

CBCS SCHEME

USN

17MAT21

Second Semester B.E. Degree Examination, July/August 2021 Engineering Mathematics – II

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions.

- 1 a. Solve $(D^3 + 6D^2 + 11D + 6)y = 0$ (06 Marks)
b. Solve $y'' + 2y' + y = e^x$ (07 Marks)
c. Using the method of undetermined coefficients, solve $y'' - 5y' + 6y = e^{3x} + x$ (07 Marks)
- 2 a. Solve $\frac{d^2y}{dx^2} - 4\frac{dy}{dx} + 13y = e^{3x}$ (06 Marks)
b. Solve $\frac{d^2y}{dx^2} + 5\frac{dy}{dx} + 6y = x^2$ (07 Marks)
c. Solve $\frac{d^2y}{dx^2} + y = \tan x$, by the method of variation of parameters. (07 Marks)
- 3 a. Solve $x\frac{d^2y}{dx^2} - \frac{2y}{x} = x + \frac{1}{x^2}$. (06 Marks)
b. Solve $p - \frac{1}{p} = \frac{x}{y} - \frac{y}{x}$. (07 Marks)
c. $(p-1)e^{3x} + p^3e^{2y} = 0$ by taking the substitution $U = e^x$, $V = e^y$ by reducing into Clairaut's form. (07 Marks)
- 4 a. Solve $(2x+1)^2y'' - 3(2x+1)y' + 16y = 8(2x+1)^2$ (06 Marks)
b. Solve $p = \tan\left(x - \frac{p}{1+p^2}\right)$ (07 Marks)
c. Modify the equation into Clairaut's form and hence solve it $xp^2 - py + kp + a = 0$. (07 Marks)
- 5 a. Form the PDE by eliminating the arbitrary function f from $Z = e^{ax+by}f(ax-by)$. (06 Marks)
b. Solve $\frac{\partial^2 z}{\partial x^2} = a^2z$ under the conditions when $x=0$ $\frac{\partial z}{\partial x} = a \sin y$, $z=0$. (07 Marks)
c. Find the solution of one dimensional wave equation, using the method of separation of variables. (07 Marks)
- 6 a. Form the PDE by eliminating the arbitrary functions in the form $Z = xf_1(x+t) + f_2(x+t)$ (06 Marks)
b. Solve $\frac{\partial^2 z}{\partial x \partial y} = \frac{x}{y}$ subject to the conditions $\frac{\partial z}{\partial x} = \log_e x$ when $y=1$ and $z=0$ when $x=1$. (07 Marks)
c. Derive one dimensional heat equation in the form $\frac{\partial u}{\partial t} = c^2 \frac{\partial^2 u}{\partial x^2}$. (07 Marks)

- 7 a. Evaluation $\iint xy dx dy$ over the positive quadrant of the circle $x^2 + y^2 = a^2$. (06 Marks)
- b. Evaluate $\int_0^{\pi/2} \int_0^{a \sin \theta} \int_0^{a^2 - r^2} r dr d\theta dz$ (07 Marks)
- c. Derive the relation $\beta(m, n) = \frac{\Gamma(m)\Gamma(n)}{\Gamma(m+n)}$ with usual notations. (07 Marks)
- 8 a. Evaluate $\iint xy dx dy$ taken over the region bounded by $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ and $\frac{x}{a} + \frac{y}{b} = 1$. (06 Marks)
- b. Find by double integration the area enclosed by the curve $r = a(1 + \cos \theta)$ between $\theta = 0$ and $\theta = \pi$. (07 Marks)
- c. Evaluate $\int_0^{\pi/2} \sqrt{\cot \theta} d\theta$ by expressing in terms of gamma function. (07 Marks)
- 9 a. Find the Laplace transform of $\frac{\cos at - \cos bt}{t} + \cos at$. (06 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 . (07 Marks)
- c. Find the inverse transform of $\log \sqrt{\frac{s^2 + 1}{s^2 + 4}}$. (07 Marks)
- 10 a. 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 transforms. (06 Marks)
- b. Employ Laplace transform to solve the equation $y'' + 5y' + 6y = 5e^{2x}$, $y(0) = 2$, $y'(0) = 1$. (07 Marks)
- c. Using convolution theorem, obtain the inverse Laplace transform of the function $\frac{1}{(s^2 + a^2)^2}$. (07 Marks)
