BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, PILANI
Second Semester 2012-13
BIO F241 – Ecology & Environmental Sciences / BIO C322 – Ecology
Comprehensive Exam (Closed Book)

Date: 13/05/2013 Duration: 90 min Max Marks: 40 (20%)

Read the following instructions carefully:

1. Mention CLOSED BOOK on top of the answer sheet. 2. No exchange of any sort is permitted during the exam. 3. Answer to the point. 4. Do not jumble the answers of section A with those of section B. 5. In questions requiring justification or calculations, marks would be awarded only if you give proper justification or show the calculations clearly. 6. After you finish the CB part, return the answer sheet to the invigilator and collect the OB question paper and answer sheet.

-Section A-

[Each question in this section carries 2.0 marks. Total 24 marks for Section A]

1. (i) How do omnivores contribute to environmental degradation as well as to the creation of ecological refugees out of ecosystem people? Discuss briefly.

(ii) Why *and* on what basis do the plants optimize their investment into secondary metabolites? Discuss briefly.

(iii) While homologous chromosomes generally stand to gain by steadily cooperating in a diploid organism, the situation in oogenesis is a Prisoner's dilemma. Why? How could this contribute to Down's syndrome?

(iv) Why is a clear zone observed in the soil around plants such as '*kaner*'? What is this phenomenon called? How does it benefit the plants?

(v) How do scientists use meshed litter bags to study decomposition? Explain briefly.

(vi) Mention point-wise your take-home message after doing this course.

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2. (i) Calculate the glucose equivalent lost by plant respiration if 500 Kg of CO_2 is released into the atmosphere by an experimental field during a given study period.

(ii) Pictorially represent a food chain with food chain length of 2 and having rank of omnivory as 1.

(iii) From the tabulated data given below for a particular ecosystem, calculate Simpson's dominance index. Also assign ranks to the species for the construction of the rank abundance diagram.

Species	No. of individuals in the species
A	22
B	13
C	65

(iv) From the tabulated data given below for a particular biome, calculate the α, β and γ diversities, as applicable.

Species	Ecosystem X	Ecosystem Y	Ecosystem Z
A	Present	Present	Absent
B	Absent	Present	Absent
C	Present	Present	Present
D	Absent	Absent	Present

(v) The following table gives the rate of uptake and loss of nitrogen and calcium by the trees in a forest ecosystem, and the mass of each element in the trees.

a) Calculate the turnover time for each element for the trees based on the amount taken up from the data given in the table below.
b) Calculate the turnover time for each element for the trees based on the amount lost to the soil from the data given in the table below.

	Nitrogen	Sodium
Uptake (Kg/hectare/year)	79.6	62.2
Loss (Kg/hectare/year)	60.4	43.9
Mass in trees (Kg/hectare)	532.0	484.0

(vi) From the tabulated data given below (units=kcal/m²/day), calculate the % production efficiencies and the % consumption efficiencies for the herbivore and the carnivore .

	Solar energy available	Ingestion	Assimilation	Respiration
Producer	2000	-	$P_G = 46$	8
Herbivore	-	6	4	2.5
Carnivore	-	0.9	0.7	0.6

-Section B-
[Total 16 marks for Section B]

3. (i) A population of Spotted Fritillary butterflies exhibits logistic growth. If the carrying capacity is 500 butterflies and r = 0.1 individuals / (individuals x month), what is the maximum population growth rate for the population? **[2M]**

(ii) What are density dependent factors w.r.t. populations? What is their significance? **[2M]**

(iii) What is compensation depth of light? In which part of a freshwater lake does it occur? **[2M]**

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4. (i) What are the three forms of genetic engineering? Give one example of each type**.** **[3M]**

(ii) Classify and briefly describe three of the five layers of vertical stratification of the tropical rain forest. **[3M]**

(iii) What is photochemical smog? What are the sources of indoor pollution? **[2M]**

(iv) How was genetic fixation proved in *Achillea millefolium* (yarrow) plants? **[2M]**

**********ALL THE BEST**********