PHY 101.1 **Reg No.....**

CREDIT BASED FIRST SEMESTER B.Sc. DEGREE EXAMINATION OCTOBER 2012

PHYSICS

PAPER I: MATHEMATICAL PHYSICS, PROPERTIES OF MATERIALS AND RELATIVITY

Duration: 3 Hours **Max Marks: 80**

PART –A

1. (A) Answer any <u>TEN</u> of the following. **1X10=10**

i) Write the cross product for two mutually parallel vectors $\vec{A}$ and $2\vec{A}$.

ii) What is a planar vector?

iii) Define argument of a complex number.

iv) Write the differential equation for a harmonic oscillator.

v) Define a perfect elastic body.

vi) What is a cantilever?

vii) How does surface tension of a liquid vary with temperature?

viii) A steel ball falls slowly through water than through air. Why?

ix) Write the S.I. unit of coefficient of viscosity.

x) Write the expression for the apparent weight of a person inside a lift which is moving up with a constant acceleration.

xi) What is the value of rest mass of a photon?

xii) What happens to the mass of a particle when its speed approaches the speed of light in vacuum?

(b) Answer any <u>FIVE</u> questions of the following. **2X5=10**

i) Obtain the dot product of the following two vectors.

$\vec{A} = 3\hat{i} - \hat{j} + \hat{k}$ and $\vec{B} = 2\hat{i} - 3\hat{j} + \hat{k}$

ii) Write the differential equation for a falling body and find its solution.

iii) Derive the relation between surface tension and surface energy.

iv) Obtain the theoretical limits of Poisson's ratio.

v) State the postulates of special theory of relativity.

vi) Show that Lorentz transformations reduce to Galilean transformations when $v \ll c$.

PART-B

UNIT-I

Answer any TWO from the following: **10x2=20**

2. (a) Define Planar vector. If $\vec{A}$ is a planar rotating vector of constant magnitude and $\vec{A}_\perp$ is a vector of same magnitude in a perpendicular direction, in the same plane show that

$\vec{A} \cdot \frac{d\vec{A}}{d\theta} = 0$ and $\vec{A} \cdot \frac{d\vec{A}_\perp}{d\theta} = \vec{A}$

(b) If $\phi = x^2 - y^2 + 2z$ find divgrad ϕ **(6+4)**

3. (a) Obtain expressions for radial and transverse velocity and acceleration of a particle.

(b) Find the total work done in moving a particle in a force field given by $\vec{F} = 3xy\hat{i} + 2z\hat{j} + x\hat{k}$ along the curve $x = 2t^2$, $y =$ and $z = t^3 - 3$ from $t = 0$ to $t = 1$ **(6+4)**

4. (a) Analyse a square wave using Fourier's theorem and draw relevant graph.

(b) Perform (3 + j4) + (5 + j2) by using both analytical method and Argand diagram method. **(6+4)**

UNIT-II

Answer any <u>TWO</u> of the following. **10x2=20**

5. (a) Derive an expression for bending moment of a beam. Hence find the bending moment of a bar of rectangular and circular cross section.

(b) Calculate the work done in stretching a uniform metal wire of area of cross section $10^{-6}\ m^2$ and length 1.5m through $4 \times 10^{-3}\ m$ Given Young's modulus $q = 2 \times 10^{11}\ N/m^2$. **(6+4)**

6. (a) Give the theory of drop weight method of finding surface tension of a liquid.

(b) Calculate the excess of pressure inside a soap bubble of radius 5×10^{-3}m. Also calculate the surface energy. Given the surface tension of soap solution is 0.02 N/m. **(6+4)**

7. (a) Deduce Poiseuilli's formula for the steady rate of flow of a liquid in a horizontal tube.

(b) A steel ball of radius 2mm falls in a vertical columm of castor oil. The coefficient of viscosity of castor oil is 0.7 Nsm^{-2} and its density is $0.98 \times 10^3\ kgm^{-3}$ Find its terminal velocity. **(6+4)**

UNIT-III

Answer any <u>TWO</u> of the following.

8. (a) State and prove Galilean principle of relativity.

(b) A spring balance suspended from the top of a lift carries a load of 1 Kg. Find the reading of balance when the lift

i) moves up with an acceleration of 0.092 ms^{-2}

ii) moves down with uniform velocity of $1ms^{-1}$. **(6+4)**

9. (a) Deduce the equation of motion of a particle in a frame of reference moving with uniform acceleration relative to an inertial frame.

