	FACULTY OF SCIENCE DEPARTMENT OF PHYSICS			TANTA UNIVERSITY
	EXAMINATION FOR FRESHMEN (THIRD LEVEL) STUDENTS OF PHYSICS			
	COURSE TITLE:	STATISTICAL PHYSICS		COURSE CODE:PH3121
DATE: 25	Mar. 2021	TERM: First	TOTAL ASSESSMENT MARKS: 100	TIME ALLOWED: 2 HOURS

Answer the following questions:

(1) a- Define the systems which you can approaches in your studies? (10 mark)

b- What are the problems in derivation of distribution law? (10 mark)

c- Given 7 distinguishable particles, two energy levels (one with degeneracy 2 and the other degeneracy of 4). Calculate the number of macrostates and microstates in this system? (10 mark)

(2) a- State third law of thermodynamic in statistical mechanics? (10 mark)

b- Prove that $U = NkT^2 \frac{\partial \ln Z}{\partial T}\Big|_{V,N}$ (10 mark)

c- Calculate the enthalpy of the classical perfect gas.
(Given that $Z = (V/h^3)(2m\pi KT)^{3/2}$) (10 mark)

(3) a- Produce ε_f in free electron model? (15 mark)

b- Calculate ε_f for copper in eV, given that; $N/V = 8.5 \times 10^{28}\ m^{-3}$, $h = 6.626 \times 10^{-34}$ J.s, $m = 9.2 \times 10^{-31}$ Kg, $1eV = 1.9 \times 10^{-19}$ J. (5 mark)

(4) a- Give a comparative study of classical (M-B) and quantum (F-D & B-E) statistics. Under what conditions quantum statistics merge into classical statistics? (10 marks)

b- What is the suitable statistic which can be applied on a liquid helium at T= 4 K where $N/V = 2 \times 10^{22}\ cm^{-3}$ (10 marks)

Good luck

EXAMINER	DR. INAGWA M. ABDEL-MONIEM

	TANTA UNIVERSITY- Faculty of Science -Department of Physics			
	COURSE TITLE:	Quantum Mechanics 1		COURSE CODE: PII3131
DATE:	16/3/2021	TERM: FIRST	TOTAL ASSESSMENT MARKS: 100	TIME ALLOWED: 2 HOURS

Answer the following questions:

1) Consider a one dimensional box its walls are at x= L/2 , x= - L/2 . The eigen states of the Hamiltonian for this system are

$$\tilde{\varphi}_n = \sqrt{\frac{2}{L}} \sin\left(\frac{n\pi x}{L}\right), \quad \text{where } n = 2,4,6,\cdots$$

$$\varphi_n = \sqrt{\frac{2}{L}} \cos\left(\frac{n\pi x}{L}\right), \quad \text{where } n = 1,3,5,\cdots$$

At $t=0$, the particle is in the state

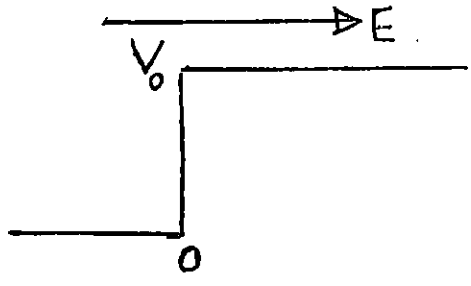
$$\psi(x,0) = \frac{1}{\sqrt{35L}}\left[6\sin\left(\frac{2\pi x}{L}\right) + 3\cos\left(\frac{\pi x}{L}\right) + 5\cos\left(\frac{3\pi x}{L}\right)\right]$$

a) Prove that $\psi(x,0)$ is normalized (5 marks)
b) What are the probability density ? (5 marks)
c) What is $\psi(x,t)$? (5 marks)
d) Calculate $\langle E \rangle$. (5 marks)
e) Calculate the expectation value of parity ? (5 marks)

