Mansoura University
Faculty of Science
Physics Department

2nd Term Examination
May 2010
Time allowed: 2 hrs

Atomic Physics

Answer the following questions

1-a) Draw the energy level diagram for X-ray spectra of the K, L and M series. Discuss Moseley's law. [15 Marks]

b) Deduce the wavelength in A^o and the energy in eV of the spectral line of the maximum wavelength of the Lyman series. [12 Marks]

2-a) For a monovalent element, deduce the possible j values for $\ell = 0,1,2,3$ and the type of each term. Explain the spectral series of the emission transition of sodium atom. Comment on the two D lines (D_1 and D_2) of sodium atom. [15 Marks]

b) State briefly the main assumptions of the vector atom model. The orbital angular momentum vector of an atom **L=2** and the spin angular momentum vector **S=3/2.** Estimate the total angular momentum vector of the atom **J**. [12 Marks]

3-a) Define the degenerate orbits. Starting with the mass relativistic effect and the general equation of the total energy, show how Sommerfeld could explain the fine structure. [15 Marks]

b) **Draw**, without mathematical derivation, the magnetic splitting due to the interaction between the orbital magnetic dipole moment μ_ℓ and the external magnetic field H of the spectral line from P state ($\ell=1$) to S state ($\ell=0$). "normal Zeeman effect". Comment on drawing. [11 Marks]

($c=3\times10^{10}$ cm/s $h=6.625\times10^{-34}$ J.s $R=1.097\times10^{7}$ m^{-1} $1eV=1.6\times10^{-19}$ J)
($e=1.6\times10^{-19}$ C $m_e=9.11\times10^{-28}$ g)

Best Wishes

Dr. A. El-Khodary

المستوى الثانى / فيزياء / فيزياء حديثة (ف ٢٢٠)

University of Mansoura Faculty of Science Physics Department Subject: Physics		Second Semester Sophomore Students Date :June 2010 Time allowed : 2 hours
Course (s): Phys 220	Modern Physics	Full Mark:: 80

Answer The Following Questions

1- In the laboratory frame an electron is at rest and a positron is observed coming directly toward the electron with momentum given by $p = 4$ MeV/c.

(a) Find the velocity of the center-of-mass with respect to the laboratory frame. (10 Marks)

(b) The total energy and the kinetic energy of each particle in the center-of-mass. (10 Marks)

($m_o c^2 = 0.511$MeV)

2 – The space and time coordinates of two events as measured in a frame S are as follows,

event 1 , $x_1 = x_o$, $t_1 = x_o/c$ ($y_1 = z_1 = 0$)

event 2 , $x_2 = 2x_o$, $t_2 = x_o/2c$ ($y_2 = z_2 = 0$)

(a) Find the velocity of the frame S' with respect to S in which these events occur at the same time. (5 Marks)

(b) What is the value of t at which both events occur in the new frame? (5 Marks)

3 – Find the velocity and the momentum of a particle whose kinetic energy equals its rest mass energy. (5 Marks)

4 – Calculate the wave length of a photon whose effective mass is

3.7×10^{-33} grams. ($h = 6.626 \times 10^{-34}$ Js) (5 Marks)

5 – Calculate the energy, wavelength and frequency of a photon which has the same momentum as that of an electron with a kinetic energy of 1 MeV. (5 Marks)

6 – x-ray with energies of 200 keV are incident on a target and undergo Compton scattering. Calculate the energy of the x-ray scattered at an angle of 60° to the incident direction, the energy of the recoiling electrons and the angle of the recoiling electron (15 Marks)

7 – What is the ultraviolet catastrophe in blackbody spectral distribution? (10Marks)

8 – Write on the wave function that describe a physical system. (10 Marks)

المستوى الثانى

برنامج فيزياء - ضوء فيزيائى (ف ٢٢١)

Mansoura University
Faculty of Science
Physics Department
El-Mansoura Egypt

Second Term Examinations, June , 2010

Subject : Physics — Course ; ٢٢١ف, Physical Optics
Time : TWO HOURS — Full Mark : 80 Marks
Date : 13 / June / 2010

Answer the Following Questions :

1 – a) What is the mean of resolving power of any optical system ? Derive an expression for resolving power of a prism for a parallel beam of light consisting of two wavelengths λ and $\lambda + d\lambda$ when the refractive indices for the material of the prism for that wavelengths are μ and $\mu + d\mu$ respectively.

(14 Marks).

b) suppose a parallel beam of monochromatic light of wavelength λ falls on a plate containing a large number of thin parallel slits, each slits have width a and the distance between adjacent slits is b , . A diffraction pattern will form on a screen . Give a model to explain the formation of this diffraction pattern. Hence derive an Expression of general condition for the bright fringes.

(13 Marks).

