PART A

Answer all questions. Each question carries 2 marks

1. What is meant by amplitude resonance? Give any two examples. (2)
2. Define frequency and wavelength of a wave. (2)
3. What are non reflecting films? (2)
4. Compare interference and diffraction of light. (2)
5. What is Kerr effect? Give the equation. (2)
6. Write down four important applications of Super conductors. (2)
7. What is tunnelling effect? (2)
8. Define phase space. (2)
9. Define intensity of sound. Give the values of threshold of hearing and threshold of pain. (2)
10. What is meant by non destructive testing (NDT)? Name an NDT technique? (2)
11. Define the terms population inversion and meta stable level. (2)
12. What is an LED? Give its working principle. (2)

PART B

Answer any 10 questions. Each question carries 4 marks

13. The frequency of a tuning fork is 250 Hz and its Q-factor is $4 \times 10^4$. Find the relaxation time. Also calculate the time after which its energy becomes $\frac{1}{10}$ of its initial undamped value. (4)

14. a. Obtain the differential equation of the oscillation of an electric circuit. (2)
   b. Compare it with mechanical oscillator. (2)

15. a. What is Rayleigh’s criterion for spectral resolution? (2)
   b. Obtain the expression for resolving power of a plane transmission grating. (2)

16. What is the higher order spectrum which may be obtained with a light of wavelength 5500 Å using a plane transmission grating having 4500 lines per cm. (4)

17. The refractive indices of Quartz for light of wavelength 5890 Å are 1.5539 for ordinary ray and 1.5634 for extra ordinary ray. Calculate the required thickness of the Quartz crystal for making a) a QWP and b) a HWP. (4)

18. a. What is Meissner effect? (2)
   b. What are Type I and Type II Superconductors (any two points)? (2)

19. a. What are the important postulates of Bose-Einstein Statistics? (3)
   b. Write down the distribution equation of BE Statistics. (1)

20. State Uncertainty principle. Using this principle calculate the uncertainty in frequency of the emitted radiation if the uncertainty in time of an excited atom is
5 x 10^{-8} \text{ s}.

21 The volume of a hall is 6000 m$^3$. It has a total absorption of 150 m$^2$ sabin. If the hall is filled with audience who add another 80 m$^2$ sabin, find the difference in reverberation time.

22 An ultrasonic source of 0.085 MHz sends down a pulse towards the sea water which returns after 0.6 sec. The velocity of sound in water is 1800 m/s. Calculate the depth of the sea and wavelength of pulse.

23 With the help of a diagram explain how a hologram is recorded?

24 Give any four advantages of optical fibre over conventional transmission lines?

**PART C**

*Answer any three questions. Each question carries 6 marks*

25 Considering transverse vibrations of a stretched string derive one dimensional wave equation.

26 a Draw the neat diagram of air wedge experiment.
   b Derive an expression for the bandwidth of the interference fringes using this arrangement.

27 Given two Nicol prisms and a Quarter wave plate. How can we produce and analyse plane, circularly and elliptically polarized light.

28 Starting from the time dependent equation, derive Schrodinger’s time independent wave equation.

**PART D**

*Answer any three questions. Each question carries 6 marks*

29 Define Reverberation and Reverberation time. What is the significance of Reverberation time? Compare Reverberation and Echo.

30 a What is inverse piezoelectric effect?
   b Describe the method of producing ultrasonic waves using this effect.

31 a Draw the energy level diagram and explain the working of He–Ne laser.
   b What are the important applications of He-Ne Laser?

32 a Define numerical aperture and fibre acceptance angle of an optic fibre.
   b Derive an expression for numerical aperture (NA) of a step index fibre.
PART A

Answer all questions, each carries 2 marks.

1. Define resonance. Give one practical example of resonance.
2. State the laws of transverse vibrations of a stretched string.
3. Distinguish between geometrical path and optical path.
4. Explain Rayleigh’s criterion for the resolution of spectral lines.
5. Distinguish between plane polarized light and un-polarized light.
6. Show that superconductors are perfect diamagnets.
7. What is the physical significance of wave function?
8. What is Fermi energy?
9. What is the relation connecting reverberation time and total absorption?
10. What is meant by non-destructive testing of materials?
11. Distinguish between spontaneous and stimulated emission.
12. What is the physical meaning of numerical aperture?

PART B

Answer any 10 questions, each carries 4 marks.

13. Compare a mechanical oscillator with an electrical oscillator.
14. Derive the differential equation of one dimensional wave and deduce its solution.
15. Newton’s rings are observed in the reflected light of wavelength 5900 Å. The diameter of tenth dark ring is 0.5 cm. Find the radius of curvature of the lens used.
16. Light of wavelength 5000 Å is incident normally on a plane transmission grating. Find the difference in the angle of deviation in the first and third order spectra. The number of lines per cm on the grating surface is 6000.
17. What is the principle of the working of a Nicol prism. Describe the method of construction of a Nicol prism.
18. Mention four important applications of super conductors.
19. Derive Schrodinger’s time dependent equation for a particle.
20. What is phase space? Show that the volume of the unit cell in phase space of quantum state is $h^3$.
21. The dimensions of an auditorium are 60m X 15m X 10M and its interior surface have an average absorption co-efficient of 0.25. Find the reverberation time of the auditorium?
An ultrasonic source of 0.09 MHz sends down a pulse towards the sea bed which returns after 0.55 sec. The velocity of sound in sea water is 1800 m/sec. Calculate the depth of the sea and the wave length of the pulse.

