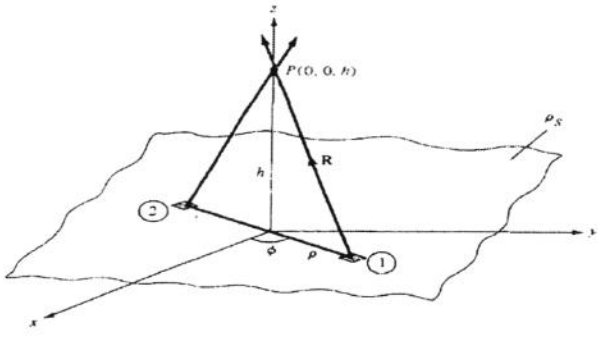
University of Technology
Department of Applied Sciences
Final Examination 2015/2016

Subject: Electromagnetic | **Class: 3 year**
Branch: Applied physics branch | **Time: 3 hour**
Examiner: Dr. Rabeah Q.Nafil | **Date: 1st Attempt**

Answer **only four** questions

Q1- An infinite sheet of charges in xy – plane is shown in the figure. Use coulombs law to drive an expression of the electric field at point P (0,0,h).

(17.5 degrees)



Q2- **A/** Prove that $P = I^2 R$ (12.5 degrees)

B/ Give the physical meaning of the relation $D = \varepsilon_o \bar{E} + P$. (5 degrees)

Q3- Two extensive homogenous isotropic dielectrics meet on plane Z=0. For $Z \geq 0$, $\varepsilon_{r1} = 4$ and for $Z \leq 0$, $\varepsilon_{r2} = 3$. A uniform electric field $\bar{E}_1 = 5\bar{a}_x - 2\bar{a}_y + 3\bar{a}_z$ kV/m exists for $Z \geq 0$. Fined:

1 - $\bar{E}_2$ for $Z \leq 0$.

2 – The angles $\bar{E}_1$ and $\bar{E}_2$ make with the interface

3 – The energy density in J/m^3 in both dielectrics. (17.5 degrees)

Q4- **A/** Prove: 1- $\bar{\nabla} \times \bar{H} = \bar{J}$. 2- $C = \dfrac{2\pi\varepsilon L}{\ln b/a}$. (12 degrees)

B/ Compare between electric and magnetic force (5.5 degrees)

Q5- Drive with the help of the diagrams the boundary conditions equations which are satisfied by an electric field at the boundary separating Conductor – Dielectric.

(17.5 degrees)

Good luck

الدور:-

University of Technology
Department of Applied Sciences
Final Examination
2015 - 2016

Branch: **physics and Material**
Subject: Matlab
Examiner: Lec. Eman H.

Class : 3rd year
Time : 3 hours
Date :

Remark: Answer four questions only

Q1: **A)** Find **3rd** derivation with respect to (**y**) for the function **f** using Matlab

$f=2x^2\cos(y)\sin(t)$

B) Solve the system using Matlab (in two ways)

$$\begin{aligned} 2x - z &= 3 \\ x + y &= 1 \\ -2y + 3z &= 4 \end{aligned}$$

Q2: If $x = [5\ 10\ 15\ 20]$

$y_1 = [3\ 5\ 7\ 12]$

$y_2 = [4\ 10\ 15\ 30]$

1) Plot y_1 and y_2 on different graphs with different axes on same figure window.

2) Plot y_1 and y_2 on same graph with same axes on the same figure window.

Q3: Consider the following two polynomials:

$\mathbf{a}(x) = x^5 + 7x^3 + 2x + 1$

$\mathbf{b}(x) = x^3 + 2x^2 + 0.5x + 4$

Find using Matlab:

1) The roots of **a** and **b** , **2)** Multiply **a** by **b** , **3)** Derive the polynomial **a** ,

4) **a(x)** + **b(x)** , **5)** Divide **a** by **b** , **6)** Evaluate **a(x)** at x=4

7) Creating symbolic form of **b**(x).

Q4: Create the matrix **E(50×50)**, all elements of matrix E are equal one except the main diagonal elements are (**2i**) where (i=0,1,2,…,50) , then find the summation of elements on the upper triangular .

Q5: A) Write a program to find the result of **g** where

$$g = \begin{cases} x^2 + 1 & \text{if x is odd.} \\ e^x & \text{if x is even.} \end{cases} \quad \text{where } x=1,2,...,20.$$

B) Let y = [-43.2 0.1 5.4 7.22]

Find:

1) round (**y**), **2)** ceil(**y**), **3)** floor (**y**), **4)** fix(*y*).

Best Wishes

University of Technology
Department of Applied Sciences
Final Examination 2015/2016

Subject: Electronics
Branch: Applied physics
Examiner: Odai N. Salman

Class: Third class
Time: 3 hours
Date:

Note: answer **four** questions only.

