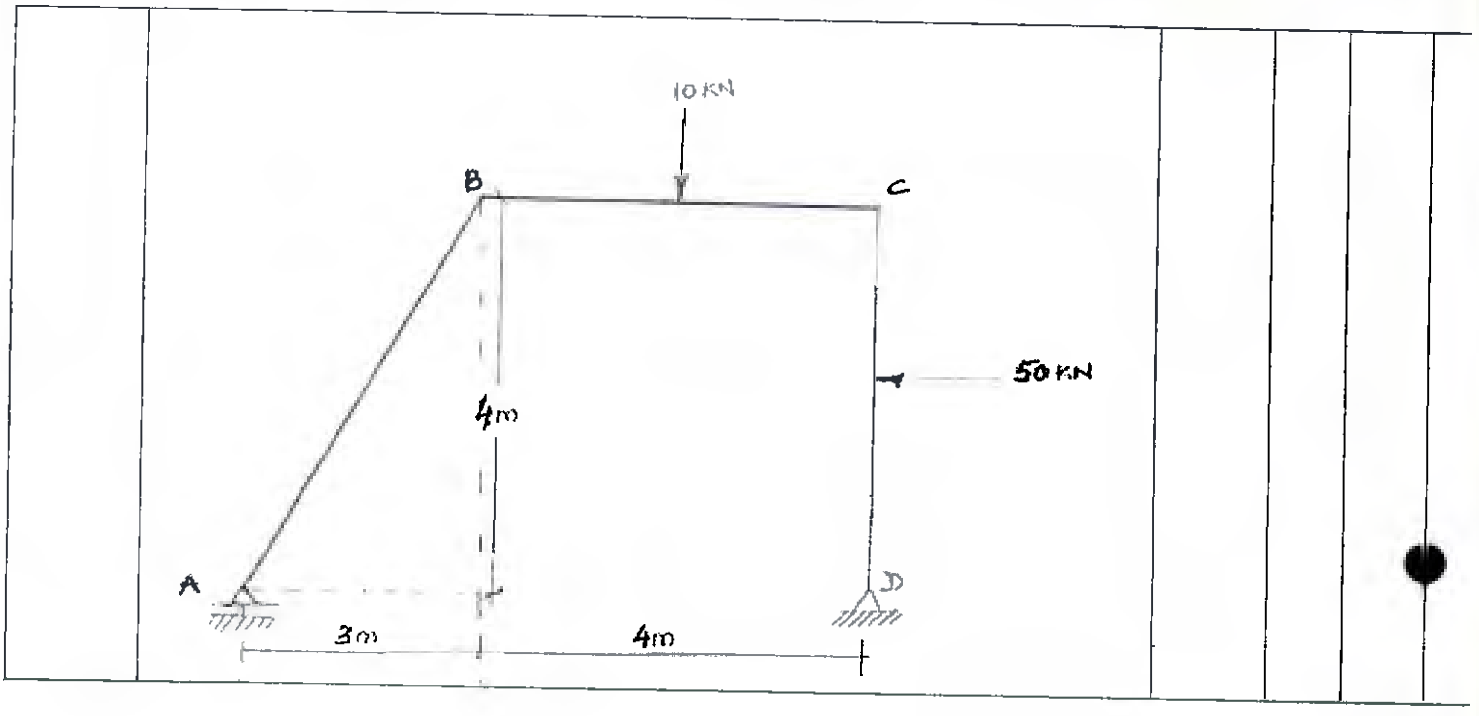
~~END SEM~~/RE-EXAM EXAMINATION ~~MAY~~/ JUNE 2025

3.a)	Find the slope and vertical deflection at C for the beam shown below using **moment area method** 	10	3	3
3.b)	Find the slope and vertical deflection at B, slope at both supports for the beam shown below using **conjugate beam method** 	10	3	3
4.a)	For the pin-jointed frame shown, find the vertical deflection at C 	10	3	3
4.b)	Analyse the deflection of vertical joint C for the frame shown below 	10	3	3

