Heaven's Light is Our Guide

Rajshahi University of Engineering & Technology

B.Sc. Engineering 1st Year Even Semester Examination, 2014

Department of Computer Science & Engineering

Course no: **Phy 1213** Course Title: Physics

Full marks: 72 Time: Three (03) hours

N.B. Answer **six** questions, taking **three** from each section.
The questions are of equal value.
Use separate answer script for each section.

SECTION-A

Q1. (a) Name different types of crystal system and write down the restrictions on conventional cell axes and angles of tetragonal and hexagonal structure. 03

(b) Explain how atoms are arranged in a crystalline solid. 03

(c) Write Bragg's law of x-ray diffraction in crystals. How is it verified? 03

(d) Draw a schematic diagram of the unit cell for the simple, body centred cubic and face centred cubic lattices. 03

Q2. (a) What is meant by thin film interference? Why do colors appear in thin film in white light? 04

(b) Explain the formation of coherent sources in the case of bi-prism. How is the separation between such coherent sources measured in the experiment with a bi-prism? 05

(c) A bi-prism is placed 5cm from a slit illuminated by Na-light. The width of the fringes obtained on a screen 75cm from the prism is 9.42×10^{-2} cm. Find the distance between the two coherent sources. 03

Q3 (a) Distinguish between Fresnel and Fraunhofer classes of diffraction. 03

(b) Discuss the Fraunhofer diffraction at a single slit and show that the intensity of the first secondary maxima is roughly 4.5% of that of principle maxima. 06

(c) Give the construction of a plane transmission grating. What is grating constant? 03

Q4. (a) Give the name of various methods of producing plane-polarized light. 02

(b) Explain Brewster's law. Show that at the polarizing angle of incidence the reflected and refracted rays are mutually perpendicular to each other. 04

(c) Describe the construction of a nicol prism and show how it can be used as a polarizer. 04

(d) Explain the properties of the refracted rays inside a double refracting crystal. 02

SECTION-B

Q5. (a) State and explain the fundamental postulates of Bohr's atom model. Explain the various series in the hydrogen spectrum on the basis of this model. 06

(b) Describe Rutherford's atom model. What are the drawbacks of this model? 03

(c) The series limit of the Balmer for hydrogen is 3.65×10^{-5} cm and an element is found to give k-series wavelength of 10^{-8} cm. Find the atomic number of the element. 03

Q6. (a) What are he main features of photoelectric effect? How can Planck's constant be determined by using this effect? 06

(b) Obtain expression for the kinetic energy and direction of the recoil electron in Compton scattering. Why Compton effect is experimentally observed for visible light rays? 06

Q7. (a) Show that the uniform motion of a particle along the circumference of a circle can be regarded as a combination of two simple harmonic motions. 03

(b) Show that the motion of a simple pendulum is simple harmonic. 03

(c) Explain how power dissipates in a damped oscillator. Show that both kinetic and potential energies of a damped oscillator decreases exponentially with time. 06

Q8. (a) Derive the equation of forced vibrations and discuss the conditions of resonance. Explain sharpness of resonance. 06

(b) Distinguish between particle velocity and wave velocity. 03

(c) Discuss the characteristics of stationary waves. How do they differ from progressive waves? 03

Heaven's light is our guide

Rajshahi University of Engineering & Technology

B.Sc. Engineering 1st Year 2nd Semester Examination, 2013

Department of Computer Science & Engineering

Course no: **Ph 207** Course Title: **Physics**

Full marks: **70** Time: **Three (03)** hours

N.B. **Answer six questions, taking three from each section.**
The questions are of equal value.
Use separate answer script for each section.

SECTION-A

Q1. (a) What are Lissajous figures? What are the parameters the shape of Lissajous figures depends on? 03

(b) A small body of mass 0.10 kg is undergoing simple harmonic motion of amplitude 1.0 meter and period 0.20 sec. What is the maximum value of the force acting on it? 03

(c) Find the resultant displacement of a particle simultaneously influenced by two mutually perpendicular simple harmonic vibrations, having the same amplitude but differing in phase by (i) 0, (ii) $\pi/2$ and (iii) π $5\frac{2}{3}$

Q2. (a) What are damped vibrations? What are the opposing forces acting on a body executing simple harmonic motion in a damping medium? 02

(b) Obtain the solution of the differential equation of a damped harmonic oscillator. Discuss in detail the condition for which the oscillation becomes oscillatory. $5\frac{2}{3}$

