KUMARAGURU
college of technology
character is life

M.E./ M.TECH DEGREE EXAMINATIONS: NOV/ DEC 2024

(Regulation 2024)

First Semester

ENVIRONMENTAL ENGINEERING

24ENI501: Environmental Chemistry and Microbiology

COURSE OUTCOMES

CO1:   Analyze and solve reaction chemistry involved in equilibrium and redox reactions

CO2:   Derive and develop kinetic equations (chemical and enzymatic) and interpret the influential parameters in water and wastewater treatment processes

CO3:   Adopt appropriate technology based on fluid surface chemistry in degrading contaminants

CO4:   Classify microorganisms and explain their metabolic pathways in aerobic and anaerobic conditions.

CO5:   Analyze real time case studies on biotransformation, bioaccumulation, and ecotoxicology

Time: Three Hours   **Maximum Marks: 100**

Answer all the Questions
PART A (4 x 20 = 80 Marks)

1. a)   Derive an expression for Self-ionization of Water.   6   CO1   [K3]

    b)   Explain theory of precipitation in salt hydrolysis.   6   CO1   [K3]

    c)   Explain the mechanism of recombinant DNA technology and illustrate its   8   CO4   [K3]
         applications in Genetic Engineering.

2. a)   Analyze the impact of temperature on the rate of reaction, given the activation   10   CO2   [K3]
         energy is 85 kJ/mol and the rate constants are $k_1 = 0.021 s^{-1}$ at 300K and
         $k_2 = 0.024 s^{-1}$ at a higher temperature. Use the Arrhenius equation.

    b)   The decomposition of ammonia on a metal surface is a zero-order reaction. If   10   CO2   [K3]
         for the reaction $2NH_3 \rightleftharpoons N_2 + 3H_2$, the rate constant $K = 5.0 \times 10^{-4}$
         Mol $L^{-1}s^{-1}$ and if the initial concentration of NH_3 was 6M, Find $[NH_3]$ at 1.5
         hrs.

3. a)   Describe the functional mechanism of surfactants during washing clothes with   10   CO3   [K2]
         neat sketch.

	b)	Explain the concept of the electric double layer and its significance in colloidal stability, with specific applications in environmental engineering.	10	CO3	[K$_3$]
4.	a)	Discuss the role of cytochrome P450 in metabolizing xenobiotics and explain its pathway mechanism.	10	CO5	[K$_3$]
	b)	Examine the environmental effects of bio-magnification in a terrestrial ecosystem, and suggest strategies for mitigation with a real time scenario.	10	CO5	[K$_4$]

Answer any ONE Question
PART B (1 x 20 = 20 Marks)

5.	a)	Elaborately discuss on various acid-base theory concepts with appropriate examples.	10	CO1	[K$_3$]
	b)	State Monod's equation, Michael Menton constants and their significance in Wastewater treatment.	5	CO2	[K$_3$]
	c)	Discuss the various properties of colloidal particles and their environmental significance.	5	CO3	[K$_2$]

OR

6.	a)	Illustrate the biochemical pathway of the Kreb's cycle in aerobic respiration with a detailed diagram. Mention the role of the co-enzymes, co-factors during the respiration process.	15	CO4	[K$_3$]
	b)	Classify pollutants under xenobiotics and explain each category with relevant examples.	5	CO5	[K$_2$]

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