MAR IVANIOS COLLEGE (AUTONOMOUS)
THIRUVANANTHAPURAM

Reg. No. :…… **Name :…….**

Second Semester B.Sc. Degree Examination, June 2015
First Degree Programme under CBCSS
Complementary Course: Physics – III (for Mathematics)
AUPY231.2c: Heat and Thermodynamics

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

SECTION – A

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

1. Define temperature gradient.
2. What is an indicator diagram ?
3. Thermal radiations are in the _____ region of the spectrum.
4. Write two examples for isothermal process.
5. Write an expression for the change of entropy of a system.
6. State second law of thermodynamics in terms of entropy.
7. Explain relation between entropy and disorder.
8. Write down the equation for the change in entropy when a liquid at its boiling point is converted to its vapour at the same temperature.
9. Is there any increase or decrease of entropy during an irreversible process ?
10. In petrol engine the combustion of fuel takes place at constant _____.

(10 x 1 = 10 Marks)

SECTION – B

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

11. Show that adiabatic elasticity is γ times isothermal elasticity.
12. What are the different processes involved in a Carnot cycle ?

13. Explain the Kelvin's statement of second law of thermodynamics.
14. State Widemann – Franz law.
15. Define coefficient of thermal conductivity. What is its unit ?
16. State and explain Wien's displacement law.
17. Explain the relation between entropy and available energy.
18. Define solar constant.
19. State Planks quantum theory of radiation.
20. Rate of formation of ice in lakes decreases with increase in the thickness of ice layer. Why ?
21. What is a perfect black body ?
22. What is the principle of increase of entropy ?

(8 x 2 = 16 Marks)

SECTION – C

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

23. Find the change in entropy when 1 kg of ice melts at 273 K ? Specific latent heat of fusion of ice is $3.36 \times 10^5 \text{ Jkg}^{-1}$.
24. Calculate the total change in entropy when 1g of water is heated from 0˚C to 100˚C. Specific heat capacity of water = $4200 \text{ Jkg}^{-1}\text{K}^{-1}$.
25. Calculate the work done when one mol of an ideal gas is compressed isothermally at 227˚C to one – fifth of the original volume. $R = 8.31 \text{ Jmol}^{-1}\text{K}^{-1}$.
26. A reversible heat engine of efficiency 75% has its efficiency increased to 90% when the temperature of the sink is lowered. If the original temperature of the sink was 500K, calculate, by how much the temperature of the sink was lowered ?
27. Find the time in which a layer of ice on the surface of a lake will increase in thickness from 3 cm to 5 cm when the temperature of air above is -11˚C. Thermal conductivity of ice $= 2 \text{ Wm}^{-1}\text{K}^{-1}$. Specific latent heat of ice = $3.3 \times 10^5 \text{ JK}^{-1}$. Density of ice = 920 kgm^{-3}.
28. A Carnot engine working between 300 K and 600 K has an output of 800 J per cycle. What is the amount of heat energy supplied to the engine from source per cycle ?

29. Derive an expression for the temperature of sun in terms of solar constant.
30. Two stars A and B emit radiations of maximum wavelength 300 nm and 400 nm respectively. Find the ratio of their temperatures.
31. One mole of oxygen gas expands isothermally to four times its initial volume. Calculate the increase in entropy.

(6 x 4 = 24 Marks)

SECTION – D

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

32. Distinguish between isothermal and adiabatic processes. Obtain an expression for the work done in an adiabatic process.
33. Describe an experiment with necessary theory to determine the thermal conductivity of a poor conductor by Lee's disc method.
34. Discuss the construction and working of a petrol engine and obtain an expression for its efficiency.
35. Briefly explain the concept of entropy. Draw the T – S diagram for a Carnot's cycle and derive the expression for efficiency of the Carnot's engine.

(2 x 15 = 30 Marks)

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