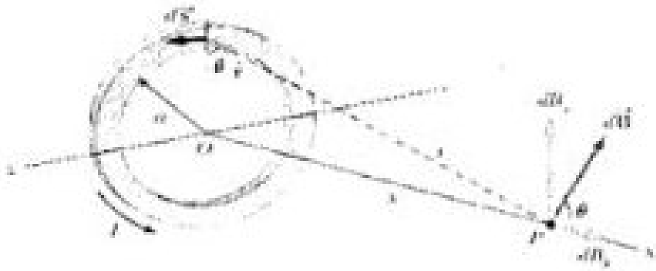
Kafrelsheikh University Faculty of Science Physics Department First level (Faculty of Computers & Information)	(Exam in 1 page)	Time: 3rd h Subject: PH:102 Mark: 60 Marks Date: 24/12/2017 First Term

Answer The following Questions: (Each Question 10 Marks)

1. **Explain:** The polarization by Absorption and Malus's law?

2. **Deduce** the Magnetic Field Due to a Current in the Axis of a Circular Loop?



3. **(a) Write short notes about:** Length Contraction according to Special Theory of Relativity?

   (b) A two-slit interference experiment in which the slits are **0.200** mm apart and the screen is **1.00 m** from the slits. The **m=2** bright fringe is **9.49** mm from the central fringe. Find the wavelength (**λ**) of the light?

4. **(a) Define:** Huygens principle and Einstein's Postulates in relativity theory?

   (b) Find the first and the second dark fringes from Diffraction by a Single Slit?

5. **Write short notes about**: Meissner Effect, and two type of superconducting materials?

6. **(a) Explain:** The Ideal and Complete models (Approximations) of Diode?

   (b) Determine the forward voltage and forward current for each of the diode Ideal and Practical models. **(V_{BIAS} = 10 V, R_{LIMIT} = 1 KΩ)**

****End of Exam****
With My Best Wishes
Dr/ Walid Ismail

Polarization By selective absorption

اذا تم ارسال حزمه ضوئيه خلال ماده التورمالين فإن الضوء يستقطب خطياً
خلال الكريستال الاول هو المستقطب ويتم توجيهه خلال ~~الثاني~~
" الثاني هو المحلل

If the beam of light is sent through a thin plate of Tourmaline the the Transitted beam will be linearly Polarized the first ~~cy~~ crystal is called Polarizer.

It serves the function of Polarizing the light
The Second cyrstal is Called the analyzer.

Malus's Law

قانون مالوس

$$\underline{I} = \underline{I}\ max\ Cos^2 \theta$$

I max → The indensity of light Coming from Polarizer
حيث تكاثف الضوء القادم من المستقطب

I → the indensity of from analyzer
التكاثف القادم من المحلل

θ → the angle betwean the Polarizer and analyzer
الزاوية بين المستقطب والمحلل

$$dB = \frac{\mu_0 I}{4\pi} \frac{|d\vec{s} \times \hat{r}|}{r^2} = \frac{\mu_0 I}{4\pi} \frac{ds}{(a^2 + x^2)}$$

Find the x component of the field element:

$$dB_x = \frac{\mu_0 I}{4\pi} \frac{ds}{(a^2 + x^2)} \cos\theta$$

Integrate over the entire loop:

$$B_x = \oint dB_x = \frac{\mu_0 I}{4\pi} \oint \frac{ds \cos\theta}{a^2 + x^2}$$

From the geometry, evaluate cos θ:

$$\cos\theta = \frac{a}{(a^2 + x^2)^{1/2}}$$

Substitute this expression for cos θ into the integral and note that x, a, and u are all constant:

$$B_x = \frac{\mu_0 I}{4\pi} \oint \frac{ds}{a^2 + x^2} \frac{a}{(a^2 + x^2)^{1/2}} = \frac{\mu_0 I}{4\pi} \frac{a}{(a^2 + x^2)^{3/2}} \oint ds$$

Integrate around the loop:

$$B_x = \frac{\mu_0 I}{4\pi} \frac{a}{(a^2 + x^2)^{3/2}} (2\pi a) = \frac{\mu_0 I a^2}{2(a^2 + x^2)^{3/2}} \qquad (2\text{-}9)$$

To find the magnetic field at the center of the loop, set $x = 0$ in Equation 2.9. At this special point,

$$B = \frac{\mu_0 I}{2a} \quad (\text{at } x = 0)$$

2. Length Contraction

Lengths Parallel to the Relative Motion

We attach a light source to one end of a ruler and a mirror to the other end. The ruler is at rest in reference frame S'

The time required for light pulse to make the round trip Δt_0

This is a proper time $$\Delta t_0 = \frac{2l_0}{c}$$

In reference frame S the ruler is moving to the right with speed during this travel of the light pulse.

