STATICS

MULTIPLLE CHOICE QUESTIONS

K1-level Questions

UNIT- 1

1. Forces are called concurrent when their lines of action meet in

(a) two points

(b) plane

(c) perpendicular planes

(d) different planes.

2. Forces are called coplanar when all of them acting on body lie in

(a) one point

(b) one plane

(c) different planes

(d) perpendicular planes

3. A force acting on a body may

(a) introduce internal stresses

(b) balance the other forces acting on it

(c) retard its motion

d) all of the above.

4. Which is the correct statement about law of polygon of forces ?

(a) if any number of forces acting at a point can be represented by the sides

of a polygon taken in order, then the forces are in equilibrium

(b) if any number of forces acting at a point can be represented in direction and magnitude by the sides of a polygon, then

the forces are in equilibrium

(c) if a polygon representing forces acting at a point is closed then forces are in equilibrium

(d) if any number of forces acting at a point can be represented in direction and magnitude by the sides of a polygon taken in order, then the forces are in equilibrium

5. Effect of a force on a body depends upon

(a) magnitude

(b) direction

(c) position or line of action

(d) all of the above

6. If a number of forces act simultaneously on

a particle, it is possible

(a) not a replace them by a single force

(b) to replace them by a single force

(c) to replace them by a single force through C.G.

(d) to replace them by a couple

7. A force is completely defined when we specify

(a) magnitude

(b) direction

(c) point of application

(d) all of the above

8. The algebraic sum of the resolved parts of a number of forces in a given direction is equal to the resolved part of their

resultant in the same direction. This is as per the principle of

(a) forces

(b) independence of forces

(c) dependence of forces

(d) resolution of forces.

9. The resolved part of the resultant of two forces inclined at an angle 9 in a given direction is equal to

(a) the algebraic sum of the resolved parts of the forces in the given direction

(b) the sum of the resolved parts of the forces in the given direction

(c) the difference of the forces multiplied by the cosine of 9

(d) the sum of the forces multiplied by the sine of 9

10. The forces, which meet at one point, but their lines of action do not lie in a plane, are called

(a) coplanar non-concurrent forces

(b) non-coplanar concurrent forces

(c) non-coplanar non-concurrent forces

(d) intersecting force.

UNIT- 2

1. Two coplanar couples having equal and opposite moments

(a) balance each other

(b) produce a couple and an unbalanced force

(c) are equivalent

(d) cannot balance each other.

2. The product of either force of couple with the arm of the couple is called

(a) resultant couple

(b) moment of the forces

(c) resulting couple

(d) moment of the couple

3. The centre of gravity of a uniform lamina lies at

(a) the centre of heavy portion

(b) the bottom surface

(c) The midpoint of its axis

(d) all of the above

4. Center of gravity of a solid cone lies on the axis at the height

(a) one-fourth of the total height above base

(b) one-third of the total height above base

(c) one-half of the total height above base

(d) three-eighth of the total height above the base

5. Centre of percussion is

(a) the point of C.G.

(b) the point of metacentre

(c) the point of application of the resultant of all the forces tending to cause a body to rotate about a certain axis

(d) point of suspension.

6. Centre of gravity of a thin hollow cone lies on the axis at a height of

(a) one-fourth of the total height above base

(b) one-third of the total height above base

(c) one-half of the total height above base

(d) three-eighth of the total height above the base

7. The units of moment of inertia of an area are

(a) kg m2

(b) m4

(c) kg/m2

(d) m3

8. The centre of gravity of a triangle lies at the point of

(a) Concurrence of the medians

(b) Intersection

c) Intersection of bisector of angles

(d) Intersection of diagonals

9. The possible loading in various members of framed structures are

(a) Compression or tension

(b) buckling or shear

(c) shear or tension

(d) all of the above

10. A heavy string attached at two ends at same horizontal level and when central dip is very small approaches the following curve

(a) catenary

(b) parabola

(c) hyperbola

(d) elliptical

UNIT- 3

1. Coefficient of friction is the

(a) angle between normal reaction and the resultant of normal reaction and the limiting friction

