Bharatiya Vidya Bhavan's

Sardar Patel College of Engineering

(A Government Aided Autonomous Institute)

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

Examinations, April 2022

First Year M.Tech – Civil Engg (Constn. Mgt.) Sem I

Total points: 100 Date-13/4/2022

Duration: 3 Hours

Class: M.TECH(CM). Semester: I Program: Civil

Name of the Course: **Applied Statistics and Quantitative Techniques** Course Code : **PC-MTCM-102**

Instructions:

1. **Q1 and Q2 are compulsory**
2. Draw neat diagrams
3. Assume suitable data if necessary and state the clearly.

Que. No		Points	CO	BL	PI
Q1 (A)	The average number of collisions occurring in a week during the summer months at a particular intersection is 2.00. Assume that the requirements of the Poisson distribution are satisfied. a) What is the probability of no collisions in any week? b) What is the probability that there will be exactly one collision in a week? c) What is the probability of exactly two collisions in a week? d) What is the probability of finding not more than two collisions in a week? e) What is the probability of finding more than two collisions in a week? f) What is the probability of exactly two collisions in a particular two-week interval?	10	1	4	1.1.1
Q1(B)	Use Simplex method to solve, Max Z = 4X1+5X2+9X3+11X4 Subject to, X1+X2+X3+X4 <=15 7X1+5X2+3X3+2X4 <= 120 3X1+5X2+10X3+15X4 <= 100 All X1 to X4 are equal to or greater than zero.	10	3	3	3.3.1
A2(A)	The following contingency table shows a random sample of 321 fatally injured passenger vehicle drivers by age and gender. The expected frequencies are displayed in parentheses. At $\alpha = 0.05$, can you conclude that the drivers' ages are related to gender in such accidents?	10	2	4	1.1.2

	Age						
Gender	16-20	21-30	31-40	41-50	51-60	60 & above	Total
Male	32	51	52	43	28	10	216
Female	13	55	33	21	10	6	105
Total	45	73	85	64	38	16	321

Q2(B)	John Thompson is the President of Stewarts & Lloyds of India ltd. John Thompson's problem is to identify whether to expand hi product line by manufacturing and marketing a new product: washing machine. To make a proposal for submitting to his board of directors, Thompson thought of following three alternatives that are available to him. 1. To construct a large new plant to manufacture the washing machine 2. To construct a small plant to manufacture the washing machine 3. No plant at all (that is he has the option of not developing the new product line). Thompson determines that there are three possible state of natures: 1. The market for the washing machine could be most favorable, meaning that there is a high demand for the product 2. The market for the washing machine could be satisfactorily favorable, meaning that there is a good demand for the product 3. It could be unfavorable, meaning that there is a low demand for the washing machine. John Thompson evaluated the profits associated with various outcomes. The payoff matrix is given below. Using following criteria's, suggest which alternative John Thompson should select 1. Maximax (optimistic) 2. Maximin (pessimistic) 3. Criterion of realism (Hurwicz) 4. Equally likely (Laplace) 5. Minimax regret	10	2	5	1.2.2

Alternatives	State of Nature		
	most favorable market	satisfactorily favorable market	Unfavorable market
Construct a Large plant	700000	300000	150000
construct a small plant	500000	450000	0
Do Nothing	300000	300000	300000

Q3(A)	Weekly demand of a product is assumed to be normally distributed. Use goodness of fit and following data to test this assumption. Use alpha=0.10, sample mean=24.5 sample std dev=3	8	2	4	1.2.3

18	20	22	27	22	26	25	25	27	25
25	22	27	25	24	25	28	24	25	26
26	23	20	24	26	31	29	28	19	21

Q3(B)	Eight coins were tossed 256 times and following results were obtained. Are coins biased? Use chi-square test.	6	2	5	1.2.2

No. of heads	0	1	2	3	4	5	6	7	8
frequency	2	6	30	52	67	56	32	10	1

Following table gives monthly sales of certain firm in three states by its four

Q3(C)	salesmen. Set up ANOVA States / Salesman: A, B, C, D X: 5, 4, 4, 7 Y: 7, 8, 5, 4 Z: 9, 6, 6, 7 **OR** A ready-mix plant produces concrete. Daily demand based on past data is given below Daily Demand: 0, 15, 25, 35, 45, 50 Probability: 0.01, 0.15, 0.20, 0.50, 0.12, 0.02 Consider following sequence of random no. 48,78,09,51,56,77,15,14,68,09 Using the sequence 1. Simulate the demand for next 10 days 2. Find the stock situation of owner of the plant to make 35 kg every day.	6	2	5	1.1
Q4(A)	Watching television also reduces the amount of physical exercise, causing weight gain. A sample of 15 10yr old children was taken. The number of pounds each child was overweight was recorded (-ve sign shows child is underweight) the no. of hours of TV viewing per week also recorded. Fit the regression line. TV: 42, 34, 25, 35, 37, 38, 33, 33, 19, 29, 38, 28, 29, 36, 18 Overwt: 18, 6, 0, -1, 13, 14, 7, 7, -9, 8, 8, 5, 3, 14, -7	10	1	5	1.3.1
Q4(B)	Using Big-M method to solve, Max Z = 6X1-3X2+2X3 Subject to, 2X1+X2+X3 <= 16 3X1+2X2+X3 <= 18 X2-2X3 >= 8 All X1 to X3 are equal to or greater than zero.	10	3	3	1.3.2
Q5(A)	Explain central limit theorem.	6	2	2	1.3.1
Q5(B)	short note on Hypergeometric and Exponential distribution.	7	1	2	1.3.1
Q5(C)	what are sampling and non-sampling errors?	7	3	2	1.3.1
Q6(A)	A potential buyer of fluorescent lamp brought 50 lamps of each of two bands e.g. national lamp and Indian lamp. after testing lamps, he found that national had mean life of 1282 hrs with population std dev 80 hrs whereas Indian brand lamp has mean life 1208 hrs and std dev 94 hrs.at 5% can buyer conclude that both brands have same mean life?	10	1	5	2.1.3

Q6(B) — 10 | 2 | 5 | 2.4.1

Use following data to find-

1. Fit a regression equation of Y on X and predict Y if X=8
2. Fit a regression equation of X on Y and predict X if Y=4

X	1	5	3	2	1	1	7	3
Y	6	1	0	0	1	2	1	5

Q7(A) — 10 | 2 | 4 | 2.2.4

Solve by Expected monetary valve criteria (EMV), Expected opportunity loss (EOL) criteria. -A departmental store purchases Christmas trees which can be order in lots of 100. Each tree cost is Rs 25/- and sell cost Rs 40/- each. Unsold tresses have no salvage value. The probability distribution is given.

Trees Sold	Probability
100	0.20
200	0.35
300	0.25
400	0.15
500	0.05

Q7(B) — 10 | 3 | 5 | 2.2.4

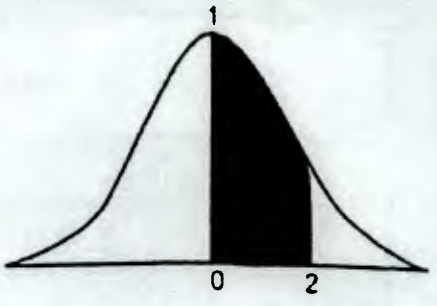
	Sources					**Supply**
Jobs	3	4	6	8	9	**20**
	2	10	1	5	8	**30**
	7	11	20	40	3	**15**
	2	1	9	14	16	**3**
Demand	**40**	**6**	**8**	**18**	**6**	

Use following methods to find optimal transportation cost and Check optimality of solution.

1.N-W corner method
2. Least cost Method
3.VAM

Table 1: Area Under Normal Curve

An entry in the table is the proportion under the entire curve which is between $z = 0$ and a positive value of z. Areas for negative values for z are obtained by symmetry.



Areas of a standard normal distribution

z	.0	0.01	.02	.03	.04	.05	.06	.07	.08	.09
.0	.0000	.0040	.0080	.0120	.0160	.0199	.0239	.0279	.0319	.0359
.1	.0398	.0438	.0478	.0517	.0557	.0596	.0636	.0675	.0714	.0753
.2	.0793	.0832	.0871	.0910	.0948	.0987	.1026	.1064	.1103	.1141
.3	.1179	.1217	.1255	.1293	.1331	.1368	.1406	.1443	.1480	.1517
.4	.1554	.1591	.1628	.1664	.1700	.1736	.1772	.1808	.1844	.1879
.5	.1915	.1950	.1985	.2019	.2054	.2088	.2123	.2157	.2190	.2224
.6	.2257	.2291	.2324	.2357	.2389	.2422	.2454	.2486	.2517	.2549
.7	.2580	.2611	.2642	.2673	.2903	.2734	.2764	.2794	.2823	.2852
.8	.2881	.2910	.2939	.2967	.2995	.3023	.3051	.3078	.3106	.3133
.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

Table 2: Critical Values of Student's *t*-Distribution

d.f.	Level of significance for two-tailed test					d.f.
	0.20	0.10	0.05	0.02	0.01	
	Level of significance for one-tailed test					
	0.10	0.05	0.025	0.01	0.005	
1	3.078	6.314	12.706	31.821	63.657	1
2	1.886	2.920	4.303	6.965	9.925	2
3	1.638	2.353	3.182	4.541	5.841	3
4	1.533	2.132	2.776	3.747	4.604	4
5	1.476	2.015	2.571	3.365	4.032	5
6	1.440	1.943	2.447	3.143	3.707	6
7	1.415	1.895	2.365	2.998	3.499	7
8	1.397	1.860	2.306	2.896	3.355	8
9	1.383	1.833	2.262	2.821	3.250	9
10	1.372	1.812	2.228	2.764	3.169	10
11	1.363	1.796	2.201	2.718	3.106	11
12	1.356	1.782	2.179	2.681	3.055	12
13	1.350	1.771	2.160	2.650	3.012	13
14	1.345	1.761	2.145	2.624	2.977	14
15	1.341	1.753	2.731	2.602	2.947	15
16	1.337	1.746	2.120	2.583	2.921	16
17	1.333	1.740	2.110	2.567	2.898	17
18	1.330	1.734	2.101	2.552	2.878	18
19	1.328	1.729	2.093	2.539	2.861	19
20	1.325	1.725	2.086	2.528	2.845	20
21	1.323	1.721	2.080	2.518	2.831	21
22	1.321	1.717	2.074	2.508	2.819	22
23	1.319	1.714	2.069	2.500	2.807	23
24	1.318	1.711	2.064	2.492	2.797	24
25	1.316	1.708	2.060	2.485	2.787	25
26	1.315	1.706	2.056	2.479	2.779	26
27	1.314	1.703	2.052	2.473	2.771	27
28	1.313	1.701	2.048	2.467	2.763	28
29	1.311	1.699	2.045	2.462	2.756	29
Infinity	1.282	1.645	1.960	2.326	2.576	Infinity

