LOVELY PROFESSIONAL UNIVERSITY
BASIC ENGINEERING MECHANICS
MCQ TUTORIAL SHEET OF MEC 107

1. Concurrent forces are those forces whose lines of action
   1. Meet on the same plane  2. Meet at one point  3. Lie on the same line
   4. None of these

2. Which of the following is a scalar quantity?

3. The principle of transmissibility of forces states that, when a force acts upon a body, its effect is
   1. Same at every point on its line of action
   2. Different at different points on its line of action
   3. Maximum, if it acts at the centre of gravity of the body
   4. Minimum, if it acts at the centre of gravity of the body

4. Non-coplaner concurrent forces are those forces which
   1. Meet at one point and their lines of action also lie on the same plane
   2. Do not meet at one point and their lines of action do not lie on the same plane
   3. Meet at one point, but their lines of action do not lie on the same plane
   4. Do not meet at one point, but their lines of action lie on the same plane

5. If a number of forces are acting at a point, their resultant will be inclined at an angle $\theta$ with the horizontal, such that
   1. $\tan \theta = \frac{\sum H}{\sum V}$
   2. $\tan \theta = \frac{\sum V}{\sum V}$
   3. $\tan \theta = \sum V \times \sum V$
   4. $\tan \theta = \sum V \times \sum H$
6. Which of the following are vector quantities?

1. Linear displacement  
2. Linear velocity  
3. Linear acceleration  
4. All of these

7. The motion of a particle round a fixed axis is

1. Rotary  
2. Translator  
3. Circular  
4. translatory as well as rotary

8. According to the law of moments, if a number of coplaner forces acting on a particle are in equilibrium, then

1. Their lines of action are at equal distances  
2. The algebraic sum of their moments about any point in their plane is zero  
3. Their algebraic sum is zero  
4. The algebraic sum of their moments about any point is equal to the moment of their resultant force about the same point.

9. The rate of change of momentum is directly proportional to the impressed force, and takes place in the same direction in which the force acts. This statement is known as

1. Newton's third law of motion  
2. Newton's first law of motion  
3. Newton's second law of motion  
4. None of these

10. A couple produces

1. Combined translatory and rotational motion  
2. Rotational motion  
3. translatory motion  
4. None of the above

11. The unit of MOMENT in S.I units is

1. kg-m  
2. Newton  
3. Joule  
4. N-m
12. Varingon’s theorem of moments states that if a number of coplaner forces acting on a particle are in equilibrium, then
1. The algebraic sum of their moments about any point in their plane is zero
2. Their lines of action are at equal distances
3. Their algebraic sum is zero
4. The algebraic sum of their moments about any point is equal to the moment of their resultant force about the same point.

13. The resultant of the two forces P and Q is R. If Q is doubled, the new resultant is perpendicular to P. Then
1. Q = R  
2. None of these  
3. Q = 2R  
4. P = Q

14. The forces, which meet at one point and their lines of action also lie on the same plane, are known as
1. Coplanar non-concurrent forces  
2. Coplanar concurrent forces  
3. Non-coplanar non-concurrent forces  
4. Non-coplanar concurrent forces

15. The moment of a force
1. is the turning effect produced by a force, on the body, on which it acts
2. is equal to the product of force acting on the body and the perpendicular distance of a point and the line of action of the force
3. is equal to twice the area of the triangle, whose base is the line representing the force and whose vertex is the point, about which the moment is taken
4. all of the above

16. The matter contained in a body, is called
1. Mass  
2. Weight  
3. Momentum  
4. Impulsive force

17. According to lami’s theorem
1. the three forces must be equal
2. the three forces must be at 120° to each other
3. the three forces must be in equilibrium
4. if the three forces acting at a point are in equilibrium, then each force is proportional to the sine of the angle between the other two

18. If \( P \) is the force acting on the body, \( m \) is the mass of the body and \( a \) is the acceleration of the body, then according to Newton’s second law of motion,

1. \( P \times m.a = 0 \)
2. \( P - m.a = 0 \)
3. \( P/m.a = 0 \)
4. \( P + m.a = 0 \)

19. The unit of force in S.I. system of units is

1. Watt
2. Newton
3. kilogram
4. Dyne

20. The three forces of 100 N, 200 N and 300 N have their lines of action parallel to each other but act in the opposite directions. These forces are known as

1. coplaner non-concurrent forces
2. coplaner concurrent forces
3. like parallel forces
4. unlike parallel forces

21. A number of forces acting at a point will be in equilibrium, if

1. sum of all the forces is zero
2. sum of resolved parts in the vertical direction is zero (i.e. \( \sum V = 0 \))
3. all the forces are equally inclined
4. none of these

