المستوى الثالث - فيزياء - أطياف جزيئية (ف٣٢٩)

Mansoura University Faculty of Science Physics Department Subject: Physics		Second Term Third Level Date : **June 2012** Course: **Phys. 329**
Course: **Phys. 329; Molecular Spectra**		Full Mark:: 80 Marks

Answer **Four** Questions **Only** : Each Question (**20**) Marks

[1]-(A) Convert the following spectroscopic quantities as indicated;

a-) 0.3 nm **to** Hz b-) $3x10^{14}$ Hz **to** cm^{-1}

c-) 10 cm^{-1} **to** μm d-) $3x10^{8}$ Hz **to** m

e-) $3.33x10^{4}$ cm^{-1} **to** Hz **[10 Marks]**

(B) The wavelength of a radiation absorbed during a particular spectroscopic transition is found to be **5 μm**. Calculate the energy change during this transition. **($c = 3x10^{8}$ $m.s^{-1}$, $h = 6.63x10^{-34}$ j.s.)** **[5 Marks]**

(C) Explain what we mean by a **persistent line**. **[5 Marks]**

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[2]-Write a short note about;

(A)- The population of the energy levels and its influence on the line intensity of emitted spectra **[8 Marks]**

(B)- Internal standard element. **[7 Marks]**

(C)- The resolving power of an instrument **[5 Marks]**

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[3]-(A) Which of the following molecules will show a microwave rotational spectrum :

Br_2 , HBr , CH_4 , CH_3Cl & SF_6 **[10 Marks]**

(B) Derive an expression gives the wavenumbers of the different possible transitions between the energy levels of a real diatomic rotator. **[10 Marks]**

[4]-(A)Explain how you can use molecular absorption spectroscopy for bond length and bond strength determination. **[8 Marks]**

(B) The following wavenumbers are for three rotational spectral lines in the spectrum of the $^{1}H\ ^{79}Br$ molecule; 84.544 cm^{-1}, 101.490 cm^{-1} & 118.435 cm^{-1} Given the masses of the H & Br atoms as 1.673×10^{-27}kg &131.03×10^{-27}kg respectively, then find :

a-) **B, I, & r** for this molecule. **[9 Marks]**

b-) The $(j + 1) \rightarrow (j)$ for each of theses three lines. **[3 Marks**

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[5]-(A) A molecule undergoes spectroscopic transition between the ground state and two excited states. If its lifetime in the first excitation state is 10 seconds and 0.1 second in the second one, calculate the approximate uncertainty in the excited state energy levels and the width of the associated spectral lines in hertz. **[8 Marks]**

(B) Discuss briefly each of the following items ;

a-) Different possible interferences during spectral analysis **[6 Marks]**

b-) Self absorption during atomic emission spectral analysis **[6 Marks]**

Examiners: **1- Dr. Mohamed MANSOUR** **2- Dr. Nabil KINAWY**

Best Wishes & Have A Good Luck

المستوى الثالث - فيزياء - مفاعلات نظرية (ف ٣٢٨)

Mansoura University Faculty of Science Physics Department Subject: Physics		Second semester Third level : Physics Date : 28/6/2012 Time allowed : 2 hours
Course (s): Theoretical Reactors (Phy 328)		Full Mark: 80 Mark

Answer **three** Questions Only: Each Questions (28.3) Mark

Answer the following Question : (30 Marks)

[1] a- Derive the time-dependent diffusion equation using Fick's rule. **[15] Marks**

b- Solve diffusion equation in spherical geometry for thermal neutrons. Consider distribution in an infinite homogeneous medium for a shell source $\delta(r-r_0)/4\pi r^2$. **[15] Marks**

Answer two Questions only: Each Questions (25) Marks

[2] a- Discuss the boundary conditions for complete solution the time-dependent diffusion equation. **[10] Marks**

b- Discuss the critical condition and derive the geometric buckling of a hemispherical reactor **[15] Marks**

[3] Discuss the iteration method which is used in solving the neutron diffusion equation for one dimensional problems. **[25] Marks**

[4] Discuss the Multigroup method which are used to solve the energy-dependent problems. **[25] Mark**

With our best wishes
Examiners:

