



Bharatiya Vidya Bhavan's
SARDAR PATEL COLLEGE OF ENGINEERING

(Government Aided Autonomous Institute)
Munshi Nagar, Andheri (W) Mumbai – 400058



End Semester/Re-Examination – May/June 2026

Program: S.Y.B.Tech (Civil) *Second Year* Duration: 3 Hours
Course Code: BS-BTC401 *Civil Sem-IV* Maximum Points: 100
Course Name: Probability, Statistics and Operation Research Semester: IV

Note:

18/05/26

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

		Questions	Points	CO	BL	Module														
1	a	A discrete random variable X has p.d.f defined by <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td>X</td><td>-2</td><td>-1</td><td>0</td><td>1</td><td>2</td><td>3</td></tr> <tr> <td>P(X)</td><td>0.2</td><td>k</td><td>0.1</td><td>2k</td><td>0.1</td><td>2k</td></tr> </table> Obtain k, mean and variance.	X	-2	-1	0	1	2	3	P(X)	0.2	k	0.1	2k	0.1	2k	6	CO1	BL5	2
X	-2	-1	0	1	2	3														
P(X)	0.2	k	0.1	2k	0.1	2k														
	b	It is claimed that a random sample of 1000 tyres with a mean life of 15629 km is drawn from a population of tyres which has a mean life of 15200 km and a standard deviation of 1248 km. Test the validity of claim at 5% level of significance.	6	CO2	BL5	4														
	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	BL3	1														
2	a	A potential buyer of light bulbs bought 50 bulbs of each of 2 brands. Upon testing the bulbs, he found that brand A had a mean life of 1282 hours with a standard deviation of 80 hours, and brand B had a mean life of 1256 hours with a standard deviation of 90 hours. Can the buyer be quite certain that the mean life of the two brands differ?	6	CO2	BL5	4														



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	b	If X is a continuous random variable with probability density function $f(x) = \begin{cases} kx, & 0 \leq x \leq 1 \\ k, & 1 \leq x \leq 2 \\ k(3-x), & 2 \leq x \leq 3 \\ 0, & \text{elsewhere} \end{cases}$ Find k and $P(1.5 \leq x \leq 2.5)$	6	CO1	BL2	3																						
	c	The height in cm of fathers (x) and of the sons (y) are given below <table><tr><td>X</td><td>165</td><td>160</td><td>170</td><td>163</td><td>173</td><td>158</td><td>178</td><td>170</td><td>175</td><td>180</td></tr><tr><td>Y</td><td>173</td><td>168</td><td>173</td><td>165</td><td>175</td><td>168</td><td>173</td><td>170</td><td>173</td><td>178</td></tr></table> Estimate the height of the son if the height of the father is 172 cm. Also estimate the height of the father if the height of the son is 173 cm. What is the coefficient of correlation between the height of fathers and sons?	X	165	160	170	163	173	158	178	170	175	180	Y	173	168	173	165	175	168	173	170	173	178	8	CO1	BL3	1
X	165	160	170	163	173	158	178	170	175	180																		
Y	173	168	173	165	175	168	173	170	173	178																		
3	a	A manufacturer of electric lamps, according to a certain process, finds the S.D. of lamp life to be 100 hours. He wants to change the process if the new process results in a smaller variation in lamp life. In adopting a new process, a sample of 150 lamps gave a S.D. of 95 hours. Is the manufacturer justified in changing the process?	6	CO2	BL4	4																						
	b	Calculate the correlation coefficient between x and y from the following data $n=10, \sum x=140, \sum y=150, \sum (x-10)^2=180,$ $\sum (y-15)^2=215, \sum (x-10)(y-15)=60.$	6	CO1	BL5	1																						
	c	Find Mean and Variance of Binomial Distribution	8	CO1	BL5	2																						



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4	a	Compute spearman's rank correlation coefficient for the following data <table><tr><td>X</td><td>11</td><td>13</td><td>20</td><td>20</td><td>15</td><td>40</td></tr><tr><td>Y</td><td>12</td><td>18</td><td>24</td><td>24</td><td>49</td><td>24</td></tr></table>	X	11	13	20	20	15	40	Y	12	18	24	24	49	24	6	CO1	BL5	1			
	X	11	13	20	20	15	40																
	Y	12	18	24	24	49	24																
b	There are 80 fishes in a pool, out of which 10 are golden. 5 fishes are taken at random from the pool. What is the probability that (a) exactly 3 fishes are golden (b) At least 2 fishes are golden?	6	CO1	BL3	2																		
c	For normal distribution, 30% items are below 45 and 8% items are above 64. Find the mean and variance of the normal distribution	8	CO2	BL3	3																		
5	a	A firm produces articles, 0.1 percent of which are defective. It packs them in boxes containing 500 articles. If a wholesaler purchases 100 such boxes, how many boxes can be expected (i) to be free from defective article (ii) to have one defective article?	6	CO1	BL4,5	2																	
	b	Two random sample gave the following data <table><tr><td>Sample No</td><td>Size</td><td>Mean</td><td>Variance</td></tr><tr><td>1</td><td>1000</td><td>67.42</td><td>2.58</td></tr><tr><td>2</td><td>1200</td><td>67.25</td><td>2.5</td></tr></table> Is the difference between standard deviation significant?	Sample No	Size	Mean	Variance	1	1000	67.42	2.58	2	1200	67.25	2.5	6	CO2	BL4	4					
	Sample No	Size	Mean	Variance																			
1	1000	67.42	2.58																				
2	1200	67.25	2.5																				
c	Two independent samples of 8 & 7 items gave the following results <table><tr><td>Sample A:</td><td>9</td><td>11</td><td>13</td><td>11</td><td>15</td><td>9</td><td>12</td><td>14</td></tr><tr><td>Sample B:</td><td>10</td><td>12</td><td>10</td><td>14</td><td>9</td><td>8</td><td>10</td><td></td></tr></table> Examine whether the difference between the mean of samples is significant at 5% level of significance?	Sample A:	9	11	13	11	15	9	12	14	Sample B:	10	12	10	14	9	8	10		8	CO2	BL2, BL4	4
Sample A:	9	11	13	11	15	9	12	14															
Sample B:	10	12	10	14	9	8	10																



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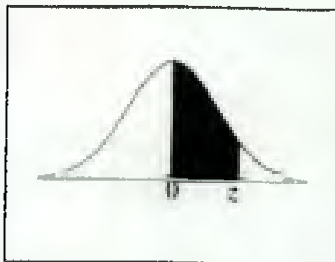
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6	a	If θ is the acute angle between the two regression lines, then prove that $\tan \theta = \frac{1-r^2}{r} \cdot \frac{\sigma_x \sigma_y}{\sigma_x^2 + \sigma_y^2},$ where r, σ_x, σ_y have their usual meanings.	6	CO1	BL5	2												
	b	Certain pesticide 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	CO2	BL3	4												
	c	Using Big M method, solve the following LPP Minimize $Z = 2x_1 + 3x_2$ Subject to $x_1 + x_2 \geq 5, \quad x_1 + 2x_2 \geq 6 \quad x_1, x_2 \geq 0$	8	CO3	BL3, BL5	5												
7	a	Fit a Poisson distribution to the following data <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></tr><tr><td>f</td><td>122</td><td>60</td><td>15</td><td>2</td><td>1</td></tr></table>	x	0	1	2	3	4	f	122	60	15	2	1	6	CO1	BL2, BL3	3
	x	0	1	2	3	4												
	f	122	60	15	2	1												
b	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.	6	CO2	BL5	2													
c	Using Simplex Method Solve the following LPP Maximize $Z = 6x_1 - 2x_2 + 3x_3$ Subject to $2x_1 - x_2 + 2x_3 \leq 2$ $x_1 + 4x_3 \leq 4$ $x_1, x_2, x_3 \geq 0$	8	CO3	BL1, BL3	5													

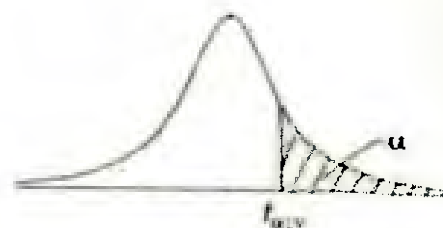
Standard Normal Distribution Table



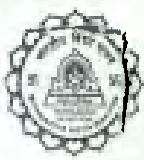
z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
0.0	.0000	.0040	.0080	.0120	.0160	.0199	.0239	.0279	.0319	.0359
0.1	.0398	.0438	.0478	.0517	.0557	.0596	.0636	.0675	.0714	.0753
0.2	.0793	.0832	.0871	.0910	.0948	.0987	.1026	.1064	.1103	.1141
0.3	.1179	.1217	.1255	.1293	.1331	.1368	.1406	.1443	.1480	.1517
0.4	.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

Table of the Student's t -distribution

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



$\alpha \backslash v$	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

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**END SEM/RE-EXAMINATION: MAY/~~JUNE~~ 2026****Second Year**Program: **B.Tech. in Civil Engineering**

