Seat No.: _____ Enrolment No._____

# GUJARAT TECHNOLOGICAL UNIVERSITY

**ME - SEMESTER–I(New course)• EXAMINATION – WINTER- 2015**

**Subject Code: 2711304** **Date: 31/12/2015**

**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.**

**Q.1** **(a)** Describe: Basic probability, Sample space, Events, Axioms of probability. **07**

**(b)** Apply Gauss-Jordan method to solve the equations **07**
$x + y + z = 9;\ 2x - 3y + 4z = 13;\ 3x + 4y + 5z = 40$.

**Q.2** **(a)** Explain: (i) Binomial distribution, (ii) Poisson distribution. **07**

**(b)** Given the values **07**

| X | 5 | 7 | 11 | 13 | 17 |
|---|---|---|---|---|---|
| f(x) | 150 | 392 | 1452 | 2366 | 5202 |

evaluate f(9) using Lagrange's interpolation formula.

**OR**

**(b)** Find a real root of the equation $x\,e^x = cosx$ by regula-falsi method correct to four decimal places **07**

**Q.3** **(a)** Evaluate $\int_1^3 \sin x\,dx$ using Gauss quadrature formula of five points. **07**

**(b)** Using Jacobi's iteration method, solve the equations **07**
$20x + y - 2z = 17;\ 3x + 20y - z = -18;\ 2x - 3y + 20z = 25$.

**OR**

**Q.3** **(a)** Apply LU factorization method to solve the equations **07**
$3x + 2y + 7z = 4;\ 2x + 3y + z = 5;\ 3x + 4y + z = 7$.
Take $l_{ii} = 1;\ i = 1,2,3$

**(b)** Fit a least square geometric curve of the form $y = a\,x^b$ to the following data: **07**

| $x$ | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| $y$ | 0.5 | 2 | 4.5 | 8 | 12.5 |

**Q.4** **(a)** It is known that 4% of the manufactured tiles have defects. Find the probability that 3 of 100 tiles will have defects, using (i) the formula for the binomial distribution, (ii) the Poisson approximation to the binomial distribution. **04**

**(b)** If a garage receives on the average 10 cars for repairing per day, what are the probabilities that it will receive (i) 6 cars on any given day; (ii) 15 cars on any two consecutive days. **04**

**(c)** The spot speeds at a particular location are normally distributed with a mean of 51.7 kmph and a standard deviation of 8.3 kmph. What is the probability that (i) the speeds exceed 65 kmph? (ii) the speeds lie between 40 kmph and 70 kmph? (iii) What is the 85$^{th}$ percentile speed? **06**

**OR**

**Q.4** **(a)** Explain 'Central limit theorem'. Discuss 'Point estimation' and 'Interval estimate' for sampling distribution. **07**

**(b)** A random sample of size n = 100 is taken from a population with σ = 5.1. Given that the sample mean $\bar{x}$ is 21.6, construct a (i) 95% confidence interval, and (ii) 99% confidence interval for the population mean μ. **07**

**Q.5** **(a)** Briefly describe: Null hypothesis, Alternative hypothesis, Single tailed and two tailed tests. **07**

**(b)** A trucking firm suspects the claim that the average life time of certain tyres is at least 28,000km. To check the claim, the firm puts 40 of these tyres on its trucks and gets a mean life time of 27,463 km with a standard deviation of 1,348 km. What can it conclude if the probability of a Type I error is to be at most 0.01? **07**

**OR**

**Q.5** **(a)** Explain Chi-square distribution. What is 'Goodness of fit'? How it is tested? **06**

**(b)** In order to assess whether there is any relationship between the accident severity and the age of drivers, an analysis of previous data yielded the following: **08**

| Accident Severity | Age group of drivers | | |
|---|---|---|---|
| | 18-30 | 30-50 | Above 50 |
| Fatal | 12 | 8 | 16 |
| Grievous Injury | 25 | 14 | 41 |
| Minor Injury | 48 | 35 | 70 |

Test whether there is any significant relationship between the accident severity and the age of drivers?

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