MURANG'A UNIVERSITY COLLEGE

(A constituent college of Jomo Kenyatta University of Agriculture and Technology)

SCHOOL OF PURE AND APPLIED SCIENCES

UNIVERSITY EXAMINATIONS 2015/2016 ACADEMIC YEAR

SEE 1102 ENGINEERING MATHEMATICS II

DATE: 7TH DECEMBER, 2015 **TIME- 2HOURS**

QUESTION ONE:

i) Find the derivative dy/dx given the function: $y = (x^2 - 3)(x + 1)^2$ *(4 marks)*

ii) Differentiate the function: $y = cos^2 x$ *(3 marks)*

iii) Find the derivative dy/dx given the function: $y = (3x + 12)^4$ *(5 marks)*

iv) A triangle ABC has its vertices at the points A(2, -1, 4); B(3, -2,5); C(-1, 6, 2). Find in the form $ai + bi + ck$, the vectors $\overrightarrow{AB}, \overrightarrow{BC}$ *and* $\overrightarrow{CA}$. *(5 marks)*

v) Find the direction cosines of vector $\overrightarrow{OP}$ where P is the point (2, 3 - 6). *(5 marks)*

vi) Evaluate: $\int_0^1 x\, e^x\, dx$ *(5 marks)*

vii) Find the stationary value of: $x^3 - 3x^2 + 2$ *(5 marks)*

QUESTION TWO:

a) Find the coordinates of P if OP is of length 5 units and is in the direction $\overrightarrow{OR}$ where R is the point (2, -1, 4). *(6 marks)*

b) A and B are two points whose position vectors are $3i + j - 2k$ and $i - 3j - k$ respectively. Find the position vectors of the points dividing AB:

i) Internally in the ratio 1:3

ii) Externally in the ratio 3:1 *(6 marks)*

c) i) The Cartesian equations of a line are: $\frac{x-5}{3} = \frac{y+4}{7} = \frac{2-6}{2}$

Find a vector equation for the line. *(3 marks)*

ii) If the vector equation of the line is: $r = i - 3j + 2k + 2(5i + 2j - k)$, express the equation of the line in parametric form and hence find the coordinates of the point where the line crosses the xy plane. *(3 marks)*

d) Find the angle between the vectors: $\tilde{u} = 4\tilde{\imath} + 3\tilde{\jmath} + 12\tilde{k}$ and $\tilde{v} = 8\tilde{\imath} - 6\tilde{\imath}$ *(5 marks)*

QUESTION THREE:

a) Given the function of two variables: $2 = 5x^3 + 3x^2y + 4y^3$, find the second order partial derivatives. *(5 marks)*

b) If $I = \frac{v}{r}$ and V = 250 volts and R = 50 ohms, find the change in I resulting from an increase of 1 volt in V and an increase of 0.5 ohm in R. *(5 marks)*

c) A farmer has an adjustable electric fence that is 100m. He uses this fence to enclose a rectangular grazing area on the sides, the fourth side being a fixed hedge. Find the area he can enclose. *(10 marks)*

QUESTION FOUR:

a) Find the mean value of the function: $y = 3x^2 + 4x + 1$ between $x = -1$ and $x = 2$ *(5 marks)*

b) Find the volume generated when the plane figure bounded by $y = 5\cos 2x$, the x-axis and ordinates at $x = 0$ and $x = \frac{\pi}{4}$, rotates about the x-axis through a complete revolution. *(5 marks)*

c) Find the position of the centre of gravity of solid formed when the plane figure bounded by the curve $x^2 + y^2 = 16$, the x-axis and the ordinates $x = 1$ and $x = 3$, rotates about the x-axis. *(5 marks)*

d) Differentiate the function: $y = \frac{x}{\int(1+x^2)}$ *(5 marks)*

QUESTION FIVE:

a) Find the solution of the following indefinite integrals:

i) $\int x^2 e^{3x}\, dx$ *(5 marks)*

ii) $\int \frac{3x}{\sqrt{(4-x)}}\, dx$ *(5 marks)*

b) Evaluate:

i) $\int_0^1 x^2 \sqrt{x^3 + 1}\, dx$ *(5 marks)*

j) $\int x^2 \ln x\, dx$