(c) What is quality factor? Show that the less the damping, the better the quality of the harmonic oscillator in so far damping is concerned. 04

Q3 (a) Write down the characteristics of wave motion. 02

(b) Show that the energy of a plane progressive wave is given by, $E=2\pi^2\rho n^2a^2$, Where the symbols have their usual meanings. $5\frac{2}{3}$

(c) What are nodes and antinodes? Show that two successive nodes or antinodes are always separated by a distance of half wavelength. 04

Q4. (a) Why the photo-electrons do not have as much energy as the quantum of light which causes its ejection? 02

(b) Derive Einstein's photo-electric equation. How does it explain the laws of photo electric emission? $4\frac{2}{3}$

(c) Is it possible to liberate an electron from a metal surface having work function 4.8 eV with an incident radiation of wave length (i) 2000Å and (ii) 5000 Å? 03

(d) What are the fundamental laws of photo-electric emission? 02

SECTION-B

Q5. (a) Derive an expression for de-Broglie wave length of a matter particle. 03

(b) Define phase velocity and group velocity of a wave packet. Derive a relation between them. $5\frac{2}{3}$

(c) What is Photon? Show that the rest mass of the photon is zero. 03

Q6. (a) Briefly explain the nature of the nuclear forces. 02

(b) Define binding energy of a nucleus. Draw the binding energy per nucleon versus mass number curve and discuss its nature. $4\frac{2}{3}$

(c) What is nuclear fission? What is the source of release of energy in nuclear fission? 03

(d) Calculate the mass of deuterium nucleus if the binding energy per nucleon is 1 Mev. Given, M_p=1.00758 amu and M_n=1.00898 amu. 02

Q7. (a) Give the theory of successive disintegration of radioactive substances. Hence distinguish between secular and transient equilibria. $6\frac{2}{3}$

(b) Explain the mass and kinetic energy relation in alpha decay. 03

(c) The half life of radon is 3.8 days. After how many days will only 5% of radon left over? 02

Q8. (a) Discuss the negative result of the Michelson-Morley experiment and how it led to the special theory of relativity? $3\frac{2}{3}$

(b) Mathematically prove the idea that, "Mass is a form of energy". 06

(c) A photon is traveling east and another photon is traveling west. Find the relative velocity of the two photons. 02

THE END

Rajshahi University of Engineering & Technology
B.Sc. Engineering 1st Year ... Semester Term Examination, 201...
Department of Computer Science and Engineering
Course no: Phy 2... Course Title: Physics
Full marks: 70 ... Time: Three (03) hours

N.B. Answer six questions, taking three from each section.
The questions are of equal value
Use separate answer script for each section.

SECTION A

			Marks
Q1.	(a)	What is called simple harmonic motion (SHM)? Show that the motion of a body suspended from a coil spring is simple harmonic.	04
	(b)	Find the solution for the displacement in the case of forced vibration.	04
	(c)	A particle performs simple harmonic motion given by the equation $y = 20\sin(\omega t + \alpha)$. If the time period is 16 sec and the particle has a displacement of 10cm at $t = 0$, find i) epoch ii) the phase angle at $t = 3$sec and iii) the phase difference between two positions of the particle 1.5 sec apart.	03
Q2.	(a)	State and explain the Doppler's effect of sound.	03
	(b)	Show that the rate of energy transfer is zero for stationary waves.	05
	(c)	The velocity of a simple harmonic wave is 40cm/sec. At a time t=0, the displacement of a particle is given by $y = 4\sin 2\pi(x/10)$. Find the equation for the displacement at $t = 2$sec.	03
Q3.	(a)	Explain the results of Rutherford's α particle scattering experiment.	03
	(b)	Find the frequency of revolution of an electron in the first Bohr orbit of the hydrogen atom	05
	(c)	Calculate the frequency of the photon that will be emitted when a hydrogen atom makes a transition from the energy state -1.5 eV to -3.4 eV.	04
Q4.	(a)	Explain the stopping potential and Debroglie wave.	03
	(b)	Obtain an expression for the change in wavelength of a photon undergoing Compton scattering.	05
	(c)	A photon of energy 5.1×10^{-5} eV is incident on aluminum foil. The photon is scattered at an angle of 90°. Calculate the wavelength of the scattered photon.	03

