(10 marks):

(a) If the human ear can detect a sound in air at a periodic time of 1 ms corresponding to an intensity of 10^{-1} Watt/m^2. Determine the pressure and displacement amplitudes associated with these two limits (ρ = 1.3 Kg/m^3 and v = 330 m/s for air).

(b) With sketch the required diagram show that Doppler effect can be used to measure the velocity of blood within the human body.

(c) Explain in detail how you can determine the velocity of acting potential in motor nerves.

Question #4

a) ***Compute*** the commutator $\left[\hat{x}^2, \hat{p}^2\right]$.

b) ***Find*** $\left[\hat{L}^2, \hat{L}_+\right]$.

Question #5

a) From separation of variables applied to the time-independent Schrödinger equation, we have:

$$\frac{1}{R(r)}\frac{d^2}{dr^2}\left(r^2\frac{dR(r)}{dr}\right) - \frac{2mr^2}{\hbar^2}\left[V(r)-E\right] = \ell(\ell+1)$$

for integer ℓ. ***Transform*** to the new function $u(r) = r\,R(r)$, and ***show*** that the above can be written as:

$$-\frac{\hbar^2}{2m}\frac{d^2u(r)}{dr^2} + \left[V(r) + \frac{\hbar^2}{2m}\frac{\ell(\ell+1)}{r^2}\right]u(r) = E\;u(r)$$

b) ***Work out*** the radial wave functions $R_{31}(r)$ and ***normalize*** it.

******** **Good Luck** *******

Prof. Dr. A. A. Ebrahim

Physics department
Faculty of science
Assiut university

1^{st} term exam 2016/2017

3^{rd} year students: Physics | Subject: environmental physics (383p) | Time : 3 hours | Total degree: 50

Answer the following questions: **(each question 10 points)**

Question1

(a) Explain how the atmosphere "protects" inhabitants at the earth's surface.

(b) Explain why the sky is blue during the day and black at night.

Question2

(a) Briefly explain the production and natural destruction of carbon dioxide near the earth's surface. Give two reasons for the increase of carbon dioxide over the past 100 years.

(b) What is latent heat? How is latent heat an important source of atmospheric energy?

Question3

(a) Derive the following equation

$$p(z) = \int_{z}^{\infty} g\rho dz$$

(b) Explain how heat is transferred in our atmosphere by:
(1) Conduction (2) Convection (3) Radiation

(C) Briefly describe how the air temperature changes from the earth's surface to the lower thermosphere.

Question4

(a) What atmospheric layer contains all of our weather?

(b) In what atmospheric layer do we find the highest concentration of ozone and the highest average air temperature?

(c) Above what region of the world would you find the ozone hole?

Question5

(a) What are the main differences between Rayleigh scattering and Mie scattering?

(b) What is the main source of atmospheric energy? Explain by using equations.

(c) Which do you feel would have the greatest effect on the earth's greenhouse effect: removing all of the CO_2 from the atmosphere or removing all of the water vapor? Explain your answer.

GOOD LUCK

Assiut University | **Term: Fall 2016- 2017**
Faculty of Science | **Date: 17 January, 2017**
Department of Physics | **Time: 3 Hours**

Course Title: Quantum Mechanics – Code P311 – Final Exam. (50%)

Answer the following question: (*all questions carry the same weight* 10 points)

Question #1

A particle is described by the wavefunction

$$\psi(x)=\begin{cases} A\cos\left(\dfrac{2\pi x}{L}\right) & for\ -\dfrac{L}{4}\le x\le\dfrac{L}{4} \\ 0 & otherwise \end{cases}$$

a) ***Determine*** the normalization constant A.

b) ***What*** is the probability that the particle will be found between x=0 and x=L/8 if we measured its position?

c) ***Find*** the expectation values for operators x, p, and p^2.

Question #2

Consider a particle described by the wavefunction $\psi(x)=A\,e^{-ikx}$.

a) ***Show*** that this wavefunction is an eigenfunction of the momentum operator and find the eigenvalue. The momentum operator is:

$$\hat{p}=-i\hbar\frac{\partial}{\partial x}$$

b) ***What*** physical system does this wavefunction represent and what is the physical meaning of the eigenvalue of the momentum operator?

c) ***What*** is the kinetic energy of this particle?

d) ***What*** is the potential energy of this particle?

e) ***Write*** the appropriate Schrödinger equation for this particle.

