Final Assessment Test – May 2024

Vellore Institute of Technology
(Deemed to be University under section 3 of the UGC Act, 1956)

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

Class/ NBR(s):/ **1543 / 1544 / 1547/ 1553/ 1554 / 1556 / 1559/ 1563 / 1565 / 1566 / 1568 / 1572 / 1577 / 1578 / 1579 / 1580 / 1581 / 4948 / 4949/ 4955 / 5873**

Slot:**A1+TA1+TAA1**

Time: **Three Hours**

Max. Marks: **100**

- **KEEPING MOBILE PHONE ELECTRONIC DEVICES EVEN IN 'OFF' POSITION IS TREATED AS EXAM MALPRACTICE**
- **DON'T WRITE ANYTHING ON THE QUESTION PAPER**

General Instructions:

1. **"*fx* series" - non Programmable calculator are permitted: YES**
2. **Reference tables permitted: NO**

Answer any TEN Questions

(10 X 10 = 100 Marks)

1. Solve $\frac{d^2y}{dx^2}-2\frac{dy}{dx}+3y=x^3+\sin x$ by the method of undetermined coefficients. [10]

2. Apply the method of variation of parameters to solve $\frac{d^2y}{dx^2}+y=\operatorname{cosec} x$. [10]

3. a) Form the partial differential equation by eliminating the arbitrary constants a and b from $z=ax+by+a^2+b^2$. [5]

   b) Solve $p^2+pq=z^2$. [5]

4. Solve $(y-z)p+(x-y)q=z-x$ [10]

5. Find the Laplace transform of the square-wave function of period $2a$ defined as [10]

$$f(t)=\begin{cases} k & when\ 0<t<a \\ -k & when\ a<t<2a \end{cases}.$$

6. Using Convolution theorem, find $L^{-1}\left\{\frac{s}{(s^2+a^2)^2}\right\}$. [10]

7. Solve $x''(t)+3x'(t)+2x(t)=H(t-2)$ with $x(0)=0$ and $x'(0)=0$ using Laplace transform. [10]

8. Find the Fourier series for $f(x)=e^{-x}$ in the interval $0<x<2\pi$. [10]

9. Find the half range Fourier cosine series of $f(x)=x$ in the interval $0<x<l$ and hence evaluate $\frac{1}{1^4}+\frac{1}{3^4}+\frac{1}{5^4}+\cdots$. [10]

10. Find the Fourier transform of $f(x)=\begin{cases} 1 & if\ |x|<a \\ 0 & if\ |x|>a \end{cases}$ $(a>0)$ and hence evaluate [10]

$$\int_{-\infty}^{\infty}\frac{\sin(ap)\cos(px)}{p}dp\ .$$

11. a) Find $z[\cos n\theta]$ and $z[\sin n\theta]$. [5]

    b) Find $Z^{-1}\left[\frac{z}{(z-1)(z+1)}\right]$ by partial fraction method. [5]

12. Solve $y_{n+2}+5y_{n+1}+6y_n=5^n$ with $y_0=0,\ y_1=0$ using Z- transform. [10]

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