DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE – RAIGAD -402 103

Mid Semester Examination – October - 2017

Branch: Chemical/Mechanical/Civil/Petrochemical **Sem.:- I**

Subject with Subject Code:- Engineering Physics (PHY 103) **Marks: 20**

MODEL ANSWER with MARKING SCHEME

Q.No.1 Answer the following **(06)**

a) Oscillations become damped due to

i) normal force ii) friction
iii) tangential force iv) parallel force

Answer: friction ------- 1 mark

b) If an object moves back and forth repeatedly around a mean position it is called

i) oscillating ii) revolving
iii) rotating iv) motion

Answer: oscillating ------- 1 mark

c) Maximum displacement from equilibrium position is

i) frequency ii) amplitude
iii) wavelength iv) period

Answer: amplitude ------- 1 mark

d) Light waves are transverse in nature, can be demonstrated by observing the phenomenon of

i) dispersion ii) interference
iii) polarization iv) diffraction

Answer: polarization ------- 1 mark

e) A system in which population inversion is achieved is called

i) parallel system ii) active system
iii) metastable state iv) pumping

Answer: active system ------- 1 mark

f) Optical fibre works on the principle of

i) photo-electric effect ii) laser effect

iii) total internal reflection iv) refraction

Answer: total internal reflection ------- 1 mark

OR

p) Why the center of Newton ring is dark?

Answer: A thin air film is formed between the plate and the lens. The thickness of the air film varies from zero at the point of contact to some value t. If the lens plate system is illuminated with monochromatic light falling on it normally, concentric bright and **dark** interference **rings** are observed in reflected light.

------- 2 marks

q) Fiber Optic Cables are preferred instead of Copper. Give reason

Answer: Besause of following reasons:

1. Fiber optic transmission is faster
2. Fiber optic transmission results in less attenuation.
3. Fiber optic cables do not break as easily.

---------- Any two reason 2 marks

r) What is the difference between Free and Forced oscillation?

Answer: Free Vibration refers to vibrations, when the system is allowed to vibrate on its own i,e the system is not subjected to periodic force. However, when a system is subjected to periodic force, the resulting vibrations are known as forced vibration.

------- 2 marks

Q.No. 2 Attempt any one of the following: (06)

a) Explain the production of Ultrasonic wave with the help of Magnetostriction generator.

Answer: **Principle:-** When a ferromagnetic rod is placed in steady magnetic field, the rod undergoes a small change in length. If the steady field is replaced by an alternating magnetic field the rod undergoes alternate contraction and rarefaction at a frequency twice, the frequency of applied magnetic field. The fundamental frequency of such vibration is given by

$$f = \frac{1}{2\ell}\sqrt{\frac{E}{\rho}}$$ ------- 1 mark

Where E = Youngs modulus, ℓ = length of rod

ρ = Density of rod

Construction: - It consists of a rod of ferromagnetic material (Iron/Nickel) clamped at its centre the two sections of rod is surrounded by coil L_1 & L_2 (fig. a).The coil L_1 is connected to gird circuit & L_2 is connected to plate circuit of triode. A variable condenser C is connected between plate and H.T.A. milliammeter is included in the circuit to read plate current. ------- 1 mark

Working:- The ferromagnetic rod gets magnetized by the plate current passing through coil L_2. Any change in the plate current change the magnetization of rod, linked with grid coil L_1, there by inducing an emf. in it. This emf is amplified & passed on to the plate circuit, so that oscillations are maintained. The frequency of oscillations are controlled by the variable capacitor C. If this frequency matches the natural frequency of longitudinal vibration of rod, then resonance occurs there by producing ultrasonic waves due to vibrating of rod vigorously.