Duration: 3 Hours

Course Code: **PC-BTC402****Sem -IV**

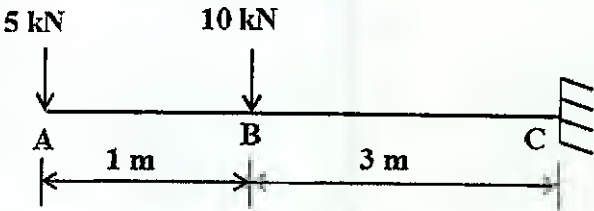
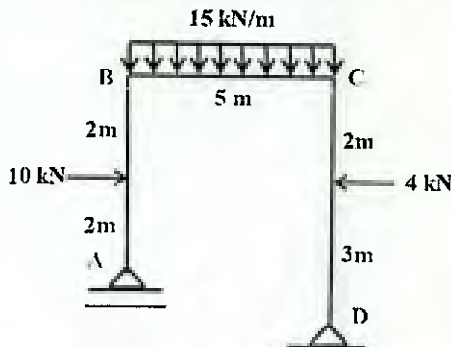
Maximum Points: 100

Course Name: **Structural Mechanics**

Semester: IV

20/5/26

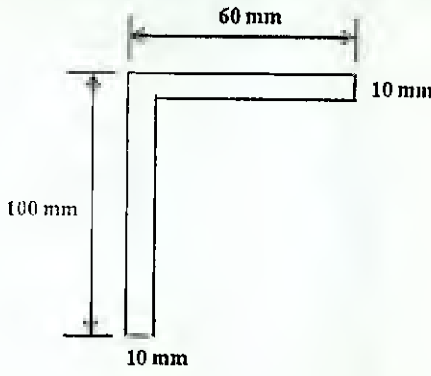
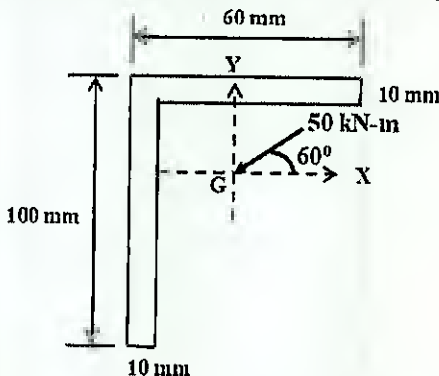
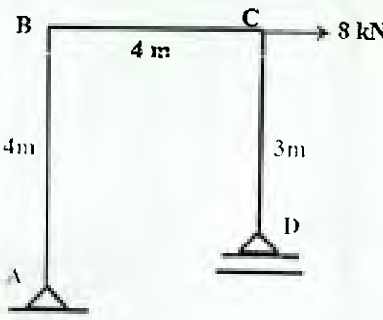
1. Attempt any FIVE questions out of SEVEN questions.
2. Answers to all sub questions should be grouped together.
3. Figures to the right indicate full marks.
4. Assume suitable data if necessary and state the same clearly.

Q.No.	Questions	Points	CO	BL	Module
Q.1(a)	A square chimney 15 m high has hollow square cross section with outside dimensions as 2.5 m x 2.5 m and internal dimensions 1.0 m x 1.0 m. It is subjected to a horizontal wind pressure of 1.5 kN/m ² . The specific weight (unit weight) of masonry of chimney is 20 kN/m ³ . Calculate the maximum and minimum stresses developed at the base of the chimney.	10	1	4	1
Q.1(b)	Using <u>Macaulay's method only</u> , find the slope and vertical deflection at A 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
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
					

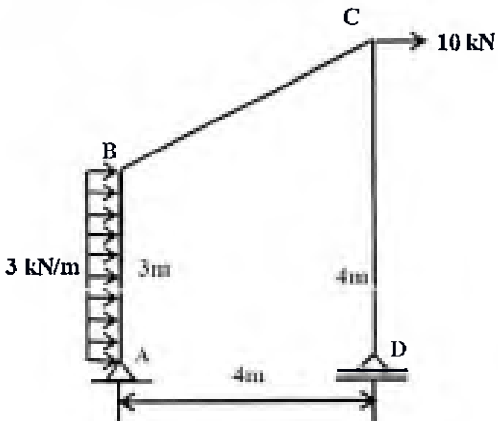


Q.3(a)	Find the slope at A and vertical deflection at C for the beam supported and loaded as shown in figure below. <u>Use conjugate method only.</u>	12	3	3,4	5
Q.3(b)	Find the slope at A and vertical deflection at C for the beam supported and loaded as shown in figure below. <u>Use moment area method only.</u>	08	3	3,4	5
Q.4(a)	For the pin jointed frame loaded as shown in figure below, find the horizontal deflection of joint C.	10	3	3,4	6
Q.4(b)	Find the strain energy stored in the rigid jointed frame shown in the figure below. Consider the effect of bending moment only.	10	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 cross section with dimensions shown in the figure below (same as given in Q. 5(a)) is subjected to a bending moment of 50 kN-m at 60 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
					



Q.6(b)	Find the crippling loads using (i) Euler's and (ii) Rankine's formulae for a 4.0 m long steel column 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 = 250 mm, Top and bottom Flange thickness = 20 mm, Depth of web = 180 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 rigid jointed 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)	A column of hollow circular cross section has outer diameter of 120mm and inner diameter of 80mm. One end of the column is fixed and the other end is pinned. Find the Euler's buckling load of the column if the length of the column is 1.5m and $E = 2 \times 10^5 \text{ N/mm}^2$.	05	4	3,4	7
Q.7(c)	What is the effective length of a column of length L for the following end conditions? (i) One end fixed and the other end pinned (ii) Both ends fixed (iii) Both ends pinned	03	2	2	4

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**END SEMESTER May 2026 / RE-EXAM July 2026**Program: Civil Engineering *Second Year B. tech*

Duration: 03 hours

Course Code: PC-BTC403*Civil*

Maximum Points: 100

Course Name: Surveying & Geomatics*Sem-IV*Semester: IV**Instructions:**

1. Main Question 1 is Compulsory
2. Answer any FOUR Main Questions out of the given SIX Main Questions.
3. All Main Questions carry equal marks.
4. Assume suitable data wherever necessary and state the assumptions clearly.
5. Draw neat sketches/figures wherever required.

22/5/26

Q. No	Question	Points	CO	BL	Module
Q.1	Answer the following	20			
a	A transition curve is provided between a straight and a circular curve. State its functions and explain different types of transition curves used in surveying practice (3). Explain what a vertical curve is and explain the necessity of vertical curves in road alignment. (2)	5	1	2	1
b	State any two advantages of trilateration over triangulation. (2)	2	3	2	2
c	Explain the two main purpose of Geodetic surveying. (2)	2	1	2	3
d	Explain the concept of stereoscopic vision in photogrammetry. Define overlap and sidelap in aerial photography. (4)	4	1	2	4
e	Define the two main data models used in GIS. (2)	2	1	2	5
f	Differentiate between static GPS and differential GPS (atleast two points). State one application of each. (3)	3	3	4	6
g	Compare the two methods of setting out foundation plans of a building. (2)	2	3	4	7
Q.2	Answer the following	20			
a	On a proposed railway alignment, two straight lines intersect at chainage 13670 m with a deflection angle of $40^{\circ}30'$ (Right). A circular curve of radius 400 m is to be provided, along with transition curves 60 m long at each end. The transition curves are to be set out with pegs at 10 m intervals by theodolite method. Calculate the following: Shift of the curve and spiral angle (2), Tangent length and length of circular arc (4), Chainages of: beginning of transition curve, transition-circular junction points, and end of transition curve (3), Deflection angles required for setting out the transition curves (4). Draw a neat sketch showing the combined curve with all relevant elements. (2)	15	4	3	1

**END SEMESTER May 2026 / RE-EXAM July 2026**

b	Explain the characteristics of a well-conditioned triangle and discuss the effect of shape of triangles on accuracy of triangulation. (5)	5	4	4	2
Q.3	Answer the following				
a	A parabolic vertical curve connects two gradients of +1.2% and -1.0%. The chainage and reduced level of the point of vertical intersection (PVI) are 2450 m and 312.480 m respectively. The allowable rate of change of grade is 0.04% per 20 m chain length. Calculate Length of the vertical curve (2), Chainages of beginning and end of the vertical curve (4), and Reduced levels of all peg points at 20 m intervals from the beginning of the vertical curve till the apex on the curve by tangent correction method (4). Draw a neat sketch showing all the relevant data.	10	4	3	1
b	Discuss the signal characteristics of GPS, including carrier waves, codes, and navigation message structure (5). Also explain the configuration and characteristics of GPS satellite orbits used for positioning and navigation (5).	10	1	2	6
Q.4	Answer the following	20			
a	Explain the concept of Geographic Information System (GIS) as a spatial decision support system (5). Differentiate between raster and vector data models used in GIS with suitable examples. Analyze their suitability for representing continuous and discrete geographical phenomena in civil engineering applications. (5) Explain how GIS helps in identifying spatial relationships and supporting decision-making processes. (5)	15	4	4	5
b	Discuss the role of geodesy in determining the shape, size, and gravity field of the Earth. Also explain the significance of geodetic control networks in large-scale surveying projects. (5)	5	1	4	3
Q.5	Answer the following	20			
a	An area measuring 36 km in the north-south direction and 28 km in the east-west direction is to be covered by aerial photography for preparation of a photomosaic. A camera having a focal length of 24 cm is used and the photograph size is 23 cm × 23 cm. The average photo scale required is 1 : 15,000 at an average terrain elevation of 550 m above datum. The required forward overlap is 65% and side-lap is 25%. The aircraft maintains a constant ground speed of 240 km/h and exposures are controlled using an intervalometer. The flight lines are planned in the north-south direction on a map having a scale of 1:50,000. The outermost flight lines are to coincide with the east and west limits of the area.	15	4	3	4



