M.Tech · Const. Mgmt · Sem I.

4b
22/11/17

Bharatiya Vidya Bhavan's

Sardar Patel College of Engineering

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

END SEM EXAMINATION
NOVEMBER 2017

Program: Construction Management
M. Tech. **Duration: 3 hr**
Course code: MTCM102 **Maximum Marks: 100**
Name of the Course: Applied Statistics and Quantitative Techniques
Semester: I

Master file.

Instructions:

1. **Solve any five 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**

<table>
<tr><th>Q. No.</th><th></th><th>Marks</th><th>CO</th><th>M.N</th></tr>
<tr><td>1a</td><td>The manager of oil refinery must decide on the optimal mix of two possible blending processes of which the inputs and outputs per production run is as follow:
<table>
<tr><td>Process</td><td colspan="2">Input Unit</td><td colspan="2">Output Unit</td></tr>
<tr><td>Units</td><td>Grade A</td><td>Grade B</td><td>Gasoline X</td><td>Gasoline Y</td></tr>
<tr><td>1</td><td>5</td><td>3</td><td>5</td><td>8</td></tr>
<tr><td>2</td><td>4</td><td>5</td><td>4</td><td>4</td></tr>
</table>
The maximum amount available of crudes A and B are 200units and 150 units respectively. Market requirement shows that at least 100 units of gasoline X and 80units of gasoline Y must be produced. The profit per production run for process 1 and process 2 are Rs 300/- and Rs 400/- respectively. Solve the LP problem by the graphical method for maximization of profit.</td><td>08</td><td>03</td><td>07</td></tr>
<tr><td>1b</td><td>Solve the following problem by simplex method.
Maximize $Z = x_1 + 2x_2 + x_3$
Subjected to the constraint
$2x_1 + x_2 - x_3 \leq 2$
$2x_1 - x_2 + 5x_3 \leq 6$
$4x_1 + x_2 + x_3 \leq 6$
$x_1, x_2, x_3 \geq 0$</td><td>12</td><td>03</td><td>07</td></tr>
<tr><td>2a</td><td>The construction company is planning to sale its flat using different advertising strategy S1, S2 and S3. The marketing department of the company worked out the payoffs in terms of net profit for each strategy of three events of expected sales. This is represented in following table.
<table>
<tr><td>Strategies</td><td colspan="3">State of Nature for sale</td></tr>
<tr><td></td><td>High</td><td>Medium</td><td>Low</td></tr>
<tr><td>S1</td><td>7,00,000</td><td>3,00,000</td><td>1,50,000</td></tr>
<tr><td>S2</td><td>5,00,000</td><td>4,50,000</td><td>0</td></tr>
<tr><td>S3</td><td>3,00,000</td><td>3,00,000</td><td>3,00,000</td></tr>
</table>
State which strategy should the concerned executive choose on the basis of
i) Maximin criterion
ii) Maximax criterion</td><td>08</td><td>02</td><td>06</td></tr>
</table>

M.Tech. Const.mgmt. Sem I

iii) Equal likely decision (Laplace) criterion
iv) Opportunity loss criterion

2b (12 | 02 | 06)

Charlotte Watson, the manager of a construction company, has the opportunity to buy a fixed quantity of flat in Uran region of which she can then offer for sale to clients. The decision to buy the flat and offer it for sale would involve a fixed cost of Rs.20,00,000. The number of flat that will be sold is uncertain, but Charlotte's prior beliefs are expressed as follows.

Sales	Probability	Profit
Poor	0.2	12,00,000
Moderate	0.5	25,00,000
Good	0.3	40,00,000

For an additional fixed cost of Rs. 3,00,000, market research can be conducted to aid the decision– making process. The outcome of the market research can be either positive or negative, with probabilities 0.58 and 0.42, respectively. Knowing the outcome of the market research changes the probabilities for the main sales project as follows:

Market Research	Main Sales Probabilities		
	Poor	Moderate	Good
Positive	0.15	0.45	0.4
Negative	0.6	0.35	0.05

Charlotte will make decisions based on expected monetary value. (a) Draw a decision tree for this problem. (b) Use expected monetary value to determine the optimal course of action for Charlotte.

3a (08 | 01 | 01)

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 particular 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?

3b (06 | 01 | 01)

A small hotel has rooms on only four floors, with four smoke detectors on each floor. Because of improper maintenance, the probability that any one detector is functioning is only 0.55. The probabilities that smoke detectors are functioning are randomly and independently distributed.
a) What is the probability that exactly one smoke detector is working on the top floor?
b) What is the probability that there will be at least 15 functioning smoke detectors in the hotel at any one time?
c) Probability that at least one detector is working.

3c (06 | 02 | 05)

Explain monte carlo method of simulation

4a (04 | 02 | 02)

An AAC Block manufacturing company uses a machine to cast block. The machine is designed to make 475 blocks. The contents vary according to a normal distribution with a mean of 473 blocks and standard deviation of 3 blocks.
a) What is the distribution, mean, and standard error of the sample mean of six randomly selected blocks?
b) What sample size should be taken in order to estimate the mean of block casted within plus minus 5 margin error @ 95% confidence level.

4b (04 | 02 | 02)

A certain dimension is measured on ten successive items coming off a production line. This sample gives $x = 2.384$ and $s = 0.048$.
(i) On the basis of this sample, what is the 90% confidence interval for the population mean?
(ii) If instead of estimating the standard deviation from a sample, we knew the true

