

DEPARTMENT OF CIVIL ENGINEERING
RAJSHAHI UNIVERSITY OF ENGINEERING & TECHNOLOGY
B.Sc. Engineering First Year Odd Semester Examination, 2018

Phy 1101
Physics-I

Full marks: 72

Time: 3 Hours

- N.B:-** (i) Answer any **SIX** questions, taking **THREE** from each section.
(ii) Figures in the margin indicate full marks.
(iii) Use separate answer script for each section.

SECTION-A

- Q 1(a) What are coherent sources? How can coherent sources be obtained in Fresnel's biprism? 4.00
(b) Give the theory of Newton's rings. Why are the central rings dark? 4.00
(c) Newton's rings are observed in reflected light of $\lambda = 5.9 \times 10^{-5}$ cm. The diameter of the 10th dark ring is 0.5 cm. Find the radius of curvature of the lens and the thickness of the air film. 4.00
- Q 2(a) Describe Fraunhofer diffraction at double slit and hence show that the angular separation between any two consecutive minima or maxima is equal to $\lambda/(a+b)$. 5.00
(b) Find an expression for resolving power of a plane transmission grating. 4.00
(c) Calculate the aperture of the objective of a telescope which is used to resolve stars separated by 4.88×10^{-6} radian for light of wavelength 6000 Å. 3.00
- Q.3(a) What is meant by polarization of light? Define the terms plane polarized light, circularly polarized light and elliptically polarized light. 4.00
(b) Describe how a polarimeter is used to measure the strength of sugar solution. 5.00
(c) Calculate the specific rotation of the given sample of sugar solution if the plane of polarization is turned through 13.2° . The length of the tube containing 10% sugar solution is 20 cm. 3.00
- Q.4(a) What are isothermal and adiabatic changes? Derive the equation $PV^\gamma = \text{constant}$ for an ideal gas. 5.00
(b) Show that $\int_A^B \frac{\delta Q}{T}$ is independent of the path for a reversible change. 3.00
(c) A Carnot's engine whose temperature of the source is 400K takes 200 calories of heat at this temperature and rejects 150 calories of heat to the sink. Calculate the temperature of the sink and the efficiency of the engine. 4.00

SECTION-B

- Q.5(a) Write the postulates of the kinetic theory of gases. 4.00
(b) Deduce an expression for the pressure of a gas from the kinetic theory of gases and hence show that $PV = RT$. 4.00
(c) Calculate the critical constants of gas in terms of the constants of Van der Waals equation. 4.00
- Q 6(a) What are Lissajous' figures? Discuss the formation of Lissajous' figures when the phase difference is (i) 0 and (ii) $\pi/2$. 4.00
(b) Define simple harmonic motion. Show that the motion of a simple pendulum is simple harmonic. 3.00
(c) Calculate the average kinetic energy and total energy of a body executing simple harmonic motion. Show that the principle of conservation of energy is obeyed by a harmonic oscillator. 5.00
- Q 7(a) What is wave motion? Deduce the following differential equation of wave motion $\frac{d^2y}{dt^2} = V^2 \frac{d^2y}{dx^2}$, where V is the velocity. 4.00
(b) Analytically discuss the formation of nodes and antinodes in stationary wave. How do they differ from ordinary progressive waves? 5.00
(c) Distinguish between particle velocity and wave velocity. 3.00
- Q.8(a) Define the terms acoustics, architectural acoustics, reverberation and reverberation time. 4.00
(b) Using Sabine's law, show that the reverberation is directly proportional to the volume and inversely proportional to the absorption co-efficient and surface area of the auditorium. 4.00
(c) Describe the technique to determine the absorption co-efficient of the used materials. Hence also define absorption co-efficient. 4.00

N.B.:-

- (i) Answer SIX questions, taking THREE from each section.
(ii) Figure in the margin indicates full marks.
(iii) Use separate answer script for each section.