Table 3: Critical Values of χ^2

Degrees of freedom	Probability under H_0 that of χ^2 > Chi square						
	.99	.95	.50	.10	.05	.02	.01
1	.000157	.00393	.455	2.706	3.841	5.412	6.635
2	.0201	.103	1.386	4.605	5.991	7.824	9.210
3	.115	.352	2.366	6.251	7.815	9.837	11.341
4	.297	.711	3.357	7.779	9.488	11.668	13.277
5	.554	.1145	4.351	9.236	11.070	13.388	15.086
6	.872	1.635	5.348	10.645	12.592	15.033	16.812
7	1.239	2.167	6.346	12.017	14.067	16.622	18.475
8	1.646	2.733	7.344	13.362	15.507	18.168	20.090
9	2.088	3.325	8.343	14.684	16.919	19.679	21.666
10	2.558	3.940	9.342	15.987	18.307	21.161	23.209
11	3.053	4.575	10.341	17.275	19.675	22.618	24.725
12	3.571	5.226	11.340	18.549	21.026	24.054	26.217
13	4.107	5.892	12.340	19.812	22.362	25.472	72.688
14	4.660	6.571	13.339	21.064	23.685	26.873	29.141
15	4.229	7.261	14.339	22.307	24.996	28.259	30.578
16	5.812	7.962	15.338	23.542	26.296	29.633	32.000
17	6.408	8.672	16.338	24.769	27.587	30.995	33.409
18	7.015	9.390	17.338	25.989	28.869	32.346	34.805
19	7.633	10.117	18.338	27.204	30.144	33.687	36.191
20	8.260	10.851	19.337	28.412	31.410	35.020	37.566
21	8.897	11.591	20.337	29.615	32.671	36.343	38.932
22	9.542	12.338	21.337	30.813	33.924	37.659	40.289
23	10.196	13.091	22.337	32.007	35.172	38.968	41.638
24	10.856	13.848	23.337	32.196	36.415	40.270	42.980
25	11.524	14.611	24.337	34.382	37.652	41.566	44.314
26	12.198	15.379	25.336	35.363	38.885	41.856	45.642
27	12.879	16.151	26.336	36.741	40.113	44.140	46.963
28	13.565	16.928	27.336	37.916	41.337	45.419	48.278
29	14.256	17.708	28.336	39.087	42.557	46.693	49.588
30	14.953	18.493	29.336	40.256	43.773	47.962	50.892

Note: For degrees of freedom greater than 30, the quantity $2\chi^2 - \sqrt{2\text{d.f.} - 1}$ may be used as a normal variate with unit variance i.e., $z_\alpha = \sqrt{2\chi^2} - \sqrt{2\text{d.f.} - 1}$.

Table 4(a): Critical Values of *F*-Distribution (at 5 per cent)

ν_2 \ ν_1	1	2	3	4	5	6	8	12	24	∞
1	161.4	199.5	215.7	224.6	230.2	234.0	238.9	243.9	249.1	243.3
2	18.51	19.00	19.16	19.25	19.30	19.33	19.37	19.41	19.45	19.50
3	10.13	9.55	9.28	9.12	9.01	8.94	8.85	8.74	8.64	8.53
4	7.71	6.94	6.59	6.39	6.26	6.16	6.04	5.91	5.77	5.63
5	6.61	5.79	5.41	5.19	5.05	4.95	4.82	4.68	4.53	4.36
6	5.99	5.14	4.76	4.53	4.39	4.28	4.15	4.00	3.84	3.67
7	5.59	4.74	4.35	4.12	3.97	3.87	3.73	3.57	3.41	3.23
8	5.32	4.46	4.07	3.84	3.69	3.58	3.44	3.28	3.12	2.93
9	5.12	4.26	3.86	3.63	3.48	3.37	3.23	3.07	2.90	2.71
10	4.96	4.10	3.71	3.48	3.33	3.22	3.07	2.91	2.74	2.54
11	4.84	3.98	3.59	3.36	3.20	3.09	2.95	2.79	2.61	2.40
12	4.75	3.88	3.49	3.26	3.11	3.00	2.85	2.69	2.51	2.30
13	4.67	3.80	3.41	3.18	3.02	2.92	2.77	2.60	2.42	2.21
14	4.60	3.74	3.34	3.11	2.96	2.85	2.70	2.53	2.35	2.13
15	4.54	3.68	3.29	3.06	2.90	2.79	2.64	2.48	2.29	2.07
16	4.49	3.63	3.24	3.01	2.85	2.74	2.59	2.42	2.24	2.01
17	4.45	3.59	3.20	2.96	2.81	2.70	2.55	2.38	2.19	1.96
18	4.41	3.55	3.16	2.93	2.77	2.66	2.51	2.34	2.15	1.92
19	4.38	3.52	3.13	2.90	2.74	2.63	2.48	2.31	2.11	1.88
20	4.35	3.49	3.10	2.87	2.71	2.60	2.45	2.28	2.08	1.84
21	4.32	3.47	3.07	2.84	2.68	2.57	2.42	2.25	2.05	1.81
22	4.30	3.44	3.05	2.82	2.66	2.55	2.40	2.23	2.03	1.78
23	4.28	3.42	3.03	2.80	2.64	2.53	2.38	2.20	2.01	1.76
24	4.26	3.40	3.01	2.78	2.62	2.51	2.36	2.18	1.98	1.73
25	4.24	3.38	2.99	2.76	2.60	2.49	2.34	2.16	1.96	1.71
26	4.22	3.37	2.98	2.74	2.59	2.47	2.32	2.15	1.95	1.69
27	4.21	3.35	2.96	2.73	2.57	2.46	2.31	2.13	1.93	1.67
28	4.20	3.34	2.95	2.71	2.56	2.45	2.29	2.12	1.91	1.65
29	4.18	3.33	2.93	2.70	2.54	2.43	2.28	2.10	1.90	1.64
30	4.17	3.32	2.92	2.69	2.53	2.42	2.27	2.09	1.89	1.62
40	4.08	3.23	2.84	2.61	2.45	2.34	2.18	2.00	1.79	1.51
60	4.00	3.15	2.76	2.52	2.37	2.25	2.10	1.92	1.70	1.39
120	3.92	3.07	2.68	2.45	2.29	2.17	2.02	1.83	1.61	1.25
∞	3.84	2.99	2.60	2.37	2.21	2.10	1.94	1.75	1.52	1.00

ν_1 = Degrees of freedom for greater variance.

ν_2 = Degrees of freedom for smaller variance.

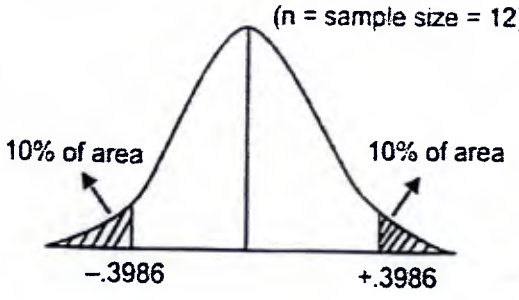
Table 4(b): Critical Values of *F*-Distribution (at 1 per cent)

v_2 \ v_1	1	2	3	4	5	6	8	12	24	∞
1	4052	4999.5	5403	5625	5764	5859	5982	6106	6235	6366
2	98.50	99.00	99.17	99.25	99.30	99.33	99.37	99.42	99.46	99.50
3	34.12	30.82	29.46	28.71	28.24	27.91	27.49	27.05	26.60	26.13
4	21.20	18.00	16.69	15.98	15.52	15.21	14.80	14.37	13.93	13.45
5	16.26	13.27	12.06	11.39	10.97	10.67	10.29	9.89	9.47	9.02
6	13.75	10.92	9.78	9.15	8.75	8.47	8.10	7.72	7.31	6.88
7	12.25	9.55	8.45	7.85	7.46	7.19	6.84	6.47	6.07	5.65
8	11.26	8.65	7.59	7.01	6.63	6.37	6.03	5.67	5.28	4.86
9	10.56	8.02	6.99	6.42	6.06	5.80	5.47	5.11	4.73	4.31
10	10.04	7.56	6.55	5.99	5.64	5.39	5.06	4.71	4.33	3.91
11	9.65	7.21	6.22	5.87	5.32	5.07	4.74	4.40	4.02	3.60
12	9.33	6.93	5.95	5.41	5.06	4.82	4.50	4.16	3.78	3.36
13	9.07	6.70	5.74	5.21	4.86	4.62	4.30	3.96	3.59	3.17
14	8.86	6.51	5.56	5.04	4.69	4.46	4.14	3.80	3.43	3.00
15	8.68	6.36	5.42	4.89	4.56	4.32	4.00	3.67	3.29	2.87
16	8.53	6.23	5.29	4.77	4.44	4.20	3.89	3.55	3.18	2.75
17	8.40	6.11	5.18	4.67	4.34	4.10	3.79	3.46	3.08	2.65
18	8.29	6.01	5.09	4.58	4.25	4.01	3.71	3.37	3.00	2.57
19	8.18	5.93	5.01	4.50	4.17	3.94	3.63	3.30	3.92	2.49
20	8.10	5.85	4.94	4.43	4.10	3.87	3.56	3.23	2.86	2.42
21	8.02	5.78	4.87	4.37	4.04	3.81	3.51	3.17	2.80	2.36
22	7.95	5.72	4.82	4.31	3.99	3.76	3.45	3.12	2.75	2.31
23	7.88	5.66	4.76	4.26	3.94	3.71	3.41	3.07	2.70	2.26
24	7.82	5.61	4.72	4.22	3.90	3.67	3.36	3.03	2.66	2.21
25	7.77	5.57	4.68	4.18	3.85	3.63	3.32	2.99	2.62	2.17
26	7.72	5.53	4.64	4.14	3.82	3.59	3.20	2.96	2.58	2.10
27	7.68	5.49	4.60	4.11	3.78	3.56	3.26	2.93	2.45	2.13
28	7.64	5.45	4.57	4.07	3.75	3.53	3.23	2.90	2.52	2.06
29	7.60	5.42	4.54	4.04	3.73	3.50	3.20	2.87	2.49	2.03
30	7.56	5.39	4.51	4.02	3.70	3.47	3.17	2.84	2.47	2.01
40	7.31	5.18	4.31	3.83	3.51	3.29	2.99	2.66	2.29	1.80
60	7.08	4.98	4.13	3.65	3.34	3.12	2.82	2.50	2.12	1.60
120	6.85	4.79	3.95	3.48	3.17	2.96	2.66	2.34	1.95	1.38
∞	6.64	4.60	3.78	3.32	3.02	2.80	2.51	2.18	1.79	1.00

v_1 = Degrees of freedom for greater variance.

v_2 = Degrees of freedom for smaller variance.

