Bharatiya Vidya Bhavan's

SARDAR PATEL COLLEGE OF ENGINEERING

(Government Aided Autonomous Institute)

Munshi Nagar, Andheri (W) Mumbai – 400058

END SEMESTER EXAMINATION - JULY 2023

Program: S.Y.B.Tech (Civil) Sem IV

Course Code: BS-BTC401

Course Name: Probability and Statistics

Duration: 3 Hours

Maximum Points: 100

Semester: IV

14/7/23

Note:

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

		Questions	Points	CO	BL	Module
1	a	The probability of a man hitting the target at a shooting range is $\frac{1}{4}$. If he shoots 10 times, what is the probability that he hits the target exactly three times? What is the probability that he hits the target at least once?	6	CO1	BL5	2
	b	The equations of the lines of regression are $20x-9y-107=0$ and $4x-5y+33=0$ Find $\bar{x}, \bar{y}$ and r.	6	CO1	BL5	1
	c	Find Mean and Variance of Poisson Distribution	8	CO1	BL3	2
2	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 bulbs gave S.D of 95 hours. Is the manufacturer justified in changing the process?	6	CO2	BL5	4
	b	Find Karl Pearson's coefficient of correlation between capital employed and profit obtained from the following data.	6	CO1	BL2	1

Capital (In Crore)	10	20	30	40	50	60	70	80
Profit (In Crore)	2	4	8	10	15	20	22	50

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	c	Two independent samples of sizes 8 and 7 contained the following values Sample I: 19, 17, 15, 21, 16, 18, 16, 14 Sample II: 15, 14, 15, 19, 15, 18, 16 Is the difference between the sample means significant?	8	CO2	BL3	5
3	a	The mean number of bacteria per milliliter of a liquid is known to be 6. Find the probability that in 1 milliliter of the liquid, there will be: (i) 0 (ii) 1 (iii) 2 (iv) 3 (v) less than 4 (vi) 6 bacteria.	6	CO3	BL4	2
	b	A random variable X has the following probability distribution: X: 1, 2, 3, 4, 5, 6, 7 P(X): k, $2k$, $3k$, k^2, k^2+k, $2k^2$, $4k^2$ Determine (*i*) k (*ii*) $P(X \le 4)$ (*iii*) $P(X > 3)$	6	CO1	BL5	1
	c	In the usual notation, prove the Spearman's formula for Rank correlation $R = 1 - \frac{6}{n(n^2-1)} \sum_{i=1}^{n} d_i^2$, where $d_i = x_i - y_i$	8	CO1	BL5	1
4	a	From the following data, compute the rank correlation. X: 82, 68, 75, 61, 68, 73, 85, 68 Y: 81, 71, 71, 68, 62, 69, 80, 70	6	CO1	BL5	1
	b	The marks obtained by students in a certain examination follow a normal distribution with mean 55 and standard deviation 10. If 500 students appeared at an examination, calculate the number of	6	CO3	BL3	3

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		students scoring (i) less than 50 marks (ii) more than 65 marks.				
	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
5	a	Find constant k such that the function $f(x)=\begin{cases} k\left(1-x^2\right), & \text{if } 0\le x\le 1 \\ 0 & \text{elsewhere} \end{cases}$ is the probability density function. Also find $P(0.1\le X\le 0.2)$ and $P(X\ge 0.5)$	6	CO1	BL4,5	3
	b	The S.D of a random sample 0f 1000 is found to be with 2.6 and the S.D of another random sample of 500 is 2.7. Assuming the samples to be independent, find whether the two samples could have come from population with the same S.D?	6	CO2	BL4	4
	c	In a certain factory turning out razor blades, there is a small chance of 0.002 for any blade to the defective. The blades are supplied in a packet of 10, Use Poisson distribution to calculate the approximate number of packets containing no defective, one defective and two defective blades respectively in a consignment of 10,000 packets.	8	CO2	BL2, BL4	2
6	a	Certain pesticide is packed into bags by a machine. A random sample of 10 bags is drawn and their contents are found to weigh (in kg) as follows 50, 49, 52, 44, 45, 48, 46, 45, 49, 45 Test if average packing can be taken to be 50 kg at 5% LOS.	6	CO3	BL5	5
	b	The coefficient of rank correlation between marks in two subjects obtained by a group of students is 0.8. If the sum of squares of the differences in ranks is 33. Find the number of students in the group.	6	CO1	BL3	1
	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, BL5	3

END SEMESTER EXAMINATION - JULY 2023

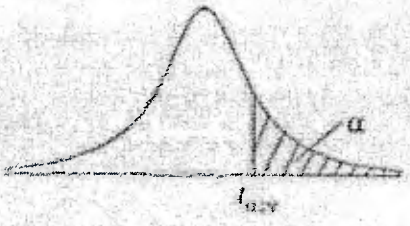
<table>
<tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>7</td><td>a</td><td>Two random sample gave the following data
<table>
<tr><td>Sample No</td><td>Size</td><td>Mean</td><td>Variance</td></tr>
<tr><td>1</td><td>1000</td><td>67.42</td><td>2.58</td></tr>
<tr><td>2</td><td>1200</td><td>67.25</td><td>2.5</td></tr>
</table>
Is the difference between standard deviation significant?</td><td>6</td><td>CO2</td><td>BL2, BL3</td><td>4</td></tr>
<tr><td></td><td>b</td><td>Fit a Binomial distribution to the following data
<table>
<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></td><td>6</td><td>CO3</td><td>BL5</td><td>1</td></tr>
<tr><td></td><td>c</td><td>300 digits were chosen at random from a table of random numbers. The frequency of digits are as follows
<table>
<tr><td>Digit</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>8</td><td>9</td><td>Total</td></tr>
<tr><td>Frequency</td><td>28</td><td>29</td><td>33</td><td>31</td><td>26</td><td>35</td><td>32</td><td>30</td><td>31</td><td>25</td><td>300</td></tr>
</table>
Using χ^2-test examine the hypothesis that the digits were distributed in equal numbers in the table</td><td>8</td><td>CO3</td><td>BL1, BL3</td><td>5</td></tr>
</table>

