

CBCS Scheme

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15MAT21

Second Semester B.E. Degree Examination, Dec.2017/Jan.2018 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 $\frac{d^3y}{dx^3} - \frac{d^2y}{dx^2} + \frac{4dy}{dx} - 4y = \sinh(2x+3)$ by inverse differential operator method. (05 Marks)
- b. Solve $\frac{d^2y}{dx^2} - \frac{3dy}{dx} + 2y = xe^{3x} + \sin 2x$ by inverse differential operator method. (05 Marks)
- c. Solve $\frac{d^2y}{dx^2} + 4y = \tan 2x$ by the method of variation of parameters. (06 Marks)

OR

- 2 a. Solve $y'' - 2y' + y = x \cos x$ by inverse differential operator method. (05 Marks)
- b. Solve $\frac{d^2y}{dx^2} + 4y = x^2 + 2^{-x} + \log 2$ by inverse differential operator method. (05 Marks)
- c. Solve $\frac{d^2y}{dx^2} + \frac{2dy}{dx} + 4y = 2x^2 + 3e^{-x}$ by the method of undetermined coefficients. (06 Marks)

Module-2

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

OR

- 4 a. Solve $(2x+5)^2 y'' - 6(2x+5)y' + 8y = 6x$. (05 Marks)
- b. Solve $y = 2px + y^2 p^3$. (05 Marks)
- c. Solve the equation : $(px - y)(py + x) = a^2 p$ by reducing into Clairaut's form, taking the substitution $X = x^2, Y = y^2$. (06 Marks)

Module-3

- 5 a. Obtain the partial differential equation by eliminating the arbitrary function given $z = yf(x) + x\phi(y)$. (05 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 $x = 0$. (05 Marks)
- c. Derive one dimensional heat equation in the form $\frac{\partial u}{\partial t} = c^2 \frac{\partial^2 u}{\partial x^2}$. (06 Marks)

OR

- 6 a. Obtain the partial differential equation given $f\left(\frac{xy}{z}, z\right) = 0$. (05 Marks)
- b. Solve $\frac{\partial^2 z}{\partial x^2} + 3\frac{\partial z}{\partial x} - 4z = 0$ subject to the conditions that $z = 1$ and $\frac{\partial z}{\partial x} = y$ when $x = 0$. (05 Marks)
- c. Obtain the solution of one dimensional wave equation $\frac{\partial^2 u}{\partial t^2} = c^2 \frac{\partial^2 u}{\partial x^2}$ by the method of separation of variables for the positive constant. (06 Marks)

Module-4

- 7 a. Evaluate $I = \int_0^a \int_0^{\sqrt{a^2-x^2}} \int_0^{\sqrt{a^2-x^2-y^2}} xyz \, dz \, dy \, dx$. (05 Marks)
- b. Find the area of the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ by double integration. (05 Marks)
- c. Derive the relation between beta and gamma function as $\beta(m, n) = \frac{\Gamma(m)\Gamma(n)}{\Gamma(m+n)}$. (06 Marks)

OR

- 8 a. Evaluate $\int_0^a \int_y^a \frac{x \, dx \, dy}{x^2 + y^2}$ by changing the order of integration. (05 Marks)
- b. Evaluate $\int_0^a \int_0^{\sqrt{a^2-y^2}} y\sqrt{x^2+y^2} \, dx \, dy$ by changing into polar co-ordinates. (05 Marks)
- c. Evaluate $\int_0^{\pi/2} \frac{d\theta}{\sqrt{\sin \theta}} \times \int_0^{\pi/2} \sqrt{\sin \theta} \, d\theta$ by using Beta-Gamma functions. (06 Marks)

Module-5

- 9 a. Find the Laplace transform of $te^{2t} + \frac{\cos 2t - \cos 3t}{t} + t \sin t$. (05 Marks)
- b. Express the function $f(t) = \begin{cases} \pi - t, & 0 < t \leq \pi \\ \sin t, & t > \pi \end{cases}$ in terms of unit step function and hence find its Laplace transform. (05 Marks)
- c. Solve $y'' + 6y' + 9y = 12t^2 e^{-3t}$ subject to the conditions, $y(0) = 0 = y'(0)$ by using Laplace transform. (06 Marks)

OR

- 10 a. Find the inverse Laplace form of $\frac{7s+4}{4s^2+4s+9}$. (05 Marks)
- b. Find the Laplace transform of the full wave rectifier $f(t) = E \sin \omega t$, $0 < t < \pi/\omega$ having period π/ω . (05 Marks)
- c. Obtain the inverse Laplace transform of the function $\frac{1}{(s-1)(s^2+1)}$ by using convolution theorem. (06 Marks)