SECTION B

			Marks
Q5	(a)	What are the physical quantities conserved in a nuclear reaction?	03
	(b)	Explain the Q-value of a nuclear reaction. In which type of reaction is the Q-value exactly zero?	05
	(c)	Distinguish between nuclear fission and fusion.	02
Q6.	(a)	Define half-life and mean life time of a radioactive substance.	03
	(b)	State the radioactive decay law and hence show that the radioactive materials decay exponentially.	05
	(c)	Find the activity of $1mg(10^{-3} mg)$ of radon Rn^{222}. The half-life of radon is 3.8 days.	03
Q7.	(a)	Write the special theory and general theory of relativity.	03
	(b)	Deduce the Lorentz transformations of relativity.	05
	(c)	At what speed will an electron move in order to double its relative mass to the rest mass?	03
Q8.	(a)	Define rest mass and effective mass.	03
	(b)	Deduce the formula for the relative variation of mass with velocity. Briefly explain its significance.	05
	(c)	A particle is moving with a speed of 0.5c. Calculate the ratio of its rest mass and mass while in motion.	03

"Heaven's light is our guide"

Rajshahi University of Engineering & Technology

B.Sc. Engineering 1st Year 2nd Semester Examination, 2011

Department of Computer Science and Engineering

Course no: Ph - 207 Course Title: Physics

Full marks: 70 Time: Three (03) hours

Rabeya
123090

N.B. Answer **six** questions, taking **three** from each section.
The questions are of equal value.
Use separate answer script for each section.

SECTION-A

			Marks
Q1	(a)	How can you differ damped oscillation from forced oscillation?	02
	(b)	What are Lissajous figure? Write how these figures are useful in the laboratory?	04
	(c)	A particle is subjected to simple harmonic vibrations of the same period but of different amplitudes and phases in mutually perpendicular directions. Show that the resulting motion is elliptical. In what situations will be the path of motion be a straight line.	$05\frac{2}{3}$
Q2	(a)	How the stationary waves differ from ordinary progressive wave?	03
	(b)	What are beats? Show that the number of beats produced per second is equal to the difference in frequency of the two notes.	$05\frac{2}{3}$
	(c)	Show that in the case of progressive longitudinal waves, particle velocity = wave velocity × compression.	03
Q3.	(a)	Discuss the shortcomings of Rutherford model of the atom.	03
	(b)	On the basis of Bohr's theory, deduce the expression for the radius and energy of an electron orbit in hydrogen atom.	$05\frac{2}{3}$
	(c)	Calculate the energy required to excite the hydrogen atom from the ground state to first excited state.	03
Q4.	(a)	A photon of frequency γ is scattered by an electron initially at rest. Determine the maximum kinetic energy of the recoil electron.	$04\frac{2}{3}$
	(b)	For photo electronic effect draw the maximum photoelectron kinetic energy, KE_{max} versus frequency, γ of incident light curve for two metals A and B. From this curve explain threshold frequency, work function and Plank's constant.	04
	(c)	The photoelectric threshold wave length of silver is 2762^0_A. Calculate i) the maximum kinetic energy of the ejected electrons, ii) the maximum velocity of the electrons, iii) the stopping potential in volts for the electrons, when the silver surface is illuminated with ultraviolet light of wavelength 2000^0_A	03

SECTION-B

			Marks
Q5.	(a)	What do you understand by exothermic and endothermic nuclear reaction? Explain the concept on compound nucleus in a nuclear reaction.	$04\frac{2}{3}$
	(b)	What is binding energy? The binding energy of $_{12}Mg^{24}$ is 198.25MeV. Find its atomic mass.	03
	(c)	Explain nuclear fusion. Calculate the amount of energy released when a single helium nucleus is formed by fusion of two deuterium nucleus.	04
Q6.	(a)	Explain the law of successive disintegration.	$02\frac{2}{3}$
	(b)	Deduce the necessary condition for secular and transient equilibrium.	06
	(c)	Explain inverse beta decay with example.	03
Q7.	(a)	What do you know about the postulates of special theory of relativity? Explain the term frame of reference.	$03\frac{2}{3}$
	(b)	Describe Michelson- Morly experiment.	05
	(c)	How did Einstein explain the negative result of Michelson- Morly experiment.	03
Q8.	(a)	What is time dialation? Derive the formula for time dialation.	$03\frac{2}{3}$
	(b)	Derive the Einstein mass energy relation.	05
	(c)	A rocket ship is 100m long on the ground, when it is in flight, its length is 99m to an observer on the ground. What is its speed?	03

"Heaven's light ... guide"

Rajshahi University of Engineering & Technology

B.Sc. Engineering 1st Year 2nd Semester Examination, 2010

Department of Computer Science & Engineering

Course no: **Ph 207** Course Title: **Physics**

Full marks: 70 Time: Three (03) hours

N.B. Answer **six** questions, taking **three** from each section.
The questions are of equal value.
Use separate answer script for each section.

