Reg No.:_______________ Name:__________________________

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

B.Tech S1,S2 (S) Examination September 2020 (2015 Scheme)

Course Code: MA102

Course Name: DIFFERENTIAL EQUATIONS

Max. Marks: 100 Duration: 3 Hours

PART A

Answer all questions, each carries 3 marks

1	Find the ODE $y'' + ay' + by = 0$ for the basis $\{ e^x, xe^x \}$	(3)
2	Reduce to first order and solve $2xy'' = 3y'$.	(3)
3	Find the particular integral of $y'' + 4y' + 4y = x^2$.	(3)
4	Using a suitable transformation, convert the differential equation $(x^2D^2 - 4xD + 6)y = x$ 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 series of the function $f(x) = x$ in the range $-\pi < x < \pi$.	(3)
7	Find the PDE by eliminating arbitrary constants a and b from $2z = \frac{x^2}{a^2} + \frac{y^2}{b^2}$.	(3)
8	Find the particular integral of $(D^3 - 4D^2D' + 4DD'^2)z = \cos(2x + y)$.	(3)
9	Write all possible solutions of one dimensional wave equation.	(3)
10	A homogeneous string is stretched and its ends are fixed at $x = 0$ and $x = 40$. Motion is started by displacing the string into the form $f(x) = \sin\left(\frac{\pi x}{40}\right)$ from which it is released at time $t = 0$. Write the boundary and initial conditions..	(3)
11	Solve one dimensional heat equation for $\lambda < 0$.	(3)
12	Find the steady state temperature distribution in a rod of length 40 cm if the ends are kept at 0^0C and 100^0C.	(3)

PART B

Answer six questions, one full question from each module

Module 1

13 a) Solve $y'' - 2y' - 3y = 0, y(-1) = e, y'(1) = -\frac{e}{4}$. (6)

b) Show that the functions x^3 and x^5 are the basis of solutions of ODE $x^2y'' - 7xy' + 15y = 0$. (5)

OR

14 a) Solve ODE $y^v - 3y^{iv} + 3y''' - y'' = 0$. (6)

b) Solve the ODE $xy'' + 2y' + xy = 0$. Given that $y_1 = \frac{cosx}{x}$ is a solution. (5)

Module 1I

15 a) By the method of variation of parameters, solve $y'' + y = secx$. (6)

b) Solve $x^2y'' - 4xy' + 6y = x^5$. (5)

OR

16 a) Solve $(2x+3)^2y'' - 2(2x+3)y' - 12y = 6x$. (6)

b) Solve $y'' + 2y' - 3y = e^{2x} sinx$. (5)

Module 1II

17 a) Find the Fourier series of f defined by $f(x) = e^x$ in $(-\pi, \pi)$. (11)

OR

18 a) Obtain Fourier series for the function $f(x) = x^2, -\pi \le x \le \pi$. (6)

b) Expand $f(x) = cosx$ as a half range sine-series in $0 \le x \le \pi$. (5)

Module 1V

19 a) Solve $r + s - 2t = \sqrt{2x + y}$. (6)

b) Find the general solution of $x^2p + y^2q = (x+y)z$. (5)

OR

20 a) Solve $4r + 12s + 9t = e^{3x-2y}$. (6)

b) Solve $(D^2 - DD' - 6D'^2)z = xy$. (5)

Module V

21 a) Using method of separation of variables, solve $y^2u_x - x^2u_y = 0$. (5)

b) Find the displacement of a finite string of length *l* that is fixed at both ends and is released from rest with an initial displacement of $2\sin\left(\frac{\pi x}{l}\right)$. (5)

OR

22 Derive one dimensional wave equation. (10)

Module VI

23 A rod of length L is heated so that its ends A and B are at zero temperature .If its initial temperature is given by $u = \frac{cx(L-x)}{L^2}$, find the temperature at time t. (10)

OR

24 A rod of length 40cm has its ends A and B kept at 0^0C and 100^0C respectively until steady state conditions prevail. Suddenly the temperature at A is raised to 20^0C and the end B is decreased to 60^0C . Find the temperature distribution in the rod at time t. (10)

****