(b) A spaceship is launched from the earth with velocity of 0.9C. The spaceship then launches a rocket in the forward direction with a velocity 0.9C relative to spaceship. Calculate the velocity of rocket with respect to earth. **(6+4)**

10. (a) Write Lorentz transformation equations and obtain an expression for length contraction.

(b) A rod of length 1m is moving with a velocity of 0.8C. Calculate the percentage contraction in length. **(6+4)**

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PHY 101.1 **Reg No.....**

CREDIT BASED FIRST SEMESTER B.Sc. DEGREE EXAMINATION OCTOBER 2013

PHYSICS

PAPER I: MATHEMATICAL PHYSICS, PROPERTIES OF MATERIALS AND RELATIVITY

Duration: 3 Hours **Max Marks: 80**

PART –A

1. (A) Answer any <u>TEN</u> of the following. **1X10=10**

xiii) If $\vec{A} \cdot \vec{B} = 0$, what is the angle between $\vec{A}$ and $\vec{B}$?

xiv) Define a vector field.

xv) Write modulus of a complex number.

xvi) Write the differential equation for Newton's law of cooling.

xvii) State Hooke's Law.

xviii) Define Poisson's ratio.

xix) What is surface tension of a liquid?

xx) Define critical velocity of a liquid.

xxi) What is a non-inertial frame of reference?

xxii) What is the weight of a person inside a lift when the lift is coming down with an acceleration equal to g.

xxiii) What is the value of rest mass of a photon?

xxiv) Write Lorentz transformation equation for space when $v<<<c$.

(b) Answer any <u>FIVE</u> questions of the following. **2X5=10**

vii) If $\vec{A} = 2\hat{\imath} + 3\hat{\jmath} + 4\hat{k}$ and $\vec{B} = 3\hat{\imath} - 3\hat{\jmath} + 2\hat{k}$ find $\vec{A} \cdot \vec{B}$.

viii) Write the differential equation for simple harmonic motion and find its solution.

ix) Mention any four factors affecting the elasticity of a material.

x) Derive the relation between surface tension and surface energy.

xi) State the postulates of special theory of relativity.

xii) What is the energy equivalent of 1 kg of matter in eV?

PART-B

UNIT-I

Answer any TWO from the following: **10x2=20**

2. (a) Obtain expressions for radial and transverse velocity and acceleration of a particle.

   (b) Prove that the vector $\vec{A} = 3y^2z^2\hat{i} + 4x^3z^2\hat{j} - 3x^2y^2\hat{k}$ is solenoidal. **(6+4)**

3. (a) Analyse a square wave using Fourier's theorem and draw the relevant graph.

   (b) Perform (3 + j4) + (5 + j2) both analytically and using Argand diagram. **(6+4)**

4. (a) What is a Planar vector? If $\vec{A}$ is a planar rotating vector of constant magnitude and $\vec{A}$ is a vector of same magnitude in a perpendicular direction, in the same plane show that

   $\vec{A} \cdot \frac{d\vec{A}}{d\theta} = \vec{A}$ and $\vec{A} \cdot \frac{d\vec{A}}{d\theta} = -$

   (b) If the mass of a body is 2Kg and position vector is $\vec{r} = 2t^3\hat{i} + 4t^2\hat{j} + 6t\hat{k}$, find the magnitude of the force acting on the particle at t = 4 sec. **(6+4)**

UNIT-II

Answer any <u>TWO</u> of the following. **10x2=20**

5. (a) What is a cantilever? Obtain an expression for the depression at the loaded end of a cantilever.

   (b) A steel rod of length 50 cm, width 2 cm and thickness 1 cm is bent into the form of an arc of radius of curvature 2m. Calculate the bending moment. Young's modulus of the material of the rod = 2×10^{11} Nm^{-2} **(6+4)**

6. (a) Give the theory of drop weight method of finding interfacial tension between two liquids.

   (b) Calculate the amount of energy evolved when eight droplets of water of radius 0.5 mm each combine to form a single drop. Given surface tension of water = 0.072 Nm^{-1}. **(6+4)**

7. (a) Derive the Stoke's formula for viscous force acting on a body falling through a viscous medium.

   (b) A steel ball of radius 4mm falls in a vertical columm of castor oil. The coefficient of viscosity of castor oil is 0.7 Nsm^{-2} and its density is $0.98 \times 10^3\ Kgm^{-3}$ the density of steel = $7.8 \times 10^3\ Kgm^{-3}$ and $g = 9.8\ ms^{-2}$. Find its terminal velocity. **(6+4)**

UNIT-III

Answer any <u>TWO</u> of the following. **10x2=20**

8. (a) State and prove Galilean principle of relativity.

