[Total No. of Questions - 9] [Total No. of Printed Pages - 3]
(2068)

18022(M)

B. Tech 2nd Semester Examination

Engineering Mathematics-II (CBS)

MA-202

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 by selecting one question from each of section A, B, C and D. Section E is compulsory.

SECTION - A

1. (a) Solve $(y^2 + xy^3)\,dx + (5y^2 - xy + y^3 \sin y)\,dy = 0$.

(b) Find the complete solution of $\frac{d^2y}{dx^2} + 3y = -48x^2e^{3x}$. (12)

2. (a) Using the method of variation of parameters, solve $\frac{d^2y}{dx^2} - a^2y = \cosh ax$.

(b) Solve the Cauchy linear equation

$$(x+a)^2\frac{d^2y}{dx^2} - 4(x+a)\frac{dy}{dx} + 6y = x. \quad (12)$$

SECTION - B

3. (a) Obtain the series solution of the equation

$$x\frac{d^2y}{dx^2} + 2y\frac{dy}{dx} + xy = 0$$

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(b) Show that $\int xJ_0^2(x)dx = \frac{x^2}{2}\left[J_0^2(x) + J_1^2(x)\right]$, where $J_n(x)$ is a Bessel's function. (12)

4. (a) Prove that $(1-2xt+t^2)^{1/2} = \sum_{n=0}^{\infty} t^nP_n(x), t \neq 1$, where $P_n(x)$ is a Legendre's polynomial.

(b) Prove that $\left[x^{-v}J_v(x)\right]' = -x^vJ_{v+1}(x)$, where $J_n(x)$ is a Bessel's function. (12)

SECTION - C

5. (a) Find the inverse Laplace transform of (i) $\frac{1}{s}\ln\left(1+\frac{1}{s^2}\right)$, (ii) $\cot^{-1}(s/k)$.

(b) Solve by using Laplace transform

$$x\frac{d^2y}{dx^2} + 2\frac{dy}{dx} + xy = \cos x,\ y(0) = 1,\ y'(0) = 0. \quad (12)$$

6. (a) Using Convolution theorem evaluate, if $f(t) = e^{-t} - \int_0^t \cos(t-\tau)f(\tau)d\tau$.

(b) If $L\{tf(t)\} = \frac{1}{s(s^2+1)}$, then show that

$$L\{e^{-t}f(2t)\} = \frac{1}{4}\log\frac{(s+1)^2+4}{(s+1)^2}. \quad (12)$$

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SECTION - D

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

(b) Obtain the Fourier expansion of x sin x as a cosine series in $(0, \pi)$. (12)

8. (a) Solve the PDE $\frac{\partial^2 z}{\partial x^2} - \frac{\partial^2 z}{\partial x \partial y} = \cos x \cos 2y$.

(b) Solve the PDE $\frac{\partial^3 z}{\partial x^3} - 2\frac{\partial^3 z}{\partial x^2 \partial y} = 2e^{2x} + 3x^2 y$. (12)

SECTION - E

9. (a) State Convolution theorem of the Laplace transform. (3)

(b) State Initial and final value theorems of the Laplace transform. (3)

(c) Write any two Recurrence relation of Legendre's. polynomial. (2)

(d) Write the periods of the functions cos 3x and $\sin\left(\frac{2n\pi x}{k}\right)$. (2)

(e) The homogeneous linear differential equation whose auxiliary equation has roots 1, –1 is............ (2)

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