Chi-Square (χ^2) Distribution

Degrees of Freedom	Area to the Right of Critical Value									
	0.995	0.99	0.975	0.95	0.90	0.10	0.05	0.025	0.01	0.005
1	—	—	0.001	0.004	0.016	2.706	3.841	5.024	6.635	7.879
2	0.010	0.020	0.051	0.103	0.211	4.605	5.991	7.378	9.210	10.597
3	0.072	0.115	0.216	0.352	0.584	6.251	7.815	9.348	11.345	12.838
4	0.207	0.297	0.484	0.711	1.064	7.779	9.488	11.143	13.277	14.860
5	0.412	0.554	0.831	1.145	1.610	9.236	11.071	12.833	15.086	16.750
6	0.676	0.872	1.237	1.635	2.204	10.645	12.592	14.449	16.812	18.548
7	0.989	1.239	1.690	2.167	2.833	12.017	14.067	16.013	18.475	20.278
8	1.344	1.646	2.180	2.733	3.490	13.362	15.507	17.535	20.090	21.955
9	1.735	2.088	2.700	3.325	4.168	14.684	16.919	19.023	21.666	23.589
10	2.156	2.558	3.247	3.940	4.865	15.987	18.307	20.483	23.209	25.188
11	2.603	3.053	3.816	4.575	5.578	17.275	19.675	21.920	24.725	26.757
12	3.074	3.571	4.404	5.226	6.304	18.549	21.026	23.337	26.217	28.299
13	3.565	4.107	5.009	5.892	7.042	19.812	22.362	24.736	27.688	29.819
14	4.075	4.660	5.629	6.571	7.790	21.064	23.685	26.119	29.141	31.319
15	4.601	5.229	6.262	7.261	8.547	22.307	24.996	27.488	30.578	32.801
16	5.142	5.812	6.908	7.962	9.312	23.542	26.296	28.845	32.000	34.267
17	5.697	6.408	7.564	8.672	10.085	24.769	27.587	30.191	33.409	35.718
18	6.265	7.015	8.231	9.390	10.865	25.989	28.869	31.526	34.805	37.156
19	6.844	7.633	8.907	10.117	11.651	27.204	30.144	32.852	36.191	38.582
20	7.434	8.260	9.591	10.851	12.443	28.412	31.410	34.170	37.566	39.997
21	8.034	8.897	10.283	11.591	13.240	29.615	32.671	35.479	38.932	41.401
22	8.643	9.542	10.982	12.338	14.042	30.813	33.924	36.781	40.289	42.796
23	9.260	10.196	11.689	13.091	14.848	32.007	35.172	38.076	41.638	44.181
24	9.886	10.856	12.401	13.848	15.659	33.196	36.415	39.364	42.980	45.559
25	10.520	11.524	13.120	14.611	16.473	34.382	37.652	40.646	44.314	46.928
26	11.160	12.198	13.844	15.379	17.292	35.563	38.885	41.923	45.642	48.290
27	11.808	12.879	14.573	16.151	18.114	36.741	40.113	43.194	46.963	49.645
28	12.461	13.565	15.308	16.928	18.939	37.916	41.337	44.461	48.278	50.993
29	13.121	14.257	16.047	17.708	19.768	39.087	42.557	45.722	49.588	52.336
30	13.787	14.954	16.791	18.493	20.599	40.256	43.773	46.979	50.892	53.672
40	20.707	22.164	24.433	26.509	29.051	51.805	55.758	59.342	63.691	66.766
50	27.991	29.707	32.357	34.764	37.689	63.167	67.505	71.420	76.154	79.490
60	35.534	37.485	40.482	43.188	46.459	74.397	79.082	83.298	88.379	91.952
70	43.275	45.442	48.758	51.739	55.329	85.527	90.531	95.023	100.425	104.215
80	51.172	53.540	57.153	60.391	64.278	96.578	101.879	106.629	112.329	116.321
90	59.196	61.754	65.647	69.126	73.291	107.565	113.145	118.136	124.116	128.299
100	67.328	70.065	74.222	77.929	82.358	118.498	124.342	129.561	135.807	140.169

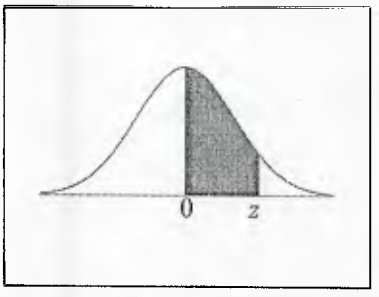
Table of the Student's *t*-distribution

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



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

Standard Normal Distribution Table



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

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End Semester Examinations: July 2023

S.Y. (C) Sem IV

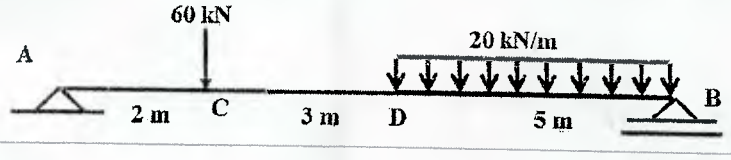
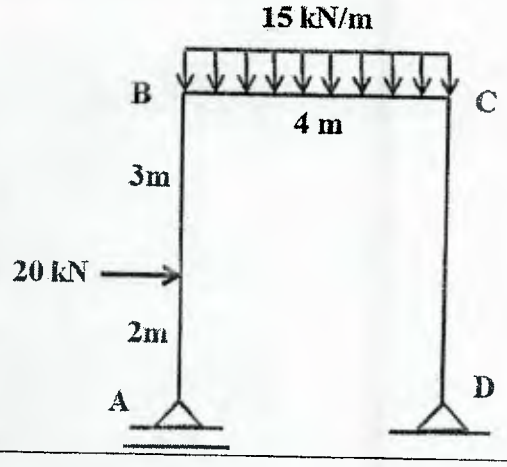
Program: B.Tech. in Civil Engineering **Duration: 3 Hours**

Course Code: PC-BTC402 **Maximum Points: 100**

Course Name: Structural Mechanics **Semester: IV**

19/7/23

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	PI
Q.1(a)	**A trapezoidal masonry dam is of height 15m. It has the top and bottom width of 4m and 8m respectively. The dam retains water on its vertical face to a depth of 15 m. Determine the maximum and minimum stresses developed at the base of the dam.** **The unit weight of masonry is 20 kN/m^3 and that of water is 10 kN/m^3.**	10	1	4	1.1.1 1.3.1 2.4.1
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	1.1.1 1.3.1 2.4.1
					
Q.2(a)	**State and explain Maxwell's reciprocal theorem.**	05	2	2	1.3.1
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	1.3.1 2.1.3
					