3-(b) $d = ,200\ mm$ $R = 1m$

$m = 2$ bright $y_m = 9{,}49\ mm$ $\lambda = ?$

عايز الطول الموجي

$$y_m = \frac{R(m\lambda)}{d}$$

$$R m \lambda = y_m d$$

$$\lambda = \frac{y_m d}{R m} = \frac{(9{,}49 \times 10^{-3}) \times (,2 \times 10^{-3})}{2 \times 1}$$

إجابة أدي $= 9{,}49 \times 10^{-7}\ m$

$= 949 \times 10^{-9}\ m \rightarrow$ $949\ nm$

Chapter 1

Hugens Principle مبدأ هيجنز

All Point on awave front serve as Point Sources of spherical Secondary wavelets.

كل الموجات التي على صدر الموجة تعمل كمصادر ثانوية لإنتاج موجات كروية

Einstein's Postulate

1. The principle of relativity:-

The laws of physics must be the same in all inertial reference frames.

2. The constancy of the speed of light:-

The speed of light in vacuum has the same value, $c = 3\text{x}10^8$, m/s, in all inertial frames, regardless of the velocity of the observer or the velocity of the source emitting the light.

1. Time Dilation

4) (b)

First dark fringe

$a \sin\theta = \lambda$

Second dark fringes

$a \sin\theta = 2\lambda$

5) → Chapte 6

(A) *Approximate Equivalent circuit:*

When the forward voltage V_F is applied across a diode, it will not conduct till the potential barrier V_0 at the junction is overcome. Therefore, the forward voltage V_F applied across the actual diode has to overcome:

(a) Potential barrier V_0

(b) Internal drop $I_F r_f$

$V_F = V_0 + I_F r_f$

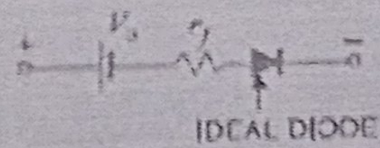
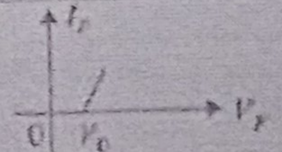
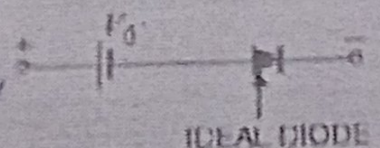
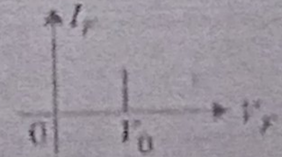
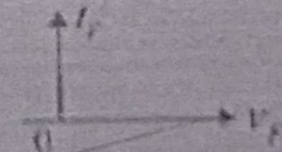
For a silicon diode, $V_0 = 0.7$ V whereas for a germanium diode, $V_0 = 0.3$ V.

(B) *Simplified Equivalent circuit:*

For most applications, the internal resistance r_f of the crystal diode can be ignored in comparison to other elements in the equivalent circuit.

(C) *Ideal diode model:*

An ideal diode is one which behaves as a perfect conductor when forward biased and as a perfect insulator when reverse biased. Obviously, in such a hypothetical situation, forward resistance $r_f = 0$ and potential barrier V_0 is considered negligible.

S.No.	Type	Model	Characteristic
1	Approximate model		
2	Simplified model		
3	Ideal Model		

(b) in Ideal Diode

Forward current

$$I_F = \frac{V_{Bias}}{R_{Limit}} = \frac{10}{1 \times 10^3} = ,01\ A$$

Forward voltage $V_F = 0\ V$

ractical models

Forward current

$$I_f = \frac{V_{Bias} - V_F}{R_{Limit}}$$

$$= \frac{10 - 0,7}{1 \times 10^3} = 9,3 \times 10^{-3}$$

Forward voltage $= 0,7\ V$