١- أ.د. السيد عبد العاطى الوكيل ٢- أ.د. محمد مدكور

٣ فيزياء - فيزياء الليزر - ف ٣٢٧

Mansoura University
Faculty of Science
Physics Department
Subject: Phy. 327
Physics: Polymer Physics

Academic Level: 3rd Level
Program: Physics
2nd Term Exam: 11 June 2012
Time Allow: 2 hours
Full Mark: 80 Marks

Answer (ALL) Questions:

1) A- Describe one method use to study the thermal Analysis of polymer. [10 Mark]

B- What are the difference between the physical state of polymer and the Phase. [10 Mark]

2) Discuss in details the first and the second order phase transitions in polymer. [20 Mark]

3) Compare between: [20 Mark]

a- Thermoplastic and Thermosets polymer.
b- Cis- and Trans- isomerism.
c- Branched and Crosslinked polymer.
d- Atactic and Isotactic polymer.
e- glass-transition temperature and Ceiling temperature.

4) A- Write briefly on: [12 Mark]

- Four factors affecting on the glass-transition temperature.
- Effect of temperature and pressure on polymerization.
- Electrical conductivity of polymer.

B- Define the polymerization. Explain the Ionic polymerization. [8 Mark]

"With Good Luck"

Examiners:
1- Prof. Dr. Eman Sesa. *2- Dr. Maysa Ismail.*

Faculty of Science Mansoura University Physics Department	Level 3 Physics(326)	Final Exam in Physics Fine Magnetism May 2012 Time : 2 Hours Full Mark: 80 Marks

Answer the following questions

Question 1(each item 6 Marks)

1. List the different applications of ferromagnetic material.
2. What does NMR Phenomenon mean? Sketch a diagram represent the two ways of nucleons transition under the effect of an external magnetic field and radiofrequency.
3. Prove that ferrous ions are the most responsible for ferrimagnetic properties of ferrites (Fe_3O_4)
4. What does magnetic domain means. Sketch a diagram represent bloch function or bloch wall
5. Discuss the different types of magnetic materials
6. Estimate what does upfield and downfield shifts
7. when an external magnetic field is applied on ferro- ferri – paramagnetic- and diamagnetic material, the spins will be aligned, sketch diagrams represent each case.

Question2) Which of the following expression is true (2 Marks for each item)

1. Chemical shift interaction of Q^4 is lower than that of Q^2 of SiO_2 groups
2. Non- bridging bonds can shield the atomic nuclei of silicon easily
3. Amorphous materials are characterized with their higher values of chemical shift
4. Q^0 characterizes lose silicate units.
5. The origin of magnetism lies in the orbital and spin motions of electrons
6. Ferromagnetic and ferrimagnetic materials are usually what we consider as being magnetic (ie., behaving like iron).

7. Diamagnetic substances are composed of atoms which have net magnetic moments
8. the atoms or ions in the paramagnetic material have not a net magnetic moment due to unpaired electrons in partially filled orbits.
9. Ferromagnetic materials exhibit parallel alignment of moments resulting in large net magnetization even in the absence of a magnetic field
10. At normal temperatures and in moderate fields, the paramagnetic susceptibility is small

Question 3) Complete \ or choose the correct(2 Marks for each item)

1. The magnetization in ferromagnetic materials is (saturated- increasing - reduced) in moderate magnetic fields and at (room- high temperature)
2. Diamagnetic materials posses ----------magnetization
3. Intrinsic magnetism may be due to ------- while technical magnetism is due to ----------
4. Above the Curie temperature, the ferromagnet is ---------- and below it, ---
5. ferromagnets can retain a memory of an applied field once it is removed. This behavior is called ----------
6. One of the most important atoms with (unpaired –Paired) electrons is iron. However, the individual magnetic moments (do not interact – interact) magnetically, like diamagnetism,
7. The entropy is a measure of the ---------- of a system, the larger its disorder, the higher its entropy.
8. (Iron – iron oxides) can posses (ferromagnetic – Ferrimagnetic) order
9. The magneto- caloric effect is based on the fact that at a fixed temperature the entropy of a system of magnetic moments can be ---------- by the application of a magnetic field.