Question #3

A particle of mass m, which moves freely inside the region $-a\le x\le a$, is initially in the state

$$\psi(x,0)=\frac{1}{\sqrt{5a}}\cos\left(\frac{\pi x}{2a}\right)+\frac{2}{\sqrt{5a}}\sin\left(\frac{\pi x}{a}\right)$$

a) ***Find*** $\psi(x,t)$ at any later time t.

b) ***What*** is the expectation value of the Hamiltonian for this system? (remember that $\langle\hat{H}\rangle$ is the average total energy)

Faculty of Science **Date: 18 January, 2017**
Physics Department **Time: 2 hours**

Final Examination in (Introduction to Solid State Physics 350P)

Teaching Staff: Prof. Dr. Abdulaziz Abualfadl

Constants: h= 6.626 x 10^{-34}J.s, 1 eV= 1.6 x 10^{-19} J, k_B= 1.38 x 10^{-23}J/K, e=1.6 x 10^{-19}, c= 3 x 10^{8}m/s, N_A= 6.02 x1 0^{23} atom/mole. m_e=9.1x10^{-31} kg, m_n=6.7x10^{-27} kg

Answer 4 questions from the following: [12.5 marks for each]

1- (a): A crystal is assumed to consist of close packed spheres. Calculate the maximum part of the available volume, which can be filled with spheres in a body centered cubic structure (b.cc), (b)- A beam of 300 eV electrons falls on a power nickel sample. Find the two highest Bragg angles at which reflection take place [(111) and (200) planes)]? (Ni is fcc with a= 3.25 A).

2- (a): A sample of chromium (Cr) is analyzed by X-ray diffraction using copper K_α radiation for which λK_α = 1.5418 Å. Determine the Miller indices of the plane from which the angle of reflection, θ, is 31.4°. The lattice constant of Cr, *a*, is 2.96 Å. Report your answer in the form (*hkl*).
(b): Explain the rotating crystal method of X-ray diffraction studies.
(c): The lattice constant of the simple cubic lattice is 5:63°A. Calculate the distance between the nearest (110) planes in simple cubic lattice.

3- (a): State the assumptions made by Einstein's model in obtaining the specific heat of solid? Derive an expression for specific heat capacity using Einstein model. Explain its behavior in high and low temperature range.
(b): Define what is meant by the terms: lattice, basis, conventional unit cell and primitive unit cell, crystal system, Bravais lattice and point groups.

4- (a): A beam of thermal neutrons emitted from the opening in a reactor come into thermal equilibrium at the temperature of 100 °C and diffracted by the (212) planes of a cubic crystal at an angle 34°. Calculate the unit cell parameter.
(b): Write the procedure for finding the Miller indices of a given plane. In a cubic unit cell, draw correctly a vector with indices [146], [100, then sketch the planes (110), (001), (111) (362).
(c) What is the relationship between the lattice vectors (lengths and angles)?. Find the allowed and missed diffraction from the lattice of face centered cubic (fcc).

5- (a): Consider the lattice vibrations of a chain of atoms containing two types of atoms of masses m and M, connected by identical springs of spring constant α. Assume that the equilibrium distance between atoms is "a". State the two dispersion relations (Acoustic branch and Optical branch).
(b): Write on: (i)-The possible point defects (Vacancies, interstitials, foreign atoms. (ii) One dimensional defects (dislocations). (iii)- Two dimensional defects (grain boundaries).

Good luck

Question4

Sketch V_o for the network of Fig.4 and determine the dc voltage available.

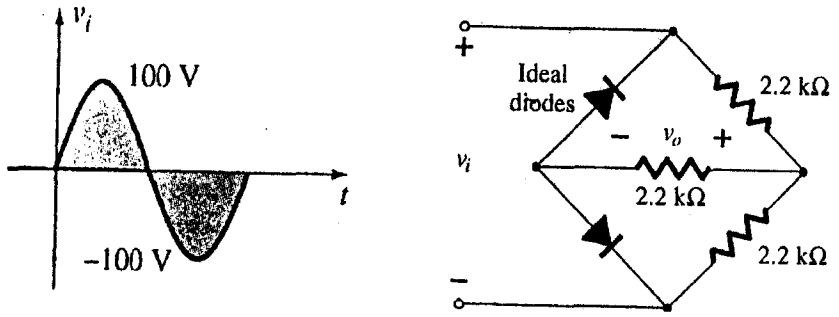

Figure 4

Question5

(a) What names are applied to the two types of BJT transistors? Sketch the basic construction of each and label the various minority and majority carriers in each. Draw the graphic symbol next to each. Is any of this information altered by changing from silicon to germanium base?

