

CBCS SCHEME

USN

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 : $x^4 P^2 + 2x^3 P y - 4 = 0$ 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 : $\int_{x=-a}^a \int_{y=0}^{\sqrt{a^2-x^2}} \sqrt{x^2 + y^2} dy dx$ 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) $L\left[\frac{\cos at - \cos bt}{t}\right]$.

(06 Marks)

b. Find : $L^{-1}\left[\frac{s^2}{(s^2 + a^2)^2}\right]$ 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 $L[f(t)] = \frac{E}{S} \tan h\left(\frac{as}{4}\right)$.

(05 Marks)

OR

10 a. Find :

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

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

(06 Marks)

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

in terms 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)
