Model questions for Mid-Sem examination

1. What is physical pendulum? Obtain an expression for the time period of angular SHM of a physical pendulum.

2. Define compound pendulum. Show that a compound pendulum executives SHM. Find its periodic time.

3. Explain the concept of length of equivalent simple pendulum.

4. Derive the condition for maximum and minimum time period of the compound pendulum.

5. Derive an expression for the time period of a compound pendulum and show that it is minimum when the distance between the centre of gravity and suspension equals its radius of gyration about a horizontal axis passing through the centre of gravity of the pendulum.

6. Show that there are four points collinear with the centre of gravity of the pendulum about which its time is the same.

7. Under what condition does the time period of a compound pendulum becomes maximum? What is the maximum value of the time period?

8. Define centre of suspension and centre of oscillation. Show that in compound pendulum they are interchangeable.

9. What is reversible compound pendulum? Derive an expression for the acceleration due to gravity in terms of two nearly equal time periods about the two parallel knife edges of the pendulum.

10. What is oscillatory motion? Mention the characteristics of this type of motion
11. Explain the role of restoring force and inertia of motion in an oscillator.
12.What are undamped and damped oscillations? Give one example of each.
13. What are free and forced oscillations? Give examples.
14. Define Q- factor of an oscillator. How does it depend on damping?
15. Are the following simple harmonic oscillators or damped Explain. (a) a simple pendulum oscillating in air, (b) a bar pendulum oscillating in air
16. What are coherent sources? Describe different methods to obtain coherent sources.

17. Two harmonic waves of same amplitude and frequency, but travelling in opposite direction are superposed. Obtain expression for the resultant amplitude. Plot the resultant amplitude with respect to position.

18. Differentiate between progressive and stationary wave.

19. With the help of suitable diagram describe the production of Newton's rings.

20. In a Newton's ring experiment with air film the diameter of the n^{th} and $n\text{-}5^{th}$ dark rings are 12.2 mm and 8.8mm respectively. Find the diameter of $n+5^{th}$ dark ring.

21. In a Newton's ring experiment the diameter of n^{th} ring is 0.46cm, it got shrink to a diameter of 0.40cm when a liquid is introduced between the Plano-convex lens and plane glass plate. Find the refractive index of the liquid.

22. In a Newton's ring experiment in laboratory sodium vapour lamp having two wavelengths 5890Å and 5896Å is used. If it is found that nth dark ring due to 5890Å coincides with $n+2^{nd}$ dark ring due to 5896Å, then calculate the radii of nth dark rings due to 5890Å and 5896Å, when the radius of curvature of the plano-convex lens used is 200cm.

23. Explain with necessary theory, how will you determine refractive index of water using Newton's ring apparatus

24. What is the condition for the destructive interference in terms of phase difference between the two interfering waves?

25. Find out the expression for diameter of dark ring in Newton's ring experiment and explain how the wavelength of a monochromatic light can be determined by it.

26. A diffraction grating when illuminated normally gives a line λ_1=6000Å, in a certain order superimposed on another line λ_2=5000Å of the next higher order. If the angle of diffraction is 30 degree, Find the grating element.

27. A plano-convex lens of radius of curvature 2.5 meter is placed on an optically plane glass plate in air medium and a parallel beam of monochromatic light is incident normally on the set up to observe the Newton's rings.

28. The diameter of the bright ring as seen by the reflected light is 0.70cm . Calculate the wavelength of the light used.

29. What is the maximum wavelength of the visible spectrum so that third order spectrum can be observed by a plane diffraction grating having 5654 lines/cm.

30. In a Newton's ring arrangement the radius of curvature of the lens is 2m.The radii of the nth dark ring and $n+4^{th}$ dark ring are 3mm and 5mm respectively. Then find the wavelength of the light used.

31. Newton's rings are formed by light of wavelength 5431Å. Find the radius of curvature of the lens if diameter of the 16^{th} bright ring is 12.2mm.

32. What is missing spectra in grating? What is the condition for their occurrence?

33. A plane diffraction grating has 6000 lines/cm. Calculate the dispersion in the 2^{nd} order spectrum for normal incidence of light in the range 5893Å.

34. A monochromatic light of wavelength 6000Å is incident on a plane diffraction grating with grating element $6.0x10^{-5}$cm. What is the maximum order of spectrum that can be observed?

35. What is the advantage of increasing the number of lines in a grating?

36. Discuss the Fresnel single slit phenomenon and show that the relative intensities of the successive maximum are nearly 1:4/9π^2: 4/25 π^2… etc

37. If the width of opaque space is equal to that of transparent space in a plane transmission grating , then which order spectra will be missing.

38. Distinguish between optical interference and optical diffraction pattern

39. What do you mean by gradient, divergence and curl. Express them in Cartesian coordinate system.

40. (a)Evaluate $\nabla\varphi$ where $\varphi=ax^2 -2by+ c^2z^2$ and a,b, c are constants at (1,-2,3).

(b) Given $\mathbf{A= x^2}$ I + $\mathbf{y^2}$ j + j $\mathbf{z^2}$ k, Find Divergence of **A**.

41. Evaluate curl **A,** where **A =i** xy **+ j** yz **+ k** zx where I, **j** and **k** are unit vectors along X, Y and Z-axes.

42, Evaluate ∇x**r ,** where **r** is the position vector

43. What do you mean by (i) solenoidal and (ii) irrotational vector?

44. A scalar function φ satisfies the condition $\nabla^2\varphi=0$. Show that the scalar function is solenoidal.

45. State Gauss divergence theorem and Stoke's theorem.

46. Evaluate $\nabla^2(1/r)$ and $\nabla(1/r^n)$ when **r** is position vector

47. When **u** is a constant vector, find the value of (i) ∇u(ii) ∇. **U,** (iii) ∇ x **u**

48. Find ∇r^n where **r** is position vector.

49. Find where **r** is position vector.

50. Given **A**= x^2 **I** + y^2 **j** + **j** z^2 **k,** Find whether **A** is solenoidal or irrotational.