

STATISTICAL PHYSICS AND THERMODYNAMICS-II

Paper-I : Semester-IV

Time Allowed : Three Hours

Maximum Marks : 30

Note : Attempt two questions each from Section A and B carrying 5 marks each, and the entire Section C consisting of 7 short answer type questions carrying 2 marks each.

SECTION-A

- I. What are Extensive and Intensive parameters ? Give two examples in each case. Prove that entropy is an extensive parameter. 5
- II. State and explain Second law of thermodynamics in different statement forms. 5
- III. What is Thermocouple ? Deduce the expression for Peltier coefficient. 5
- IV. Derive an expression for change in entropy of a perfect gas. 5

SECTION-B

- V. Show that for a perfect gas no Joule-Thomson effect takes place. 5
- VI. Starting from four thermodynamic potentials, derive the Maxwell's Thermodynamic relations. 5
- VII. For a perfect gas $C_p - C_v = R$. Prove. 5
- VIII. Discuss the liquefaction of Helium using the principle of Regenerative cooling. 5

- SECTION-C**
- IX. Attempt any five parts :
- (a) Differentiate between Refrigerator and a Heat pump.
 - (b) Define Thomson coefficient.
 - (c) How does the internal energy of an ideal gas differ from that of a real gas ?
 - (d) What do you mean by Disorder ?
 - (e) What is an S-T diagram ? What is its significance ?
 - (f) What is Temperature of Inversion in a Thermocouple ?
 - (g) Can the entropy of a system increase when it loses heat ?
- (5×2=10)

LASERS - II

Semester-IV

Time Allowed : Three Hours

Maximum Marks : 30

Note : Attempt two questions each from Section A and B carrying 5 marks each, and the entire Section C consisting of 7 short answer type questions carrying 2 marks each.

- SECTION-A**
- I. Derive the threshold condition for Laser oscillations. 5
 - II. Explain Doppler broadening in detail. 5
 - III. Distinguish between spontaneous and stimulated emission. 5
 - IV. What is Population inversion ? How is it achieved in a Laser? 5
- SECTION-B**
- V. Briefly discuss Semiconductor laser. 5
 - VI. Explain Mode locking. 5
 - VII. What is Holography ? Explain. Give its uses. 5
 - VIII. Discuss Nd-YAG Laser. 5

- SECTION-C**
- IX. Attempt any five parts :
- (a) Laser beams are highly directional. Explain.
 - (b) What is Non-homogeneous broadening ?
 - (c) Explain why Four-level laser is less efficient as compared to Three-level laser.
 - (d) What is Laser spiking ?
 - (e) Give four applications of Lasers.
 - (f) Laser light is highly monochromatic. Why ?
 - (g) Optical pumping cannot be used for gas lasers. Why ?
- (5×2=10)