MAR IVANIOS COLLEGE (AUTONOMOUS)
THIRUVANANTHAPURAM

Reg. No. :…… **Name :…….**

Third Semester B.Sc. Degree Examination, November 2016

First Degree Programme under CBCSS

Core Course: Physics – II

AUPY341: Thermodynamics and Statistical Physics

(*for 2014 Admissions – **Improvement** Only*)

Time: **3** Hours Max. Marks: **80**

SECTION – A

*Answer **ALL** questions in a word or one or two sentences.*

1. Which one among solid, liquid and gas of same mass at the same temperature, has the greatest internal energy ?
2. Why conversion of heat into work is not possible without sink at a lower temperature ?
3. A gas does work during adiabatic change. What is the source of mechanical energy so produced ?
4. Distinguish between reversible and irreversible processes.
5. Why it is cooler at the top of the mountain than at the sea level ?
6. What are the conditions of thermodynamic equilibrium of a system ?
7. What is phase space ?
8. Define entropy.
9. Can you design a heat engine with 100% efficiency ?
10. Define solar constant.

(10 × 1 = 10 Marks)

SECTION – B

*Answer any **EIGHT** questions, not exceeding a paragraph.*

11. Is it possible to increase the temperature of a gas without adding heat to it ? If yes, explain how ?
12. If a drop of water falls on a very hot iron, it takes long time to evaporate. Why ?

13. An electric refrigerator transfers heat from low temperature to the surroundings at high temperature. Does this violate second law of thermodynamics ?
14. Write a note on ensembles.
15. What is Bose Einstein condensation.
16. State and explain Nernst Heat theorem.
17. Obtain an expression for the change in entropy in a reversible isothermal process.
18. State and explain zeroth law of thermodynamics.
19. How is the thermal conductivity of rubber determined by radial heat flow method ?
20. Write not on the behaviour of liquid Helium.
21. Explain micro state and macro state.
22. Give the name of different strokes in Diesel engine.

(8 × 2 = 16 Marks)

SECTION – C

*Short essay type / Problems : Answer any **SIX** questions.*

23. Obtain the expression for the work done in an isothermal and adiabatic process.
24. Calculate the black body temperature of Sun if the distance of earth from Sun is 1.5×10^{11} m and the radius of Sun is 6.96×10^{8} m. Given solar constant =1400 W/m^2 and Stefan's constant = 5.6697×10^{-8} W/m^2K^4.
25. A Carnot cycle is performed by 1litre of air ($\gamma = 1.4$) initially at 327° C and at a pressure of 12 atmospheres. Each state represents a compression or expansion in the ratio 1: 6. Calculate the lower temperature and efficiency of the cycle.
26. 10gm of water is heated from 40° C to 80° C. Calculate the change of entropy. Specific heat of water = 4.2×10^{3} J/ (kg K).
27. Calculate the depression in melting point of ice produced by 1.01×10^{5} Pa increase of pressure. Specific latent heat of fusion of ice = 3.3×10^{5} J/kg. The densities of ice and water at 273 K are 920 kgm^{-3} and 1000 kgm^{-3} respectively.
28. A refrigerator working on the principle of reverse carnot cycle remove 40 $kJ\,min^{-1}$ of heat from a reservoir at 1° C and rejects heat to reservoir at 41° C. Find i). the coefficient of performance and ii). heat rejected to the hot reservoir.

29. A motor car tire has a pressure of 2 atmospheres at the room temperature of 27° C. If the tire suddenly bursts find the resulting temperature.
30. Obtain an expression for the number of molecules with speeds between c and (c + dc).
31. Three particles are to be arranged in four available quantum states. Find the number of ways in which this can be done, if the particles obey i). B – E statistics ii). F – D statistics.

(6 × 4 = 24 Marks)

SECTION – D

*Long essay type : Answer any **TWO** questions.*

32. Discuss Fermi – Dirac Statistics for the most probable distribution of particles among energy levels. Also make a comparison between MB, FD and BE statistics.
33. Derive Clausius Clapeyron equation for first order phase transition and apply it to explain the effect of change of pressure on the melting point and boiling point.
34. Describe Carnot's cycle and obtain an expression for the efficiency of an ideal heat engine in terms of temperature.
35. State and explain Stefan's law. With necessary theory explain an experiment to determine Stefan's constant.

(2 × 15 = 30 Marks)

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