------- 2 marks

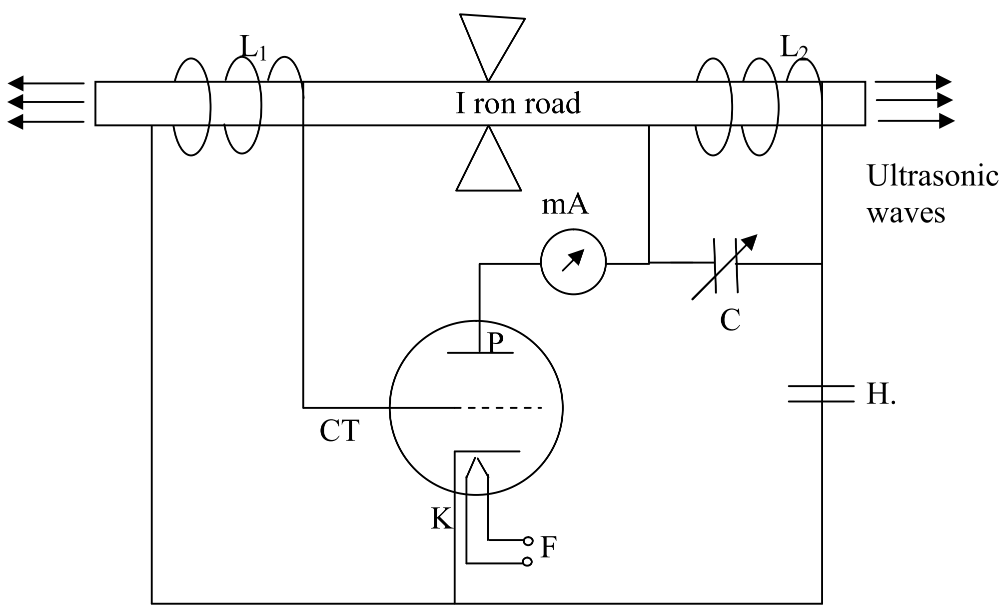
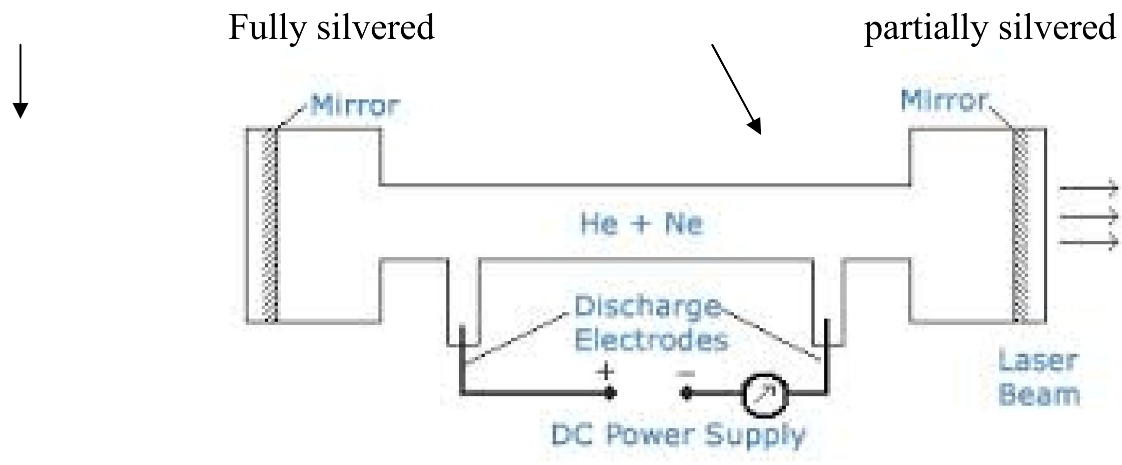


Fig. (a) ------- 2 marks

b) Explain the construction and working of He-Ne Laser with neat diagram

Answer: The first gas laser to be operated successfully was the He-Ne laser.

Diagram for He-Ne laser is as shown below.

