2021

Time : 3 hours

Full Marks : 100

Pass Marks : 45

Candidates are required to give their answers in their own words as far as practicable.

The questions are of equal value.

*Answer **five** questions selecting, at least **one** from each Group in which Q. No. 1 is compulsory.*

1. Select the correct answer from the given alternatives :

   (a) Maxwell-Boltzmann law is for the :

      (i) Distinguishable particles

      (ii) Indistinguishable particles

      (iii) Particles with half integral spin

      (iv) Particles of integral spin

   (b) Phase space is a :

      (i) 3-dimensional space

(ii) 4-dimensional space

(iii) 5-dimensional space

(iv) 6-dimensional space

(c) Maxwell-Boltzmann statistics cannot be applied to :

(i) Atom

(ii) Molecule

(iii) Photons

(iv) Lattice

(d) The ratio of rms velocity and most probable velocity is :

(i) $\sqrt{3} : \sqrt{2}$

(ii) $\sqrt{2} : \sqrt{3}$

(iii) 5 : 2

(iv) 2 : 5

(e) The average K. E. associated with each degrees of freedom is :

(i) KT

(ii) 2KT

(iii) $\frac{1}{2}KT$

(iv) $\frac{1}{4}KT$

(f) The density of molecules is maximum at which temperature ?

(i) V_{rms}

(ii) V_p

(iii) V_{mean}

(iv) None of these

(g) Bose-Einstein statistics can be applied to :

(i) Electrons

(ii) Photons

(iii) Fermions

(iv) Proton

(h) Helium shows Bose-Einstein condensation below what temperature ?

(i) 100k

(ii) 12.5 k

(iii) 2.13 k

(iv) 6.18 k

(i) Black Holes are :

(i) Dead Star

(ii) Old supenova

(iii) Strong Nabulas

(iv) Dead planet

(j) A FET is a :

(i) Unipolar transistor

(ii) Bipolar transistor

(iii) Tripolar transistor

(iv) None of these

(k) A diode which has zero breakdown voltage, is known as :

(i) Zener diode

(ii) Schottky diode

(iii) Tunnel diode

(iv) Backward diode

(l) The material used for the construction of LED is :

(i) Ge

(ii) Si

(iii) GaASP

(iv) None of these

(m) The ideal value of stability factor is :

(i) 1

(ii) 10

(iii) 100

(iv) 1000

(n) The final stage of an amplifier uses :

(i) R-C Coupling

(ii) Transformer Coupling

(iii) Direct Coupling

(iv) None of these

(o) For amplification of very low frequency signal, the most appropriate amplifier is :

(i) R-C Coupled amplifier

(ii) Transfermer-coupled amplifier

(iii) Direct-coupled amplifier

(iv) None of these

(p) The output voltage of a bridge rectifier is :

(i) Sin wave

(ii) Full wave signal

(iii) Cosine wave

(iv) Half wave signal

(q) Digital circuits can be made by repetitive use of :

(i) OR gates

(ii) AND gates

(iii) NAND gates

(iv) NOT gates

(r) A binary half adder is a :

(i) 2-bit adder

(ii) 1-bit adder

(iii) Performs arithmetical addition

(iv) Has an output

(s) The resistance of a loudspeaker is usually :

(i) A few ohms

(ii) A few hundred ohms

(iii) A few kilo ohm

(iv) A few of mega ohm

(t) The principal methods electron emission ore :

(i) Thermonic emission

(ii) Field emisison

(iii) Photo emission

(iv) All of these

Group – A

2. State and prove Liouville's theorem.

3. Derive Fermi-Dirac distribution law.

4. Give an account of Bragg-William Theory of Using model.

5. Write notes on any **two** of the folllwoing :

(a) Fundamental assumptions of statistical mechanics

(b) Entropy of perfect gas

(c) Grand canonical ensemble

(d) Pertition function

Group – B

6. What is thermionic emission and work function ? Derive Richardson's equation for thermionic emission.

7. State and prove Norton's and Reciprocity theorems for electronic network.

Group – C

8. Sketch a Hartly oscillator circuit and explain its action. Derive an exoression for the frequency of the oscillator.

9. Draw the circuit diagram of an astable multivibrator and explain its operation with the help of wavegones.

10. Define OR, AND, NOR and NAND gates. Write down truth tables and Boolean expression of sub-gates.