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Exam.Code:0906
Sub. Code: 6206

2014

B.E., Second Semester

MATHS-201/ASM-201: Differential Equations and Transforms

(Common to all streams)

Time allowed: 3 Hours

Max. Marks: 50

NOTE: Attempt five questions in all, including Question No. 1 which is compulsory and selecting two questions from each Section.

x-x-x

1. (a) Find the curve through the point $(1, 0)$ and having at each of its points the slope $-\frac{x}{y}$.

(b) Define exact differential equation along with suitable example. Under what conditions, the equation: $(ax + y)\, dx + (kx + by)\, dy = 0$ is exact?

(c) Define Laplace transform. Find the Laplace transform of $f(t) = \cos^2(a\, t)$.

(d) Explain the differences between Fourier series and Fourier transform. Also write down their applications. $(5 \times 2 = 10)$

(e) What are the three possible solutions of an one dimensional wave equation? What are the three possible solutions of an one dimensional wave equation?

SECTION-A

2. (a) Discuss the geometrical interpretation for the differential equation: $\frac{dy}{dx} = 1$.

(b) Solve the IVP: $e^x\, (\cos y\, dx - \sin y dy) = 0, y(0) = 0.$ $(3 + 3 + 4)$

(c) Solve the differential equation: $\frac{d^2y}{dx^2} - 2\,\frac{dy}{dx} + y = x\, e^x \sin x$.

3. (a) Find the general solution of the ODE: $\frac{d^2 y}{dx^2} + 3\,\frac{dy}{dx} + 2y = 2\, e^x$, using the method of variation of parameters. $(4 + 4 + 2)$

(b) Solve the differential equation: $(1 - x^2)\,\frac{d^2y}{dx^2} + 2\, y = 0$, given $y(0) = 4, \frac{dy}{dx}(0) = 5$ by power series method.

(c) Find the Laplace transform of the function: $f(t) = e^{i\,t}$.

P.T.O.

4. (a) Solve the IVP using Laplace transform:

$$\frac{d^2y}{dx^2} + 2\frac{dy}{dx} - 3y = 3,\ y(0) = 4,\ \frac{dy}{dx}(0) = -7.$$

(b) Using convolution theorem, solve the IVP: (5 + 5)

$$\frac{d^2y}{dx^2} + 9\,y = \sin 3t,\ y(0) = 0,\ \frac{dy}{dx}(0) = 0.$$

SECTION-B

5. (a) Determine the Fourier series for the function $f(x) = x \sin x$ in $0 < x < 2\pi$.

(b) Find the Fourier sine ans cosine transforms of $f(x) = e^{-ax}, a > 0$. Henec, find the value of the integrals $\int_0^{\infty} \frac{\omega \sin \omega x}{a^2+\omega^2}\, d\omega$. (5 + 5)

6. (a) Form a partial differential equation by elimination of the arbitrary functions from: $z = f(x + ay) + g(x - ay)$. (5 + 5)

(b) Solve the partial differential equation: $(x^2 + y^2 + z^2)\,p - 2\,xy\,q = -2\,x\,z.$

7. (a) Find the general solution of the partial differential equation:

$(3 - 2yz)\,p + x\,(2z - 1)\,q = 2x\,(y - 3)$. Hence, obtain the particular solution which passes through the curve $z = 0, x^2 + y^2 = 4$. (5 + 5)

(b) Use the method of separation of variables to solve the equation: $\frac{\partial^2 v}{\partial x^2} = \frac{\partial v}{\partial t}$ given that $v = 0$ when $t \to \infty$, as well as $v = 0$ at $x = 0$ and $x = l$.

x-x-x