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Code No. : 14109 FC

**VASAVI COLLEGE OF ENGINEERING (Autonomous), HYDERABAD**  
**B.E. (CBCS) IV-Semester Main Examinations, May-2018**

**Fundamentals of Cryogenics**

(Open Elective-III)

Time: 3 hours

Max. Marks: 70

*Note: Answer ALL questions in Part-A and any FIVE from Part-B*

**Part-A (10 × 2 = 20 Marks)**

1. List any four methods of production of low temperatures.
2. Obtain the relationship between inversion, Boyle's and critical temperatures.
3. Along with a labeled diagram narrate the regenerative cooling technique.
4. Give the significance of van der Waals coefficients in liquefaction of gases.
5. Explain along with a diagram the fountain effect shown by liquid Helium-II.
6. Distinguish properties of Helium-III and Helium-IV.
7. Mention the basic requirements for a cryocooler.
8. Write a note on cryogenic insulations.
9. Under what conditions a gas can be converted into a liquid.
10. Write a note on two fluid model of liquid helium-II.

**Part-B (5 × 10 = 50 Marks)**

11. a) State Joule-Thomson effect of cooling a gas and narrate its various stages pictorially and give at the results of J-T effect. [4]  
b) Derive expression for J-T coefficient by applying appropriate thermodynamic equations. [6]
12. a) Why Hydrogen and Helium cannot be liquefied at room temperature? [3]  
b) Explain in detail the liquefaction of air by Linde process with the help of a neat labeled diagram. [7]
13. a) What is lambda point transition in liquid helium? Draw the transition curve. [4]  
b) Discuss Rollin thin film effect of Helium-II. Draw and explain Helium-III phase diagram. [6]
14. a) What is adiabatic demagnetization? Narrate with necessary diagram the experimental set up of adiabatic demagnetization. [4]  
b) Give the theory of adiabatic demagnetization and derive expression for change in temperature. [6]
15. a) What is fractional distillation? Explain production of liquid oxygen by fractional distillation. [5]  
b) Elaborate the method of production of liquid hydrogen with necessary schematic diagram. [5]
16. a) Outline the properties of materials at low temperatures. [3]  
b) Describe the working and construction of Gifford- McMahon cryocooler. [7]
17. Answer any *two* of the following:  
a) What are the advantages of cascade cooling? Explain two stage cascade refrigeration system. [5]  
b) Give the detailed classification of cryocoolers. [5]  
c) Mention any five applications of cryogenic temperatures with examples. [5]

