



**Maratha Vidya Prasarak Samaj's**

**Rajarshi Shahu Maharaj Polytechnic, Nashik**

**Udoji Maratha Boarding Campus, Near Pumping Station, Gangapur Road, Nashik-13.**

**Affiliated to MSBTE Mumbai, Approved by AICTE New Delhi, DTE Mumbai & Govt. of Maharashtra, Mumbai.**

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*Subject:*

*Applied MEchanics*

*(22203)*



# SYLLABUS

Chapter No.	Name of chapter	Marks
1	Mechanics and Force System	6
2	Simple Lifting Machine	12
3	Resolution and Composition	14
4	Equilibrium	14
5	Friction	12
6	Centroid and Centre of Gravity	12
<b>Total Marks: -</b>		<b>70</b>



# **BOARD THEORY PAPER**

## **PATTERN**

<b>Q.1</b>		<b>Attempt any FIVE</b>	<b>5*2=10</b>
	a)	Resolution and Composition	
	b)	Simple Lifting Machine	
	c)	Mechanics and Force System	
	d)	Equilibrium	
	e)	Friction	
	f)	Centroid and Centre of Gravity	
	g)	Equilibrium	
<b>Q.2</b>		<b>Attempt any THREE</b>	<b>3*4=12</b>
	a)	Resolution and Composition	
	b)	Simple Lifting Machine	
	c)	Simple Lifting Machine	
	d)	Friction	
<b>Q.3</b>		<b>Attempt any THREE</b>	<b>3*4=12</b>
	a)	Resolution and Composition	
	b)	Resolution and Composition	
	c)	Simple Lifting Machine	
	d)	Simple Lifting Machine	
<b>Q.4</b>		<b>Attempt any THREE</b>	<b>3*4=12</b>
	a)	Resolution and Composition	
	b)	Equilibrium	



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	c)	Equilibrium	
	d)	Friction	
	e)	Equilibrium	
<b>Q.5</b>		<b>Attempt any TWO</b>	<b>2*6=12</b>
	a)	Equilibrium	
	b)	Friction	
	c)	Resolution and Composition	
<b>Q.6</b>		<b>Attempt any TWO</b>	<b>2*6=12</b>
	a)	Centroid and Centre of Gravity	
	b)	Centroid and Centre of Gravity	
	c)	Centroid and Centre of Gravity	



# **CLASS TEST - I**

## **PAPER PATTERN**

**COURSE: -Applied Mechanics (22203)**

**PROGRAMME: -Mechanical engineering**

**Syllabus: -**

<b>Unit No.</b>	<b>Name of the Unit</b>	<b>Course Outcome (CO)</b>
1	Mechanics and Force System	<b>CO-203.01</b>
2	Resolution and Composition	<b>CO-203.03</b>
3	Equilibrium	<b>CO-203.04</b>

<b>Q.1</b>	<b>Attempt any FOUR</b>	<b>Course Outcome (CO)</b>
	<b>4*2=8Marks</b>	
a)	Mechanics and Force System	CO-203.01
b)	Resolution and Composition	CO-203.03
c)	Mechanics and Force System	CO-203.01
d)	Equilibrium	CO-203.04
e)	Equilibrium	CO-203.04
f)	Resolution and Composition	CO-203.03



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<b>Q.2</b>	<b>Attempt any THREE</b>	<b>3*4= 12Marks</b>	
a)	Resolution and Composition		CO-203.03
b)	Resolution and Composition		CO-203.03
c)	Mechanics and Force System		CO-203.01
d)	Equilibrium		CO-203.04



# **CLASS TEST - II**

## **PAPER PATTERN**

**COURSE: -Applied Mechanics (22203)**

**PROGRAMME: -Mechanical engineering**

<b>Unit No.</b>	<b>Name of the Unit</b>	<b>Course Outcome (CO)</b>
<b>4</b>	Friction	<b>CO-203.05</b>
<b>5</b>	Centroid and Centre of Gravity	<b>CO-203.06</b>
<b>2</b>	Simple Lifting Machine	<b>CO-203.02</b>

<b>Q.1</b>	<b>Attempt any FOUR</b>	<b>4*2= 8Marks</b>	<b>Course Outcome (CO)</b>
a)	Friction		<b>CO-203.05</b>
b)	Centroid and Centre of Gravity		<b>CO-203.06</b>
c)	Friction		<b>CO-203.05</b>
d)	Centroid and Centre of Gravity		<b>CO-203.06</b>
e)	Simple Lifting Machine		<b>CO-203.02</b>
f)	Simple Lifting Machine		<b>CO-203.02</b>
<b>Q.2</b>	<b>Attempt any THREE</b>	<b>3*4= 12Marks</b>	
a)	Friction		<b>CO-203.05</b>
b)	Centroid and Centre of Gravity		<b>CO-203.06</b>



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c)	Centroid and Centre of Gravity	<b>CO-203.06</b>
d)	Simple Lifting Machine	<b>CO-203.02</b>





# **COURSE OUTCOME**

## **(CO)**

**COURSE: -Applied Mechanics(22203)**

**PROGRAMME: -Mechanical Engineering**

<b>CO.NO.</b>	<b>Course Outcome</b>
<b>CO-203.01</b>	Select relevant material in industry by analyzing it's physical properties
<b>CO-203.02</b>	Apply laws of motion in various applications
<b>CO-203.03</b>	Apply laws of motion in various applications
<b>CO-203.04</b>	Select relevant Metallurgical process related to industrial application.
<b>CO-203.05</b>	Select relevant water treatment process to solve industrial problems.
<b>CO-203.06</b>	Use relevant fuel in relevant application.

# 1. Mechanics and Force System

Position in Question Paper

Total Marks-06

Q.1. a) 2-Marks.

Q.1. b) 2-Marks.

Q.2. a) 2-Marks.

## Descriptive Question

1. State principle of transmissibility of force.
2. Define unlike parallel force system and general force system with sketch.
3. Find the angle between two equal forces of magnitude 300 N each, if their resultant is 150 N
4. State law of Parallelogram of forces.
5. Write relation between resultant and equilibrant.
6. Define force and state its effects.
7. Define Statics and Dynamics.

## MCQ Question

(Total number of Question=Marks\*3=06\*3=18)

Note: Correct answer is marked with **bold**.