~~END SEM~~/RE-EXAM EXAMINATION ~~MAY~~ / JUNE 2025

5.a)	Analyse the slope and deflection at points B and C using **Macaulay's method** 	10	3	3	
5.b)	Calculate the crippling loads given by Euler's and Rankine's formulae for a steel column 3.0 m long with one end fixed and the other end hinged (pinned). The cross section of the column is a symmetrical box section with the following dimensions. Top and bottom Flange width = 220 mm, Top and bottom Flange thickness = 20mm, Depth of webs = 350 mm, Thickness of webs = 25 mm. Take E = $2x10^5$ N/mm^2, σ_c= 350 MPa and Rankine's constant = 1/7000.	10	4	3	
6.a)	Locate the principal axes and find the principal moments of inertia for the angle section of thickness 10 mm and length of both legs as 125mm each.	10	1	3	
6.b)	Find the strain energy stored due to bending moment only for the beam shown below 	05	2	4	
6.c)	State and explain Betti's Theorem	05	2	2	4
7.a)	Explain the assumptions made in Euler's theory of buckling of columns	03	2	2	7
7.b)	A simply supported beam of a certain cross section and material undergoes 5mm deflection for a 4m span when loaded by a UDL of 20kN/m. If the same cross section is used as a cantilever beam of 2m span loaded by a UDL of 10kN/m, evaluate the [redacted] deflection at free end.	05	3	3	5
7.c)	Determine the support reactions and draw the SFD,BMD and SFD for member AB only for the figure shown below	12	2	3	3

~~END SEM~~/RE-EXAM EXAMINATION ~~MAY~~ / JUNE 2025



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~~END SEM~~/RE-EXAM EXAMINATION -~~MAY /~~JUNE 2025

S.Y. Working Professional

Program: Civil Engineering Sem IV

Course Code: MI-BT031

Course Name: Introduction to Sust. & Sust. Development

Duration: 3 hours

Maximum Points: 100

Semester: IV

30/6/25

Notes:

1. **Question no.1 is compulsory**
2. **Attempt any FOUR Questions from remaining SIX questions.**
3. **Start every MAIN question from a new page.**
4. **Answers should he accompanied with proper figures and tables, wherever necessary.**

Q.no.	Question	Points	CO	BL
1	Answer the following: (Any 5) – 4 points each a) Define 'economic sustainability' and explain how are the countries categorized based on its economy. b) Explain how eco-development programmes help in protecting the environment of a country. c) Suggest how an old building can be made into a green building by improving materials and energy use. d) Define embodied carbon and embodied energy. Explain why they are important for sustainability. e) Explain what 'institutional theory' is and explain how it helps in promoting sustainable development. f) Explain the role of community involvement in improving social sustainability.	20	1	1,2
2	a) List the three flexible, market-based mechanisms under the Kyoto Protocol. Explain how each works. (10) b) Explain what is meant by a green economy and why is it important for policies related to climate change? (10)	20	1,2,3	2,3
3	a) Explain what is meant by participation of public in making environmental policies? Give reasons with examples. (10)	20	1,2,3	2,3

~~END SEM~~/RE-EXAM EXAMINATION ~~-MAY -~~/JUNE 2025

Working Professional

	b) List various tools and methods used to assess sustainability. Explain how three of them work. (10)			
4	a) Explain how social problems like poverty, gender inequality, or environmental damage makes sustainability difficult. Also explain how involvement of the local communities would help solve these problems. 10) b) Define "green building". Describe the benefits of green buildings and also, explain one major certification system like GRIHA, IGBC, or LEED. (10)	20	2,3,4	2, 3
5	a) Discuss what responsibilities developed countries have in promoting global sustainability. Support your answer using examples from international agreements. (10) b) List the common pollutants found in water and explain how can they be treated or removed. (10)	20	2,3	2,3
6	a) Describe your personal daily carbon footprint. Explain how can one calculate it, and what steps can reduce it. (10) b) Discuss how both, rural and urban development, help India move towards sustainability. (10)	20	3,4	1,2
7	Prepare a case study report on one of the following: material, food, water, energy, or building. Explain the sustainable practices used and suggest how these ideas can be improved or copied in other situations. OR Choose any one of the following real-life situations and present a detailed case study on interconnected challenges of social and economic sustainability in today's world: i. Urban slum development and social cohesion ii. Industrial expansion vs. environmental sustainability iii. Renewable energy investments and economic trade-offs iv. Gender-inclusive economic policies v. International trade agreements and poverty reduction	20	3,4	2,3

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RE/~~END SEMESTER~~ EXAMINATION ~~MAY/~~JUNE 2025

S.Y. (C2 Scheme) Sem IV

Program: B.Tech. Working Professional **Duration: 3 hr**

Course Code: PC-BTC405 **Maximum Points: 100**

Course Name: Transportation Engineering **Semester: IV**

Notes:

26/6/25

i. **Question 1 is compulsory**
ii. **Solve any four out of remaining six questions**
iii. **Figure on right indicate maximum marks for the given question, course outcome attained and module no. of questions.**

