M.A./M.Sc. 1st Semester Exam., 2024

ECONOMICS

(*Quantitative Economics*)

PAPER — ECO-103

Full Marks : 50

Time : 2 hours

Answer **all** questions

The figures in the right hand margin indicate 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

1. Is nonlinear programming technique an improvement over linear programming ? Justify.

2. 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 $x_1, x_2 \geq 0.$

3. What are concave and quasi-concave functions ?

4. The Universal Set $= \{x \in Z| - 4 \leq x < 4\}$ and $A = \{ 0 \}$. What is the complement of A ?

   (*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

(*Continued*)

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

5. What is constraint qualification ? What are the requirements ?

6. 'Give suitable examples of the prevalence of nonlinearity in economics.

7. What are the alternative methods of solving constrained optimization problem ? Which method do you think to be more advantageous than the others and why ?

8. What are injective, surjective and bijective functions ?

Answer any **one** of the following question : 8×1

9. Derive the Kuhn-Tucker condition for a non-linear programming problem of maximization type.

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

(4)

GROUP – B

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

11. Find the nature of steady state solution of a system of two linear differential equations if the characteristic roots and negative.

12. Distinguish between state variable and control variable.

13. What do you mean by Bayasian game.

14. Distinguish between incomplete and imperfect information in game.

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

15. Explain the concept of Nash equilibrium in the context of game theory. Highlight the limitations or challenges associated with Nash equilibrium providing relevant examples for illustration.

1 + 3

16. Describe the concept of the 'Tragedy of the Commons' within the framework of game theory.

17. Define mixed strategy in a game problem.

Two players A and B match coins. The matching player is paid Rs. 16 if the two coins turn both heads and Rs. 2 if the coins turn both tails. The non-matching player is paid Rs. 6 when the two coins do not match. Given the choice of being matching or non-matching player which one would you choose and what would be your strategy ?   1 + 3

18. Explain the process for determining the subgame perfect equilibrium in extensive form game.

Answer any **one** of the following question : 8 × 1

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

$$\text{Max} \int_0^2 (3y - 2x^2)dt$$

subject to $\dot{y} = 8x$

$y(0) = 5$ and $y(2)$ is free. 3 + 5

20. How can you find the roots of simultaneous differential equations ? Define saddle path in this context. Draw the phase diagram and find the saddle path for following system

2 + 1 + 5

$$\dot{x}_1 = x_2 - 3$$

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

[Internal Assessment — 10 Marks]