SECTION-A

Q1. (a) What is simple harmonic motion? Derive the differential equation for a body executing simple harmonic motion. 3

(b) Establish the differential equation of a damped harmonic oscillator and solve it to obtain an expression for the displacement of the oscillation.

(c) A particle executes simple harmonic motion by the equation $y = 12\sin(\frac{2\pi}{10}t + \frac{\pi}{4})$. 3
Calculate (i) velocity at $t = 2.5$ sec. and (ii) acceleration at $t = 5$ sec.

Q2. (a) What are the main differences between the progressive and stationary waves? 3

(b) Show that the energy of a plane progressive wave is given by $E = 2\pi^2 \rho n^2 a^2$. 6

(c) Find the relation between particle velocity and wave velocity. 2 2/3

Q3 (a) Derive Rutherford's formula for the scattering of alpha particles by a heavy nucleolus of charge Ze. 2 2/3

(b) Write the postulates of Bohr atom model. 2

(c) Explain the origin of spectral line in hydrogen atom. 2

(d) The wavelength of sodium D_1 line is 590 mm. Calculate the difference in energy levels involved in the emission or absorption of this line. 2

Q4 (a) What is Compton effect? 2

(b) Find an expression for Compton effect. 7

(c) X-rays of wavelength 10 pm are scattered from a target. Find (a) the wavelength of the X-rays scattered at 45° (b) the maximum wavelength present in the scattered rays. 2 2/3

SECTION-B

Q5. (a) What is binding energy of a nucleus? 2

(b) What is nucleon? Do nuclei contain electrons? 2

(c) Define Q-value of nuclear reaction and find out the equation of Q-value of this reaction. 2 2/3

(d) What ${}^{6}_{3}Li$ is bombarded with 5.0 MeV deuterons, two alpha particles each with 13.7 MeV of energy may be produced. Find the Q-value of this reaction. 3

Q6. (a) Derive radioactive decay law. 5

(b) Define a half-life and mean-life. Derive the relation between half-life and mean-life. 3

(c) The half-life of a ${}^{25}Na$ is 15h. How long does it take for 80% of a sample of this nuclide to decay? 3 2/3

Q7. (a) Discuss mass conditions for three types of β decays. 1 2/3

(b) Name two isotopes of oxygen; one radiates e^-, another e^+. Write their decay modus. 2

(c) How hoes the neutrino hypothesis resolve various problems facing the beta decay? 3

(d) Mention some of the uses of radioactive isotopes. 2

Q8. (a) Write the postulates of special theory of relativity? Explain the term frame of reference. 3

(b) Derive Lorentz transformation equation. 6

(c) What is the speed of a space-craft whose clock runs 1 sec slower per hour relative to a clock on the earth. 2 2/3

Heaven Light is our guide

Rajshahi University of Engineering & Technology
B Sc. Engineering 1st Year 2nd Semester Examination, 2009
Department of Computer Science and Engineering
Course no: Ph 207 Course Title: Physics
Full marks: 70 Time: Three (03) hours

N.B. Answer **six** questions, taking **three** from each section
The questions are of equal value.
Use separate answer script for each section.

SECTION-A

Q1. (a) What is simple harmonic motion? Derive the differential equation of a body executing simple harmonic motion. 03

(b) What are meant by free damped and forced vibrations? Obtain an expression for displacement in the case of forced vibrations.

(c) Show that resonance occurs when the forced frequency is equal to the natural frequency of the vibrating particle. 03

Q2. (a) Define wave motion and deduce the differential equation of wave motion. 03

(b) Define phase velocity and group velocity. Find the relation between them.

(c) What is meant by stationary wave? Discuss the formation of stationary waves. 03

Q3. (a) What are the shortcomings of Rutherford atom model? Clearly explain.

