M E T U – N C C
Mathematics Group

<table>
<tr><td colspan="2">Calculus with Analytic Geometry
Second Midterm Exam</td></tr>
<tr><td>Code : MATH 119
Acad.Year : 2010-2011
Semester : Spring
Instructors : A.D./H.T./B.W.</td><td>Last Name :
Name :   Stud. No :
Dept. :   Sec. No :
Signature :</td></tr>
<tr><td>Date : 30.04.2011
Time : 15.30
Duration : 120 minutes</td><td>6 Questions on 6 Pages
Total 100 Points</td></tr>
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1	2	3	4	5	6		

Q.1 ($4 \times 5 = 20$ pts) Find the following derivatives:

(a) $\dfrac{\mathrm{d}}{\mathrm{d}x}\dfrac{(x-1)^{2/3}\sqrt{x^2+1}}{x^4 \sin x}$ (Use logarithmic differentiation)

(b) $\dfrac{\mathrm{d}}{\mathrm{d}x} \arcsin\Big[\ln(2^x)\Big]$

(c) $\dfrac{\mathrm{d}}{\mathrm{d}x}\displaystyle\int_x^{x^2} t^2 \tan t \,\mathrm{d}t$

(d) $\dfrac{\mathrm{d}}{\mathrm{d}x}(\ln x)^{\ln x}$

Q.2 (4 × 5 = 20 pts) Evaluate the following integrals:

(a) $\displaystyle\int \frac{x^9}{\sqrt{x^5+2}}\,\mathrm{d}x$

(b) $\displaystyle\int_0^{1/2} \frac{\arcsin x}{\sqrt{1-x^2}}\,\mathrm{d}x$

(c) $\displaystyle\int_{-1}^{1} x^8 \sin x\,\mathrm{d}x$

(d) $\displaystyle\int \frac{\sec(\ln x)\,\tan(\ln x)}{x}\,\mathrm{d}x$

Q.3 (5 × 3 = 15 pts) Consider the function $f(x) = \sqrt{x} + \dfrac{1}{\sqrt{x}}\cdot$

(a) Write down its domain. Is the line $x = 0$ a vertical asymptote? Why?

(b) Find intervals of increase and decrease.

(c) Find local maximum and minimum points if there is any.

(d) Find intervals of concavity. Is there any inflection points?

(e) Sketch its graph.

Q.4 (15 pts) Let $f(x) = 4 - x^2$ and $g(x) = 2 + x$. Calculate the **area** (finding its numerical value) of the region bounded by f and g between the lines $x = 0$ and $x = 2$.

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Q.5 (20 pts) Find the **minimal** surface area of a cylindrical can with volume 16π.
Hint. The surface area and volume are given, respectively, by $A(r, h) = 2\pi r^2 + 2\pi rh$ and $V = \pi r^2 h$, where r is the radius of the base (and the top) of the can, and h denotes its height.

Q.6 (10 pts) Use the mean value theorem (MVT) to show that $\ln x < x - 1$ for $x > 1$.