

**I B. Tech II Semester Regular/Supplementary Examinations, July/August-2023**  
**MATHEMATICS-III**

(Only Electrical and Electronics Engineering)

Time: 3 hours

Max. Marks: 70

*Answer any five Questions one Question from Each Unit*  
*All Questions Carry Equal Marks*

**UNIT - I**

1. a) Find the directional derivative of  $\phi = xy + yz + zx$  at A in the directional of  $\overline{AB}$  where  $A(1, 2, -1)$  and  $B(1, 2, 3)$  [7M]
- b) Determine the constant 'a' if  $\vec{f} = \frac{1}{x^2 + y^2} (x\vec{i} + ay\vec{j}) + \vec{k}$  is solenoidal. [7M]
- (OR)**
2. a) Evaluate  $\int_C \vec{F} \cdot d\vec{r}$  where  $\vec{F} = 2x^2yz\vec{i} + x^2y\vec{j}$  and C is the curve  $x = t, y = t^2, z = t^3$  from  $t = 0$  to 1. [7M]
- b) Evaluate  $\iint_S \vec{F} \cdot \vec{n} \, ds$  where  $\vec{F} = 18z\vec{i} - 12\vec{j} + 3y\vec{k}$  and S is part of the plane.  $2x + 3y + 6z = 12$ . Located in first octant. [7M]

**UNIT - II**

3. a) Find inverse Laplace transform  $\frac{s+5}{(s-1)^2(s+2)}$ . [7M]
- b) Using Convolution theorem find the inverse Laplace transform  $\frac{1}{(s^2+9)(s^2+1)}$  [7M]
- (OR)**
4. a) Find Laplace transform by using the definition  $f(t) = \begin{cases} \cos(t-a), & t > a \\ 0, & t < a \end{cases}$  [7M]
- b) Find  $L\left\{\int_0^t te^{-2t} \cos 2t \, dt\right\}$  [7M]

**UNIT - III**

5. a) Find the Fourier series of  $f(x) = e^{-x}$  in  $(0, 2\pi)$  and hence deduce that  $\frac{\pi}{2\sinh\pi} = \sum_{n=2}^{\infty} \frac{(-1)^n}{n^2 + 1}$  [7M]
- b) Find the Half range sine series of  $f(x) = \begin{cases} 1 & 0 < x < 1 \\ -1 & 1 < x < 2 \end{cases}$  in  $[0, 2]$  [7M]
- (OR)**
6. a) Find the Fourier cosine transform of  $f(x) = \begin{cases} x & \text{if } 0 < x < 1 \\ 2-x & \text{if } 1 < x < 2 \\ 0 & \text{if } x > 2 \end{cases}$  [7M]
- b) Find the inverse Fourier finite sine transform of  $f(x)$  if  $F_s(n) = \frac{2\pi(-1)^n}{n^3}$  in  $(0, \pi)$  [7M]

**UNIT - IV**

7. a) Form the differential equation by elimination arbitrary function from [7M]  
 $f(x^2 + y^2, x^2 - z^2) = 0$
- b) Solve the PDE  $(y + xz)p - (x + yz)q = x^2 - y^2$  [7M]

**(OR)**

8. a) Solve the PDE  $p\sqrt{x} + q\sqrt{y} = \sqrt{z}$  [7M]
- b) Find complete and singular solutions of  $z = px + qy - p - 2q + 3$ . [7M]

**UNIT - V**

9. a) Solve the PDE  $(D^3 - 3D^2D^1 + 4D^1^3)z = e^{x+2y}$  [7M]
- b) Solve the PDE  $(D^2 + DD^1 - 6D^1^2)z = \cos(3x + y)$  [7M]

**(OR)**

10. a) Solve the PDE  $(D^2 - D^1^2)z = x^2 + y^2$  [7M]
- b) Solve the PDE  $3\frac{\partial u}{\partial x} + 2\frac{\partial u}{\partial y} = 0$  by the method of variation of parameters. [7M]

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