Course code	Course Name	L-T-P -Credits	Year of Introduction
FS201	PRINCIPLES OF CHEMICAL ENGINEERING	3-1-0-4	2016

Prerequisite : Nil

Course Objectives

- To provide fundamental knowledge in chemical engineering.
- To familiarize the concept of material balance and energy balance calculations
- To understand the fundamentals of chemical engineering thermodynamics
- To understand the application of laws of thermodynamics

Syllabus

Basic Principles-Introduction to basic chemical calculations, Ideal gases and gas mixtures, Material balance-material balance without and with chemical reactions, Energy balance-enthalpy, specific heat, Fundamentals of Chemical Engineering Thermodynamics-thermodynamic system Application of laws of Thermodynamics-entropy, Maxwel relation, Reaction equilibria

Expected outcome.

i. Understand the principles of chemical engineering
ii. Solve problems with material balance and energy balance.
iii. Apply the first and second laws of thermodynamics to chemical processes

Text Books:

1. K.V. Narayanan & B. Lakshmikutty : Stoichiometry and Process Calculations, PHI, New Delhi
2. K.V. Narayanan: A Textbook of Chemical Engineering Thermodynamics, PHI, New Delhi

References:

1. B.I Bhat & S.M. Vora: Stoichiometry, Tata McGraw Hill, New Delhi
2. Hougen O. A, Watson. K. M and Ragatz R. A, Chemical Process Principles (Part-II), 2nd Edition, CBS Publishers, 2004.
3. Smith J. M, H. C. Van Ness and M. M. Abbott, Introduction to Chemical Engineering Thermodynamics, 7th ed., McGraw-Hill, 2004.

Course Plan

Module	Contents	Hours	Sem.Exam Marks
I	**Basic Principles:** Introduction to basic chemical calculations- mole concept, methods of expressing composition-mole fraction, weight fraction, volume fraction, concentration of liquid solutions- molarity, molality, normality, ppm. Ideal gases and gas mixtures- Ideal gas law, Amagat's law, Dalton's law, Henry's law, average molecular weight, density of gases, partial pressure and partial volume calculations	8	15%
II	**Material Balance:** Material balance without chemical reactions, simple calculations involving recycle ,bypass and purge streams Material balance with chemical reactions	10	20%

FIRST INTERNAL EXAMINATION			
III	**Energy Balance:** Energy balance ,heat capacity, specific heat and enthalpy, heat capacity of gases at constant pressure, heat capacity of gaseous mixtures, latent heats Enthalpy changes accompanying chemical reactions- standard heat of formation, standard heat of combustion and standard heat of reaction, Hess's law of heat summation	10	15%
IV	**Fundamentals of Chemical Engineering Thermodynamics:** Chemical thermodynamics - fundamental concepts and definitions- types of thermodynamic systems and properties- closed, open and isolated system- intensive and extensive properties- path and state functions	8	15%
SECOND INTERNAL EXAMINATION			
V	**Application of laws of Thermodynamics** First law of thermodynamics and applications, equation of state of gases, the principle of corresponding states Second law of thermodynamics- entropy, change in entropy, compression and expansion of fluids, Joule –Thomson expansion.	8	15%
VI	**Reaction Equilibria** Gibbbs Free energy change -Thermodynamic property relations, Maxwell relations- equilibrium constant, effect of temperature on equilibrium constant.	8	15%
END SEMESTER EXAM			

QUESTION PAPER PATTERN:

Maximum Marks: 100 Duration: 3 Hours

Part – A: 5 MARK QUESTIONS

There will be two questions from module 2 and module 3 and one question each from remaining modules (5x8 = 40)

PART B: 10 MARK QUESTIONS

5 questions uniformly covering the first four modules. Each question can have maximum of three sub questions, if needed. Student has to answer any 3 questions

(3 x10 = 30 marks)

PART C: 15 MARK QUESTIONS

4 questions uniformly covering the last two modules. Each question can have maximum of four sub questions, if needed. Student has to answer any two questions

(2 x15 = 30 marks)