٣ فيزياء - ضوء متقدم ف٣١٦

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] a- Discuss Raman scattering theory in a classical frame work ? [15]Mark

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

[2] a-Calculate the electric field at a large distance from a thin glass plate if a source of light is placed at a large distance from its opposite side? [15] Mark

b- Write briefly about the quarter wave plate?
Calculate the thickness required for a quarter wave plate having $n_o = 1.768$ and $n_E = 1.760$ using light of wavelength $\lambda = 5893$ Å. [10] Mark

[3] a- Derive Rayleigh equation for elastic light scattering by isolated small particle in vacuum illuminated by plane polarized light? [15] Mark

b- Describe the anomalous dispersion phenomenon using Sellmeier mechanism (clarify your answer with suitable drawing)? [10] Mark

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

المستوى الثالث - فيزياء - ف ٣١١ فيزياء الكواكب
فيزياء صوى

Mansoura University Faculty of Science Department of Physics Course Code: Phys. 311 Title: Solid State Physics		First Semester (Jan. 2015) Exam Type (Final): 3rd Year (Physics, Biophysics) Time: Two Hours Full Mark: 80 Mark

Answer **only three** questions from the following

1- a: Density of FCC copper is 8.96 g/cm^3 and its atomic mass is 63.54 g/atom. Find the Bragg angle for the first order reflection from the planes (110) at $\lambda = 0.5$ Å. Will there be any higher order reflections? [14 Mark]

b: Derive a relation for the separation distance between planes in a crystalline structure. Is that relation valid for all types of lattices? [13 Mark]

2- a: The energy of interaction of two atoms a distance r apart can be written as:
$U(r) = -(a/r) + (b/r^7)$ where a and b are constants.
(*i*) Show that for the particles to be in equilibrium, $r = r_0 = (7b/a)^{1/6}$.
(*ii*) In stable equilibrium, show that the energy of attraction is seven times that of the repulsion in contrast to the forces of attraction and repulsion being equal. [14 Mark]

b: Which type of cubic lattice has the highest packing density? Give a proof. [13 Mark]

3- a: Describe an experimental method for determination of the separation distance between planes in a crystalline structure. [14 Mark]

b: Can gamma rays be used to study the crystalline structure? Explain! [13 Mark]

4- a: Show that the bulk properties of a solid does not depend on its volume . [14 Mark]

b: Write down the atomic radii r in terms of the lattice constant a, for:
(*i*) Simple cubic structure, (*ii*) FCC structure, (*iii*) BCC structure. [13 Mark]

أطيب التمنيات : أ.د. حمدى دويدار

لجنة التصحيح: أ.د. حمدى دويدار - أ.د. جمعة الدمراوى (شعبة فيزياء)
أ.د. حمدى دويدار - د. شليبى بدر (شعبة فيزياء حيوية)

المستوى الثالث - فيزياء - ف ٣١٢ فيزياء المفاعلات والنيوترونات

Mansoura University
Faculty of Science
Physics Department

Course code: ph 312

First semester 2014-2015
Date: 29-12-2014

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

Answer the following questions:

1-A-Define the following quantity:

i- The reactor ii- The cross section of an event iii- The neutron angular density

iv- The reaction rate v- The scattering angle . (10 Mark)

1-B- Derive the neutron transport equation in term of the angular density (10Mark)

2-Write short notes about the nuclear reactors, and take an example of the reactors to show how obtained the electricity. (20 Mark)

3-a- Using the Fick's rule to derive the diffusion equation (15 Mark)

3-b- Show the relation between the mean free path and the macroscopic cross section. (5 mark)

4- Consider a homogeneous bare slab reactor with inner width 2a, and outer width 2b. Calculate the *eigen values* of the one speed transport equation, and *Criticality factor* for the emitting neutrons. (20 Mark)

Best wishes:

Prof. Dr. S. A. El-Wakil & Dr. Abeer Awad

المستوى الثالث - فيزياء - فيزياء رياضيات (١) (ف٣١٥)

Mansoura University Faculty of Science PHYSICS DEPARTMENT Final Exam – 1st Term (1 Jan. 2014)	2014-2015	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: A) Estimate the following integrals by using *Gamma* and *Beta* functions:

i) $\int_0^{\pi} \tan^{5/2}(x/2)dx$ ii) $\int_0^1 \sqrt{\frac{1}{x}-1}\,dx$ iii) $\int_0^{\infty} \exp\left(-\frac{x^2}{4}\right)dx$

B) Prove the relation between Beta and Gamma functions as: $B(x,y)=\frac{\Gamma(x)\Gamma(y)}{\Gamma(x+y)}$

Q2:

A) Prove Rodrigues formula of the Legendre Polynomials as: $P_n(\mu)=\frac{1}{2^n n!}\frac{d^n}{d\mu^n}\left(\mu^2-1\right)^n$

B) Show that: i) $\int_{-1}^{1} xP_n(x)P_{n-1}(x)dx=\frac{2n}{4n^2-1}$ ii) $P_3(x)=\frac{1}{2}\left(5x^3-3x\right)$

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) i) Show that: $\int_0^{\infty} e^{-x}J_0(x)dx=1$ ii) Evaluate $\int_{-\infty}^{\infty} xe^{-x^2}H_i(x)H_j(x)dx$

Q4:

A) What is the relation between Weber-Hermite function $\Psi_n(x)$ and Hermite function $H_n(x)$? Explain how can you obtain the expression of Weber-Hermite function in terms of Hermite function and solve the corresponding Weber-Hermite differential equation.

