CBCS SCHEME

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15MAT21

Second Semester B.E. Degree Examination, Feb./Mar. 2022
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 $\frac{d^2y}{dx^2} - 6\frac{dy}{dx} + 9y = 6e^{3x} + 7e^{-2x} - \log 2$ **(05 Marks)**

b. Solve $\frac{d^2y}{dx^2} + 3\frac{dy}{dx} + 2y = 1 + 3x + x^2$ **(05 Marks)**

c. Solve $(D^2 + 1)y = 2\cos x$ using method of undetermined coefficients. **(06 Marks)**

OR

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

b. Solve $(D + 2)(D - 1)^2 y = e^{-2x} + 2\sinh x$ **(05 Marks)**

c. Solve $(D^2 + 1)y = \tan x$ using the method of variation of parameters. **(06 Marks)**

Module-2

3 a. Solve $x^2\frac{d^2y}{dx^2} - 3\frac{dy}{dx} + 4y = (1 + x)^2$ **(05 Marks)**

b. Solve $\frac{dy}{dx} - \frac{dx}{dy} = \frac{x}{y} - \frac{y}{x}$ **(05 Marks)**

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

OR

4 a. Solve $(1 + x)^2\frac{d^2y}{dx^2} + (1 + x)\frac{dy}{dx} + y = 2\sin(\log(1 + x))$ **(05 Marks)**

b. Solve $y = 2px + y^2p^3$ **(05 Marks)**

c. Solve $(px-y)(py+x) = a^2p$ (by choosing $x^2 = u$ and $y^2 = v$) by reducing into Clairaut's form. **(06 Marks)**

Module-3

5 a. Form the partial differential equation by eliminating the arbitrary constants from the relation $\frac{x^2}{a^2} + \frac{y^2}{b^2} + \frac{z^2}{c^2} = 1$ **(05 Marks)**

b. Solve $\frac{\partial^2 z}{\partial x \partial y} = \sin x \sin y$, given that $\frac{\partial z}{\partial y} = -2\sin y$ when $x = 0$ and $z = 0$ when y is odd multiple of $\frac{\pi}{2}$. **(05 Marks)**

c. Derive one dimensional heat equation as $\frac{\partial u}{\partial t} = c^2\frac{\partial^2 u}{\partial t^2}$ **(06 Marks)**

OR

6 a. Form the partial differential equation by eliminating the arbitrary function given by $f(x+y+z, x^2+y^2+z^2)=0$. **(05 Marks)**

b. Solve $\dfrac{\partial^2 z}{\partial x^2}+z=0$ given that when $x=0$, $z=e^y$ and $\dfrac{\partial z}{\partial x}=1$ **(05 Marks)**

c. Solve $\dfrac{\partial^2 u}{\partial t^2}=c^2\dfrac{\partial^2 u}{\partial x^2}$ using method of separating of variables. **(06 Marks)**

Module-4

7 a. Evaluate $\int_0^{4a}\int_{x^2/4a}^{2\sqrt{ax}} dydx$ by changing the order of integration. **(05 Marks)**

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

c. Evaluate $\int_0^{\pi/2}\sqrt{\sin\theta}\,d\theta\times\int_0^{\pi/2}\dfrac{d\theta}{\sqrt{\sin\theta}}$ using Beta and Gama functions. **(06 Marks)**

OR

8 a. Evaluate $\int_0^1\int_0^{\sqrt{1-x^2}}\int_0^{\sqrt{1-x^2-y^2}}\dfrac{1}{\sqrt{1-x^2-y^2-z^2}}\,dzdydx$. **(05 Marks)**

b. Find the area lying between the parabola $y = 4x - x^2$ and the line $y = x$. **(05 Marks)**

c. Evaluate $\int_0^1\dfrac{dx}{\sqrt{1+x^4}}$ using Beta and Gamma functions. **(06 Marks)**

Module-5

9 a. Find: $L\left\{\sin^3 2t + t^2e^{2t}\right\}$ **(05 Marks)**

b. Find the Laplace transform of the periodic function given by

$$f(t)=\begin{cases}1, & 0<t<\dfrac{a}{2}\\ -1, & \dfrac{a}{2}<t<a\end{cases}\quad \text{where } f(t+a)=f(t)$$ **(05 Marks)**

c. Find $L^{-1}\left\{\dfrac{s}{(s^2+a^2)^2}\right\}$ using convolution theorem **(06 Marks)**

OR

10 a. Find the Laplace transform of the function using unit step function given that

$$f(t)=\begin{cases}2+t, & 0<t<1\\ e^t, & t>1\end{cases}$$ **(05 Marks)**

b. Find $L^{-1}\left\{\dfrac{5s+3}{(s-1)(s^2+2s+5)}\right\}$ **(05 Marks)**

c. Solve $\dfrac{d^2y}{dt^2}-2\dfrac{dy}{dt}+y=e^t$, $y(0) = 2$, $y'(0) = -1$ using Laplace transform. **(06 Marks)**

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