VIT

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

DEPARTMENT OF MATHEMATICS
SCHOOL OF ADVANCED SCIENCES
Continuous Assessment Test – I

Course Code : MAT1011 **Slot: E2+TE2**

Course Name: Calculus for Engineers **Max. Marks: 50**

ANSWER ALL QUESTIONS

1. Identify the inflection points and local maxima and local minima of the function $f(x) = \frac{x^3}{3} - \frac{x^2}{2} - 2x + \frac{1}{3}$, and also identify the intervals on which the function is concave up and concave down. (10)

2. The region between the curves $y = x^2$, and the line $y = 2x$ in the first quadrant is revolved about the y −axis to generate a solid. Find its volume. (10)

3. (a)Express $f(t) = \begin{cases} e^{-t} & 0 < t < 3 \\ 0 & t > 3 \end{cases}$, In terms of unit step function and hence find its Laplace transform. (5)

   (b) Evaluate $\int_0^\infty \frac{e^{-3t} - e^{-6t}}{t}\, dt$, Using Laplace transform. (5)

4. Find the Laplace transform of the periodic half-wave rectified signal $f(t)$ which is given by $f(t) = \begin{cases} sinat & 0 < t < \frac{\pi}{a} \\ 0 & \frac{\pi}{a} < t < \frac{2\pi}{a} \end{cases}$, $f\left(t + \frac{2\pi}{a}\right) = f(t)$. (10)

5. (a) Using convolution theorem, find the inverse Laplace transform of $\frac{s}{(s^2+9)(s^2+4)}$. (7)

   (b) Find the Inverse Laplace transform of $\frac{e^{-2s}}{s(s+1)}$. (3)