Q. No.	Questions	Points	CO	BL	Module No.
Q1					
(a)	Describe the term Social infrastructure and give its example	5	1	L2	1
(b)	From the case study of Navi Mumbai International airport, List the causes of delays and learning to prevent such delays in future projects	7	1	L3	1
(c)	Describe the effects of Infrastructure on economic growth of the nation	8	1	L3	1
Q.2					
(a)	List and explain essential components of an aircraft	6	2	L2	2
(b)	Elaborate the necessary data for Runway orientation	7	2	L3	2
(c)	Describe important criteria considered before finalizing location of an airport	7	2	L3	2
Q.3					
(a)	Explain minimum turning radius and minimum circling radius and discuss their impact on design of an airport.	7	3	L3	3
(b)	Describe aircraft characteristics and their impact on design of an airport	6	3	L2	3
(c)	How would you plan and co-ordinate multimodal transport facilities for Indian conditions	7	3	L4	3
Q.4					
(a)	With a neat sketch explain coning of wheels in railway engineering	7	4	L2	4
(b)	Compare the types of railway gauges and suggest most appropriate type for connecting two cities by a rail line in India.	6	4	L4	4

(c)	Explain the types of wear of rails and suggest measures to reduce the same.	7	4	L3	4
Q.5					
(a)	Explain the significance of geometric design of a railway track	5	5	L2	5
(b)	Describe the various types of gradients in railway alignment with a neat sketch	7	5	L3	5
(c)	Draw a neat sketch of permanent way of railway line and explain its components	8	5	L3	5
Q.6					
(a)	For a Broad gauge line with a ruling gradient of 1 in 250, find the steepest gradient on a 3° curve	5	5	L4	5
(b)	Explain any five aircraft characteristics an their impact on design of an airport.	7	2	L3	2
(c)	Describe the various track fittings and fastenings used in railways	8	4	L3	4
Q.7					
(a)	Suggest measures which can be taken to reduce wearing of railway tracks	5	4	L4	4
(b)	Draw a neat layout of an airport with two runways, label each component.	5	2	L3	2
(c)	Describe in detail the objectives of Transportation	10	1	L4	1

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Working Professional

SET II

RE/~~END~~-SEMESTER EXAM – ~~MAY~~/JUNE 2025

Program: Civil Engineering S.Y. Sem IV **Duration: 3hr**

Course Code: PC-BTC404 **Maximum Points: 100**

Course Name: Hydraulic Engineering **Semester: IV**

Instructions

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

27/6/25

Q. No.	Questions	Points	CO	BL	Mod
1 a	An open channel of most economical section, having the form of a half hexagon with horizontal bottom is required to give a maximum discharge of 20.2 m^3/s of water. The slope of the channel bottom is 1 in 2500. Taking Chezy's constant, C = 60 in Chezy's equation, determine the dimensions of the cross section.	7	CO3	BL3	6
1b	Describe the similitude and discuss the types of similarities.	6	CO3	BL2	6
1c	Two geometrically similar pumps are running at the same speed of 1000 r. p. m. One has an impeller diameter of 0.4 m and discharge of 30 lps against a head of 20 m. If the other pump gives half of this discharge rate, determine the head and the diameter of the second pump.	7	CO3	BL3	6
2 a	What do you mean by most economical channel section. Derive the conditions for most economical channel section in case of trapezoidal channel section	8	CO3	BL2	6
2 b	The diameter of a horizontal pipe which is 300 mm is suddenly enlarged to 600 mm. The rate of flow of water through this pipe is 0•4 m3 /s. If the intensity of pressure in the smaller pipe is 125 kN/m2 , determine. (i) Loss of head, due to sudden enlargement,	8	CO1	BL3	2

	(ii) (ii) Intensity of pressure in the larger pipe, and (iii) (iii) Power lost due to enlargement.				
2 c	What do you understand by model prototype relationship?	4	CO3	BL1	1
3 a	Three pipes of diameters 300 mm, 200 mm and 400 mm and lengths 450 m, 255 m and 315 m respectively are connected in series. The difference in water surface levels in two tanks is 18 m. Determine the rate of flow of water if co-efficient of friction are 0.0075, 0.0078 and 0.0072 respectively considering : (i) Minor losses also, and (ii) Neglecting minor losses	7	CO1	BL2	2
3b	Explain the specific energy, specific force diagram and discuss the importance of critical depth in channel section.	8	CO3	BL2	6
3c	Discuss the cavitation in centrifugal pump and its harmful effects.	5	CO2	BL1	5
4 a	In a rectangular channel 12 m wide and 3.6 m deep water is flowing with a velocity of 1.2 m/s. The bed slope of the channel is 1 in 4000. If flow of water through the channel is regulated in such a way that energy line is having a slope of 0.00004 find the rate of change of depth of water in the channel.	8	CO3	BL2	6
4 b	Two geometrically similar pumps are running at the same speed of 1500 r. p. m. One has an impeller diameter of 0.5 m and discharge of 40 lps against a head of 25 m. If the other pump gives half of this discharge rate, determine the head and the diameter of the second pump.	6	CO2	BL3	5
4 c	13. Differentiate open channel flow and pipe flow.	6	CO1	BL2	2,6
5	A. The impeller of centrifugal pump has an external diameter of 450mm and internal diameter of 200 mm and it runs at 1440 rpm. Assuming a constant radial flow through the impeller at 2.5m/sec and that the vane exit are set back at an angle of 25 degrees. Determine 1. Inlet vane angle 2. The angle, absolute velocity of water at exit makes with the tangent and 3. The work done per N of water.	8	CO2	BL2	5

