ENGINEERING PHYSICS

(Theory — 2(a))

Full Marks : 80

Time : 3 hours

Answer any **five** questions including **Q. Nos. 1 & 2**

Figures in the right-hand margin indicate marks

1. Answer *all* questions : 2 × 10

   (*a*) What are the basic units in SI system.

   (*b*) State triangle law of vector addition.

   (*c*) What is relation between linear velocity and angular velocity ?

   (*d*) Define Work and write its SI unit.

   (*e*) Define universal gravitational constant(G).

   (*f*) Define transverse wave.

   (*g*) Define Latent Heat.

   (*h*) State the laws of refraction

   (*i*) Define unit charge.

   (*j*) State Lenz's law.

2. Answer any *six* questions : 5 × 6

   (*a*) State the principle of homogeneity and check the correctness of the formula

   $$v^2 - u^2 = 4as.$$

   (*b*) A body projected vertically upward reaches height of 89 m. Calculate its initial velocity.

   (*c*) Distinguish between mass and weight.

   (*d*) Define ultrasonics and write its properties.

   (*e*) State first law of thermodynamics.

   (*f*) Define critical angle and total internal reflection.

   (*g*) State Coulomb's law of magnetism and define unit pole.

   (*h*) Write the properties and application of LASER.

3. Derive expression for Time of flight, Maximum height and Horizontal Range for a projectile fired at an angle θ. 10

4. State the laws of limiting friction and mention different methods to reduce friction. 10

5. (a) State Kepler's laws of planetary motion.

(b) A body weights 40 kg wt on the surface of earth. What will be its weight on the surface of Mass of radius $\frac{1}{3}$ and mass $\frac{1}{12}$ of that of earth. 6 + 4

6. Calculate the quantity of heat required to raise the temperature of 10 gm of ice at $-10\,^{\circ}\text{C}$ to water at $60\,^{\circ}\text{C}$. 10

7. State Faraday's laws of electromagnetic induction and compare between Fleming's Left Hand Rule and Right Hand Rule. 6 + 4

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Th. 2a-ENGINEERING PHYSICS

Full Marks: 80   Time: 3 Hours

Answer any **Five** Questions including Q No.1&2

Figures in the right hand margin indicates marks

1.	Answer **ALL** questions.	2×10

(a) Express 1 Joule into erg. 10^7 erg

(b) A force of 100N is resolved into two equal components at 60° to each other. Find the magnitude of each component. $10/\sqrt{3}$ N

(c) Establish a relation between linear velocity & angular velocity. $v = rc\omega$

(d) State two methods to reduce friction.

(e) Write down the S.I. unit and dimension of specific heat. $J\,kg^{-1}\,°K^{-1}$ $[M^1 L^2 T^{-2}]$

(f) What are the conditions for minimum deviation when a ray of light passes through a prism?

(g) Two capacitors of capacitances C_1 and C_2 are connected in parallel. If a charge Q is given to the assembly the charge gets shared. What is the ratio of the charge on the capacitor C_1 to the charge on the capacitor C_2? c_1/c_2

(h) The gravitational force between two objects is F. If masses of both the objects are halved without altering the distance between them, then what will be the change in gravitational force? $F/4$

(i) State Fleming's Left Hand Rule.

(j) Define Population Inversion.

2.	Answer any **SIX** questions.	5×6

(a) Check the correctness of the following equation by dimensional analysis where the symbols have their usual meaning.

$$T = 2\pi\sqrt{\frac{l}{g}}$$

(b) State the properties of magnetic lines of force.

(c) Distinguish between mass and weight.

(d) How much heat is needed to convert 0.005 kg of ice at 0°C to water at 10°C?

(e) Define optical fibre. Mention two of its properties and applications.

(f) Derive a relation between 1) farad and stat farad 2) farad and ab farad

(g) State laws of limiting friction.

3.	Derive an expression for equation of trajectory, time of ascent and maximum height of a projectile fired at an angle θ with the horizontal.	10

$y = x\tan\theta - \dfrac{g}{2u^2\cos^2\theta}x^2$, $t = \dfrac{u\sin\theta}{g}$, $y_0 = \dfrac{u^2\sin^2\theta}{2g}$

4. Derive an expression for displacement, velocity and acceleration of a particle executing S.H.M.

$y = r \sin \omega t$, $v = \omega \sqrt{r^2 - y^2}$, $a = \omega^2 y$

5. State and explain Kirchhoff's laws with an example. Derive the condition for a balanced Wheatstone bridge.

6. State Faraday's law of electro magnetic induction. A field of 0.0125 T is at right angles to a coil of area 5×10^{-3} m² with 1000 turns. It is removed from the field in 1/20 s. Find the e.m.f. produced.