2) a- Calculate $[\hat{x}, \hat{p}^2]$. (10 marks)
b- Derive the law covers the time development of the expectation values (15 marks)

3) Use the annihilation and creation operators for calculating the expectation value of the kinetic Energy of the n th eigen state of the Harmonic oscillator. (25 marks)

4) a- Derive an expression for the current density in terms of the wave functions. (10 marks)
b- Calculate the current density of the incident , reflected and transmited beam for the potential step showing in the figure (25 marks)



	TANTA UNIVERSITY FACULTY OF SCIENCE DEPARTMENT OF PHYSICS			
	THIRD YEAR (PHY)			
COURSE TITLE:	Computational Physics			COURSE CODE: PH3181
DATE:	21-03-2021	TERM: FIRST	TOTAL ASSESSMENT MARKS: 100	TIME ALLOWED: 2 HOUR

Please Answer the Following:

Q1) a) Put True or false: [12 Marks]

1- All physical problems could be solved analytically.
2- Computational and numerical methods always produce exact solutions.
3- Bisection method is not computationally efficient with respect to Newton's method.
4- Matlab can deal only with real numbers and functions.

b) Computationally integrate the function $f(x) = 5\sqrt[3]{x}$ from x=0 to x=5 assuming $\Delta x = 1$ and calculate the error. [13 Marks]

Q2) a) If these two vectors are given in MATLAB

A= [2 -1 0]; B= [1 2 3];

Find dot (A, B), prod(B), sum(A), cross (A, B). [12 Marks]

b) Find the output of [13 Marks]

```
>> x=0;
>> n=0;
>> while n<8
    y(n) =n^2
    n=n+4
    end
```

Q3) a) Find solutions of the equation x^2-5=0 by using Newton's method. For the starting point use (a) x=4 and (b) x=-4. [13 Marks]

b) Explain truncation errors with examples [12 Marks]

Q4) a) Solve the following system of three equations using the Gauss elimination method.

$$2x_1+x_2+x_3=7$$
$$2x_2+x_1+x_3=8$$
$$2x_3+x_2+x_1=9$$

[12 Marks]

b) If $f(x) = 3\ x^2$+ Ln(x), calculate numerically the first derivative at x=5. [13 Marks]

☺ ☺ Best Wishes ☺ ☺

A. Prof. Dr. Mohammed Shihab

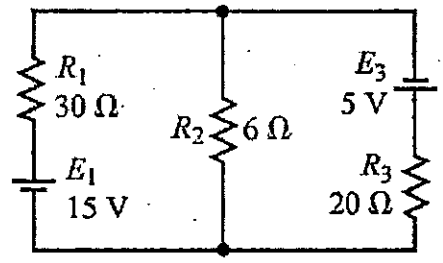
	TANTA UNIVERSITY FACULTY OF SCIENCE DEPARTMENT OF PHYSICS			
	EXAMINATION FOR THIRD YEAR STUDENTS OF PHYSICS (SEMESTER 1)			
1960	COURSE TITLE:	ELECTRICAL CIRCUITS		COURSE CODE: PH3151
DATE: 7	MARCH, 2021	TERM: FIRST	TOTAL ASSESSMENT MARKS: 100	TIME ALLOWED: 2 HOURS

Answer The Following:

First Question (25 points):

1-(15 points) Define: (SPST – stray capacitance – phase shift – phasors - duration of transient)

2- (10 points) Using branch analysis, find the current in each branch in the circuit.

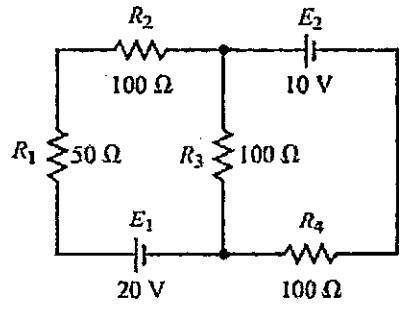


Second Question (25 points):

1-(15 points) State if each sentence of the following is true or false and discuss **the reason** of your choice

a) The law of energy conservation in electrical circuits states that the summation of voltage rises and drops equals zero.
b) Ideal current sources have infinite shunt internal resistances.
c) When $I=I_m\sin(wt+\theta)$ and $V=V_m\sin(wt+\theta)$ then current is in phase with the voltage. (show your reason using phasors)
d) In Norton analysis technique, it is recommended to transform each current source to voltage source.
e) The total energy stored in an inductor is given by 2*L*i.

