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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

SECOND SEMESTER B.TECH DEGREE EXAMINATION, JULY 2017

Course Code: MA102

Course Name: DIFFERENTIAL EQUATIONS

Max. Marks: 100 Duration: 3 Hours

PART A

Answer all questions. Each carries3 marks.

1 Find a second order homogeneous linear ODE for which e^{-x} and e^{-2x} are the solutions. (3)

2 Find a basis of solutions of $y^{11} - y^{1} = 0$. (3)

3 Find the particular integral of $(D^2 - 4)y = x^2$. (3)

4 Solve $(D^2 + 3D + 2)y = 5$. (3)

5 Expand $\pi x - x^2$ in a half range sine series in the interval $(0, \pi)$. (3)

6 Expand f(x) in Fourier series in the interval (-2 , 2) when (3)

$$f(x) = \begin{cases} 0 & -2 < x < 0 \\ 1 & 0 < x < 2 \end{cases}$$

7 Obtain the partial differential equation by eliminating the arbitrary function from $z = f(x^2 + y^2)$. (3)

8 Solve $xp + yq = 3z$. (3)

9 Using the method of separation of variables solve $u_{xy} - u = 0$. (3)

10 Write down the possible solutions of one dimensional wave equation. (3)

11 Find the solution of one dimensional heat equation in steady state condition. (3)

12 State one dimensional heat equation with boundary conditions and initial conditions for solving it. (3)

PART B

Answer six questions,one full question from each module.

Module 1

13 a) Reduce to first order and solve $x^2y^{11} - 5xy^{1} + 9y = 0$.Given $y_1 = x^3$ is a solution. (6)

b) Solve the initial value problem $4y^{11} - 25y = 0$ where $y(0) = 0$, $y^1(0) = -5$. (5)

OR

14 a) Show that the functions $e^{-x}\text{Cos}x$ and $e^{-x}\text{Sin}x$ are linearly independent. Form a second order linear ODE having these functions as solutions. (6)

b) Solve $y^{1V} - 2y^{111} + 5y^{11} - 8y^{1} + 4y = 0$. (5)

Module 1I

15 a) Solve $x^3\frac{d^3y}{dx^3} + 2x^2\frac{d^2y}{dx^2} + 2y = 10\left(x + \frac{1}{x}\right)$. (6)

b) Solve $y^{11} - 4y^{1} + 3y = e^x\text{Cos } 2x$. (5)

OR

16 a) Solve $y^{11} + y = \text{Cosec } x$ using the method of variation of parameters. (6)

b) Solve $(D^2 - 2D + 1)y = x\text{Sin}x$. (5)

Module 1II

17 a) If f(x) = x + x^2 for $-\pi < x < \pi$ find the Fourier series expansion of f(x). (6)

b) Express f(x) = $|x|$ $-\pi < x < \pi$ as Fourier series. (5)

OR

18 a) Obtain Fourier series for the function f(x) = $\begin{cases} \pi x & when\ 0 \leq x \leq 1 \\ \pi(2-x) & when\ 1 \leq x \leq 2 \end{cases}$ (6)

b) Obtain the half range cosine series for f(x) = x in the 2interval $0 \leq x \leq \pi$. (5)

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

Module 1V

19 a) Solve xp – yq = $y^2 - x^2$. (6)

b) Solve $\frac{\partial^2 z}{\partial x^2} - 7\frac{\partial^2 z}{\partial x \partial y} + 12\frac{\partial^2 z}{\partial y^2} = e^{x-y}$. (5)

OR

20 a) Solve $\frac{\partial^2 z}{\partial x^2} - \frac{\partial^2 z}{\partial x \partial y} = SinxCos2y$. (6)

b) Solve p – 2q = $3x^2$Sin (y + 2x). (5)

Module V

21 Derive one dimensional wave equation. (10)

OR

22 a) A tightly stretched homogeneous string of length l with its fixed ends at x = 0 and x = l executes transverse vibrations. Motion starts with zero initial velocity by displacing the string into the form f(x) = k(x^2- x^3).Find the deflection u(x,t) at any time t. (10)

Module VI

23 Find the temperature distribution in a rod of length 2m whose end points are maintained at temperature zero and the initial temperature is f(x) = 100(2x – x^2). (10)

OR

24 A long iron rod with insulated lateral surface has its left end maintained at a temperature 0^oC and its right end at x=2 maintained at 100^0C. Determine the temperature as a function of x and t if the initial temperature is (10)

u(x,0) = $\begin{cases} 100x & 0 < x < 1 \\ 100 & 1 < x < 2 \end{cases}$.

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