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Course Code 

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**Second Semester B.E. Degree Examinations, July 2026**  
**APPLIED MATHEMATICS FOR EEE STREAM-II**

Duration: 3 hrs

Max. Marks: 100

- Note:**
1. Answer any FIVE full questions, choosing ONE full question from each module.
  2. Use of Mathematics Formula Handbook is permitted
  3. Missing data, if any, may be suitably assumed

| <u>Q. No</u>                                                                                                                                                                              | <u>Question</u>                                                                                                                                                          | <u>Marks</u> | <u>(RBTL:CO: PI)</u> |     |     |      |   |   |   |    |   |    |    |     |     |     |      |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|----------------------|-----|-----|------|---|---|---|----|---|----|----|-----|-----|-----|------|
| <u>Module-1</u>                                                                                                                                                                           |                                                                                                                                                                          |              |                      |     |     |      |   |   |   |    |   |    |    |     |     |     |      |
| 1.                                                                                                                                                                                        | a. Use the Regula falsi method to obtain a root of the equation $2x - \log_{10}x = 7$ which lies between 3.5 and 4.                                                      | 06           | (2 :1: 1.2.1)        |     |     |      |   |   |   |    |   |    |    |     |     |     |      |
|                                                                                                                                                                                           | b. Show that a root of the equation $x^3 + 5x - 11 = 0$ lies between 1 and 2. Find the root by Newton-Raphson method (Carry out 3 iterations).                           | 07           | (2 :1: 1.2.1)        |     |     |      |   |   |   |    |   |    |    |     |     |     |      |
|                                                                                                                                                                                           | c. Find $f(2.5)$ by using Newton's backward interpolation formula given that $f(0) = 7.4720$ , $f(1) = 7.58545$ , $f(2) = 7.6922$ , $f(3) = 7.8119$ , $f(4) = 7.95252$ . | 07           | (2:1: 1.2.1)         |     |     |      |   |   |   |    |   |    |    |     |     |     |      |
| (OR)                                                                                                                                                                                      |                                                                                                                                                                          |              |                      |     |     |      |   |   |   |    |   |    |    |     |     |     |      |
| 2.                                                                                                                                                                                        | a. Construct an interpolating polynomial for the data given below using Newton's divided difference formula.                                                             | 06           | (2 :1: 1.2.1)        |     |     |      |   |   |   |    |   |    |    |     |     |     |      |
| <table><tr><td>x</td><td>2</td><td>4</td><td>5</td><td>6</td><td>8</td><td>10</td></tr><tr><td>y</td><td>10</td><td>96</td><td>196</td><td>350</td><td>868</td><td>1746</td></tr></table> |                                                                                                                                                                          |              |                      | x   | 2   | 4    | 5 | 6 | 8 | 10 | y | 10 | 96 | 196 | 350 | 868 | 1746 |
| x                                                                                                                                                                                         | 2                                                                                                                                                                        | 4            | 5                    | 6   | 8   | 10   |   |   |   |    |   |    |    |     |     |     |      |
| y                                                                                                                                                                                         | 10                                                                                                                                                                       | 96           | 196                  | 350 | 868 | 1746 |   |   |   |    |   |    |    |     |     |     |      |
|                                                                                                                                                                                           | b. Using Lagrange's interpolation formula compute $u_4$ , given $u_0 = 707, u_2 = 819, u_3 = 866, u_6 = 966$ .                                                           | 07           | (2 :1: 1.2.1)        |     |     |      |   |   |   |    |   |    |    |     |     |     |      |
|                                                                                                                                                                                           | c. Evaluate $\int_0^1 \frac{dx}{1+x}$ taking seven ordinates by applying Simpson's 3/8 th rule.                                                                          | 07           | (2:1: 1.2.1)         |     |     |      |   |   |   |    |   |    |    |     |     |     |      |
| <u>Module-2</u>                                                                                                                                                                           |                                                                                                                                                                          |              |                      |     |     |      |   |   |   |    |   |    |    |     |     |     |      |
| 3.                                                                                                                                                                                        | a. Use Taylor's method to find y at x=0.1 considering terms up to the third degree given that $\frac{dy}{dx} = x^2 + y^2$ and $y(0) = 1$ .                               | 06           | (2 :2: 1.2.1)        |     |     |      |   |   |   |    |   |    |    |     |     |     |      |
|                                                                                                                                                                                           | b. Given $\frac{dy}{dx} = 1 + \frac{y}{x}$ , y=2 at x=1, find y at x=1.2 taking h=0.2 by applying Modified Euler's method.                                               | 07           | (2 :2: 1.2.1)        |     |     |      |   |   |   |    |   |    |    |     |     |     |      |
|                                                                                                                                                                                           | c. Given $\frac{dy}{dx} = 3x + \frac{y}{2}$ , $y(0) = 1$ , compute y(0.2) by taking h=0.2 using R-K method of fourth order.                                              | 07           | (2 :2: 1.2.1)        |     |     |      |   |   |   |    |   |    |    |     |     |     |      |
| (OR)                                                                                                                                                                                      |                                                                                                                                                                          |              |                      |     |     |      |   |   |   |    |   |    |    |     |     |     |      |

