



Bharatiya Vidya Bhavan's

SARDAR PATEL COLLEGE OF ENGINEERING

(Government Aided Autonomous Institute)

Munshi Nagar, Andheri (W) Mumbai - 400058



ENDSEM/RE-EXAMINATION MAY/JUNE 2025

Program: CIVIL

Duration: 03 Hours

Course Code: BS-BTC401

Maximum Points: 100

Course Name: Probability Statistics & OR

Semester: IV

- Attempt any five out of seven questions
- Use of scientific calculator is allowed.

S.Y. S. Tech (C)
Sem IV

12/5/25

Q N O	QUESTION	POI NT S	C O	B L	Mod ule no.																				
Q 1a)	The experiment is repeated 128 times and following distribution is obtained. <table><tr><td>No.of heads</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>Total</td></tr><tr><td>Freque ncy</td><td>7</td><td>6</td><td>19</td><td>35</td><td>30</td><td>23</td><td>7</td><td>1</td><td>128</td></tr></table> Fit a Binomial distribution if the nature of coins is unknown.	No.of heads	0	1	2	3	4	5	6	7	Total	Freque ncy	7	6	19	35	30	23	7	1	128	10	1	2	3
No.of heads	0	1	2	3	4	5	6	7	Total																
Freque ncy	7	6	19	35	30	23	7	1	128																
Q 1 b)	Two cards are drawn simultaneously from a well – shuffled deck of 52 cards. Compute the variance for the number of aces	10	1	2	4																				
Q 2 a)	If $z = ax + by$ and 'r' is the correlation between x and y show that $\sigma_z^2 = a^2\sigma_x^2 + b^2\sigma_y^2 + 2ab\rho\sigma_x\sigma_y$ Further show that $r = \frac{\sigma_x^2 + \sigma_y^2 - \sigma_{x-y}^2}{2\sigma_x\sigma_y}$ Where σ_x, σ_y and σ_{x-y} are the standard deviation of x, y and x – y respectively	10	2	2	1																				
Q 2 b)	1000 students are graded according to their I.Q. & their economic conditions. Use chi-square test to find out whether there is any association between economic conditions and the level of I.Q. <table><tr><td>Economic</td><td></td><td>I.Q.</td><td></td></tr><tr><td>Conditions</td><td>High</td><td>Medium</td><td>Low</td></tr><tr><td>Rich</td><td>160</td><td>300</td><td>140</td></tr></table>	Economic		I.Q.		Conditions	High	Medium	Low	Rich	160	300	140	10	3	2	5								
Economic		I.Q.																							
Conditions	High	Medium	Low																						
Rich	160	300	140																						



	Poor	140	100	160					
Q 3a	Show that the correlation coefficient r lies between -1 and 1.					10	2	2	1
Q 3b	In an examination marks obtained by students in mathematics, physics and chemistry are normally distributed with means 51,53 and 46 with standard deviations 15,12,16 respectively. Find the probability of securing total marks (i) 180 or more (ii) 90 or below					10	1	4 5	4
Q 4a	Verify whether the following functions can be looked upon as probability density function? $f(x) = \frac{1}{2}e^{- x }, -\infty < x < \infty$					10	1	3	4
Q 4b	Of the three men, the chances that a politician, a businessman and an academician will be appointed as a vice chancellor of a university are 0.50,0.30 & 0.20 respectively. Probability that research is promoted by these people if they are appointed as vice chancellor are 0.3,0.7 7 0.8 respectively. Determine the probability that research is promoted in the university. Also find if research is promoted in the university what is the probability that the VC is an academician.					10	1	2	2
Q 5a	In an examination it is laid down that a student passes if he secures 30% or more marks. He is placed in Ist,IInd or IIIrd division according as he secures 60% or more marks, between 45% & 60% and between 30% & 45% respectively. He gets distinction in case he secures 80% or more marks. It is noticed from the result that 10% of the students failed in the examination where as 5% of them obtained distinction. Calculate the percentage of students placed in the second division.					10	1	2	
Q 5b	Management of a soft-drink bottling company wished to develop a method for allocating delivery costs to customers. Although one cost clearly relates to travel time within a particular route, another variable cost reflects time required to unload the cases of soft drink at the delivery point. A sample of 20 customers was selected from within a territory and the delivery time and the number of cases delivered were measured, with the following results					10	2	2	1
	Customer	No.of cases	Delivery time(minutes)						
	1	52	32.1						
	2	64	34.8						
	3	73	36.2						
	4	85	37.8						
	5	95	37.8						
	6	103	39.7						
	7	116	38.5						
	8	121	41.9						



	9	143	44.2																						
	10	157	47.1																						
	11	161	43.0																						
	12	184	49.4																						
	13	202	57.2																						
	14	218	56.8																						
	15	243	60.6																						
	16	254	61.2																						
	17	267	58.2																						
	18	275	63.1																						
	19	287	65.6																						
	20	298	67.3																						
	Assume that you wanted to develop a model to predict delivery time based on the number of soft drink. i)State the Regression equation . ii)Predict the delivery time for a customer who is receiving 150 cases of soft drink.																								
Q 6 a)	The heights of six randomly chosen sailors are in inches;63,65,68,69,71 & 72.The heights of ten randomly chosen soldiers are;61,62,65,66,69,69,70,71,72&73.Discuss in the light of this data that the soldiers on an average are taller than sailors							10	3	3	5														
Q 6 b)	In a precision bombing attack there is a 50% chance that any one bomb will strike the target.Two direct hits are required to destroy the target completely.How many bombs must be dropped to give atleast 99% chance of destroying the target?							10	1	3	3														
Q 7a)	Prices of shares of a company on different days in a month were found to be 66, 65, 69, 70, 69, 71, 70, 63, 64 and 68. Discuss whether the price of shares to be 65.							10	3	3	5														
Q 7 b)	Compute spearman's rank coorelation coefficient for the following data <table><tr><td>X</td><td>10</td><td>12</td><td>18</td><td>18</td><td>15</td><td>40</td></tr><tr><td>Y</td><td>12</td><td>18</td><td>25</td><td>25</td><td>50</td><td>25</td></tr></table>							X	10	12	18	18	15	40	Y	12	18	25	25	50	25	10	2	2	1
X	10	12	18	18	15	40																			
Y	12	18	25	25	50	25																			

Area Under Standard Normal Curve



The table gives the area under the standard normal curve from $z = 0$ to $z = z_1$, which is the probability that z will lie between $z = 0$ and $z = z_1$.

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	1629	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	2703	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	4618	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

Percentage Points of χ^2 - Distribution



Example

For $\Phi = 10$ d. o. f.

$$P(\chi^2 > 15.99) = 0.10$$

	0 = .99	0.95	0.50	0.10	0.05	0.02	0.01
1	0.00157	.00393	.455	2.706	3.841	5.214	6.635
2	.0201	.103	1.386	4.605	5.991	7.824	9.210
3	.115	.352	2.366	6.251	7.815	9.837	11.341
4	.297	.711	3.357	7.779	9.488	11.668	13.277
5	.554	1.145	4.351	9.236	11.070	13.388	15.086
6	.872	1.635	5.348	10.645	12.592	15.033	16.812
7	1.339	2.167	6.346	12.017	14.067	16.622	18.475
8	1.646	2.733	7.344	13.362	15.507	18.168	20.090
9	2.088	3.325	8.343	14.684	16.919	19.679	21.666
10	2.558	3.940	9.340	15.987	18.307	21.161	23.209
11	3.053	4.575	10.341	17.275	19.675	22.618	24.725
12	3.571	5.226	11.340	18.549	21.026	24.054	26.217
13	4.107	5.892	12.340	19.812	22.362	25.472	27.688
14	4.660	6.571	13.339	21.064	23.682	26.873	29.141
15	4.229	7.261	14.339	22.307	24.996	28.259	30.578
16	5.812	7.962	15.338	23.542	26.296	29.632	32.000
17	6.408	8.672	16.338	24.769	27.587	30.995	33.409
18	7.015	9.390	17.338	25.989	28.869	32.346	34.805
19	7.633	10.117	18.338	27.204	30.144	33.697	36.191
20	8.260	10.851	19.337	28.412	31.410	35.020	37.566
21	8.897	11.591	20.337	29.615	32.671	36.349	38.932
22	9.542	12.338	21.337	30.813	33.924	37.659	40.289
23	10.196	13.091	22.337	32.007	35.172	38.968	41.638
24	10.856	13.848	23.337	32.196	36.415	40.270	42.980
25	11.524	14.611	24.337	34.382	37.652	41.566	44.314
26	12.198	15.379	25.336	35.363	38.885	41.856	45.642
27	12.879	16.151	26.336	36.741	40.113	44.140	46.963
28	13.565	16.928	27.336	37.916	41.337	45.419	48.278
29	14.256	17.708	28.336	39.087	42.557	46.693	49.588
30	14.953	18.493	29.336	40.256	43.773	47.962	50.892

Percentage Points of t - distribution



Example

For $\Phi = 10$ d. o. f.

