

Unit: 5. EMW & WO (25 marks)

1 mark → 4 Questions 5 mark → 1 Question 56

3 mark → 2 Questions 38, 39 10 mark → 1 Question 66

UNIT – 5.EMW& WO – 1 mark Questions

- In an electromagnetic wave the phase difference between electric field E and magnetic field B is --
a) $\pi/4$ b) $\pi/2$
c) πd d° [DMP,S-08,M-09,10,J-06,10,11,13]
- In an electromagnetic wave ---- [J-09,S-12]
a) power is equally transferred along the electric and magnetic fields
b) power is transmitted in a direction perpendicular to both fields
c) power is transmitted along the electric field
d) power is transmitted along the magnetic field
- Electromagnetic waves are ---- [S-09,10,J-11,M13]
a) transverse b) may be longitudinal or transverse
c) longitudinal d) neither longitudinal nor transverse
- The existence of emw was confirmed experimentally by [S-12]
a) Hertz b) Maxwell
c) Huygens d) Planck [M-06, O-11]
- Which of the following is used to study crystal structure ----
a) x-rays b) infrared rays
c) ultraviolet rays d) β -rays
- Which one of the following is not an electromagnetic wave? --
a) X-rays b) γ -rays
c) U-V rays **d) β -rays** [O-06]
- Which of the following gives rise to continuous emission spectrum? ----
a) electric filament lamp b) sodium vapour lamp
c) gases in discharge tube d) calcium salt in Bunsen burner [M-08]
- The velocity of light in vacuum is ----- [J-06]
a) $\sqrt{\mu_0 \epsilon_0}$ **b) $1/\sqrt{\mu_0 \epsilon_0}$**
c) $\sqrt{\mu_0 / \epsilon_0}$ d) $\sqrt{\epsilon_0 / \mu_0}$
- The wavelength of D_1 and D_2 lines emitted by sodium vapour lamp is ---
a) 589.6 nm, 589 nm b) 589 nm, 589.6 nm
c) 589.3 nm, 589 nm d) 589 nm, 589.3 nm [M-06]
- If C is velocity of light in vacuum, the velocity in a medium with refractive index μ is – [O-06]
a) μC **b) C/μ**
c) μ/C d) $1/\mu C$
- Atomic spectrum should be ----- [M-07,S-09,J-12,S-12]
a) pure line spectrum b) emission band spectrum
c) absorption line spectrum d) absorption band spectrum
- Waves from two coherent sources interfere with each other. At a point where the trough of one wave superposes with the trough of the other wave, the intensity of light is ----[M-11]
a) maximum b) minimum
c) zero d) no change
- In Young's double slit experiment, bandwidth β contains [M-13]
a) a bright band only b) a dark band only
c) either a bright band or a dark band **d) both bright band dark a dark band**
- Radiations used in physiotherapy are -----[M-07]
a) ultraviolet **b) infra**
- Electric filament give rise to ----- [J-07]
a) line spectrum **b) continuous spectrum**
c) band spectrum d) line absorption spectrum
- Dark lines in solar spectrum is called ---- [O-10]
a) Raman line **b) Fraunhofer**
c) Stoke's line d) Anti-stokes line
- In Raman effect, the spectral line with lower frequency than the incident frequency is [S-07]
a) Fraunhofer line b) Rayleigh line
c) Stoke's line d) anti-stoke's line
- In Raman effect, if the scattered photon gains energy, it gives rise to ---[S-08]
a) Stoke's line b) anti- stoke's line
c) Stoke's and anti-Stokes' line d) Rayleigh's line
- In Raman, incident photon makes collision with an excited molecule of the substance. The scattered photon give rise to
a) stoke' **b) anti-stoke's line**
c) Reileigh line d) Zeeman line [M-10]
- Soap bubbles exhibit brilliant colors in sunlight due to ----
a) scattering of light b) diffraction of light
c) polarization of light **d) interference of light** [M-09]
- The phenomenon of light used in the formation of Newton's rings is
a) diffraction **b) interference**
c) refraction d) polarization [S-07]
- When a drop of water is introduced between the glass plate and plano convex lens in Newton's ring system, the ring system
a) contracts b) expands [M-06,J-07,10,11,J-12]
c) remains same d) first expands, then contracts
- A diffraction pattern is obtained using a beam of red light. What happens if the red light is replaced by blue light?
[J-07,08,M-11,12,O-11]
a) Bands disappear b) No change
c) Diffraction pattern becomes narrower & crowded together
d) Diffraction pattern becomes broader and farther apart
- In plane transmission grating, the unit of grating element is ---
a) no unit **b) metre**
c) metre^{-1} d) degree [J-06,13]
- In the grating formula $\sin\theta = Nm\lambda$, the unit of N is ----
a) metre **b) metre^{-1}**
c) no unit d) $(\text{metre})^2$ [J-09,10]
- The transverse nature of light is demonstrated by the phenomenon of --
a) interference b) diffraction
c) polarisation d) reflection [M-08,J-10]
- Unpolarised light passes through a tourmaline crystal. The emergent light is analyzed by an analyser. When the analyser is rotated through 90° , the intensity of light--- [M-06]
a) remains uniformly bright b) remains uniformly dark
c) varies between maximum and minimum
d) varies between maximum and zero
- In case of fraunhofer diffraction, the wavefront undergoing diffraction is
a) spherical wavefront b) cylindrical wavefront
c) elliptical wavefront **d) plane wavefront** [S-08]
- Of the following, which one is uniaxial crystal? -----[O-06]
a) mica b) Aragonite

