Exam Date: 28/03/2022

CHITTAGONG UNIVERSITY OF ENGINEERING AND TECHNOLOGY
B.Sc. ENGINEERING LEVEL-1TERM-II(19 Batch) EXAMINATION '2020

DEPARTMENT	: ELECTRONICS AND TELECOMMUNICATION ENGINEERING
FULL TITLE OF PAPER	: Engineering Physics
COURSE NO.	: PHY 181
FULL MARKS	: 210
TIME	: 3 HOURS

The figures in the right margin indicate full marks. Answer any THREE questions from each section. Use separate script for each section.

Section-A

Q.1(a) Define the following terms: **08**
(i) Crystalline and non-crystalline solid
(ii) Unit cell
(iii) Crystal systems.

(b) What are Miller indices? Draw (210), (236), (110) planes and (110), (111) directions in a simple cubic system. **10**

(c) What is packing fraction of a solid? Prove that the values of packing fraction for Sc, BCC and FCC crystal structure are $\frac{\pi}{6}$, $\sqrt{3}(\frac{\pi}{8})$and $\sqrt{2}(\frac{\pi}{6})$ respectively. **12**

(d) Aluminium has afcc structure. Its density is $2.7 \times 10^3\ kg/m^3$. Calculate the unit cell dimensions and the atomic diameter. **05**

Q.2(a) How could you differ a photoelectric effect from Compton effect? **07**

(b) Obtain an expression for the change in wavelength of a Photon undergoing Compton scattering. What is Compton wavelength? **20**

(c) A Photon of energy $5.1 \times 10^5 eV$ is incident on Aluminium foil. The Photon is scattered at angle of 90^o.Calculate (i) Wavelength of scattered Photon and (ii) energy of recoil Electron. **08**

Q.3(a) What are drift velocity and mobility of Electrons? Derive the classical Drude model to explain the electrical conductivity. **18**

(b) What is Hall effect? Show how Hall effect can be used to determine the nature of the change carriers and the number of change carriers per unit volume of a conductor. **12**

(c) A ftrip of copper $150\mu m$ thick is placed in a magnetic field B of magnitude $0.65T$, and a current $i = 23A$ is sent through the strip. What Hall potential difference V will appear across the width of the strip? The number of chrge carriers per unit volume of Copper is $8.49 \times 10^{28} m^{-3}$. **05**

Q.4(a) State Wiedemann-Franz law with its limitations. Give a derivation of Wiedemann-Franz Lorenz law for a thermal conduction. **20**

(b) State and explain Heisenberg's uncertainty principle with its significance. **08**

(c) Using the uncertainty principle, prove that electron cannot exist in a nucleus. **07**

Section-B

Q.5(a) Why population inversion is important in case of Laser phenomenon? **05**

(b) What is LASER? Give construction and working principle of He-Ne Laser. **12**

(c) Show that the energy density of a plane progressive wave is given by $= 2\pi^2 n^2 a^2 \rho$, where the symbols have their usual meanings. **14**

(d) What are free, damped and forced oscillations? **04**

Q.6(a) What is interference of light? Discuss the important condition for the interference of light. **10**

(b) Discuss interference of light analytically and obtain conditions of maximum and minimum intensities. **17**

(c) In a Young's double slit experiment the separation between the sources are 0.18 mm. The fringes are observed on a screen 100 cm away. If with certain monochromatic source of light, the 4^{th} bright fringe is situated at a distance of 8.1 mm from the central bright fringe. Find the wavelength of light. **08**

Q.7(a) Show that the intensity expression for Fraunhofer double slit diffraction phenomena is $I = 4R_0^2 \frac{Sin^2\beta}{\beta^2} Cos^2\delta$, where the symbols have their usual meanings and discuss the condition for maxima and minima pattern and draw the intensity distribution for the diffraction pattern. **20**

(b) Give the construction and theory of plane transmission grating and show how you would use it to find the wavelength of light. **10**

(c) Calculate the angle between the lamp filament and its first diffracted image produced by a fabric with 160 threads/cm. $\pi = 6000\text{Å}$. **05**

Q.8(a) Define simple harmonic motion and discuss its characteristics. **05**

(b) Obtain an expression for the resultant displacement of a particle which is being simultaneously acted upon by tow simple harmonic vibrations of same frequency but different phase and amplitude. What happens if the two vibration are (i) in the same phase and (ii) in opposite phase? **15**

(c) What are De-Broglie matter waves? Mention the factor on which the wavelength of the particle depends. **10**

(d) In a TV set, electron are accelerated by a p.d. of 10 kV. What is the wavelength associated with this electron? **05**

THE END

Exam Date: 28/03/2022

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Section-B

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(d) In a TV set, electron are accelerated by a p.d. of 10 kV. What is the wavelength associated with this electron? 05

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CHITTAGONG UNIVERSITY OF ENGINEERING AND TECHNOLOGY
B.Sc ENGINEERING LEVEL-I TERM SELF STUDY FINAL EXAMINATION '2020

DEPARTMENT : ELECTRONICS AND TELECOMMUNICATION ENGINEERING
FULL TITLE OF PAPER : Engineering Physics
COURSE NO. : PHY-181
FULL MARKS : 210
TIME : 3 HOURS

The figures in the right margin indicate full marks. Answer any THREE questions from each section. Use separate script for each section.

