

**Malla Reddy Engineering College(Autonomous)**  
**I B.Tech I Semester (MR15 Regulations) Online I Mid Examination**  
**Subject: Applied Physics**

**Multiple choice Questions:**

1. Phase difference ( $\Phi$ ) and path difference ( $\delta$ ) are related by  $\Phi =$  [      ]  
a.  $\frac{2\pi}{\lambda} \delta$       b.  $\frac{\lambda}{2\pi} \delta$       c.  $\frac{\pi}{2\lambda} \delta$       d.  $\frac{2\lambda}{\pi} \delta$
2. If two waves ( $y_1$ ) and ( $y_2$ ) traverse in a medium, then the resultant displacement at a point in the medium is given by [      ] a.  $y_1 - y_2$   
b.  $y_1 + y_2$       c.  $y_1 * y_2$       d.  $y_1 / y_2$
3. The condition for constructive interference is path difference should be equal to  
a. odd integral multiple of wavelength  
b. Integral multiple of wavelength  
c. odd integral multiple of half wavelength  
d. Integral multiple of half wavelength [      ]
4. The condition for destructive interference is path difference should be equal to  
a. odd integral multiple of wavelength  
b. Integral multiple of wavelength  
c. odd integral multiple of half wavelength  
d. Integral multiple of half wavelength [      ]
5. The ratio of intensities of two waves that produce interference pattern is 16:1 then the ratio of maximum and minimum intensities in the pattern is [      ]  
a. 25:9    b. 9:25    c. 1:4    d. 4:1
6. Correlation between the field at a point and the field at the same point at later time is known as [      ]  
a. Temporal coherence      c. coherence  
b. Spatial coherence      d. none
7. A phase difference  $\pi$  between two interfering beams is equivalent to the path difference  
a)  $\lambda$       b)  $\lambda/2$       c)  $\lambda/3$       d)  $\lambda/4$  [      ]
8. The penetration of waves into the regions of the geometrical shadow is [      ]  
a. Dispersion    b. polarization    c. diffraction    d. interference
9. Interference occurs due to \_\_\_\_\_ of light [      ]  
a. Wave nature      b. particle nature      c. both a and b      d. none of these
10. Superposition of crest and trough results in \_\_\_\_\_ [      ]  
a. Destructive interference      b. Constructive interference  
c. Diffraction      d. Polarization
11. Two waves having their intensities in the ratio 9:1 produce interference. In the interference pattern the ratio of maximum to minimum intensity is equal to

- a. 2:1                      b. 9:1                      c. 3:1                      d. 4:1                      [     ]
12. Two interfering beams have their amplitudes ratio 2:1 then the intensity ratio of bright and dark fringes is [     ]
- a. 2:1                      b. 1:2                      c. 9:1                      d. 4:1
13. If the two coherent waves intensity ratio is 9:4 then the ratio of maximum to minimum intensity of the fringe is [     ]
- a. 25:9    b. 9:25    c. 1: 4    d. 25:1
14. If  $a_1$  and  $a_2$  are the amplitudes of light coming from two slits in Young's double slit experiment, then the maximum intensity of interference fringe is [     ]
- a.  $a. (a_1 + a_2)$     b.  $2(a_1 + a_2)$                       c.  $(a_1 + a_2)^2$                       d.  $(a_1 - a_2)^2$
15. If  $a_1$  and  $a_2$  are the amplitudes of light coming from two slits in Young's double slit experiment then the minimum intensity of interference fringe is [     ]
- a.  $(a_1 + a_2)^2$     b.  $(a_1 - a_2)^2$     c.  $(a_1 + a_2)^3$                       d.  $2(a_1 + a_2)$
16. Young's double slit experiment is an example of division of [     ]
- a. amplitude    b. Wavelength                      c. wave front                      d. None
17. In Young's double slit experiment, the fringe width ( $\beta$ ) is given by [     ]
- a.  $\frac{\lambda d}{2D}$                       b.  $\frac{\lambda D}{2d}$                       c.  $\frac{2d}{\lambda D}$                       d.  $\frac{2D}{\lambda d}$
18. The fringe width ( $\beta$ ) of the interference pattern in the Young's double slit experiment increases \_\_\_\_\_ [     ]
- a. with increase in wavelength                      b. With decrease in wavelength
- c. independent of wavelength                      d. none of these
19. The fringe width ( $\beta$ ) of the interference pattern in the Young's double slit experiment decreases \_\_\_\_\_ distance between the two slits. [     ]
- a. with increase in                      b. With decrease in
- c. independent of                      d. none of these
20. The fringe width ( $\beta$ ) of the interference pattern in the Young's double slit experiment increases \_\_\_\_\_ distance between the slits and the screen. [     ]
- a. with increase in                      b. With decrease in
- c. independent of                      d. none of these
21. If the thickness of the parallel film increases, the path difference [     ]
- a. increases    b. Decreases    c. remains same                      d. None of these
22. When a light wave is reflected at the surface of an optically denser medium, then the change in the phase difference is [     ]
- a.  $\pi/4$                       b.  $\pi / 2$                       c.  $\pi$     d.  $2\pi$
23. When a light wave is reflected at the surface of an optically denser medium, then the change in path difference is [     ]
- a.  $\lambda/4$                       b.  $\lambda/2$                       c.  $\lambda$     d.  $2 \lambda$
24. Interference due to reflected light is also called \_\_\_\_\_ law [     ]
- a. sine law    b. cosine law    c. Tangent law                      d. cotangent law
25. In case of the thin film, the condition for constructive interference is that the apparent path difference should be equal to [     ]