Table 5: Values for Spearman's Rank Correlation (r_s) for Combined Areas in Both Tails



n	.20	.10	.05	.02	.01	.002
4	.8000	.8000	—	—	—	—
5	.7000	.8000	.9000	.9000	—	—
6	.6000	.7714	.8236	.8857	.9429	—
7	.5357	.6786	.7450	.8571	.8929	.9643
8	.5000	.6190	.7143	.8095	.8571	.9286
9	.4667	.5833	.6833	.7667	.8167	.9000
10	.4424	.5515	.6364	.7333	.7818	.8667
11	.4182	.5273	.6091	.7000	.7455	.8364
12	.3986	.4965	.5804	.6713	.7273	.8182
13	.3791	.4780	.5549	.6429	.6978	.7912
14	.3626	.4593	.5341	.6220	.6747	.7670
15	.3500	.4429	.5179	.6000	.6536	.7464
16	.3382	.4265	.5000	.5824	.6324	.7265
17	.3260	.4118	.4853	.5637	.6152	.7083
18	.3148	.3994	.4716	.5480	.5975	.6904
19	.3070	.3895	.4579	.5333	.5825	.6737
20	.2977	.3789	.4451	.5203	.5684	.6586
21	.2909	.3688	.4351	.5078	.5545	.6455
22	.2829	.3597	.4241	.4963	.5426	.6318
23	.2767	.3518	.4150	.4852	.5306	.6186
24	.2704	.3435	.4061	.4748	.5200	.6070
25	.2646	.3362	.3977	.4654	.5100	.5962
26	.2588	.3299	.3894	.4564	.5002	.5856
27	.2540	.3236	.3822	.4481	.4915	.5757
28	.2480	.3175	.3749	.4401	.4828	.5660
29	.2443	.3113	.3685	.4320	.4744	.5567
30	.2400	.3059	.3620	.4251	.4665	.5479

cum. prob	$t_{.50}$	$t_{.75}$	$t_{.80}$	$t_{.85}$	$t_{.90}$	$t_{.95}$	$t_{.975}$	$t_{.99}$	$t_{.995}$	$t_{.999}$	$t_{.9995}$
one-tail	0.50	0.25	0.20	0.15	0.10	0.05	0.025	0.01	0.005	0.001	0.0005
two-tails	1.00	0.50	0.40	0.30	0.20	0.10	0.05	0.02	0.01	0.002	0.001
df											
1	0.000	1.000	1.376	1.963	3.078	6.314	12.71	31.82	63.66	318.31	636.62
2	0.000	0.816	1.061	1.386	1.886	2.920	4.303	6.965	9.925	22.327	31.599
3	0.000	0.765	0.978	1.250	1.638	2.353	3.182	4.541	5.841	10.215	12.924
4	0.000	0.741	0.941	1.190	1.533	2.132	2.776	3.747	4.604	7.173	8.610
5	0.000	0.727	0.920	1.156	1.476	2.015	2.571	3.365	4.032	5.893	6.869
6	0.000	0.718	0.906	1.134	1.440	1.943	2.447	3.143	3.707	5.208	5.959
7	0.000	0.711	0.896	1.119	1.415	1.895	2.365	2.998	3.499	4.785	5.408
8	0.000	0.706	0.889	1.108	1.397	1.860	2.306	2.896	3.355	4.501	5.041
9	0.000	0.703	0.883	1.100	1.383	1.833	2.262	2.821	3.250	4.297	4.781
10	0.000	0.700	0.879	1.093	1.372	1.812	2.228	2.764	3.169	4.144	4.587
11	0.000	0.697	0.876	1.088	1.363	1.796	2.201	2.718	3.106	4.025	4.437
12	0.000	0.695	0.873	1.083	1.356	1.782	2.179	2.681	3.055	3.930	4.318
13	0.000	0.694	0.870	1.079	1.350	1.771	2.160	2.650	3.012	3.852	4.221
14	0.000	0.692	0.868	1.076	1.345	1.761	2.145	2.624	2.977	3.787	4.140
15	0.000	0.691	0.866	1.074	1.341	1.753	2.131	2.602	2.947	3.733	4.073
16	0.000	0.690	0.865	1.071	1.337	1.746	2.120	2.583	2.921	3.686	4.015
17	0.000	0.689	0.863	1.069	1.333	1.740	2.110	2.567	2.898	3.646	3.965
18	0.000	0.688	0.862	1.067	1.330	1.734	2.101	2.552	2.878	3.610	3.922
19	0.000	0.688	0.861	1.066	1.328	1.729	2.093	2.539	2.861	3.579	3.883
20	0.000	0.687	0.860	1.064	1.325	1.725	2.086	2.528	2.845	3.552	3.850
21	0.000	0.686	0.859	1.063	1.323	1.721	2.080	2.518	2.831	3.527	3.819
22	0.000	0.686	0.858	1.061	1.321	1.717	2.074	2.508	2.819	3.505	3.792
23	0.000	0.685	0.858	1.060	1.319	1.714	2.069	2.500	2.807	3.485	3.768
24	0.000	0.685	0.857	1.059	1.318	1.711	2.064	2.492	2.797	3.467	3.745
25	0.000	0.684	0.856	1.058	1.316	1.708	2.060	2.485	2.787	3.450	3.725
26	0.000	0.684	0.856	1.058	1.315	1.706	2.056	2.479	2.779	3.435	3.707
27	0.000	0.684	0.855	1.057	1.314	1.703	2.052	2.473	2.771	3.421	3.690
28	0.000	0.683	0.855	1.056	1.313	1.701	2.048	2.467	2.763	3.408	3.674
29	0.000	0.683	0.854	1.055	1.311	1.699	2.045	2.462	2.756	3.396	3.659
30	0.000	0.683	0.854	1.055	1.310	1.697	2.042	2.457	2.750	3.385	3.646
40	0.000	0.681	0.851	1.050	1.303	1.684	2.021	2.423	2.704	3.307	3.551
60	0.000	0.679	0.848	1.045	1.296	1.671	2.000	2.390	2.660	3.232	3.460
80	0.000	0.678	0.846	1.043	1.292	1.664	1.990	2.374	2.639	3.195	3.416
100	0.000	0.677	0.845	1.042	1.290	1.660	1.984	2.364	2.626	3.174	3.390
1000	0.000	0.675	0.842	1.037	1.282	1.646	1.962	2.330	2.581	3.098	3.300
z	0.000	0.674	0.842	1.036	1.282	1.645	1.960	2.326	2.576	3.090	3.291
	0%	50%	60%	70%	80%	90%	95%	98%	99%	99.8%	99.9%

Bharatiya Vidya Bhavan's

Sardar Patel College of Engineering

(A Government Aided Autonomous Institute)

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

ReExaminations, July 2022

F. Y. M. Tech (Construction Mgt) Sem I

Total points: 100

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

Class: M.TECH(CM). Semester: I Program: Civil

Name of the Course: **Applied Statistics and Quantitative Techniques** Course Code : **PC-MTCM-102**

18/7/22

Instructions:

1. **All Questions are compulsory**
2. Draw neat diagrams
3. Assume suitable data if necessary and state the clearly.

Que. No		Points	CO	BL	PI
Q1(a)	**1.1** A random sample of size 10 from a normal population gives a sample mean of 22 and sample SD 6. Test if the population mean is 24? **1.2** The mean lifetime of 30 fans produced by a company is computed to be 1500 hours with SD 100 hrs. The company claims that the average life of fans produced by them is 1650 hours. Is the claim acceptable. **1.3** if a 5% of items produced turn out to be defective then find out probability that out of 20 items selected at random there are using binomial Distribution- 1. exactly three defectives 2. At least two defectives 3. find mean and variance	10	1,2	3	1.2.3
Q1(b)	**1.1** The side effects of a new drug are being tested against a placebo. A simple random sample of 565 patients yields the results below. At a significance level of α= 0:05, is there enough evidence to conclude that the treatment is independent of the side effect of nausea?	10	2,3	3	1.2.3

result	Drug 1	Placebo	Total
Nausea (r.1)	36	13	49
No Nausea	254	262	515
Total	290	275	565

1.2 Explain normal Distribution and its characteristics

1.3 a small scale unit operates an automatic machine which produces screws . it is know from past records that machine produces 5% defective on an average. Certain unassembled screws needs 95 such screws for assembly and is supplied with a box of 100 screws produced by the unit. what is probability that purchase of a box(using Possions Distribution)-

1. will get exactly five defectives I the box
2. will not have enough screws to complete assembly

Q2(a)	solve by Big-M method- Maximize U= y1+2y2+3y3-y4	10	3,2	4	2.2.1

	subject to constraints, y1+2y2+3y3=15 2y1+y2+5y3=20 y1+2y2+y3+y4=10 All y1.... y4 greater than or equal to 0				
Q2(b)	Show that there is unbounded solution to following LPP problem using Simplex method- Maximize Z= 4y1+y2+3y3+5y4 subject to constraints, 4y1-6y2-5y3-4y4>= -20 -3y1-2y2+4y3+y4<= 10 -8y1-3y2+3y3+2y4<= 20 y1.....y4 >=0	10	3,2	4	2.3.2
Q3(a)	3.1Formulate LPP and solve by Graphical Method- A firm uses lathes ,milling machines and grinding machines to produce two machine parts. Following table shows machining time required for each part, the machining times available on different machines and profit on each machine part. find the number of parts I and II to be manufactured per week to maximize the profit.	10	3,2	4	2.3.2
Q3(b)	3.1 A departmental lead has three subordinates and four tasks for completion. The employees differ in their capabilities and task differ in their work content, with performance matrix given below, which three of four tasks should be assigned to the subordinates?	10	1,2	4	2.3.2

