Total No. of Questions : 4]

SEAT No. :

**PE577**

[Total No. of Pages : 2

**[6578]-50**

**S.E. (Production and Industrial Engineering/Production Sandwich/ Robotics and Automation) (Insem)**

**ENGINEERING MATHEMATICS - III**

**(2019 Pattern) (Semester - III) (207007)**

*Time : 1 Hour]* *[Max. Marks : 30*

***Instructions to the candidates:***

1) *Attempt Q.1 or Q.2, Q.3 or Q.4.*
2) *Figures to the right side indicate full marks.*
3) *Assume suitable data wherever necessary.*
4) *Use of electronic pocket calculator is allowed.*

***Q1)*** a) Solve any two. **[10]**

i) $\frac{d^2y}{dx^2} + y = \sec x$ (variation of parameters).

ii) $(1 - D^2)\, y = x^4$.

iii) $x^2\frac{d^2y}{dx^2} - 4x\frac{dy}{dx} + 6y = x^5$.

b) Solve the simultaneous equations. **[5]**

$$\frac{du}{dx} + v = \sin x \;;\; \frac{dv}{dx} + u = \cos x.$$

OR

***Q2)*** a) Solve any two. **[10]**

i) $\frac{d^2y}{dx^2} - y = e^{3x}$ (variation of parameters).

ii) $(D^2 - 3D + 2)\, y = \sin x$.

iii) $x\frac{d^2y}{dx^2} + \frac{dy}{dx} = -x$.

b) A body weighing W = 20N is hung from a spring. A pull of 40N will stretch the spring to 10 cm. The body is pulled down to 20 cm below the static equilibrium position and then released. Find the position and velocity as function of time. **[5]**

***P.T.O.***

**Q3)** a) Find the Laplace transform of $e^{-2t}(3\cos 6t - 5\sin 6t)$. **[5]**

b) Find the inverse Laplace transform of $F(s) = \dfrac{1}{s(s^2+4)}$. **[5]**

c) Using Fourier integral representation show that **[5]**

$$\int_0^\infty \left[\frac{a^2\sin a\lambda}{\lambda} + \frac{2a\cos a\lambda}{\lambda^2} - \frac{2\sin a\lambda}{\lambda^3}\right]\cos\lambda x\, d\lambda = \begin{cases} \dfrac{\pi}{2}x^2 & , \quad 0 < x < a \\ 0 & , \quad x > a \end{cases}$$

OR

**Q4)** a) Find the Laplace transform of : $\dfrac{e^{-3t} - e^{-2t}}{t}$ **[5]**

b) Find the Fourier sine transform of $f(x) = e^{-x}$. **[5]**

c) Solve the integral equation $\int_0^\infty f(x)\sin\lambda x\, dx = \begin{cases} 1-\lambda & , \quad 0 \le \lambda \le 1 \\ 0 & , \quad \lambda \ge 1 \end{cases}$ to find $f(x)$. **[5]**

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