- a. odd integral multiple of wavelength  
 b. Integral multiple of wavelength  
 c. odd integral multiple of half wavelength  
 d. Integral multiple of half wavelength
26. In case of the thin film, the condition for destructive interference is that the apparent path difference should be equal to [      ]  
 a. odd integral multiple of wavelength  
 b. Integral multiple of wavelength  
 c. odd integral multiple of half wavelength  
 d. Integral multiple of half wavelength
27. In Newton's rings experiment  $\lambda = \frac{\quad}{\quad}$  ( $n > m$ ) [      ]  
 a.  $D_m^2 - D_n^2 / 4R(m-n)$       b.  $D_m^2 + D_n^2 / 4R(m-n)$   
 c.  $D_n^2 - D_m^2 / 4R(n-m)$       d.  $D_m^3 - D_n^3 / 4R(m-n)$
28. Usually, \_\_\_\_\_ vapour lamp is used as source of light to demonstrate Newton's rings experiment. [      ]  
 1. a. mercury    b. sodium    c. neon    d. nitrogen
29. The lens used in Newton's rings experiment in addition to the glass plate, to trap air film is [      ]  
 a. concave    b. plano convex    c. plano concave    d. none
30. In Newton's rings experiment, the diameter of bright rings is proportional to [      ]  
 a. Odd natural numbers      b. Natural numbers  
 c. Even natural numbers      d. Square root of odd natural numbers
31. In Newton's rings experiment, the diameter of dark rings is proportional to [      ]  
 a. Odd natural numbers      b. Natural numbers  
 c. Even natural numbers      d. Square root of natural numbers
32. In Newton's rings experiment, rings are formed when the light \_\_\_\_\_ by lower surface of the lens and upper surface of the glass plate interfere. [      ]  
 a) reflected      b) refracted      c) both      d) none
33. Newton's rings can be viewed through a \_\_\_\_\_ [      ]  
 a) microscope      b) telescope      c) gyroscope    d) any of the three
34. Which of the following can be used as monochromator in addition to the prism?  
 a. thin film      b. thin glass plate  
 c. diffraction grating      d. none [      ]
35. The diffraction phenomenon is [      ]  
 a. Bending of light around an obstacle      b. Rectilinear propagation of light  
 c. Oscillation of wave in one direction      d. None of them

36. Diffraction effect is predominant when [      ]
- Size of the obstacle is less than the wavelength of light
  - Size of the obstacle is nearly equal to the wavelength of light
  - Size of the obstacle is greater than the wavelength of light
  - None
37. The grating equation is given by [      ]
- $e \sin \theta = n\lambda$
  - $(e+d)\sin \theta = n\lambda$
  - $d \sin \theta = n\lambda$
  - $\sin \theta = n\lambda$
38. If white light is used in Young's double slit experiment, what will happen to the interference bands? [      ]
- No bands will be obtained
  - Many bands will be obtained as in the case of monochromatic light, but they will be coloured except the centre of the central band which will be white
  - Very few bands will be obtained, but they will be coloured except the centre of the central band which will be white
  - Many bands will be obtained as in the case of monochromatic light, but all of them will be white
39. In Young's double slit experiment, the wavelength of the light used is doubled and distance between two slits is half of initial distance, the resultant fringe width increases by [      ]
- 2 times
  - 4 times
  - 3 times
  - 1/2 times
40. Wavelength of light of frequency 100Hz. [      ]
- $2 \times 10^6$  m
  - $4 \times 10^6$  m
  - $3 \times 10^6$  m
  - $5 \times 10^6$  m
41. If (D) is the distance between the slits and the screen in Young's double slit experiment and the two slits are separated by a distance equal to twice that of the wave length, then the fringe width will be \_\_\_\_\_ [      ]
- D
  - D/2
  - D/3
  - D/4
42. A transparent film of refractive index 1.5 is viewed in reflected monochromatic light of wave length  $6000 \text{ \AA}$ . If the angle of refraction in to the film is  $60^\circ$ , what is the smallest thickness of the film to make it appear dark? [      ]
- $4 \times 10^{-5}$  cm
  - $5 \times 10^{-5}$  cm
  - $6 \times 10^{-5}$  cm
  - $7 \times 10^{-5}$  cm