Q1: (a) compare between I-V characteristic curve for p-n diode and zener diode in reverse bias.

(b) What are the major differences between the collector characteristics of a BJT transistor and the drain characteristics of a JFET transistor?

Q2: Given the information provided in Fig. (2), determine:

(a) R_C. (b) R_E. (c) R_B. (d) V_{CE}. (e) V_B.

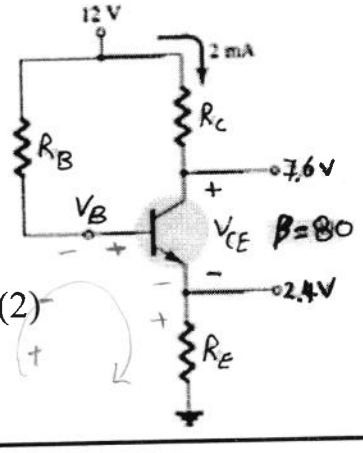


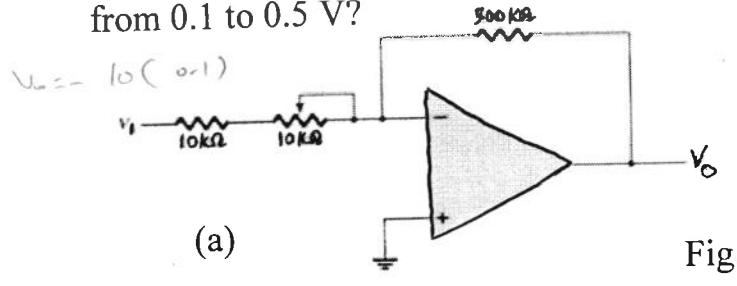
Fig.(2)

Q3: Given I_{DSS} = 6 mA and V_P = 4.5 V: (a) Determine I_D at V_{GS} = - 2 and -3.6 V.

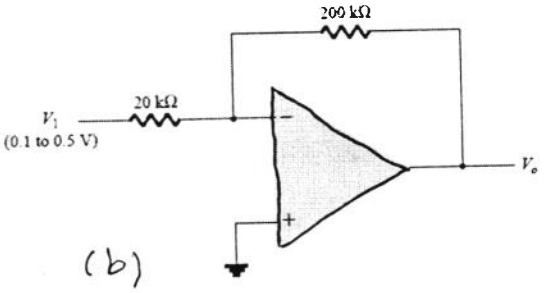
(b) Determine V_{GS} at I_D = 3 and 5.5 mA.

Q4: (a) What is the range of the voltage-gain adjustment in the circuit of Fig. (3 a)?

(b) What is the range of the output voltage in the circuit of Fig. (3 b) if the input can vary from 0.1 to 0.5 V?



(a)



(b)

Fig.(3)

Q5: Determine the gate current and the anode current when the switch, SW1, is momentarily closed in Figure (4). Assume V_{AK} = 0.8 V, V_{GK} = 0.7 V, and I_H = 20 mA.

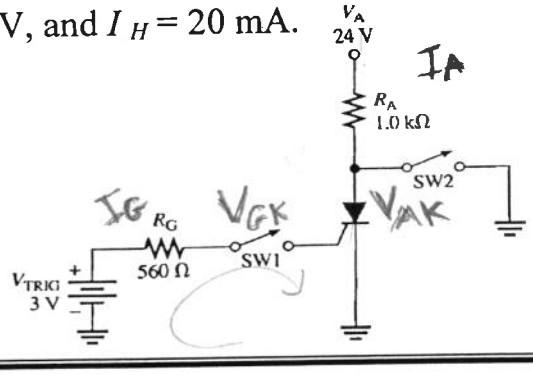


Fig.(4)

University of Technology
Department of Applied Sciences
mid examination 2015/2016

Subject : optics
Branch : Applied physics
Examiner :Dr. Esam A. Tawfiq

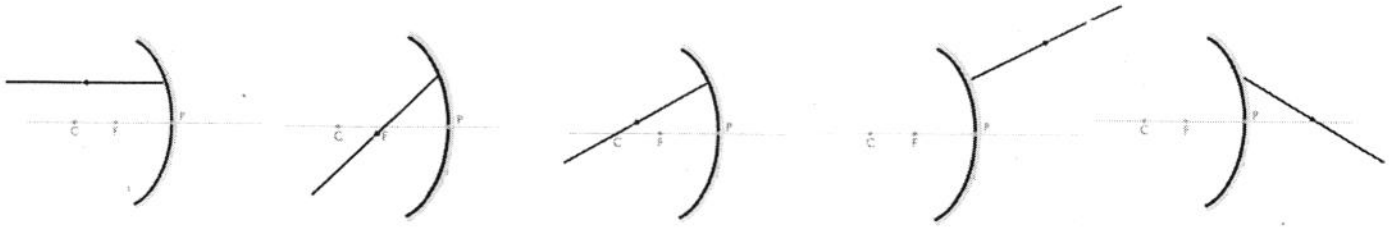
Class: third level
Time : 3 hours
Date :

NOT: ANSWER FOUR QUESTIONS ONLY

Q1)1-A spherical concave mirror has a radius of curvature of 30 cm. What is the magnification when the face is 10cm from the vertex of the mirror? Draw a ray diagram of the image formation.

