Time : 3 Hours   **Marks : 80**

Instructions :

1.   All Questions are Compulsory.
2.   Each Sub-question carry 5 marks.
3.   Each Sub-question should be answered between 75 to 100 words. Write every questions answer on separate page.
4.   Question paper of 80 Marks, it will be converted in to your programme structure marks.

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1.   Solve any **four** sub-questions.

   a)   Evaluate $\lim\limits_{x \to 2} \dfrac{x^{10} - 1024}{x^5 - 32}$.   5

   b)   Find $\dfrac{dy}{dx}$ if $y = \dfrac{\cos x}{x^2 - 1}$ 5

   c)   If $x = \sin\theta$, $y = \cos\theta$ where θ is a parameter, show that $\dfrac{dy}{dx} = -\tan\theta$ 5

   d)   If $s = t^3 - 3t^2 - 9t$, find the acceleration when velocity is zero.   5

   e)   Divide 60 into two parts so that sum of their square is minimum.   5

2.   Solve any **four** sub-questions.

   a)   Evaluate $\int \sin 2x \sin 4x \, dx$ 5

   b)   Evaluate $\int \dfrac{x^2}{x^3 + 1} dx$.   5

   c)   Evaluate $\int \dfrac{dx}{2x^2 - 3x + 1}$ 5

   d)   Evaluate $\int\limits_{0}^{1} xe^x dx$ 5

e) Find the area bounded by $i = \sin\theta$, between $\theta = \dfrac{\pi}{6}$ to $\theta = \dfrac{\pi}{2}$ and the θ – axis.   5

3. Solve any **four** sub-questions.

a) Form the differential equation from $x = a\sin(wt + c)$ where a and c are arbitrary constants.   5

b) Solve, $\dfrac{dy}{dx} = \cos(x + y)$.   5

c) Solve differential equation   5

$$\left(x - 2e^y\right)dy + (y + x\sin x)\,dx = 0.$$

d) Solve, $\log \dfrac{dy}{dx} = ax + by$.   5

e) A resistance of 100 ohms and inductance of 0.5 henries are connected in series with a battery of 20 volts. Find the current in the circuit at any instant. Take $i = 0$ at $t = 0$.   5

4. Solve any **four** sub-questions.

a) Find $L\left[\left(e^t + 1\right)^2\right]$ 5

b) Find the Laplace transform of $e^{-t}\sin 3t \cos t$ 5

c) Find the Laplace transform of $\dfrac{dy}{dt} + 2y + \displaystyle\int_0^1 y\,dt = \sin t$, given that $\psi(0) = 1$.   5

d) Find inverse Laplace transform of $\dfrac{s + 7}{s^2 + 2s + 5}$.   5

e) Find Inverse Laplace transform of $\dfrac{1}{4S + 3}$.   5

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