



**B.Tech II Semester Supplementary Examinations, January 2024**

**ORDINARY DIFFERENTIAL EQUATIONS & VECTOR CALCULUS**  
 (Common to CE, CSE, CSE(AI&ML), CSE(DS) & IT)

**Maximum Marks: 70**

Date: 19.01.2024 Duration: 3 hours

- Note:** 1. This question paper contains two parts A and B.  
 2. Part A is compulsory which carries 20 marks. Answer all questions in Part A.  
 3. Each question carries 10 marks in Part B and may have a, b, c, d as sub questions.

**Part-A**

All the following questions carry equal marks		(10x2M=20 Marks)	CO	Bloom Tx
1	Define Linear differential equation.		CO1	L1
2	Check whether the differential equation $(x^2 + 2xy) dx + (y^2 + x^2) dy = 0$ is exact or not.		CO1	L1
3	Solve $(D^2 - 3D + 4)y = 0$		CO2	L3
4	Find the wronskin of the differential equation $(D^2 + 4)y = 0$		CO2	L3
5	Transform the differential equation $x^2 \frac{d^2y}{dx^2} + 4x \frac{dy}{dx} + 2y = 0$ with constant coefficients.		CO3	L2
6	Find C.F of $[(x + 2)^2 D^2 - (x + 2)D + 1]y = 3x + 4$		CO3	L3
7	Find the greatest value of the directional derivative of the function $f = x^2 y z^3$ at $(2, 1, -1)$		CO4	L3
8	Solve $(x^3 D^3 + 3x^2 D^2 + xD + 8)y = 65 \cos(\log x)$		CO4	L3
9	Prove that the vector $(x^2 - yz)i + (y^2 - zx)j + (z^2 - xy)k$ is irrotational and find its scalar potential.		CO5	L3
10	State the Stokes theorem.		CO5	L1

**Part-B**

- Answer All the following questions. (5X10M=50Marks)
- |    |   |     |    |
|----|---|-----|----|
| 11 | Prove that the system of confocal conics<br>a. $\frac{x^2}{a} + \frac{y^2}{a-b} = 1$ , is self orthogonal. Here $a$ is the parameter and $b$ is the constant. [10M] | CO1 | L3 |
|----|---|-----|----|

OR

- |    |   |     |    |
|----|---|-----|----|
| 12 | In a chemical reaction a given substance is being converted into another at a rate proportional to the amount of substance unconverted. If $(1/5)$ th of the original amount has been transformed in 4 minutes, how much time will be required to transform one half. [10M] | CO1 | L3 |
|----|---|-----|----|

- 13 Solve by the method of variation of parameter  $(D^2 - 2D)y = e^x \sin x$ . [10M] CO2 L3
- OR
- 14 Solve  $D^2(D^2 + 4)y = 96x^2 + \sin 2x - k$  [10M] CO2 L3
- 15 Solve  $(x+1)^2 \frac{d^2 y}{dx^2} - 3(x+1) \frac{dy}{dx} + 4y = x^2 + x + 1$  [10M] CO3 L3
- OR
- 16 Solve  $(x^3 D^3 + 3x^2 D^2 + xD + 8)y = 65 \cos(\log x)$  [10M] CO3 L3
- 17 Prove that the vector  $(x^2 - yz)i + (y^2 - zx)j + (z^2 - xy)k$  is irrotational and find its scalar potential. [10M] CO4 L3
- OR
- 18 (a) Find the values of a and b so that the surface  $ax^2 - byz = (a+2)x$  will be orthogonal to the surface  $4x^2y + z^2 = 4$  at the point  $(-1, 1, 2)$  [5M] CO4 L3
- (b) Prove that  $\text{curl}(\vec{a} \times \vec{b}) = \vec{a} \text{div} \vec{b} - \vec{b} \text{div} \vec{a} + (\vec{b} \cdot \nabla) \vec{a} - (\vec{a} \cdot \nabla) \vec{b}$  [5M]
- 19 Use Greens theorem for  $\int_c (3x^2 - 8y^2)dx + (4y - 6xy) dy$  where 'c' is the region bounded by  $x=0$ ,  $y=0$ , and  $x+y=1$ . [10M] CO5 L3
- OR
- 20 Verify stokes theorem for  $F = y^2 \mathbf{i} + y \mathbf{j} - 3x \mathbf{k}$  and S is the upper half of the sphere  $x^2 + y^2 + z^2 = a^2$  and  $z \geq 0$ . [10M] CO5 L4