TED (10)—1016A
(RTEVISION—2010)

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SECOND SEMESTER DIPLOMA EXAMINATION IN ENGINEERING/ TECHNOLOGY-OCTOBER, 2014

APPLIED SCIENCEII (PHYSICS)
(Common except for DCM and CABM)

[time : 1 ½ hours]

(Maximum mark 50)

PART-A

(Answer all questions in one or two sentences. Each question carries 2 marks)

I.a) Name the different forms of energy associated with a flowing liquid.

Ans) The different forms of energy associated with a flowing liquid are kinetic energy($1/2\ mv^2$, potential energy(mgh), pressure energy (mP/d).

b) How is critical angle related to refractive index?

Ans) If μ is the refractive index of a medium, then $\mu = 1/\sin i_c$ where i_c is the critical angle of that medium.

PART-B

(Answer any 2 questions. Each question carries 8 marks.)

I. a) Define the moment of a force about a point. State the conditions of equilibrium of a body under the action of coplanar parallel forces.

Ans) Moment force about a point (Torque) is the turning or rotational effect produced by the force. It is Measured as the product of force(F). And perpendicular distance(r) of point application of the force from the point.

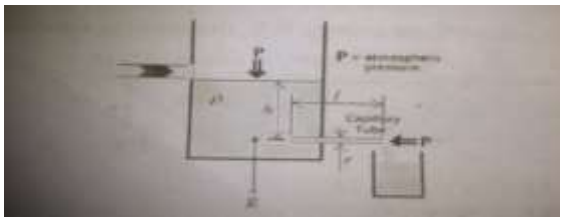
Moment of force(Ƭ) =rf

Condition for equilibrium:

1) The net force acting on the body must be zero
2) The clockwise torque about any point of the body must be equal to anti clockwise torque about the same point

II b) Explain Poiseuille's method to determine the coefficient of viscosity of water.

Ans)



By Poiseuille's formula, the volume V of the liquid flowing in t sec through a capillary tube of radius 'r' And length 'l' is given by

$$V/t = P\pi r^4 / 8\eta l$$

Where ŋ is the coefficient of viscosity of the liquid. P = hpg is the pressure different between the Ends of the tube. Where ρ is the density of liquid and h is height of liquid column

Therefore $\eta = P\pi r^4 \times t / 8 vl$

III a)Define simple harmonic motion. Write down the differential equation of a simple harmonic motion and expain the various terms.

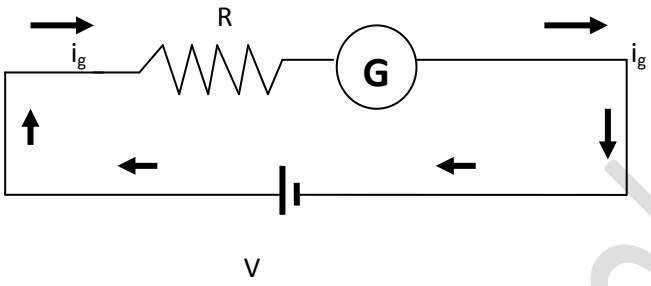
Ans) A particle is said to execute simple harmonic motion if its acceleration at any instant is directed to a fixed point and is directly proportional to the displacement from the fixed point. The fixed point is called the equilibrium position of the particle.

$d^2x/dt^2 = -\omega^2 x$. Here displacement of the particle at any instant t is x, its acceleration is d^2x/dt^2, ω is the angular velocity.

b) How will you convert a galvanometer to a voltmeter.

A galvanometer can be converted into voltmeter by connecting a high R resistance in series with it.

$R = (V / ig) - G$



IV a) Which two gates are recognized as Universal gates? Why? Draw their logical symbol and explain the truth table of both.

Ans) NAND and NOR gates are termed as universal gates since any logical gate can be constructed using them.

NAND NOR

b) Threshold wavelength for Sodium is 540 nm. Calculate the photoelectric work function.