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2) Derive an expression for the intensity distribution in a fabry – perot system of interference fringes in transmission when the two coated plate are of same transmission coefficient T and of same reflectivity R . Show that the visibility of intensity distribution does not account for the absorption of the silver layer.

(26 Marks)

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3 –a) Discuss the forming of dark spot in the centre of Newton's rings. Derive the necessary formula of these rings .

(10 Marks)

b) If you have unpolarized monochromatic source and Nicole prism, explain a method to produce a beam of plan polarized light.

(10 Marks)

c) When a very thin plate of glass of refractive index $\mu = 1.54$ is placed into one of the interfering beams, the central light fringe shifts by six fringe width. Find the thickness of the glass plate if the wavelength is 5896 Å .

(7 Marks)

Good Luck
Prof. Dr. Taha Sokkar

المستوى الثانى فيزياء - ميكانيكا تحليلية

Mansoura University Faculty of Science Physics Department	Second Level Physics	Second Semester, 2009-2010 June, 2010 *(2010-06-29)* Time: 2 Hours

Subject: Phys 223 (Analytical Mechanics)

Answer All the following Questions: *(Full mark: 80)*		*Mark*
1.a)	Given the generating function: $$F_1(q,Q,t) = \frac{1}{2}m\omega[q - F(t)/(m\omega^2)]^2 \cot(Q),$$ Find the transformation equations and obtain the equation of motion of a simple harmonic oscillator acted upon by the force $F(t)$ in terms of Q and P.	*10*
b)	Define the followings: 1) Cyclic coordinates, 2) Conservative system 3) The difference between Newton and Lagrange for obtaining the equation of motion, 4) Holonomic and nonholonomic.	*10*
2.a)	A uniform circular hoop of mass (M) can slide freely on a smooth horizontal table and a bug of mass (m) can run on the hoop. The system was at rest when the bug starts to run. What is the angle turned through by the hoop when the bug has completed one loop of the hoop?	*10*
b)	Derive the Hamilton's equations.	*10*
3.a)	A solid cylinder of radius (a) and mass (m) rolls without slipping down on inclined plane of angle (α). Show that : i) the acceleration is constant and equal to $\frac{2}{3}g\sin(\alpha)$. Ii)The coefficient of friction must be at least $\frac{1}{3}\tan(\alpha)$.	*10*
b)	Derive the equation of motion of spinning top.	*10*
4.a)	Calculate the inertia tensor of a homogeneous cube of density (ρ), mass (m) and side of length (b).	*10*
b)	The spherical pendulum is a particle of mass (m) attached to a fixed point by a light inextensible string of length (a) and moving under gravity. Show that the Lagrangian is $L = \frac{1}{2}ma^2[\theta^{\cdot 2} + \sin^2(\theta)\varphi^{\cdot 2} + mga\cos(\theta)$, where θ and φ are the polar angles. Find the Hamiltonain and obtain Hamilton's equations. Identify which is cyclic coordinates.	*10*

With our Best wishes

Examiners:	*Prof. M. T. Attia (*)*	*Prof. A. Elhanbaly*

المستوى الثانى

تناظر فيزياء - (ف ٢٢٤) - قياسات كهربية وأجهزة قياس

فيزياء رصد

University of Mansoura Faculty of Science Physics Department Subject: Physics (224)		Second Term Second year Physics Date : 20 June 2010 Time allowed : 2 hours
Course : Electrical Measurements & Instrumentation		Full Mark:: 80 Mark

Answer the following Questions :

[1] a - Develop a circuit using a movement galvanometer of 10 mA full scale ($R_m = 150\Omega$) for an ammeter having ranges of 1.0 and 10 amperes. (8 mark)

b- What is the sensitivity of the meter of problem 1-a. (4 mark)

c- What is the full scale voltage that can be measured with the meter of Problem 1-a. (4 mark)

d- Ten measurements of the resistance of a resistor gave 101.2, 101.7, 101.3, 101.0, 101.5, 101.3, 101.2, 101.4, 101.3, and 101.1 Ω. Assume that only random errors are present. Calculate: (i) the arithmetic mean, (ii) the standard deviation of the readings, (iii) the probable error. (12 mark)

[2] a- The solution for the unknown resistance for a Wheastone bridge is $R_x = R_2R_3/R_1$ where $R_1 = 100 \pm 0.5\ \%\ \Omega$, $R_2 = 1000 \pm 0.5\ \%\ \Omega$, $R_3 = 842 \pm 0.5\ \%\ \Omega$ Determine the magnitude of the unknown resistance and the limiting error in percent and in ohm for the unknown resistance R_x. (10 mark)

b- A slide wire potentiometer has a battery of 4 V and negligible internal resistance. The resistance of the slide wire is 100 Ω and its length 200 cm. A standard cell of 1.018 V is used for standardizing the potentiometer and The rheostat is adjusted so that balance is obtained when the sliding contact Is at 101.8 cm.
(i) Find working current of the slid wire and the rheostat setting.
(ii) If the slide wire has divisions marked in mm and each division can be interpolated to one fifth, calculate the resolution of the instrument. (15 mark)