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	Determine: Flying height (1), Theoretical ground spacing of flight lines (2), No. of flight lines required (1), Actual spacing of flight lines (1), Spacing flight lines on flight map (1), Ground distance between exposures (2), exposure interval (2), adjusted ground distance between exposures (2), No. of photographs in a flight line (2), Total no. of photographs (1).				
b	Define 'radial distortion'. With a proper sketch, prove that the radial distortion is radial from the isocenter. (5)	5	4	3	7
Q.6	Answer the following	20			
a	Explain various remote sensing observation platforms (5). Explain, with a neat sketch, an idealized space remote sensing system (5).	10	1	2	4
b	A section line AB appears to be 10.16cm on a photograph for which the focal length is 16cm. The corresponding line measures 2.54 cm on a map which is to a scale of 1: 50,000. The terrain has an average elevation of 200m above mean sea level. Calculate the flying altitude of the aircraft, above mean sea level, when the photograph is taken (3). Calculate the relief displacement of a point on the image whose distance from the principal point is 6.44cm (2).	5	4	3	3
c	Explain the process of contour generation using GIS. Discuss the data requirements, methodology, and applications of contour mapping in terrain analysis and civil engineering projects. (5)	5	4	4	5
Q.7	Answer the following	20			
a	Compare the tangent correction method and chord gradient method used for setting out vertical curves with respect to principle, accuracy, computations, field application, and suitability (4). State the advantages and limitations of each method (4)	8	4	4	1
b	Explain the single chain, double chain, braced quadrilateral, and central point triangulation with its suitability. (4)	4	3	2	2
c	Explain the principles, procedures, advantages, and applications of Static GPS surveying. (4)	4	3	2	6
d	Explain the procedure of setting out foundation plan by centre-line method. (4)	4	3	3	7



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Munshi Nagar, Andheri (West), Mumbai – 400058.

End Semester Examination/ Re-Examination, May/June 2026



Max. Marks: 100 Second Year Civil

Duration: 03 hours

Class: SY Civil Engineering Semester: IV

Program: UG Civil

Name of the Course: Hydraulic Engineering

Sem-IV

Course Code: PC-BTC404

Instructions:

28/5/26

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

Question No		Maximum Marks	Course Outcome Number	Module No.
Q1.	(a) Explain the significance of dimensional analysis in experimental studies with special emphasis in hydraulic engineering and explain Rayleigh's method.	10	4	1
	(b) The ' η ' of a fan depends on density ' ρ ' and viscosity of fluid ' μ ', angular velocity ' ω ', diameter ' D ' and discharge ' Q '. Obtain a functional relationship for ' η ' in terms of dimensionless parameters. Use Buckingham's- π theorem.	10	4	1
Q2.	(a) Derive Darcy-Weisbach's equation. Explain all terms used with a neat sketch.	10	1	2
	(b) Three pipes joined in series discharges water from 55 m level to 25 m level. The details of piping system are lengths 925 m, 750m, 910m, Diameters 25 cm, 15 cm, 20 cm and friction factors 0.019, 0.023, 0.022 respectively. Determine discharge, velocity and head loss in each pipe. Consider all losses.	10	1	2
Q3.	(a) Write short notes on; (i) Working of syphon	05	1	2
	(ii) Pipes in parallel	05	1	2
	(b) A pipe of diameter 30 cm and length 4.75 km is used for the transmission of power by water. The total head at the inlet of the pipe is 180 meter. Find the maximum power available at the outlet of the pipe. Take $f = 0.018$.	10	1	2

Q4.	(a) Prove that for the jet striking at the center of the moving semi-circular curved vane maximum efficiency is less than 60 %.	10	2	3
	(b) A 42 m/sec velocity jet of water strikes without shock a series of vanes moving at 15 m/sec. The jet is inclined at an angle of 20° 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 angles at entrance and exit; (ii) Work done on vanes by the jet; and (iii) Hydraulic efficiency.	10	2	3
Q5.	(a) Differentiate between Impulse turbine and Reaction Turbine. Draw velocity triangles and explain all terms used.	10	2	4
	(b) The penstock supplies water from a reservoir to Pelton wheel with a gross head of 480 m. One third of gross head is lost in friction in penstock. The rate of flow of water through the nozzle is $5 \text{ m}^3/\text{s}$. The angle of direction of jet is 165° . Determine power given by water to runner and also hydraulic efficiency of Pelton wheel. Take speed ratio = 0.46 and $C_v = 1.0$	10	2	4
Q6.	(a) Write short notes on: (i) Work done by an impeller of a centrifugal pump	05	2	5
	(ii) Priming of a centrifugal pump and its necessity	05	2	5
	(b) The internal and external diameters of the impeller of a centrifugal pump are 30 cm and 60 cm respectively. The pump is running at 875 r.p.m. The vane angles at inlet and outlet are 20° and 30° respectively. The water enters the impeller radially and velocity of flow is constant. Determine the work done by the impeller per unit weight of water.	10	2	5
Q7.	(a) Differentiate between:			
	(i) Open Channel flow and Pipe Flow.	05	3	6
	(ii) Prismatic and Non-prismatic Channels	05	3	6
	(b) Derive the conditions for most economical Trapezoidal channel section.	10	3	6



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End Semester Examination/ Re-Examination, May ~~June~~ 2026

Program: S. Y. B. Tech. Civil

Second Year

Duration: 3 Hour

Course Code: BTC - 406

Civil Sem-IV

Maximum Points: 100

Course Name: Transportation Engineering

Semester: IV

Notes:

01/06/26

- (i) Question 1 is compulsory
- (ii) Solve any four out of remaining six questions
- (iii) Assume suitable data if required
- (iv) Use graph paper if required

Q.No.	Questions	Points	CO	BL
Q.1				
a	Write short notes on sleeper density	05	02	01
b	Explain with sketch how the movement of aircraft can control in space.	05	01	01
c	Draw a Neat Sketch of Aircraft and show all its component parts. Also, Discuss wing of the aircraft with respect to (i) lift to drag ratio, (ii) surface area, (iii) aspect ratio, (iv) camber shape of wing.	10	01	02
Q.2.				
a	Explain with neat sketch (i) Take off climb surface and (ii) Approach surface	06	01	02
b	Define the terms (i) Cross wind component and its limiting value, (ii) Wind coverage (iii) Calm period,	06	01	01
c	Discuss the systematic approach for expansion of existing airport or construction of new airport	08	01	02
Q.3.				
a	write short notes on (i) Classification of airport considering basic length of runway	05	01	02
b	Enlist the assumptions made while calculating basic length of runway	05	01	01
c	The length of runway under standard condition is 2400 m. the airport is to be provided at an elevation of 380 m above mean sea level. The gradient need to be provided at the site under consideration is given Table 1. The monthly mean of maximum daily temperature and average daily temperature is 42°C and 27°C respectively. Apply the necessary correction as per ICAO and FAA and calculate the corrected length of runway.	10	01	03
Q.4.				



