Reg. No. : ....

Name : ....

Second Semester B.Sc. Degree Examination, December 2021

First Degree Programme Under CBCSS

Physics

Core Course

PY 1241 — HEAT AND THERMODYNAMICS

(2020 Admission Regular)

Time : 3 Hours

Max. Marks : 80

SECTION – A

Answer **all** questions in **one** or **two** sentences. **Each** question carries **1** marks.

1. What is mean by conduction?

2. What is the SI unit of thermal conductivity?

3. State Stefan's law.

4. What is an adiabatic process?

5. Give the expression for Weidman-Franz law.

6. State Nernst theorem.

7. Give two examples for reversible processes.

8. Define solar constant.

9. What is Carnot cycle?

10. Give the expression for first law of thermodynamics in differential form.

(**10 × 1 = 10 Marks**)

SECTION – B

Answer **any eight** questions, not exceeding a paragraph. **Each** question carries **2** marks.

11. How to find the thermal conductivity of rubber?

12. Differentiate between Homogeneous and heterogeneous systems.

13. What is mean by quasi-static process?

14. Explain the term Temperature.

15. Discuss about the sign conversion for heat transfer.

16. What is Radiation mode of heat flow?

17. State first law of thermodynamics.

18. Define internal energy as a thermodynamic property.

19. Write any two corollaries of first law of thermodynamics.

20. What is the differential form of first law of thermodynamics?

21. Discuss about thermal reservoirs.

22. What is mean by refrigerator? Derive the expression for coefficient of performance.

23. State and explain Kelvin-Planck statement.

24. Define Entropy.

25. Explain third law of thermodynamics.

26. What is Phase transition in thermodynamics?

(8 × 2 = 16 Marks)

SECTION – C

Answer **any six** questions; not exceeding a paragraph. **Each** question carries **4** marks.

27. The air in a room is at 25°c and outside temperature is 0°c. The window of the room has an area of $2m^2$ and thickness 2mm. Calculate the rate of loss of heat by conduction through window? Thermal conductivity for glass is 1 Wm^{-1} $degree^{-1}$.

28. The temperatures at the ends of a bar are 95°C at warmer end and 37° C at the cooler end. The length of the bar is 0.9 m. what is the temperature at a point that is 0.3 in from the cooler end of the bar?

29. Deep bore holes into the earth show that the temperature increases about 1°C for each 30 m of depth. The earth's crust has a thermal conductivity of about 0.80 W/°C m, how much heat flows out through the surface of the earth each second for each square meter of surface area?

30. Calculate the entropy change of 1.00 kg of ice at 0°C when it melts (reversibly)to water at the same temperature. The latent heat of ice is 80 cal / gas.

31. A Carnot engine operates between 317°C and 67°C. What is its efficiency?

32. What is the maximum amount of work that a Carnot engine can perform per kilocalorie of heat input which absorbs heat at 427°C and exhaust heat at 177°C?

33. The fluid contained in a tank is stirred by a paddle wheel. The work input to the paddle wheel is 5057 kJ. Determine change in internal energy by considering tank and fluid as a system.

34. In an engine, for one cycle the working fluid engages in two work interactions : 15 kJ to the fluid and 44 kJ from the fluid and three heat interactions : 75 kJ to the fluid and 40kJ from the fluid. Determine the magnitude and direction of third heat transfer.

35. Determine the thermal conductivity of rubber.

36. A domestic refrigerator is loaded with food and the door is closed. During certain period, the refrigerator consumes 1.5Kw hr of energy and the internal energy of the system drops by 3800 kJ. Find the net heat transfer for the system.

37. A heat engine working at the rate of 105 kW has an efficiency of 22%. Determine the quantity of heat received and transferred from the working fluid.

38. A heat Pump is driven by a heat engine. The heat transfer from the heat engine and heat pump are used to heat the water circulating through the radiators of a building. The heat engine efficiency is 30% and COP of the heat pump is 3.8. Evaluate the ratio of heat transfer to the circulating water to the heat transfer to the heat engine.

(6 × 4 = 24 Marks)

Answer **any two** questions. **Each** question carries **15** marks.

39. Discuss about the determination of Thermal conductivity of bad conductors using Lee's disc method.

40. Write Kelvin-Planck and Clausius statements of second law, and prove that they are equivalent.

41. State and explain first law of thermodynamics and define specific heat capacity at constant pressure and volume, also deduce the relationship between C_p and C_v.

42. Discuss the working of Carnot's ideal engine on P-V diagram and deduce an expression for its efficiency. Why is not possible in practice?

43. Derive Clausius inequality and hence prove that entropy is a property of the system.

44. Define Diesel engine and it's working.

(2 × 15 = 30 Marks)