5	B. In a rectangular channel 0.5 m width, a hydraulic jump occurs at a point where depth of water flow is 0.15 m. Froude number is 2.5. Determine: a) The specific energy b) The critical and subsequent depths c) Loss of head d) Energy dissipated.	8	CO3	BL3	6
5	C. Discuss the priming of a centrifugal pump.	4	CO2	BL1	5
6	A. Derive an expression for force exerted by jet on a fixed stationary inclined plate. B. What do you mean by Impulse-Momentum Principle? A jet of water of diameter 40 mm moving with a velocity of 30 m/s, strikes a curved fixed symmetrical plate at the center. Find the force exerted by the jet of water in the direction of the jet, if the jet is deflected through an angle of 120° at the outlet of the curved plate. C. Derive an expression for force exerted by jet on a moving vertical plate. D. Write a short note on Jet Propulsion of ships	05+05 05+05	CO2	BL2	3
7	A. Discuss the specifications, components, & working of Francis Turbine with neat sketch. B. What is the draft tube? Distinguish between Impulse turbines and reaction turbine. C. Discuss the various design rules governing in hydraulic turbines.	10+ 05+05	CO3	BL2	3

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~~Endsem~~/Reexam Paper R-23
~~May~~ 2025

Max. Marks: 100 (C) June 2025 **Duration: 3 Hrs**
Class: W.P. S.Y.B.Tech Sem IV **Semester: IV**
Name of the Course: Water Supply Engineering **Program: B. Tech CIVIL**
Course Code: PC BTC-406

24/6/25

Instructions:

- **Question 1 is compulsory. Attempt any 4 of remaining 6**
- **Draw neat sketches/diagrams wherever required in the answer sheet and upload**
- **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 **modules of the given questions**

Q1	**Answer the following Questions**	(20)	CO	BL
(a)	Explain with flowsheet a surface water treatment plant with reductions in each unit. Also explain the functions of each unit in detail	(10)	CO1-CO4	3
(b)	**Answer the questions**	(10)	CO3	3
i	In continuous flow settling tank 3.5 m deep and 50 m long, what is flow velocity of water that you would recommend for effective removal of 0.02 mm particles at 25°C. The specific gravity of particles is 2.65 and γis 0.01cm²/sec. Check scour velocity too if Beta is 0.04 and friction factor is 0.03. Take 50 cm free board (H=3 m)	(05)		
ii ii	Explain the importance of Jar Test and how is it performed **OR** Explain the importance of MPN test and what are the indicator microorganisms	(05)		
Q2	**Answer the following questions**	(20)		
(a)	A news item of Times of India February 17 2025 quoted "The quality of water at the confluence of river Ganga and Yamuna at Prayagraj, at the ongoing Maha Kumbh, is failing to meet the primary standards for bathing. The water has high levels of faecal coliform, the Central Pollution Control Board (CPCB) informed the National Green Tribunal (NGT) on Monday (February 17). A CPCB report dated February 3 mentioned that "faecal coliform levels at all monitored locations were above the permissible limit of 2,500 units per 100 ml, indicating significant sewage contamination. The issue is particularly concerning as millions of devotees take ritual baths at the Sangam, especially on auspicious days, increasing bacterial concentrations in the water". What is the issue with respect to MPN units observed in Kumbha Water. Which test is done in lab to test water for E. Coli and why is it important	(10)	CO1	3, 4

