Nirma University
Institute of Technology
Department of Mathematics & Humanities
B. Tech. (ALL) – Semester - I
Calculus (MA101)
Tutorial – 2

Schedule week: 28-08-17 to 01-09-17

Part I: Differential Calculus

1. Find n^{th} derivative of the following functions:

   (i) $y = \dfrac{x}{(4x+3)(x-1)}$

   (ii) $y = \log\left(\dfrac{3x-1}{3x+1}\right)^{1/3}$

   (iii) $y = \dfrac{1}{x^2 + a^2}$

2. Find n^{th} derivative of $y = a^{2x} + \dfrac{x}{x-1}$.

Part-II Integral Calculus

1. Show that $\int_0^\infty 3^{-x^2}\,dx = \dfrac{1}{2}\sqrt{\dfrac{\pi}{\log 3}}$.
2. Show that $\int_0^1 \left(x \log\dfrac{1}{x}\right)^{1/3} dx = \left(\dfrac{3}{4}\right)^{4/3}\sqrt{\dfrac{4}{3}}$.
3. Show that $\int_0^\infty e^{-a^2 x} x^{\frac{3}{2}}\,dx = \dfrac{3}{4a^5}\sqrt{\pi}$.
4. Show that $\int_0^1 \left(\dfrac{x^3}{1-x^3}\right)^{\frac{1}{2}} dx = \dfrac{\pi^2\, 2^{-\frac{1}{3}}}{\left(\sqrt{\dfrac{1}{3}}\right)^3 .\sin\left(\dfrac{\pi}{3}\right)}$
5. A particle of mass *m* starts moving from rest along the *x*-axis towards the origin from its initial position $x = 1$. Its initial potential is given by $V = -\dfrac{1}{2} m \log x$. Find the time required for the particle to reach the origin which is given by $\int_0^1 \dfrac{1}{\sqrt{-\log x}}\,dx$ for the problem.