CBCS SCHEME

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15MAT21

Second Semester B.E. Degree Examination, Dec.2024/Jan.2025
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 $\frac{d^2y}{dx^2}+2\frac{dy}{dx}+y=e^{2x}-\cos^2 x$ **(06 Marks)**

b. Solve by inverse differential operator method $(D^4+4D^3-5D^2-36D-36)\,y=0$. **(05 Marks)**

c. Solve by the method of undetermined coefficients $y''+4y=e^{-x}+x^2$. **(05 Marks)**

OR

2 a. Solve $y''-4y=\sin h^2 x$ by inverse differential operator method. **(06 Marks)**

b. Solve $(D^2+3)y=x^2e^{3x}+\cos 3x$ by inverse differential operator method. **(05 Marks)**

c. Solve by the method of variation of parameters $y''+y=\operatorname{cosec} x$ **(05 Marks)**

Module-2

3 a. Solve $x^2y''-xy'+2y=x\sin(\log x)$. **(06 Marks)**

b. Solve $p^2+p(x+y)+xy=0$ **(05 Marks)**

c. Find general and singular solution of $(a^2-x^2)\,p^2+2xyp+b^2-y^2=0$. **(05 Marks)**

OR

4 a. Solve $(x+a)\frac{d^2y}{dx^2}-4(x+a)\frac{dy}{dx}+6y=x$ **(06 Marks)**

b. Solve $y=2px+\tan^{-1}(xp^2)$ **(05 Marks)**

c. Find the general and singular solution of $(px-y)(py+x)=a^2p$ by using the substitution $u=x^2,\ v=y^2$ **(05 Marks)**

Module-3

5 a. Obtain the partial differential equation by eliminating the arbitrary function from $xyz=f(x^2+y^2+z^2)$ **(06 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 an odd multiple of $\pi/2$. **(05 Marks)**

c. Derive one dimensional heat equation $\frac{\partial u}{\partial f}=c^2\frac{\partial^2 y}{\partial x^2}$ **(05 Marks)**

OR

6 a. Find the partial differential equation by eliminating constants a and b from $(x-a)^2+(y-b)^2+z^2=16$. **(06 Marks)**

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

c. Find the various possible solutions of one dimensional wave equation $\frac{\partial^2 u}{\partial t^2}=c^2\frac{\partial^2 y}{\partial x^2}$. **(05 Marks)**

Module-4

7 a. Evaluate $\int_0^a \int_{x/a}^{\sqrt{x/a}} (x^2+y^2)\,dy\,dx$ by changing the order of integration. **(06 Marks)**

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

c. Prove that $\beta(m,n)=\frac{\Gamma(m)\Gamma(n)}{\Gamma(m+n)}$ **(05 Marks)**

OR

8 a. Evaluate $\int_0^\infty \int_0^\infty e^{-(x^2+y^2)}\,dx\,dy$ by changing to polar coordinates. **(06 Marks)**

b. Evaluate $\int_0^1 \int_0^2 \int_1^2 x^2yz\,dx\,dy\,dz$ **(05 Marks)**

c. Prove that $\int_0^a \sqrt{x}\,e^{-x^2}dx \times \int_0^\infty \frac{e^{-x^2}}{\sqrt{x}}dx=\frac{\pi}{2\sqrt{2}}$ **(05 Marks)**

Module-5

9 a. Find : i) $L\,[te^{-t}\sin 3t]$ ii) $L\left[\frac{\sin 3t\cos 2t}{t}\right]$ **(06 Marks)**

b. Show that $L[f(t)]=\frac{1}{s}\tanh\left(\frac{as}{2}\right)$ if $f(t)=\begin{cases}1 & 0<t<a\\ -1 & a\le t\le 2a\end{cases}$ and $f(t+2a)=f(t)$ **(05 Marks)**

c. Using Laplace transform solve $y''-2y'+y=e^{2t}$ with $y(0)=0$, $y'(0)=1$ **(05 Marks)**

OR

10 a. Express $f(t)=\begin{cases}t & 0<t<2\\ 2 & t\ge 2\end{cases}$ in terms of unit step function and hence find Laplace transform. **(05 Marks)**

b. Find : i) $L^{-1}\left[\frac{s+1}{(s-2)^2}\right]$ ii) $L^{-1}\left[\log\left(1-\frac{a}{s}\right)\right]$ **(06 Marks)**

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

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