Ans) Photoelectric work function $\phi = h\nu_0 = hc/\lambda_0 = 6.6\times10^{-34} \times 3\times10^8/540\times10^{-9} = 3.67\times10^{-19}$ J

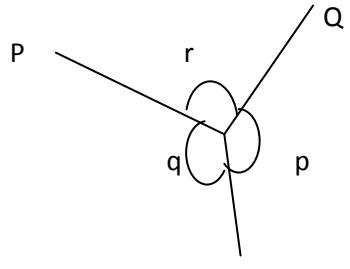
PART-C

(Answer one full question from each unit. Each question carries 15 mark)

UNIT-1

V a)State and explain Lami's theorem.

Ans) Lami's theorem states that if three forces acting at point keep the point in equilibrium, then each Force is directly proportional to sine of the angle between other two forces.

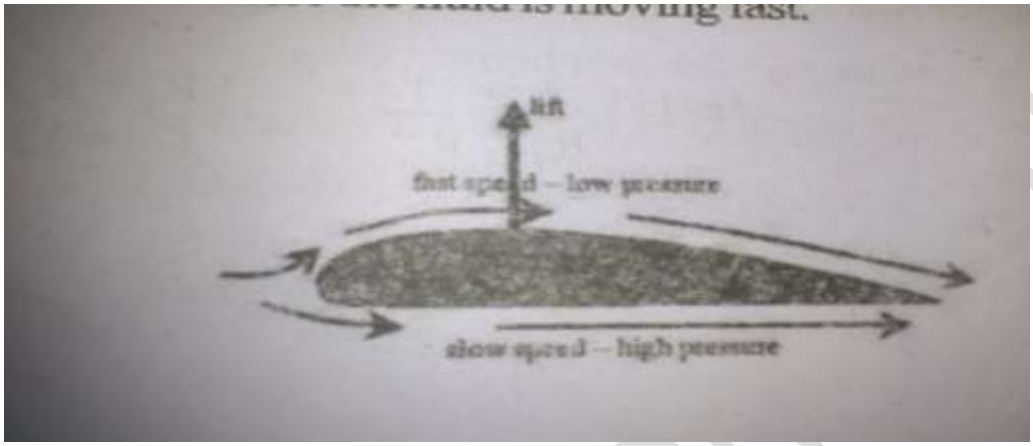


R

P/sin p = Q / sin q = R / sin r

b) Discuss the working principle of aerofoil.

Ans)) An aerofoil works on the principle of Bernoulle 's theorem. That is the total energy of an Incompressible non viscous fluid remains constant through out its flow. In other words, the pressure in a moving fluid is the least where the fluid is moving fast.



When the air above the aerofoil moves faster, the pressure decreases and it is lifted up.

c) Distinguish between transverse and longitudinal waves.

Ans)) **Transverse wave**

1. The particles of the medium conveying the wave vibrates perpendicular to direction of propagation of the wave.
2. They travel in the form crests and troughs
3. One crest and one trough constitute a wave.
4. E.g.: light wave, waves on the surface of the water

Longitudinal wave

1. The particles of the medium vibrate parallel to the direction of propagation of the wave.
2. They travel in the form of condensations and rarefactions.
3. One condensation and rarefaction constitute a wave.
4. E.g. : sound wave, waves on the loaded spring

d) Define co efficient of viscosity. A raindrop of radius 0.2 mm falls through air. If the viscosity of air is 1.8 X 10 -5 kg m -1 s -1, find the viscous force acting on the drop when its speed is 1 m/s.

VI a)Explain Bernoulli's theorem.

Ans) It states that in a stream line flow of an incompressible non viscous fluid, the total energy remains

Constant throughout the flow.

Kinetic energy + potential energy + pressure energy = K

Where K is a constant.

i.e, $v^2 + gh + p = K$, is constant.

b) Explain the magnetostriction method to produce ultrasonic waves.

Ans) If a ferromagnetic material placed in an alternating magnetic field, it undergoes alternate contraction and elongations resulting in longitudinal vibrations of the ferromagnetic rod. The frequency of the waves produced depends on the length of the rod. Ultrasonic waves are generated in this way in magnetostriction method

C) The audible frequency range of human ear is 20 Hz to 20 kHz. Convert this to the corresponding wavelength range.