$P(|t| > 1.812) = 0.1$

P	0.20	0.10	0.05	0.02	0.01
1	3.078	6.314	12.706	31.812	63.657
2	1.886	2.920	4.303	6.965	9.925
3	1.638	2.353	3.182	4.541	5.841
4	1.533	2.122	2.776	3.747	4.604
5	1.476	2.015	2.571	3.365	4.032
6	1.440	1.943	2.447	3.143	3.707
7	1.415	1.895	2.365	2.998	3.499
8	1.397	1.860	2.306	2.896	3.355
9	1.383	1.833	2.262	2.821	3.250
10	1.372	1.812	2.228	2.764	3.169
11	1.363	1.798	2.201	2.718	3.105
12	1.356	1.785	2.179	2.681	3.055
13	1.350	1.771	2.160	2.650	3.012
14	1.345	1.761	2.145	2.624	2.977
15	1.341	1.753	2.131	2.602	2.947
16	1.337	1.746	2.120	2.583	2.921
17	1.333	1.740	2.110	2.567	2.899
18	1.330	1.734	2.101	2.552	2.878
19	1.328	1.729	2.093	2.539	2.861
20	1.325	1.725	2.086	2.528	2.845
21	1.323	1.721	2.080	2.518	2.831
22	1.321	1.717	2.074	2.508	2.819
23	1.319	1.714	2.069	2.500	2.807
24	1.318	1.711	2.064	2.492	2.797
25	1.316	1.708	2.060	2.485	2.787
26	1.315	1.706	2.056	2.479	2.779
27	1.314	1.703	2.052	2.473	2.771
28	1.313	1.701	2.048	2.467	2.763
29	1.311	1.699	2.045	2.462	2.756
30	1.310	1.697	2.042	2.457	2.750
40	1.303	1.684	2.021	2.423	2.704
60	1.296	1.671	2.000	2.390	2.660
120	1.289	1.658	1.980	2.358	2.617
∞	1.282	1.645	1.960	2.325	2.576

**ENDSEM/RE-EXAMINATION MAY/JUNE 2025**

Program: CIVIL

S.Y. (Civ) Sem IV

Duration: 03 Hours

Course Code: BS-BTC401

Maximum Points: 100

Course Name: Probability Statistics & OR

Semester: IV

23/6/25

- Attempt any five out of seven questions
- Use of scientific calculator is allowed.

QNO.	QUESTION	POINTS	C	B	Module no.														
Q1a)	Fit a binomial distribution for the following data and compare the theoretical frequencies with the actual ones: <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td>X</td> <td>0</td> <td>1</td> <td>2</td> <td>3</td> <td>4</td> <td>5</td> </tr> <tr> <td>f</td> <td>2</td> <td>14</td> <td>20</td> <td>34</td> <td>22</td> <td>8</td> </tr> </table>	X	0	1	2	3	4	5	f	2	14	20	34	22	8	10	1	2	3
X	0	1	2	3	4	5													
f	2	14	20	34	22	8													
Q1b)	An urn contains 4 white and 3 red balls. Three balls are drawn with replacement, from this urn. Find μ , σ^2 and σ for the number of red balls drawn.	10	1	2	4														
Q2a)	If $z = ax + by$ and 'r' is the correlation between x and y show that $\sigma_z^2 = a^2\sigma_x^2 + b^2\sigma_y^2 + 2ab\rho_{xy}\sigma_x\sigma_y$ Further show that $r = \frac{\sigma_x^2 + \sigma_y^2 - \sigma_{x-y}^2}{2\sigma_x\sigma_y}$ Where σ_x, σ_y and σ_{x-y} are the standard deviation of x, y and x - y respectively	10	2	2	1														
Q2b)	A certain drug is claimed to be effective in curing cold. In an experiment on 500 persons with cold, half of them were given the drug and half of them were given sugar pills. The patients' reactions to the treatment are recorded in the following table. <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td></td> <td>Helped</td> <td>Harmed</td> <td>No effect</td> </tr> <tr> <td>Drug</td> <td>150</td> <td>30</td> <td>70</td> </tr> <tr> <td>Sugar Pills</td> <td>130</td> <td>40</td> <td>80</td> </tr> </table> On the basis of this data, can it be concluded that the drug and sugar pills differ significantly in curing cold?		Helped	Harmed	No effect	Drug	150	30	70	Sugar Pills	130	40	80	10	3	2	5		
	Helped	Harmed	No effect																
Drug	150	30	70																
Sugar Pills	130	40	80																
Q3a)	Show that the correlation coefficient r lies between -1 and 1.	10	2	2	1														



Q3 b)	In an examination marks obtained by students in mathematics, physics and chemistry are normally distributed with means 51, 53 and 46 with standard deviations 15, 12, 16 respectively. Find the probability of securing total marks (i) 180 or more (ii) 90 or below	10	1	4	4
Q4 a)	The length of time a lady speaks on telephone is found to be a random variable with PDF $f(x) = \begin{cases} Ae^{-x/5}, & x \geq 0 \\ 0, & x < 0 \end{cases}$. Find A and the probability that she will speak for (i) more than 10 minutes (ii) less than 5 minutes (iii) between 5 & 10 minutes.	10	1	3	4
Q4 b)	Of the three men, the chances that a politician, a businessman and an academician will be appointed as a vice chancellor of a university are 0.50, 0.30 & 0.20 respectively. Probability that research is promoted by these people if they are appointed as vice chancellor are 0.3, 0.7 & 0.8 respectively. Determine the probability that research is promoted in the university. Also find if research is promoted in the university what is the probability that the VC is an academician.	10	1	2	2
Q5 a)	In an examination it is laid down that a student passes if he secures 30% or more marks. He is placed in Ist, IInd or IIIrd division according as he secures 60% or more marks, between 45% & 60% and between 30% & 45% respectively. He gets distinction in case he secures 80% or more marks. It is noticed from the result that 10% of the students failed in the examination where as 5% of them obtained distinction. Calculate the percentage of students placed in the second division.	10	1	2	
Q5 b)	In a partially destroyed laboratory record of an analysis of correlation data, the following results only are legible: Variance of X = 9 Regression equations: $8x - 10y + 66 = 0$ $40x - 18y = 214$ What are i. Mean, value of x and y ii. Standard deviation of y. iii. Coefficient of correlation between x and y	10	1	2	1
Q6b)	In a precision bombing attack there is a 50% chance that any one bomb will strike the target. Two direct hits are required to destroy the target completely. How many bombs must be dropped to give at least 99% chance of destroying the target?	10	1	3	3
Q7a)	For a random sample of 10 pigs fed diet A, the increases in weight in pounds in a certain period were 10, 6, 16, 17, 13, 12, 8, 14, 15, 9. For another random sample of 12 pigs, fed on diet B, the increase in the same period were 7, 13, 22, 15, 12, 14, 18, 8, 21, 23, 10, 17. Test whether the diets A & B differ significantly as	10	3	3	5



Bharatiya Vidya Bhavan's

SARDAR PATEL COLLEGE OF ENGINEERING

(Government Aided Autonomous Institute)

Munshi Nagar, Andheri (W) Mumbai - 400058



regards their effect on increase in weight.															
Q7 b)	Ten contestants in a beauty contest are judged by three judges in the following order.											10	2	2	1
	Ranks by 1st judge	6	10	2	9	8	1	5	3	4	7				
	IInd judge	5	4	10	1	9	3	8	7	2	6				
	IIInd judge	4	8	2	10	7	5	9	1	3	6				
Using rank coorelation coeeficient find which pair of judges has the nearest approach to common tastes in beauty															



