CBCS SCHEME

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17MAT21

Second Semester B.E. Degree Examination, Aug./Sept.2020
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: $\frac{d^3y}{dx^3} - 2\frac{d^2y}{dx^2} + 4\frac{dy}{dx} - 8y = 0$ **(06 Marks)**

b. Solve: $y'' - 4y' + 13y = \cos 2x$ **(07 Marks)**

c. Solve by the method of undetermined coefficients of the equation
$\frac{d^2y}{dx^2} - 3\frac{dy}{dx} + 2y = e^x$ **(07 Marks)**

OR

2 a. Solve: $\frac{d^2y}{dx^2} - 4y = \cosh(2x - 1)$ **(06 Marks)**

b. Solve: $y'' + 3y' + 2y = 12x^2$ **(07 Marks)**

c. Solve by the method of variation of parameters: $y'' + a^2y = \sec ax$ **(07 Marks)**

Module-2

3 a. Solve: $x^2\frac{d^2y}{dx^2} - 3x\frac{dy}{dx} + 4y = (1 + x)$ **(06 Marks)**

b. Solve: $\frac{dy}{dx} - \frac{dx}{dy} = \frac{x}{y} - \frac{y}{x}$ **(07 Marks)**

c. Obtain the general solution and the singular solution of the equation $x^4p^2 + 2x^3py - 4 = 0$ **(07 Marks)**

OR

4 a. Solve: $(1 + x)^2\frac{d^2y}{dx^2} + (1 + x)\frac{dy}{dx} + y = \sin 2[\log(x + 1)]$ **(06 Marks)**

b. Solve: $p^2 + 2py \cot x = y^2$ **(07 Marks)**

c. Solve the equation $(px - y)(py + x) = 2p$ by reducing into Clairaut's form, taking the substitutions $X = x^2$, $Y = y^2$. **(07 Marks)**

Module-3

5 a. If $z = e^{ax+by} f(ax - by)$, then show that $b\frac{\partial z}{\partial x} + a\frac{\partial z}{\partial y} = 2abz$. **(06 Marks)**

b. Solve $\frac{\partial^2 z}{\partial x^2} = xy$ subject to the conditions that $\frac{\partial z}{\partial x} = \log(1 + y)$ when $x = 1$, and $z = 0$ when $x = 0$. **(07 Marks)**

c. Find the solution of one dimensional wave equation, using the method of separation of variables. **(07 Marks)**

OR

6 a. Form the PDE by eliminating the arbitrary functions ϕ from $lx + my + nz = \phi(x^2 + y^2 + z^2)$ **(06 Marks)**

b. Solve $\left[\frac{\partial^2 z}{\partial x \partial y}\right] = \sin x \sin y$ subject to the condition $\left[\frac{\partial z}{\partial y}\right] = -2\text{Sin}y$ when x = 0 and z = 0 if y is a odd multiple of $\pi/2$. **(07 Marks)**

c. Derive an one dimensional heat equation in the form $\frac{\partial u}{\partial t} = C^2 \frac{\partial^2 u}{\partial x^2}$. **(07 Marks)**

Module-4

7 a. Change the order of integration and hence evaluate $\int_0^{4a} \int_{x^2/4a}^{2\sqrt{ax}} xy\, dy\, dx$ **(06 Marks)**

b. Evaluate $\int_0^a \int_0^x \int_0^{x+y} x + y + z\, dz\, dy\, dx$ **(07 Marks)**

c. Show that $\beta(m,n) = \frac{\Gamma(m)\Gamma(n)}{\Gamma(m+n)}$ with usual notations. **(07 Marks)**

OR

8 a. Evaluate $\int_0^\infty \int_0^\infty e^{-(x^2+y^2)} dxdy$ by changing to polar coordinates. **(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. Show that $\Gamma\left(\frac{1}{2}\right) = \sqrt{\pi}$ **(07 Marks)**

Module-5

9 a. Find the Laplace transform of f(t) = t(sint). **(06 Marks)**

b. If $f(t) = t^2$, $0 < t < 2$ and $f(t + 2) = f(t)$ for $t > 2$, find L{f(t)}. **(07 Marks)**

c. Find the inverse Laplace transform of $\left[\frac{s+5}{s^2 - 6s + 13}\right]$ **(07 Marks)**

OR

10 a. Find the Laplace transform of the unit step function $f(t) = \begin{cases} \sin t, & 0 < t \le \frac{\pi}{2} \\ \text{Cos}t, & t > \frac{\pi}{2} \end{cases}$ **(06 Marks)**

b. Employ Laplace transform to solve the equation $y'' + 5y' + 6y = 5e^{2x}$ **(07 Marks)**

c. Find the inverse Laplace transform of $\frac{s^2}{(s^2 + a^2)^2}$, using convolution theorem. **(07 Marks)**

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