Code No: R201206 **R20** SET - 1

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

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UNIT-I

1. a) Prove that $\nabla(r^n) = nr^{n-2}\bar{r}$ (7M)

   b) Prove that div $curl\, \bar{f} = 0$. (7M)

Or

2. a) Evaluate $\int_c \bar{f}\,.\,d\bar{r}$ where $\bar{f} = z\bar{\imath} + x\bar{\jmath} + y\bar{k}$ and C is the arc of the curve $\bar{r} = cost\,\bar{\imath} + sint\,\bar{\jmath} + t\,\bar{k}$ from t = 0 to 2π. (7M)

   b) Evaluate $\int_v \bar{f}\, dv$ *where* $\bar{f} = xz\bar{\imath} + 2x\bar{j} - y^2\bar{k}$ over the volume bounded by $x = 0$, $y = 0$, $z = x^2$; $z = 2$, $x = 2$. (7M)

UNIT-II

3. a) If $f(t) = \begin{cases} 1, & 0 \le t < 1 \\ -1, & 1 \le t < 2 \end{cases}$ is a periodic function with period 2. Then find its Laplace transform. (7M)

   b) Find $L\left(\frac{1-cost}{t}\right)$ (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 $f(x) = \begin{cases} 1 & if\ 0 < x < \pi \\ 0 & if\ x > \pi \end{cases}$ as a Fourier sine integral and (7M)

   Hence Evaluate $\int_0^\infty \frac{(1-\cos\lambda\pi)\sin\lambda x}{\lambda} d\lambda$

   b) Find the Fourier transform of $f(x)$ defend by $f(x) = \begin{cases} 1 & if\ |x| < a \\ 0 & if\ |x| > a \end{cases}$ (7M)
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UNIT-IV

7. a) Form the PDE by eliminating the orbitrary constants from $z = ce^{wt}\cos wx$ (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 $z^2p^2 + q^2 = p^2q$ (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 $\left(D^3 - 4D^2D^1 + 3DD^{1^2}\right)z = \sin(3x + 2y)$ (7M)

Or

10. Solve the wave equation $\frac{\partial^2 y}{\partial y^2} = 4\frac{\partial^2 y}{\partial x}$, given that (14M)

    a) $y(0,t) = 0$

    b) $y(5,t) = 0$

    c) $y(x,0) = 0$

    d) $\frac{\partial y}{\partial t}(x,0) = 5\sin \pi x$