المستوى الرابع - فيزياء
جسيمات أولية ف ٤١٦

Mansoura University Faculty of Science Physics Department	Year: 4th Level Specialization: *Physics Program*	First Semester, 2011-2012 December, 2012 Time: 2 Hours

Subject: *Elementary Physics* *Tuesday 25/12/2012* *12-02 PM*

(جسيمات أولية- ف ٤١٦)

Answer (3) Questions ONLY:	**(Full mark: 80)**	*Mark*
1.a)	**Make a brief classification of the elementary particles, then give a quark description of:** $\Sigma^+, \Sigma^0, \Sigma^-, \Xi^0, \Xi^-, \Lambda, \Lambda_c^+, \Omega^-$.	*10*
1.b)	**Put the charge (Q) & strangeness (S) values for the 9 spin-0 mesons in a table, then draw the hexagonal 8-fold way pattern (strangeness versus charge plot) for these values, [using a horizontal axis for (S) & a sloping axis for (Q)].**	*17*
2.a)	- **Chick the Baryon Numbers Conservations for the reaction:** $p + n \rightarrow p + p + n + \bar{p}$, and - **Chick the Lepton Numbers Conservations for the reaction:** $\pi^+ \rightarrow \mu^+ + \nu_\mu + \nu_e$, and - **Chick the Strangeness Conservations for the reactions:** $\pi^0 + n \rightarrow K^+ + \Sigma^-$	*11*
2.b)	**Tabulate the values of the charge & baryon numbers for each of the following quarks: u, d, s, c, b & t & the corresponding antiquarks. Then represent quark description of: p, p', n,** π^0, π^+, k^0.	*16*
3.a)	**Write a brief account about the three generations of matter.** **Then show that the neutron decay via weak interaction, as indicated by *Feynman* diagram, is a good example of quark transformations which led to the discovery of the *neutrino*.**	*17*
3.b)	**Show how the decay of a kaon (K+) into three pions (2** π**+, 1** π**−) is a process that involves both weak and strong interactions**	*10*
4.a)	**How many color quantum numbers present for quarks & anti-quarks?** **And by using these colors mention all possible combinations for gluons**	*13*
4.b)	**Show how by introducing the new quantum number (color), the problem of existing 3 strange quarks (sss) in the omega-minus (Ω^-) particle can be solved?**	*14*
5	**Write briefly on ONE of the following: Hadron Collider or Higgs Particle.**	*27*

With our Best wishes

Examiners:	*Prof. Dr Ali H. El-Farrash**	*Prof. Dr Ahmad El-Garayhy*
	Prof. Dr Mostafa Kamal	*Prof. Dr Abu-Bakr El-Bedawi*

* *Corresponding Examiner*

المستوى الرابع - فيزياء الليزر وتطبيقاته ف ٤١٠

Mansoura University Faculty of Science Physics Department		**First Term. 2013** **4th level** **Date : 29-12- 2012** Time allowed : **2 hours** Full Mark: **80 Mark**
Subject: **Physics**		Course: **Laser and Application 410 ف**

Answer the Following Questions

[1] a-Explain a method to obtain in single laser-mode out pout . Construct an experiment to investigate the longitudinal mode structure. **[12 Marks]**

b- Discuss the basic laser welding process of two metals. **[8 Marks]**

c- Calculate the ratio of spontaneous and stimulated emission for a tungsten filament lamp operating at a temperature of 2000 K, taking the average frequency to be $5x10^{-14}$ Hz ,

Not: $h=6.625x10^{-34}$ J. sec, $K=1.38x10^{-23}$ J /K. $C=3\ x10^{8}$ m/sec. **[7 Marks]**

[2] Deduce the condition of population inversion in a three level laser. Sketch curves for dependence of $\Delta N/N$ as a function of excitation intensity Γexpressed in terms of Γ_o. **[26 Marks]**

[3] a- Describe the essential feature of He- Ne laser. Sketch schematic diagram of this laser tube. Explain by the aid of an energy-level diagram, how population inversion is brought about in such gaseous system? **[12 Marks]**

b- Calculate the spectral broading due to Dopplers effect in He -Ne laser (λ= 6328A°). Assuming a discharge temperature of about 400K and a Neon atomic mass of 20.

