B. E. METALLURGICAL AND MATERIAL ENGINEERING EXAMINATION, 2019

FIRST YEAR, FIRST SEMESTER (Old)

CHEMISTRY-I

Full Marks: 100   **Time: Three Hours**

Answer any six questions

1. (a) Deduce the Henderson equation: $p^H = pK_a + \log\{[\text{Salt}]/[\text{Acid}]\}$ 5
   (b) Define buffer solutions with examples. Briefly discuss the mechanism of buffer
   action.   2+1+4
   (c) Define buffer capacity.   3
   (d) Mention two applications of buffer solutions.   1

2. (a) What do you mean by hydrolysis? Cite suitable examples of your choice.   2+2
   (b) Calculate the p^H of pure water at 100 °C.
              [Given: K_w at 100 °C is 5.45×10^{-13}]   2
   (c) Define solubility product.   2
   (d) Write a short note on the application of solubility product principle and common ion
    effect in inorganic qualitative group analysis.   5
   (e) Define redox indicator with one example.   3

3. (a) Write down the complete balanced equation of the reaction involving Fe^{2+} and
   $K_2Cr_2O_7$ in acidic medium.   3
   (b) What do you mean by a primary standard in quantitative titrimetric analysis? Provide
   examples of a primary standard and a secondary standard.   3+1
   (c) "The p^H scale is extended from 0 to 14" – Comment or criticize the statement.   3
   (d) The solubility of silver chloride at any particular temperature is 0.0016 gm dm^{-3}.
   Calculate its solubility product at that temperature. [Given: Molecular weight of AgCl is
   143.5]   3
   (e) Write a concise note on "Ionic product of water'   3

4. (a) What was the product that Union Carbide, Bhopal produced? Write down the synthetic
      scheme of the compound.   5
   (b) How SO_x is generated in the atmosphere? Write down the chemical roles of them in
   'smog' formation.   2+3
   (c) Write a short note on "Biochemical effects of Arsenic".   6

5. (a) What are Green House Gases? Based on Global Warming Potential (GWP) explain the highest efficiency of CFC. 5

(b) Write a note on 'Pesticide Toxicity'. 5

(c) Account on the composition and classification of layers in the atmosphere. 3

(d) 'CO is a deadly poisonous gas.' Explain this statement with reference to CO-toxicity.

3

6. (a) What are the differences between chemical reaction and nuclear reaction? 2

(b) Write short notes on 3+3

(i) Neutron activation analysis.

(ii) Radio carbon dating.

(c) Discuss the characteristic features of the neutron to proton ratio curve. How does the curve predict the modes of decay of the unstable nuclides? 3+3

(d) Mention one application of radio isotope. 2

7. (a) Comment on the charge of Tl in TlI_3. 2

(b) Define 'nuclear binding energy' and 'mass defect'. Explain the 'fission' and 'fusion' reactions from nuclear binding energy per nucleon curve. 6

(c) Explain the advantages and disadvantages of homogeneous and heterogeneous catalysis. Give one example of an auto-catalysis reaction. 3+2

(d) Interpret the mode of the following redox reaction:

3

$$Sn^{2+} + Pb^{4+} \rightleftharpoons Sn^{4+} + Pb^{2+}$$

General Proficiency: 4