Code No. BTS 118 (E_1)

B.TECH. DEGREE III SEMESTER (SUPPLEMENTARY) EXAMINATION IN SAFETY AND FIRE ENGINEERING, JUNE 2001

SE 304 CHEMICAL ENGINEERING - I

(1995 Admissions)

Time: 3 Hours Maximum Marks: 100

I. (a) Distinguish between
(i) Intensive and extensive properties
(ii) State and path functions. (6)

(b) Define:
(i) Gibbs free energy
(ii) Joule-Thomson coefficient (6)

(c) Water flows over a water fall 100 m in height. Consider 1 kg water and assume that no energy is exchanged between this and the surroundings. Calculate
(i) The potential energy at the top of the falls
(ii) The kinetic energy just before the water strikes the bottom
(iii) The temperature rise of the water when it enters the river whose down stream velocity is assumed negligible. (8)

OR

II. (a) Derive the following Maxwells relation $\left(\frac{\partial T}{\partial V}\right)_s = -\left(\frac{\partial P}{\partial S}\right)_v$. (6)

(b) State Carnot's principle. (4)

(c) A new engine is claimed to have a power output of 4.5 HP while receiving 377 KJ/min when working between the source and sink temperatures of 1000 K and 500 K. Is the claim for the engine possible? (5)

(d) Calculate the entropy of vaporization of 1 Kg of dry saturated steam at 7 bar given that the saturation temperature at 7 bar is 440 K and the latent heat of vaporization is 2067 KJ/kg. (5)

III. (a) Describe the effect of temperature and pressure on equilibrium constant. (6)

(b) Explain Le Chatlier's Principle and discuss the effect of temperature on an endothermic reaction. (6)

(c) Calculate the equilibrium constant at 1 bar and 298 K for the following reaction

$$C_4H_{10} + C_2H_4 \rightarrow C_6H_{14}$$

given that the standard free energies of formation are – 21 KJ/mol, 68.4 KJ/mol and –10 KJ/mol respectively for C_4H_{10}, C_2H_4 and C_6H_{14}. (8)

OR

IV. (a) Explain order and molecularity of reaction with examples. (6)

(b) Explain reaction rate and how it is affected by temperature change. (7)

(c) At 500 K the rate of a bimolecular reaction is ten times the rate at 400 K. Find the activation energy from Arrhenius Law. (7)

V. (a) List the static and dynamic characteristics of measuring instruments. (6)

(b) Explain the principle of working of thermocouples.
List the different types of thermocouples indicating their range. (8)

(c) With a neat sketch explain any one type of radiation pyrometer. (6)

OR

(Turn over)

VI.	(a)	Derive the equation for actual flow rate through an orifice meter.	(6)
	(b)	Describe with a neat sketch an instrument used for measuring high pressures in industries.	(8)
	(c)	What are the various methods for level measurement?	(6)
VII.	(a)	With examples explain active and passive transducers.	(7)
	(b)	Describe the hydraulic and pneumatic load cells for force measurement.	(7)
	(c)	Write a short note on computer control.	(6)
		OR	
VIII.	(a)	Explain the working of a proportional-integral-derivative controller.	(7)
	(b)	Distinguish between feed-back control and open-loop control systems.	(6)
	(c)	Write short note on final control elements.	(7)
IX.	(a)	Indicate on a diagram the different regions of the electromagnetic spectrum.	(5)
	(b)	Explain Nuclear Magnetic Resonance Spectroscopy. With a schematic sketch explain the working of an NMR spectrometer.	(15)
		OR	
X.	(a)	Discuss the modern methods of chemical analysis.	(6)
	(b)	Explain the principle of X-ray diffraction. What are its applications?	(8)
	(c)	Write a short note on the structure of polymers.	(6)

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