

DR VS KRISHNA GOVERNMENT DEGREE COLLEGE VISAKHAPATNAM
B.Sc. PHYSICS SYLLABUS UNDER CBCS
III Year B.Sc Physics: V Semester
ELECTIVE -EA-1: LOW TEMPERATURE PHYSICS & REFRIGERATION
(Credits: 04)

Work load: 60 hrs per semester

4 hrs/week

UNIT-I

PRODUCTION OF LOW TEMPERATURE

(10 hrs)

Production of low temperatures-Introduction, Freezing mixtures, Joule-Thomson effect, Regenerative cooling, Different methods of liquefaction of gases, liquefaction of air, Production of liquid hydrogen and nitrogen, *liquefaction of Helium Kapitza method* Adiabatic demagnetization, Properties of materials at low temperatures, Superconductivity

UNIT-II

MEASUREMENT OF LOW TEMPERATURE

(10 hrs)

Gas thermometer its correction and calibration. Secondary thermometers, resistance thermometers, thermocouples, Vapour pressure thermometers, Magnetic thermometers, *Electronic thermometers*, Advantages and drawbacks of each type of thermometer.

UNIT-III

PRINCIPLES OF REFRIGERATION

(10 hrs)

Introduction to Refrigeration- Natural and artificial refrigeration , Stages of refrigeration, Types of refrigeration - Vapor compression and vapor absorption refrigeration systems, Refrigeration cycle and explanation with a block diagram, Introductory ideas on air conditioning. Refrigerants-Introduction, Ideal refrigerant, Properties of refrigerant, Classification of refrigerants, commonly used refrigerants, Eco-friendly refrigerants, *and effect of refrigerants on ozone layer.*

UNIT-IV

COMPONENTS OF REFRIGERATOR

(10 hrs)

Refrigerator and its working, Block diagram, Coefficient of Performance (COP), Tons of refrigeration (TR) and Energy Efficiency Ratio (EER), Refrigerator components: Types of compressors, evaporators and condensers and their functional aspects, defrosting in a refrigerator, Refrigerant leakage and detection, *applications of refrigerators.*

UNIT-V

APPLICATIONS OF LOW TEMPERATURE & REFRIGERATION (10 hrs.)

Applications of Low temperatures: Preservation of biological material, Food freezing, liquid nitrogen and liquid hydrogen in medical field, Superconducting magnets in MRI- Tissue ablation (cryosurgery) - Cryogenic rocket propulsion system. Applications of refrigeration: Domestic refrigerators, Water coolers, Cold storages, Ice plants, Food preservation methods, Chemical and Process industries, Cold treatment of metals, Construction field, Desalination of water, Data centers.

III. References:

1. Heat and Thermodynamics by Brij Lal & N. Subramanyam, S.Chand Publishers.
2. Thermal Physics by S C Garg, R M Bansal & C K Ghosh, McGraw-Hill Education, India
3. Heat and Thermodynamics by M M. Zemansky, McGraw Hill Education (India).
4. Low-Temperature Physics by Christian E. & Siegfried H., Springer.
5. Thermal Engineering by S. Singh, S. Pati, Ch:18 Introduction to Refrigeration.
6. The Physics Hyper Text Book. Refrigerators.<https://physics.info/refrigerators/>
7. Refrigeration and Air Conditioning by Manohar Prasad, New age international (P) limited, New Delhi
8. A course in Refrigeration and Air Conditioning by S.C. Arora and S. Domkundwar, Dhanpatrai and sons, Delhi
- 9.https://trc.nist.gov/cryogenics/Papers/Review/2017Low_Temperature_Applications_and_Challenges.pdf
10. <https://nptel.ac.in/content/storage2/courses/112105129/pdf/RAC%20Lecture%203.pdf> 11. Other Web sources suggested by the teacher concerned and the reading material. <https://nptel.ac.in>