

INDIAN INSTITUTE OF TECHNOLOGY KHARAGPUR

EV20001 Environmental Science

Mid-Semester Exam - Section 4

B Tech/B Sc (EE, GG, PH, MA, BT)

Number of Students 151 $f A = 155$

Spring 2018-19

Time: 2 hrs

Full Marks: 100

Answer Q 1 and any three from the rest.

- Q. 1. (a) What are the major health effects of exposure to noise pollution?
(b) Determine the sound pressure levels (SPL) in dB for sound pressures $p = 2$ Pa and $p = 1$ atm with reference to $p_{\text{ref}} = 20 \mu\text{Pa}$.
(c) In a residential area, A-weighted equivalent noise level (L_{eq}) during day-time and night were found to be 84 dB(A) and 73 dB(A) respectively. Find day-night equivalent noise level (L_{dn}) for a period of 24 hours. ('Day' means a period from 6 a.m. to 10 p.m. and 'night' is considered from 10 p.m. to 6 p.m.)

10+6+9

Q. 2. In order to determine the distribution of dissolved oxygen in the water in a non-tidal river, it is assumed that the river cross-section is uniform at A and the breadth at the water surface is B . A point source at $x = 0$ discharges BOD at a constant rate of W kg/hour. The velocity of the river water is also uniform at U m/h and the aeration 'mass transfer coefficient' at the air-water interface is k_L m/h. Removal of BOD of river water is a first order process and the rate constant is $k_d \text{ hr}^{-1}$.

- (a) Write down the steady state oxygen balance equation in river in terms of dissolved oxygen deficit D ($D = C_s - C$; C_s = saturation concentration of aerial oxygen in river water at the given temperature, C = actual local concentration of oxygen, all in consistent units) taking into consideration the convective transport of oxygen because of flow, absorption of oxygen from air at the free surface of water and the biological consumption of oxygen.
(b) Solve the model equation for the distribution of oxygen if the dissolved oxygen deficit is D_0 at $x = 0$.
(c) Obtain the maximum dissolved oxygen deficit along the river.

10+10+5

- Q. 3. (a) Write down four major water quality parameters and their effects. What is the existing law in our country for prevention of water pollution and maintenance of water quality?
(b) Briefly discuss the Ganga Action Plan and the subsequent initiatives for improving the water quality of the Ganga river?
(c) What is a Persistent Organic Pollutant (POP)? Name four such pollutants
(d) In a BOD test, 100 ml of river water is taken in a 300 ml BOD bottle and diluted with oxygenated distilled water at 20°C to make up the volume. The initial DO in the bottle is 8.5

mg/L and that after a 5-day incubation at 20°C drops down to 5.0 mg/L. Calculate the BOD degradation rate constant and BOD₃

8+6+3+8

- Q. 4.** (a) Discuss the concept of Sustainable Development. When was the concept first enunciated?
(b) How many Sustainable Development Goals were identified by UNDP? Write down seven of these goals.
(c) Explain how Environmental Kuznets Curve relates environmental quality with level of poverty.
(d) Briefly discuss the Polluter Pays Principle (PPP) and Prevention Principle (PP) of environmental protection.

5+8+6+6

- Q. 5.** (a) What were the major agenda of Earth Summit 1992, Rio+10 and Rio+20?
(b) Briefly discuss with simple sketches the basic principles behind primary and secondary treatment of wastewater.
(c) A stream of wastewater is to be treated at a rate of 1000 m³/day in an activated sludge chamber at an influent BOD of 400 mg/l to reduce the BOD to 30 mg/l in order to comply with the regulatory provisions. A bench scale study indicates that the first order rate constant for BOD degradation is 0.6 day⁻¹. Calculate the size of the aerated activated sludge tank. The operating conditions are the same as in the lab experiment.

6+10+ 9

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