Not: Avogadro's number = $6.022x10^{23}$.
$C=3\ x10^{10}$ cm/sec.
$K=1.38x10^{-16}$ erg /K. **[7 Marks]**

c- Explain the sandwich hologram technique to measure the distortion of an object. **[8 Marks]**

Good Luck

Examiner: Prof. Dr. Taha Sakkar

المستوى الرابع - فيزياء الليزر وتطبيقاتها ف ٤١٠

Mansoura University Faculty of Science Physics Department		**First Term. 2013** **4th level** **Date : 29-12- 2012** Time allowed : **2 hours** Full Mark: **80 Mark**
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Good Luck

Examiner: Prof. Dr. Taha Sakkar

المستوى الرابع - فيزياء - ف ٤١٣ الكتروديناميكا (٢)

Mansoura University Faculty of Science Physics Department Subject : Physics	Fourth Year Physics	First Term Fourth Year : Physics Date : 1 / 1 / 2013 Time allowed : 2 hours

Electrodynamics(٢) - phys. (413)

Answer the following questions **Points**

1- Unpolarized plane electromagnetic wave is incident obliquely on the interface between two dielectric media with refractive indices n_1 ,n_2 and $\mu_1 = \mu_2$, respectively , **(25)**

(a)Find an expression for the reflection coefficient when the $\vec{E}$ component is parallel to the plane of incidence .

(b) Show that at Brewster's angle the reflected wave is linearly polarized normal to the plane of incidence .

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2 – Answer **(a) or (b) only**

(a) Show that the wave guide acts as a high pass filter and each of the electromagnetic field vectors inside the guide is a superposition of two modes, one is TE and the other is TM. Explain why TEM wave can not be propagated through wave guides . **(15)**

(b) Write the equation of motion for a free electron in a metal under the influence of an electromagnetic field with angular frequency ω . Solve the equation to obtain the Conductivity as a function of ω . Use the result to discuss the propagation of the wave through plasma medium . **(15)**

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3 - (a) The Lorentz gauge for the electromagnetic field requires that $\vec{\nabla}.\vec{A} = -\epsilon\mu\frac{\partial\varphi}{\partial t}$, find the differential equation satisfied by the vector potential $\vec{A}$ and the scalar potential φ . **(25)**

(b) Show that the retarded potential $\varphi(\vec{r},t)$ satisfies the inhomogeneous wave equation obtained in part (a) .

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4 – Obtain the ratio of the reflected to incident powers of an electromagnetic wave reflecting from a conducting surface at normal incidence. Show that the transmitted power tends to zero in case of a perfect conductor . **(15)**

Good luck

Hayam mashaly

المستوى الرابع - فيزياء - ميكانيكا الكم ف ٤١٢

Mansoura University Faculty of Science Physics Department	Level: Four Program: Physics Code: Ph 412	First Semester Final Exam, 2012-2013 September, 2013 *[2013-01-05]* Time: 2 Hours

Quantum Mechanics II

Answer ALL of the Following Questions:

(Total mark: 80 marks)

1.	A nuclear particle of spin ½ initially in spin state $\alpha_z = \begin{pmatrix} 1 \\ 0 \end{pmatrix}$ has spin motion only immersed in a magnetic field has the form $\underline{B}(t) = B_0[\cos(\omega t)\hat{\underline{i}} - \sin(\omega t)\hat{\underline{j}}] + B_z\hat{\underline{k}}$. Find the resonance frequency of this system.	*15*
2.a)	Consider an atom in its unperturbed state $\psi_n(\underline{r},t)$ at time $t<0$ interacts with a weak electro-magnetic field of Hamiltonian $H'(\underline{r},t) = 2H'(\underline{r})\cos(\omega t)$. What is the transition probability of this atom to another state $\psi_m(\underline{r},t)$ at time $t>0$. Find the transition probability rate after a long-time.	*15*
b)	Assume that an adiabatic perturbation is turned on at time $t=0$ on an unperturbed system in state n. Calculate the probability of transition of this system to another state $m \neq n$.	*10*
3.	A particle of mass (m) and energy (E) scattered from a fixed scattering center of central potential $V(r)$. Derive the total scattering cross-section of this process in terms of the partial wave phase shift. Then calculate the total scattering cross-section for low energy incident particle.	*15*
4.a)	Consider a particle of mass (m) and energy (E) scattered from a central potential $V(r)$. Using Born approximation, calculate the scattering amplitude of this process. [The normalized plane-wave of a particle in a box of length (L) is $\|k\rangle = e^{i\underline{k}.\underline{r}}/\sqrt{L^3}$, the energy density in this box is $g(E_k) = mL^3k/(2\pi^2\hbar^2)$ and the rate of transition probability is $w_{kk'} = (2\pi/\hbar)g(E_{k'})|\langle k|V(r)|k'\rangle|^2$.]	*15*
b)	Using Born approximation, evaluate the differential scattering cross-section of a particle of mass (m) scattered from an attractive Gaussian potential $V(r) = -V_0 e^{-(r/R)^2}$, where V_0 and R are constants. [$\int_0^\infty dr\, r\sin(Kr)e^{-(r/R)^2} = (\sqrt{\pi}/4)KR^3e^{-(KR/2)^2}$].	*10*

