Roll No. ☐☐☐☐☐☐☐☐☐☐☐☐ **Total No. of Pages : 02**

Total No. of Questions : 09

B.Tech.(CE/ECE/EE/Electrical & Electronics/
Electronics & Computer Engg./Electronics & Electrical/ETE)
(2011 Onwards)
B.Tech.(Electrical Engg. & Industrial Control) (2012 Onwards)
(Electronics Engg.) (2012 Onwards)
(Sem.–3)

ENGINEERING MATHEMATICS – III

Subject Code : BTAM-301
Paper ID : [A1128]

Time : 3 Hrs. **Max. Marks : 60**

INSTRUCTIONS TO CANDIDATES :

1. **SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.**
2. **SECTION-B contains FIVE questions carrying FIVE marks each and students have to attempt any FOUR questions.**
3. **SECTION-C contains THREE questions carrying TEN marks each and students have to attempt any TWO questions.**

SECTION-A

1) Write briefly :

a) Define even and odd functions. Give an example of a function which is neither even nor odd.

b) Write the sufficient conditions for the existence of Laplace transform.

c) Find the Fourier series of the function $f(x) = x, -\pi < x < \pi$.

d) Let $f(t)$ satisfies the conditions of the existence theorem of Laplace transform and

$\mathbb{L}[f(t)] = \mathbb{F}(s)$. Then which of the following is true

i) $\lim_{s\to\infty} \mathbb{F}(s) \neq 0$.

ii) $\lim_{s\to\infty} s\,\mathbb{F}(s)$ is bounded.

e) Classify the singular points of the following equation

$x^2y'' + axy' + by = 0$, where a, b are constants.

f) Show that $P_n(1) = 1$, where $P_n(x)$ denotes the Legendre Polynomial.

g) Eliminate the arbitrary constants a and b from $z = ax + by + a^2b^2$, to obtain the partial differential equation.

h) Classify the following partial differential equations :

i) $u_{xx} - 2u_{xy} + u_{yy} = 0$

ii) $xu_{xx} - yu_{xy} = 0$.

i) Using the definition of limits, show that $\lim_{z\to\infty} \frac{1}{z^2} = 0$.

j) Compute the residue at all singular points of the function $f(z) = \cot z$.

SECTION-B

2) Find the Fourier series of the function :

$$f(x) = \begin{cases} -k, & if\ -2 < x < 0 \\ k, & if\ 0 < x < 2 \end{cases}$$

3) Find $L^{-1}\left[\log\left(1+\frac{\omega^2}{s^2}\right)\right]$, where the symbol $\mathbb{L}^{-1}$ denotes inverse Laplace transform.

4) Using the recurrence relation $(n + 1)P_{n+1}(x) = (2n + 1)xP_n(x) - nP_{n-1}(x)$ recursively, evaluate $P_2(1.5)$ and $P_3(2.1)$.

5) Show that the function $f(z) = \begin{cases} \frac{x^3(1+i) - y^3(1-i)}{x^2+y^2}, & z \neq 0 \\ 0, & z = 0 \end{cases}$ satisfies the Cauchy-Riemann equations at $z = 0$ but $f'(0)$ does not exist.

6) Using the method of separation of variables, solve the parabolic partial differential equation $\frac{\partial^2 u}{\partial x^2} = 16\frac{\partial u}{\partial y}$.

SECTION-C

7) If $f(z) = u + iv$ is an analytic function of $z = x + iy$ and $u - v = e^{-x}[(x - y)\sin y - [(x + y)\cos y]$, then find u, v and the analytic function $f(z)$.

8) Solve the following initial value problem using Laplace transform

$4y'' - 8y' + 3y = \sin t$, $y(0) = 0$, $y'(0) = 2$.

9) An elastic string of length l which is fastened at its ends $x = 0$ and $x = l$ is picked up at its center point $x = \frac{1}{2}$ to a height of $\frac{1}{2}$ and released from rest. Find the displacement of the string at any instant of time.