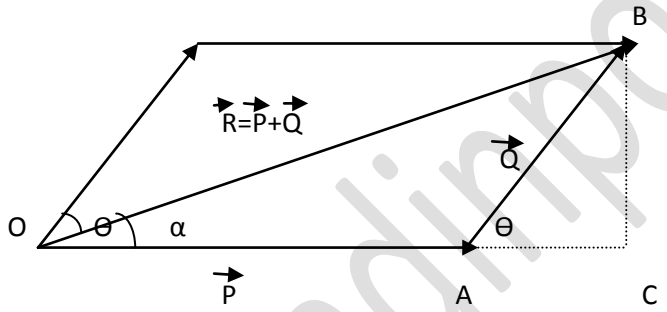
Ans: We have, $\lambda = v/\nu$.

Wavelength corresponding to 20Hz = 340m/s / 20Hz = 17m

Wavelength corresponding to 20KHz = 340m/s / 20KHz = 17×10^{-3} m

D) State parallelogram law of forces. Explain the analytical method to find the resultant of two forces.

Ans)Parallelogram law of vector addition states that If two given vectors are represented, both in magnitude and direction, by the sides of a parallelogram drawn from a point, then the diagonal of the parallelogram starting from their point of intersection represents their resultant



Let OA represents $\overline{P}$, AB represents $\overline{Q}$ so that OB represent $\overline{R}$. Let Θ be the angle between the directions of P and Q and α the angle between the directions of P and R.

From right △ OCB

$OB^2 = OC^2 + BC^2$

$= (OA + AC)^2 + BC^2$

$= OA^2 + AC^2 + 2\,OA.AC + BC^2$

{ △ ABC ,$AB2 = AC^2 + BC^2$ and $\cos\Theta = (AC/AB)$}

i.e, $OB^2 = OA^2 + AB^2 + 2.OA.AB\cos\Theta$

i.e, $R^2 = P^2 + Q^2 + 2PQ\cos\Theta$

$r = \sqrt{P^2 + Q^2 + 2PQ\cos\Theta}$

Direction of the resultant

From △ OCB

$\tan\alpha = BC/OC$

$\tan\alpha = BC/(OA+AC)$

$= AB\sin\Theta/(OA + AB\cos\Theta)$

{ △ ABC $\sin\Theta = BC/AB$; $\cos\Theta = AV/AB$}

When Θ =0; Cos 0=1 ; Sin 0 = 0

$R^2 = P^2 + Q^2 + 2PQ = (P+Q)^2$

$R = P + Q$

$\alpha = \tan^{-1}(0) = 0^o$

when $\Theta = 180^o$; Cos 180 =-1 ; Sin 180 = 0

$R^2 = P^2 + Q^2 - 2PQ = (P-Q)^2$

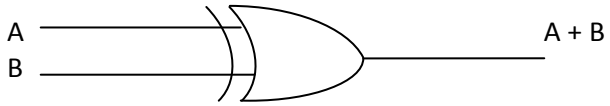
$R = P - Q$

$\alpha = \tan^{-1}(0) = 0^o$ or 180^o

UNIT-II

VII. a) What is an XOR gate? Draw its logic symbol and truth table.

Ans)



A	B	Y= A+B
0	0	0
0	1	1
1	0	1
1	1	0

b) A concave lens made of a transparent material has a refractive index 1.5. Find its focal length if the radii of curvature are 10cm and 30cm.

Ans) $1/f = (\mu-1)(1/R_1 + 1/R_2)$ for convex lens.

$1/f = (1.5-1)(1/10 + 1/30) = 0.067$

$f = 14.9$cm

c) State Einstein's photoelectric equation. What are the laws of photoelectric effect?

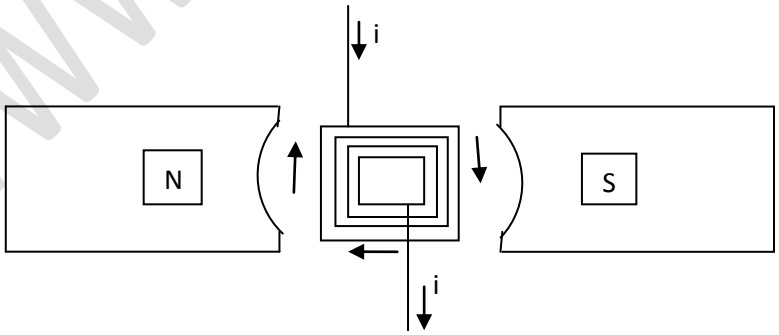
Photoelectric equation is, $E = \phi + KE$ where E is the energy of the radiation, ϕ is the work function of the metal and KE is the kinetic energy of the ejected electron.

