Mansoura University Faculty of Science Department of Physics Course Code: Phys. 322 Title: Non-crystalline Solids		Second Semester (May 2015) Exam Type (Final): 3rd Year (Physics) Time: Two Hours Full Mark: 80 Mark

Answer the **first** question and **any other two**.

1- Discuss the electric conduction process in a glass of composition $25Li_2O$-$10CaO$-$65SiO_2$ and discuss the factors that affect it. [24 Mark]

2-a: Select the glass of higher electric conductivity in each case of the following. Give the basis for your choice. Compositions are given in (mol%).

i) $30B_2O_3$-$70SiO_2$ or $30CaO$-$70SiO_2$,
ii) $20Li_2O$-$80SiO_2$ or $20K_2O$-$80SiO_2$,
iii) $20Li_2O$-$80SiO_2$ or $10Li_2O$-$10Al_2O_3$-$80SiO_2$,
iV) $30Li_2O$-$70SiO_2$ or $15Li_2O$-$15K_2O$-$70B_2O_3$. [14 Mark]

b: The molecular mass of Li_2O is 29.88 g/mol and 60 g/mol for SiO_2. However, the density of Li_2O-SiO_2 glasses increases when increasing Li_2O content in the region ($0 < Li_2O \leq 33$ mol%). Can you explain? [14 Mark]

3-a: Explain how can the phonon vibration be determined in a polaronic conducting glass. [14 Mark]

b: Calculate the concentration of structural units in the glass $20Na_2O$-$10BaO$-$70SiO_2$ (mol%). (The density is 2.84 g/cm^3, molecular mass = 62 g/mol for Na_2O, 153 g/mol for Na_2O and 60 g/mol for SiO_2, Avogadro number is 6.022×10^{23} mol^{-1}). [14 Mark]

4-a: Calculate the concentration (per mole) of each type of structural units in a glass of the composition ($0.30CaO{\cdot}0.15Al_2O_3{\cdot}0.55SiO_2$). [14 Mark]

b: Write a short note on the structure of silicate and borate glasses. [14 Mark]

أطيب التمنيات: أ.د. حمدى دويدار

لجنة التصحيح: أ.د. حمدى دويدار - أ.د.

Mansoura University Faculty of Science Physics Department Subject: Physics		Second semester **Third level : Physics** **Date** JUNE **2015** Time allowed : 2 hours
Course : electronic circuits (Phy321)		Full Mark:: 80 Mark

Answer **The Following** Questions

1- a) Derive the condition required for stable biasing of the transistor circuit shown in figure (1-a).

b) The Zener diode used in the regulator circuit of figure (1- b) has the following data : I_{zk} =1 mA , I_{zM} = 540 mA , r_z =3 ohms and (V_z=15 volts at I_{zT}=160 mA) .Determine the output voltage V_{out} at I_{zk} and at I_{zM} then, determine the minimum value of R_L that can be used .

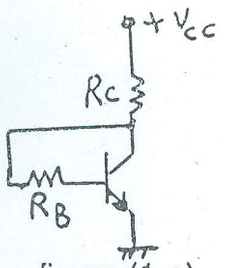

figure (1-a)

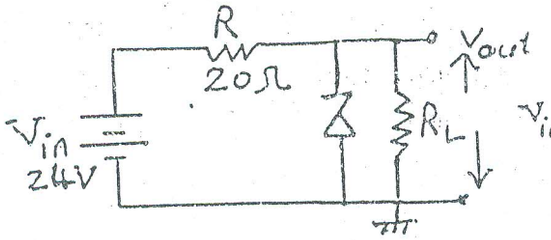

figure (1-b)

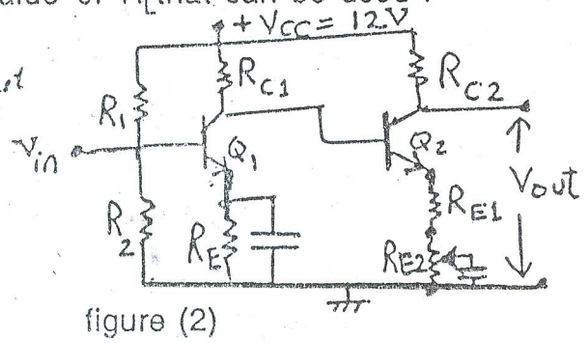

figure (2)

2- a) Derive an expression for the voltage gain of the non - inverting operational amplifier.

b) Determine the overall minimum and maximum gain of the two stage amplifier circuit shown in figure (2), where R_1 = 10 K, R_2 = 2.2 K , R_{C1} = 3 K , R_E = 650 ohm & R_{C2} =1 K , R_{E1}= 100 , R_{E2} = 0 To 900 ohm & $\beta_{dc} = \beta$ = 150.

