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Second Semester B.E. Degree Examination, Dec.2023/Jan.2024

Engineering Mathematics – II

Time: 3 hrs.

Max. Marks: 80

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

Module-1

- 1 a. Solve $\frac{d^3y}{dx^3} + 2\frac{d^2y}{dx^2} + \frac{dy}{dx} = e^{-x} + \sin 2x$ by inverse differential operator method. (06 Marks)
- b. Solve $y'' + y' + y = x^2 + x + 1$ by inversed differential operator method. (05 Marks)
- c. Solve $\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + y = \frac{e^x}{x}$ by the method of variation of parameters. (05 Marks)

OR

- 2 a. Solve $y'' + 2y' + y = x \sin x$ by inverse differential operator method. (06 Marks)
- b. Solve $(D^2 - 4D + 3)y = 2xe^{3x}$ by inverse differential operator method. (05 Marks)
- c. Solve $(D^2 - 3D + 2)y = x^2 + e^x$ by the method of undetermined co-efficient. (05 Marks)

Module-2

- 3 a. Solve $(2x + 1)^2 y'' - 6(2x + 1)y' + 16y = 8(2x + 1)^2$. (06 Marks)
- b. Solve $x^2 p^4 + 2xp - y = 0$ by solving for y. (05 Marks)
- c. Solve $y = 2px + y^2 p^3$. (05 Marks)

OR

- 4 a. Solve $x^2 y'' + xy' + 9y = 3x^2 \sin[3 \log x]$. (06 Marks)
- b. Solve $xy \left(\frac{dy}{dx}\right)^2 - (x^2 + y^2) \frac{dy}{dx} + xy = 0$. (05 Marks)
- c. Solve $xp^2 - py + kp + a = 0$ by reducing into Clairaut's form. Hence find singular solution. (05 Marks)

Module-3

- 5 a. Form the partial differential equation by eliminating the arbitrary function, $z = \phi(x + ay) + \psi(x - ay)$. (05 Marks)
- b. Solve $\frac{\partial^2 z}{\partial x \partial y} = \sin x \cos y$, given that $\frac{\partial z}{\partial y} = -2 \cos y$ when $x = 0$ and $z = 0$ when $y = n\pi$. (05 Marks)
- c. Derive one dimensional wave equation $\frac{\partial^2 u}{\partial t^2} = C^2 \frac{\partial^2 u}{\partial x^2}$. (06 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. Obtain the partial differential equation, $\phi(x + y + z, x^2 + y^2 + z^2) = 0$. (05 Marks)
- b. Solve $\frac{\partial^2 z}{\partial y^2} = z$ given that $z = 0$ and $\frac{\partial z}{\partial y} = \sin x$ when $y = 0$. (05 Marks)
- c. Find the solution of heat equation, $\frac{\partial u}{\partial t} = C^2 \frac{\partial^2 u}{\partial x^2}$ by the method of separation of variables. (06 Marks)

Module-4

- 7 a. Evaluate $\int_{-c}^c \int_{-b}^b \int_{-a}^a (x^2 + y^2 + z^2) dz dy dx$. (05 Marks)
- b. Evaluate $\int_0^1 \int_x^{\sqrt{x}} xy dy dx$ by changing the order of integration. (05 Marks)
- c. Evaluate $\int_0^2 \frac{x^2}{\sqrt{2-x}} dx$ by using Beta and Gamma functions. (06 Marks)

OR

- 8 a. Evaluate $\iint_R xy(x+y) dy dx$ taken over the region between $y = x^2$ and $y = x$. (05 Marks)
- b. Find the area of the circle $x^2 + y^2 = a^2$ by double integration. (05 Marks)
- c. Show that $\int_0^{\frac{\pi}{2}} \frac{d\theta}{\sqrt{\sin \theta}} \times \int_0^{\frac{\pi}{2}} \sqrt{\sin \theta} d\theta = \pi$ (06 Marks)

Module-5

- 9 a. Find $L[te^{-2t} \sin 4t]$. (05 Marks)
- b. Given that $f(t) = \begin{cases} a, & 0 \leq t \leq a \\ -a, & a < t \leq 2a \end{cases}$, where $f(t+2a) = f(t)$. Show that $L\{f(t)\} = \frac{a}{5} \tanh\left(\frac{as}{2}\right)$. (05 Marks)
- c. Solve $y'' + 4y' + 4y = e^t$, given that $y(0) = y'(0) = 0$ by using Laplace transform method. (06 Marks)

OR

- 10 a. Find $L^{-1}\left[\frac{s+1}{s^2+6s+9}\right]$ (05 Marks)
- b. Find $L^{-1}\left[\frac{1}{s(s^2+a^2)}\right]$ by using convolution theorem. (05 Marks)
- c. 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 term of unit step function and hence find its Laplace transform. (06 Marks)