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End Semester Examination/ Re-Examination, May /June 2026

a	Define the terms (i) Cant deficiency , (ii) heel divergence, (iii) number of crossing, (iv) theoretical nose of crossing & actual nose of crossing (v) relationship between number of crossing and angle of crossing	10	02	02												
b	Design an exit taxiway joining runway and parallel main taxiway. The total angle of turn is 30 ⁰ and turning speed 95 km/hr. draw a neat sketch showing all design elements.	10	01	02												
Q.5.																
a	Discuss with sketch following types of wayside stations (a) Halt station (b) Flag Station	08	02	01												
b	Write short notes on passenger bogie yard and marshalling yard.	07	02	01												
c	Enlist the Advantage and Disadvantage of concrete sleepers.	05	02	01												
Q.6.																
a	The speed of several train running on 4 ⁰ curve is shown in table below. Calculate the equilibrium speed for which super elevation is to be design. Also design the super elevation for BG & MG track <table><tr><td>Speed of trains in km/hr</td><td>Number of train</td></tr><tr><td>50</td><td>50</td></tr><tr><td>60</td><td>20</td></tr><tr><td>70</td><td>15</td></tr><tr><td>75</td><td>10</td></tr><tr><td>80</td><td>05</td></tr></table>	Speed of trains in km/hr	Number of train	50	50	60	20	70	15	75	10	80	05	08	02	03
Speed of trains in km/hr	Number of train															
50	50															
60	20															
70	15															
75	10															
80	05															
b	Explain with neat sketch coning of wheel and tilting of rail.	07	02	02												
c	What is gauge & its types	05	02	01												
Q.7.	Write short notes on															
a	Location of Exit Taxiway	05	01	02												
b	Different types of joints	05	02	01												
c	Different types of Gradient	05	02	01												
d	Public requirement at station	05	02	01												

Q.3. (c), table - 1

End to end runway length (m)	0 to 300	300 to 1200	1200 to 1800	1800 to 2400	2400 to 3500
Gradient (%)	+ 1.0	- 0.50	+ 0.50	- 0.60	+0.50



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END SEMESTER EXAM MAY ~~JUNE~~ 2026-SET-A

Max. Marks: 100

Class: S.Y.B.Tech

Name of the Course: Water Supply Engineering

Course Code: PC BTC-406

Second Year B.Tech Civil
Sem-IV

Duration: 3 Hrs

Semester: IV

Program: B. Tech CIVIL

03/06/26

Instructions:

- Question 1 is compulsory. Attempt any 4 of the 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 the right indicates the maximum points for the given question, course outcomes attained, Bloom's Level

QN	Description	Pts	CO	B L	MN
Q1	Answer the questions	(20)			
(a)	Explain with a neat flowsheet the complete water supply scheme from source to consumer. Label all components. Describe design periods as per GOI manual for each component (intakes, treatment units, distribution system, service reservoir, pumping).	(10)	CO1 – CO4	4	1
(b)	Solve the following numericals: (i) A city has population records: 1980=30,000; 1990=38,000; 2000=48,000; 2010=60,000; 2020=74,000. Forecast 2050 population using Arithmetic Increase Method. (3 marks) (ii) Calculate alum required (kg/day) for treating the design flow from Q1(b)(i) at 100 lpcd if alum dose = 28 mg/L and purity = 85%. (3 marks) (iii) Find lime and soda ash required (kg/day) to remove $MgCl_2$ = 190 mg/L from the design flow. Purity = 90%. (4 marks)	(10)	CO3	4	1
Q2	Answer the Questions	(20)			
(a)	The population of a town per census records is: 1940=40,185; 1950=44,522; 1960=60,395; 1970=75,614; 1980=98,886; 1990=1,24,230; 2000=1,58,800. Estimate the population in 2020 and 2035 using: (i) Arithmetic Increase Method (ii) Incremental Increase Method (iii) Geometric Increase Method Compare results and recommend which method is most suitable for this town, giving reasons.	(10)	CO1, CO4	3	1
(b)	Design a bell-mouth canal intake for a city of 75,000 persons drawing water from an irrigation canal that runs only 10 hrs/day with a depth of 1.5 m. Treatment works are 0.25 km away. Average consumption = 150 lpcd. Assume velocity through screens = 16 cm/s and through bell-mouth = 32 cm/s. Screens are vertical iron bars of 20 mm dia placed 3–5 cm c/c. Minimum water level in canal = 0.3 m below FSL. Use: $v = 0.85 CH R^{0.63} S^{0.54}$ (CH=130, $R=d/4$ for circular) Find: design	(10)	CO1, CO4	4	2

**END SEMESTER EXAM MAY JUNE 2026-SET-A**

	discharge, screen area, bell-mouth area, pipe diameter, and head loss. Draw a neat labelled sketch of the canal intake.				
Q3	Answer the Questions	(20)			
(a)	Explain the concept of an ideal settling tank. Design a coagulant-aided sedimentation tank for a town of 50,000 population (water demand 100 lpcd). Check SOR, detention time, L:B ratio, weir loading rate.	(10)	CO2	4	2
(b)	Design water depth for a slow mixing basin (gravity flocculator) having around the end baffles in order to treat 30 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	4	2
Q3	Answer the Questions	(20)			
(a)	Explain methods of rainwater harvesting and how would you go about designing a rainwater system for a college campus	(10)	CO2, CO3	4	5
(b)	Explain (i) Reverse Osmosis (ii) Electrodialysis	(10)	CO3	3	4
Q4	Answer the questions	(20)			
(a)	Design a rapid sand filter for a town of 60,000 population with water demand 100 lpcd: (i) Filter box: number of units, area per unit, L×B, depth. (6 marks) (ii) Underdrainage — perforated pipe system: header, laterals, spacing, perforation dia, total perforation area, manifold area with all checks. (8 marks) (iii) Wash water system: wash water rate, tank capacity, pump head. (6 marks)	(20)	CO3, CO4	4	3
Q5	Answer the following questions				
(a)	Explain coagulation and flocculation processes in detail. Design a mechanical rapid-mix unit (flash mixer) for a flow of 400 m ³ /hr. Take $\mu = 1.0087 \times 10^{-3}$ Ns/m ² , $G = 500$ s ⁻¹ , detention time = 45 sec. Find volume, depth, diameter, and power requirements. Also describe the jar test procedure with a neat diagram.	(14)	CO3, CO4	4	2
(b)	Explain with typical values (a) Surface overflow rate (b) Weir Loading rate (c) Displacement efficiency	(06)	CO3, CO4	3	2
Q6	Answer the questions	(20)			
(a)	Draw and explain the breakpoint chlorination curve in detail. Explain free residual and combined residual chlorine zones. For a town of 60,000 (100 lpcd), if chlorine demand = 1.6 mg/L and residual = 0.4 mg/L, find: (i) Chlorine dosage (mg/L) (ii) Chlorine consumed (kg/day) Also explain: superchlorination + dechlorination, chloramine treatment, chlorine dioxide, UV disinfection. What disinfectant suits rural well disinfection with bleaching powder?	(10)	CO3, CO4	3	4



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(b)	Explain causes of color, taste, and odor in water. Describe any two methods to remove them.	(10)	CO3	2	4
Q7	Answer the questions	(20)			
(a)	Answer the following rural water supply problems: (i) A coastal village has only saline groundwater (TDS > 3000 mg/L). Recommend and explain reverse osmosis — principle, membrane, pressure, pre-treatment, advantages. Draw schematic. (6 marks) (ii) A remote town reports fluoride of 4.0 mg/L in its borewell. Explain dental and skeletal fluorosis. Compare Nalgonda technique, Prashanti technique (activated alumina), and ion exchange resin for defluoridation. (8 marks) (iii) Explain step-by-step procedure to disinfect a rural open well using bleaching powder. (6 marks)	(20)	CO2, CO3	4	5

Formula sheet

$P_n = P_o \left[1 + \frac{r}{100} \right]^n$ $P_n = P_o + nx + \frac{n(n+1)}{2} y$ $\log_e \left[\frac{P_s - P}{P} \right] - \left[\frac{P_s - P_o}{P_o} \right] = -kP_s * t$ $P_n = (P_o + nx)$ $r = \sqrt[n]{r_1 * r_2 * r_3 * \dots * r_n}$ 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 $G = \sqrt{\frac{P}{\mu * V}}$ $\mu=1.0087*10^{-3}$Ns/m² 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 $G * t = \frac{v}{Q} * \sqrt{\frac{P}{\mu v}} = \frac{\sqrt{PV/\mu}}{Q}$
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 v=1.002X10⁻⁶ m²/sec $v_d = \sqrt{\left(\frac{8\beta}{f'} \right) (S_s - 1) dg}$ $f' = 0.025 - 0.03$ $g=9.8\text{m/s}^2$ $v_d = \sqrt{\frac{8\beta g (S_s - 1) d}{f'}}$	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 Semester/Re-Examination – May/June 2026

Program: S.Y.B.Tech (Civil) Second Year **Duration:** 3 Hours

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

Course Name: Probability, Statistics and Operation Research **Semester:** IV

Note:

Sem-IV 13/7/26

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

		Questions	Points	CO	BL	Module																
1	a	The probability density function of a random variable is <table border="1"><tr><td>X</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td></tr><tr><td>P(X)</td><td>2k</td><td>4k</td><td>5k</td><td>7k</td><td>10k</td><td>15k</td><td>17k</td></tr></table> Find (i) k (ii) $P(2 \leq X \leq 5)$ (iii) $P(X \geq 3)$	X	0	1	2	3	4	5	6	P(X)	2k	4k	5k	7k	10k	15k	17k	6	CO1	BL5	2
	X	0	1	2	3	4	5	6														
	P(X)	2k	4k	5k	7k	10k	15k	17k														
b	An ambulance service claims that it takes an average of 8.9 minutes to reach its destination in emergency calls. To check this claim, the agency that licenses ambulance services has them timed for 80 emergency calls, yielding a mean of 9.1 minutes with a standard deviation of 1.5 minutes. What can they conclude at the level of significance $\alpha = 0.05$?	6	CO1	BL5	1																	
	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	BL3	2																
2	a	A potential buyer of light bulbs bought 50 bulbs of each of 2 brands. Upon testing the bulbs, he found that brand A had a mean life of 1282 hours with a standard deviation of 80 hours, and brand B had a mean life of 1256 hours with a standard deviation of 90 hours. Can the buyer be quite certain that the mean life of the two brands differ?	6	CO2	BL5	4																