[3] a- A CRT of an oscilloscope has an accelerating voltage of 2000 V and parallel deflecting plates 2 cm long and 5 mm apart. The screen is 30 cm from the centre of the plates. (i) Find the deflecting voltage applied to the deflecting plates required to deflect the beam by 3 cm.
(ii) Find the sensitivity of a CRT.
(iii) The deflection factor of a CRT. (13 mark)

b- The ohmmeter of the Fig.(1) uses a 50-Ω basic movement requiring full scale current of 1 mA. The internal battery voltage is 3 V. The desired scale marking for half-scale deflection is 2000 Ω. Calculate (i) the values of R_1 and R_2 ; (ii) the maximum values of R_2 to compensate for 10 % drop in battery voltage; (iii) the scale error at the half –scale mark (2000 Ω) when R_2 is set as in (ii). (14 mark)

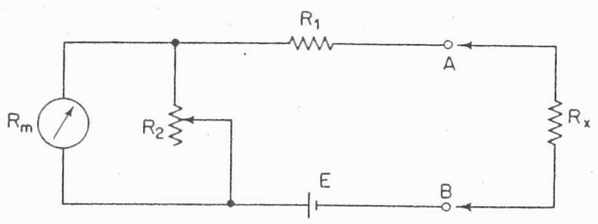

Fig .(1)

Examiners:

Prof. Dr. A. Oraby & Dr A . Lashein.

المستوى الثالث - فيزياء حيوية - ميكانيكا الموائع (ف ٢٢٧)

University of Mansoura Faculty of Science Physics Department		جامعة المنصورة كلية العلوم قسم الفيزياء

Second Semester May 2010

Educational Year: Second Level — Program: Physics & Biophysics
Time: 2 Hours — Subject: Physics
Date: 27/6/2010 — Course (s) code: Phys. 227 [Fluid Mechanics]
Full Mark: 80

Answer **the following** Questions

Mark

[1.a] Calculate the rate of blood flow In artery with cross-section of 2 cm^2 and the speed of the blood is 40 cm/s. Also, Determine the speed of the blood if it reached to capillary with cross – section of 0.1 cm^2. [10] Mark

[1.b] Mass of ice floating in salt water at north pole. What percent of the size of submarine to the total volume with the knowledge that the density of the ice is $\rho_i = 0.92\ g/cm^3$ and the density of salt water is $\rho_w = 1.03\ g/cm^3$. [10] Mark

Mark

[2.a] Derive the flow and particle Reynolds number. [10] Mark

[2.b] A sample of oil mist is taken at a flow rate of 1.2 L/min through a horizontal tube 1 cm in diameter. The aerosol consists of 2 μm diameter oil droplets in air at standard conditions. The particles are moving through the tube with the air but are settling at 0.01 cm/s. What is (a) the flow Reynolds number and (b) the particle Reynolds number. [10] Mark

Mark

[3.a] Deduce Bernoulli's equation to an ideal fluid. [10] Mark
[3.b] discuss the difference between Newtonian and n Newtonian fluid. [10] Mark

Mark

[4] Consider the outflow of water from a cylindrical tank with a hole at the bottom. You are asked to find the height of the water in the tank at any time if the tank has diameter 2m, the hole has diameter 1 cm and the initial height of the water when the hole is opened is 2.25 m. When will the tank be empty. [20] Mark

With my best wishes
Prof. Dr. A. Elgarayhi

Examiners: 1- Prof. Dr. S. A. El-Wakil 2- Dr. Emad Khedr

المستوى: الثاني برنامج : فيزياء المادة: **مقدمة في الاحصاء و الاحتمالات** ر 202	كلية العلوم	دورمايو 2010 الزمن : ساعاتان التاريخ: 17/6/2010

اجب عما يلي: (درجة الجزء 10 درجات)

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1 –ا- باقة زهور بها 4 زهرات لونها أحمر و 3 لونها أصفر و2 بيضاء أخذت زهرتين من الباقة بارجاع وكان المتغير العشوائي X يمثل عدد الزهرات الحمراء في العينة اوجد دالتي الاحتمال و التوزيع للمتغير العشوائي .

ب-اذا كانت دالة الكثافة للمتغير العشوائي X هي $0<X<7$ $f(x)= 1/7$

فما هي قيم الاحتمالات $p(2<X<4)$,$p(1<X<3)$.

ج- يصوب طفل على قرص دائري نصف قطره 9 سم وكانت اصابته سديدة اوجد احتمال ان تكون الاصابة على بعد اقل من او يساوي ثلثي نصف القطر من ناحية المركز.

