



SEARCH VIT QUESTION PAPERS
ON TELEGRAM TO JOIN



VIT

Vellore Institute of Technology

Fall semester 2019-2020

Continuous Assessment Test - I

Programme Name & Branch: B.Tech & M.Tech(SE)

Course Name & Code: Calculus for Engineers & MAT1011

Slot: B1+TB1

Exam Duration: 90 minutes

Maximum Marks: 50

Answer All the Questions ($5 \times 10 = 50$)

1. For the function $f(x) = 3x^4 - 4x^3 - 12x^2 + 4$ $\rightarrow 12x^3 - 12x^2 - 24x$
 $36x^2 - 24x - 24$
 (i) find the critical points of $f(x)$
 (ii) find the intervals where the function is increasing and the intervals where it is decreasing
 (iii) identify the intervals where the function is concave up and concave down, hence find the points of inflection. (10)

2. (a) Verify Rolle's theorem for the function $f(x) = x^2 - x$ on $[0, 1]$. (5)
 (b) Find the area of the region in the first quadrant that is bounded by $y = \sqrt{x}$ and above the x-axis and the line $y = x - 2$. (5)

3. Find the volume of the solid obtained by rotating the region bounded by $y = x^2 - 2x$ and $y = x$ about the line $y = 4$. (10)

4. (a) Find the Laplace transform of the function $f(t) = e^{-t} \sin t$ (5)
 (b) 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)

5. (a) Find the Laplace transform of the following periodic function
 $f(t) = \begin{cases} E, & \text{for } 0 < t < \frac{a}{2} \\ 0, & \text{for } \frac{a}{2} < t < a \end{cases}$
 given that $f(t + a) = f(t)$. (5)

6. Using method of partial fractions, find the inverse Laplace transform of the function $F(s) = \frac{s}{(s-1)(s+1)(s+3)}$ (5)



Handwritten calculations for Question 6:

$$F(s) = \frac{s}{(s-1)(s+1)(s+3)} = \frac{A}{s-1} + \frac{B}{s+1} + \frac{C}{s+3}$$

$$s = (s-1)(s+3)A + (s-1)(s+1)B + (s-1)(s+1)(s+3)C$$

$$s = (s^2 + 2s - 3)A + (s^2 + 0s - 1)B + (s^3 + 3s^2 - 2s - 3)C$$

$$s = (A+B+C)s^3 + (2A+0B+3C)s^2 + (-3A-1B-2C)s + (-3A-3C)$$

$$\begin{cases} A+B+C=0 \\ 2A+3C=0 \\ -3A-1B-2C=1 \\ -3A-3C=0 \end{cases}$$

$$A = -\frac{1}{8}, B = \frac{1}{4}, C = \frac{1}{8}$$

$$f(t) = -\frac{1}{8}e^{t-1} + \frac{1}{4}e^{t+1} + \frac{1}{8}e^{t+3}$$