Section-A

Q.1(a) What are Bravais lattices? Describe the different types of crystal systems along with their characteristics. 10

(b) What are Miller indices? Show that in a crystal of cubic structure, the distance between the planes with Miller indices h,k,l is equal to $d_0 = \frac{a}{\sqrt{h^2 + k^2 + l^2}}$, where a is the lattice parameter. 15

(c) Deduce the density of lattice points in (100), (110) and (111) planes in Nacl cubic lattice which belongs to fcc lattice. Given that lattice parameter=5.63A^0, number of lattice points per unit cell=4. 10

Q.2(a) Explain the following : 06
(i) Ionic bonding
(ii) Covalent bonding
(iii) Metallic bonding

(b) Briefly discuss the various defects in a crystal. How does the defect in solid influence the properties of the solid? 17

(c) Explain the formation of the different energy bands in a solid and hence distinguish between insulator, a semiconductor and a conductor. 12

Q.3(a) How could you differ a photo-electric effect from Compton effect? 05

(b) What is photo-electric effect? Describe an experiment for studying the phenomenon of photo-electric emission and discuss the results obtained therefrom. How has this phenomenon been explained by Einstein? 18

(c) The stopping potential for electrons emitted from a metal due to photoelectric effect is found to be 1v for light of 2500A^0. Calculate the work function of the metal in eV. 06

(d) Explain De Broglie's hypothesis. What are the wavelengths of a 0.10kg ball moving at 35m/s and an electron moving at 1.0X10^7 ms^{-1}? Explain the results. 06

Q.4(a) Explain the following: 12
(i) Induced Absorption
(ii) Spontaneous emission and
(iii) Stimulated emission

(b) What is LASER? Describe the construction and working principles of a semiconductor laser. 15

(c) Discuss the effect of temperature on metal and semiconductor with some examples. 08

Section-B

Q.5(a) Explain the defects astigmatism, coma and curvature. Explain how they may be minimized. 10

(b) What are coherent sources? Write down the conditions of interference. 08

(c) Prove that the distance X, between two successive bright or dark fringes is given by $X = \frac{D\lambda}{d}$ 17

Q.6 (a) Distinguish between the Fresnel and Fronhofer classes of diffraction. 08

(b) Show that the intensity expression for Fraunhofer diffraction by a single slit is 20

$$I = R_0^{\,2} \frac{Sin^2 \beta}{\beta}$$

(c) How many orders will be visible if the wavelength of incident radiation is 5000 A.U and the number of lines on the grating is 14000 per inch? 07

Q.7(a) What is meant by the term polarization of light? Distinguish between ordinary light and polarized light. 05

(b) State and explain Brewster's law. Show that at the polarized angle of incidence, the reflected and refracted rays are mutually perpendicular to each other. 20

(c) Describe the construction and use of a Nicol prism and explain how it produces plane polarized light. 10

Q.8(a) Explain simple harmonic motion. Obtain the expression for the frequency, amplitude, velocity and acceleration of a body executing simple harmonic motion. 10

(b) Explain how two simple harmonic motion vibrations acting simultaneously on a particle in mutually perpendicular directions can be compounded. Deduce an expression for the resultant vibrations. 15

(c) Two simple harmonic motion acting simultaneously on a particle are given by the equations 10

$$Y_1 = 2\sin(wt + \frac{\pi}{6})$$

$$Y_1 = 3\sin(wt + \frac{\pi}{3})$$

Calculate the amplitude and phase constant of the resultant vibrations.

THE END

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$$Y_1 = 3\sin(wt + \frac{\pi}{3})$$

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THE END

CHITTAGONG UNIVERSITY OF ENGINEERING AND TECHNOLOGY
B. Sc. ENGINEERING LEVEL-I SELF STUDY EXAMINATION 2019

DEPARTMENT : ELECTRONICS AND TELECOMMUNICATION ENGINEERING
FULL TITLE OF PAPER : Engineering Physics
COURSE NO. : PHY 181
FULL MARKS : 210
TIME : 3 HOURS

The figures in the right margin indicate full marks. Answer any THREE questions from each section. Use separate script for each section.

