FIRST SEMESTER

B.E. (common for all branches)

B.E. MID SEM. EXAMINATION, SEP-2016

FC004 (PHYSICS)

Time: 1:30 Hrs.

Max. Marks: 15

Note: Q. No. 1 is compulsory.

Attempt any 3 questions from Q. No. 2-5.

1. (a) Find the speed of 0.1 MeV electrons according to the classical and relativistic mechanics. (1)

   (b) Differentiate between Doppler's red shift and the gravitational red shift? (1)

   (c) An experimenter observes a radioactive atom moving with a velocity of 0.25 c. the atom then emits a β-particle which has a velocity 0.9 c relative to the atom in the direction of its motion. What is the velocity of the beta particle as observed by the experimenter? (1)

   (d) Define logarithmic decrement for damped harmonic oscillator and obtain an expression for it. (1)

   (e) Discuss the various applications of ultrasonic wave. (1)

   (f) L_0^3 is the rest volume of a cube. It is viewed from a reference frame moving with a uniform velocity v parallel to an edge of the cube, calculate the observed volume. (1)

2. (a) What are the fundamental postulates of the special theory of relativity? (0.5)

   (b) Discuss the difference between special theory of relativity and general theory of relativity. (0.5)

   (c) Derive inverse Lorentz transformation equations. (2)

3. (a) How does a star convert into black hole? (1.5)

   (b) Find the approximate gravitational red shift in 500 nm light emitted by a white dwarf star whose mass is 2.0×10^{30} kg and radius is that of the earth, 6.4×10^6 m. ($G=6.673 \times 10^{-11}$ N m² kg⁻²) (1.5)

4. (a) Prove that in the steady state of a driven oscillator the average power supplied by the driving force equals that being dissipated against frictional forces. Explain sharpness of resonance on the basis of power dissipation. (1.5)

   (b) If Q of a sonometer wire is 2×10^3. On plucking, it executes 240 vibrations per second. Calculate the time in which the amplitude decreases to $1/e^2$ of the initial value. (1.5)

5. (a) Show that the slope of a displacement curve (dy/dx) is represented by the volumetric strain (ΔV/V). Discuss reflection of acoustic waves and obtain expression for it. (2)

   (b) Write the general solution of differential equation representing damped harmonic oscillator and show that the frequency in case of under damping condition is different from the natural frequency. (1)

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FIRST SEMESTER　　　　　　　　　**B.E.(ALL)**

B.E. MID SEM. EXAMINATION, Sept 2014
103 : PHYSICS - I

Time: 1 hr 30 mts　　　　　　　　　Max. Marks: 20

Note: Attempt any **four** questions.
Assume missing data, if any. Symbols have their usual meaning.

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1. (a) What are the quantities which are invariant under Galilean transformations? (1)

   (b) Why the two events occur at the same point in space in a frame while deriving the time dilation? (2)

   (c) What was the objective of conducting the Michelson- Morley experiment? (2)

2. (a) Plot (i) mass (classical and relatistic) vs. velocity and

   (ii) momentum (classical and relatistic) vs. velocity. (2)

   (b) Show that the idea of infinite mass makes no sense due to some valid reasons. Give 3 reasons. (1.5)

   (c) find the momentum of an electron whose K.E equals to its rest energy of 511KeV. (1.5)

3. (a) Explain the failure of simultaneity in relativity. (2)

   (b) A spaceship moving away from the earth with velocity 0.6c fires a rocket whose velocity relative to the spaceship is 0.7c (i) away from the earth (ii) towards the earth. What will velocity of the rocket be as observed from the earth in above cases? How will the results differ if Galilean Transformations are used? (2+1)

4. (a) Explain Energy-Mass equivalence. (3)

   (b) A rod of length L_0 moves with speed v along the horizontal direction. The rod makes an angle θ_0 with respect to the x' axis.

   (i) Determine the length of the rod as measured by a stationary observer. (ii) Determine the angle θ the rod makes with the x axis. (2)

5. (a) Show that whereas at resonance displacement lags behind the driving force by $\pi/2$, the velocity is in phase with driving force. (4)

FIRST SEMESTER

B.E.(ALL)

B.E. MID SEM. EXAMINATION, Sept 2014

103 : PHYSICS – I

Time: 1 hr 30 mts

Max. Marks: 20

Note: Attempt any **four** questions.
Assume missing data, if any. Symbols have their usual meaning.

1. (a) What are the quantities which are invariant under Galilean transformations? (1)

    (b) Why the two events occur at the same point in space in a frame while deriving the time dilation? (2)

    (c) What was the objective of conducting the Michelson- Morley experiment? (2)

2. (a) Plot (i) mass (classical and relatistic) vs. velocity and

    (ii) momentum (classical and relatistic) vs. velocity. (2)

    (b) Show that the idea of infinite mass makes no sense due to some valid reasons. Give 3 reasons. (1.5)

    (c) find the momentum of an electron whose K.E equals to its rest energy of 511KeV. (1.5)

3. (a) Explain the failure of simultaneity in relativity. (2)

    (b) A spaceship moving away from the earth with velocity $0.6c$ fires a rocket whose velocity relative to the spaceship is $0.7c$ (i) away from the earth (ii) towards the earth. What will velocity of the rocket be as observed from the earth in above cases? How will the results differ if Galilean Transformations are used? (2+1)

4. (a) Explain Energy-Mass equivalence. (3)

    (b) A rod of length L_0 moves with speed v along the horizontal direction. The rod makes an angle θ_0 with respect to the x' axis.

