2022

1st Semester Examination

ECONOMICS

Paper : ECO 103

(Quantitative Economics)

Full Marks : 40 Time : Two Hours

The figures in the margin indicate full marks. Candidates are required to give their answers in their own words as far as practicable.

Group - A

Answer any ***two*** of the following questions : 2×2=4

1. Is nonlinear programming technique an inprovement over linear programming? Justify your answer.
2. What are the requirements of constraint qualification test?
3. Consider the following nonlinear programming problem and write the Kuhn-Tucker condition for this problem :

   Max $Z = xy$

   subject to $P_x x + P_y y \leq M$

   $x \leq 40$

   and $x_1, y_2 \geq 0$

P.T.O.

4. Consider the Universal Set = $\{x \in z \mid -4 \leq x < 4\}$ and A = $\{0\}$. The complement of A will be—

   (i) $\{-4, -3, -2, -1, 0, 1, 2, 3\}$

   (ii) $\{-3, -2, -1, 1, 2, 3\}$

   (iii) $\{-4, -3, -2, -1, 1, 2, 3\}$

   (iv) none of the above

Answer any ***two*** of the following questions : 4×2=8

5. Distinguish between Kuhn-Tucker sufficiency theorem and Arrow-Enthoven sufficiency theorem for a maximization problem.

6. Define (i) injective, (ii) surjective and (iii) bijective functions.

7. Discuss the prevalence of nonlinearity in economics with suitable examples.

8. What do you mean by finite and infinite sets?

   If A is the set of factors of 15, B is the set of prime numbers less than 10 and C is the set of even numbers less than 9, what is $(A \cup B) \cap C$? 2+2

Answer any ***one*** of the following questions : 8×1=8

9. Derive the Kuhn-Tucker condition for a maximization problem.

10. What are the alternative methods of solving constrained optimization problem? What method do you think to be the most advantageous than the others and why? 3+5

Group - B

Answer any ***two*** of the following questions : 2×2=4

11. How can you find the roots in a simultaneous differential equations system?

12. What is current valued Hamiltonian?

13. Write one difference between dynamic game and static game.

14. Distinguish between perfect information and imperfect information in a game problem.

Answer any ***two*** of the following questions : 4×2=8

15. Show that the steady state solution of a system of linear differential equations is asymptotically stable if and only if the characteristic roots are negative.

16. Draw the phase diagram and find the saddle path for the following system :

$$\dot{x}_1 = x_2 - 2$$
$$\dot{x}_2 = \frac{x_1}{4} - \frac{1}{2}$$

17. Consider a duopoly market where firms 1 and 2 produce the same commodity and face the market demand curve $P = 8 - (Q_1 + Q_2)$. The cost functions of the two firms are $C_1 = 4Q_1$ and $C_2 = 4Q_2$ respectively. Let the two firms act as monopoly firm and make an agreement to sell at monopoly price. Will the firms stick to the agreement? Justify your answer.

P.T.O.

18. Suppose that in a game of matching coins there are two players A and B. Player A wins Rs. 8 when there are 2 heads, and gets Re. 1 when there are 2 tails. On the other hand Player B wins Rs. 3 when there are one head and one tail. Determine the best strategies for each player and the value of the game.

Answer any ***one*** of the following questions : $8\times1=8$

19. Write the necessary and sufficient conditions of optimisation in optimal control theory. Solve the following optimal control problem :

$$\int_0^1 \left(5x+3y-2y^2\right)dt$$

subject to $\dot{x} = 6y$

$x(0) = 7$ and $x(1) = 70$ 3+5

20. Define Nash equilibrium of a game problem. Discuss the problems of Nash equilibrium. Explain in this context subgame perfect Nash equilibrium. 2+3+3