Type of Machine	machining time required for each part(mints)		Maximum time available per week (Mints)
	I	II	
Lathe	12	6	3000
Milling machine	4	10	2000
Grinding machine	2	3	900
Profit per unit	Rs. 40	Rs.100	

Tasks	Subordinates		
	I	II	III
A	9	12	11
B	8	13	17
C	20	12	13
D	21	15	17

3.2 A company is making a large boiler installation. A certain automatic monitoring unit is critical for operation of whole system. At the time of original order, the spares for this unit can be purchased for Rs. 2000 per unit. The probability distribution for the failure of this unit during the lifetime of installation is given by –

Failure	Probability
0	0.35
1	0.25
2	0.20
3	0.15
4	0.05

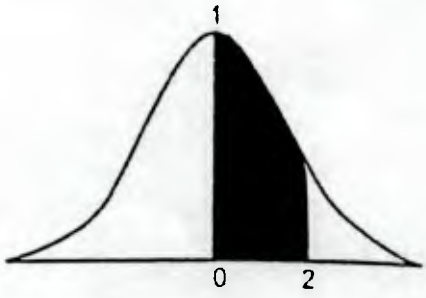
	If spare is needed and not available, the total cost of idle time and replacement cost will be Rs. 15000. Unused spares no salvage value. Determine the optimal number of spares to be ordered.				
Q4(a)	Weekly demand of a product is assumed to be normally distributed. Use goodness of fit and following data to test this assumption. Use alpha=0.10, sample mean=24.5 sample std dev=3 18 20 22 27 22 26 25 25 27 25 25 22 27 25 24 25 28 24 25 26 26 23 20 24 26 31 29 28 19 21	10	1,2	2	1.3.2
Q4(b)	Watching television also reduces the amount of physical exercise, causing weight gain. A sample of 15 10yr old children was taken. The number of pounds each child was overweight was recorded (-ve sign shows child is underweight) the no. of hours of TV viewing per week also recorded. Fit the regression line. TV: 42 34 25 35 37 38 33 33 19 29 38 28 29 36 18 Overwt: 18 6 0 -1 13 14 7 7 -9 8 8 5 3 14 -7	10	1,2	4	2.3.2
Q5(a)	Explain Assignment Model? Explain central limit theorem	10	3,2	2	1.3.2
Q5(b)	short note on Hypergeometric and Exponential distribution. what are sampling and non-sampling errors?	10	3,2	2	1.3.2
Q6	**Sources** / **Supply** **Jobs**: 3 4 6 8 9 — **20** 2 10 1 5 8 — **30** 7 11 20 40 3 — **15** 2 1 9 14 16 — **3** **Demand**: **40** **6** **8** **18** **6** Use following methods to find optimal transportation cost and Check optimality of solution. 1.N-W corner method 2. Least cost Method 3.VAM	20	1,2	3	2.3.2
Q7(a)	7.1An automobile company manufactures around 150 scooters. The daily production varies from 146 to 154 depending upon availability of raw material and other working conditions. Production per day / Probability 146 0.04 147 0.09 148 0.12 149 0.14 150 0.11 151 0.10 152 0.20	10	2	4	2.3.2

	153 | 0.12 154 | 0.08 The finished scooters are transported in a special truck accommodating 150 scooters. Use following random numbers- 80,81,76,75,64,43,18,26,10,12,65,68,69,61,57. Simulate- What will be average no of scooters waiting in factory? What will be average number of empty space on the lorry?				
Q7(b)	7.1 F-ollowing data relate to average monthly price (X) and demand(Y) of a commodity during last ten months. determine the Karl Pearson's correlation coefficient.	10	1,2	4	2.3.2

Price in rs	Demand in kgs
3.80	3.6
2.20	6.0
2.40	5.8
2.60	5.8
2.80	5.0
3.20	4.8
3.00	4.8
3.60	4.2
3.40	4.8
4.00	3.2

Table 1: Area Under Normal Curve

An entry in the table is the proportion under the entire curve which is between $z = 0$ and a positive value of z. Areas for negative values for z are obtained by symmetry.



Areas of a standard normal distribution

z	.0	0.01	.02	.03	.04	.05	.06	.07	.08	.09
.0	.0000	.0040	.0080	.0120	.0160	.0199	.0239	.0279	.0319	.0359
.1	.0398	.0438	.0478	.0517	.0557	.0596	.0636	.0675	.0714	.0753
.2	.0793	.0832	.0871	.0910	.0948	.0987	.1026	.1064	.1103	.1141
.3	.1179	.1217	.1255	.1293	.1331	.1368	.1406	.1443	.1480	.1517
.4	.1554	.1591	.1628	.1664	.1700	.1736	.1772	.1808	.1844	.1879
.5	.1915	.1950	.1985	.2019	.2054	.2088	.2123	.2157	.2190	.2224
.6	.2257	.2291	.2324	.2357	.2389	.2422	.2454	.2486	.2517	.2549
.7	.2580	.2611	.2642	.2673	.2903	.2734	.2764	.2794	.2823	.2852
.8	.2881	.2910	.2939	.2967	.2995	.3023	.3051	.3078	.3106	.3133
.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

Table 2: Critical Values of Student's *t*-Distribution

d.f.	Level of significance for two-tailed test					d.f.
	0.20	0.10	0.05	0.02	0.01	
	Level of significance for one-tailed test					
	0.10	0.05	0.025	0.01	0.005	
1	3.078	6.314	12.706	31.821	63.657	1
2	1.886	2.920	4.303	6.965	9.925	2
3	1.638	2.353	3.182	4.541	5.841	3
4	1.533	2.132	2.776	3.747	4.604	4
5	1.476	2.015	2.571	3.365	4.032	5
6	1.440	1.943	2.447	3.143	3.707	6
7	1.415	1.895	2.365	2.998	3.499	7
8	1.397	1.860	2.306	2.896	3.355	8
9	1.383	1.833	2.262	2.821	3.250	9
10	1.372	1.812	2.228	2.764	3.169	10
11	1.363	1.796	2.201	2.718	3.106	11
12	1.356	1.782	2.179	2.681	3.055	12
13	1.350	1.771	2.160	2.650	3.012	13
14	1.345	1.761	2.145	2.624	2.977	14
15	1.341	1.753	2.731	2.602	2.947	15
16	1.337	1.746	2.120	2.583	2.921	16
17	1.333	1.740	2.110	2.567	2.898	17
18	1.330	1.734	2.101	2.552	2.878	18
19	1.328	1.729	2.093	2.539	2.861	19
20	1.325	1.725	2.086	2.528	2.845	20
21	1.323	1.721	2.080	2.518	2.831	21
22	1.321	1.717	2.074	2.508	2.819	22
23	1.319	1.714	2.069	2.500	2.807	23
24	1.318	1.711	2.064	2.492	2.797	24
25	1.316	1.708	2.060	2.485	2.787	25
26	1.315	1.706	2.056	2.479	2.779	26
27	1.314	1.703	2.052	2.473	2.771	27
28	1.313	1.701	2.048	2.467	2.763	28
29	1.311	1.699	2.045	2.462	2.756	29
Infinity	1.282	1.645	1.960	2.326	2.576	Infinity

Table 3: Critical Values of χ^2

Degrees of freedom	Probability under H_0 that of χ^2 > Chi square						
	.99	.95	.50	.10	.05	.02	.01
1	.000157	.00393	.455	2.706	3.841	5.412	6.635
2	.0201	.103	1.386	4.605	5.991	7.824	9.210
3	.115	.352	2.366	6.251	7.815	9.837	11.341
4	.297	.711	3.357	7.779	9.488	11.668	13.277
5	.554	.1145	4.351	9.236	11.070	13.388	15.086
6	.872	1.635	5.348	10.645	12.592	15.033	16.812
7	1.239	2.167	6.346	12.017	14.067	16.622	18.475
8	1.646	2.733	7.344	13.362	15.507	18.168	20.090
9	2.088	3.325	8.343	14.684	16.919	19.679	21.666
10	2.558	3.940	9.342	15.987	18.307	21.161	23.209
11	3.053	4.575	10.341	17.275	19.675	22.618	24.725
12	3.571	5.226	11.340	18.549	21.026	24.054	26.217
13	4.107	5.892	12.340	19.812	22.362	25.472	72.688
14	4.660	6.571	13.339	21.064	23.685	26.873	29.141
15	4.229	7.261	14.339	22.307	24.996	28.259	30.578
16	5.812	7.962	15.338	23.542	26.296	29.633	32.000
17	6.408	8.672	16.338	24.769	27.587	30.995	33.409
18	7.015	9.390	17.338	25.989	28.869	32.346	34.805
19	7.633	10.117	18.338	27.204	30.144	33.687	36.191
20	8.260	10.851	19.337	28.412	31.410	35.020	37.566
21	8.897	11.591	20.337	29.615	32.671	36.343	38.932
22	9.542	12.338	21.337	30.813	33.924	37.659	40.289
23	10.196	13.091	22.337	32.007	35.172	38.968	41.638
24	10.856	13.848	23.337	32.196	36.415	40.270	42.980
25	11.524	14.611	24.337	34.382	37.652	41.566	44.314
26	12.198	15.379	25.336	35.363	38.885	41.856	45.642
27	12.879	16.151	26.336	36.741	40.113	44.140	46.963
28	13.565	16.928	27.336	37.916	41.337	45.419	48.278
29	14.256	17.708	28.336	39.087	42.557	46.693	49.588
30	14.953	18.493	29.336	40.256	43.773	47.962	50.892

Note: For degrees of freedom greater than 30, the quantity $2\chi^2 - \sqrt{2\text{d.f.} - 1}$ may be used as a normal variate with unit variance i.e., $z_\alpha = \sqrt{2\chi^2} - \sqrt{2\text{d.f.} - 1}$.