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SARDAR PATEL COLLEGE OF ENGINEERING
(An Autonomous Institution Affiliated to University of Mumbai)
Munshi Nagar Andheri (W) Mumbai 400058
Endsem/Revision Paper-R-23



May 2025

Max. Marks: 100

Class: S.Y.B.Tech

Name of the Course: Water Supply Engineering

Course Code: PC BTC-406

Duration: 3 Hrs

Semester: IV

Program: B. Tech CIVIL

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 the visit to Pise Panjrapole Water Treatment Plant with the flowsheet of the same the treatment flowsheet adopted with details and explanations of units and the amount in reductions at each stage.	(10)	CO1 - CO4	3
(b)	You are an engineer at the Binsar Municipality. 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
Q2	Answer the following questions	(20)		
(a)	Classify water quality parameters. A story in London times on 28 th 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 how is it used to decide the quality? Explain ways to improve quality of river water?	(10)	CO1	3,4
(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	(05)	CO1	4

	(i) Population forecasting (2) Design period			
Q3	Answer the following questions	(20)		
(a)	A bell mouth canal intake is to be designed for Binsar 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 H/L)	(10)	CO2	4
(b)	Design a coagulant aided sedimentation tank for Binsar in Uttarakhand (data of Q3 (a))with checks	(10)	CO1	
Q4	Answer the following questions	(20)		
(a)	Choose the correct answer	(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) 37.5 m^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)	CO4	4
(b)	Design a mechanical rapid mix unit for a design flow to be treated as 500 m³/hr. Take value of μ as 1.0087E-⁰³Ns/m². Also Compute power requirements and give check	(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 two (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) the population of 60,000 for Binsar town having water demand 180 lpcd. Design wash water system too	(15)	CO3	3-5
(b)	Enumerate 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 Binsar in if the residual chlorine is 1 mg/L and a chlorine demand is	(05)	CO3 ,CO 4	2-4

	40 kg/day for average flow and average water demand of 180 lpcd and population 60,000.			
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 is 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

$P_n = P_o \left[1 + \frac{r}{100} \right]^n$ $P_n = P_o + n\bar{x} + \frac{n(n+1)}{2} \bar{y}$ $\log_e \left[\frac{P_s - P}{P} \right] - \left[\frac{P_s - P_o}{P_o} \right] = -k P_s * t$ $P_n = (P_o + n\bar{x})$ $r = \sqrt[n]{r_1 * r_2 * r_3 * \dots * r_n}$ 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 $G = \sqrt{\frac{P}{\mu * V}}$ $\mu = 1.0087 * 10^{-3} \text{Ns/m}^2$ $Q = Av$	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 $G * t = \frac{V}{Q} \sqrt{\frac{P}{\mu V}} = \frac{\sqrt{PV/\mu}}{Q}$
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 $\nu = 1.002 \times 10^{-6} \text{m}^2/\text{sec}$ $v_d = \sqrt{\left(\frac{8\beta}{f'} \right) (S_s - 1) dg}$ $f' = 0.025 - 0.03$ $g = 9.8 \text{m/s}^2$ $v_d = \sqrt{\frac{8\beta g (S_s - 1) d}{f'}}$	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 $G * t = \frac{V}{Q} \sqrt{\frac{P}{\mu V}} = \frac{\sqrt{PV/\mu}}{Q}$



Bharatiya Vidya Bhavan's
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Munshi Nagar Andheri (W) Mumbai 400058
Engineering/Reexam Paper R-23
May 2025



Max. Marks: 100

Class: S.Y.B.Tech

Name of the Course: Water Supply Engineering

Course Code: PC BTC-406

Duration: 3 Hrs

Semester: IV

Program: B. Tech CIVIL

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 the visit to Pise Panjrapole Water Treatment Plant with the flowsheet of the same the treatment flowsheet adopted with details and explanations of units and the amount in reductions at each stage.	(10)	CO1- CO4	3
(b)	You are an engineer at the Mukteshwar Municipality. 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)	CO3	3
Q2	Answer the following questions	(20)		
(a)	Draw a flowsheet for ground water treatment with details of removals of turbidity, Hardness and MPN. If there is excess of salt (NaCl) present, which steps will be taken by you to give alternative to the flowsheet of ground water. 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 <u>Maha Kumbh</u> , is failing to meet the primary standards for bathing. The water has <u>high levels of faecal coliform</u> , 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	(15)	CO1	3, 4

	to MPN units observed in Kumbha Water. Which test is done in lab to test water for E. Coli and why is it important															
(b)	Forecast population of Mukteshwar for 2050 using geometric mean and arithmetic mean method for following data <table><tr><td>Year</td><td>1970</td><td>1980</td><td>1990</td><td>2000</td><td>2010</td></tr><tr><td>Population</td><td>50000</td><td>55000</td><td>64000</td><td>79000</td><td>120000</td></tr></table>	Year	1970	1980	1990	2000	2010	Population	50000	55000	64000	79000	120000	(05)		
Year	1970	1980	1990	2000	2010											
Population	50000	55000	64000	79000	120000											
Q3	Answer the following questions	(20)														
(a)	A bell mouth canal intake is to be designed for Mukteshwar considering population for the year 2050 for Mukteshwar 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 H/L)	(10)	CO2	4												
(b)	Design coagulant aided sedimentation tank for Mukteshwar in Uttarakhand with checks	(10)	CO1													
Q4	Answer the following questions	(20)														
a	In continuous flow settling tank 3 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 ν is 0.01cm ² /sec. Check scour velocity too if Beta is 0.04 and friction factor is 0.03. Take 50 cm free board ($H=2.5$ m)	(05)	CO2	3												
b	Explain the importance of Jar Test and how is it performed	(03)	CO2	2												
c	Explain the importance of MPN test and what are the indicator microorganisms	(02)	CO3	3												
d	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-03Ns/m ² . Compute power requirements too and give checks if required	(5)	CO2	2												
e	Explain with short notes (i) Tube settlers (ii) Types of water distribution system	(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 75 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) 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 1,60,000 for Mukteshwar 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 Mukteshwar in if the residual chlorine is 0.4 mg/L and a chlorine demand is 1.5 mg/L and average water demand of 200 lpcd and population 1, 60,000.	(05)	CO3, CO4	2-4
Q7	Give solutions to the following problems encountered in Rural India	(20)	CO2- CO3	3-4
(a)	The content of iron and manganese is 4 mg/ and 0.8mg/L resp. What are the typical values expected for drinking water and other types of water. What are the implications? Explain how will you solve this problem in remote village	(05)		
(b)	It was observed that very high NaCl is visible in one of the sources in remote village in Gujarat due to sea water intrusion. 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 NEERI two pot process for the same in detail	(05)		
(d)	In a far flung small town in India the only water available is ground water contaminated with fluoride. Discuss two techniques that can be used to solve the problem	(05)		

Formula sheet

$P_n = P_o \left[1 + \frac{r}{100} \right]^n$ $P_n = P_o + nx + \frac{n(n+1)}{2} y$ $\log_e \left[\frac{P_s - P}{P} \right] - \left[\frac{P_s - P_o}{P_o} \right] = -k P_s * t$ $P_n = (P_o + n\bar{x})$ $r = \sqrt[n]{r_1 * r_2 * r_3 * \dots * r_n}$ 100-160m³/m/d (max=200m³/m/d) Width of tank = max 12 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 $G = \sqrt{\frac{P}{\mu * V}}$ $\mu = 1.0087 * 10^{-3} \text{Ns/m}^2$ $Q = Av$ Length should not be greater than 4 B For circular tanks max diameter allowed is 60 m	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 $G * t = \frac{v}{q} * \sqrt{\frac{P}{\mu v}} = \sqrt{\frac{PV}{\mu q}}$
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 $v = 1.002 \times 10^{-6} \text{ m}^2/\text{sec}$ $v_d = \sqrt{\left(\frac{8\beta}{f'} \right) (S_s - 1) dg}$ $f' = 0.025 - 0.03$ $g = 9.8 \text{ m/s}^2$ $v_d = \sqrt{\frac{8\beta g (S_s - 1) d}{f'}}$	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 Qavg



