

MASTER OF ARTS EXAMINATION, 2025
(2nd Year, 1st Semester)
ECONOMICS
Course : ECO/PG/309
[Resource and Environmental Economics–I
(Local Issues)]

Time : Two Hours

Full Marks : 30

1. Answer any two questions: 5×2=10

(a) Consider the following production function for certain types of fish :

$$Y = \gamma E \quad [\gamma = \text{Constant}]$$

Adopting the following model

$$\dot{X} = rX \left(1 - \frac{X}{K}\right) - Y$$

$$U(X, Y) = pY - cE$$

where symbols Y, X, q, r, p, c and K have their usual meanings.

Determine the optimal solutions. Find the optimal value of X for $\delta = 0.1/\text{year}$ and $0.2/\text{year}$, when $r = 0.15/\text{year}$, $K = 800,000 \text{ MT}$, $\gamma = 50 \text{ MT/SFD}$, $p = \$200/\text{MT}$, $c = \$1000/\text{SFD}$. 3+2

(b) What do you mean by Most Rapid Approach Path (MRAP)? Diagrammatically illustrate investment strategy for fishing when initial capacity is very high by using MRAP. 2+3

(2)

- (c) Derive the fundamental equation of renewable resources by assuming a constant price. Consider the following equations :

$$\text{Net Benefit} = pY - cE$$

$$Y = qXE$$

$$\dot{X} = F(X) - H(X, H)$$

Symbols have their usual meanings. 5

2. Answer *any two* questions : 10×2=20

- (a) (i) Compare the 'complete exhaustion time' for the extraction of exhaustible resources by competitive and monopolistic industries. Assume zero extraction cost.

- (ii) Assume that the unit price (p) is exogenous and known in advance to the mine owner and the initial reserve is R . Consider the following demand function :

$$q = 5 - p, (0 \leq p \leq 5)$$

$$= 0 \text{ for } p \geq 5$$

where q is the quantity of extracted mine, show graphically the complete exhaustion time of the mine stock. 6+4

- (b) (i) Discuss the Faustmann model in the context of commercial forestry for a single and infinite rotation with an equal length of time. 6

- (ii) Suppose a forest product company planted its land with a fast growing species of pine at $t = 0$. The merchantable volume of timber at instant $t \geq 0$ is given by

(3)

$$Q(t) = \alpha t + \beta t^2 - \gamma t^3, \text{ where } \alpha = 10, \beta = 1 \text{ and } \gamma = 0.01.$$

- (i) Find the maximum volume of merchantable timber. When does it occur?

- (ii) What rotation length maximises mean annual increment and what is the associated volume? 2+2

- (c) Show that the normalised current value Hamiltonian measures NNP (Net National Product) in optimal growth by treating exhaustible resources as distinct capital goods. Also, find the equation of NNP by considering environmental capital instead of exhaustible resources in the production function. Distinguish between economic depreciation for two said cases. 4+4+2

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