	Tanta University
	Faculty of Science
	Physics Department
	Examination of Level 2
	Physics and Material Science Programs
Course Title: Electromagnetic Theory I	Course Code: PH2151
Date:10-1- 2017	1st Semester

The first question (30 marks): -

Put (√) for the right sentences and (x) for the incorrect sentences, then correct it.

1. Gauss's law relates the electric flux through the closed surface to the charge inside it.
2. The divergence theorem relates the volume integral to the closed line integral.
3. The operation on the potential **V** by which -**E** (electric field intensity) is obtained, known as divergence.
4. The work expended in carrying a positive charge in an electrostatic field between two points depends on the path taken between them.
5. The magnitude of **E** is given when the direction of the distance increment is in the same direction of **E**.

The second question: -

a- Prove that in an electric dipole the potential field is proportional to the inverse square of distance and the electric field intensity is proportional to the inverse cube of the distance (**20 marks**).

b- Transform the vector field $\overline{G} = (XZ/Y)\,\overline{a}_y$ in Cartesian coordinate system to a spherical system (**20 marks**).
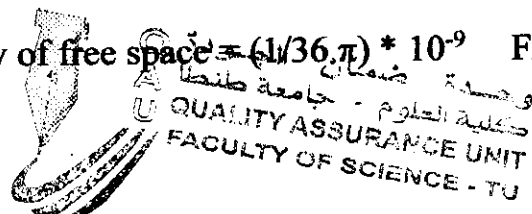
The third question:-

a- Find the work done in carrying the positive charge q near an infinite line charge: first about a circular path, second about a radial path changing from $\rho=a$ to $\rho=b$ (**25 marks**).

b- If $\overline{E} = (5r * 10^{-5} /\epsilon_o)\,\overline{a}_r$ N/c in the region $r \leq 2$ m in spherical coordinate system, find the volume charge density ρ_v, then find the net charge q in the region r=2 m (**15 marks**).

The forth question: -

a- Use Gauss's law to find the density of electric flux $\overline{D}$ for infinite sheet with surface charge density ρ_s C/m² (**10 marks**)

b- Calculate the energy stored in the electrostatic field in the system consists of three equal charges 4 μc put on the three corners of trigonal with equal sides, each side equal 0.5 mm (**30 marks**).

(ϵ_o is the permittivity of free space = (1/36.π) * 10⁻⁹ F/m).

TANTA UNIVERSITY
FACULTY OF SCIENCE
DEPARTMENT OF PHYSICS

EXAMINATION FOR SESOND YEAR STUDENTS OF PHYSICS AND BIOPHYSICS

COURSE TITLE:	ACOUSTICS	COURSE CODE: PH2141
DATE: 5 JANUARY 2017	TERM: FIRST	TOTAL ASSESSMENT MARKS: 100 TIME ALLOWED: 2 HOURS

Answer the following questions

FIRST QUESTION (25 marks)

A- Choose the correct answer:

(20 marks)

1- Stiffer bonds between molecules .... (increase – decrease) the pressure exerted by a molecule of speed c .
2- When the impedance mismatch is very large, the reflection is .... (low – high).
3- In A-mode imaging, the .... (frequency – amplitude) of returning echoes is recorded.
4- The application of ultrasound waves generates electrical signals depend on the .... (amplitude – pressure) of the incident waves.
5- The string under greater tension has a .... (greater – lower) wave speed.
6- Standing waves generates when the two wanes are in the .... (same – opposite) directions.
7- Reflections that undergo scattering are called .... (defuse – specular) reflection.
8- The energy transferred to a medium when a sound wave propagates through it causes .... (attenuation – vibration) to the molecules.
9- Dosimetry is the measurement of .... (transmitted – absorbed) energy.
10- (Lungs – Bones) .... are most susceptible to the effect of acoustic cavitation.

B- In blood flow measurement: blood flow is given by $Q = A v \cos\theta$. Why large sample volume is preferred to be used? (5 marks)

....

SECOND QUESTION (25 marks)

A- Write (√) or (x) and correct the wrong sentence: (20 marks)

1- The sound wave created by vibrating objects propagates through vacuum. ( )
2- In standing waves, the particle displacement is perpendicular to the direction of wave propagation. ( )
3- When a dielectric is placed in an electric field, electric charges flow through the material. ( )
4- Scatter cross section: is the ratio of the incident energy to the total power scattered by an object. ( )
5- On logarithmic scale, a change between two values is based on the difference between them. ( )
6- The absorption of ultrasound energy by tissues can be expressed in terms of temperature rise or degree of cell damage. ( )
7- C- mode imaging provides information about the variations in signal amplitude due to static objects. ( )
8- The absorption coefficient is the same in bone and soft tissues. ( )
9- The speed of sound depends on the density and compressibility. ( )
10- When the objects which cause reflection are much greater than the wavelength of the incident waves, it is called Rayleigh scattering. ( )

B- Which of the following frequencies are higher harmonics of a string with fundamental frequency of 150 Hz?
(a) 200 Hz (b) 300 Hz (c) 400 Hz (d) 500 Hz (e) 600 Hz. (5 marks)