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END SEM/DE EXAMINATION: MAY/JUNE 2025

S.Y.
Program: B.Tech. in Civil Engineering

Course Code: PC-BTC402

Course Name: Structural Mechanics

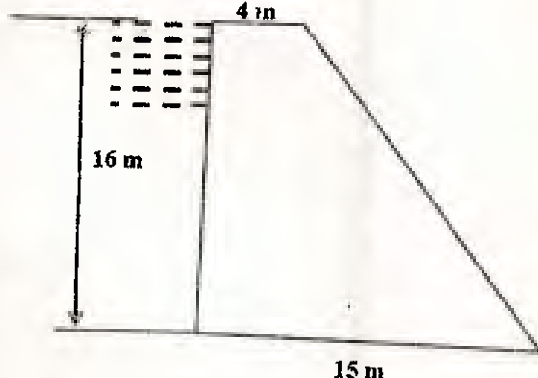
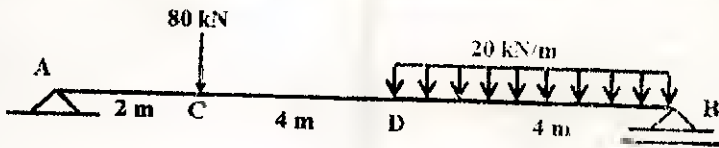
Duration: 3 Hours

Maximum Points: 100

Semester: IV

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

19/5/25

Q.No.	Questions	Points	CO	BL	Module
Q.1(a)	A 16 m high concrete dam of trapezoidal cross section has the top and bottom widths of 4m and 15m respectively as shown in figure below. The dam retains water on its vertical face to a depth of 16 m. Determine the maximum and minimum stresses developed at the base of the dam. The unit weight of masonry is 24 kN/m^3 and that of water is 10 kN/m^3. 	10	1	4	1
Q.1(b)	Using <u>Macaulay's method only</u>, find the slope at A and vertical deflection at C for the beam supported and loaded as shown in figure below. 	10	3	3,4	5
Q.2(a)	State and explain Maxwell's reciprocal theorem.	05	2	2	4



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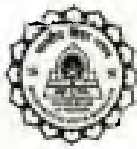
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END SEM/DE EXAMINATION: MAY/JUNE 2025

Q.2(b)	For the frame loaded as shown in figure below a) Find the support reactions b) Draw AFD, SFD & BMD	15	2	3,4	3
Q.3(a)	Find the slope at A and vertical deflection at C for the beam supported and loaded as shown in figure below. <u>Use conjugate method only.</u>	12	3	3,4	5
Q.3(b)	Find the slope at C and vertical deflection at B for the beam supported and loaded as shown in figure below. <u>Use moment area method only.</u>	08	3	3,4	5
Q.4(a)	For the pin jointed frame loaded as shown in figure below, find the vertical deflection of joint A.	12	3	3,4	6

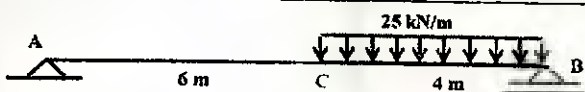
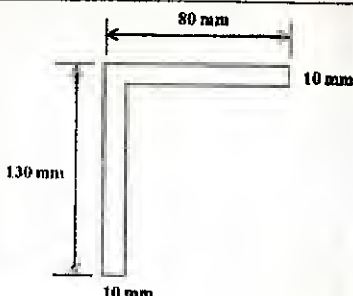
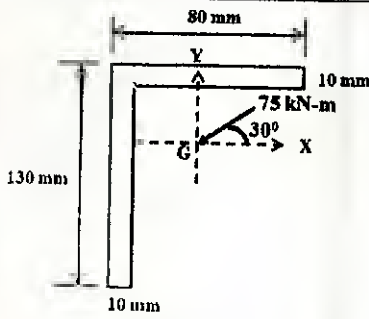
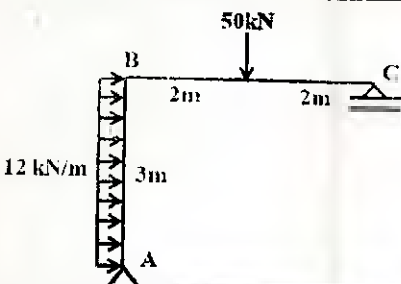


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END SEM/RE EXAMINATION: MAY/JUNE 2025

Q.4(b)	Find the strain energy stored in the beam shown in the figure below.	08	2	3,4	4
					
Q.5(a)	Locate the principal axes and find the principal moments of inertia for the cross section shown in figure below.	10	1	3,4	2
					
Q.5(b)	The angle section with dimensions shown in the figure below (same as given in Q. 5(a)) is subjected to a bending moment of 70 kN-m at 30 degrees to the positive X axis as shown in the figure. Find the location of the neutral axis and show it in the cross section. Find the maximum and minimum bending stresses and state their location in the cross section. (The properties of the cross section obtained in Q5(a) can be used. No need to calculate them again.)	10	1	4	2
					
Q.6(a)	Determine the horizontal deflection of point C of the rigid jointed frame loaded as shown in figure below.	10	3	3,4	6
					



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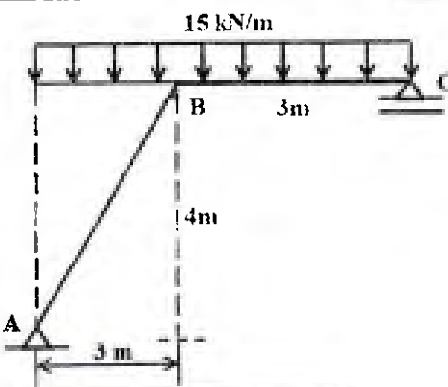
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END SEM/ ~~DE~~ EXAMINATION: MAY/JUNE 2025

Q.6(b)	Find the crippling loads using (i) Euler's and (ii) Rankine's formulae for a steel column 3.0 m long with one end fixed and the other end pinned. The cross section of the column is a symmetrical I section with the following dimensions. Top and bottom Flange width = 300 mm, Top and bottom Flange thickness = 25 mm, Depth of web = 200 mm, Thickness of web = 15 mm. Take $E = 2 \times 10^5 \text{ N/mm}^2$, $f_c = 350 \text{ MPa}$ and Rankine's constant = $1/7000$.	10	4	3,4	7
Q.7(a)	For the frame loaded as shown in figure below a) Find the support reactions b) Draw AFD, SFD & BMD.	12	4	3,4	3
					
Q.7(b)	A column of square cross section and another column of circular cross section are made of the same material and have the same length and same cross sectional area. Each column is pinned at both the ends. Determine the ratio of the buckling load P_1 of column of square cross section to the buckling load P_2 of column of circular cross section.	05	4	3,4	7
Q.7(c)	Write the expression for strain energy stored in a member due to bending moment. Explain the terms involved in the expression.	03	2	2	4



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

Program: B.Tech. in Civil Engineering

Duration: 3 Hours

Course Code: PC-BTC402

Maximum Points: 100

Course Name: Structural Mechanics

Semester: IV

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

21/6/25

Q.No.	Questions	Points	CO	BL	Module
Q.1(a)	A masonry chimney of hollow circular cross section is of height 8m. It has an external diameter of 2.2m and internal diameter of 1.6m. It is subjected to a horizontal wind pressure of 1.5 kN/m^2 . Determine (i) total wind force acting on the chimney. (ii) bending moment at the base of the chimney due to wind pressure. (iii) maximum and minimum stresses developed at the base of the chimney. The unit weight of masonry is 20 kN/m^3 .	10	1	4	1
Q.1(b)	Using Macaulay's method only, find the slope at C and vertical deflection at D for the beam supported and loaded as shown in figure below.	10	3	3,4	5
Q.2(a)	State and explain Bette's theorem.	05	2	2	4
Q.2(b)	For the frame loaded as shown in figure below a) Find the support reactions b) Draw AFD, SFD & BMD	15	2	3,4	3



