Registration No.:

3rd Semester Back Examination: 2025-26
SUBJECT: MATHEMATICS - III
BRANCH(S): AE, AEIE, AERO, AME, AUTO, BIOTECH, CIVIL, CSE, CSEAI, CSEAIML, CSEDS, CSIT, CST, ECE, EEE, ELECTRICAL, ELECTRICAL & C.E, ELECTRONICS & C.E, ETC, IT, MANUTECH, MECH, METTA, MINERAL, MINING, MME, MMEAM, PLASTIC
Time: 3 Hours
Max Marks: 100
Q.Code: U496
Answer Q1 (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 iterative formula for the Newton-Raphson method to find a root of $f(x) = 0$.
  b) Discuss the difference between Doolittle method and Crout method?
  c) What is the geometrical interpretation of the Trapezoidal Rule?
  d) Using modified Euler method, find y (0.6) if h = 0.3 and $y' = x^2 + y^2, y(0) = 1$
  e) Define conditional probability with a suitable example.
  f) State the Baye's theorem.
  g) If X follows a Binomial Distribution $B(n, p)$, write the expressions for its Mean and Variance.
  h) Write 2 properties of correlation coefficients.
  i) Define the probability density function of a Normal Distribution with mean μ and variance σ^2.
  j) Differentiate between a Null Hypothesis (H_0) and an Alternative Hypothesis (H_1) .

Part-II

Q2 **Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)** (6 x 8)
  a) How many iterations is required to approximation a root f(x) = 0 in [a,b], for which error less than 10^{-5} in bisection method?
  b) Using Newton's divided difference interpolation, find y (10) given that y (5) = 12, y (6) = 13, y (9) = 14, y (11) = 16.
  c) Solve the system of equations using Crout's Method (LU Decomposition): $x + y + z = 1, 3x + y - 3z = 5, x - 2y - 5z = 10$.
  d) Evaluate $\int_0^6 \frac{1}{1+x^2} dx$ using Simpson's $\frac{3}{8}$ Rule.
  e) Using the Runge-Kutta method of order two, find y (0.6) if h = 0.1 for $y' = x^2 + y^2, y(0) = 1$.
  f) Evaluate $\int_0^1 (1 + \frac{\sin x}{x}) dx$ correct to 3 decimal places using trapezoidal rule.

g) A bag contains 4 white and 6 black balls. Two balls are drawn at random without replacement. Find the probability that both balls are black.

h) A random variable X has the following probability distribution:

X	0	1	2	3	4
$P(X)$	k	3k	5k	7k	9k

Then find the value of k and calculate $P(X \geq 2)$.

i) If 3% of the electric bulbs manufactured by a company are defective, find the probability that in a sample of 100 bulbs, exactly 4 bulbs are defectives. (Use Poisson Distribution)

j) In a normal distribution, 31% of the items are under 45 and 8% are over 64. Find the mean and standard deviation of the distribution.

k) Calculate the Coefficient of Correlation between X and Y from the following data:

X	1	2	3	4	5
Y	2	5	11	8	14

l) Find the Maximum Likelihood Estimator (MLE) for the parameters Binomial distribution.

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

Q3 **a)** Solve the system of linear equations $10x + 2y + z = 9, 2x + 20y - 2z = -44, -2x + 3y + 10z = 22$ using the Gauss-Seidel Method. Perform 3 iterations starting with initial guess $(0,0,0)$. **(8 x 2)**

b) Using Newton-Raphson method find the smallest positive real root of the equation $x^4 - 3x^2 + x - 10 = 0$.

Q4 **a)** Apply Euler's Modified Method to find the value of $y(0.2)$ given $\frac{dy}{dn} = x + \sqrt{y}, \ y(0) = 1$, taking step size $h = 0.1$. **(8 x 2)**

b) Evaluate the integral $\int_0^1 e^{-x^2} \ by \ using$ Gauss-Legendre 2-point integration formula.

Q5 **a)** The joint probability density function of two random variables $X \ and \ Y$ is given by $f(x,y) = c(xy + e^x)$ for $0 < x < 1, 0 < y < 1$ and 0 otherwise. Find the value of c and the marginal density functions of $X \ and \ Y$. **(8 x 2)**

b) State and prove Chebyshev's Inequality for a random variable X with mean μ and variance σ^2.

Q6 **a)** Compute and interpret the correlation coefficient for the following data of 6 students selected at random: **(8 x 2)**

Mathematics grade	70	92	80	74	65	83
English grade	74	84	63	87	78	90

b) Obtain the lines of regression for the following data and estimate $Y \ when \ X = 10$

X	1	2	3	4	5
Y	3	4	5	7	11