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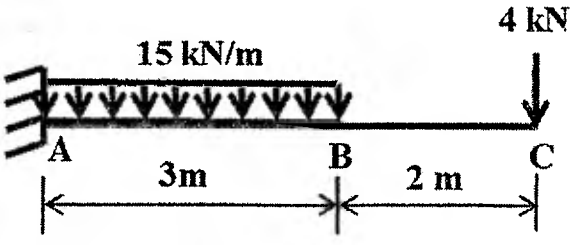
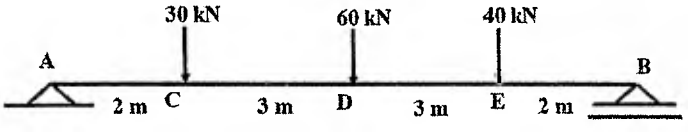
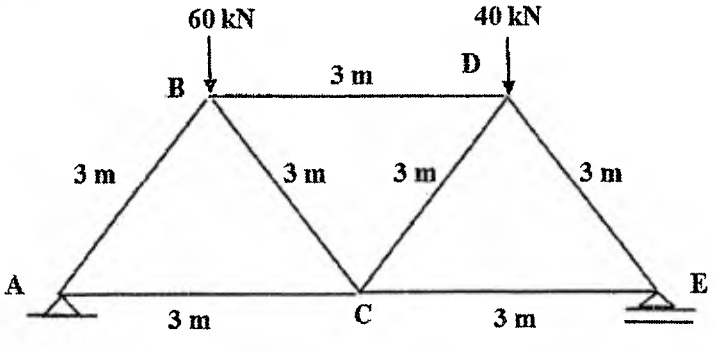
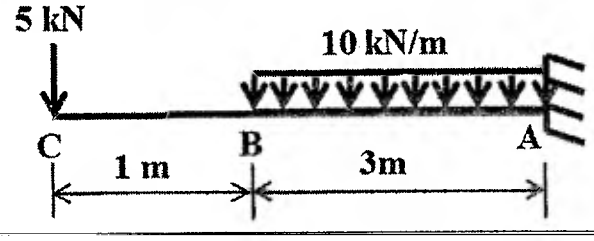
Q.3(a)	**Find the slope and vertical deflection at the free end C for the beam supported and loaded as shown in figure below. Use conjugate method only.**	10	3	3,4	1.3.1 2.1.3
					
Q.3(b)	**Find the slope and vertical deflection at C for the beam supported and loaded as shown in figure below. Use moment area method only.**	10	3	3,4	1.3.1 2.1.3
					
Q.4(a)	**For the pin jointed frame loaded as shown in figure below, find the horizontal deflection of joint E.**	12	3	3,4	1.3.1 2.1.3
					
Q.4(b)	**Find the strain energy stored due to bending moment only for the beam loaded as shown in the figure below.**	08	2	3,4	1.1.1 1.3.1 2.4.1
					

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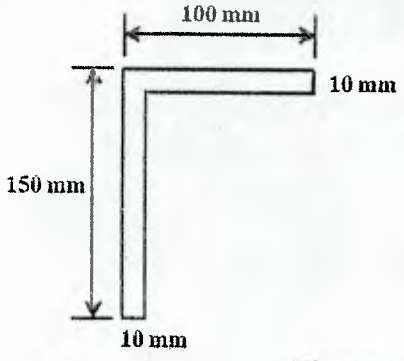
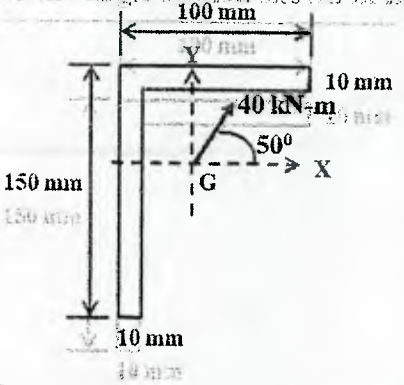
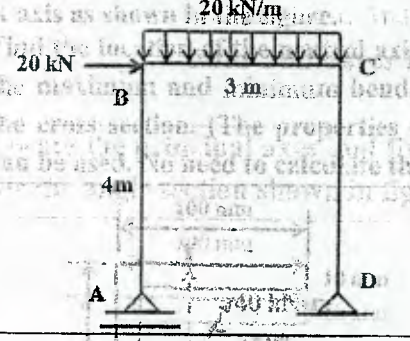
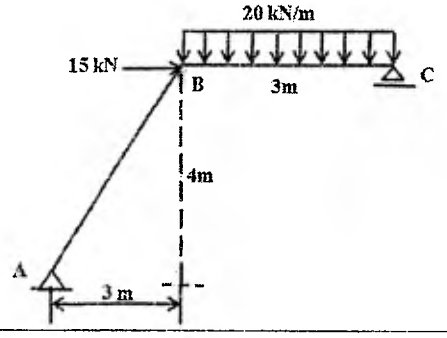
SARDAR PATEL COLLEGE OF ENGINEERING

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

End Semester Examinations: July 2023

Q.5(a)	**Locate the principal axes and find the principal moments of inertia for the angle section shown in figure below.**	10	1	3,4	1.1.1 1.3.1 2.4.1
					
Q.5(b)	**The angle section with dimensions shown below (same as given in Q. 5(a)) is subjected to a bending moment of 40 kN-m at 50 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	1.1.1 1.3.1 2.4.1
					
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	1.3.1 2.1.3
					

Q.6(b)	**A timber column has a rectangular cross section of 150mmx200mm and length 3m with both the ends fixed. Find the Euler's crippling loads of the column.** **Take E = $2x10^5$ N/mm^2**	05	4	3,4	1.1.1 1.3.1 2.4.1
Q.6(c)	**Find the crippling load using Rankine's formula for the cast iron column of hollow circular cross section with external diameter 100mm and internal diameter 80 mm and a length of 4m. The column is fixed at one end and hinged at the other end.** **Take f_c = 550 MPa and** **Rankine's constant = 1/1600.**	05	4	3,4	1.1.1 1.3.1 2.4.1
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	1.1.1 1.3.1 2.4.1
					
Q.7(b)	**What do you understand by the principal axes of a given cross section? Explain**	03	1	2	1.3.1
Q.7(c)	**What are the assumptions made in the classical theory of buckling?**	05	4	2	1.3.1

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

End Semester Examinations, July 2023

S.Y. (C) Sem IV — 21/7/23

Program: B.Tech. Civil Engineering
Course Code : **PC-BTC403**
Course Name : **Concrete Technology**

Duration: 3 Hour
Maximum points: 100
Semester: IV

Instructions:

1. Attempt *any FIVE questions out of SEVEN* questions
2. Answers to all sub questions should be grouped together
3. Draw neat diagrams wherever required
4. Assume suitable data if necessary and state the clearly.