(b) Determine the voltage available from the voltage doubler of Fig.5 if the secondary voltage of the transformer is 120 V (rms).

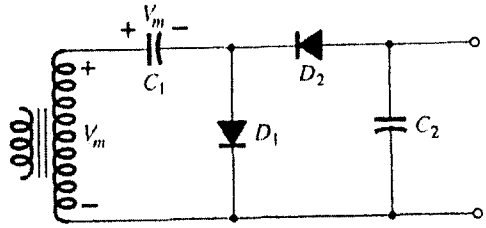

Figure 5

Question6

Determine v_o for each network of Fig. 6 for the input shown.

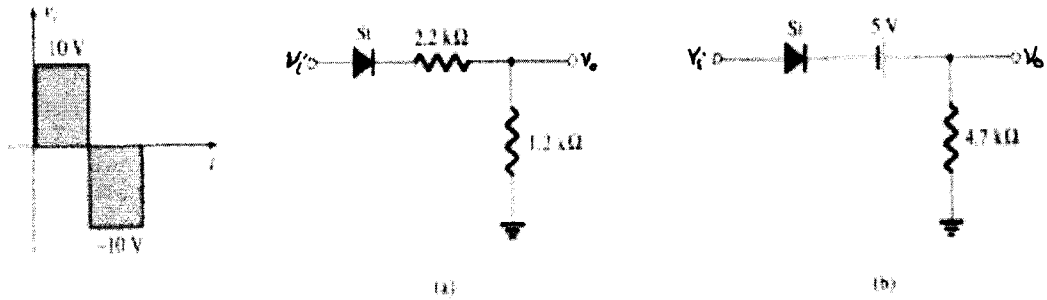

Figure 6

GOOD LUCK

Assiut University
Faculty of science
Physics Department

جامعة اسيوط
كلية العلوم
قسم الفيزياء

Final Exam. "In Solid state physics" (353 P)

Jan , 2017 Time: 3hours

Answer only Five questions:

1. a) Prove that the total electronic charges enclosed within a cylindrical conductor depends on its radius, then find an expression of the electron mobility in terms of the current density.

b) Compare between the surface and one of the linear defects of the crystalline structure.

2. a) Find the atomic specific heat contribution, and if the average energy of the crystal oscillator given as:

$U = h\upsilon[exp(h\upsilon / k_B T) - 1]^{-1}$, find the condition of an agreement between Einstein and classical theories.

b) X-ray beam with energy 2.7 KeV incident on BCC crystal with angle 30^0, determine the crystalline plane reflected the 1St order spectrum (given: atomic radius 0. 2 nm, and h = 6.62×10^{-27} erg.sec)

3. a) Consider a monatomic lattice in one dimension, find the equation of motion of the nth atom to prove that:

$\omega^2 = \pm(\frac{4B}{M})^{1/2} Sin(\frac{ka}{2})$, prove that the propagation velocity is a constant at a certain frequency.

b) Write the conditions required for applying Bragg's low, explain its application to determine Miller indices.

4. a) Apply two boundary conditions on Schrödinger eqn.: $\frac{d^2\Psi}{dx^2} + \frac{2mE}{\hbar^2}\Psi = 0$ to describe the wave form associated the electron at each energy level of the potential barrier.

b) Show that for a simple cubic lattice : $d_{100} : d_{110} : d_{111} = \sqrt{6} : \sqrt{3} : \sqrt{2}$

5. a)Explain the availability of applying the low of energy conservation and momentum for different optical processes

b) Determine the wavelength of X-ray beam with the Bragg's angle of 19.21^0 for the 1St order reflection in (111) plane of Aluminum of FCC structure (atomic weight =27, density 2.7 gm/cm^3, $N_A = 6.023 \times 10^{23}$)

6. a)Study the effect of the electric and magnetic fields on the ferroelectric and ferromagnetic materials, respectively. Find the magnetic dipole moment dependence of electron angular momentum.

b) Explain, with the eqns., the conductions required for using the neutron diffraction to study the crystal structure.