4. a. Apply Milne's predictor-corrector formula to find  $y(0.4)$  using the values  $y(0)=1$ ,  $y(0.1)=1.1113$ ,  $y(0.2)=1.2507$ ,  $y(0.3)=1.426$ , given that  $\frac{dy}{dx} = x^2 + y^2$ . Write the answer approximating correct to four decimal places. 06 (2 :2: 1.2.1)
- b. If  $\frac{dy}{dx} = 2e^x - y$ ,  $y(0) = 2$ ,  $y(0.1) = 2.010$ ,  $y(0.2) = 2.040$  and  $y(0.3) = 2.090$ , find  $y(0.4)$  corrects to four decimal places by using Adams – Bashforth predictor-corrector method. 07 (2 :2: 1.2.1)
- c. Given that  $\frac{dy}{dx} = x - y^2$  and the data  $y(0) = 0$ ,  $y(0.2) = 0.02$ ,  $y(0.4) = 0.0795$ ,  $y(0.6) = 0.1762$ . Compute  $y$  at  $x=0.8$  by applying Milne's method. 07 (2 :2: 1.2.1)

### Module-3

5. a. Evaluate  $\int_0^a \int_0^x \int_0^{x+y} e^{x+y+z} dz dy dx$  06 (2 :3: 1.2.1)
- b. Evaluate  $\int_0^1 \int_x^{\sqrt{x}} xy dy dx$  by changing the order of integration. 07 (2 :3: 1.2.1)
- c. Find the area of ellipse  $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$  by double integration 07 (2 :3: 1.2.1)

(OR)

6. a. Prove that  $\beta(m, n) = \frac{\Gamma(m) \cdot \Gamma(n)}{\Gamma(m+n)}$  06 (2 :4: 1.2.1)
- b. Prove that:  $\Gamma\left(\frac{1}{2}\right) = \sqrt{\pi}$  07 (2 :4: 1.2.1)
- c. Evaluate  $\int_0^{\pi/2} \sqrt{\tan \theta} d\theta$  by expressing in terms of gamma functions 07 (2 :4: 1.2.1)

### Module-4

7. a. Find the unit vector normal to the surface  $x^2y + 2xz = 4$  at  $(2, -2, 3)$ . 06 (2 :4: 1.2.1)
- b. Find  $\text{div } \vec{F}$  and  $\text{curl } \vec{F}$  where  $\vec{F} = \nabla(x^3 + y^3 + z^3 - 3xyz)$  07 (2 :4: 1.2.1)
- c. Find constants  $a$  and  $b$  such that  $\vec{F} = (axy + z^3)i + (3x^2 - z)j + (bxz^2 - y)k$  is irrotational. Also find a scalar function  $\phi$  such that  $\vec{F} = \nabla\phi$ . 07 (2 :4: 1.2.1)

(OR)

8. a. If  $\vec{F} = xyi + yzj + xzk$ , evaluate  $\int_C \vec{F} \cdot d\vec{r}$  where  $C$  is the curve represented by  $x = t, y = -t^2, z = t^3, -1 \leq t \leq 1$ . 06 (2 :4: 1.2.1)
- b. Evaluate  $\int (3x^2 - 8y^2)dx + (4y - 6xy)dy$ , by Green's theorem in a plane, where  $C$  is the boundary of the region enclosed by  $y = \sqrt{x}$  and  $y = x^2$  07 (2 :4: 1.2.1)
- c. Evaluate  $\vec{F} = (2x - y)i - yz^2j - y^2zk$  by Stoke's theorem, where  $S$  is the upper half surface of the sphere  $x^2 + y^2 + z^2 = 1$ ,  $C$  is its boundary 07 (2 :4: 1.2.1)

### Module-5

9. a. Find the Laplace transform of (i)  $e^{-2t} \sinh 4t$ , (ii)  $\sin 5t \cos 2t$  06 (2 :5 1.2.1)

- b. Find the Laplace transform of the periodic function defined by  $f(t) = \frac{kt}{T}, 0 < t < T; f(t+T) = f(t)$  **07** (2 :5: 1.2.1)
- c. Express the following functions in terms of Heaviside unit step function and hence find their Laplace transform. **07** (2 :5: 1.2.1)
- $$f(t) = \begin{cases} t, & 0 < t < 4 \\ 5, & t > 4 \end{cases}$$

(OR)

10. a. Find the inverse Laplace transform of  $\frac{1}{s+2} + \frac{3}{2s+5} + \frac{4}{3s-2}$  **06** (2 :5: 1.2.1)
- b. Using convolution theorem, obtain the inverse Laplace transform of  $\frac{s}{(s^2+a^2)^2}$  **07** (2 :5: 1.2.1)
- c. Solve by using Laplace transforms:  $\frac{d^2y}{dt^2} + k^2y = 0$  given that  $y(0) = 2, y'(0) = 0$ . **07** (2 :5: 1.2.1)

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