CBCS SCHEME

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15MAT21

Second Semester B.E. Degree Examination, Jan./Feb. 2023
Engineering Mathematics – II

Time: 3 hrs. Max. Marks: 80

Note: ***1. Answer FIVE full questions, choosing ONE full question from each module.***
2. Missing data, if any, may be suitably assumed.

Module-1

1 a. Solve : $\frac{d^3y}{dx^3} - 7\frac{dy}{dx} + 6y = x^2 - x + 1$ by inverse differential operator method. **(06 Marks)**

b. Solve : $(D^3 + 6D^2 + 11D + 6)y = e^x + 1$ by inverse differential operator method. **(05 Marks)**

c. Solve : $\frac{d^2y}{dx^2} - 4\frac{dy}{dx} + 4y = e^x$ by the method of undetermined coefficient. **(05 Marks)**

OR

2 a. Solve : $\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + 4y = e^x \cos x$ by inverse differential operator method. **(06 Marks)**

b. Solve : $\frac{d^2y}{dx^2} + 4y = x \sin x$ by inverse differential operator method. **(05 Marks)**

c. Solve : $\frac{d^2y}{dx^2} + y = \sec x \tan x$ by the method of variation of parameters. **(05 Marks)**

Module-2

3 a. Solve : $(2x+1)^2 \frac{d^2y}{dx^2} - 2(2x+1)\frac{dy}{dx} - 12y = 3(2x+1)$. **(06 Marks)**

b. Solve : $p - \frac{1}{p} = \frac{x}{y} - \frac{y}{x}$. **(05 Marks)**

c. Find the general and singular solution of the equation : $y = Px + 2P^2$. **(05 Marks)**

OR

4 a. Solve : $x^3 \frac{d^3y}{dx^3} + 3x^2 \frac{d^2y}{dx^2} + x\frac{dy}{dx} + 8y = 65\cos(\log x)$. **(06 Marks)**

b. Solve : $x^4P^2 + 2x^3Py - 4 = 0$ by solvable for y. **(05 Marks)**

c. Solve the equation : $(px - y)(py + x) = 2p$ by reducing into Clairaut's form, taking the substitutions $X = x^2$, $Y = y^2$. **(05 Marks)**

Module-3

5 a. Obtain the partial differential equation : $f(x^2+2yz, y^2+2zx)=0$. **(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. **(05 Marks)**

c. Find the solution of the 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 constant K = 0. **(05 Marks)**

OR

6 a. Obtain the partial differential equation by eliminating the arbitrary function given : $z=e^{ax+by}f(ax-by)$. **(06 Marks)**

b. Solve: $\frac{\partial^2 z}{\partial x^2}=a^2 z$ given that when $x=0, \frac{\partial z}{\partial x}=a\sin y$ and $\frac{\partial z}{\partial y}=0$. **(05 Marks)**

c. Derive one dimensional heat equation : $\frac{\partial u}{\partial t}=C^2\frac{\partial^2 u}{\partial x^2}$. **(05 Marks)**

Module-4

7 a. Evaluate : $\int_{z=-1}^{1}\int_{x=0}^{z}\int_{y=x-z}^{x+z}(x+y+z)\,dy\,dx\,dz$. **(06 Marks)**

b. Evaluate by changing the order of integration : $\int_{y=0}^{1}\int_{x=\sqrt{y}}^{1}dx\,dy$. **(05 Marks)**

c. Obtain the relation between beta and gamma function in the form :

$\beta(m,n)=\frac{\Gamma(m)\Gamma(n)}{\Gamma(m+n)}$. **(05 Marks)**

OR

8 a. Evaluate : $\int_{x=-a}^{a}\int_{y=0}^{\sqrt{a^2-x^2}}\sqrt{x^2+y^2}\,dydx$ by changing into polar coordinates. **(06 Marks)**

b. Find the area enclosed by the curve $r = a(1 + \cos\theta)$ between $\theta = 0$ and $\theta = \pi$ by double integration. **(05 Marks)**

c. Evaluate : $\int_0^1 x^{3/2}(1-x)^{1/2}\,dx$ by using Beta and Gamma functions. **(05 Marks)**

Module-5

9 a. Find :

i) $L(\cos t \cos 2t \cos 3t)$

ii) $L\left[\dfrac{\cos at - \cos bt}{t}\right]$. **(06 Marks)**

b. Find : $L^{-1}\left[\dfrac{s^2}{(s^2+a^2)^2}\right]$ by using convolution theorem. **(05 Marks)**

c. Given : $f(t) = \begin{cases} E \; ; & 0 < t < \frac{a}{2} \\ -E \; ; & \frac{a}{2} < t < a \end{cases}$ where f(t + a) = f(t), show that $L[f(t)] = \dfrac{E}{S} \tan h\left(\dfrac{as}{4}\right)$. **(05 Marks)**

OR

10 a. Find :

i) $L^{-1}\left[\dfrac{3s+2}{(s+1)(s-2)}\right]$

ii) $L^{-1}\left[\log\left(\dfrac{s+a}{s+b}\right)\right]$. **(06 Marks)**

b. Express : $f(t) = \begin{cases} 1 \; ; & 0 < t \le 1 \\ t \; ; & 1 < t \le 2 \\ t^2 \; ; & t > 2 \end{cases}$

interms of unit step function and hence find its Laplace transforms. **(05 Marks)**

c. Solve the differential equation :

$y''' + 2y'' - y' - 2y = 0$ given y(0) = 0; y′(0) = 0 and y″(0) = 6,

using Laplace transforms. **(05 Marks)**

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