With best Dr. G. El-Damrawi

المستوى الثالث - فيزياء - فيزياء رياضيات (ب) (ف ٢٥)

Mansoura University Faculty of Science Physics Department Subject: Physics		Second semester Third level : Physics Date : 21/6/2012 Time allowed : 2 hours
Course (s): Mathematical physics (2) (Phy325)		Full Mark:: 80 Mark

Answer the following Question : (30 Marks)

[1] a- What is the solution to the IBVP

PDE $u_t = u_{xx}$ $0 < x < 1,\ 0 < t < \infty$

BCs $u(0,t)= 0,$ $u(1,t)=0$ $0 < t < \infty$

and IC $u(x,0) = \sin(2\pi x) + \frac{1}{3}\sin(4\pi x) + \frac{1}{5}\sin(6\pi x)$ $0 \le x \le 1$ (20 marks)

b- Transform

$u_t = u_{xx}$ $0 < x < 1,\ 0 < t < \infty$

with BC's $\begin{cases} u_x(0,t) = 0 \\ \\ u_x(1,t) + hu(1,t) = 1 \end{cases}$ $0 < t < \infty$

and IC. $u(x,0) = \sin(\pi x)$ $0 \le x \le 1$

into a new problem with zero BCs? (10 Marks)

Answer two Questions only: Each Questions (25) Marks

2) Solve the Non-homogeneous PDE's Problem:

PDE $u_t = u_{xx} + \sin(\pi x) + \sin(2\pi x)$ $0 < x < 1,\ 0 < t < \infty$

BCs $u(0,t)= 0,$ $u(1,t)=0$ $0 < t < \infty$

and IC. $u(x,0) = 0$ $0 \le x \le 1$

by using the eigenfunction – expansion method (25 marks)

3) Consider a large container of liquid that is insulated on the sides. Suppose the liquid has an initial temperature of u_0 and that the temperature of the air above the liquid is zero. Using the Laplace transform to find the temperature of the liquid at various depths of the container at different values of time. So, solve the problem

PDE $u_t = u_{xx}$ $0 < x < \infty,\ 0 < t < \infty$

BC $u_x(0,t) - u(0,t) = 0$ $0 < t < \infty$

IC. $u(x,0) = u_0$ $0 < x < \infty$

Notes: $\mathcal{L}^{-1}[\frac{1}{s}] = 1,$ $\mathcal{L}^{-1}[e^{-\sqrt{s}\,x}(\frac{1}{s})] = [erfc(x/2\sqrt{t})$

And $\mathcal{L}^{-1}[e^{-\sqrt{s}\,x}(\frac{1}{\sqrt{s}(\sqrt{s}+1)})] = erfc(\sqrt{t} + x/2\sqrt{t})e^{(x+t)}$ (25 marks)

4) Solve the following problem by means of the Fourier transform

$u_t = \alpha^2 u_{xx}$ $-\infty < x < \infty,\ 0 < t < \infty$

I.C. $u(x,0) = e^{-x^2},$ $-\infty < x < \infty,$ (25 marks)

1 . أ.د. السيد الوكيل 2. أ.د. محمد مدكور

Mansoura University Faculty of Science Physics Department Subject : Physics	Third Year Physics	Second Term Third Year : Physics Date : 18/6/ 2012 Time allowed : 2 hours

Electrodynamics - phys. (324)

Answer the following questions

(1) a - In steady state conditions Ampere's law may *be expressed as* $\vec{\nabla} \times \vec{H} = \vec{J}$. (20)
Exams the validity of this eq. in the case of time dependent fields and shows that Maxwell's modification for this equation is compatible with conservation of charge

b - In a region where the conductivity $\sigma = 0.5$ S /m, the electric field is given by $\vec{E} = 4y\,\vec{e}_x + 2xz\,\vec{e}_y + 2z^3\vec{e}_z$. Find the charge density ρ

(2) a - Show that the time average energy flow when the electromagnetic field vectors vary harmonically with time is given by $\langle \vec{S} \rangle = \frac{1}{2} Re\left(\vec{E} \times \vec{H}^*\right)$. (20)

b - The propagation constant $\hat{k}$ in a conducting medium is complex with real and imaginary parts given respectively by : $\alpha = \omega \sqrt{\frac{\mu\epsilon}{2}} \left[\sqrt{1+\left(\frac{\sigma}{\omega\epsilon}\right)^2} + 1\right]^{\frac{1}{2}}$ and

$\beta = \omega \sqrt{\frac{\mu\epsilon}{2}} \left[\sqrt{1+\left(\frac{\sigma}{\omega\epsilon}\right)^2} - 1\right]^{\frac{1}{2}}$. Obtain the relation between $\vec{E}_0$ and $\vec{B}_0$ for good conductors. Show that in perfect conductors most of the electromagnetic energy is of magnetic type and the phase difference φ between $\vec{E}$ and $\vec{B}$ equals $\frac{\pi}{4}$.

