



B.E/B.TECH DEGREE EXAMINATIONS: APRIL / MAY 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)

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|---|-----|-------------------|
| 1. State the condition for the convergence of the iteration method. | CO1 | [K ₂] |
| 2. Get the iterative formula to find the value of square root of N, using Newton's Raphson method. | CO1 | [K ₃] |
| 3. State Lagrange's inverse interpolation formula. | CO2 | [K ₁] |
| 4. Give under what condition Simpson's rule are used to evaluate integrals. | CO2 | [K ₂] |
| 5. Explain multi step method. | CO3 | [K ₁] |
| 6. Give the Runge Kutta formula to solve the second order differential equation. | CO3 | [K ₂] |
| 7. Classify one dimensional heat equation and give the Bender Schmidt explicit formula to solve it. | CO4 | [K ₂] |
| 8. Give numerical solution formula to solve poisson equation. | CO4 | [K ₂] |

9. A continuous random variable X follows the probability law $f(x)=cx^2, 0 \leq x \leq 1$. Determine the value of c. CO5 [K₃]
10. Define poisson distribution. CO6 [K₁]

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 $2x^3 - 3x - 6 = 0$ correct to 4 decimal places using Newton's method. 8 CO1 [K₃]
- b) Find the numerically largest Eigenvalue & Eigenvector by power method for the matrix $A = \begin{pmatrix} 25 & 1 & 2 \\ 1 & 3 & 0 \\ 2 & 0 & -4 \end{pmatrix}$ 8 CO1 [K₃]
12. From the following table of half-yearly premium for policies maturing at different ages, estimate the premium for policies maturing at age 46 and 63. 16 CO2 [K₃]

Age	x:	45	50	55	60	65
Premium	y:	114.84	96.16	83.32	74.48	68.48

13. a) A rod is rotating in a plane. The following table gives the angle θ (in radians) through which the rod has turned for various values of time t (seconds). Calculate the angular velocity and angular acceleration of the rod at t=0.6 seconds. 8 CO2 [K₃]

t	0	0.2	0.4	0.6	0.8	1
θ	0	0.12	0.49	1.12	2.02	3.20

- b) The velocity v of a particle moving in a straight line covers a distance x Find the time taken to reverse the distance in time t. They are related as follows: 8 CO2 [K₃]

t	0	2	4	6	8	10	12
v	4	6	16	34	60	94	136

14. a) Using Taylor's series method, compute $y(0.2)$ and $y(0.4)$, correct to 4 decimal places given $\frac{dy}{dx} = 1 - 2xy$ and $y(0)=0, h=0.2$. 8 CO3 [K₃]
- b) Given $y' + xy^2 + y = 0, y(0) = 1$, find the value of $y(0.1)$, by using Runge-Kutta method of fourth order, with $h = 0.1$. 8 CO3 [K₂]

15. a) Evaluate the pivoted values of the following equation taking $h=1$ and upto one half of the period of the oscillation $16u_{xx} - u_t = 0$ 8 CO4 [K₃]
 $u(0,t) = u(5,t) = 0, u_t(x,0) = 0, u(x,0) = x^2(5-x)$
- b) Using Crank Nicholson method, solve $u_{xx} = 16u_t, 0 < x < 1, t > 0$ subject to 8 CO4 [K₄]
 $u(x,0) = u(0,t) = 0$ and $u(1,t) = 100t$. Compute u for one step, take $h = \frac{1}{4}$.
16. a) The chances of three candidates A, B and C becoming the manager of a company are in the ratio 3: 5: 4. The probability that a special bonus scheme will be introduced by them if selected are 0.6, 0.4 and 0.5 respectively. If the bonus scheme is introduced, what is the probability that B has become the manager? 8 CO5 [K₃]
- b) There is rain fall in a certain place for 10 days in every thirty days. Find the probability that 8 CO6 [K₃]
 (i) There is rain fall on atleast 3 days of a given week.
 (ii) The first four days of a given week will be wet and the remaining days are dry.