(b) ratio of limiting friction and normal reaction

(c) the friction force acting when the body is just about to move

(d) the friction force acting when the body is in motion

2. Pick up wrong statement about friction force for dry surfaces. Friction force is

(a) proportional to normal load between the surfaces

(b) dependent on the materials of contact surface

(c) proportional to velocity of sliding

(d) independent of the area of contact surfaces

3. If rain is falling in the opposite direction of the movement of a pedestrain, he has to hold his umbrella

(a) more inclined when moving

(b) less inclined when moving

(c) more inclined when standing

(d) less inclined when standing

4. Limiting force of friction is the

(a) tangent of angle between normal-reaction and the resultant of normal reaction and limiting friction

(b) ratio of limiting friction and normal reaction

(c) the friction force acting when the body is just about to move

(d) the friction force acting when the body is in motion

5. Dynamic friction as compared to static friction is

(a) same

(b) more

(c) less

(d) may be less of more depending on nature of surfaces and velocity

6. Tangent of angle of friction is equal to

(a) kinetic friction

(b) limiting friction

(c) angle of repose

(d) coefficient of friction

7. Kinetic friction is the

(a) tangent of angle between normal reaction and the resultant of normal reaction and the limiting friction

(b) ratio of limiting friction and normal reaction

(c) the friction force acting when the body is just about to move

(d) the friction force acting when the body is in motion.

8. The algebraic sum of moments of the forces forming couple about any point in their plane is

(a) equal to the moment of the couple

(b) constant

(c) both of above are correct

(d) none

9. A single force and a couple acting in the same plane upon a rigid body

(a) balance each other

(b) cannot balance each other

(c) produce moment of a couple

(d) are equivalent

10. If three forces acting in one plane upon a rigid body, keep it in equilibrium, then they must either

(a) meet in a point

(b) be all parallel

(c) at least two of them must meet

(d) all the above are correct

UNIT- 4

1.Two parallel forces are said to be like when they are in

a) opposite direction

b) same direction

c) parallel position

d) none of these

2. Two parallel forces are said to be unlike when they are in

a) opposite direction

b) same direction

c) parallel position

d) none of these

3 .Moment of force is ------

a) parallel force*distance

b) perpendicular distance *force

c) perpendicular line*force

d) all the above

4. Measures of the tendency to rotate the body

a) moment

b) momentum

c) couple

d) all the above

5. The moment about any point is given by _____ area of a triangle

a) never

b) once

c) twice

d) none of the above

6. If the moment is negative ,then the force tend to turn the body in _____ direction

a) opposite direction

b) anti clockwise

c) clockwise

d) all the above

7. If the moment is negative ,then the force tend to turn the body in _____ direction

a) opposite direction

b) anti clockwise

c) clockwise

d) all the above

8. If the unit of force is poundal then the unit of distance is foot then the unit of moment is

a) poundal foot

b) foot poundal

c) all the above

d) none of these

9. If the unit of force is dyne then the unit of distance is 1cm then the unit of moment is

a) poundal foot

b) dyne cm

c) dyne foot

d) none of the above

10. A couple is positive then the moment is

a) neutral

b) negative

c) positive

d) all the above

UNIT - 5

1. The moment of P1 about O - the moment of P2 about O =_____

a) moment of R2

b) moment of P1 &P2

c) moment of R1

d) none

2. In Varigon's theorem O lies inside the angle then the moment P is positive then Q is ____

a) negative

b) positive

c) neutral

d) none of these

3. The moment of P1 about O +the moment of P2 about O =_____

a) moment of R2

b) moment of P1 &P2

c) moment of R1

d) moment of P3

4. The moment of R1 about O +the moment of P3 about O =_____

a) moment of R2

b) moment of P1 &P2

c) moment of R1

d) moment of P3

5. Example of a couple is _____

a) turning a key

b) turning a tap

c) winding a clock

d) all the above

6. If two forces P & Q act in same direction simultaneously on a particle then the resultant is clearly equal to a force_____

