


Final Assessment Test – April 2025

 Course: **BMAT102L - Differential Equations and Transforms**

 Class NBR(s): **1048 / 1049 / 1051 / 1052 / 1053 / 1054 /**
1055 / 1056 / 1057 / 1058 / 1059 / 1060 / 1061 / 1062 /
1063 / 1064 / 1065 / 1066 / 1067 / 1068 / 1069 / 1070 /
3640

 Time: **Three Hours**

 Max. Marks: **100**

 Slot: **C1+TC1+TCC1**

- **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 $t^2 \frac{d^2x}{dt^2} + 9x = \log t$ by the method of variation of parameters. [10]
 2. Use the method of undetermined coefficients, to solve the differential equation [10]
 $\frac{d^2y}{dx^2} - 4 \frac{dy}{dx} + 4y = e^{2x} + \cos 2x.$
 3. (i) Obtain the partial differential equation by eliminating the arbitrary function [5]
 from $\phi(x^2 + y^2 + z^2, z^2 - 2xy) = 0.$
 (ii) Solve $q^2 = z^2 p^2 (1 - p^2)$, where $p = \frac{\partial z}{\partial x}, q = \frac{\partial z}{\partial y}.$ [5]
 4. Solve $4 \frac{\partial u}{\partial x} + \frac{\partial u}{\partial y} = 3u, u(0, y) = 3e^{-y} - e^{-5y}$ using the method of separation of [10]
 variables.
 5. (i) Evaluate the improper integral $\int_0^{\infty} \frac{\cos 2t - \cos 3t}{t} dt$ using Laplace transform. [10]
 (ii) Find the Laplace transform of a periodic function $f(t) = \begin{cases} 1, & 0 < t < 1 \\ t, & 1 < t < 2 \end{cases}$
 with period 2.
 6. Using the Convolution theorem, find $L^{-1} \left[\frac{s}{s^4 + 37s^2 + 36} \right].$ [10]
 - 7.a) Solve the following differential equation using Laplace transform. [10]
 $\frac{d^2x}{dt^2} + 4x = H(t - \pi) + H(t - 2\pi), x(0) = 0 = x'(0).$
- OR**
- 7.b) Obtain the solution of $u_x + u_t + u = 0$ with [10]
 $u(0, t) = 0 (t > 0), u(x, 0) = \cot x (x > 0)$ using Laplace Transform.

8.a) Find the Fourier series for the function $f(x) = x \sin x$, $0 < x < 2\pi$. [10]

OR

8.b) Find the half range Fourier cosine series of $f(x) = x(2-x)$ in $0 \leq x \leq 3$, and [10]
hence find the sum $\frac{1}{1^2} - \frac{3}{2^2} + \frac{1}{3^2} - \frac{3}{4^2} + \dots$

9. Find the sine transform of $f(x) = \frac{e^{-3x}}{x}$. [10]

10. Find the response of the system $x_{n+2} - 8x_{n+1} + 15x_n = 1$, with $x_0 = 0, x_1 = 0$ [10]
using Z-transform.

⇔⇔⇔ Y/D/TY ⇔⇔⇔

$$= \int_{-\infty}^{\infty} \frac{2}{\pi} \int_0^{\infty} \sin sn \cdot \frac{e^{-3n}}{n} dn$$
$$= \int_{-\infty}^{\infty} \frac{\sin sn}{n} \cdot [\cos$$