KENYATTA UNIVERSITY

UNIVERSITY EXAMINATIONS 2016/2017

FIRST SEMESTER EXAMINATIONS FOR THE DEGREE OF BACHELOR OF ECONOMICS

EES 300 : MATHEMATICS FOR ECONOMISTS III

DATE: Tuesday 22nd November 2016

TIME: 4.30 P.M. – 6.30 P.M.

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INSTRUCTIONS

ANSWER QUESTION ONE AND ANY OTHER TWO QUESTIONS

Question one

a) The demand for calculators is given by the formula $q = 400 - 2p^2$. What is the price that maximizes revenue? [Hint: Revenue is maximized at elasticity (∈) = -1 (4marks)

b) Compute the Eigen values and Eigen vectors of the following matrices

  i) $\begin{bmatrix} 5 & 1 \\ 4 & 2 \end{bmatrix}$ ii) $\begin{bmatrix} 10 & -1 \\ 12 & 3 \end{bmatrix}$ (8marks)

c) Solve the integral problems

  i) $\int 5x^2\,(x^3 + 1).dx$ (3marks)

  ii) $5x^2 e^{-x}.dx$ (3marks)

d) Solve the following definite integrals with respect to t.

  i) $\int_a^b x^4.dt$ (3marks)

  ii) $\int_1^2 e^{-xt}\,.dt$ (3marks)

e) The equation of motion for capital (K) is given as:

$$\frac{\delta K}{\delta t} = I_0 - \delta K$$

Where I_0 represents the constant level of investment and δ represents the rate of depreciation. Find the capital stock at the time $t[K(t)]$ and explain why $K(t)$ converges at a steady state. (6marks)
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Question Two

a) Given the problem Max Z= $x^2ye^{-(x+y)}$ subject to $2x + 2y \leq 8; x \geq 0; y \geq 0$
   i) Write down the Kuhn Tucker conditions (6marks)
   ii) Find all the solutions to this problem (6marks)

b) The demand and supply equations for the cobweb model are given respectively as follows: $Q_{dt} = 0.3P_t$ and $Q_{st} = -2 + P_{t-1}$. Find the time path for P_t and check whether it is stable or not. (8marks)

Question Three

a) Triton oil company owns two plants (A and B). It takes KES 20,000 per day to operate plant A, it can produce 400 barrels of high-grade oil, 300 barrels of medium grade oil and 200 barrels of low grade oil each day. Plant B costs KES 25,000 per day to operate and it can produce 300 barrels of high- grade oil, 400 barrels of medium grade oil and 500 barrels of low grade oil each day. The company has orders totaling to 25,000 barrels of high-grade oil, 27,000 barrels of medium grade oil and 30,000 barrels of low grade oil. How many days should it run each refinery to minimize its costs and still produce enough oil to meet its orders? (simplex method) (20 marks)

Question Four

a) Given the differential equation $(2xy - 3x^2)dx + (x^2 - 2y)dy = 0$
   i) Show that he differential equation is exact (4marks)
   ii) Solve the differential equation (4marks)

b) Test the existence of functional dependence between the following paired functions:
   i) $Y_1 = X_1 + 3X_2$ and $Y_2 = X_1^2 + 6X_1X_2 + 9X_2^2$ (3marks)
   ii) $Y_1 = e^{2X_1+3X_2}$ and $Y_2 = 4X_1^2 + 9X_2^2 - 12X_1X_2$ (3marks)

c) Find the extreme value(s) of the following function, its definiteness and specify whether it gives rise to a maximum or minimum.
   $f(X_1, X_2, X_3) = X_1^2 + 3X_2^2 - 6X_1X_2 + 4X_2X_3$ (6marks)

Question Five

a) Solve for the following:
   i) $dy/dt + 10y = 20$ given $y(0) = 10$ (4marks)
   ii) $y_{t+1} + y_t = 3$ given $y(0) = 10$ (4marks)

b) Solve the following simultaneously using Gauss- Jordan method (6marks)

   3x – 2y – 3z = -14
   4x – 2y + 3z =19
   2x – 2y +10z =48

c) A first difference order equation is given as: $\frac{3}{2}Y_{t+1} + Y_t = 22(0.8)^t$ and Y(0)=900. Find the general solution to this equation. (6marks)