(3) a - Write Maxwell's equations in l.i.h. medium with no free charges . Show that the Plane electromagnetic waves are transverse . (20)

b - Find ϵ_r , ω and $\langle \vec{S} \rangle$ where $\mu_r = 1$; $\vec{E} = 30\pi e^{i\left(\frac{4}{3}z - \omega t\right)}\hat{e}_y$ and $\vec{H} = 1.0e^{i\left(\frac{4}{3}z - \omega t\right)}\hat{e}_x$

(4) a- State the boundary conditions that must be satisfied by the electromagnetic field vectors at the interface between two different media . Prove two from these conditions. (20)

Note: $\epsilon_0 = 8.85 \times 10^{-12}\ F/m$, $\mu_0 = 4\pi \times 10^{-7} henry/m$

Good luck

Hayam mashaly

٣ فيزياء - فيزياء نووية (ف ٣٢٣)

Mansoura University Faculty of Science Physics Department Time allowed : 2 hours		Second Term (May 2012) Level : Third Program : Physics Course Code : Phys323 Date : 14/6/2012
Course Title : Nuclear Physics (2)		Full Mark:: 80 Marks

Answer **THREE** Questions Only: السؤال الأول اجبارى

[1a] – Discuss the methods to evaluate r_0 which depend wholly on the nuclear force. **[10] Marks**

[1b] – Define the quantum numbers l , j and m_j and give in table the relation between them and their capacities l = 0 to l = j . **[10] Marks**

[1c] - Discuss the ways of coupling of the individual nucleon orbital and spin motions. **[10] Marks**

[2a] – Study the magnetic dipole moment of the nucleus containing Z protons and N neutrons classically and quantum mechanically . **[10] Marks**

[2b] - Prove that the electric quadrupole moment of an ellipsoidal nucleus with major axis b and minor axis a is given by $Q = (2/5) Z (b^2 - a^2)$ using Legendre polynomial. **[10] Marks**

[2c] - Define the parity of the nucleus. Represent this in Cartesian and spherical polar coordinates . When parity is conserves and non-conserved . **[5] Marks**

[3a] - List the evidences for the shell structure and explain the role of the neutron capture cross section with examples . **[10] Marks**

[3b] - Study the spin-orbit coupling model and give in table assembly of nucleons in substates according to strong spin-orbit interaction. **[10] Marks**

[3c] - Find the ground-state angular momentum of (a) $_7N^{15}$ (b) $_{19}K^{39}$. **[5] Marks**

[4a] – With reasonable physical considerations, find the magnitude of the attractive potential responsible for nuclear force. **[15] Marks**

[4b] - Discuss this statement : "The experimental and theoretical work indicates that the nucleon-nucleon forces are not simple. It looks as if many different types of forces are acting at the same time". **[10] Marks**

لجنة التصحيح :

ا.د / على حسن الفراش ا.د.م/ أحمد أبوالعلا أحمد

المستوى الثالث - فيزياء - فيزياء الحالة غير المتبلورة ف٣٢٢

Mansoura University Faculty of Science Department of Physics Course Code: Phys. 322 Title: Non-crystalline Solids		Second Semester (June 2012) Exam Type (Final): 3rd Year (Physics) Time: Two Hours Full Mark: 80 Mark

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

1- a: Compare between the structure of Na_2O-SiO_2 and Na_2O-B_2O_3 glasses. [9 Mark]

b: Explain how a crystalline structure can be transformed to a non-crystalline one. Discuss the factors affecting this process. [8 Mark]

b: A glass has a molar formula $0.06Na_2O{\cdot}0.13CaO{\cdot}0.19Al_2O_3{\cdot}0.62SiO_2$. Its density is 2.533 g/cm^3. Calculate the concentration of structural units per unit volume of glass. (Molecular mass = 62 g/mol for Na_2O, 56 g/mol for CaO, 102 g/mol for Al_2O_3 and 60 g/mol for SiO_2, Avogadro number is 6.022×10^{23} mol^{-1}). [9 Mark]

