

For,
Mr. Breev

University of Asia Pacific
Department of Basic Sciences & Humanities
Final Examination, Spring 2012
Program : B.Sc Engineering (Civil)

Course Title: Mathematics I
Time: 3 hrs

Course Code: MTH 101
Full Marks: 150

There are two sections in the question paper namely "**SECTION A**" and "**SECTION B**". You have to answer from both sections according to the instruction mentioned in each section.

SECTION A

There are **FOUR** questions in this section. Answer any **THREE**.

- Q1. (a) State and prove Rolle's theorem. 12.5
(b) Verify this theorem for the function $f(x) = x^2 - x + 2$ on $(0, 1)$. 12.5
- Q2. (a) State and prove Cauchy's Mean value theorem (MVT). 12.5
(b) Verify this theorem for $f(x) = x^2 + x + 1$ and $g(x) = x^2 + 2x + 1$ on the interval $[1, 2]$. 12.5
- Q3. (a) Let $f(x) = x^3 - 2x^2 + 1$. Find the intervals on which the function $f(x)$ is increasing, decreasing, concave up and concave down. 12.5
(b) Find the local extrema of $f(x) = \sin x (1 + \cos x)$. 12.5
- Q4. (c) State Taylor's theorem with remainder. Use Taylor's theorem to expand $f(x) = \cos x$ in powers of $x - \pi/2$ with the remainder term. 12.5
(b) State and prove L'Hospital's rule. Apply this rule to evaluate 12.5

$$\lim_{x \rightarrow 1} \left(\frac{\tan x - \sin x}{x^3} \right)$$

$x \rightarrow 0$

SECTION B

There are **FOUR** questions in this section. Answer any **THREE**.

Q5. (a) Integrate the following

* (i) $\int (a+bx)^n dx$ (ii) $\int \frac{dx}{\sqrt{(x-2)(3-x)}}$ (iii) $\int \tan^5 x dx$

* (b) Find a reduction formula for $\int x^3 e^{ax} dx$

15

10

Q6. a) State and prove the fundamental theorem of calculus.

b) Define reduction formula. Find a reduction formula for $\int \sin^n x dx$.

6

9

* (b) Evaluate (i) $\int_0^{\frac{\pi}{2}} \frac{dx}{3+2\cos x}$ (ii) $\int_0^1 \frac{dx}{1+x^2}$

10

Q7.

(a) Find the arc length of the curve $y = \ln \frac{e^x - 1}{e^x + 1}$ from $x = 1$ to $x = 2$.

12.5

(b) Find the area of the region that is inside the cardioid $y = 4(1 + \cos \theta)$ and outside the circle $r = 6$.

12.5

How $r = r \sin \theta$???

Q8.

(a) Find the area of the region enclosed by the curves $y^2 = 4ax$ and $x^2 = 4ay$

9

(b) Find the area of the region bounded by $y^2 = x$, $y = 2 - x$.

8

(c) Find the volume of the solid generated by the revolution of an ellipse and its minor axis.

8