(Total No. of Questions - 9] [Total No. of Printed Pages - 3]

Dec.-22-0108

MA-202 (Engineering Mathematics-II)

B. Tech. 2nd (CBCS)

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

The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.

Note : Attempt Five questions in all, selecting one question from each section A, B, C and D. Question no. 9 is compulsory.

SECTION - A

1. (a) Solve the differential equation $(x+y+1)^2 \frac{dy}{dx} = 1$. (5)

   (b) Solve $(xy^2 + y)dx + (x - x^2y)\,dy = 0$ (5)

2. (a) Solve $(x^2D^2 - xD + 1)y = \left(\frac{\log x}{x}\right)^2$ (5)

   (b) Solve $\frac{d^2y}{dx^2} + a^2y = \sec ax$ by the method of variation of parameters. (5)

SECTION - B

3. Find the general solution in series solution of powers of x of the differential equation $4x\frac{d^2y}{dx^2} + 2\frac{dy}{dx} + y = 0$ (10)

4. State and prove the orthogonal property of Bessel's function. (10)

SECTION - C

5. (a) Find the Laplace transform of the function defined as

   $$f(t) = |t-1| + |t+1| + |t+2| + |t-2|, \quad t \geq 0$$ (5)

   (b) Find the inverse Laplace transform of $\frac{s^2+s}{(s^2+1)(s^2+2s+2)}$ (5)

6. (a) Evaluate $\int_0^\infty \frac{\cos 6t - \cos 4t}{t} dt$ (5)

   (b) Solve the differential equation using Laplace transform method $\frac{d^2x}{dt^2} + 9x = \cos 2t$, $x(0) = 1$, $x\left(\frac{\pi}{2}\right) = -1$ (5)

SECTION - D

7. (a) Find the Fourier series of $f(x) = \begin{cases} 0, & -\pi \leq x \leq 0 \\ x^2, & 0 \leq x \leq \pi \end{cases}$ (5)

   (b) Find the half range cosine series for the function $f(x) = x\sin x$ in the interval $(0, \pi)$. (5)

8. Solve $\left(2D_x^2 - 5D_xD_y + 2D_y^2\right)z = 5\sin(2x+y)$ (10)

SECTION - E
(Compulsory question)

9. (a) Solve $ydx - xdy + 3x^2y^2e^{x^3} = 0$

   (b) Define Particular integral.

[P.T.O.]

(c) Define singular point of a differential equation.

(d) Define Bessel's function of first kind.

(e) Prove that $\int x J_0(x)dx = x J_1(x)$.

(f) State and prove first shifting theorem for Laplace transform.

(g) Given that $L\left\{2\sqrt{\frac{t}{\pi}}\right\} = \frac{1}{s^{3/2}}$, show that $L\left\{\frac{1}{\sqrt{\pi t}}\right\} = \frac{1}{\sqrt{s}}$.

(h) Find the Laplace transform of Unit step function.

(8×2½=20)