USN

15MAT21

Second Semester B.E. Degree Examination, July/August 2022
Engineering Mathematics – II

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Solve $(4D^4 - 8D^3 - 7D^2 + 11D + 6)y = 0$. **(05 Marks)**

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

c. Solve $y'' - 2y' + y = e^x \log x$ by the method of variation of parameters. **(06 Marks)**

OR

2 a. Solve $(D^2 - 2D + 4)y = e^x \cos x$. **(05 Marks)**

b. Solve $(D^2 + 4)y = x^2 + \sin 2x$. **(05 Marks)**

c. Solve $\frac{d^2y}{dx^2} + \frac{dy}{dx} - 2y = x + \sin x$ by the method of undetermined coefficients. **(06 Marks)**

Module-2

3 a. Solve $x^2y'' + xy' + y = 2\cos^2(\log x)$. **(05 Marks)**

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

c. By reducing into Clairaut's form, obtain the general and singular solution of $xp^3 - yp^2 + 1 = 0$. **(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 for y : $x^2p^4 + 2xp - y = 0$. **(05 Marks)**

c. Solve for x : $P = \tan\left[x - \frac{P}{1+P^2}\right]$. **(06 Marks)**

Module-3

5 a. Obtain the partial differential equation by eliminating the arbitrary function given $Z = y^2 + 2f\left(\frac{1}{x} + \log y\right)$. **(05 Marks)**

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

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

OR

6 a. Obtain the partial differential equation of $\phi(x+y+z,\ x^2+y^2-z^2)=0$. **(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 $z=0$ if $y=(2n+1)\frac{\pi}{2}$. **(05 Marks)**

c. Find the solution of heat equation $\frac{\partial u}{\partial t}=c^2\frac{\partial^2 u}{\partial x^2}$ by the method of separation of variables. **(06 Marks)**

Module-4

7 a. Evaluate $\int_{-c}^{c}\int_{-b}^{b}\int_{-a}^{a}(x^2+y^2+z^2)dzdydx$. **(05 Marks)**

b. Change the order of integration and evaluate $\int_0^{\infty}\int_x^{\infty}\frac{e^{-y}}{y}dydx$. **(05 Marks)**

c. Obtain the relation between Beta and Gamma function $\beta(m,n)=\frac{\Gamma(m)\,\Gamma(n)}{\Gamma(m+n)}$. **(06 Marks)**

OR

8 a. Find the area of ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$ by double integration. **(05 Marks)**

b. Find the volume of the tetrahedron bounded by the planes x = 0, y = 0, z = 0, $\frac{x}{a}+\frac{y}{b}+\frac{z}{c}=1$. **(05 Marks)**

c. Show that $\int_0^{\pi/2}\frac{d\theta}{\sqrt{\sin\theta}}\times\int_0^{\pi/2}\sqrt{\sin\theta}\,d\theta=\pi$. **(06 Marks)**

Module-5

9 a. Find the Laplace transform of $\frac{\cos at-\cos bt}{t}$. **(05 Marks)**

b. If f(t) is a periodic function of period T, then prove that $L[f(t)]=\frac{1}{1-e^{-ST}}\int_0^T e^{-st}f(t)dt$. **(05 Marks)**

c. Find the inverse Laplace transform of $\frac{4s+5}{(s+1)^2(s+2)}$ **(06 Marks)**

OR

10 a. Express $f(t)=\begin{cases}\cos t, & 0<t<\pi\\ \cos 2t, & \pi<t<2\pi\\ \cos 3t, & t>2\pi\end{cases}$ interms of unit step function and hence find its Laplace transform. **(05 Marks)**

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

c. Solve $\frac{d^2y}{dx^2}+4\frac{dy}{dx}+4y=e^{-t}$ with y(0) = 0, y′(0) = 0. **(06 Marks)**

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