المستوى الرابع. فيزياء - فيزياء غير خطية (ف ٤٢٦)

Mansoura University
Faculty of Science
Physics Department

Second semester
Date:30-6-2012

4th level physics students
Full Mark: 80
Allowed time: 2 hours
Course title: Non linear physics
Course code: Phys 426

Answer the following questions: Marks

1-	Find the time-dependent integrals of the following systems i. $\dot{x} = y,$ $\dot{y} = x - \lambda y.$ ii. $\dot{x} = -\frac{1}{2}x + y^2,$ $\dot{y} = -\frac{1}{2}y - xy.$	20
2-	Show that the following system of equations admits a limit cycle $\dot{x} = x + y - x(x^2 + y^2),$ $\dot{y} = -x + y - y(x^2 + y^2)$	20
3-	Derive and discuss: i. The travelling wave solutions ii. Similarity solution of the KdV equation $u_t - 6uu_x + u_{xxx} = 0$	20
4-	Show that $u_t - 6uu_x + u_{xxx} = 0$ is Galilean invariant $(t^* = t;\quad x^* = x - ct,\quad u^* = u + \frac{1}{6}c)$ whereas $u_t + 6u^2u_x + u_{xxx} = 0$ is not.	20

Best wishes:

Examiners: أ.د/ محروص شاكر * أ.د/ عطاالله الحنبلى

المستوى الرابع - فيزياء - ميكانيكا (صباحية) (ف ٤٢٤)

Mansoura University Faculty of Science Physics Department Subject : Physics	Forth Year Physics	Second Term Forth Year : Physics Date : 23/6/ 2012 Time allowed : 2 hours

Statis.Mech. - ph (424)

Answer the following questions

(1) a - Derive the equation of motion for a statistical ensemble . (20)

b - The microcanonical Gibb's distribution is given by $\rho(\vec{x}, a) = \frac{1}{\Omega(E,a)} \delta[E - H(\vec{x}, a)]$ where E and $H(\vec{x}, a)$ are the energy and the Hamiltonian of the system respectively, what is Ω (E , a) ?, discuss it's geometrical meaning .

(2) a - Use the canonical Gibb's distribution to obtain Helmholtz equation (20)

$\bar{H} = \Psi - \theta \frac{\partial \Psi}{\partial \theta}$.

b - An ideal gas consists of N - particles is placed in thermal contact with a thermostat at temperature T. Find the free energy of the gas and discuss briefly Gibb's paradox (Note: the partition function $z = V^N (2\pi mkT)^{\frac{3N}{2}}$).

(3) a- Prove the equipartition law of kinetic energy and use it to obtain the specific heat of a diatomic gas. (20)

b- A fermions gas of N – particles confined within a volume V. Show that at absolute zero, all energy states blew Fermi level are occupied while all states above Fermi level are empty . Find $\epsilon_f(0)$.

4) a - Show that the partition function for a real gas in thermal contact with a heat reservoir Could be written in the form $z = z_0 z_{int}$ where z_o is the partition function for the ideal gas and z_{int} is the partition function of interaction . (20)

b - If $z_{int} = 1 + \frac{2\pi N^2}{V} \int_0^\infty f(r) r^2 dr$, find the free energy for the real gas .

With best wishes

Hayam mashaly

المستوى الرابع - فيزياء - كم إلكترونى ف٤٢٣

Mansoura University Faculty of Science Physics Department Subject: Physics		Second Term Fourth Year : Physics Date : 19 June 2012 Time allowed : 2 hours
Course (s): Phys 423 [Quantum electronics]		Full Mark: 80 Mark

Answer the following questions: Each question (20) Mark

[1] Derive the contribution of quantum theory for electrical conduction. [20] Mark
[2] Deduce the thermionic current arising from the emission of electrons from hot surfaces. [20] Mark
[3-a] discuss the improvement of thermionic current when the transmission coefficient is taken into account. [10] Mark **[3-b] Write on the transport phenomena. [10] Mark**
[4] Deduce Bloch functions and Kronig-Penny model for one dimensional crystals. [20] Mark
With my best wishes **Prof. Dr. Ahmed Elgarayhi**
Examiners: 1- Prof. Dr. Ahmed Elgarayhi 2- Prof. Dr. Abeer Awad

المستوى الرابع - فيزياء - كم إلكترونى ف٤٢٣

Mansoura University Faculty of Science Physics Department Subject: Physics		Second Term Fourth Year : Physics Date : 19 June 2012 Time allowed : 2 hours
Course (s): Phys 423 [Quantum electronics]		Full Mark: 80 Mark