- c) Topaz **d) Quartz**
30. An example of uniaxial crystal is -----
a) selenite b) mica
c) topaz d) calcite [O-11]
31. Which of the following is not an optically active material? -----
a) Quartz b) sugar crystals
c) turpentine oil **d) calcium chloride** [S-09]
32. An example of uniaxial crystal is ----- [S-07]
a) tourmaline b) mica
c) topaz d) selenite
33. Of the following, which one is biaxial ----- [DPM]
a) tourmaline b) ice
c) calcite **d) mica**
34. A ray of light travelling in a rarer medium and reflected at the surface of denser medium automatically undergoes -
a) a phase change of $\pi/2$ b) a phase change of 2π
c) path difference of λ **d) path difference of $\lambda/2$** [O-10]
35. The nature of wavefront corresponding to extraordinary ray inside a calcite crystal is [J-11]
a) plane b) spherical
c) elliptical d) cylindrical
36. A nicol prism is based on the principle of ----- [DPM]
a) refraction b) reflection
c) double refraction **d) diffraction**
37. In nicol prism, the ordinary ray is prevented from coming out of Canada balsam by the phenomenon of ----- [J-12]
a) reflection **b) polarisation**
c) diffraction d) total internal reflection
38. The optical rotation does not depend on ---- [S-07]
a) concentration of the solution b) frequency of the light used
c) the temperature of the solution
c) intensity of light used
39. Of the following, optically active material is -----
a) sodium chloride b) calcium chloride
c) sodium d) chlorine [M-07]
- UNIT – 5.EMW& WO – 1 mark Problems**
1. If the wavelength of light is reduced to one fourth, then the amount of scattering will – [DPM,J-09M-10]
a) increased by 16 times b) decrease by 16 times
c) increased by 256 times d) decrease by 256 times
2. If the wavelength of light is reduced to one half, then the amount of scattering will – [DPM,J-09,M-10]
a) increased by 16 times b) decrease by 16 times
c) increased by 256 times d) decrease by 256 times
3. A ray of light passes from a denser medium into a rarer medium. For an angle of incidence of 45° , the refracted ray grazes the surface of separation of the two media. The refractive index of the denser medium is ----- [O-06]
a) $3/2$ **b) $1/\sqrt{2}$**
c) $\sqrt{2}$ d) 2
4. If the velocity of light in a medium is 2.25×10^8 m/s, then the refractive index of the medium will be ----- [J-08]
a) 1.6 b) 0.5
c) 1.33 d) 1.73
5. The refractive index of glass is 1.5. The taken for light to pass through glass plat of thickness 10 cm is ----- [M-11]
a) 2×10^{-8} s b) 2×10^{-10} s
- c) 5×10^{-8} s d) 5×10^{-10} s
6. The refractive index of glass is 1.5. The velocity of light in glass is - ---- [M-10]
a) **$2 \times 10^8 \text{ms}^{-1}$** b) $4.5 \times 10^8 \text{ms}^{-1}$
c) $3 \times 10^8 \text{ms}^{-1}$ d) $1.33 \times 10^8 \text{ms}^{-1}$
7. The refractive index of the medium, for the polarizing angle 60° is - ---- [S-08, M-10, J-13]
a) 1.732 b) 1.414 c) 1.5 d) 1.468
8. Refractive index of a material for a polarizing angle 55° is ----- [J-12]
a) 1.4281 b) 1.7321 c) 1.4141 d) 1.5051
9. In Young's double slit experiment, the separation between the slit is halved, and the distance between the slits and the screen is doubled. Then the fringe width is ----- [J-07]
a) unchanged b) halved
c) doubled **d) quadrupled**
10. In Young's double slit experiment, the third bright band for wave length 6000 \AA coincides with fourth bright band for another source in the same arrangement. The wavelength of another source is --
a) 4500 \AA b) 6000 \AA [S-10]
c) 5000 \AA d) 4000 \AA
11. A light of wavelength 6000 \AA is incident normally on a grating 0.005 m wide with 2500 lines. Then the maximum order is -----
a) 3 b) 2 c) 1 d) 4 [M-08,13]
12. In a plane transmission grating the width of a ruling is 12000 \AA and the width of the slit is 8000 \AA . The grating element is --
a) $20 \mu\text{m}$ **b) $2 \mu\text{m}$** c) $1 \mu\text{m}$ d) $10 \mu\text{m}$ [S-12]
13. In Newton's ring experiment, light of wavelength 5890 \AA is used. The order of the dark ring produced where the thickness of the air film is $0.589 \mu\text{m}$ is -----[M-07]
a) 2 b) 3 c) 4 d) 5
14. In Newton's rings experiment, the radii of m^{th} and $(m+4)^{\text{th}}$ dark rings are respectively $\sqrt{5} \text{ mm}$ and $\sqrt{7} \text{ mm}$. What is the value of m ?

