Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–IV(New) • EXAMINATION – WINTER 2016

Subject Code:2141703 **Date:18/11/2016**

Subject Name:Numerical Techniques & Statistical Methods

Time:02:30 PM to 05:30 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 **Answer the following short questions** **14**

1 Evaluate the sum $S=\sqrt{3}+\sqrt{5}+\sqrt{7}$ to 4 significant digits and find its absolute error.

2 If equation $f(x)=0$, is expressed as $x=\phi(x)$ while finding root using iteration method, how $\phi(x)$ should be selected?

3 Show that $E=1+\Delta$

4 Of what integer, should number of subintervals be multiple, so that Simpson's $1/3^{rd}$ and Simpson's $3/8^{th}$ rule both can be applied?

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

6 Using power method, how the smallest eigen value of a square matrix can be found?

7 Write predictor formula used in Milne's method

8 For two events A and B, if $p(A)=0.52$, $p(B)=0.34$, and $p(A\cap B)=0.15$, what is probability of $p(A\cap\overline{B})$?

9 For two independent events A and B, what will be $p(\overline{A}\cap\overline{B})$ if $p(A)=0.25$ and $p(B)=0.44$

10 What is the probability of not getting any 6's in 4 rolls of a balanced die?

11 Among five True or False statements, what is the probability of answering all the statements correctly?

12 Find the value of $F_{0.95}(12,15)$.

13 Write (i) mean and (ii) variance of standard normal distribution.

14 State main differences between CPM and PERT

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

(b) Find a root of the equation $\sin x - 2x + 1 = 0$ correct up to 3 decimal places, using Bisection method. **04**

(c) Apply the power method to find the dominant eigen value of the matrix $A = \begin{bmatrix} 2 & -1 & 0 \\ -1 & 2 & -1 \\ 0 & -1 & 2 \end{bmatrix}$ **07**

OR

(c) Solve the following system of equations using Gauss-Seidel method correct up to three decimal places: **07**

$$8x_1 - 3x_2 + 2x_3 = 20$$
$$4x_1 + 11x_2 - x_3 = 33$$
$$x_1 + x_2 + 4x_3 = 9$$

Q.3 **(a)** Evaluate $\int_0^1 \frac{1}{1+x}\,dx$ by Simpson's one-third rule correct to three decimal places, taking $h = 0.25$ **03**

(b) Values of x (in degrees) and $\sin x$ are given in the following table: **04**

x (in degrees)	$\sin x$
15	0.2588190
20	0.3420201
25	0.4226183
30	0.5
35	0.5735764
40	0.6427876

Determine the value of $\sin 38^\circ$

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

OR

Q.3 **(a)** The table below gives the values of $\tan x$ for $0.10 \le x \le 0.30$: **03**

x	$\tan x$
0.10	0.1003
0.15	0.1511
0.20	0.2027
0.25	0.2553
0.30	0.3093

Find value of $\tan 0.12$

(b) Evaluate $\int_1^2 e^{-\frac{x}{2}} dx$ using (1) Trapezoidal rule **04**

(2) Simpson's $1/3$ rule

(c) Using Milne's predictor-corrector method, find $y(2)$ for **07**

$$y' = \frac{1}{2}(x+y) \text{ where } y(0) = 2, \quad y(0.5) = 2.636,$$
$$y(1) = 3.595, \quad y(1.5) = 4.968.$$

Q.4 **(a)** If the probability is 0.20 that any one person will dislike the taste of a new tooth-paste, what is the probability that 5 of 18 randomly selected persons will dislike it? **03**

(b) If the distribution of the weights of all men travelling by air between Dallas and EI Paso has a mean of 163 pounds and a standard deviation of 18 pounds, what is the probability that the combined gross weight of 36 men travelling on a plane between these two cities is more than 6,000 pounds? **04**

(c) In a labor-management discussion it was brought up that workers at a certain large plant take on the average 32.6 minutes to get to work. If a random sample of 60 workers took on the average 33.8 minutes with a standard deviation of 6.1 minutes, can we reject the null hypothesis $\mu = 32.6$ in favour of the alternative hypothesis $\mu > 32.6$ at the 0.05 level of significance? **07**

OR

Q.4 **(a)** The number of gamma rays emitted per second by a certain radioactive substance is a random variable having Poisson distribution with $\lambda = 5.8$. If a recording instrument becomes inoperative when there are more than 12 rays per second, what is the probability that this instrument becomes inoperative during any given second? **03**

(b) Adding graphite to iron can improve its ductile qualities. If measurements of the diameter of graphite spheres within an iron matrix can be modeled as a normal distribution having standard deviation 0.16, what is the probability that the mean of a sample of size 36 will differ from the population mean by more than 0.06? **04**

(c) Given a random sample of 5 pints from different production lots, we want to test whether the fat content of a certain kind of ice cream exceeds 0.14. What can we conclude at the 0.01 level of significance about the null hypothesis $\mu = 0.14$ if the sample has the mean $\bar{x} = 0.149$ and the standard deviation $\sigma = 0.0042$? **07**

Q.5 **(a)** The claim that the variance of a normal population is $\sigma^2 = 21.3$ is rejected if the variance of a random sample of size 15 exceeds 39.74. What is the probability that the claim will be rejected even though $\sigma^2 = 21.3$? **03**

(b) 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. **04**

(c) A small project is composed of 7 activities, whose time estimates are listed in the table below. Activities are identified by their beginning i and ending j node numbers. **07**

Activity ($i - j$)	Estimated Duration (weeks)		
	Optimistic	Most Likely	Pessimistic
1 – 2	1	1	7
1 – 3	1	4	7
1 – 4	2	2	8
2 – 5	1	1	1
3 – 5	2	5	14
4 – 6	2	5	8
5 – 6	3	6	15

(a) Find the critical path.

(b)What is the expected project length?

(c) Calculate the variance and standard deviation of the project length.

OR

Q.5 (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) Ten bearings made by a certain process have a mean diameter of 0.5060 cm with a standard deviation of 0.0040 cm. Assuming that the data may be looked upon as a random sample from a normal population, construct a 95 % confidence interval for the actual average diameter of bearings made by this process. **04**

(c) The following maintenance job has to be performed periodically on the heat exchangers in a refinery : **07**

Task	Description	Immediate Predecessors	Time (days)
A	Dismantle pipe connections	-	14
B	Dismantle header, closure, and floating head front	A	22
C	Remove tube bundle	B	10
D	Clean bolts	B	16
E	Clean header and floating head front	B	12
F	Clean tube bundle	C	10
G	Clean shell	C	6
H	Replace tube bundle	F,G	8
I	Prepare shell pressure test	D, E, H	24
J	Prepare tube pressure test and make the final reassembly	I	16

(1) Draw a network diagram of activities for the project.

(2) Identify the critical path. What is its length?

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