With our Best Regards

Examiners:	*Prof. Essam M. Abulwafa (*)*	*Prof. Gomma' El-Damarawy*

المستوى الرابع - أشباه الموصلات ف ٢٠١١

غير مبارد

Mansoura University	Specialization: physics	1st Semester, 2012-2013
Faculty of Science	4th level	Jan., 2013
Physics Department	Phys (411)	Time: 2 Hours

Subject: Semiconductors
Final examination

(Full mark: 80 degrees)

Answer the Following Questions:		*Mark*
1. a)	What do we mean with: i- Intrinsic Semiconductors. ii- Extrinsic Semiconductors. iii- Depletion region. iv- Drift mobility. v- Conduction Band. vi- Forbidden energy gap. vii- Valence Band . viii- hot-electrons.	*16 marks*
b)	Calculate the resistively of intrinsic specimen of Ge at 300K if the electron density is $2x10^{19}/m^3$, electron mobility 0.39 and positive holes mobility is 0.19 m^2/ V.S respectively.	*4 marks*
2. a)	Deduce the effective mass relation in crystal lattice.	*12 marks*
b)	"All elements of IV- group has the diamond structure" .Explain in details this expression.	*8 marks*
3. a)	Deduce the position of Fermi level at zero Kelven in intrinsic semiconductor.	*12 marks*
b)	Study the effect of temperature on both the drift velocity and hot – electrons.	*8 marks*
4. a)	Deduce the concentration of carriers in intrinsic semiconductor.	*12 marks*
b)	A crystal of semiconductor has positive holes with density $4.2x10^{15}/cm^3$ and density of states in V.B = $8.4x10^{14}/cm^3$. Calculate the position of Fermi energy level at - 9°C.	*8 marks*

With our Best wishes,

Examiners: *Dr. Safaa Abdelmaksoud & Prof.Dr A.M.Abdelrazek.*

المستوى الرابع - فيزياء - فيزياء رياضيات ٣ ف ٤١٤

Mansoura University Faculty of Science Physics Department	4th Level Physics	First Semester, 2012-2013 January, 2013 *(15-01-2013)* Time: 2 Hours

Phy 414: Mathematical Physics 3

Answer All of the Following Questions: *(Full mark: 80)*		*Mark*
1.a)	Show that: $f(z)=\exp(x)[\cos(y)+i\sin(y)]$ is analytical and then find $f'(z)$.	*8*
b)	Calculate the harmonic conjugate of: $u(x,y)=2x(1-y)$.	*8*
2.a)	Solve the integral equation: $\phi(x)=\int_0^x dt\exp(x+t)[1+\phi^2(t)]$, by the degenerate kernels method.	*8*
b)	Solve the Volterra integral equation: $\phi(x)=\exp(x)+\int_0^x dt\exp(x-t)\phi(t)$, by Laplace transform.	*8*
3.	Find the characteristic number and eigen-function of the homogeneous integral equation if the kernel is given by: $k(x,t)=\begin{cases}x(t-1), & 0\le x\le t,\\ t(x-1), & t\le x\le 1.\end{cases}$	*16*
4.a)	Construct the resolvent kernel for: $k(x,t)=\sin(x)\cos(t)$, $[a,b]=[0,\pi/2]$.	*8*
b)	Find the value of the integral: $\int_C dz\frac{(3z^3+2)}{(z+1)(z^2+9)}$, where C is $\lvert z-2\rvert=2$.	*8*
5.a)	Find the Laurent series for: $\frac{\exp(2z)}{(z-1)^3}$ at $z=1$.	*8*
b)	Evaluate the integral: $\int_C dz\frac{\cosh(\pi z)}{z(z^2+1)}$, where C is the circle $\lvert z\rvert=2$.	*8*

With our Best wishes

Examiners:	*Prof. Sayed A. Elwakil*	*Prof. Ahmed H. Oraby*
	Dr. Ahmed Abulella	*Dr. Aziza A. Abd-el-Aziz*

المستوى الرابع - فيزياء - إلكترونيات رقمية ف ٢٠١٧

Mansoura university **Faculty of Science** **Physics Department**		**first Term** **Fourth Year: Physics** **Date: 22 jan. 2013** **Allowed time: 2 hours**
Digital Electronics Exam .	**Code : Phys. 417**	**Full Mark: 80 Marks**

Answer The following Questions:

1- a) Draw the comparator logic circuit which used to compare Two 4 -bit binary numbers P , Q

b) Design the logic circuit required to drivethe segment g in the 7- segment display used to display numbers from 0 TO 9 as shown in figure (2) using

8 To 1 line data Multiplexer

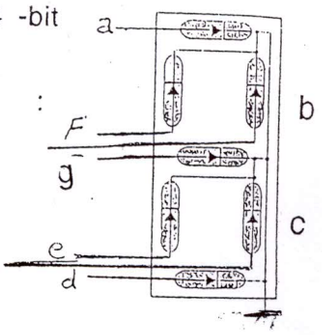

figure (2)

2- a) Design a logic circuit that has four inputs A ,B ,C and D . The output of this circuit should be high only when at least two of the inputs are high .Then show how to implement this circuit using

ALL- NAND gates

b) Desgine synchronous decade counter using J-k flip-flops and draw the output waveform of each flip-flop .