a) P=Q

b) P+Q

c) P-Q

d) all the above

7. If two forces P & Q act in different direction then the resultant is clearly equal to a force_____

a) P=Q

b) P+Q

c) P-Q

d) all the above

8.If two forces P & Q act in different direction then acts in the direction of _____ force

a) equal

b) unequal

c) smaller

d) greater

9.The algebraic sum of the moments of any number of forces about any point in their plane is _____

a) once

b) twice

c) thrice

d) zero

10. The algebraic sum measures the total turning effect of the forces of the couple upon the body and is called as _____

a) equilibrium of a couple

b) equivalent of a couple

c) moment of a couple

d) none of these

STATICS

K2-level Questions

UNIT-1

1). Define parallelogram of forces.

If two forces acting at a point be represented in magnitude and directions by the sides of a parallelogram drawn from the point, their resultant is represented both in magnitude and direction by the diagonal of the parallelogram drawn through that point.

2).Define triangle of forces.

If two forces acting at a point are represented in magnitude and direction by two sides of a triangle taken in the same order, the resultant will be represented in magnitude and direction by the third side taken in the reverse order.

3). Define perpendicular triangle of forces.

If three forces acting at a point are such that their magnitude are proportional to the sides of a triangle and their directions are perpendicular to the corresponding sides to the all inward or outwards then also the forces will be in equilibrium.

4). Define converse triangle of forces.

If three forces acting at appoint are in equilibrium then any triangle drawn so as to have its sides parallel to a direction of the forces shall represent them in magnitude also.

5). Define polygon of forces.

If any number of forces acting at a point can be represented in magnitude and direction by the sides of a polygon taken in order, the forces will be in equilibrium.

6). Define lami's theorem.

If three forces acting at a point are in equilibrium each force is proportional to the sine of the angle between the other two.

7). Define resolution of a force.

A single force can be resolved into components in an infinite number of ways, since any number of parallelogram can be constructed on a given line AC as diagonal.

8). Define theorem on resolved parts.

The algebraic sum of the resolved parts of two forces in any direction is equal to the resolved part of the resultant in the same direction.

9). Define like parallel forces.

Two parallel forces are said to be like when they act in the same direction.

10). Define unlike parallel forces.

It is said to be unlike when they act in opposite directions.

UNIT-2

11). Define the resultant of two like parallel forces.

The magnitude of the resultant of two like parallel forces is their sum. The direction of the resultant is parallel to the components and in the same sense.

12). Define the resultant of two unlike parallel forces.

The magnitude of the resultant of two unlike parallel forces is their difference. The direction of the resultant is parallel to and in the greatest component.

13). Define conditions of equilibrium of three coplanar forces.

If three parallel forces are in equilibrium, each is proportional to the distance between the other two.

14). Define centre of two parallel forces.

Centre of two parallel forces is a fixed point through which their resultant always passes whatever be the direction of parallelism.

15). Define centre of parallel forces.

The resultant of a system of parallel forces of given magnitude, acting at given points of a body, will always pass through a fixed point, for all directions of parallelism. This point is called the centre of parallel forces.

16). Define moment of a force.

Moment of a force about a point is defined to be the product of the force and the perpendicular distance of the point from the line of action of the force.

17). Define unit of moment.

The moment of a unit force about a point at a unit perpendicular distance from the line of action of the force is defined as the unit for the measurement of moments, if the unit of force be a poundal and unit of distance be one foot then the unit of moment is a poundal-foot.

18). What are the situations in which the moment of a force is zero?

a). the force itself is zero

b). the line of action of the force passes through that point.

19). Define varigon's theorem on moments.

The algebraic sum of the moments of two forces about any point in their plane is equal to the moment of their resultant about that point.

20). Define generalization theorem of moments.

If any number of forces acting on a rigid body has a resultant, the algebraic sum of their moments about any point in their plane is equal to the moment of their resultant about the same point.

UNIT-3

21). Define couple.