জুয়েলার বস্টেটসিটি
মদান ইঞ্জিনিয়ারিং সোসাইটি
মোবাইল ০১৯২২-০৭০৭০৫

SECTION-A

- Q.1(a) What are Newton's rings? Explain the formation of these rings. 4.00
(b) Describe an experiment to determine the radius of curvature of the lens by using these rings. 4.00
(c) Newton's rings are observed in reflected light of $\lambda = 5.9 \times 10^{-5}$ cm. The diameter of the 10th dark ring is 0.5 cm. Find the radius of curvature of the lens and the thickness of the air filter. 4.00
- Q.2(a) Distinguish between single slit and double slit diffraction patterns. 4.00
(b) Discuss the phenomena of Fraunhofer diffraction at a single slit and show that the intensities of successive maxims are nearly in the ratio as, $1: \frac{1}{21} : \frac{1}{61} : \frac{1}{121} : \dots$ 5.00
(c) Deduce the missing orders for a double slit diffraction pattern if the widths are 8.8×10^{-3} cm and they are 4.4×10^{-2} cm apart and hence draw the intensity distribution curve using these missing orders. 3.00
- Q.3(a) Define plane polarized light and write the different methods of plane polarized light. 3.00
(b) Define plane of vibration and plane polarization 2.00
(c) What is Nicol prism? Explain with figure the construction of Nicol prism. 4.00
(d) Define optically active substances. On which factors the angle of rotation of plane of polarization depends on? 3.00
- Q.4(a) State the first and second laws of thermodynamics. 4.00
(b) Show that the entropy of a perfect gas remains constant in a reversible process but increases in an irreversible process. 5.00
(c) The volume of air is made three times the original volume by adiabatic expansion. If the initial pressure is 1 atmospheric pressure, what is the final pressure? ($\gamma = 1.4$) 3.00

SECTION-B

- Q.5(a) Define isothermal and adiabatic changes. Distinguish between them. 4.00
(b) Describe the construction and working principle of a platinum resistance thermometer. 5.00
(c) Calculate the critical constants of gas in terms of the constants of the Vander Waals equation. 3.00
- Q.6(a) Deduce the equation for the simple harmonic motion (S.H.M) of a particle. Find expressions for the velocity and acceleration of the particle executing S.H.M. 4.00
(b) Obtain an expression for the displacement of a particle executing simple harmonic motion. 5.00
(c) Define quality factor for damped oscillator and forced vibration. 3.00
- Q.7(a) Define wave velocity and group velocity. 4.00
(b) Obtain an expression for energy per unit volume of a progressive wave. 4.00
(c) Distinguish between progressive and stationary waves. 4.00
- Q.8(a) Define acoustic. What are the acoustic requirements of a good auditorium? 4.00
(b) State and explain Doppler effect and write some applications of Doppler effect. 4.00
(c) Deduce an expression for the frequencies when the source moves away from the listener and listener moves towards the source. 4.00

Full marks: 72

Time: 3 Hours

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জুয়েল ফটো কপি
নর্দীন ইউনিভার্সিটির মাধ্যমে
মোবাইল: ০১৯২২-০৭০৭০৭

SECTION-A

- Q.1 (a) What is diffraction of light? Distinguish between Fraunhofer and Fresnel diffraction. 4.0
(b) Describe the diffraction pattern obtained at a straight edge 5.0
(c) How many orders will be visible if the wave length of light is 5000\AA and the number of lines per inch on the grating is 2620? 3.0
- Q.2 (a) Define coherent sources and hence explain with figure how coherent sources are produced in Newton's rings experiment? 4.0
(b) Explain interference phenomena due to reflected light for thin films. 5.0
(c) In Young's double slit experiment the separation of the slits is 1.9 mm and fringe spacing is 0.31 mm at a distance of 1 meter from the slits. Calculate the wavelength of light. 3.0
- Q.3 (a) Define polarized and unpolarized of light with figure clearly. 3.0
(b) Distinguish between ordinary and extraordinary ray. 2.0
(c) Describe the construction of a Nicol Prism and hence explain with figure how it can produce polarized light. 4.0
(d) Calculate the specific rotation if the plane of polarization is turned through 26.4° , traversing 20 cm length of 20% sugar solution. 3.0
- Q.4 (a) Define isothermal and adiabatic transformations. Give examples. 4.0
(b) Discuss the second law of thermodynamics and the principle of increase entropy. 5.0
(c) Show that the thermodynamic relation for a perfect gas $\left(\frac{\partial U}{\partial V}\right)_T = 0$. 3.0

