**Seat No.: _____** **Enrolment No._____**

# GUJARAT TECHNOLOGICAL UNIVERSITY

## ME Semester –I Examination Feb. - 2012

**Subject code: 711403N** **Date: 17/02/2012**
**Subject Name: Statistical and Numerical Analysis**
**Time: 10.30 am – 01.00 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 of statistical tables is allowed.**

**Q.1** **(a)** Find the Lagrange interpolating polynomial that fits the following data: **07**

| $x$ | - 1 | 0 | 2 | 3 |
|---|---|---|---|---|
| $f(x)$ | - 8 | 3 | 1 | 12 |

Hence, find the value of $f(2.5)$.

**(b)** Express the following system in matrix form. Find the inverse of the coefficient matrix by Gauss Jordan method and hence solve the system of equations **07**

$$2x+4y+8z=36$$
$$3x+6y+2z=24$$
$$x-2y+4z=9$$

**Q.2** **(a)** Obtain an approximate value of $\int_{-1}^{1}\frac{dx}{1+x^2}$ by one point, two point and three point Gaussian formula and compare with the exact value. **07**

**(b)** Find the coefficient matrix for the following system. Whether it is diagonally dominant? Also find the solution of the system by Gauss-Seidel method correct up to five decimal places. **07**

$$6x+15y+2z=72$$
$$27x+6y-z=85$$
$$x+y+54z=110$$

**OR**

**(b)** A simply supported beam carries a concentrated load P at its mid point. Corresponding to various values of P the maximum deflection Y is measured and is given below. **07**

| P | 100 | 120 | 140 | 160 | 180 | 200 |
|---|---|---|---|---|---|---|
| Y | 0.45 | 0.55 | .60 | 0.70 | 0.80 | 0.85 |

Find a law of the form Y=a+bP and hence estimate Y when P=150.

**Q.3** **(a)** Find LU decomposition of the matrix **07**

$$A = \begin{bmatrix} 1 & 2 & 3 \\ 2 & -4 & 6 \\ 3 & -9 & -3 \end{bmatrix}.$$

**(b)** If a card is drawn from a well-shuffled deck of 52 playing cards, what is the probability of drawing **07**

(i) A red king

(ii) A 3, 4, 5 or 6

(iii) A black card

A red ace or a black queen?

**OR**

**Q.3** **(a)** Evaluate the integral $\int_0^1 \frac{dx}{2+x^2}$ , using **07**

(i) Trapezoidal rule,

(ii) Simpson's 3/8$^{th}$ rule,

with 8-equal subintervals.

**(b)** (i) If the probabilities that, while under warranty, a new car will required a repair of engine is 0.87, require a repair of drive train is 0.36 and require a repair of both engine and drive train is 0.29. What is the probability that a car will require at least one repair under the warranty? **07**

(ii) If 3 out of 20 fans in storage are defective, what is the probability that one out of 4 randomly chosen fans for inspection is defective?

**Q.4** **(a)** State Baye's theorem for conditional probability. **07**

An assembly plant receives its voltage regulators from three different suppliers, 60% from supplier $B_1$, 30% from supplier $B_2$ and remaining from supplier $B_3$. If 95% of regulators from $B_1$, 80% from $B_2$ and 65% from $B_3$ perform according to specifications, what is the probability that any one voltage regulator performing according to specifications came from supplier $B_3$.

**(b)** It is known from past experience that the daily demand for a perishable product is as shown in the following table **07**

| Number of order | 3 | 4 | 5 | 6 |
|---|---|---|---|---|
| Probability | 0.2 | 0.35 | 0.37 | 0.08 |

If each item costs Rs. 35 (including the cost of carrying it in stock, it sells for Rs. 50 provided that it is in stock, and it represents a total loss if it remains in stock at the end of a day, how many items should be stocked each day so as to maximize the expected profit?

**OR**

**Q.4** **(a)** It is known that 5% of the books bound at a certain bindery have defective bindings. Find the probability that 2 of 100 books bound by this bindery will have defective bindings using **07**

(i) Binomial distribution

(ii) Poisson distribution.

**(b)** The following data gives bending force required to bend a specific type of steel road. Choose appropriate classes and prepare a frequency distribution. **07**

| | | | | | |
|---|---|---|---|---|---|
| 33.2 | 25.3 | 25.1 | 33.9 | 50.1 | 52.9 |
| 63.2 | 38.1 | 16.8 | 51.4 | 25.1 | 18.8 |
| 64.0 | 39.6 | 38.9 | 58.9 | 63.2 | 63.8 |
| 27.4 | 37.3 | 46.6 | 61.9 | 40.6 | 42.4 |
| 23.7 | 53.9 | 20.4 | 34.8 | 26.0 | 47.1 |

Draw frequency polygon for the data. Also find the mean of the distribution.

**Q.5** **(a)** An industrial engineer intends to use the mean of a random sample of size n to estimate the average mechanical aptitude ( as measured by a certain test) of assembly line workers in a large industry. If on the basis of experience, the engineer can assume that $\sigma = 6.2$ for such data, what can he assert with probability 0.99 about the sample size if the maximum size of his error is 1.30? **07**

**(b)** Test the null hypothesis $\mu = 0.180$ against the alternate hypothesis $\mu < 0.180$ with a level of significance 0.01. Given that the sample size is 5 and sample mean is 0.1695 and standard deviation is 0.0057. **07**

**OR**

**Q.5** **(a)** In an experiment the material cost for rebuilding 35 traction motors a computer calculates mean $\overline{x}$ =1.4707 and $s = 0.5235$ thousand dollars. Obtain a 90% confidence interval for the mean material cost to rebuild a motor. **07**

**(b)** According to the norms established for a mechanical aptitude test, persons who are 18 years old should average 73.2 with a standard deviation of 8.6. If 45 randomly selected persons of that age averages 76.7, test the null hypothesis $\mu = 73.2$ against the alternative hypothesis $\mu > 73.2$ at the 0.01 level of significance. **07**

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