12 March 2024
10:00 A.M to 11:30 A.M

(2)

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
ORGANISATION OF ISLAMIC COOPERATION (OIC)
DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

Mid-Semester Examination | **Summer Semester: 2022 - 2023**
Course No.: GS 4253 | **Full Marks: 75**
Course Title: Ecology and Environment | **Time: 1.5 Hours**

There are **3 (Three)** questions. Answer all **3 (Three)** questions. Programmable calculators are not allowed. Do not write on this question paper. The figures in the right margin indicate full marks and corresponding CO and PO. Symbols convey their usual meanings. Assume reasonable data/values for any missing data/info.

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1. **(a)** Describe the importance of the ecological services of an ecosystem with necessary examples and diagrams. **CO1, PO1: 7**

   (b) Explain the importance of percolation in recharge of the water bodies with the help of hydrological cycle along with diagram. **CO2,PO2: 8**

   (c) Analyze the scenario of a country having a per capita ecological footprint of 1.6 hectares per person and per capita biocapacity of 0.8 hectares per person. **CO2, PO2: 3**

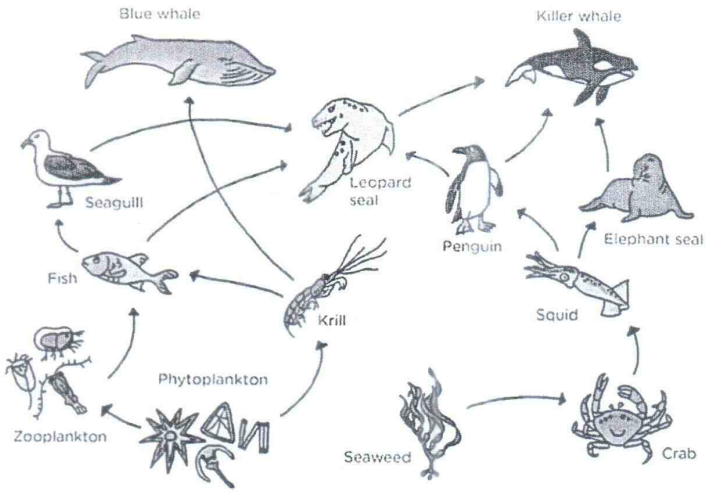
   (d) A group of ecologists estimated a population of mice (Peromyscus maniculatus). Setting out traps on the first night, they captured 44 mice in traps laid out on a large grid in an agricultural area outside of town. Having obtained all the necessary permits and Research Ethics approvals, they marked 44 mice using small metal ear tags. A week later, they opened their traps again and caught 51 mice, 10 of them with ear tags (13 of them were found dead, including 3 with ear tags). Find out the size of the mouse population in this area using the Lincoln Index. **CO3, PO2: 7**

2. **(a)** State how belt transect method is efficient in data production than the line transect method. Give real life examples based on the Sundarban forest of Bangladesh. **CO1, PO1: 6**

   (b) Explain the importance of Phosphorus along with a diagram to maintain the amount of nutrients in the biosphere. **CO2, PO2: 10**

   (c) Describe the type of ecological succession that may take place after an incident of volcanic eruption. **CO2, PO2: 5**

   (d) Identify all the food chains and different biotic components associated with the following food web shown below. **CO1, PO1: 4**



3. **(a)** John and Neil have decided to go to the Sahara Desert. They stumble across two kinds of scorpions: red and black. John and Neil decided to study the competition between the two species. They determined that the carrying capacity (K1) of red scorpions was 100 and that the carrying capacity (K2) of black scorpions was 150. John calculated that the impact of the black scorpion on the red scorpion (α) was 2, and the impact of the red scorpion on the black scorpion (β) was 3. The initial population sizes are 25 red scorpions and 50 black scorpions. Graph the isoclines for each species, plot the initial population sizes, and predict the outcome of interspecific competition. Neil does his calculations and determines that John's calculation of the carrying capacity (K1) of red scorpions is wrong but that the rest of his calculations are correct. Analyze the situation and find out what are the relationships between carrying capacities needed for red scorpions to win the competition? **CO4, PO2:10**

(b) Energy flow through the tropic level of an ecosystem is shown below. As an ecologist you need to assess the ecosystem sustainability in an environment. Find the following information for assessing: **CO3, PO2:15**

(1) Measure consumption, assimilation and production efficiency
(2) Lastly, give valid reasons of the sustainability of the ecosystem by analyzing ecological efficiency.
(3) What is the significance of D2 in the ecosystem?

Energy Process	Energy (kcal/y)	Energy Process	Energy (kcal/y)
GPP	10^6	R_D	423500
R_A	35×10^4	D1	50×10^4
R_H	30000	F	112500