### Fill up the blanks

- According to the Principle of superposition the resultant displacement at a point in the medium is the \_\_\_\_\_ sum of the individual displacements.

2. If the path difference is equal to integral multiple of wavelength, \_\_\_\_\_ interference takes place.
3. If the path difference is equal to odd integral multiple of half the wavelength, \_\_\_\_\_ interference takes place.
4. The sources of light are said to be coherent if the waves produced by them have same wavelength and \_\_\_\_\_.
5. If ( $n_1$ ) and ( $n_2$ ) are the refractive indices of two different media, ( $i$ ) and ( $r$ ) are angles of incidence and refraction respectively, then according to Snell's law the relation among them is \_\_\_\_\_.
6. If two waves maintain constant phase difference or same phase at any two points on a wave is known as \_\_\_\_\_.
7. Now-a-days the slit (S) in Young's double slit experiment is illuminated by \_\_\_\_\_ instead of Sunlight.
8. In Young's double slit experiment, the separation between the slits is halved and the distance between the slits and the screen is doubled, then the fringe width increases by \_\_\_\_\_ times.
9. In the Young's double slit experiment if the amplitude of light from one slit is half the amplitude (a) of the light from the second slit, then the maximum intensity of the resultant light wave will be \_\_\_\_\_.
10. In the Young's double slit experiment if the amplitude of light from one slit is half the amplitude (a) of the light from the second slit, then the minimum intensity of the resultant light wave will be \_\_\_\_\_.
11. If (D) is the distance between the slits and the screen in Young's double slit experiment, then fringe width ( $\beta$ ) decreases with \_\_\_\_\_ in (D).
12. The distance between two consecutive bright or dark fringes is called \_\_\_\_\_.
13. In Young's double slit experiment, the fringe width decreases with \_\_\_\_\_ in the wavelength.
14. In Young's double slit experiment, the fringe width increases with \_\_\_\_\_ in the distance between the two slits.
15. The path difference decreases with \_\_\_\_\_ in the refractive index of the thin film.
16. In the case of thin film, the path difference increases with the \_\_\_\_\_ in the angle of refraction.
17. In terms of ( $\lambda$ ), the difference between apparent path difference and path difference, in the case of thin film is \_\_\_\_\_.
18. The condition for constructive interference in thin film is \_\_\_\_\_.
19. The condition for destructive interference in thin film is \_\_\_\_\_.
20. In the Newton's rings experiment, interference takes place between light reflected from the lower and upper surfaces of the \_\_\_\_\_ film.
21. \_\_\_\_\_ lens is used in Newton's rings experiment to render the monochromatic beam, parallel.

22. In Newton's rings experiment, parallel monochromatic beam is permitted to fall on the glass plate arranged at an angle of \_\_\_\_\_ .
23. The equation for dark ring in the case of Newton's rings experiment represents a straight line with \_\_\_\_\_ y – intercept.
24. \_\_\_\_\_ film is formed between the plano convex lens and the glass plate in Newton's rings experiment.
25. Newton's rings illustrate the phenomenon of \_\_\_\_\_
26. In the Newton's rings experiment, graph is plotted by taking \_\_\_\_\_ on x- axis.
27. In the Newton's rings experiment, graph is plotted by taking \_\_\_\_\_ on y- axis.
28. In the Newton's rings experiment, wavelength can be calculated by dividing \_\_\_\_\_ with  $4R$ , where  $R$  is the radius of curvature.
29. In the Newton's rings experiment, the expression for the diameter of bright ring is \_\_\_\_\_
30. In the Newton's rings experiment, the expression for the diameter of dark ring is \_\_\_\_\_
31. Radius of 4<sup>th</sup> dark ring in Newton's ring experiment is \_\_\_\_\_
32. In Newton's rings experiment the thickness of the air film at the point of contact of the glass plate and Plano convex lens is \_\_\_\_\_.
33. In Newton's rings experiment when we move radially towards the edge of the lens, the thickness of the air film \_\_\_\_\_.
34. In Newton's rings experiment, the radius of curvature of Plano convex lens placed on an optically plane glass plate should be \_\_\_\_\_.
35. In Newton's rings experiment with reflected light, at the point of contact of lens with the glass plate where thickness of air is zero, \_\_\_\_\_ fringe appears.
36. Separation of white light into its constituent wavelengths is called \_\_\_\_\_.
37. In diffraction pattern, fringes have \_\_\_\_\_ width.
38. In a grating, the combined width of a ruling and a slit is called \_\_\_\_\_
39. In grating, if the number of lines per inch ( $N$ ) increases, then width of the slit \_\_\_\_\_.
40. The theory that successfully explains the laws of reflection, laws of refraction, interference and diffraction is \_\_\_\_\_.

