المستوى الثالث - فيزياء
فيزياء حيوية - فيزياء الجوامد ف ٣١١

Mansoura University Faculty of Science Department of Physics Course Code: Phys. 311 Title: Solid State Physics		First Semester (Jan. 2014) Exam Type (Final): 3rd Year (Physics, Biophysics) Time: Two Hours Full Mark: 80 Mark

Answer **the first one and any other two questions** from the following

1-a: Draw the planes (120), (201) and $(1\bar{1}1)$ in a cubic crystal. Calculate the interplaner distance in each case ($a = 3 \times 10^{-10}$ m) [13 Mark]

b: Explain why there is no diffraction patterns from the planes (111) in BCC crystals, whereas these planes form strong patterns in the FCC crystals. [13 Mark]

2-a: Is there a dependence of the bulk modulus of a solid on its volume? [14 Mark]

b: The molecular weight of NaCl is 58.5 g and its density is 2.17 g/cm^3. Calculate the Bragg angle for the maximum diffraction intensity at $\lambda = 1.2\times10^{-10}$ m. [13 Mark]

3-a: Show that the diffraction condition in a reciprocal lattice satisfies Bragg law. [14 Mark]

b: How many atoms per mm^2 are there in (*i*) (101) plane and (111) plane for iron which has BCC structure. (Atomic radius = 1.24×10^{-10} m). [13 Mark]

4-a: Find the shape and dimensions of the first Brillouin zone in a BCC lattice. [14 Mark]

b: Deduce a relation for the crystal interplaner distance in terms of Miller indices of the planes. [13 Mark]

($N_A = 6.022\times10^{23}$ mol^{-1})

مع التمنيات بالتوفيق: أ.د. حمدى دويدار

المستوى الثالث - الفيزياء - ضوء متقدم ف ٣١٦

Mansoura University
Faculty of Science
Physics Department.
Subject: Physics(316)
Title: Advanced optics

Final term exam – First Term
Third level /physics
Date: Jan. 2014
Allowed Time: Two hours.
Full Mark: 80

Answer the following questions

[1] -Considering an isolated small particle in vacuum illuminated with monochromatic Plane polarized light, deduce Rayleigh's equation for elastic light scattering? Discuss why the sky is blue ?

[20] Mark

[2] **a-** Explain, giving both theory and experimental details, how you would produce elliptically and circular polarized light? [15]Mark

b- Describe the basic principles of holography (clarify your answer with suitable drawing) [15] Mark

[3] **a-** Using the dispersion equation , $n-1=\frac{Ne^2}{2\varepsilon_o m(\omega_o^2-\omega^2)}$, derive Caushy's equation for normal dispersion? [15] Mark

b- Describe the anomalous dispersion phenomenon using Sellmeier's mechanism (clarify your answer with suitable drawing) ? [15] Mark

Best wishes: *Prof. Dr. Kermal El-Farahaty*

المستوى الثالث فيزياء . ف ٣١٢ المفاعلات والنيوترونات

Mansoura University Faculty of Science Subject: Physics		Level 3 Jan 2014
Course (s): Reactor physics and neutrons 312		Time allowed : 2 hours

Answer All Questions

1- Comment on each of the following:

a- Control group of reactor.

b- Coolant group of reactor.

c- Lawson criterion.

d- Ignition temperature. [20] Mark

2-

a- Prove the four factors theory.

b- Explain how to control the fission reactors. [20] Mark

3- Discuss the following:

a- Theory of reactors and diffusion equation.

b- The effect of reactor pollution on the human. [20] Mark

4- Investigate the three cycles for thermonuclear reactions in the sun and write your comment. [20] Mark

مع اطيب التمنيات بالنجاح والتوفيق

الممتحنون أ.د/ السيد الوكيل – أ.د/ عماد الشيوي

المستوى الثالث - فيزياء - فيزياء رياضيات ف ٢١٥

Mansoura University Faculty of Science Physics Department **Final Exam – 1st Term** (2 Jan. 2014)	**2013-2014**	**Third Level Students** **(Special Physics)** **Course: Math. Physics 1 (Phy315)** **Time allowed: 2 hours**

Full Mark: 80 (Every question: 20 Mark)

Answer the following questions

Q1: Estimate the following integrals by using *Gamma* and *Beta* functions:

i) $\int_0^{\pi} \tan^{3/2}(x/2)dx$ ii) $\int_{-1}^{1}\left(\frac{1-x}{1+x}\right)^{3/2} dx$ iii) $\int_0^1 \frac{dx}{\sqrt[3]{1-x^3}}$ iv) $\int_0^{\infty} \exp(-x^2)dx$

Q2:

A) Prove the following orthogonality property of the Legendre Polynomials:

$$\int_{-1}^{1} P_n(\mu)P_m(\mu)d\mu = \frac{2}{2n+1}\delta_{nm}$$

B) Show that: $\int_{-1}^{1} xP_n(x)P_{n-1}(x)d\mu = \frac{2n}{4n^2-1}$

Q3:

A) Prove that the generating function of the Bessel functions $J_n(x)$ can be expressed as:

$$\exp\left[\frac{x}{2}\left(t-\frac{1}{t}\right)\right] = \sum_{n=-\infty}^{\infty} t^n J_n(x)$$

B) Show that: $\int_0^{\infty} e^{-ax}J_0(x)dx = \frac{1}{\sqrt{a^2+1}}$

Q4:

A) In quantum mechanics, the solution of Schrödinger equation of the H_2 – atom is obtained in terms of Hermite polynomial functions $H_n(x)$. Define this function and its properties (generating function, orthogonality, and alternative expression).