Two equal and unlike parallel forces not acting at the same point are said to constitute a couple.

22). Define equilibrium of two couples.

If two couples, whose moment is equal and opposite, act in a same plane on a rigid body, they balance one another.

23). Define equivalence of two couples.

Two couples in the same plane whose moments are equal and of the same sign are equivalent to one another.

24). Couples in parallel planes.

The effect of a couple upon a rigid body is not altered if it is transferred to a parallel plane provided its moment remains unchanged in magnitude and direction.

25). Define resultant of coplanar couples.

The resultant of any number of couples in the same plane on a rigid body is a single couple whose moment is equal to the algebraic sum of the moments of the several couples.

26). Define resultant of a couple and a force.

A couple and a single force acting on a body cannot be in equilibrium but they are equivalent to the single force acting at some other point parallel to its original direction.

27). Define triangle of forces.

If three forces acting at a point can be represented in magnitude and direction by the sides of a triangle taken in order, they will be in equilibrium.

28). whether the force act along the sides of a triangle?

The forces act at a point and do not act along the sides of the triangle.

29). whether the component of a force in a direction is variable quantity?

Yes, the component of a force in a direction is a variable quantity.

30). whether the resolved part of the force in a direction is a variable quantity?

No, the resolved part of the force in a direction is a fixed quantity, its value being $F\cos\Theta$.

UNIT-4

31). Define reduction of any number of coplanar forces theorem.

Any system of forces acting in one plane on a rigid body can be reduced to a single force or a couple.

32). Two trigonometrically theorem formula?

$(m+n)\cos\Theta = m\cot\Theta - n\cot\beta$.

$(m+n)\cot\Theta = n\cot B - m\cot C$.

33).what is the equation to the line of action of the resultant?

G-xY+yX
=0

34). Define friction.

One body from sliding on the other is known as friction.

35). Define dynamical friction.

One body sliding over another the friction exerted is called dynamical friction.

36). Define statistical friction.

One body in contact with another is in equilibrium friction exerted in just sufficient to maintain equilibrium is called statistical friction.

37). Define limited friction.

One body is just o the point sliding on another the friction exerted attains its maximum value is called limited friction.

38). How much law of frictions is available?

There are 5 laws.

39). Define cone of friction.

The greatest angle which the direction of the resultant reaction makes with the normal is $\tan^{-1}\mu$. It is known as cone of friction.

40). Define coplanar.

A set of points, lines, line segments, rays or any other geometrical shapes that lie on the same plane are said to be coplanar.

UNIT-5

41). Define centre of gravity.

A point from which the weight of a body or system may7 be considered to act.

42). Define centre of mass.

A point representing the mean position of the matter in a body or system.

43). what is the condition of coplanar forces?

If three forces acting on a rigid body are in equilibrium, they must be coplanar.

44). Difference between centre of mass and centre of gravity.

Centre of mass is the point at which the distribution of mass is equal in all directions, and does not depend on gravitational field. Centre of gravity is the point at which the distribution of weight is equal in all directions, and does not depend on gravitational field.

45). Define law of dynamical friction.

When motion ensues by one body sliding over the other, the direction of is opposite to that of motion.

46). what is the condition of the resultant of two equal forces?

The resultant of two equal forces bisects the angle between them.

47). what is the notation of centre of like parallel forces?

$C_{1C2/C2A3} = P3/P1+P2.$

48). Centre of gravity of a uniform solid hemisphere value?

3/8.

49). Define three coplanar forces theorem.

If three coplanar forces acting on a rigid body keep it in equilibrium, they must either be concurrent or be all parallel.

50). Define centre of gravity of a thin uniform rod.

The centre of gravity of a thin uniform rod is at its middle point.

