FE112

Total No. of Printed Pages:3

F.E. Semester-I (Revised Course 2007-2008)
EXAMINATION NOV/DEC 2019
Applied Science-I (Physics & Chemistry)

[Duration : Three Hours] **[Total Marks : 100]**

Instructions:
1) Answer one question from each module.
2) Answer the two Sections in separate answer books.
3) Assume additional data, if required.
4) Draw diagrams wherever required.

Planck's constant = 6.626×10^{-34} J − s
Electron charge =1.6×10^{-19}C
Boltzmann's constant=1.38×10^{-23}J/K
Electron mass=9.1×10^{-31}kg
Rydberg constant=1.097×10^{7}/m
Velocity of Light = 3×10^{8}m/s

Section –I (Physics) **(50 Marks)**

MODULE-I

Q.1 a) Derive an expression for the fringe width in a wedge shaped film in terms of wavelength and wedge angle. **(5)**

b) Obtain an expression for Conductivity and resistivity of an intrinsic semiconductor in terms of carrier mobility and carrier concentration. **(5)**

c) White light is incident on a thin film at an angle of 30°. The reflected light when observed with an spectroscope, two consecutive dark bands corresponding to wavelengths 5890 A° and 5790 A° are seen. Determine thickness of the thin film if its refractive index is 1.4. **(5)**

d) What are Newton's rings? How are they formed? Show that radii of dark Newton's rings are proportional to square root of natural numbers. Hence describe the method for determination of the wavelength of monochromatic light by Newton's rings method. **(10)**

Q.2 a) Give an account of Phase change due to reflection of light from the surface of a denser medium. Obtain necessary formula. **(5)**

b) The Hall coefficient of a doped silicon is found to be 3.66×10^{-4}m^3/c. The resistivity of sample is $8.93 \times 10^{-3}\Omega - m$. Determine the mobility and density of charge carriers. **(5)**

c) What are antireflection films? Explain phase and amplitude requirement in such films. **(5)**

d) What is a continuity equation? Derive an equation of continuity for excess carriers in a semiconductor. **(10)**

MODULE-II

Q.3

a) Describe four methods of detection of ultrasonic waves. **(5)**

b) Write a short note on magnetostatic focusing. **(5)**

c) Draw block diagram of CRO and mention its principle sections. Explain in brief application of CRO to determine amplitude of DC voltage. **(5)**

d) Write short notes on the following: **(10)**

i) Cavitation
ii) Ionization Chamber
iii) Electron Gun
iv) Echo sounding on the marine application

Q.4

a) A piezoelectric crystal of thickness 3 mm produces ultrasonic waves of frequency 400 kHz. Calculate the thickness of this crystal to produce ultrasonic waves of frequency of 500 KHz. **(5)**

b) Briefly explain the principle and working of ionization chamber. How does it differ from a proportional counter. **(5)**

c) Explain four properties of ultrasonic waves. Give an account of medical and Industrial applications of ultrasonic waves. **(5)**

d) Describe the principle and working of GM counter. Give an account of quenching in this counter. Mention the scientific application of GM counter. How does it differ from Proportional Counter and ionization Chamber. **(10)**

SECTION – II (Chemistry)
Module-III

Q5

a) Outline the construction of Glass electrode and illustrate how it can be used to find pH. **6**

b) With the help of a neat labeled diagram, explain the construction of Zn-air battery. **5**

c) Explain the working of Solid Oxide Fuel with the help of a neat labeled diagram. **5**

d) Construct a cell, write the cell reactions and calculate the emf of the cell. Given a Mg electrode, a Ni electrode 0.02 M $MgSO_4$ solution, 0.2M $NiSO_4$ solution and a salt bridge. (E° Mg= -2.37V and E°Ni= -0.23V) **5**

e) Define the terms
(i) E.M.F. series (ii) Reduction potential. **4**

Q6

a) Construct an electro chemical cell using the following constituents: Zn (E^0= -0.76V), Mg (E^0= -2.37V), $ZnSO_4$(0.1M), $MgSO_4$(0.01M) and a salt bridge. Calculate the E.M.F. of the working cell. Also write the Cell representation and the reactions involved. **6**

b) Give the construction and working of H_2-O_2 Fuel cell. **5**

c) With the help of a neat labeled diagram, explain the construction of Ni-MH battery. **5**

d) A copper rod is placed in 0.1M $CuSO_4$ solution at 298K. Write the electrode reaction and Nernst equation. Also calculate the standard electrode potential. Given E^0_{Cu}=0.34V. **5**

e) Explain any two characteristics of a battery system. **4**

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MODULE – IV

Q7.	a)	Outline the various factors due to nature of metal which affects the corrosion rate.	6
	b)	Explain the phenomenon of differential aeration corrosion with regard to pitting corrosion.	5
	c)	Explain the process of PCB preparation using electroless method.	5
	d)	Explain the process of electroplating with Chromium.	5
	e)	Explain how a metallic structure can be protected against corrosion by using metal coating.	4
Q8.	a)	With the help of neat labeled diagram explain Galvanic Corrosion.	6
	b)	Explain the wet corrosion taking place with the evolution of hydrogen gas.	5
	c)	Explain the process of electroplating an article with Chromium.	5
	d)	Outline the Various Constituents of electro – less plating bath with suitable examples.	5
	e)	What do you understand by the term 'Galvanization'.	4