A **Reg. No. :** | | | | | | | | | | |

Question Paper Code: 93023

B.E./B.Tech. DEGREE EXAMINATION, DEC 2021

Third Semester

Electronics and Communication Engineering

19UMA323- Numerical Analysis and Linear Algebra

(Regulation 2019)

Duration: Three hours Maximum: 100 Marks

Answer All Questions

PART A - (10x 1 = 10 Marks)

1. Trapezoidal rule is so called, because it approximates the integral by the sum of _______trapezoids CO6-U

   (a) n (b) n+1 (c) n-1 (d) 2n

2. Gaussian two point quadrature formula is exact for polynomials up to degree ______ CO6- U

   (a) 1 (b) 2 (c) 3 (d) 5

3. Taylor Series method will be very useful to give some _____ values for RK, Milne's and Adam's methods CO6- U

   (a) initial (b) final (c) intermediate (d) two

4. _____ prior values are required to predict the next value in Adam's method CO6- U

   (a) 1 (b) 2 (c) 3 (d) 4

5. PDE of second order, if $B^2 - 4AC < 0$ then CO6- U

   (a) parabolic (b) elliptic (c) hyperbolic (d) Non homogeneous

6. Bender-Schmidt recurrence equation is valid if λ= CO6- U

   (a) $\frac{1}{2}$ (b) $\frac{1}{3}$ (c) $\frac{1}{4}$ (d) 1

7. In a vector space V, for every $x, y \in$ V then the property $x + y = y + x$ is known as _________ CO6- U

(a) commutative (b) associative (c) identity (d) inverse

8. If T: V→W be linear transformation then T(0) = _________ CO6- U

(a) 0 (b) 1 (c) 2 (d) 3

9. In a vector sapace V , if $\langle x, y \rangle = \langle y, z \rangle$ then _________ CO6- U

(a) $y = z$ (b) $y \neq z$ (c) $y = -z$ (d) none of these

10. The norm of $(3, -4, 0)$ is _________ CO6- U

(a) 3 (b) -4 (c) 0 (d) 5

PART – B (5 x 2= 10Marks)

11. Evaluate $\int_1^2 \frac{dx}{1+x^2}$ with 2 equal intervals using trapezoidal rule CO1- App

12. Using Euler's method find y(0.2) given $\frac{dy}{dx} = y + e^x$, y(0) =0 CO2- App

13. Write down the Standard Five Point formula and Diagonal Five Point formula to find the numerical solution of the Laplace equation $u_{xx} + u_{yy} = 0$ CO3- U

14. Verify the commutative property for a vector space $R \times R$ over R under addition defined by $(x_1, x_2) + (y_1, y_2) = (x_1 + y_1, x_2 + y_2)$ CO4- App

15. Find the norm of $(2, 1, -1)$ in $V_3(R)$ with standard inner product. CO5 App

PART – C (5 x 16= 80Marks)

16. (a) (i) Evaluate $\int_0^6 \frac{dx}{1+x^2}$ with 6 equal intervals by (a) Trapezoidal rule CO1-App (8)

(b) Simpson's $\frac{1}{3}$ rule.

(ii) Using Romberg's method Evaluate $\int_0^1 \frac{dx}{1+x^2}$ correct to 4 decimal places CO1-App (8)

Or

(b) (i) Evaluate $\int_0^{\pi/2} \sin x \, dx$ by dividing the range into 10 equal parts CO1 -App (8)

(i) Trapezoidal rule (ii) Simpson's $\frac{1}{3}$ rule

(ii) Evaluate $\int_0^2 \frac{dx}{4+x^2}$ using Romberg's method correct to 4 decimal places. CO1 -App (8)

17. (a) Using R-K method of fourth order, solve $\frac{dy}{dx} = \frac{y^2 - x^2}{y^2 + x^2}$ with $y(0) = 1$ at $x = 0.2$ CO2 -App (16)

