جامعة أسيوط ـــــــ امتحان الفصل الدراسي الأول / يناير 2015 الزمن: ثلاث ساعات

كلية العلوم الفرقة الثالثة والرابعة علوم (ساعات معتمدة)

قسم الفيزياء فيزياء فلكية 381ف التاريخ الخميس 2015/1/15م

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أجب عن ستة أسئلة فقط مما يأتى (الدرجات متساوية) :

(1) اكتب باختصار عن ثلاثة فقط مما يلي : الازاحة تحت الحمراء – حزامي فان ألن – دورة البروتون بروتون الاندماجية في قلب الشمس – سرعة الهروب من جاذبية الأرض وكيف يمكن حساب قيمتها

(2) اشرح كيف يمكن تحديد موضع نقطة ما على سطح الأرض بدلالة زوايا الميل وبدلالة نصف قطر الأرض كوحدة طول باستخدام الاحداثيات الاستوائية الأرضية مع ذكر مثال لذلك .

(3) اذا كانت $\varphi = 21.8$ ورصدت الشمس في العشرين من يونيو 2000م فوجدت على ارتفاع قدره $a = 30$ وعند زاوية سمتية $A=74.7$ قدرها فأوجد كلا من H, δ

(4) اكتب باختصار عن ثلاثة فقط مما يلي : النجوم الخسان – ظاهرة موت النجوم – المثلث الفلكي – الزمن المحلي والمنطقي

(5) احسب طول النهار في مدينة القاهرة حيث $\varphi = 30.75$ لكل من أيام 22ديسمبر و22 مارس و22 يونيو حيث ميل الشمس هو 23.43- و صفر و 23.43+ درجة على الترتيب

(6) اكتب بالتفصيل عن ثلاثة فقط مما يلي : الشهب والنيازك – ظاهرة الكسوف والخسوف – الأشعة الكونية – الاحداثيات البروجية

(7) اذا كانت الوحدة الفلكية تمثل متوسط بعد الأرض عن الشمس وقيمتها 149.6 مليون كيلومتر . احسب سرعة حركة الأرض في مدارها حول الشمس وكم تبلغ المسافة بين الأرض وكوكب المريخ اذا كان نصف قطر مداره حول الشمس يساوي 1.5237 وحدة فلكية .

*******انتهت الأسئلة***مع أطيب التمنيات*** د. جلال سعد ********

جامعة أسيوط - كلية العلوم – قسم الفيزياء

Final Exam - First Term: 2014 - 2015 - Course Title:
Biophysics Time: 3 h Teaching Staff: Prof. Dr. Ahmed Sedky

Answer the following questions:

Q1a (5 marks),What is the reason for the following:

1-The center of gravity of erect person is 112 cm when its height is 200 cm.

2-Eustachian tube is necessary for the eardrum.

3- The systolic pressure is always higher than the diastolic pressure.

4- The synapses are necessary for transmission the electrical impulse a cross the axon.

5- The aqueous medium of the cell body is relativity conductor.

Q1b (5 marks), Complete the following sentences:

1-The destructive interference occurs when the path difference equal……

2-In terms of weight representation held in the hand, the components of forces are ……

……..

3- The neurons are divided into……..,……,……

4- A simple neural circuit is responsible for ……..

……

5- Bernoulli's equation can be written ……..……..

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Q2 (10 marks): Put √ or X in the following :

1- Hydrophilic is considered as a water- soluble end. ( )

2- Surfactant molecules depressed the surface tension of water. ( )

3-The excess pressure in a liquid sphere is given by 4T/D. ( )

4- The tendons are made of strong tissue. ( )

5- The contraction of triceps is different than that of biceps. ( )

6- It is difficult to hear the performance behind a pillar in auditorium. ( )

7- Ultrasonic cannot be focused on a very small area. ( )

8- A positive pressure must be applied to withdraw the water from the soil ( )

9- The bats can see even better than we can. ( )

10- The center of the nerve network is located in the heart ( )

Q3 (10 marks):

(a) Write short account about the mechanism of pumping blood through circulating system.

(b) Calculate the height of a person of mass 100 Kg standing in spreading his legs with 1 m and foot width of 0.2 m if the applied force to topple him is 400 N ($g = 10\ m/s^2$).

