# 2019/EVEN/03/10/ECO-405/194

2019

PG Even Semester (CBCS) Exam., May-2019

## ECONOMICS

#### (4th Semester)

Course No. : ECOCC-405

## (Mathematical Economics—II)

 $\frac{Full Marks: 70}{Pass Marks: 28}$ 

Time : 3 hours

The figures in the margin indicate full marks for the questions

Answer five questions, taking one from each Unit

#### UNIT—I

**1.** (a) Prove that an interior point in the feasible region of an LPP can be expressed as a convex combination of extreme points.

(b) You are given the following LPP :

Minimize  $Z = 3x_1 - 2x_2$ subject to

 $\begin{array}{cccc} 2x_1 & x_2 & 1 \\ x_1 & 3x_2 & 4 \\ (x_1, x_2) & (0, 0) \end{array}$ 

- *(i)* Write down the dual of this problem.
- (*ii*) Express this in standard form and show the initial basic feasible solution (BFS).
- (c) Illustrate the concept of BFS on the basis of the following maximization problem :

Maximize  $40x_1$   $30x_2$ 

subject to

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(Continued)

**2.** (a) Distinguish between LPP and NLPP. Solve the following NLPP using some suitable methods :

Minimize C  $(x_1 \ 4)^2 \ (x_2 \ 4)^2$ 

subject to

- $\begin{array}{ccccc} 2x_1 & 3x_2 & 6 \\ 3x_1 & 2x_2 & 12 \\ x_1 & 0, \ x_2 & 0 \end{array}$
- (b) Set up a 2 2 2 standard Heckscher-Ohlin-Samuelson general equilibrium model in linear equations and bring out the Stolper-Samuelson and Rybczynski effects. 6+8=14

### Unit—II

- **3.** (a) Distinguish between current value Hamiltonian and present value Hamiltonian in the context of optimal control. What are the first-order conditions for maximizing the functional?
  - (b) Derive an equation of motion for the current value co-state variable.

(c) Solve the following optimal control problem :

Maximize 
$$V = \begin{bmatrix} T \\ 0 \end{bmatrix} (1 = u^2)^{1/2} dt$$

subject to  $\dot{y}(t) = u(t)$ 

Given u(0) A and y(T) free. (2+2)+4+6=14

**4.** Illustrate the use of control theory to derive an optimal extraction path for an exhaustible resource over a finite time horizon. 14

## UNIT—III

- 5. (a) In a 2 2 LSOM, verify whether for the existence of a strictly positive output vector (X 0), Solow conditions imply Hawkin-Simon conditions.
  - *(b)* Provide economic interpretation of Hawkin-Simon conditions.
  - (c) Examine whether Hawkin-Simon conditions can be fulfilled even if Solow conditions are not fulfilled. 8+3+3=14

( Turn Over )

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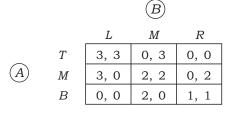
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# (5)

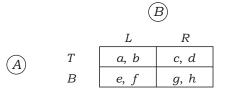
- **6.** (a) How is the Leontief static closed model different from the open model?
  - (b) Can you solve for output quantities uniquely? If not, find the necessary conditions for a strictly positive output ratio in this model.
  - (c) You are given the following sets of technical coefficient values. Comment on the nature of the outputs in the Leontief system :
    - (i)  $a_{11}$  0 85,  $a_{22}$  0 8,  $a_{12}$  0 12,  $a_{21}$  0 20 (ii)  $a_{11}$  0 80,  $a_{22}$  0 85,  $a_{12}$  0 10,  $a_{21}$  0 30 2+8+(2+2)=14

### UNIT—IV

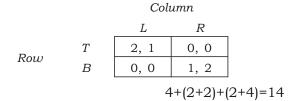
**7.** (a) What are the Nash equilibria of the following game?



(b) Consider the game matrix below and answer the following :



- *(i)* If *(T, L)* is a dominant strategy equilibrium, write down the necessary inequalities.
- (*ii*) If (T, L) is a Nash equilibrium (NE), what would be the inequalities?
- (c) How do you calculate NE in mixed strategies? Calculate NE for the following game :



**8.** (a) Analyze the following prisoner's dilemma game under cooperation and defection :

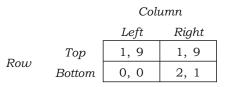
Column

		Coop.	Defect.
Row	Coop.	3, 3	0, 4
	Defect.	4, 0	1, 1

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(b) What are sequential games? For the following game, suppose row moves first and then column reacts. Draw the game tree and solve this by backwards induction.



Does this game have a Nash equilibrium in pure strategies? In this game, what are subgames and subgame perfect equilibria? 4+(2+4+2+2)=14

## Unit—V

- 9. (a) Distinguish between (i) risk aversion,
  (ii) risk loving and (iii) risk neutrality on the basis of Arrow-Pratt measure of absolute risk aversion.
  - (b) Suppose the utility functions of wealth are—

(i) (w) 
$$a e^{bw}$$
, (a, b)  $0$ 

*ii)* (*w*) 
$$a, e^{bw}, (a, b) 0$$

Comment on the nature of the individuals behaviour regarding risk.

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(c) Which utility function below has expected utility property? Explain—

(*i*) 
$$u = 0 \ 8\sqrt{c_1} = 0 \ 2 \ c_2$$
  
(*ii*)  $u = \frac{1}{2} (0 \ 6\sqrt{c_1} = 0 \ 4 \ \sqrt{c_2})$ 

- (d) A person has a utility function of the form u √w. He has an initial wealth of ₹4. He has a lottery ticket that will be worth ₹12 with probability 1/2 and worth ₹0 with probability 1/2. What is his expected utility? What is the lowest price at which he would part with the ticket? 3+(2+2)+(2+2)+3=14
- **10.** Write short notes on any *two* of the following :  $7 \times 2=14$ 
  - (a) The demand for insurance
  - (b) VNM expected utility
  - (c) Optimal Pigovian Tax
    - $\star\star\star$