Que. No.	Descriptions	Points	CO	BL	PI
Q1	(a) Explain various components of RMC plant observed during site visit. State the advantages of RMC over conventional concrete.	08	3	2	1.2.1
	(b) What do you mean by Half-cell Potentiometer? How it helps to assess the corrosion of steel reinforcement?	07	3	4	2.1.2
	(c) Write note on low heat cement?	05	1	2	1.2.1
Q2	a. What are the tests to be conducted on chemical admixtures?	5	1	3	1.3.2
	b. Design concrete for M40 grade using guidelines given in IS 10262:2019 for the following data.	15	2	2	2.3.1

Exposure condition: Moderate	Maximum size of aggregate —20 mm	Method of placement - Pumping	Specific gravity of 20 mm aggregate — 2.74
Strength of cement OPC —53 grade	Workability — slump, 150 mm	Type of coarse aggregate — angular coarse aggregate	Specific gravity of 10 mm aggregate — 2.70
Zone of sand — II	Total moisture content M_2-0.5% & M_1- 0.3%	Total moisture content in fine aggregate - 2.5 %	Specific gravity of fine aggregate — 2.68

Q3	(a) Design concrete for **M 30** grade using DOE method. Refer the data from Que2 and chart attached at the end of manuscript.	12	3	4	2.1.2
	(b) What is core test of concrete? Why it is required? Explain in detail the procedure for conducting core test of concrete.	08	2	2	2.4.2
Q4	**(a) Design concrete for M35 grade using ACI Method; consider the data related to the properties of material as given in Que.No.2.**	12	2	3	1.3.1
	(b) State the importance of mixing of concrete. Explain different methods mixing.	8	1	2	2.3.1

Q5	**(a)** Enlist the various stages of concrete production and discuss curing of concrete in detail.	**8**	1	2	2.1.2
	(b) Differentiate between (i) Light weight concrete and ordinary concrete (ii) Retarder and accelerators	**8**	**2**	2	2.3.1
	(c) How will you check the workability of flowable concrete?	**4**	3	1	1.2.1
Q6	(a) How High Performance concrete (HPC) is differ than normal concrete? Discuss various ways to improve the concrete performance.	**8**	1	2	2.3.1
	(b) Explain different methods of compaction with their suitability.	**8**	3	3	1.3.2
	(c) How silica fume improve the performance of concrete?	**4**	2	3	1.4.1
Q7	Write explanatory notes on the following ***(any Four)***				
	i) Cold weather concrete	**5**	3	2	1.3.1
	ii) Rice husk ash	**5**	2	2	1.3.1
	iii) Hydration products	**5**	3	2	1.3.1
	iv) Alkali-silica reaction	**5**	1	2	1.3.1
	v) Carbonation of Concrete	**5**	1	2	1.3.1
	vi) self-compacting concrete	**5**	3	2	1.3.1

Reference Charts and Tables for DOE Method of Concrete mix design

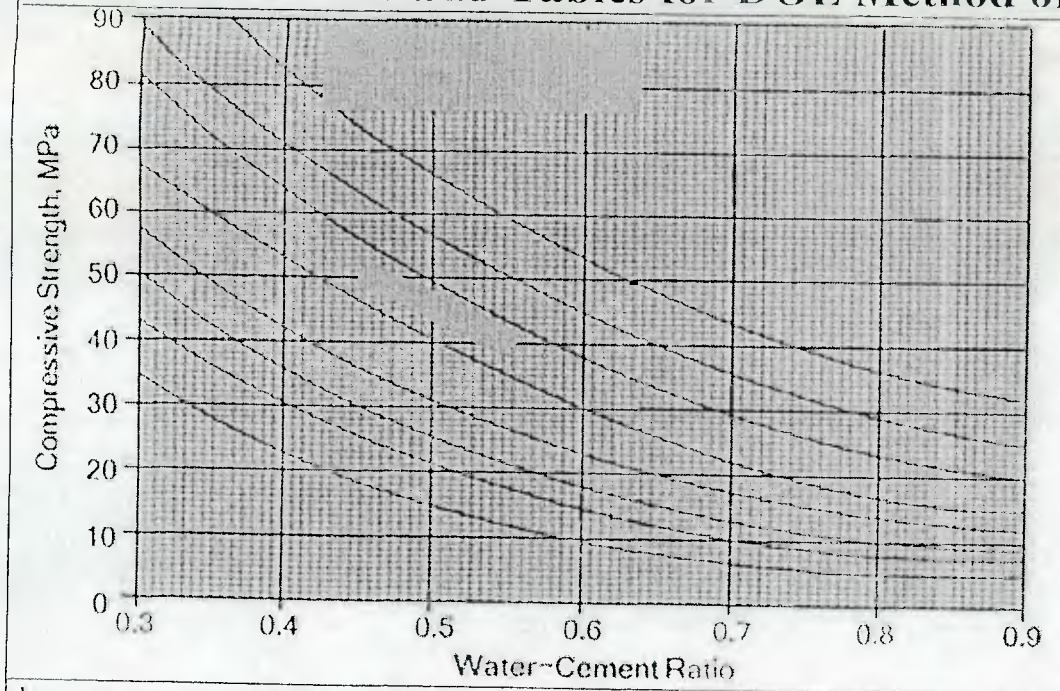
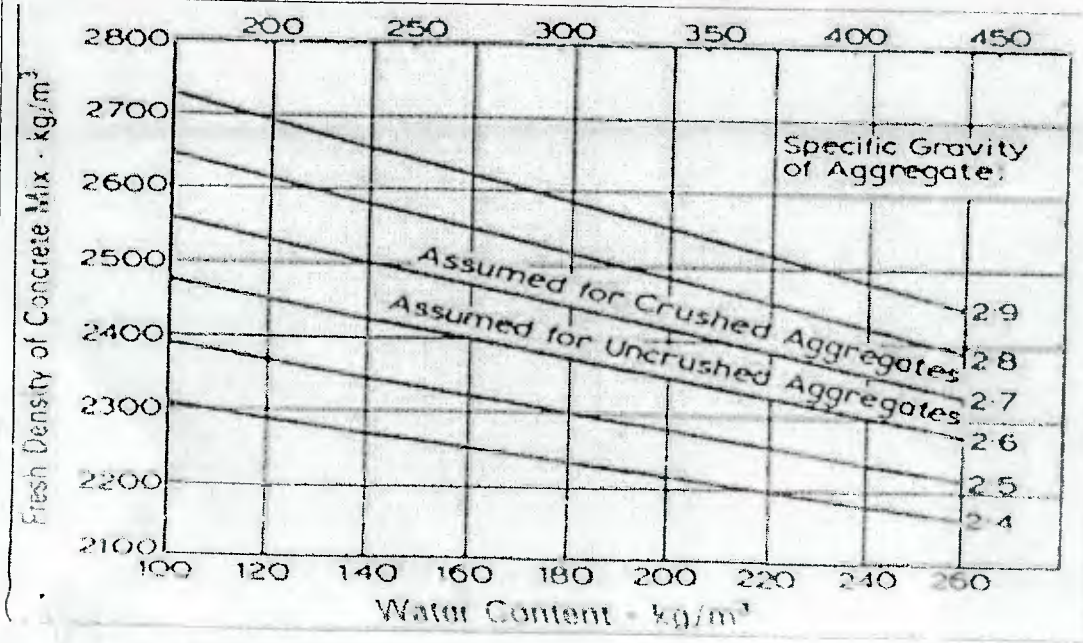


Table 20.47. App. Free water content required for various workability according to 1988 British Method

Aggregate		Water content kg/m³ for slump			
Max. size mm	Type	0 — 10 mm	10 — 30 mm	30 — 60 mm	60 — 180 mm
		Vee Bee secons > 12	6 — 12	3 — 6	0 — 3
10	Un crushed	150	180	205	225
	crushed	180	205	230	250
20	Un crushed	135	160	180	195
	crushed	170	190	210	225
30	Un crushed	115	140	160	175
	crushed	155	175	190	205

Table 20.48. Reduction in water content of table 21.47 when fly ash used.