Section-A

Q.1(a) What is the photo-electric effect? Deduce the Einstein's photo-electric equation and explain it on the basis of quantum theory. 10

(b) Describe different factors on which photoelectric effect depends. 08

(c) Explain the operation of a He-Na laser with essential components. 12

(d) Find the kinetic energy of a photon whose De- Broglie wavelength is 1 fm. 05

Q.2(a) What do you mean by a crystal lattice? With the help of an example distinguish between crystal lattice and crystal structure. 06

(b) What is the packing fraction? Calculate packing fraction for BCC and FCC. 13

(c) Draw (110) and (111) planes and (110) and (111) directions in a simple cube crystal. What do you infer from these diagrams? 08

(d) The Bragg angle corresponding to first order reflection from (111) plane in a crystal is 30^{o} when X-rays of wavelength 1.75 Å are used. Calculate the interatomic spacing. 08

Q.3(a) Describe Wiedemann-Franz law for a material which consists of freely moving electrons. 18

(b) How you can calculate electron density and mobility in material using Hall effect measurement system? 12

(c) What is the applied electric field that will impose a drift velocity equal to 0.1 percent of the mean speed μ ($\sim 10^{6}$ ms^{-1}) of conduction electrons in Copper? What is the corresponding current density and current through a Cu wire of diameter 1mm? 05

Q.4(a) Describe the Schrodinger time dependent wave equation. 10

(b) Derive an expression for the energy levels of a particle enclosed within infinite potential well. 15

(c) Consider an electron confined to a region of size 0.1 nm, which is the typical dimension of an atom. What will be the uncertainty in its momentum and hence its kinetic energy? 10

Section-B

Q.5(a) What is meant by aberration? Write down the different kinds of aberration. 10

(b) What is meant by a different grading? Give the theory of the formation of spectra with a phase transmission grating and show how you would use it to find the wavelength of light. 20

(c) How many orders will be visible if the wavelength of the incident radiation is 500 Å and the number of lines on the grating is 2540 in one inch? 05

Q. 6(a) Define group velocity and phase velocity. Hence establish the relation between them. 11

(b) Show that the energy (E) of a plane progressive wave is $2\pi^2x^2a^2c$, where the symbols have their usual meaning. 12

(c) Deduce the resultant vibration of a particle influenced by two mutually perpendicular simple harmonic motions having the same amplitude but differing in phase by $\pi/4$. 12

Q.7(a) Describe an experiment that can prove that wave is transverse in nature. 07

(b) What is quarter wave plate? Deduce its thickness for a given wavelength in terms of its reflective indices. 15

(c) Explain the phenomenon of double refraction in a calcite crystal. 07

(d) Find the thickness of a quarter wave plate when the wavelength of light is 5890 Å. $\mu_E = 1.553$ *and* $\mu_o = 1.544$. 06

Q.8(a) What you mean by coherent sources? Derive a relation between path difference and phase differences. 08

(b) Prove that the distance β between two successive bright fringes formed in Young's experiment is given by $\beta = \frac{\lambda D}{d}$ where the symbols have their usual meaning. 20

(c) Green light of wavelength 5100 Å from a narrow slit is incident on a double slit. If the overall separation of 10 fringes on a screens 200 cm away is 2cm. Find the slit separation. 07

THE END

CHITTAGONG UNIVERSITY OF ENGINEERING AND TECHNOLOGY
B.Sc ENGINEERING LEVEL-I TERM-II (17 BATCH) EXAMINATION '2018

DEPARTMENT : ELECTRONICS AND TELECOMMUNICATION ENGINEERING
FULL TITLE OF PAPER : Engineering Physics
COURSE NO. : PHY181
FULL MARKS : 210
TIME : 3 HOURS

The figures in the right margin indicate full marks. Answer any THREE questions from each section. Use separate script for each section.

Section-A

Q.1(a) What do you understand by space lattice? With the help of an example distinguish between crystal lattice and crystal structure. 06

(b) What do you mean by defects in crystal? How many types of defects can exist in a crystal? Discuss different types of point detects. 18

(c) Draw (110) and (111) planes and (110) and (111) directions in a simple cubic crystal. 04

(d) Calculate the glancing angle on the cubic (100) of a rock salt ($a=2.814A^0$) corresponding to second order diffraction maximum for x-rays of wavelength $0.710A^0$. 07

Q.2(a) Describe the classical Drude model to explain electric conductivity. 12

(b) Calculate the drift mobility and the mean scattering time of conduction electrons in copper at room temperature, given that the conductivity of copper is $5.9\times10^5\Omega^{-1}cm^{-1}$. The density of copper is 8.96 gcm^{-3} and its atomic mass is 63.5 $gmol^{-1}$. 08

(c) How electron density and mobility of a material can be calculated using Hall effect measurement system? 10

(d) Mention various importance of Hall effect. 05

Q.3(a) Describe the Schrodinger time dependent wave equation. 10

(b) Derive an expression for the energy levels of a particle enclosed within infinite potential well. 15

(c) Consider an electron in an infinite potential well of size 0.1 nm. What is the ground energy of the electron? 10

Q.4(a) What is Compton shift? Prove that the Compton shift 18
$\Delta\lambda = \frac{h}{m_0 c}(1-\cos\theta)$. Where the symbols have their usual meanings.

