




المستوى الثالث

فيزياء

بسم الله الرحمن الرحيم


1

	TANTA UNIVERSITY FACULTY OF SCIENCES			
	DEPARTMENT OF PHYSICS			
	EXAMINER: <i>PROF. DR. RIYAD A.M. GHAFER</i>			
	COURSE TITLE:	<i>laser physics (Physics & Biophysics students)</i>		CODE: <u>3222</u>
DATE:	4 JUN, 2017	TERM: SECOND	TOTAL MARKS: 200	PERIOD: 2 HOURS

Answer the following questions :-

- 1- Derive the expression of the population inversion under steady-state oscillation ΔN_{th} as a function of transition probability $|\mu_{21}|^2$?
- 2- The laser beam has some special physical properties, write- down and give a short account about each of them?
- 3- Explain physically the laser action in terms of the rate equations theory?
- 4- Find the relationship between the gain coefficient G and the loss coefficient L_{eff} in the laser resonator?

-----e N d

	TANTA UNIVERSITY FACULTY OF SCIENCE DEPARTMENT OF PHYSICS		
	EXAMINATION OF (LEVEL THREE) STUDENTS OF PHYSICS		
COURSE TITLE:	Mathematical physics 3		COURSE CODE: PH 3264
DATE: 8/6/2017	FINAL SECOND TERM EXAM	TOTAL ASSESSMENT MARKS: 100	TIME ALLOWED: 2 HOURS

Answer the following questions:

First question:- (25 Marks)

- (i) Show that the function $f(z) = x^2 - y^2 + 2ixy$ is differentiable for all values of z .
- (ii) Find the transformer matrix L corresponding to a rotation of the coordinate axis through an angle θ about the e_3 - axis.

Second question: - (25 Marks)

-The sample of five values for the weight of different student given as: 2, 3, 5, 8, 9.

- (i) Find ; the geometric mean, and harmonic mean.
- (ii) Find ; the sample variance and sample standard deviation of the data.

Third question:- (25 Marks)

- The student of fourth year at physics department selected random and their height and weights are found as follows,

Height (m)	1.6	1.64	1.7	1.8	1.82	1.77
Weight (kg)	75	80	89	95	93	90


Calculate the sample correlation between the heights and weights.

Fourth question:-

(25 Marks)

Find the Fourier series expansion of the function $f(x) = x^2$ for, $0 < x \leq 2$.

EXAMINERS	DR. Atef Elbendary أطيب التمنيات بالتوفيق
-----------	--

		TANTA UNIVERSITY FACULTY OF SCIENCE DEPARTMENT OF PHYSICS	
		THIRD YEAR (PHYSICS)	
COURSE TITLE:	Quantum mechanics II		COURSE CODE: PH3232
DATE:	24-6- 2017	TERM: SECOND	TOTAL ASSESSMENT MARKS:150 TIME ALLOWED: 2 HOUR

Please Answer the Following:

Question 1: Put true or false and comment on the false statements:

- 1) The wave-function completely specifies the state of a quantum system.
 - 2) The photon is a quantization of vibration motion.
 - 3) The eigenfunctions of Hermitian operators are orthogonal.
 - 4) The convergence of the perturbation theory requires that the magnitude of high order corrections must be larger than the zero order.
 - 5) Non-commute operators have simultaneously measurable eigenvalues.
 - 6) The four quantum numbers are derived during the solution of Schrödinger equation of Hydrogen atom.
 - 7) The components of the orbital angular momentum are not simultaneously measurable.
 - 8) Quantum mechanics as well as classical mechanics predicts that the spectrum of harmonic oscillator is continuous.
 - 9) The exact solution of Schrodinger equation for He and Na atoms is analytically feasible as the solution of hydrogen atom.
 - 10) The energy of an electron hydrogen atom derived from Schrödinger equation is not like the results of Bohr theory.
 - 11) In perturbation theory, the first order correction is calculated from the state function of zero-order.
- (45 Marks)

Question 2: (a) Plot a schematic of the energy-level diagram of atomic hydrogen.

(b) Derive the energy of even states of a harmonic oscillator starting from Hermite equation:

$$\frac{d^2 H}{d\xi^2} - 2\xi \frac{dH}{d\xi} + (\lambda - 1)H = 0,$$

and using the power series method.

(30 Marks)

باقى الاسئلة فى الصفحة التالية

Question 3: (a) Define the orbital angular momentum and find $[L_x, L_y]$ and $[L^2, L_z]$.

(b) Assume that the lowest eigenfunction of the simple harmonic oscillator is approximated by $\psi_0 = N e^{-c x^2}$, where N is the normalization constant and c is the variational parameter. Use the variational method to determine c and calculate the energy associated with lowest eigenfunction.

c) Derive the wave function of an electron in a Hydrogen atom when its radius tends to infinity. (45 Marks)

Question 4: (a) Derive the first order energy correction using time-independent perturbation theory of a non-degenerate energy level.

(b) Write short notes on the difference between quantum mechanics and classical mechanics in treating particle collisions, the importance of quantum collision theory in microscopic physics, and the method of partial waves.

(30 Marks)

Note: In spherical coordinate:

$$\nabla^2 = \frac{1}{r^2} \frac{\partial}{\partial r} r^2 \frac{\partial}{\partial r} + \frac{1}{r^2 \sin(\theta)} \frac{\partial}{\partial \theta} \sin \theta \frac{\partial}{\partial \theta} + \frac{1}{r^2 \sin^2(\theta)} \frac{\partial^2}{\partial \phi^2}$$

☺ ☺ Best Wishes ☺ ☺
Dr. Mohammed Shihab