22. Two forces are acting at an angle of 120°. The bigger force is 40N and the resultant is perpendicular to the smaller one. The smaller force is
1. 40 N  2. 20 N  3. 30 N  4. none of these

23. Determine the magnitude of the resultant force by adding the rectangular components of the three forces. (Fig)

1. \( R = 29.7 \text{ N} \)  2. \( R = 54.2 \text{ N} \)  3. \( R = 90.8 \text{ N} \)  4. \( R = 24.0 \text{ N} \)

![Diagram showing forces F1, F2, and F3 with magnitudes and angles]

28. The term 'force' may be defined as an agent which produces or tends to produce, destroys or tends to destroy motion.

1. Agree  2. Disagree

29. If the resultant of two equal forces has the same magnitude as either of the forces, then the angle between the two forces is

1. 30°  2. 60°  3. 90°  4. 120°
30. The triangle law of forces states that if two forces acting simultaneously on a particle, be represented in magnitude and direction by the two sides of a triangle taken in order, then their resultant may be represented in magnitude and direction by the third side of a triangle, taken in opposite order

1. True

2. False

31. The angle between two forces when the resultant is maximum and minimum respectively are

1. $0^\circ$ and $180^\circ$

2. $180^\circ$ and $0^\circ$

3. $90^\circ$ and $180^\circ$

4. $90^\circ$ and $0^\circ$

32. A resultant force is a single force which produces the same effect as produced by all the given forces acting on a body.

1. True

2. False
EQUILIBRIUM OF FORCES IN 2D AND 3D

Q1 What do you mean by equilibrium
a) The condition when there is no translational motion
b) The condition when there is no rotational motion
c) The condition when there is translational and rotational motion
d) The condition when there is no translational and rotational motion

Q2 The examples of equilibrium are
a) Rotation of fan
b) Motion of wheel
c) Book resting on table and table is stationary
d) Book resting on table but table moving.

Q3 In equilibrium
a) Sum of all forces in x direction and z direction and moment about any axis is zero
b) Sum of all forces and moment in any direction is zero
c) Sum of all forces is zero but moment is not zero
d) Sum of all moments are zero but net forces not zero

Q4 Use of equilibrium condition is
a) To find the unknown moments
b) To find the unknown forces
c) To find the unknown forces and moments
d) To find the unknown forces and moments to constrain the motion

Q5 To solve the problems of equilibrium what is necessary
a) To draw the FBD
b) To write the equations of equilibrium then solve them
c) To draw the fbd and solving the equations of equilibrium
d) To solve the equations without drawing the FBD
Q6 If on a body a force of 1500N is acting at an angle of 60 degree how much force in X direction must be act to stop the motion in x direction
   a) 75000000dyne
   b) 1299 N
   c) 75 N
   d) 0N

Q7 For the diagram shown below two forces are acting at A of magnitude 2000N, 30° with horizontal and at B of magnitude 800 N, 45° with vertical surfaces as shown below and the weight of box is 500 N find the force exerted by ground to keep the body in stationary condition.

A

B

a) 1000N
b) 565.68N
c) 1166.32N
d) 934.32N

Q8 Three books are placed on top of each other as shown below mass of A is 200Kg, B is 500Kg and C is 850Kg how much force body A has to exert on B to maintain the static condition.
a) 1350Kg

b) 1350N

C) 13230N

d) 500N

FOR PROBLEMS 9, 10 AND 11 FOLLOW THE FIG OF PROBLEM 9

Q9 Three cables are used to tether a balloon as shown in fig. knowing that the balloon exerts an 800N vertical force at A then the tension in cable AB would be

Q10 Find the tension in cable AC considering the problem 9 for the diagram.

a) 202N

b) 373N

c) 200N

d) 201N

a) 370N
b) 369N

c) 372N

d) 373N

Q11 Find the tension in cable AD considering the problem 9 for the diagram

a) 415N

b) 414N

c) 417N

d) 416N

Q12 The crate is supported by as shown. Determine the weight of the crate knowing the tension in cable AB is 3750N

a) 10510N

b) 10508N

c) 10500N

d) 10501N
FOR THE PROBLEMS 13, 14, AND 15 FOLLOW THE FIG OF PROBLEM 13

Q13 An 8000N crate is supported by three cables as shown determine the tension in AB cable.

![Diagram of cable support system]

a) 2855N  
b) 2851N  
c) 2850N  
d) 2855N

Q14 The tension in cable AC is

a) 4152N  
b) 4155N  
c) 4154N  
d) 4150N

Q15 The tension in cable AD is

a) 2640N
Q16 Three cables are connected at A where the forces P and Q are applied as shown knowing that Q = 0, find the value of P for which the tension in cable AD is 305N.