23 Explain the recording and reconstruction of hologram.

24 Calculate the numerical aperture and acceptance angle of a fibre with a core index of 1.54 and a cladding index of 1.50 when the fibre is inside water of refractive index 1.33.

PART C

Answer any three questions, each carries 6 marks.

25 Write down the differential equation of a damped harmonic oscillator and obtain its solution. Show graphically the displacement –time curve for over damped, critically damped and under damped cases of a harmonic oscillator. Mention the conditions of their occurrence.

26 Derive an expression for the diameter of a thin wire in air wedge experiment.

27 Distinguish between Type I and Type II superconductors with suitable diagrams and examples.

28 Write down the Schrodinger equation for a particle in a one-dimensional infinite potential well. Also derive the equation for wave function and energy.

PART C

Answer any three questions. Each question carries 6 marks

29 Explain the production of ultrasonic waves using a piezo electric oscillator with the help of a neat labelled circuit diagram.

30 What are the factors affecting acoustics of buildings? Give remedies.

31 Explain the principle, construction and working of Helium-Neon laser with the help of energy level diagram.

32 What is an LED? Explain the construction and working of LED. Give two applications.

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PART A

Answer all questions. Each question carries 2 marks

1. What is resonance in forced oscillation? Give one example.
2. Distinguish between transverse and longitudinal waves with examples.
3. What are coherent sources?
4. Why diffraction of light is not as evident in daily experience as that of sound waves?
5. What are positive and negative uniaxial crystals?
6. Define critical magnetic field in superconductors? How this is related to the temperature of superconductor?
7. What is meant by wave function? Write its normalization condition.
8. What are bosons and fermions? Give examples.
9. Define reverberation and reverberation time.
10. Mention any two medical applications of ultrasonic waves.
11. What is a laser? What are the three requisites for laser action to take place?
12. Distinguish between an LED and a semiconductor laser.

PART B

Answer any 10 questions. Each question carries 4 marks

13. What is a damped harmonic oscillator? Draw the graph showing the variation of amplitude with time in case of over damped, critically damped and under damped case of an oscillator by clearly marking the conditions for the above cases in the graph itself.
14. The equation of a transverse vibration of a stretched string is given by
   \[ y = 1.5 \times 10^{-3} \sin \left( \frac{2\pi}{8} x - 80\pi t \right) \]
   Where x is measured in metres and t in seconds. Evaluate (i) Amplitude (ii) Wavelength (iii) Frequency and (iv) Velocity of wave?
15. If the diameter of \( n^{th} \) dark ring in an arrangement giving Newton’s rings changes from 0.03m to 0.025m as a liquid is introduced between the lens and plate, what is the value of refractive index of the liquid?
16. A parallel beam of monochromatic light of wavelength 589.6 nm from a narrow slit is diffracted by a plane transmission grating containing 6000 lines/cm, placed normal to the beam. Calculate the angle at which the second order diffracted images of the slits will be observed.
17. Calculate the thickness of (i) a quarter wave plate (ii) a half wave plate. Given \( \mu_e = 1.553 \) and \( \mu_o = 1.553 \) and \( \lambda = 5000\text{Å} \).
18. What is Meissner effect? Prove that a superconductor acts as a perfect diamagnet.
19. An electron confined in an one dimensional box of width ‘L’ is known to be in its first excited state. Determine the probability density of electron in the central half.
21. The area of interior surface of an auditorium is 3340 m\(^2\). Its reverberation time is 1.5 seconds. If average absorption coefficient of interior surface is 0.4, find the volume of auditorium.
22. With a neat circuit diagram explain the working of a Piezoelectric Oscillator to produce ultrasonic waves.
23. What type of pumping method is used in ruby laser? Draw the energy level diagram of a ruby laser.
24. Mention any four applications optical fibre.

**PART C**

*Answer any 3 questions. Each question carries 6 marks*

25. Derive an expression for the velocity of transverse waves in stretched uniform string.
26. Obtain an expression for fringe width in wedge shaped thin film.
27. Distinguish between type I and type II superconductors with relevant graphs.
28. State Heisenberg’s uncertainty principle. Write its mathematical form for the following pairs of variables (i) position and momentum (ii) energy and time (iii) angular position and angular momentum. How this principle can be used to prove the absence of electrons inside the nucleus of an atom.

**PART D**

*Answer any 3 questions. Each question carries 6 marks.*

29. What are the basic requirements of an acoustically good hall?
30. What are NDT and SONAR? How ultrasonic waves are used in it?
31. What is holography? How is it different from ordinary photography? Draw the diagrams illustrating the recording and reconstruction of a hologram.
32. With a neat diagram obtain an expression for the numerical aperture of an optical fibre.