STATICS

K3 LEVEL QUESTIONS

UNIT – 1

1) Prove that the theorem of parallelogram of forces.
2) The resultant of two forces P, 2 action at certain angle 10X 2 that of P, R acting at the same angle is also X. The resultant of 2 R again acting at the same angle is X.
3) Explain perpendicular triangle of forces.
4) Explain converse of the triangle of forces.
5) Two forces act on a particle. If the sum of difference of the force act at right angles to each other. Show that the forces are of equal magnitude.
6) A & B are two fixed points on a horizontal line at a distance C apart. Two line light string AC and BC of length b & a respectively. Support a mass at C. Show that the tension of the strings act in the ration of $(a^2+c^2-b^2)$: $a(b^2+c^2-a^2)$.
7) To show that components of a forces along two given direction.
8) To prove theorem on resolved parts.
9) State and prove Resultant of any number of forces acting at a point, Graphical method.
10) State and prove Resultant of any number of coplanar forces acting of a point with diagram.

UNIT - 2

11) Derive condition of equilibrium of three coplanar parallel forces
12) Two men one stronger than the other have to remove a block of stone Weighing 3oo kilograms with a light pole whose strength is 6 meters . The weaker men cannot carry more than 100 kilograms . Where must the stone be fastened to the pole, so as just to allow him his full share of weight?
13) Three like parallel forces acting at the vertices of a triangle have magnitudes proportional to the opposite sides. Show that their resultant passes through the in center of the triangle.
14) Derive the form of generalized theorem of moments.
15) Prove that "The algebraic sum of the moments of two forces about any point in their plane is equal to the moment of their resultant .
16) Derive moment of force.
17) Derive resultant of a number of parallel forces acting on a rigid body.
18) Derive unit of moment.
19) If l and m are the moments of a given force p about two fixed point A &B respectively. Show that the line of action of p divides AB in the ratio l:m deduce that a forces completely known when the moments of the force about any 3 points not lying in the same straight line are known.

20) Forces p, q, r act along the sides BC,AC,BA respectively of an equilateral triangle. If their resultant is a force parallel to BC through the centroid of the triangle, prove that Q=R=1/2P.

UNIT - 3

21. State and prove : equivalence of two couples.
22. A force acting at any point A of a body is equivalent to a equal and parallel force acting at any other orbitary point B of the body, together with the couple.
23. If three forces acting on a rigid body be represented in magnitude, direction and line of action by the sides of a triangle taken in order, they are equivalent to a couple whose moment is twice the area of the triangle.
24. State and prove resultant of a couple and a force.
25. State and prove couples in parallel planes.
26. If any number of forces acting on a rigid body by represented in magnitude by direction and the line of action by the sides of a polygon taken in order, they are equivalent to a couple, whose moment is twice the area of the polygon.
27. State and prove representation of a couple by a vector.
28. Forces of magnitude 1,2,3,4,$2\sqrt{2}$ act respectively along the sides AB , BC,CD,DA and the diagonal AC of the square ABCD . show that their resultant is a couple and find its moment.
29. FORCES OF 3, 4, 5, 6 and $2\sqrt{2}$ act respectively along the sides AB, BC,CD and DA along the diagonal AC of the square ABCD: find the resultant.
30. ABCD is a quadrilateral lamina AB=5 cm, BC= DC= DB= 4cm;AD=3cm. forces 10,8,8,6 gms.wt respectively act along AB, BC, CD,DA. Prove that they are equivalent to a couple and find the moment.

UNIT - 4

31. State and prOve the three coplanar force
32. Two trigonometrical theorem – state and proof
33. Condition of equilibrium – explain
34. State and prove Rigid body subjected to any three forces
35. State and prove Reduction of any number of coplanar forces
36. Explain the Conditions of equilibrium of a system of a coplanar forces.
37. If forces p_1,p_2,p_3 act along the sides BC,CA,AB of a DABC and if the
38. Explain Conditions for a system of forces to reduce to a single forces or to a couple
39. Forces F_1,F_2,F_3,F_4,F_5,F_6 act along the sides of a regular hexagon taken in order. Show that they will be in equilibrium if (1) $F_1+F_2+F_3+F_4+F_5+F_6= 0$ (2) $F_1-F_4= F_3-F_6= F_5-F_2$

40. Forces 3,2,4,5 Kg WT act respectively along the sides AB, BC,CD and DA of a square. Find the magnitude of their resultant and the points where its line of action meets AB and AD .