SECTION-B

- Q.5 (a) Distinguish between perfect gas and real gas. 3.0
(b) Deduce Vander Waal's equation with correction. 5.0
(c) Show that the entropy in a reversible process is zero. 4.0
- Q.6 (a) What are Lissajous figures? Show how they can be produced. 3.0
(b) Show that the time period of a body vibrating simple harmonically is directly proportional to the square root of the displacement per unit acceleration. 5.0
(c) Calculate the average kinetic energy and the total energy of a body executing simple harmonic motion. 4.0
- Q.7 (a) What is wave motion? What propagates in wave motion? 3.0
(b) Deduce an equation of a single harmonic wave travelling in the positive x-direction. 3.0
(c) Define particle velocity and wave velocity. Establish the relation between them. 3.0
(d) What are stationary wave and how are they formed? 3.0
- Q.8 (a) Define reverberation time. 2.0
(b) What are the requirements of a good auditorium? 3.0
(c) State and explain Doppler effect. 4.0
(d) Calculate the apparent frequency of the sound of a whistle of frequency 500 vib/s from an engine approaching a station observer at a speed of 10 m/s. Take velocity of sound as 332 m/s. 3.0

Phy- 1101
Physics -I

Full marks: 72

Time: 3 Hours

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(iv) Assume reasonable value for any data missing.

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মর্দান ইউনিভার্সিটি
যোগাযোগ: ০১৯২২-০৭৭০৫

SECTION-A

- Q.1(a) What is interference of light? Under what conditions can interference of light take place? 3.00
(b) Describe how will you determine the wave length of light using Fresnel's biprism. 6.00
(c) When the movable mirror of a Michelson interferometer is moved through a diameter of 0.03mm, 100 fringes are displaced. What is the wavelength and colour of the light used? 3.00
- Q.2 (a) What is a diffraction grating? Explain why grating with larger number of lines are preferred. 4.00
(b) Find an expression for the resolving power of a plane transmission grating 5.00
(c) A screen is placed 2m away from a narrow slit which is illuminated with height of wavelength 600\AA . If the first minimum lines 5mm on either side of the central maximum, calculate the slit width. 3.00
- Q.3 (a) Define Plane wave, Plane of vibration and Plane of polarization. 3.00
(b) Distinguish between ordinary and Extra-ordinary ray. 3.00
(c) What is optical active substance? On which factor the angle of rotation of plane of polarization depends on? 3.00
(d) Calculate the specific rotation if the plane of polarization is turned through 26.4° , Traversing 20 cm length of 20% sugar solution. 3.00
- Q.4(a) What do you mean by thermal equilibrium? What will be happened when two identical copies are in thermal contact with each other? 4.00
(b) What is thermometer? Deduce temperature equation for constant volume Hydrogen thermometer. 4.00
(c) Define ratio of specific heats of gases and hence calculate ratio of specific heats for diatomic molecules. 4.00

SECTION-B

- Q.5(a) Distinguish between a perfect gas and a real gas. 3.00
(b) Define mean free path of the molecules. Derive an expression for the mean free path of a molecule of a gas. 6.00
(c) Calculate the Van der Waals constants for dry air, given that $T_c = 132\text{k}$, $P_c = 37.2\text{atmos}$. R per mole = $82.07\text{cm}^3\text{atmos K}^{-1}$. 3.00
- Q.6(a) Distinguish between simple harmonic motion and damped oscillator 3.00
(b) Define Quality factor for damped harmonic oscillator and hence show $Q = \sqrt{cm/b}$, where, symbols have their usual meanings. 4.00
(c) Obtain an expression for the displacement of a particle executing simple harmonic motion. 5.00
- Q.7(a) Define and explains the particle velocity and wave velocity. 3.00
(b) What are Lissajous figures? On what factors the shape of these figures does depend. Write the uses of these figures. 5.00
(c) Obtain an expression for energy per unit volume of a progressive wave. 4.00
- Q.8(a) State and explain Doppler effect. 4.00
(b) Show that if the source moves away with the velocity of sound from an observer who is at rest, the frequency of vibration is halved. 4.00
(c) Discuss optimum value of reverberation time. 4.00