   (b) A spaceship 100m in length in its rest position is moving at a uniform speed of 0.8C. Find its length as it appears to an observer on the earth. **(6+4)**

9. (a) Derive Einstein's mass energy equivalence formula.

(b) How fast a rocket has to go relative to an observer for its length to be contracted to 99% of its length at rest? **(6+4)**

10. (a) Deduce the equation of motion of a particle in a frame of reference moving with uniform acceleration relative to a frame which is at rest.

(b) A person weighing 80Kg is standing on a weighing machine inside a moving lift. What will be the reading shown by the weighing machine, when the lift moves a) down with a constant velocity 9.8 ms^{-1} b) down with an acceleration of 9.8 ms^{-2}.
(6+4)

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PHY 101.2 **Reg No.....**

CREDIT BASED FIRST SEMESTER B.Sc. DEGREE EXAMINATION OCTOBER 2014

PHYSICS

PAPER I: MATHEMATICAL PHYSICS, PROPERTIES OF MATERIALS AND RELATIVITY

Duration: 3 Hours **Max Marks: 80**

PART –A

1. (A) Answer any <u>TEN</u> of the following. **1X10=10**

xxv) Write the expression for position vector in Cartesian co-ordinate system.
xxvi) What is Argand diagram?
xxvii) Define order of a differential equation.
xxviii) State Fourier's Theorem.
xxix) State Hooke's Law.
xxx) What is meant by Neutral Layer of a bent beam?
xxxi) Define surface tension. Give its unit.
xxxii) Why lubricating oils must have high viscosity?
xxxiii) Define an inertial frame of reference.
xxxiv) Write the expression for coriolis force.
xxxv) Write Einstein's Mass-Energy Relation.
xxxvi) Define proper length.

(b) Answer any <u>FIVE</u> questions of the following. **2X5=10**

xiii) If $\vec{A} = 3\hat{i} + \hat{j} + \hat{k}$ and $\vec{B} = 2\hat{i} - 3\hat{j} + 4\hat{k}$, determine '' and ''.

xiv) Mention the applications of Fourier's analysis.

xv) Define different types of strain.

xvi) Distinguish between stream line and turbulent flow.

xvii) Give two differences between real force and inertial force.

xviii) Show that the relativistic expression for kinetic energy reduces to classical expression at low speeds.

PART-B

UNIT-I

Answer any TWO from the following: **10x2=20**

2. (a) Define Planar Vector. If $\vec{A}$ is a Planar rotating vector rotating vector of constant magnitude, and is a vector of same magnitude in a perpendicular direction in the same plane, show that

$\frac{d\vec{A}}{dt}$ and $\frac{d\vec{A}}{dt}$

(b) If $\vec{F} = 3xy\hat{i} - y^2\hat{j}$, evaluate $\int \vec{F} \cdot d\vec{r}$ where C is the curve in the x plane. **(6+4)**

3. (a) Analyze a saw-tooth wave using fourier's theorem and draw the relevant graph.

(b) Perform (3 + j4) + (5 + j2) both analytically and using Argand diagram. **(6+4)**

4. (a) Write the second order differential equation and find its solutions.

(b) If $\frac{dA}{dt}$ and $\frac{dB}{dt}$, find $\frac{dZ}{dt}$ and $\frac{dZ}{dt}$. **(6+4)**

UNIT-II

Answer any <u>TWO</u> of the following. **10x2=20**

5. (a) Define Elastic potential energy. Derive an expression for the work done in stretching a wire.

(b) A uniform steel wire of length 2.5m and of density $8\times10^{3}\ kg/m^{3}$ weighs 0.05 kg. When stretched by a force of 10kg wt, the length increases by . Calculate Young's modulus of steel. **(6+4)**

6. (a) Derive the general expression for the excess of pressure due to surface tension inside a liquid surface.

(b) Calculate the work done to blowing a soap bubble of radius 0.05m. Surface tension of soap solution is **(6+4)**

7. (a) Using stokes method, derive an expression for the terminal velocity of the liquid.