2- (10 points) Prove that the super position theorem does not apply to power dissipated through R4.



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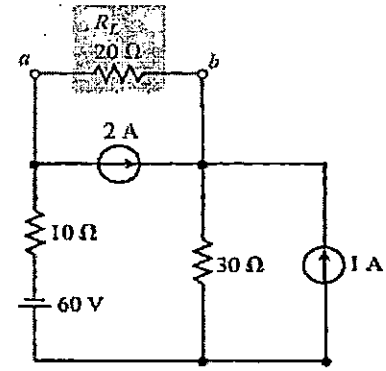
Third Question (25 points):

1-(15 points) Using Kirchhoff's Laws Find:

a) Equivalent resistance to three resistance connected in parallel
b) Equivalent capacitance to three capacitors connected in series

2- (10 points) Using Thevenin theorem find the current through the load resistance

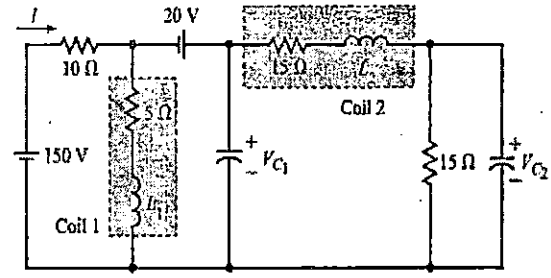


Fourth Question (25 points):

1-(15 points) list the difference between:

a) Different types of circuit diagrams.
b) Vc pulse response to different pulse widths.

2- (10 points) Find the current in each branch when the circuit reached steady state.



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TANTA UNIVERSITY
FACULTY OF SCIENCE
DEPARTMENT OF PHYSICS

EXAMINATION FOR (FIRST YEAR) STUDENTS OF BIOTECHNOLOGY

COURSE TITLE:	Heat & Properties of Matter			COURSE CODE:PH131
DATE:	2 /3 /2021	TERM:FIRST	TOTAL ASSESSMENT MARKS:60	TIME ALLOWED: 2HOURS

Answer the Following Questions

First question (15 Marks)

a)If the period of the simple pendulum (t) depends on :

i- the mass of pendulum bob (m)

ii- the length of the string of the pendulum (L) and

iii- the gravitational intensity (g)

By using the dimensional analysis find the equation.

b) Explain the elastic Limit of the Material

Second question (15 Marks)

a) Explain the Bulk Modulus (Hints : deduce its mathematical formula and writing the units and dimension)

b) A 5 cm cube gelatin has its upper surface displaced 0.64 cm by a tangential force of 0.3 N , What is the share Modulus of gelatin?

Third question (15 Marks)

a) Define and write the units if there are any of the following:
i-latent heat , ii-specific heat and iii- zeroth law of thermodynamics

b) Explain in details the Platinum resistance thermometer.

Fourth question (15 Marks)

a) Explain Joule experiment (electrical method) for determination the specific heat of a liquid

b) For an ideal gas if its specific heat at constant pressure CP =(7/2) R calculate the following:

i-The ratio γ

ii- The change in internal energy

iii- The work done and the total energy transferred per unit mole when its temperature decreases by 10 K

Best Wishes

Prof. Dr. S. Aboul Enein

	TANTA UNIVERSITY FACULTY OF SCIENCE DEPARTMENT OF PHYSICS			
	EXAMINATION OF (THIRD YEAR) STUDENTS OF PHYSICS (CREDIT HOURS)			
	COURSE TITLE:	Atomic spectroscopy		COURSE CODE: PH3141
DATE:	9\3\2021	TERM: FIRST	TOTAL ASSESSMENT MARKS:100	TIME ALLOWED: 2HOURS