(b) On the basis of Bohr's theory, derive an expression for the energy of an electron in the n^{th} orbit. Explain the various series in the hydrogen spectrum. 06

(c) In the hydrogen atom, an electron experiences a transition from a state whose binding energy is 0.54 eV to another state whose excitation energy is 10.2 eV. What are the quantum numbers for these states? 03

Q4. (a) Establish the Einstein photoelectric equation. Describe an experiment to verify this equation.

(b) The stopping potential for electrons emitted from a metal due to photoelectric effect is found to be 1 V for the light of 2500 Å. Calculates the work function of the metal in eV. 03

(c) Explain De Broglie waves and with the help of this define electron orbit. 03

SECTION-B

Q5. (a) What is binding energy of a nucleus? 02

(b) Draw the binding energy per nucleon versus mass number curve and discuss various features of this curve.

(c) Discuss briefly the general characteristics of nuclear force. 03

(d) Define nuclear reaction. When a nuclear reaction is exoergic or endoergic? 02

Q6. (a) Define the term radioactivity. Describe the nature and properties of the charged particles emitted from radioactive substance.

(b) What do you mean by radioactive equilibrium? Describe secular and transient equilibriums. 06

(c) What is curie? How is it related to SI unit? 02

Q7. (a) What is alpha decay? Show that for a radioactive parent of mass number A, the kinetic energy of alpha particle is related to the Q-value by $K_\alpha \approx \frac{A-4}{A} Q$ 05

(b) Describe Michelson-Morley experiment. Explain the reasons for negative of the experiment.

Q8. (a) What are fictitious forces? Give examples. 02

(b) 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. 03

(c) Obtain the mass-energy equivalence relationship

(d) An astronaut whose height on the earth is exactly 6 ft is laying parallel to the axis of a spacecraft moving at 0.9c relative to the earth. What is its height as measured by an observer in the same spacecraft? 02

"Heaven's light is our guide"

Rajshahi University of Engineering & Technology
B.Sc. Engineering 1st Year 2nd Semester Examination, 2003
Department of Computer Science and Engineering
Course no: Ph 207 Course Title: Physics
Full marks: 70 Time: Three (03) hours

N.B. Answer **six** questions, taking **three** from each section.
The questions are of equal value
Use separate answer script for each section

SECTION-A

Q1. (a) What is meant by a damping or a dissepative force? Establish the differential equation of a damped harmonic oscillator and solve it to obtain an expression for the displacement of the oscillator. 5 2/3

(b) Two simple harmonic motions acting simultaneously on a particle are given by 3

$$y_1 = \sin(\omega t + 11/3)$$

$$y_2 = 2\sin\omega t$$

Find the equation of the resultant vibration.

(c) A sound wave is represented by the equation $5\sin 0.3142(500t - x)$. Write the equation of the wave which, on superposition with y_1 Would produce a standing wave. 3

Q2. (a) Write the characteristics of Thomson atom model. 2

(b) Derive an expression for impact parameter in terms of scattering angle. 5 2/3

(c) Show that the change in wavelength of photon on scattered from an stationary electron is independent of the wavelength of the incident radiation. 4

Q3 (a) What do you mean by Q-value of nuclear reaction? How can it be determined experimentally? 5 2/3

(b) In their old age, heavy stars obtain part of their energy by the reaction $2^{He^4} + 6^{C^{12}} \rightarrow 8^{O^{16}}$. How much energy does each such event give off? 3

(c) A piece of wood from the rains of an ancient dwelling wave found to leave a C^{14} activity of 13 disintegration per minutes per gram of its carbon content. The C^{14} activity of living wood is 16 disintegration per minute per gram. How long age did the tree die from whicl the wood sample came? 3

Q4. (a) Discuss continuous energy spectrum of beta rays and hence explain neutrino hypothesis of beta decay. 5

(b) Show that the length of an object appears to contact when moving with a velocity comparable to velocity of light. 3 2/3

(c) What is kinetic energy in MeV of a neutron whose mass is double its rest mass? 3

SECTION-B

Q5. (a) How does a progressive wave differ from stationary wave? Deduce the equation of standing wave. 4

(b) Explain Doppler's effect considering the velocity of air. Obtain an expression for the frequency of a note heard by an observer, when the observer is in motion and the source is at rest. 4

(c) Show that at any given instant, the energy of a plane progressive harmonic wave is, one the average, half kinetic and half potential in form. 3 2/3