2- Write a brief report on the electric conduction in glass. [27 Mark]

3- a: Explain how all the atoms and ions affect the specific heat of a glass. [13 Mark]

b: The density is 2.33 g/cm^3 for the glass $30Li_2O{\cdot}70SiO_2$ (mol%) and it is 2.205 g/cm^3 for vitreous SiO_2. Calculate the volume of the Q_{3Li} unit. (Atomic mass = 1.153×10^{-23} g for (Li), 2.658×10^{-23} g for (O) and 4.665×10^{-23} g for (Si). [14 Mark]

أطيب التمنيات: أ.د. حمدى دويدار

لجنة التصحيح: أ.د. حمدى دويدار - أ.د. أحمد حمزه عرابى

Mansoura University Faculty of Science Physics Department Subject: Physics		Second semester **Third level : Physics** Date : 7 /6/2012 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_{zT}=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 .

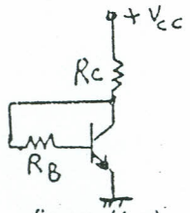

figure (1-a)

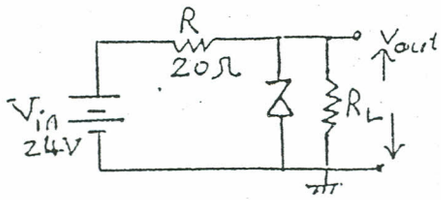

figure (1-b)

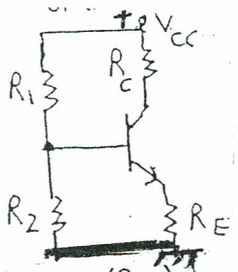

figure (2)

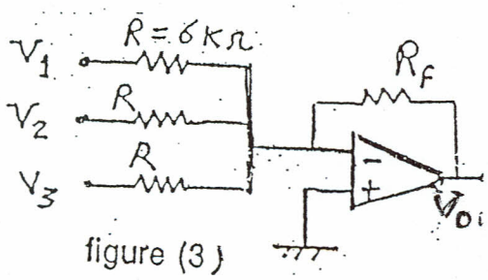

figure (3)

2- a) Derive the condition required for stable operating point of the transistor circuit shown in figure (2) .

b) Derive an expression for the output voltage of the operational amplifier circuit In figure (3) , then determine the value of R_f which make the output voltage equal the average value of the input voltages .

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

b) Determine the overall minimum and maximum gain of the two stage amplifier circuit shown in figure (4), where $R_1 = R_3$ = 33 K, $R_2 = R_4$ = 8.2 K , $R_{C1} = R_{C2}$ = 3.3 K , R_E= 1K , R_{E1}= 60 , R_{E2} = 0 To 940 ohm & $\beta_{dc} = \beta$ = 175

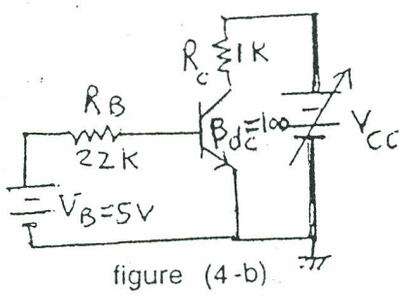

figure (4-b)

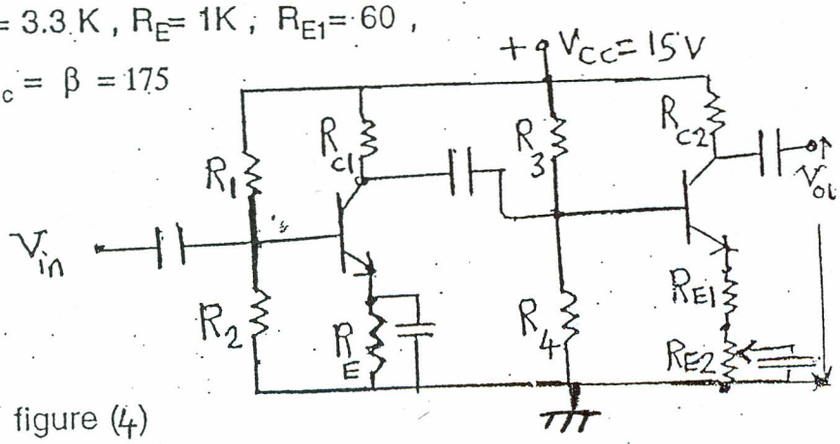

figure (4)

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

b) The transistor in figure (4-b) has the following maximum ratings : $V_{CE(max)}$ = 25 V , $I_{C(max)}$ = 200 mA , $P_{D(max)}$ = 0.5 W . Determine the maximum value to which V_{CC} can be adjusted without exceeding a rating .which rating would be exceeded first ?

