T.Y. B.Sc. PHYSICS Semester-V
PHY-3503 Advanced Optics
Question Bank

➢ **Objective Questions**

1   Waves diffracts most when going through a slit when wavelength is……
    a) Large and slit is large
    b) Large and slit is small
    c) Small and slit is large
    d) Both a & C

2   Thin film interference is caused by interference after….
    a) Refraction
    b) Diffraction
    c) Polarization
    d) Reflection and refraction

3   Light refracts when it goes from air to water. This is because which of the following gets smaller?
    a) Frequency
    b) Amplitude
    c) Wavelength and speed
    d) Period

4   You can see interference of light around you every day in…
    a) *Oil films*
    b) *CDs*
    c) Wall
    d) Both a & b

5   Refraction is caused by..
    a) Different wave speed
    b) Bending
    c) Interference
    d) Diffraction

6   A penny (Coin) lies in the bottom of a tea cup. As you look down the at the penny (Coin), compared to its actual depth, it looks…
    a) Farther away
    b) Closer
    c) At the actual depth
    d) None of the above

7   When light wave passes through an opening, some of the wave is bent. This phenomenon is called…
    a) Diffraction
    b) Reflection
    c) Refraction
    d) polarization

8   Waves diffract most when their wavelengths are….
    a) Only short
    b) Only long
    c) Short and long

d) None of the above

9   Destructive interference occurs when...
   a) The crests of two waves overlaps
   b) Waves do not overlap
   c) Crest of one wave meets the trough of another wave
   d) None of the above

10   A diffraction grating has...
   a) Many closely spaced parallel slits
   b) No slits
   c) Single slit
   d) Double slits

11   A hologram is most similar to....
   a) Diffraction grating
   b) Prism
   c) Lens
   d) Photograph

12   Light can be polarised by..
   i.   Scattering
   ii. Diffraction
   iii. Reflection
   iv. Interference

   a) Only (ii)
   b) (i) and (ii)
   c) (ii) and (iii)
   d) (i) and (iii)

13   Polarization of light is used in...
   i.   Sunglasses
   ii. Stress-strain analysis
   iii. Engines
   iv. All of the above

   a) Only (ii)
   b) (i) and (ii)
   c) (ii) and (iii)
   d) (i) and (iii)

14   A material is said to be birefrigent if its displays..
   a) Two different refractive indices
   b) No refraction
   c) Dispersion
   d) Interference

15   Malus's law is used to determine whether a particular device is a..
   a) Interferometer
   b) Linear polarizer
   c) Reflector
   d) None of the above

16   Brewster's law is applied to the polarization by....
   a) Scattering
   b) Birefringence
   c) Reflection
   d) None of the above

17   What principle is responsible for light spreading as it passes through a narrow slit?
      a.   refraction
      b.   polarization
      c.   diffraction
      d.   interference

18   What principle is responsible for the fact that certain sunglasses can reduce glare from
     reflected
     surfaces?
      a.   refraction
      b.   polarization
      c.   diffraction
      d.   total internal reflection

19   The principle which allows a rainbow to form is
      a.   refraction
      b.   polarization
      c.   dispersion
      d.   total internal reflection

20   Light has a wavelength of 600 nm in a vacuum. It passes into glass, which has an index of
     refraction of 1.50. What is the wavelength of the light in the glass?
      a.   600 nm
      b.   500 nm
      c.   400 nm
      d.   300 nm

21   Light has wavelength 600 nm in a vacuum. It passes into glass, which has an index of
     refraction of 1.50. What is the frequency of the light inside the glass?
      a. 3.3×10^{14} Hz
      b. 5.0×10^{14} Hz
      c. 3.3×10^{5} Hz
      d. 5.0×10^{5} Hz

22   Light has a wavelength of 600 nm in a vacuum. It passes into glass, which has an index of
     refraction of 1.50. What is the speed of the light in the glass?
      a. 3.0×10^{8} m/s
      b. 2.5×10^{8} m/s
      c. 2.0×10^{8} m/s
      d. 1.5×10^{8} m/s

23   When a light wave enters into a medium of different optical density,
      a. its speed and frequency change.
      b. its speed and wavelength change.
      c. its frequency and wavelength change.
      d. its speed, frequency, and wavelength change.

24   Light of wavelength 575 nm falls on a double-slit and the third order bright fringe is seen
     at an angle of 6.5 degree. What is the separation between the double slits?
      a. 5.0 micro-m
      b. 10 micro-m
      c. 15 micro-m

    d. 20 micro-m

25   One beam of coherent light travels path P_1 in arriving at point Q and another coherent beam
    travels path P_2 in arriving at the same point. If these two beams are to interfere destructively,
    the path difference P_1 - P_2 must be equal to
    a. an odd number of half-wavelengths.
    b. zero.
    c. a whole number of wavelengths.
    d. a whole number of half-wavelengths.

