

## CHAPTER-6 Engineering Mechanics (Answer Key)

### 1. FBD, equilibrium and system of forces

1	2	3	4	5	6	7	8	9	10
a	c	a	d	c	b	b	b	d	d
11	12								
*	c								

### 2. Motion of particles

1	2	3	4	5	6	7	8	9	10
d	b	b	c	b	a	d	c	c	b
11	12	13							
d	b	b							

### 3. Centroids And Moment Of Inertia

1	2	3	4	5	6	7
b	a	c	c	*	d	d

### 4. Friction

1	2	3	4	5	6	7	8	9	10
b	a	d	b	a	b	d	c	a	b
11	12								
c	d								

### 5. Work And Energy

1	2	3	4	5
b	c	c	d	d

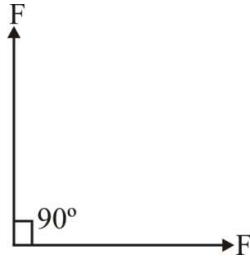
### 6. Impulse, Momentum And Collision

1	2	3	4	5	6	7	8
a	d	a	b	d	d	a	a

## SOLUTIONS

### 1. FBD, Equilibrium & System of Forces

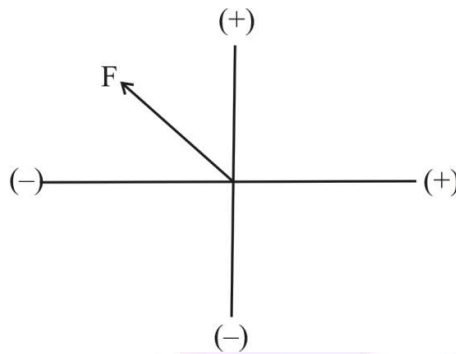
1. (a)  
Given data:



$$F_1 = F_2 = F, \quad \theta = 90^\circ$$

$$R = \sqrt{F_1^2 + F_2^2 + 2F_1F_2 \cos \theta} = \sqrt{2} \cdot F$$

2. (c)



$$F_x = -ve$$

$$F_y = +ve$$

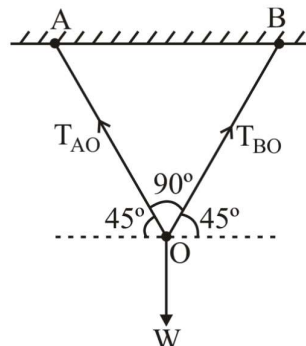
The direction of this force is present in second quadrant.

3. (a)  
For 3 - D equilibrium condition of a body under action of different forces -

$$\sum F_x = 0, \quad \sum F_y = 0, \quad \sum F_z = 0$$

$$\text{and also, } \sum M_x = 0, \quad \sum M_y = 0 \quad \text{and} \quad \sum M_z = 0$$

4. (d)  
By Lami's theorem:



$$\frac{T_{AO}}{\sin(90^\circ+45^\circ)} = \frac{T_{BO}}{\sin(90^\circ+45^\circ)} = \frac{W}{\sin 90^\circ}$$

$$T_{AO} = T_{BO} = \frac{W \cdot \sin(90^\circ+45^\circ)}{\sin 90^\circ}$$

$$T_{AO} = T_{BO} = \frac{W \times 1}{\sqrt{2} \times 1} = \frac{W}{\sqrt{2}}$$

5. (c)

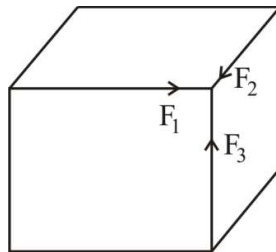
Tie – A member which carries a axial tensile load.

Strut – A member carries a axial compressive load.

Column – A vertical member, carries a axial compressive load.

6. (b)

The forces which are meet at one point and the plane of forces are different, called concurrent non – coplanar forces.



7. (b)

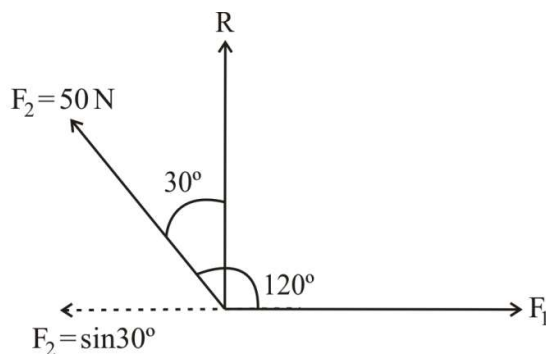
**Given data:**  $m = 10\text{kg}$ ,  $W = 9.81\text{kg} = 9.81 \times 10\text{N}$   
 $W = 98.1\text{N}$

$$\therefore W = mg \Rightarrow g = \frac{W}{m} = \frac{98.1}{10} = 9.81\text{m/sec}^2$$

8. (b)

**Given data:** let,  $F_1 < F_2$

$$\theta = 120^\circ, F_2 = 50\text{N}$$



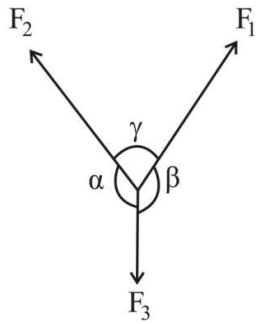
Balance the forces

$$F_2 \sin 30^\circ = F_1$$

$$F_1 = 25\text{N}$$

9. (d)

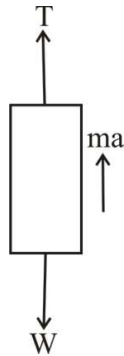
For three concurrent and coplanar forces, Lami's theorem is applied.



$$\frac{F_1}{\sin \alpha} = \frac{F_2}{\sin \beta} = \frac{F_3}{\sin \gamma}$$

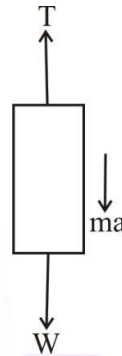
10. (d)

Tension in the cable of lift is more when lift is moving with acceleration in upward direction.



**Upward:**  $T - W = ma \Rightarrow T = ma + mg$

$$T = m(a + g)$$



**Downward:**  $W - T = ma$

$$T = W - ma = mg - ma \quad T = m(g - a)$$