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Second Semester B.E. Degree Examination, Dec.2024/Jan.2025
Engineering Mathematics II

Time: 3 hrs. Max. Marks: 100

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 $(D^3+6D^2+11D+6)y=0$. **(06 Marks)**

b. Solve $\left(\frac{d^2y}{dx^2}-4\right)y=e^{2x}+3^x$. **(07 Marks)**

c. Solve $\frac{d^2y}{dx^2}+y=\tan x$ by method of variation of parameters. **(07 Marks)**

OR

2 a. Solve $(D-2)^2y=8(e^{2x}+\sin 2x)$. **(06 Marks)**

b. Solve $(D^2+2D+1)y=2+x^2$ **(07 Marks)**

c. Solve $\frac{d^2y}{dx^2}-4\frac{dy}{dx}+3y=20\cos x$ by method of undetermined co-efficients. **(07 Marks)**

Module-2

3 a. Solve $x^2\frac{d^2y}{dx^2}+x\frac{dy}{dx}+y=2\cos(\log x)$ **(06 Marks)**

b. Solve for p: $p^2+2py\cot x=y^2$. **(07 Marks)**

c. Solve Clairaut's equation $p=\sin(y-px)$ **(07 Marks)**

OR

4 a. Solve $(2x+1)^2\frac{d^2y}{dx^2}-2(2x+1)\frac{dy}{dx}-12y=6x+5$ **(06 Marks)**

b. Solve for p : $xp^2-(2x+3y)p+6y=0$ **(07 Marks)**

c. Solve $(px-y)(py+x)=2p$ by reducing it to Clairaut's form by substituting $X=x^2$, $Y=y^2$ **(07 Marks)**

Module-3

5 a. Form partial differential equation by Eliminating arbitrary constant for $ax^2+by^2+z^2=1$. **(06 Marks)**

b. Solve $\frac{\partial^2 z}{\partial x\partial y}=\sin x\sin y$, given conditions $\frac{\partial z}{\partial y}=-2\sin y$ when $x=0$ and $z=0$ when y is odd multiple of $\frac{\pi}{2}$. **(07 Marks)**

c. Find various solution for 1-Dimensional Heat equation by variable separable method. **(07 Marks)**

OR

6 a. Form Partial differential equation by eliminating arbitrary function, $\phi(x+y+z,\ x^2+y^2+z^2)=0$ **(06 Marks)**

b. Solve $\frac{\partial^2 z}{\partial x^2}+3\frac{\partial z}{\partial x}-4z=0$ subject to conditions $z=1$, $\frac{\partial z}{\partial x}=y$ when $x=0$. **(07 Marks)**

c. Derive one dimensional wave equation in standard form. **(07 Marks)**

Module-4

7 a. Evaluate $\int_{-c}^{c}\int_{-b}^{b}\int_{-s}^{s}(x^2+y^2+z^2)\,dx\,dy\,dz$. **(06 Marks)**

b. By changing the order of Integration, evaluate $\int_0^\infty\int_x^\infty \frac{e^{-x}}{y}\,dy\,dx$. **(07 Marks)**

c. Prove that $\Gamma\left(\frac{1}{2}\right)=\sqrt{\pi}$ by using definition of Gamma function. **(07 Marks)**

OR

8 a. Find the area enclosed by parabolas $y^2=4ax$ and $x^2=4ay$. **(06 Marks)**

b. By changing the variables into polar form evaluate $\int_0^\infty\int_0^\infty e^{-(x^2+y^2)}\,dx\,dy$ **(07 Marks)**

c. For m>0, n>0, prove that $\beta(m,n)=\frac{\Gamma(m)\Gamma(n)}{\Gamma(m+n)}$ **(07 Marks)**

Module-5

9 a. Evaluate $\alpha\left\{\frac{\cos 2t-\cos 3t}{t}\right\}$. **(06 Marks)**

b. If $f(t)=\begin{cases} t & \text{if } 0\le t\le a \\ 2a-t & \text{if } a\le t\le 2a\end{cases}$ is a periodic function of period 2a, then show that $L\{f(t)\}$ is $\frac{1}{s^2}\tanh\left(\frac{as}{2}\right)$. **(07 Marks)**

c. By using convolution theorem evaluate $\frac{1}{s(s^2+a^2)}$. **(07 Marks)**

OR

10 a. Express $f(t)=\begin{cases} \cos t & 0<t<\pi \\ \cos 2t & \pi<t<2\pi \\ \cos 3t & t>2\pi\end{cases}$ in terms of unit step function, then find $L\{f(t)\}$. **(07 Marks)**

b. Find Inverse Laplace Transform of $\log\left(\frac{s+a}{s+b}\right)$. **(06 Marks)**

c. Solve $\frac{d^2y}{dx^2}+4\frac{dy}{dx}+4y=e^{-t}$ given $y(0)=y'(0)=0$, using Laplace Transform method. **(07 Marks)**

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