(b) Determine the radius of the drop of water falling through air, if the terminal velocity of the drop is $4gzl$. Coefficient of viscosity for air = and density of air = **(6+4)**

UNIT-III

Answer any TWO of the following. 10x2=20

8. (a) Derive the equation of motion of a particle in a frame of reference moving with uniform acceleration relative to an inertial frame and hence obtain an expression for pseudo force. Give one example of pseudo force.

   (b) A body whose actual weight is 13 kg appears to weigh 12 kg in a moving lift. Find the magnitude and direction of acceleration of the lift. **(6+4)**

9. (a) State and prove Galilean principle of relativity.

   (b) The length of a rod is found to be half of its length when at rest. What is the speed of the rod relative to the observer? **(6+4)**

10. (a) Obtain classical velocity addition theorem using Galilean transformation.

    (b) Half life of a particle at rest is 20 Nano Seconds. What will be the half life if its speed is 0.9 c? **(6+4)**

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PHY 101.2 Reg No.....

CREDIT BASED FIRST SEMESTER B.Sc. DEGREE EXAMINATION OCTOBER 2014

PHYSICS

PAPER I: MATHEMATICAL PHYSICS, PROPERTIES OF MATERIALS AND RELATIVITY

Duration: 3 Hours Max Marks: 80

PART –A

1. (A) Answer any TEN of the following. 1X10=10

xxxvii) Write the expression for position vector in Cartesian co-ordinate system.

xxxviii) What is Argand diagram?

xxxix) Define order of a differential equation.

xl) State Fourier's Theorem.

xli) State Hooke's Law.

xlii) What is meant by Neutral Layer of a bent beam?

xliii) Define surface tension. Give its unit.

xliv) Why lubricating oils must have high viscosity?

xlv) Define an inertial frame of reference.

xlvi) Write the expression for coriolis force.

xlvii) Write Einstein's Mass-Energy Relation.

xlviii) Define proper length.

(b) Answer any <u>FIVE</u> questions of the following. 2X5=10

xix) If $\vec{A} = 3\hat{i} + \hat{j} + \hat{k}$ and $\vec{B} = 2\hat{i} - 3\hat{j} + 4\hat{k}$, determine $\vec{A}''$ and $\vec{B}''$.

xx) Mention the applications of Fourier's analysis.

xxi) Define different types of strain.

xxii) Distinguish between stream line and turbulent flow.

xxiii) Give two differences between real force and inertial force.

xxiv) Show that the relativistic expression for kinetic energy reduces to classical expression at low speeds.

PART-B

UNIT-I

Answer any TWO from the following: 10x2=20

2. (a) Define Planar Vector. If $\vec{A}$ is a Planar rotating vector rotating vector of constant magnitude, and is a vector of same magnitude in a perpendicular direction in the same plane, show that

$\frac{d\vec{A}}{dt}$ and $\int \vec{F} \cdot d\vec{r}$

(b) If $\vec{F} = 3xy\hat{i} - y^2\hat{j}$, evaluate where C is the curve in the *x* plane. **(6+4)**

3. (a) Analyze a saw-tooth wave using fourier's theorem and draw the relevant graph.

(b) Perform (3 + j4) + (5 + j2) both analytically and using Argand diagram. **(6+4)**

4. (a) Write the second order differential equation and find its solutions.

(b) If $\frac{dA}{dt}$ and $\frac{dB}{dt}$, find $\frac{dZ}{dt}$ and $\frac{dZ}{dt}$. **(6+4)**

UNIT-II

Answer any TWO of the following. **10x2=20**

5. (a) Define Elastic potential energy. Derive an expression for the work done in stretching a wire.

   (b) A uniform steel wire of length 2.5m and of density $8\times10^{3}\ kg/m^{3}$ weighs 0.05 kg. When stretched by a force of 10kg wt, the length increases by . Calculate Young's modulus of steel. **(6+4)**

6. (a) Derive the general expression for the excess of pressure due to surface tension inside a liquid surface.

   (b) Calculate the work done to blowing a soap bubble of radius 0.05m. Surface tension of soap solution is **(6+4)**

7. (a) Using stokes method, derive an expression for the terminal velocity of the liquid.

   (b) Determine the radius of the drop of water falling through air, if the terminal velocity of the drop is $1\ cm/s$. Coefficient of viscosity for air = and density of air = **(6+4)**

UNIT-III

Answer any TWO of the following. **10x2=20**

8. (a) Derive the equation of motion of a particle in a frame of reference moving with uniform acceleration relative to an inertial frame and hence obtain an expression for pseudo force. Give one example of pseudo force.

