JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY SCHOOL OF MATHEMATICAL & ACTUARIAL SCIENCE

UNIVERSITY EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE (COMMUNITY HEALTH)

1ST YEAR 2ND SEMESTER 2013/2014 ACADEMIC YEAR

KISUMU LEARNING CENTRE

COURSE CODE: SMA 3121

COURSE TITLE: MATHEMATICS II

EXAM VENUE: **STREAM: (Community Health)**

DATE: 15/4/2014 **EXAM SESSION: 9.00 – 11.00 AM**

TIME: 2 HOURS

Instructions:

1. **Answer question 1 (compulsory) and ANY other 2 questions.**
2. **Candidates are advised not to write on the question paper.**
3. **Candidates must hand in their answer booklets to the invigilator while in the examination room.**

QUESTION ONE (30 marks)

a) A is the point $(6,6)$ and $B(8,2)$ lies on the straight line $x-2y-4=0$

(i) Find the equation of the straight line parallel to the given straight line and passes through point A. Write it in the form $ax+by+c=0$. (3 marks)

(ii) Show that the straight line joining A and B is perpendicular to the line $x-2y-4=0$. (3 marks)

b) Use the following matrices to evaluate the given expression:

$$P=\begin{bmatrix}0 & 3 & -5\\ 1 & 2 & 6\end{bmatrix},\ Q=\begin{bmatrix}4 & 1\\ 6 & 2\\ -2 & 3\end{bmatrix}$$

$PQ-3I_2$ (4 marks)

c) Determine the point of discontinuity (if any) of the function $f(x)$,

$$f(x)=\frac{3x^2-7x+2}{x-2}.$$

If the continuity is removable, define the function to make it continuous. (6 marks)

d) Evaluate

$$\lim_{x\to\infty}\frac{3x^2-4x+2}{7x^3+5}$$ (4 marks)

e) Find the second order derivative of the function

$$y=5\sqrt{x}+\frac{3}{x^2}+\frac{1}{3\sqrt{x}}+\frac{1}{2}$$ (5 marks)

f) Evaluate the given definite integral

$$\int_{-1}^{0}\left(-3x^5-3x^2+2x+5\right)dx$$ (5 marks)

QUESTION TWO (20 marks)

a) Three points have coordinates $A(2,6)$, $B(8,10)$ and $C(6,0)$.

The perpendicular bisector of AB meets the line BC at D.

Find:

(i) The equation of perpendicular bisector of AB in the form $ax+by=c$; (3 marks)

(ii) the coordinates of D. (3 marks)

b) $P(0,1)$, $Q(1,4)$, $R(4,3)$ and $S(3,0)$ are the vertices of a quadrilateral $PQRS$.

(i) Find the equations of the diagonals PR and QS. (3 marks)

(ii) Show that the diagonals PR and QS bisect each other at right angles. (3 marks)

(iii) Find the lengths of PR and QS. (3 marks)

(iv) What type of quadrilateral is $PQRS$? (3 marks)

QUESTION THREE (20 marks)

a) Given a system of equations

$$\begin{cases} 7x + 2y + z = 21 \\ 3y - z = 5 \\ -3x + 4y - 2z = -1 \end{cases}$$

(i) Express the system in the form of matrix equation $AB = C$, where A is a 3×3 matrix of coefficients of the variables, B and C are suitable column matrices. (2 marks)

(ii) Determine the adjoint of the matrix A. (5 marks)

(iii) Hence solve the system of equations. (4marks)

b) Solve the system of equations below using Cramer's Rule if it is applicable. If Cramer's rule is not applicable say so:

$$\begin{cases} 3x + 2y - z = 4 \\ 3x - 2y + z = 5 \\ 4x - 5y - z = -1 \end{cases}$$

(9 marks)

QUESTION FOUR (20 marks)

a) Use logarithmic differentiation to find the derivative of the function:

$$y = \frac{e^{-x}\left(2 - x^3\right)^{3/2}}{\sqrt{1 + x^2}}$$ (6 marks)

b) Evaluate the integral

$$\int_{-1}^{4} \frac{4x^2 - 7}{2x + 3}\,dx$$ (4 marks)

c) If $\left(1 - x + y\right)^3 = x + 7$, find $\left.\frac{dy}{dx}\right|_{(x=-1, y=2)}$ (5 marks)

d) Evaluate $\int_{\pi/2}^{\pi} \left(\cos y\right) e^{\sin y}\,dy$ (5 marks)

QUESTION FIVE (20 marks)

a) Find the total area between the region and the $x-axis$.

$y = x^3 - 3x^2 + 2x, \;\; 0 \le x \le 2$ (8 marks)

b) An environmental study of a certain suburban community suggests that t years from now, the average level of carbon monoxide in the air will be $H\left(t\right) = 0.04t^2 + 0.1t + 2.7$ parts per million.

(i) At what rate will the carbon monoxide level be changing with respect to time 1 year from now?
. (4 marks)

(ii) By how much will the carbon monoxide level change this year? (4 marks)

(iii) By how much will the carbon monoxide level change over the next 2 years? (4 marks)