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(c)With sketch the required diagram prove that $v_1/v_2 = d_1/d_2$ in levers.

Q4(10 marks):

(a) Explain in details how the electrical potential is produced inside the axon.

(b) Calculate the depressed of Hg in capillary tube of radius 0.1 cm when placed in a vessel contained Hg. (T= 485 dyne/cm, $\Theta = 140^{o}$, $\rho = 13.6$ gm/cm^3, g = 1000 cm/s^2).

(c) Explain in details the role of myosin-actin structure for contraction of muscles.

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Q5(10 marks):

(a) Write short account about the mechanism of hearing by the ear.

(b) Calculate the critical kinetic energy for turbulent flow of blood through the aorta. (D = 2 cm, $\rho = 1.05$ gm/cm^3, $\eta = 0.04$ poise, $R = 2500$).

(c) With sketch the required diagram show that the bones can exhibit a piezoelectric effect.

With my best wishes (Prof. Dr Ahmed Sedky)

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(1)

Assiut University Faculty of Science Department of Physics	Final Exam	Term: 2014/2015 Date: Jan 19th, 2015 Time: 3 hours
Course: Electronic Physics – P361		

Answer the followings: **(50 marks)**

P1. Sketch the output v_o and determine the dc-level of the output for the network of Fig.1 . **(4 marks)**

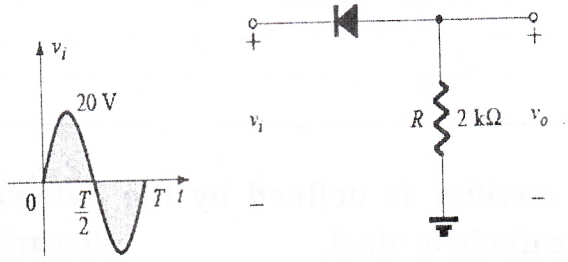


Fig. 1

P2. The diode can be used as voltage multiplier, sketch a full-wave or half-wave voltage doubler. **(3 marks)**

P3. Explain the reason of Zener region (avalanche region) in the reverse-bias of the diode. **(5marks)**

(2)

P4. Determine I, V_1, V_2, and V_o for the series dc configuration of Fig. 2. (4 marks)

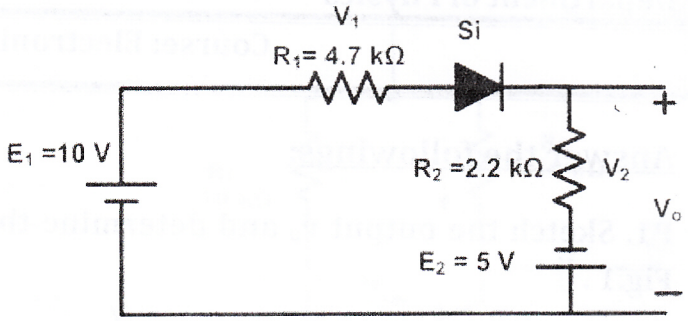


Fig. 2

P5. Prove that the dc-level of the full wave rectifier is defined by the following equation: $V_{dc} = 0.636\, V_m$; considering that the diode is ideal. (5 marks)

(3)

P6. The field-effect transistor (FET) is a three-terminal device. Its applications match those of the bipolar junction transistor (BJT). Compare between FET and BJT transistors. **(4 marks)**

	FET	BJT
1.		
2.		
3.		
4.		

P7. Junction field effect transistor (JFET) is one of FET transistors. *Show graphically the construction of JFET*. Showing I-V characteristics, explain the operation of JFET in case of: **(6 marks)**

(a) No bias on the Gate (V_{GS}=0)

(4)

(b) and $V_{GS} < 0$ for n – channel JFET

P8. Calculate the voltage gain A_v for the network of Fig.3, consider 100 Ω internal resistance connected in series with the input resistance. (4 marks)