(b) Explain the operation of a He-Ne laser with the essential components. How simulated emission takes place with the exchange of energy between He and Ne atoms 12

(c) Which voltage must be applied to an electron microscope to produce electrons of wavelength $0.40A^0$. 05

Section-B

Q.5(a) Describe and explain the phenomenon of interference in thin flims. Give necessary theory. Why do colours appears in thin flim in white light? 15+5=20

(b) State and explain Huygens principle of secondary waves. 08

(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 thickness of the air film. 07

Q.6(a) What is meant by diffraction of light? Distinguish between Fresnel and Fraunhofer classes of diffraction. 08

(b) Describe and explain Fraunhofer diffraction pattern produced by a single slit illuminated by nano-chromstic light and find the conditions for minima and maxima. 20

(c) Deduce the missing orders for a double slit Fraunhofer diffraction pattern. If the slits widths are 0.16 mm and they are 0 8 mm apart. 07

Q.7(a) Two thin convex lenses of focal length f_1 and f_2 are placed co-axially in air in a certain distance 'd' apart. Show that their equivalent focal lengths 'f' is given by $\frac{1}{f} = \frac{1}{f_1} + \frac{1}{f_2} - \frac{d}{f_1 f_2}$ 17

(b) Show that, when light is incident on an transparent substance at the polarising angle, the reflected and the refracted rays are mutually perpendicular to each other. 08

(c) What is Nicol prism? How it be used as a polarizer and as an analyser. 10

Q 8(a) What are the Lissajous figures? Find the resultant of two simple harmonic S.H.M motions of right angles to each other having equal frequencies but different in phase and amplitudes. Analytically discuss the different important case. 4+18 22

(b) An object executes SHM, whose displacement x varies with time t according to the relation; $x = 5.0 \sin(2\pi t - \pi/2)$ 09
Where x is in centimeters and t is in seconds.

i) velocity Acceleration at t

(c) What are the free, damped and forced oscillation? 04

ii) displacement, velocity, acceleration at , t = 2 sec.

iii) max speed max acceleration.

THE END

CHITTAGONG UNIVERSITY OF ENGINEERING AND TECHNOLOGY
B.Sc ENGINEERING LEVEL-1 TERM-II EXAMINATION '2017

DEPARTMENT	: ELECTRONICS AND TELECOMMUNICATION ENGINEERING
FULL TITLE OF PAPER	: Engineering Physics
COURSE NO.	: PHY181
FULL MARKS	: 210
TIME	: 3 HOURS

The figures in the right margin indicate full marks. Answer any THREE questions from each section. Use separate script for each section.

Section-A

Q.1(a) What do you mean by coherent sources? Derive a relation between path difference and phase difference. 08

(b) Establish the expression of phase difference for both constructive and destructive interference due to a reflected light from a plan parallel thin film. 22

(c) In Young's double slit experiment the separation of the slits is 1.9 mm and the fringe spacing is 0.31 mm at a distance of 1 m from the slits. Calculate the wavelength of light. 05

Q.2(a) What is meant by aberration? Write down the different kinds of aberration. 12

(b) Give the construction and theory of plane transmission grating and show how you would use it to find the wavelength of light. 18

(c) Interference fringes are observed with a bi-prism by refracting angle 1^0 and refractive index 1.5 on a screen 80 cm away from it. if the distance between the source and bi-prism is 20 cm .Calculate the fringe width when the wavelength of light used is (i) 6900 ^{0}A ((ii) 5890^{0}A. 05

Q.3(a) Describe an experiment that can prove that light wave is transverse in nature. 07

(b) State Brewster law. Show that at the polarizing angle of incidence, the reflected and refracted rays are mutually perpendicular to each other. 15

(c) Explain the phenomenon of double refraction in a calcite crystal. 07

(d) How will you orient the polarizer and analyzer so that a beam of natural light is reduced to (i) 0.5 and (ii) 0.75 of its original intensity? 06

Q.4(a) State the basic postulate of Einstein's special theory of relativity. 05

(b) Deduce Lorentz transformation equation by describing every terms and constants. 20

(c) Show that an interval of time observed in a moving frame of reference will be less than the same interval of time observed in a stationary frame of reference. 10

Section-B

Q.5(a) Deduce the resultant vibration of a particle influenced by two mutually perpendicular simple harmonic vibrations having the same amplitude but differing in phase by (i) 0 (ii) $\pi/4$ (iii) $\pi/2$ (iv) π. 16

(b) Show that the group velocity is given by the following expression 10

$V_g = V_p - \lambda \frac{dv_p}{d\lambda}$, Where the symbols have their usual meaning.

(c) Two SHM acting simultaneously on a particle are given by the equations: 09

$$y_1 = 2\sin\left(\omega t + \frac{\pi}{6}\right)$$

and $$y_2 = 3\sin\left(\omega t + \frac{\pi}{3}\right)$$

Calculate i) amplitude ii) phase constant and iii) time period of the resultant vibration.