% of fly ash in cementitious material	Slump in mm Vee Bee seconds	Reduction in water content kg/m³			
		0 — 10 > 12	10 — 30 6 — 12	30 — 60 3 — 6	60 — 180 0 — 3
10		5	5	5	10
10		10	10	10	15
10		15	15	20	20
10		20	20	25	25
10		25	25	30	30



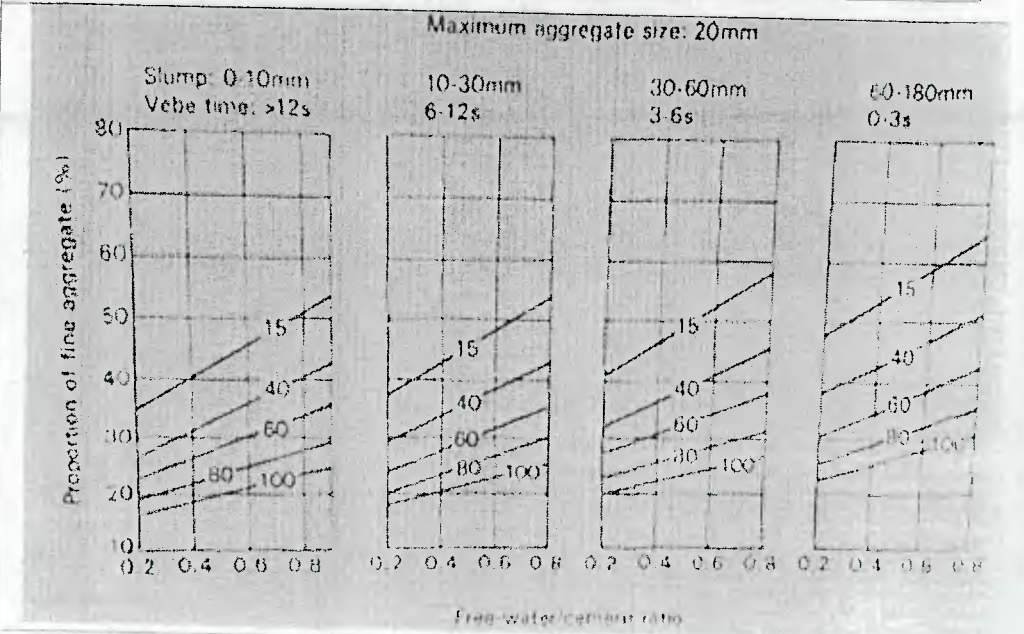


Table 1,2 and 3 for ACI Method Concrete Mix Design

(1) Dry Bulk Volume of coarse aggregate/ unit volume of concrete as per ACI 211.1-91

Maximum size of aggregate	Bulk volume of dry rodded CA /unit volume of concrete for fineness modulus of sand of			
FM	2.4	2.6	2.8	3.00
10	0.5	0.48	0.46	0.44
12.5,	0.59	0.57	0.55	0.53
20 (25,40,50,70)	0.66	0.64	0.62	0.60
150	87	0.85	0.83	0.81

(2) Relation between water/cement ratio & average compressive strength of concrete, as per ACI211.1-91

Average compressive strength at 28 days	Effective water/cement ratio (by mass)	
MPa	Non air entrained concrete	Air entrained concrete
45	0.38	-
40	0.43	-
35 (30,25,20)	0.48	0.4
15	0.8	0.71

(3) Requirements of ACI-318-89 for w/c ratio & strength for special exposure conditions

Exposure condition	Maximum w/c ratio, normal density aggregate concrete	Minimum design strength, low density aggregate concrete MPa
Concrete intended to be watertight		
(a) Exposed to fresh water	0.5	25
(b) Exposed to sea water	0.45	30
Concrete exposed to freezing in a moist condition	0.45	30
For corrosion protection of reinforced concrete exposed to de icing salts, sea water	0.4	33

Table 4,5 and 6 for ACI Method Concrete Mix Design

(4) Recommended value of slump for various types of construction as per ACI 211.1-91

Type of construction	Range of slump (mm)
Reinforces foundation walls & footings	20-80
Plain footings,substructure wall	20-80
Beams & reinforced walls	20-100
Building columns	20-100
Pavements & slabs	20-80
Mass concrete	20-80

(5) Approximate requirements for mixing water & air content for different workabilities & nominal maximum size of aggregates as per ACI211.1-91

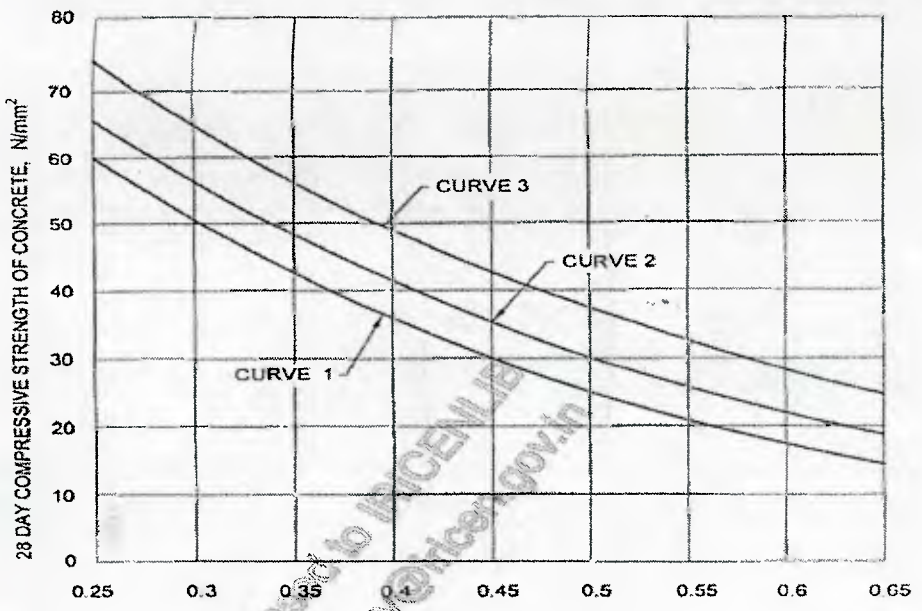
Non air entrained concrete				
Workability or air content (Slump)	Water content, kg/m3 of concrete for indicted maximum aggregate size			
	10 mm (25, 40,50,70)	12.5 mm	20 mm	150 mm
30 -50 mm	205	200	185	125
80-100 mm	225	215	200	140
150-180 mm	240	230	210	-
Approx entrapped air (%)	3	2.5	2	0.2