UNIT - 5

41. Define statical and dynamical limiting function.

42. Explain coefficient of friction.

43. Determination of the centre of gravity in simple cases.

44. Define centre of gravity by symmetry.

45. Prove general formula for determination of centre of gravity.

46. Prove central gravity of a thin plate

47. prove the centre of gravity of the uniform triangular laW.

48. AB & AC are two uniform rods of lengths 2a and 2b respectively. If the angle BAC = 0 . Prove that the distance from A of the centre of gravity of the two rods is

$$\frac{(a^4 + 2a^2b^2\cos\theta + b^4)^{1/2}}{a+b}$$

49. Define laws of friction.

50. Define angle of friction and explain the coefficient of friction.

STATICS

K4 LEVEL QUESTIONS

UNIT-1

1. To show that analytical expressions for the resultant of two forces acting at a point with a diagram and corollary.
2. Define triangle of force with a diagram.
3. Define the polygon of forces.
4. State and prove lami's theorem.
5. Weight W,w,W are attached to points B,C,D Respectively of a light string AE where B,C,D divide the string into 4 equal lengths.If the string hangs in the form of 4 consecutive sides of a regular octagon with the ends A&E Attached to points on the same level ,then show that $W=(\sqrt{2}+1)w$.

UNIT-2

6. If h and h' be the greatest height in the two parts of the projectile with a given velocity for a given range prove that $R=4\sqrt{hh'}$
7. To find the resultant of two like parallel forces acting on a rigid body.
8. To find the resultant of two unlike and unequal parallel forces acting on a rigid body.
9. Derive varigon's theorem of moments
10. Two men carry a load of 224 kg. Wt which hangs from a light pole of length 8m each end of which rests on a shoulder of any of the men. The point from which the load is hung is 2m. What is the pressure on each shoulder.

UNIT-3

11. A uniform plank of length 2 a and weight W is supplied horizontally on two vertical props at a distance b apart. Two greatest weight that can placed at the two ends in succession without upsetting the plank are W1 and W2 respectively. Show that $W_1/W+W_1+W_2/W+W_2=b/a$.
12. ABC is an equivalent triangle of side A : D: E:F divide the sides BC,CA,AB respectively in the ratio 2:1. Three forces each equal to P act at D,E,F perpendicular to the sides and outward from the triangle. Prove that they are equivalent to the couple of moment 1\2 Pa.
13. Five equal forces act along the sides AB, BC, CD, DE, EF of a regular hexagon find the sum of the moment of these force about a point Q on AF at a distance x from A. interpret the result and explain why it is so.
14. State and prove equilibrium of two couples.
15. State and prove resultant of coplanar couples.

UNIT-4

16. P and Q are the two like parallel forces. A couple of moment G is combined with them. Show that the resultant of the two parallel force is displaced through a distance G/P+Q.
17. State and prove Equation to the line of action of the resultant
18. ABCDEF is regular hexagon forces p,2p,3p,4p,5p,6p act along AB,BC,CD,ED,EF,AF respectively. Show that the six forces are equivalent to a couple and find the moment of the couple.
19. State and prove the reduction of any number of coplanar forces.
20. Three forces each equal to P act along the sides of a triangle ABC is order. Proof that the resultant is $P(1-8\sin A/2 \sin B/2 \sin C/2)^{1/2}$ and that its line of action divides BC externally in the ratio c :b .

UNIT-5

21. If six forces of relative magnitudes 1,2,3,4,5 and 6 act along the sides of a regular hexagon taken in order, show that the single equivalent force is of relative magnitudes 6 and that if act along a line parallel to the force 5 at a distance from the center of the hexagon 3 ½ times the distance of a sides from the center.
22. Define and explain centre of like parallel forces.
23. State and Prove centre of gravity.
24. Define types of friction and explain the angle of friction.
25. Explain equilibrium of a body on a rough inclined plane under a force parallel to the plane.