Q17 A circular horizontal plate weighing 300N is suspended as shown from three wires that are attached to a support at D and form 30 angles with the vertical. The tension in wire AD is
Q18 The tension in cable BD is

a) 52.4N  
b) 54.5N  
c) 51.5N  
d) 51.3N

Q19 The tension in cable CD is

a) 147.6N  
b) 148.5N  
c) 147.8N  
d) 147.9N

Q20 Two cables are tied together at C and loaded as shown determine the tension in cable AC
Q21 The tension in cable BC is

- a) 2747.8N
- b) 2747.9N
- c) 2747.5N
- d) 2747.1N

Q22 Two cables are tied together at C as shown knowing that P = 360N and Q = 480N determine the tension AC.
Q23 The tension in cable BC is

a) 145N  
b) 146N  
c) 147N  
d) 144N

Q24 In order to move a wrecked truck two cables are attached at A and pulled by winches at B and C as shown. Knowing that the tension in cable AB is 10Kn and in cable AC is 7.5Kn then the magnitude of the resultant of the forces exerted at A by the two cables is

a) 1512N  
b) 1514N  
c) 1515N
Q 25 The container of weight 1165N is supported by three cables as shown then the tension in cable AB is

a) 400N  
b) 500N  
c) 499N  
d) 501N

Q26 The tension in cable AC is

a) 460N  
b) 459N  
c) 461N  
d) 458N

Q27 The tension in cable AD is

a) 516N
Q28 Two cables are tied together at C are loaded as shown knowing that \( Q=300 \)N determine the tension in cable AC

a) 261N  
b) 260N  
c) 262N  
d) 259N

Q29 Then the tension in cable BC is

a) 252N  
b) 225N  
c) 522N  
d) 226N

Q30 A frame ABC is supported in part by cable DBE that passes through a frictionless ring at B. knowing that the tension in the cable is 385N determine the components of the forces exerted by the cable on the support at D that is \( F_X,F_Y,F_Z \).
a) +255N, -240N, +160N
b) +240N, -160N, +255N
c) -160N, -240N, +255N
d) +240N, -255N, +160N
Question 1: Two vectors are given as follows.
\[ \vec{A} = -2i - 5j + 2k \quad \vec{B} = -5i - 2j - 3k \]
Find the magnitude of the following vectors: \( \vec{A} \times \vec{B} \)
A) 12 B) 43 C) 18 D) 26 E) 31

Question 2: Which of the following statements is true?
(a) A scalar times a quantity can be added to a vector.
(b) It is possible for the magnitude of a vector to equal zero even though one of its components is non-zero.
(c) Scalar quantities are path dependent, while vectors are not.
(d) Scalar quantities and vector quantities can both be added algebraically.
(e) A vector contains magnitude and direction while a vector does not.

Question 3: Moment of a force about a point does not depend upon -
(a) line of action of force.
(b) direction of force.
(c) magnitude of force.
(d) point at which the force is acting.

Question 4: \( x, \ y, \ z \) components for \( AB \) cable:
- Given that tension is 4250 N in cable \( AB \)

\[ a) \ -400, \ 450, \ -600 \]
\[ b) \ +400, \ -450, \ 600 \]
\[ c) \ -600, \ 400, \ -1000 \]
\[ d) \ +600, \ 450, \ 1000 \]
Question 5 Refer Question 4 x, y, z components for AC cable, given that tension is 5100 N.
(a) -600, 400, -1000
(b) -1000, 600, 1000
(c) +600, 450, 800
(d) +1000, -450, 600

Question 6 A force F has the components
\[ F_x = 20 \text{N}, \ F_y = -30 \text{N}, \ F_z = 60 \text{N} \]
Magnitude of F is:
(a) 700  (b) 70  (c) 100  (d) 80

Question 7 Refer to Question 6 what are the angles \( \theta_x, \theta_y, \theta_z \) it forms with co-ordinate axis
(a) 90°, 90°, 100°
(b) 90°, 100°, 20°
(c) 73.4°, 115.4°, 31.0°
(d) 71.4°, 111.4°, 28.0°

Question 8 A force of 50N force forms angle of 60°, 45° and 120° resp. with the x, y and z axis. Find the components \( F_x, F_y, F_z \) of the force.
(a) 25\sqrt{2}N, 30\sqrt{2}N, 35\sqrt{2}N
(b) 25\sqrt{2}N, 35\sqrt{2}N, 30\sqrt{2}N
(c) -22.5N, 200N, 100N
(d) 250N, 354N, -250N

Question 9 Which one of the following properties satisfies vectors
(a) Distributive  (c) Commutative
(b) Associative   (d) None of these
A 500N vertical force is applied at the end of a lever which is attached to a shaft at O. Determine the smallest force applied at A which creates the equal moment about O.