	standard deviation was 0 048, what then would be the 95% confidence interval for the population mean?			
4c	Define sampling and state the methods of sampling in brief with examples	**12**	**02**	**02**
5a	In a 2-week study of the productivity of workers, the following data were obtained on the total number of acceptable pieces which 100 workers produced. 21 35 41 47 51 55 60 64 70 76 22 35 42 47 52 55 60 65 70 77 26 36 43 48 52 56 60 65 72 78 28 36 43 48 52 56 61 65 73 79 32 37 44 49 53 56 61 67 73 80 33 38 45 50 53 57 61 67 74 82 34 39 45 50 53 57 62 68 74 82 34 40 45 50 54 58 62 68 74 84 35 40 45 51 54 59 63 68 75 85 35 41 46 51 55 59 63 69 76 88 Group the above data into suitable distribution classes and Find mean, median, mode, 3rd quartile, 4th decile and 78th percentile for the given productivity. Plot mean median mode and discuss the type of graph from position of the mean median mode.	**12**	**01**	**01**
5b	Briefly explain method of collection of data and explain use of different type of graph for presentation of data.	**08**	**01**	**01**
6a	The ICARE Company has three plants located throughout a state with production capacity 50, 75 and 25 gallons. Each day the firm must furnish its four retail shops R1, R2, R3, & R4 with at least 20, 20, 50, and 60 gallons respectively. The transportation costs (in Rs.) are given below. Company | Retail: R1, R2, R3, R4 | Supply P1: 3, 5, 7, 6 | 50 P2: 2, 5, 8, 2 | 75 P3: 3, 6, 9, 2 | 25 Demand: 20, 20, 50, 60 The economic problem is to distribute the available product to different retail shops in such a way so that the total transportation cost is minimum?	**08**	**03**	**07**
6b	From the following data examine whether input of oil and output of electricity can said to be correlated, draw the scatter diagram for respective. Input Oil: 6.9 8.2 7.8 4.8 9.6 8.0 7.7 Output Electricity: 1.9 3.5 6.5 1.3 5.5 3.5 2.2 Also find the equation of line for above relation using least square method.	**12**	**03**	**04**
7a	The mean lifetime of a sample of 400 fluorescent light tube produce by a company is found to be 1570hrs with a standard deviation of 150 hours. Test the hypothesis that the mean lifetime of bulb produced by the company is 1600 hours against the alternative hypothesis that it is greater than 1600 hours @ 5% level of significance.	**08**	**02**	**03**

M.Tech. cont.mgmt. Sem I

	Also explain two tail test and one tail test of testing hypothesis.			
7b	A manufacturer wants to test the hypothesis that the mean lifetime of two brands of machine used for excavation are equal. The lifetime is measured by the no. of operating hours between the overhauls. A random sample of 15 machines of both brands each gives the following details.	12	02	03

X	1050	1150	850	800	1000	1350	1100	1300	1450
	900	1200	1250	1550	825	650			
Y	1170	970	880	1410	700	775	940	1650	950
	1190	600	1600	975	450	1290			

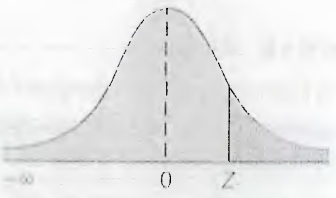
Using U-Test will you conclude that lifetime of two brands is equal.

M.Tech Const. mgmt. sem I

TABLE A.2

The Cumulative Standardized Normal Distribution (*Continued*)

Entry represents area under the cumulative standardized normal distribution from $-\infty$ to Z



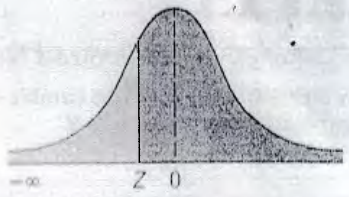
Cumulative Probabilities

Z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.5000	0.5040	0.5080	0.5120	0.5160	0.5199	0.5239	0.5279	0.5319	0.5359
0.1	0.5398	0.5438	0.5478	0.5517	0.5557	0.5596	0.5636	0.5675	0.5714	0.5753
0.2	0.5793	0.5832	0.5871	0.5910	0.5948	0.5987	0.6026	0.6064	0.6103	0.6141
0.3	0.6179	0.6217	0.6255	0.6293	0.6331	0.6368	0.6406	0.6443	0.6480	0.6517
0.4	0.6554	0.6591	0.6628	0.6664	0.6700	0.6736	0.6772	0.6808	0.6844	0.6879
0.5	0.6915	0.6950	0.6985	0.7019	0.7054	0.7088	0.7123	0.7157	0.7190	0.7224
0.6	0.7257	0.7291	0.7324	0.7357	0.7389	0.7422	0.7454	0.7486	0.7518	0.7549
0.7	0.7580	0.7612	0.7642	0.7673	0.7704	0.7734	0.7764	0.7794	0.7823	0.7852
0.8	0.7881	0.7910	0.7939	0.7967	0.7995	0.8023	0.8051	0.8078	0.8106	0.8133
0.9	0.8159	0.8186	0.8212	0.8238	0.8264	0.8289	0.8315	0.8340	0.8365	0.8389
1.0	0.8413	0.8438	0.8461	0.8485	0.8508	0.8531	0.8554	0.8577	0.8599	0.8621
1.1	0.8643	0.8665	0.8686	0.8708	0.8729	0.8749	0.8770	0.8790	0.8810	0.8830
1.2	0.8849	0.8869	0.8888	0.8907	0.8925	0.8944	0.8962	0.8980	0.8997	0.9015
1.3	0.9032	0.9049	0.9066	0.9082	0.9099	0.9115	0.9131	0.9147	0.9162	0.9177
1.4	0.9192	0.9207	0.9222	0.9236	0.9251	0.9265	0.9279	0.9292	0.9306	0.9319
1.5	0.9332	0.9345	0.9357	0.9370	0.9382	0.9394	0.9406	0.9418	0.9429	0.9441
1.6	0.9452	0.9463	0.9474	0.9484	0.9495	0.9505	0.9515	0.9525	0.9535	0.9545
1.7	0.9554	0.9564	0.9573	0.9582	0.9591	0.9599	0.9608	0.9616	0.9625	0.9633
1.8	0.9641	0.9649	0.9656	0.9664	0.9671	0.9678	0.9686	0.9693	0.9699	0.9706
1.9	0.9713	0.9719	0.9726	0.9732	0.9738	0.9744	0.9750	0.9756	0.9761	0.9767
2.0	0.9772	0.9778	0.9783	0.9788	0.9793	0.9798	0.9803	0.9808	0.9812	0.9817
2.1	0.9821	0.9826	0.9830	0.9834	0.9838	0.9842	0.9846	0.9850	0.9854	0.9857
2.2	0.9861	0.9864	0.9868	0.9871	0.9875	0.9878	0.9881	0.9884	0.9887	0.9890
2.3	0.9893	0.9896	0.9898	0.9901	0.9904	0.9906	0.9909	0.9911	0.9913	0.9916
2.4	0.9918	0.9920	0.9922	0.9925	0.9927	0.9929	0.9931	0.9932	0.9934	0.9936
2.5	0.9938	0.9940	0.9941	0.9943	0.9945	0.9946	0.9948	0.9949	0.9951	0.9952
2.6	0.9953	0.9955	0.9956	0.9957	0.9959	0.9960	0.9961	0.9962	0.9963	0.9964
2.7	0.9965	0.9966	0.9967	0.9968	0.9969	0.9970	0.9971	0.9972	0.9973	0.9974
2.8	0.9974	0.9975	0.9976	0.9977	0.9977	0.9978	0.9979	0.9979	0.9980	0.9981
2.9	0.9981	0.9982	0.9982	0.9983	0.9984	0.9984	0.9985	0.9985	0.9986	0.9986
3.0	0.99865	0.99869	0.99874	0.99878	0.99882	0.99886	0.99889	0.99893	0.99897	0.99900
3.1	0.99903	0.99906	0.99910	0.99913	0.99916	0.99918	0.99921	0.99924	0.99926	0.99929
3.2	0.99931	0.99934	0.99936	0.99938	0.99940	0.99942	0.99944	0.99946	0.99948	0.99950
3.3	0.99952	0.99953	0.99955	0.99957	0.99958	0.99960	0.99961	0.99962	0.99964	0.99965
3.4	0.99966	0.99968	0.99969	0.99970	0.99971	0.99972	0.99973	0.99974	0.99975	0.99976
3.5	0.99977	0.99978	0.99978	0.99979	0.99980	0.99981	0.99981	0.99982	0.99983	0.99983
3.6	0.99984	0.99985	0.99985	0.99986	0.99986	0.99987	0.99987	0.99988	0.99988	0.99989
3.7	0.99989	0.99990	0.99990	0.99990	0.99991	0.99991	0.99992	0.99992	0.99992	0.99992
3.8	0.99993	0.99993	0.99993	0.99994	0.99994	0.99994	0.99994	0.99995	0.99995	0.99995
3.9	0.99995	0.99995	0.99996	0.99996	0.99996	0.99996	0.99996	0.99996	0.99997	0.99997
4.0	0.999968329									
4.5	0.999996602									
5.0	0.999999713									
5.5	0.999999981									
6.0	0.999999999									