(6) First estimate of density of fresh concrete as per ACI 211.1-91

Maximum size of aggregate (mm)	First estimate of density of fresh concrete	
	Non air entrained kg/m³	Air entrained kg/m³
10	2285	2190
12.5 (20,25,40,50)	2315	2235
20	2355	2280
150	2505	2435

Reference Tables for IS 10262:2019 Method of Concrete mix design

IS 10262 : 2019



Curve 1 : for expected 28 days compressive strength of 33 and < 43 N/mm².
Curve 2 : for expected 28 days compressive strength of 43 and < 53 N/mm².
Curve 3 : for expected 28 days compressive strength of 53 N/mm² and above.

NOTES

Table 5 Minimum Cement Content, Maximum Water-Cement Ratio and Minimum Grade of Concrete for Different Exposures with Normal Weight Aggregates of 20 mm Nominal Maximum Size

(Clauses 6.1.2, 8.2.4.1 *and* 9.1.2*)*

Sl No.	Exposure	Plain Concrete			Reinforced Concrete		
		Minimum Cement Content kg/m³	Maximum Free Water-Cement Ratio	Minimum Grade of Concrete	Minimum Cement Content kg/m³	Maximum Free Water-Cement Ratio	Minimum Grade of Concrete
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
i)	Mild	220	0.60	–	300	0.55	M 20
ii)	Moderate	240	0.60	M 15	300	0.50	M 25
iii)	Severe	250	0.50	M 20	320	0.45	M 30
iv)	Very severe	260	0.45	M 20	340	0.45	M 35
v)	Extreme	280	0.40	M 25	360	0.40	M 40

NOTES

1 Cement content prescribed in this table is irrespective of the grades of cement and it is inclusive of additions mentioned in 5.2. The additions such as fly ash or ground granulated blast furnace slag may be taken into account in the concrete composition with respect to the cement content and water-cement ratio if the suitability is established and as long as the maximum amounts taken into account do not exceed the limit of pozzolona and slag specified in IS 1489 (Part 1) and IS 455 respectively.

2 Minimum grade for plain concrete under mild exposure condition is not specified.

IS 10262 : 2019

Table 5 Volume of Coarse Aggregate per Unit Volume of Total Aggregate for Different Zones of Fine Aggregate for Water-Cement/Water-Cementitious Materials Ratio of 0.50

(Clause 5.5*)*

Sl No.	Nominal Maximum Size of Aggregate mm	Volume of Coarse Aggregate per Unit Volume of Total Aggregate for Different Zones of Fine Aggregate			
		Zone IV	Zone III	Zone II	Zone I
(1)	(2)	(3)	(4)	(5)	(6)
i)	10	0.54	0.52	0.50	0.48
ii)	20	0.66	0.64	0.62	0.60
iii)	40	0.73	0.72	0.71	0.69

NOTES

1 Volumes are based on aggregates in saturated surface dry condition.

2 These volumes are for crushed (angular) aggregate and suitable adjustments may be made for other shape of aggregate.

3 Suitable adjustments may also be made for fine aggregate from other than natural sources, normally, crushed sand or mixed sand may need lesser fine aggregate content. In that case, the coarse aggregate volume shall be suitably increased.

4 It is recommended that fine aggregate conforming to Grading Zone IV, as per IS 383 shall not be used in reinforced concrete unless tests have been made to ascertain the suitability of proposed mix proportions

Table 4 Water Content per Cubic Metre of Concrete For Nominal Maximum Size of Aggregate

(Clause 5.3*)*

Sl No.	Nominal Maximum Size of Aggregate mm	Water Content[1] kg
(1)	(2)	(3)
i)	10	208
ii)	20	186
iii)	40	165

[1]Water content corresponding to saturated surface dry aggregate.

Table 3 Approximate Air Content

(Clause 5.2*)*

Sl No.	Nominal Maximum Size of Aggregate mm	Entrapped Air, as Percentage of Volume of Concre
(1)	(2)	(3)
i)	10	1.5
ii)	20	1.0
iii)	40	0.8

5.2.1 The actual values of air content can also adopted during mix proportioning, if the site data least 5 results) for similar mix is available.

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End Semester Examinations July 2023

(2022-23)

Program: S.Y. B. TECH Sem IV Civil **Duration: 03 Hrs.**

Course Code: PC-BTC-405 **Maximum Points: 100**

Course Name: HYDRAULIC ENGINEERING **Semester: IV**

26/7/23

Notes:

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

Q. No.	Questions	Points	CO	BL	PI
1	(a)What do you understand by model prototype relationship? Discuss the importance of laws of similarity, geometric, kinematic and dynamic similarities used in dimensional analysis.	10	4	2	1.3.1
	(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	4	2.1.2
2	(a)Explain briefly the phenomenon of water hammer flow in pipe lines and distinguish clearly between rapid closure and slow closure of valve.	05	1	2	1.3.1
	(b) Explain: Hardy cross method of pipe network analysis.	05	1	2	1.3.1
	(c)Three pipes connected in series discharge water from 80 meter level to 40 meter level. The details of piping system are as given in **Table 1**. Considering minor losses: determine discharge, velocity and head loss in each pipe. **Table 1.**	10	1	4	2.1.2

Pipe	Length (m)	Diameter (cm)	Friction Factor (f)
1	1000	30	0.022
2	800	15	0.018
3	1200	25	0.021

3	(a)Show that the efficiency of a free jet striking normally on a series of flat plates mounted on the periphery of a wheel never exceeds 50%.	10	1	4	1.3.1
	(b)A 45 m/sec velocity jet of water strikes without shock on a series of vanes moving at 12 m/sec. The jet is inclined at an angle of 23^0 to the direction of motion of vanes. The relative velocity of jet at outlet is 0.82 times the value at inlet and the flow is radial. Determine: Vane angles at entrance and exit and Hydraulic efficiency.	10	1	5	2.2.3