3-a) Design the logic circuit of a full adder, then draw how to connect a half-adder and three full-adders to form a four- bit parallel adder.

b) Convert the follwing binary numbers to octal and Hexadecimal equivalent : 101010100110 , 10110 . 010101 .

4 - a) Determine the Q - output in relation to the clock for S-R flip-flop connected as shown in figure (3) .

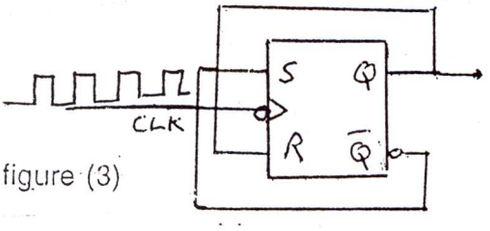

figure (3)

b) Convert the follwing numbers to their binary equivalent .

$(48C)_{16}$, $(356.25)_8$, $(35.625)_{10}$.

المستوى الرابع - فيزياء - فيزياء الطاقة الجديدة والمتجددة ف ٤٧

Mansoura University Faculty of Science Physics Department	Physics Students	First Semester, 2012-2013 Credit hours Students: 4th level January, 2013 (22/01/2013) Time: 2 Hours
Course: Physics (418)	Renewable Energy	Full Mark: 80 Marks

Answer the first question then "Only Two" From The Following:

1-a)	The Sun is considered as the main source of Renewable Energy consists of a body and atmosphere. Discuss this phrase.	*15*
1-b)	Calculate the area of the solar panel needed to give 5 KW, if the sensors in the panel are supplied by energy from silicon photocells of efficiency 30% and the photosphere temperature is 5800 ^{o}k, and if sensors are located at: i- Mercury planet, ii- Earth, iii-Jupiter . $r_{Mercury} = 0.58 \times 10^{8}$ Km, $r_{Earth} = 1.5 \times 10^{8}$ Km, $r_{Jupiter} = 7.78 \times 10^{8}$ Km, $R_{\odot} = 6.96 \times 10^{5}$ Km, $\sigma = 5.67 \times 10^{-8}$ w m^{-2} k^{-4}.	*15*
2-a)	If the sun temperature is 5785 ^{o}k, determine the value of the solar constant of the earth. Also determine the characteristic color of the spectra. $h = 6.6252 \times 10^{-34}$ J sec , $k = 1.3806 \times 10^{-23}$ J/ ^{o}k, $R_{\odot} = 6.96 \times 10^{8}$ m, $C_o = 2.9979 \times 10^{8}$ m / sec , $\alpha = 2897.8$ μm ^{o}k, $r = 1.5 \times 10^{11}$ m	*15*
2.b)	Define each of the following : i- Photovoltaic phenomena. ii-Incidence monochromatic flux, iii-Transmitted monochromatic flux, iv- Reflected monochromatic flux, v- Absorbed monochromatic flux.	*10*
3.a)	Derive an expression for calculation of the daily extraterrestrial irradiation on a horizontal surface.	*10*
3.b)	Compare between the daily extraterrestrial irradiation on 22 March with that of monthly average daily irradiation for El-Mansoura (31° N), on an inclined surface with angle of inclination = 20°. Consider that $I_{sc} = 1367$ W/m^2.	*15*

4.a) Prove that the incident angle θ_o for the irradiation over an inclined surface with angle β at latitude ϕ is equivalent to the zenith angle "θ_Z" at latitude $(\phi-\beta)$. *10*

4.b) Using the given table, determine the percentage of the energy in the spectra of a black body at temperature 5785 °k , for the wavelengths in the following ranges:

i- 0 – 0.39 μm. *ii*- 0.39 – 0.7 μm. *iii*- 0.7– 4 μm. *iv*- $\lambda > 4$ μm.

Comment on the results. *15*

x $\mu m\ k$	$f(x)$	x $\mu m\ k$	$f(x)$	x $\mu m\ k$	$f(x)$	x $\mu m\ k$	$f(x)$
2200	0.101	4000	0.483	6300	0.762	19000	0.983
2300	0.120	4100	0.499	6400	0.770	20000	0.986
2400	0.140	4200	0.516	6500	0.776	30000	0.995

With My Best Wishes

Examiners:	*Prof. Magdy Tadros (*)*	*Dr. Mohamed Abu zaid*
	Dr. Shalabeia Badr	*Dr. Neven Kamal*