Q. 6(a) What is meant by Doppler effect in sound? 05

(b) Deduce an expression for the apparent frequency due to Doppler effect when the source and observer are moving. 15

(c) A car sounding a horn producing a node of 500 Hz approaches and then passes a stationary observer at a steady speed of 20 m/sec. What will be the frequencies apparent to the observer when the car is i) approaching and ii) Receding? (velocity of sound =340 m/sec). 08

(d) What are the sound waves? Mention the applications of ultrasonic waves. 07

Q.7(a) What is Compton shift? How does it support the photon nature of light. 08

(b) Prove that Compton shift 20

$\Delta\lambda = \frac{h}{m_0 c}(1 - \cos\theta)$ Where the symbols have the usual significance.

(c) A beam of gamma radiation having photon energy 510 KeV is incident on a foil aluminum .Calculate the wavelength of radiation at 90^0. 07

Q.8(a) What is meant by fiber optics? Mention some application of fiber optics. 10

(b) Describe the phenomena of travelling mechanism of a ray in a single mode optical fiber. 15

(c) Consider a multimode step index fiber with n_1=1.53 and n_2=1.5, and λ=1 um. If the core radius is 50 um then calculate the normalized frequency of the fiber (V) and number of guided mode. 10

THE END

Chittagong University of Engineering & Technology
Department of Electronics & Telecommunication Engineering
Level 1,Self Study, Examination-2016-17

COURSE TITLE : Engineering Physics
COURSE NO. : PHY181
FULL MARKS : 210
TIME : 3 HOURS

The figures in the right margin indicate full marks. Answer any THREE questions from each section.

SECTION A

1(a). State the basic postulates of Einstein's special theory of relativity. 05

1(b). Discuss the Michelson-Morley experiment and explain the physical significance of negative results. 22

1(c). At what speed should a clock be moved so that it may appear to lose 01 minute in each hour? 08

2(a). What is the photoelectric effect? Deduce the Einstein's photoelectric effect equation and explain it on the basis of quantum theory. 12

2(b). Describe different factors on which photoelectric effect depends. 10

2(c). What is the De-Broglie's concept of matter waves? Find as expression for the velocity of De-Broglie waves. 08

2(d). Find the kinetic energy of a photon whose De-Broglie wavelength is 1 fm. 05

3(a). What is meant by Doppler effect in sound? Deduce an expression for the apparent frequency due to Doppler effect when the source and observer are moving. 14

3(b). Calculate the frequency heard by a stationary listener when an ambulance passes him at speed of 25 m/s: i) When the ambulance is moving towards him, ii) When the ambulance is moving away from him. 06

3(c). Show that the group velocity is given by the following expressions: 09

$v_g = v_p - \lambda \frac{dv_p}{d\lambda}$, when the symbols have their usual meanings.

3(d). A particle perform simple harmonic motion given by the equation y= 20sin($wt+\alpha$), if the time period is 20 sec. and particle has a displacement of 10 cm at t=0, find:- i) Epoch, ii) The phase angle at t=5 sec. and iii) The phase difference between two positions of the particle 15 seconds apart. 06

4(a). What is meant by fibre optics? What is "ray model" and how light is propagated in an optical fibre? 10

4(b). Derive an expression for the Schrodinger time independent wave equation. 15

4(c). An electron is bounded by a potential which closely approaches an infinite square wall of width 2.5×10^{-10} m. Calculate the lowest three permissible quantum energies the electron can have. 10

SECTION-B

5(a). What is meant by the term achromatism? Derive and discuss the condition of achromatism for two thin lenses in contact. 18

5(b). Two thin convex lenses of focal lengths f_1 and f_2 are placed co-axially in air in a certain distance 'd'apart. Show that their equivalent focal length 'f' is given by $1/f = 1/f_1 + 1/f_2 - d/f_1 f_2$ 17

6(a). What do you mean by fringe width? Show that for bright and dirk fringe, the fringe width is $X = \frac{\lambda_D}{d}$, where the symbols have their usual meanings. 20

6(b). Describe the construction of Nicol prism and explained how it can be used as a polarizer and analyzer. 15

7(a). Distinguish between interference and diffraction of light. 08

7(b). Derive the intensity expression for Fraunhofer single slit diffraction and draw the intensity distribution for the diffraction pattern. 22

7(c). Deduce the missing orders for a double slit Fraunhofer diffraction pattern if the widths are 8.8×10^{-3} cm and they are 4.4×10^{-2}cm apart. 05

8(a). Show that the principle of conservation of energy is obeyed by a harmonic oscillator. 10

8(b). What areLisajous figures? Find the resultant of two simple harmonic motions of equal periods when they act at right angle to one another. Analytically discuss the different important cases. 17

8(c). Show that $\frac{\partial^2 y}{\partial t^2} = v^2 \frac{\partial^2 y}{\partial x^2}$, where the symbols have their usual meanings. 08

----------THE END----------

CHITTAGONG UNIVERSITY OF ENGINEERING AND TECHNOLOGY
B.Sc ENGINEERING LEVEL-I TERM-II FINAL EXAMINATION '2016

DEPARTMENT : ELECTRONICS AND TELECOMMUNICATION ENGINEERING
FULL TITLE OF PAPER : Engineering Physics
COURSE NO. : PHY181
FULL MARKS : 210
TIME : 3 HOURS

The figures in the right margin indicate full marks. Answer any THREE questions from each section. Use separate script for each section.

