Register Number:……..

KUMARAGURU college of technology
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B.E/B.TECH DEGREE EXAMINATIONS: NOV /DEC 2024

(Regulation 2018)

Fourth Semester

COMMON TO AERO/AUTO/CIVIL/MECH/MCE/EEE

U18MAT4101**:** Numerical Methods and Probability

COURSE OUTCOMES

CO1: Apply various numerical techniques for solving non-linear equations and systems of linear equations.
CO2: Analyze and apply the knowledge of interpolation and determine the integration and differentiation of the functions by using the numerical data.
CO3: Predict the dynamic behaviour of the system through solution of ordinary differential equations by using numerical methods.
CO4: Solve PDE models representing spatial and temporal variations in physical systems through numerical methods.
CO5: Apply the concepts of probability to random variables.
CO6: Construct probabilistic models for observed phenomena through distributions which play an important role in many engineering applications.

Time: Three Hours **Maximum Marks: 100**

Answer all the Questions:-

PART A (10 x 2 = 20 Marks)

(Answer not more than 40 words)

1. Write down the Newton-Raphson formula to find the square root of positive number 'N' and hence find $\sqrt{5}$. CO1 [K_3]

2. Find the inverse of the matrix $A = \begin{bmatrix} 1 & 3 \\ 2 & 5 \end{bmatrix}$ using Gauss Jordan method. CO1 [K_3]

3. State Lagrange's inverse interpolation formula for unequal intervals. CO2 [K_1]

4. Form the difference table from the following data: CO2 [K_2]

x	20	23	26	29
y	0.3420	0.3907	0.4384	0.4848

5. Solve $\frac{dy}{dx} = x + y$ given y(1) = 0, and get y(1.1) by Taylor series Method. CO3 [K_2]

6. Compute y (0.2) by Euler's method, given $y' = x + y, y(0) = 1$. CO3 [K_3]

7. State Standard five-point formula and Diagonal five-point formula for solving Laplace equation. CO4 [K_1]

8. Write the explicit formula to solve the one dimensional wave equation $a^2 u_{xx} = u_{tt}$. CO4 [K_1]

9. Check whether the function $f(x) = \frac{5-x^2}{6}$ $for\ x = 0,1,2,3$ can define a probability distribution and explain your answer. CO5 [K2]

10. The mean and SD of a binomial distribution are 6 and 2 respectively. Determine the distribution. CO6 [K2]

Answer any FIVE Questions: -
PART B (5 x 16 = 80 Marks)
(Answer not more than 400 words)

11. a) Find the real positive root of $3x - \cos x - 1 = 0$ by Newton-Raphson method correct to 5 decimal places. 8 CO1 [K3]

b) Solve $x + y + 54z = 110; 27x + 6y - z = 85; 6x + 15y + 2z = 72$ by Gauss -Seidel method. 8 CO1 [K3]

12. a) Evaluate the numerically largest eigen / value of $A = \begin{bmatrix} 25 & 1 & 2 \\ 1 & 3 & 0 \\ 2 & 0 & -4 \end{bmatrix}$ and the corresponding eigen / vector. 8 CO1 [K5]

b) Find the values of f(2), f(8) and f(15) using Newton's divided difference formula 8 CO2 [K3]

x	4	5	7	10	11	13
f(x)	48	100	294	900	1210	2028

13. a) The population of a certain town is shown in the following table. Find the rate of growth of population in 1931 and 1971. 8 CO2 [K4]

year	1931	1941	1951	1961	1971
population	40.62	60.80	79.95	103.56	132.65

b) Evaluate $\int_0^{\pi} \sin x\, dx$ using trapezoidal rule, Simpson's rule by dividing the range into ten equal parts. 8 CO2 [K5]

14. a) Using Runge Kutta method of fourth order, find y (0.8) if $y' = y - x^2, y(0.6) = 1.7379$, h=0.2. 8 CO3 [K3]

b) Find y (2) if y(x) is the solution of $\frac{dy}{dx} = \frac{1}{2}(x + y)$ given y (0) = 2, y (0.5) =2.636, y (1) = 3.595 and y(1.5) = 4.968 by Milne's method. 8 CO3 [K5]

15. a) Solve $\frac{\partial^2 u}{\partial x^2} - 2\frac{\partial u}{\partial t} = 0$ given u (0, t) = 0, u (4,t) = 0, u(x,0) = x(4-x), h = 1. Find the values of u up to t = 5. 8 CO4 [K3]

b) Solve $\nabla^2 u = -10(x^2 + y^2 + 10)$ over the square mesh with sides $x = 0, y =$ 8 CO4 [K5]

$0, x = 3, y = 3$ with u = 0 on the boundary and mesh length 1 unit.

16. a) A random variable X has the following probability distribution — 8 — CO5 — [K_3]

X	0	1	2	3	4	5	6	7
P(X)	0	K	2K	2K	3K	K^2	$2K^2$	$7K^2+K$

Find (i) K? (ii) Find the Cumulative Distribution Function (iii) Find the mean and variance.

b) The weekly wages of 1000 workmen are normally distributed around a mean of Rs.70 with a S.D of Rs.5. Estimate the number of workers whose weekly wages will be — 8 — CO6 — [K_4]

i) Between Rs.69 and Rs.72
ii) Less than Rs.69
iii) More than Rs.72.

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