Unit 1

1. The subjects Engineering Mechanics deals with

(a) Static   (b) kinematics   (c) Kinetics   **(d) All of the above**

2. If the resultant of two forces P and Q is acting at an angle α with P, then

(a) $\tan \alpha = \frac{P \sin \theta}{Q + P \cos \theta}$ (b) $\tan \alpha = \frac{P \cos \theta}{P + Q \sin \theta}$ (c) $\tan \alpha = \frac{Q \sin \theta}{Q + P \cos \theta}$ **(d) $\tan \alpha = \frac{Q \sin \theta}{P + Q \cos \theta}$**

3. If the resultant of two equal forces is equal to either of them, then the angle between the two forces is

(a) 30^0 (b) 60^0 (c) 90^0 **(d) 120^0**

4. Two forces act at an angle of 120^0. The bigger force is 40 N and the resultant is perpendicular to the smaller one. The smaller force is

(a) 20 N   (b) 40 N   (c) 80 N   (d) None of these

5. The resultant of two forces each equal to P/4 and acting at right angle is

(a) P/2   (b) $P/\sqrt{2}$ **(c) $P/2\sqrt{2}$**   (d) $2\sqrt{P}$

6. Component of a force in its own direction will be always

(a) Equal to itself   (b) less than the given force   (c) greater than the given force   (d) may be less or greater than the given force

7. If three coplanar forces, acting at a point are in equilibrium, then each force is proportional to the sine of the angle between the other two. This statement is

(a) Condition of equilibrium   **(b) Lami's theorem**   (c) Parallelogram Law   (d) Varignon's Theorem
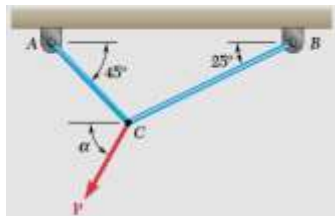
8. The necessary condition of equilibrium of a body is

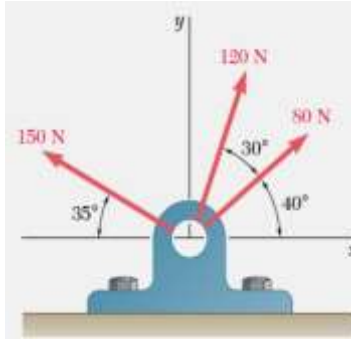a) $\sum H = 0$ b) $\sum V = 0$ c) $\sum M = 0$ **d) all the above**

9. Cycle pedaling is an example of

(a) Couple   (b) moment   (c) Collinear force   (d) two unequal parallel force

10. Two cables are tied together at *C* and are loaded as shown. Knowing that **P** = 500 N and α = 60°, the tension in cable *AC* will be
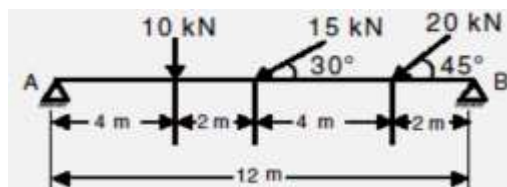

     (a) **305 N**   (b) 350 N   (c) 205 N   (d) 250 N

13. In the following system, the value of $\sum F_X$ in N is

(a)   20.55   (b)   120.55   (c)   -120.55   **(d) -20.55**

14. Three forces are acting at the beam AB shown in following diagram, the moment of force about point B is (in KN- m)
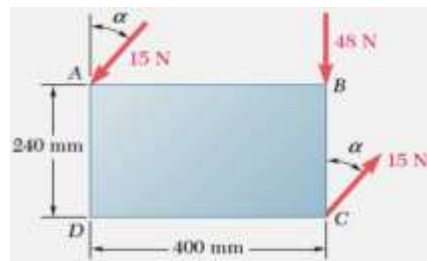

(a)   - 45   (b)   -153.28   (c)   - 80   (d)   153.28

15. A force $\mathbf{F}$ has the components $F\,x = 20$ lb, $F\,y = 30$ lb, $F\,z = 60$ lb. The angle α made by force $\mathbf{F}$ with "x" axis is
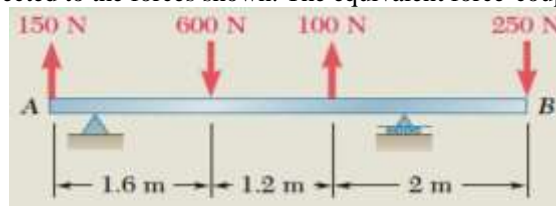
(a) 53.4^0 (b) 31.0^0 (c) 115.4^0 **(d) 73.4^0**

16. A rectangular plate is acted upon by the force and couple shown. This system is to be replaced with a single equivalent force. For $\alpha = 40°$, the magnitude of moment of force about point D is (in N-m).
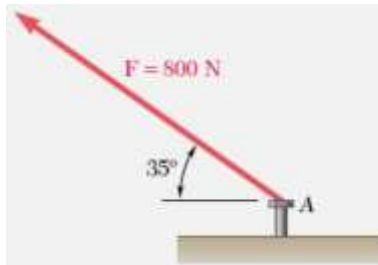

