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17MAT21

Second Semester B.E. Degree Examination, June/July 2019 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 $(D^2 + 1)y = 3x^2 + 6x + 12$. (06 Marks)
- b. Solve $(D^3 + 2D^2 + D)y = e^{-x}$. (07 Marks)
- c. By the method of undetermined coefficients, solve $(D^2 + D - 2)y = x + \sin x$. (07 Marks)

OR

- 2 a. Solve $(D^2 - 6D + 9)y = 6e^{3x} + 7e^{-2x}$. (06 Marks)
- b. Solve $(D^3 - D)y = (2x + 1) + 4\cos x$. (07 Marks)
- c. By the method of variation of parameters, solve $(D^2 + 1)y = \operatorname{cosec} x$. (07 Marks)

Module-2

- 3 a. Solve $x^2 y'' - 3xy' + 4y = 1 + x^2$. (06 Marks)
- b. Solve $xyp^2 - (x^2 + y^2)p + xy = 0$. (07 Marks)
- c. Solve $(px - y)(py + x) = a^2 p$ by taking $x^2 = x$ and $y^2 = y$. (07 Marks)

OR

- 4 a. Solve $(2 + x)^2 y'' + (2 + x)y' + y = \sin(2 \log(2 + x))$. (06 Marks)
- b. Solve $yp^2 + (x - y)p - x = 0$. (07 Marks)
- c. Obtain the general and singular solution of the equation $\sin px \cos y = \cos px \sin y + p$. (07 Marks)

Module-3

- 5 a. Form a partial differential equation by eliminating arbitrary function $lx + my + nz = \phi(x^2 + y^2 + z^2)$ (06 Marks)
- b. Solve $\frac{\partial^2 z}{\partial x^2} = xy$ subject to the conditions $\frac{\partial z}{\partial x} = \log(1 + y)$ when $x = 1$ and $z = 0$ when $x = 0$. (07 Marks)
- c. Derive an expression for the one dimensional wave equation. (07 Marks)

OR

- 6 a. Form a partial differential equation $z = f(y + 2x) + g(y - 3x)$. (06 Marks)
- b. Solve $\frac{\partial^2 z}{\partial y^2} = z$, given that when $y = 0$, $z = e^x$ and $\frac{\partial z}{\partial y} = e^{-x}$. (07 Marks)
- c. Find all possible solutions of heat equation $u_t = c^2 u_{xx}$ by the method of separation of variables. (07 Marks)

Module-4

- 7 a. Evaluate $\iint r \sin \theta \, dr \, d\theta$ over the cardioids $r = a(1 - \cos \theta)$ above the initial line. (06 Marks)
- b. Evaluate $\int_0^1 \int_{y^2}^{1-x} \int_0^{1-x} x \, dz \, dx \, dy$. (07 Marks)
- c. Derive the relation between Beta and Gamma function as $B(m, n) = \frac{\Gamma(m)\Gamma(n)}{\Gamma(m+n)}$. (07 Marks)

OR

- 8 a. Evaluate by changing the order of integration $\int_0^\infty \int_x^\infty \frac{e^{-y}}{y} \, dy \, dx$. (06 Marks)
- b. Find by double integration, the area lying between the parabola $y = 4x - x^2$ and the line $y = x$. (07 Marks)
- c. Show that $\int_0^{\pi/2} \sqrt{\cot \theta} \, d\theta = \frac{1}{2} \left[\left(\frac{1}{4} \right) \right] \left[\left(\frac{3}{4} \right) \right]$. (07 Marks)

Module-5

- 9 a. Find the Laplace transform of $\left(t \cos 2t + \frac{1 - e^{3t}}{t} \right)$. (06 Marks)
- b. Find the Laplace transform of $f(t) = E \sin \omega t$, $0 < t < \frac{\pi}{\omega}$ having the period $\frac{\pi}{\omega}$. (07 Marks)
- c. Solve $y'' - 3y' + 2y = 2e^{3t}$, $y(0) = y'(0) = 0$ by using Laplace transforms. (07 Marks)

OR

- 10 a. Find the inverse Laplace transforms of $\frac{s+1}{s^2+2s+2} + \log\left(\frac{s+a}{s+b}\right)$. (06 Marks)
- b. By using convolution theorem, find $L^{-1}\left[\frac{s}{(s^2+1)(s-1)}\right]$. (07 Marks)
- c. Express $f(t) = \begin{cases} \sin t, & 0 < t \leq \pi/2 \\ \cos t, & \pi/2 < t \leq \pi \\ 1, & \pi < t \end{cases}$ in terms of unit step functions and hence find its Laplace transform. (07 Marks)
