Reg. No.____________ Name:____________________

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

SECOND SEMESTER B.TECH DEGREE EXAMINATION, MAY 2017

MA 102: DIFFERENTIAL EQUATIONS

Max. Marks: 100 Duration: 3Hours

PART A

Answer all questions. 3 marks each.

1. Solve the initial value problem $y^{II} - y = 0,\ y(0) = 4, y^{I}(0) = -2$
2. Show that $e^{2x},\ e^{3x}$are linearly independent solutions of the differential equation $\frac{d^2y}{dx^2} - 5\frac{dy}{dx} + 6y = 0\ \ in\ -\infty < x < +\infty$.What is its general solution?
3. Solve $\frac{d^3y}{dx^3}$ -4$\frac{d^2y}{dx^2}$ + 5$\frac{dy}{dx}$ -2y =0
4. Find the particular integral of $(D^2 + 4D + 1)y = e^x sin3x$
5. Find the Fourier series of f(x)=x , $-\pi\ \le x \le \pi$
6. Obtain the half range cosine series of f(x)= x^2 , $0 \le x \le C$
7. Form the partial differential equation from $z = xg(y) + yf(x)$
8. Solve $(y - z)p + (x - y)q = (z - x)$
9. Write down the important assumption when derive one dimensional wave equation.
10. Solve $3u_x$ +$2u_y$=0 with u(x,0)=4e^{-x} by the method of separation of variables.
11. Solve one dimensional heat equation when k> 0
12. Write down the possible solutions of one dimensional heat equation.

PART B

Answer six questions, one full question from each module.

Module I

13. a) Solve the initial value problem $y^{II} - 4y^1 + 13y = 0$ with y(0)= -1 ,$y^1(0) = 2$ **(6)**

b) Solve the boundary value problem$y^{II} - 10y^{I} + 25y = 0$, y(0)=1,y(1)=0 **(5)**

OR

14. a) Show that $y_1(x) = e^{-4x}$ and $y_2(x) = xe^{-4x}$ are solutions of the differential equation $\frac{d^2y}{dx^2} + 8\frac{dy}{dx} + 16y = 0$. Are they linearly independent? **(6)**

b) Find the general solution of $(D^4 + 3D^2 - 4)y = 0$. **(5)**

Module II

15. a) Solve $(D^3 + 8\,)y = sinx\cos x + e^{-2x}$ **(6)**

b) Solve $y^{II} + y = tan\,x$ by the method of variation of parameters. **(5)**

OR

16. a) Solve $x^3\frac{d^3y}{dx^3}+2x^2\frac{d2y}{dx2}+2y=\frac{1}{x}$ (6)

b) Solve $(D^2+2D-3)y=e^x\, cosx$ (5)

Module III

17. a) Find the Fourier series of $f(x)=\begin{cases}-1+x, -\pi<x<0\\ 1+x,\ 0<x<\pi\end{cases}$ (6)

b) Find the half range sine series of $f(x)=\begin{cases}x,\ 0<x<1\\ 2-x,\ 1<x<2\end{cases}$ (5)

OR

18. a) Obtain the Fourier series of $f(x)=\begin{cases}-\frac{\pi}{4}, -\pi<x<0\\ \pi/4,\ 0<x<\pi\end{cases}$ (6)

b) Find the half range cosine series of $f(x)=x, 0<x<l$ (5)

Module IV

19. a) Solve $(D^2-2DD'+D'^2)z=e^{x+2y}+x^3$ (6)

b) Find the Particular Integral of $\frac{\partial^3 z}{\partial x^3}-7\frac{\partial^3 z}{\partial x^2\partial y}-6\frac{\partial^3 z}{\partial y^3}=\sin(x+2y)$ (5)

OR

20. a) Solve $(D^2+DD'-6D'^2)z=y\, sinx$ (6)

b) Solve $(mz-ny)p+(nx-lz)q=ly-mx$ (5)

Module V

21. Solve the one dimensional wave equation $\frac{\partial^2 u}{\partial t^2}=c^2\frac{\partial^2 u}{\partial x^2}$ with boundary conditions $u(0,t)=0, u(l,t)=0\ for\ all\ t$ and initial conditions $u(x,0)=f(x), \left.\frac{\partial u}{\partial t}\right\}_{t=0}=g(x)$. (10)

OR

22. A sting of length 20cm fixed at both ends is displaced from its position of equilibrium, by each of its points an initial velocity given by $=\begin{cases}x, & 0<x\le 10\\ 20-x, & 10\le x\le 20\end{cases}$, x being the distance from one end. Determine the displacement at any subsequent time. (10)

Module VI

23. Derive one-dimensional heat equation. (10)

OR

24. Find the temperature in a laterally insulated bar of length L whose ends are kept at temperature 0°C, assuming that the initial temperature is $f(x)=\begin{cases}x, & 0<x<L/2\\ L-x, & L/2<x<L\end{cases}$ (10)

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