2- Light with a wavelength of 646 nm passes trough two slits and forms an interference pattern on a screen 8.75 m away. The distance between the central bright fringe and the first-order (m: 1) bright fringe is 5.16 cm. (a) What is the separation between the slits?(b) What will be the distance between the central bright fringe and the second-order(m =2)minimum.

Q2)1-A very narrow light ray AB strikes the surface of a concave mirror as shown on the diagram. Which of the following diagrams represents the reflected ray?

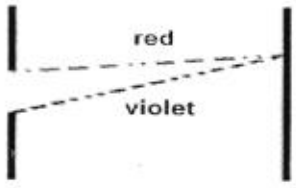


2-Which of the lens or lenses is the converging lens? (A) I and V (B) II, III and IV (C) II and III (D) III and IV (E) IV and V

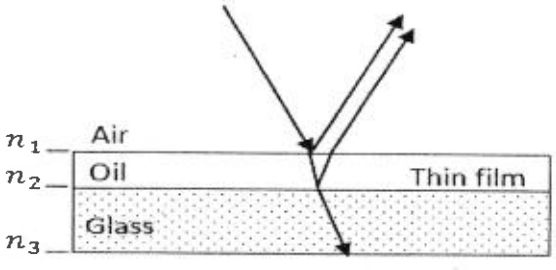
Q3)1- Derive the lens makers' formula for a thin lens

2- With two slits spaced 0.2mm apart, and a screen at a distance of l=1m, the third bright fringe is found to be displaced h=7.5mm from the central fringe. , what is the wavelength, λ, of the light used .

Q4)1-For a single slit experiment apparatus like the one described below, determine how far from the central fringe the first order violet (λ = 350nm) and red (λ = 700nm) colours will appear if the screen is 10 m away and the slit is 0.050cm wide.



2- Blue light of wavelength 480 nanometers is most strongly reflected off a thin film of oil on a glass slide when viewed near normal incidence. Assuming that the index of refraction of the oil is 1.2 and that of the glass is 1.6, what is the minimum thickness of the oil film?



Q5)1-The dark fringe for m=0 in Young's double- slit experiment is located at an angle $\theta = 15^{\circ}$ .What is the angle that locates the dark fringe for m=1 ?

2- A concave mirror has a radius of curvature of 24 cm.How far is an object from the mirror if an image is formed that is (a) virtual and 3 times the size of the object, (b) real and 3 times the size of the object?

GOOD LUCK

University of Technology
Department of Applied Sciences
Final Examination 2015/2016

Subject: Laser Principles | **Class: 3rd year**
Branch: Applied Physics | **Time: 3 hours**
Examiner: Dr. Uday M. Nayef | **Date:**

NOTE: answer only *Four* questions (total of 50 Marks, 12.5 Marks for each question).

Q.1

(a)Write about generate population inversion? (8 marks)

(b) Calculate the Gaussian beam divergence of He-Ne laser (λ=633 nm) which has a confocal cavity with a minimum beam radius (waist) W_o=0.22 mm?

Q.2

(a) i. What are processes in LASERS?
ii. What is physical property coherent in laser?
iii. How to calculate the diffraction angle for laser beam?

(b) The length of the optical cavity in He-Ne laser is 55 cm. The Laser bandwidth is 1.5 GHz. Find the approximate number of longitudinal laser modes?

Q.3

(a) How is Q-Switching - Giant Pulse Laser?

(b) Compute the pulse width Δt_p and the separation between pulses Δt_{spe} for the mode-locked Nd-YAG laser where the fluorescent line width is 1.1×10^{11} Hz and the laser rod of refractive index (1.82 for YAG) is 0.1 mm long. Assume that the laser mirrors are very close to the ends of the rod?

Q. 4

(a) The length of the optical cavity in He-Ne laser is 30 cm. The emitted wavelength is 0.6328 mm. Calculate:-

1. The difference in frequency between adjacent longitudinal modes?
2. The number of the emitted longitudinal mode at this wavelength?
3. The laser frequency?

(b) Mention application for mode locked optical pulses?

