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17MAT21

## Second Semester B.E. Degree Examination, July/August 2022 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 :  $(4D^4 - 4D^3 - 23D^2 + 12D + 36)y = 0$ , where  $D = \frac{d}{dx}$ . (06 Marks)
- b. Solve  $\frac{d^3y}{dx^3} + y = 65\cos(2x + 1)$ . (07 Marks)
- c. Solve :  $y'' + 4y = x^2 + e^{-x}$  by the method of undetermined co-efficients. (07 Marks)

**OR**

- 2 a. Solve  $\frac{d^2y}{dx^2} - 4y = \cosh(2x - 1) + 3^x$ . (06 Marks)
- b. Solve  $(D^2 + D + 1)y = 1 - x + x^2$ . (07 Marks)
- c. Solve  $\frac{d^2y}{dx^2} + y = \frac{1}{1 + \sin x}$  by the method of variation of parameters. (07 Marks)

### Module-2

- 3 a. Solve  $x^3 \frac{d^3y}{dx^3} + 3x^2 \frac{d^2y}{dx^2} + x \frac{dy}{dx} = x^3$ . (06 Marks)
- b. Solve  $p^2 + 2p \cot x = y^2$ . (07 Marks)
- c. Modify the following equations into Clairaut's form and hence obtain its general and singular solution.  $xp^2 - py + Kp + a = 0$ . (07 Marks)

**OR**

- 4 a. Solve  $(3x + 2)^2 y'' + 3(3x + 2)y' - 36y = 8x^2 + 4x + 1$ . (06 Marks)
- b. Solve  $p(p + y) = x(x + y)$ . (07 Marks)
- c. Solve  $(px - y)(py + x) = 2p$  by reducing it to Clairaut's form, by taking the substitution  $X = x^2, Y = y^2$ . (07 Marks)

### Module-3

- 5 a. Form a PDE by eliminating arbitrary functions  $\phi(x + y + z, x^2 + y^2 - z^2) = 0$ . (06 Marks)
- b. Solve  $\frac{\partial^2 z}{\partial x \partial y} = \sin x \sin y$  for which  $\frac{\partial z}{\partial y} = -2 \sin y$  where  $x = 0$  and  $z = 0$  if  $y$  is an odd multiple of  $\frac{\pi}{2}$ . (07 Marks)
- c. Derive one dimensional wave equation in the form  $\frac{\partial^2 u}{\partial t^2} = C^2 \frac{\partial^2 u}{\partial x^2}$ . (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 PDE by eliminating arbitrary functions,  $z = yf(x) + x\phi(y)$ . (06 Marks)
- b. Solve the equation  $\frac{\partial^2 z}{\partial x^2} + z = 0$  given that  $z = e^y$  and  $\frac{\partial z}{\partial x} = 1$  when  $x = 0$ . (07 Marks)
- c. Find various possible solution of one dimensional heat equation, by the method of separation of variables. (07 Marks)

**Module-4**

- 7 a. Evaluate  $\int_0^a \int_0^{x+y} \int_0^{x+y+z} e^{x+y+z} dz dy dx$ . (06 Marks)
- b. Evaluate  $\int_1^2 \int_1^{x^2} (x^2 + y^2) dy dx$  by changing the order of integration. (07 Marks)
- c. Derive the relation between Beta and Gamma function as  $\beta(m, n) = \frac{\Gamma m \Gamma n}{\Gamma m + n}$ . (07 Marks)

OR

- 8 a. Evaluate  $\iint_R x^2 y dx dy$ , where R is the region bounded by the lines  $y = x$ ,  $y + x = 2$  and  $y = 0$ . (06 Marks)
- b. Evaluate  $\int_0^a \int_0^{\sqrt{a^2 - y^2}} y \sqrt{x^2 + y^2} dx dy$  by changing into polars. (07 Marks)
- c. Show that  $\int_0^\infty x e^{-x^8} \times \int_0^\infty x^2 e^{-x^4} dx = \frac{\pi}{16\sqrt{2}}$ . (07 Marks)

**Module-5**

- 9 a. Find the Laplace transform of  $2^t + \frac{\cos 2t - \cos 3t}{t}$ . (06 Marks)
- b. If  $f(t) = \begin{cases} t, & 0 \leq t \leq a \\ 2a - t, & a \leq t \leq 2a \end{cases}$ ,  $f(t + 2a) = f(t)$   
Sketch the graph of  $f(t)$  as a periodic function and show  $L[f(t)] = \frac{1}{s^2} \tanh\left(\frac{as}{2}\right)$ . (07 Marks)
- c. Find the inverse Laplace transform of  $\frac{s^2}{(s^2 + a^2)^2}$ , using convolution theorem. (07 Marks)

OR

- 10 a. Express  $f(t) = \begin{cases} \cos t: & 0 < t \leq \pi \\ 1: & \pi < t \leq 2\pi \\ \sin t: & t > 2\pi \end{cases}$  in terms of unit step function and hence find its Laplace transform. (06 Marks)
- b. Find the inverse Laplace transform of  $\frac{5s + 3}{(s - 1)(s + 1)^2}$ . (07 Marks)
- c. Solve the differential equation  $\frac{d^2 y}{dx^2} + 5 \frac{dy}{dx} + 6y = e^{2x}$ ,  $y(0) = 2$ ,  $y'(0) = 1$  using Laplace transform method. (07 Marks)

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