

KATHMANDU UNIVERSITY
End Semester Examination [C]
January, 2019

Marks scored:

Level : B.Sc.

Course : PHYS 211

Year : II

Semester: II

Exam Roll No. :

Time: 30 mins.

F. M. : 20

Registration No.:

Date JAN 01 2019

SECTION "A"

[20Q. \times 1 = 20 marks]

Choose and encircle the most appropriate answer. The symbols have their usual meanings.

- The amplitude of a damped harmonic oscillator is reduced to $1/e$ times of its initial value in the time called
[a] mean life time [b] relaxation time
[c] time period [d] one second
- A converging lens of refractive index 1.5 is kept in a liquid medium having same refractive index. What would be the focal length of the lens in this medium?
[a] 0 [b] ∞ [c] 10 [d] 100
- A pendulum suspended from the ceiling of a train has a period T when the train is at rest. When the train accelerates with a uniform acceleration a , the period of oscillation will
[a] increase [b] decrease
[c] remain unaffected [d] becomes infinite
- White light is incident on one of the refracting surfaces of a prism of angle 5° . If the refractive indices for red and blue colours are 1.641 and 1.659 respectively, the angular separation between these two colours when they emerge out of the prism is
[a] 0.9° [b] 0.09° [c] 1.8° [d] 1.2°
- A particle is oscillating according to equation $y=7\cos 0.5\pi t$. The particle moves from position of equilibrium to maximum displacement in time
[a] 4 second [b] 2 second [c] 1 second [d] 0.5 second
- The condition of achromatism for two lenses of the same material separated by a distance 'd' is
[a] $d = \omega_1 + \omega_2$ [b] $d = f_1 / f_2$ [c] $d = f_2 \times f_1$ [d] $d = (f_1 + f_2) / 2$
- In a driven harmonic oscillator the displacement lags behind the driven force by
[a] $\pi/2$ [b] $\pi/4$
[c] between 0 and $\pi/2$ [d] between 0 and π
- A telescope has an objective lens of focal length 200 cm and an eyepiece with focal length 2 cm. If this telescope is used to see a 50 metre tall building at a distance of 2 km, what is the height of the image of the building formed by the objective lens?
[a] 5 cm [b] 10 cm [c] 1 cm [d] 2 cm
- Phon is the unit of:
[a] frequency [b] amplitude [c] intensity [d] loudness

10. When monochromatic light is replaced by white light in Fresnel's biprism arrangement the central fringe is
 [a] dark [b] white [c] coloured [d] none of these
11. The speed of sound in a gas at NTP is 300 m/s. If the pressure is increased four times without change in temperature, the velocity of sound will be
 [a] 150 m/s [b] 300 m/s [c] 600 m/s [d] 1200 m/s
12. In a single slit diffraction pattern, for a slit width (d) and wavelength (λ), the separation between the central maximum and the first minimum is
 [a] $\theta = \lambda/d$ [b] $\theta = \lambda/2d$ [c] $\theta = \lambda/4d$ [d] $\theta = \pi/2$
13. Ultrasonic waves can be used to determine the depth of sea by echo-sounding because of their
 [a] large velocity [b] small velocity
 [c] small wavelength [d] large wavelength
14. The maximum number of lines of a grating which will resolve the third order spectrum of two lines having wavelengths 5890 \AA and 5896 \AA is
 [a] 327 [b] 227 [c] 228 [d] 173
15. A wave is propagating along X-axis and another identical wave is propagating along Y-axis. If initial phase difference between the two waves is $\pi/2$, the resultant wave is
 [a] circular [b] parabolic [c] straight line [d] elliptical

Fill in the blanks with correct answer

16. The optical path of a monochromatic light is the same if it goes through 2 cm of glass or 2.25 cm of water. If the refractive index of water is 1.33, the refractive index of glass is.....
17. A hall of volume 6500 m^3 found to have a reverberation time of 3 sec. The sound absorbing surface of the hall has an area of 450 m^2 . The average absorption coefficient is.....
18. The thickness of a quarter wave plate for light of wavelength 589 nm and refractive indices for o-rays and e-rays are 1.55 and 1.50 respectively is.....
19. Velocity of sound waves in air is 330 m/s. For a particular sound in air, a path difference of 40 cm is equivalent to a phase difference of 1.6π . The frequency of this wave is
20. Two polarizing sheets have their directions so that the intensity of transmitted light is maximum. The required angle that either sheet be turned so that the intensity becomes one half of the initial is.....

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Time : 2 hrs. 30 mins.

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Semester: II
F. M. : 55

SECTION "B"

[5Q. × 4 = 20 marks]

1. Discuss air vibrations in a Helmholtz resonator and obtain an expression for its frequency.

OR

Derive the lens maker's formula for double convex lens. State the assumptions made and convention of sign used.

2. What do you mean by relaxation time and Quality factor of damped harmonic oscillator? Derive relation between them?
3. Show how prisms should be combined to obtain dispersion without deviation.
4. Distinguish between particle velocity and wave velocity and find a relation between them.
5. (a) The inclined faces of a biprism of refractive index 1.5 make an angle of 2° with the base. A slit illuminated by monochromatic light is placed at a distance of 10 cm from the biprism. If the distance between two dark fringes observed at a distance of 1 cm from the prism is 0.18 mm, find the wavelength of light used.
(b) A particle executes SHM of period 3.14 second and amplitude 5 cm. Calculate its maximum velocity and maximum acceleration.

SECTION "C"

[5Q. × 7 = 35 marks]

6. Write the equation of LCR circuit (or a damped electrical circuit). Solve this equation for weak damping to find the frequency and quality factor.
7. What is a zone plate? Explain its theory. Show that a zone plate has multiple foci. Compare the zone plate with a convex lens.
8. What are stationary waves? Show that there is no transfer of energy in the case of a stationary wave in a linear bounded medium.

OR

Give the theory of Fabry-Perot's interferometer. Prove that in the fringe system formed; the ratio of the intensity of maxima to the intensity mid-way between minima is given by $\left\{\frac{1+R}{1-R}\right\}^2$, where R is the reflection coefficient.

9. What is Lissajous' figure? Discuss with necessary theory the superposition of two rectangular simple harmonic motions of equal frequencies but different amplitudes. Discuss what happens if one of the vibrations changes its phase from 0° to 180° relative to the other.
10. (a) The intensity level due to two waves of same frequency in a medium are 10 dB and 40 dB. What is the ratio of their amplitudes?
(b) What should be the minimum number of lines per inch in a half inch width grating? to resolve the D_1 (5896 \AA) and D_2 (5890 \AA) lines of sodium?

