

Indian Institute of Technology, Delhi
Centre for Energy Studies
Semester 2, 2016-2017
ESL 330: Energy Ecology and Environment

Minor-I Examinations
Duration: 60 minutes

Marks: 20
31 Jan. 2017

Answer all questions

[General instruction: Any variable used or assumptions made should be written clearly]

1. Fill in the blanks:
- i. The population of _____ which usually reside in large numbers on a host and are the cause of diseases or death of the latter are called _____.
 - ii. The study of population dynamics is called _____.
 - iii. A species having a wide tolerance factor to temperature implies that its tolerance to this factor is _____ - thermal.

[2]

2. Answer the following in brief:
- i. Differentiate between assimilation and absorption with respect to the nutrition of a heterotrophic individual.
 - ii. State the five types of herbivores named after their food habits, stating what the latter are?
 - iii. What is meant by a life table flowchart in population dynamics?
 - iv. What is metabolic rate of an individual and its relation to size of individual?
 - v. A poikilothermic animal.

[1+2.5+2.5+ 2+1=9]

3. Answer the following in brief:
- i. Where does one find boreal forests (with respect to the equator)? Why and how does the leaves of these trees adapt to their surroundings with respect to budgeting of energy resources?
 - ii. Write down the differential equation that describes the population evolution and regulation. State the role of each term in population dynamics.

[2.5+2.5=5]

4. A creek carries $10.0 \text{ m}^3/\text{s}$ of water with a selenium (Se) concentration of $10 \text{ } \mu\text{g}/\text{lt}$. A farmer channels half the flow-rate of the creek-water to irrigate his land. During irrigation, the water picks up selenium from the salts in the soil. One-fourth of the irrigation water is returned to the creek and the rest is lost to the ground and plants. Selenium is a conservative non-reactive substance.

- i. The farmer is irrigating continuously. However, he is soon informed by the municipality that the steady state concentration of selenium in the stream downstream from the farm is $0.12 \text{ mg}/\text{lt}$ (Note: after irrigation the run-off returns to the stream and the stream does not pick up more selenium from any other source other than the irrigated land). What is the Se concentration in the irrigation runoff to the creek?
- ii. Fish are sensitive to selenium levels over $0.04 \text{ mg}/\text{lt}$. The farmer is told that he needs to tap just sufficient water from the creek that will keep the stream selenium level below this critical concentration. How much water can the farmer withdraw from the stream to use for irrigation assuming that he ensures that the concentration of Se from irrigation runoff to the stream is reduced by 10%? Assume one-fourth of irrigation water is still returned to the creek.

[2+2=4]