المستوى الثالث - فيزياء - فيزياء رياضيات (أ) ف ٣١٥

Mansoura University
Faculty of Science
Physics Department

Level (3) physics students
Full Mark: 80
Allowed time: 2 hours
Course title: phys 315
mathematical phys.

First semester
Date:31-12-2012

Answer the following questions:

			Marks
1-	a-	Solve the following differential equation $y'' - 2xy' + 2n = 0$ for $n=0,1,2,3$	15
	b-	Show that the Hermitain function follows: $H_n'(x) = 2nH_{n-1}(x)$	10
2-	a-	Show that $y'' + (\lambda - x^2)\, y = 0$ reduces to Hermit equation via the transformation $y = Z\, e^{-x2/2}$.	20
	b-	Evaluate: $\int_{-\infty}^{\infty} e^{-x2} H_n(x) H_m(x)\, dx$ for the cases (n=2,m=2) and (n=3,m=4)	10
3-	a-	Solve $xy'' + (1-x)y' + ny = 0$ for $n= 0,1,2,3$	15
	b-	show that $L_n(0) = 1$, $L_n'(0) = -n$	10

Best wishes:

أ.د/ عطاالله الحنبلى

المستوى الثالث - فيزياء - فيزياء المفاعلات والنيوترونات ف ٢١٤

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

Answer All Questions

1-

a- Prove the four factors theory.

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

2- Discuss with plot:

a- The types of nuclear chain reactions.

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

3-

Comment on each of the following:

1- Fuel group.
2- Control group.
3- Coolant group.
4- Protection and shield group. [20] Mark

4-

Solve the diffusion equation in:

a- point source.

b- plane neutron source. [20] Mark

الممتحنون أ.د/ محمود ابو ذيد – أ.د/ علي الفراش – أ.د/ أحمد الجرايحي – أ.د/ عماد الشيوي

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

Course: Quantum Mechanics I Phys.(314)

Answer Four Questions Only:

1.a) Find the bound state energy levels and their corresponding eigen-functions of a particle moving in one-dimensional harmonic oscillator potential. [15 Marks]
1.b) Discuss the Degeneracy of the lowest three energy states of a spherical harmonic oscillator. [5 Marks]

2.) Using the radial part of the Schrodinger equation in spherical coordinates to determine the bound state energies of a hydrogen-like atom. [20 Marks]

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3) A particle of mass m and energy E free to move on a straight line in x-direction approaching a potential step given by V(x)=0 for x<0 and V(x)=V_0 for x>. Calculate the reflection and transmission coefficients of the particle in the case of E>V_0 . [12 Marks]

4.a) 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. [14 Marks]
4.b) Calculate $[\hat{E}, t]$ and $[\hat{p}_x, x^2]$. [6 Marks]

5.a) Prove that $\hat{L}_+ Y_{lm}$ and $\hat{L}_- Y_{lm}$ are eigenfunctions of $\hat{L}^2$ and $\hat{L}_z$ operators and find their eigenvalues. [10 Marks]
5.b) Determine the discrete energy levels and their corresponding eigenfunctions of a particle moving freely in an infinite deep potential. [10 Marks]

With Our Best Wishes

Prof. Dr. A.R. Degheidy Prof. Dr. A. Elhanbaly

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. 2013
Allowed Time: Two hours.
Full Mark: 80

Answer the following questions

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

b- Discuss the classical description of Raman scattering? [10] 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- Describe briefly the normal dispersion phenomenon using Cauchy's equation?(clarify your answer with suitable drawing) [10] Mark

[3] a- Derive Rayleigh equation for elastic light scattering by isolated small particle in vacuum in the following cases:
i) plane polarized light. ii) unpolarized light ? [25] Mark

b- Explain why the sky is blue? [5] Mark

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

Mansoura University Faculty of Science Physics Department Subject: Physics		First Term Third Year : Physics Date : 13-1-2013 Time allowed : 2 hours
Course (s): Phys 310 (statistical thermodynamics)		Full Mark:: 80 Mark

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

[1] Deduce the Maxwellian distribution of molecular velocity.

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

[2.b] Discuss the differences between Boltzmann, Bose- Einstein and Fermi-Dirac Statistics.

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

[3.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)

[4] Prove that the Ferm-Dirac distribution function is given by:

$$\frac{n_i}{g} = \frac{1}{Be^{\beta\varepsilon_i} + 1}.$$

With my best wishes
Prof. Dr. A. Elgarayhi

Examiners: 1. Prof. Dr. A. Elgarayhi
2. Dr. M. Mansour
2.Prof. Dr. Maher Eltonsy
4. Dr.Mohamed Mokhmer

المستوى الثالث . فيزياء الكوانتم ف ٣١١

Mansoura University Faculty of Science Department of Physics Course Code: Phys. 311 Title: Solid State Physics		First Semester (Jan. 2013) 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: Show that the bulk properties of a solid does not depend on its volume . [13 Mark]

b: Illustrate with drawings the planes in an orthorhombic crystal whose Miller indices are (101), (201), (123). [13 Mark]

2- a: Derive a relation for the spacing between planes in a crystalline structure. [14 Mark]

b: Copper has fcc structure, its density is 8.93 g/cm^3 and its atomic weight is 63.5 g/atom. Calculate:

(*i*) Number of atoms per mm^2 in the (101) plane,

(*ii*) The radius of Cu atom. (N_A =6.022×10^{23} mol^{-1}) [13 Mark]

3- a: Proof that Brag condition for diffraction is consistent with Laue equations. [14 Mark]

b: Explain how the spacing (*d*) between parallel planes in a crystal can be determined experimentally. [13 Mark]

4- a: Write on the effect of lattice imperfections on the physical properties of crystalline materials. [14 Mark]

b: Compare between the packing fractions of SC, BCC, FCC cubic lattices. [13 Mark]

مع التمنيات بالتوفيق: أ.د. حمدى دويدار

المستوى الثالث - فيزياء فيزياء تجريبية ف ٣١٣

Mansoura University Faculty of Science Physics Department		First Term Examination Third Level : Physics Date : **14/1/ 2013** Time : **2 hours**
Course (s) : **Experimental Physics , 313 ف**		Full Mark : **80 Mark**

Answer on the Following Questions

[1] **a-** Describe and explain with the help of suitable figures, one kind of the rotary and diffusion pumps. **[10 Marks]**

b- Flame photometer as a tool in spectrum analyses. **[10 Marks]**

c- Find the kinetic energy of the molecules of 1 gm of Helium at 0 °C if $R=8.31 \times 10^7$ erges/K and molecular weight of He is 4. **[10 Marks]**

[2] **a-** Describe a method for the qualitative and quantitative spectrographic estimation of trace elements in a powdered sample using an internal standard. **[18 Marks]**

b- Give examples for systematic errors and random errors. **[7 Marks]**

[3] Account on the following :

a- Fogging produced in the photographic plates. **[9 Marks]**

b- Discuss the factors usually considered for the selection and choice of a vaccum pump. **[9 Marks]**

c- Photographic process. **[7 Marks]**

With best wishes

أ.د. إبراهيم فوده - أ.د. حمدى دويدار - أ.د. متولى عبد الرازق - د. عبير عون