

**BACHELOR OF SCIENCE EXAMINATION, 2017**

(1st Year, 1st Semester)

PHYSICS (Subsidiary)

Paper – SO2

Time: Two hours

Full Marks: 50

**Answer any four questions**

1. (a) "The first law of thermodynamics is not merely a restatement of the principle of conservation of energy in the context of interconversion of heat and work – something more" – Explain the statement critically.  
 (b) Distinguish between isothermal and adiabatic process? Of the two curves - isothermal and adiabatic – which one has greater slope? What is its significance?  
 (c) A motor tyre is pumped to a pressure of two atmosphere at 15°C when it suddenly bursts. Calculate the resulting drop in temperature. [ $\gamma = 1.4$ ]  
[2+(3+3)+4.5]
2. (a) Describe Carnot's cycle. Show that the work done by a perfect gas undergoing adiabatic change is  $(P_1V_1 - P_2V_2)/\gamma - 1$ .  
 (b) Prove that the efficiencies of all reversible engines working between the same two temperatures are the same.  
 (c) A Carnot engine whose low temperature reservoir is at 7°C has an efficiency of 40%. To increase the efficiency to 50% by how many degrees should the temperature of the source be increased?  
[(2+3)+4+3.5]
3. (a) Define entropy of a system. What is its physical significance?  
 (b) Calculate the change in entropy of a perfect gas between two stages of an isothermal change.  
 (c) 2g of nitrogen double in volume at constant temperature. Calculate the change in entropy, given relative molecular mass of nitrogen = 28. [ $R_0 = 8.31$ ]  
[(2+1)+5+4.5]
4. (a) Establish TdS relations in thermodynamics.  
 (b) Show that for real gas  $C_p - C_v = R[1 + (2a/RTV)]$ .  
[6+6.5]
5. (a) State the basic assumptions of kinetic theory of gases.  
 (b) From these assumptions, derive the expression of pressure of a gas.  
[4+8.5]
6. (a) Derive Boyle's law from the expression of pressure of the gas.  
 (b) What do you mean by most probable velocity of the gas molecule? Write down its expression. Estimate its value with temperature.  
[3.5+(2+2+5)]
7. (a) What are the van der Waal's corrections suggested to derive the gas laws.  
 (b) What do you mean by critical constant? Derive the value of the critical constant?  
[3.5+(2+7)]