TABLE A.2 M.Tech. const.mgmt. sem I

The Cumulative Standardized Normal Distribution

Entry represents area under the cumulative standardized normal distribution from $-\infty$ to Z



	Cumulative Probabilities									
Z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
−6.0	0.000000001									
−5.5	0.000000019									
−5.0	0.000000287									
−4.5	0.000003398									
−4.0	0.000031671									
−3.9	0.00005	0.00005	0.00004	0.00004	0.00004	0.00004	0.00004	0.00004	0.00003	0.00003
−3.8	0.00007	0.00007	0.00007	0.00006	0.00006	0.00006	0.00006	0.00005	0.00005	0.00005
−3.7	0.00011	0.00010	0.00010	0.00010	0.00009	0.00009	0.00008	0.00008	0.00008	0.00008
−3.6	0.00016	0.00015	0.00015	0.00014	0.00014	0.00013	0.00013	0.00012	0.00012	0.00011
−3.5	0.00023	0.00022	0.00022	0.00021	0.00020	0.00019	0.00019	0.00018	0.00017	0.00017
−3.4	0.00034	0.00032	0.00031	0.00030	0.00029	0.00028	0.00027	0.00026	0.00025	0.00024
−3.3	0.00048	0.00047	0.00045	0.00043	0.00042	0.00040	0.00039	0.00038	0.00036	0.00035
−3.2	0.00069	0.00066	0.00064	0.00062	0.00060	0.00058	0.00056	0.00054	0.00052	0.00050
−3.1	0.00097	0.00094	0.00090	0.00087	0.00084	0.00082	0.00079	0.00076	0.00074	0.00071
−3.0	0.00135	0.00131	0.00126	0.00122	0.00118	0.00114	0.00111	0.00107	0.00103	0.00100
−2.9	0.0019	0.0018	0.0018	0.0017	0.0016	0.0016	0.0015	0.0015	0.0014	0.0014
−2.8	0.0026	0.0025	0.0024	0.0023	0.0023	0.0022	0.0021	0.0021	0.0020	0.0019
−2.7	0.0035	0.0034	0.0033	0.0032	0.0031	0.0030	0.0029	0.0028	0.0027	0.0026
−2.6	0.0047	0.0045	0.0044	0.0043	0.0041	0.0040	0.0039	0.0038	0.0037	0.0036
−2.5	0.0062	0.0060	0.0059	0.0057	0.0055	0.0054	0.0052	0.0051	0.0049	0.0048
−2.4	0.0082	0.0080	0.0078	0.0075	0.0073	0.0071	0.0069	0.0068	0.0066	0.0064
−2.3	0.0107	0.0104	0.0102	0.0099	0.0096	0.0094	0.0091	0.0089	0.0087	0.0084
−2.2	0.0139	0.0136	0.0132	0.0129	0.0125	0.0122	0.0119	0.0116	0.0113	0.0110
−2.1	0.0179	0.0174	0.0170	0.0166	0.0162	0.0158	0.0154	0.0150	0.0146	0.0143
−2.0	0.0228	0.0222	0.0217	0.0212	0.0207	0.0202	0.0197	0.0192	0.0188	0.0183
−1.9	0.0287	0.0281	0.0274	0.0268	0.0262	0.0256	0.0250	0.0244	0.0239	0.0233
−1.8	0.0359	0.0351	0.0344	0.0336	0.0329	0.0322	0.0314	0.0307	0.0301	0.0294
−1.7	0.0446	0.0436	0.0427	0.0418	0.0409	0.0401	0.0392	0.0384	0.0375	0.0367
−1.6	0.0548	0.0537	0.0526	0.0516	0.0505	0.0495	0.0485	0.0475	0.0465	0.0455
−1.5	0.0668	0.0655	0.0643	0.0630	0.0618	0.0606	0.0594	0.0582	0.0571	0.0559
−1.4	0.0808	0.0793	0.0778	0.0764	0.0749	0.0735	0.0721	0.0708	0.0694	0.0681
−1.3	0.0968	0.0951	0.0934	0.0918	0.0901	0.0885	0.0869	0.0853	0.0838	0.0823
−1.2	0.1151	0.1131	0.1112	0.1093	0.1075	0.1056	0.1038	0.1020	0.1003	0.0985
−1.1	0.1357	0.1335	0.1314	0.1292	0.1271	0.1251	0.1230	0.1210	0.1190	0.1170
−1.0	0.1587	0.1562	0.1539	0.1515	0.1492	0.1469	0.1446	0.1423	0.1401	0.1379
−0.9	0.1841	0.1814	0.1788	0.1762	0.1736	0.1711	0.1685	0.1660	0.1635	0.1611
−0.8	0.2119	0.2090	0.2061	0.2033	0.2005	0.1977	0.1949	0.1922	0.1894	0.1867
−0.7	0.2420	0.2388	0.2358	0.2327	0.2296	0.2266	0.2236	0.2206	0.2177	0.2148
−0.6	0.2743	0.2709	0.2676	0.2643	0.2611	0.2578	0.2546	0.2514	0.2482	0.2451
−0.5	0.3085	0.3050	0.3015	0.2981	0.2946	0.2912	0.2877	0.2843	0.2810	0.2776
−0.4	0.3446	0.3409	0.3372	0.3336	0.3300	0.3264	0.3228	0.3192	0.3156	0.3121
−0.3	0.3821	0.3783	0.3745	0.3707	0.3669	0.3632	0.3594	0.3557	0.3520	0.3483
−0.2	0.4207	0.4168	0.4129	0.4090	0.4052	0.4013	0.3974	0.3936	0.3897	0.3859
−0.1	0.4602	0.4562	0.4522	0.4483	0.4443	0.4404	0.4364	0.4325	0.4286	0.4247
−0.0	0.5000	0.4960	0.4920	0.4880	0.4840	0.4801	0.4761	0.4721	0.4681	0.4641

