25/11/16

INDIAN INSTITUTE OF ENGINEERING SCIENCE AND TECHNOLOGY, SHIBPUR
B. E. 7th SEMESTER FINAL EXAMINATIONS, 2016
Environmental Management and Legislation (CE 705/19)

Full Marks: 70 **Time: 3 hrs**

Answer any five questions

1. Briefly indicate the sequential steps to conduct an Environmental Impact Assessment. Do you perceive any loopholes and deficiencies in the present practice of EIA in India? What are the benefits that an industry and the society may get as a consequence of EIA conducted before implementation of an activity/project?

(5+4+5)

2. (a) Name the gases which are taken into consideration by the Kyoto Protocol. What is 'carbon footprint'? What is 'carbon dioxide equivalency' for an amount of greenhouse gas? What is 'carbon credit?

(b) Briefly describe the three mechanisms suggested to achieve the goals of Kyoto protocol.

(8+6)

3. (a) What is meant by sustainable development? Discuss about equitable basis for sustainable development.

(b) In protective environmental decision making process, assess the precautionary principle with respect to the assimilative capacity principle.

(c) Discuss the salient features of 'Polluter Pay Principle'.

(6+5+3)

4. (a) What is biomedical waste? What are the rationale and reasons for biomedical waste management?

(b) What are the different components of biomedical waste management under the Bio-medical Waste (Management and Handling) Rules 1998?

(b) According to the Bio-medical Waste (Management and Handling) Rules 1998, in how many categories the segregation of waste is suggested?What are the suggested treatment methods for 'human anatomical wastes' and 'microbiology and biotechnology wastes'?

(c) Briefly describe the process of 'deep burial' for disposal of certain types of biomedical waste.

(5+2+4+3)

5. (a) A lagoon is to be designed to accommodate an input flow of 0.10 m^3/s of non-conservative pollutant with concentration 30.0 mg/L and reaction rate 0.20/day. The effluent from the lagoon must have pollutant concentration of less than 10.0 mg/L. Assuming complete mixing, how large must the lagoon be?

(b) Consider the air over a city to be a box 100 km on a side that reached upto an altitude of 1.0 km. Clean air is blowing into the box along one of its sides with a speed of 4 m/s. Suppose an air pollutant with reaction rate K = 0.2/hr is emitted into the box at a total rate of 10.0 kg/s. Find the steady-state concentration if the air is assumed to be completely mixed? If the wind speed suddenly dropped to 1 m/s, estimate the concentration of pollutant 2 hr later.

(c) A lagoon with volume 1200 m^3 has been receiving a steady flow of conservative waste at the rate of 100 m^3/day for long enough time to assume that steady-state conditions apply. The waste entering the lagoon has a concentration of 10 mg/L. If the input waste concentration suddenly increases to 100 mg/L, what would be the concentration in the effluent 7 days later? Also find the effluent concentration if the pollutant is non-conservative with reaction rate K = 0.2/day.

(4+5+5)

6. Why would an organization wish to undertake an environmental audit? What are the distinctions between financial audits and environmental audits? With a diagram, show the different steps for conducting an environmental audit.

(4+5+5)

7. (a) Why the DO profile assumes the shape of a sag curve downstream of the point of discharge of a waste in any river? What is the self-purification capacity of a river?

(b) A municipal wastewater treatment plant discharges secondary effluent to a surface stream. The wastewater is found to have a maximum flow rate of 15000 m^3/d, BOD_5 of 40 mg/L, a dissolved oxygen content of 2 mg/L, and a temperature of 25°C. The stream is found to have a minimum flow rate of 0.5 m3/s, a BOD_5 of 3 mg/L, a dissolved oxygen content of 8 mg/L and a temperature of 22°C. Complete mixing of the wastewater and the stream is almost instantaneous, and the velocity of the mixture is 0.2 m/s. The reaeration constant is estimated to be 0.4 d^{-1}. Find the critical oxygen concentration and the location where it occurs. Assume other data suitably.

(5+9)

8. (a) What is 'air quality index'? How the concept of an air quality index is helpful (possible applications)? Which air quality parameters are taken into account while estimating the air quality index in India (prescribed by CPCB)?

(b) If the 24 hourly average value for NO_2 is found to be 90 micrograms per cubic meter, what is the calculated AQI?

Breakpoints for AQI

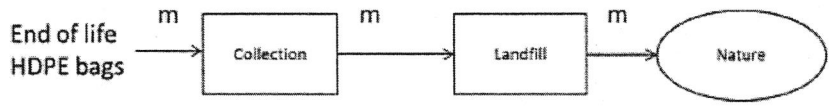
AQI Category (Range)	**NO_2 (micrograms/ cubic meter)**
Good (0 – 50)	0 – 40
Satisfactory (51 – 100)	41 – 80
Moderately Polluted (101 – 200)	81 – 180
Poor (201 – 300)	181 – 280
Very poor (301 – 400)	281 – 400
Severe (401 – 500)	400+

(c) CPCB developed a tool known as Comprehensive Environmental Pollution Index. What are the main objectives of CEPI?

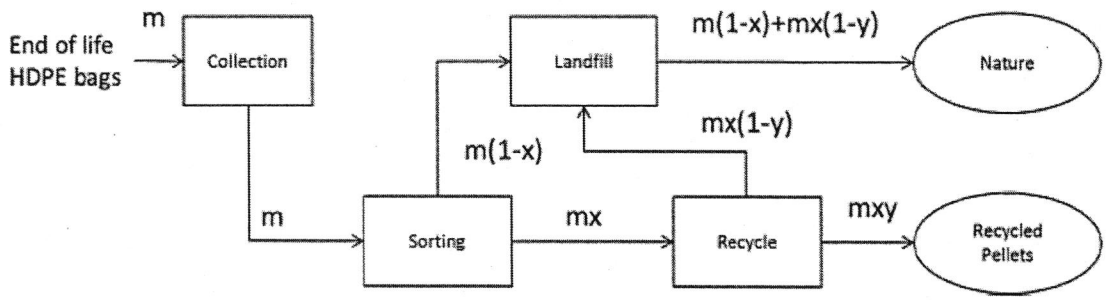
(d) The sub index scores are calculated for each of the individual environmental components, i.e. Air Index = 60, Water Index = 60 and Land Index = 50. What will be the aggregated CEPI? What can be the maximum score for each sub index and CEPI? What score of CEPI will indicate that the industrial area is critically polluted?

(e) Suppose we want to analyze the CO2 emissions of different end of life scenarios for plastic grocery bags in an urban region in an effort to inform policy makers. Two end of life processes for waste plastic bags collected in our urban region are considered: landfill and recycling. Let's assume that currently all collected mass is being sent to landfill (System1). Now suppose we wanted to evaluate changing this system by recovering some portion of the collected mass for recycling (System 2).

(1) Once-through landfill system (end of life stage only)



(2) System with plastic bag recycling (end of life stage only)



- e_c = MJ/kg input to collection
- e_l = MJ/kg input to landfill
- e_s = MJ/kg input to sorting
- e_r = MJ/kg input to recycling

energy intensity of each unit process

- s = MJ/kg recycled pellets -- the energy savings credit associated with the recycled pellets (i.e., the energy savings "credited" to the recycled pellets because they save energy by avoiding the production of virgin pellets in a subsequent product life cycle)

What is the maximum acceptable value of s for recycling to make sense from energy use point of view? Assume that e_c = 6 MJ/kg, e_l = 5 MJ/kg, e_s = 10 MJ/kg, e_r = 15 MJ/kg, x = 0.9, and y = 0.9.

(4+2+2+3+3)