Q6. (a) Discuss De-Broglie theory of matter waves. Calculate the De-Broglie wavelength of an electron accelerated through a potential of 150 volts ($h = 6.626 \times 10^{-34}$ JS). 4

(b) Show that the wavelength (λ') of the scattered photon is greater than the wavelength of the incident photon (λ). Find the change in wavelength of an x-ray photon when it is scattered through an angle of 90° by a free electron. 4 2/3

(c) Ultraviolet light of wavelength 350 nm and intensity $1.00\ W/m^2$ is directed at a potassium surface (i) find the maximum kinetic energy of the photoelectrons (ii) if 0.5% of the incident photons produce photoelectrons, how many are emitted per seconds if the potassium surface has an area of $1.00 \times m^2$ 3

Q7. (a) Explain the law of successive disintegration. 3

(b) Why electron captures are more among heavy nuclides than among light nuclides? Show that an electron capture is equivalent to positron decay. 3

(c) Discuss the fine structure of an alpha spectrum. 3

(d) Define alpha-particle $88^{Ra^{226}}$ emits 3.5×10^{10} alpha particles per sec. Find the half life of radium. (Avogadro's number = 6.025×10^{23}). 3

Q8. (a) What is meant by rest mass and effective mass. 3

(b) Explain meson theory of nuclear force. Using time-energy uncertainty compare its mass with rest mass of an electron 3

(c) Given rest mass $m_0 = 9.028 \times 10^{-31}$ kg. Calculate its self energy in MeV unit. 3

(d) Find out the binding energy of He^4 (Given mass of He^4 nucleus is 4.00260

"Heaven's light is our guide"

Rajshahi University of Engineering & Technology

B.Sc. Engineering 1st Year 2nd Semester Examination, 2007

Department of Computer Science & Engineering

Course no: Ph 207 Course Title: Physics

Full marks: 70 Time: Three (03) hours

N.B. Answer Six questions, taking Three from each section.
The questions are of equal value.
Use separate answer script for each section.

SECTION-A

Q1. (a) Establish the differential equation of a damped harmonic oscillator and solve it to obtain an expression for displacement of the oscillator. 6

(b) What is meant by forced vibrations? Obtain the condition for resonance. 2½

(c) Two simple harmonic motions, acting simultaneously on a particle, are given by the equations 3

$$y_1 = 2\sin(\omega t + \pi/6)$$

$$y_2 = 3\sin(\omega t + \pi/3)$$

Calculate the amplitude of the resultant vibration.

Q2. (a) How does a progressive wave differ from a stationary wave? 3½

(b) What are beats? Differentiate between the phenomenon of beats and interference. Show that the number of beats per second is equal to the difference between the frequencies of the two sources sound together. 4

(c) Show that at any given instant, the energy of a plane progressive wave is, on the average, half kinetic and half potential in form. 4

Q3 (a) Briefly discuss the structure of an atom. Deduce the expression for energy of n-th orbit and hence explain the significance of negative sign arriving in it. 4½

(b) Distinguish ground state and excited state of an atom. 3

(c) The wavelength of the first member of the Bracket series of hydrogen is 6865×10^{-10} m. Calculate the wavelength of its fourth member. 4

Q4. (a) What is photoelectric effect? Discuss the failure of the wave theory of light to explain the observed experimental facts. How does Einstein's photoelectric equation explain these facts? 6

(b) The photoelectric threshold of tungsten is 2300 Å. Calculate the energy of the electrons ejected from the tungsten surface by ultraviolet light of wavelength 1500 Å. 2

(c) Explain dual nature of light. 3½

SECTION-B

Q5. (a) What is meant by binding energy? Calculate the binding energy per nucleon of $^{18}_{8}O$. Mass of $^{18}_{8}O$ is 17.994768 amu. 4

(b) Describe the construction of a nuclear reactor. 3½

(c) Explain nuclear fusion. Calculate the amount of energy released when a single helium nucleus formed by the fusion of two deuterium nuclei. 4

Q6. (a) Define mean life of radioactive atom and show that mean life is inversely proportional to the radioactive decay constant. 4

(b) Why electron captures are more among heavy nuclides than among light nuclides? Show that an electron capture is equivalent to positron decay. 4

(c) Discuss the fine structure of an alpha spectrum. 3½

Q7. (a) Explain inertial and non-inertial frames of reference with examples. 3

(b) Discuss Michelson-Morley experiment. What are the reasons for the negative result of this experiment? 6½