B) For Laguerre polynomial functions $L_n(x)$, prove that

$$L_n(x) = \frac{e^x}{n!}\frac{d^n}{dx^n}\left(x^n e^{-x}\right)$$

and obtain the first Laguerre polynomials $\{L_0(x), L_1(x), L_2(x), L_3(x)\}$

With my best wishes

Dr. M. Sallah

Mansoura University Faculty of Science Physics Department Subject: Physics		First Term Third Year : Physics Date : 9-1-2013 Time allowed : 2 hours
Course (s): Phys 310 (statistical thermodynamics)		Full Mark:: 80 Mark

Answer **the** following Questions : Each Question [20] Mark

[1] Using Bose-Einstein and Fermi dirac distribution functions, find
a) Plank's law of black body radiation and
b) thermionic emission.

[2.a] State and discuss the properties of partition function.

[2.b] A system consists of two particles. Suppose that the system has two energy level, where $\varepsilon_1 = 0, \quad \varepsilon_2 = \varepsilon, \; g_1 = g_2 = 1$. Calculate the partition function for
(a) a single particle
(b) two particles (distinguishable)
(c) two particles (indistinguishable)

[3.a] Derive the distribution function of Bose – Einstein statistics.
[2.a] Derive the distribution function of Fermi – Dirac statistics.

[4.a] Derive the energy distribution of molecular speed.

[4.a] Discuss the difference betweenm Boltzmann, Bose- Einstein and Fermi-Dirac Statistics.

With my best wishes
Prof. Dr. A. Elgarayhi

Examiners: 1. Prof. Dr. A. Elgarayhi **2. Dr. M. Mansour**

المستوى الثالث - فيزياء - فيزياء تجريبية ف ٣١٣

Mansoura University Faculty of Science Physics Department		First Term Examination, Third Year : Physics Date : **16/1/ 2014** Time : **2 hours**
Course (s) : **Experimental Physics , 313 ف**		Full Mark : **80 Mark**

Answer the Following Questions

[1-a] Describe in detail, with a neat sketch, the constriction and working of Mcleod gauge, and describe the construction of the resistance type gauge(priani gauge).

[15 Marks]

[1-b] Nine particles have speed of 5.00,8.00, 12.0,12.0,12.0,14.0, 14.0,17.0 and 20.0 m/s:

i- Find the particles average speed.
ii- What is r.m.s. speed of the particles?
iii - What is the most probable speed of the particles? **[15 Marks]**

[2] Account on the following :

i- The quartz spectrograph as a tool in spectrum analysis. **[10 Marks]**

ii- Flame photometer as a tool in spectrum analysis. **[10 Marks]**

iii- Photographic process. **[10 Marks]**

[3- a] Describe with a neat diagram the construction and working of root high vacuum pump.

[10 Marks]

[3- b] Write short easy on the principal of scanning electron microscope and give a comparison of the scanning electron microscope and the optical microscope.

[10 Marks]

With best wishes

أ.د . إبراهيم فوده & أ.د. المتولى عبد الرازق

المستوى الثالث فيزياء - فيزياء حيوى - ميكانيكا الكم ١ ف ٢١٤ .

Mansoura University Faculty of Science Physics Department	20 Jan. 2013	***Third Year Physics & Biophysics*** Time allowed: 2 hrs Full Mark: 80

Course: Quantum Mechanics I (314)

Answer the following questions:

1. a) Find the bound state energy levels and their corresponding eigenfunctions of a particle moving In a one-dimensional harmonic oscillator potential.
b) Discuss the Degeneracy of the lowest three energy states of a spherical harmonic oscillator. [25 Marks]

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2) A mono-energetic beam of particles of energy E strikes from left a one-dimensional potential step given by $V(x)=0$ for $x<0$ and $V(x)=V_0$ for $x>0$. Obtain the reflection and transmission coefficients in the case of $E>V_0$ and compare the quantum mechanical results with the classical one. [20 Marks]

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3) Using the perturbation theory for non-degenerate states to derive the first-order corrections on the energy eigenvalues and their eigenfunctions of a perturbed system. [20 Marks]

4-a) An infinite potential well of width L given by $V(x)=0$ for $0<x<L$ and oo elsewhere is perturbed in the region $0< x <L/2$ by a value V_0 , find the first order correction on its ground state energy.
4-b) Calculate $[\hat{E}, t]$ and $[\hat{p}_x, x^2]$ [15 Marks]

With Our Best Wishes

Prof. Dr. A.R. Degheidy Prof. Dr. A..El-hanbaly

المستوى الثالث - فيزياء - فيزياء المعادن ف ٣١٧

Mansoura University	First Semester Exam (Jan.2014)
Faculty of Science	Phys 317 Physics of Metal
Physics Department	Third Level – Physics

Answer the Following Questions — Total Mark [80 Mark]

Time allowed Two Hours — 23-01-2014

Question 1, Interpret why Metal crystallize typically in one of three structures namely, the face Centered cubic, the body centered cubic and the hexagonal closed packed structure. [20Mark]

Question 2, Lithium has electrical conductivity of $1.05 \times 10^{7}\ \Omega^{-1}.m^{-1}$ and there are 4.8×10^{28} electrons per m^3 .

Determine: (a) The mobility of electrons in lithium, (b) The average electron energy at zero Kelvin. [20Mark]

Lithium is a monovalent element.

Question 3, Distinct Physically between Metals and Non – Metals. [20Mark]

Question 4, Discuss Scattering mechanisms in Metals At: (i) high temperature, and (ii) low temperature. [20Mark].

Useful information: Electron mass = 9.109×10^{-31} Kg , Electron Charge $=1.602 \times 10^{-19}$ Coul. Density of Lithium 0.534 g/cm^3 , Planck's constant $h = 6.626 \times 10^{-34}$Js, and Avogadro's number 6.022×10^{23} atoms / mole

Prof.Dr. Mustafa Kamal