2- ا-اوجد خط انحدار Y على X اذا كان (x,y): (4,9), (8,17), (10,21), (6,13), (2,5) واجد قيمة Y عندما $X=3.5$.

ب- اذا كان المتغير العشوائي X يمثل عدد مرات اصابه الهدف خلال 10 محاولات و كان احتمال اصابة الهدف في كل مرة هو 3/5 فما هو احتمال اصابة الهدف ثلاث مرات على الاقل وكذلك اوجد التوقع الرياضي والتباين لعدد مرات اصابة الهدف.

ج- اذا كانت الفرق الثلاث لمدرسة إعدادية تمثل 35% و 40% و 25% من اعداد المدرسة وكانت نسب النجاح في العام الماضي هي 50% و 60% و 40% على الترتيب . اختير طالب عشوائيا من المدرسة ما هو احتمال ان يكون ناجحا .

3- ا- احسب قيمة الوسيط لمجموعة البيانات التالية :

الفئة	5-	10-	15-	20-	25-	30-	35-	40-
التكرار	4	5	23	58	61	30	4	3

ب- اثبت انه اذا كانت A,B حوادث مستقلة فإن A^c و B ايضا تكون مستقلة.

مع أطيب التمنيات بالتوفيق د. عديله عثمان

المستوى الثاني (فيزياء - فيزياء حيوية)
معادلات تفاضلية

الفرقة: الثانية		دور: مايو 2010
الشعبة: الفيزياء	كلية العلوم – قسم الرياضيات	التاريخ: 2010/6/
المادة: المعادلات التفاضلية		

أجب عما يأتي

[1] –أ) استخدم طريقة متسلسلات القوى لإيجاد الحل العام حول $x = 0$ للمعادلة

$$y'' - y' = 0$$

ب) استخدم طريقة تغيير البارامترات الحل المعادلة

$$y'' - 2y' + y = \frac{e^x}{x}$$

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[2] –أ) $5e^{-x}, e^{-x}$ حلان للمعادلة $y'' - 2y' + y = 0$ هل الحل العام هو $y = c_1 e^{-x} + c_2 5e^{-x}$ حيث c_2, c_1 ثوابت اختيارية.

ب) أوجد عائلة المسارات المتعامدة على $x^2 - y^2 = cx$.

جـ) استخدم المؤثر D لإيجاد حل خاص للمعادلة $y'' - 5y' + 6y = x^3 e^{2x}$.

د) أوجد الحل العام للمعادلة $y'' \cos^2 x = 1$.

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[3] –أ) اثبت أن $\mu(x,y) = x^2 y^{-2}$ هو عامل مكاملة للمعادلة $y' = \frac{3yx^2}{x^3 + 2y4}$ ومن ثم حل المعادلة.

ب) بإيجاد عامل مناسب حل المعادلة $3x^2y^2dx + (3x^3y + x^3y^4)dy = 0$.

جـ) حل المعادلات التفاضلية الآتية

a) $y' = \frac{2 + ye^{xy}}{2y - xe^{xy}}$

b) $y' = \frac{2xy}{x^2 - y^2}$

c) $y' = \frac{x+1}{y^4 + 1}$

d) $y' = 6x\sqrt{y} - xy$

مع أطيب التمنيات بالنجاح والتوفيق

د. مجدى يوسف برسوم

المستوى الثانى برنامج نيزيار
صوتيات

Mansoura University Faculty of Science, Physics Department	بسم الله الرحمن الرحيم 2nd Term Exam 2009/2010 For the 2nd Year Students (PHYSICS)	Time Allowed : TWO Hours Subject : Ultrasonic & sonic

Answer the following questions: (**Note: 20 degrees for each**)

1 – a) Explain the mechanism of the piezoelectric effect in quartz, then show the difference between the X-cut and Y-cut quartz transducers.

b) Prove that the power of a forced oscillating vibrator is inversely proportional to the square of the mechanical impedance of the system.

2 – a) Deduce expressions for the amplitude and phase angle of the resultant wave when two non- harmonic motions are added. Refer to the phenomenon that associated with this case.

b) A mass of 0.2 kg hangs on a spring of 0.35 Kg mass. The stiffness constant of the spring is 100 N/m, and the mechanical resistance of the system is 7 Kg/sec. What is the damped free oscillation frequency of the system?

3 – a) Drive an expression for the Doppler shift of frequency.

b) How much is the Doppler shift recorded by stationary observer when sound source moves toward the observer with a velocity equals to:

(i) half that of the sound , and (ii) speed of sound.

4 – Rewrite the displacement equation of the following non-harmonic wave as summation of at least four harmonic terms,

$$y = a\left(1 - \frac{t}{2T}\right)$$ where a is constant and T is the periodic time.

Prof.Dr. Maher El-Tonsy & Dr. Husam Salah