(c) Discuss Galilean transformations for position. 2

Q8. (a) Prove the relativistic formula $m = m_0/\sqrt{1-v^2/c^2}$ where the symbols have their usual meaning. 4

(b) Work out the expression for Lorentz's transformation. 4½

(c) Suppose that a 25 years old mother leaves on a rocket trips. She travels at a speed of 0.99c relative to earth and is gone for 30 years as measured to on an earth clock. How old is the mother in terms of physiological age, when she returns? How old is her daughter who is 3 years old when the mother left? 3

Department of Computer Science & Engineering
Rajshahi University of Engineering & Technology
Engineering 1st Year 2nd Semester Examination 2006
Course ... Ph 207 Course Title: Physics
Time: Three Hours Full Marks: 70

(i) Answer Six questions taking Three from each section
(ii) Figures in the right margin indicate full marks
(iii) Use separate answer script for each section

SECTION-A

Q1 (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
(b) Find an expression for the total energy of a particle executing simple harmonic motion
(c) A body is vibrating with simple harmonic motion of amplitude 15 cm and frequency 4Hz. Calculate the maximum velocity when the body is 9.0 cm from the equilibrium position

Q2 (a) Explain Doppler's effect
(b) A source produces a note of frequency n and is moving towards a stationary observer with a uniform speed 'u'. Show that the apparent pitch is $n' = n\left|\begin{matrix} v & \\ v & u \end{matrix}\right|$
(c) A person is standing on a platform. A railway engine moving away from the person with a speed of 90km/hr blows a whistle of pitch 780hertz. Calculate the apparent pitch of the whistle as heard by the person. Velocity of sound in air = 340 m/s

Q3 (a) Give the postulates of Bohr's atom model
(b) Based on Bohr's assumptions, obtain the expression for the orbital energy of an electron in the hydrogen atom
(c) At what speed must the electron revolve round the nucleus of a hydrogen atom in order that it may not be pulled into the nucleus by electrostatic attraction?

Q4 (b) Explain briefly the vector atom model.
(b) Write down the laws of photoelectric emission
(c) What is compton effect? Obtain an expression for the change in wavelength of the photon when it is scattered by an electron.

SECTION-B

Q5 (a) What do you mean by nuclear binding energy? From binding energy per nucleon versus mass number curve; calculate the amount of energy released in nuclear fission.
(b) What is Q value of a nuclear reaction? Find an expression for the Q value
(c) Discuss nuclear fusion in stars.

Q6 (a) Deduce the expressions for half-life and mean life and establish the relationship between these two.
(b) Triton has a half life of 12.5 years against beta decay. What fraction of a sample of triton will remain undecayed after 50years?
(c) Explain beta decay and inverse beta decay with examples.
(d) Explain why alpha particles are emitted from radioactive nuclei rather than proton, triton and deuteron.

Q7 (a) State the postulates of special theory of relativity.
(b) Deduce the Einstein's max-energy relation
How fast must a space craft travel relative to the earth for each day on the spacecraft to correspond to 2 days on the earth?

Q8 (a) Explain dual nature of matter.
(b) Explain the properties of de Broglie's Matter wave
What is the de broglie wavelength of neutron whose energy is 1ev? Given $e = 1.6\times10^{-19}$ C, $h = 6.622\times10^{-34}$ J-s and mass of neutron 1.676×10^{-27} kg

"Heaven's light is our guide"

Rajshahi University of Engineering & Technology

B.Sc. Engineering 1st Year 2nd Semester Examination, 2005

Department of Computer Science and Engineering

Course no: Ph 207 Course Title: Physics

Full marks: 70 Time: Three (03) hours

N.B. Answer **six** questions, taking **three** from each section.
The questions are of equal value.
Use separate answer script for each section.

SECTION – A

1. (a) Briefly explain how atoms are arranged in a crystalline solid.

   (b) With the help of energy band diagram distinguish between semiconductors and conductors.

   (c) Show that for a body executing simple harmonic motion, the instantaneous velocity and instantaneous acceleration are respectively, $\omega\sqrt{a^2 - y^2}$ and $-\omega^2 y$.

2. (a) What do you mean by free undamped and damped Oscillations?

   (b) Find an expression for the amplitude in the case of forced Oscillation.