Laws of photoelectric effect:

1. In order to cause photo electric emission from a metal, the incident radiation must have minimum frequency called threshold frequency
2. The kinetic energy of emitted electron depends on the energy of incident radiation.
3. The number of photo electrons emitted and hence photo electric current is directly proportional to the intensity of incident light.
4. The photo electric emission is an instantaneous process

d) Explain the construction and working of moving coil galvanometer

Ans) The current carrying conductor placed in a magnetic field experiences a force. This is the working principle of moving coil galvanometer.



A rectangular coil of length 'l' and breadth 'b' is placed in a magnetic field B. the poles of the Magnet are made concave to produce radial magnetic field. Let a current 'i' experience any force as they are parallel to magnetic field. The length sides of the coil experience a force of Bil each acting in the opposite direction.

Deflecting torque acting on the coil = Bil x b

= bi x A

{ A = l x b , the area of the coil}

If there 'N' turns of the coil, then
Total deflecting torque = BiAN
When restoring torque becomes equal to the deflecting torque, the coil comes to a halt
After turning through an angle Θ

Then deflecting torque = restoring torque

Ie $I = \frac{C\Theta}{BAN}$

$i = K\Theta$ Where $K = C / BAN$ is a constant.

ie $I \ \alpha \ \theta$

OR

VIII. a) Distinguish between spontaneous emission and stimulated emission.

Ans) When an atom is in excited state, it may soon change to a state of lower energy emitting a photon is without any external causation, it is called spontaneous emission. Sometimes a photon striking an excited atom return to the ground state by emitting an identical photon. This process is called stimulated emission.

b)A circular coil of 40 turns of wire and negligible section has diameter 32cm. What current must exist in the coil to produce a flux density of $3x\ 10^{-4}T$

Ans) $B_c = \frac{\mu_0 ni}{2a}$ Here n = 40, a = 0.32m, $B = 3x\ 10^{-4}Tm$

$I = (Bx2a)/ \mu_0 n = 3x10^{-4}x2x0.32/(4\pi x10^{-7}x40) = 3.82A$

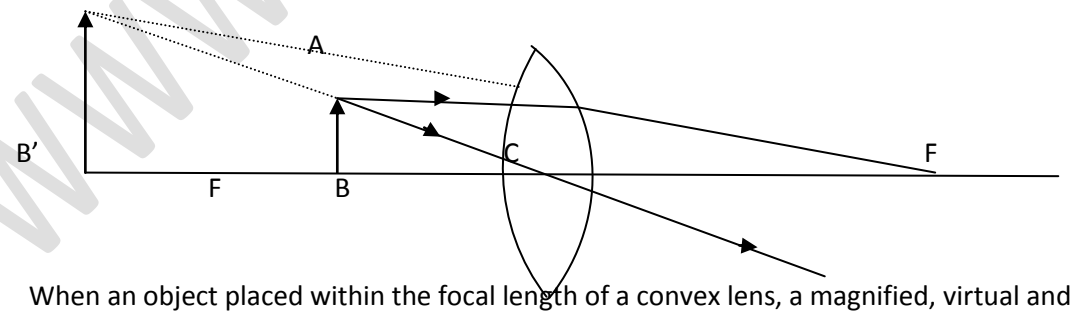
C) What is photoelectric cell? Write any three applications of photoelectric effect.

Ans: Photoelectric cell is a device for converting light energy into electrical energy employing photoelectric effect.

Applications of photoelectric effect:

1) A photo electric cell used in automatic counting machine.
2) it is used automatic switch of street lights.
3) it is used in burglar alarm.

d) With the help of a diagram, explain the principle of a simple microscope. Write the formula for magnification and explain the various terms used. Ans) A'



When an object placed within the focal length of a convex lens, a magnified, virtual and erect image is formed on the same side of the object.

The magnifying power of simple microscope

$M = 1 + D/f$

Where D - the least distance of distinct vision and

thus the shorter the focal length, the larger the magnifying power. But 'f' cannot be reduced below a particular value because the image will be distorted

the magnifying power of simple microscope is limited (M<20) and it suffers from spherical and chromatic aberrations.