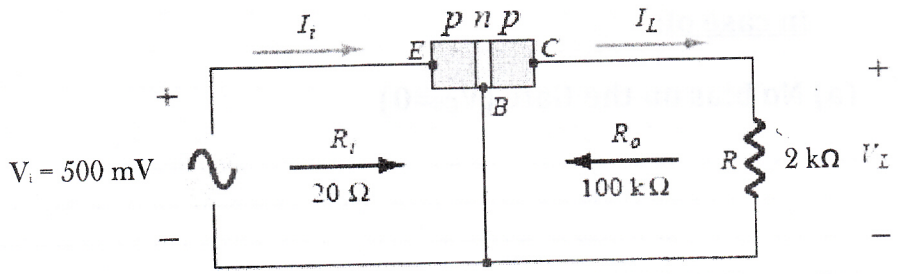


Fig. 3

P9. Prepare a table and compare the bias voltage and currents of the circuits of Figs.(4-6) for the given value of β = 50 and for a new value of β = 100. Compare the changes in the operating point (I_C and V_{CE}). Write the configuration name for each circuit.

(a) ..... **(4 marks)**

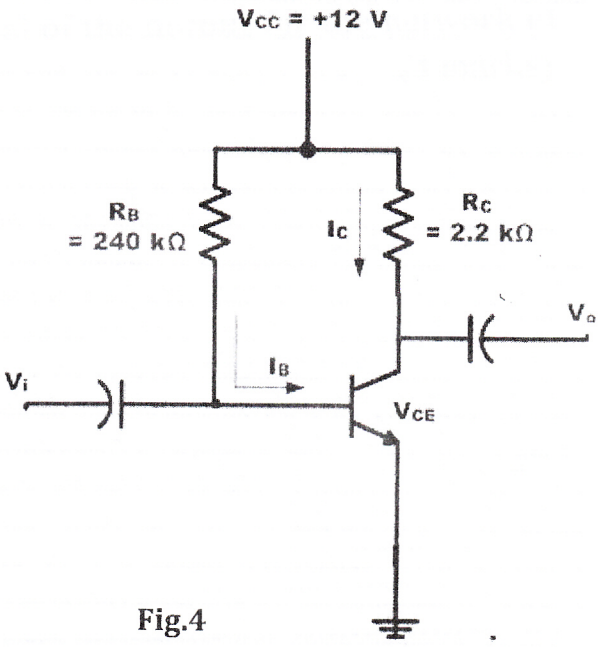


Fig.4

(b) ..... **(4 marks)**

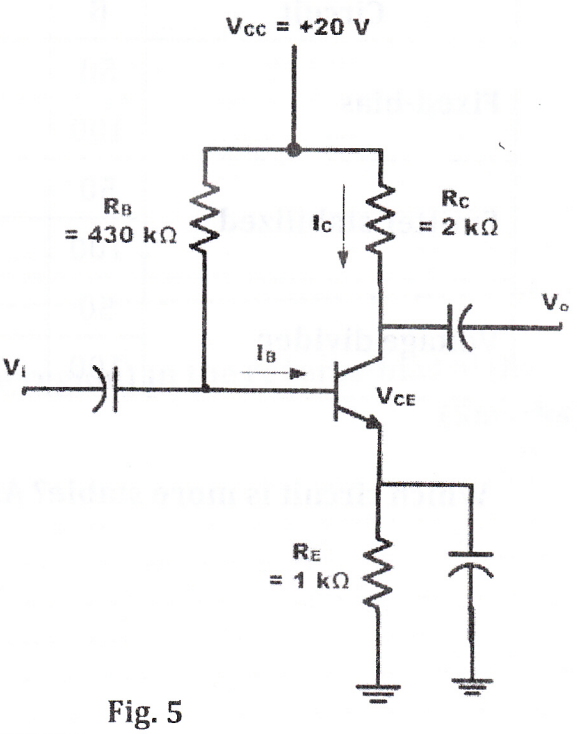


Fig. 5

(6)

(c) ..... (4 marks)

