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Vellore Institute of Technology
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CHENNAI

Continuous Assessment Test I - Feb 2024

Programme	:	B.Tech.	Semester	:	Win 2023-24
Course	:	Differential Equations and Transforms	Code	:	BMAT102L
			Slot	:	C1+TC1+TCC1
Faculty	:	Dr. Balaji A, Dr. Jayagopal R, Dr. David Raj Michael, Dr. Surat Ghosh, Dr. Dhivya M, Dr. Vijaya Kumar Dr. Sowndarrajan, Dr. Radha S Dr. Manimaran, Dr. Sethukumaraswamy Dr. Durgaprasad, Dr. Amit Kumar Rahul Dr. Tharasi Dilleswar	Class ID	:	CH2023240501574, 1575,1579, 1573, 1576,1577, 1578, 1408, 0789, 0790,0791, 0792,0793
Time	:	90 Minutes	Max.Marks	:	50

General Instructions:

- Write only your registration number on the question paper in the box provided and do not write other information
- Use statistical tables supplied from the exam cell as necessary
- Use graph sheets supplied from the exam cell as necessary
- Only non-programmable calculator without storage is permitted

Part – A ($5 \times 10 = 50$)

Answer all the Questions

Q1. Module: 01 CO: 01 Level: Medium BL: K2 Hots: No Marks: 10

Solve $(x+1)^2y'' - 4(x+1)y' + 6y = 6(x+1), y(0) = 0, y'(0) = 0$

Solution: $y = -6(x+1)^2 + 3(x+1)^3 + 3(x+1)$

Q2. Module: 01 CO: 01 Level: Easy BL: K2 Hots: No Marks: 10

(a) Solve the differential equation $y'' - 100y = \cos x$ by using the method of undetermined coefficients. [5]

(b) Solve the ordinary differential equation $y'' + a^2y = cosecax$. [5]

Solution: a) $y = c_1e^{10x} + c_2e^{-10x} - \frac{1}{101}cosx$
b) $y = c_1cos(ax) + c_2sin(ax) - \frac{x}{a}cos(ax) + \frac{1}{a^2}log(sinax))sin(ax)$

Q3. Module: 02 CO: 02 Level: Medium BL: K2 Hots: Yes Marks: 10

Solve the partial differential equation $q^2x - p^2y - p^2q^2 = 0$

Solution: $z = \pm\frac{2}{3\sqrt{k+1}}x^{\frac{3}{2}} \pm \frac{2}{3\sqrt{k}}y^{\frac{3}{2}} + c$, k,c are arbitrary constants

Q4. Module: 02 CO: 02 Level: Difficult BL: K2 Hots: Yes Marks: 10

Find the general solution of the partial differential equation $(3-2yz)p = x(2z-1)q = 2x(z-3)$

Solution: $\phi(y^2 - 6y - z^2 + z, x^2 + z^2 + 6y) = 0$

Q5. Module: 03 CO: 02 Level: Easy BL: K2 Hots: No Marks: 10

(a) Find the Laplace transform of the function $f(t)$ of period $\frac{2\pi}{\omega}$ given by [6]

$$f(x) = \begin{cases} sin\omega t, & 0 < t < (\pi/\omega) \\ 0, & (\pi)/\omega) < t < (2\pi/\omega) \end{cases}$$

(b) Find the Laplace transform of $e^{2t} + 4t^3 - 2\sin 3t + 3\cos^2 3t$ [4]

Solution: (a) $\frac{\omega}{(1-e^{-\frac{\pi s}{\omega}})(s^2+\omega^2)}$

(b) $\frac{1}{s-2} + \frac{24}{s^4} - \frac{6}{s^2+9} + \frac{3}{2s} + \frac{3s}{2(s^2+36)}$