Heaven's Light is Our Guide
DEPARTMENT OF CIVIL ENGINEERING
RAJSHAHI UNIVERSITY OF ENGINEERING & TECHNOLOGY
B.Sc. Engineering First Year Odd Semester Examination, 2014

Phy-1101
Physics-I

Full marks: 70

Time: 3 Hours

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- Answer any **SIX** questions, taking **THREE** from each section.
 - Figures in the margin indicate full marks.
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জুরেল ফটোকপি
নর্দান ইঞ্জিনিয়ারিং সেন্টার
মোবাইল: ০১৯২১-০৭০৭০৫

SECTION-A

- Q.1(a) Define coherent sources. Explain with diagram how two coherent sources are produced in Fresnel's biprism. 3.67
- (b) Show that for interference the distance between any two consecutive bright fringes is equal to $\lambda D/d$, where the symbols have their usual meanings. 5.00
- (c) In a Newton's rings experiment the diameter of the 15th ring was found to be 0.590 cm and that of the 5th ring was 0.336cm. If the radius of the plano-convex lens is 100 cm. Calculate the wave length of light used. 3.00
- Q.2 (a) What do you mean by diffraction of light? 3.00
- (b) Deduce an expression for the wave length of light for the diffraction through transmission. 5.67
- (c) How many orders will be visible if the wave-length of light is 5000\AA and the number of lines per inch on the grating is 2620? 3.00
- Q.3 (a) Outline the principle of a half shade Polarimeters (HSP). 3.00
- (b) Explain how you will use it (HSP) to determine the specific rotation of substance like glucose. 5.67
- (c) A 20 cm long tube containing sugar solution rotates the plane of polarization by 11° . If the specific rotation of sugar is 66° , calculate the strength of the solution 3.00
- Q.4 (a) What do you mean by thermal equilibrium? 2.00
- (b) derive an expression for the work done during isothermal process 5.00
- (c) Give the block diagram of (i) Heat Engine and (ii) Refrigerator. What is efficiency? Compare the efficiency between Heat Engine and Refrigerator. 4.67

SECTION-B

- Q.5(a) State and explain the law of equipartition of energy. 3.00
- (b) Deduce from the kinetic theory of gases, an expression for the pressure of a gas. Also, prove that $PV = RT$. 5.67
- (c) Calculate the number of molecules in one litre of an ideal gas at 136.5°C temperature and 3 atmospheres pressure. 3.00
- Q.6(a) Distinguish between simple harmonic motion and Oscillatory. 3.67
- (b) Show that charge on the capacitor in an LC circuit oscillates simple harmonically. 5.00
- (c) The equation of a point on a damped Oscillator is given by $x = 5e^{-0.25t} \sin(\pi/2)t$ meter. Find the velocity of the oscillating point at $t = T/4$ and T , Where T is the time period of the oscillator. 3.00
- Q.7(a) Explain the term wave motion. Differentiate between transverse and longitudinal wave motion. 4.00
- (b) Show that the energy transfer per unit volume for a stationary wave is zero. 4.67
- (c) At a time $t = 0$, a simple harmonic wave is represented by $Y = 12 \sin 2\pi(x/400)$. The velocity of the wave is 50cm/sec, What should be the form of the equation at a time $t = 4$ Sec? 3.00
- Q.8 (a) What is reverberation time? 3.00
- (b) What are the requirements of a good auditorium? 3.00
- (c) Explain Doppler effect. Obtain an expression for the frequencies of a note heard by the observer, when both the source and the observer are in motion away from each other. 3.00

N.B.s-

- (i) Answer SIX questions, taking THREE from each section.
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জায়েদ ফটিকিয়া
 মহান ইঞ্জিনিয়ারিং কলেজ
 মোবাইল: ০১৯২২-০৭০৭০৫

