

**Indian Maritime University**  
**(A Central University, Govt of India)**  
**Sep/Oct'25 SE**  
**Programme Name: B Tech (ME)**  
**Semester: I**  
**Subject Code: UG11T4102**  
**Subject Name: Physics**

Date: 02.09.2025

Max Marks: 70

Duration: 03 Hrs

Pass Marks: 35

**General Instructions :-**

- (i) All Sections (A & B) are to be attempted.  
(ii) In section B, Attempt any five question out of seven question.  
(iii) Options, if any, are specified in respective section.

**Section A****Attempt all following question [ 10 Question = 10 × 1 = 10 Marks]**

1. \_\_\_\_\_ in magnetic circuit is analogous to the electrical term of current
 

a) Flux density	b) Permeance
c) Flux	d) Reluctance
  
2. The strongest diamagnetic material among the following is \_\_\_\_\_
 

a) Sulphur	b) Bismuth
c) Glass	d) Graphite
  
3. By which law, the direction of induced EMF will be identified
 

a) Faraday's first law	b) Faraday's second law
c) Lenz's law	d) Fleming's left hand rule
  
4. Which among the following is not passive component?
 

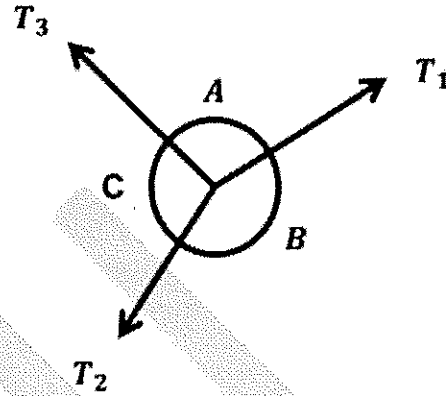
a) Resistor	b) Capacitor
c) Inductor	d) Diode
  
5. Which of the following metals is used to make electrical wires?
 

a) Copper	b) Silver
c) Lead	d) Magnesium
  
6. The force system is said to be in equilibrium when
 

a) $\sum f_x = 0$ and $\sum f_y = 0$	b) $f_x = 0$ and $f_x = 0$
c) $\sum f_x \neq 0$ and $\sum f_y = 0$	d) $\sum f_x = \delta_x$ and $\sum f_y = \delta_y$
  
7. The physical quantity which has magnitude, as well as direction, is called \_\_\_\_\_ quantity.

8. What are the types of kinetic friction?
- Sliding friction, rolling friction, and adhesive friction
  - Sliding friction and rolling friction
  - Rolling friction and adhesive friction
  - Sliding friction and adhesive friction
9. Consider the following figure, identify the correct option

- $\frac{T_1}{\sin A} = \frac{T_2}{\sin B} = \frac{T_3}{\sin C}$
- $\frac{T_3}{\cos B} = \frac{T_1}{\cos C} = \frac{T_2}{\cos A}$
- $\frac{\sin C}{T_2} = \frac{\sin B}{T_1} = \frac{\sin A}{T_3}$
- $\frac{T_2}{\sin A} = \frac{T_1}{\sin C} = \frac{T_3}{\sin B}$



10. What does the moment of the force measure?
- The tendency of rotation of the body along any axis
  - The moment of inertia of the body about any axis
  - The couple moment produced by the single force acting on the body
  - The total work is done on the body by the force

### Section B

**Answer the following question [ 5 Question = 5 × 2 = 10 Marks]**

- Define potential gradient
- Define skin effect
- Define the Couple and Moment of a couple?
- State characteristics of force
- Draw a classification flow chart for the system of force

### Section C

**[Any five = 5 × 10 = 50 Marks]**

- 16 a)** State & explain working principle of electric kettle. State Joule's law of heating. [5 Mark]

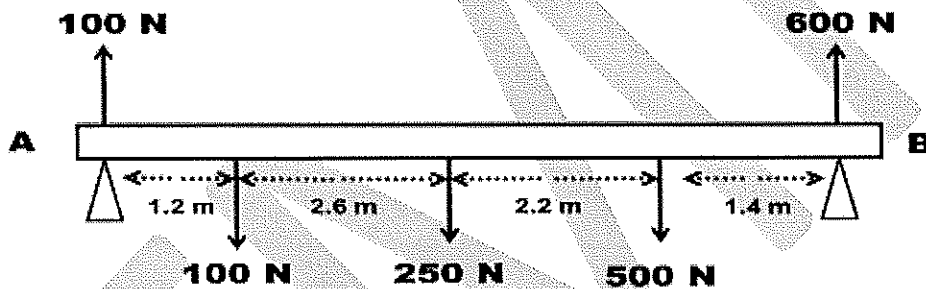
b) State and explain law of parallelogram of force, and derive expression for resultant and direction of resultant [5 Mark]

