

I B. Tech II Semester Regular Examinations, September- 2021
MATHEMATICS-III
 (Only EEE)

Time: 3 hours

Max. Marks: 70

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

UNIT-I

1. a) Prove that $\nabla(r^n) = nr^{n-2}\bar{r}$ (7M)
 b) Prove that $\text{div } \text{curl } \bar{f} = 0$. (7M)

Or

2. a) Evaluate $\int_C \bar{f} \cdot d\bar{r}$ where $\bar{f} = z\bar{i} + x\bar{j} + y\bar{k}$ and C is the arc of the curve $\bar{r} = \cos t \bar{i} + \sin t \bar{j} + t \bar{k}$ from $t = 0$ to 2π . (7M)
 b) Evaluate $\int_V \bar{f} \cdot d\bar{v}$ where $\bar{f} = xz\bar{i} + 2xz\bar{j} - y^2\bar{k}$ over the volume bounded by $x = 0, y = 0, z = x^2; z = 2, x = 2$. (7M)

UNIT-II

3. a) If $f(t) = \begin{cases} 1, & 0 \leq t < 1 \\ -1, & 1 \leq t < 2 \end{cases}$ is a periodic function with period 2. Then find its Laplace transform. (7M)
 b) Find $L\left(\frac{1-\cos t}{t}\right)$ (7M)

Or

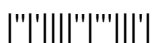
4. a) Find $L^{-1}\left\{\frac{s+1}{(s^2+2s+2)^2}\right\}$ (7M)
 b) Find $L^{-1}\left\{\frac{1}{(s^2+9)(s^2+1)}\right\}$ using convolution theorem. (7M)

UNIT-III

5. a) Find the fourier series of $f(x) = \begin{cases} -\pi, & -\pi < x < 0 \\ x, & 0 < x < \pi \end{cases}$ (7M)
 b) Find the half range cosine series of $f(x) = ax+b$ in $[0,1]$ (7M)

Or

6. a) Express the $f(x) = \begin{cases} 1 & \text{if } 0 < x < \pi \\ 0 & \text{if } x > \pi \end{cases}$ as a Fourier sine integral and
 Hence Evaluate $\int_0^\infty \frac{(1-\cos \lambda\pi) \sin \lambda x}{\lambda} d\lambda$ (7M)
 b) Find the Fourier transform of $f(x)$ defined by $f(x) = \begin{cases} 1 & \text{if } |x| < a \\ 0 & \text{if } |x| > a \end{cases}$ (7M)



UNIT-IV

7. a) Form the PDE by eliminating the arbitrary constants from $z = ce^{mx} \cos wx$ (7M)
b) Solve the PDE $xp - yq = y^2 - x^2$ (7M)

Or

8. a) Solve the PDE $\left(\frac{b-c}{a}\right)yzp + \left(\frac{c-a}{b}\right)xzq = \left(\frac{a-b}{c}\right)xy$ (7M)
b) Solve the PDE $z^2 p^2 + q^2 = p^2 q$ (7M)

UNIT-V

9. a) Solve the PDE $4\frac{\partial u}{\partial x} + \frac{\partial u}{\partial y} = 3u$ by the method of separation of variables (7M)
b) Solve the PDE $(D^3 - 4D^2D^1 + 3DD^1^2)z = \sin(3x + 2y)$ (7M)

Or

10. Solve the wave equation $\frac{\partial^2 y}{\partial y^2} = 4\frac{\partial^2 y}{\partial x^2}$, given that (14M)
a) $y(0, t) = 0$
b) $y(5, t) = 0$
c) $y(x, 0) = 0$
d) $\frac{\partial y}{\partial t}(x, 0) = 5 \sin \pi x$