Answer the following questions: Each question (20) Mark

[1] Derive the contribution of quantum theory for electrical conduction. [20] Mark
[2] Deduce the thermionic current arising from the emission of electrons from hot surfaces. [20] Mark
[3-a] discuss the improvement of thermionic current when the transmission coefficient is taken into account. [10] Mark **[3-b] Write on the transport phenomena. [10] Mark**
[4] Deduce Bloch functions and Kronig-Penny model for one dimensional crystals. [20] Mark
With my best wishes **Prof. Dr. Ahmed Elgarayhi**
Examiners: 1- Prof. Dr. Ahmed Elgarayhi 2- Prof. Dr. Abeer Awad

المستوى الرابع - فيزياء - فيزياء البلازما (ف ٤٢٢)

Mansoura University Faculty of Science Physics Department	بسم الله الرحمن الرحيم	جامعة المنصورة كلية العلـــوم قسم الفـــيزياء

Second Term Examination

Educational Level: 4th Level (physics) **Full mark: 80 mark** **subject: Physics**

Time: 2 hours **Course: 422phy**

Date: 12/6/2012 **Plasma physics**

Answer the following questions.

1- Write short notes on the following quantity.

i-The application of plasma in physics ii-Collective behavior

iii- Collisions in plasma iv- The conditions for existence the plasma. (20 mark)

2-a- Derive the Debye length for a system of plasma in which both the ions and electrons will follow the Boltzmann distribution

$n_j = n_0 \exp(-q_j \varphi / kT_j)$

(10 mark)

2-b Prove that the plasma frequency is given by the following relation

$$\omega_p = \left(\frac{4\pi n_0 e^2}{m_e}\right)^{\frac{1}{2}}$$

(10 mark)

3- Show the effect of the pressure in the plasma frequency for the electron acoustic wave. (20 mark)

4-For a single particle, derive the drift velocity for the particle, and show the effect of the electric and magnetic fields on his motion with assuming that the magnetic field will applied in the z-direction and the component of the electric field in the y-direction equal to zero . (20 mark)

Examiner: pr. Dr. M. Kabil & Dr. Abeer Awad

With best wishes

٤ فيزياء - فيزياء الجوامد (ف ٤٠)

University of Mansoura Faculty of Science Physics Department Subject Physics		2 nd Term Fourth year Date: June
Course(s):Physics solid state		

Answer the following questions:

1. Correlate between energy and wave number, and give the density of energy levels in both Sommerfeld's model and Brillouin zone model with showing how the solids can be classified to conductors, insulators and semiconductors.

2. a. What were the assumptions made by Drude in his theory of the electrical conductivity of metals?. What are the difficulties encountered by this theory? . Deduce the equation of motion of an electron under the applied of an alternating electric field.

b. Define the terms (a). thermal velocity (b)drift velocity and (c) mobility

C. What is the maximum velocity of an electron in a metal in which the Fermi energy has a value of 3.75 ev ?, and what would be the mobility of electrons when the mean free time between the collision in 10^{-14} sec?. e = 1.602×10^{-19} and m= 9.1×10^{-31} Kg.

3.a. Explain the terms polarization and dielectric polarization and give polarization mechanisms?

b. Give the physical concepts of dielectric constant, dielectric loss and dielectric strength.

4. Discuss the difference between the three following models Dulong-Petit, Einstein, and Debye used for describing the relation between specific heat of solids and temperature.

ع خزيا.د- فيزيا رسفورية (٣) ف ٤٢١

Mansoura University Faculty of Science Physics Department Course code: Phy 421 Radiation ف ٤٢١	Second Semester 2011-2012 Date: 9/6/2012	Fourth Level Physics students Full Mark: 80 Allowed time: 2 hours Course title: Nuclear Physics (3)

Answer only FIVE questions: **Marks**

1 -	Discuss the basic processes of beta decay and obtain the expression of Q-value in each process.	16
2 -	In Fermi theory of beta decay, describe the physical situation applied to the transition rate equation and calculate the square of the matrix element of interaction.	16
3 -	Classify in table the beta transitions according to ft-values.	16
4 -	Estimate the order of magnitude of the effect of the nuclear quadrupole moment on the hyperfine structure. Use a simple model consisting of a nucleus with quadruople moment Q = 1 barn separated from a unit charge by one angstrom unit.	16
5-	Give examples of the alkali atoms. Consider one of them in its atomic ground state , make a schematic drawing of the splitting of a $^2S_{1/2}$ state (L=0 , S=1/2 , J=1/2) with nuclear momentum I =1 caused by internal fields (hyperfine structure) and a weak external field.	16
6 – a	A proton with kinetic energy K collides with a proton at rest, producing a pion (π^0 , rest energy 135 MeV). What minimum value of K is needed ?	8
6 - b	Discuss and compare the main features of the four interactions of nature and list the mediating particle for each.	8

With my best wishes:

Examiners: أ.د.م / أحمد أبوالعلا أحمد