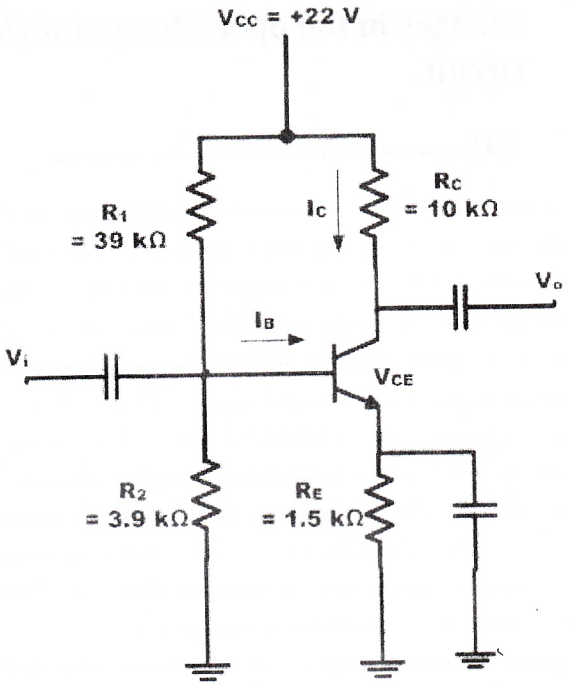


Fig. 6

(1.5 marks)

Circuit	β	I_B (μA)	I_{CQ} (mA)	V_{CQ} (V)
Fixed-bias	50			
	100			
Emitter stabilized	50			
	100			
Voltage divider	50			
	100			

Which circuit is more stable? And why? (1.5 marks)

GOOD LUCK

Dr. Nagih Shaalan

(1)

Assiut University Faculty of Science Physics Department Final Exam: 50 Marks		Semester: Fall 2014 Date: 11/1/2015 Course: Quantum Mechanics (1) Course Code: (P311) Time Allowed: 3 hours

ANSWER ALL THE FOLLOWING QUESTIONS

Question I: (16 Marks, 2 per each)

Answer whether the following statements are true or false, EXPLAINING YOUR ANSWER in each case:

1. In quantum mechanics, the group and phase velocities of a wave packet that represents an electron moving with a relativistic velocity must be smaller than the speed of light in vacuum c.

2. The eigenvalues of the Hermitian operator are real.

3. The trigonometric function $\sin(\omega t)$ could be a solution to the time−dependent Schrödinger equation.

4. It is possible to make a simultaneous measurement of the position and momentum of a particle with unlimited precision.

5. In the Bohr model of the Hydrogen atom, it is assumed that a half−integer number of electron wavelengths can fit into a circular orbit of radius r.

6. For an operator $\hat{A}$, the relation $\hat{A}^{\dagger\dagger} = \hat{A}$ is satisfied where $\hat{A}^{\dagger}$ is the Hermitian conjugate of $\hat{A}$.

7. In the Hydrogen atom, if the degeneracy of a bound state is 4 folds, this means that the allowed number of the orbital angular momentum quantum number ℓ is 4.

8. The normalized wave function in infinitely potential barrier of width $a = 2$ nm is $\psi_n(x) = \sin[(n\pi x)/a]$. Then, in the lowest possible energy state, the probability of finding an electron between 0.0 nm and 0.5 nm from one side of the well is approximately 1/2.

(Hint: $2\sin^2(\theta) = [1 - \cos(2\theta)]$)

Question II: (15 Marks, 5 per each)

1.

a. Discuss the matrix representations of the state vectors and operators.

b. The operator $\hat{B} = \begin{pmatrix} 1 & i \\ 0 & -1 \end{pmatrix}$ is a Hermitian operator where $i = \sqrt{-1}$, true or false and why?

2. In the Hydrogen atom, give a brief note on the azimuthal, orbital angular momentum, and principal quantum numbers m_ℓ, ℓ, and n. Elaborate your answer graphically.

(Hint: NO derivations are required)

3. A particle in the infinite square well of width a has the wave function:

$$\left\{ \begin{array}{ll} \psi(x) = \sqrt{\dfrac{30}{a^5}}\, x(a-x), & 0 < x < a \\ \psi(x) = 0, & x \geq a \ \text{and} \ x \leq 0 \end{array} \right\}$$

Compute the expectation value of the particle position $\langle x \rangle$. Explain your result physically.

(2)

Question III: **(10 Marks, 5 per each)**

1. Prove that the momentum of a charged particle p must be transformed to $p - eA$ when the charged particle interacts with an electromagnetic wave. e is the unit charge of the particle and A is the potential vector of the electromagnetic wave.

2. Explain, physically and mathematically, the second postulate of quantum mechanics that states "the energy of a physical system $\langle\psi|\hat{H}|\psi\rangle$ represents the average value of a series of measurements where this system is described by the state vector $|\psi\rangle$. $\hat{H}$ is the quantum mechanical energy operator.

