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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

SECOND SEMESTER B.TECH DEGREE EXAMINATION, DECEMBER 2018

Course Code: MA102

Course Name: DIFFERENTIAL EQUATIONS

Max. Marks: 100 Duration: 3 Hours

PART A

Answer all questions, each carries 3 marks

1	Find a general solution of the ordinary differential equation $y'' + y = 0$	(3)
2	Find the Wronskian of $e^x \cos 2x$ and $e^x \sin 2x$	(3)
3	Find the particular integral of the differential equation $y'' + y = cosh5x$	(3)
4	Using a suitable transformation, convert the differential equation. $(3x+2)^2y'' + 5(3x+2)y' - 3y = x^2 + x + 1$ into a linear differential equation with constant coefficients.	(3)
5	If $f(x)$ is a periodic function of period $2L$ defined in $[-L, L]$. Write down Euler's Formulas $a_0,\ a_n,\ b_n$ for $f(x)$.	(3)
6	Find the Fourier cosine series of $f(x) = x^2$ in $0<x\leq c$.	(3)
7	Find the partial differential equation of all spheres of fixed radius having their centres in xy-plane.	(3)
8	Find the particular integral of $r + s - 2t = \sqrt{2x+y}$.	(3)
9	Write any three assumptions involved in the derivation of one dimensional wave equation.	(3)
10	Solve $x\frac{\partial u}{\partial x} - 2y\frac{\partial u}{\partial y} = 0$ using method of separation of variables.	(3)
11	Find the steady state temperature distribution in a rod of 30 cm having its ends at 20^0C and 80^0C respectively.	(3)
12	Write down the possible solutions of the one dimensional heat equation.	(3)

PART B

Answer six questions, one full question from each module

Module 1

13	a)	Solve the initial value problem $y'' + 4y' + 5y = 0, y(0) = 2, y'(0) = -5$.	(5)
	b)	Find a basis of solutions of the ODE $(x^2 - x)y'' - xy' + y = 0$, if $y_1 = x$ is a	(6)

solution.

OR

14 a) Reduce to first order and solve $y'' + (1 + \frac{1}{y})(y')^2 = 0$ (5)

b) Solve the initial value problem $9y'' - 30y' + 25y = 0, y(0) = 3, y'(0) = 10.$ (6)

Module 1I

15 a) Solve $y'' - 2y' + 5y = e^{2x} sinx.$ (5)

b) Using method variation of parameters solve $y'' + 4y = tan2x$ (6)

OR

16 a) Solve $x^3y''' + 3x^2y'' + xy' + y = x + logx$ (5)

b) Solve using method of variation of parameters $y'' - 2y' + y = \frac{e^x}{x}$ (6)

Module 1II

17 Find the Fourier series of periodic function $f(x) = \begin{cases} -x, -1 \le x \le 0 \\ x, 0 \le x \le 1 \end{cases}$ with period 2. Hence prove that $1 + \frac{1}{3^2} + \frac{1}{5^2} + \cdots \ldots . = \frac{\pi^2}{8}.$ (11)

OR

18 Find the Fourier series of periodic function $f(x) = xsinx$,$0 < x < 2\pi$ with period 2π. (11)

Module 1V

19 a) Solve $p - 2q = 3x^2 \sin(y+2x)$. (5)

b) Solve $r + s - 6t = y \sin x$. (6)

OR

20 a) Solve $x(y - z)p + y(z - x)q = z(x - y).$ (5)

b) Solve $(D^2 - 2DD' - 15D'^2)\, z = 12xy.$ (6)

Module V

21 A tightly stretched string of length L is fixed at both ends. Find the displacement u(x,t) if the string is given an initial displacement f(x) and an initial velocity g(x). (10)

OR

22 A tightly stretched string with fixed end points $x = 0$ and $x = l$ is initially in a position given by $u = v_0 sin^3\left(\frac{\pi x}{l}\right), 0 \le x \le l$. If it is released from rest from this position, find the displacement function $u(x, t)$ (10)

Module VI

23 The ends A and B of a rod of length L are maintained at temperatures 0^0C and 100^0C respectively until steady state conditions prevails. Suddenly the temperature at the end A is increased to 20^0C and the end B is decreased to 60^0C. Find the temperature distribution in the rod at time t. (10)

OR

24 Find the temperature distribution in a rod of length 2 m whose end points are maintained at temperature zero and the initial temperature is (10)

$f(x) = 100(2x-x^2),\ 0 \le x \le 2$

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