4	(a)Discuss head and efficiency of hydraulic turbine and explain working of a Pelton type turbine with neat sketch.	10	2	2	2.1.2
	(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 15^0. Flow width is 0.10 m. at inlet and outlet. Determine: (i) the guide blade angle (ii) vane angle at inlet	10	2	4	2.3.1
5	(a)Explain: (i) Priming of a centrifugal pump; and (ii) Cavitation in centrifugal pump	05 05	2	2	.1
	(b) The impeller of a centrifugal pump runs at 500 r.p.m. and has vanes inclined at 120^0 to the direction of motion at exit. If the manometric head is 20m and the manometric efficiency is 75%, determine (i) the diameter of impeller at exit, (ii) vane angle at inlet. Take the velocity of flow as 2.0 m/sec, throughout and the diameters of the impeller at exit as twice that at inlet.	10	2	4	3.1.6
6	(a)Explain unit quantities for a hydraulic turbine and state the importance of specific speed.	10	2	2	2.1.2
	(b) Derive conditions for most economical triangular channel section.	10	2	3	3.4.2
7	(a) Explain specific energy and specific force diagram and discuss the importance of critical depth in channel flow.	10	3	4	2.3.1
	(b)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.	10	3	4	2.3.1

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17/7/23

End SemesteExam

July 2023

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

Class: S.Y B. Tech Civil Sem IV **Semester: IV**

Name of the Course: Environmental Engineering I **Program: Civil**

Course Code: PC-BTC407

Instructions:

- **Draw neat sketches/diagrams wherever required and wherever design is asked.**
- **Assume suitable data if necessary and state them clearly**
- Figure on right indicate **maximum points** for the given question, **course outcomes attained and Bloom's Level**
- **All the best**

		Marks	CO	BL
Q1	**Answer the following questions:**	**(20)**	**3-4**	**3-4**
(a)	There is a **river named Godavari** that flows through Nashik. Nashik is a developing city and requires a water supply scheme. Explain the need of surface water supply scheme with components that could be considered in the water supply scheme (**draw the figure for water supply scheme**). What are the main parameters considered when designing a water supply scheme and how is the scheme designed.	**(10)**		
(b)	**Nashik** has many **wineries and vegetable growers** around it. The municipal authorities want to find **physical, chemical and biological parameters of water of Godavari and assign the task to you.** As an environmental engineer **which parameters** should be considered specifically for wineries or distillation? **Explain** in detail parameters (impact and measurement) to be considered while deciding the quality of water in Godavari. Also, give characterisation for the ground water of the area as it has bedrock having iron and manganese deposits.	**(07)**		
(c)	List the reservoirs from where MMR receives it's water from and what is the typical water supply rate for individual in Mumbai. Comment on the rate of water supply for Mumbai	**(03)**		
Q2	**Answer the following questions:**	**(20)**	**1-4**	**2, 6**
(a)	Based on the parameters evaluated for Godavari, draw a flowsheet of **water treatment facility** required for **Nashik** explaining the **reductions of important parameters** and **functions of various units in detail (showing reductions of parameters required)** of the facility. It was observed that **hardness and fluoride** is present in excess in water, **list down additional units** required to remove the impurities and how do they remove the impurities listed above.	**(12)**		
(b)	Forecast the **population of Nashik for 2040** based on the earlier census records using incremental increase and geometric increase methods	**(08)**		

Year	1970	1980	1990	2010	2020
Population	3,50,000	4,80,000	5,70,000	7,90,000	14,30,000

Q3	**Answer the following questions:**	**(20)**	**1-4**	**3-4**
(a)	Design a bell mouth canal intake for Nashik region drawing water from a canal built beside **Gangapur reservoir** which runs only for **10 hrs** a day with a depth of 2.0 m for the year 2040. Also calculate head loss in intake conduit if treatment works are 0.4 km away. **Draw a neat sketch**. Given average consumption per person is 180 lpcd. Assume velocity through screens and bell mouth as 15 cm/sec and 30 cm/sec (for screens consider it is made of vertical iron bars of 20 mm dia and placed at 3 to 5 cm c to c). **Design for average discharge**. Assume min water level in canal to be 0.4 m below FSL. Use head loss equation as • $v=0.85\ C_H R^{0.63} S^{0.54}$ (C_H= 130 dependent on pipe material, R is hydraulic mean depthand for circular section it is d/ 4; and S is slope of energy line or Hl/L)	**(15)**		
(b)	Explain the concept of vertical flow sedimentation tanks.	**(05)**	**1-2**	**2**
Q4	**Answer the questions**	**(20)**	**1-4**	**3-4**
(a)	2 rectangular settling tanks are to treat 5 MLD of raw water. The sedimentation period is 6 hrs and velocity of flow is 8 cm/min and depth 4.2 m. If 1.2 m depth out of 4.2 is for sediment allowance what should be length of basin and width of basin.	**(05)**		
(b)	Articulate where will you opt for plain sedimentation and which areas will you opt for coagulant aided sedimentation and why citing advantages and disadvantages of both the methods?	**(05)**		
(c)	Design a mechanical rapid mix unit/units (dia and height) for the area of Nashik for a design flow in 2040 and considering 180lpcd average demand. Take value of **μ as 1.0087×10^{-3} Ns/m^2. Computepower requirements and give checks**	**(05)**		
(d)	Design coagulant aided ideal sedimentation tank/tanks for Nashik city for 2040 considering 180lpcd demand. Assume any data as required. Give required checks	**(05)**		
Q5	Answer the following questions	**(20)**	**1-4**	**3-4**
(a)	Explain any two color and odor removal methods in detail	**(06)**		
(b)	Explain 2 desalination methods with figures	**(06)**		
(c)	A cross flow horizontal paddle wheel flocculator is designed for Nashik city for population of 2040 with 180lpcd average flow. The mean G value is 30Sec^{-1} and detention time is 40 min. There are three compartments with G_1=50sec^{-1}, G_2= 25Sec^{-1} and G_3 = 15sec^{-1}. Basins width is 30 m. Speed of blades relative to water is 0.8 times peripheral speed of the blade. Cd is 1.5 Find (1) Dimensions of the basin (2) Number of blades and geometry of basin (3) Power requirements (4) Rotational speed of shaft	**(08)**		
Q6	**Answer the following Questions**	**(20)**		
(a)	Design rapid sand filter for Nashik's design flow (with under drains and wash water troughs) for 2040 with 180 lpcd average demand.	**(15)**		
(b)	Develop a plan for disinfection of rural water well. Rationalize your plan	**(05)**		
Q7	**Answer the following questions (any 4)**	**(20)**	**1-4**	**1-4**
(a)	Explain the (a) Ion exchangers (b) Fluoride removal	**(05)**		
(b)	Types of water distribution system	**(05)**		

(c)	Explain the process of filtration and backwashing with a figure	(05)		
(d)	List the various water distribution system with figures and explain the one or two existing in Mumbai	(05)		
(e)	Explain chlorination. If the chlorine dose is 5 mg/L and residual chlorine is 3 mg/L what is chlorine demand? Is the dose of residual chlorine appropriate? If the Nashik region requires the dose of 5mg/L what is the requirement of chlorine per day	(05)		
(f)	Calculate lime and soda ash for hard water containing following parameters (a) $CaCl_2$= 50 mg/L (b) $MgHCO_3$= 40 mg/L for Nasik for a day. Consider 100 percent purity	(05)		