a) 2 b) 4 c) 8 **d) 10** [S-09]
15. The ratio of radii of 4^{th} and 9^{th} dark rings in Newton's rings experiment is ----- [J-09]
a) 4:9 **b) 2:3** c) 16:81 d) $\sqrt{2}:\sqrt{3}$
16. The radii of Newton's dark rings are in the ratio -----[M-09]
a) 1:2:3 b) $\sqrt{1}:\sqrt{2}:\sqrt{3}$ **c) $\sqrt{1}:\sqrt{3}:\sqrt{5}$** d) 1:4:9
17. The polarizing angle for water is $53^\circ 4'$. If the light is incident at this angle on the surface of water, the angle of refraction in water is
a) $53^\circ 4'$ b) $26^\circ 20'$ c) $30^\circ 4'$ **d) $36^\circ 56'$** [J-08,M-13]
18. A ray of light is incident on a glass surface such that the reflected ray is completely plane polarized. The angle between the reflected ray and the refracted ray is ---- [M-09]
a) 57.5° b) 32.5° **c) 90°** d) 115°
19. When a ray of light is incident on a glass surface at polarising angle of 57.5° , the angle between the incident ray and reflected ray is --- [M-06, J-11]
a) 57.5° b) 32.5° **c) 115°** d) 90°
20. In a pile of plates arrangement, the angle between the incident light and the reflected plane polarized light is ----- [O-11]
a) 32.5° b) 57.5° c) 90° d) **115°**
21. The path difference between two monochromatic light waves of wavelength 4000 \AA is $2 \times 10^{-7} \text{ m}$. The phase difference them is
a) π b) 2π c) $3\pi/2$ d) $\pi/2$ [M-12, J-13]

22. If i is the angle of incidence, the angle between the incident wavefront and the normal to the reflecting surface is -
 a) i
 b) $90^\circ - i$
 c) $90^\circ + i$
 d) $i - 90^\circ$ [M-12]

UNIT – 5.EMW& WO – 3 mark Questions

- Write any three uses of infrared radiations. [S-07]
- What are emission and absorption spectra? [M-06]
- What is band emission spectrum? Give an example. [O-06]
- What is Tyndall scattering? [M-07,O-10,12, J-09,13]
- Why does sky appear blue in color? [DPM, M-06]
- What are Fraunhofer line? [M-13]
- State Huygens principle. [S-09,11,M-12]
- Write the conditions for total internal reflection to take place. [S-08]
- Write the differences between interference and diffraction bands. [S-07,O-10]
- Why is the centre of Newton's ring dark? [M-09,J-13]
- Distinguish between Fresnel and Fraunhofer diffractions. [M-10,J-12]
- State and Brewster's law. [M-11]
- Define optic axis of a crystal. [J-07]
- Define specific rotation. [M-08, M-10]
- On what factors does the amount of optical rotation depends [J-08,11]
- In Newton's ring experiment the diameter of certain order of dark ring is measured to be double that of second ring. What is the order of the ring? [O-11]