1.25 V

7. Establish the relation between α, β & γ. A piece of copper wire has a length of 2m at 0°C. Find its length at 100°C. Given $\alpha = 17 \times 10^{-6}$ °C⁻¹.

2.0034 m

$\phi = n B A$

Full Marks: 80   Time : 3 Hours

Answer any FIVE Questions including Q No. 1 & 2

Figures in the right hand margin indicates marks

1.	Answer ALL the questions:	2×10

(a) Write down the units of the following physical quantities :

i) Power $-$ watt

ii) Wavelength $-$ m.

iii) Stress $=$ N/m^2.

iv) Torque $-$ N.m

(b) State parallelogram law of vector addition.

(c) Given $\vec{A} = 4\hat{i} + 3\hat{j} + 2\hat{k}, \vec{B} = 5\hat{i} + 2\hat{j} + \hat{k}$. Find $\vec{A} \times \vec{B}$ $= -\hat{i} + 6\hat{j} + 7\hat{k}$

(d) Under what condition the range of a projectile is maximum?

(e) Write down two applications of Ultrasonics.

(f) Define Joule's Mechanical equivalent of heat.

(g) State the laws of reflection.

(h) Write down two applications of optical fibre.

(i) Define Unit pole.

(j) State Lenz's law.

2.	Answer any SIX questions:	5 × 6

(a) Check the correctness of formula dimensionally.

$$T = 2\pi\sqrt{\frac{l}{g}}$$

(b) State Kepler's laws of planetary motion.

(c) Distinguish between longitudinal and transverse wave.

(d) Discuss the properties of ultrasonic.

(e) Define critical angle and total internal reflection.

(f) State and explain Coulomb's law of electrostatics.

(g) Distinguish between Fleming's left hand rule and Fleming's right hand rule.

(handwritten notes in right margin):

$y = x\tan\theta - \dfrac{g}{2u^2\cos^2\theta}x^2$

$y_o = \dfrac{u^2\sin^2\theta}{2g}$

$T = \dfrac{2u\sin\theta}{g}$

$x = \dfrac{u^2\sin2\theta}{g}$

|		
3.	Derive expression for Equation of trajectory, Time of flight, maximum height for a projectile fired at an angle θ with the horizontal.	10
4.	State the laws of limiting friction and discuss the methods to reduce friction.	10

5.i) State and explain Newton's laws of gravitation.

ii) Derive a relation between g &G.

6. How much steam at 100^0 C will melt 3.2 kg of ice at -10^0 C ? Given that the Specific heat capacity of ice $=0.5 Kcalkg^{-1}$, Specific latent heat of steam $= 540$ Kcalkg^{-1}, Specific latent heat of ice $=80$ Kcalkg^{-1}

7.i) State Kirchhoff's laws.

ii) Find the equivalent resistances between A &B.
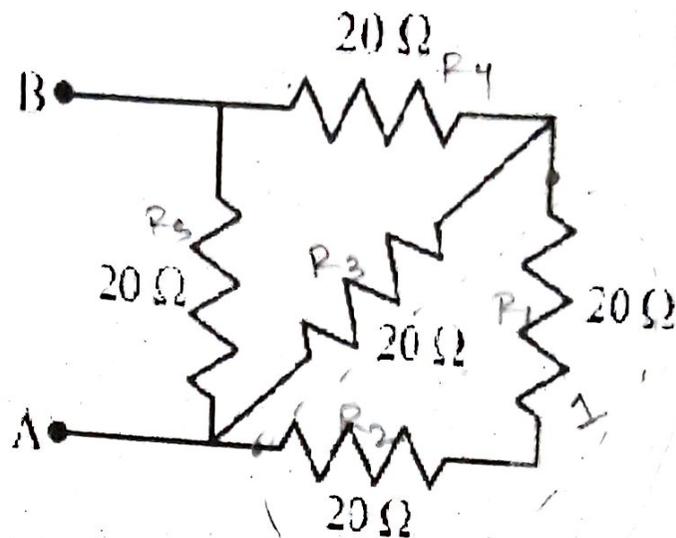
20

$R_1 \& R_2 - series$

$R_{12} = R_1 + R_2 = 40\Omega$

$R_{12} \& R_3 - parallel$

$\dfrac{1}{R_{123}} = \dfrac{1}{40} + \dfrac{1}{20} = \dfrac{1+2}{40}$

$\therefore R_{123} = \dfrac{40}{3}\Omega$

$R_4 \& D$

$m_s = ?$

ENGINEERING PHYSICS
(Theory : 2(A))

Full Marks : 80   *Time* : 3 hours

Answer any **five** questions including **Q. Nos. 1 & 2**

Figures in the right-hand margin indicate marks

1. Answer *all* questions : 2×10

   (a) Write down the dimensional formula of the following physical quantities :

   $[M^1 L^2 T^{-2}]$

   $[T^{-1}]$

   (i) Power $[M^1 L^2 T^{-3}]$

   (ii) Frequency $[T^{-1}]$

   (b) Given, $\vec{A} = \hat{i} - 2\hat{j} - 3\hat{k}$, $\vec{B} = 2\hat{i} + \hat{j} - 5\hat{k}$, Find $\vec{A} \cdot \vec{B}$. $= 2 - 2 + 15 = 15$

   (c) State Triangle law of vector addition.

