

Sl. N<sup>o</sup>.

**Total No. of Pages : 3**

**IV Semester B.Sc. Examination, June/July - 2024**

**(Semester Scheme) (NEP)**

**PHYSICS (DSC) (Paper - IV)**

## Thermal Physics and Electronics

**Time : 2½ Hours**

**Max. Marks : 60**

**Instruction :** Answer any one question Each Part-A, Part-B Part-C and Part-D and answer any four from Part-E.

**PART - A**

1.
  - a) What are thermodynamic variables? [2]
  - b) Derive an expression for work done by a gas during adiabatic expansion. [5]
  - c) Distinguish between reversible and irreversible process. [3]
2.
  - a) Explain with a diagram the working of Carnot engine. [6]
  - b) Distinguish between isothermal and adiabatic process. [4]

**PART - B**

3.
  - a) Define internal energy of a thermodynamic system. [2]
  - b) What is degree of freedom? Explain. [3]
  - c) Derive the relation  $C_p - C_v = R$  using Maxwell thermodynamic relations. [5]
4.
  - a) Explain black body radiation. [2]
  - b) Explain the concept of energy density and pressure of radiation. [4]
  - c) State : [4]
    - i) Wien's displacement law
    - ii) Stefan - Boltzmann law

**P.T.O.**

PART - C

5. a) What is PN Junction. Explain its I-V characteristic in forward and reverse bias. [4]  
b) With neat circuit diagram explain the construction and working of full wave rectifier. [6]
6. a) Discuss the input and output characteristics of a common base configuration of BJT. [6]  
b) Draw the symbol of : [2]  
i) n-p-n and  
ii) p-n-p transistor  
c) What is an amplifier? [2]

PART - D

7. a) Explain inverting configuration of an op-amp. [4]  
b) What is binary number system? [2]  
c) Write logic symbol and truth table for [4]  
i) NAND and  
ii) NOR gate
8. a) State and explain De-morgan's theorems [4]  
b) Explain Digital wave form with diagram [2]  
c) Convert : [4]  
i)  $(376)_8$  into decimal  
ii)  $(0.875)_{10}$  into binary number

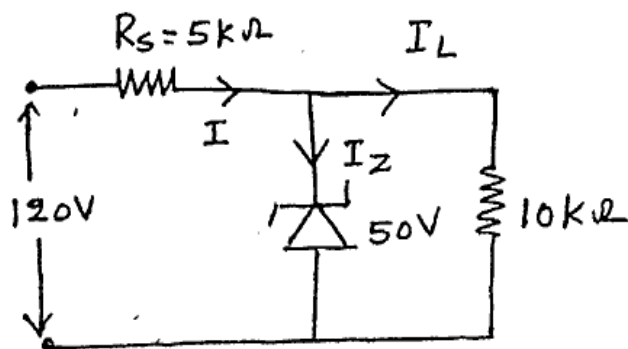
PART - E

9. The efficiency of Carnot engine is 60% when the temperature of the sink is  $500^\circ\text{K}$  find the temperature of the source? [5]
10. Calculate the radiant energy of a black body at a temperature : [5]  
a)  $400^\circ\text{K}$  and  
b)  $4000^\circ\text{K}$  ( $\sigma = 5.672 \times 10^{-8} \text{W/m}^2$ )

11. For the circuit shown in figure find :

[5]

- the output voltage
- the voltage drop across  $R_s$
- the current through zener diode.



12. For the circuit of inverting amplifier,  $R_f = 100k\Omega$ ,  $R_i = 10k\Omega$  and  $V_i = 1V$ . calculate.

[5]

- Current ( $I$ )
- $V_o$  (output)
- Closed loop gain

13. Calculate the RMS velocity of oxygen at 327K. Given the molecular weight of oxygen are  $32 \times 10^{-3} \text{ kg}$  and  $R = 8.31 \text{ Jk}^{-1}$ .

[5]

14. Convert the following decimal numbers to binary numbers :

[5]

- 43
- 4096

