Ref. No. Ex/ SC /UG/AECC/ENV SC/02/2023

B.Sc. Chemistry, Geography, Geological Sciences, Mathematics, Physics
1st year 2nd Semester Examination, 2023

SUBJECT : ENVIRONMENTAL SCIENCE

Time: Two hours **Full Marks: 50**

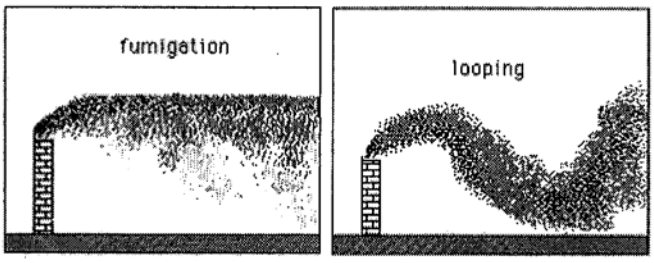
1. Answer briefly the following questions (all questions carry equal marks):

   (i) Sketch the layers of the atmosphere according to vertical temperature distribution.
   (ii) Why are deserts located at 30^{o} latitude?
   (iii) Sketch averaged absorbed short wave radiation by the Earth surface and averaged outgoing long wave radiation to space as a function of latitude.
   (iv) What is 'hydrological cycle'?
   (v) What are renewable and non-renewable natural resources?
   (vi) What do you mean by an ecosystem?
   (vii) What is a "food chain"?
   (viii) Name two biodiversity hotspots of India.
   (ix) List out at least one endemic and one endangered species of India.
   (x) Define primary and secondary pollutants with examples.
   (xi) What makes natural and unpolluted rain water acidic?
   (xii) What is acid rain?
   (xiii) What do you mean by 'ozone hole' over Antarctica?
   (xiv) What is 'principle of competitive exclusion' in connection with population model?
   (xv) Sketch a graph of BOD versus time and explain the meaning of ultimate BOD, i.e., BOD_u.

15x2=30 Marks

2. Answer any four questions from the following (all questions carry equal marks):.

   (a) The following figure represents the dispersion of pollutants from a smoke stack under two different circumstances.



   Describe briefly the atmospheric conditions that result the above vertical appearance of instantaneous plumes.

(b) 6 ml of wastewater is diluted to 300 ml in a standard BOD bottle. Initial DO and DO after 5-days are determined at 20°C to be 8.5 mg/L and 5.0 mg/L respectively. Determine BOD_5 of the wastewater and compute the ultimate BOD. Rate constant K at 20°C is 0.23 per day.

(c) The wastewater is being discharged into a river that has a temperature of 15°C. The rate constant K at 20°C is known to be 0.12 per day. Find the ratio of BOD_5 and BOD_u of the wastewater.

(d) Observations at Jadavpur University campus on a particular day show concentration of some of the pollutants as follows:
1-hour PM2.5 value of 103.9 $\mu g/m^3$,
1-hour CO value of 12.4 ppm and
1-hour NO_2 value of 43.5 ppb.
Find Air Quality Index (AQI) of Jadavpur University campus on that day, based on the given AQI index and breakpoint concentration values.

AQI Index and breakpoint pollution concentration for India are as follows:

PM2.5 ($\mu g/m^3$) 1-hour	CO (ppm) 1-hour	NO2 (ppb) 1-hour	AQI
0 - 60	0 - 1.7	0 - 42	0 – 100
61 – 90	1.8 - 10.3	43 - 94	101-200
91 – 210	10.4 - 14.7	95-295	201-300
211-252	14.8 – 30.2	296 – 667	301-400
253 & above	30.3 & above	668 & above	401-500

(e) Set up a differential equation that describes the nonlinear growth of a single species. Sketch the solution (without derivation) for two different initial conditions: (i) initial population of the species is less than K and (ii) initial population of the species is greater than K, where K is the environmental carrying capacity.

(f) Write a short note on the recent tropical cyclonic storm "Mocha".

4x5=20 Marks