   (b) A body whose actual weight is 13 kg appears to weigh 12 kg in a moving lift. Find the magnitude and direction of acceleration of the lift. **(6+4)**

9. (a) State and prove Galilean principle of relativity.

   (b) The length of a rod is found to be half of its length when at rest. What is the speed of the rod relative to the observer? **(6+4)**

10. (a) Obtain classical velocity addition theorem using Galilean transformation.

    (b) Half life of a particle at rest is 20 Nano Seconds. What will be the half life if its speed is 0.9 c? **(6+4)**

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PHY 101.2 **Reg No.....**

CREDIT BASED FIRST SEMESTER B.Sc. DEGREE EXAMINATION OCTOBER 2015

PHYSICS

PAPER I: MATHEMATICAL PHYSICS, PROPERTIES OF MATERIALS AND RELATIVITY

Duration: 3 Hours **Max Marks: 80**

PART –A

1. (A) Answer any <u>TEN</u> of the following. **1X10=10**

xlix) Write the expression for position vector in Cartesian co-ordinate system.

l) Write complex number in trigonometric form.

li) Define degree of a differential equation.

lii) Write Fourier's theorem in mathematical form.

liii) State Hooke's Law.

liv) Why fluids possess only Bulk modulus?

lv) What are I-section girders?

lvi) Define surface tension. Give its unit.

lvii) Give an example for Pseudo force.

lviii) Write an expression for variation of mass with velocity.

lix) Define proper length.

lx) What is the value of rest mass of a photon?

(b) Answer any <u>FIVE</u> of the following. **2X5=10**

xxv) Using Argand diagram explain addition of two complex numbers.

xxvi) Write the first order differential equation and find its solution by separating the variables method.

xxvii) Why do we prefer to wash clothes in hot soap solution than in cold solution?

xxviii) What are the assumptions of Stokes law?

xxix) Give two differences between inertial and non-inertial frames of references.

xxx) Material particle cannot have velocity equal to or greater than velocity of light. Explain.

PART-B

UNIT-I

Answer any TWO from the following: **10x2=20**

2. (a) Obtain expressions for radial and transverse velocity and accelerations of a particle.

(b) Find the total work done in moving a particle in a force field given by $\vec{F}$ along the curve and from t = 0 to t = 1. **(6+4)**

3. (a) What is a second order differential equation. Give an example. Write the differential equation for single harmonic oscillator and find its solution.

   (b) Perform (6 + j2) + (2 + j5) both analytically and using Argand diagram. **(6+4)**

4. (a) Analyse a square wave using Fourier's theorem and draw relevant graph.

   (b) Evaluate where along the surface A bounded by x = 0, x = 1, y = 0, y = 1 and z = 0, z = 1. **(6+4)**

UNIT-II

Answer any <u>TWO</u> of the following. **10x2=20**

5. (a) Define an expression for torsional couple per unit twist.

   (b) Calculate the Poisson's ratio for silver. Given Young's modulus for silver is and bulk modulus is . **(6+4)**

6. (a) Give the theory of drop weight method of finding interfacial tension between two liquids.

   (b) Two drops of water of the same size are falling through air with terminal velocities of . If two drops combine to form a single drop, what will be the new terminal velocity? **(6+4)**

7. (a) Give the theory of comparing the coefficients of viscosity of two given liquids using Ostwald's viscometer.

   (b) A drop of mercury of radius 2mm is split into 8 identical droplets. Find the increase in surface energy. Surface tension of mercury **(6+4)**

UNIT-III

Answer any <u>TWO</u> of the following. **10x2=20**

8. (a) Obtain relativistic law of addition of velocities using Lorentz transformations.

   (b) At what velocity will be relativistic contraction in the moving rod is 25%. **(6+4)**

9. (a) Establish mathematically Einstein's mass-energy relationship.

   (b) What is Pseudo force and the total force acting on a freely falling body of mass 3kg with reference to a frame moving downwards with the acceleration . **(6+4)**

10. (a) Write a note on gravitational red shift.

(b) Kinetic energy of a particle is 3 times its rest mass energy. What is its velocity?
(6+4)

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PHY 101.2 Reg No.....

