Mark Scored:

KATHMANDU UNIVERSITY
End Semester Examination [C]
May/June, 2019

Level : B. E.
Year : II
Course : EEEG 207
Semester : I

Exam Roll No. :
Time: 30 mins.
F. M. : 20

Registration No. :
Date : 02 JUN 2019

SECTION "A"
[20 Q × 1 = 20 marks]

Choose the most appropriate option

1. The critical temperature of the superconductor, Mercury is _____
   a. 1.2K b. 2.2K c. 3.2K d. 4.2K

2. The packing efficiency of a body centered cubic unit cell is _____
   a. 68% b. 74% c. 52% d.48%

3. If λ, m, v, represent wavelength, mass, velocity respectively of an electron, which of the following expression represents the de Broglie equation?
   a. $\lambda = hv/m$ b. $\lambda = h/mv$ c. $\lambda = mv/h$ d. $\lambda = m/hv$

4. The magnetic susceptibility of a perfect diamagnetic substance is_____
   a. Negative b. Zero
   c. Positive and low value d. Positive and high value

5. If $\vec{E}, \vec{V}, \mu$ represent the electric field applied, drift velocity and mobility, which of the following expression provides the relation between the drift velocity and mobility of electron?
   a. $\vec{V} = \mu\vec{E}$ b. $\vec{V} = \mu/\vec{E}$ c. $\vec{V} = \mu - \vec{E}$ d. $\vec{V} = \mu + \vec{E}$

6. The position of Fermi level in intrinsic semiconductor is _____
   a. $E_F = \frac{E_c . E_v}{2}$ b. $E_F = 2(E_c + E_v)$ c. $E_F = \frac{E_c - E_v}{2}$ d. $E_F = \frac{E_c + E_v}{2}$

7. What is the process of producing electric dipoles inside the dielectric by an external electric field?
   a. Magnetization b. Polarization c. Piezoelectricity d. Ferroelectricity

8. Piezoelectric transducer consists of _____
   a. Copper rod b. Aluminum c. Gold crystal d. Quartz crystal

9. Etching in IC fabrication is used for _____
   a. Selective removal of surface b. Cleaning
   c. Interconnection d. Protection

10. The presence of parallel alignment of magnetic dipole moment is given by which materials?
a. Diamagnetic b. Ferromagnetic c. Paramagnetic d. Antiferromagnetic

11. The responsivity of a photodiode having quantum efficiency of 1% at 0.8μm is _____
a. 6.4mA/w b. 4.5 mA/w c. 2.4mA/w d. 0.4mA/w

12. Example for magnetic material used in data storage devices is _____
a. Permalloy b. C_rO_2 c. Cunife d. Alnico

13. The lowest energy of an electron confined to move in one dimensional potential box of length $1A^0$ is _____
a. 27.01eV b. 37.51eV c. 47eV d. 57.31eV

14. If a photon of energy 1.53×10^{-19} J is incident in a photodiode resulting in a photocurrent of 6.5μA and given that the optical power falling on the diodes is 10μW. The quantum efficiency is given by _____
a. 62% b. 50% c. 70% d. 50%

15. If L is the length of the finite potential box, the energy of an electron moving in a finite barrier potential is inversely proportional to _____
a. L b. $\sqrt{L}$ c. $L^{1.5}$ d. L^2

16. What should be the energy of an electron so that the associated electron waves have wavelength of 600nm?
a. 2.1×10^{-6} eV b. 4.8×10^{-6} eV c. 6.8×10^{-6} eV d. 8.8×10^{-6} eV

17. In which regions does BJT act like switch?
a. Reverse active and cut off b. Cut off and forward active
c. Saturation and active d. Cut off and saturation

18. A uniform silver wire has a resistivity of 1.54×10^{-18} ohm/m at room temperature. For an electric field along the wire of 1 volt/cm. The mobility, assuming that there are 5.8×10^{28} conduction electrons/m^3 is _____
a. 1.54 m^2/Vs b. 6.9973m^2/Vs
c. 6.9973×10^{-3} m^2/Vs d. 0.69973 m^2/Vs

19. Optical masking in IC fabrication process is done for _____
a. Protection b. Cleaning c. Interconnection d. Pattern transfer

20. Varactor diodes are used in FM receivers to obtain _____
a. Automatic frequency control b. Automatic noise control
c. Automatic gain control d. Automatic volume control

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Semester : I
F. M. : 55

SECTION "B"
[5 Q × 11 = 55 marks]

Attempt *ANY FIVE* questions. Figure in the margin indicates the full mark. **Symbols have their usual meaning**. Students are required to answer in their own words as far as practicable.

1.
a. Find the relationship between the edge length of cube and atomic radius for face centered cubic unit cell (BCC). Also find the packing fraction for BCC structure. [5]
b. Write the names of most commonly used superconductors. Explain about the superconductivity, types of super conductors and their applications. [6]

2.
a. How is classical mechanics different from the quantum mechanics? Describe with some examples. [3]
b. Derive an expression for time dependent Schrodinger equation and also write the significance of this Schordinger equation. [5]
c. Determine the critical temperature and critical field at 4.2 K for a super conductor if the critical fields are 1.41×10^5 Am^{-1} and 4.204×10^5 Am^{-1} at 14.1 K and 12.9 K respectively. [3]

3.
a. How does a photodiode work? Explain with the help of figure. [3]
b. What is wafer? With reference to a semiconductor device, describe the integrated circuit fabrication process in detail. [6]
c. A sample of Si, doped with 10^{17} pentavalent atoms per cm^3. If width of conductor is 100μm, magnetic field strength is 10^{-5} Wb/cm^2, current density is 1 mA/cm^2 and mobility is equall to $700cm^2$. Find its resistivity and Hall volage. [2]

4.
a. Show that electron energy is quantized for an electron moving in a finite potential barrier. [5]
b. How is electricity produced by using fast breeder nuclear reactor? Explain with the help of suitable diagram. [6]

5.
a. With the help of a relevant figure, derive an expression that locates the position of Fermi level in an intrinsic semiconductor. [5]
b. Differentiate between the ferroelectricity and piezoelectricity. Also mention some ferroelectric materials and piezoelectric materials along with their applications. [4]
c. Briefly describe the optical properties of silica glass. [2]

6.

a. Write the properties and applications of composite materials in electrical engineering perspective. [3]

b. Calculate the energy relative to the Fermi energy level for which Fermi function equals to 5%. Write answer in K_BT where K_B is Boltzmann constant and T is the absolute temperature. [2]

c. Write short notes on: [3 × 2]

   i. Curie-Weis law

   ii. Tunnel diode