POST-GRADUATE DEGREE PROGRAMME
Term End Examination — December, 2024
ENVIRONMENTAL SCIENCE (PGES)
Paper : ENVS CC102 : ENVIRONMENTAL CHEMISTRY
(Under CBCS from January 2024 Enrolment Session)

Time : 2 hours   Full Marks : 50

Weightage of Marks : 80%

Special credit will be given for accuracy and relevance in the answer. Marks will be deducted for incorrect spelling, untidy work and illegible handwriting. The weightage for each question has been indicated in the margin.

1. Answer any *five* of the following :   2 × 5 = 10

   a) Define acid rain. Mention one gas and the chemical reaction for formation of acid rain.   1 + 1

   b) What is the difference between COD and BOD in water quality analysis ?

   c) What is electrophoresis ? Mention one application in Environmental Science.   1 + 1

   d) Write a short note on ozone hole formation.

   e) A sample contains 0.5 g of NaCl dissolved in 250 ml of water. Calculate its morality.

   f) Define buffer solution with an example.

   g) What is the role of chlorophyll in photosynthesis from a biochemical perspective ?

   h) Define Gibb's free energy. What is meant by "Standard state free energy" ?   1 + 1

2. Answer any *four* of the following :   5 × 4 = 20

   a) Explain the biochemical significance of proteins in enzymatic reactions.

   b) A river water sample has a DO of 8.2 mg/l and a BOD_5 of 4.8 mg/l. Interpret these results with respect to water quality.

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    c) Outline the principle and applications of Atomic Absorption Spectroscopy.

    d) Discuss the chemistry of stratospheric O_3 formation and destruction.

    e) A buffer solution is prepared by mixing 0.2 (M) CH_3COOH and 0.1 (M) CH_3COONa. The pKa of CH_3COOH is 4.76. at 298K.

        i) Calculate the pH of the buffer, using the Henderson – Hasselbach equation.   3

        ii) What will be the new pH if 0.01 (M) HCl is added to the buffer solution (Assuming negligible volume change).   2

    f) Oxygen plays a key role in the troposphere, while ozone, in the stratosphere. Elucidate.

    g) Differentiate between coagulation and flocculation. Mention the chemical reactions using sodium aluminate and alum as coagulants.

    h) Mention five structural differences between DNA and RNA.

3. Answer any *two* of the following : $10 \times 2 = 20$

    a) Write an essay on photochemical smog formation. Include reactions, environmental effects and mitigation measures.

    b) Explain the biogeochemical cycling of N_2, highlighting key chemical transformations and environmental concerns.

    c) Discuss in detail the principles of chromatography and its types with special reference to applications in environmental monitoring.

    d) A groundwater sample contains 200 mg/L of $CaCO_3$ equivalent hardness. Express this in terms of

        a) ppm of hardness

        b) mill equivalents per litre (meq/L)

        c) molarity of $CaCO_3$.   4 + 3 + 3

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