



Name : .....

Roll No. : .....

Invigilator's Signature : .....

**CS/B.Tech(BT-NEW)/SEM-6/BT-603/2011  
2011**

**POLLUTION CONTROL & ENVIRONMENTAL  
BIOTECHNOLOGY**

Time Allotted : 3 Hours

Full Marks : 70

*The figures in the margin indicate full marks.*

*Candidates are required to give their answers in their own words  
as far as practicable.*

**GROUP – A**

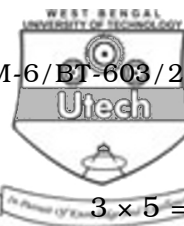
**( Multiple Choice Type Questions )**

1. Choose the correct alternatives for any *ten* of the following :  
10 × 1 = 10

- i) Example of a persistent organic pollutant is
  - a) phenol
  - b) cellulose
  - c) mercury
  - d) phosphomolybdic acid.
- ii) Metallothionein is a protein specialised in
  - a) degradation of toxic organic compounds
  - b) pumping out toxic compounds
  - c) synthesis of antibiotics
  - d) binding with heavy metals.
- iii) For a good sludge in activated sludge process is have SVI
  - a) < 40
  - b) > 200
  - c) between 40 and 200
  - d) none of these.
- iv) The unit of hydraulic loading rate is
  - a)  $\text{m}^3 / \text{m}^2 / \text{day}$
  - b)  $\text{kg} / \text{m}^3 / \text{day}$
  - c)  $\text{m}^2 / \text{m}^3 / \text{day}$
  - d)  $\text{kg} / \text{m}^2 / \text{day}$ .



- v) Full form of EPA is
  - a) Environmental Protocol Academy
  - b) Environmental Protection Agency
  - c) Ecology Protection Agency
  - d) Ecology Protection Authority.
- vi) Centrifugal scrubber is used for removal of
  - a) mist
  - b) fog
  - c) particulate matter
  - d) gaseous air pollutants.
- vii) Bacterial-Algal symbiosis is observed in
  - a) aerobic pond
  - b) activated sludge process
  - c) facultative pond
  - d) both (a) and (c).
- viii) Mist is a
  - a) liquid with droplet size less than  $10\ \mu\text{m}$
  - b) gas with molecule size less than  $10\ \mu\text{m}$
  - c) liquid with droplet size greater than  $10\ \mu\text{m}$
  - d) gas with molecule size greater than  $10\ \mu\text{m}$ .
- ix) Full form of MLVSS
  - a) Mixed Liquid Vaporized Suspended Solid
  - b) Mixed Liquor Vaporized Settable Solid
  - c) Mixed Liquor Volatile Suspended Solid
  - d) Mixed Liquid Volatile Settable Solid.
- x) PAN is an
  - a) underground water pollutant
  - b) a reserve water pollutant
  - c) a primary air pollutant
  - d) a secondary air pollutant.
- xi) Clause method is designed for the removal of
  - a) carbon monoxide
  - b) nitric oxide
  - c) hydrocarbon
  - d) sulphur di-oxide.
- xii) Minamata disease is associated with
  - a) mercury pollution
  - b) arsenic pollution
  - c) cadmium pollution
  - d) lead pollution.



**GROUP – B**  
**( Short Answer Type Questions )**

Answer any *three* of the following.  $3 \times 5 = 15$

2. Define primary and secondary air pollutants with examples. Discuss the biochemical effects of toxic metals found in the environment.
3. State the working principle of tape sampler for sampling particulate matter from air.
4. Define turbidity and describe the common method of laboratory measurement.
5. Briefly define xenobiotic compound ? What are the roles of methanogenic bacteria in biodegradation of xenobiotics ?
6. Write down the major sections of the Water ( Prevention and Control of Pollution ) Act, 1974.

**GROUP – C**  
**( Long Answer Type Questions )**

Answer any *three* of the following.  $3 \times 15 = 45$

7. a) Describe different modifications in air supply in activated sludge process that can be used in industry to overcome the inequality between oxygen supply and oxygen demand.  
b) Describe different pond systems used in biological treatment of waste water.  
c) Define HLR of trickling filter.  $8 + 6 + 1$
8. Write down the different forms of mercury that are present in nature. Arrange them according to their toxicity level. What are broad spectrum and narrow spectrum mer operon ? What are the genes present in a broad-spectrum mer operon ? Discuss their roles in conferring mercury resistance to bacteria.  $2 + 1 + 4 + 3 + 5$
9. a) What do you mean by primary and secondary treatment of waste water ? Compare trickling filter with activated sludge system.



- b) How is nitrogen removed from waste water ?
- c) A completely mixed sludge process is to be used to treat a waste water flow of  $1000 \text{ m}^3/\text{hr}$  having a BOD of  $250 \text{ mg/l}$ . design criteria are as follows :
- $Y = 0.4$ ,  $k = 8 \text{ day}^{-1}$ ,  $k_s = 75 \text{ mg/l}$ ,  $\theta_c = 5 \text{ days}$ .
- $X = 2000 \text{ mg/l MLSS}$ . Calculate the substrate exit concentration and the volume of the aeration tank.

5 + 5 + 5

10. An air stream with a flow rate of  $7 \text{ m}^3/\text{s}$  is passed through a cyclone separator of standard proportions. The diameter of the cyclone separator is  $2.0 \text{ m}$  and air temperature is  $77^\circ\text{C}$ .
- a) Determine the diameter of the particle that is collected with 50 per cent efficiency.
- b) Determine the particle diameter collected with 50 per cent efficiency if 64 cyclones with  $24 \text{ cm}$  diameters are used.

Given :

Number of effective turns = 5

Particle's density =  $1.5 \text{ g/cm}^3$

Air viscosity =  $2.1 \times 10^{-5} \text{ kg/m.s}$ . 7 + 8

11. a) What is the principle of electrostatic precipitator ( ESP ) ? Derive the equation for its efficiency (  $\eta$  ).

$$\eta = 1 - e^{-\frac{V_{pm} P L}{v A}} \quad \text{and} \quad \eta = 1 - e^{-\frac{V_{pm} A_c L}{v V}}$$

where  $V_{pm}$ ,  $v$ ,  $A$ ,  $A_c$ ,  $P$  and  $L$  are particle migration velocity, gas velocity, gas passage area, collector area, perimeter of the geometry and length of the plate respectively.

- b) Calculate the ESP ( 99% collection efficiency ) plate area required when the drift velocity of charged particles is  $0.1 \text{ m/s}$  and the flow rate of air is  $10 \text{ m}^3/\text{s}$ . 4 + 7 + 4