17. a) A conductor material has free-electron density of  $10^{24}$  electrons/m<sup>3</sup>. When a voltage is applied, a constant drift velocity of  $1.5 \times 10^{-2}$  m/s is attained by electrons. If the cross sectional area of material is  $1 \text{ cm}^2$ , Calculate the magnitude of the current. Electronic charge is  $1.6 \times 10^{-19}$  Coulomb [5 Mark]

b) Explain types of supports and support reactions with neat diagrams. [5 Mark]

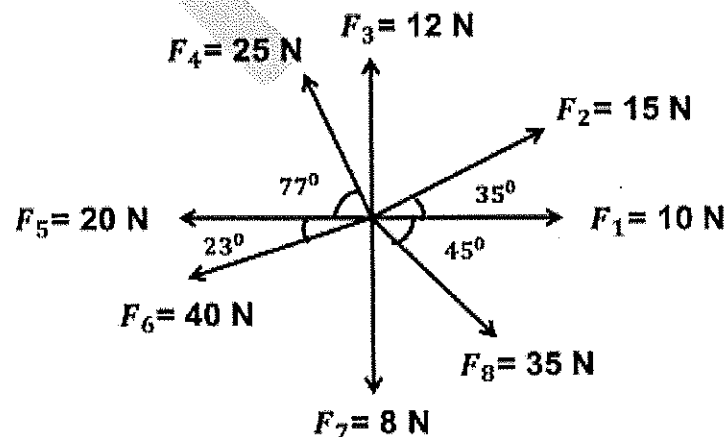
18 a) Two resistances R1 & R2 are connected in parallel. If voltage source V is connected across parallel circuit, derive expression for current flowing through each resistance. [5 Mark]

b) For the beam, reduce the system of forces shown to (a) an equivalent force-couple system at A, (b) an equivalent force couple system at B, and (c) a single force or resultant. [5 Mark]



19 a) A series magnetic circuit that has 3 parts of different dimensions, different relative permeability, Find total MMF. [5 Mark]

b) Consider the following 2-D co-planer force system and find out the resultant & direction of the resultant draw vector diagram. [5 Mark]



20 a) An electric iron operates from a 230V outlet and draws 8 amperes of current. At Rs. 4/KWh, how much does it cost to operate the iron for 2

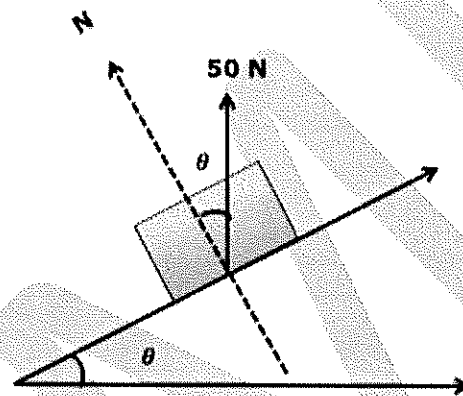
hours?

[ 5 Mark ]

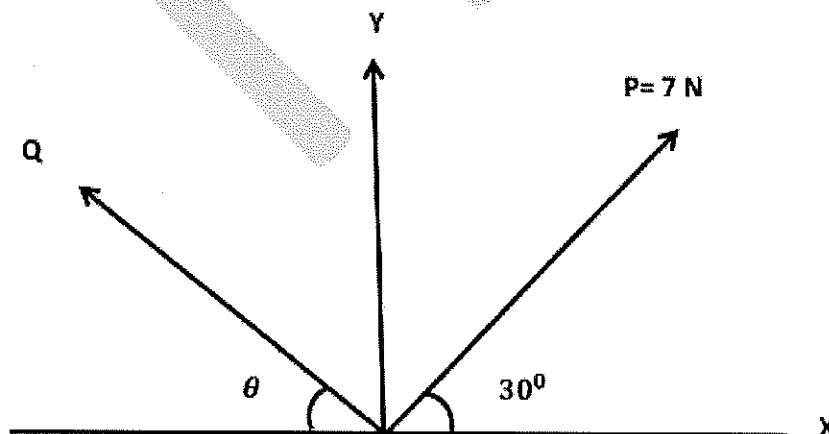
**b)** Explain angle of repose and angle of friction with sketch. State any four application of friction [ 5 Mark ]

**21 a)** Find the magnetic field strength applied to a magnetic circuit of length 50cm when a coil of 400 turns is applied to it carrying a current of 1.2Amp. [ 5 Mark ]

**b)** A block weighing 50 N just starts moving down a rough inclined plane when supported by a force of 20N acting parallel to the plane in upward direction. The same block is on the verge of moving up the plane when pulled by a force of 30N acting parallel to the plane. Find the inclination of the plane and coefficient of friction between the inclined plane and the block.



**22 a)** The resultant of two forces P and Q is 15 N vertical. Determine the force Q and the corresponding angle  $\theta$  for the system of forces as shown in Fig.



**b)** State & explain basic law of electromagnetism used to induce EMF. (5+5)