3. Write down a mathematical model of a food web consisting of two competing prey and one predator populations with predator interference on the trophic function. Determine all biologically feasible equlibria of your model system and discuss the stability analysis of a prey-predator sub-system. 16

4. Write down a succession process of three species simple food chain model in a closed biocenosis. Investigate the qualitative behaviour of the model and give your comments on the results. 16

5. Write down the three species donor-controlled general food chain model. Determine the steady states and discuss their qualitative behaviour. 16

6. Distinguish between prey-predator and predator dependent function response. 2

M. Sc. Mathematics Examination, 2022

(2nd Year, 2nd Semester)

Mathematical Ecology - II

Paper – 4.4 (B-2.22)

Time : Two hours   Full Marks : 50

The figures in the margin indicate full marks.

(Symbols/Notations 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 an environment whose total nutrient level is conserved. Determine all biologically feasible equilibria of your model system and discuss the local stability analysis of one autotroph-herbivore subsystem. 16

2. A ratio-dependent prey-predator interaction is taken in the following form:

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

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

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

[Turn over