SECTION-A

- Q.1(a) What are Newton's rings? Explain the formation of Newton's rings. 3.67
 (b) Describe Newton's rings method for the determination of wavelength of light. 5.00
 (c) A thin plate of refractive index 1.5 displaces 10 fringes when it is introduced in one of the arms of the Michelson interferometer. Calculate the thickness of the plate. 3.00
- Q.2(a) What is diffraction of light? Distinguish between Fraunhofer and Fresnel diffraction. 3.67
 (b) Discuss the Fraunhofer diffraction pattern due to a single slit. 4.00
 (c) What is meant by dispersive power of a grating? A plane transmission grating having 6000 lines/cm is used to obtain a spectrum of light from a sodium lamp in the second order. Calculate the angular separation between two sodium lines whose wavelengths are 5890 Å and 5896 Å. 4.00
- Q.3(a) What is meant by polarization of light? Define plane of polarization and plane of vibration of light. 3.00
 (b) State and explain Brewster's law. Show that at the polarizing angle of incidence the reflected and refracted rays are mutually perpendicular to each other. 5.00
 (c) How a nicol prism can be used as a polarizer and as an analyzer. 3.6
- Q.4(a) Define Entropy. What is its physical significance? 3.0
 (b) Show that the entropy of a perfect gas remains constant in a reversible process but increases in an irreversible process. 5.6
 (c) Prove that $PV^\gamma = \text{constant}$, in an adiabatic transformation. 3.0

SECTION-B

- Q.5(a) Derive Van Der Waals equation of state of a gas. 4.00
 (b) Obtain expressions for critical constants in terms of the constants of the equations. 4.6
 (c) Calculate the total random kinetic energy of one gm-molecule of oxygen at 300 K. $K.E. = \frac{3}{2} kT \frac{P}{N} \tau$ 3.00
- Q.6(a) Define simple harmonic motion and discuss its characteristics. 2.6
 (b) Show that the total energy of a particle executing simple harmonic motion is proportional to the square of the amplitude of the motion. 5.00
 (c) Obtain an expression for the displacement of a particle executing simple harmonic motion. 4.00
- Q.7(a) What is plane progressive wave? Obtain an expression for a plane progressive wave travelling in the positive x-direction in the form $y = a \sin \frac{2\pi}{\lambda} (vt - x)$ and obtain a phase velocity. 5.6
 (b) Distinguish between particle velocity and wave velocity and obtain a relation between the two. 3.0
 (c) The velocity of a simple harmonic motion wave is 30 cm/s. At a time $t = 0$, the displacement of a particle is given by $y = 4 \sin 2\pi \left(\frac{x}{100} \right)$. Find the equation for the displacement at a time $t = 2$ sec. 3.0
- Q.8(a) Distinguish between progressive wave and stationary wave. 3.6
 (b) Show that in the case of stationary wave, no energy is transferred across any section of the medium. 5.0
 (c) Show that if the source moves away with the velocity of sound from an observer who is at rest, the frequency of vibration is halved. 3.0

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Marks: 70

Time: 3 Hours

- (i) Answer S.X questions, taking THREE from each section.
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জুয়েল কলেজ
নর্দান ইউনিভার্সিটি সামলে
মোবঃ ০১৯২২-০৭০৭০৭

SECTION-A

- Q.1(a) What is interference of light? Give the conditions for the production of interference fringes. 3.67
(b) Describe Fresnel's biprism method for the determination of wavelength of light. 5.00
(c) Fringes of equal inclination are observed in a Michelson interferometer. As one of the mirrors is moved back by 1 mm, 3663 fringes move out from the center of the pattern. Calculate the wavelength of light. 3.00
Q.2(a) Explain what do you mean by polarization of light? 3.00
(b) Describe the construction and mode of action of a diffraction grating and derive an expression for its resolving power. 5.67
(c) A 20 cm long tube containing sugar solution rotates the plane of polarization by 11°. If the specific rotation of sugar is 66°, calculate the strength of the solution. 3.00
Q.3(a) Explain the phenomenon of double refraction. What are ordinary and extra-ordinary rays? 3.00
(b) Describe the construction and use of a Nicol prism and explain how it produces plane polarized light. 5.67
(c) State and explain Malus' law. 3.00
Q.4(a) State the two laws of Thermodynamics and explain their significance. 3.00
(b) Derive an expression for the efficiency of a Carnot's engine in terms of the temperature of the source and the sink. 5.67
(c) A Carnot engine whose low temperature reservoir is at 7°C has an efficiency of 50%. It is desired to increase the efficiency to 70%. By how many degrees should the temperature of the high temperature reservoir be increased? 3.00