Q. 5

(a) Description of mechanism Helium-Neon Laser?

(b) How CO_2 laser radiation is created?

Good Luck

University of Technology
Department of Applied Sciences
Final Examination
2015 -2016

Branch: Applied Physics
Subject: Quantum Mechanics
Examiner: Dr. Mukhlis M. Ismail

Class : 3rd year
Time : 3 hours
Date :

Note: Answer 4 questions only. (25 points for each question)

Q1/ A) Give the meaning of the following: (18 points)

1) Zero point energy, 2) $[\alpha, \beta] \neq$ zero, 3) $\frac{\hbar}{i}\int_{-\infty}^{\infty} \psi_x \frac{d\psi_x}{dx}\, dx$,

4) $\langle\psi|\psi\rangle = 1$, 5) Tunnel Effect 6) Eign Value Equation.

B) Prove that the momentum operator is a Hermitian operator. (7 points)

Q2/ A) Evaluate the normalization constant, N, for

$\psi = N \sin\theta \cos\phi \quad for -\frac{\pi}{2} \leq \theta \leq \frac{\pi}{2} \quad and \quad 0 \leq \phi \leq 2\pi$ (12 points)

B) Given that $\psi_{x,t} = \cos(kx - \omega t) + i\sin(kx - \omega t)$,

1- Drive momentum operator.

2- Show that $\psi_{x,t}$ is a solution of time independent Schrodinger equation for free particle in one dimension. (13 points)

Q3/ A) Drive the time independent Schrodinger Equation using time dependent Schrodinger Equation. (13 points)

B) Find the commutator between Hamiltonian and momentum operator, then find $\frac{d<p>}{dt}$ using Ehrenfest Theorem and compare your result with classical. (12 points)

Q4/ A) Given wave functions ψ_1 and ψ_2 are solutions of Schrodinger Equation, and $\Psi = \sum_{i=1}^{2} c_i \psi_i$ where c_1 and c_2 are constants. Prove that Ψ is a solution of Schrodinger Equation. (15 points)

B) Prove that the probability of finding a free particle is constant everywhere. (10 points)

Q5/ A) Drive the relation between ladder operator and Hamiltonian operator for the harmonic oscillator. ($using\ a_{\mp} = \frac{1}{\sqrt{2\hbar m\omega}}(\pm ip + m\omega x)$) (12 points)

B) Find the expectation value of potential energy in the n^{th} state of the harmonic oscillator.

Using: $\hat{x} = \sqrt{\frac{\hbar}{2m\omega}}(\hat{a}_+ + \hat{a}_-)$ and $\hat{p} = i\sqrt{\frac{\hbar m\omega}{2}}(\hat{a}_+ - \hat{a}_-)$ (13 points)

University of Technology
Department of Applied Sciences
Final Examination 2015/2016

Subject: Mathematics | **Class: 3ed year**
Branch: Applied physics branch | **Time: 3 hour**
Examiner: D. Atheer Ibrahim Abdali | **Date: 2016**

Note answer Four questions only

Q1\ (a) Solve the P.D.E $\frac{\partial u}{\partial x} = 2\frac{\partial^2 u}{\partial y^2}$ with $u(2,y) = u(0,y) = 0$ and $u(0,y) = 5\sin(4\pi y)$? **[7.5 marks]**

(b) Evaluate $\int_0^\infty x^2 e^{-2x^2} dx$? **[5 marks]**

Q2\ (a) Solve the O.D.E $\frac{d^2y}{dx^2} + x^3\frac{dy}{dx} + x^2 y = 0$ with $y(0) = 0$, $\dot{y}(0) = 1$ using Power series ? **[7.5 marks]**

(b) Evaluate $\int_1^4 \sqrt[3]{x^2} - 2x \ dx$ to four decimal places by trapezoidal rule , where the interval [1 , 4] is subdivided into 3 equal parts compare your answer with the exact solution ? **[5 marks]**

Q3\ (a) Evaluate $\int_0^1 \sqrt[3]{ln(x)} \ dx$? **[5 marks]**

(b) Prove that $\beta(m,n) = \frac{\Gamma m \, \Gamma n}{\Gamma(m+n)}$? **[7.5 marks]**

Q4\ (a) Solve the P.D.E $\frac{\partial u}{\partial x} - x\frac{\partial u}{\partial y} = 0$? **[5 marks]**

(b) Evaluate $\int_c z\,dz$? Where (c) is the line from the origin point to z = 2-3i ? **[7.5 marks]**

Q5\ (a) Is f (z) = e^z analytic function or not? **[5 marks]**

(b) Use Simpson's rule for evaluate of $\int_0^{10} \sqrt{x+4} \ dx$ to four decimal places considering n=5? **[7.5 marks]**

Good luck