Question(1):-

a. Prove that the particle velocity is equal the group velocity. (15Marks)
b. Find out the longest wavelength of Balmer series transitions of hydrogen atom, then find the end of the series. (10 Marks)
(m=9.035x10^{-28}g, e=4.77x10^{-10} e.s.u. h= 6.0547x10^{-27}erg sec)

Question(2):-

a. Write short notes about:- (15Marks)
Wien's displacement Law
Band spectrum
Positronium
b. What is the de Broglie wavelength of an electron whose kinetic energy is100 eV (10 Marks)

Question(3):-

a. Derive the Rutherford scattering formula, where: (20 Marks)

$$N(\theta)=\frac{N_i n t z^2 e^4}{(8\pi\varepsilon)^2 r^2 T^2 \sin^4(\theta/2)}$$

b. The wavelength of the photoelectric threshold of Tungsten is 230 nm. Determine the energy of the electrons ejected from the surface by ultraviolet light of wavelength 180 nm. (5Marks)

Question(4):-

a. State the three Bohr's assumptions and write the equation only of each one with the meaning of each symbol. (10 Marks)
b. Derive the Schrödinger equation for a single particle (15 Marks)

DR. Shrouk F. Elashry

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	TANTA UNIVERSITY FACULTY OF SCIENCE DEPARTMENT OF PHYSICS			
	EXAMINATION OF (LEVEL THREE) PHYSICS STUDENTS &BIOPHYSICS STUDENTS			
	COURSE TITLE:	Electrodynamics 1		COURSE CODE: PH3171
DATE:	10\01\ 2021	FIRST-TERM EXAM	TOTAL ASSESSMENT MARKS: 100	TIME ALLOWED: 2 HOURS

Answer the following questions:

Q1: Given a vector field $D = r \sin\varphi\, a_r - (1/r)\sin\theta\cos\varphi\, a_\theta + r^2 a_\varphi$. determine;

i) D at p(10°, 150°, 330°)

ii) The component of D tangential to the spherical surface r=10 at p

iii) A unit vector at p perpendicular to D and tangential to the cone θ=150°.

Q2: A wire of diameter 1mm and conductivity 5×10^{7} S/m has 10^{29} free electrons per cubic-meter when an electric field of 10 mV/m is applied. Determine;

i) The charge density of free electrons

ii) The current density

iii) The drift velocity of electrons(taken $e=-1.6\times10^{-19}$ C)

Q3: (i) Write Laplace's equation in cylindrical and spherical coordinates.

(ii) Two conducting cones ($\theta = \pi/10$ and $\theta = \pi/6$) of finite extent are separated by an infinitesimal gap at $r = 0$. If $V(\theta = \pi/10)=0$ and $V(\theta = \pi/6)=50$ V, find V,E between the cones.

Q4: (i) Write with explain BIOT-SAVART'S Law.

(ii) A circular loop located on $x^2 + y^2 = 9$, $z=0$ carries a direct current of 10 Amp along a_φ. Determine H at (0,0,4) and (0,0, 1)

EXAMINERS	Prof. Dr. Atef Elbendary
	أطيب التمنيات بالتوفيق

	TANTA UNIVERSITY FACULTY OF SCIENCE DEPARTMENT OF PHYSICS			
	THIRD YEAR (PHYSICS+BIOPHYSICS)			
	COURSE TITLE:	Quantum Mechanics II		COURSE CODE: 3232
DATE:	28-12- 2020	TERM:	TOTAL ASSESSMENT MARKS:150	TIME ALLOWED: 2 HOUR

Please Answer the following:

Q1) a) Define the wavefunction, its characteristics, and its physical meaning.

b) Which of the following may be a wave function:

1) $\Psi(x) = A\,sin(kx)$ **2)** $\Psi(x) = e^{-x^3}$ **3)** $\Psi(x) = e^{-ix}$

c) Explain 3 of the quantum postulates.

