Nurturing Innovators

SCHOOL OF EDUCATION

SEPTEMBER - DECEMBER 2019 END OF SEMESTER EXAMINATION
REGULAR PROGRAMME

EXAMINATION FOR BACHELOR OF EDUCATION (ARTS)
REM 414: DIFFERENTIAL CALCULUS

INSTRUCTOR: JOHN MBUTHI

DATE: 9ᵀᴴ DECEMBER 2019   **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 books/reference books/notes are not permitted.

SPECIAL INSTRUCTIONS:

1.   **Write your ADMISSION NUMBER clearly on the cover of the answer booklet(s).**

2.   **Answer Question ONE and ANY OTHER TWO questions.**

3.   **Questions in all sections should be answered in answer booklet(s).**

4.   **Marks allocated to each question are shown at the end of the question.**

5.   **PLEASE start the answer to EACH question on a NEW PAGE.**

6.   **Indicate the number of the questions answered on the cover of the answer booklet(s) in the order you answered them.**

7.   **Write your answers in paragraph form unless stated otherwise.**

8.   **Keep your phone(s) SWITCHED OFF at the front of the examination room.**

9.   **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.**

10. **You are only allowed to leave the examination room 30 minutes to the end of the Examination.**

QUESTION ONE: COMPULSORY (30 MARKS)

a. Evaluate the following indefinite integrals:

1. $\int 3x(2x^2 - 5)^2 dx$ **[5 marks]**

2. $\int (xlnx + \frac{1}{xlnx})\, dx$ **[5 marks]**

3. $\int \frac{cos^3 x + sin\, x}{cos^2 x}\, dx$ **[5 marks]**

b. Evaluate the following definite integrals:

1. $\int_{ln\frac{1}{2}}^{2}(e^t - e^{-t})dt$ **[5 marks]**

2. $\int_{e}^{e^2} \frac{3}{xlnx}\, dx$ **[5 marks]**

3. $\int_{0}^{\sqrt{\pi}} xsin\left(x^2 - \frac{\pi}{2}\right) dx$ **[5 marks]**

QUESTION TWO

a. Find the function $f(x)$ whose tangent has slope $x^3 - \frac{2}{x^2} + 2$ for each value of x and whose graph passes through the point (1, 3).   **[8 marks]**

b. It is projected that t years from now, the population of a certain community in Kenya will be changing at the rate of $e^{0.02t}$ million per year. If the current population is 50 million, estimate the population of this community after 10 years.   **[12 marks]**

QUESTION THREE

a. It is estimated that t days from now a farmer's crop will be increasing at the rate of $0.3t^2 + 0.6t + 1$ bushel per day. Determine by how much the value of the crop will increase during the next 5 days if the market price remains fixed at 3 Euros per bushel. ?   **[12 marks]**

b. Find the area bounded by the curves y= $x^2 - 2x$ and $y = -x^2 + 4$ **[8 marks]**

QUESTION FOUR

a. An object moves along a straight line with acceleration given by $\dfrac{dv}{dt} = 1 - sin(\pi t)$. Given that when
    $t = 0$, s(t)=v(t)=0, find:

    i. The velocity function   **[5 marks]**

    ii. The distance function, of the object.   **[5 marks]**

b. Find the volume of the solid obtained by revolving the region bounded by $y = x - x^2$ and the x-axis
    around the x-axis.   **[10 marks]**

QUESTION FIVE

a. Find the arc length of $f(x) = \dfrac{1}{3}(x^2 + 2))^{\frac{3}{2}}$ on the interval [0,a]   **[10 marks]**

b. Compute the area of the surface formed when f(x)= $y = 2\sqrt{x - 1})$ between -1 and 0 is rotated
    around the x-axis.   **[10 marks]**