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	b	A random variable X has density function $f(x) = \begin{cases} cx, & 1 \leq X \leq 2 \\ cx^2, & 2 < X < 3 \\ 0, & \text{otherwise} \end{cases}$ Find the constant C, $P(X > 1.5)$	6	CO1	BL2	1																						
	c	The height in cm of fathers (x) and of the sons (y) are given below <table border="1"><tr><td>X</td><td>165</td><td>160</td><td>170</td><td>163</td><td>173</td><td>158</td><td>178</td><td>170</td><td>175</td><td>180</td></tr><tr><td>Y</td><td>173</td><td>168</td><td>173</td><td>165</td><td>175</td><td>168</td><td>173</td><td>170</td><td>173</td><td>178</td></tr></table> Estimate the height of the son if the height of the father is 172 cm. Also estimate the height of the father if the height of the son is 173 cm. What is the coefficient of correlation between the height of fathers and sons?	X	165	160	170	163	173	158	178	170	175	180	Y	173	168	173	165	175	168	173	170	173	178	8	CO2	BL3	5
X	165	160	170	163	173	158	178	170	175	180																		
Y	173	168	173	165	175	168	173	170	173	178																		
3	a	A manufacturer of electric bulbs, according to certain process, finds the S.D. of the life of lamps to be 100 hours. He wants to change the process, if the new process results in a smaller variation in the life of lamps. In adopting a new process, a sample of 150 lamps gave S.D of 95 hours. Is the manufacturer justified in changing the process?	6	CO3	BL4	2																						
	b	A sample of 25 pairs of values x and y gave the 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 the correct values (8,12) and (6,8). Find correct correlation coefficient between x and y.	6	CO1	BL5	1																						
	c	Find Mean and Variance of Poisson Distribution	8	CO1	BL5	1																						



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End Semester/Re-Examination – May/June 2026

4	a	Calculate rank correlation coefficient from the following data	6	CO1	BL5	1																				
		<table><tr><td>X</td><td>36</td><td>56</td><td>20</td><td>42</td><td>33</td><td>44</td><td>50</td><td>15</td><td>60</td></tr><tr><td>Y</td><td>50</td><td>35</td><td>70</td><td>58</td><td>75</td><td>60</td><td>45</td><td>80</td><td>38</td></tr></table>	X	36	56	20	42	33	44	50	15	60	Y	50	35	70	58	75	60	45	80	38				
X	36	56	20	42	33	44	50	15	60																	
Y	50	35	70	58	75	60	45	80	38																	
	b	During war, 1 ship out of 7 was sunk on average during a certain voyage. What is the probability that out of a convoy of 6 ships (i) exactly 3 will arrive safely, (ii) at least 3 will arrive safely?	6	CO3	BL3	3																				
	c	For normal distribution 30% items are below 45 and 8% items are above 64. Find the mean and variance of the normal distribution	8	CO1	BL3	1																				
5	a	In a certain factory producing certain articles, the probability that an article is defective is $\frac{1}{500}$. 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 15000 packets	6	CO1	BL4,5	3																				
	b	Two random samples gave the following data <table><tr><td>Sample No</td><td>Size</td><td>Mean</td><td>Variance</td></tr><tr><td>1</td><td>1000</td><td>67.42</td><td>2.58</td></tr><tr><td>2</td><td>1200</td><td>67.25</td><td>2.5</td></tr></table> Is the difference between the standard deviations significant?	Sample No	Size	Mean	Variance	1	1000	67.42	2.58	2	1200	67.25	2.5	6	CO2	BL4	4								
Sample No	Size	Mean	Variance																							
1	1000	67.42	2.58																							
2	1200	67.25	2.5																							
	c	Two independent samples of sizes 8 and 7 contained the following values <table><tr><td>Sample I</td><td>19</td><td>17</td><td>15</td><td>21</td><td>16</td><td>18</td><td>16</td><td>14</td></tr><tr><td>Sample II</td><td>15</td><td>14</td><td>15</td><td>19</td><td>15</td><td>18</td><td>16</td><td></td></tr></table> Is the difference between the sample means significant?	Sample I	19	17	15	21	16	18	16	14	Sample II	15	14	15	19	15	18	16		8	CO2	BL2, BL4	2		
Sample I	19	17	15	21	16	18	16	14																		
Sample II	15	14	15	19	15	18	16																			



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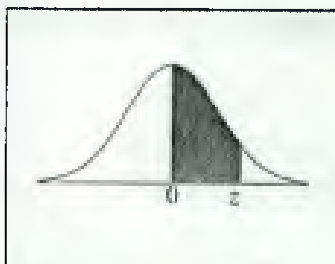
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End Semester/Re-Examination – May/June 2026

6	a	If θ is the acute angle between the two regression lines, then prove that $\tan \theta = \frac{1-r^2}{r} \cdot \frac{\sigma_x \sigma_y}{\sigma_x^2 + \sigma_y^2},$ where r, σ_x, σ_y have their usual meanings.	6	CO3	BL5	5												
	b	Test results for the breaking strength of 10 pieces of metal were: 578, 572, 570, 568, 572, 570, 570, 572, 596, and 584 kg. Test whether the mean breaking load of the metal wire can be assumed to be 577 kg at 5% LOS	6	CO1	BL3	1												
	c	Using the Big M method, solve the following LPP Minimize $Z = 2x_1 + 3x_2$ Subject to $x_1 + x_2 \geq 5, \quad x_1 + 2x_2 \geq 6 \quad x_1, x_2 \geq 0$	8	CO1	BL3, BL5	3												
7	a	Fit a binomial distribution to the following data <table border="1" style="margin: 10px auto;"><tr><td>x</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td></tr><tr><td>f</td><td>12</td><td>66</td><td>109</td><td>59</td><td>10</td></tr></table>	x	0	1	2	3	4	f	12	66	109	59	10	6	CO2	BL2, BL3	4
	x	0	1	2	3	4												
	f	12	66	109	59	10												
b	The weights of 5000 students are found to be normally distributed with a mean of 50 kilograms and a standard deviation of 5 kg. Find the number of students with weights (i) less than 45 kg. (ii) Between 45 and 60 kg.	6	CO3	BL5	1													
c	Using Simplex Method Solve the following LPP Maximize $Z = 6x_1 - 2x_2 + 3x_3$ Subject to $2x_1 - x_2 + 2x_3 \leq 2$ $x_1 + 4x_3 \leq 4$ $x_1, x_2, x_3 \geq 0$	8	CO3	BL1, BL3	5													

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

Table of the Student's t -distribution

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



$\alpha \backslash v$	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



second year
Program: B.Tech. in Civil Engineering

Duration: 3 Hours**Course Code: PC-BTC402****Sem - IV** 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.

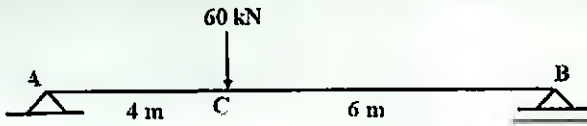
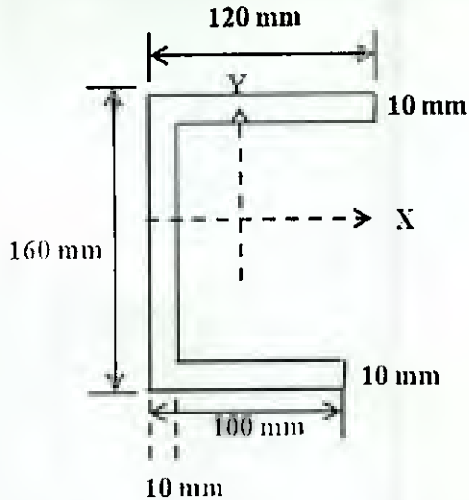
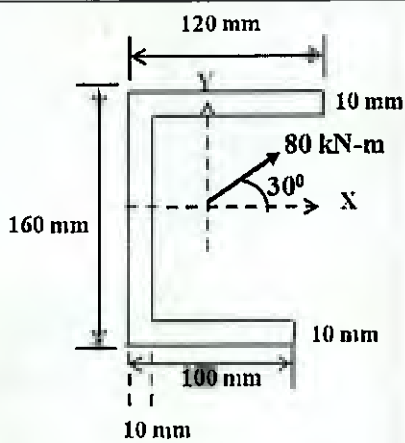
14/7/26

