Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–IV(New) EXAMINATION – SUMMER 2016

Subject Code:2141703 **Date:26/05/2016**

Subject Name:Numerical Techniques & Statistical Methods

Time:10:30 AM to 01:30 PM **Total Marks: 70**

Instructions:

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

MARKS

Q.1 **Short Questions** **14**

1 Find the relative error in finding xy if absolute error in x is 0.20 and y is 0.15.

2 Write the order of convergence of Bisection method and Regula – Falsi method.

3 What is meant by diagonally dominant system of linear equations ?

4 Write Lagrange's interpolation formula to find the polynomial.

5 Write an iterative formula using Newton-Raphson method, to find $\sqrt{N}$ where N is a positive number,

6 Give the Trapezoidal rule to find the integration of a function $f(x)$ between the limits x_0 and x_n.

7 Find $P(\overline{A} \cap \overline{B})$ if $P(A) = 0.42$ and $P(B) = 0.37$ where A and B are independent events.

8 Find the probability of answering five True or False statements correctly.

9 It is impossible that for some events A and B, $P(A) = 0.51$ and $P(A \cup B) = 0.47$. Why ?

10 What is the probability of getting a head and a 6 when a coin is tossed and a die is rolled simultaneously?

11 Find $P(A/B)$, if $P(A) = 0.5$, $P(B) = 0.4$ and $P(A \cap B) = 0.12$.

12 What is the probability of getting three aces if three cards are drawn from an ordinary deck of 52 cards in succession without replacement ?

13 Find the value of $F_{0.95}$ for 12 and 15 degrees of freedom.

14 What is main difference between CPM and PERT.

Q.2 **(a)** A civil engineer has measured the height of a floor building as 2950 cm **03**

and the working height of each beam as 35 cm while the true values are 2945 cm and 30 cm, respectively. Compare their absolute and relative errors.

(b) Find a real root of the equation $\cos x = 3x - 1$ correct to four decimal places by iteration method. **04**

(c) Find the dominant eigen value and the corresponding eigen vector of **07**

$$A = \begin{bmatrix} 1 & 6 & 1 \\ 1 & 2 & 0 \\ 0 & 0 & 3 \end{bmatrix}$$

by taking the initial approximation as $\begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix}$.

OR

(c) Solve the following system of equations by Gauss – Seidel method correct upto three decimal places. **07**

$$\begin{aligned} x + y + 54z &= 110 \\ 27x + 6y - z &= 85 \\ 6x + 15y + 2z &= 72 \end{aligned}$$

Q.3 **(a)** Using modified Euler method, find y(0.1) and y(0.2) given **03**

$$\frac{dy}{dx} = x^2 + y^2 \quad , y(0) = 1$$

(b) Find the equation of least degree and passing through the points (-1 , -21) , (1 , 15) , (2 , 12) and (3 , 3) using Newton's divided difference formula. Also find y at x = 0. **04**

(c) Find $y(2)$ if $y(x)$ is the solution of $\frac{dy}{dx} = \frac{1}{2}(x + y)$ given $y(0) = 2,\ y(0.5) = 2.636,\ y(1) = 3.595,\ y(1.5) = 4.968$, using Milne's predictor-corrector method. **07**

OR

Q.3 **(a)** Evaluate $\int_0^1 e^x \, dx$ by Simpson's one-third rule correct to five decimal places. **03**

(b) Using Lagrange's interpolation formula, find $y(10)$ from the following table- **04**

x	5	6	9	11
y	12	13	14	16

(c) Apply the fourth order Runge-Kutta method to find y(0.2) given that $y' = x + y$, $y(0) = 1$. **07**

Q.4 **(a)** If a 1-gallon can of paint covers on the average 513.3 square feet with a standard deviation of 31.5 square feet, what is the probability that the sample mean area covered by a sample of 40 of these 1-gallon cans will be anywhere from 510.0 to 520.0 square feet? **03**

(b) An optical firm purchases glass to be ground into lenses and it is known from past experience that the variance of the refractive index of this **04**

kind of glass is 1.26×10^{-4}. As it is important that the various pieces of glass have nearly the same index of refraction, the firm rejects such a shipment if the sample variance of 20 pieces selected at random exceeds 2.00×10^{-4}. Assuming that the sample values may be looked upon as a random sample from a normal population, what is the probability that a shipment will be rejected even though $\sigma^2 = 1.26\times10^{-4}$?

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

OR

Q.4 **(a)** An industrial engineer intends to use the mean of a random sample of size n = 150 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 the probability 0.99 about the maximum size of his error ? **03**

(b) The dean of a college wants to use the mean of a random sample to estimate the average amount of time students take to get from one class to the next and she wants to be able to assert with 99 % confidence that the error is at most 0.25 minute. If it can be presumed from experience that $\sigma = 1.40$ minutes, how large a sample will she have to take? **04**

(c) The specifications for a certain kind of ribbon call for a mean breaking strength of 180 pounds. If five pieces of the ribbon (randomly selected from different rolls) have a mean breaking strength of 169.5 pounds with a standard deviation of 5.7 pounds, test the null hypothesis $\mu = 180$ pounds against the alternative hypothesis $\mu < 180$ pounds at the 0.01 level of significance. Assume that the population distribution is normal. **07**

Q.5 **(a)** In six determinations of the melting point of tin, a chemist obtained a mean of 232.26 degrees Celsius with a standard deviation of 0.14 degree. If he uses this mean to estimate the actual melting point of tin, what can the chemist assert with 98 % confidence about the maximum error? **03**

(b) A research worker wants to determine the average time it takes a mechanic to rotate the tires of a car and she wants to be able to assert with 95 % confidence that the mean of her sample is off by at most 0.50 minute. If she can presume from past experience that $\sigma = 1.6$ minutes, how large a sample will she have to take? **04**

(c) An architect has been awarded a contract to prepare plans for an urban renewal project. The job consists of the following activities and their estimated times : **07**

Activity	Description	Immediate Predecessors	Time (days)
A	Prepare preliminary sketches	-	2
B	Outline specifications	-	1
C	Prepare drawings	A	3
D	Write specifications	A, B	2

E	Run off prints	C, D	1
F	Have specification	B, D	3
G	Assemble bid packages	E, F	1

a) Draw the network diagram of activities for the project.
b) Indicate the critical path and calculate the total float and free float for each activity.

OR

Q.5 **(a)** A random sample of size n = 100 is taken from a population with $\sigma = 5.1$. Given that the sample mean is $\bar{x} = 21.6$, construct a 95 % confidence interval for the population mean μ. **03**

(b) The mean weight loss of n = 16 grinding balls after a certain length of time in mill slurry is 3.42 grams with a standard deviation of 0.68 gram. Construct a 99 % confidence interval for the true mean weight loss of such grinding balls under the stated conditions. **04**

(c) A research and development is developing a new power supply for a console television set. It has broken the job down into the following : **07**

Job	Description	Immediate Predecessors	Time (days)
A	Dtermine output voltages	-	5
B	Determine whether to use solid state rectifiers	A	7
C	Choose rectifier	B	2
D	Choose filters	B	3
E	Choose transformer	C	1
F	Choose chassis	D	2
G	Choose rectifier mounting	C	1
H	Layout chassis	E, F	3
I	Build and test	G, H	10

a) Draw the network diagram of activities involved in the project and indicate the critical path.
b) What is the minimum completion time for the project?

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