26   Two beams of coherent light travel different paths arriving at point P. If the maximum
    constructive interference is to occur at point P, the two beams must
    a. arrive 180ø out of phase.
    b. arrive 90ø out of phase.
    c. travel paths that differ by a whole number of wavelengths.
    d. travel paths that differ by an odd number of half-wavelengths.

27   Two light sources are said to be coherent if they
    a. are of the same frequency.
    b. are of the same frequency, and maintain a constant phase difference.
    c. are of the same amplitude, and maintain a constant phase difference.
    d. are of the same frequency and amplitude.

28   Light of wavelength 580 nm is incident on a slit of width 0.300 mm. An observing screen is
    placed 2.00m from the slit. Find the position of the first order dark fringe from the center of
    the screen.
    a. 0.26 mm
    b. 1.9 mm
    c. 3.9 mm
    d. 7.7 mm

29   . A diffraction grating has 4000 lines per cm. The angle between the central maximum
    and the third order maximum is 36^0. What is the wavelength of the light?
    a. 240 nm
    b. 490 nm
    c. 570 nm
    d. 620 nm

30   On a clear day, the sky appears to be more blue toward the zenith (overhead) than it does
    toward the horizon. This occurs because
    a. the atmosphere is denser higher up than it is at the earth's surface.
    b. the temperature of the upper atmosphere is higher than it is at the earth's surface.
    c. the sunlight travels over a longer path at the horizon, resulting in more absorption.
    d. none of the above is true.

31   What principle is responsible for alternating light and dark bands when light passes through two
    or more narrow slits?

     a.   refraction
     b.   polarization
     c.   diffraction
     d.   interference

32   Who proposed the idea of transmission of light via dielectric waveguide structure?
     a) Christian Huygens
     b) Karpon and Bockham
     c) Hondros and debye
     d) Albert Einstein

33   Who proposed the use of clad waveguide structure?
     a) Edward Appleton
     b) Schriever
     c) Kao and Hockham
     d) James Maxwell

34   Which law gives the relationship between refractive index of the dielectric?
     a) Law of reflection
     b) Law of refraction (Snell's Law)
     c) Millman's Law
     d) Huygen's Law

35   Which of the following statements best explain the concept of material absorption?
     a) A loss mechanism related to the material composition and fabrication of fiber
     b) A transmission loss for optical fibers
     c) Results in attenuation of transmitted light
     d) Causes of transfer of optical power

36   When optical fibers are to be installed in a working environment, the most important parameter to be considered is?
     a) Transmission property of the fiber
     b) Mechanical property of the fiber
     c) Core cladding ratio of the fiber
     d) Numerical aperture of the fiber

37   It is not important to cover these optical fibers required for transmission.
     a) True
     b) False

38   Optical fibers for communication use are mostly fabricated from _____
     a) Plastic
     b) Silica or multicomponent glass
     c) Ceramics
     d) Copper

39   _____ results from small lateral forces exerted on the fiber during the cabling process.
     a) Attenuation
     b) Micro-bending
     c) Dispersion
     d) Stimulated Emission

40   Microscopic meandering of the fiber core axis that is micro-bending is caused due to _____
     a) Environmental effects
     b) Rough edges of the fiber
     c) Large diameter of core
     d) Polarization

41   How many forms of modal power distribution are considered?
     a) One

b) Two
c) Three
d) Four

42 What does micro-bending losses depend on _____
a) Core material
b) Refractive index
c) Diameter
d) Mode and wavelength

43 The fiber should be_____ to avoid deterioration of the optical transmission
characteristics resulting from mode-coupling-induced micro-bending.
a) Free from irregular external pressure
b) Coupled with plastic
c) Large in diameter
d) Smooth and in a steady state

44 The diffusion of hydrogen into optical fiber affects the _____
a) Transmission of optical light in the fiber
b) Spectral attenuation characteristics of the fiber
c) Core of the fiber
d) Cladding of the fiber

45 _____ can induce a considerable amount of attenuation in optical fibers.
a) Micro-bending
b) Dispersion
c) Diffusion of hydrogen
d) Radiation Exposure

46 The radiation-induced attenuation can be reduced through photo-bleaching.
a) True
b) False

47 The losses due to hydrogen absorption and reaction with fiber deposits can be temporary.
a) True
b) False

48 The losses caused due to hydrogen absorption mechanisms are in the range of _____
a) 20 dB/km to 25 dB/km
b) 10 dB/km to 15 dB/km
c) 25 dB/km to 50 dB/km
d) 0 dB/km to 5 dB/km