Q.No.	Questions	Points	CO	BL	Module
Q.1(a)	The cross section of a concrete pier is subjected to compressive loads of $P_1 = 100$ kN, $P_2 = 50$ kN and $P_3 = 50$ kN with eccentricities as shown in figure below. Find the maximum and minimum stresses and the locations of these stresses.	10	1	4	1
Q.1(b)	Using <u>Macaulay's method only</u> , find the slope at A and vertical deflection at B 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
Q.3(a)	Find the slope at A and vertical deflection at D 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 and vertical deflection at C 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 E.	12	3	3,4	6



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 cross section with dimensions shown in the figure below (same as given in Q. 5(a)) is subjected to a bending moment of 80 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
					

**END-SEM/RE EXAMINATION: MAY/JUNE 2026**

Q.6(a)	Determine the horizontal deflection of point A 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 3.0 m long with both ends fixed. The cross section of the column is a symmetrical I section with the following dimensions. Top and bottom Flange width = 200 mm, Top and bottom Flange thickness = 15 mm, Depth of web = 150 mm, Thickness of web = 10 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 rigid jointed 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)	A column of hollow rectangular cross section has outer dimensions of 100 mm x 200 mm and inner dimensions of 60 mm x 160 mm. One end of the column is fixed and the other end is pinned. Find the Euler's buckling load of the column if the length of the column is 3m and $E = 2 \times 10^5 \text{ N/mm}^2$.	05	4	3,4	7
Q.7(c)	What are the factors on which the Euler's buckling load of a column depends upon? Explain.	03	2	2	4



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~~END SEMESTER May 2026~~ / RE - EXAM July 2026

Program: Civil Engineering

Second Year

Duration: 03 hours

Course Code: PC-BTC403

Maximum Points: 100

Course Name: Surveying & Geomatics

Semester: IV

Instructions:

Sem - IV

145/07/26

1. Main Question 1 is Compulsory
2. Answer any FOUR Main Questions out of the given SIX Main Questions.
3. All Main Questions carry equal marks.
4. Assume suitable data wherever necessary and state the assumptions clearly.
5. Draw neat sketches/figures wherever required.

Q. No	Question	Points	CO	BL	Module
Q.1	Answer the following	20			
a	Explain the necessity of transition curves in highway and railway alignment. (1). State any two characteristics of an ideal transition curve (2). Calculate the algebraic difference in the gradient of the vertical curve having a falling gradient of 1 in 40 followed by a rising gradient of 1 in 50. (2)	5	1	2	1
b	Differentiate between triangulation and trilateration surveying w.r.t principle and instruments used. (2)	2	3	2	2
c	Define 'Geodetic Surveying' and state different types of geodetic surveying. (2)	2	1	2	3
d	Explain the following terms with neat sketches: Principal point (2) and Relief displacement (2).	4	1	2	4
e	Explain what is attribute data in GIS? Give any two applications of GIS in civil engineering. (2)	2	1	2	5
f	Explain the principle of GPS positioning and state any three sources of errors in GPS observations. (3)	3	3	4	6
g	State the established methods used for setting out foundation plans of a building. (2)	2	3	4	7
Q.2	Answer the following	20			
a	A road bend which deflects through an angle of 80° is to be designed for a maximum speed of 100 km/h. The maximum centrifugal ratio is limited to $1/4$ and the maximum permissible rate of change of radial acceleration is 30 cm/s^3 . The curve consists of a circular arc combined with two cubic spiral transition curves. Calculate the following: Radius of the circular curve (2), Length of transition curve (2), Total length of the composite curve (2), and Chainages of: beginning of transition curve, junction points of transition curve and circular curve, and end of transition curve,	10	4	3	1



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END-SEMESTER May 2026 / RE - EXAM July 2026

	if the chainage of the point of intersection (P.I.) is 42862 m (3). Draw a neat and labelled sketch showing all the elements (1).				
b	1. Define the strength of figure in triangulation (2). Derive the equation used for determining the strength of a figure in a triangulation system and explain its significance in achieving accurate triangulation results (3). 2. In a triangulation system ABCD, stations A, B, C and D form three connected triangles ABC, BCD and ACD. The length and bearing of side AB are known as follows: Length of AB = 450 m, Whole Circle Bearing of AB = $60^{\circ}00'$. The following angles were observed during the triangulation survey - Triangle ABC: $\angle BAC = 48^{\circ}20'$ and $\angle ABC = 72^{\circ}40'$, Triangle BCD: $\angle CBD = 56^{\circ}10'$ and $\angle BCD = 68^{\circ}30'$. Using the triangulation principle, calculate: Length of side BC (2), Bearing of line BC (1), Length of side BD (2). Draw a neat sketch of the triangulation system.	10	4	4	2
Q.3	Answer the following	20			
a	Explain the principle and working of the Global Positioning System (GPS) with a neat schematic diagram. Explain how the coordinates of the unknown position are obtained. (10)	10	4	3	6
b	A symmetrical parabolic summit vertical curve is to be provided between two gradients of +0.8% and -0.9%. The chainage and reduced level of the point of vertical intersection (PVI) are 1664 m and 238.755 m respectively. The permissible rate of change of grade is 0.05% per 20 m chain length. Calculate Length of the vertical curve (2), Chainages of beginning and end of the vertical curve (4), and Reduced levels of all peg points at 20 m intervals from the beginning of the vertical curve till the apex on the curve by tangent correction method (4). Draw a neat sketch showing all the relevant data.	10	1	2	
Q.4	Answer the following	20			
a	Describe the Universal Transverse Mercator (UTM) projection system used in topographic mapping (5). Discuss its zone system, coordinate representation, and applications in geospatial engineering and mapping practices in India (5).	10	4	4	3
b	Differentiate between spatial data and attribute data with suitable examples. Also discuss the importance of database management in GIS applications. (5) Discuss the applications of GIS in civil engineering and disaster management (2). Evaluate the advantages and limitations of open-source GIS software such as QGIS for geospatial analysis and mapping. (3)	10	1	4	5



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END SEMESTER May 2026 / RE - EXAM July 2026

Q.5 Answer the following		20												
a	An area 30 km long in the north–south direction and 24 km in the east–west direction is to be photographed with a lens having 30 cm focal length for the purpose of constructing a mosaic. The photograph size is 20 cm × 20 cm. The average scale is to be 1:12,000 effective at an elevation of 400 m above datum. The overlap is to be at least 60% and the side-lap is to be at least 30%. An intervalometer will be used to control the interval between exposures. The ground speed of the aircraft will be maintained at 200 km/h. The flight lines are to be laid out in a north–south direction on an existing map having a scale of 1:60,000. The two outer flight lines are to coincide with the east and west boundaries of the area. Determine: <i>Flying height (1), Theoretical ground spacing of flight lines (2), No. of flight lines required (1), Actual spacing of flight lines (1), Spacing flight lines on flight map (1), Ground distance between exposures (2), exposure interval (2), adjusted ground distance between exposures (2), No. of photographs in a flight line (2), Total no. of photographs (1).</i>	15	4	3	4									
b	With proper sketches, define the following: Airbase (2), Principal point (2), Isocentre (1)	5	4	3	7									
Q.6 Answer the following		20												
a	Differentiate between active and passive remote sensing (5). Explain the electromagnetic spectrum. State the wavelength regions used for remote sensing (5).	10	1	2	4									
b	Two points A and B having elevations of 500 m and 300 m respectively above datum appear on a vertical photograph having focal length of 20 cm and flying altitude of 2500 m above datum. Their corrected photographic coordinates are given here. Determine length AB. <table><tr><td>Point</td><td>x (cm)</td><td>y (cm)</td></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	x (cm)	y (cm)	A	+2.65	+1.36	B	-1.92	+3.65	5	4	3	3
Point	x (cm)	y (cm)												
A	+2.65	+1.36												
B	-1.92	+3.65												
c	Describe the functions and applications of the following tools with suitable examples: Buffer, Dissolve, and Clip. Discuss their significance in spatial data analysis and decision-making applications. (5)	5	4	4	5									
Q.7 Answer the following		20												
a	A parabolic vertical curve is widely used in surveying and transportation engineering. With proper sketch showing all relevant elements, derive the expression for rate of change of gradient and Tangent correction for a vertical curve (4). Also	8	4	4	1									



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~~END SEMESTER May 2026~~ / RE - EXAM July 2026

	explain the assumptions made in tangent correction method for setting out vertical curves (4).				
b	Discuss the characteristics and applications of primary, secondary, and tertiary triangulation systems used in geodetic surveying. (4)	4	3	2	2
c	Discuss the different types of Earth satellite orbits — LEO, MEO, and HEO — and justify the suitability of MEO for GPS satellite systems. (4)	4	3	2	6
d	Explain the procedure of setting out foundation plan by circumscribing rectangle method. (4)	4	3	3	7



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END SEMESTER EXAM MAY JUNE 2026-SET-B

