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B.Tech.(BME/ECE/EE/EEE/EIE/Textile) (Sem.–3)

APPLIED MATHEMATICS – III / ENGINEERING MATHEMATICS

Subject Code : AM-201

Paper ID : [A0303]

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 :

1. State Euler's formula for the coefficients a_o, a_n and b_n in the fourier series expansion of a function $f(x)$ as $\frac{a_o}{2}+\sum_{n=1}^{\infty} a_n \cos n\pi+\sum_{n=1}^{\infty} b_n \sin n\pi$ in the internal $(d, d+2\pi)$.
2. Express $4x^3-2x^2-3x+8$ in terms of Legendre polynomials.
3. Derive a partial differential equation by eliminating the arbitrary constants from the equation $2z=\frac{x^2}{a^2}+\frac{y^2}{b^2}$
4. Solve the partial differential equation $(x^2-y^2-z^2)\,p+2xyq=2xz$
5. State Cauchy Riemann equations in Cartesian and polar coordinates.
6. Let $f(z)=u+iv$ be an analytic function of z, prove that $u\,(x,y)$ and $v\,(x,y)$ both satisfy the Laplace equation.
7. Find the Laplace transform of $\cos^2 2t$.
8. State the change of scale property of Laplace transform.
9. Define the Legendre's equation of order n. What are its particular solutions called?
10. What is the coefficient of sin nx in the Fourier series representation of $x-x^2$ from $x=-\pi$ to $x=\pi$.

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SECTION-B

2. Prove that $J_n''(x) = \frac{1}{4}\left[J_{n-2}(x) - 2J_n(x) + J_{n+2}(x)\right]$

3. Solve the partial differential equation

$$\frac{\partial^2 z}{\partial x^2} + \frac{\partial^2 z}{\partial x \partial y} - 6\frac{\partial^2 z}{\partial y^2} = \cos(2x+y)$$

4. Determine the analytic function whose real plant is $\frac{y}{x^2+y^2}$.

5. Find the inverse Laplace transform of $\frac{s}{s^4+4a^4}$.

6. Solve the differential equation $(D^3 - 3D^2 + 3D - 1)y = t^2 e^t$ given that $y(0) = 1$, $y'(0) = 0$, $y''(0) = -2$; using Laplace transforms.

SECTION-C

7. Obtain Fourier series for the function $f(x)$ given by $f(x) = \begin{cases} 1+\frac{2x}{\pi}, -\pi \le x \le 0 \\ 1-\frac{2x}{\pi}, 0 \le x \le \pi \end{cases}$

   Deduce that $\frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + ... = \frac{\pi^2}{8}$.

8. The diameter of a semi circular plate of radius a is kept at 0°C and the temperature at the semi-circular bounding is T°C. Show that the steady state temperature in the plate is given by $u(r, \theta) = \frac{4T}{\pi}\sum_{n=1}^{\infty}\frac{1}{2n-1}\left(\frac{r}{a}\right)^{2n-1}\sin(2n-1)\theta$

9. Evaluate $\int_0^{2\pi} \frac{\cos 3\theta}{5-4\cos\theta}\, d\theta$, by using complex integration.

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