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MAX-003-1014002 Seat No. _____

B. Sc. (Physics) (Sem. IV) Examination

March / April - 2018

Wave Optics - Semiconductor Devices

(New Course)

Faculty Code : 003
Subject Code : 1014002

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

Instructions : (1) All questions are compulsory.
(2) Symbols have their usual meaning.
(3) Figures on right side indicates full marks.
(4) Student can use non-programmable calculator.

1 (a) Answer the following questions in short : **4**

(1) Define first law of thermodynamics.

(2) Define efficiency of heat engine.

(3) If heat is added to the system its temperature must be decreased. (True/False)

(4) What is the unit of C_p OR C_v ?

(b) Answer any one of the following question : **2**

(1) Carnot's engine has the same efficiency between $1000K$ and $500K$ and between "X" K and $1000K$. Calculate "X", the temperature of sink.

(2) Calculate the efficiency of the Carnot's engine working between the $373K$ and $273K$.

(c) Answer any one of the following question : **3**

(1) A refrigerator has to transfer an average of 200 joules of heat per sec. from temperature $263K$ to $300K$. Calculate (W) the average power consumed. Assuming ideal reversible cycle and no other losses.

(2) Describe concept of heat.

(d) Answer any one of the following question in detail: **5**

(1) Write note on heat engine.

(2) Explain working and results of porous-plug experiment.

2 (a) Answer the following questions in short : **4**

(1) What is the unit of entropy.

(2) SI unit of Stefan's constant is _____

(3) Define change of entropy (ds) in equation form.

(4) The entropy remains constant in reversible process but increase in irreversible process. (True/False)

(b) Answer any one of the following question : **2**

(1) Calculate the increase in entropy of 10 kg of water at 100 °C when it changes to vapour. [Latent heat of vapour (L) = 540 cal/gm]

(2) Compare the radiant emittance of a black body at $300K$ and $3000K$ given.

(c) Answer any one of the following question: **3**

(1) Two ideal black bodies X and Y at temperatures 500K and 600K respectively are placed in an evacuated enclosure whose walls are blackened and kept at 300K. Compare their rates of loss of heat.

(2) Discuss: Entropy.

(d) Answer any one of the following question in detail: **5**

(1) Write notes on T-S diagram.

(2) Explain Kirchhoff's law.

3 (a) Answer the following questions in short : **4**

(1) Maxwell's first relation is $\left(\frac{\partial T}{\partial V}\right)_S$ = _____

(2) What is the equation of enthalpy H ?

(3) Write the mathematical form of Stefan's law?

(4) What is difference between C_p and C_v ?

(b) Answer any one of the following question : **2**

(1) Calculate the change in boiling point of water when the pressure is increased by 10^5 Pa. Boiling point of water is 373 K. Specific volume of steam is 1.671 m^3/kg and latent heat of steam is 2.268×10^6 J/Kg.

(2) Calculate under what pressure ice would freeze at 272 K, if the change in specific volume when lkg of water freezes in to ice is 91×10^{-6} m^3. [Latent heat of ice = 3.36×10^5 J/Kg and 1 atmosphere pressure = 10^5 N/m^2]

(c) Answer any one of the following question : **3**

(1) Water boils at a temperature of 101 °C at a pressure of 78.7 cm of Hg. 1 gm of water occupies 1601 cm^3 on evaporation. Calculate the latent heat of steam. [J = 4.2×10^7 erg/cal]

(2) Derive Maxwell second relation.

(d) Answer any one of the following question in detail : **5**

(1) Write a short note on specific heat equation.

(2) Describe Joule-Thomson effect and Joule-Thomson Co-efficient.

4 (a) Answer the following questions in short : **4**

(1) LED emits no light when reverse biased. (True/False)

(2) Draw the symbol of photodiode.

(3) What is the Full Form of FET.

(4) Draw the symbol of OR Gate.

(b) Answer any one of the following question : **2**

(1) Convert the following binary number in to decimal number $(110011)^2$.

(2) Convert the following decimal number in to binary number $(49)_{10}$

(c) Answer any one of the following question: **3**

(1) Prove that $\overline{A \cdot B} = \overline{A} + \overline{B}$ by using truth table.

(2) Explain in brief LED.

(d) Answer any one of the following question in detail: **5**

(1) Discuss the construction and working of JFET.

(2) Write the principle, construction and working of solar cell.

5 (a) Answer the following questions in short : **4**

(1) The Q-factor is the measure of voltage magnification for acceptor circuit. (True / False)

(2) At resonance what is the phase difference between current and applied ac voltage for LCR series circuit.

(3) Accept in special cases, all ac bridges involve a double balance. (True / False)

(4) How many stages of amplifier used in phase shift oscillator?

(b) Answer any one of the following question : **2**

(1) What is the resonance frequency of a series LCR Circuit if L = 200×10^{-6} H and C = 200×10^{-12} F.

(2) A phase shift oscillator having R = $10^6 \Omega$. Find the value of capacitor to produce 954 Hz frequency.

(c) Answer any one of the following question: **3**

(1) An ac circuit consists of a 2200 resistance and a 0.7 H inductance connected in series with 220 V and 50 Hz ac source. Find the impedance and current following in the circuit.

(2) Write a short note on phase shift oscillator.

(d) Answer any one of the following question in detail: **5**

(1) Explain the construction and working of Hartley Oscillator.

(2) Explain in detail LCR series circuit.
