



CBCS SCHEME

USN

21MAT21

Second Semester B.E. Degree Examination, June/July 2023

Advanced Calculus and Numerical Methods

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

- 1 a. Evaluate triple integral...
b. Evaluate double integral...
c. Prove that pi(1/2) = sqrt(pi)...

OR

- 2 a. Evaluate double integral of e^-(x^2+y^2) dx dy...
b. Find area between parabolas y^2 = 4ax and x^2 = 4ay...
c. Show that beta(m,n) = (Gamma(m)Gamma(n))/Gamma(m+n)...

Module-2

- 3 a. Find directional derivative of phi = x^2yz + 4xz^2...
b. If F = grad(xy^3z^2), find div F and curl F...
c. If F = (x+y+az)i + (bx+2y-z)j + (x+cy+2z)k, find a,b,c...

OR

- 4 a. If F = xyi + yzj + zxk, evaluate surface integral...
b. Using Green's theorem, evaluate line integral...
c. Apply Stoke's theorem to evaluate surface integral...

Module-3

- 5 a. Form a partial differential equation by eliminating arbitrary function from Z = f(x+at) + g(x-at)...
b. Solve partial differential equation...
c. Derive one dimensional heat equation.

OR

- 6 a. Form a partial differential equation by eliminating arbitrary constant from Z = (x-a)^2 + (y-b)^2...
b. Solve (y-z)p + (z-x)q = x-y...
c. Solve partial differential equation...

Module-4

- 7 a. The area of a circle (A) corresponding to diameter (D) is given below:

Table with 2 rows (D, A) and 5 columns (80, 85, 90, 95, 100)

Find the area corresponding to diameter 105 using an appropriate interpolation formula. (06 Marks)

- b. Find a real root of x^3 - 2x - 5 = 0 using Regula-Falsi method...
c. Evaluate integral from 0 to pi/2 of sqrt(cos theta) d theta...

OR

- 8 a. Use Newton's divided difference formula to find f(4) given the data:

Table with 2 rows (x, f(x)) and 4 columns (0, 2, 3, 6)

- b. Use Newton-Raphson method to find a real root of x sin x + cos x = 0...
c. Use Lagrange's interpolation formula to find y when x = 35...

Table with 2 rows (x, f(x)) and 4 columns (25, 30, 40, 60)

(07 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. 2. Any revealing of identification, appeal to evaluator and /or equations written eg. 42+8 = 50, will be treated as malpractice.

**Module-5**

- 9 a. Use the Taylor series method to find  $y(0.2)$  from  $\frac{dy}{dx} = y + \sin x$ ,  $y(0) = 1$ . (06 Marks)
- b. Use Runge-Kutta method of order 4, find  $y$  at  $x = 0.1$ , given that  $\frac{dy}{dx} = 3e^x + 2y$ ,  $y(0) = 0$  with  $h = 0.1$ . (07 Marks)
- c. Apply Milne's predictor-corrector method, to find  $y(1.4)$  from  $\frac{dy}{dx} = x^2 + \frac{y}{2}$  given that  $y(1) = 2$ ,  $y(1.1) = 2.2156$ ,  $y(1.2) = 2.4649$ ,  $y(1.3) = 2.7514$ . (07 Marks)

OR

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- 10 a. Use modified Euler's method to solve  $\frac{dy}{dx} = x^2 + y$  with  $y(0) = 1$ ,  $h = 0.05$  at  $x = 0.1$ . (06 Marks)
- b. Use Taylor series method to find  $y(0.1)$  from  $\frac{dy}{dx} = x^2 + y^2$  with  $y(0) = 1$ . (07 Marks)
- c. Use Runge-Kutta method of 4<sup>th</sup> order, find  $y(0.1)$  given that  $\frac{dy}{dx} = 3x + \frac{y}{2}$ ,  $y(0) = 1$  with  $h = 0.1$ . (07 Marks)

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