M.Tech. Const. mgmt. Sem I.

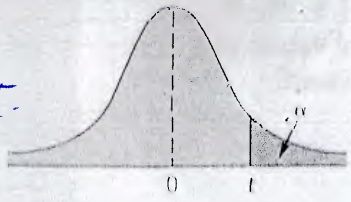
TABLE A.3
Critical Values of t (Continued)

Degrees of Freedom	Cumulative Probabilities					
	0.75	0.90	0.95	0.975	0.99	0.995
	Upper-Tail Areas					
	0.25	0.10	0.05	0.025	0.01	0.005
49	0.6795	1.2991	1.6766	2.0096	2.4049	2.6800
50	0.6794	1.2987	1.6759	2.0086	2.4033	2.6778
51	0.6793	1.2984	1.6753	2.0076	2.4017	2.6757
52	0.6792	1.2980	1.6747	2.0066	2.4002	2.6737
53	0.6791	1.2977	1.6741	2.0057	2.3988	2.6718
54	0.6791	1.2974	1.6736	2.0049	2.3974	2.6700
55	0.6790	1.2971	1.6730	2.0040	2.3961	2.6682
56	0.6789	1.2969	1.6725	2.0032	2.3948	2.6665
57	0.6788	1.2966	1.6720	2.0025	2.3936	2.6649
58	0.6787	1.2963	1.6716	2.0017	2.3924	2.6633
59	0.6787	1.2961	1.6711	2.0010	2.3912	2.6618
60	0.6786	1.2958	1.6706	2.0003	2.3901	2.6603
61	0.6785	1.2956	1.6702	1.9996	2.3890	2.6589
62	0.6785	1.2954	1.6698	1.9990	2.3880	2.6575
63	0.6784	1.2951	1.6694	1.9983	2.3870	2.6561
64	0.6783	1.2949	1.6690	1.9977	2.3860	2.6549
65	0.6783	1.2947	1.6686	1.9971	2.3851	2.6536
66	0.6782	1.2945	1.6683	1.9966	2.3842	2.6524
67	0.6782	1.2943	1.6679	1.9960	2.3833	2.6512
68	0.6781	1.2941	1.6676	1.9955	2.3824	2.6501
69	0.6781	1.2939	1.6672	1.9949	2.3816	2.6490
70	0.6780	1.2938	1.6669	1.9944	2.3808	2.6479
71	0.6780	1.2936	1.6666	1.9939	2.3800	2.6469
72	0.6779	1.2934	1.6663	1.9935	2.3793	2.6459
73	0.6779	1.2933	1.6660	1.9930	2.3785	2.6449
74	0.6778	1.2931	1.6657	1.9925	2.3778	2.6439
75	0.6778	1.2929	1.6654	1.9921	2.3771	2.6430
76	0.6777	1.2928	1.6652	1.9917	2.3764	2.6421
77	0.6777	1.2926	1.6649	1.9913	2.3758	2.6412
78	0.6776	1.2925	1.6646	1.9908	2.3751	2.6403
79	0.6776	1.2924	1.6644	1.9905	2.3745	2.6395
80	0.6776	1.2922	1.6641	1.9901	2.3739	2.6387
81	0.6775	1.2921	1.6639	1.9897	2.3733	2.6379
82	0.6775	1.2920	1.6636	1.9893	2.3727	2.6371
83	0.6775	1.2918	1.6634	1.9890	2.3721	2.6364
84	0.6774	1.2917	1.6632	1.9886	2.3716	2.6356
85	0.6774	1.2916	1.6630	1.9883	2.3710	2.6349
86	0.6774	1.2915	1.6628	1.9879	2.3705	2.6342
87	0.6773	1.2914	1.6626	1.9876	2.3700	2.6335
88	0.6773	1.2912	1.6624	1.9873	2.3695	2.6329
89	0.6773	1.2911	1.6622	1.9870	2.3690	2.6322
90	0.6772	1.2910	1.6620	1.9867	2.3685	2.6316
91	0.6772	1.2909	1.6618	1.9864	2.3680	2.6309
92	0.6772	1.2908	1.6616	1.9861	2.3676	2.6303
93	0.6771	1.2907	1.6614	1.9858	2.3671	2.6297
94	0.6771	1.2906	1.6612	1.9855	2.3667	2.6291
95	0.6771	1.2905	1.6611	1.9853	2.3662	2.6286
96	0.6771	1.2904	1.6609	1.9850	2.3658	2.6280
97	0.6770	1.2903	1.6607	1.9847	2.3654	2.6275
98	0.6770	1.2902	1.6606	1.9845	2.3650	2.6269
99	0.6770	1.2902	1.6604	1.9842	2.3646	2.6264
100	0.6770	1.2901	1.6602	1.9840	2.3642	2.6259
110	0.6767	1.2893	1.6588	1.9818	2.3607	2.6213
120	0.6765	1.2886	1.6577	1.9799	2.3578	2.6174
∞	0.6745	1.2816	1.6449	1.9600	2.3263	2.5758

TABLE A.3

Critical Values of t M.Tech. Const. mgmt. Sem I.