- 1 Which of the following conditions should be satisfied for co-planer concurrent forces to be in equilibrium?  
a)  $\Sigma F_x = \Sigma F_y = 0$  c) Both a) and b)  
b)  $\Sigma M = 0$  d) None of the above
- 2 If a body in equilibrium condition is acted by three forces at three points, then the line of action of these forces should be  
a) **always concurrent** c) concurrent or parallel  
b) always parallel d) none of the above
- 3 Two forces act an angle of  $120^\circ$ . If the greater force is 50 kg and their resultant is perpendicular to the smaller force, the smaller force is  
a) **20 kg** c) 30 kg  
b) 25 kg d) 35 kg

- 4 The necessary condition of equilibrium of a body is:
- Algebraic sum of horizontal components of all the forces must be zero
  - Algebraic sum of vertical components of all the forces must be zero
  - Algebraic sum of the moments of the forces about a point must be zero
  - All (a), (b) and (c)**
- 5 If the body is under equilibrium under the influence of a set of non-collinear force, then the minimum number of forces has to be
- Two
  - Three**
  - Four
  - Five
- 6 According to Lami's theorem which of the following statements is true?
- Three forces acting at a point will be in equilibrium.
  - Three forces acting upon a particle will be in equilibrium if they are represented in magnitude and direction by the sides of a triangle, taken in order.
  - If three forces acting at a point are in equilibrium, each force is proportional to the sine of the angle between the other two.**
  - Three forces acting at a point can be represented by a triangle, each side being proportional to the force.
- 7 What is the dot product of two vectors which are having a magnitude equal to unity and are making an angle of  $45^\circ$ ?
- 0.707**
  - 0.707
  - 1.414
  - 1.414
- 8 The Law of Polygon of Forces states that
- if a polygon representing the forces acting at point in a body is closed, the forces are in equilibrium
  - if forces acting on a point can be represented in magnitude and direction by the sides of a polygon taken in order, then the resultant of the forces will be represented in magnitude and direction by the closing side of the polygon
  - if forces acting on a point can be represented by a polygon taken in order, their sides of a polygon taken in order, their resultant will be represented in magnitude and direction by the closing side of the polygon, taken in opposite order**
  - if forces acting on a point can be represented in magnitude and direction by the sides of a polygon in order, the forces are in equilibrium.
- 9 A force of 250N acts at an angle of 80 degree with x-axis. Find its components along 1650 and 3300
- 962.25N, -907.67N**
  - 856.25N, 770.14N
  - 962.25N, 907.67N
  - 856.25N, -770.14N
- 10 The resultant of two equal forces P making an angle  $2\theta$  is given by
- $2P\sin\theta$
  - $2P\cos\theta$
  - $2P\tan\theta$
  - $2P\cot\theta$

- b)  $2P\cos\theta$  d)  $2P\cot\theta$
- 11 Varignon's theorem is used to find  
 a) direction of resultant force c) magnitude of resultant force  
 b) location of resultant force d) nature of resultant force
- 12 What is the angle made by force A with X or Y ?(where X and Y are components of force A) \*  
 a) **75.52o** c) 14.03o  
 b) 60.65o d) 14.47o
- 13 The maximum and minimum magnitude of resultant forces is 1000 N and 500 N at point. What are the values of two forces acting on it?  
 a) 500 N, 500 N c) 300 N, 700 N  
 b) **450 N, 550 N** d) 250 N, 750 N
- 14 Couple is formed due to two  
 a) like, parallel and non-collinear forces of same magnitude  
 b) like, perpendicular and collinear forces of different magnitude  
 c) **unlike, parallel and non-collinear forces of same magnitude**  
 d) unlike, perpendicular and non-collinear forces of different magnitude
- 15 What are the X and Y components of point P for the force system shown below?  
 a) **X = 186.00 N, Y = 464 N** c) X = 466.12 N, Y = -180 N  
 b) X = 464.23 N, Y = 185 N d) None of the above
- 16 If two concurrent forces A and B acting on a point are 200 N and 300 N. What is the magnitude of resultant force, if it makes an angle of 50o with each force?  
 a) **471.08 N** c) 400.56 N  
 b) 455.12 N d) Insufficient data
- 17 The method of splitting a single force into two perpendicular components along x-axis and y-axis is called as  
 a) **orthogonal resolution** c) both a) and b)  
 b) perpendicular resolution d) none of the above
- 18 Find the angle between two force 120N each, such that their resultant is 60N  
 a) **Angle=151.04 deg** c) Angle=154.04 deg  
 b) Angle =152.04 deg d) Angle =153.04 deg

## 2. Simple Lifting Machine

Position in Question Paper

Total Marks-12

Q.2. a) 4-Marks.

Q.3. a) 4-Marks.

Q.3. d) 4-Marks.

### Descriptive Question

1. A solid cone of 500 mm height and 200 mm base diameter. The portion above half of its height is removed. Locate the point at which remaining body can be balanced.
2. In a machine, an effort required to lift a certain load is 200 N. When efficiency is 60% find the ideal effort.
3. What are the characteristic of ideal machine?
4. The diameter of bigger and smaller Pulley's of Weston's differential pulley block are 250 mm and 100 mm respectively. Determine effort required to lift a load of 3 KN with 80% efficiency.
5. A machine has V.R. of 250 and has its law  $P = (0.01W + 5)$  N, Find M.A., efficiency, effort lost in friction at a load of 1000 N and also state whether machine is reversible or not.
6. Define ideal machine and state law of machine for it with help of sketch.
7. A screw jack having 5 mm pitch and has 300 mm as diameter of effort wheel is used to lift a load of 80 kN. Find V.R. and effort required it efficiency of machine is 40%.
8. In a machine load of 500 N was lifted by an effort 50 N, Another load of 750 N was lifted by an effort of 60 N. Obtain law of machine.
9. Calculate effort lost in friction and load lost in friction, it machine lifts a load of 100 N by an effort of 8 N at an efficiency of 60%.
10. Explain law of machine. State it's use.
11. State ideal machine and write it's any two characteristics.



## MCQ Question

(Total number of Question=Marks\*3=12\*3=36)

Note: Correct answer is marked with **bold**.

