EMBU UNIVERSITY COLLEGE

(A CONSTITUENT COLLEGE OF THE UNIVERSITY OF NAIROBI)

FIRST SEMESTER EXAMINATIONS 2013/2014

FIRST SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE IN MANAGEMENT OF AGROECOSYSTEMS, AGRICULTURE, HORTICULTURE, WATER RESOURCES MANAGEMENT, AGRIBUSINESS, AGRICULTURAL EDUCATION AND EXTENSION AND RANGE MANAGEMENT

ACS 103: MATHEMATICS

DATE: NOVEMBER 29, 2013   TIME: 8.30 – 10.30AM

INSTRUCTIONS:

Answer Question ONE and ANY Other TWO Questions.

QUESTION ONE (30 marks)

(a) Using factorization method, solve for x in

$$x^2 - 3x = 18$$ (2 marks)

(b) If $f(x) = \frac{15}{x-3}$, $g(x) = 16 + 3x - x^2$ and $h(x) = \frac{6}{\sqrt{x}-1}$, find $f(0) + g(4) - h(16)$

(4 marks)

(c) Evaluate $\lim_{s \to 1} \frac{s^3 - 1}{s - 1}$ (4 marks)

(d) Discuss the continuity of these functions at the given points

    I. $f(x) = x^2 + 2x - 1$ at $x = 2$ (4 marks)

    II. $f(x) = \frac{x^2 - 4}{x + 2}$ at $x = -2$ (4 marks)

(e) Find the derivative of $h(x) = \frac{x^2-1}{4x^3+x}$ at $x = 1$ (4 marks)

(f) Let $P = \{x \mid x^4 - 17x^2 + 16 = 0\}$. Enumerate the elements of set P. (3 marks)

(g) Find

$$\int \frac{x^2+2}{x^3+6x+9}\,dx$$

(5 marks)

QUESTION TWO (20 marks)

(a) Integrate

$$\int 3x^2(x^3+2)^2\,dx$$

(3 marks)

(b) Find the Cartesian equations of $r = a(1 + 2\cos\theta)$ (3 marks)

(c) Define the universal set U as the set of all whole numbers ranging from 0 to 20, 0 and 20 inclusive. Let set $A = \{1,2,3,4,5,6,7,8\}$, set $B = \{0,5,10,15,20\}$, and set $C = \{0,2,4,6,8,10,12\}$. With the help of a Venn diagram, evaluate:

   i. $A^C \cap B$ (3 marks)

   ii. $(C \backslash B) \cup A$ (4 marks)

(d) If $y = xe^{x^2}$, find dy/dx (3 marks)

(e) Find the area of the region bounded by the curves $y = \sin x$, $y = -1$, $x = 0$ and $x = \pi/2$.

(4 marks)

QUESTION THREE (20 marks)

(a) Evaluate $3\log_2 81 + 2\log_2 16$ (3 marks)

(b) Find the solution set of $|2x - 3| \le 5$ and show the region diagrammatically.

(2 marks)

(c) A company manufactures three products X, Y and Z, each of which must go through three processes A, B and C for the following times.

Product   Time spend in processes

Product	A	B	C
X	3	3	1
Y	3	2	3
Z	2	0	1

The maximum capacities of processes A, B and C are 130, 85 and 60 respectively. Using the matrix inverse method, calculate the number of units to be produced of products X, Y and Z to ensure the utilization of maximum capacity. (10marks)

(d) Given that set $A = \{-3, -2, -1, 0, 1, 2, 3\}$, list the members of

     i. $\{x^3 - x | x \in A\}$ (2marks)

    ii. $\{\frac{1}{(x+5)} | x \in A\}$ (3marks)

QUESTION FOUR (20 marks)

(a) Prove that $\sqrt{2}$ is not a rational number. (5 marks)

(b) Obtain the parametric equation of the locus $y^3 = x^3 - x^2$. (3marks)

(c) (i)Find the adjoint of the matrix

$$A = \begin{bmatrix} 1 & 2 & 3 \\ 0 & 4 & 5 \\ 1 & 0 & 6 \end{bmatrix}$$

(7marks)

(ii)Using adj A, find A^{-1} (2marks)

Hence or otherwise, solve the following system of linear equations:

$$x + 2y + 3z = 15$$
$$4y + 5z = 18$$
$$x + 6z = 12$$

(3marks)

QUESTION FIVE (20 marks)

a) In a particular insurance Life Office, employees Smith, Jones, Williamson and Brown have "A" levels, with Smith and Brown also having a degree. Smith, Melville, Williamson, Tyler, Moore and Knight are associate members of the chartered Insurance Institute (ACII) with Tyler and Moore having "A" levels. Identifying set A as those employees with "A" levels, set C as those employees who have ACII and set D as graduates

     i.   Specify the elements of set A, C and D (3 marks)

    ii.   Draw a Venn diagram representing sets A, C and D together with their known elements. (2 marks)

    iii.   What special relationship exists between sets A and D? (1 mark)

iv. Specify elements of the following sets and for each set, state in words what information is being conveyed.

      I. $A \cap C$ (2 marks)

      II. $D \cup C$ (2 marks)

      III. $D \cap C$ (2 marks)

v.   What would be a suitable universal set for this situation?   (1 mark)

b) Find the equation of the normal to the curve $y = (x^2 + x + 1)(x - 3)$ at the point where it cuts the x – axis.   (3 marks)

c) An invoice clerk receives a bill for \$37.50 for ten blank ledger books and three special filing trays. On phoning the supplier (after discovering the order had been written out incorrectly) the clerk agrees to return three of the ledger books in return for the supplier sending an extra filing tray. Given that there will be an extra \$2.50 to pay and that there is 10%discount for orders of 10 ledger books or more:

   (i)   Derive linear equations in x and y to represent the components of the original and revised invoices, where x is the price of a single ledger book and y is the price of a filing tray.   (1marks)

   (ii)   Applying Cramer's rule, solve for x and y.   (3marks)

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