Q.P. Code – 42341

Third Semester B.Sc. Degree Examination, October/November 2019

(CBCS Scheme – 2016-18 Repeators)

Physics

Paper III (301) - THERMODYNAMICS LOW TEMPERATURE PHYSICS RADIATION AND OPTICS

Time : 3 Hours] *[Max. Marks : 90*

Instructions to Candidates : Answers should be written Completely in English only.

PART – A

Answer any **FIVE** from the following. Each question carries 8 marks :

(5 × 8 = 40)

1. State and prove the law of equipartition of energy.

2. What is 'transport phenomena'? Derive the expression for coefficient of viscosity of gas by using kinetic theory of gases.

3. What is diesel engine? Derive the expression for efficiency of diesel engine.

4. Derive Maxwell's thermodynamic relations using thermodynami potentials.

5. Describe with necessary theory the porous-plug experiment.

6. (a) State and prove Kirchoff's law of radiation.

   (b) Give any two illustrations of Kirchoff's law. **(6 + 2)**

7. (a) What is Fresnel's Biprism?

   (b) Give the theory of Fresnel's Biprism.

8. (a) What are Newton's Rings?

   (b) Give the theory of Newton's rings by reflected light.

PART – B

Answer any **SIX** questions from the following. Each question carries 5 marks :

(6 × 5 = 30)

9. Calculate the mean free path of a gas molecule whose diameter is 5×10^{-10} m and the number of molecules per unit volume is $2.2\times10^{25}\,m^{-3}$.

10. Calculate the elevation of the boiling point of water due to a change in pressure of 1 cm of mercury. Assume $L = 2.268\times10^{6}$ J/kg and specific volume of steam as 1.671 m^3.

11. A Carnot's reversible engine absorbs 150 J of heat per cycle from the source at a temperature of 450 K. If the engine rejects 120 J of heat to the sink per cycle, what is the temperature of the sink?

12. One mole of a perfect gas expands isothermally to thrice its initial volume. Calculate the change of entropy. Given R = 8.313 J/K/mol.

13. Calculate the temperature of inversion and Joule-Thomson cooling for 2 atm. tall of pressure with the following data :

    Vander Waals constants for hydrogen are

    a = 0.247 atm litre^2/mol^2

    b = 2.65 10^{-2} Litre/mole

    Initial temperature = 100 k and

    R = 8.2 J/K/mole.

14. A copper furnace emits 2.6×10^{6} J of energy per hour through an area $10^{-6}\,m^2$. If the emissivity is 0.82, calculate the temperature of the furnace.

    Stefan's constant $\sigma = 5.67\times10^{-8}\,w/m^2/k^4$.

15. In Young's double slit experiment the slit separation is 2 mm and the distance between slit and screen is 1.2 m. The distance of the 6th bright fringe from the central bright fringe is 10 mm. Calculate the wavelength of light and fringe width.

16. When the movable mirror of Michelson's interferometer is moved through 0.02 mm a shift of 65 fringes is observed. Calculate the wave length of light used.

PART – C

Answer any **TEN** from the following questions. Each question carries 2 marks : **(10 × 2 = 20)**

17. (a) Does co-efficient of diffusion depend on temperature. Justify.

(b) In what way ideal gas and real gases are different? Explain.

(c) Among Vrms, Vav and Vmpv, which is the greatest and which is the least?

(d) The entropy of the universe is always increasing. Justify.

(e) Among otto engine and diesel engine which one has higher efficiency at a given conditions? Explain.

(f) Food gets cooked faster in pressure cooker. Justify.

(g) Can mercury be used in diffusion pump? Why?

(h) Is energy of thermal radiation less than that of visible light? Justify.

(i) Animals curl their body during winter season. Justify.

(j) Name any two types of wave font.

(k) Soap bubbles and oil spills appears colorful. Why?

(l) What happens to fringe width if yellow light is replaced by violet light? Justify.