انتهت الأسئلة ، .....تمنياتي بالتوفيق والتفوق .....ا.د. عبد المنعم سلطان

First Term -Final Exam (2016/2017) Biophysics
P-323 - Time: 3h -Teaching Staff: Prof. Dr. Ahmed Sedky

Answe the following questions:

Q1a(5 marks), Complete the following sentences:

1- Syst lic pressure = _____ **Dyne/cm^2** for young person at rest (ρ = 1.05 g/cm^3)

2- The verage periodic time interval of the bats chirps' = _____

3- Cryo urgery is made by freezing the tip of the probe at a temperature of _____ K

4- A good ear normally needs about _____ more intensity to detect a sound at **100 Hz** than that of _____

5- The rain acoustic impedance = _____ (ρ = 1.02 g/cm^3, v = 1530 m/s).

Q1b (5 marks): Put √ or X in the following :

1. The nergy released per one gram of fuel equal **10000 J** ( )
2. The me interval for short spike of the axon potential is **32 ms** ( )
3. Pres vopia occurs when the refractive index of the outer layer decreases. ( )
4. The bats emit sound waves and also detect the echoes in **50 ms**. ( )
5. Ast matism occurs due to lack of symmetry in the curvature of the retina ( )

I (10 marks):

Explain in details how the resting and acting potentials are produced inside the axon.

Write only Goldman equation for the membrane potential and then calculate the Nernst potential at NPT when K^+ ions are replaced by Ca^{2+} ($Ca^{2+}_{out} = 200$ and $Ca^{2+}_{in} = 50$).

Write only the most information's which can be obtained by ECG.

Q 5(10 marks):

(a) Write short account about the deafness and hearing aids

b) Calculate the critical kinetic energy for turbulent flow of blood through a vessel (D = 2 cm, ρ = 1.0 g/cm^3, η = 0.04 poise, R = 2500, l = 1 cm)

(c) With sketch of wave signal diagram write short account about the mechanism of electrocardiograph (ECG).

Physics department
Faculty of science
Assiut university

1st term exam 2016/2017

Time : 3 hours

3rd year students: Physics

Subject: electronics (361P)

Total degree: 50

ANSWER THE FOLLOWING QUESTIONS ***(each question 10 points)***

Question1

(a) Describe in your own words the conditions established by forward- and reverse-bias conditions on a p-n junction diode and how the resulting current is affected.

(b) Determine V_o and I_D for the networks of Fig.1.

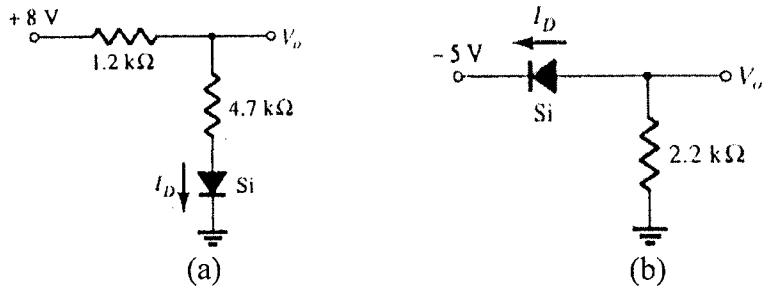

Figure 1

Question2

Calculate the voltage gain (Av = V_L/V_i) for the network of Fig. 2. if :

(1)V_i= 500 mV and R = 1 kΩ.

(2) The source has an internal resistance of 100 Ω in series with V_i.

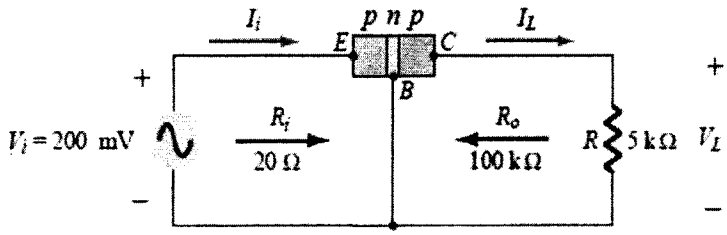

Figure 2

Question3

Determine the level of V_o for each networks of Fig.3.