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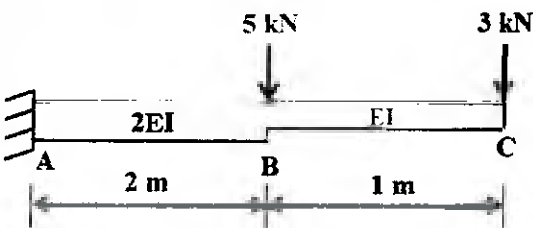
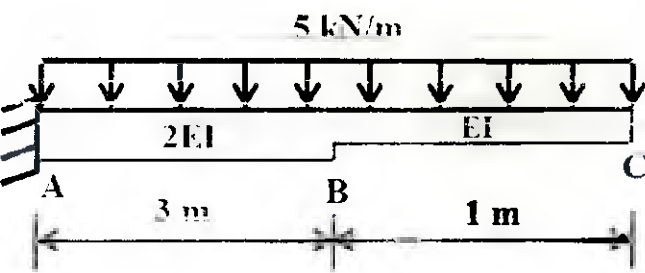
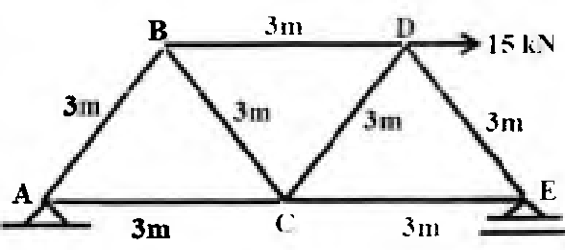
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END SEM/RE EXAMINATION: MAY/JUNE 2025



Q.3(a)	Find the slope at B and vertical deflection at C for the cantilever beam supported and loaded as shown in figure below. <u>Use conjugate method only.</u>	12	3	3,4	5
					
Q.3(b)	Find the slope at B and vertical deflection at C for the cantilever beam supported and loaded as shown in figure below. <u>Use moment area method only.</u>	08	3	3,4	5
					
Q.4(a)	For the pin jointed frame loaded as shown in figure below, find the horizontal deflection of joint D.	12	3	3,4	6
					



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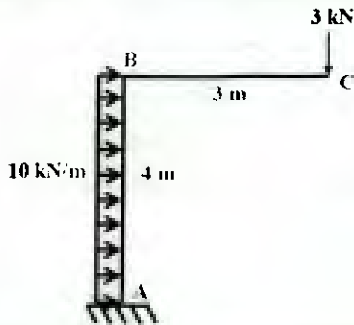
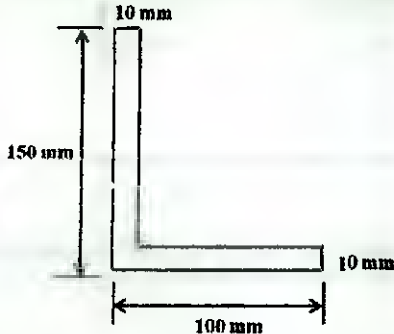
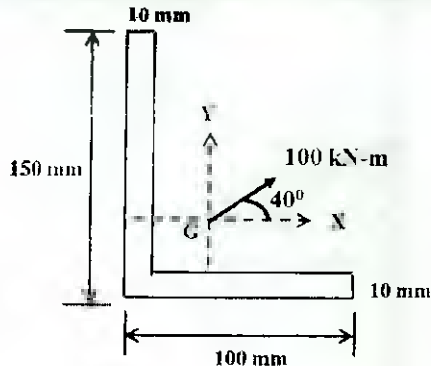
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END SEM/RE EXAMINATION: MAY/JUNE 2025

Q.4(b)	Find the strain energy stored <u>due to bending moment alone</u> in the frame loaded as shown in the figure below.	08	2	3,4	4
					
Q.5(a)	Locate the principal axes and find the principal moments of inertia for the cross section shown in figure below.	10	1	3,4	2
					
Q.5(b)	The angle section with dimensions shown in the figure below (same as given in Q. 5(a)) is subjected to a bending moment of 100 kN-m at 40 degrees to the positive X axis as shown in the figure. Find the location of the neutral axis and show it in the cross section. Find the maximum and minimum bending stresses and state their location in the cross section. (The properties of the cross section obtained in Q5(a) can be used. No need to calculate them again.)	10	1	4	2
					



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END SEM /RE EXAMINATION: MAY/JUNE 2025

Q.6(a)	Determine the vertical deflection of point C of the rigid jointed frame loaded as shown in figure below.	10	3	3,4	6
Q.6(b)	Find the crippling loads using (i) Euler's and (ii) Rankine's formulae for a steel column 2.5 m long with both ends pinned. The cross section of the column is a symmetrical I section with the following dimensions. Top and bottom Flange width = 140 mm, Top and bottom Flange thickness = 10 mm, Depth of web = 180 mm, Thickness of web = 12 mm. Take $E = 2 \times 10^5 \text{ N/mm}^2$, $f_c = 300 \text{ MPa}$ and Rankine's constant = $1/7000$.	10	4	3,4	7
Q.7(a)	For the frame loaded as shown in figure below a) Find the support reactions b) Draw AFD, SFD & BMD for members AB and BC only.	12	4	3,4	3
Q.7(b)	Find the Euler's buckling load for the structural steel column of hollow rectangular cross section with external dimensions of 100mm width by 180 mm depth and internal dimensions of 75mm width by 130 mm depth. The length of the column is 3m. The column is fixed at both the ends. Take $E = 200 \text{ GPa}$	05	4	3,4	7
Q.7(c)	What is the limitation of formula of Euler's huckling load?	03	2	2	4



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END SEM/II EXAM EXAMINATION -MAY / JUNE 2025

Program: Civil Engineering

Course Code: PC-BTC403

Course Name: Surveying & Geomatics

Duration: 3 hours

Maximum Points: 100

Semester: IV

Instructions:

1. Question No. 1 is compulsory.
2. Attempt any four questions from the remaining six questions.
3. Begin the answer to each main question on a new page.
4. Support your answers with appropriate figures and tables, wherever applicable.
5. Do not use pencil for writing answers. Only pen is permitted.

Q.no.	Question	Points	CO	BL
1	A. Explain the purpose of providing vertical curves in highway or railway alignment. Illustrate your answer with a neat sketch showing the key elements of a vertical curve. (4) B. Explain the difference between surface datum and earth centered earth fixed (ECEF) datum and state its region of applicability. (3) C. Define triangulation and trilateration. State a key difference between them. (3) D. An aerial photograph was taken from a flying height of 6200 m above mean sea level using a camera with a focal length of 152 mm. A point on the photograph lies 80 mm from the principal point. The elevation of the ground point is 450 m above mean sea level. Calculate the relief displacement of the point. (3) E. Give the names of the navigation satellite system of United States., India, and Russia. (3) F. List the major components of a Geographic Information System. (2) G. Explain what is meant by the term 'setting out' in construction survey (2)	20	1,2,3,4	1,2,3
2	A. A parabolic vertical curve is to be set out connecting two uniform grades of +0.8% and -0.9%. The chainage and reduced level of point of intersection are 1664m and 238.755m respectively. The rate of change of grade is 0.05% per chain of 20m. Calculate the length of the curve (1), chainages at the tangent points (1), and reduced level of the various station pegs till the apex of the curve along with the necessary check (5). Use Tangent correction method. Draw proper sketch of the vertical curve showing all elements (1). B. Explain the principle of triangulation and state and explain the basic requirements for forming a well-conditioned triangle. (6) C. Explain the principles of remote sensing and explain the significance of electromagnetic radiation (EMR) and wavelength bands in remote sensing. Also, briefly describe two applications of remote sensing. (6)	20	1,2,3,4	1,2,3