For a particular number of degrees of freedom, entry represents the critical value of t corresponding to the cumulative probability $(1-\alpha)$ and a specified upper-tail area α.



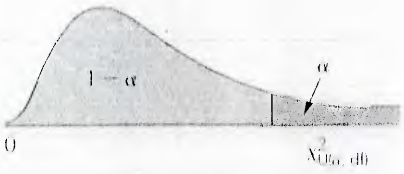
Degrees of Freedom	Cumulative Probabilities					
	0.75	0.90	0.95	0.975	0.99	0.995
	Upper-Tail Areas					
	0.25	0.10	0.05	0.025	0.01	0.005
1	1.0000	3.0777	6.3138	12.7062	31.8207	63.6574
2	0.8165	1.8856	2.9200	4.3027	6.9646	9.9248
3	0.7649	1.6377	2.3534	3.1824	4.5407	5.8409
4	0.7407	1.5332	2.1318	2.7764	3.7469	4.6041
5	0.7267	1.4759	2.0150	2.5706	3.3649	4.0322
6	0.7176	1.4398	1.9432	2.4469	3.1427	3.7074
7	0.7111	1.4149	1.8946	2.3646	2.9980	3.4995
8	0.7064	1.3968	1.8595	2.3060	2.8965	3.3554
9	0.7027	1.3830	1.8331	2.2622	2.8214	3.2498
10	0.6998	1.3722	1.8125	2.2281	2.7638	3.1693
11	0.6974	1.3634	1.7959	2.2010	2.7181	3.1058
12	0.6955	1.3562	1.7823	2.1788	2.6810	3.0545
13	0.6938	1.3502	1.7709	2.1604	2.6503	3.0123
14	0.6924	1.3450	1.7613	2.1448	2.6245	2.9768
15	0.6912	1.3406	1.7531	2.1315	2.6025	2.9467
16	0.6901	1.3368	1.7459	2.1199	2.5835	2.9208
17	0.6892	1.3334	1.7396	2.1098	2.5669	2.8982
18	0.6884	1.3304	1.7341	2.1009	2.5524	2.8784
19	0.6876	1.3277	1.7291	2.0930	2.5395	2.8609
20	0.6870	1.3253	1.7247	2.0860	2.5280	2.8453
21	0.6864	1.3232	1.7207	2.0796	2.5177	2.8314
22	0.6858	1.3212	1.7171	2.0739	2.5083	2.8188
23	0.6853	1.3195	1.7139	2.0687	2.4999	2.8073
24	0.6848	1.3178	1.7109	2.0639	2.4922	2.7969
25	0.6844	1.3163	1.7081	2.0595	2.4851	2.7874
26	0.6840	1.3150	1.7056	2.0555	2.4786	2.7787
27	0.6837	1.3137	1.7033	2.0518	2.4727	2.7707
28	0.6834	1.3125	1.7011	2.0484	2.4671	2.7633
29	0.6830	1.3114	1.6991	2.0452	2.4620	2.7564
30	0.6828	1.3104	1.6973	2.0423	2.4573	2.7500
31	0.6825	1.3095	1.6955	2.0395	2.4528	2.7440
32	0.6822	1.3086	1.6939	2.0369	2.4487	2.7385
33	0.6820	1.3077	1.6924	2.0345	2.4448	2.7333
34	0.6818	1.3070	1.6909	2.0322	2.4411	2.7284
35	0.6816	1.3062	1.6896	2.0301	2.4377	2.7238
36	0.6814	1.3055	1.6883	2.0281	2.4345	2.7195
37	0.6812	1.3049	1.6871	2.0262	2.4314	2.7154
38	0.6810	1.3042	1.6860	2.0244	2.4286	2.7116
39	0.6808	1.3036	1.6849	2.0227	2.4258	2.7079
40	0.6807	1.3031	1.6839	2.0211	2.4233	2.7045
41	0.6805	1.3025	1.6829	2.0195	2.4208	2.7012
42	0.6804	1.3020	1.6820	2.0181	2.4185	2.6981
43	0.6802	1.3016	1.6811	2.0167	2.4163	2.6951
44	0.6801	1.3011	1.6802	2.0154	2.4141	2.6923
45	0.6800	1.3006	1.6794	2.0141	2.4121	2.6896
46	0.6799	1.3002	1.6787	2.0129	2.4102	2.6870
47	0.6797	1.2998	1.6779	2.0117	2.4083	2.6846
48	0.6796	1.2994	1.6772	2.0106	2.4066	2.6822

continued

TABLE A.4

Critical Values of χ^2 M. Tech. const. mgmt. Sem I

For a particular number of degrees of freedom, entry represents the critical value of χ^2 corresponding to the cumulative probability $(1 - \alpha)$ and a specified upper-tail area (α).