- A simple machine has \_\_\_\_\_ point of application of effort and one point for load)
- 1  
a) **1** c) 3  
b) 2 d) 4
  - 2 Mechanical advantage is the ratio of \_\_\_\_\_ lifted to the effort applied)  
a) **weight** c) all the above  
b) effort d) none of these
  - 3 \_\_\_\_\_ of a machine is the work done on the machine.  
a) velocity ratio c) **out put**  
b) input d) none of these
  - 4 \_\_\_\_\_ is the ratio of the distance moved by the effort to the distance moved by the load)  
a) **velocity ratio** c) out put  
b) input d) none of these
  - 5 \_\_\_\_\_ of a machine is the actual work done by the machine.  
a) velocity ratio c) **out put**  
b) input d) none of these
  - 6 According to newton's second law of motion;  $P=$  \_\_\_\_\_.  
a) MA c) MT  
b) **MV** d) none of these
  - 7 A machine is said to be \_\_\_\_\_ if its efficiency 100%.  
a) **ideal** c) compound  
b) perfect d) none of these
  - 8 The first law of motion supplies the definition of \_\_\_\_\_.  
a) **momentum** c) energy  
b) force d) pressure
  - 9 Momentum of a moving mass is the amount of \_\_\_\_\_.  
a) **energy possessed by a body** c) inertia possessed by a body  
b) motion possessed by a body d) work possessed by a body

- 10 Momentum of body is given by the relation \_\_\_\_\_.  
a) force\*distance  
b) mass\*velocity  
c) mass\*time  
**d) mass\*acceleration**
- 11 Fulcrum is the \_\_\_\_\_ of a lever.  
**a) fixed part**  
b) moving part  
c) can't say  
d) Sliding Part
- 12 Lever consists of \_\_\_\_\_ parts.  
**a) two**  
b) three  
c) four  
d) none of these
- 13 Lever helps in \_\_\_\_\_.  
**a) moving the objects**  
b) lifting the objects  
c) all of the above  
d) Sliding Part
- 14 Nail cutter is a \_\_\_\_\_ class lever.  
**a) first**  
b) second  
c) third  
d) fifth
- 15 Lemon squeezer is a \_\_\_\_\_ class lever.  
**a) first**  
b) second  
c) third  
d) Sliding Part
- 16 Scissors is a \_\_\_\_\_ class lever.  
a) first  
**b) second**  
c) third  
d) fifth
- 17 Stapler is a \_\_\_\_\_ class lever.  
a) first  
**b) second**  
c) third  
d) fifth
- 18 Stair case is a/an \_\_\_\_\_.  
a) lever  
**b) inclined plane**  
c) wheel and axle  
d) none of these
- 19 In case of third class lever, the sequence is :  
a) effort, load, fulcrum  
**b) fulcrum, load, effort**  
c) fulcrum, effort, load  
d) load, fulcrum, effort
- 20 In case of second class lever, the sequence is :  
a) fulcrum, load, effort  
**b) load, fulcrum, effort**  
b) fulcrum, effort, load  
d) fifth







a) 10 N

c) 30 N

**b) 20 N**

d) 40 N

30 In a lifting machine, the effort required to lift loads of 200N and 300N were 50N and 60N respectively. If the velocity ratio of the machine is 20 determine law of the machine.

a)  **$P = 1/10W + 30$**

c)  $P = 1/30W + 30$

b)  $P = 1/20W + 30$

d)  $P = 1/40W + 30$

31 In a lifting machine, the effort required to lift loads of 200N and 300N were 50N and 60N respectively. If the velocity ratio of the machine is 20 determine efficiency to load of 200 N.

a) 10 %

**c) 20 %**

b) 15 %

d) 25 %

32 In a lifting machine, the effort required to lift loads of 200N and 300N were 50N and 60N respectively. If the velocity ratio of the machine is 20 determine efficiency to load of 300 N.

a) 10 %

c) 20 %

b) 15 %

**d) 25 %**

33 A machine has velocity ratio 30, determine the effort required to lift a load of 100N if efficiency of the machine is 30%.

**a) 11.11N**

c) 13.13N

b) 12.12N

d) 14.14N

34 At a certain machine an effort of 18N lifts a load of 100 N at an efficiency of 65%. Find the effort

**a) 6.29**

c) 5.28

b) 2.36

d) 9.25

35 In a certain lifting machine an effort of 2N lifts a load of 30N. If the effort lost due to friction at this load is 0.5N. efficiency of machine.

a) 75

**b) 50**

c) 78

d) 40

36 A machine lifts a load of 400 N by effort of 60 N. It lifts load of 600 N by effort of 80 N. Find the law of Machine.

**a)  $P=0.1 W+20 N$**

c)  $P=0.1 W+40 N$

b)  $P=0.1 W+30 N$

d)  $P=0.2 W+40 N$

### 3. Resolution and Composition

Position in Question Paper

Total Marks-14

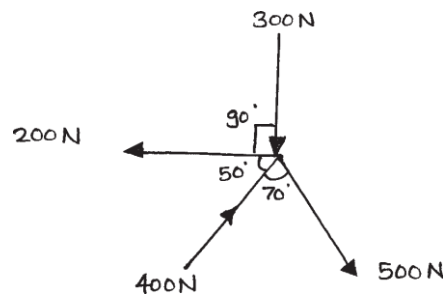
Q.2. d) 2-Marks.

Q.5. d) 6-Marks.

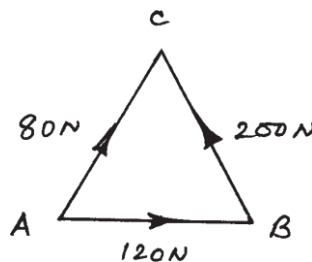
Q.6. d) 6-Marks.

### Descriptive Question

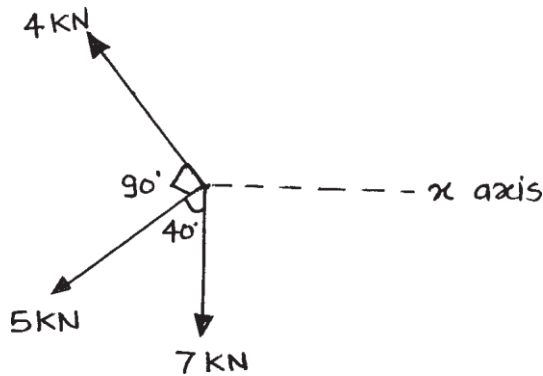
1. A concurrent force system is shown in Figure No. 7 find graphically the resultant of this force system.



