HI-003-2014002

Second Year B. Sc. (Sem.-IV) (W.E.F. 2019)
Examination
April - 2023
Physics : Paper-401
Thermodynamics & Electronics
(New Course)

Faculty Code : 003
Subject Code : 2014002

Time : $2\frac{1}{2}$ Hours / Total Marks : **70**

1 (a) Give the correct answers of following questions :   **4**
     (1) What is the value of "J" ?
     (2) Eq. of the thermal efficiency of the Engine.
     (3) Mayer's formula.
     (4) Heat capacity per unit mass is known as _____.

   (b) Solve any one :   **2**
     (1) Find the efficiency of Carnot's engine working between 227°C and 177°C.
     (2) Calculate the efficiency of the Carnot's engine working between the steam point and the ice point.

   (c) Answer any one :   **3**
     (1) An inventor claims to have developed an engine working between 100°C and 0°C capable of having an efficiency of 30%. Comment and find real efficiency of engine.
     (2) Write note on heat.

   (d) Answer any one in detail :   **5**
     (1) Write note on heat engine.
     (2) Write note on porous plug.

2 (a) Give the correct answers of following questions :   **4**
     (1) For a perfect gas PV = _____
     (2) All natural processes take place in universe are reversible. (True/False)
     (3) At absolute zero temperature, the entropy tends to zero. (True/False)
     (4) According to Stefan's law Heat Energy E = _____.

(b) Solve any one : **2**

(1) Calculate the increase in entropy when 40 gm of water at 100°C is converted into vapour at same temp. Latent heat of water = 2.27 ×10³ Joule/gm.

(2) Calculate the surface temperature of the Sun. Given that λ_m = 4753 $\overset{\circ}{A}$, being wavelength of Maximum intensity of emission (with the help of Wien's law) constant = 0.2898 c.m. K.

(c) Answer any one : **3**

(1) Calculate the change in entropy when 5 kg of water at 373 K is converted into steam at the same temp. Latent heat = 540 cal/gm.

(2) Describe the Wien's displacement law.

(d) Answer any one in detail : **5**

(1) Explain in detail T-S diagram.

(2) Write a short note on Black Body Radiation.

3 (a) Give the correct answers of following question : **4**

(1) Write Maxwell's Second thermodynamical relation.

(2) The first latent heat equation is $\dfrac{dP}{dT} = \dfrac{L}{T\left(V_2 - V_1\right)}$. (True/False)

(3) Enthalpy remain constant in a reversible Isobaric adiabatic process. (True/False)

(4) What is enthalpy ?

(b) Solve any one : **2**

(1) At 373 K, 1 gm of water occupies 1601 cm³ on evaporation. Calculate latent heat of steam if $\dfrac{dP}{dT}$ = 35985 dyne/cm²K.

(2) Calculate the change in boiling point of water when the pressure is increased by 1 atmosphere. Boiling point of water is 373 K. Specific volume of steam = 1.671 m³ kg⁻¹ and latent heat of steam 2.268 ×10⁶ J·kg⁻¹.

(c) Answer any one : 3

(1) Calculate under what pressure water will boil at 150°C if the change in specific volume when 1 gram of water is converted into steam is 1676 c.c. Given latent heat of vaporization of steam = 540 cal/gm, $J = 4.2 \times 10^7$ erg/cal and one atmosphere pressure = 10^6 dyne/cm^2.

(2) Derive first Tds equation.

(d) Answer any one in detail : 5

(1) Derive specific heat equation $C_p - C_v = R$.

(2) Write a short note on Joule - Thomson effect.

4 (a) Give the correct answer of following question : 4

(1) Write the full form of UJT.

(2) Draw the symbol of n-channel JFET.

(3) Draw the symbol of NAND gate.

(4) Transistor is used to construct NOT gate (True/False)

(b) Solve any one : 2

(1) The transfer characteristic of a JFET reveals that when $V_{GS} = -20$ V, $I_D = 8$ mA determine the value of R_S.

(2) Convert decimal to Binary :

(i) $(13)_{10}$ = _____

(ii) $(49)_{10}$ = _____

(c) Answer any one : 3

(1) Convert Binary to decimal :

(i) $(110011)_2$ = _____

(ii) $(1110001)_2$ = _____

(iii) $(10101101)_2$ = _____

(2) Discuss the OR gate in detail.

(d) Answer any one in detail : 5

(1) Discuss in detail NAND gate as universal gate.

(2) Discuss the working and construction of JFET.

5 (a) Give the correct answer of following questions : 4

(1) Oscillators can produce Sin and non-sin wave both. (True/False)

(2) In phase shift oscillator, the equation of frequency is

$$f_o = \frac{1}{2\pi\sqrt{6}R_c}. \text{ (True/False)}$$

(3) In Wein bridge oscillator, the equation of frequency is

$$f_o = \frac{1}{2\pi\sqrt{R_1\,R_2\,C_1\,C_2}}\,.$$ (True/False)

(4) An oscillator convert d.c. power into _____ .

(b) Solve any one :   **2**

    (1) Find the frequency of phase shift oscillator, where R $10^6\,\Omega$ and value of capacitor is 68×10^{-12} F.

    (2) Find the frequency of Wein Bridge oscillator, where $R_1 = R_2 = R = 51\,k\Omega$ and $C_1 = C_2 = C = 0.001 \times 10^{-6}$ F.

(c) Answer any one :   **3**

    (1) The value of Capacitor of a Wein bridge oscillator is $C_1 = C_2 = C = 0.001\ \mu F$. Find the value of resistor to produce 3121 Hz frequency (Value of $R_1 = R_2 = R$).

    (2) Explain Positive feedback and Negative feedback.

(d) Answer any one in detail :   **5**

    (1) Explain Hartley Oscillator with a neat diagram.

    (2) Explain Owen's bridge.

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