

B.A. (Honours) Examination, 2016

Semester-V

Economics

Paper-H-12

(Mathematical Economics-II)

Time: 3 Hours

Full Marks: 40

Questions are of value as indicated in the margin

Answer any four questions

1. (a) Consider the following product and money market equilibrium conditions following a Keynesian framework (with symbols having their usual meaning):

$$Y = C + I + G$$

$$C = a + b(Y - T)$$

$$T = t.Y$$

$$M/P = L_1(Y) + L_2(r)$$

$$a > 0; \quad 0 < b < 1$$

$$0 < t < 1$$

Assuming real money supply to be fixed, use Cramer's rule to find out the effect of a change in government expenditure (G) on equilibrium rate of interest (other parameters of the model remaining constant).

(b) Suppose a plantation crop survives for three years. The initial cost for planting the trees is Rs. 1500 per Bigha. Crops can be harvested only in the second and third year. The estimated net revenue per Bigha (after deducting harvesting and marketing costs) for these two years are Rs. 1100 and Rs. 1210 respectively. If the market rate of interest is 10%, find the present value of profit per Bigha for this crop. 5+5=10

2. (a) Consider a commodity where both the demand and supply quantities are functions of its current price:

$$Q_{dt} = 180 - 6 P_t \quad \text{and} \quad Q_{st} = -20 + 4 P_t$$

However, the price adjustment is made by suppliers and in each period the price is set at a discount over the previous period's price depending on the stock (inventory) of the commodity accumulated from the previous period. The price setting mechanism is given by the equation:

$$P_{t+1} = P_t - 0.15 (Q_{st} - Q_{dt})$$

Also, the initial price is given as $P_0 = 10$.

(i) Find the equilibrium price and the time path of price.

(ii) Find the nature of time path of price and show the time path graphically 4 + 2 = 6

(b) Explain the nature of time path of price (P_t) for the following two equations using diagrams: (assume initial price $P_0 = 10$ in both cases)

(i) $P_t = 15 + (-0.75)^t$

(ii) $P_t = 25 + (0.5)^t$

2+2=4

3. Following are the demand and supply equations of a commodity which includes the time trends of price:

$$Q_d(t) = 9 - P(t) + 5P'(t) + 4P''(t)$$

$$Q_s(t) = -18 + 8P(t) - P'(t) + 5P''(t)$$

P.T.O.

(2)

If the market clears continuously at every point of time, find and analyze the time path of price. 10

4.(a) A person needs a diet that contains at least 2000 units of carbohydrates, 500 units of fat and 300 units of protein. Two foods A and B are available. Food A costs Rs. 20 and food B costs Rs. 40 per unit. A unit of food A contains 10 units of carbohydrates, 20 units of fat and 15 units of protein. A unit of food B contains 25 units of carbohydrates, 10 units of fat and 20 units of protein. Formulate his problem mathematically as an LPP.

(b) For the following LPP, show the feasible region in (x_1, x_2) plane and find the optimum solution.

$$\text{Maximize } Z = 5x_1 + 8x_2$$

$$\text{Subject to, } 3x_1 + 2x_2 \geq 3$$

$$x_1 + 4x_2 \geq 4$$

$$x_1 + x_2 \leq 5$$

$$x_1, x_2 \geq 0$$

5+5=10

5. (a) Consider the following standard production problem in LPP where three commodities are being produced in x_1, x_2 and x_3 quantities using two inputs A and B. The availability of the inputs and the profit per unit of the two commodities results in the following maximization problem for the producer.

$$\text{Maximize } Z = 3x_1 + 2x_2 + 5x_3$$

$$\text{Subject to, } x_1 - 3x_2 + 4x_3 = 40$$

$$x_1 - x_2 \leq 30$$

$$x_1, x_2, x_3 \geq 0$$

Find the dual of the above problem

(b) Interpret the dual variables. 7+3=10

6. State and prove the theory of complementary slackness in the context of an LPP assuming a standard profit maximization problem. What economic interpretation will you attach to the theorem when it is applied to a standard production problem? 7+3= 10

7. (a) Formulate a two-sector open Input-Output model clearly stating the assumptions and defining the input coefficients.

(b) State the conditions that are required to be fulfilled for getting a feasible vector of gross outputs for a targeted vector of final consumption. Are the conditions satisfied with the following input coefficient matrix? 5+5=10

$$\begin{pmatrix} 0.2 & 0.4 \\ 0.6 & 0.2 \end{pmatrix}$$

8 (a). Find the optimum gross output vector for a targeted final consumption vector of (150, 200) in a two-sector open input-output model with the inter-industry coefficient matrix given in question 7(b).

(b) If the direct labour coefficients for the two commodities are 2 and 4 units respectively and the total availability of labour is 500 units, find the Consumption Possibility Frontier with the same coefficient matrix. 5+5=10