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B.Tech.(BME/ECE/EE/EEE/EIE/TXE) (Sem.–3)
APPLIED MATHEMATICS-III
Subject Code : AM-201
Paper ID : [A0303]

Time : 3 Hrs.   Max. 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   (10 × 2 = 20 Marks)

1. (a) Explain Euler's formula.

   (b) Explain Laplace transform of derivative and integral.

   (c) Discuss Frobenius method.

   (d) Write down wave equation and heat conduction equation in one dimension.

   (e) Explain Analytic function & Cauchy-Riemann equation.

   (f) Write down the Cauchy's integral formula.

   (g) An electrostatic field in the xy-plane is given by the potential function $\phi = 3x^2y - y^3$, find the stream function.

   (h) Expand the function $\frac{\sin z}{z - \pi}$ about $z = \pi$.

   (i) What do you mean by singular points?

   (j) Discuss Laplace transform of unit step function with an example.

SECTION-B   (4 × 5 = 20 Marks)

2. (a) Explain Fourier series. If $f(x) = x^2$ for $-3 \leq x \leq 3$, write Fourier series for $f(x)$ on $[-3,3]$.

   (b) If $f(x) = |\cos x|$ expand $f(x)$ as a Fourier series in the interval $(-\pi, \pi)$

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3. (a) Explain saw-toothed waveform with an example.

   (b) Find the Laplace transform of $\dfrac{1-\cos 2t}{t}$.

4. (a) Solve $ty'' + 2y' + ty = \cos t$ given that $y(o) = 1$

   (b) Find the Inverse Laplace transform of $[s/(s^4+4a^4)]$

5. (a) Solve $2x^2y'' - xy' + (1- x^2)y = 0$

   (b) Explain $J_n(x)$. Prove that $J_n(x) = (x/2n)\,[J_{n-1}(x) + J_{n+1}(x)$

6. Use generating function for legendre polynomials to derive recursion formula

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

SECTION-C   (2 × 10 = 20 Marks)

7. (a) Form the partial differential equation from

   (i) $(x-a)^2 + (y-b)^2 + z^2 = c^2$

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

   (b) Solve the following differential equations

   (i) $Y^2p - xyq = x\,(z-2y)$

   (ii) $\{D^2 - DD' + D' -1\}z = \cos\,(x+2y)$

   Where symbols have their usual meaning.

8. (a) Determine the analytic function whose real part is $e^{2x}\,(x\,\cos 2y - y\,\sin 2y)$

   (b) Find the bilinear transformation which maps the points $z = 1, 1, -1$ into the points $w = I, 0, -i$

9. (a) Define residues of the function $f(z)$. Also find the residues of the function

   $f(z) = \left[\dfrac{\sin z}{z\,\cos z}\right]$ at its pole inside the circle $|z| = 2$

   (b) Evaluate $\displaystyle\int_0^{2\pi} \dfrac{d\theta}{1 - 2a\sin\theta + a^2}$, $0 < a < 1$