Section-A

Q.1(a) What is meant by Doppler effect in sound? Deduce an expression for the apparent frequency due to Doppler effect when the source and observer are moving. 15

(b) A car is travelling towards you at 16 ms^{-1} sounding its hoofer with a frequency of 320 Hz. The velocity of sound is 330 ms^{-1}. What is the frequency of the sound that you will hear? 05

(c) Describe the phenomena of travelling mechanism of a ray in a single mode optical fibre. 15

Q.2(a) State the basic postulates of Einstein's special theory of relativity. 06

(b) Deduce Lorentz-Einstein's transformation by describing every terms and conditions. 22

(c) Calculate the mass of a body when its speed is 0.8 times the speed of light. Assume the rest mass of the body to be one gram. What will be its momentum at this speed? 07

Q.3(a) Discuss the nature of dé Broglie wave associated with a particle in motion. Prove that the di Broglie wavelength associated with a particle having kinetic energy K which is not negligible compared to its rest energy m_0c^2, is given by 14

$$\lambda = (h/\sqrt{2m_0k})(1+k/2m_0c^2)^{-1/2}$$

(b) Derive the time-independent-Schrodinger equation for a particle. Given the physical meaning of the wave function, what is meant by normalized wave function? 21

Q.4(a) What is meant by photo-electric effect? Deduce the Einstein's photo-electric equation. 15

(b) Using the experimental apparatus shown in Figure 4(b), when ultraviolet light with a wavelength of 240 nm shines on a particular metal plate, electrons are emitted from plate 1, crossing the gap to plate 2 and causing a current to flow through the wire connecting the two plates. The battery voltage is gradually increased until the current in the ammeter drops to zero, at which the battery voltage is 1.40 V. 20

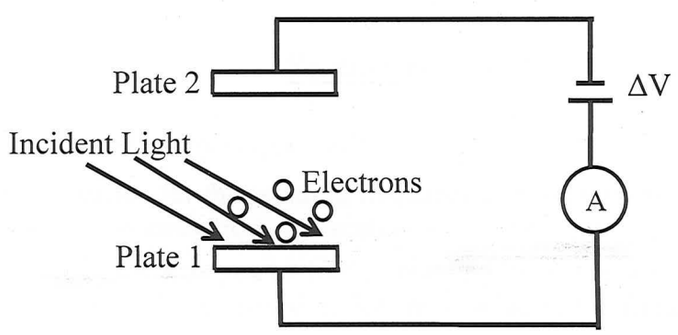

Fig. 4 (b)

Answer the following questions:

i) What is the energy of the photon in the beam of light, in eV?
ii) What is the maximum kinetic energy of the emitted electrons in eV?
iii) What is the work function of the metal, in eV?
iv) What is the longest wavelength that would cause electron to be limited for this particular metal?
v) Is this wavelength in the visible spectrum? If not, in what part of the spectrum is this light found?

Section-B

Q.5(a) Obtain an expression for refraction at a single spherical surface. Hence derive the lens maker's formula. 18

(b) Two thin convex lenses of focal length 20 cm and 5 cm are placed 10 cm apart. Calculate the equivalent focal length and find the position of the principal points of the combinations. 07

(c) Distinguish between spherical aberration and chromatic aberration. 10

Q.6 (a) What are the coherent-sources? Describe the theory of interference fringes and hence find an expression for the fringe width. 19

(b) Distinguish between Fresnel and Fraunhoffer class of diffraction. 08

(c) A thin convex lens of focal length 4m and refractive index 1.5 rests on and in contact with an optical flat, and using light of wavelength 5460Å, Newton's rings are viewed normally by reflection. What is the diameter of the 7^{th} bright ring? 08

Q.7(a) Describe the Fraunhoffer diffraction of light due to a single slit and hence find an expression for the width of central maximum. How does this pattern differ from that due to a double slit? 22

(b) Distinguish between interference and diffraction phenomena. 06

(c) A plane diffraction grating used at normal incidence gives a line, $\lambda_1 = 6000\,\text{Å}$ in a certain order superimposed on another line $\lambda_2 = 4500\,\text{Å}$ of the next higher order. If the angle of diffraction is 30°, how many lines are there in a cm in the grating? 07

Q.8(a) What is meant by plane of polarization? State and explain Brewster's law. 11

(b) Describe a nicol prism and show how it can be used for the study of polarization of light. 18

(c) If the plane of vibration of the incident beam makes an angle 30° with the optic axis, compare the intensities of extraordinary and ordinary light. 06

THE END

CHITTAGONG UNIVERSITY OF ENGINEERING AND TECHNOLOGY
B.Sc ENGINEERING LEVEL-I TERM-II FINAL EXAMINATION '2015

DEPARTMENT : ELECTRONICS AND TELECOMMUNICATION ENGINEERING
FULL TITLE OF PAPER : Engineering Physics
COURSE NO. : PHY181
FULL MARKS : 210
TIME : 3 HOURS

The figures in the right margin indicate full marks. Answer any THREE questions from each section. Use separate script for each section.

