

Max. Marks: 80

Duration: 180 minutes

Answer all questions.

Answer all parts of a question together.

1. Determine the flow in river required per 1000 population for disposing off sewage from a residential town with the following data: [15]
 - a. Average temperature of river water = 20°C and Initial DO concentration of river=8.38 ppm
 - b. 5-day BOD of sewage at 20°C = 300 ppm
 - c. Average sewage flow = 150 litre per person per day
 - d. K at 20°C = 0.15 per day
 - e. R at 20°C = 0.27 per day
 - f. Minimum DO to be provided in the river water = 4 ppm
 - g. Saturation DO of river water at 20°C = 8.38 ppm
 - h. DO of sewage = 0
 - i. BOD of river water =0

2. Find out the weighted arithmetic water quality index for the following data of water sample: [10]

Parameters	BIS standard	Ideal Value	Observed Value
pH	8.5	7	7.9
EC (mS/cm)	65	50	100
TDS (mg/l)	500	250	270
TH (mg/l)	300	200	230
Ca (mg/l)	75	40	50
Mg (mg/l)	30	20	40
Fe (mg/l)	0.3	0.2	0.25
F(mg/l)	1.2	0.7	0.8
Turbidity (NTU)	5	2	3

3. Find out the air quality index by the method given by Central Pollution Control Board, New Delhi for the following air sample data of ITO Delhi. [10]

Parameters	Observed Value ($\mu\text{g}/\text{m}^3$)
PM ₁₀	82
PM _{2.5}	64
NO ₂	83
SO ₂	285

AQI category	Range	PM ₁₀ ($\mu\text{g}/\text{m}^3$), Standard values	PM _{2.5} ($\mu\text{g}/\text{m}^3$), Standard values	NO ₂ ($\mu\text{g}/\text{m}^3$), Standard values	SO ₂ ($\mu\text{g}/\text{m}^3$), Standard values
NAAQ Standard	0-500	100	60	80	80
Good	0-50	0-50	0-30	0-40	0-40
Satisfactory	51-100	51-100	31-60	41-80	41-80

Moderately Polluted	101-200	101-250	61-90	81-180	81-380
Poor	201-300	251-350	91-120	181-280	381-800
Very Poor	301-400	351-430	121-250	281-400	801-1600
Severe	401-500	430+	250+	400+	1600+

4. A coal burning power plant burns 5.25 tons of coal per hour and discharges the combustion product through a stack that has an effective height of 80 m. The coal has Sulphur content of 4.5 % and the wind velocity at the top of the stack is 7 m/s. Determine the following: [10]
- Ground level concentration at a distance of 4.5 km downwind at the Centre line of plume
 - Crosswind distance 0.5 km either side of Centre line (for same downwind distance)
{Take $\sigma_y = 380$ m, $\sigma_z = 200$ m}.
 - If σ_y / σ_z ratio is constant, find the relationship between σ_z and stack height, so that maximum concentration downwind will occur.
5. Please explain the following:
- Prepare a map of physical disturbances in the growth of flora and fauna by defining zone of influence.
 - What do you understand by terrestrial species for the prediction of biological impact?
 - List the impact on the health of an employee, working in Coal mines project.
 - If a 200 bed multi-specialty hospital comes in Pilani, explain the socio economic impacts of the project.
 - What do you understand by ISO1400? Write an Environmental Policy for a Pulp and paper industry.
 - List 10 Personal Protective equipment and explain the usage.
 - What do you understand by Off Site Emergency Plan, discuss in detail? [2X7=14]
6. Suppose each customer put out 0.25 m³ of waste each week. Packer tucks with a compaction ratio 4 take 0.4 minute per customer to collect the waste. Two trucks are being considered: one that makes two trips per day to the disposal site, and other that makes three. [15]

Trips per day disposal site	2	3
Truck volume (m ³)	27	15
Annualized(maintenance + running) Tuck Cost) (\$/yr)	1,20,000	70,000
Time driving, unloading, breaks (min/day)	160	215

- Operating 5 days per week, with once-per-week pick up, how many customers would each truck service?
 - How many hours per day would each truck and crew have to operate to fill the truck each day?
 - With the cost of crew being \$ 40 per hour, what is the total annual cost of trucks and crew for each system? From that, find the annual cost per customer. Which system is less expensive.
7. The following are the rate of rainfall for successive 20 minutes period of a 140 minute storm 3, 3, 12, 7.5, 2, 2, 5 cm/hr. taking the value of Φ_{index} 3.5 cm/hr. Find the net runoff in cm. if the catchment area is 20 km², calculate the amount of Ni in runoff in kg after the end of storm. Take Ni concentration in runoff water as 0.5 mg/l. [6]

Paper Ends