(a) 250N  (c) 150N
(b) -200N  (d) 225N

Refer Question 10. How far from the shaft a 1200N vertical force must act to create the same moment about O.

(a) 0.125 m  (c) 0.225 m
(b) 0.25 m  (d) 0.325 m.

Horizontal force applied at A which creates the same moment about O. Refer Question 10.

(a) 278.5N  (c) 300.5 N
(b) 288.5 N  (d) 298.5N

What are the sign conventions taken for moment of forces.

(a) Clockwise is taken as +ve.  (c) Clockwise and anti-clockwise both +ve.
(b) Anti-Clockwise is taken as -ve  (d) None of these.
(e) Counter-clockwise is taken as +ve.

According to the definition of Moment of force at point distance d taken is

(a) I distance from the point where the force acting.
(b) Il distance from the line of action of forces from that point
(c) I distance from the line of action of forces from that point.
(d) All of above.
Question 15
A small section of precast concrete is temporarily held by two cables. Knowing that the tension is 4.2 KN in cable AB and 6 KN in cable AC. What are the components x, y, z according to the cable AB in meters.

a) -5, 3, 4  
b) 5, -3, -4  
c) 4, 3, -5  
d) -3, 5, 4

Question 16
What are the components x, y, z according to cable AC.

(A) -5, 3, -5  
(B) -3, -5, -5  
(C) 3, 5, -5  
(D) 9, 4, -5.
2.1 The number of reactions at the hinged support:
(a) one  (b) two  (c) three  (d) all of the above

2.2 If one end of a beam is fixed and the other end of the beam is supported by a roller, such type of beam is known as:
(a) Cantilever beam  (b) Propped cantilever beam  (c) Continuous beam  (d) Simply supported beam.

2.3 The no of reaction components at the fixed end of a beam are:
(a) 3  (b) 2  (c) 1  (d) zero.

2.4 UD stands for:
(a) Point load  (b) Uniform dead load  (c) Uniformly distributed load  (d) All the above.

2.5 Number of different types of supports are commonly used in structures:
(a) Supports can provide a reaction force in one direction only.
(b) Supports can provide a reaction in any direction.
(c) Supports can provide not only reactions in any direction but also moments.
(d) All the above.
Q6. FBD stands for ________.
Q7. Write the forces acting on the sphere of weight kl resting on a frictionless plane surface.

(a) kl (b) zero (c) reaction force (d) both a & c
Q8. Draw the FBD of AB.

(a) (b) (c) (d) all above.
Q9. Draw the FBD of object A as shown.

(a) (b) (c) RBA (d) all of the above.
Q10. Fig from problem 9, draw FBD of object B.

(a) RAB (b) RCB (c) RBC (d) all of the above.
Q11: From Fig 9 in Problem 9, draw SBD of object c.

(a) \[ \text{Diagram of forces} \]

(b) \[ \text{Diagram of forces} \]

(c) \[ \text{Diagram of forces} \]

(a) None of the above.

Q12: Draw the SBD of given Fig below on smooth horizontal surface.

(a) \[ \text{Diagram of forces} \]

(b) \[ \text{Diagram of forces} \]

(c) \[ \text{Diagram of forces} \]

(a) None of the above.

Q13: Draw the SBD of block resting on rough surface.

(a) \[ \text{Diagram of forces} \]

(b) \[ \text{Diagram of forces} \]

(c) \[ \text{Diagram of forces} \]

(d) None of the above.
Q14.1 Concept of SFD is important in solving the problems of
(a) Moment (b) Resolution (c) Couple
(d) Equilibrium of body.

Q15.1 A circular roller of weight W hangs by a string and rolls against a smooth vertical wall. Then the forces acting on roller are:

- String tension \( T \)
- Smooth surface

Q16.1 - A sphere rolling in a V-shaped groove.

(a) Weight of the sphere acting vertically downward through its center, \( C \).
(b) Reaction \( R_A \) acting normal to the inclined plane at the contact point \( A \).
(c) Reaction R_b acting normal to the inclined plane at in contact at point B.
(d) All of the above.

Q17: A uniform ladder of weight W leans against a smooth wall and rests on a rough floor.

(a) R_b (b) R_a (c) Wt. of body (d) R_a, R_b, W.

Q18: Draw the FBD of the beam ladder and supported.

Ans: Draw in space below.
Q19: - Two spheres P & Q placed in a vessel.

Forces acting on sphere P
(a) Weight W1 of sphere acting downwards through its mass centre C1.
(b) Reaction R1 (towards right) normal to the vertical wall surface.
(c) Reaction Rb (upwards) normal to the base.
(d) Rd of a sphere Q on sphere P at the point of contact D.
(e) all of the above.

Q20: - Forces acting on sphere Q
(a) R1c (b) H2 (c) Rd (d) all of the above.