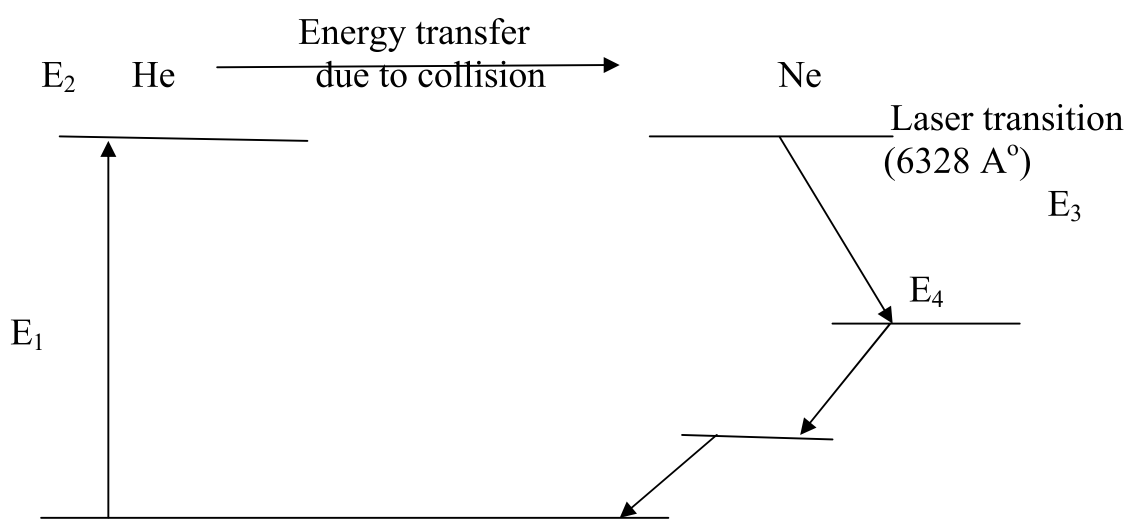


------- 2 marks

Construction:- The gas Laser consists of fused quartz tube with a diameter of about 1.5 cm and 80 cm long. This tube is filled with a mixture of Neon under pressure of 0.1 mm of mercury and Helium under pressure of 1mm of mercury. There is a majority of He atom and Minority of Ne atoms. At both the ends of the tube, parallel mirrors are placed. One of which is partly transparent and other is fully reflecting. An electric discharge is produced in a gas by connecting electrodes to the power supply.

------- 2 mark

Working;- An energy level diagram illustrating the operation of He-Ne laser is shown below



An electric discharge is produced in the gas when the electrodes are connected to power supply. The electrons from discharge collide with Helium atoms. The energetic electrons excite the He atoms through collision to the metastable state E_2. These excited Helium atoms collides with Neon atoms in ground state. A resonant energy transfer takes place. Population inversion is achieved in metastable state of Neon. After stimulated emission, emited photons reflected back and forth and emerge out through partly silvered end in the form of laser beam having wavelength 6328A^0 ------- 2 marks

Q.No 3. Attempt any two of the following (08)

a) Distinguish between positive and negative crystal.

Answer:

Positive Crystal	Negative Crystal
1. For positive crystal $V_o > V_e$	1. For negative crystal $V_o < V_e$
2. $\mu_o < \mu_e$	2. $\mu_o > \mu_e$
3. The velocity of O-ray is same in all direction	3. The velocity of O-ray is same in all direction
4. Example –Quartz, Ice	4. Example – Tourmaline, Calcite

------- Any four difference 4 marks

b) Define Ultrasonic Wave. Give its engineering applications.

Answer: Sound waves having frequencies greater than 20 KHz are known as Ultrasonic Waves.

1. Ultrasonic soldering:Metals can be soldered by subjecting them to ultrasonic vibrations. Example-Al soldering
2. Ultrasonic waves can be used for cleaning utensils, washing clothes, removing dust and soot from chimney etc.
3. Ultrasonic wave can be used for drilling and metal cutting purpose.
4. It can be used to measure water depth in the mapping of the ocean floor and to detect submerged objects such as submarines.

---------- Any four engg. application 4 marks

c) The refrective index of core and cladding material of a step index fibre are 1.48 and 1.45 respectively. Calculate:
1. Numerical aperature 2. Acceptance angle

Solution: refractive index of core, n_1=1.48
refractive index of cladding, n_2=1.45

1. Numerical aperature, $N.A = (n_1^2 - n_2^2)^{1/2}$
$= ((1.48)^2-(1.45)^2)^{1/2}$
$= 0.2965$ ------- 2 marks
2. Acceptance angle, $\sin\theta_o = N.A = (n_1^2 - n_2^2)^{1/2}$
$\theta_o = \sin^{-1}(n_1^2 - n_2^2)^{1/2}$
$\theta_o = \sin^{-1}(0.2965)$
$\theta_o = 17^0 15'$ ------- 2 marks