Degrees of Freedom	Cumulative Probabilities											
	0.005	0.01	0.025	0.05	0.10	0.25	0.75	0.90	0.95	0.975	0.99	0.995
	Upper-Tail Areas (A)											
	0.995	0.99	0.975	0.95	0.90	0.75	0.25	0.10	0.05	0.025	0.01	0.005
1			0.001	0.004	0.016	0.102	1.323	2.706	3.841	5.024	6.635	7.879
2	0.010	0.020	0.051	0.103	0.211	0.575	2.773	4.605	5.991	7.378	9.210	10.597
3	0.072	0.115	0.216	0.352	0.584	1.213	4.108	6.251	7.815	9.348	11.345	12.838
4	0.207	0.297	0.484	0.711	1.064	1.923	5.385	7.779	9.488	11.143	13.277	14.860
5	0.412	0.554	0.831	1.145	1.610	2.675	6.626	9.236	11.071	12.833	15.086	16.750
6	0.676	0.872	1.237	1.635	2.204	3.455	7.841	10.645	12.592	14.449	16.812	18.458
7	0.989	1.239	1.690	2.167	2.833	4.255	9.037	12.017	14.067	6.013	18.475	20.278
8	1.344	1.646	2.180	2.733	3.490	5.071	10.219	13.362	15.507	17.535	20.090	21.955
9	1.735	2.088	2.700	3.325	4.168	5.899	11.389	14.684	16.919	19.023	21.666	23.589
10	2.156	2.558	3.247	3.940	4.865	6.737	12.549	15.987	18.307	20.483	23.209	25.188
11	2.603	3.053	3.816	4.575	5.578	7.584	13.701	17.275	19.675	21.920	24.725	26.757
12	3.074	3.571	4.404	5.226	6.304	8.438	14.845	18.549	21.026	23.337	26.217	28.299
13	3.565	4.107	5.009	5.892	7.042	9.299	15.984	19.812	22.362	24.736	27.688	29.819
14	4.075	4.660	5.629	6.571	7.790	10.165	17.117	21.064	23.685	26.119	29.141	31.319
15	4.601	5.229	6.262	7.261	8.547	11.037	18.245	22.307	24.996	27.488	30.578	32.801
16	5.142	5.812	6.908	7.962	9.312	11.912	19.369	23.542	26.296	28.845	32.000	34.267
17	5.697	6.408	7.564	8.672	10.085	12.792	20.489	24.769	27.587	30.191	33.409	35.718
18	6.265	7.015	8.231	9.390	10.865	13.675	21.605	25.989	28.869	31.526	34.805	37.156
19	6.844	7.633	8.907	10.117	11.651	14.562	22.718	27.204	30.144	32.852	36.191	38.582
20	7.434	8.260	9.591	10.851	12.443	15.452	23.828	28.412	31.410	34.170	37.566	39.997
21	8.034	8.897	10.283	11.591	13.240	16.344	24.935	29.615	32.671	35.479	38.932	41.401
22	8.643	9.542	10.982	12.338	14.042	17.240	26.039	30.813	33.924	36.781	40.289	42.796
23	9.260	10.196	11.689	13.091	14.848	18.137	27.141	32.007	35.172	38.076	41.638	44.181
24	9.886	10.856	12.401	13.848	15.659	19.037	28.241	33.196	36.415	39.364	42.980	45.559
25	10.520	11.524	13.120	14.611	16.473	19.939	29.339	34.382	37.652	40.646	44.314	46.928
26	11.160	12.198	13.844	15.379	17.292	20.843	30.435	35.563	38.885	41.923	45.642	48.290
27	11.808	12.879	14.573	16.151	18.114	21.749	31.528	36.741	40.113	43.194	46.963	49.645
28	12.461	13.565	15.308	16.928	18.939	22.657	32.620	37.916	41.337	44.461	48.278	50.993
29	13.121	14.257	16.047	17.708	19.768	23.567	33.711	39.087	42.557	45.722	49.588	52.336
30	13.787	14.954	16.791	18.493	20.599	24.478	34.800	40.256	43.773	46.979	50.892	53.672

For larger values of degrees of freedom (df) the expression $Z = \sqrt{2\chi^2} - \sqrt{2(df) - 1}$ may be used and the resulting upper-tail area can be found from the cumulative standardized normal distribution (Table A.2).

Lib
20/11/17

M.Tech. Const. Mgmt. Sem I

Bharatiya Vidya Bhavan's

Sardar Patel College of Engineering

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

END SEMESTER EXAMINATION
November 2017

Date: 20/11/2017
Program: M.Tech. Construction Management **Duration: 3hr**
Course code: MTCM101 **Maximum Marks: 100**
Name of the Course: Construction Management and Organization **Semester: I**
Note: Attempt any Five

Master file.

Q.No.		Marks	CO	Mod No.
1a	Define management and explain system approach to management process in detail.	10	01	01
1b	Write short Note on: i) Social responsibility of Manager ii) Ethics in Managing	10	01	01
2a	Explain steps of planning for a construction project.	10	02	02
2b	Discuss in detail method of analyzing strength or weakness of an organization with respect to threat in external environment.	10	02	02
3a	Define productivity, state the method of measuring productivity on site and explain any two in detail.	10	01	07
3b	Explain the concept 'Management by Objectives (MBO) and highlight its importance.	10	01	01
4a	You need to set up a real estate business in all region of India and a construction business in a particular area separately what kind of organization structure do you suggest for both the business and explain the advantage and disadvantages of the organization structure suggested.	10	03	03
4b	Explain difference in authority and power, Explain relationship between power and responsibility.	10	03	03

M.Tech. (Const. Mgmt.) Sem I

Bharatiya Vidya Bhavan's

Sardar Patel College of Engineering

(A Government Aided Autonomous Institute)

Munshi Nagar, Andheri (West), Mumbai – 400058

Q.No.	Description	Marks	CO	Mod No.
5a	Define staffing and explain in detail system approach to selection.	10	03	04
5b	Discuss different views on appraisal issues and explain any one kind of review of performance appraisal.	10	03	04
6a	What are the elements of Controlling process?	10	02	06
6b	Explain in detail the qualities of good leader?	10	03	05
7a	What is motivation? Explain Maslow's hierarchy theory of motivation.	08	03	05
7b	"Planning and controlling are opposite sides of same coin", justify your answer with suitable examples.	07	02	06
7c	Distinguish between 'Manager and leader'.	05	01	05

M.Tech. Sem I.

Lib
29/11/17

Bharatiya Vidya Bhavan's

Sardar Patel College of Engineering

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

END SEMESTER EXAMINATION
November 2017

Date: 29/11/2017
Program: M.Tech. Construction Management **Duration: 3hr**
Course code: MTCM105 **Maximum Marks: 100**
Name of the Course: Elective – I: (Safety Management) **Semester: I**
Note: Attempt any Five out of Seven

Master file.

Q.No.		Marks	CO	Mod No.
1a	Define Safety in construction. Explain the importance of safety management at site.	10	01	01
1b	Explain the types and causes of skin diseases for construction workers.	10	02	02
2a	Explain the main hazards of excavation.	10	01	03
2b	Discuss the role of different personnel to ensure safety at construction site.	10	04	01
3	Explain the causes of fire at construction site. Give your suggestions to improve management of fire.	20	04	04
4a	What are the problems in managing electricity at construction site?	10	03	05
4b	Suggest the ways of managing electric shock.	10	04	03
5	What are the causes for mental stress? Suggest measures to remedy the situation.	20	03	04
6 a	You are required to suggest the means of handling equipments at site.	10	01	04
6 b	What are the issues in material handling? Suggest how you can improve them.	10	04	05
7	Define audit. Explain the importance of safety audit.	20	03	07

M.Tech. Cont. Mgmt. Sem I.

Lib 27/11/17

Bharatiya Vidya Bhavan's

Sardar Patel College of Engineering

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

END SEMESTER EXAMINATION
November 2017

Date: 27/11/2017

Program: M.Tech. Construction Management **Duration: 3hr**
Course code: MTCM104 **Maximum Marks: 100**
Name of the Course: Accounting and Finance Management **Semester: I**
Note: Attempt any Five Master file.