CREDIT BASED FIRST SEMESTER B.Sc. DEGREE EXAMINATION OCTOBER 2016

PHYSICS

PAPER I: MATHEMATICAL PHYSICS, PROPERTIES OF MATERIALS AND RELATIVITY

Duration: 3 Hours **Max Marks: 80**

PART –A

1. (A) Answer any TEN of the following. **10X1=10**

i) If $\vec{A}\cdot\vec{B}=0$, what is the angle between $\vec{A}$ and $\vec{B}$?
ii) Define uniform circular motion.
iii) Define argument of a complex number.
iv) What is a first order differential equation?
v) Write the S.I. unit of elasticity.
vi) What are I-section girders?
vii) Why it is easier to spray soap solution than water?
viii) Define critical velocity of a liquid.
ix) What is an inertial frame of reference?
x) What is weightlessness?
xi) State Galilean principle of relativity
xii) Define proper length.

(b) Answer any FIVE of the following. **5X2=10**

i) Show that the vectors $\vec{A}=\hat{i}+2\hat{j}+3\hat{k}$ and $\vec{B}=2\hat{i}+4\hat{j}+6\hat{k}$ are parallel to each other.
ii) Using Argand diagram explain subtraction of two complex numbers.
iii) Obtain the theoretical and practical limits of Poisson's ratio.
iv) Distinguish between streamline and turbulent flow.
v) Obtain classical velocity addition theorem using two inertial frames.
vi) Explain the concept of time dilation.

PART-B

UNIT-I

Answer any TWO from the following: **2x10=20**

2. (a) With usual notation, for a planar vector of constant magnitude and changing direction show that,

$$\frac{d\vec{A}}{d\theta}=\overrightarrow{A_{\perp}} \text{ and } \frac{d\overrightarrow{A_{\perp}}}{d\theta}=-\vec{A}$$

(b) If $\vec{F}=3xy\hat{i}-y^2\hat{j}$, evaluate $\int\vec{F}\cdot\vec{dr}$ where C is the curve in the xy plane, $y=x^2$ from (0, 0) to (1, 2) **(6+4)**

3. (a) What is a second order differential equation? Give an example. Write the differential equation for the motion of pendulum and find its solution.

   (b) Perform (3 + j4) + (5 + j2) both analytically and using Argand diagram. **(6+4)**

4. (a) State Fourier's theorem and explain how amplitude terms in a Fourier series are evaluated.

   (b) A particle moves along the curve $x = 2t^2, \quad y = t^2 - 4t, \quad z = 3t - 5$. Find the components of its velocity and acceleration at t = 1 in the direction $\left(\hat{i} - 3\hat{j} + 2\hat{k}\right)$ **(6+4)**

UNIT-II

Answer any <u>TWO</u> of the following. **2x10=20**

5. (a) Derive the expression for bending moment of a beam. Hence find the bending moment of a bar of rectangular and circular cross section.

   (b) A steel rod of length 50 cm, width 2 cm and thickness 1 cm is bent into the form of an arc of radius of curvature 2 m. Calculate the bending moment. Youngs modulus of the material of the rod is $2 \times 10^{11} N \mid m^2$. **(6+4)**

6. (a) Give the theory of drop weight method of finding surface tension of a liquid.

   (b) A steel ball of radius 2 mm falls in a vertical column of castor oil. Find its terminal velocity. Given that coefficient of viscosity of castor oil is $0.7 N\, s\, m^{-2}$ and its density is $0.98 \times 10^3 kg\, m^{-3}$. The density of steel is $0.78 \times 10^4 kg\, m^{-3}$ and $g = 9.8 ms^{-2}$ Find its terminal velocity. **(6+4)**

7. (a) Obtain Stoke's formula for viscous force acting on a body falling through a viscous medium.

   (b) Eight drops of water of the same size are falling through air with terminal velocity of $10 ms^{-1}$. If eight drops combine to form a single drop, what will be the new terminal velocity? **(6+4)**

UNIT-III

Answer any <u>TWO</u> of the following. **2x10=20**

8. (a) Using Lorentz transformation equations derive the formula for length contraction.

   (b) A rod 2.5m long is moving with a velocity of 0.73c. Calculate the percentage contraction in length. **(6+4)**

9. (a) Obtain the relativistic equation connecting momentum and energy and hence write down the formulae for energy and momentum of a photon.

   (b) Calculate the kinetic energy of an electron moving with a velocity 0.99C given rest mass of electron = $9.1 \times 10^{-31} kg$. **(6+4)**

10. (a) Establish mathematically Einstein's mass energy relation.

    (b) Calculate the pseudo force and apparent force acting on a freely falling body of mass 10 kg with reference to a frame moving with a downward acceleration of $5 ms^{-2}$. **(6+4)**

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