Question IV: **(9 Marks, 4.5 per each)**

1. Describe how to find the possible energies of a particle confined in a finite square well of width $2a$ where the potential energy inside the well is $-V_0$. Explain your results physically showing two essential differences between the quantum and classical mechanics.

2. Prove that the Poisson bracket satisfies the relation of

$$\{F, H\} \equiv \frac{1}{i\hbar}[\hat{F}, \hat{H}]$$

where $i = \sqrt{-1}$ and $\hbar$ is the reduced Planck constant. $\hat{F}$ and $\hat{H}$ are the quantum mechanical operators of the classical function $F(x, p_x, t)$ and the classical Hamiltonian $H(x, p_x, t)$, respectively.

End of the Exam.....Good Luck!

Dr. Hesham Fares

Assiut University	Solid State	Final Exam (January 2015)
Faculty of Science	Physics 353	
Department of Physics		Time Allow: Three hours

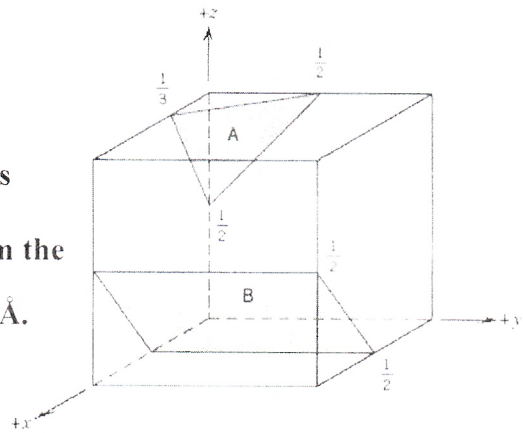
Answer ALL following questions [10 marks for each]

1-a) Based on the angle of rotation, determine the rotation axis in a cubic cell. [6 marks]

b) calculate the lattice points in:

i) An corner-centered cubic lattice. ii) A primitive lattice. iii) A diamond structure.

2-a) What are the Miller indices for each shaded plane drawn in the figure? [4 marks]



b) A single crystal of $FeSO_4$ has unit cell dimensions $a = 4$Å, $b = 6$Å. Calculate the diffraction angle from the (100) and (010) planes. The used X rays have $\lambda = 1$Å.

3-a) Iodine has an orthorhombic unit cell for which the a, b, and c lattice parameters are 0.481, 0.720, and 0.981 nm, respectively. If the atomic packing factor is 0.547 and atomic radius is 0.177 nm determine the number of atoms in each unit cell. [4 marks]

b) The bonds between two atoms in a solid have the potential energy $V(R)$ versus distance R between the two atoms given by: $V(R) = c\left[-\left(\frac{a}{R}\right)^6 + \left(\frac{a}{R}\right)^{12}\right]$ where $c = 1\times10^{-20}$ J/bond and $a = 0.38$ nm. Find the equilibrium distance R_0 between the two atoms.

4-a) Deduce the dispersion relation $\omega = \sqrt{\frac{4C}{M}}\sin(\frac{qa}{2})$ in a monatomic chain.

b) Deduce the factors affecting the electrical conductivity σ. [5 marks]

5-a) Discuss the heat capacity of conduction electrons in both classical and quantum pictures showing which one is in agreement with the experimental results. [5 marks]

b) Electrical resistivities of Cu and Ni at room temperature are 1.65×10^{-8} and 14×10^{-8} Ω.m. If the Wiedmann-Franz Law applies to these materials, find the electronic contribution to thermal conductivities of these materials. ($e = 1.6\times10^{-19}$ C and $k = 1.38\times10^{-23}$ J/K)

Best wishes

Prof. Dr. Mostafa Boudi

جامعة أسيوط – قسم الفيزياء – الاختبار النهائي للفصل الدراسي الأول 2014 / 2015 – فيزياء إحصائية (ف 313) – الزمن ثلاث ساعات.
اجب عن أربعة أسئلة فقط:

السؤال الأول

ا- اكتب تعبيرا للمعادلة الفيريالية (في الحجم).

