University of Pune, Pune
B.E. (Mechanical) (2008 Course)
ELECTIVE –IV (OPEN ELECTIVE)
402050D CRYOGENIC ENGINEERING

Teaching Scheme
Lectures 4 hrs/week

Examination Scheme
Theory   100 Marks

Section I

UNIT-I   08

Introduction to cryogenic systems: development and present state, Low temperature properties of engineering materials, Properties of cryogenic fluids.

UNIT-II   10

Gas liquefaction systems: - Joule-Thomson effect, Adiabatic v/s Isenthalpic expansion, Inversion curve, System performance parameters, thermodynamically ideal system, Linde-Hampson, Claude cycle for liquefaction.

UNIT-III   08

Cryogenic Refrigerators:- Importance of refrigerator effectiveness, refrigerator using solids as working media, Vuilleumier refrigerator, Solvey refrigerator, G-M refrigerator, Stirling refrigerator.

Section II

UNIT-IV   10

Gas purification and separation systems: - Ideal work required for separation of gas mixtures, Roult's Law, Flash calculations, Murphree efficiency Theoretical plate calculation using McCabe-Thiele technique.

UNIT-V   10

Cryogenic measurement techniques: for temperature, pressure, flow rate, liquid level.

Cryogenic fluid storage and transfer, Dewar vessel, Vacuum technology and insulations for cryogenics, cryopumping.

UNIT-VI   06

Applications of cryogenic systems: - space, medical, superconductivity, biological, industry, power generation.

Text Books:

1. Cryogenic Systems- R. Barron Oxford University Press.

2. Cryocooler, Fundamentals Part-I- G.Walker Plenum Press New York.

3. Cryocooler, Fundamentals Part-II- G.Walker Plenum Press New York.

4. Cryogenic Process Engineering- K.D.Timmerhaus

5. Cryogenic Engineering: Thomas Flynn, Taylor and Francis

Reference Book:

1. Stirling Cycle Design Manual- Martini W.NASA Report, 1978