Registration No.: | | | | | | | | | | |

337-09/01/2025--58

Total Number of Pages : 02

Course: B.Tech./IDD
Sub_Code: RMA3A001

3rd Semester Back Examination: 2024-25
SUBJECT: Mathematics-III
BRANCH(S): ELECTRICAL & C.E, EEE, ELECTRICAL, ETC, ENV, ELECTRONICS & C.E, IT, MANUTECH, ME, MECH, MINING, MINERAL, METTA, AEIE, AE, CSIT, AG, AERO, AUTO, BIOTECH, BIOMED, CE, CHEM, CIVIL, ECE, ECE, CSEDS, CST, CSEAIML,CSEAI, CSE, CSE, MME, PLASTIC, MMEAM, PT
Time: 3 Hours
Max Marks: 100
Q.Code: R410

Answer Question No.1 (Part-I) which is compulsory, any eight from Part-II and any two from Part-III.
The figures in the right hand margin indicate marks.

Part-I

Q1 **Answer the following questions:** **(2 x 10)**

a) Write the limitations of Lagrange's interpolation method.
b) What is Doolittle method? Explain with an example.
c) Write the first order relation between forward and backward differences?
d) Solve $y' = x + y;\ y(0) = 1$ by Euler's method with $h = 0.1$.
e) Determine L and U to compute the LU factorization of $A = \begin{pmatrix} 2 & 1 & 1 \\ 4 & 5 & 2 \\ 2 & -2 & 0 \end{pmatrix}$.
f) Define expectation.
g) Define conditional probability with a suitable example.
h) Compute the probability of obtaining at least two 6 in rolling a fair die 4 times.
i) Define correlation coefficient. What can you say about its range?
j) Define test of Hypothesis. Give one example.

Part-II

Q2 **Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)** **(6 × 8)**

a) Solve the system of equation $\begin{pmatrix} 3 & 2 & 1 \\ 2 & 3 & 2 \\ 1 & 2 & 2 \end{pmatrix}\begin{pmatrix} x_1 \\ x_2 \\ x_3 \end{pmatrix} = \begin{pmatrix} 5 \\ 6 \\ -10 \end{pmatrix}$ using Cholesky method.

b) If $f(x) = \frac{1}{x^2}$, find the divide difference $f[x_1, x_2, x_3, x_4, x_5]$.

c) Find the smallest positive real root of the $\tan x + \tanh(x) = 0$ by using Bisection method.

d) Evaluate $\int_1^{1.4} e^{-x^2} dx$ dividing the range in to 4 equal parts by Simpson's $\frac{1}{3}rd$ rule.

e) Using improved Euler's method find y at $x = 0.1$ *and* $x = 0.2$, given $y' = y - \frac{2x}{y}$, $y(0) = 1$ with h = 0.1.

f) Find the mean of the random variable X whose probability density is given by

$$f(x) = \begin{cases} x\,; 0 < x < 1 \\ 2 - x; 1 \le x < 2 \\ 0;\ elsewhere \end{cases}.$$

g) Find the mean and variance of Exponential distribution.

h) A fair die is tossed. Find the probability of getting a 4, 5, or 6 on the first toss and a 1, 2, 3, or 4 on the second toss.

i) Find the mode of Normal distribution.

j) Find a formula for the probability distribution of the total number of heads obtained in four tosses of a balanced coin.

k) Find the regression line y on x for the data

$$(-2,3.5), (0,1.5), (2,1), (4,-0.5), (6,-1).$$

l) Write a short note on testing of hypothesis.

Part-III

Only Long Answer Type Questions (Answer Any Two out of Four)

Q3 Solve the system of equations $Ax = b$, where $A = \begin{bmatrix} 2 & 1 & 1 & -2 \\ 4 & 0 & 2 & 1 \\ 3 & 2 & 2 & 0 \\ 1 & 3 & 2 & -1 \end{bmatrix}$, $b = \begin{bmatrix} -10 \\ 8 \\ 7 \\ -5 \end{bmatrix}$, **(16)**

Using the LU decomposition method. Take all the diagonal elements of L as 1. Also find A^{-1}.

Q4 **a)** Using fourth order Runge-Kutta method, find $y(1)$ if $y' = y - x^2 + 1, y(0) = 0.5, h = 0.2$. **(8x2)**

b) Evaluate $\int_2^3 \frac{cos2x}{1+sinx} dx$ by Gauss-Legendre 3-point quadrature formula.

Q5 **a)** Compute the mean and variance of hyper geometric distribution. **(8x2)**

b) State and prove Baye's theorem.

Q6 **a)** The pdf of a random variable X is assumed to be of the form $f(x) = cx^{\alpha}, 0 \le x \le 1$ for some number and constant c. If $X_1, X_2, ..., X_n$ is a random sample of size n, find the maximum likelihood estimate of α. **(8x2)**

b) A sample of size 25 from a normal population with variance 81, produced a mean of 81.2. Find a 0.95 level of confidence interval for the mean. What is the probability that the true mean will lie within a $\sigma / 2$ limit of the average.

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