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

Subject: *Elementary Physics*

(جسيمات أولية – ف 416)

		Mark
Answer (3) Questions ONLY: *(Full mark: 80)*		
1.a)	Make a brief classification of the elementary particles, then give a quark description of: p, $\bar{p}$, n, Λ, π°, π^{+}, and J/ψ particles.	13
b)	Draw the Baryon Octet (strangeness versus charge plot using a sloping axis for the charge number Q).	13
2.a)	Show that the reaction: $\pi^{-} + p \rightarrow \pi^{-} + \Sigma^{+}$ does not conserve strangeness.	13
b)	Find the baryon number, charge and strangeness of the following quark combinations & identify the corresponding hadrons: uud, udd, uus, dds, sss, uuu, ddd.	13
3.a)	Show that the neutron decay via weak interaction as indicated by *Feyman* diagram, is a good example of quark transformations which led to the discovery of the *neutrino*.	13
b)	Given the n, p, and e masses as: 939.5656, 938.2723, and 0.510999 MeV, respectively, find the Q-value for the reaction: (n $\rightarrow$ p + e⁻), then from the conservation of momentum between e⁻ and p , calculate the kinetic energy and momentum of the electron in MeV.	14
4.a)	The Super Kamiokande neutrino detection facility in Japan contains 50000 metric tons of water. Estimate the average time interval between detected proton decays in this much water if the half-life of a proton is 10^{33} yr.	13
4,b)	Show how the introducing of the new (*color*) quantum number solve the problem arising due to the existing of three identical strange quarks (SSS) in the recently discovered (Ω^{-})-quark.	14

With our Best wishes

Examiners:	*Prof. Dr Ali H. El-Farrash*[*]	*Prof. Dr Ahmad H. Oraby*

* Corresponding Examiner

Mansoura University		First semester
Faculty of Science		**Fourth level : Physics**
Physics Department		Date :24 /12/2011
Subject: Physics		Time allowed : 2 hours
Course (s): Mathematical physics (3) (Phy 414)		Full Mark:: 80 Mark

Answer the following Questions

[1] a- Show that

$$f(z) = e^z (\cos y + i \sin y) \text{ is analytic and then find } f'(z)$$

[8] Mark

b) Calculate the harmonic conjugate of

$$u(x,u) = z \, x(1-y)$$

[8] Mark

2-) verify that $z^n = \dfrac{z}{1-z}$ then

show $\displaystyle\sum_{n=1}^{\infty} a^n \cos n\ \theta = \dfrac{a\cos\theta - a^2}{1 - 2a\cos\theta + a^2}$

[16] Mark

[3] a) Solve the integral equation

$$\phi(x) = \int_0^1 e^{x+t}[1+\phi^2(t)]dt$$

by the degenerate kernels method

[8] Mark

b) Solve the Volterra integral equation

$$\phi(x) = e^x + \int_0^x e^{(x-t)}\phi(t)dt$$

[8] Mark

by Laplace transform

4-) Find the characteristic number and eigenfunction of the homogenous integral equation if their 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] Mark

5-a) Construct the resolvent Kernel for

$$K(x,t) = \sin x \cos t \qquad [a,b] = [0, \pi/2]$$

[8] Mark

-b) Find the Laurent series of

$$\dfrac{e^{2z}}{(z-1)^3} \quad \text{at } z = 1$$

[8] Mark

أ.د. السيد الوكيل   أ.د. عبد الرازق الدغيدى

Mansoura University Faculty of Science Physics Department		First Term. Date : Jan. 2012 Time allowed : **2 hours** Full Mark: **80 Mark**
Subject: **Physics**		Course: **412** ف **Laser and Application**

Answer the Following Questions

[1] a- Describe the essential feature of He- Ne laser. Sketch schematic diagram of He- Ne laser tube. Explain by the aid of an energy-level diagram, how population inversion is brought about in such gaseous system? Explain a technique to encourage the 633nm transition. in this laser. **[17 Marks]**

b- If the spectral width of the 633nm transition of neon is about 1.5 GHz and the cavity is 0.5m in length, calculate the number of oscillation modes (Not: Velocity of light $C=3 \times 10^8$ m/sec) . **[10 Marks]**

[2] a- Explain how you can achieve some measure of coherence with a non-laser source . **[9 Marks]**

b- Explain the deep penetrating welding of two metals when using pulsed CO_2 laser. **[9 Marks]**

c- Calculate the ratio of spontaneous and stimulated emission for tungsten lamp operating at a temperature of 2000 K, taking the average frequency to be 5×10^{14} Hz , $h=6.625 \times 10^{-34}$ J. sec, $K=1.38 \times 10^{-23}$ J /K. **[9 Marks]**

[3] a- Deduce the condition of population inversion for an atom having four levels. **[10 Marks]**

b- Derive an expression for the growth of a laser beam in medium enjoying population inversion. **[8 Marks]**

c- Sketch and explain schematic diagram for recording a hologram and reconstruction of the wavefront ?Explain how double exposure holographic interferometric technique measure the distortion of an object. **[8 Marks]**

Good Luck

Examiner: Prof. Dr. Taha Sakkar

Mansoura University Faculty of Science Physics Department		First Term. Date : Jan. 2012 Time allowed : 2 hours Full Mark: 80 Mark
Subject: **Physics**		Course: 412 ف **Laser and Application**

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[1] a- Describe the essential feature of He- Ne laser. Sketch schematic diagram of He- Ne laser tube. Explain by the aid of an energy-level diagram, how population inversion is brought about in such gaseous system? Explain a technique to encourage the 633nm transition. in this laser. **[17 Marks]**

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Good Luck

Examiner: Prof. Dr. Taha Sakkar