3- a) Determine the minimum and maximum input voltage V_{in} that can be regulated using Zener diode circuit in figure (5) , given that I_{zk} =1 mA , I_{zm} = 15 mA , r_z =10 ohms and(V_z= 5.1 volts at I_{zk} =1 mA) ,then determine the change in the out put voltage when the input vogtage varies from the minimum to the maximum value .

b) Draw a circuit diagram of the internal cicuitry of a basic operational amplifier .

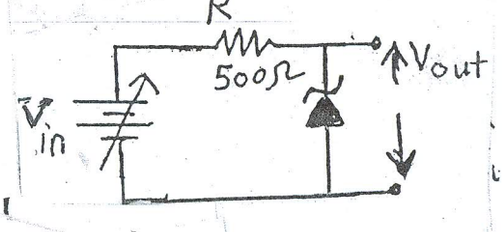

figure (3a)

4- a)Derive the condition required for stable biasing of the transistor circuit shown in figure (4-a).

b) Derive an expression for the output voltage of the operational amplifier circuit in figure (4-b) ,then determine the value of R which make the output voltage equal the average value of the input voltages

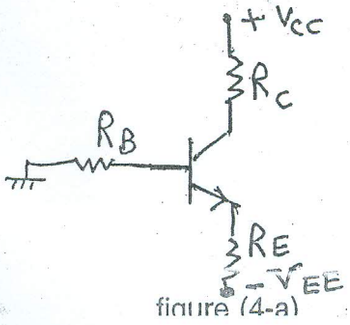

figure (4-a)

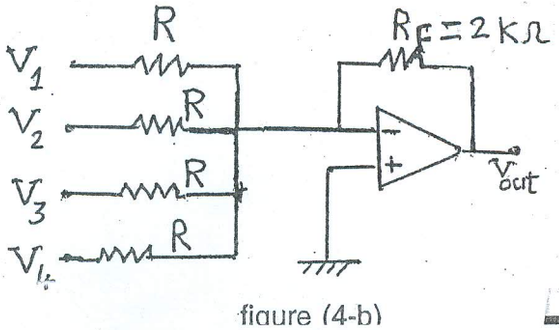

figure (4-b)

University of Mansoura Faculty of Science Physics Department Subject: Physics		Second Term Year : Physics –level 3 Date : May 2015 Time allowed : 2 hours
Course (s): Physics: Fine Magnetism		Full Mark:: 80 Marks

Answer **the following** Questions

1- Complete with the correct words and sketch diagrams represent the followings cases. [17 Marks]

1] ---------- have unpaired electrons in outer shell and ---------- electrons in the inner shells

b-The magnetic susceptoplity of any magnetic materials ----------with decreasing temperature.

c-Diamagnetic material is defined as ---------- d- The magnetization of ionic compounds is -------

e- Chemical shift interaction of shielded ^{29}Si nuclei is defined as --------- in terms of bridged bonds

f- Different characteristics of Ferromagnetic materials, particularly in terms of saturated its magnetization are ------- , -------- and ---------

g- Discuss the principles of :

NMR resonance – Up field shift of resonance frequency - Magnetic domains [12 Marks]

[2] a) write shortly on [15 Marks]

1- Negative magnetization 2- Paramagnetic and ferromagnetic orders.

3- Magnetic hysteresis and its applications- 4- Correlation between entropy and material structure 5- Features of magneto-caloric effect

b- List a diagram representing how NMR spectral signal could be obtained. [12 Mark]

[3] a- Give at least three examples for shielded and deshielded silicon nuclei. [8 Marks]

b -Write shortly on magnetic domain and Bloch wall draw a diagram represents this feature. [8 Marks]

C- Sketch diagrams clarifying different between magnetization of diamagnetic and ferromagnetic materials in cases of exerting of an external magnetic fields [8Marks]

Best wishes Dr.G-ElDamrawi

Mansoura University Faculty of Science Department of Physics Course code : Phys 323 Course title : Nuclear Physics		Program: Physics 2nd Semester (2014/2015) Final-Term Exam Time allowed: 2 hours Full Mark: 80 Marks

Answer the following questions

(1a) Compare between the L-S Coupling or the Russel-Saunders Coupling and the jj or Spin-Orbit Coupling. (10 marks)

(1b) Define and derive an exact form of the electric quadrupole moment Q and show how it can be used as an evidence for the shell structure. (10 marks)

(2a) Classify the nuclear reactions by the type of bombarding particle, bombarding energy, target, or reaction product. (10 marks)

(2b) In the ^{10}B (α,p)^{13}C with 4.77 MeV α-particles the two most energetic proton groups which were be observed to be emitted at an angle of 90^{o} with the direction of the incident α-particle beam had energies of 6.34 MeV and 3.98 MeV, respectively.