(a)   (b)   (c)   (d)

17. A 4.80-m-long beam is subjected to the forces shown. The equivalent force-couple system at point A will be

(a)   -1880 N-m $\hat{k}$ (b)   -1880 N-m $\hat{j}$ (c)   -1880 N-m $\hat{i}$ (d)   1880 N-m $\hat{k}$

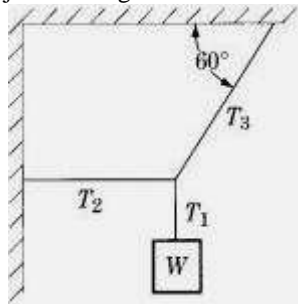18. A force of 800 N act on the bolt A as shown in figure. The vector force equation is (N)

F = 800 N

35°

A

(a)   655 i + 459 j   (b)   655 j – 459 i   **(c)   - 459i + 655 j**   (d)   - 655i + 459 j

19. A force of 300 N is act on the rope AB in following diagram. The vertical component of force exerted by the rope at point A is
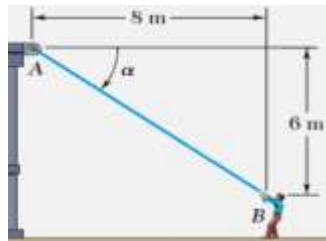
(a)   180 N   (b)   240 N   (c)   -180 N   (d)   -240 N

20. A system in equilibrium consist of an object of weight W. The correct value of T_2 and T_3 is

	T_2	T_3
a)	W tan60°	W/ cos 60°
b)	W tan 60°	W/ sin 60°
c)	W tan 60°	W sin 60°
d)	W/ tan 60°	W/ cos 60°
e)	**W/ tan 60°**	**W/ sin 60°**

21. If resultant of two equal forces have same magnitude as either of the given forces, than angle between the two forces is

a. 30   b. 60   c. 90   **d. 120**

22. Determine the magnitude and direction of the moment of the force of the movement if the force at A about point P
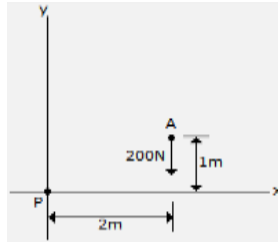
a) 400N-m clockwise   **b) 400 N-m anticlockwise**   c) 200N-m clockwise   d) 200 N-m anticlockwise

23. Varignon's Theorem is based on ---------------- property of vector
a. Commutative   **b. Distributive**   c. Associative   d. Additive

24. Least and Maximum resultant of two forces acting on a body are 35kN and 5kN respectively. Magnitude of forces are

   a. 20kN and 15kN   b. 20kN and 14kN   c. 10kN and 25kN   d. 5kN and 35kN

25. A weight 2000N attatched at point Cis supported by two strings AC and BC inclined at angle 30 and 60 degree to the horizontal.Tension in the strings is
   a. 0.8kN and 0.9 kN   **b. 0.8kN and 0.6kN**   c. 0.4kN and 0.7kN
   d. 0.4kN and 0.8kN

26. Two unlike parallel force of 400N and 100N acting in such a way that their lines of action are 150 mm apart. Determine the point at which the resultant acts.
   a. 75mm   b. 80mm   **c. 50mm**   d. 90mm

27. A triangle ABC has side AB=40mm along positive x-axis, side BC=30mm along positive Y axis. Three forces of 40N, 50N and 30N acts along AB, BC and CA. Resultant of such a system is
   a. 33N   **b. 35.8 N**   c. 40 N   d. 43.6 N

28. Determine Moment of force about point O
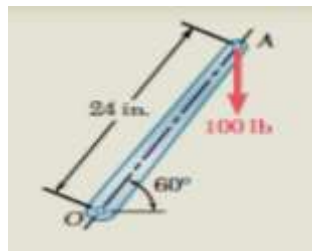
a. 1000 lb-in   b. 1100 lb-in   **c. 1200 lb-in**   d. 1050 lb-in

29. Angle between two forces P ahen their resultant is equal to P/2 is

   a. 120   b. 100   c. 151   d 111

30. A square ABCD has sides equal to 200mm. Forces of 150N acts along AB and CD and 250N along CB and AD. Find moment of couple that will keep the system in equilibrium

   a. 20000 Nmm   b. 25000Nmm   **c. -20000 Nmm**   d. -25000 Nmm

31. Select the correct statement, Lami's theorem is,

a) Three concurrent forces are in equilibrium each forces will be proportional to the cosine of the angle between the other two forces.
b) Three concurrent forces are in equilibrium each forces will be proportional to the sine of the angle between the other two forces.
c) Both is applicable
d) Both is not applicable

