MASTER OF ARTS (ECONOMICS)

Term-End Examination

December, 2006

MEC-003 : QUANTITATIVE METHODS

Time : 3 hours *Maximum Marks : 100*

Note : *Answer **two** questions from Section A, **four** from Section B and **two** from Section C.*

SECTION A

*Answer any **two** questions from this section.* 2×20

1. (i) Discuss the importance of first and second order conditions in optimisation problems.

(ii) A firm produces two products (x_1 and x_2) in a perfectly competitive market structure. The prices of these two products are given as $p_1 = 5$ and $p_2 = 3$. If the revenue and cost functions of the firm are,

$$R = p_1x_1 + p_2x_2 \text{ and}$$

$$C = 2x_1^2 + 2x_2^2 + x_1x_2,$$

find the maximum profit earned by it. Examine that the profit obtained meets the first and second order conditions.

2. (i) Write a linear first order differential equation and work out its general solution.

(ii) How will you solve Harrod – Domar formulation of steady growth through differential equation ?

3. (i) Discuss the Hawkins – Simon condition in the context of input – output analysis.

(ii) Suppose the technology matrix is given as

$$[A] = \begin{bmatrix} 0{\cdot}2 & -0{\cdot}2 \\ -0{\cdot}9 & 0{\cdot}3 \end{bmatrix}.$$

Find whether any solution will be possible for the underlying system or not.

4. (i) Explain the importance of duality of linear programming in economic analysis.

(ii) Consider the linear programming problem,

Maximise $z = 5x_1 + 10x_2$

subject to $x_1 + 3x_2 \leq 50$

$4x_1 + 2x_2 \leq 60$

$x_1 \leq 5$

$x_1, x_2 \geq 0$

(a) State the dual of the above LPP.

(b) Given that (5, 15) is an optimal solution to the LPP above, find the optimal solution to the dual.

SECTION B

*Answer any **four** questions from this section.* *4×10*

5. You are given a Cobb-Douglas production function, $q = A L^{\alpha} K^{1-\alpha}$ with A, $\alpha > 0$ and q, L and K are level of output, labour and capital respectively. Prove that its elasticity of substitution is unity and interpret this value.

6. Find the extreme value(s) of $q = p^3 - 2p^2 + p - 6$ and determine whether they are maxima or minima.

7. A piece of land yields a constant rent of Rs. 1,000 per year. Find its market value if the rate of interest is 10% per year.

8. Find solution to the equation

$$y_{t+1} + \frac{1}{4} y_t = 5 \quad \text{for} \quad y_0 = 2.$$

9. You are given a Keynesian model with money. The behavioural equations are,

$$C = 0{\cdot}8\, Y$$

$$I = 102 - 0{\cdot}2\, r$$

$$M^d = 0{\cdot}25\, Y - 2{\cdot}5\, r$$

$$M^s = 100$$

If the equilibrium conditions are given as $Y = C + I$ and $M^d = M^s$, evaluate the equilibrium of Y and r using Cramer's rule.

10. Assume a normal distribution with a mean of 90 and a standard deviation of 7. What limits would include the middle 65% of the cases ?

SECTION C

*Answer any **two** questions from this section.* *2×10*

11. Define the following terms :

(i) Type I error

(ii) Monotone function

(iii) Cross-partial derivatives

(iv) Efficient estimator

(v) Saddle point

12. Answer the following as directed :

(i) What is the difference between probability mass function and probability density function ?

(ii) A box contains 6 white and 4 red balls. One ball is drawn at random. What probability will you assign to getting the ball to be white ?

13. (i) You are given that $z = x - 3y - xy$ subject to $x + y = 6$.

Find the minimum value of z with the help of bordered Hessian determinant.

(ii) Find the inner product of the following pair of vectors :

$(-2, -3, 4)$ and $(4, 5, -6)$.