B) For Laguerre polynomial functions $L_n(x)$, prove its orthogonality property as

$$\int_0^{\infty} e^{-x}L_n(x)L_m(x)dx=\delta_{nm}$$

With my best wishes

Dr. M. Sallah

٣ فيزياء

(ف ٣١٣) فيزياء تجريبية

Mansoura University Faculty of Science Physics Department		First Term Examination, Third Year : Physics , **313 ف** Date : **2/1/ 2015** Time : **2 hours**
Course (s) : **Methods of Experimental Physics**		Full Mark : **80 Mark**

Answer the Following Questions

[1] a- Describe the working of a rotary oil pump for producing law pressures. **[10 Marks]**

b- Calculate the root mean square velocity (r.m.s) velocity of the nitrogen molecules at 0 °C. the density of nitrogen at N.T.P is 1.25 g/cm^3 and g=981 cm /s^2. **[10 Marks]**

c- Discuss the factors usually considered for the selection and choice a pump. **[10 Marks]**

[2]Account on the following :

i- The quartz spectrograph. **[10 Marks]**

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

iii- Photographic process. **[5 Marks]**

[3]Account on the following :

i- Light losses in spectrographs. **[10 Marks]**

ii- Fogging produced in the photographic plates. **[10 Marks]**

iii- Give some examples for systematic errors and random errors. **[5 Marks]**

With best wishes

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

Mansoura University
Faculty of Science
Physics Department
Course: Phys. 314

First Term Exam. Jan. 2015
3rd year Phys. and Bio-phys.
Allowed Time: 2 hours
Full Mark: 80

Quantum Mechanics

Answer the following questions:

[1-a] Write on the basic postulates of quantum mechanics. [5 Marks]

[1-b] A beam of mono-energetic particles of energy E moves freely in x-direction is subjected to a potential jump of height $V_0<E$. Determine the reflection and transmission coefficients of the beam and compare the results with those calculated classically. [15 Marks]

[2-a] Using the time-independent perturbation theory to estimate the first order corrections on the energy eigen-values and their corresponding eigen- functions of a particle moves in a perturbed system. [12 Marks]

[2-b] Verify that $[x^2, \mathbf{P}_x]=2ihx$, and calculate $[\mathbf{E},t]$. [8 Marks]

[3-a] Solve the one-dimensional Schrodinger equation to determine the allowed energy levels of a particle moves freely inside an infinite potential well of width L. [12 Marks]

[3-b] If this potential is perturbed by $\mathbf{H'}=V_0$ in the region $0<x<L/2$, calculate the 1st order correction on the ground state energy of the particle. [8 Marks]

[4-a] Determine the allowed energy levels and the corresponding eigen functions of a one-dimensional harmonic oscillator. [15 Marks]

[4-b] Discuss the degeneracy of a spherical harmonic oscillator and calculate its value for the 2nd excited state energy level (N=2). [5 Marks]

WITH OUR BEST WISHES

Examiners: Prof. Dr. A. R. Degheidy and Dr. E. B.Elkenany

٣ فيزياء - فيزياء المعادن ف ٣١٧

Mansoura University
Faculty of Science
Physics Department

First Semester "Jan.2015"
Metal Physics Exam –Phys-317
Third Level Physics "Group 1" -

Total Mark [80]

Time Allowed TWO HOURS

ANSWER THE FOLLOWING QUESTIONS:

Q.1: A Copper wire of cross –sectional area 3×10^{-6} m^2carries a current 10 A. Find the drift velocity of electrons in this metal wire. The density of copper is 8.95 g/cm^3, the atomic weight is 63.5 g/mole. Estimate the average time between collisions for electrons in copper at 20°C, where the resistivity of copper is 1.7×10^{-8}Ohm-m.Compute the average electron energy in a metal at zero Kelvin. Avogadro's number, 6.02×10^{23}, electron mass, 9.109×10^{-31}Kg, Planck's constant 6.63×10^{-34}Js, electron charge =1.602×10^{-19}Coul. , 1eV -1.602×10^{-19}J, 1Cal=4.2 J, Copper is monovalent. [*20Mark*]

Q.2 : Give possible reasons why Trivalent and Quadrivalent are metallic in character , and why metal crystallize typically in one of three structures , namely : BCC , FCC , and HCP structure ?. [*20Mark*].

Q.3: (a): Explain why electrons make only small contributions to the specific heat of a metal? [*10Mark*]. (b): The element sodium has density 0.97×10^3 Kgm^{-3}, relative atomic mass 23 and electrical conductivity 2.1x107 $Ohm^{-1}.m^{-1}$. Determine (i) the thermal conductivity at 20°C of the element sodium by knowing that the numerical value of Lorenz number is 5.2×10^{-9}cal.ohm/s.$deg^2$and (ii) the mobility of electrons [*10Mark*].

Q.4 (a): Explain the meaning of the phase transformations in metals and illustrate your answer with examples. [*10Mark*]. (b): Consider a cube of gold 1mm on an edge. Calculate the approximate number of conduction electrons in this cube whose energies lie in the range 4.000 eV to 4.025 eV. [*10Mark*].

انتهت الأسئلة :

Prof.Dr. Mustafa Kamal.

٣ فيزياء - فيزياء حرارية إحصائية (ف ٣١٠)

Mansoura University Faculty of Science Physics Department Subject: Physics		First Term Third Year : Physics Date : 5-1-2014. Time allowed : 2 hours
Course (s): Phys 310 (Statistical Thermodynamics)		Full Mark: 80 Mark

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

[1] Deduce the Maxwellian distribution for molecular velocities.

[2] Find:

a) Plank's law of black body radiation and
b) Maxwell- Boltzmann velocity distribution

Using Bose-Einstein distribution functions.

[3] Derive the distribution function of Fermi – Dirac statistics.

[4.a] 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)

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

With my best wishes
Prof. Dr. A. Elgarayhi

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