   (d) Define Latent Heat of Vaporization.

   (e) Draw a ray diagram for refraction through a prism.

   (f) Define Unit Pole.

   (g) State the First Law of Thermodynamics.

   (h) State Kirchhoff's 2nd Law.

   (i) Write down two important applications of LASERS in Industry.

   (j) State Fleming's Left Hand Rule.

2. Answer any *six* questions : 5×6

   (a) Two forces whose magnitudes are in the ratio 3 : 5 give a resultant equal to 70 N. If the angle between them is 60°, find the magnitude of each force. $x = 10$
   $30N, 50N$

   $v = u + at$
   $50 = 0 + a(5 \times 60)$
   (b) A car attains a velocity of 50 m/sec in 5 minutes from standstill. Calculate the acceleration. $0.167 \ m/s^2$

   $a = \frac{50}{300} \ m/s^2$
   $= \frac{1}{6}$
   (c) Distinguish between mass and weight.

   (d) State Newton's Laws of Gravitation and define G.

   (e) Write different methods to reduce Friction.

   (f) Establish the relation between α and β.

   (g) State Coulomb's Laws in magnetism.

   (h) State Faraday's Laws of Electromagnetic Induction.

3. Derive expressions for time of flight, maximum height and range of a projectile fired at an angle θ with the horizontal.   10

   $T = \frac{2u\sin\theta}{g}$

   $Y_0 = \frac{u^2\sin^2\theta}{2g}$

   $x = \frac{u^2\sin 2\theta}{g}$

4. Calculate the amount of heat required to convert 5 gm of ice at $-5°C$ to water at 60°C. Given, specific Heat of Ice = 0.5 Cal/gm °C, Latent Heat of ice = 80 Cal/gm. 10

5. Define Critical Angle and Total Internal Reflection with diagram. Write down the principle and application of Optical Fibre. 6 + 4

6. State Coulomb's Laws of Electrostatics. Find out the equivalent resistance of 5 Resistors of which 2 Ω, 3 Ω and 5 Ω connected in series and 10 Ω and 20 Ω are connected in parallel to them. 4 Ω 5 + 5

7. Derive an expression for force acting on a current carrying conductor placed in a uniform magnetic field. Compare between Fleming's Left Hand Rule and Right Hand Rule. 6 + 4

ENGINEERING PHYSICS
(Theory : 2 (A))

Full Marks : 80   *Time* : 3 hours

Answer any **five** questions including **Q.Nos.1 & 2**

Figures in the right-hand margin indicate marks

1. Answer *all* questions :   2 × 10

   (a) State the Principle of Homogeneity.

   (b) Define Universal Gravitational Constant (G).

   (c) State Triangle law of vector addition.

   (d) State two properties of Ultrasonic.

   (e) State the Laws of Refraction.

   (f) Define Unit Charge.

   (g) Define Joule's Mechanical Equivalent of Heat.

   (h) State Ohm's Law.

   (i) Mention the properties of LASER.

   (j) State Lenz's Law.

2. Answer any *six* questions :   5 × 6

   (a) Check the correctness of the relation dimensionally : $F = 2mv^2/r$.

   (b) Establish the relation between (i) Linear and Angular Velocity (ii) Linear and Angular Acceleration.

   (c) Distinguish between Transverse wave and Longitudinal wave.

   (d) State Kepler's Laws of Planetary Motion.

   (e) State the Laws of Limiting Friction.

   (f) Define Specific Heat. Find its unit and dimension.

   (g) State Coulomb's Laws in Magnetism.

   (h) Find the total capacity when three capacitors of capacity, $2\mu F$, $3\mu F$ and $5\ \mu F$ are connected in series.