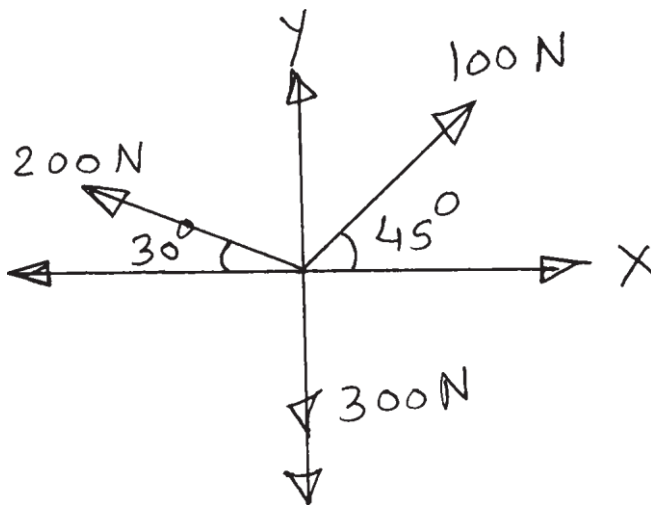
2. Calculate the resultant and its position wrt. point A for the force system shown in Figure No. 2.  $AB = BC = CA = 2\text{m}$



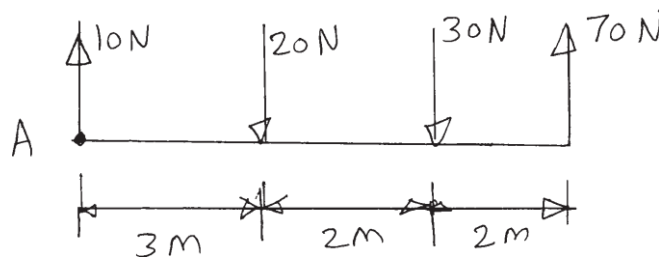
3. Find the angle between two equal forces of magnitude 300 N each, if their resultant is 150 N.
4. Find analytically the resultant of following concurrent force system. Refer to Figure No



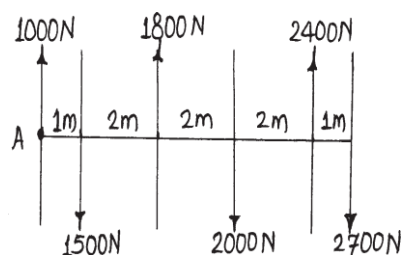
5. Find analytically the resultant of following concurrent force system



6. Define unlike parallel force system and general force system with sketch.
7. State principle of transmissibility of force.
8. Define resultant force
9. Locate the resultant with magnitude and direction for a parallel force system



10. Locate the resultant with magnitude and direction for a parallel force system





## MCQ Question

(Total number of Question=Marks\*3=14\*3=42)

- A force of 10 N is making an angle of  $30^\circ$  with the horizontal. Its horizontal component will be
  - 4 N
  - 5 N**
  - 7 N
  - 10 N
- A man is pulling a trolley on a horizontal road with a force of 100 N making  $45^\circ$  with the road. The horizontal and vertical components will be
  - 52.5 N, 85.09 N**
  - 55.6 N, 78.6 N
  - 60.3 N, 54.11 N
  - 70 N, 29.23 N
- Splitting up of a force into two mutually perpendicular components is called the
  - determination of that force
  - subtraction of the forces
  - resolution of that force**
  - line of action of that force
- The number of perpendicular components of force are
  - 1**
  - 3
  - 2
  - 4
- The number of perpendicular components of a force are
  - 1
  - 2**
  - 3
  - 4
- The process of finding out the resultant force is known as
  - Superposition of forces
  - Addition of forces
  - Resolution of forces
  - Composition of forces**
- The resultant of two forces which are acting at an angle  $\theta$  is
  - $(P^2 - Q^2 + 2PQ \cos \theta)^{1/2}$
  - $(P^2 + Q^2 + 2PQ \cos \theta)^{1/2}$**
  - $(P^2 - Q^2 + 2PQ \sin \theta)^{1/2}$
  - $(P^2 + Q^2 + 2PQ \sin \theta)^{1/2}$
- The resultant of two equal forces P making an angle  $2\theta$  is given by
  - $2P \sin \theta$**
  - $2P \cos \theta$
  - $2P \tan \theta$
  - $2P \cot \theta$
- The resultant for a number of forces acting at a point, is given by
  - $(\sum V)^2 - (\sum H)^2$
  - $(\sum V)^2 + (\sum H)^2$
  - $[(\sum V)^2 - (\sum H)^2]^{1/2}$
  - $[(\sum V)^2 + (\sum H)^2]^{1/2}$**
- The forces which meet at a point and their lines of action lie in the same plane and known as
  - Non-coplanar non concurrent forces
  - Non-coplanar concurrent forces
  - Coplanar non concurrent forces
  - Coplanar concurrent forces

- b) Coplanar non concurrent forces **d) Coplanar concurrent forces**
- 11 The angle between two forces when the resultant is maximum and minimum respectively are
- a) **0° and 180°** c) 180° and 0°  
b) 90° and 180° d) 90° and 0°
- 12 If the resultant of two equal forces has the same magnitude as either of the forces, then angle between the two forces is
- a) 30° c) 60°  
b) 90° **d) 120°**
- 13 Concurrent forces are those forces whose lines of action
- a) lie on the same line **c) meet at one point**  
b) meet on the same plane d) none of these
- 14 The forces, which meet at one point and their lines of action also lie on the same plane, are known as
- a) coplaner concurrent forces** c) coplaner non-concurrent forces  
b) non-coplaner concurrent forces d) non-coplaner non-concurrent
- 15 The forces which do not meet at one point and their lines of action do not lie on the same plane are known as
- a) coplaner concurrent forces c) coplaner non-concurrent forces  
b) non-coplaner concurrent forces **d) none of these**
- 16 Coplaner concurrent forces are those forces which
- a) meet at one point, but their lines of action do not lie on the same plane  
**b) meet at one point and their lines of action also lie on the same plane**  
c) do not meet at one point and their lines of action do not lie on the same plane  
d) do not meet at one point, but their lines of action lie on the same plane
- 17 Two like parallel forces are acting at a distance of 24 mm apart and their resultant is 20 N. If the line of action of the resultant is 6 mm from any given force the two forces are
- a) 15 N and 5 N** c) 20 N and 5 N  
b) 15 N and 10 N d) none of these
- 18 Three forces acting on a rigid body are represented in magnitude, direction and line of action by the three sides of a triangle taken in order. The forces are equivalent to a couple whose moment is equal to

