V/D/TY

Reg. No [redacted]

Final Assessment Test – April 2025

VIT
Vellore Institute of Technology

Course: BMAT102L - Differential Equations and Transforms

Class NBR(s): 1119 / 1120 / 1121 / 1122 / 1123 / 1124 / 1125 / 1126 / 1127 / 1128 / 1129 / 1130

Slot: A2+TA2+TAA2

Time: Three Hours

Max. Marks: 100

- KEEPING MOBILE PHONE/ANY ELECTRONIC GADGETS, EVEN IN 'OFF' POSITION IS TREATED AS EXAM MALPRACTICE
- DON'T WRITE ANYTHING ON THE QUESTION PAPER

Answer ALL Questions
(10 X 10 = 100 Marks)

1. Solve: $y''+3y'+2y=2e^{x}$, using the method of variation of parameters. [10]

2. Solve: $2x^2y''+3xy'-3y=x^3$ using the method of undetermined coefficients. [10]

3. (i) Form the partial differential equation by eliminating arbitrary functions from [5]
$z=f(x+at)+g(x-at)$

(ii) Find the general solution of the equation [5]
$\frac{dx}{x(y^2-z^2)}=\frac{dy}{-y(z^2+x^2)}=\frac{dz}{z(x^2+y^2)}$ using method of multipliers.

4. Using the method of separation of variables, solve $\frac{\partial u}{\partial x}=2\frac{\partial u}{\partial t}+u$ where [10]
$u(x,0)=6e^{-3x}$.

5. (i) Find Laplace transform of $f(t)=(\cos t+\sin t)^2$ [5]

(ii) Find the Laplace transform of the square wave given by [5]
$f(t)=\begin{cases} k & ,0\le t<a, \\ -k & ,a\le t<2a, \end{cases}$ and $f(t+2a)=f(t)$.

6. Find the Inverse Laplace transform of the function $\frac{s}{(s^2+4)(s^2+9)}$ using convolution theorem. [10]

7.a) Solve the initial value problem $y''+2y'+10y=3\delta(t-3)$, $y(0)=0, y'(0)=0$ using Laplace transforms. [10]

OR [10]

7.b) Solve by the Laplace transforms method, of the first order initial boundary value problem $\frac{\partial u}{\partial x}+x\frac{\partial u}{\partial t}=4xt,\ u(x,0)=0,\ u(0,t)=0$. [10]

8.a) Find the Fourier series expansion of the periodic function [10]
$f(x)=\begin{cases} \pi+x, & -\pi<x<0 \\ 0, & 0\le x<\pi \end{cases}$ with period 2π.

OR [10]

8.b) Find the half range Fourier cosine series for the function $f(x)=(x-1)^2$ in the interval $0<x<1$. Hence find $\frac{1}{1^2}+\frac{1}{3^2}+\frac{1}{5^2}+\ldots$ [10]

9. Find the Fourier transform of the function $f(x)=\begin{cases}0, & x<0\\ 1, & 0\le x\le 1\\ 0, & x>1\end{cases}$. Hence, evaluate [10]

$$\int_0^{\infty}\frac{\sin\left(\frac{x}{2}\right)}{x}dx.$$

10. Solve the difference equation $y_{n+2}-2y_{n+1}+y_n=n,\ y_0=1,\ y_1=1$ using Z transforms. [10]

⇔⇔⇔ V/D/TY ⇔⇔⇔