3. Derive expression for displacement, velocity and acceleration of a particle executing Simple Harmonic Motion.   10

4. State Kirchhoff's Laws and obtain Balanced condition of Wheatstone's Bridge.   4 + 6

(Turn Over)

5. Define the coefficients of Linear, Superficial and cubical Expansion of solids and Establish the relation α : β : γ :: 1 : 2 : 3.   4 + 6

6. State Faraday's Laws of Electromagnetic Induction. Calculate the equivalent resistance of 5 resistors of 5Ω each connected in parallel.   6 + 4

7. Write short notes on any *two* :   5 × 2

(*i*) Total Internal Reflection

(*ii*) Properties of Magnetic Lines of Force

(*iii*) Relation between wave parameters

(*iv*) Fleming's Left Hand Rule.

$$\frac{1}{R_{eqv}} = \frac{1}{r_1} + \frac{1}{r_2} + \frac{1}{r_3} + \frac{1}{r_4} + \frac{1}{r_5}$$

$$\frac{1}{5} \times 5 = 1$$

$$R_{eqv} = 1\ \Omega$$

Full Marks: 80   Time- 3 Hrs

Answer any five Questions including Q No.1& 2
Figures in the right hand margin indicates marks

1. Answer **All** questions   2 x 10
    a. Name the basic units in S.I system.
    b. Define dot product of 02 vectors.
    c. What is Dynamic friction?
    d. Mention the relationship between (i) Linear & Angular velocity (ii) Linear & Angular acceleration
    e. Define Universal Gravitational Constant (G).
    f. How are velocity, frequency and time period of a wave related ?
    g. Define Specific Heat of a substance.
    h. What is Refractive Index? State its unit.
    i. Define Unit Charge.
    j. What does LASER stand for?

2. Answer **Any Six** Questions   5 x 6
    a. Check the dimensional correctness of the physical relations
        (i) $s = 6ut + 8at^2$ (ii) $v^2 - u^2 = 9as$ (2.5+2.5)
    b. At what angle 02 forces (A+B) and (A-B) should be inclined to have a resultant $\sqrt{3A^2 + B^2}$
    c. What are different methods of reducing friction ?
    d. Explain the variation of acceleration due to gravity (g) with
        (i) Altitude (ii) Depth   (2.5+2.5)
    e. Explain "Critical Angle" and "Total Internal reflection" with ray diagram
    f. The effective capacitance of 02 capacitors is 4 µF when connected in series and 18 µF when connected in parallel. Find the capacitance of each capacitor.
    g. State & explain Coulomb's Law in Magnetism.   (2 + 3)

               ANSWER ANY THREE QUESTIONS   10 x 3

3   Derive formulae for (i) Time of flight (T) (ii) Maximum Height attained (iii)   10
    Maximum Horizontal Range of a projectile fired at an angle θ with horizontal.
    (3+4+3)

4   Obtain equations for (i) Displacement (ii) Velocity (iii) Acceleration of a body   10
    executing Simple Harmonic Motion (SHM)   (3+4+3)

5   Prove that $\alpha : \beta : \gamma = 1 : 2 : 3$ where α, β and γ are co-efficients of linear,   10
    areal and cubical expansion of solid material.

6   Establish the condition of balance in a wheatstone bridge using Kirchoff's law   10
    with a clear circuit diagram.

7   State Faraday's laws of electromagnetic induction. Compare Fleming's Left   10
    Hand Rule and Right Hand Rule.   (5+5)

1

Full Marks: 80

Time- 3 Hrs

Answer any five Questions including Q No.1 & 2
Figures in the right hand margin indicates marks

1.   Answer All questions   2 x 10
  a. Write down the SI units of work, angular velocity, electric potential and acceleration
  b. What are ultrasonics?
  c. State laws of reflection.
  d. What is the condition for maximum horizontal range?
  e. State Newton's law of gravitation.
  f. State Lenz's law.
  g. Define specific heat.
  h. State Fleming's right hand thumb rule.
  i. Write down the properties of LASER.
  j. If two capacitors with capacities 2 farad and 3 farad are connected in series connection then, find out the total capacity.

2.   Answer Any Six Questions   5X6

  a. Differentiate between **G** & **g** with example

  b. State Laws of limiting friction.

  c. State Kepler's laws of planetary motion.

  d. Define critical angle and total internal reflection with a diagram.

  e. Distinguish between longitudinal and transverse wave.

  f. State and explain Coloumb's Law of electrostatic

  g   Define lines of force and write down its properties.

3   A projectile fired with an initial velocity 'u' by making an angle 'θ' with the   10
      horizontal. Derive expressions for equation of trajectory, maximum height,
      horizontal range and time of flight.

4   Derive an expression for force acting on a current carrying conductor placed in a   10
      uniform magnetic field. Distinguish between Fleming's left hand rule &
      Fleming's right hand rule.

5   Find expressions for displacement, velocity and acceleration of a particle   10
      executing in S.H.M

6   Calculate the total amount of heat required to convert 2.5 Kg of ice from -30°C,   10
      to a steam at 200°C.

7   State Kirchoff's laws. Apply it to find out balanced condition of the wheatstone   10
      bridge.