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P.P-rock s-5606A

[Time : Three hours]

[Marks: 100]

Please check whether you have received the right question paper

N.B:

1. All questions carry equal marks
2. Attempt all questions

Q.I A. Define the following: (05)

- i) Extramural aero microbiology - study of microorganisms in air of outdoor environments
- ii) Continuous point source - Launching of aerosols occurring over an extended period of time
- iii) Slow sand filters - Used in water purification for treating raw water to produce a potable product. They are typically 1 to 2 metres deep, can be rectangular or cylindrical in cross section and are used primarily to treat surface water.
- iv) Biosolids: They may be defined as organic wastewater solids that can be reused after suitable sewage sludge treatment processes leading to sludge stabilization such as anaerobic digestion and composting.
- v) Edaphon: Living organisms found in soil

Q.I B. State whether the following statements are true or false: (05)

- i) Relative humidity does not influence the survival of microorganisms in air. **false**
- ii) HEPA filters are reported to virtually remove all infectious particles in air. **true**
- iii) An ideal indicator organism should not grow in water : **True**
- iv) *Salmonella* is a member of fecal coliform group.: **False**
- v) Iron bacteria oxidize iron from the ferric to ferrous state- **False**

Q.I C. Give one example for each of the following: (05)

- i) Intramural environments -**laboratory, hospitals, homes**
- ii) Organism associated with pneumonia – **Klebsiella pneumoniae, Streptococcus pneumoniae**
- iii) Halogens used as disinfectants in water purification: **Chlorine, Chloramines, Chlorine dioxide, bromine and iodine**
- iv) Indicator organisms present in raw sewage: **Coliforms, Fecal coliforms, Fecal streptococci, Enterococci, C. perfringens, Coliphages. Bacteroides**
- v) Nitrifying bacteria - **Nitrobacter**

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- Q.1 D. Select the most appropriate alternative:** (05)
- i) Transport of airborne particles over a distance of 50 km is considered as _____ transport (microscale, **mesoscale**, macroscale)
 - ii) The _____ standards of NAAQS are designed to protect soils, water, crops, and animals from adverse effects of air pollutants (primary, **secondary**, tertiary)
 - iii) The coliform group includes *Escherichia*, *Enterobacter*, *Klebsiella* and _____ (*Citrobacter*, coliphages, *Enterococci*)
 - iv) In the Membrane filter (MF) test water is passed through a membrane filter having pore size of _____ (0.045µm, **0.45µm**, 4.5 µm)
 - v) Soil particles of diameter 0.2 mm are classified as _____ (sand, silt, clay)

- Q.2 A Answer any two of the following:** (20)
- i) Discuss in detail the stages in the aeromicrobiological pathway. –**Maier 87-91**
 - ii) Give an account of the major steps of modern wastewater treatment with suitable diagrams. **Maier 2nd ed. page 506 to 511**
 - iii) Write a note on Soil bioremediation – **Kolwzan – pg. 33-39**

- Q.3 A. Answer any three of the following:** (18)
- i) Justify: Air flora can be controlled by suppression of dust and use of chemicals (**Salle 662**)
 - ii) Discuss the various factors that affect the survival of microorganisms in air – **Maier 91-92**
 - iii) Write a short note on : Intramural aeromicrobiology – **Maier 95-97**
 - iv) Give an account of the use of u.v. radiation in air sanitation with special reference to operation theatres and food storage - **Salle 665-668**
 - v) Discuss: Centrifugal air samplers (**Salle 656 and Maier 152-153**)
 - vi) Compare and Contrast: Lemon sampler and AGI- 30 (**Maier 153**)

- Q.3 B. Do as directed:** (02)
- i) Explain the significance of Anderson sampler - **it separates airborne particles on the basis of their size**
 - ii) Explain the term 'nuclei mode bioaerosol' – **Diameter less than 0.1 micrometer**
 - iii) Organism associated with diphtheria - **Corynebacterium diphtheriae**

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- Q.4 A. Answer any three of the following: (18)
- i) Give the principle and procedure of BOD estimation -Maier 2nd ed.page 503 to 505
 - ii) Discuss physical chemical and microbial characteristics of lakes and rivers. Maier 2nd ed.page 111 to115
 - iii) With suitable diagram explain various steps of most probable number (MPN) test. Prescott 7thed Page 1052 to 1053
 - iv) Explain different methods used for land application of sewage effluent. Maier 2nd ed.page 516 to518
 - v) What are Class A and Class B biosolids? Explain the methods to convert Class B biosolids to Class A biosolids Maier 2nd ed.page 523 to 524
 - vi) Justify: Indicator organisms are used in microbiological analysis of water Maier 2nd ed.page 485 to 486
- Q.4 B. Do as directed: (02)
- i) Give principle of disinfection by chlorination :Chlorine is strong oxidizing agent , when added as a gas to water, forms a mixture of hypochlorous acid and hydrochloric acid which inactivates pathogens.
 - ii) Give significance of FC/FS ratio:
Fecal coliform/ fecal streptococci ratio. Higher value >4.0 is indication of pollution of human origin and lower value <0.7 is indication of animal origin.
 - iii) Define and give example of fecal indicator: A group of organisms that indicate the presence of fecal contamination, such as the fecal coliform or *Escherichia coli*.
 - iv) Define COD :Chemical Oxygen Demand or COD is a measurement of the oxygen required to oxidize soluble and particulate organic matter in water.
- Q.5 A. Answer any three of the following: (18)
- i) Discuss the significance of the various types of microorganisms found in soil – Kolwzan – pg.12-14.
 - ii) Justify: Humus is formed by a series of processes catalyzed by soil microorganisms – Maier 295 & 297
 - iii) Give an account of the Nitrogen cycle in soil – Maier 299-307 (in short)



- iv) Justify: Sulphur and phosphorus are continually cycled through the activity of soil microorganisms – **Subbarao pg. 292-295**
- v) Comment on: Physiological methods to study microbial activity in soil -**Maier 192- 197 (in short)**
- vi) Comment on: Molecular methods to study soil microorganisms – **Subbarao pg 74-78**

Q.5 B.

Do as directed (any two):

(02)

- i) Explain the term 'iron respiration'
Use of ferric ion as a terminal electron acceptor for energy generation during anaerobic respiration
- ii) State whether true or false: Air constitutes around 25% of the volume of soil -
True
- iii) How would you use radio labelled substrates to study microbial activity in soil?
Incubate soil sample with radiolabelled substrate such as ^{14}C labelled glucose and measure the amount of $^{14}\text{CO}_2$ evolved.
- iv) Explain the term 'siderophore'
They are iron chelators produced by microbial cells that bind ferric ion. The ferric ion is further reduced to ferrous form and taken up into the cell