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Roll No..........................

Total No. of Questions : 09] **[Total No. of Pages : 03**

Paper ID [A0807]

(Please fill this Paper ID in OMR Sheet)

B.Tech. (Sem. - 3rd/4th)

APPLIED MATHEMATICS - III (AM - 201)

Time : 03 Hours **Maximum Marks : 60**

Instruction to Candidates:

1) Section - A is **Compulsory**.
2) Attempt any **Four** questions from Section - B.
3) Attempt any **Two** questions from Section - C.

Section - A

Q1) *(10 × 2 = 20)*

a) Define the conditions on a function for its representation as Fourier series.

b) Evaluate, using Laplace transform technique,

$$\int_0^\infty \frac{e^{-t}-e^{-3t}}{t}\,dt$$

c) Find the inverse Laplace transform of $F(s)=\frac{1}{2}\log\left(\frac{s^2+b^2}{s^2+a^2}\right)$

d) What are ordinary, regular singular and irregular singular points of an ordinary differential equation?

e) What are orthogonal functions? State the orthogonality condition of Bessel functions.

f) Form a partial differential equation by eliminating the arbitrary constants, a, b and c from $(x-a)^2+(y-b)^2+z^2=c^2$.

g) Form a differential equation by eliminating the arbitrary function

$$F(xy+z^2,\ x+y+z)=0$$

h) Solve the differential equation $p+q=\sin x+\sin y$

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i) Find analytic function $f(z) = u(r, \theta) + i\,v(r, \theta)$ such that

$$v(r, \theta) = r^2 \cos 2\theta - r\cos\theta + 2.$$

j) What are singularities of an analytic function. Find the nature and location of singularities of $f(z) = (z+1)\sin\dfrac{1}{(z-2)}$

Section - B

(4 × 5 = 20)

Q2) Find the Fourier series of

$$f(x) = \begin{cases} x^2 & 0 \le x \le \pi \\ -x^2 & -\pi \le x \le 0 \end{cases}$$

Q3) A beam has its ends damped at $x = 0$ and $x = l$. A concentrated load W acts vertically downward at the point $x = l/3$. Describe the governing boundary value problem and find the resulting deflection.

Q4) Using generating function for Legendre Polynomial $P_n(x)$, prove that

$$(n+1)\,P_{n+1}(x) = (2n+1)x\,P_n(x) - n\,P_{n-1}(x)$$

Q5) Solve the differential equation

$$\frac{\partial^2 z}{\partial x^2} - \frac{\partial z}{\partial x}.\frac{\partial z}{\partial y} - 2\frac{\partial^2 z}{\partial y^2} = (y-1)e^x$$

Q6) Discuss the transformation

$$w = \sqrt{z}.$$

Is it conformal at the origin.

Section - C

(2 × 10 = 20)

Q7) The currents I_1 and I_2 in mesh are given by differential eqs.

$$\frac{dI_1}{dt} - wI_2 = a\cos pt$$

$$\frac{dI_2}{dt} + wI_1 = a\sin pt$$

with $I_1 = I_2 = 0$ at $t = 0$. Using Laplace transformation technique, find the currents $I_1(t)$ & $I_2(t)$.

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Q8) (a) Evaluate $\int_0^{2+i} (\bar{z})^2 \, dz$ along the real axis to 2 and then vertically to 2+*i*.

(b) Using Charpit method, solve $2z + p^2 + qy + 2y^2 = 0$.

Q9) Determine the poles of the function

$$f(z) = \frac{z^2}{(z-1)^2(z+2)}$$

and residue at each pole.

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