Q.No.		Marks	CO	Mod No.
1a	Journalize the following and post them into ledger. Jan 1- Sudhir Commenced business with Rs.10000/- Jan 15- Purchased goods worth Rs.10000/- for cash. Jan 20- Purchased goods from Ramesh on credit for Rs.6000/- Jan 30- Paid WagesRs.5000/- February 2- Purchased machinery for cash Rs.100000/- March 3- Goods lost by fire- Rs.7000/-	08	02	01
1b	From the following particulars prepare Trading & Profit loss A/c of XYZ for 31.03.1993 Opening Stock 2000/- Interest Paid 200/- Wages 2000/- Rent Paid 200/- Salaries 2500/- Discount Received 250/- Carriage Inwards 300/- Closing Stock 4000/- Purchases 6000/- Travelling Expenses 150/- Purchase Returns 300/- Sales 12000/- Sales Returns 600/- Commission Paid 600/- Carriage Outward 400/-	12	02	02
2a	Explain funds flow analysis. Highlight the importance of fund flow statement.	10	01	03

M.Tech. Const. Mgmt Sem I

Bharatiya Vidya Bhavan's

Sardar Patel College of Engineering

(A Government Aided Autonomous Institute)

Munshi Nagar, Andheri (West), Mumbai – 400058

2b	Define cash flow statement. Highlight the importance of cash flow statement.	**10**	03	03
3	Explain how you propose to manage current assets.	**20**	04	06
4a	List out the uses of ratio analysis and highlight the limitations of ratio analysis.	**08**	03	03
4b	The balance sheet of Punjab Auto Limited as on 31.12.1991 are as follows:- **Liabilities** — **Assets** Equity capital 40000/- — Plant & Machinery 24000/- Capital Reserves 8000/- — Land & Building 40000/- 8% loan on Mortgage 32000/- — Furniture 16000/- Creditors 16000/- — Stock 12000/- Bank Overdraft 4000/- — Debtors 12000/- Taxation- Current 4000/- — Short Term Investment 4000/- Taxation- Future 4000/- — Cash in Hand 12000/- P& L A/c 12000/- **Total 120000/- — Total 120000/-** **Calculate: - (a) Current Ratio, (b) Quick Ratio(c) Debt Equity Ratio.**	**12**	04	05
5	Explain the sources of finance for project execution	**20**	01	04
6	Explain the features, objectives & techniques for inflation accounting.	**20**	01	07

M.Tech. Const. Mgmt. Sem I

Bharatiya Vidya Bhavan's

Sardar Patel College of Engineering

(A Government Aided Autonomous Institute)

Munshi Nagar, Andheri (West), Mumbai – 400058

7	Following is the profit & loss A/c of Well Balanced Ltd. Prepare Income Statement.	**20**	03	02

Opening Stock	700000/-	Plant	30000/-
Purchases	900000/-	Delivery Van	20000/-
Wages	150000/-	Loss on sale of Van	5000/-
Factory Expenses	350000/-	Income Tax	175000/-
Office Salaries	25000/-	Net Profit	145000/-
Office Rent	39000/-	Sales- Cash	520000/-
Postage	5000/-	Sales- Credit	1500000/-
Directors Fee	6000/-	Sales Return	20000/-
Salesmen Salary	12000/-	Closing Stock	600000/-
Advertising	18000/-	Dividend Received	10000/-
Delivery Expenses	20000/-	Profit on sale of Furniture	20000/-
Debenture Interest	20000/-		
Depreciation in office furniture	10000/-		

Lib
24/11/2017

M.Tech. Mech. Sem I.

Bharatiya Vidya Bhavan's

Sardar Patel College of Engineering

(A Government Aided Autonomous Institute)

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

End Semester Exam

November 2017

Max. Marks:100 | Semester: I | Duration: 3hrs

Class: M.tech M/C design | Program: Mtech. M/C Design

Name of the Course: CAD | Course Code : MTMD103

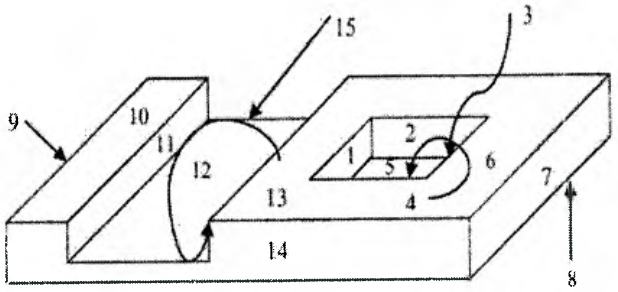
Master file.

Instructions:

1. Question No 1 is compulsory.
2. Attempt any four questions out of remaining six.
3. Draw neat diagrams
4. Assume suitable data if necessary

Question no.	Questions	Maxi. marks	Course outcome no
Q.1 (a)	Develop a C++ program to carry out following 3Dtransformations using homogeneous coordinates & matrix concept on a 2D object like triangle. Insert necessary comments wherever necessary. 1) Translation 2) Rotation @ Y-axis 3) Rotation @ Z-axis 4) Scaling 5) Reflection	20	4
Q.2 (a)	Explain Cohen Sutherland Algorithm	10	3
Q.2 (b)	Explain Painters Algorithm along with neat sketches	10	3
Q.3 (a)	What do you understand by the terms "Window" & "Viewport". Derive the mapping for any given point (Xw Yw) from the window onto the viewport	10	1
Q.3 (b)	Obtain the transformation matrix for rotation about the line joining the points (0,0,0) & (1,1,1) with the angle of rotation 45^0 in counter clockwise sense	10	2
Q.4 (a)	Plot the Bezier curve using Bernstein Polynomials having endpoints P_0 (1,3) & P_3 (7,2). The other control points are P_1 (5,6) & P_2 (6,0). Plot the values for U= 0, 0.1, 0.2, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8, 0.9, 1.0, if the characteristics polygon is drawn in the sequence P_0 - P_1 - P_2 - P_3. Give the results in tabulated form	10	2
Q.4(b)	Explain Reverse Engineering & its data capture techniques with neat sketches	10	1

M.Tech. Mech. Sem I.