(b)	Forecast population of Khirsu for 2050 using geometric mean and arithmetic mean method for following data **Year** 1970 1980 1990 2000 2010 **Population** 50000 55000 64000 79000 120000						**(10)**		
Q3	**Answer the following questions**						**(20)**		
(a)	A **bell mouth canal intake is to be designed for Khirsu** considering population for the year **2050 for Khirsu** and water demand of 200 lpcd (a) drawing water from a canal which runs for 9 hrs a day with a depth of 2 m. Calculate head loss in intake conduit if treatment works are 0.75 km away. Consumption of the town is to be considered 200 lpcd. Assume velocity through screens and bell mouth to be less than 16cm/sec and 32 m/sec. Also draw a neat sketch of design. **$v=0.85\ C_H R^{0.63} S^{0.54}$ (C_H= 130 dependent on pipe material, R is hydraulic mean depth and for circular section it is d/4; and S is slope of energy line or Hl/L)**						**(10)**	**CO2**	**4**
(b)	Two circular sedimentation basins (coagulant aided) are 30 m in dia with 2.1 m side depth. Single effluent weirs are located at periphery for water flow of 36000 m3/d calculate (i) SA and Volume (II) overflow rate (III) Detention Time(iv) Weir loading Comment on values obtained for detention time, SOR and weir loading						**(10)**	**CO1**	
Q4	**Answer the following questions**						**(20)**		
(a)	Design an ideal sedimentation (rectangular tank) coagulant aided sedimentation tank for **Khirsu** in Uttarakhand with checks						**(10)**	**CO4**	**4**
(b)	Design a mechanical rapid mix unit for a design flow to be treated as 800 m^3/hr. Take value of μ as 1.0087E-^{03}Ns/m^2. Compute power requirements too and give checks if required						**(5)**	**CO2**	**2**
(c)	Compare rapid gravity filter with slow gravity filter (min 7 points)						**(5)**	**CO3**	**2**
Q5	**Answer the following questions**						**(20)**		
(a)	Explain coagulation and flocculation. Design water depth for a slow mixing basin (gravity flocculator) having around the end baffles in order to treat 750 MLD. Tank is divided in two compartments by providing longitudinal partition wall and each half has a width of 10 m. Assume suitable detention times and flow velocities. Clear distance between baffles may be kept min permissible. Mention number of channels and overall length.						**(10)**	**CO2**	**2-3**
(b)	**Explain any two (i) Displacement efficiency (ii) Filter troubles (iii) Electrodialysis**						**(10)**	**CO2**	**3-4**
Q6	**Answer the following questions**						**(20)**		
(a)	**Design rapid sand filter for (size and underdrainage system)** for the population of 1,60,000 for Khirsu town having water demand **200 lpcd. Design wash water system too**						**(15)**	**CO3**	**3-5**
(b)	Explain factors affecting disinfectant use and dose. Enlist disinfectants used in water treatment. Draw the graph of chlorine utilization. Find chlorine consumed in kg/day and chlorine dosage in mg/L for the city of Khirsu in if the residual chlorine **is 0.4 mg/L** and a **chlorine demand**						**(05)**	**CO3, CO4**	**2-4**

(a)	You are an engineer at the Ranikhet Municipal Council, located in the town of Ranikhet (Uttarakhand). Your responsibility is to plan and design a water distribution network for a greenfield project in the region. Explain steps with figures and steps in detail how would you use QGIS, JalTantra, and EPANET to create an efficient water distribution system	(10)	CO4	4
(b)	Design a mechanical rapid mix unit for a design flow to be treated as 500 m^3/hr. Take value of μ as 1.0087E-^{03}Ns/m^2 . Assume DT find volume. Find depth and diameter. Compute power requirements	(5)	CO2	2
(c)	Explain with short notes (i) Ion Exchange (ii) Coagulants	(5)	CO3	2
Q5	**Answer the following questions**	(20)		
(a)	Explain the concept **Ideal Settling Tank in depth. Design ideal** settling tank for the population of 6,00,000 for Ranikhet town having average water demand **130 lpcd.**	(10)	CO2	2-3
(b)	Explain coagulation and flocculation. Design water depth for a slow mixing basin (gravity flocculator) having around the end baffles in order to treat 90 MLD. Tank is divided in two compartments by providing longitudinal partition wall and each half has a width of 10 m. Assume suitable detention times and flow velocities. Clear distance between baffles may be kept min permissible. Mention number of channels and overall length.	(10)	CO2	3-4
Q6	**Answer the following questions**	(20)		
(a)	**Explain the need of filtration and filtration mechanism. Design rapid sand filter for (size and underdrainage system)** for the population of 6,00,000 for Ranikhet town having water demand **130 lpcd. Design wash water system too**	(15)	CO3	3-5
(b)	Explain factors affecting disinfectant use and dose. Enlist disinfectants used in water treatment. Draw the graph of chlorine utilization. Find chlorine consumed in kg/day and chlorine dosage in mg/L for the city of Ranikhet in if the residual chlorine **is 0.2 mg/L** and a **chlorine demand is 1.1 mg/L and average water demand of 130 lpcd and population 6,00,000.**	(05)	CO3,CO4	2-4
Q7	**Give solutions to the following problems encountered in India**	(20)		
(a)	The content of fluoride is 7 mg/L. What are the typical values expected for drinking water and what are the implications? Explain how the problem can be solved for a remote village in India.	(05)		
(b)	It was observed that very high odor and color is visible in one of the sources in remote village in Maharashtra. How this problem could be solved in the village. Explain the processes that can be adopted for the same	(05)		
(c)	A rural well is to be disinfected. Explain the process for the same in detail	(05)		
(d)	In a far flung small town in India the only water available in sea water and ground water also has high amount of salt ingress. Which technique can be used in this town for generating drinkable water. Explain in detail with figures	(05)		