UNIT – 5.EMW& WO – 3 mark Problems

- An LC resonant circuit contains a capacitor 400 pF and an inductor $100 \mu\text{H}$. It is sent into oscillations coupled to an antenna. Calculate the wavelength of the radiated electromagnetic wave. [M-13]
- In Young's experiment, the width of the fringe obtained with light of wavelength 6000 \AA is 2 mm. Calculate the fringe width if the entire apparatus is immersed in a liquid of refractive index 1.33. [J-06,M-11]
- A light of WL 6000 \AA (5890 \AA for S-07) falls normally on a thin air film. 6 dark rings are seen between two points. Calculate the thickness of the air film. [S-07]
- Two slits 0.3 mm apart are illuminated by light of wavelength 4500 \AA . The screen is placed at 1 m distance from the slits. Find the separation between the second bright fringe on both side of the central maximum. [O-06J-08, J-09,J-11]
- In YDSE, the distance between the slits is 1.99 mm. The distance between slits and the screen is 1m. If the bandwidth is 0.35 mm, calculate the wavelength of light used. [M-12]
- In Newton's rings experiment the diameter of certain order of dark is measured to be double that of second ring. What is the order of the ring? [M-07, J-07]
- The refractive index of the medium is $\sqrt{3}$. Calculate the angle of refraction if the unpolarised light is incident on it at the polarising angle. [S-09,S-12]
- A plano-convex lens of radius 3 m is placed on an optically flat glass plate and is illuminated by monochromatic light. The radius of 8th dark ring is 3.66 mm. Calculate the wavelength of light used. [O-10/3m,J-12]
- A 300 mm long tube containing 60c.c. of sugar solution produces a rotation of 9° when placed in a polarimeter. If the specific rotation is 60° , calculate the quantity of sugar contained in the solution. [M-06 -09,J-13]

UNIT – 5.EMW& WO – 5 mark Questions

- Derive an expression for radius of n^{th} dark ring in Newton's ring experiment [DPM,J-11,M-12]
- State and prove Brewster's law. [J-06,O-06, J-07,08, M-09,J-10,S-12,M-13]

- Distinguish between interference and diffraction. [S-10]
- Write a note on pile of plates. [M-06, J-09]
- Write a note on Nicol prism. [M-07,S-09,11]

UNIT – 5.EMW& WO – 5 mark Problems

- A soap film of refractive index 1.34, is illuminated by white light incident at an angle 30° . The reflected light is examined by a spectroscope in which dark band corresponding to the wavelength 5893 \AA is found. Calculate the smallest thickness of the film. [S-,07,08] (or)
- A monochromatic light of WL 5893 \AA is incident on a water surface of refractive index 1.33. Find the velocity, frequency and WL of the light in water. [S-08]
- A monochromatic light of WL 589 nm is incident on a water surface of refractive index 1.33. Find the velocity, frequency and WL of the light in water. [M-11]
- In Young's experiment a light of frequency $6 \times 10^{14} \text{ Hz}$ is used. Distance between the centres of adjacent fringes is 0.75 mm. Calculate the distance between the slits, if the screen is 1.5 m away. [S-07]
- A parallel beam of monochromatic light is allowed to incident normally on a plane transmission grating having 5000 lines per cm. A second order spectral line is found to be diffracted at an angle of 30° . Calculate the wave length of the light. [M-08,M-10]
- In a Newton's rings experiment the diameter of the 20th dark ring was found to be 5.82 mm and that of the 10th ring 3.36 mm. If the radius of the plano convex lens is 1 m, calculate the wavelength of light used. [M-10]
- A plane transmission grating has 5000 lines/cm. Calculate the angular separation in second order spectrum of red line 7070 \AA and blue line 5000 \AA . [J-13]
- A plano-convex lens of radius 3 m is placed on an optically flat glass plate and is illuminated by monochromatic light. The radius of 8th dark ring is 3.66 mm. Calculate the wavelength of light used. [O-10/3m,M-11]
- A 300 mm long tube containing 60c.c. of sugar solution produces a rotation of 9° when placed in a polarimeter. If the specific rotation is 60° , calculate the quantity of sugar contained in the solution. [M-06 -09,J-13] (OR)

UNIT – 5.EMW& WO – 10 mark Questions

- Explain the emission and absorption spectra. [J-09,M-10,M-12, J-12,S-12]
- What is emission and absorption spectra? Explain the different types of emission and absorption spectra with examples. [J-13]
- What is Raman scattering? Explain Raman scattering with energy level diagram. [M-07,S-07,M-08,J-11,M-13]
- State Huygen's principle. On the basis of wave theory, prove that laws of reflection. [S-08]
- On the basis of wave theory, explain the total internal reflection. Write the condition for TIR to take place. [M-06,J-06]
- What is known as interference of light? Derive an expression for bandwidth of interference fringes in Young's double slit experiment. [DPM,O-06,J-07,10, M-09,O-10,M-11,O-11]
- Discuss the theory of interference in thin transparent film due to reflected light and obtain condition for the intensity to be maximum and minimum. [S-09,J-08]

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