



UNIVERSITY EXAMINATIONS
EXAMINATION FOR SEPTEMBER/DECEMBER 2015/2016 FOR
BACHELOR OF SCIENCE IN COMPUTER SCIENCE

RCCS 103: CALCULUS (MATHEMATICS).

DATE: 4th December- 2015

TIME: 2 HOURS

GENERAL INSTRUCTIONS:

Students are NOT permitted to write on the examination paper during reading time. This is a closed book examination. Text book/Reference books/notes are not permitted.

SPECIAL INSTRUCTIONS:

This examination paper consists Questions in Section A followed by section B.

Answer **Question 1 and any Other Two** questions.

QUESTIONS in ALL Sections should be answered in answer booklet(s).

1. PLEASE start the answer to EACH question on a NEW PAGE.
2. Keep your phone(s) switched off at the front of the examination room and NOT on your person.
3. Keep ALL bags and caps at the front of the examination room and DO NOT refer to ANY unauthorized material before or during the course of the examination.
4. ALWAYS show your working.
5. Marks indicated in parenthesis i.e. () will be awarded for clear and logical answers.
6. Write your REGISTRATION NO. Clearly on the answer booklet(s).
7. For the Questions, write the number of the question on the answer booklet(s) in the order you answered them.
8. DO NOT use your PHONE as a CALCULATOR .
9. YOU are ONLY ALLOWED to leave the exam room 30minutes to the end of the Exam.
10. Advanced Mathematics log table / Formulas will be provided.
11. Calculator will be required.

SECTION A (COMPULSORY)

QUESTION 1 (30 MARKS)

a) Explain the following terms? **(8 Marks)**

- i. Calculus.
- ii. Differentiation.
- iii. Gradient.
- iv. Integration.
- v. Integral.
- vi. Derivative.
- vii. Turning point.
- viii. Point of inflexion

b) Using suitable functions, compare definite and indefinite integrals. **(4 Marks)**

c) Given that $\tan x = \frac{\sin x}{\cos x}$ prove that $\frac{dy}{dx} (\tan x) = \sec^2 x$. **(5 Marks)**

d) Determine the slope (Gradient) of the following lines. **(2 Marks)**

- i. $y = 3x + 5$.
- ii. $y = \frac{1}{5}x + 3$.

e) Differentiate the functions below. **(4 Marks)**

- i. $y = x^2 - 9x + 7$.
- ii. $y = \sin x \cos x$.

f) Integrate the functions below.

$$\int_0^7 2x^3 + 3x - 6. dx \quad \textbf{(4 Marks)}$$

g) Determine algebraically, from the first principle, the gradient of the curve below.

$$y = 3x^2 + 4. \quad \textbf{(3 Marks)}$$

SECTION B (Answer Any Two Questions)

Question (2) - (20Marks)

- a) Given that the exponential function can be expressed using the series below.

$$e^x = 1 + \frac{x}{1!} + \frac{x^2}{2!} + \frac{x^3}{3!} + \frac{x^4}{4!} \dots, \quad -\infty < x < \infty$$

Hence prove that $\frac{dy}{dx}(e^x) = e^x$ (6 Marks)

- b) Given that $y = \frac{e^x + e^{-x}}{2} = \cosh x$ and $y = \frac{e^x - e^{-x}}{2} = \sinh x$ (6 Marks)

Prove that $\frac{dy}{dx}(\cosh x) = \sinh x$

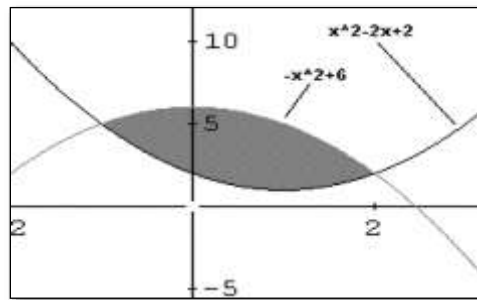
- c) Solve the following integral. (8 Marks)

$$\int_3^7 x^3 + 8x^2 + 4x + 2 \, dx$$

Question (3) - (20Marks)

- a) Find the area of the shaded region bounded by the curves below. (10 Marks)

$$y = -x^2 + 6 \quad \& \quad y = x^2 - 2x + 2$$



- b) Given that $\sin^2 x = \frac{1}{2}(1 - \cos 2x)$ integrate the function below. **(5 Marks)**

$$\int \sin^2 x \, dx.$$

- c) From the *first Principal* determine the Gradient of the function below.

$$y = 7x^2 + 5x - 3 \quad \textbf{(5 Marks)}$$

Question (4) - (20Marks)

- a) Considering the function below **(10 Marks)**

$$y = \frac{x^3}{3} - \frac{x^2}{2} - 2x + 5$$

Evaluate

- i. Maximum turning point.
- ii. Minimum turning point.
- iii. Inflexion points (if they exists).

- b) Evaluate the derivatives of the following functions.

i. $y = \frac{\tan x}{e^x}$ **(4 Marks)**

ii. $y = x^3 \sin x$. **(4 Marks)**

iii. $y = \cosh(3x - 7)$. **(2 Marks)**

Question (5) - (20Marks)

a. Determine the following integrals.

i. $\int \frac{x+1}{x^2-3x+2} dx$ **(5 Marks)**

ii. $\int \frac{2x+3}{x^2+3x-5} dx$ **(3 Marks)**

iii. $\int (5x - 4)^6 dx$ **(3 Marks)**

b. Calculate the volume of the solid generated by rotating the curve

$y = 2x^2 + 3x - 6$. Along the X-axis and bounded by the points
($x = 3$)&($x = 5$).

(5 Marks)

c. Evaluate the area bounded by the function $y = 16x^2 + 17x - 16$, the
X-axis from ($x = 0$)&($x = 7$).

(4 Marks)