Section-A

Q.1(a) What do you mean by aberration? Classify it and explain the causes of spherical aberration fully and the methods to minimize it. 20

(b) What do you mean by an equivalent tens and equivalent focal length? Explain it. Find an expression for the focal length of two thin lenses placed in contact. 15

Q.2(a) Illustrate the mechanism of interference by a thin film and hence find out the conditions for constructive and destructive interference. 15

(b) Describe Young's double-slit experiment and derive and expression for fringe width $x = \frac{D\lambda}{d}$. 15

(c) In a Newtons ring experiment with air film, the diameter of the 15^{th} dark ring is 0.59 cm. On introducing a liquid film in between the glass plate and the curved surface plate, it diameter decreases by 0.09 cm. What is the refractive index of the liquid? 05

Q.3(a) Describe the construction and use of a Nicol prism and explain how it produces plane polarized light. 15

(b) Explain Brewsters law. Show from this law that when light is incident in a transparent substances at the polarizing angle, the reflected and refracted rays are perpendicular to each other. 15

(c) Determine the specific rotation of given sample of sugar solution if the plane of polarization is turned through 13.2^0. The length of the tube contauning10% sugar solution is 20cm. 05

Q.4(a) Establish the differential equation of simple harmonic motion and solve it to obtain an expression for the displacement of a particle executing simple harmonic motion. 18

(b) Define group velocity and phase velocity. Hence establish the relation between them. 07

(c) A simple harmonic motion is represented by $y = 10\sin\left(10t - \pi/6\right)$, where y is measured in meters, t is second and phase angle is in radians. Calculate (i) frequency (ii) time period (iii) the maximum displacement (iv) the maximum velocity (v) the maximum acceleration. 10

Section-B

Q.5(a) What do you understand by Doppler effect in sound? 10

(b) Deduce an expression for the apparent frequency due to Dopplers effect when the source is moving away from the receiver. 20

(c) A car is travelling towards you as 16m/s sounding its hooter with a frequency of 320 Hz. The velocity of sound is 330 m/s. What is the frequency of the sound that you will hear? 05

Q.6 (a) State the fundamental postulates of special theory of relativity. 06

(b) Deduce Lorentz-Einstein transformation equations. 22

(c) At what speed the mass of an object will be double of its value at rest. 07

Q.7(a) What is meant by Compton effect? Show that the theory of Compton effect $\Delta\lambda = \frac{h}{m_0 c}(1-\cos\theta)$, when the symbols have their usual meanings. 18

(b) Deduce an expression of the time independent Schrodinger wave equation. 12

(c) In a Compton experiment, the wavelength of X-ray radiation Scattered at an angle of 45^0 is $0.022A^0$. Calculate the wavelength of incident X-rays. 05

Q.8(a) What is absorption, spontaneous emission and stimulated emission? 06

(b) Describe the basic construction, principle and production of He-Ne laser. 16

(c) Meridional rays are classified as either bound or unbound rays. Bound rays propagate through fiber according to what property? 13

THE END

CHITTAGONG UNIVERSITY OF ENGINEERING AND TECHNOLOGY
B.Sc ENGINEERING LEVEL-I TERM-II FINAL EXAMINATION '2014

DEPARTMENT	: ELECTRONICS AND TELECOMMUNICATION ENGINEERING
FULL TITLE OF PAPER	: Engineering Physics
COURSE NO.	: PHY181
FULL MARKS	: 210
TIME	: 3 HOURS

The figures in the right margin indicate full marks. Answer any THREE questions from each section. Use separate script for each section.

Section-A

Q.1(a) What in meant by the term achromatism? Derive and discuss the conditions of achromatism for two thin lenses in contact. 17

(b) Two thin convex lenses of focal lengths f_1 and f_2 are placed coaxially in air in a certain distance 'd' apart. Show that their equivalent focal lengths 'f' is given by $\frac{1}{f}=\frac{1}{f_1}+\frac{1}{f_2}-\frac{1}{f_1 f_2}$ 18

Q.2(a) Discuss the interference of light analytically and obtain the conditions of maximum and minimum intensities. 12

(b) Describe Young's double-slit experiment and derive and expression for fringe width $x=\frac{D\lambda}{d}$. 15

(c) How will you use Michelson's interferometer to determine the difference between two wavelengths very close to each other? 06

Q.3(a) Describe the arrangement of Michelson-Morley experiment and show the calculation of this experiment. Hence explain the findings of their experiment. 18

(b) Deduce Einstein mass-energy relation. Discuss its physical significance. 12

(c) The rest mass of an electron is 9.1×10^{-31} kg. Calculate it's mass if it were moving with a speed of 4/5th the speed of light. 05

Q.4(a) Define quarter-wave plate and half wave plate. Derive an expression for both of them. 10

(b) Describe the construction and use of a Nicol prism and explain how it produces plane produced light. 12