- a) area of the triangle  
b) half the area of the triangle  
c) **twice the area of the triangle**  
d) none of these
- 19 The moment axis, force and the perpendicular distance in the moment of the force calculation is lying in \_\_\_\_\_  
a) **Two planes perpendicular to each other**  
b) A single plane in the direction of the force  
c) A single plane in the direction of the perpendicular distance  
d) A single line in the direction of the force
- 20 If the rotation is clockwise in this page, suppose, then in which direction will the thumb project if you curl your hand in the same direction of the rotation?  
a) It will point to the direction perpendicular to the plane of the paper and towards you  
b) **It will point to the direction perpendicular to the plane of the paper and away from you**  
c) It will point to the direction parallel to the plane of the paper and towards right  
d) It will point to the direction parallel to the plane of the paper and towards left
- 21 Which of the following is true?  
a) **Total moment of various forces acting on the body is the vector sum of all moments**  
b) Total moment of various forces acting on the body is the algebraic sum of all moments  
c) Total moment of various forces acting on the body is always zero  
d) Total moment of various forces acting on the body is the vector sum of all moments which is perpendicular to each other forces
- 22 The \_\_\_\_\_ forces do not cause the rotation.  
a) Non-concurrent  
b) **Concurrent**  
c) Parallel  
d) Non-Parallel
- 23 Which of the following is true?  
a) **Total moment of various forces acting on the body is the vector sum of all moments in 3D**  
b) Total moment of various forces acting on the body is the algebraic sum of all moments in 3D  
c) Total moment of various forces acting on the body is always zero in any dimension  
d) Total moment of various forces acting on the body is the vector sum of all moments which is perpendicular to each other forces whatever be the dimensions
- 24 A force of 50 N acting tangentially to a circle of radius 6 m. Its moment about diametrically opposite point will be \_\_\_\_\_.  
(a) 150 Nm  
(c) 60 Nm

- (b) 600 Nm (d) 300 Nm
- 25 Which of the following conditions should be satisfied for co-planer concurrent forces to be in equilibrium?  
a)  $\Sigma F_x = \Sigma F_y = 0$  c) Both a) and b)  
b)  $\Sigma M = 0$  d) None of the above
- 26 If a body in equilibrium condition is acted by three forces at three points, then the line of action of these forces should be  
a) **always concurrent** c) concurrent or parallel  
b) always parallel d) none of the above
- 27 Two forces act an angle of  $120^\circ$ . If the greater force is 50 kg and their resultant is perpendicular to the smaller force, the smaller force is  
a) **20 kg** c) 30 kg  
b) 25 kg d) 35 kg
- 28 The necessary condition of equilibrium of a body is:  
a) Algebraic sum of horizontal components of all the forces must be zero  
b) Algebraic sum of vertical components of all the forces must be zero  
c) Algebraic sum of the moments of the forces about a point must be zero  
d) **All (a), (b) and (c)**
- 29 If the body is under equilibrium under the influence of a set of non-collinear force, then the minimum number of forces has to be  
a) Two c) Four  
b) **Three** d) Five
- 30 According to Lami's theorem which of the following statements is true?  
a) Three forces acting at a point will be in equilibrium.  
b) Three forces acting upon a particle will be in equilibrium if they are represented in magnitude and direction by the sides of a triangle, taken in order.  
c) **If three forces acting at a point are in equilibrium, each force is proportional to the sine of the angle between the other two.**  
d) Three forces acting at a point can be represented by a triangle, each side being proportional to the force.
- 31 What is the dot product of two vectors which are having a magnitude equal to unity and are making an angle of  $45^\circ$ ?  
a) **-0.707** c) -1.414  
b) 0.707 d) 1.414
- 32 The Law of Polygon of Forces states that  
a) if a polygen representing the forces acting at point in a body is closed, the forces are in equilibrium  
b) if forces acting on a point can be represented in magnitde and direction by the

sides of a polygon taken in order, then the resultant of the forces will be represented in magnitude and direction by the closing side of the polygon

**c) if forces acting on a point can be represented of a polygon taken in order, their sides of a polygon taken in order, their resultant will be represented in magnitude and direction by the closing side of the polygon, taken in opposite order**

d) if forces acting on a point can be represented in magnitude and direction by the sides of a polygon in order, the forces are in equilibrium.

- 33 A force of 250N acts at an angle of 80 degree with x-axis .find its components along 1650 and 3300  
a)-962.25N,-907.67N  
b)-856.25N ,770.14N  
c)962.25N,907.67N  
d)856.25N,-770.14N
- 34 The resultant of two equal forces P making an angle  $2\theta$  is given by  
a)  $2P\sin\theta$   
b)  **$2P\cos\theta$**   
c)  $2P\tan\theta$   
d)  $2P\cot\theta$
- 35 Varignon's theorem is used to find  
a) direction of resultant force  
b) location of resultant force  
c) magnitude of resultant force  
d) nature of resultant force
- 36 What is the angle made by force A with X or Y ?(where X and Y are components of force A)  
a) **75.52o**  
b) 60.65o  
c) 14.03o  
d) 14.47o
- 37 The maximum and minimum magnitude of resultant forces is 1000 N and 500 N at point. What are the values of two forces acting on it?  
a) 500 N, 500 N  
b) **450 N, 550 N**  
c) 300 N, 700 N  
d) 250 N, 750 N
- 38 Couple is formed due to two  
a) like, parallel and non-collinear forces of same magnitude  
b) like, perpendicular and collinear forces of different magnitude  
c) **unlike, parallel and non-collinear forces of same magnitude**  
d) unlike, perpendicular and non-collinear forces of different magnitude
- 39 What are the X and Y components of point P for the force system shown below?  
a) **X = 186.00 N, Y = 464 N**  
b) X = 464.23 N, Y = 185 N  
c) X = 466.12 N, Y = -180 N  
d) None of the above
- 40 If two concurrent forces A and B acting on a point are 200 N and 300 N. What is the magnitude of resultant force, if it makes an angle of 50o with each force?  
a) **471.08 N**  
b) 455.12 N  
c) 400.56 N  
d) Insufficient data