SECTION-B

- Q.5(a) What are critical constants of a gas? 3.00
(b) Show that the pressure exerted by a perfect gas is 2/3 of the mean kinetic energy per unit volume. 5.67
(c) Calculate the mean free path of a gas molecule, given that the molecular diameter is 2×10^{-8} centimeter and the number of molecule per cubic centimeter is 3×10^{19} . 3.00
Q.6(a) Distinguish between free and forced vibrations. Give the necessary conditions for the production of forced vibrations. 3.00
(b) What is damped vibrations? Derive its differential equation. 4.67
(c) The equation of displaced of a point on a damped oscillator is given by $x = 5e^{-0.25t} \sin(\pi/2)t$ meter. Find the velocity of the oscillating point at $t = T/4$ and T , where T is the time period of the oscillator. 4.00
Q.7(a) Explain the term wave motion? What is propagated in a wave motion? 3.67
(b) Show that the energy of a plane progressive wave is given by $E = 2\pi^2 \rho n^2 a^2$ where the symbols have their usual meanings. 5.00
(c) A source of sound has a frequency of 512 Hz and an amplitude of 0.25 cm. What is the flow of energy across a square cm per second, if the velocity of sound in air is 340 m/s and the density of air is 0.00129 g/cm³. 3.00
Q.8(a) Explain clearly the distinction between progressive waves and longitudinal waves. 3.00
(b) Explain Doppler's effect. Obtain an expression for the frequency of a note heard by an observer, when both the source and the observer are in motion towards each other. 6.00
(c) What are the acoustic requirements of a good auditorium? 2.67



Full marks: 70

Time: 3 Hours

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 - (iv) Assume reasonable value for any data missing.

SECTION-A

- Q.1(a)** What are Newton's ring and how they are formed? 3.67
- (b)** Describe Newton's rings method for the measurement of the wavelength of light. 5.00
- (c)** Fringes of equal inclination are observed in Michelson interferometer. As one of the mirrors is moved back by 1mm, 3663 fringes move out from the center of the pattern. Calculate the wavelength, λ . 3.00
- Q.2(a)** What is meant by diffraction of light? Distinguish between Fraunhofer and Fresnel diffraction. 3.00
- (b)** Give the theory of a plane transmission grating and describe how it is used to determine the wavelength of light. 5.67
- (c)** Calculate the aperture of the objective of a telescope which may be used to resolve stars separated by 4.88×10^{-6} radian for light of wavelength 6000\AA . 3.00
- Q.3(a)** State and explain Brewster's law. Show that at the polarizing angle of incidence, the reflected and refracted rays mutually perpendicular to each other. 3.67
- (b)** What is specific rotation? Give with details the construction and working of a Laurent's half-shade polarimeter. Explain how you would use it to determine the specific rotation of sugar. 6.00
- (c)** Determine the specific rotation of the given sample of sugar solution if the plane of polarization is turned through 13.2° . The length of the tube containing 10% sugar solution is 20cm. 2.00
- Q.4(a)** Define thermometer. Write the principles underlying the working of the following thermometers: (i) Liquid thermometer, (ii) Gas thermometer, (iii) Resistance thermometer, and (iv) Thermoelectric thermometer. 3.67
- (b)** Describe a platinum resistance thermometer. Explain how it works with the help of Callendar and Griffith's bridge. 5.00
- (c)** A platinum resistance thermometer gives 2.57Ω and 3.53Ω resistances at 0°C and 100°C respectively. What will be its corresponding value at 33.3°C ? 3.67