RE-Exam July 2026

Max. Marks: 100

Duration: 3 Hrs

Class: S.Y.B.Tech

Second Year

Semester: IV

Name of the Course: Water Supply Engineering

Program: B. Tech CIVIL

Course Code: PC BTC-406

Sem-IV 16/7/26

Instructions:

- Question 1 is compulsory. Attempt any 4 of the 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 the right indicates the maximum points for the given question, course outcomes attained, Bloom's Level and the modules of the given questions

Q1	Answer the following Questions	(20)	CO	BL	M N
(a)	Explain the water treatment flowsheet adopted with details and explanations of units and the amount in reductions at each stage and explain how it is adopted for Mumbai in Bhandup	(10)	CO1 CO4	3	2
(b)	Solve the following	(10)	CO3	3	1-3
i	The surface loading rate ($m^3/m^2/d$) of 4 tanks with Length= 50 m , width= 10 m and height 3 m with a flow of 30 MLD	(03)			
ii	The quantity of 85% pure alum required (per year in kgs) for treating 40 MLD of water if alum required is 30 mg/L	(03)			
iii	Calculate lime and soda ash required to remove 145 mg/L of $MgSO_4$	(04)			
Q2	Answer the following questions	(20)			
(a)	Explain MPN. 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 surface and ground water quality?	(10)	CO1	3,4	2
(b)	The industrial development is limited to urban areas. Explain it in context of need of water supply schemes	(05)	CO1	3	1
(c)	Explain the following terms (i) Short Circuiting in Sedimentation tanks (2) Detention time	(05)	CO1	4	2
Q3	Answer the following questions	(20)			
(a)	A bell mouth canal intake is to be designed for Khirsu considering population of 30,000 and water demand of 100 lpcd (a) drawing water from a canal which runs for 10 hrs a day with a depth of 2 m. Calculate head loss in intake conduit if treatment works are 0.75 km away. 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	(10)	CO2	4	2

**REEXAM JULY 2021 END SEMESTER EXAM MAY JUNE 2026-SET-B**

	mean depth and for circular section it is $d/4$; and S is slope of energy line or H/L) Canal is designed for average flow				
(b)	Design coagulant aided ideal sedimentation for Khirsu Q3(a) in Uttarakhand with checks	(10)	CO1	3	2
Q4	Answer the following questions	(20)			
(a)	You are an engineer at the Khirsu Municipality. Your responsibility is to plan and design a water distribution network for a greenfield project in the region. Explain the typical steps you would take. (Explain with use of EPANET and Jaltantra basics)	(10)	CO4	4	6
(b)	Design a mechanical rapid mix unit for a design flow to be treated as 350 m ³ /hr. Take value of μ as 1.0087E-03Ns/m ² . Assume DT find volume. Find depth and diameter. Compute power requirements and give checks	(5)	CO2	2	3
(c)	Explain with short notes (i) Ion Exchange (ii) Reverse Osmosis	(5)	CO3	2	4
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 30 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	2
(b)	Explain any two (i) tube settlers and (ii) Filter troubles	(10)	CO2	3-4	3
Q6	Answer the following questions	(20)			
(a)	Design rapid sand filter for (size and underdrainage system) for the population of 30,000 for Khirsu town having water demand 100 lpcd. Design wash water system too	(15)	CO3	3-5	3
(b)	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 is 1.8 mg/L and average water demand of 100 lpcd and population 30,000.	(05)	CO3, CO4	2-4	4
Q7	Give solutions to the following problems encountered in Rural India	(20)	CO2, CO3	3-4	4, 5
(a)	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)			
(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)			



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RE-Exam July 2026 END SEMESTER EXAM MAY JUNE 2026-SET-B

(c)	A rural well is to be disinfected. Explain the process for the same in detail	(05)			
(d)	Explain process of removal of hardness in rural area and calculation related to it specifically areas in Mehsana in Gujarat with Hardness= 500mg/L	(05)			

Formula sheet

$P_n = P_o \left[1 + \frac{r}{100} \right]^n$ $P_n = P_o + nx + \frac{n(n+1)}{2} y$ $\log_e \left[\frac{P_s - P}{P} \right] - \left[\frac{P_s - P_o}{P_o} \right] = -kP_s * t$ $P_n = (P_o + nx)$ $r = \sqrt{r_1 * r_2 * r_3 * \dots * r_n}$ 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 $G = \sqrt{\frac{P}{\mu * V}}$ $\mu=1.0087*10^{-3}$Ns/m² 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	$v_s = \frac{1}{18v} (S_s - 1) * d^2$ Value of v=1.002X10⁻⁶ m²/sec $v_d = \sqrt{\left(\frac{8\beta}{f'} \right) (S_s - 1) dg}$ $f' = 0.025 - 0.03$ $g=9.8$m/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 Qavg

ALL THE BEST



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End Semester Examination/ Re-Examination, May /June 2026



Max. Marks: 100

Class: SY Civil Engineering Semester: IV

Name of the Course: Hydraulic Engineering

Duration: 03 hours

Program: UG Civil

Course Code: PC-BTC404

sem-IV 17/7/26

Instructions:

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

Question No		Maximum Marks	Course Outcome Number	Module No.											
Q1.	(a) What do you understand by Dimensional homogeneity? Explain the term distorted and undistorted models and scale effects in model studies.	10	4	1											
	(b)State Buckingham's- π theorem. The ' η ' of a fan depends on density ' ρ ' and viscosity of fluid ' μ ', angular velocity ' ω ', diameter ' D ' and discharge ' Q '. Obtain a functional relationship for ' η ' in terms of dimensionless parameters.	10	4	1											
Q2.	(a)Explain briefly the phenomenon of water hammer flow in pipelines. Also derive an expression for pressure rise due to water hammer blow in the elastic pipe.	10	1	2											
	(b)Two pipes connected in series discharge water from 65-meter level to 32-meter level. The details of piping system are as given in Table 1. Considering minor losses: determine discharge and draw HGL and TEL.	10	1	2											
	Table 1. <table><tr><th>Pipe</th><th>Length (m)</th><th>Diameter (cm)</th><th>Friction Factor (f)</th></tr><tr><td>1</td><td>1250</td><td>25</td><td>0.018</td></tr><tr><td>2</td><td>850</td><td>15</td><td>0.022</td></tr></table>	Pipe	Length (m)	Diameter (cm)	Friction Factor (f)	1	1250	25	0.018	2	850	15	0.022		
Pipe	Length (m)	Diameter (cm)	Friction Factor (f)												
1	1250	25	0.018												
2	850	15	0.022												
Q3.	(a) Write short notes on; (i) Power transmission through pipe and nozzle. (ii)Three Reservoir Problem	05 05	1 1	2 2											

	(b) A siphon of length 850 m has its vertex 6.25 meters above the water level in the upper reservoir. The length of inlet leg of siphon is 210 m and total head loss in siphon is 26 m. Determine the diameter of the siphon such that pressure at summit does not fall below vapor pressure of water. Take $f = 0.020$.	10	1	2
Q4.	(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	3
	(b) A jet of water of diameter 50 mm. strikes a fixed plate in such a way that the angle between the plate and the jet is 30 degrees. If the force exerted in the direction of the jet is 1450 N, determine the rate of flow of water.	10	2	3
Q5.	(a) Explain working of Impulse turbine with a neat sketch and define hydraulic efficiency, mechanical efficiency and overall efficiency of a hydraulic turbine	10	2	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 15° . Flow width is 0.10 m. at inlet and outlet. Determine (i) the guide blade angle (ii) vane angle at inlet	10	2	4
Q6.	(a) Write short notes on: (i) Work done by an impellor of a centrifugal pump (ii) Pumps in series and parallel	05 05	2 2	5 5
	(b) A centrifugal pump lifts water under a static lift of 45 meters of which 5 meter is suction lift. The suction and delivery pipes are both 20 cm in diameter. The friction loss in suction pipe is 3 meters and in delivery pipe it is 5 meters. 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	5
Q7.	(a) Explain prismatic and non-prismatic Channels and types of Flow in Open channel	10	3	6
	(b) Derive the conditions for most economical Trapezoidal channel section.	10	3	6



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~~End Semester Examination/~~ Re-Examination, ~~May~~ /June 2026

Sem IV

Max. Marks: 100

Class: S.Y.B.TECH

Semester: IV

Duration: 3 hours

Program: Civil/Mechanical

Name of the Course: Minor 1 Introduction to Sustainability and Sustainable Development

Course Code : MI-BT031

Instructions:

1. Attempt any FIVE questions out of SEVEN questions.
2. Answers to all sub questions should be grouped together.
3. Answers should be accompanied with proper figures and tables, wherever necessary.