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- 41 The method of splitting a single force into two perpendicular components along x-axis and y-axis is called as
- a) **orthogonal resolution**
  - b) perpendicular resolution
  - c) both a) and b)
  - d) none of the above
- 42 Find the angle between two force 120N each, such that their resultant is 60N
- a) **Angle=151.04 deg**
  - b) Angle=152.04 deg
  - c) Angle=154.04 deg
  - d) Angle=157.04 deg

## 4. Equilibrium

Position in Question Paper

Total Marks-14

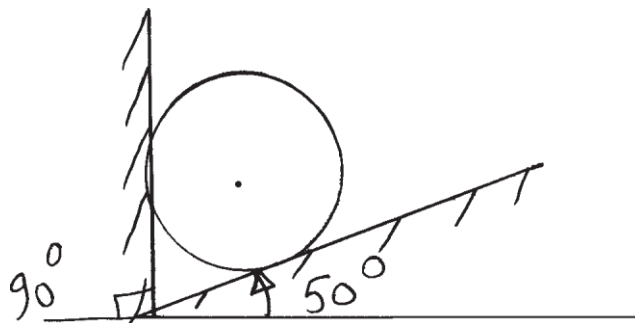
Q.4. b) 4-Marks.

Q.3. d) 4-Marks.

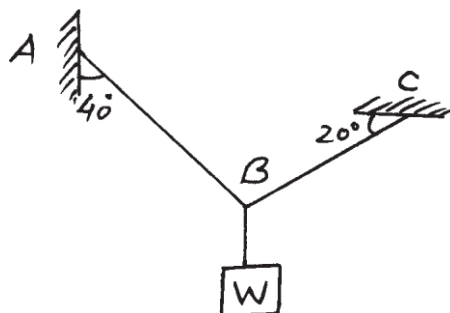
Q.6. d) 6-Marks.

### Descriptive Question

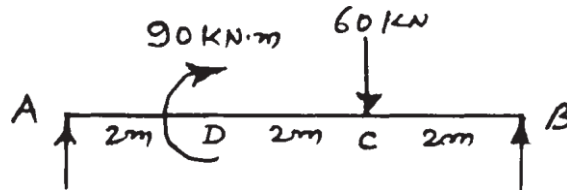
1. Calculate reactions offered by surface as shown in Figure , if a cylinder weighing 1000 N is resting on inclined surfaces at  $90^\circ$  and  $50^\circ$  with horizontal



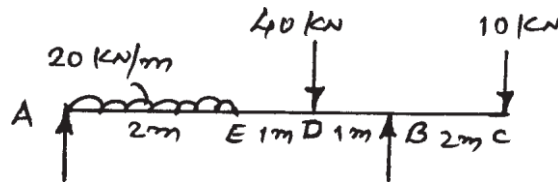
2. State Lami's theorem.
3. State any two types of beam along with sketch.
4. Calculate the tension induced in the cable used for the assembly shown in Figure  $W = 1500$  N.



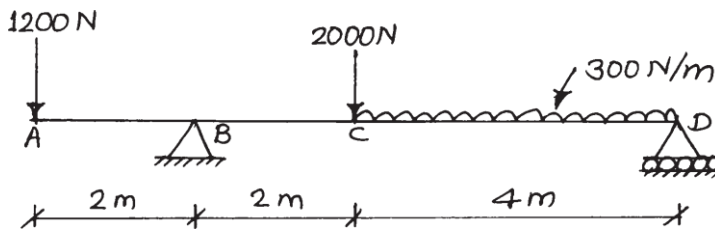
5. Calculate the reaction of beam loaded as shown in Figure



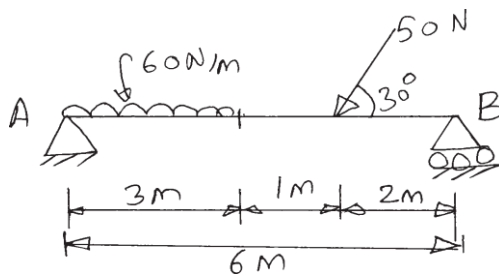
6. Calculate the reaction of beam loaded as shown in Figure



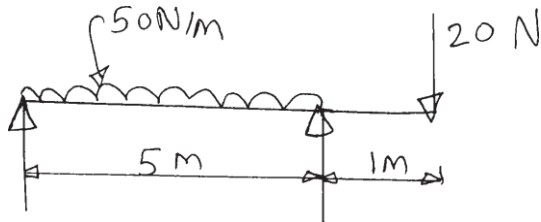
7. Calculate the reaction of beam loaded as shown in Figure



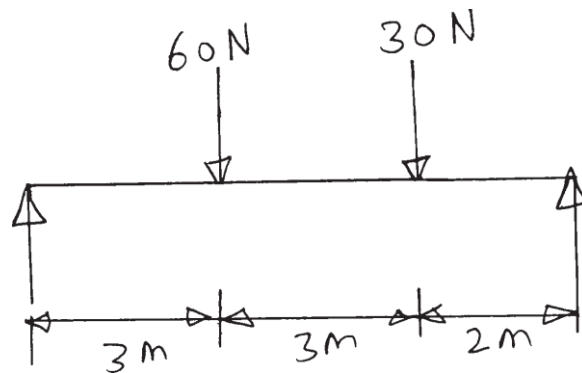
8. Calculate the reaction of beam loaded as shown in Figure



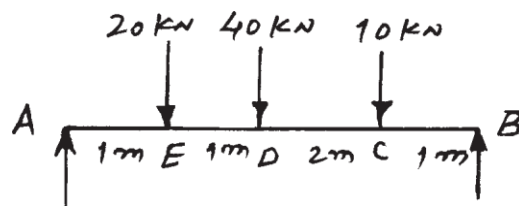
9. Calculate the reaction of beam loaded as shown in Figure



10. Calculate the reaction of beam loaded as shown in Figure No. use graphical method



11. Calculate the reaction of beam loaded as shown in Figure No. use graphical method





## MCQ Question

(Total number of Question=Marks\*3=14\*3=42)

Note: Correct answer is marked with **bold**.