   (c) A simple harmonic motion is represented by $y = 10\sin(10t - 11/6)$, where y is measured in meters, t in seconds and the phase angle in radians. Calculate the displacement, velocity and acceleration at t = 2 seconds.

3. (a) Describe Einstein's photoelectric equation.

   (b) Derive the expression for the change in wavelength when an incident radiation of wavelength λ is scattered by a free electron at an angle θ.

   (c) The wavelength of light falling on the surface of a metal of work function 2.3 ev is 4300 A^0. With what velocity will be the electron be emitted?

4. (a) Discuss nuclear fission.

   (b) Describe how nuclear energy is released in a controlled way from a nuclear reactor?

   (c) An X-ray diffraction of a crystal gave the closest line at an angle 0 of 6.45^0. If the wavelength of X-rays is 0.58 A^0, find the interplaner spacing for that reflection.

SECTION – B

5. (a) Explain what is meant by radioactive equilibrium.

   (b) In the case of successive disintegration obtain an expression for the number of atoms of the second element present after a time t.

   (c) Deduce radioactive decay law and show that radioactive atoms decay exponentially.

6. (a) What are stationary waves and how are they formed?

(b) Show that no energy transfer takes place for a standing wave.

(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 gm/cm^3?

7. (a) Show that $m = \frac{m_0}{\sqrt{1 - v^2/c^2}}$. Symbols have their usual meaning.

(b) Calculate the velocity that one atomic mass unit will have if it had a kinetic energy three times its rest mass energy.

(c) Explain de Broglie matter waves.

8. (a) State the postulates of the special theory of relativity.

(b) Describe Michelson-Morely experiment. Discuss the results obtained.

(c) The rest mass of a proton is 2000 times the rest mass of an electron. Calculate the speed at which the electron should move so that it's mass will be equal to the rest mass of the proton.

...Engineering 1st Year 2nd Semester Examination, 2004
Department of Computer Science and Engineering
Course no: Ph 207 Course Title: Physics
Full marks: 70 Time: Three (03) hours

...answer six questions, taking three from each section
The questions are of equal value
Use separate answer script for each section

SECTION-A

Q1 (a) Distinguish between a streamline and turbulent flow of a liquid.
(b) Prove Bernoulli's theorem for fluid motion
(c) Deduce the equation of continuity of flow.

Q2 (a) Define plasticity and crystal defects
(b) State and explain Bragg's law. How can with the help of such a law crystal structure be determined?
(c) Distinguish between extrinsic and intrinsic semiconductor.

Q3 (a) What are meant by adhesive and cohesive forces?
(b) Deduce the expression to find out the surface tension of a liquid by the capillary tube method
(c) A capillary tube of 5 mm diameter stands vertically in a vessel containing a liquid which wets the tube. If the surface tension of the liquid be 30 dynes/cm and its density 0.8 gm/cc, find the rise of liquid in the tube (Angle of contact is taken to be zero and $g = 981$ cm/sec^2)

Q4 (a) Write the postulates of special theory of relativity
(b) Define rest mass and effective mass. Prove that the relativistic formula $m = \frac{m_0}{\sqrt{1 - \frac{v^2}{c^2}}}$
(c) Two photons A and B are moving in opposite directions each with a speed c. Calculate the relative velocity of the photon A with respect to the photon B.

SECTION-B

Q5 (a) State and explain the law of radioactive disintegration
(b) Establish the secular radioactive equilibrium
(c) Write short note on nuclear reaction

Q6 (a) Write the conditions and obtain the differential equation of undamped vibration
(b) Find the resultant of two simple harmonic motions of equal periods when they act at right angles to each other
(c) A spring is hung vertically and loaded with a mass of 100 gm and allowed to oscillate. Calculate (i) the time period, and (ii) the frequency of oscillation, when the spring is loaded with 200 gm, it extends by 10 cm

Q7 (a) State and explain Doppler's effect in sound
(b) Derive the expression for the change in frequency of a note when both the source of sound and the observer are in motion
(c) An observer on a railway platform observed a train passing through the station at a speed a. Show that the frequency of the whistle changes by $n\left|\frac{v-2a}{v-a}\right|$

Q8 (a) What is reverberation and on what factors does it depend?
(b) Using Sabine's formula show that reverberation time is directly proportional to the volume and inversely proportional to the surface area and absorption coefficient of an auditorium.
(c) Obtain an expression to find absorption coefficient?

The End