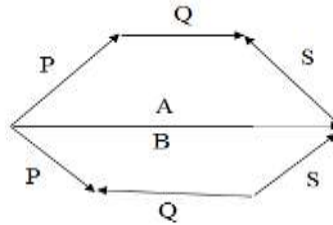32. Select correct option

a) $(A \times B) \times C \neq A \times (B \times C)$ b) $(A \times B) \times C = A \times (B \times C)$

c) Option (a) and (b) both is true   d) Option (a) and (b) both is not true

33. Two equal forces (P and Q) are acting at a point A angle of 50° between them the resultant force is equal to R=10√3, find the magnitude of each forces. (i.e., P=Q)

a) 11.57 N   b) 3.67 N   c) 9.56 N   d) 8.78 N

34. Which vector addition is correct

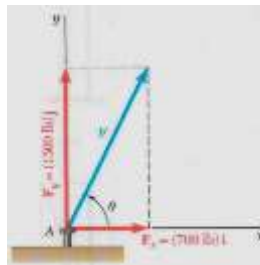a) A=P+Q+S, B=P+Q-S   c) A=P+Q+S, B=P-Q+S
b) **A=P+Q-S, B=P+Q-S**   d) A=P+Q-S, B=P-Q+S

35. Given vectors A=4i-2j+3k, B=2i+4j+5k and C=7i-j+Xk, determine the value of "X" for which the three vectors are coplanar.
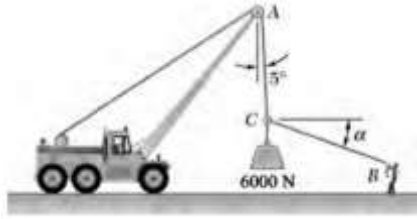
a) X = 6   **b) X=7**   c) X=5   d) X=14

36. Find F=? and θ=?

a) **θ=65°, F=1665 lb**   c) θ=65°, F=1579 lb
b) θ= 60°, F=1579 lb   d) θ=60°, F=1665 lb

37. Knowing that α = 20°, determine the tension (a) in cable AC (b) in rope BC

a) T_{AC} = 6220 N , T_{BC} =577 N   b) T_{AC} = 6000 N, T_{BC} =577 N   c) T_{AC} = 6005 N, T_{BC} =500 N   d) T_{AC} = 6220 N, T_{BC} =500 N

38. A force F has the components Fx=20 N, Fy = -30 N, Fz = 60 N. determine its magnitude F and the angles θx θy θz it forms with the coordinate axes.

a) 70 N, θx=73.4° θy=115.4° θz=31.0°   b) 80 N, θx=69.4° θy=135.4° θz=40.0°

c) 70 N, θx=59.4° θy=105.4° θz=25.0°   d)80 N, θx=73.4° θy=105.4° θz=30.0°

39. Select correct option ,

   a)   When the resultant of all the forces acting on a particle is some vale, so the particle is equilibrium.
   b)   When the resultant of all the forces acting on a particle is zero, so the particle is equilibrium.
   c)   Option (a) and (b) is true.
   d)   Option (a) and (b) is not true.

40.
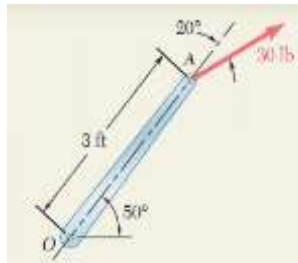
   A 30 lb force acts on the end of the 3 ft lever shown. Determine the moment of force about O.
   a)   **30.8 lb**   b)   39.3 lb   c) 20.8 lb   d) 25.6 lb

41. Which of the following is a vector quantity?

a) Mass   b) Time   **c) Velocity**   d) Temperature

42. Two forces of 100N and 150N are acting at a point. Find the resultant if angle between these two forces is 45^0.

a) 232N   b) 323N   c) 188N   d) 132N

43. Which of the following statement is correct?

   a.   A force is an agent which produces or tends to produce motion.
   b.   A force is an agent which stops or tends to stop motion.
   c.   A force is an agent to balance the given number of forces acting on a body.
   d.   Both (a) and (b).

44. In order to determine the effect of the force acting on a body, we must know

a) Magnitude and direction   b) Its nature   c) Point of application   **d) All of the above**

45. A force of 15 N is applied at an angle of 60^0 to the handle of the door 0.8 m wide. Find the moment of the force about the hinge.

a) 12.4 N-m   b) 13.9 N-m   **c) 10.4 N-m**   d) 9.56 N-m

46. The moment of force about any point is geometrically equals to _____ the area of the triangle whose base is the line representing the force and vertex is the point about which the moment is taken.

a) Half   b) Same   c) Twice   d) None of the above

47. Two like parallel forces of 50 N and 100 N acts downward at the ends of a rod 360mm long. Find the magnitude of resultant and the point where it acts from left end of the rod.

a) 125 N and 220 mm   **b) 150 N and 240 mm**   c) 175 N and 180 mm   d) 150 N and 260 mm

48. A couple consists of

a) Two like parallel forces of same magnitude   b) Two like parallel forces of different magnitude

c) Two unlike parallel forces of same magnitude   d) Two unlike parallel forces of different magnitude

49. If the arm of the couple is doubled, its moment will be

a) halved   b) remain the same   **c) be doubled**   d) none of the above

50. The Lami's theorem is applicable only for

a) Coplanar forces   b) Concurrent forces   **c) Coplanar and concurrent forces**   d) Any type of forces