Seat No.: ________ Enrolment No.___________

GUJARAT TECHNOLOGICAL UNIVERSITY

ME – SEMESTER-1 (NEW) EXAMINATION – WINTER 2016

Subject Code: 2711304 **Date:03/01/2017**

Subject Name: Numerical Methods and Statistical Analysis

Time: 2:30 pm to 5:00 pm **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Use the attached statistical tables wherever necessary.**

Q.1 **(a)** What is 'Probability Distribution'? Explain Binomial and Poisson Distribution. **07**

(b) Given the values **07**

X	0	1	2	5
f(x)	2	3	12	147

Evaluate f(3) using Lagrange's interpolation formula.

Q.2 **(a)** Apply LU factorization method to solve the equations **07**

$6x + 4y + 14z = 8;\ \ 4x + 6y + 2z = 10;\ \ 6x + 8y + 2z = 14$.

Take $l_{ii} = 1;\ \ i = 1,2,3.$

(b) Find a real root of the equation $-x\,e^{x} + cosx = 0$ by bisection method correct to four decimal places. **07**

OR

(b) Find a real root of the equation $x^3 - x - 1 = 0$ by iteration method correct to three decimal places. **07**

Q.3 **(a)** Evaluate $\int_0^1 e^{-x^2}\,dx$ using Gauss quadrature formula of three points. **07**

(b) Apply Gauss-Jordan method to solve the equations **07**

$2x + 5y + 7z = 52;\ 2x + y - z = 0;\ x + y + z = 9.$

OR

Q.3 **(a)** Fit a second degree parabola to the following data: **07**

x	1.5	2.0	2.5	3.0	3.5	4.0
y	1.3	1.6	2.0	2.7	3.4	4.1

(b) Using Jacobi's iteration method, solve the equations **07**

$10x + y - z = 11.19;\ \ x + 10y + z = 28.08;\ \ -x + y + 10z = 35.61$

Q.4 **(a)** Calculate mean and standard deviation for the given data **05**

Marks	0-10	10-20	20-30	30-40	40-50	50-60	60-70	70-80	80-90
Students	2	5	12	25	38	27	14	7	3

(b) It has been claimed that in 60% of all solar heater installations the utility bill is reduced by at least $1/3^{rd}$. Accordingly, what are the probabilities that the utility bill will be reduced by at least $1/3^{rd}$ in (i) four of five installations; (ii) at least four of five installations? **05**

(c) Find the probabilities that a random variable having the standard normal distribution will take on a value: (i) between 0.87 & 1.28, (ii) between - 0.34 & 0.62 **04**

OR

Q.4 **(a)** What is 'Probability density function'? Discuss with sketches Normal, Uniform, and Exponential probability density functions. **07**

(b) If 20% of the diodes made in a certain plant are defective, what are the probabilities that in a lot of 100 randomly chosen for inspection: (i) at most 15 will be defective; (ii) exactly 15 will be defective? **07**

Q.5 (a) Explain random sampling from the finite and infinite populations. **04**

(b) State and discuss 'Central Limit Theorem'. **04**

(c) A manufacturer of fuses claims that with a 20% overload, the fuses will blow in 12.4 min on the average. To test this claim, a sample of 20 of the fuses was subjected to a 20% overload, and the times it took them to blow had a mean of 10.63 min and a standard deviation of 2.48 min. If it can be assumed that the data constitute a random sample from a normal population, do they tend to support or refute the manufacturer's claim? **06**

OR

Q.5 (a) Explain 't-test' and 'chi-square test'. **04**

(b) Briefly describe the hypothesis testing procedure and significance intervals. **04**

(c) The mean weight loss of 16 grinding balls after a certain length of time in mill slurry is 3.42 gm with a standard deviation of 0.68 gm. For the 95% confidence interval, test the null hypothesis for the claimed mean weight loss of (i) 3.7 gm, and (ii) 3 gm. Which claim will be rejected? **06**

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Table 3 Normal Distribution Function

$$F(z) = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{z} e^{-t^2/2}\, dt$$

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	0.7517	0.7549
0.7	0.7580	0.7611	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	0.9987	0.9987	0.9987	0.9988	0.9988	0.9989	0.9989	0.9989	0.9990	0.9990
3.1	0.9990	0.9991	0.9991	0.9991	0.9992	0.9992	0.9992	0.9992	0.9993	0.9993
3.2	0.9993	0.9993	0.9994	0.9994	0.9994	0.9994	0.9994	0.9995	0.9995	0.9995
3.3	0.9995	0.9995	0.9995	0.9996	0.9996	0.9996	0.9996	0.9996	0.9996	0.9997
3.4	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9998
3.5	0.9998									
4.0	0.99997									
5.0	0.9999997									
6.0	0.999999999									

Table 4 Values of t_α*

ν	$\alpha = 0.10$	$\alpha = 0.05$	$\alpha = 0.025$	$\alpha = 0.01$	$\alpha = 0.005$	ν
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	2.131	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
inf.	1.282	1.645	1.960	2.326	2.576	inf.