

B.TECH. DEGREE III SEMESTER (SUPPLEMENTARY) EXAMINATION IN
SAFETY AND FIRE ENGINEERING
JUNE 2002

SE 304 CHEMICAL ENGINEERING I
(1995 Admissions)

Time: 3 Hours

Maximum Marks: 100

- I. (a) Obtain an expression for the thermodynamic efficiency of a process using a Carnot cycle of operations. (7)
 (b) Prove that for 1 mole of an ideal gas, $C_p - C_v = R$. (7)
 (c) Calculate the maximum theoretical efficiency of a reversible heat engine working between 25 deg.C and 100 deg. C. (6)
- OR**
- II. (a) State the Second law of thermodynamics. Explain with an example. (7)
 (b) Calculate the change in entropy of 2Kg of air, when it is heated at a constant volume from 1Kg/cm² abs. to 4 Kg/cm² abs. Assume $C_v = 0.169$. (7)
 (c) Prove $dG = -SdT + VdP$, from $G = H - TS$. (6)
- III. (a) What is meant by order of reaction? Explain how zero and fractional order reactions occur. (7)
 (b) Discuss briefly the concept of activation energy of chemical reactions. What is its usefulness? (6)
 (c) Show how the activation energy of a chemical reaction can be determined. (7)
- OR**
- IV. (a) Define 'Equilibrium Constant' of a reaction. Write the relationship between K_c and K_p . (7)
 (b) Discuss the effect of temperature and pressure on the following reaction:

$$N_2 + 3H_2 \rightleftharpoons 2NH_3, \Delta H = -22.0KCal.$$
 (7)
 (c) State the distinguishing characteristics of each of the following reactions: Single, Multiple and Elementary. (6)
- V. (a) Describe the working of an industrial bimetallic thermometer with the help of a neat sketch. (7)
 (b) Discuss the working principle of bourdon tube and diaphragm elements for pressure measurement. (7)
 (c) How are level measuring instruments classified? (6)
- OR**
- VI. (a) Explain the working principle of a venturimeter. (7)
 (b) Describe the constructional features of a resistance thermometer. (7)
 (c) How will you measure the liquid level in an open vessel? (6)
- VII. (a) Explain the terms 'closed-loop system' and 'feedforward control'. (7)
 (b) What are the basic components of a pneumatic controller? (7)
 (c) Discuss the different modes of computer control. (6)
- OR**
- VIII. (a) What are the different modes of control? Discuss the merits of each mode of control. (7)
 (b) Discuss the importance of transducers in electronic measuring systems. (6)
 (c) Explain the principle of resistance wire strain gauges. (7)
- IX. (a) Describe the Turbidimetry and Nephelometry methods of analysis. (7)
 (b) Explain the working principle of Infrared Analyzers. (6)
 (c) Discuss the instrumental method for determining the structure of ceramics. (7)
- OR**
- X. (a) Describe the colorimetric methods of analysis. What are its applications? (7)
 (b) Discuss the application of nuclear magnetic resonance in chemical analysis. (7)
 (c) Explain the principle of mass spectrometry. (6)