- 1 If a body in equilibrium condition is acted by three forces at three points, then the line of action of these forces should be
  - a) **always concurrent**
  - b) always parallel
  - c) concurrent or parallel
  - d) none of the above
- 2 According to Lami's theorem, a body is in equilibrium condition if each force among three\_ are proportional to sine angle between other two.
  - a) coplanar, collinear forces
  - b) collinear, non-concurrent forces
  - c) coplanar, non-concurrent forces
  - d) **coplanar, concurrent forces**
- 3 Cantilever beam has one end and other end
  - a) **hinged, free**
  - b) fixed, free
  - c) fixed, hinged
  - d) none of the above
- 4 The necessary condition of equilibrium of a body is: \*
  - a) Algebraic sum of horizontal components 0
  - b) Algebraic sum of vertical components zero
  - c) Algebraic sum of the moments 0
  - d) **All (a), (b) and (c)**
- 5 Three coplanar forces A, B and C acting at a point in the plane are in equilibrium. If the given value of A is 1.9318 kg wt and  $\sin\theta_1$  is 0.9659, what is the value of C?
  - a) 1
  - b) 2
  - c) **0.9659**
  - d)  $\frac{1}{2}$
- 6 A body under the action of coplanar forces X, Y and Z, is in equilibrium as shown in the figure. Which of the following is the correct statement? \*
  - a)  **$P/\sin a = Q/\sin B = R/\sin r$**
  - b)  $P/\sin r = Q/\sin a = R/\sin r$
  - c) Both
  - d) None of the above
- 7 If the body is under equilibrium under the influence of a set of non- colinear force, then theminimum number of forces has to be \*
  - a) Two
  - b) **Three**
  - c) Four
  - d) Five
- 8 According to Lami's theorem which of the following statements is true? \*
  - a) Three forces acting at a point will be in equilibrium.

- b) Three forces acting upon a particle will be in equilibrium if they are represented in magnitude and direction by the sides of a triangle, taken in order.
- c) If three forces acting at a point are in equilibrium, each force is proportional to the sine of the angle between the other two.
- d) Three forces acting at a point can be represented by a triangle, each side being proportional to the force.
- 9 A 30 kg iron block is suspended using supports A and B as shown in the figure. What is the tension in both ropes? \*
- a) **263.566 N and 215.2 N** c) 663.566 N and 615.2 N  
b) 463.566 N and 415.2 N d) 863.566 N and 815.2 N
- 10 The maximum and minimum magnitude of resultant forces is 1000 N and 500 N at point. What are the values of two forces acting on it? \*
- a) **500 N, 500 N** c) 300 N, 700 N  
b) 450 N, 550 N d) 250 N, 750 N
- 11 If two concurrent forces A and B acting on a point are 200 N and 300 N. What is the magnitude of resultant force, if it makes an angle of  $50^\circ$  with each force?
- a) **471.08 N** c) 400.56 N  
b) 455.12 N d. Insufficient data
- 12 The beam shown in below figure is supported by a hinge at A and a roller at B. The reaction  $R_A$  of the hinged support A of the beam, is \*
- a) 10.8 t c) 10.4 t  
b) 10.6 t d) **10.2 t.**
- 13 A Weight 100 N is attached by two string. calculate the tension in the string
- a)  $T_1 = 50\text{N}, T_2 = 86.60\text{N}$  b)  $T_1 = 60\text{N}, T_2 = 86.60\text{N}$   
b)  $T_1 = 50\text{N}, T_2 = 80.60\text{N}$  c)  $T_1 = 50\text{N}, T_2 = 96.60\text{N}$
- 14 A sphere having 300 mm as radius and 1000N as weight against a well and on a inclined plane as shown in fig. Calculate the reactions given by the wall and the plane.
- a)  **$R_A = 363.97\text{N}, R_B = 1064.18\text{N}$**  c)  $R_A = 363.97\text{N}, R_B = 1164.18\text{N}$   
b)  $R_A = 263.97\text{N}, R_B = 1064.18\text{N}$  d)  $R_A = 383.97\text{N}, R_B = 1064.18\text{N}$
- 15 Find the beam Reactions \*
- a) **1.94 KN, 2.84 KN** c) 3.94 KN, 3.84 KN  
b) 2.94 KN, 4.84 KN d) 11.94 KN, 10.84 KN
- A beam AB of 9m span is simply supported at the ends. The Beam carries point load of 2kN upwards at 2m from A And uniformly distributed load of 1000N/m downwards on a length of 6m from B. Determine the support reactions analytically.
- 16 a) 8.33N, 4.66N c) **9.33N, 70.66N**

- b) 8.33N, 5.66N d) 5.33N, 8.66N
- 17 An electric bulb of weight 10N hangs vertically from a ceiling. Its wire is pulled by a horizontal force 'P' such that its wire will make an angle of with vertical. Find force 'P' and tension in wire. \*
- a) T = 10.15N, P = 1.76N c) T = 10.15N, P = 2.76N  
b) T = 12.15N, P = 1.76N d) T = 22.15N, P = 12.76N
- 18 Six parallel forces of magnitude 1 kN,1.5 kN,1.8 kN,2.0 kN,2.4 kN and 2.7 kN are acting at 1,3,5,7,8m from first force. Forces of first third and fifth are acting upwards while other are acting downwards find the resultant
- a) R=-1KN c) R=1KN  
b) R=-10KN d) R=10KN
- 19 Calculate resultant in magnitude, direction and position with respect to 40kN force for the parallel force system shown fig. \*
- a) R=35KN c) R=40KN  
b) R=-35KN d) R=-40KN
- 20 Varignon's theorem is used to find
- a) direction of resultant force c) magnitude of resultant force  
b) location of resultant force d) nature of resultant force
- 21 What is the angle made by force A with X or Y ?(where X and Y are components of force A)
- a) 75.52o c) 14.03o  
b) 60.65o d) 14.47o
- 22 The maximum and minimum magnitude of resultant forces is 1000 N and 500 N at point. What are the values of two forces acting on it?
- a) 500 N, 500 N c) 300 N, 700 N  
b) 450 N, 550 N d) 250 N, 750 N
- 23 Couple is formed due to two
- a) like, parallel and non-collinear forces of same magnitude  
b) like, perpendicular and collinear forces of different magnitude  
c) **unlike, parallel and non-collinear forces of same magnitude**  
d) unlike, perpendicular and non-collinear forces of different magnitude
- 24 What are the X and Y components of point P for the force system shown below?
- a) X = 186.00 N, Y = 464 N c) X = 466.12 N, Y = -180 N  
b) X = 464.23 N, Y = 185 N d) None of the above
- 25 If two concurrent forces A and B acting on a point are 200 N and 300 N. What is the magnitude of resultant force, if it makes an angle of 50o with each force?
- a) 471.08 N c) 400.56 N  
b) 455.12 N d) Insufficient data

