

BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, PILANI
Ecology & Environmental Sciences (BIO F241) - Second Semester 2022-23
Mid Semester Test – Closed Book

Date: 18.03.2023

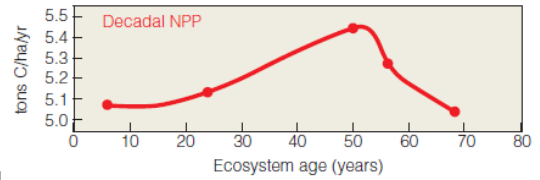
Duration: 1 ½ hrs.

Max Marks: 50 (25% weightage)

Note: Do not jumble answers for Part A and Part B.

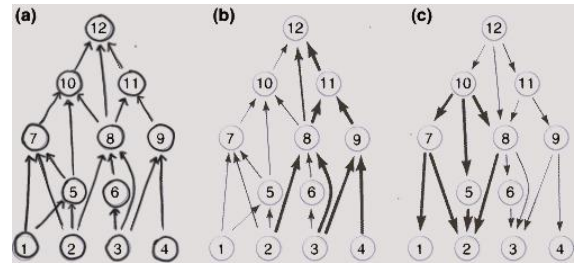
Part A (10 marks)

A1. Study the adjacent graph and comment on why NPP (Y-axis) decrease for the given species. (2)



A2. State the different types of ecological pyramids (Answer using diagrams only). Do all these exist in both the inverted and upright positions? Justify. (3)

A3. Identify the food webs represented in (a), (b), and (c) in the adjacent diagram. Based on the given information, can you calculate the food chain length for these? If yes, show the calculation. If no, justify. (5)



Part B (40 marks)

B1. History of the ecology shows that initially, plant ecology and animal ecology were studied separately. What/ whose contribution then lead to the unified concept of general ecology? (2M)

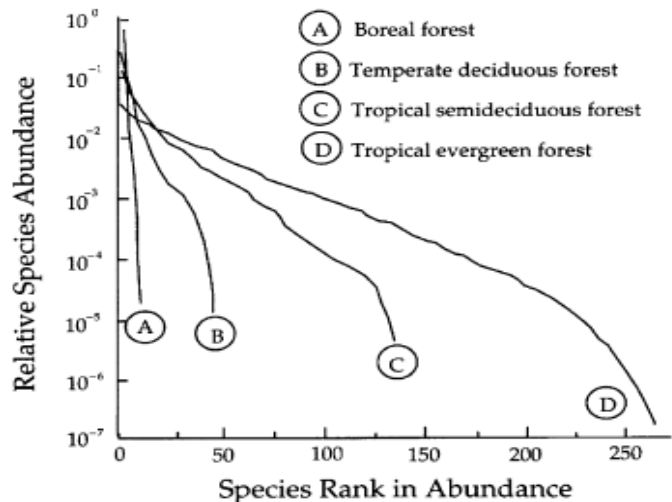
B2. “Cow’s ability to digest grass” is indicative of emergent property at _____ level. Fill in the blank with appropriate word and justify the statement. (3M)

B3. “In fact, **they** are so concentrated when **this** happens that they can no longer be thought of as nutrients for plants, but as chemical salts, often of more **harm** than benefit to plants”. What is the phenomenon referred here as **this** in the statement? In which type of ecosystem would you expect it to happen? (5M)

B4. If you are given choice of clearing tropical forest or *Sphagnum* bog to use for cultivation, which one would you choose? Justify. (4M)

B5. How did the plants of *Achillea millefolium* help in studying genetic fixation? (5M)

B6. What does a dominance – diversity curve indicate? From the dominance diversity curve given in adjacent figure, comment on the characteristics of A, B, C and D in the graph. (5M)



B7. Describe an example of negative feedback mechanism operating at ecosystem level in order to keep a homeorhetic balance in place. (5M)

B8. “Agriculture”, is it a source or sink for CO₂? How do oceans play as buffering systems for CO₂? (4M)

B9. In a certain study, storage and flux of N, P, Ca, K and Na were studied in a dry tropical forest. The study was conducted on three sites. N, P, Ca, K and Na concentrations in different components of trees, shrubs, herbs, fine roots and litter layer are summarized in Table below.

Components	Nutrient concentration (% ± 1 s e)				
	N	P	Ca	K	Na
Trees					
Bole	0.600 ± 0.121	0.041 ± 0.010	0.260 ± 0.160	0.196 ± 0.040	0.080 ± 0.030
Branch	0.710 ± 0.140	0.048 ± 0.010	0.455 ± 0.040	0.399 ± 0.020	0.056 ± 0.001
Coarse root	0.820 ± 0.100	0.043 ± 0.010	0.574 ± 0.079	0.286 ± 0.050	0.060 ± 0.003
Foliage	2.040 ± 0.250	0.134 ± 0.020	0.401 ± 0.070	0.749 ± 0.180	0.074 ± 0.005
Shrubs					
Stem	0.770 ± 0.080	0.053 ± 0.003	0.460 ± 0.064	0.464 ± 0.070	0.067 ± 0.004
Coarse root	0.790 ± 0.085	0.049 ± 0.006	0.406 ± 0.110	0.450 ± 0.050	0.055 ± 0.002
Foliage	2.340 ± 0.300	0.159 ± 0.003	0.521 ± 0.043	1.001 ± 0.120	0.079 ± 0.006
Herbs	1.540 ± 0.110	0.131 ± 0.020	0.460 ± 0.070	0.969 ± 0.140	0.094 ± 0.010
Litter	1.160 ± 0.110	0.065 ± 0.011	0.383 ± 0.128	0.467 ± 0.159	0.071 ± 0.003
Fine root	1.045 ± 0.150	0.075 ± 0.025	0.548 ± 0.174	0.327 ± 0.073	0.111 ± 0.030

- What is the order of nutrient concentration in different growth forms (trees, shrubs and herbs)?
- Which part of the plant is the most metabolically active? Give justification.
- leaf litter was found to be poorer in nutrient concentration than green foliage. Why?

Turnover time for different nutrients in standing vegetation of the three study sites is as follows:

	Sites	Nutrient turnover time (years)				
		N	P	Ca	K	Na
Trees	1	5.46	5.32	8.44	5.83	7.83
	2	4.48	4.51	8.32	4.65	7.77
	3	6.45	6.71	10.72	6.97	10.70
Shrubs	1	2.16	2.25	3.52	2.59	3.54
	2	2.86	2.85	4.94	3.44	4.81
	3	1.64	1.53	2.46	1.83	2.20

iv) What does turnover time tell about the ecosystem?

Turnover rate and turnover time of litter nutrients on forest floor are as follows:

Sites	Nutrients				
	N	P	Ca	K	Na
Turnover rate					
1	0.72	0.76	0.80	0.69	0.74
2	0.76	0.80	0.84	0.73	0.79
3	0.77	0.81	0.85	0.74	0.79
x̄	0.75	0.79	0.83	0.72	0.77
Turnover time (years)					
1	1.39	1.32	1.24	1.45	1.35
2	1.32	1.25	1.19	1.37	1.27
3	1.30	1.23	1.18	1.35	1.27
x̄	1.33	1.27	1.20	1.39	1.30

v) what does the above table indicate about nutrient cycling in the forest floor? (7M)