Table 4(a): Critical Values of *F*-Distribution (at 5 per cent)

v_2 \ v_1	1	2	3	4	5	6	8	12	24	∞
1	161.4	199.5	215.7	224.6	230.2	234.0	238.9	243.9	249.1	243.3
2	18.51	19.00	19.16	19.25	19.30	19.33	19.37	19.41	19.45	19.50
3	10.13	9.55	9.28	9.12	9.01	8.94	8.85	8.74	8.64	8.53
4	7.71	6.94	6.59	6.39	6.26	6.16	6.04	5.91	5.77	5.63
5	6.61	5.79	5.41	5.19	5.05	4.95	4.82	4.68	4.53	4.36
6	5.99	5.14	4.76	4.53	4.39	4.28	4.15	4.00	3.84	3.67
7	5.59	4.74	4.35	4.12	3.97	3.87	3.73	3.57	3.41	3.23
8	5.32	4.46	4.07	3.84	3.69	3.58	3.44	3.28	3.12	2.93
9	5.12	4.26	3.86	3.63	3.48	3.37	3.23	3.07	2.90	2.71
10	4.96	4.10	3.71	3.48	3.33	3.22	3.07	2.91	2.74	2.54
11	4.84	3.98	3.59	3.36	3.20	3.09	2.95	2.79	2.61	2.40
12	4.75	3.88	3.49	3.26	3.11	3.00	2.85	2.69	2.51	2.30
13	4.67	3.80	3.41	3.18	3.02	2.92	2.77	2.60	2.42	2.21
14	4.60	3.74	3.34	3.11	2.96	2.85	2.70	2.53	2.35	2.13
15	4.54	3.68	3.29	3.06	2.90	2.79	2.64	2.48	2.29	2.07
16	4.49	3.63	3.24	3.01	2.85	2.74	2.59	2.42	2.24	2.01
17	4.45	3.59	3.20	2.96	2.81	2.70	2.55	2.38	2.19	1.96
18	4.41	3.55	3.16	2.93	2.77	2.66	2.51	2.34	2.15	1.92
19	4.38	3.52	3.13	2.90	2.74	2.63	2.48	2.31	2.11	1.88
20	4.35	3.49	3.10	2.87	2.71	2.60	2.45	2.28	2.08	1.84
21	4.32	3.47	3.07	2.84	2.68	2.57	2.42	2.25	2.05	1.81
22	4.30	3.44	3.05	2.82	2.66	2.55	2.40	2.23	2.03	1.78
23	4.28	3.42	3.03	2.80	2.64	2.53	2.38	2.20	2.01	1.76
24	4.26	3.40	3.01	2.78	2.62	2.51	2.36	2.18	1.98	1.73
25	4.24	3.38	2.99	2.76	2.60	2.49	2.34	2.16	1.96	1.71
26	4.22	3.37	2.98	2.74	2.59	2.47	2.32	2.15	1.95	1.69
27	4.21	3.35	2.96	2.73	2.57	2.46	2.31	2.13	1.93	1.67
28	4.20	3.34	2.95	2.71	2.56	2.45	2.29	2.12	1.91	1.65
29	4.18	3.33	2.93	2.70	2.54	2.43	2.28	2.10	1.90	1.64
30	4.17	3.32	2.92	2.69	2.53	2.42	2.27	2.09	1.89	1.62
40	4.08	3.23	2.84	2.61	2.45	2.34	2.18	2.00	1.79	1.51
60	4.00	3.15	2.76	2.52	2.37	2.25	2.10	1.92	1.70	1.39
120	3.92	3.07	2.68	2.45	2.29	2.17	2.02	1.83	1.61	1.25
∞	3.84	2.99	2.60	2.37	2.21	2.10	1.94	1.75	1.52	1.00

v_1 = Degrees of freedom for greater variance.

v_2 = Degrees of freedom for smaller variance.

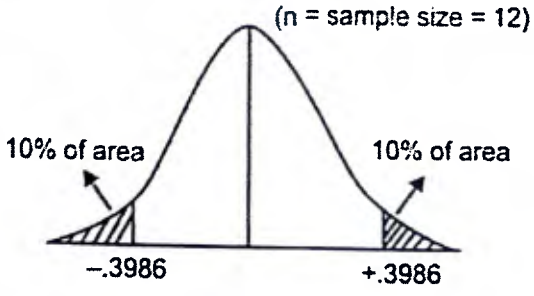
Table 4(b): Critical Values of *F*-Distribution (at 1 per cent)

ν_2 \ ν_1	1	2	3	4	5	6	8	12	24	∞
1	4052	4999.5	5403	5625	5764	5859	5982	6106	6235	6366
2	98.50	99.00	99.17	99.25	99.30	99.33	99.37	99.42	99.46	99.50
3	34.12	30.82	29.46	28.71	28.24	27.91	27.49	27.05	26.60	26.13
4	21.20	18.00	16.69	15.98	15.52	15.21	14.80	14.37	13.93	13.45
5	16.26	13.27	12.06	11.39	10.97	10.67	10.29	9.89	9.47	9.02
6	13.75	10.92	9.78	9.15	8.75	8.47	8.10	7.72	7.31	6.88
7	12.25	9.55	8.45	7.85	7.46	7.19	6.84	6.47	6.07	5.65
8	11.26	8.65	7.59	7.01	6.63	6.37	6.03	5.67	5.28	4.86
9	10.56	8.02	6.99	6.42	6.06	5.80	5.47	5.11	4.73	4.31
10	10.04	7.56	6.55	5.99	5.64	5.39	5.06	4.71	4.33	3.91
11	9.65	7.21	6.22	5.87	5.32	5.07	4.74	4.40	4.02	3.60
12	9.33	6.93	5.95	5.41	5.06	4.82	4.50	4.16	3.78	3.36
13	9.07	6.70	5.74	5.21	4.86	4.62	4.30	3.96	3.59	3.17
14	8.86	6.51	5.56	5.04	4.69	4.46	4.14	3.80	3.43	3.00
15	8.68	6.36	5.42	4.89	4.56	4.32	4.00	3.67	3.29	2.87
16	8.53	6.23	5.29	4.77	4.44	4.20	3.89	3.55	3.18	2.75
17	8.40	6.11	5.18	4.67	4.34	4.10	3.79	3.46	3.08	2.65
18	8.29	6.01	5.09	4.58	4.25	4.01	3.71	3.37	3.00	2.57
19	8.18	5.93	5.01	4.50	4.17	3.94	3.63	3.30	3.92	2.49
20	8.10	5.85	4.94	4.43	4.10	3.87	3.56	3.23	2.86	2.42
21	8.02	5.78	4.87	4.37	4.04	3.81	3.51	3.17	2.80	2.36
22	7.95	5.72	4.82	4.31	3.99	3.76	3.45	3.12	2.75	2.31
23	7.88	5.66	4.76	4.26	3.94	3.71	3.41	3.07	2.70	2.26
24	7.82	5.61	4.72	4.22	3.90	3.67	3.36	3.03	2.66	2.21
25	7.77	5.57	4.68	4.18	3.85	3.63	3.32	2.99	2.62	2.17
26	7.72	5.53	4.64	4.14	3.82	3.59	3.20	2.96	2.58	2.10
27	7.68	5.49	4.60	4.11	3.78	3.56	3.26	2.93	2.45	2.13
28	7.64	5.45	4.57	4.07	3.75	3.53	3.23	2.90	2.52	2.06
29	7.60	5.42	4.54	4.04	3.73	3.50	3.20	2.87	2.49	2.03
30	7.56	5.39	4.51	4.02	3.70	3.47	3.17	2.84	2.47	2.01
40	7.31	5.18	4.31	3.83	3.51	3.29	2.99	2.66	2.29	1.80
60	7.08	4.98	4.13	3.65	3.34	3.12	2.82	2.50	2.12	1.60
120	6.85	4.79	3.95	3.48	3.17	2.96	2.66	2.34	1.95	1.38
∞	6.64	4.60	3.78	3.32	3.02	2.80	2.51	2.18	1.79	1.00

ν_1 = Degrees of freedom for greater variance.

ν_2 = Degrees of freedom for smaller variance.

Table 5: Values for Spearman's Rank Correlation (r_s) for Combined Areas in Both Tails



n	.20	.10	.05	.02	.01	.002
4	.8000	.8000	—	—	—	—
5	.7000	.8000	.9000	.9000	—	—
6	.6000	.7714	.8236	.8857	.9429	—
7	.5357	.6786	.7450	.8571	.8929	.9643
8	.5000	.6190	.7143	.8095	.8571	.9286
9	.4667	.5833	.6833	.7667	.8167	.9000
10	.4424	.5515	.6364	.7333	.7818	.8667
11	.4182	.5273	.6091	.7000	.7455	.8364
12	.3986	.4965	.5804	.6713	.7273	.8182
13	.3791	.4780	.5549	.6429	.6978	.7912
14	.3626	.4593	.5341	.6220	.6747	.7670
15	.3500	.4429	.5179	.6000	.6536	.7464
16	.3382	.4265	.5000	.5824	.6324	.7265
17	.3260	.4118	.4853	.5637	.6152	.7083
18	.3148	.3994	.4716	.5480	.5975	.6904
19	.3070	.3895	.4579	.5333	.5825	.6737
20	.2977	.3789	.4451	.5203	.5684	.6586
21	.2909	.3688	.4351	.5078	.5545	.6455
22	.2829	.3597	.4241	.4963	.5426	.6318
23	.2767	.3518	.4150	.4852	.5306	.6186
24	.2704	.3435	.4061	.4748	.5200	.6070
25	.2646	.3362	.3977	.4654	.5100	.5962
26	.2588	.3299	.3894	.4564	.5002	.5856
27	.2540	.3236	.3822	.4481	.4915	.5757
28	.2480	.3175	.3749	.4401	.4828	.5660
29	.2443	.3113	.3685	.4320	.4744	.5567
30	.2400	.3059	.3620	.4251	.4665	.5479

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End Semester Examination

M.Tech (Civil Engg) in Constn. mgt. Sem I

Date: 22/4/2022

Total points: 100
Duration: *10:00am-1:00pm*
Class: M.TECH (CM). **Semester**: I **Program**: Civil
Name of the Course: Management of Housing Projects
Code: MTCMPEC 123
Instructions:
Attempt any 5 questions:-

Q. No		Points	CO	BL	PI
1.	Discuss in detail:- a. Illustrate the difference in Rural and Urban housing. Explain in detail PMAY. b. Explain the concept of Affordable housing. Also discuss "Housing for All" with reference to government of Maharashtra.	10 10	2 2	4 3	7.1.2 7.1.2
2.	Write Short Notes on:- a. Innovative materials & construction techniques b. Low cost housing c. Mass housing d. Industrialized housing	5 5 5 5	1 1 1 1	3 2 2 2	5.4.1 5.4.1 5.4.1 5.4.1
3.	a. What are the main reasons for project failure? b. What are Roles and Responsibilities a project manager should have?	10 10	1 1	4 4	5.4.1 5.4.1
4.	a. Discuss in detail Heat Ventilation & Air-Conditioning System with reference to functions and types of HVAC systems. b. Plumbing system	10 10	1 1	5 5	6.3.1 6.3.1

