FE | Sem-I | NEP 2020 | All branches | Winter 2025 | 26-12-2025

Time: 1:30 hours **Marks: 45**

N.B.
1. Question No. 1 is compulsory.
2. Attempt any two questions from Question No.2 to Question No.5.
3. Draw a neat and well-labelled diagram, and write the chemical reaction wherever necessary.
4. Marks are given on the right side of the questions.

1. ATTEMPT ANY FIVE QUESTIONS.

(a) Define calorific value and write the significance of proximate analysis of coal. 03

(b) Explain the sacrificial anode cathodic protection method with a neat and well-labelled diagram. 03

(c) Explain the terms involved in Gibbs phase rule with an example of a one-component system. (Phase, Component and Degree of Freedom) 03

(d) Define the tensile strength of a polymer and explain its significance. 03

(e) Discuss applications of composites. 03

(f) Discuss super critical solvents with its applications. 03

(g) How is the percentage of sulphur determined in a solid fuel? 03

2. (A) How can material selection and design prevent corrosion? Explain which protective coatings can be used for corrosion prevention. 06

(b) Calculate the gross and net calorific value of coal having the following compositions. Carbon=85%, hydrogen=8%, sulphur=1%, nitrogen=2%, ash=4%, and the latent heat of steam is 587 cal/gm. 05

(c) Write the conventional and green methods for the synthesis of adipic acid. 04

3. (a) Explain all types of chemical bonds existing in polymers. 06

(b) Write notes on (a) reduced phase rule(c) applications of phase diagram. 05

(c) Classify composites with the help of a diagram and an example of each class. 04

4. (a) Write short notes on crystallinity, number average molecular weight and fatigue of polymers. 06

(b) Write about the synthesis and advantages of biodiesel. 05

(c) 1.0 g of coal sample was digested (Kjeldahl method). The liberated ammonia was absorbed in 25 ml of N/10 H_2SO_4. To neutralise excess acid, 15 ml of 0.1 N NaOH was required. Determine the % nitrogen in the given sample of coal. 04

5. a) Explain the rusting of iron with the help of the electrochemical theory of corrosion and a diagram. 06

(b) Define matrix and dispersed phase with its functions and examples. 05

(c) An alloy of Cd and Bi contains 25% Cd. Find the mass of eutectic in 1 kg of alloy if the system contains 40% Cd. 04

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