### True or false

1. Corpuscular theory of light was proposed by Sir Isaac Newton. (True / False)
2. Wave theory of light was proposed by Albert Einstein. (True / False)
3. Law of refraction is also called Snell's law. (True / False)

4. When the light ray traverses from denser medium to rarer medium, it refracts towards the normal. (True / False)
5. The condition to be satisfied for the constructive interference to take place is that the path difference should be equal to integral multiple of wavelength. (True / False)
6. The plano convex lens used in Newton's rings experiment should have smaller radius of curvature for better results. (True / False)
7. Young punched two pinholes in the opaque material, in his famous experiment that demonstrated interference. (True / False)
8. According to Principle of Superposition, a crest on a crest results in destructive interference. (True / False)
9. According to Principle of Superposition, a crest on a trough results in destructive interference. (True / False)
10. In Newton's rings experiment the glass plate arranged at  $65^\circ$  permits the normal incidence of monochromatic light on to the plano convex lens and glass plate arrangement. (True / False)
11. Prism is better dispersive element than diffraction grating. (True / False)
12. Monochromator filters out the required wavelength (True / False)
13. A monochromator has five components. (True / False)
14. A monochromator has three slits (True / False)
15. Diffraction means superposition of two different wave fronts. (True / False)
16. The phenomenon of interference is consistent with the law of conservation of momentum. (True / False)
17. Huygen's wave theory could explain laws of reflection and refraction only. (True / False)
18. Division of amplitude occurs due to refraction. (True / False)
19. The phenomenon of interference supports the wave nature of light (True / False)
20. In interference pattern, width of the bright fringe is equal to width of two dark fringes. (True / False)
21. In the expression for the displacement of wave,  $y = a \sin ( \omega t + \phi )$ , the term ( $\phi$ ) represents wave length. (True / False)
22. Light waves are longitudinal waves. (True / False)
23. The source of light used in Young's double slit experiment is Sun light. (True / False)
24. Newton's rings are formed due to air film. (True / False)
25. The graph drawn with number of the ring on x – axis and square of the diameter of that ring on y – axis (in Newton's rings experiment) will be a straight line with positive y – intercept. (True / False)
26. When a liquid film is introduced in the place of air film, then the diameter of the rings decreases. (True / False)
27. A polychromatic source is used in Newton's rings experiment. (True / False)
28. Diffraction grating has large number of random slits. (True / False)
29. Newton's corpuscular theory could explain interference. (True / False)

30. Optical path length is the product of refractive index of the medium and the geometrical path traversed by the light in that medium. (True / False)

**Match the following:**

- |   |  |   |   |
|---|--|---|---|
| 1. (a) Sir Isaac Newton                   | (i) Wave theory  | [ | ] |
| (b) Snell                                 | (ii) Corpuscular theory                                      | [ | ] |
| (c) Huygen                                | (iii) Law of refraction                                      | [ | ] |
| 2. (a) Thomas Young                       | (i) Interference   | [ | ] |
| (b) Sir Isaac Newton                      | (ii) Diffraction   | [ | ] |
| (c) Fresnel                               | (iii) Double slit experiment                                 | [ | ] |
| 3. In Newton's rings experiment,          |  |   |   |
| (a) plano convex lens and glass plate     | (i) at an angle $45^\circ$                                   | [ | ] |
| (b) glass plate is arranged               | (ii) renders parallel beam                                   | [ | ] |
| (c) Convex lens                           | (iii) trap air film  | [ | ] |
| 4. The fringe width ( $\beta$ )           |  |   |   |
| (a) increases                             | (i) if $(2d)$ increases                                      | [ | ] |
| (b) decreases                             | (ii) if $(D)$ increases by 2 times and $(\lambda)$ is halved | [ | ] |
| (c) remains same                          | (iii) if $(\lambda)$ increases.                              | [ | ] |
| 5. $\cos \Phi$ is                         |  |   |   |
| (a) Maximum                               | (i) when $\Phi = (2n+1)\pi$                                  | [ | ] |
| (b) Zero                                  | (ii) when $\Phi = 2n\pi$                                     | [ | ] |
| (c) Minimum                               | (iii) when $\Phi = (2n+1)\pi/2$                              | [ | ] |
| 6. The phenomenon associated with         |  |   |   |
| (a) colour in soap bubbles                | (i) refraction   | [ | ] |
| (b) Light emerging out of the prism       | (ii) Interference  | [ | ] |
| (c) Light entering the prism              | (iii) Dispersion   | [ | ] |
| 7. The principle involved in              |  |   |   |
| (a) Monochromator                         | (i) Superposition principle                                  |   |   |
| (b) Interference                          | (ii) Interference  |   |   |
| (c) Newton's rings experiment             | (iii) Diffraction  |   |   |
| 8. (a) No. of slits in Young's experiment | (i) 1  | [ | ] |
| (b) Types of interference                 | (ii) 3   | [ | ] |
| (c) No. of wave fronts in Diffraction     | (iii) 2  | [ | ] |

