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.

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.

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 $\frac{\partial^2 z}{\partial x^2} = a^2 z$ 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 $\iint xydxdy$ over the positive quadrant of the circle $x^2 + y^2 = a^2$. **(06 Marks)**

b. Evaluate $\int_0^{\pi/2} \int_0^{a\sin\theta} \int_0^{\frac{a^2-r^2}{a}} rdr\, d\theta dz$ **(07 Marks)**

c. Derive the relation $\beta(m,n) = \dfrac{\Gamma(m)\Gamma(n)}{\Gamma(m+n)}$ with usual notations. **(07 Marks)**

8 a. Evaluate $\iint xydxdy$ taken over the region bounded by $\dfrac{x^2}{a^2} + \dfrac{y^2}{b^2} = 1$ and $\dfrac{x}{a} + \dfrac{y}{b} = 1$. **(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 $\dfrac{\cos at - \cos bt}{t} + \cos at$. **(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 $\log \sqrt{\dfrac{s^2+1}{s^2+4}}$. **(07 Marks)**

10 a. Express the function $f(t) = \begin{cases} \pi - t, & 0 < t \le \pi \\ \sin t, & t > \pi \end{cases}$, 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 $\dfrac{1}{(s^2 + a^2)^2}$. **(07 Marks)**

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