Mansoura University Faculty of Science Physics Department Subject: Physics		2nd Term Credit hours Students: Physics Level: 3 Date : June 2012 Time allowed : 2 hours
Course: Physics 320, Computer Programming		Full Mark : 80 Mark

Answer the 1st question then any other two questions

[1]

a)Determine the value of J1, J2, R1 and R2 during and after the execution of the following statements:

```
      J1=0
      J2=12
      R1= 0.0
      R2= 24.0
5     IF (R1.GT.R2) GOTO 10
      J1=J1+1
      J2=J2-1
      R1=R1+2.0
      R2=R2-2.0
      GOTO 5
10    R1=R1-2.0
      R2=R2+2.0
      J1=J1+1
      J2=J2+3
      END
```

(14Marks)

b) (8Marks)

```
      Y=5.0
      X=8.0
      DO 10 J=1,7,2
      IF(J*2.GE.13) GOTO 10
      Y=Y+X
      X=X+1.0
10    CONTINUE
      END
```

c) (8Marks)

```
      Y=5.0
      X=8.0
      DO 10 J=1,7,2
      IF(J*3.LE.13)X=X+3.0
      X=X+1.0
      Y=Y+X
10    CONTINUE
      END
```

[2] a- Write the following expressions in FORTRAN FORM: [12] Marks

i- $\beta = \frac{-1}{2x} + \frac{a^2}{4x^2}$

ii- $f = \frac{\pi}{2}\log|x| + \frac{a}{x} - \frac{a^3}{9x^3}$

iii- $g = \frac{1}{2}\ln\frac{1+\sin x}{1-\sin x}$

iv- $B = \frac{e^{x/\sqrt{2}}\cos(\sqrt{x/2} + \pi/8)}{\sqrt{2\pi x}}$

b- Determine the correct format expression, and correct the wrong from the following :

```
i.   100  FORMAT(10X,13F6.2)
ii.  200  FORMAT(4F7.2,4E13.8)
iii. 300  FORMAT(7I2,6F5.3.3E12.5)
iv.  400  FORMAT(3X,5I2,7F5.3,3E11.6)
```

[8] Marks

c-Sow the order of execution of the given following statement: [5] Marks

```
Y= EXP(A*B/(C*D)-X**3)+COS(SQRT(X/2.)+PI/8.)/SQRT(2.*PI*X)
```

P.T.O. ⟶

[3]) a- Draw a Flow chart, using the Block IF statement, for the application of the following step function:

$$Y = \begin{cases} 8.92 & \textbf{if } \mathbf{0.0 \le x < 10.9} \\ 17.23 & \textbf{if } \mathbf{10.9 \le x < 18.6} \\ 25.50 & \textbf{if } \mathbf{18.6 \le x \le 50.0} \end{cases}$$

b- Write a Fortran program for the execution of the above step function using the Block IF statement.

[25] Marks

[4] **In solving the least square approximation to determine the fitted equation it was found that the two main equations are given as in follows:**

$$N A + B \sum_{i}^{N} X_i = \sum_{i=1}^{N} Y_i \qquad (1)$$

$$A \sum_{i}^{N} X_i + B \sum_{i=1}^{N} X_i^2 = \sum_{i=1}^{N} X_i Y_i \qquad (2)$$

a) Determine the slope and the intersection for the equation of straight line

[10] Marks

b) If you have 30 X points in 10F5.2 and the corresponding 30 Y points in the same format are to be fitted, write the Fortran program to execute the fitting process. The output must be in three columns for the X, Y and the corresponding fitted values.

[15] Marks

Good Luck

Examiners: 1- Prof. Dr. Magdy Tadros Yacoub* **2-** Dr. Shalabeia Badr