- |                                   |                 |   |   |
|-----------------------------------|-----------------|---|---|
| 9. (a) Distance between two nodes | (i) Period      | [ | ] |
| (b) No. of cycles per second      | (ii) Wavelength | [ | ] |
| (c) Time for completing one cycle | (iii) Frequency | [ | ] |
- 
- |                               |         |   |   |
|-------------------------------|---------|---|---|
| 10. In grating Monochromator, |         |   |   |
| (a) No. of components are     | (i) 1   | [ | ] |
| (b) No. of mirrors are        | (ii) 5  | [ | ] |
| (c) No. of gratings are       | (iii) 2 | [ | ] |

## Applied Physics - I

### Module – I: Optics

#### KEY for the Question bank

##### Multiple choice questions

- |       |       |       |
|-------|-------|-------|
| 1. a  | 15. b | 29. b |
| 2. b  | 16. c | 30. d |
| 3. b  | 17. b | 31. d |
| 4. c  | 18. a | 32. a |
| 5. a  | 19. a | 33. b |
| 6. a  | 20. a | 34. c |
| 7. b  | 21. a | 35. a |
| 8. c  | 22. c | 36. b |
| 9. a  | 23. b | 37. b |
| 10. a | 24. b | 38. b |
| 11. d | 25. c | 39. b |
| 12. c | 26. b | 40. c |
| 13. d | 27. c | 41. b |
| 14. c | 28. b | 42. a |

##### Fill up the blanks

- |                                |                                       |
|--------------------------------|---------------------------------------|
| 1. algebraic                   | 13. decrease                          |
| 2. constructive                | 14. decrease                          |
| 3. destructive                 | 15. decrease                          |
| 4. constant phase difference   | 16. decrease                          |
| 5. $n_1 \sin(i) = n_2 \sin(r)$ | 17. $\lambda / 2$                     |
| 6. spatial coherence           | 18. $2\mu t \cos r = (2n-1)\lambda/2$ |
| 7. LASER source                | 19. $2\mu t \cos r = n\lambda$        |
| 8. Four                        | 20. Air                               |
| 9. $9a^2/4$                    | 21. Convex                            |
| 10. $a^2/4$                    | 22. $45^\circ$                        |
| 11. decrease                   | 23. Zero                              |
| 12. fringe width               |                                       |

24. Air
25. Interference
26. number of the ring
27. square of the diameter
28. the slope of the graph
29.  $\sqrt{2(2n - 1)\lambda}$
30.  $\sqrt{4Rn\lambda}$
31.  $4\sqrt{R\lambda}$

32. Zero
33. Increases
34. Larger
35. Dark
36. Dispersion
37. unequal
38. grating element
39. decreases
40. Huygen's wave theory

True or false

- |       |       |       |
|-------|-------|-------|
| 1. T  | 11. F | 21. F |
| 2. F  | 12. T | 22. F |
| 3. T  | 13. T | 23. T |
| 4. F  | 14. F | 24. T |
| 5. T  | 15. F | 25. F |
| 6. F  | 16. F | 26. T |
| 7. T  | 17. F | 27. F |
| 8. F  | 18. F | 28. F |
| 9. T  | 19. T | 29. F |
| 10. F | 20. F | 30. T |

Match the following:

1. c, a, b
2. b, c, a
3. b, c, a
4. b, c, a
5. c, a, b
6. c, a, b
7. b, c, a
8. c, a, b
9. c, a, b
10. c, a, b