*********باقي الأسئلة خلف الورقة*********

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فيزيا ٢

أجب عن الأسئلة التالية:-

السؤال الأول :-

(1) كون المعادلة التفاضلية من العلاقة

$y = ae^x + be^{-2x}$ حيث أن a, b ثوابت أختيارية

(2) حل المعادلة التفاضلية غير الخطية

$$x \frac{dv}{dx} + y = xy^3$$

السؤال الثاني :

(1) حل المعادلة التفاضلية

$$\frac{2x}{y^3} \frac{dx}{dy} + \left(\frac{y^2 - 3x^2}{y^4}\right) = 0$$

(2) أدرس هل المعادلة التفاضلية التالية تامة أم غير تامة ثم أوجد الحل

$$2xydx + (y^2 - 3x^2)dy = 0$$

السؤال الثالث :-

(1) حل المعادلة التفاضلية التي تؤول إلي المتجانسة

$$\frac{dy}{dx} = \frac{x - y - 2}{x + y}$$

(2) حل المعادلة التفاضلية

$$y'' + 3y' + 2y = 3e^{3x} + (4x + 1)$$

السؤال الرابع :-

(١) حل المعادلة التفاضلية

$$(D^2 + 1)y = \sin 2x + \cos 2x$$

(2) حل المعادلة التفاضلية

$$(x^2 - xy + y^2)dx = xydy$$

السؤال الخامس :-

(١) أوجد قيمة كلا من

(a) $\Gamma\left(\frac{5}{2}\right)$;   (b) $\dfrac{\Gamma\left(\frac{5}{2}\right)}{\Gamma\left(\frac{1}{2}\right)}$,   (b) $\dfrac{\Gamma(10)}{\Gamma(6)}$,

(2) أحسب قيمة التكامل

$$\int_0^\infty \sqrt{y}\, e^{-y^3}\, dy .$$

أنتهت الأسئلة ونتمنى لكم النجاح

Answer The Following Questions

First Question: (25 Mark)

a) If the equation of motion of a forced oscillator is given by: $\ddot{x} + 2\dot{x} + 16x = 10\cos(2t)$

Then:

   i.   The resonance frequency of the velocity is equal to...................................

   ii.   The maximum value of the velocity amplitude is equal to...............................

   iii. The resonance frequency of the displacement is equal to...............................

b) - The equation of motion $m\ddot{x} + sx = 0$ applies to a mass m at the center of a light string of length 2L fixed at both ends under a constant tension T. Show that he stiffness s is equal to $\frac{2T}{L}$ and that $w^2 = 2T/mL$.

Second Question: (25 Mark)

a) If the displacement of a simple harmonic motion of a body of one gram mass is given by:

   $x = 5\sin(2t + \frac{\pi}{2})$ then :

   i.   The amplitude of the motion is equal to...................................

   ii.   The normal frequency is equal to...................................

   iii. The total energy of the motion is equal to ....

b) - The equation of motion of a forced oscillator is given by $m\ddot{x} + r\dot{x} + sx = F_o e^{iwt}$. Find the steady state displacement and the velocity of the given oscillator.

Third Question: (25 Mark)

a) For damping simple harmonic motion verify that the solution $x = (A + B)e^{-\frac{rt}{2m}}$ satisfies the equation $m\ddot{x} + r\dot{x} + sx = 0$ when $\frac{r^2}{4m^2} = \frac{s}{m}$

b) - Prove that the energy of a simple harmonic oscillator is constant.

Fourth question: (25 Mark)

If x and y are the displacements of a coupled oscillator which made of two identical pendulum each having a mass m suspended on a light rigid rod of length L and connected by a light spring of stiffness s. Discuss and drive expressions for these displacements as a function of time, t.

EXAMINERS	PROF.DR. G.A.GABALLA	

Tanta University Faculty of Science Department of Physics	Final First Term Examination Academic year 2016/2017 Mathematical Physics (1) Course	Course Code: PH 2161 Biophysics Date: 1/1/2017 Time allowed: 2 hours	

Solve the Following Questions:

First Question:

(a) Find the differential equation of the equation

$$y = a \sin(x + b)$$

Where a & b are arbitrary constants.

(b) According to Newton's law of cooling, which states that "The rate of heat loss of a body is proportional to the difference in temperatures between the body and its surroundings". If the temperature of the surroundings is 20°C and the temperature of the body decreases from 100°C to 70°C in 10 minutes. Find an expression of the body temperature as a function of time.

Second Question:

(a) Show that which of the next differential equation is homogeneous, then find its general solution.

$$\cot y \, dx + x \, dy = 0$$

$$x^3 dx + (y+1)^2 dy = 0$$

$$x\frac{dy}{dx} = y - xe^{y/x}$$

(b) Find the inverse of the matrix

$$A = \begin{pmatrix} 1 & 3 & 3 \\ 1 & 4 & 3 \\ 1 & 3 & 4 \end{pmatrix}$$

Third Question:

(a) Find the integrating factor of the next differential equation, then find its solution:

$$x \, dy - (y+1) dx = 0$$

(b) Find the value or values of x which satisfies the equation:

$$\begin{vmatrix} x^2 & x & 1 \\ 4 & 2 & 1 \\ 9 & -3 & 1 \end{vmatrix} = 0$$