49 An optical fiber has core-index of 1.480 and a cladding index of 1.478. What should be the
core size for single mode operation at 1310nm?
a) 7.31μm
b) 8.71μm
c) 5.26μm
d) 6.50μm

50 An optical fiber has a core radius 2μm and a numerical aperture of 0.1. Will this fiber
operate at single mode at 600 nm?
a) Yes
b) No

51 What is needed to predict the performance characteristics of single mode fibers?
a) The intermodal delay effect
b) Geometric distribution of light in a propagating mode
c) Fractional power flow in the cladding of fiber
d) Normalized frequency

52 Multimode step index fiber has _____
a) Large core diameter & large numerical aperture

b) Large core diameter and small numerical aperture
c) Small core diameter and large numerical aperture
d) Small core diameter & small numerical aperture

53   Multimode step index fiber has a large core diameter of range is _____
a) 100 to 300 μm
b) 100 to 300 nm
c) 200 to 500 μm
d) 200 to 500 nm

54   Fiber mostly suited in single-wavelength transmission in O-band is?
a) Low-water-peak non dispersion-shifted fibers
b) Standard single mode fibers
c) Low minimized fibers
d) Non-zero-dispersion-shifted fibers

55   A fiber which is referred as non-dispersive shifted fiber is?
a) Coaxial cables
b) Standard single mode fibers
c) Standard multimode fibers
d) Non zero dispersion shifted fibers

56   Single mode fibers allow single mode propagation; the cladding diameter must be at least _____
a) Twice the core diameter
b) Thrice the core diameter
c) Five times the core diameter
d) Ten times the core diameter

57   The fibers mostly not used nowadays for optical fiber communication system are _____
a) Single mode fibers
b) Multimode step fibers
c) Coaxial cables
d) Multimode graded index fibers

58   In single mode fibers, which is the most beneficial index profile?
a) Step index
b) Graded index
c) Step and graded index
d) Coaxial cable

59   Multimode graded index fibers have overall buffer jackets same as multimode step index fibers but have core diameters _____
a) Larger than multimode step index fibers
b) Smaller than multimode step index fibers
c) Same as that of multimode step index fibers
d) Smaller than single mode step index fibers

60   The performance characteristics of multimode graded index fibers are _____
a) Better than multimode step index fibers
b) Same as multimode step index fibers
c) Lesser than multimode step index fibers
d) Negligible

61   Multimode graded index fibers are manufactured from materials with _____
a) Lower purity
b) Higher purity than multimode step index fibers.
c) No impurity
d) Impurity as same as multimode step index fibers.

> ➢ **Answer in sentence**

62   What is optics
63   Define coherence.
64   What is polarization?
65   What is refraction?
66   What is interference?
67   Define resolving power.
68   What is diffraction?
69   Define wavefront.

> ➢ **Shorts Notes**

70   Define irradiance (intensity) of light.
71   Define phasor.
72   Define grating element.
73   Define phenomenon of polarization.
74   Define birefringence.
75   Define transverse wave.
76   Define longitudinal wave.
77   Define Brewster's law.
78   Define numerical aperture.
79   Define types of diffrcations
80   What is Polarimeter?

> ➢ **Short Answer Questions**

81   What is difference between interference and diffraction?
81   Define coherence. Also give conditions that must be satisfied to produce stable interference pattern.
83   State and explain principle of superposition of waves.
84   What is polarization of light?
85   Describe plane or liner polarization of light.
86   Define polarizer and an analyser.
87   Define polarizing axis.
88   Give classifications of polarizers
89   Describe circular polarization.
90   Describe elliptical polarization.
91   Pulse dispersion in step index fiber.
92   Advantages of optical fiber
93   Disadvantages of optical fiber
94   Write short note on Fiber materials, photonic crystal, fiber optic cables
95   What is Rayleigh's criterion for resolution?
96   Differentiate: Resolving power of telescopes and microscopes.
97   What is difference between Dispersive and resolving power of grating?

> ➢ **Long Answer Questions**

98   Explain Interference due to Wedge Shaped thin film.
99   Define resolving power and explain Rayleigh criterion.
100   Define dispersion and resolving power of a grating. Give expression for them.
101   Discuss phenomenon of Newton's ring. Give its application.
102   Describe Fraunhofer diffraction through single slit.
103   Describe Fraunhofer double slit diffraction.

104   Describe diffraction through plane diffraction grating.
105   Write about component of polarization.
106   Discuss polarization by Nicol prism.
107   State and explais Malus's law.
108   Discuss polarization by birefringence or by double refraction.
109   Write down structures and types of fibers.
110   Describe Optical communication system
111   Describe construction and working of Michelson Interferometer & its applications
112   Explain Interference by parallel sided thin films.
113   Explain Interference due to reflected light
114   Explain Interference due to refracted light

115   Explain Interference due to Wedge Shaped thin film.