No. of Printed Pages : 6

Sl. No.

B2.1-R5 : COMPUTER BASED STATISTICAL & NUMERICAL METHODS

DURATION : 03 Hours **MAXIMUM MARKS : 100**

Roll No. : | | | | | | |

Answer Sheet No. : | | | | | | |

Name of Candidate : _____ **; Signature of Candidate :** _____

INSTRUCTIONS FOR CANDIDATES :

- Carefully read the instructions given on Question Paper, Answer Sheet.
- Question Paper is in English language. Candidate has to answer in English Language only.
- **Question paper contains Seven questions. The Question No. 1 is compulsory. Attempt any FOUR Questions from Question No. 2 to 7.**
- **Parts of the same question should be answered together and in the same sequence.**
- **Questions are** to be answered in the **ANSWER SHEET** only, supplied with the Question Paper.
- **Candidate cannot leave the examination hall/ room without signing on the attendance sheet and handing over his/her Answer Sheet to the Invigilator. Failing in doing so, will amount to disqualification of Candidate in this Module/Paper.**
- After receiving the instruction to open the booklet and before answering the questions, the candidate should ensure that the Question Booklet is complete in all respects.

DO NOT OPEN THE QUESTION BOOKLET UNTIL YOU ARE TOLD TO DO SO.

1. (a) Given the number $x = 0.2218$ with its relative error, $\text{Er} = 0.2 \times 10^{-1}$, find the number of correct digits.

(b) The normal rate of infection of certain disease in animals is known to be 25%. In an experiment with 6 animals injected with a new vaccine, find the probability that none of the animals caught infection.

(c) Ten gas cylinders are taken at random from a gas agency. The mean weight of the cylinders found to be 15.8 kg, and the standard deviation = 0.50 kg. Does the sample mean differ significantly from the intended weight of cylinder of 16 kg ?

(d) Solve the following tridiagonal system of linear equations by Gaussian elimination method :

$$x_1 + x_2 = 5$$
$$2x_1 - x_2 + 5x_3 = -4$$
$$3x_2 - 4x_3 = 11$$

(e) Let $I = \int_0^1 \frac{1}{1+x^2} dx$. Determine the value of h for which the approximate value of π (pie), correct to four decimal places, using Trapezoidal rule.

(f) Let X be a continuous random variable with the p.d.f.

$$f(x) = \begin{cases} \frac{1}{\ln 2}\left(\frac{1}{x}\right) & \text{for } 1 < x < 2, \text{ and} \\ 0 & \text{elsewhere} \end{cases}$$

Find the mean and variance of X.

(g) Let X and Y be jointly distributed with the correlation coefficient, r = ½, $\sigma_X = 2$, $\sigma_Y = 3$. Find Var $(2X - 4Y + 3)$.

(7x4)

2. (a) Find all the roots of $\cos x - x^2 - x = 0$ to five decimal places, using the Newton Raphson method.

(b) Solve the following system of equations :

$$4x + y + 2z = 4$$
$$3x + 5y + z = 7$$
$$x + y + 3z = 3$$

Using the Gauss-Seidel iterative method, iterate three times with the initial vector $x^{(0)} = 0$. Also compare with the exact solution.

(10+8)

3. (a) A random variable X is defined as the larger of the scores obtained in two throws of an unbiased, six-sided dice. Show that $\Pr(X = x) = (2x - 1)/36$, $x = 1, 2, ..., 6$.

(b) A continuous random variable X, with mean unity, has probability density function $f_x(x)$ given by :

$$f_x(x) = \begin{cases} a(b-x)^2, & 0 \le x \le b, \\ 0, & \text{otherwise} \end{cases}$$

Find the values of a and b.

(8+10)

4. (a) A telephone exchange receives, on average, 5 calls per minute. Find the probability that :

(i) in a 1-minute period no calls are received;

(ii) in a 2-minute period fewer than 4 calls are received.

(b) In samples of a certain species of rabbits, it was observed that the number of females were 44 out of total 100 rabbits at one location and 86 females out of 200 at the second location. Test whether the proportions of females differ between the two locations. **(8+10)**

5. (a) Determine the difference formula :

$$f''(x_0) = \frac{f(x_0+h) - 2f(x_0) + f(x_0-h)}{h^2},$$

with error $= O(h^2)$. Further, compute f''(0.6) with $h = 0.4$, 0.2 and 0.1 from the following table :

x :	0.2	0.4	0.5	0.6	0.7	0.8	1.0
f(x) :	1.420072	1.881243	2.128147	2.386761	2.657971	2.942897	3.559753

(b) Using Simpson's rule determine the approximate value of the integral

$$\int_0^{\pi} \sin x \, dx$$

Further verify the theoretical error bound. **(10+8)**

6. (a) If the joint density of X and Y is given by :

$$f(x,y) = \begin{cases} (x+y)/3 & \text{for } 0 < x < 1, 0 < y < 2, \\ 0 & \text{otherwise} \end{cases}$$

Find the regression curves of Y on X and of X on Y.

(b) The life time of a certain brand of an electric heater may be considered a random variable with mean 24 months, and standard deviation 10 months. Using Central limit theorem, find the probability that the average life-time of 50 electric heaters exceeds 28 months. **(10+8)**

7. (a) A sample information of different age groups about their liking for a particular model of bike by a company is given as follows :

Choice	**Age groups of informants**			
	Below 20	20-39	40-59	Total
Liked	125	420	60	605
Disliked	75	220	100	395
Total	200	640	160	1000

Can it be concluded that the model appeal independent of the age group of the informants ?

(b) A Chatgpt, while calculating the correlation coefficient between two variables X and Y form 25 pairs of observations, obtained the following results: $n = 25$, $\Sigma X = 125$, $\Sigma X^2 = 650$, $\Sigma Y = 100$, $\Sigma Y^2 = 460$, and $\Sigma XY = 508$.
Later it was discovered that he had copied two pairs of observations as

X	Y
6	14
8	6

instead of

X	Y
8	12
6	8

Obtain the correct value of correlation coefficient between X and Y. **(10+8)**

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SPACE FOR ROUGH WORK

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