Code: 20A54402

R20

B.Tech II Year II Semester (R20) Regular & Supplementary Examinations April/May 2024

NUMERICAL METHODS & PROBABILITY THEORY

(Common to EEE and ME)

Time: 3 hours | Max. Marks: 70

PART – A

(Compulsory Question)

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1 Answer the following: (10 X 02 = 20 Marks)

(a) Write the difference between Bisection, Regula Falsi and Newton Rapson method. 2M

(b) Explain the rate of convergence. 2M

(c) Show that $((1+\Delta)(1-\nabla) \equiv 1)$. 2M

(d) Evaluate the $f(x)$ $at\ x = 4$ by using Lagrange's interpolation formula: 2M

x :	3	5
$y = f(x)$:	6	24

(e) Evaluate the value of y (1) by Taylor's series method for the differential equation $\frac{dy}{dx} = -x\,y^2, y(0) = 1$. 2M

(f) Discuss Trapezoidal rule for integration. 2M

(g) The distribution function of a random variable X is given by 2M

$$F(X) = \begin{cases} 1-(1+x)\,e^{-x} & x \geq 0 \\ 0 & x < 0 \end{cases}$$

Determine the density function of random variable X.

(h) A die is thrown. Find the probability of getting a composite number. 2M

(i) A manufacturer knows that the razor blades he makes contain on an average 0.5% of defectives. He packs them in packets of 5. What is the probability that a packet picked at random will contain 3 or more faulty blades? 2M

(j) Suppose that X has a Poisson distribution. If $P(X=2) = \frac{2}{3}P(X=1)$. Find $P(X=0)$. 2M

PART – B

(Answer all the questions: 05 X 10 = 50 Marks)

2 Solve the following equations by Gauss-Jorden method: 10M

$2x - 3y + z = -1$; $x + 4y + 5z = 25$ and $3x - 4y + z = 2$.

OR

3 Calculate the root of the equation $x\,log_{10}x = 1.2$ using the Newton Rapson method correct to four decimal places. 10M

4 Find the value of e^x when $x = 0.644$ by using Stirling's formula: 10M

x :	0.61	0.62	0.63	0.64	0.65	0.66	0.67
$y = e^x$:	1.840431	1.858928	1.877610	1.896481	1.915541	1.934792	1.954237

OR

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5 Evaluate f(1.235) using backward interpolation formula from the following table. 10M

x :	1.00	1.05	1.10	1.15	1.20	1.25
f(x) :	0.682689	0.706282	0.728668	0.749856	0.769861	0.788700

6 Apply Modified Euler's method to find an approximate value of y when x = 0.3, given that $\frac{dy}{dx} = y\,x$ and y = 2 when x = 1. Taking h = 0.2. 10M

OR

7 Use Runge-kutta method of fourth order to approximate y when x = 1.4, given that $\frac{dy}{dx} = y + x$ and y = 1 when x = 0. 10M

8 A businessman goes to hotels X, Y, Z, 20%, 50%, 30% of the time respectively. It is known that 5%, 4%, 8% of the rooms in X, Y, Z hotels have faulty plumbings. What is the probability that business man's room having faulty plumbing is assigned to hotel Z? 10M

OR

9 A can hit a target 3 times in 5 shots, B hits target 2 times in 5 shots, C hits target 3 times in 4 shots. Find the probability of the target being hit when all of them try. 10M

10 Determine the mean and variance of Poisson Distribution. 10M

OR

11 In a normal distribution 31% of items are under 45 and 8% are over 64. Obtain the mean and standard deviation of the distribution. [Area 0.19 is Z = 0.496 and Area 0.42 is Z = 1.405]. 10M

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Code: 20A54402 | **R20**

B.Tech II Year II Semester (R20) Regular & Supplementary Examinations August/September 2023

NUMERICAL METHODS & PROBABILITY THEORY

(Common to EEE and ME)

Time: 3 hours | Max. Marks: 70

PART – A

(Compulsory Question)

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1 Answer the following: (10 X 02 = 20 Marks)

(a) Solve the equation e^x- x^2 = 0 using the Regula Falsi method. Use an initial bracket [a, b] = [1, 2]. 2M

(b) Solve the system of algebraic equations using the Gauss-Seidel method: $4x + y = 5$, $3x + 7y = 10$.

(c) State Newton's backward interpolation formula. 2M

(d) State Lagrange's interpolation formula. 2M

(e) Apply Simpson's 1/3 Rule to approximate the value of the definite integral $\int_0^2 (3x^3 - 2x^2 + 5x)\mathrm{d}x$. 2M

(f) Solve the initial value problem (IVP) using the Modified Euler's method: $\frac{dy}{dx}$ = x^2+y, y(0) = 1, over the interval [0, 0.2] with a step size of h = 0.1. 2M

(g) State the three probability axioms that form the foundation of probability theory. 2M

(h) Explain the addition law of probability and when it is applicable. 2M

(i) Define the uniform distribution and explain its key properties. 2M

(j) Explain the exponential distribution and its relevance in modeling certain types of real-world phenomena. 2M

PART – B

(Answer all the questions: 05 X 10 = 50 Marks)

2 Using Regula falsi position method find the positive root of xe^x=2. 10M

OR

3 Consider the function f(x) = x^3 - 2x - 5. Use the bisection method to find a root of the equation f(x) = 0 in the interval [1, 2] correct to five decimal places. 10M

4 Use Newton's backward interpolation formula to estimate the value of f(2.5) based on the following data points: 10M

x:	2.0	2.2	2.4	2.6	2.8
f(x):	2.5	3.0	3.5	4.0	4.5

OR

5 (a) A second degree polynomial passes the points (1, -1), (2, -1), (3, 1), (4, 5). Find the Polynomial f(x). Also find (1.2).

(b) The value of x and e^x are give in the table below:

x	0.61	0.62	0.63	0.64	0.65
e^x	1.840	1.858	1.877	1.896	1.934

Find the approximate value of e^x at x = 0.644 by using Bessel's formula (upto 4rd differences). Choose x_0= 0.63.

6 Use the Modified Euler's method to approximate the solution of the initial value problem (IVP): $\frac{dy}{dx}$ = $x^2 + y$, y(0) = 1, over the interval [0, 0.4] with a step size of h = 0.2. 10M

OR

7 Solve the initial value problem (IVP) using the fourth-order Runge-Kutta method: $\frac{dy}{dx}$= x^2+ y, y(0) = 1, over the interval [0, 0.6] with a step size of h = 0.2. 10M

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8 (a) If X and Y are independent variables prove that E(X+Y) = E(X) +E(Y) and E (XY) = E(X) E (Y). 5M

(b) For a discrete random variable X with the following probability distribution: 5M

x	0	1	2
P(x)	0.2	0.3	0.5

(i) Calculate the expected value of X (ii) Calculate the variance of X.

OR

9 For a continuous random variable Y with the probability density function (PDF): f(y) = $3y^2$, $0 \leq y \leq 1$. 10M

(i) Show that the given function is a valid PDF (ii) Calculate the cumulative distribution function (CDF) of Y (iii) Calculate the probability that Y takes a value between 0.2 and 0.6.

10 Consider a binomial distribution with parameters n = 8 and p = 0.6. 10M

(i) Calculate the probability mass function (PMF) for each possible value of X (ii) Find the mean and variance of the distribution.

OR

11 Suppose a random variable X follows a normal distribution with a mean of 70 and a standard deviation of 5. 10M

(i) Calculate the probability that X is between 65 and 75 (ii) Find the value of X that corresponds to the 90th percentile.

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