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~~End Semester Examination~~/ Re-Examination – ~~May~~/June 2025

Program: S.Y.B.Tech (Civil)_Working Professionals Sem IV **Duration: 3 Hours**

Course Code: BS-BTC401 **Maximum Points: 100**

Course Name: Probability Statiscics and OR **Semester: IV**

23/6/25

Note:

1. **Attempt Any Five Questions**
2. **Answers to the sub questions should be grouped together**

		Questions	Points	CO	BL	Module
1	a	The probability that the pen manufactured by a company will be defective is $\frac{1}{10}$. If 15 such pens are manufactured, find the probability that (i) exactly two will be defective (ii) at least two will be defective (iii) none will be defective	6	CO2	BL5	2
	b	In a partially destroyed laboratory record of an analysis of a correlation data, the following results are available: Variance of x is 9, Regression equations: $8x-10y+66=0$, $40x-18y=214$ Find (i) the means of x and y (ii) the standard deviation of y (iii) the coefficient of correlation between x and y	6	CO1	BL5	1
	c	A random variable X has the following probability distribution: X: 0, 1, 2, 3, 4, 5, 6 P(X): k, 3k, 5k, 7k, 9k, 11k, 13k Determine (*i*) k (*ii*) $P(2<X\leq 5)$ (*iii*) $P(X<4)$ (*iii*) *Mean*	8	CO1	BL3	2

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~~End Semester Examination~~/ Re-Examination – ~~May~~/June 2025

2	a	Find the lines of regressions for the following data X: 65, 66, 67, 67, 68, 69, 70, 72 Y: 67, 68, 65, 66, 72, 72, 69, 71	6	CO1	BL5	1
	b	A sample of 25 pairs of values x and y gave following results $\sum x = 127$, $\sum y = 100$, $\sum x^2 = 760$, $\sum y^2 = 449$, $\sum xy = 500$. Later on it was found that two pairs of values were taken as $(8,14)$ and $(8,6)$ instead of correct values $(8,12)$ and $(6,8)$. Find correct correlation coefficient between x and y.	6	CO1	BL2	1
	c	Two independent samples of sizes 8 and 7 contained the following values Sample I: 19, 17, 15, 21, 16, 18, 16, 14 Sample II: 15, 14, 15, 19, 15, 18, 16 Is the difference between the sample means significant?	8	CO3	BL3	5
3	a	An automatic machine makes paper clip from coils of wire. On an average 1 in 200 clips is defective. If the paperclips are packed in boxes of 100, what is the probability that any given box of clips will contain (i) One defective (ii) One or more defective (iii) less than three defective clips?	6	CO2	BL4	2
	b	A potential buyer of light bulbs bought 50 bulbs each of 2 brands. Upon testing the bulbs, he found that brand A had a mean life of 1282 hours with S.D of 80 hours, brand B had a mean life of 1208 hours with S.D of 94 hours. Can the buyer be quite certain that the mean of the two brands differ?	6	CO3	BL5	4
	c	Find Mean and Variance of Poisson Distribution	8	CO1	BL5	2

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~~End Semester Examination~~/ Re-Examination – ~~May~~/June 2025

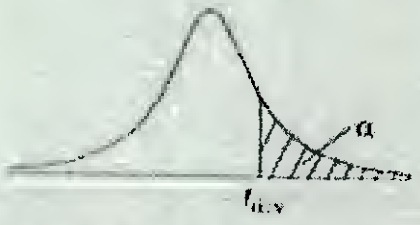
4	a	Compute spearman's rank correlation coefficient for the following data X: 12, 17, 22, 27, 32 Y: 113, 119, 117, 115, 121	6	CO1	BL5	1
	b	An aptitude test for selecting officers in a bank is conducted on 1000 candidates. The average score is 42 and standard deviation of score is 24. Assuming normal distribution for the scores, find (i) The numbers of candidates whose scores exceed 60. (ii) The numbers of candidates whose score lie between 30 and 60.	6	CO2	BL3	3
	c	Let X be a continuous random variable with probability density function $f(x)=\begin{cases} Ke^{-3x}, & x>0 \\ 0 & x\le 0 \end{cases}$ Find (i) K (ii) $P(1\le X\le 2)$ (iii) $P(X\ge 3)$ (iv) Mean	8	CO1	BL3	3
5	a	Tests made on the breaking strength of 10 pieces of a metal gave the following results: 578, 572, 570, 568, 572, 570, 570, 572, 596 and 584 kg. Test if the mean breaking strength of the wire can be assumed as 577 kg.	6	CO3	BL4,5	4
	b	With usual notation, find p of binomial distribution if $n=6$, $9P(X=4)=P(X=2)$	6	CO2	BL4	2
	c	Calculate the correlation coefficient between x and y from the following data $n=10$, $\sum x=140$, $\sum y=150$, $\sum(x-10)^2=180$, $\sum(y-15)^2=215$, $\sum(x-10)(y-15)=60$.	8	CO1	BL2, BL4	1
6	a	The coefficient of rank correlation of marks obtained by 10 students in Physics and Chemistry was found 0.5. It was later discovered that the difference of ranks in the two subjects obtained by one of the students was wrongly taken as 3 instead of 7, find the correct coefficient of rank correlation.	6	CO1	BL5	1

