**CBCS SCHEME**

USN | | | | | | | | | | |   **15MAT21**

## Second Semester B.E. Degree Examination, Jan./Feb.2021
# Engineering Mathematics – II

Time: 3 hrs.  Max. Marks: 80

**Note:** ***Answer any FIVE full questions, choosing ONE full question from each module.***

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.

### Module-1

1 a. Solve by inverse differential operator method,
$\frac{d^3y}{dx^3} - 4\frac{dy}{dx} = 3e^{2x} + 10$. **(05 Marks)**

b. Solve by Inverse differential operator method,
$\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + y = xe^x \sin x$. **(05 Marks)**

c. Solve by variation of parameters method $\frac{d^2y}{dx^2} + y = \tan x$. **(06 Marks)**

**OR**

2 a. Solve $(D^3 + 1)y = \cos x$. **(05 Marks)**

b. Solve $(D^2 - 2D)y = x^2 + 2x + 1$. **(05 Marks)**

c. Solve by undetermined coefficients method $(D^2 + 3D + 2)y = 2e^{-x} + x^2$. **(06 Marks)**

### Module-2

3 a. Solve $x^2\frac{d^2y}{dx^2} - x\frac{dy}{dx} + y = \log x$. **(05 Marks)**

b. Solve $xy\left(\frac{dy}{dx}\right)^2 - (x^2 + y^2)\frac{dy}{dx} + xy = 0$. **(05 Marks)**

c. Solve $y = 2px + \tan^{-1}(xp^2)$. **(06 Marks)**

**OR**

4 a. Find the general and singular solution of the equation,
$\sin px \cos y = \cos px \sin y + p$. **(05 Marks)**

b. Solve $p = \tan\left[x - \frac{p}{1+p^2}\right]$. **(05 Marks)**

c. Solve the Legendre's linear equation,
$(1+x)^2 y'' + (1+x)y' + y = 2\sin[\log(1+x)]$. **(06 Marks)**

### Module-3

5 a. Form the partial differential equation by eliminating the orbitrary functions from,
$z = f(y + 2x) + g(y - 3x)$. **(05 Marks)**

b. Solve the partial differential equation,
$\frac{\partial^3 z}{\partial x^2 \partial y} = \cos(2x + 3y)$, by direct integration. **(05 Marks)**

c. With usual notations derive the one dimensional wave equation as, $\frac{\partial^2 u}{\partial t^2} = C^2\frac{\partial^2 u}{\partial x^2}$. **(06 Marks)**

**OR**

6 a. Form the partial differential equation from $z=(x+y)f(x^2-y^2)$. **(05 Marks)**

b. Solve $\frac{\partial^2 z}{\partial x^2}+5\frac{\partial z}{\partial x}+6z=0$ with $z=0$ and $\frac{\partial z}{\partial x}=e^{-y}$ at $x=0$. **(05 Marks)**

c. Solve one dimensional heat equation by variable seperable method as, $\frac{\partial y}{\partial t}=C^2\frac{\partial^2 y}{\partial x^2}$. **(06 Marks)**

**Module-4**

7 a. Change the order of integration and hence evaluate,

$$\int_0^a\int_y^a \frac{x}{x^2+y^2}\,dxdy.$$ **(05 Marks)**

b. Evaluate $\int_0^1\int_{y^2}^1\int_0^{1-x} x\,dzdxdy$. **(05 Marks)**

c. Prove that $\beta(m,n)=\frac{\Gamma(m)\Gamma(n)}{\Gamma(m+n)}$. **(06 Marks)**

**OR**

8 a. Evaluate by Changinginto polar co-ordinates,

$$\int_0^1\int_0^{\sqrt{1-y^2}}(x^2+y^2)\,dxdy.$$ **(05 Marks)**

b. Find the volume of the sphere, $x^2+y^2+z^2=a^2$ by triple integration. **(05 Marks)**

c. Prove that $\int_0^1\frac{x^2}{\sqrt{1-x^4}}dx\times\int_0^1\frac{dx}{\sqrt{1+x^4}}=\frac{\pi}{4\sqrt{2}}$ by using Beta gamma functions. **(06 Marks)**

**Module-5**

9 a. Find the Laplace transform of $(1+te^{-t})^3$. **(05 Marks)**

b. Find the Laplace transform of the function, $f(t)=E\sin\omega t$, $0<t<\frac{\pi}{\omega}$, having the period $\frac{\pi}{\omega}$. **(05 Marks)**

c. Using Laplace transform techniques, solve $\frac{d^2x}{dt^2}-2\frac{dx}{dt}+x=e^t$ with $x=2$, $\frac{dx}{dt}=-1$ at $t=0$. **(06 Marks)**

**OR**

10 a. Find the Laplace transforms of,

(i) $t\cos t$ and (ii) $\frac{\sin^2 t}{t}$. **(05 Marks)**

b. Find $L^{-1}\left[\log\sqrt{\left(\frac{s^2+b^2}{s^2+a^2}\right)}\right]$. **(05 Marks)**

c. Use convolution theorem to evaluate $L^{-1}\left[\frac{1}{(s+a)(s+b)}\right]$. **(06 Marks)**

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