B.A. (Honours) Examination, 2023
Semester–III (CBCS)
Economics
Skill Enhancing Compulsory Course – SECC-1
(Mathematical Methods-III)

Time: 2 Hours **Full Marks: 25**

Questions are of values as indicated in the margin
Answer ***any five*** questions

1. Find the value of $\int_0^4 f(x)dx$, where

$$f(x) = x \quad for \quad 1 \leq x \leq 2$$
$$f(x) = x^2 \quad for \quad 2 < x \leq 4$$
$$f(x) = 0 \quad Otherwise$$

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2. Prove that the solution to a linear, autonomous, first-order differential equation $\dot{y} + ay = b$ converges to the steady-state equilibrium $\bar{y} = \frac{b}{a}$, irrespective of the initial value y_0, if and only if the coefficient in the differential equation is positive (i.e., $a > 0$.)

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3. If per-capita income is growing at a rate of 3% per year, how long will it take to double? 5

4. Find the steady-state points and determine their stability properties for the following
$\dot{y} = 2y - 6y^2$.

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5. Solve the following equations and ensure that the initial conditions are satisfied
(i) $\dot{y} + 3y = 12$ and $y(0) = 10$.
(ii) $\dot{y} = 5$ and $y(0) = 1$.

3+2

6. Suppose demand for a commodity in any period is a function of its current price while the supply depends on the price in the previous period. The demand and supply equations are given as:

$$Q_t^d = 86 - 0.8\,P_t \quad \text{and} \quad Q_t^s = -10 + 0.2\,P_{t-1}$$

The commodity is perishable and whatever quantity is brought to the market in any period has to be sold in that period only. It is also known that the price in the initial period is 100. What should be the time path of price for the commodity? Comment on its nature.

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7. A subcommittee of 6 members is to be formed randomly out of a group of 7 men and 4 women. Find the probability that the subcommittee will consist of (i) exactly 2 women (ii) at least two women.

2+3

8. There are 5 black and 2 white balls in a box. Two balls are drawn from it successively without replacement. What is the probability of the following events?
(i) One is black and the other is white
(ii) First one is black and the second one is white

2+3