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15MAT21

Second Semester B.E. Degree Examination, Jan./Feb.2021 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 by inverse differential operator method,

$$\frac{d^3y}{dx^3} - 4 \frac{dy}{dx} = 3e^{2x} + 10. \quad (05 \text{ Marks})$$
- b. Solve by Inverse differential operator method,

$$\frac{d^2y}{dx^2} - 2 \frac{dy}{dx} + y = xe^x \sin x. \quad (05 \text{ Marks})$$
- c. Solve by variation of parameters method $\frac{d^2y}{dx^2} + y = \tan x. \quad (06 \text{ Marks})$

OR

- 2 a. Solve $(D^3 + 1)y = \cos x. \quad (05 \text{ Marks})$
- b. Solve $(D^2 - 2D)y = x^2 + 2x + 1. \quad (05 \text{ Marks})$
- c. Solve by undetermined coefficients method $(D^2 + 3D + 2)y = 2e^{-x} + x^2. \quad (06 \text{ Marks})$

Module-2

- 3 a. Solve $x^2 \frac{d^2y}{dx^2} - x \frac{dy}{dx} + y = \log x. \quad (05 \text{ Marks})$
- b. Solve $xy \left(\frac{dy}{dx} \right)^2 - (x^2 + y^2) \frac{dy}{dx} + xy = 0. \quad (05 \text{ Marks})$
- c. Solve $y = 2px + \tan^{-1}(xp^2). \quad (06 \text{ Marks})$

OR

- 4 a. Find the general and singular solution of the equation,
 $\sin px \cos y = \cos px \sin y + p. \quad (05 \text{ Marks})$
- b. Solve $p = \tan \left[x - \frac{p}{1+p^2} \right]. \quad (05 \text{ Marks})$
- c. Solve the Legendre's linear equation,
 $(1+x)^2 y'' + (1+x)y' + y = 2 \sin [\log(1+x)]. \quad (06 \text{ Marks})$

Module-3

- 5 a. Form the partial differential equation by eliminating the arbitrary functions from,
 $z = f(y + 2x) + g(y - 3x). \quad (05 \text{ Marks})$
- b. Solve the partial differential equation,

$$\frac{\partial^3 z}{\partial x^2 \partial y} = \cos(2x + 3y), \text{ by direct integration.} \quad (05 \text{ Marks})$$
- c. With usual notations derive the one dimensional wave equation as, $\frac{\partial^2 u}{\partial t^2} = C^2 \frac{\partial^2 u}{\partial x^2}. \quad (06 \text{ Marks})$

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 the partial differential equation from $z = (x + y)f(x^2 - y^2)$. (05 Marks)
- b. Solve $\frac{\partial^2 z}{\partial x^2} + 5\frac{\partial z}{\partial x} + 6z = 0$ with $z = 0$ and $\frac{\partial z}{\partial x} = e^{-y}$ at $x = 0$. (05 Marks)
- c. Solve one dimensional heat equation by variable seperable method as, $\frac{\partial y}{\partial t} = C^2 \frac{\partial^2 y}{\partial x^2}$. (06 Marks)

Module-4

- 7 a. Change the order of integration and hence evaluate,
$$\int_0^a \int_y^a \frac{x}{x^2 + y^2} dx dy.$$
 (05 Marks)
- b. Evaluate $\int_0^1 \int_{y^2}^{1-x} \int_0^{1-x} x dz dx dy$. (05 Marks)
- c. Prove that $\beta(m, n) = \frac{\Gamma(m)\Gamma(n)}{\Gamma(m+n)}$. (06 Marks)

OR

- 8 a. Evaluate by Changing into polar co-ordinates,
$$\int_0^1 \int_0^{\sqrt{1-y^2}} (x^2 + y^2) dx dy.$$
 (05 Marks)
- b. Find the volume of the sphere, $x^2 + y^2 + z^2 = a^2$ by triple integration. (05 Marks)
- c. Prove that $\int_0^1 \frac{x^2}{\sqrt{1-x^4}} dx \times \int_0^1 \frac{dx}{\sqrt{1+x^4}} = \frac{\pi}{4\sqrt{2}}$ by using Beta gamma functions. (06 Marks)

Module-5

- 9 a. Find the Laplace transform of $(1 + te^{-t})^3$. (05 Marks)
- b. Find the Laplace transform of the function, $f(t) = E \sin \omega t$, $0 < t < \frac{\pi}{\omega}$, having the period $\frac{\pi}{\omega}$. (05 Marks)
- c. Using Laplace transform techniques, solve $\frac{d^2 x}{dt^2} - 2\frac{dx}{dt} + x = e^t$ with $x = 2$, $\frac{dx}{dt} = -1$ at $t = 0$. (06 Marks)

OR

- 10 a. Find the Laplace transforms of,
(i) $t \cos t$ and (ii) $\frac{\sin^2 t}{t}$. (05 Marks)
- b. Find $L^{-1} \left[\log \sqrt{\frac{s^2 + b^2}{s^2 + a^2}} \right]$. (05 Marks)
- c. Use convolution theorem to evaluate $L^{-1} \left[\frac{1}{(s+a)(s+b)} \right]$. (06 Marks)