(c) Discuss the Fraunhofer diffraction at a single slit. Draw the intensity distribution for the diffraction pattern. 13

Section-B

Q.5(a) What are spontaneous emission, stimulated emission and population inversion? 12

(b) What are the characteristics of laser beam? Write the basic principle and production of He-Ne laser. 17

(c) Describe some technological applications of laser. 06

Q.6 (a) Distinguish between particle velocity and wave velocity and obtain the following relation connecting them: $u=-v\frac{dy}{dx}$. Where, 'u' is the particle velocity, 'v' is the wave velocity. 12

(b) Show that the energy of a plane progressive wave is given by: $E= 2\pi\rho n^2 a^2$ where the symbols have their usual meanings. 13

(c) Two simple harmonic motions acting simultaneously on a particle are given by the equations: 10

$$y_1 = 2\sin\left(\omega t + \frac{\pi}{6}\right)$$

$$y_2 = 3\sin\left(\omega t + \frac{\pi}{3}\right)$$

Calculate i) amplitude ii) phase iii) time period of the resultant vibration. What is the equation of the resultant vibration?

Q.7(a) What is meant by fibre optics? What is 'ray model" and how light is propagated in an optical fibre? 15

(b) Describe the phenomena of travelling mechanism of a ray in a single mode optical fibre. 20

Q.8(a) What is meant by Doppler effect in sound? 05

(b) Deduce and expression for the apparent frequency due to Doppler's effect when the source and observer are moving. 20

(c) A car sounding a horn producing a node of 500Hz, approaches and then passes a stationary observer at a steady speed of 20m/sec. What will be the frequencies apparent to the observer when the car is i) approaching and ii) receding? (velocity of sound =340m/sec) 10

THE END

CHITTAGONG UNIVERSITY OF ENGINEERING AND TECHNOLOGY
B.Sc ENGINEERING LEVEL-I TERM-II FINAL EXAMINATION '2013

DEPARTMENT	: ELECTRONICS AND TELECOMMUNICATION ENGINEERING
FULL TITLE OF PAPER	: Engineering Physics
COURSE NO.	: PHY-181
FULL MARKS	: 210
TIME	: 3 HOURS

The figures in the right margin indicate full marks. Answer any THREE questions from each section. Use separate script for each section.

Section-A

Q.1(a) What in meant by an equivalent lens and equivalent focal length? Find the expression for the equivalent focal length (f) of two coaxial thin convergent lenses of focal length f_1 and f_2 separated by a distance'd' in air. 17

(b) Explain Spherical aberration, Astigmatism, Coma and Chromatic aberration with required ray diagram 4×4.5 =18

Q.2(a) Illustrate the mechanism of interference by a thin film and hence find out the conditions for constructive and destructive interference. 14

(b) Define Brewester's angle with diagram. 'How does a Nicol Prism work'- Explain. 05+10 =15

(c) In a biprism experiment, the bands, 0.0196 cm in width are observed at a distance of 100cm from the slit. A converse lens is then put at 30cm from the slit so as to give two images of the source 0.70cm apart. Calculate the wave-length of the light used. 06

Q.3(a) Describe 'Michelson-Morley' experiment with proper diagram and give the interpretation of its result. 18

(b) Deduce the relation, $E=mc^2$, where the symbols have their usual meanings. 12

(c) Calculate the rest energy of an electron. Rest mass of electron=9.1×10^{-31} kg. 05

Q.4(a) State Heisenberg's uncertainty principle and hence prove that an electron cannot exit inside the nucleus. 05+06 =11

(b) Describe Bohr's theory of Hydrogen atom and derive the general expression for the frequency of Hydrogen spectrum. What will be the form of this expression for Balmer series? 18+06 =24

Section-B

Q.5(a) What are the basic properties of a laser beam? Outline the principle and production of He-Ne laser. 17

(b) Describe phenomenon of travelling mechanism of a ray in a single mode optical fiber. 18

Q.6 (a) Two mutually perpendicular simple harmonic motions represented by $x = a \sin(\omega t + \alpha)$ and $y = b \sin \omega t$ (where the symbols have their usual meanings), acting simultaneously on a particle. Find the displacement equation of the particle for the different possible values of epoch. 27

(b) A body describing simple harmonic motion has a maximum acceleration of 8π m/s^2 and a maximum speed of 1.6m/s. Find the period and amplitude. 08

Q.7(a) Explain clearly Doppler's effect in sound. 05

(b) Show that the change in frequency due to this effect when the source and the listener are i) moving towards each other, and ii) moving away from each other. 20

(c) A train approaches a stationary observer at a speed of 75km/hr sounding a whistle of frequency 1000Hz. What will be the apparent frequency of the whistle to the observer? (velocity of sound 330 m/sec) 10

Q.8(a) How can the 'Compton Scattering' ensure the corpuscular properties of radiation? Explain and find an expression for Compton wavelengths. 25

(b) Define 'Nuclear Binding Energy'. Calculate the binding energy of an α-particle and the result both in Mev and Joules. 10

THE END

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