SECTION - B

- Q.5(a)** Differentiate between the reversible and irreversible process of thermodynamics. 3.00
- (b)** State and explain second law of thermodynamics and the principle of increase of entropy. 5.67
- (c)** One gram molecule of a gas expands isothermally to four times its volume. Calculate the change in its entropy in terms of gas constant. 3.00
- Q.6(a)** What is simple harmonic motion? Derive the differential equation of a body executing simple harmonic motion. 3.00
- (b)** Obtain an expression for the time period of a body which executes simple harmonic motion. 5.67
- (c)** Write short notes on Lissajous's figures. 3.00
- Q.7(a)** What do you mean by wave motion? Derive the equation of wavemotion in the form of $y = a \sin 2\pi/\lambda (vt-x)$ 3.67
- (b)** Show that in the case of a stationary wave no energy is transferred across any section of the medium. 5.00
- (c)** Distinguish between the wave velocity and group velocity. 3.00
- Q.8(a)** Define reverberation and reverberation time. 3.00
- (b)** Deduce the formula reverberation time of an auditorium using Sabine's law. 5.67
- (c)** A steady sound is stopped in a room having reverberation time of 1.2 sec. By what factor does the intensity drop in the next 0.1 sec. 3.00

Physics-I

Full Marks: 70

Time: 3 Hours

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SECTION -A

- Q.1 (a) What are coherent sources? Discuss why two independent sources of light of the same wavelength cannot produce interference fringes. 3.67
- (b) Prove that the distance β between two successive bright fringes formed in Young's experiment is given by $\beta = \frac{D\lambda}{d}$, where d is the distance between two sources and D is the distance between sources and the screen. 5.00
- (c) In a Newton's rings experiment the diameter of the 15th ring was found to be 0.590cm and that of the 5th ring was 0.336cm. If the radius of the plano-convex lens is 100cm, calculate the wavelength of light used. 3.00
- (d) In what respect is an echelon grating superior to an ordinary grating? 2.67
- (e) Describe and explain the Fraunhofer diffraction pattern obtained with a narrow slit and illuminated by a parallel beam of monochromatic light. 6.00
- (f) In a plane transmission grating the angle of diffraction for the second order principal maximum for the wavelength 5×10^{-5} cm is 30° . Calculate the number of lines in one cm of the grating surface. 3.00
- (g) Write short note on quarter-wave plate. 3.00
- (h) State Brewster's law. Show that the reflected and refracted rays are at right angles when light is incident on a transparent substance at the polarizing angle. 3.67
- (i) Explain the phenomenon of double refraction in a calcite crystal. 3.00
- (j) Discuss the role of Canada balsam layer in a Nicol prism. 2.00
- (k) Explain Zeroth law of thermodynamics. 2.00
- (l) Describe the principle, construction and working of a thermoelectric thermometer. State its advantages and disadvantages. 6.67
- (m) Show that the work done during an adiabatic process is $W = \frac{1}{1-\gamma} [RT_2 - RT_1]$, where the symbols have their usual meaning. 3.00

SECTION-B

- Q.5 (a) State the First and Second laws of thermodynamics and explain their significance. 4.67
- (b) Derive an expression for the efficiency of a Carnot's engine. 4.00
- (c) One gram molecule of a gas expands isothermally to four times of its volume. Calculate the change in its entropy in terms of the gas constant. 3.00
- (d) Define amplitude, phase, epoch and time period of a simple harmonic motion (SHM). 4.00
- (e) Prove that for a particle vibrating in a SHM, the time period is directly proportional to the square root of displacement per unit acceleration. 4.67
- (f) Establish the differential equation for free undamped vibration of a particle. 3.00
- (g) (a) What are Lissajous' figures? On what factors, the shape of these figures does depend? 3.00
- (b) Discuss the formation of these figures when the periods of the two vibrations are equal and the phase difference is $\pi/2$. 5.67
- (c) Distinguish between the progressive and stationary waves. 3.00
- (h) (a) Explain the terms acoustics and reverberation. 3.67
- (b) Establish the Sabine's reverberation formula and using this formula, derive an expression for reverberation time. 5.00
- (c) What are the acoustic requirements of a good auditorium? 3.00

THE END