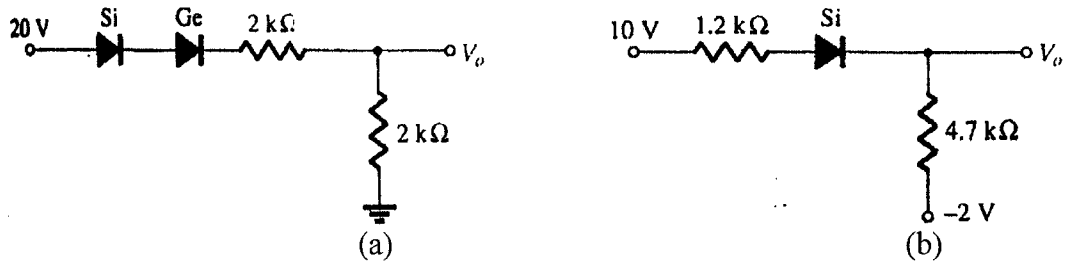

Figure 3

Look Back

marks):

at is the power radiated per cm^2 from your skin at a temperature of 33 °C 10^{-12} ($Cal/cm^2.h.K^4$)

Write short account about the work mechanism of sensory neurons, motor neurons and r-neurons of nervous system.

Sketch only the diagram for the behavior of blood velocity against cross-section area oss the aorta, capillaries and vein cava.

Q 5(10 marks):

(a)Write short account about the deafness and hearing aid.

b) Calculate the critical kinetic energy for turbulent flow of blood through a vessel (D = 2 cm, ρ = 1000 kg/cm^3, η = 0.04 poise, R = 2500, l = 1 cm)

(c) With sketch of valve signal diagram write short account about the mechanism of electrocardiograph (ECG).

كلية العلوم – جامعة أسيوط – قسم الفيزياء

اختبار نهاية الفصل الدراسي الأول ٢٠١٦-٢٠١٧- فيزياء احصائية ٣١٣ ف – الزمن المتاح: ثلاث ساعات. الأسئلة متساوية الوزن. اجب اربعة أسئلة فقط:

السؤال الأول

١- عرّف درجات الحرية.

٢- عدّد درجات الحرية لجزئ متعدد الذرات (n من الذرات) خطي و لآخر غير خطي.

٣- استخدم نظرية تساوي توزيع الطاقة لحساب طاقة الجزئ في الحالتين السابقتين.

السؤال الثاني

١- عرّف دوال الحالة ثم اذكر المقابل الرياضي لهذا التعريف.

٢- اذكر ثلاثة أمثلة لدوال الحالة مع التعريف الرياضي لكل.

٣- احسب الضغط الداخلي لنظامين أحدهما تصفه معادلة الحالة للغاز المثالي و الآخر تصفه معادلة فان ديرفال.

السؤال الثالث

لمسألة المتذبذب التوافقي في بعد واحد (كتلة m معلقة في لولب مرن ثابت القوة له k):

١- من خلال المعادلة التفاضلية التي تصف تذبذب الكتلة مع الشروط الأولية المناسبة، عرّف فراغ الطور.

٢- من خلال المجمّع الميكروقانوني، صف فراغ الطور لهذه المسألة.

٣- اكتب مؤثر هاملتون لهذه المسألة وكذلك القيمة المميزة eigenvalue.

السؤال الرابع

بفرض ظهور حدث n من المرات بعد N من المحاولات. إذا كان احتمال ظهور هذا الحدث هو p ، توصل لدالة التوزيع، توزيع ذات الحدين $W_N(n)$ ثم استخدمها لحساب المتوسط $\bar{n}$.

السؤال الخامس

مستخدما القيمة المميزة لمسألة جسيم في صندوق احسب دالة المجموع لغاز مثالي.

arks):

at is the power radiated per cm^2 from your skin if the temperature of 33 °C is 10^{-12} (Cal/cm^2.h.K^4)

Write short account about the work mechanism of sensory neurons, motor neurons and inter-neurons of nervous system.

Sketch only the diagram for the behavior of blood velocity against cross-section area across the aorta, capillaries and vein cava.