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

Question Paper Code: 93023

B.E./B.Tech. DEGREE EXAMINATION, NOV 2022

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. Truncation error in Simpson's rule is of the order ___ CO6-U

   (a) h^3 (b) h^2 (c) h^4 (d) 0

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. For any two vectors x and y in an inner product space V , $|\langle x, y\rangle| \le$ _________ CO6- U

(a) $\|x\| + \|y\|$ (b) $\|x\|\|y\|$ (c) $\|x\| - \|y\|$ (d) $\|x\|/\|y\|$

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. Apply three –point Gaussian quadrature formula to evaluate $\int_{-1}^{1} \cos x dx$ 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 vectors (1,0,0),(1,1,0) in R^3 is a basis of R^3 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) Find $\frac{dy}{dx}, \frac{d^2y}{dx^2}$ at x=1.5 CO1-App (8)

x	1.5	2.0	2.5	3.0	3.5	4.0
y	3.375	7.000	13.625	24.000	38.875	59.000

(ii) Using three point Gaussian Quadrature Evaluate $\int_{0.2}^{1.5} e^{-x^2} dx$ 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) (i) Using Taylor's series method find y(0.1) for $\frac{dy}{dx} = x^2 y - 1$, y(0) = 1 — CO2 -App (8)

(ii) Given $\frac{dy}{dx}$ =1+ y^2, y(0) =0 , y(0.2) = 0.2027 , y(0.4) =0.4228, y(0.6) = 0.6841 evaluate y(0.8) by Adams – Bash forth Method. — CO2 -App (8)

Or

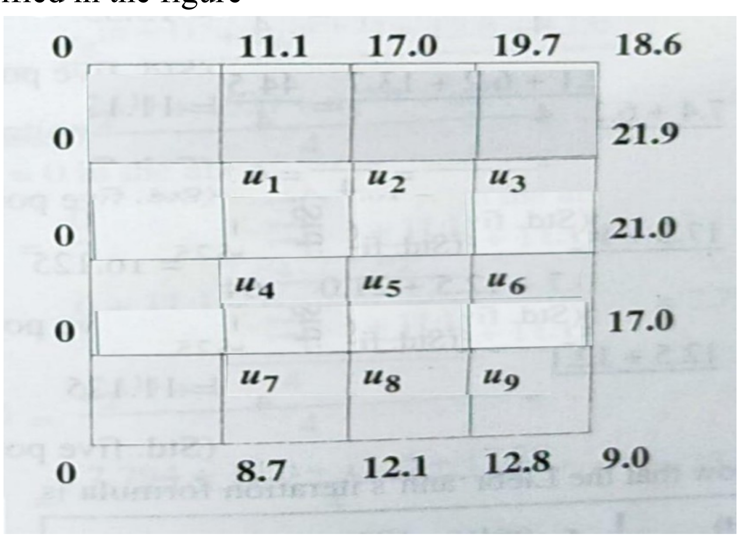
(b) Using R.K Method of 4th order, solve $\frac{dy}{dx} = x + y^2$ with $y(0) = 1$ at $x = 0.1$ — CO2 -App (16)

18. (a) (i) 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
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. — CO3- App (8)

(ii) 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 $T:R^2 \to R^3$ 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)	(i) Find the dimension of the subspace spanned by the vectors (1,2,-3) ,(0,0,1),(-1,2,1) in $V_3(R)$.	CO4 -App	(8)
		(ii) Verify the vectors (2,1,0) , (-3,-3,1) ,(-2,1,-1) in R^3 is a basis of R^3	CO4 -App	(8)
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 $\langle x, y \rangle = 6x_1y_1 + 7x_2y_2$	CO5- App	(8)
		(ii) If $x = (2, 1+i, i)$ and $y = (2-i, 2, 1+2i)$ then verify Schwarz's inequality.	CO5- App	(8)