Or

(b) Using R.K Method of 4th order, solve $\frac{dy}{dx} = x + y^2$ with $y(0) = 1$ at $x = 0.1$ CO2 -App (16)

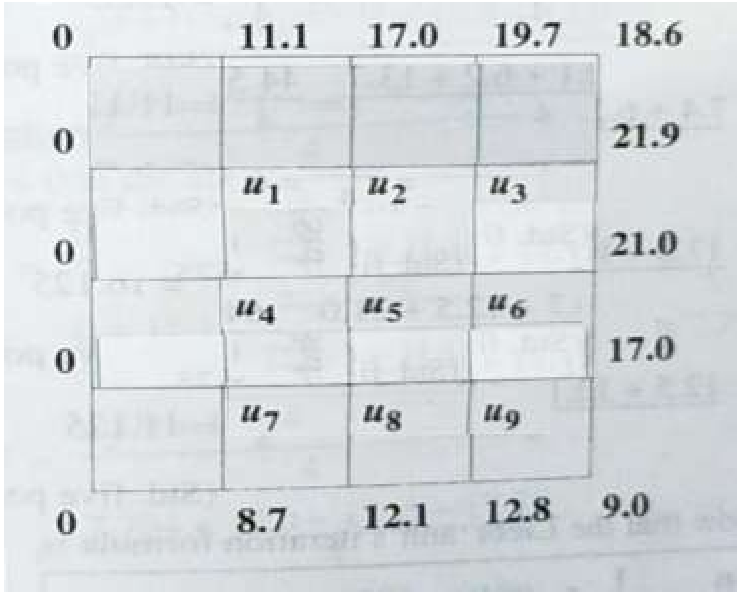
18. (a) Solve $\frac{\partial^2 u}{\partial x^2} = 16 \frac{\partial u}{\partial t}$ in $0 \le x \le 1$, $t \ge 0$ u(0,t) = 0 , u(1,t) = 100t CO3- App (8)

u(x,0) = 0 find the values of u for 1 time step function with $h = \frac{1}{4}$ by Crank-Nicholson's difference method.

Solve $\frac{\partial^2 u}{\partial x^2} = 2 \frac{\partial u}{\partial t}$, u(0,t) = 0 , u(4,t) = 0 , u(x,0) = x(4 - x) .Take h = 1 and find the values of u up to t = 5 using Bender-Schmidt's difference equation. CO3- App (8)

Or

(b) Solve the Laplace equation $u_{xx} + u_{yy} = 0$ at the nine mesh points of the square given below. The values of u at the boundary are specified in the figure CO3- App (16)



19. (a) If $T:R^2 \rightarrow R^3$ be linear transformation defined by $T(a_1, a_2) = (a_1 + a_2, 0, 2a_1 - a_2)$ then find nullity(T) ,rank(T), Is T one-to-one? Is T onto? Also check the rank nullity theorem. CO4-App (16)

Or

(b) If T: $R^2 \rightarrow R^3$ be linear transformation defined by $T(a_1, a_2) = (a_1 + a_2, a_1 - a_2, a_2)$ then find nullity(T) ,rank(T), Is T one-to-one? Is T onto? Also check the rank nullity theorem. CO4 -App (16)

20. (a) Apply Gram-Schmidt process to construct an orthonormal basis for $V_3(R)$ with the standard inner product for the basis $\{v_1, v_2, v_3\}$ where $v_1 = (1,0,1)$, $v_2 = (1,3,1)$ and $v_3 = (3,2,1)$ CO5- App (16)

Or

(b) (i) Show that the following function defines an inner product on $V_2(R)$ where $x = (x_1, x_2)$ and $y = (y_1, y_2)$ and CO5- App (8)

$$\langle x, y \rangle = x_1 y_1 + 2x_2 y_1 + 2x_1 y_2 + 5x_2 y_2$$

(ii) If $x = (1 + i, 2, i)$ and $y = (3i.2 + 3i, 4)$ then verify triangle inequality. CO5- App (8)