CBCS SCHEME

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17MAT21

Second Semester B.E. Degree Examination, June/July 2023
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 : $(4D^4 - 8D^3 - 7D^2 + 11D + 6)y = 0$ **(06 Marks)**

b. Solve : $(D^3 + 6D^2 + 11D^2 + 6)y = e^x + 1$. **(07 Marks)**

c. Apply the method of undetermined coefficient to solve $\frac{d^2y}{dx^2} - 3\frac{dy}{dx} + 2y = x^2 + e^x$. **(07 Marks)**

OR

2 a. Solve : $(D^4 - 4D^3 - 5D^2 - 36D - 36)y = 0$. **(06 Marks)**

b. Solve : $\frac{d^2y}{dx^2} + 4y = x^2 + \cos 2x + 2^{-x}$. **(07 Marks)**

c. By the method of variation of parameters solve $(D^2 + a^2)y = \sec ax \tan ax$. **(07 Marks)**

Module-2

3 a. Solve : $(2x+5)^2 y'' - 6(2x+5)y' + 8y = 6x$. **(07 Marks)**

b. Solve : $xy\left(\frac{dy}{dx}\right)^2 - (x^2 + y^2)\frac{dy}{dx} + xy = 0$. **(06 Marks)**

c. Solve : $(p-1)e^{3x} + p^3e^{2y} = 0$ by taking the substitution $u = e^x$, $v = e^y$ by reducing it into the Clairaut's form. **(07 Marks)**

OR

4 a. Solve : $x^3y''' + 3x^2y'' + xy' + y = x + \log x$. **(07 Marks)**

b. Solve : $\frac{dy}{dx} - \frac{dx}{dy} = \frac{x}{y} - \frac{y}{x}$. **(06 Marks)**

c. Obtain the general and the singular solution of the equation $xp^2 - yp + a + kp = 0$. **(07 Marks)**

Module-3

5 a. Form a partial differential equation by eliminating the arbitrary constants a, b, c from $\frac{x^2}{a^2} + \frac{y^2}{b^2} + \frac{z^2}{c^2} = 1$. **(06 Marks)**

b. Solve $\frac{\partial^2 u}{\partial y^2} = 4u$, given that $u = 0$, $\frac{\partial u}{\partial y} = 2\sin x$ when $y = 0$. **(07 Marks)**

c. Derive the expression for one dimensional wave equation. **(07 Marks)**

OR

6 a. Form a partial differential equation by eliminating Arbitrary function F from $F(x+y+z,\ x^2+y^2+z^2)=0$. **(06 Marks)**

b. Solve : $\dfrac{\partial^2 z}{\partial x \partial t} = e^{-t}\cos x$, given that $z=0$ when $t=0$ and $\dfrac{\partial z}{\partial t}=0$ when $x=0$. **(07 Marks)**

c. Use the method of separation of variable to solve the heat equation $c^2\dfrac{\partial^2 u}{\partial x^2}=\dfrac{\partial u}{\partial t}$. **(07 Marks)**

Module-4

7 a. Evaluate $\int_{-1}^{1}\int_{0}^{z}\int_{x-z}^{x+z}(x+y+z)\,dy\,dx\,dz$. **(07 Marks)**

b. Evaluate $\int_{0}^{a}\int_{0}^{2\sqrt{ax}} x^2\,dy\,dx$ by changing the order of integration. **(07 Marks)**

c. Find the value of $\int_{0}^{\pi/2}\dfrac{d\theta}{\sqrt{\sin\theta}} \times \int_{0}^{\pi/2}\sqrt{\sin\theta}\,d\theta$. **(06 Marks)**

OR

8 a. Evaluate $\int_{0}^{a}\int_{0}^{x}\int_{0}^{x+y} e^{x+y+z}\,dz\,dy\,dx$. **(07 Marks)**

b. By changing the order of integration, evaluate $\int_{0}^{a}\int_{y}^{a}\dfrac{x\,dx\,dy}{x^2+y^2}$. **(07 Marks)**

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

Module-5

9 a. Find the Laplace transform of $te^{2t}+t\sin t$ **(06 Marks)**

b. A periodic function of period $2a$ is defined by, $f(t)=\begin{cases} t, & 0<t<a \\ 2a-t, & a<t<2a \end{cases}$. Show that $L\{f(t)\}=\dfrac{1}{s^2}\tanh\left(\dfrac{as}{2}\right)$. **(07 Marks)**

c. Using convolution theorem, find $L^{-1}\left\{\dfrac{1}{(s^2+a^2)^2}\right\}$. **(07 Marks)**

OR

10 a. Express $f(t)=\begin{cases} \pi-t, & 0<t\le\pi \\ \sin t, & t>\pi \end{cases}$ in terms of unit step function and hence find its Laplace transform. **(06 Marks)**

b. Find $L^{-1}\left\{\log\left(\dfrac{s^2+1}{s(s+1)}\right)\right\}$. **(07 Marks)**

c. By using Laplace transform, solve $y''(t)+4y'(t)+4y(t)=e^{-t}$, $y(0)=0$ and $y'(0)=0$. **(07 Marks)**

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