



VIT[®]
UNIVERSITY
(Established by UGC Act 1956)
Vellore, CHENNAI
www.vit.ac.in

School of Advanced Sciences

Department of Mathematics

Subject: MAT 1011 – Calculus for Engineers

Continuous Assessment Test (CAT) – I, August 2016

Slot: D₂

Date: 24/8/2016

Duration: 90 Mins.

Max. Marks: 50

Answer ALL questions (5 x 10 = 50 Marks)

1. (A) During the first 40 s of a rocket flight, the rocket is propelled straight up so that in t seconds it reaches a height of $s = 5t^3$ ft. (6M)

- (i) How high does the rocket travel in 40 seconds?
- (ii) What is the average velocity of the rocket during the first 40 seconds?
- (iii) What is the instantaneous velocity of the rocket at the end of 40 seconds?

(B) The voltage V volts, current I amperes and resistance R ohms of an electric circuit are related by the equation $V = IR$. Suppose that V is increasing at the rate of 1 ohm/sec, while I is decreasing at the rate of $\frac{1}{3}$ amp/sec. Find the rate at which R is changing when $V=12$ volts and $I=2$ amp. Is R increasing or decreasing? (4M)

2. (A) The arithmetic mean of two numbers a and b is the number $\frac{a+b}{2}$. Show that the value of c in the conclusion of the Mean value theorem for $f(x) = x^2$ on the interval $[a, b]$ is $c = \frac{a+b}{2}$. (3M)

(B) Suppose that a point moves along some unknown curve $y = f(x)$ in the xy -plane in such a way that at each point (x, y) on the curve, the tangent line has slope x^2 . Find an equation for the curve given that it passes through the point $(2, 1)$. (3M)

(C) Consider the function $f(x) = \frac{e^x + e^{-x}}{2}$ for $-\infty < x < \infty$ (4M)

- (i) Find the interval(s) on which $f(x)$ is increasing
- (ii) Show that $f(x)$ is always concave up.