5.	a. Why maintenance is important in building? b. What is maintenance and repair of building?	10 10	2 2	4 4	6.3.1 6.3.1
6.	a. Discuss Estate Management with respect to MHADA-Maharashtra Housing and Area Development Board. b. Short Note on Estate Management	10 10	1 1	3 3	
7.	a. What are the objects and reasons for which the Real Estate (Regulation and Development) Act 2016 has been framed? b. Is it mandatory for the promoter to obtain permissions for the real estate project before applying for registration to MahaRERA? c. In case of delay in getting possession from the promoter, will the buyer be entitled to get interest on the amount paid by him, for such delayed period?	10 5 5	2 2 2	4 4 4	7.1.2 7.1.2 7.1.2

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Re-Exam Semester Examination

F.Y. M. Tech (Constn. mgt) Sem I

Total points: 100 **Date**: 21/7/2022
Duration: *2:00pm-5:00pm*
Class: M.TECH (CM). **Semester**: I **Program**: Civil
Name of the Course: Management of Housing Projects
Code: MTCMPEC 123
Instructions:
Attempt any 5 questions:-

Q. No		Points	CO	BL	PI
1.	Discuss in detail:-				
	a. Explain the contribution of various national and state level agencies in housing development.	10	2	4	7.1.2
	b. Illustrate the national housing policy.	10	2	3	7.1.2
2.	Write Short Notes on:-				
	a. Innovative materials	10	1	3	5.4.1
	b. Low cost housing	10	1	2	5.4.1
3.	a. Describe causes for project failure?	10	1	4	5.4.1
	b. What are Roles and Responsibilities a project manager should have?	10	1	4	5.4.1
4.	a. Importance of Building services in any building environment.	10	1	5	6.3.1
	b. HVAC system	10	1	5	6.3.1
5.	a. Why maintenance is important in building?	10	2	4	6.3.1
	b. What is maintenance and repair of building?	10	2	4	6.3.1
6.	a. Discuss MHADA in detail.	10	1	3	7.1.2
	b. Short Note on Estate Management	10	1	3	7.1.2
7.	a. Illustrate RERA in detail?	10	2	4	7.1.2
	b. Explain Slum Rehabilitation policies.	10	2	3	7.1.2

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END SEMESTER EXAMINATION

Total points:100
Duration: 3 Hr

Date: 11/4/2022

First year M.Tech - Civil Engg (Constn. Mgt) Sem I

Class: M.TECH (CM). **Semester**: I **Program**: Civil
Name of the Course: Construction Organisation & Safety Management Course
Code : PC-MTCM-101
Instructions:

Attempt any 5 questions

Q. No.		Points	CO	BL	PI
1	a. Illustrate the theory of Fedrick Taylor -Scientific management approach, with current scenario of construction industry.	10	1	4	2.3.1
	b. Discuss in detail Characteristic of Management with the help of following salient features: 1. Economic Resources 2. Goal Oriented 3. Distinct Process 4.Integrative Role 5.System of Authority 6.Multi-disciplinary Subject 7.Universal Application	10	1	4	2.1.1
2	a. What are the qualities of project Manager?	5	2	3	8.3.1
	b. Explain role of organizational leader in team development and conflict management?	10	3	3	2.1.1
	c. What is Motivation? Why is it important? What are various ways of motivation in general context?	5	1	3	2.1.1
3	a. Illustrate with the help of flow-chart relationship between time and motion study to work study.	10	1	4	2.5.3
	b. Write a short note on : Work Measurement	10	1	4	2.5.3
4	a. Roles, responsibilities and duties of site managers, safety officers, general employee and safety committee.	10	2	3	7.3.2
	b. Importance of safety training, incentives and monitoring in construction safety.	10	2	5	7.3.2
5	a. What are different accidents that can occur on various construction site during different stages of construction?	10	1	3	6.3.1
	b. Safety during use of construction equipment.	10	3	3	6.3.1
6	a. Write a note on: First Aid on site.	10	1	4	6.3.1
	b. What are labor laws, legal requirement and cost aspect of accidents on site?	10	2	5	6.4.1
7	a. Equipment and training provided on any ISO approved Construction Company.	10	3	4	6.4.1
	b. Safety audit and OSHA guidelines.	10	3	4	6.4.1

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

Examinations, April 2022

First year M.Tech (Civil Engg in) Constn. mgt. Sem I

Total points: 100 Date-18/4/2022

Duration: 3 Hours

Class: M.TECH(CM). Semester: I Program: Civil

Name of the Course:

Accounting and Finance Management

Course Code :

PECMTCM 103

Instructions:

1. Attempt any five
2. Draw neat diagrams
3. Assume suitable data if necessary and state the clearly.

Que. No		Points	CO	BL	PI
Q1 (A)	Mr. Sharma will retire after 34 years from now. He expects that he will live 26 years after retirement. He wants to have enough money upon reaching the retirement age to withdraw INR 5,00,000 from the account at the beginning of each year he expects to live after retirement, and yet he wants to have INR 35,00,000 left in account at the time of his expected death (i.e., 60 years from now). He plans to accumulate retirement funds by making equal deposits at the end of each year for the next 34 years from now. He expects that he will be able to earn 14% per annum on his deposits. However, he only expects 7 % interest per annum after retirement (he will choose to place his money in less risky investments). What equal annual instalment should he make each year to reach his retirement goal?	6	1	4	1.1.1
Q1(B)	Company named XYZ limited is considering two project investment options (i.e., Project A and Project B), both of which initially cost INR 20 lakhs. Further cash-inflows of both the project are given in following table	6	3	3	3.3.1

Year	Project A (INR)	Project B (INR)
1	1,000,000	900,000
2	600000	1,000,000
3	800000	600000

Based on the payback period method, which of the project should be chosen?

A. Project A which has a payback period of 2 years and 8 months

B. Project A which has a payback period of 2 years and 6 months

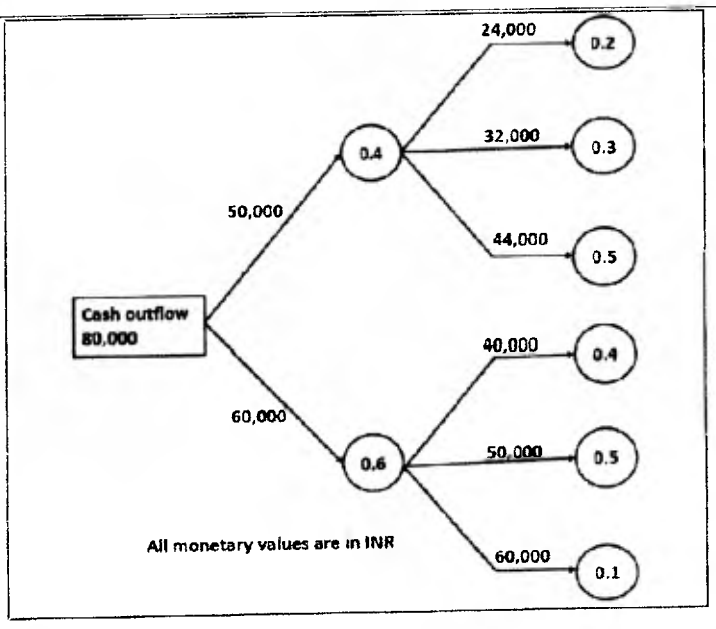
C. Project B which has a payback period of 2 years and 2 months

D. Project B which has a payback period of 2 years and 6 months

	Rohit has purchased a new motor bike for INR 120,000. He was able to make a down payment equal to 20% of the value of the motorbike; the balance was loaned	8	2	3	1.1.2

Q 1(C)	by the bank. The interest rate charged by the bank is 14% compounded quarterly. The loan must be returned in a 5-year period by equal yearly payments. What is the value of the yearly instalments that Rohit must pay?				
Q2(A)	The initial cost of a piece of construction equipment is Rs.30,00,000 having a useful life of 10 years. The estimated salvage value of the equipment at the end of the useful life is Rs.450,000. 1. The book value of the construction equipment at the end of 5th year using Straight -line method is_____ 2. The book value of the construction equipment at the end of 5th year (BV5) and depreciation (d5) for 5th year using Double-declining balance method are_____ 3. Determine the book value (BV5) of the construction equipment at the end of 5th year and depreciation (d5) for 5th year using Sum-of-the-years-digits method_____ 4. Determine accumulated depreciation at the end of 5th year using Sinking fund method, if interest rate is 8.2 % per year_____	16	2	4	1.1.2
Q2(B)	A consultant proposes two designs (Type 'A' and Type 'B') for a bridge to be constructed across a river. Type 'A' design of a bridge costs INR 45 crores and an expense of INR 3 crores every year to operate and maintain it. Type 'B' design of bridge costs INR 60 crores and an expense of INR 1.5 crores every year to operate and maintain it. Both the designs have considered 100 years as the design life of the bridge. The minimum required rate of return is 8 percent. Which of the following options is the best recommendation based on the information provided above? A. Go-ahead with Type 'A' design as it has lower initial investment B. Go- ahead with Type 'B' design as it has lower operating and maintenance cost C. Go-ahead with Type 'A' design as its net present worth is INR 825,000,000 D. Go-ahead with Type 'B' design as its net present worth is INR 787,000,000	4	3	3	1.2.2
Q3(A)	A piece of land was purchased at INR 40 lakhs. An investment of an additional INR 20 lakhs was made to construct a small shopping complex on this land. The complex is expected to fetch an annual rental of INR 75,000 to the owner, while the cost towards its upkeep, tax, etc., is expected to be INR 30,000 annually. The owner plans to sell the entire plot with constructed facilities at an expected price of INR 120 lakhs at the end of five years. What percent rate of return will be earned by the owner on this investment?	4	1	4	1.2.3
Q3(B)	Consider the following information with respect to two projects (Project 'A' and Project 'B') provided in the table.	10	2	4	1.1.2