~~End Semester Examination~~/ Re-Examination – ~~May~~/June 2025

	b	An ambulance service claims that it takes on an average 8.9 minutes to reach its destination in emergency calls. To check on this claim, the agency which licenses ambulance services has them timed on 50 emergency calls, getting a mean of 9.3 minutes with standard deviation of 1.6 minutes. What can they conclude at the 5% level of significance?	6	CO3	BL3	4
	c	The distribution of marks obtained by a group of students may be assumed to be normal with mean 50 marks and standard deviation 15 marks. Estimate the proportion of students with marks less than 35. If 15% of the students secured more than K marks, determine K	8	CO2	BL3, BL5	3
7	a	Two random sample gave the following data Sample No | Size | Mean | Variance 1 | 1500 | 67.42 | 2.58 2 | 2000 | 67.25 | 2.5 Is the difference between standard deviation significant?	6	CO3	BL2, BL3	4
	b	The marks obtained by students in a certain examination follow a normal distribution with mean 45 and standard deviation 10. If 1000 students appeared at an examination, calculate the number of students scoring (i) less than 40 marks (ii) more than 60 marks.	6	CO2	BL5	3
	c	If x and y are two correlated variables with the same standard deviation and having coefficient of correlation r. Show that the correlation coefficient between x and $x+y$ is x and $x-y$ is $\sqrt{\frac{1-r}{2}}$	8	CO1	BL1, BL3	1

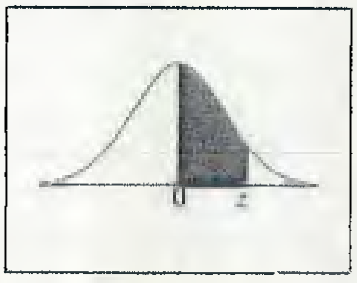
Table of the Student's *t*-distribution

The table gives the values of $t_{\alpha,\nu}$ where
$\Pr(T_\nu > t_{\alpha,\nu}) = \alpha$, with ν degrees of freedom



ν \ α	0.1	0.05	0.025	0.01	0.005	0.001	0.0005
1	3.078	6.314	12.076	31.821	63.657	318.310	636.620
2	1.886	2.920	4.303	6.965	9.925	22.326	31.598
3	1.638	2.353	3.182	4.541	5.841	10.213	12.924
4	1.533	2.132	2.776	3.747	4.604	7.173	8.610
5	1.476	2.015	2.571	3.365	4.032	5.893	6.869
6	1.440	1.943	2.447	3.143	3.707	5.208	5.959
7	1.415	1.895	2.365	2.998	3.499	4.785	5.408
8	1.397	1.860	2.306	2.896	3.355	4.501	5.041
9	1.383	1.833	2.262	2.821	3.250	4.297	4.781
10	1.372	1.812	2.228	2.764	3.169	4.144	4.587
11	1.363	1.796	2.201	2.718	3.106	4.025	4.437
12	1.356	1.782	2.179	2.681	3.055	3.930	4.318
13	1.350	1.771	2.160	2.650	3.012	3.852	4.221
14	1.345	1.761	2.145	2.624	2.977	3.787	4.140
15	1.341	1.753	2.131	2.602	2.947	3.733	4.073
16	1.337	1.746	2.120	2.583	2.921	3.686	4.015
17	1.333	1.740	2.110	2.567	2.898	3.646	3.965
18	1.330	1.734	2.101	2.552	2.878	3.610	3.922
19	1.328	1.729	2.093	2.539	2.861	3.579	3.883
20	1.325	1.725	2.086	2.528	2.845	3.552	3.850
21	1.323	1.721	2.080	2.518	2.831	3.527	3.819
22	1.321	1.717	2.074	2.508	2.819	3.505	3.792
23	1.319	1.714	2.069	2.500	2.807	3.485	3.767
24	1.318	1.711	2.064	2.492	2.797	3.467	3.745
25	1.316	1.708	2.060	2.485	2.787	3.450	3.725
26	1.315	1.706	2.056	2.479	2.779	3.435	3.707
27	1.314	1.703	2.052	2.473	2.771	3.421	3.690
28	1.313	1.701	2.048	2.467	2.763	3.408	3.674
29	1.311	1.699	2.045	2.462	2.756	3.396	3.659
30	1.310	1.697	2.042	2.457	2.750	3.385	3.646
40	1.303	1.684	2.021	2.423	2.704	3.307	3.551
60	1.296	1.671	2.000	2.390	2.660	3.232	3.460
120	1.289	1.658	1.980	2.358	2.617	3.160	3.373
∞	1.282	1.645	1.960	2.326	2.576	3.090	3.291