FORMULA SHEET

$P_n = P_o\left[1+\frac{r}{100}\right]^n$ $P_n = P_o + n\bar{x} + \frac{n(n+1)}{2}\bar{y}$ $\log_e\left[\frac{P_s - P}{P}\right] - \left[\frac{P_s - P_o}{P_o}\right] = -kP_s * t$ $P_n = (P_o + n\bar{x})$ $r = \sqrt[n]{r_1 * r_2 * r_3 * \ldots\ldots * r_n}$	Al=27 Ca=40 C=12 O=16 S=32 Cl=35.5 H=1 Na=23 Fe= 55.5 Mg=24 Si=14 H:D= 2:1	WLR=Q/B WLR= Q/2πR DT= V/Q SOR= 12-20 $m^3/d/m^2$ V= 0.849 C $R^{0.63}$ $S^{0.54}$ SOR= 24-30$m^3/d/m^2$ WLR= 200$m^3/m^2/d$ DT= 20 to 50 min Minimum distance between successive baffle walls 0.45 m(d) Clear opening at end of baffle and basin wall =1.5 (d)
SA=volume/SOR	G =300-700s^{-1} 0.5 min to 1 min	$P=\frac{1}{2}C_d\rho . A_p . v_r^3$ $C_d = 1.8\ for\ flat\ paddles$ $\rho = 998kg/m^3$ $v_r = (1-0.25)v_p$
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 Entire filter area Area of manifold= 1.5 to 2 times laterals Rate of filtration = 300 to 500l/hr/m^2 Rate of filtration = 3000-6000l/hr/m^2 Max. demand= 1.8 Q	$v_s = \frac{1}{18}\frac{g}{v}(S_s - 1) * d^2$ Value of υ=1.002X10^{-6} m^2/sec $v_d = \sqrt{\left(\frac{8\beta}{f'}\right)(S_s - 1)dg}$ $f' = 0.025 - 0.03$ g=9.8m/s^2	Q/A; Q/ perimeter; Q/b; V/Q V= D^2(0.011D+0.785H) Rate = 3000-6000litre/hr/m^2 G^2 = P/μV = $C_D A\rho v^3/2\mu V$
$G = \sqrt{\frac{P}{\mu * V}}$	$P = F_D * v_r$	$G * t = \frac{V}{Q} * \sqrt{\frac{P}{\mu V}} = \frac{\sqrt{PV/\mu}}{Q}$

ALL THE BEST

Bharatiya Vidya Bhavan's
SARDAR PATEL COLLEGE OF ENGINEERING
(An Autonomous Institution Affiliated to University of Mumbai)
Munshi Nagar Andheri (W) Mumbai 400058

End Semester Exam

July 2023

28/7/23

Max. Marks: 100 Civil sem IV **Duration: 3 Hrs**

Class: S.Y B. Tech **Semester: IV**

Name of the Course: Indian Traditional Knowledge **Program: Civil/Elect**

Course Code: MC 002

Instructions:

- **Draw neat sketches/diagrams wherever required**
- Figure on right indicate **maximum points** for the given question, **course outcomes attained and Bloom's Level**
- **All the best**

		Marks	CO	BL
Q1	**Answer the following questions:**	(20)	1-2	1-3
(a)	Explain the concept of traditional knowledge and it's importance. Explain it's components.	(10)		
(b)	Write a note on traditional water harvesting systems used and in use today.	(05)		
(c)	a Austro Asiatic — i Munda, Khasi b Indo Aryan — ii Devnagari c Dravidian — iii Assamese d Tibetan Burman — iv Hindi e Khariboli — v Tamil	(05)		
Q2	**Answer the following questions:**			
(a)	Match the following	(20)		
	a Bhaskaracharya — i Connection of Physical Well being and mental health b Kanad — ii Motion of planets c Bhardwaj — iii "Anu" (unbreakable particle) d Aryabhatta — iv Lilavati and Bijganit e Charak — v Vimana Shastra	(05)	3	1-2
(b)	Explain similarities of typical inventions and discoveries supposed to made by specific sages with western discoveries and inventions.	(10)	2-3	2
(c)	Explain the context of Mahabharata in regards to nuclear weapons. Also what is the importance of 30 th chapter of Shrimad Bhagwatam.	(05)	3-4	2
Q3	**Answer the following questions:**	(20)	1-3	4
(a)	Explain the importance of any 3 local medicinal plants in Ayurveda and diseases cured by them.	(10)		
(b)	Write a note on vernacular architecture. Explain the elements of vernacular architecture in any building or structure observed by you in India	(10)		

Q4	**Answer the following questions:**			
(a)	Explain all 4"Vedas" in detail. What are the sections of Vedas.	**(10)**	2-3	2
(b)	**Fill in the blanks**	**(05)**		
	i. Sam Veda is chanted by _____ priests.			
	ii. The term_____ means those who sit near.			
	iii. The hymns of _____ are dedicated to five elements of nature			
	iv. The _____ is second section of Vedas which try to explain the importance of hymns in Samhitas			
	v. _____ means liberation from the cycle of birth and death according to Rig Veda			
(c)	Match the following	**(05)**		

a	Ayurveda	i	Yajurveda
b	Nirukta	ii	Sam Veda
c	Gandharvaveda	iii	Upanga
d	Dhanurveda	iv	Rig Veda
e	Yoga	v	Vedanga

Q5	Answer the following questions	**(20)**	3-4	
(a)	Explain in details the following classical dances with respect to region, description, dress/makeup ,unique features, instruments accompanied (a) Bharatnatyam (b) Kathak (c) Kathakali (d) Kuchipudi	**(10)**		
(b)	Give names of any 10 states with specific folk dance related to it	**(05)**		
(c)	Explain the term yoga and it's origin. Explain the role of yoga Asanas in day to day life of human being.	**(05)**		
Q6	Answer the following questions		3-4	
(a)	Explain the teachings and learning of Guru Nanak Dev	**(05)**		
(b)	Write a note on the journey of Prince Siddartha to Gautam Buddha.	**(10)**		
(c)	Explain the meaning of following dohas माटी कहे कुम्हार से, तू क्या रौंदे मोय। एक दिन ऐसा आएगा, मैं रौंदूगी तोय॥ गुरु गोविंद दोऊं खड़े, काके लागूं पांय। बलिहारी गुरु आपकी, गोविंद दियो बताय॥	**(05)**		
Q7	Answer the following questions	**(20)**		
(a)	Explain the various preachings of Jainism	**(10)**		
(b)	Write a note on linguistic history and tradition of India	**(10)**		

ALL THE BEST