Q2) a) Define the angular momentum and calculate $[L_x, L_x]$ **and** $[L^2, L_z]$.

b) Derive the wavefunction of a free particle in a three-dimensional box.

c) Plot the allowed angular momenta for l=3.

Q3) a) Separate the Schrodinger equation of Hydrogen atom into three independents equations.

b) Derive the eigenvalues and the eigenfunctions of L_z **and plot a schematic show Zeeman effect.**

Q4) a) Define the degeneracy and write down possible energies and wavefunctions of the first three energy levels of a free particle in a box.

b) Derive the first order energy correction of time independent perturbation for non-degenerate states.

☺ ☺ **Best Wishes** ☺ ☺

Dr. Mohammed Shihab

	TANTA UNIVERSITY FACULTY OF SCIENCE DEPARTMENT OF PHYSICS			
	THIRD YEAR (PHYSICS+BIOPHYSICS)			
	COURSE TITLE:	Quantum Mechanics II		COURSE CODE: 3232
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☺ ☺ **Best Wishes** ☺ ☺

Dr. Mohammed Shihab

	TANTA UNIVERSITY FACULTY OF SCIENCE DEPARTMENT OF PHYSICS			
	COURSE TITLE:	BIOPHYSICS ENERGY PHYSICS EXAM		COURSE CODE: PH3132
DATE:	JAN, 2021	TREM: First	TOTAL ASSESSMENT MARK: 100	TIME ALLOWED: 2 HOURS

Answer the following questions:

1.a. Define:

Energy, Electric current, efficiency, heavy water, and critical mass of Uranium.

(15 marks)

b. Discuss the laws of thermodynamics (10 marks)

2.a. Define the electrical energy and discuss its characteristics.

(15 marks)

b. A (He) nucleus has 4 nucleons (2 P & 2 n). The mass of P=1.0073u, and of n=1.0087u, while the mass of the nucleus is 4.0015u. Determine the Binding Energy of the nucleus (1u ≡ 931MeV).

(10 marks)

3.a. Explain the relation between "Nuclear Forces" & "Binding Energy"

(10 marks)

b. Define "Nuclear Fusion", and describe this process in the core of the sun to create solar energy. (15 marks)

4.a. Use schematic diagrams to describe one of the applications of solar energy. (15 marks)

b. Discuss the "Global Warming" issues and green house gases.

(10 marks)

Good Luck

	TANTA UNIVERSITY FACULTY OF SCIENCE DEPARTMENT OF PHYSICS			
	EXAMINATION FOR THIRD LEVEL STUDENTS OF PHYSICS			
	COURSE TITLE:	Solid state physics 1		COURSE CODE: PH3161
DATE:	5 / 01 / 2021	TERM: FIRIST	TOTAL ASSESSMENT MARKS:100	TIME ALLOWED: 2 HOURS

Answer the following

First question:

Write short notes about:

A) Crystal system and fourteen Bravais lattices.

B) Diffraction of x-ray and deduce Bragg`s law.

Second question:

A) In a cubic unit cell draw the planes (111), (101), (234) and (001). Calculate the inter planer distances for these planes if a = 4.2 Å.

B) Discuss in details the inter atomic forces in crystals.

Third question:

A) Discuss in details the ionic crystals.

B) Explain only one type of x-ray photographs.

Fourth question:

Prove that:

A) The inter planer distance d of a given plane (hkl) for a rectangular unit cell is given by that equation

$$d = \frac{1}{\sqrt{\frac{h^2}{a^2} + \frac{k^2}{b^2} + \frac{l^2}{c^2}}}$$

B) The Fermi energy E0 in an intrinsic semiconductor lies half way between the top of the valence band and the bottom of the conduction band.

Good luck