KATHMANDU UNIVERSITY
End Semester Examination [C]
November, 2018

Marks scored:

Level : B.E.
Year : II

Course : EEEG 207
Semester: I

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

Registration No.: Date : NOV 16 2018

SECTION "A"

[20 Q × 1 = 20 marks]

Choose the most appropriate option. Symbols have their usual meaning.

1. Fiber reinforced plastic is ______________
   a. Metal b. Ceramic c. Semiconductor d. Composite

2. The total number of atoms in simple cubic unit cell is given by ___________
   a. 1 b. 4 c. 6 d. 8

3. Which of the following represents the Schordinger wave equation in time independent form?
   a. $\Delta^2 \psi + \frac{m\pi^2}{h^2}(E-V)\psi = 0$ b. $\Delta^2 \psi + \frac{8m\pi^2}{h^2}(E-V)\psi = 0$
   c. $\Delta^2 \psi + \frac{8\pi^2}{h^2}(E-V)\psi = 0$ d. $\Delta^2 \psi + \frac{8m}{h^2}(E-V)\psi = 0$

4. Which of the following expression relates the edge length (A) of the cube and the atomic radius (R) of FCC structure?
   a. $A = 2R$ b. $A = 2\sqrt{R}$ c. $A = \sqrt{2}\,R$ d. $A = \sqrt{8}\,R$

5. Which of the following compound best suits as an electrolyte in alkali fuel cell?
   a. NaOH b. $Ca(OH)_2$ c. KOH d. $Mg(OH)_2$

6. 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

7. The tunnel diode exhibits special characteristic known as____________
   a. Positive resistance b. Positive reactance
   c. Negative reactance d. Negative resistance

8. The drift velocity of free electrons with mobility of 3.5×10^{-3} m^2/Vs in copper for an electric field strength of 0.5 V/m is ________
   a. 3.5 m/s b. 1.75×10^{3} m/s c. 11.5 m/s d. 1.75×10^{-3} m/s

9. Assuming the number of electron per meter cube is 5×10^{12}, the position of Fermi level at room temperature (27^0c) for a germanium crystal is _______________
   a. 0.36 eV b. 0.1 eV c. 0.56 eV d. 0.75 eV

10. 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

11. The temperature at which conductivity of a material becomes infinite is called ________

a. Crystallization temperature
b. Mean Temperature
c. Absolute temperature
d. Critical temperature

12. The electrons in conduction bands are free to ____________

a. Transport vibration
b. Transport signals
c. Transport charge
d. Transport impulse

13. In IC fabrication process, oxidation is used for __________

a. Metallization
b. Diffusion
c. Conductivity
d. Isolation

14. The superconducting state is perfectly _____ in nature.

a. Diamagnetic
b. Paramagnetic
c. Ferromagnetic
d. Ferrimagnetic

15. Which of the following material is an example for piezo-electric material?

a. Rochelle salt
b. Lead zirconate
c. Potassium niobate
d. Barium Titanium oxide

16. Polarization which can occur in water is _________

a. Magnetic
b. Electronic
c. Electrical
d. Ionic

17. The materials suitable for making electromagnets should have____________

a. High retentivity and high coercivity
b. Low retentivity and low coercivity
c. High retentivity and low coercivity
d. Low retentivity and high coercivity

18. Example for ferri-magnetic materials is____________

a. Salts of transition elements
b. Rare earth elements
c. Transition metals
d. Ferrites

19. If t is relaxation time, I_0 initial intensity of luminescence, I – fraction of luminescence after time, t, the intensity of luminescence is given as ____________

a. $I = I_0 \, e^{-\frac{T}{t}}$
b. $I = I_0 \, e^{-\frac{t}{T}}$
c. $I = I_0 \, e^{-2\frac{T}{t}}$
d. $I = I_0 \, e^{\frac{2T}{t}}$

20. At room temperature, an intrinsic silicon crystal acts approximately as________

a. A battery
b. A conductor
c. An Insulator
d. A semiconductor

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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) Compare the electrical, magnetic and chemical properties of copper, aluminum and tungsten. [5]

b) State the basic postulates of Schordinger wave equation. Also derive the time independent form of Schordinger wave equation. [6]

2)

a) Find the relationship between the edge length of cube and atomic radius for face centered cubic unit cell (FCC). Also find the packing fraction for FCC structure. [5]

b) For an electron moving in a finite potential well, show that electron energy is quantized. [6]

3)

a) Write the anode and cathode reaction in alkali fuel cell and explain the working principle of fuel cell. [6]

b) Elaborate the concept regarding the junction capacitance and junction diode switching times. [5]

4)

a) Explain the monolithic IC fabrication process in detail. [6]

b) Explain the construction, working principle and application of varactor diode. [3]

c) Copper has body centered cubic unit cell structure with lattice constant, 'a' = 3.61 Angstrom. Find the atomic radius. [2]

5)

a) Calculate the energy relative to the Fermi energy level for which Fermi function equal to 5%. Write answer in K_BT. [3]

b) State and explain the Curie –Wesis law. [4]

c) Differentiate between ferroelectricity and piezoelectricity with example. [4]

6)

a) Obtain an expression that locates the Fermi energy in n type semiconductor. Find the expression in terms of energy gap of the material. [6]

b) Write short notes on: [2×2.5=5]
   (i) Tunnel effect
   (ii) Superconductors