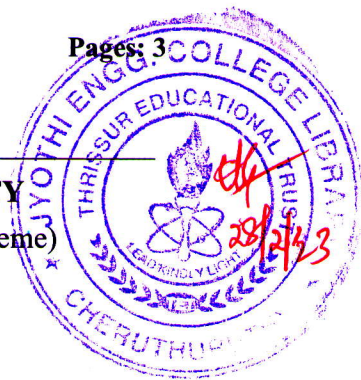


Reg No.: \_\_\_\_\_

Name: \_\_\_\_\_

**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY**

B.Tech S1 (S,FE) S2 (S) Examination February 2023 (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 general solution of the differential equation  $y'' + y = 0$  (3)
- 2 Reduce to first order and solve  $yy'' = 3(y')^2$ . (3)
- 3 Find the particular solution of the differential equation  $y''' + y = \cos 2x$ . (3)
- 4 Using a suitable transformation, convert the differential equation  $(x+1)^2 y'' + (x+1)y' + y = 4\cos(\log(1+x))$  into a linear differential equation with constant coefficients. (3)
- 5 Find the Fourier series of the function  $f(x) = x + \pi$  in the range  $-\pi < x < \pi$ . (3)
- 6 Find the Fourier sine series of  $f(x) = x$ , in  $0 \leq x \leq 3$  (3)
- 7 Find the partial differential equation of all spheres having their centre lies on z-axis. (3)
- 8 Solve  $2r + 5s + 2t = 0$ . (3)
- 9 Solve  $\frac{\partial u}{\partial x} + \frac{\partial u}{\partial y} = 0$  using method of separation of variables. (3)
- 10 Write the three possible solutions of one dimensional wave equation. (3)
- 11 Find the steady state temperature distribution in a rod of 50 cm having its ends at  $20^\circ\text{C}$  and  $70^\circ\text{C}$  respectively. (3)
- 12 Write the three basic laws which are used in the derivation of 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  $y''' + y'' + 4y' + 4y = 0$ ,  $y(0) = 2$ ,  $y'(0) = -5$ ,  $y''(0) = -3$ . (5)

- b) Find a basis of solutions of the differential equation  $y'' - 3y' + 2y = 0$  (6)

OR

- 14 a) Find a basis of solution of the ODE  $(x^2)y'' + xy' - 4y = 0$  if  $y_1 = x^2$  is a solution. (5)

- b) Solve  $y^v - 3y'^v + 3y''' - y'' = 0$ . (6)

### Module II

- 15 a) Solve  $x^2y'' - xy' + 4y = \cos(\log x) + x\sin(\log x)$ . (5)

- b) Use method of variation of parameters solve  $y'' + y = \sec x$ . (6)

OR

- 16 a) Solve  $y'' - 4y' + 4y = 8x^2e^{2x}\sin 2x$ . (5)

- b) Solve  $y'' + 4y = \tan 2x$ . (6)

### Module III

- 17 Find the Fourier series for the function  $f(x) = \begin{cases} x, & 0 < x < 1 \\ 1-x, & 1 < x < 2 \end{cases}$ . Hence deduce that  $1 + \frac{1}{3^2} + \frac{1}{5^2} + \dots = \frac{\pi^2}{8}$ . (11)

OR

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

- b) Find the Fourier cosine series of  $f(x) = \cos x$  in  $0 < x < \frac{\pi}{2}$ . (5)

### Module IV

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

- b) Find the particular integral of  $(D^3 - 10D^2D' + D'^5)z = \cos(2x+3y)$  (6)

OR

- 20 a) Solve  $xy dx + y^2 dy = zxy - 2x^2$  (5)

- b) Solve  $(D^2 + 3DD' + 2D'^2)z = x^2y^2$  (6)

### Module V

- 21 Derive one dimensional wave equation. (10)

OR

- 22 Find the deflection of the vibrating string which is fixed at the ends  $x=0$  and  $x=2$  (10)

and the motion is started by displacing the string into the form  $\sin^3 \frac{\pi x}{2}$  and released it with zero initial velocity at  $t=0$ .

### Module VI

- 23 The ends A and B of a rod of length 20 cm are maintained at temperatures  $30^\circ\text{C}$  and  $80^\circ\text{C}$  respectively until steady state conditions prevail. The temperature of the ends are changed to  $40^\circ\text{C}$  and  $60^\circ\text{C}$  respectively. Find the temperature distribution in the rod at time  $t$ . (10)

OR

- 24 Find the temperature distribution in a bar of length  $\pi$  whose surface is thermally insulated with end points maintained at  $0^\circ\text{C}$ . The initial temperature distribution in the rod is  $u(x, 0) = \begin{cases} x, & 0 \leq x \leq \frac{\pi}{2} \\ \pi - x, & \frac{\pi}{2} \leq x \leq \pi \end{cases}$  (10)

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