Standard Normal Distribution Table



z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
0.0	.0000	.0040	.0080	.0120	.0160	.0199	.0239	.0279	.0319	.0359
0.1	.0398	.0438	.0478	.0517	.0557	.0596	.0636	.0675	.0714	.0753
0.2	.0793	.0832	.0871	.0910	.0948	.0987	.1026	.1064	.1103	.1141
0.3	.1179	.1217	.1255	.1293	.1331	.1368	.1406	.1443	.1480	.1517
0.4	.1554	.1591	.1628	.1664	.1700	.1736	.1772	.1808	.1844	.1879
0.5	.1915	.1950	.1985	.2019	.2054	.2088	.2123	.2157	.2190	.2224
0.6	.2257	.2291	.2324	.2357	.2389	.2422	.2454	.2486	.2517	.2549
0.7	.2580	.2611	.2642	.2673	.2704	.2734	.2764	.2794	.2823	.2852
0.8	.2881	.2910	.2939	.2967	.2995	.3023	.3051	.3078	.3106	.3133
0.9	.3159	.3186	.3212	.3238	.3264	.3289	.3315	.3340	.3365	.3389
1.0	.3413	.3438	.3461	.3485	.3508	.3531	.3554	.3577	.3599	.3621
1.1	.3643	.3665	.3686	.3708	.3729	.3749	.3770	.3790	.3810	.3830
1.2	.3849	.3869	.3888	.3907	.3925	.3944	.3962	.3980	.3997	.4015
1.3	.4032	.4049	.4066	.4082	.4099	.4115	.4131	.4147	.4162	.4177
1.4	.4192	.4207	.4222	.4236	.4251	.4265	.4279	.4292	.4306	.4319
1.5	.4332	.4345	.4357	.4370	.4382	.4394	.4406	.4418	.4429	.4441
1.6	.4452	.4463	.4474	.4484	.4495	.4505	.4515	.4525	.4535	.4545
1.7	.4554	.4564	.4573	.4582	.4591	.4599	.4608	.4616	.4625	.4633
1.8	.4641	.4649	.4656	.4664	.4671	.4678	.4686	.4693	.4699	.4706
1.9	.4713	.4719	.4726	.4732	.4738	.4744	.4750	.4756	.4761	.4767
2.0	.4772	.4778	.4783	.4788	.4793	.4798	.4803	.4808	.4812	.4817
2.1	.4821	.4826	.4830	.4834	.4838	.4842	.4846	.4850	.4854	.4857
2.2	.4861	.4864	.4868	.4871	.4875	.4878	.4881	.4884	.4887	.4890
2.3	.4893	.4896	.4898	.4901	.4904	.4906	.4909	.4911	.4913	.4916
2.4	.4918	.4920	.4922	.4925	.4927	.4929	.4931	.4932	.4934	.4936
2.5	.4938	.4940	.4941	.4943	.4945	.4946	.4948	.4949	.4951	.4952
2.6	.4953	.4955	.4956	.4957	.4959	.4960	.4961	.4962	.4963	.4964
2.7	.4965	.4966	.4967	.4968	.4969	.4970	.4971	.4972	.4973	.4974
2.8	.4974	.4975	.4976	.4977	.4977	.4978	.4979	.4979	.4980	.4981
2.9	.4981	.4982	.4982	.4983	.4984	.4984	.4985	.4985	.4986	.4986
3.0	.4987	.4987	.4987	.4988	.4988	.4989	.4989	.4989	.4990	.4990
3.1	.4990	.4991	.4991	.4991	.4992	.4992	.4992	.4992	.4993	.4993
3.2	.4993	.4993	.4994	.4994	.4994	.4994	.4994	.4995	.4995	.4995
3.3	.4995	.4995	.4995	.4996	.4996	.4996	.4996	.4996	.4996	.4997
3.4	.4997	.4997	.4997	.4997	.4997	.4997	.4997	.4997	.4997	.4998
3.5	.4998	.4998	.4998	.4998	.4998	.4998	.4998	.4998	.4998	.4998

Gilles Cazelais. Typeset with LaTeX on April 20, 2006