What information can be gained from these results about the energy levels of the residual C13 nucleus? (10 marks)

(3a) Study the shell model in the case the square well potential with infinite wall and find the nuclear energy levels from the bottom of the well and the occupation number of protons and neutrons of each level. (10 marks)

(3b) Use the nuclear shell model to predict the ground state characteristics of the following nuclei: $_{7}N_{7}^{14}$, $_{13}Al_{14}^{27}$, $_{30}Zn_{37}^{67}$ and in each case make a rough estimate of the magnetic moment in nuclear magneton. (5 marks)

(3c) Consider a neutron with E = 10 MeV moving in a potential with V0 = 40 MeV and W = 10 MeV. Calculate the real part of the wave number and the mean free path of the neutron. (Given: h = 4.14×10^{-15} eV.s) (5 marks)

(4a) Discuss the nuclear forces and their characteristics (properties and Types) (10 marks)

(4b) Illustrate schematically and discuss theoretically the different types of exchange forces between a neutron and proton. (10 marks)

Best Wishes, Ass.Prof. Ahmed Abu El-Ela

Mansoura University
Faculty of Science
Physics Department

Course code: ph 325

Second semester 2014-2015
Date: 4-6-2015

3rd level Physics Students
Full Mark: 80
Allowed time: 2 hours
Course title: Math. Physics2

Answer the following questions:

1-a- Classify the following P. D. E. (10 Mark)

i- $x^2u_{xxx}+u_{xx}+u_t+\sin(x)=0$ **ii-** $Au_{tt}+Bu_{xx}+Cu_{yy}+Du_{zz}=\sin(u)$

iii- $u_{xy}+A(u,x)u_x+u_y=0$

1-b- Verify that the given function is a solution of corresponding PDE. (10Mark)

i- $u_{tt}-2(u_{xx}+u_{yy})=0,\quad u(x,y,t)=\cos(x)\cos(y)\cos(2t)$

ii- $(xu_x+yu_y)=0,\quad u(x,y)=\frac{x}{y},\quad u(x,y)=\sin(\frac{x}{y})$

2- Solve the following PDE. (20 Mark)

$$u_t(x,t)=\alpha^2u_{xx}(x,t)-\beta u(x,t),\qquad B.C\begin{cases}u(0,t)=0\\u(1,t)=0\end{cases},\qquad IC\quad u(x,0)=\sin(\pi x)$$

3-Prove that (10 Mark)

i- $F_S(f'(x))=-\omega F_C(f(x))$

ii- $L(u'(t))=sU(s)-U(0)$

4- Solve the following equations by using three different methods (30 Mark)

i- $u_x(x,y)+u_y(x,y)=u(x,y),\quad u(x,0)=1+e^x$

ii- $3u_x(x,y)-2u_y(x,y)=3\sin(x),\quad u(0,y)=3y-1$

Best wishes: Dr Abeer Awad

Mansoura University
Faculty of Science
Physics Department

Course code: ph 328

Second semester 2014-2015
Date: 11-6-2015

3rd level Physics Students
Full Mark: 80
Allowed time: 2 hours
Course title: Theo. React. Physics

Answer the following questions:

1:- Write short notes about the following (20 mark)

I- Building up of the nucleus.

II- Nuclear reactions.

2:- Derive the fundamental decay law, and show how the radioactive equilibrium can be occurred. (17 mark)

3:- Show the similarity between the nucleus and the liquid drop, and derive an empirical formula for the binding energy by using the liquid drop model.(18mark)

4:-a- Derive the relation between the intensity of the neutron beam I which incident with initial intensity I_0 on a target with thickness X, and area equal to 1 cm^2, with considering the number of atoms per unit volume is $N_0\beta$. (15 mark)

4:- b- Show that, the dependence of the cross section of the neutron on its energy can be effect on the type of the reaction of the neutron with the target. (10 mark)

With best wishes

Dr Abeer Awad