20/7/26

Question No		Maximum Marks	Course Outcome Number	Module No.
Q.1 a)	Define sustainability and sustainable development. Explain how sustainable development can help mitigate the effects of climate change with suitable examples.	10	1,2	1
Q.1 b)	Discuss water pollutants and ways to treat them.	10	2,3	2
Q.2 a)	Evaluate the obligations and responsibilities of developed nations in fostering global sustainable development. Support your answer with international agreements and policies.	10	2,3	6
Q.2 b)	Analyze how demographic dynamics such as population growth, urbanization, migration, and resource consumption influence sustainability in developing countries.	10	2,3	4
Q.3 a)	Discuss the role of international environmental agreements in promoting sustainable economic development and climate change mitigation.	10	2,3,4	3
Q.3 b)	Analyze the role of Corporate Social Responsibility (CSR) in achieving sustainable development goals.	10	2,3,4	5
Q.4 a)	Explain the concept of limits to exponential growth on a finite planet and discuss its implications for sustainable development.	10	1,2	1
Q.4 b)	Evaluate how integrated resource management can support sustainability goals across sectors like agriculture, water resources, and forest conservation.	10	2,3	4
Q.5 a)	Explain with a case study concept of green building (GRIHA, IGBC or LEED).	10	1,2,3	5
Q.5 b)	Explain embodied carbon, Global Warming Potential, Greenhouse gases and CO2 equivalence.	10	1,2,3	2

Q.6 a)	Discuss the evolution of international sustainable development initiatives from the Brundtland Report to the Rio Earth Summit and the United Nations Sustainable Development Goals. Explain their impact on global environmental governance.	10	1,2	6
Q.6 b)	Explain the concept of social sustainability and discuss its major components such as equality, diversity, democracy, and social cohesion.	10	1,2	3
Q7	Select any one of the following Real world scenarios and present a detailed case study analysis: 1) Coastal tourism development vs. Local livelihoods 2) Affordable housing vs. rising urban land prices 3) Urban Flooding and infrastructure planning 4) Renewable energy investments and economic trade-offs 5) Skill development programs and employment generation 6) International trade agreements and poverty reduction.	20	2,3,4	3,4,5



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Re Exam ~~End Semester~~ 2026 Examinations
SET A



Program: ~~CNE~~

Course Code: MIT011

Course Name: Minor in Management
Principles of Management

Duration: **03 hours**

Maximum Points: **100**

Semester: **IV**

sem IV

20/7/26

Note:

- Question 01 is compulsory
- Attempt any four questions out of remaining 06 questions
- Attempt main question and sub question together
- Draw neat charts wherever required

Q.No.	Questions	Points	CO	BL
Q.1.A.	Explain the functions of management—planning, organizing, staffing, directing, and controlling. Illustrate how these functions are interrelated and essential for achieving organizational goals.	10	01,2,	01
Q.1.B.	Write short notes on any two: 1. Leadership Traits 2. Management by Objectives (MBO) 3. Importance, advantages and Disadvantages of Forecasting 4. Difference between Authority and Power	10	01	L3
Q.2.A.	Explain different types of Organizational structures (functional, divisional, matrix). Compare their advantages and limitations with suitable examples.	10	02	L2
Q.2.B	Case: A retail chain is expanding into three new cities. The operations head must decide how to structure teams, whether to centralize decision-making at headquarters or give autonomy to local managers. Employees are confused about reporting lines, and duplication of tasks is occurring. Questions 1. Explain how proper organizing could resolve the confusion in reporting and duplication of tasks. 2. Recommend an organizational structure suitable for this expansion and justify your choice.	10	04	L5

Q.3.A.	Discuss the evolution of management thought. Compare the contributions of classical, behavioral and modern management approaches and examine their relevance in present-day organizations.	10	01	L1
Q.3.B	How will you classify the levels of Management in an organization? Describe the functions performed by different levels of Management.	10	02	L2
Q.4. A	Tata Motors has undergone significant transformation in recent years. The company faced declining sales and employee dissatisfaction. The leadership introduced new strategies, restructured teams, and implemented training programs to improve performance and morale. However, some employees resisted change due to fear of job loss and unclear communication. Questions: a Identify the leadership style adopted by the company. b What organizational barriers are evident in the case? c Suggest strategies to overcome employee resistance. d Evaluate the importance of training in organizational development.	10	03	L6
Q.4.B.	What are the basic characteristics of formal and informal organization? How does informal organization differ from formal organization?	10	02	L2
Q.5. A	Explain the concept and importance of controlling as a managerial function. Discuss the process of controlling and explain how effective control contributes to organizational efficiency and achievement of objectives.	10	04	L5
Q.5 B.	Discuss Henri Fayol's principles of management . Evaluate their relevance in today's dynamic and technology-driven business environment with suitable examples.	10	01	L2
Q.6.A.	A mid-sized IT company is preparing to launch a new software product. The CEO insists on entering the market quickly, but the project manager highlights the need for detailed planning—market research, competitor analysis, budgeting, and timeline allocation. The team is divided: some want to rush, while others stress structured planning. Questions 1. Identify the importance of planning in this case. How could poor planning affect the product launch? 2. Suggest two planning tools or techniques the project manager could use to balance speed and accuracy.	10	03	L4
Q.6.B	Define motivation and explain its significance in organizational behaviour. Critically discuss the major theories of motivation with suitable examples from workplace situations.	10	05	L2
Q.7. A.	Explain in detail the roles of a manager in an organisation. Draw a neat diagram too.	10	02	L2

Q.7. B	What is the importance of Directing in an organisation. How and why do directing and planning go hand in hand? Explain in detail the elements of Directing with examples.	10	03	L1
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End Semester Examination/ Re-Examination, May /June 2026

Program: S. Y. B. Tech. Civil

Duration: 3 Hour

Course Code: BTC - 406

Maximum Points: 100

Course Name: Transportation Engineering

Sem-IV

Semester: IV

21/7/26

Notes:

- (i) Question 1 is compulsory
- (ii) Solve any four out of remaining six questions
- (iii) Assume suitable data if required
- (iv) Use graph paper if required

Q.No.	Questions	Points	CO	BL
Q.1				
a	Discuss suitability of Different mode of transportation.	05	01	01
b	Write short notes on weight component of aircraft	05	01	01
c	Explain with sketch how the movement of aircraft can control in space.	05	01	01
d	What is gauge? Discuss different types of gauges used in India.	05	02	01
Q.2.				
a	Enumerate the various factors you would like to keep in mind while selecting suitable site for the Airport.	10	01	02
b	State the assumption made while calculating the basic length of runway.	05	01	01
c	How will you calculate the basic length of runway	05	01	02
Q.3				
a	write short notes on (i) Geometric Design of Runway (ii) Apron	10	01	02
b	The average wind data collected at particular site is given in Table 1. Plot wind rose diagram considering Direction and total duration. Also, calculate calm period, orientation of runway and wind coverage.	10	01	03
Q.4.				
a	Enlist the different marking on airport. Also, Draw a neat sketch of runway showing the following (i) runway orientation (ii) runway threshold (iii) runway center line (iv) runway touch down zone (v) runway edge. Also, discuss the guideline related to dimensions, spacing etc. of these marking.	10	01	02
b	What do you meant by creep of rail? How will you measure it.	06	02	
c	Write short notes on (i) weight of rail (ii) Length of rail	04	02	01
Q.5.				



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End Semester Examination/ Re-Examination, May /June 2026

a	Using the sleeper density of $(n + 5)$ estimate the number of rail, sleeper's fish plate and fish bolts required for construction of 1 km long (i) broad gauge (ii) meter gauge railway track.	10	02	03
b	Discuss about speed of train in India. Also, state the equations suggested by indian railway for safe speed of train on curve when (i) transition curve is present (ii) transition curve is absent.	10	02	02
Q.6.				
a	What is turnout. Draw a neat sketch of lay out of left hand turnout and explain the function of each component part.	10	02	02
b	A 5° curve diverges from 2° main curve in reverse direction in a layout of broad gauge yard. If the speed on branch line is restricted to 25 km/hr. determine the restricted speed on main line.	10	02	03
Q.7.				
a	What is sleeper, discuss its function and requirement	04	02	01
c	Derive the relationship between superelevation, speed, Gauge and radius of circular curve. What are its limiting values of superelevation for different gauges.	08	02	02
	Calculate the value of superelevation for the broad gauge railway track to be constructed on a circular curve of radius 400 m. assume the maximum permissible speed is 75 km/hr.	08	02	02

Q.3. (b) Table 1. Data Related to Wind at airport site under consideration

Wind direction	Duration of wind in percentage		
	6.4 to 25 km/hr	25 to 50 km/hr	50 to 75 km/hr
N	4.5	1.3	0.1
NNE	3.3	0.8	0
NE	1.8	0.1	0
ENE	2.7	0.3	0
E	2	0.4	0
ESE	5.3	0.1	0
SE	6.3	3.2	0.1
SSE	7.4	7.7	0.3
S	4.6	2.2	0
SSW	2.4	0.9	0
SW	1.1	0.1	0
WSW	3.6	0.4	0
W	1.8	0.3	0
WNW	5.9	2.6	0.2
NW	5.8	2.4	0.2
NNW	6.8	4.9	0.3