Q.5(a)	A rectangle ABCD is represented by the vertices A (20,20), B (106.603, 70) , C(81.603, 113.301), D(-5, 63.301). The rectangle is rotated by 30^0 clockwise about the vertex A. Determine the new vertex positions A', B', C' & D'. The transformed rectangle is then to be mirrored about a line joining the diagonal vertices A' and B'. Determine the new vertices of the rectangle. Represent the complete transformation using graph paper.	10	2
Q.5(b)	Explain Geometric Modeling along with neat sketches	10	2
Q.6(a)	Part shown in the figure (A) below has a slot and a pocket feature. Using graph based Method 1) Develop the Attributed adjacency Graph (AAG) of the object, 2) Give the matrix representation of the AAG, and 3) Recognize the features in this object.  Figure.A	10	2
Q.6 (b)	Explain the concept of Concurrent Engineering (CE) in detail?	10	1
Q.7	Write Short notes on (Any Three) • Graphics Standards • Artificial Intelligence in Design • Design of Gears using Object Oriented Programming. • Structured Query Language (SQL) • Augmented Reality & its applications • CAD-PDM-VR integration • Design for Assembly (DFA)	10	1

M.Tech. (Mech) Sem I.

Lib
29/11/17

Bharatiya Vidya Bhavan's
SARDAR PATEL COLLEGE OF ENGINEERING

(An Autonomous Institution Affiliated to University of Mumbai)

END SEM EXAM

Subject code MTMD114 — **NOV 2017**

Total Marks : 100 — **Duration : 3 Hrs.**

CLASS/SEM :_M.Tech Mech, Machine Design , SEM I — **Subject : RE DOE**

Master file.

- Attempt any ~~Four~~ Five questions out of ~~Five~~ Seven questions.
- Figures to the right indicate full marks
- Assume Suitable data wherever required.

Sr.No.	Questions	Marks	CO	Module
Q1A	Heavy Engineering Division use to load a plate for bending in the process of fabricating Pressure vessel. A team wants to reduce Cycle time in minutes for plate loading. There are 3 major lines A,B,C where the loading takes place. The table below gives the data for each lines for 15 loadings. Find out which line should be focused to improve loading process. Assume any suitable data if necessary.	10	CO1	M2

Sr.No.	Plate loading time for machine A	Plate loading time for machine B	Plate loading time for machine C
1.	22	25	32
2.	26	21	21
3.	28	23	23
4.	21	24	34
5.	24	26	21
6.	29	32	21
7.	30	35	32
8.	37	21	42
9.	27	23	38
10.	23	21	39
11.	26	21	40
12.	29	21	23
13.	27	24	24
14.	25	26	20
15.	24	23	23

Q1B	Explain the following with respect to hypothesis testing. Level Of significance, Test Statistic, Type one and Type Two error, procedure for Hypothesis test, Two Tailed test	10	CO1	M1
Q2A	Carry out a Design FMEA for launching a new Racing Cycle	10	CO1	M1
Q2B	Illustrate Event Tree Analysis with suitable example.	10	CO3, CO4	M6

M.Tech. (Mech) Sem I

<table>
<tr><td>Q3A</td><td>A data of interview process of Administrative services is reviewed to know association between type of location from which the candidate applied and success in interview. The response by type of location is as follows.

<table><tr><td></td><td>Rural area</td><td>Urban area</td><td>Total</td></tr><tr><td>Successful in Interview</td><td>27</td><td>43</td><td>70</td></tr><tr><td>Not successful in interview</td><td>19</td><td>31</td><td>50</td></tr><tr><td>Total</td><td>46</td><td>74</td><td>120</td></tr></table>
At alpha =0.05 , 0.01 do these data suggest an association between Type of location of candidate and candidate's success in interview?</td><td>10</td><td>CO2</td><td>M2</td></tr>
<tr><td>Q3B</td><td>We want to test on the basis of sample size 35 determinations and at 0.05 level 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 $\sigma = 0.01$.</td><td>10</td><td>CO1</td><td>M1</td></tr>
<tr><td>Q4A</td><td>Prepare the Reliability Block Diagram for a Gas Geyser</td><td>10</td><td>CO2</td><td>M5</td></tr>
<tr><td>Q4B</td><td>Explain Scatter plot, Coefficient of correlation and Regression equation. Illustrate it with suitable example.</td><td>10</td><td>CO3, CO4</td><td>M3</td></tr>
<tr><td>Q5A</td><td>The mean lifetime of a sample of 100 bulbs produced by company is 1570 hrs with SD of 120 hrs.

If μ is the mean lifetime of all bulbs test the hypothesis against the alternative hypothesis $\mu \neq 1600$ hrs using a level of

a] 0.05 b] 0.01 Draw the appropriate figure assume suitable data if required.</td><td>10</td><td>CO3</td><td>M2</td></tr>
<tr><td>Q5B</td><td>A data of 350 Life Cycle Test machines was collected and analysed to know association between type of machines and acceptability of Guage R and R . The response by Type of machine are as follows. At alpha =0.05 do these data suggest an association between Type of machine and acceptability of Guage R and R?</td><td>10</td><td>CO1, CO4</td><td>M2</td></tr>
</table>

M.Tech. (Mech) Sem I.

			Automatic machines	Semi Automatic machines	Total			
		Acceptable Guage R&R	14	25	39			
		Not Acceptable Guage R&R	159	152	311			
		Total	173	177	350			
Q6A	With reference to study of hazard Models , the strain Energy stored in an elastic bar subjected to an axial force Q is given by U= [L/ 2AE]Q^2 Where l=length of bar , A-Cross section area, E-Elastic Modulus of the bar If Q is standard normal variate with μ=0, SD =1 , Determine the density function of U.					**10**	**CO3**	**M5**
Q6B	With respect to failure data analysis obtain an expression of Mean time to failure in Integral Form					**10**	**CO3**	**M7**
Q7A	Explain the following terms in detail with Reference to MSA 1. Repeatability 2. Reproducibility 3. Linearity 4. Stability 5. Process Variation and Guage R and R relation 6. R chart and X bar chart in MSA 7. Types of Graphs and their significance 8. Distinct categories					**10**	**CO1**	**M2**
Q7B	Explain the following with respect to Design of Experiments. Illustrate the following points with suitable industrial case. 1. Levels 2. No of Runs 3. Lurking variable 4. Main effect Plot 5. Interaction effect plot 6. Prediction Model 7. Repetition 8. Replication 9. Screening DOE 10. Merits of DOE					**10**	**CO2** **CO4**	**M1** **M4**

*****