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

3	A	A transition curve is to be provided for a design speed of 80 km/h and a circular curve radius of 400 m. Calculate the length of the transition curve assuming a rate of change of centrifugal acceleration as 0.6 m/s^3 . Also, find the shift required for the curve. Draw a proper sketch showing all elements of transition curve. (6)	20	1,2,3,4	1,2,3
	B	Define geodetic datum and briefly describe the difference between a local datum and a global datum with proper examples. (4)			
	C	To determine the elevation of the top (Point Q) of the signal on a hill, observations were made from two instrument stations, P and R at a horizontal distance 100m apart, the station P and R being in the line with Q. the angles of elevation of Q at P and R were $28^\circ 42'$ and $18^\circ 6'$ respectively. The staff reading on the benchmark (BM) of elevation 287.28m were respectively 2.870m and 3.750m 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 3m. (6)			
	D	Differentiate between raster and vector data models in GIS. Provide one example of spatial data best suited for each model. (4)			
4	A	Explain how data is captured and integrated into a GIS. Discuss a spatial analysis technique used in GIS and illustrate how GIS can be applied in surveying or geomatics with one example. (6)	20	1,2,3,4	1,2,3
	B	Compare Differential GPS (DGPS) and Real-Time Kinematic (RTK) surveying. Discuss their differences in accuracy and applications. (4)			
	C	Describe the complete procedure for setting out a rectangular building on a construction site. Explain how right angles are established and how the accuracy of the layout is verified before excavation. (6)			
	D	Explain how vector data can be classified, categorically or graduated, in a GIS. Give proper example. (4)			
5	A	Explain with the help of a diagram different earth surfaces and explain how the ellipsoid and the geoid differ. (4)	20	1,2,3,4	1,2,3
	B	Explain the concept of geodetic latitude and longitude and explain how they differ from geographic latitude and longitude. (4)			
	C	Explain, with proper sketch, the working principle of GPS. (4)			
	D	The scale of an aerial photograph is $1\text{cm}=100\text{m}$. The photograph size is $20\text{cm} \times 20\text{cm}$. The longitudinal lap is 60% and side lap is 30%. Determine the number of photographs required to cover: 1. An area of 100 sq.km (3) 2. An area of $10\text{km} \times 10\text{km}$ (3) Is there any difference in the number of photographs in both the cases? Justify. (2)			
6	A	List the different types of vertical curves used in geometric design. Briefly explain the conditions under which these curves are preferred. (4)	20		
	B	Explain the concept of 'strength of figure' in triangulation networks. (4)			



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C	Two points A and B having elevations of 500m and 300m respectively above datum appear on the vertical photograph having focal length of 20cm and flying altitude of 2500m above datum. Their corrected photographic co-ordinates are as follows:														
	<table><tr><th rowspan="2">Point</th><th colspan="2">Photographic Co-ordinates</th></tr><tr><th>x (cm)</th><th>y (cm)</th></tr><tr><td>a</td><td>+2.65</td><td>+1.36</td></tr><tr><td>b</td><td>-1.92</td><td>+3.65</td></tr></table>	Point	Photographic Co-ordinates		x (cm)	y (cm)	a	+2.65	+1.36	b	-1.92	+3.65			
	Point		Photographic Co-ordinates												
		x (cm)	y (cm)												
	a	+2.65	+1.36												
b	-1.92	+3.65													
	Determine the length of the ground line AB. (4)														
D	Explain the concept of geo-referencing. Explain how spatial analysis helps in decision-making. (4)														
E	Explain: Receiver clock error and Selective availability in GPS. (4)														
A	Describe the procedure for setting-out a vertical curve using the chord gradient method. (4)	20	1,2,3,4	1,2,3											
B	List and briefly explain any four types of figures commonly used in triangulation or trilateration networks and for what survey works they are used. (4)														
C	Explain the principles of remote sensing and the significance of electromagnetic radiation (EMR) and wavelength bands in remote sensing. (4)														
D	Explain how GIS is different than any other Computer aided Design system with a proper example. (4)														
E	Explain any two applications of GPS in each of the following domains: Oceanic studies, Solid Earth studies, Atmospheric studies, and Ionospheric studies. (4)														



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

Program: Civil engineering *Sum IV*

Course Code: PC-BTC403

Course Name: Surveying & Geomatics

Instructions:

Duration: 3 hours

Maximum Points: 100

Semester: IV

1. Question No. 1 is compulsory.
2. Attempt any four questions from the remaining six questions.
3. Begin the answer to each main question on a new page.
4. Support your answers with appropriate figures and tables, wherever applicable.
5. Do not use pencil for writing answers. Only pen is permitted.

Q.no.	Question	Points	CO	PO
1	A. Differentiate between a circular curve and a transition curve. Explain the objectives of providing transition curves on highways or railways. (4) B. Illustrate with a diagram the difference between the geoid and ellipsoid. Explain why the geoid is considered a more accurate representation of mean sea level. (3) C. State the basic concept of trilateration. Explain how distance is measured in this method. (3) D. A vertical photograph taken at an altitude of 1200m above mean sea level. Determine the scale of the photograph for terrain lying at an elevation of 80m and 300m if the focal length of the camera is 15cm. (3) E. Describe the three main segments of the Global Positioning System (GPS) and explain the function of each segment in ensuring accurate positioning. (3) F. Define Geographic Information System (GIS) and explain the fundamental components of GIS. (2) G. State the main objectives of construction surveying. (2)	20	1,2,3,4	1,2,3
2	A. A parabolic vertical curve is to be set out connecting a falling gradient of -1.8% with a rising gradient of +1.2%. The chainage and reduced level of point of intersection are 1200m and 250m respectively. The length of the curve is 100m. Calculate the chainages (1), and reduced level of the various station pegs by tangent correction method (6) with proper sketch showing all elements (1).	20	1,2,3,4	1,2,3



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	B	Describe the role of signals and towers in triangulation and trilateration surveys. Explain with sketches, the different types of signals and towers used. (6)			
	C	State the elements of aerial image interpretation and explain any three elements in detail, with proper examples. (6)			
3	A	Explain the necessity of providing horizontal circular curves in road or railway alignment. With the help of a neat sketch, describe the geometric elements of a simple circular curve. (6)	20	1,2,3,4	1,2,3
	B	Differentiate between Quantitative and Qualitative thematic maps. (4)			
	C	To determine the elevation of the top (Point T) of a tower on a hill, observations were made from two instrument stations, A and B, which are 120 m apart, and aligned with T. The angles of elevation to the top of the tower from A and B were observed to be $30^{\circ}15'$ and $20^{\circ}10'$ respectively. The staff readings on a benchmark (BM) of elevation 312.45 m were found to be 2.610 m from A and 3.430 m from B, with the telescope kept horizontal. Calculate the elevation of the base of the tower, given that the height of the tower above its base is 4.2 m. (6)			
	D	Compare Static GPS and Differential GPS (DGPS) (RTK) surveying. Discuss their differences in accuracy and applications. (4)			
4	A	State and explain the spatial data and non-spatial data types in a GIS with proper examples. (6)	20	1,2,3,4	1,2,3
	B	Compare active and passive GPS tracking. (4)			
	C	Explain the step-by-step procedure for setting out a rectangular building on a construction site. Include the role of reference points and right-angle methods in ensuring accuracy. (6)			
	D	Explain how GIS can be helpful for spatial analysis and mapping. Give proper example. (4)			
5	A	Explain the concept of map projection. Explain why distortions occur in map projection. (4)	20	1,2,3,4	1,2,3
	B	List the main parameters used to define a reference ellipsoid. Name two commonly used ellipsoid models in geodesy and mention their regions of applicability. (4)			
	C	Explain "GPS Signal characteristics and operational concepts". (4)			
	D	i. The scale of an aerial photograph is $1\text{cm}=100\text{m}$. The photograph size is $20\text{cm} \times 20\text{cm}$. The longitudinal lap is 60% and side lap is 30%. Determine the number of photographs required to cover an area of $8\text{km} \times 12.5\text{km}$. (3)			



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		ii. State the elements of aerial image interpretation and explain any four elements in detail. (5)			
6	A	Compare the Tangent Correction Method and the Chord Gradient Method used for setting out vertical curves. Highlight the differences with respect to at least four parameters such as reference line, calculation steps, ease of field application, and accuracy. (4)	20		
	B	Discuss how the geometry of a triangle or network configuration affects the accuracy of position fixing. (4)			
	C	Derive the expression for relief displacement of a point on an aerial photograph due to its elevation above datum. Clearly state the assumptions involved and explain the significance of each term in the final formula. (4)			
	D	Explain the role of GIS in surveying. Give two examples of GIS in Civil Engineering. (4)			
	E	Discuss the typical co-ordinate reference systems (CRS) used for Static, DGPS, and RTK GPS and its application. (4)			
7	A	Derive the expression for tangent correction in a vertical curve. Clearly define the geometric significance of each parameter used in the derivation. (4)	20	1,2,3,4	1,2,3
	B	Describe at least two types of figures commonly used in triangulation or trilateration networks, and evaluate their relative merits in terms of strength and stability. (4)			
	C	Compare (at least 4 points) ground based, air borne, and space borne remote sensing methods. (4)			
	D	State the advantages and limitations of an Open source GIS environment. (4)			
	E	Explain Multipath error and Ionospheric error in GPS. (4)			



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END SEM/RE-SEM. EXAMINATION MAY/JUNE 2024-25

Program: S.Y. B. TECH *crack sem IV*

Course Code: PC-BTC-404

Course Name: HYDRAULIC ENGINEERING

Duration: 03 Hrs.

