MACHAKOS UNIVERSITY

University Examinations 2016/2017

SCHOOL OF PURE AND APPLIED SCIENCES

DEPARTMENT OF MATHEMATICS AND STATISTICS

FIRST YEAR SECOND SEMESTER EXAMINATION FOR MASTER OF BUSINESS ADMINISTRATION

BMS 840: QUANTITATIVE TECHNIQUES

DATE: 4/8/2017 **TIME: 10:00 – 1:00 PM**

INSTRUCTIONS

Answer ALL the questions in Section A and ANY TWO Questions in Section B

SECTION A

QUESTION ONE (30 MARKS) (COMPULSORY)

a) Define the following terms as used in operation research.

i Objective function

ii Constraints

iii Mathematical model

iv Optimization problem

v Feasible solution (5 marks)

b) Evaluate the following limits

i) $\lim_{x \to 1}\left(x^2 - 2x + 3\right)$ (2 marks)

ii) $\lim_{x \to 0}\frac{\left(x^2 + 9\right)}{\left(x - 2\right)^2}$ (3 marks)

c) Find the $\lim_{x \to 0} x^2 \sin \frac{1}{x}$ (3 marks)

d) Find the limit of $\lim_{\theta \to \infty} \frac{\sin 2\theta}{\theta}$ (3 marks)

e) Find the derivative of $f(x) = 2x^2 - x + 5$ from the first principal (3 marks)

f) Find the derivative of $f(x) = \sin x$ using the 1st principal (4 marks)

g) Obtain the derivative of $f(x) = 5x^2 - \cos x + 2$ (3 marks)

h) Integrate the following functions with respect to x

$y = tan^8 x sec^2 x$ (4 marks)

SECTION B

QUESTION TWO (20 MARKS)

a) Mr. Wafula has a 50 hectares piece of land. He wishes to plant tomatoes and onions. He has a capital of Ksh. 2700. One hectare of tomatoes cost Ksh. 60 to cultivate and onions cost Ksh. 30 to cultivate. He has a work force of 160 labourers and it takes 2 labourers to cultivate an hectare of tomatoes and 4 labourers to cultivate an hectare of onions. Suppose that he gets a profit of Ksh. 30 from tomatoes and 60 from onions

i Set up a linear programming model (10 marks)

ii Solve the problem using graphical method. (10 marks)

QUESTION THREE (20 MARKS)

a) Calculate the maxima and minima values of function $y = x^3 - 3x^2 + 2$ and distinguish between them and sketch the graph. (5 marks)

b) A cylinder is to be constructed so that the sum of height and ball radius is 6cm. Denoting ball radius by *r*cm, volume *v*cm^3. Show that $r = \pi(6r^2 - r^3)$. Hence show the value of *r* which make *V* a maxima. (5 marks)

c) Evaluate

i. $\lim_{x \to 0} x \sin\left(\frac{\sqrt{x+2}}{x}\right)$ (3 marks)

ii. $\lim_{x \to 2} \sqrt{\frac{5x^3 - 15}{x^3}}$ (2 marks)

d) For each of the following functions obtain their derivatives from first principal

i $f(x) = \frac{1}{2x+1}$ (3 marks)

ii $f(x) = 2x + 3$ (2 marks)

QUESTION FOUR (20 MARKS)

a) Find the integrals of the following function with respect to x, $y = \frac{2x+2}{x^2+2x+1}$ (5 marks)

b) Evaluate the following integral using the given change of variable

$$\int \frac{x(x-4)}{(x-2)^2}, \quad u = x - 2$$ (5 marks)

c) Evaluate the following integral

i $\int \ x^4\sqrt{x^5 + 5}\, dx$ (5 marks)

ii $\int \ sin3xcos4x\ dx$ (5 marks)

QUESTION FIVE (20 MARKS)

Using appropriate integration techniques evaluate

i $\int \frac{x^2}{(\sqrt{(x^3 + 4)}}\ dx$ (6 marks)

ii $\int sin^5 x\ cos^2\ x\ dx$ (6 marks)

iii $\int (2 - x)\ (x^2 \ - \ 4x \ + \ 4)^{-4}\ dx$ (4 marks)

iv Find the derivative of $f(x) = \sin x$ using the 1st principal (4 marks)