

Ex/M.Sc./Math/22/4.4/B-2.22/2018

MASTER OF SCIENCE EXAMINATION, 2018

(2nd Year, 2nd Semester)

MATHEMATICS

Unit - 4.4 (B - 2.22)

(Mathematical Ecology - II)

Full Marks : 50

Time : Two Hours

The figures in the margin indicate full marks.

Notations / Symbols have their usual meanings.

Answer question no. 6 and any *three* from the rest.

1. Write down a mathematical model of succession process of a food web consisting of two competing autotrophs utilising single nutrient and one heterotroph in the same environment whose total nutrient level is conserved. Determine all biologically feasible equilibria of the model system and discuss the local stability analysis of one autotroph-herbivore system. 16
2. Write down a succession process of three species general food chain model in a closed biocenosis. Investigate the qualitative behaviour of the model and give your comments on the results. 16

[Turn over]

[2]

3. Deduce the De Angelis model of two interacting species. Show that the positive interior equilibrium is globally asymptotically stable. 16
4. Write down a detritus-based prey-predator model in a mangrove ecosystem. Determine the steady states of the system and discuss the qualitative behaviour of the system around the steady states. 16
5. A ratio-dependent prey-predator system is taken in the following form :

$$\frac{dx}{dt} = rx \left(1 - \frac{x}{k} \right) - \frac{\alpha xy}{\beta y + x}$$

$$\frac{dy}{dt} = y \left(\frac{e \alpha x}{\beta y + x} - \mu \right)$$

where the symbols have their usual meanings. Determine the steady states and discuss their qualitative behaviour. 16

6. Define functional response with predator interference. 2
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