

# CBCS SCHEME



17MAT21

## Second Semester B.E. Degree Examination, June/July 2023 Engineering Mathematics – II

Time: 3 hrs.

Max. Marks: 100

*Note: Answer any FIVE full questions, choosing ONE full question from each module.*

### Module-1

- 1 a. Solve :  $(4D^4 - 8D^3 - 7D^2 + 11D + 6)y = 0$  (06 Marks)  
b. Solve :  $(D^3 + 6D^2 + 11D^2 + 6)y = e^x + 1$ . (07 Marks)  
c. Apply the method of undetermined coefficient to solve  $\frac{d^2y}{dx^2} - 3\frac{dy}{dx} + 2y = x^2 + e^x$ . (07 Marks)

OR

- 2 a. Solve :  $(D^4 - 4D^3 - 5D^2 - 36D - 36)y = 0$ . (06 Marks)  
b. Solve :  $\frac{d^2y}{dx^2} + 4y = x^2 + \cos 2x + 2^{-x}$ . (07 Marks)  
c. By the method of variation of parameters solve  $(D^2 + a^2)y = \sec ax \tan ax$ . (07 Marks)

### Module-2

- 3 a. Solve :  $(2x + 5)^2 y'' - 6(2x + 5)y' + 8y = 6x$ . (07 Marks)  
b. Solve :  $xy \left( \frac{dy}{dx} \right)^2 - (x^2 + y^2) \frac{dy}{dx} + xy = 0$ . (06 Marks)  
c. Solve :  $(p - 1)e^{3x} + p^3 e^{2y} = 0$  by taking the substitution  $u = e^x$ ,  $v = e^y$  by reducing it into the Clairaut's form. (07 Marks)

OR

- 4 a. Solve :  $x^3 y''' + 3x^2 y'' + xy' + y = x + \log x$ . (07 Marks)  
b. Solve :  $\frac{dy}{dx} - \frac{dx}{dy} = \frac{x}{y} - \frac{y}{x}$ . (06 Marks)  
c. Obtain the general and the singular solution of the equation  $xp^2 - yp + a + kp = 0$ . (07 Marks)

### Module-3

- 5 a. Form a partial differential equation by eliminating the arbitrary constants a, b, c from  $\frac{x^2}{a^2} + \frac{y^2}{b^2} + \frac{z^2}{c^2} = 1$ . (06 Marks)  
b. Solve  $\frac{\partial^2 u}{\partial y^2} = 4u$ , given that  $u = 0$ ,  $\frac{\partial u}{\partial y} = 2 \sin x$  when  $y = 0$ . (07 Marks)  
c. Derive the expression for one dimensional wave equation. (07 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.  
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

OR

- 6 a. Form a partial differential equation by eliminating Arbitrary function F from  $F(x + y + z, x^2 + y^2 + z^2) = 0$ . (06 Marks)
- b. Solve :  $\frac{\partial^2 z}{\partial x \partial t} = e^{-t} \cos x$ , given that  $z = 0$  when  $t = 0$  and  $\frac{\partial z}{\partial t} = 0$  when  $x = 0$ . (07 Marks)
- c. Use the method of separation of variable to solve the heat equation  $c^2 \frac{\partial^2 u}{\partial x^2} = \frac{\partial u}{\partial t}$ . (07 Marks)

**Module-4**

- 7 a. Evaluate  $\int_{-1}^1 \int_0^z \int_{x-z}^{x+z} (x + y + z) dy dx dz$ . (07 Marks)
- b. Evaluate  $\int_0^a \int_0^{2\sqrt{ax}} x^2 dy dx$  by changing the order of integration. (07 Marks)
- c. Find the value of  $\int_0^{\pi/2} \frac{d\theta}{\sqrt{\sin \theta}} \int_0^{\pi/2} \sqrt{\sin \theta} d\theta$ . (06 Marks)

OR

- 8 a. Evaluate  $\int_0^a \int_0^x \int_0^{x+y} e^{x+y+z} dz dy dx$ . (07 Marks)
- b. By changing the order of integration, evaluate  $\int_0^a \int_y^a \frac{xdxdy}{x^2 + y^2}$ . (07 Marks)
- c. Prove that  $\beta(m, n) = \frac{\Gamma(m) \Gamma(n)}{\Gamma(m+n)}$ . (06 Marks)

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BANGALORE - 560 037**Module-5**

- 9 a. Find the Laplace transform of  $te^{2t} + t \sin t$ . (06 Marks)
- b. A periodic function of period  $2a$  is defined by,  $f(t) = \begin{cases} t, & 0 < t < a \\ 2a - t, & a < t < 2a \end{cases}$ . Show that  $L\{f(t)\} = \frac{1}{s^2} \tanh\left(\frac{as}{2}\right)$ . (07 Marks)
- c. Using convolution theorem, find  $L^{-1}\left\{\frac{1}{(s^2 + a^2)^2}\right\}$ . (07 Marks)

OR

- 10 a. Express  $f(t) = \begin{cases} \pi - t, & 0 < t \leq \pi \\ \sin t, & t > \pi \end{cases}$  in terms of unit step function and hence find its Laplace transform. (06 Marks)
- b. Find  $L^{-1}\left\{\log\left(\frac{s^2 + 1}{s(s+1)}\right)\right\}$ . (07 Marks)
- c. By using Laplace transform, solve  $y''(t) + 4y'(t) + 4y(t) = e^{-t}$ ,  $y(0) = 0$  and  $y'(0) = 0$ . (07 Marks)

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