Maximum Points: 100

Semester: IV

Notes:

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

23/5/25

Q. No.	Questions	Points	CO	BL	Module
1	(a) What do you mean by hydraulic model testing? Explain in brief. Derive the dimensions of force, bulk modulus of elasticity, momentum, torque and bending moment.	10	1	2	1
	(b) The head loss due to friction 'hf' in a pipe depends upon diameter of pipe 'D', friction factor 'f', length of pipe 'L' and rate of flow through pipe 'Q'. Obtain an expression for loss of head using any method of dimensional analysis.	10	2	4	1
2	(a) Explain with neat sketches; (i) Working of siphon; (ii) HGL and TEL for three pipes of different diameters and lengths connected in series	10	2	3	2
	(b) A 25 cm wrought iron pipeline 750 meter long discharges water 125 meter below the surface of a reservoir. Determine the diameter of the nozzle which will deliver the maximum power. Assume $f = 0.022$ and coefficient of velocity of the nozzle is 0.96.	10	2	3	2
3	(a) Explain water hammer theory and obtain an expression for the rise in pressure in a thin elastic pipe of circular section in which the flow of water is stopped by sudden closure of valve.	10	2	2	3
	(b) A valve is provided at the end of a cast iron pipe of diameter 15 cm and of thickness 10 mm. Water is flowing through the pipe, which is suddenly stopped by closing the valve. Find the maximum velocity of water, when the rise of pressure due to sudden closure of valve is $200 \times 10^4 \text{ N/m}^2$. Take bulk modulus (K) for water as $19.62 \times 10^8 \text{ N/m}^2$ and elasticity modulus (E) for cast iron as $11.75 \times 10^{10} \text{ N/m}^2$.	10	2	4	3



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END SEM/RE-ENTRY EXAMINATION MAY/JUNE 2024-25

4	(a) Prove that the force exerted by a jet of water on a stationary semi-circular vane in the direction of the jet when the jet strikes at the center of the semi-circular vane is two times the force exerted by the jet on the stationary flat plate.	10	2	4	4
	(b) A jet of water of diameter 45 mm. strikes a fixed plate in such a way that the angle between the plate and the jet is 30° . If the force exerted in the direction of the jet is 1600 N, determine the rate of flow of water.	10	2	4	4
5	(a) Differentiate between impulse turbine and reaction turbine, and derive an expression for hydraulic efficiency of a Pelton wheel turbine.	10	2	4	4
	(b) In an inward flow reaction turbine the diameter at inlet and outlet are 1.20m and 0.60 m. The hydraulic efficiency = 92%. Head = 45m. The velocity of flow at outlet = 2 m/sec. The discharge at outlet is radial. The vane angle at outlet is 150° . Flow width is 0.10 m. at inlet and outlet. Determine (i) the guide blade angle (ii) vane angle at inlet	10	2	4	4
6	(a) Write short notes on: (any two) (i) Priming and minimum starting speed of a centrifugal pump. (ii) Pumps in parallel, series and multistage pumps (iii) Manometric head and efficiencies of centrifugal pump.	10	2	4	5
	(b) The outer diameter of an impellor of a centrifugal pump is 45 cm and outlet width 5 cm. The pump is running at 975 r.p.m. and is working against a total head of 35 meter. The vane angle at outlet is 40 degrees and manometric efficiency is 82%. Determine; (i) velocity of flow at outlet; (ii) velocity of water leaving the vane; and (iii) angle made by the absolute velocity at outlet.	10	2	4	5
7	(a) Derive: conditions for most economical rectangular channel section.	05	2	3	3
	(b) Draw and explain specific energy curve.	05	2	3	2
	(c) Establish a relationship between Chezy's C and Manning's N.	05	2	3	3
	(d) Determine the most economical trapezoidal channel section with side slope of 2H: 1V carrying a discharge of 12 cum/sec with a velocity of 0.85 meter/sec. Also determine the bed slope for this channel. Take Manning's 'n' = 0.025.	05	2	3	4



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~~END SEM~~/RE-EXAM. EXAMINATION ~~MAY~~/JUNE 2024-25

Program: S.Y. B. TECH *Civil Sem IV*
Course Code: PC-BTC-404
Course Name: HYDRAULIC ENGINEERING

Duration: 03 Hrs.
Maximum Points: 100
Semester: IV

Notes:

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

27/6/25

Q. No.	Questions	Points	CO	BL	Module
1	(a) What do you mean by hydraulic model testing? Explain in brief. Also explain scale effects in hydraulic model testing including distorted and undistorted models.	10	1	2	1
	(b) Obtain dimensionless parameters for the thrust (T) of a screw propeller of diameter 'D', moving with angular velocity ' ω ' in a liquid of density ' ρ ', and viscosity ' μ '. The speed of rotation is N. Use Buckingham's- π method.	10	2	3	1
2	(a) Show that: for a maximum power transmission through pipe of diameter 'D' connected with nozzle having diameter 'd': (i) the head loss (h_f) is one third of the total head at inlet (H); and (ii) Find nozzle diameter (d). Take; f = friction factor, and L = length of the pipe.	10	2	3	2
	(b) Three pipes connected in series discharges water from 90 meter level to 30 meter level. The lengths of pipes are 900m, 950m, 1250 m, diameters are 35 cm, 20 cm, 30 cm and friction factors are 0.022, 0.019, 0.020 respectively. Considering minor losses: determine discharge, velocity and head loss in each pipe.	10	2	3	2
3	(a) What is mean by water hammer? Obtain an expression for the rise in pressure in a thin elastic pipe of circular section in which the flow of water is stopped by sudden closure of valve.	10	2	2	3
	(b) A siphon of length 850 m has its vertex 7 meters above the water level in the upper reservoir. The length of inlet leg of siphon is 200 m and total head loss in siphon is 25 m. Determine the diameter of the siphon such that pressure at summit do not fall below vapour pressure of water. Take $f = 0.022$.	10	2	4	3

**END SEM / RE-EXAM. EXAMINATION MAY/JUNE 2024-25**

4	(a) Show that the efficiency of a free jet striking normally on a series of flat plates mounted on the periphery of a wheel can never exceed 50%.	10	2	4	4
	(b) A 40 m/sec velocity jet of water strikes without shock on a series of vanes moving at 10 m/sec. The jet is inclined at an angle of 22° to the direction of motion of vanes. The relative velocity of jet at outlet is 0.80 times the value at inlet and the flow is radial. Determine: (i) Vane angle at entrance and exit; (ii) Work done on vanes per second per unit weight of water; and (iii) Hydraulic efficiency.	10	2	3	4
5	(a) Explain working of hydraulic turbine with a neat sketch, Differentiate between impulse turbine and reaction turbine, and define hydraulic efficiency, mechanical efficiency and overall efficiency.	10	2	4	4
	(b) A Pelton wheel has a mean bucket speed of 10 m/sec and is supplied with water at a rate of 750 liters per second under head of 45 meter. If the bucket deflects the jet through an angle of 160° , find the power developed by the turbine and its hydraulic efficiency. Take the coefficient of velocity as 0.98. Neglect friction in the bucket. Also determine the overall efficiency of the turbine if its mechanical efficiency is 82%.	10	2	4	4
6	(a) Write short notes on: (any two) (i) Minimum starting speed of a centrifugal pump. (ii) Pumps in parallel, series and multistage pumps (iii) NPSH and Cavitation in centrifugal pump	10	2	4	5
	(b) A centrifugal pump lifts water under a static lift of 45 meter of which 5 meter is suction lift. The suction and delivery pipes both are 20 cm in diameter. The friction loss in suction pipe is 3 meter and in delivery pipe it is 5 meter. The impeller is 50 cm in diameter and 30 mm wide at outlet and runs at 1000 rpm. The exit blade angle is 22 degrees. If the manometric efficiency of the pump is 85 %, Determine: (i) Discharge from a pump; and (ii) Pressure at the suction and delivery ends of the pump.	10	2	4	5
7	(a) Discuss types of flow in open channel	05	2	3	3
	(b) Explain most economical trapezoidal channel section	05	2	3	2
	(c) Draw and explain specific energy curve	05	2	3	3
	(d) Calculate the maximum discharge through a rectangular channel having depth 3m, bed slope of 1 in 1000 and $C = 60$.	05	2	4	4



