MASTER OF SCIENCE EXAMINATION, 2017

(2nd Year, 1st Semester)

MATHEMATICS

Unit - 3.4 (B1.22)

(Mathematical Ecology - I)

Full Marks : 50 Time : Two Hours

The figures in the margin indicate full marks.

Symbols/Notations have their usual meanings.

Answer Question No. 6 and any *four* from the rest.

1. Explain single species growth model in the form

$$\frac{dN}{dt} = f(N)$$

and discuss the stability of its critical value. Evaluate the asymptotic behaviour of the model when

$f(N) = -\lambda N \log\left(\frac{N}{\theta}\right)$, λ and θ are positive parameters.

8+4

[*Turn over*]

2. Explain functional response and numerical response in a prey-predator interactions. Describe different Holling type functional responses in mathematical form and draw the response curve.

   Also describe the merits or demerits, if any, of different Holling Response functions. 12

3. Deduce the Gauss model of competition for two species sharing a common resources. Discuss the conditions for coexistence and extinction of either of the competing species. Also give your comments on the results. 12

4. Write down the three species simple food chain model with logistic growth of prey population. Determine all the possible steady states and discuss their stability. How can you interpret your results biologically ? 12

5. Write down a mathematical model with one prey and two competiting predator populations. Find out the biologically feasible equilibria of the system and discuss the local stability analysis of a prey-predator subsystem. 6+6

6. What do you mean by obligate mutualism ? 2

———————