		End of year Cash flows (INR)	0	1	2	3			
		Project 'A'	-50,000	9,000	18500	45000			
		Project 'B'	-50,000	45000	15000	17000			
		Assume minimum attractive rate of return to is 10 percent. **1**. Using computations based on present worth method, which of the following sets correctly represents the net present worth of both the projects? A. Net Present Worth Project 'A' is INR 22,500 and Net Present Worth of Project 'B' is INR 27000 B. Net Present Worth Project 'A' is INR 27,000 and Net Present Worth of Project 'B' is INR 22,500 C. Net Present Worth Project 'A' is INR 7,280 and Net Present Worth of Project 'B' is INR 16,078 D. Net Present Worth Project 'A' is INR 16,078 and Net Present Worth of Project 'B' is INR 7,280 **2**. Using computations based on annual worth method, choose the best alternative. A. Chose Project 'A' as its Annual Worth is INR 2,927 B. Chose Project 'A' as its Annual Worth is INR 7,280 C. Chose Project 'B' as its Annual Worth is INR 6,465 D. Chose Project 'B' as its Annual Worth is INR 16,078 **3**.What is Net Present Worth based on difference in cashflows of two projects (i.e., Project 'A' - Project 'B').								
	Q3(C)	Two pumps can be used for pumping a corrosive liquid. A pump with a brass impeller costs INR 40,000 and is expected to last for three years. A pump with a stainless-steel impeller will cost INR 95,000 and lasts for five years. An overhaul costing INR 15,000 will be required after 2000 operating hours of brass one while an overhaul of INR 35, 000 for stainless steel after 9000 hours. If the operating cost of each pump is INR 25/hour, how many hours /year (rounded off to nearest integer) must the pump be required to justify the purchase of an expensive pump? Interest rate 10% per year					6	4	3	1.1.3
	Q4(A)	The estimates of the cash inflows after taxes (CFAT) for a proposed project, whose expected life is 2 years, are shown in the given decision tree. As shown, the initial investment needed for the project is INR 80,000. The cash inflows are shown on arrows and the associated probabilities are shown inside the circles. Assuming that there is no correlation between the cash inflows of two years, and, that the annual interest rate is 10%, what is the expected net present value (in INR) of the proposed project.					10	1	5	1.3.1



Q4(B)	An equipment (called the defender equipment) that was purchased at a cost of INR 23,000 four years ago is considered for replacement against a challenger whose cost is INR 25,000. The existing equipment can be traded in today at INR 6,500, and if kept for another 6 years, it will have a salvage value of INR 2,200. The annual maintenance cost of the existing asset is INR 7,500 and that of the challenger is INR 3,700. The challenger equipment has a salvage value is INR 3, 200 at the end of year 10. Assuming the rate of interest to be 15%, answer the following questions 1. What is the equivalent annual cost (in INR) of the defender equipment? 2. What is the equivalent annual cost (in INR) of the challenger equipment? 3. What is the sunk cost (in INR)?	10	3	3	1.3.2
Q5(A)	For a given project, the contractor has estimated the direct cost and indirect cost of labor, material, and plant (given in the Table). The contractor plans to apply an off top of 15%, 10% and 10% on labor, material, and plant respectively.	7	2	2	1.3.1

Description	Labor	Material	Plant
Direct cost ($)	100	700	50
Indirect cost ($)	80	35	5
Off top (%)	15	10	10

1. Which of the following options give the correct combination of the bid price (without tax consideration) to be applied on labor, material, and plant?

A. Labor: $112; Material: $717; Plant: $51
B. Labor: $212; Material: $817; Plant: $61
C. Labor: $112; Material: $817; Plant: $61
D. Labor: $212; Material: $717; Plant: $51

2. Which of the following options give the correct combination of the cover (multiplication factor) that needs to be applied on labor, material, and subcontractor costs?

A. Labor: 2.64; Material: 15.33; Plant: 12.22
B. Labor: 2.12; Material: 2.17; Plant: 1.22

C. Labor: 2.12; Material: 1.17; Plant: 1.22
D. Labor: 2.64; Material: 23.33; Plant: 12.22

Q5(B)	Transit Mixers (used to transport concrete to placing locations) arrive at a batching plant from different sites in an area served by a common ready mix concrete plant. The arrival time intervals of the Transit Mixers are observed and yield the following results.	6	3	4	1.2.3

Arrival time interval (minutes)	Frequency
2	10
3	15
4	30
5	25
6	20

The time taken to load the Transit Mixers which are either 6 or 9 cum capacity are constant at 3 and 5 minutes respectively, and both types are equally represented (equal probability) at the depot.
Start the trial from 10:00 AM and assume no Transit Mixer is waiting currently. Random numbers to be used for the computations are given with the question.
If the batching plant loads each of the Transit Mixer immediately it arrives, calculate the following corresponding to the first six trials only:

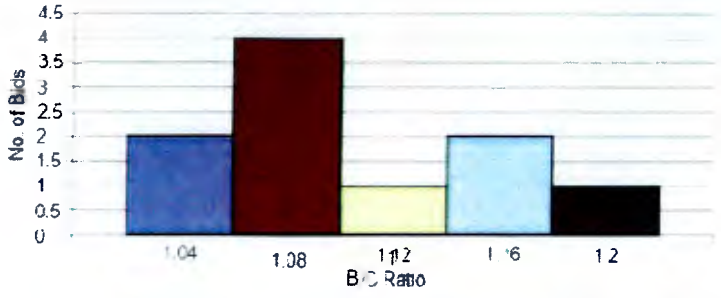
1. What is the total time (in minutes) likely that the Batching Plant will be waiting?
2. What is the total time (in minutes) likely that the Transit Mixers will be waiting?

Two Digit Random Number Table-

52 06 50 88 53 30 10 47 99 37 66 91 35 32 00 84 57 07
37 63 28 02 74 35 24 03 29 60 74 85 90 73 59 55 17 60
82 57 68 28 05 94 03 11 27 79 90 87 92 41 09 25 36 77
69 02 36 49 71 99 32 10 75 21 95 90 94 38 97 71 72 49
98 94 90 36 06 78 23 67 89 85 29 21 25 73 69 34 85 76
96 52 62 87 49 56 59 23 78 71 72 90 57 01 98 57 31 95
33 69 27 21 11 60 95 89 68 48 17 89 34 09 93 50 44 51
50 33 50 95 13 44 34 62 64 39 55 29 30 64 49 44 30 16
88 32 18 50 62 57 34 56 62 31 15 40 90 34 51 95 26 14
90 30 36 24 69 82 51 74 30 35 36 85 01 55 92 64 09 85
50 48 61 18 85 23 08 54 17 12 80 69 24 84 92 16 49 59
27 88 21 62 69 64 48 31 12 73 02 68 00 16 16 46 13 85
45 14 46 32 13 49 66 62 74 41 86 98 92 98 84 54 33 40
81 02 01 78 82 74 97 37 45 31 94 99 42 49 27 64 89 42
66 83 14 74 27 76 03 33 11 97 59 81 72 00 64 61 13 52
74 05 82 82 93 09 96 33 52 78 13 06 28 30 94 23 37 39
30 34 87 01 74 11 46 82 59 94 25 34 32 23 17 01 58 73

Q5(C)	Analysis of the bidding behavior of a typical competitor (Y) against you, reveals that the ratio of his bid (B) to your cost (C) in 10 previous bids take the following histogram. For the computation of standard deviation use the following formula.	7	4	3	1.2.3

$$\sigma = \sqrt{\frac{\Sigma[(x-\mu)^2 \times f(x)]}{n-1}}$$



1. Based on that behavior, what is the mark-up value that this competitor uses on average?
2. What is the probability of your winning against this competitor if you use a markup of 14%?
3. In a new project with a cost of INR1,000,000 estimated cost, what is your optimum markup strategy (in terms of markup percentage) against four typical competitors using Friedman's model?

Q6(A)	Explain Break-even analysis.	4	4	2	2.1.3
Q6(B)	Calculate payback period of following projects each requiring a cash outlay of Rs. 12000. Suggest which one acceptable id standard payback period is 6 years.	4	2	3	2.4.1
Q6(C)	The XYZ company is considering three investment A, B, C. Each requires an investment of 4900 Rs and each has economic life of three years and total cash inflow over the period of 6000 Rs. The pattern for each of proposal differs as below-	4	3	3	1.2.3

	Cash inflows		
year	Project X	Project Y	Project Z
1	2400	5000	500
2	2400	3000	1500
3	2400	2000	2000
4	2400	1500	3000
5	2400	500	5000
6	2400	0	0

year	Annual Cash Inflows		
	A	B	C
1	1000	2000	3000
2	2000	2000	2000
3	3000	2000	1000

Q6(D)	Calculate NPV of each proposal at 10% rate of return Consider the data for two projects (given in the Table) that a construction company is carrying out:	8	4	2	1.2.3

Description	Project - X	Project - Y
	All amounts in INR	
Contract amount	15,00,000	25,00,000
Original estimated cost	18,00,000	26,00,000
Billed to date	13,00,000	11,00,000
Payments received to date	1050000	1050000
Costs incurred to date	750000	8000000
Forecasted costs to complete the balance work	250000	17,00,000
Cost paid to date	700000	700000

1. The percentage completion of Project X is _____
2. Which of the following statements is TRUE?
   a) There is an over-billing of 1.5 lakh for Project X
   b) There is an under-billing of 1.5 lakh for Project X
   c) There is an over-billing of 3 lakhs for Project Y
   d) There is an under-billing of 2 lakhs for Project Y

3. Let 'P' and 'Q' represent the amount receivable till date, for projects X and Y, respectively. The sum of P and Q (in INR) is _____.

