MASTER OF SCIENCE EXAMINATION, 2017

(2nd Year, 1st Semester)

MATHEMATICS

Unit - 3.5 (B-1.36)

(Renewable Bio-economic Modelling - I)

Full Marks : 50   Time : Two Hours

The figures in the margin indicate full marks.

Answer Question No. 6 and any *three* questions from the rest.

1. (a) Explain the principal results for a common property fishery. Hence give an idea of biological over-exploitation.

   (b) Define Production function and discuss the idea of Cobb-Douglas production function. Hence give an idea for the applicability of Cobb-Douglas production function in the fishery model.   8+8

2. Discuss the Faustmann model for forest rotation problem. Give an economic interpretation of the Faustmann formula for the optimal rotation problem. Explain the idea of zero-discounting and infinite-discounting.   16

[*Turn over*]

3. With suitable assumption, discuss the Beverton-Holt fishery model and hence show that the total annual yield from all cohorts equals the total lifetime yield from single cohort. 16

4. (a) Write down a mathematical model of combined harvesting of two independent fish population and discuss the dynamic behaviour of the model system.

   (b) A certain forest is divided into three height classes and has a growth matrix

   $$G = \begin{pmatrix} \frac{1}{2} & 0 & 0 \\ \frac{1}{2} & \frac{1}{3} & 0 \\ 0 & \frac{2}{3} & 1 \end{pmatrix}.$$

   If the prices of trees in the second and third class be Rs. 30/- and Rs. 50/- respectively, then which class should be completely harvested to attain optimal sustainable yield ? What is the optimal yield if there are 1000 trees in the forest ? 10+6

5. Prove Pantryagin's Maximum Principle in one dimensional control problem. Discuss its applicability to the linear variational problem and explain the idea of Bang-Bang control. 16

6. What do you mean by economic overfishing ? 2

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[Turn over]