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Reg. No. : .....

Name : .....

Third Semester B.Sc. Degree Examination, March 2022

First Degree Programme Under CBCSS

Physics

Core Course I

PY 1341 – THERMODYNAMICS AND STATISTICAL PHYSICS

(2013 – 2017 Admission)

Time : 3 Hours Max. Marks : 80

SECTION – A

(Answer **all** questions in **one** or **two** sentences. **Each** question carries **1** mark).

1. What is a black body?
2. What is thermal conductivity?
3. Define open and closed system.
4. What is the spectrum of black body radiation?
5. What is a diesel cycle?
6. What is meant by thermodynamic equilibrium?
7. What is the main purpose of heat engine?
8. Define entropy.
9. How is entropy related to energy?
10. What is canonical ensemble?

(10 × 1 = 10 Marks)

P.T.O.

SECTION – B

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

11. What is the significance of Wiedemann-Franz law?
12. Obtain an expression for the temperature of the sun.
13. Discuss Lee's disc method to find the thermal conductivity of bad conductor.
14. What is an isothermal process? Give an example.
15. A heat engine cannot attain 100% efficiency. Why?
16. Obtain an expression for work done in an adiabatic process.
17. Show that for an adiabatic change in a perfect gas PV^{γ} = constant.
18. State and explain zeroth law of thermodynamics.
19. State and explain Clausius statement entropy.
20. State and explain Nernst heat theorem.
21. Explain Liouville's theorem.
22. What is specific heat of solids? How do you find the specific heat of a solid?

(8 × 2 = 16 Marks)

SECTION – C

(Answer **any six** questions. **Each** question carries **4** marks).

23. The sun emits maximum radiation at $\lambda = 0.52 \mu m$. Assuming the sun to be a black body, calculate the surface temperature of the sun. Also calculate the monochromatic emissive power of the sun's surface.

24. The normal body temperature of a person is 36.11 °C. Calculate the rate at which heat is flowing out of his body through the clothes assuming the following values Room temperature = 8.33 °C, surface of the body under clothes = 1.6 m^2, conductivity of the cloth = 0.04 J/m-s-° C, thickness of the cloth = 0.5 cm.

25. Two large closely spaced concentric spheres (both are black body radiators) are maintained at temperatures 200K and 300K respectively. The space in between the two spheres is evacuated. Calculate the net rate of energy transfer between the two spheres. (Given $\sigma = 5.672 \times 10^{-8}$ M.K.S. unit)

26. The average kinetic energy of a gas molecule at a certain temperature is 6.21×10^{-21} joule. Find the temperature. Boltzmann's constant $K = 1.38\times10^{-23}$ joule K^{-1}.

27. Calculate the Fermi energy at absolute temperature.

28. A Carnot's engine whose source temperature is 400K takes 2000J of heat and rejects 1600J of heat to the sink. Find the temperature of the sink and the efficiency of the engine.

29. Air is compressed adiabatically to half its volume. Calculate the change in temperature. Initial temperature is 27° C.

30. Calculate the change in entropy when 10 grams of ice at 0 °C is converted into water at the same temperature. Given latent heat of ice = 80 cal/gram.

31. 1 kg of water at 273*K* is brought in contact with a heat reservoir at 373 *K*. What is the change in entropy of water as its temperature reaches 373 *K*?

(6 × 4 = 24 Marks)

SECTION – D

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

32. State Stefan's law. Discuss the laboratory method for the determination Stefan's constant.

33. Describe Carnot's cycle and obtain an expression for the efficiency of an ideal heat engine in terms of temperature.

34. State and prove Clausius theorem for entropy and write down Clausius mathematical statement of second law.

35. Derive an expression for V_{rms} starting from Maxwell Boltzmann velocity distribution law.

(2 × 15 = 30 Marks)
