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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

B.Tech Degree S1 (S,FE) S2 (S,FE) Examination May 2024 (2015 Scheme)

Course Code: MA 102

Course Name: DIFFERENTIAL EQUATIONS

Max. Marks: 100 Duration: 3 Hours

PART A

Answer all Questions. Each question carries 3 Marks

		Marks
1	Find the wronskian of e^{2x} *and* e^{3x}	(3)
2	Solve the differential equation $y''' + y = 0$.	(3)
3	Find the particular integral of $(D^2 + 3D + 2)\,y = 4$.	(3)
4	Solve $y'' + 9y = sin3x$	
5	If f(x) is a periodic function with period 2π defined in$[-\pi, \pi]$. Write the Euler's formulas a_0 , a_n, b_n	(3)
6	Find the Fourier sine series of the function $f(x) = x$ in the interval $(0, \pi)$	(3)
7	Find the differential equation of all spheres whose centre lies on the z axis	(3)
8	Solve $p - q = \log(x + y)$	
9	Solve one dimensional wave equation for $k < 0$.	
10	Write any three assumptions in deriving one dimensional wave equation.	(3)
11	Find the steady state temperature distribution in a rod of length 10cm if the ends are kept at 50^0C and 100^0C.	(3)
12	Write down the possible solutions of one dimensional heat equation.	(3)

PART B

Answer six questions, one full question from each module

Module I

13	a)	Show that the functions e^x and xe^x are linearly independent. Hence form an ODE for the given basis$\{e^x, xe^x\}$	(6)
	b)	Find the general solution of $(D^4 - 81)y = 0$	(5)

OR

14	a)	Solve the initial value problem: $y'' + y' + 0.25y = 0, y(0) = 3, y'(0) = -3.5$	(6)
	b)	Show that the functions x^3 *and* x^5 are basis of solutions of the ODE $x^2y'' - 7xy' + 15y = 0$.	(5)

Module II

15 a) Solve $\frac{d^2y}{dx^2} + 4y = tan2x$ using method of variation of parameters. (6)

b) Find the P.I of $(D^3 - 3D^2 + 4)y = e^{2x}$ (5)

OR

16 a) Solve $x^2\frac{d^2y}{dx^2} + x\frac{dy}{dx} = 12logx$ (6)

b) Solve $(D^2 + 2D + 1)y = x^3$ (5)

Module III

17 Express f(x) = $|x|$ as a Fourier series in the range $-\pi < x < \pi$.Hence show that $1 + \frac{1}{3^2} + \frac{1}{5^2} + \frac{1}{7^2} + \ldots. = \frac{\pi^2}{8}$ (11)

OR

18 a) Obtain the Fourier series expansion of $f(x) = x + x^2, -\pi < x < \pi$ (6)

b) Find the half range Fourier cosine series of $f(x) = (x-1)^2, 0 < x < 1$. (5)

Module IV

19 a) Solve $(y^2 + z^2)p - xyq + xz = 0$ (6)

b) Solve $r - 4s + 4t = e^{2x-y}$ (5)

OR

20 a) Solve $\left(D^2 + DD' - 6D'^2\right)z = \sin(2x + y)$ (6)

b) Form the PDE by eliminating arbitrary functions from $z = f(x) + e^y g(x)$ (5)

Module V

21 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)

OR

22 A string of length l is initially at rest in the equilibrium position and each of its points is given the velocity $u = u_0 sin^3\left(\frac{\pi x}{l}\right), 0 < x < l$. Determine the displacement function $u(x,t)$. (10)

Module VI

23 A rod of 30 cm long has its ends A and B kept at 20⁰C and 80⁰C respectively until steady state temperature prevail. The temperature at each end is then suddenly reduced to zero temperature and kept so. Find the resulting temperature function u(x ,t) taking x=0 at A. (10)

OR

24 Find the temperature distribution in a bar of length π whose surface is thermally insulated with end points at 0^0C. The initial temperature distribution in the rod is (10)

$$u(x,0) = \begin{cases} x, & 0 \le x \le \pi/2 \\ \pi - x, & \pi/2 \le x \le \pi \end{cases}$$

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