    (i) Determine the length of the rod as measured by a stationary observer. (ii) Determine the angle θ the rod makes with the x axis. (2)

5. (a) Show that whereas at resonance displacement lags behind the driving force by $\pi/2$, the velocity is in phase with driving force. (4)

(b) If the quality factor of a sonometer wire of frequency 300 Hz be 2×10^3 in what time will its energy be reduced to $1/e^{th}$ of its energy in the absence of damping? (1)

6. Write short notes on any **two** of the following. (2.5x2)

 (a) Reflection and transmission of acoustic wave at discontinuity

(b) Propagation of longitudinal waves in gaseous medium.

(c) Damped oscillations in the case of under damping.

(d) Relativistic momentum-energy transformations

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FIRST SEMESTER B.E. (Common to all branches)

B.E. MID SEM. EXAMINATION, September 2013
103 : PHYSICS-I

Time: 1 Hr 30 Min. Max. Marks: 20

Note: Attempt any <u>four</u> questions.
Symbols have their usual meaning.
Assume suitable missing data, if any.

1.(a) Show that in no case the resultant velocity of a material particle be greater than "c". [1]

(b) A rod of true length 100cm is moving with velocity 0.6c in a direction making an angle of 30° with its length. What is the contraction produced in its length and along what direction does it appear to move? [4]

2.(a) "The idea of infinite mass makes no sense due to a number of reasons". Explain. [2]

(b) The mass of a moving electron is 11 times its rest mass. Calculate its kinetic energy and momentum. [3]

3. (a) Explain proper time interval and observed time interval. [2]

(b) Prove that $E^2 = p^2c^2 + m_e^2c^4$ is invariant to Lorentz transformation. [3]

4. (a) Show that the volumetric strain of the media in which a progressive longitudinal wave is travelling, is represented by the slope of displacement curve. [3]

(b) What is acoustic impedance? How would you realize perfect impedance matching between two acoustic media? Explain. [2]

5. (a) Show that in a driven harmonic oscillator, the maximum power is absorbed at the frequency of velocity resonance and not at the frequency of amplitude resonance. [3]

(b) A damped vibrating system from rest reaches a first amplitude of 500 mm, which reduces to 50 mm after 100 oscillation, each of period 2.3 seconds. calculate: (i) damping constant, k and (ii) relaxation time, τ. [2]

6. Write short note on any TWO of the following :

[a] Under damping condition of a damped harmonic oscillator.

[b] Lorentz transformation equation and its consequences.

[c] Equivalence of mass and energy. [2.5+2.5]

FIRST SEMESTER   **B.E. (ALL)**

B.E. MID SEM. EXAMINATION, Sept. 2009
103 : PHYSICS – I

Time: 1:30 Hrs.   Max. Marks: 20

> **Note:** *Attempt all questions. Symbols have their usual meanings.*

1.

[a] Derive the relativistic law of addition of velocities
   i)   Hence show that C is the ultimate speed.
   ii) Prove that the law is in conformity with the principle of
        constancy of speed of liquid.   [3]

[b] Determine the length and the orientation of a rod of length 10
   meters in a frame of reference which is moving with 0.6C
   velocity in a direction making an angle 30^0 with rod.   [2]

2.

[a] Show that $E^2 - p^2c^2 = m_0^2 c^4$ is Lorentz invariant.   [3]

[b] Two velocities of 0.8C each are inclined to each other at an angle
   30^0. Find their resultant speed with respect to earth.   [2]

3.

[a] Show how Lorentz transformation equations are superior to
   Galilean Transformations.   [3]

[b] Calculate the speed of electron which has kinetic energy 2MeV.
   (Rest mass of electron = $9 \times 10^{-31} Kg$)   [2]

4.

[a] Write the condition for bright and dark Newton rings in the
   reflected and transmitted pattern. Show that the difference in
   radii between successive rings for large n is given by

$$\Delta r = \frac{1}{2}\sqrt{\frac{\lambda R}{n}}$$ [3]

[b] An interference pattern is obtained on the screen at a distance
   1m from two slits which are separated by $500 \times 10^{-6} m$ using
   monochromatic light of wavelength 5000A^0. A thin glass plate of
   thickness $1.5 \times 10^{-6} m$ and μ=1.5 is placed between one of the slit
   and screen. Find intensity at the centre of the screen and
   lateral shift of the central maximum.   [2]

<div align="center">OR</div>

4.

[a] Show that resonant frequencies of amplitude resonance and
   power resonance are different?   [3]

[b] If a particle of 1gm is initially displaced through 2cm and then
   released, find tout whether the resulting motion is oscillatory or
   not and if so, what is its period, when the particle is subjected to
   a restoring force of 29 dynes/cm/gm and frictional forces of 4
   dynes/cm/gm. Write down the solution.   [2]

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