ب- اكتب تعبيرا رياضيا لدالة الجهد المربع square well potential

ج- احسب المعامل الفيريالي الثاني لهذا الجهد ثم اثبت انه يؤول إلى حالة جهد الكرة الصلبة إذا اختفي بئر الجهد، عرضاً أو عمقاً.

السؤال الثاني

مستخدما مفكوك Taylor لدالة الجهد لجزئ ثنائي الذرة حول موضع الاتزان، ناقش خواص نموذج المتذبذب التوافقي ثم عرّج على تطوير هذا النموذج من خلال اعتبار حدود غير توافقية anharmonic terms . ارسم دالة الجهد في الحالتين، التوافقية و بعد إضافة الشق غير التوافقي.

السؤال الثالث

استخدم المعادلة الفيريالية في الضغط للحصول على معادلة فيريالية للانتروبي ككثيرة حدود في الضغط.

السؤال الرابع

ا- مستخدما التعريف الإحصائي للانتروبي، احسب التغير في الانتروبي لغاز مثالي يحتوي على N من الجزيئات، يتمدد من V_i إلى V_f أيزوثيرميا.

ب- عالج نفس المسألة مستخدما قوانين الديناميكا الحرارية.

السؤال الخامس

تعرف على التوزيع

$$p(x)\,dx = \frac{1}{(2\pi a^2)^{1/2}} \exp(-\frac{x^2}{2a^2})\,dx\,, \quad -\infty < x < \infty$$

ثم اثبت أن a هى الانحراف المعياري. قد تحتاج إلى الصيغة التكاملية

$$\int_0^\infty x^{2n} e^{-ax^2}\,dx = \frac{1.3.5.....(2n-1)}{2^{n+1}a^n} (\frac{\pi}{a})^{1/2}$$

Assiut University
Faculty of Science
Department of Physics

Solid State
Physics 350

Final Exam (January 2014)

Time Allow: two hours

Answer ALL following questions

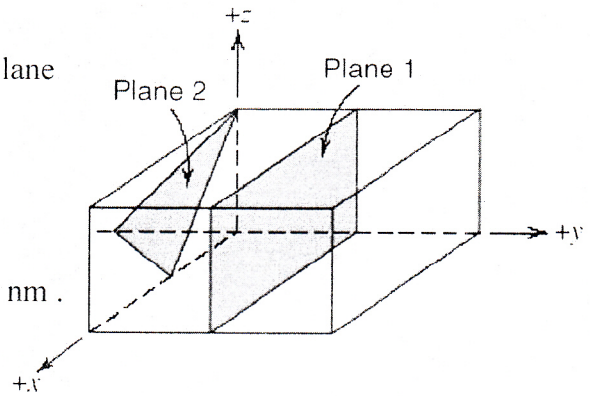
1-a) Draw lattice points B and C that satisfy $\vec{R}_B = 2\vec{a} + \vec{b}$ and $\vec{R}_C = -\vec{a} + 2\vec{b}$ [4 marks]

b) Iron has a BCC crystal structure, an atomic radius of 0.124 nm.

i) What is the edge length of the unit cell? [3 marks]

ii) What is the packing fraction? [3 marks]

2-a) What are the Miller indices for each shaded plane drawn in the figure? [4 marks]



b) An element X has a FCC crystal structure. If the diffraction occurs at 22° for the first peak when x-ray having a wavelength of 0.154 nm . Compute : [6 marks]

(i) the corresponding interplanar spacing.

(ii) the lattice parameter.

3-a) Discuss the interatomic force between two atoms. [5 marks]

b) The phase velocity v_p in an elastic wave is 3000m/s for one dimensional crystal atoms of mass 6.3×10^{-27} kg. If the interatomic distance a = 10^{-10} m.

Calculate the maximum frequency (ω_{max}) at very large wave length. [5 marks]

4-a) Explain the temperature dependence of the thermal conductivity resulting from phonons. [5 marks]

b) Estimate the conductivity of a metal with electrons velocity of 1.16×10^5 m/s and the mean free path ℓ is 1 nm and the number of valence electrons is 10^{29} electrons/m^3. ($m^* = 9.11 \times 10^{-31}$ kg, $k = 1.38\times10^{-23}$ J/K). [5 marks]

Best wishes

Prof. Dr. Mostafa Boudi