Q7(A)	A contractor had an income of INR 50,000 (after tax) in the year 2020. The depreciation expenses were INR 6,500, and total cash flow was INR 50,000. What happened to the net working capital during the year?	4	2	4	2.2.4
Q7(B)	For a given project, the contractor has estimated that he would be required to keep an average stock equivalent to INR 20 lakhs. Further, it is also estimated that the average outstanding and average unadjusted advance would be INR 270 lakhs and 60 lakhs, respectively. Estimate the average funds likely to be to be employed for this project if it is known that the contractor would be required to keep an average fixed asset of INR 50 lakhs.	4	1	2	1.1.3
Q7(C)	Calculate the acid test ratio and current ratio from the given Table:	4	4	1	1.3.2

Description	Amount (INR)
Cash	1500
Debtors	1000
Total current liabilities	5000

Choose the correct answer for acid test ratio and current ratio respectively from the given options
A. (0.25:1, 0.25:1)
B. (0.5:1, 0.5:1)
C. (0.25:1, 0.5:1)

Q7(D)	D. (0.5:1, 0.25:1) Calculate the total liabilities and assets from the given Table Description: Amount (INR) Capital: 8000 Mortgage: 3500 Land: 11000 Furniture: 500 Outstanding expanses: 900 Stock: 990	4	3	5	2.2.4
Q7(E)	Choose the correct answer for total liabilities and assets respectively from the given options A. 12000, 12890 B. 12400, 12400 C. 12490, 12400 D. 12400, 12490	4	4	2	1.2.3

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Bharatiya Vidya Bhavan's

Sardar Patel College of Engineering

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

End Sem Exam April 2022

20/4/22

Program: M. Tech. Construction Management Sem I Duration: 3 hr

Course code:MTCM103 Maximum Marks: 20

Name of the Course: Advanced Construction Techniques

Semester: I

Instructions:

1. **Attempt any 5 questions.**
2. **Neat diagrams must be drawn wherever necessary.**
3. **Figures to the right side indicate full marks.**
4. **Assume Suitable data if necessary and state it clearly**

Q. No.	Questions	Points	CO	BL	PI
1a	Discuss advantage of pre-engineered building	05	CO2	BL1	1.3.1
1b	Explain in detail soil exploration for bridge construction site	10	CO1	BL2	1.3.1
1c	Discuss issues and challenges faced during Teesta dam construction project.	05	CO3	BL3	1.3.1
2a	Discuss Causes of landslide and precautionary measures for the same	10	CO1	BL1	1.3.1
2b	State the effect of inadequate or improper soil exploration on any construction project.	05	CO2	BL1	1.3.1
2c	Discuss sprayed concrete along with its application.	05	CO2	BL1	2.1.2
3a	Discuss in detail different methods of drilled shaft constructions	10	CO1	BL2	1.3.1
3b	Differentiate PEBs vs Conventional steel building.	10	CO1	BL1	1.3.1
4a	Elaborate on the advantages and limitations of precast and pre-stressed components of buildings	10	CO2	BL1	2.1.2
4b	Define micro tunneling and discuss its advantages	05	CO2	BL1	2.1.2

4c	Explain about low cost roads.	05	CO2	BL1	1.3.1
5a	Discuss slip form method of construction.	05	CO2	BL1	1.3.1
5b	Discuss applications of GGBs.	05	CO2	BL2	2.1.2
5c	You have been assigned responsibility of construction of Smart city project, wherein it is proposed to use sustainable materials, which materials will you prefer for this project, explain in detail.	10	CO3	BL3	3.1.6
6a	Explain in detail the various types of pile foundations.	08	CO1	BL1	1.3.1
6b	Discuss the need of recycling of material along with purpose of recycled aggregates.	06	CO2	BL2	1.3.1
6c	Discuss different methods of boring.	06	CO1	BL1	2.1.2
7a	Elaborate on various types of patented formworks with their advantages and disadvantages.	10	CO2	BL2	1.3.1
7b	Define and discuss pre-stressing along with its type and advantages	06	CO1	BL1	1.3.1
7c	Brief about safety precautions to be taken during geotechnical exploration.	04	CO1	BL2	1.3.1

Bharatiya Vidya Bhavan's
SARDAR PATEL COLLEGE OF ENGINEERING

(An Autonomous Institution Affiliated to University of Mumbai)

25/4/22

END SEMESTER EXAMINATION

M.Tech in (Civil Engg) in Constn. mgt Sem I

Programme	MTech Structural Engineering	MTech Construction Management	MTech Power Sytems and Power Electronics
Course Code	MC-PG01	MC-PG01	MC-MTPX101

Subject : Research Methodology and IPR ✓

Total Marks :100

Class: MTech, Sem:I,

Duration : 3 Hours

25th April 2022

- **Question 1 is compulsory**
- **Solve Any Four Questions from the remaining**
- Answers to all sub questions **must be** grouped together
- Figures to the right indicate full marks
- Assume suitable data wherever necessary

SN	Question statement	Points	Module	CO
Q1	Explain the following with suitable examples A. Guidelines for writing a Literature survey for a paper A. Statistical Hypothesis Test Procedures and the Criminal Trial Analogy B. Types of IPR and their significance C. Scatter Plot and Co-relation	20	M1,M3, M4, M6, M7	CO3, CO4
Q2A	A population is divided into four strata so that N1 = 8500, N2 = 4500 and N3 = 9500, N4 = 11500 Respective standard deviations are: s1=12, s2=14, s3=7, s4=6 . Costs in rupees to collect the strata are C1= 9000, C2=5000, C3=10000, C4= 12000. How should a sample of size n = 98 be allocated to the four strata, if we want optimum allocation using Cost Optimal Disproportionate sampling design?	10	M3	CO2
Q2B	Researcher conducted experimental investigations on concrete cubes, to study the influence of fly ash, GGBS and glass waste powder (GWP) individually, on the compressive strength of concrete. The cubes were casted for M30 grade of concrete and by random sampling method, tested after 28 days curing. For cubes in Group I, 30% fly ash was added, for Group II, 30% GGBS was added and in Group III, 30% GWP was added. The 28 days compressive strengths of cubes in N/mm^2 are given below. Check whether the mean compressive strength of the 3 different groups is same or not. Group I – 35, 29, 34, 35, 27, 29 Group II – 33, 29, 30, 29, 33 Group III – 34, 28, 29, 32, 33, 27, 28	10	M5	CO2

<table>
<tr><td>Q3A</td><td>A data of 450 construction Projects was reviewed to know association between type of construction project and success of construction project. The response by Type of Project are as follows. At alpha =0.05 do these data suggest an association between Type of Project and being successful?
<table>
<tr><td></td><td>International Projects</td><td>Domestic Project</td><td>Total</td></tr>
<tr><td>Successful</td><td>46</td><td>88</td><td>134</td></tr>
<tr><td>Not Successful</td><td>184</td><td>179</td><td>363</td></tr>
<tr><td>Total</td><td>230</td><td>267</td><td>497</td></tr>
</table></td><td>10</td><td>M5</td><td>CO2</td></tr>
<tr><td>Q3B</td><td>Manufacturer wants to test on the basis of sample size 35 determinations and at 0.05 and 0.01 levels of significance whether the thermal conductivity of a certain kind of plate is 0.34 units, as has been claimed. The mean of sample is 0.343. From the information gathered in similar studies , we can expect that the variability of such determinations is given by σ = 0.01. Assume any suitable data if necessary.</td><td>10</td><td>M1, M5</td><td>CO1, CO2</td></tr>
<tr><td>Q4A</td><td>A maker of golf shirts has been tracking the relationship between sales and advertising dollars. Use linear regression to find out what sales might be if the company invested $68,000 in advertising next year.
<table>
<tr><td></td><td>1</td><td>2</td><td>3</td><td>4</td></tr>
<tr><td>Sales $ (y)</td><td>150</td><td>171</td><td>170</td><td>178</td></tr>
<tr><td>Advertisement expenditure</td><td>42</td><td>62</td><td>60</td><td>65</td></tr>
</table></td><td>10</td><td>M1, M5</td><td>CO1, CO2</td></tr>
<tr><td>Q4B</td><td>State the characteristics of Good research Problem</td><td>10</td><td>M1</td><td>CO1</td></tr>
<tr><td>Q5A</td><td>Differentiate between Research Paper and Review paper.
State the Guidelines to write the research article.</td><td>10</td><td>M2, M3</td><td>CO1, CO2</td></tr>
<tr><td>Q5B</td><td>Differentiate between Qualitative and Quantitative Research</td><td>10</td><td>M1, M2</td><td>CO1</td></tr>
<tr><td>Q6A</td><td>State the difference between Copyright Patent and Trademark</td><td>10</td><td>M5</td><td>CO3, CO4</td></tr>
<tr><td>Q6B</td><td>Draw the flow chart and explain the procedure to receive the patent.</td><td>10</td><td>M4, M6</td><td>( ), CO4</td></tr>
<tr><td>Q7</td><td>Explain the following with suitable examples
• Null Hypothesis and Alternate Hypothesis
• Type 1 error and Type 2 error
• Test Statistics
• Confidence Level and p value
• Limitations and advantages of Hypothesis Test
• Rejection Region
• Left Tail Test and Right Tail Test
• One Tail Test and Two Tail Test</td><td>20</td><td>M1</td><td>CO1</td></tr>
</table>

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Bharatiya Vidya Bhavan's

SARDAR PATEL COLLEGE OF ENGINEERING

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

End Semester – April 2022 Examinations

M.Tech in Civil Engg in Construction Mgt. Sem I

Program: F Y M.Tech **Duration:** 3 Hours

Course Code: AU-PG 01 **Maximum Points:100** 27/4/22

Course Name: Project Planning and Management

Semester: I

Notes: 1. Answer any five questions.
2 All questions carry 20 points.

Q.No.	Questions	Points	CO	BL	PI
1	1.1 What are the attributes or skills that a Project Manager should have?	10	2	2	2.1.2
	1.2 Explain the three Project Quality Management processes	10	2	2	11.3.1
2	2.1 List out ten steps, in sequence, for the preparation of Civil Structural, Architectural Tender specification.	10	1	2	11.3.1
	2.2 Why is it important to issue a Civil, Structural, Architectural design basis for the project? List ten of the most important design requirements that should be contained in the design basis.	10	1	2	3.1.6
3	3.1 Explain the three fundamental components of a computer model used for structural analysis. What are the three stages in the process of computer analysis?	10	3	2	6.1.1
	3.2 List out at least ten steps, in sequence, in the designing of a complex plant steel structure	10	3	2	6.1.1
4	4.1 What is the difference in approach between Limit state (Load Factor) design and working stress design? In Limit state design what are the two key load conditions? What are the checks for each of these load conditions?	10	3	4	3.4.1

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SARDAR PATEL COLLEGE OF ENGINEERING

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

End Semester – April 2022 Examinations

	4.2 Define degrees of freedom. Specify the degrees of freedom and the equilibrium conditions for a rigid body in two dimensions.	5	2	3	1.2.1
	4.3 Explain Strength, Stiffness, Stability and Ductility at the element and system levels.	5	2	3	11.3.2
5	Explain any three top emerging trends which are impacting the Construction industry today.	10	1	2	3.3.1
	5.2 In five areas, explain how structural engineers can overcome the challenges faced by the profession.	10	1	2	2.4.2
6	List out atleast ten points defining the scope of a contour and traverse survey for a project plot.	10	3	4	2.4.2
	6.2 Why is quantity/cost monitoring important during execution of a CSA item-rate contract? How is quantity monitoring done during the project execution?	5	3	5	1.3.1
	6.3 What are the main objectives of constructability reviews	5	4	2	11.3.1
7	7.1 In a soil investigation specification, describe five field tests you would specify along with the soil parameter each test would measure	10	3	2	3.2.2
	7.2 List six soil properties and four recommendations for pile foundations that you would ask for in the final geo-technical report.	10	2	3	3.4.2