GUJARAT TECHNOLOGICAL UNIVERSITY

M.E Semester: 2

Mechanical Engineering (Cryogenic Engineering)

Subject Name CRYOGENIC SYSTEMS

Sr.No	Course content
1	Cryogenic Refrigeration System: Ideal isothermal and reversible isobaric source refrigeration cycles, Joule Thomson system, cascade or pre-cooled joule–Thomson refrigeration systems, expansion engine and cold gas refrigeration systems, Philips refrigerators, Importance of regenerator effectiveness for the Philips refrigerators, Gifford single volume refrigerator, Gifford double volume refrigerators analysis, COP,FOM ,regenerators ,pulse tube refrigerators , various types of pulse tube refrigerator
2	Refrigerators using solids as working media: Magnetic cooling, magnetic refrigeration systems, thermal; valves, nuclear demagnetization
3	Gas liquefaction systems: Introduction, thermodynamically ideal systems ,joule Thomson effect, liquefaction systems such as Lnde Hampton ,precooled Linde Hampson ,linde dual pressure ,cascade, Claude ,Kapitza ,Heyland systems using expanders, comparison of liquefaction systems .liquefaction systems for neon ,hydrogen & helium
4	Adsorbents: various adsorbents, salient features – properties, determination of mass of absorbents for the adsorption of gases
5	Adsorption processes Physical principles of adsorption , BET equation for single and multiple layer , Use of sorption process in cryogenics static and dynamic arrangement for the sorption processes , Adsorption columns , PSA and VSA adsorption systems, isotherms, reactivisation

List of Experiments:

1. Study and analysis of cryo refrigeration system. – isothermal source system, isobaric source system.
2. Study and analysis of Philips refrigeration system.
3. Study and analysis of precooked cycle of refrigeration
4. Study and analysis of GM refrigerator.
5. Study and analysis of Vuilleumier and Solvay refrigerators.
6. Study and analysis of magnetic refrigerator and thermal valves.
7. Study and analysis of dilution refrigerator.
8. Study of ideal liquefaction system.
9. Study of Linde dual pressure system.
10. Study of hydrogen liquefaction system.
11. Study of pulse tube refrigeration system.

Reference Books:

1. Cryogenic Systems, **Barron, McGraw Hill Book Co**.
2. Theory and design of cryogenic systems : **A.Arkherov**
3. Cryogenic process engineering **Timmerchand & Flynn**

4. **"**Theory and design of cryogenic systems", **Mikulin,** MIR Publication, 2002