



11621

B.Sc. VI Semester Degree Examination, May/June 2016
PHYSICS

Paper – 6.1 : Statistical Physics and Solid State Physics

Time : 3 Hours

Max. Marks : 80

- Instructions :** 1) Section – I is compulsory.
2) Answer **any four** questions **each** from Section – II and from Section – III.

SECTION – I

1. Answer **any twelve** of the following. (12×1=12)

A) Choose the correct answer :

i) Example for fermian

- a) electron b) proton c) neutron d) all these

ii) Astronomical distances are measured in

- a) Light year b) Par-sec
c) Astronomical unit d) All these

iii) For a crystal if $a = b \neq c$, then the crystal is

- a) Tetragonal b) Hexagonal
c) Either (a) or (b) d) Neither (a) nor (b)

iv) Susceptibility of diamagnetic substance is to

- a) Absolute temperature
b) Square root of absolute temperature
c) Square of absolute temperature
d) None of these

B) Fill in the blanks :

i) _____ statistics is applicable to gas molecules.

ii) The number of atoms per unit cell in a simple cubic crystal is _____

iii) Miller indices of a set of parallel planes having equal intercepts on X, Y and Z axes is _____

iv) Critical temperature of super conductor _____ with impurity.



C) State **true** or **false** :

- i) Fermions obey Pauli's exclusion principle.
- ii) Holes are not found in conduction band.
- iii) Super conductors exhibit Paramagnetism.

D) Answer the following in **one** or **two** sentences :

- i) What are Bosons ?
- ii) Define Fermi energy.
- iii) Define mobility of charge carriers in solids.
- iv) Define critical magnetic field in superconductor.

SECTION – II

(4×4=16)

2. Explain canonical and micro canonical ensemble.
3. Write a note on H R diagram.
4. Describe KCl crystal with a neat diagram.
5. Explain briefly the classification of conductors, semiconductors and insulators based on band theory.
6. Explain Meissner's effect in superconductors.
7. Give the assumptions of classical free electron theory of metals.

SECTION – III

8. a) What are the assumptions made by Bose-Einstein statistics ? Derive equation for B-E distribution law.
- b) How does F-D statistics differ from B-E statistics ?

(9+4)



10. a) Derive Bragg's relation $2d \sin\theta = n\lambda$.
- b) Describe the construction and working of Bragg's spectrometer.
- c) Ni has fcc structure with lattice constant 3.52 Å. Calculate the interplanar spacing for (i) (101) planes, (ii) (123) planes and (iii) (320) planes. (4+5+4)
11. a) Derive an expression for electron concentration in an intrinsic semiconductors.
- b) The Hall co-efficient of a specimen of a doped silicon is found to be $2.66 \times 10^{-4} \text{ m}^3/\text{coulomb}$. The resistivity of the specimen is $8.93 \times 10^{-3} \text{ ohm-m}$. Find the mobility and density of the charge carrier, assuming single carrier conduction. (9+4)
12. a) Explain classical theory of paramagnetism.
- b) Write any four properties of paramagnetic materials. (9+4)
13. a) Explain type I and type II superconductors.
- b) Super conducting tin (Sn) has a critical temperature of 3.7 K at zero magnetic field and a critical field of 0.0306 tesla at 0 K. Find the critical field at 2.5 K. (9+4)
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11622

B.Sc. Sixth Semester Degree Examination, May/June 2016
PHYSICS

Paper – 6.2 : Network Theorems, Optoelectronics and Electronics

Time : 3 Hours

Max. Marks : 80

- Instructions :** 1) Section – I is **compulsory**.
2) Answer **any four** questions **each** from Section – II and from Section – III.

SECTION – I

1. Answer **any twelve** of the following : (12×1=12)

A) Choose the correct answer :

- i) Decimal equivalent of binary number 11111_2 is
 - a) 27
 - b) 29
 - c) 31
 - d) 33
- ii) The common emitter input characteristics are the plots of
 - a) V_{CE} versus I_C at constant I_B
 - b) V_{CB} versus I_C at constant I_E
 - c) V_{CE} versus I_E at constant V_{BE}
 - d) V_{BE} versus I_B at constant V_{CE}
- iii) Negative feedback is used in
 - a) Rectifier
 - b) Oscillator
 - c) Amplifier
 - d) Detector
- iv) The value of noise in AM when compared to FM is
 - a) Zero
 - b) Less
 - c) More
 - d) None of the above

B) Fill in the blanks :

- i) The collector of transistor is _____ than the emitter.
- ii) The _____ current of F.E.T. is practically zero.
- iii) In FM, the _____ of the carrier is changed and not its _____.
- iv) L.E.D. means _____.



C) State true or false :

- i) F.E.T. is a three terminal device.
- ii) The frequency response curve is a graph of voltage gain versus input current.
- iii) In FM, modulation index cannot be greater than unity.

D) Answer the following in **one** or **two** sentences :

- i) Define angle of acceptance.
- ii) What is a full adder ?
- iii) Define thermal runaway.
- iv) What is biasing ?

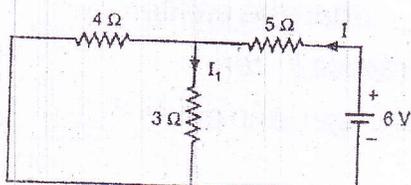
SECTION – II

(4×4=16)

2. Mention the applications of optical fiber.
3. Explain the construction and working of AND gate using diodes.
4. How will you determine the input and output characteristics of a transistor in CE configuration ?
5. Derive an expression for voltage gain of an inverting amplifier.
6. Describe the construction of L.E.D.
7. Explain the modes of propagation of light through an optical fiber.

SECTION – III

8. a) State and prove superposition theorem. 9
- b) Using Thevenin's theorem, determine the current flowing through R_L of the network shown in the following figure. 4





9. a) What is a flip-flop ? Describe the construction and working of RS flip-flop. 9
b) How do you convert NAND gate into basic gates. 4
10. a) What is MOSFET ? How many types of MOSFETs are there ? Briefly outline the action of a MOSFET of any type. 9
b) In a transistor, the base current is 0.08 mA and the emitter current is 9.6 mA. Find (i) collector current, (ii) α and (iii) β . 4
11. a) Draw the h parameter model for a transistor in CE configuration. Derive the expressions for the voltage gain, current gain, input and output impedance. 9
b) An amplifier has a gain of 800. When the feedback is applied the gain is reduced to 150. Find the feedback ratio. 4
12. a) Draw a neat circuit diagram of Wien bridge oscillator and explain briefly its working. Give an expression for frequency in terms of the circuit elements. 9
b) A phase shift oscillator using transistor has parameter values $R = 2.2 \text{ k}\Omega$, $C = 0.1 \mu\text{F}$. Calculate the frequency of oscillation. 4
13. a) Give the theory of frequency modulation. What are the advantages of frequency modulation over amplitude modulation ? 9
b) A sinusoidal carrier voltage of 80 volt amplitude and 1 MHz frequency is amplitude modulated by a sinusoidal voltage of frequency 5 kHz producing 50% modulation. Calculate the amplitude and frequency of lower and upper side bands. 4
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