

10251

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

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

**SECOND SEMESTER B.TECH DEGREE EXAMINATION, JULY 2016**

**Course Code: MA-102**

**Course Name: DIFFERENTIAL EQUATIONS**

Max. Marks: 100

Duration: 3 hrs

**PART A**

*Answer all questions Each carries 3 marks*

- (1) Find the general solution of  $y''' - y = 0$
- (2) Find the wronskian of the following  $e^{-x} \cos 5x ; e^{-x} \sin 5x$
- (3) Solve  $\frac{d^2y}{dx^2} - 4\frac{dy}{dx} + 4y = e^{2x}$
- (4) Solve  $\frac{d^2y}{dx^2} + 2\frac{dy}{dx} = x^2$
- (5) Express  $f(x) = x$  as a Fourier series in the interval  $-\pi < x < \pi$
- (6) Obtain the half range Fourier sine series for the function  $e^x$  in  $0 < x < 2$
- (7) Form the partial differential equation by eliminating the arbitrary function from  $z = y^2 + 2f\left(\frac{1}{x} + \log y\right)$
- (8) Solve  $p\sqrt{x} + q\sqrt{y} = \sqrt{z}$
- (9) Using the method of separation of variables solve  $\frac{\partial u}{\partial x} = 2\frac{\partial u}{\partial t} + u$  where  $u(x, 0) = 3e^{-5x}$
- (10) State the one dimensional wave equation with boundary conditions and initial conditions for solving it
- (11) In the Heat equation  $\frac{\partial u}{\partial t} = \alpha^2 \frac{\partial^2 u}{\partial x^2}$  what does  $\alpha^2$  indicate. State the boundary and initial conditions for solving it
- (12) Find the steady state temperature distribution in a rod of length 25cm, if the ends of the rod are kept at  $20^\circ\text{C}$  and  $70^\circ\text{C}$ .

**PART B**

*Answer one full question from each module*

Module -I

- (13) (a) Solve  $y''' - 8y'' + 37y' - 50y = 0$  (6)

A

- (b) Determine all possible solutions to the initial value problem  
 $y' = 1 + y^2, y(0) = 0$  in  $|x| < 3, |y| < 2$  (5)

OR

- (14) (a) Find the general solution of  $y^{(4)} - y''' - 9y'' - 11y' - 4y = 0$  (6)  
 (b) Determine all possible solutions to the initial value problem  
 $y' = y^{\frac{1}{2}}, y(0) = 0.$  (5)

Module - II

- (15) (a) Solve by method of variation of parameters  $\frac{d^2y}{dx^2} + y = x \sin x.$  (6)  
 (b) Solve  $\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + y = xe^x \sin x.$  (5)

OR

- (16) (a) Solve  $x^2 \frac{d^2y}{dx^2} - 2x \frac{dy}{dx} - 4y = x^2 + 2 \log x.$  (6)  
 (b) Solve  $\frac{d^2y}{dx^2} - 4\frac{dy}{dx} + 3y = \sin 3x \sin 2x.$  (5)

Module - III

- (17) (a) Obtain the Fourier series for the function  $f(x)$  given by  
 $f(x) = \begin{cases} 1 + \frac{2x}{\pi} & -\pi \leq x \leq 0 \\ 1 - \frac{2x}{\pi} & 0 \leq x \leq \pi \end{cases}$  (6)  
 (b) Obtain the Fourier series to represent the function  
 $f(x) = |\sin x|; -\pi < x < \pi$  (5)

OR

- (18) (a) Expand the function  $f(x) = x \sin x$  as a Fourier series in the interval  
 $-\pi \leq x \leq \pi$  (6)  
 (b) Find the half range cosine series for the function  $f(x) = x^2$  in the range  
 $0 \leq x \leq \pi$  (5)

Module - IV

(19) (a) Solve  $\frac{\partial^3 z}{\partial x^3} - 2 \frac{\partial^3 z}{\partial x^2 \partial y} = 5e^{3x} - 7x^2 y.$  (6)

(b) Solve  $(x + y)zp + (x - y)zq = x^2 + y^2$  (5)

OR

(20) (a) Solve  $\frac{\partial^3 z}{\partial x^3} - 4 \frac{\partial^3 z}{\partial x^2 \partial y} + 4 \frac{\partial^3 z}{\partial x \partial y^2} = 2 \sin (3x + 2y).$  (6)

(b) Solve  $\frac{\partial^2 z}{\partial x^2} - \frac{\partial^2 z}{\partial y^2} = \cos 2x \cos 3y.$  (5)

Module - V

(21) A tightly stretched string with fixed end points  $x = 0$  and  $x = l$  is initially in a position given by  $y = y_0 \sin^3 \left( \frac{\pi x}{l} \right)$ . If it is released from rest from this position, find the displacement  $y(x, t)$ . (10)

OR

(22) A tightly stretched string with fixed end points  $x = 0$  and  $x = l$  is initially at rest in its equilibrium position. If it is vibrating by giving to each of its points a velocity  $\lambda x(l - x)$ , find the displacement of the string at any distance  $x$  from one end at any time  $t$ . (10)

Module - VI

(23) A bar 10 cm long with insulated sides has its ends A and B maintained at  $30^\circ \text{C}$  and  $100^\circ \text{C}$  respectively until steady state conditions prevail. The temperature at A is suddenly raised to  $20^\circ \text{C}$  and at the same time that of B is lowered to  $40^\circ \text{C}$ . Find the temperature distribution in the bar at time  $t$ . (10)

OR

(24) A rod of 30cm long has its ends A and B kept at  $30^\circ \text{C}$  and  $90^\circ \text{C}$  respectively until steady state temperature prevails. The temperature at each end is then suddenly reduced to zero temperature and kept so. Find the resulting temperature function  $u(x, y)$  taking  $x = 0$  at A. (10)

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