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

Program: Civil engineering

S. Y. (C) 10th

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 four) a) Discuss the role of community engagement in achieving social sustainability. (5) b) State and explain the major challenges in implementing eco-development strategies. (5) c) Explain how the Sustainable Development Goals (SDGs) guide international cooperation for sustainability. Illustrate with an example of how one SDG can be implemented at the national level. (5) d) State and explain the role of institutional theory in sustainable development. (5) e) Explain the term embodied carbon and embodied energy. (5) f) Explain the concept of net zero energy building and how is it different from a green building.	20	1	1,2
2	a) Discuss the significance of international environmental agreements in promoting economic sustainability. (10) b) Explain the concept of green building and how is it beneficial. Also, explain any one standard available to certify green building. (10)	20	1,2,3	2,3
3	a) Explain the concept of a green economy and its relevance to climate change policies. (10)	20	1,2,3	2,3



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

	b) Explain embodied carbon, Global Warming Potential, greenhouse gases and CO ₂ eq. (10)			
4	a) Evaluate the effectiveness of integrated resource management in ensuring long-term sustainability. (10) b) Describe various sustainability assessment methods. (10)	20	2,3,4	2, 3
5	a) Evaluate the obligations and responsibilities of developed nations in fostering global sustainable development. Support your answer with international agreements and policies. (10) b) Discuss Water Pollutants and ways to treat them. (10)	20	2,3	2,3
6	a) Explain how rural and urban development contributes to the path of sustainable development in India. (10) b) Explain a case-study for reuse and recycle of wastewater with flowsheet and critique on it. (10)	20	3,4	1,2
7	Present a case study in the form of a report that demonstrates the sustainability aspect of either material, food, water, energy, or a building. Analyze the key sustainability practices involved, and create recommendations to improve or replicate the model in other contexts. (20) Or Select any one of the following real-world scenarios and present a detailed case study analysis: (20) 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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~~END SEM~~ **RE-EXAM EXAMINATION - MAY / JUNE 2025**

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 four) a) Define social sustainability and explain its importance in modern society. (5) b) Explain the importance of eco-development programmes in environmental conservation. (5) c) Define sustainable development. Briefly explain the contribution of the Brundtland Report and the Rio Summit in shaping the global understanding of sustainability. (5) d) Compare Kyoto Protocol and Paris Agreement. (5) e) Explain Greenhouse gas emissions and Global Warming Potential. (5) f) Explain how an existing building can be converted to green building with respect to material and energy criteria. (5)	20	1	1,2
2	a) Analyze the social issues that hinder sustainability, such as gender inequality, poverty, and environmental degradation. Evaluate how community engagement and empowerment can address these challenges and promote social sustainability performance. (10) b) Explain with a case study concept of green building (GRIHA, IGBC or LEED). (10)	20	1,2,3	2,3



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

3	a) How do democratic institutions support social sustainability? Provide examples. (10) b) State and explain the three market based - flexibility mechanism of Kyoto protocol. (10)	20	1,2,3	2,3
4	a) Analyze the role of public participation in shaping environmental policies. (10) b) Enlist tools to measure sustainability. Explain any three which you find most appropriate for measurement. (10)	20	2,3,4	2,3
5	a) Evaluate how developed countries contribute to sustainable development through policy frameworks. (10) b) Explain your carbon footprint in a day. Explain the procedure for the same. (10)	20	2,3	2,3
6	a) Explain concept of LCA and LCA thinking. Explain how it is useful for sustainability. (10) b) Discuss International Action Plans for sustainable development: their purpose and key instruments. (10)	20	3,4	1,2
7	Present a case study in the form of a report that demonstrates the sustainability aspect of either material, food, water, energy, or a building. Analyze the key sustainability practices involved, and create recommendations to improve or replicate the model in other contexts. (20) Or Select any one of the following real-world scenarios and present a detailed case study analysis: (20) 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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Munshi Nagar, Andheri (W) Mumbai – 400058



RE-EXAM/~~END SEMESTER~~ EXAMINATION (MAY - JUNE 2025)

Program: Civil Engineering

Duration: 3 Hr.

Course Code: PC – BTC – 405

Maximum Points: 100

Course Name: Transportation Engineering

Semester: IV

Notes:

- Q.1. is compulsory
- Solve any four questions out of remaining six questions
- Assume suitable data if required

Q.No.	Questions	Point s	CO	BL
Q.1				
a	What is rail? Discuss with neat sketch different types of rail	08	02	01
b	What do you mean by creep of rail? How will you measure it?	08	02	01
c	State the assumption made while calculating the basic length of Runway	04	01	01
Q.2				
a	What is exit taxiway? Draw the neat sketch of exit taxiway connecting runway and parallel taxiway. Also discuss How you will apply the elevation correction for its location.	10	01	01
b	Discuss the requirement of railway station with respect to following points. (i) Passenger requirement (ii) staff requirement (iii) locomotive requirement (iv) train requirement	10	02	01
Q.3				
a	Write short notes on i. Cross wind component and its limiting values ii. Wind coverage iii. Calm period	06	01	
b	Discuss with sketch How you will plan the orientation of Runway Considering Direction and total duration.	07	01	02
c	How will you calculate the Basic Length of Runway	07	01	02
Q.4				
a	What is gradient? Explain following types of gradient i. Rulling gradient ii. Momentum gradient iii. Pusher gradient	08	02	01
b	Draw the cross section of single line railway track in embankment. Label all its component parts.	06	02	02
c	What is uniformity of gauge? List out its advantages	06	02	02



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Q.5																
a	What is sleepers? Discuss its function and requirement.	08	02	01												
b	State the advantages and disadvantages of wooden sleepers	08	02	01												
c	Write short notes on sleeper density	04	02	01												
Q.6																
a	Draw the layout of Airport and show all the details.	06	01	02												
b	Explain with neat sketch the takeoff climb surface	06	01	02												
c	Design the exit taxiway joining the runway and parallel main taxiway. The total angle of turn is 30 degree and exit speed is 95 km/hr. also, Draw the neat sketch showing all design elements	08	01	03												
Q.7																
a	Estimate the cost required for construction of 1 km long single line railway track for a sleeper density of (n+5). Use the following data for cost estimation. Cost of rail = 210 Rs./kg Cost of ballast including transportation = 500 Rs./m³ Cost of timber sleeper = 800 Rs./ m³ Cost of fish plate = 125 R/piece Cost of fish bolt = 50 R/piece. Labour cost = 30 % of the cost of material. Given ; Volume of ballast = 1.08 m³/m Width and depth of formation 5.5 m and 0.3 m Volume of one sleeper = 0.08855 m³	10	02	03												
b	The length of runway under standard condition is 2200 m. the airport is to construct at an elevation of 380 m above mean sea level. The gradient is to be provided along the alignment of runway is shown in table below. The monthly mean of average daily temperature and the monthly mean of maximum daily temperature for hottest month of year is 40.4 and 50.60 degree respectively. Apply the correction as per ICAO and FAA recommendation and calculate the corrected length of runway. <table border="1"> <tr> <td>End to end runway length</td> <td>0 to 300 m</td> <td>300 to 1200 m</td> <td>1200 to 1800 m</td> <td>1800 to 2400 m</td> <td>2400 to 3500 m</td> </tr> <tr> <td>Gradient, (%)</td> <td>+ 0.75</td> <td>+ 0.25</td> <td>+ 0.5</td> <td>- 0.60</td> <td>- 0.30</td> </tr> </table>	End to end runway length	0 to 300 m	300 to 1200 m	1200 to 1800 m	1800 to 2400 m	2400 to 3500 m	Gradient, (%)	+ 0.75	+ 0.25	+ 0.5	- 0.60	- 0.30	10	01	03
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