- 26 The method of splitting a single force into two perpendicular components along x-axis and y-axis is called as
- a) **orthogonal resolution**
  - b) perpendicular resolution
  - c) both a) and b)
  - d) none of the above
- 27 Find the angle between two force 120N each, such that their resultant is 60N
- a) **Angle=151.04 deg**
  - b) Angle=152.04 deg
  - c) Angle=154.04 deg
  - d) Angle=157.04 deg
- 28 How is the weight of the aeroplane flying in the air balanced?
- a) **The weight is balanced because of the force due to the pressure difference between the upper and lower surfaces of the wings created by different airspeeds on the surfaces.**
  - b) The weight is balanced due to the vertical component of the thrust created by air currents striking the lower surface of the wings
  - c) The weight is balanced due to the force produced when the reactions of gases are ejected by the revolving propellor.
  - d) Upthrust of the air which will be equal to the weight of the air having the same volume as the plane
- 29 Which of the following is true when a body is stationary?
- a) The force acting on it is not in contact with it
  - b) The body is in vacuum
  - c) There is no force acting on it
  - d) **The combination of forces acting on it balance each other**
- 30 Two forces with magnitude F have the resultant of same magnitude F. What is the angle between the forces?
- a) 450
  - b) 600
  - c) **1200**
  - d) 1500
- 31 What is the angle between the forces if two forces with equal magnitudes F act on a body and the magnitude of the resultant force is F/3?
- a.  **$\cos^{-1}(17/18)$**
  - b.  $\cos^{-1}(2/3)$
  - c)  $\cos^{-1}(8/19)$
  - d)  $\cos^{-1}(-1/3)$
- 32 In which direction should the force be applied to balance a force in the direction of North-East direction?
- a) South
  - b) West
  - c) **South-West**
  - d) North-East







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- 42) If three forces acting in different planes can be represented by a triangle, these will be in
- a) Meet in a point
  - b) Be all parallel
  - c) At least two of them must meet
  - d) All the above are correct**
- a) Non-equilibrium
- b) Partial equilibrium
- c) Full equilibrium
- d) Unpredictable

## 5. Friction

Position in Question Paper

Total Marks-12

Q.4. c) 6-Marks.

Q.6. d) 6-Marks.

### Descriptive Question

1. A block of weight 500 N resting on a horizontal surface requires a horizontal force of 200 N to just move the block. Calculate i) Normal reaction ii) Frictional resistance iii) Resultant reaction and iv) Coefficient of friction.
2. Define angle of repose.
3. State four laws of static friction.
4. Write two advantages and two disadvantages of friction.
5. Draw FBD of ladder in friction.
6. A body of weight 2000N rests on a horizontal plane. if the coefficient of friction is 0.4 .Find the horizontal force required to move the body.
7. A parcel weighing 200N is just on the point of moving horizontally by a force of 52N .What is the Coefficient of Friction?
8. Calculate the force 'P' applied parallel to the plane, just to move the block up the plane, if the block weighing 500N is placed on an inclined plane at an angle of  $20^\circ$  with the horizontal. Coefficient of friction is 0.14.
9. Calculate the force 'P' applied parallel to the plane, just to move the block up the plane, if the block weighing 500N is placed on an inclined plane at an angle of  $20^\circ$  with the horizontal. Coefficient of friction is 0.14.
10. Calculate coefficient of friction if a block weighing 600 N resting on a rough horizontal plane can be moved by a force of 150 N applied at an angle of  $60^\circ$  with the horizontal.
11. A block weighing 100N on a  $30^\circ$  inclined rough plane. If coefficient of friction is 0.25. Calculate force required to be applied parallel to plane to make the block slide downward.
12. A block weighing 40kN resting on a rough horizontal plane can be moved by a force 20kN applied at angle  $40^\circ$  with horizontal. Find the coefficient of friction.



13. A push of 30 N applied at  $30^\circ$  to horizontal just move the block of weight 'W' N. If angle of friction is  $16^\circ$ . Find coefficient of friction, total reaction and weight of block.
14. A block weighing 1000 N, resting on a horizontal plane requires a pull of 400 N to start its motion. When applied at an angle of  $30^\circ$  with the horizontal. Find the coefficient of friction, along with normal reaction, force of friction and resultant reaction.
15. Calculate the force required to prevent body from falling down the plane if body of weight 600 N is resting on rough inclined plane of  $40^\circ$  and  $\mu = 0.58$ .
16. Calculate the horizontal force required to drag a body of weight 100 N along horizontal plane. If the plane is raised gradually up to  $16^\circ$  the body will begin to slide

## MCQ Question

(Total number of Question=Marks\*3=12\*3=36)

Note: Correct answer is marked with **bold**.

- Complete the sentence. Friction always \_\_\_\_\_
  - helps the motion
  - opposes the motion**
  - both of these
  - none of these
- Which one of these characteristics does a smooth surface has?
  - Less frictional force**
  - More frictional force
  - Sometimes less
  - All of above
- Friction is a \_\_\_\_\_
  - Contact force
  - Non-contact force
  - Magnetic force
  - None of these
- What kind of substances are known as lubricants
  - Increase friction
  - Decrease friction**
  - Increase or decrease friction
  - None of these
- For maximum range of a projectile, the angle of projection should be
  - $30^\circ$
  - $45^\circ$**
  - $60^\circ$
  - $90^\circ$
- On what force of friction depends?
  - Smoothness of surface
  - Roughness of surface
  - Inclination of surface
  - All of above**
- Limiting force of friction is the
  - Tangent of angle between normal-reaction
  - The friction force acting**

- and the resultant of normal reaction and limiting friction
- b) Ratio of limiting friction and normal reaction
- 8 Lubricants \_\_\_\_\_
- a) Increase friction
- b) Reduce friction**
- 9 Rolling friction is smaller than?
- a) Sliding friction
- b) Static friction
- 10 Tangent of angle of friction is equal to
- a) Kinetic friction
- b) Limiting friction
- c) Angle of repose
- d) Coefficient of friction**
- 11 The coefficient of static friction is \_\_\_\_\_
- a) Less than the coefficient of kinetic friction
- b) Greater than coefficient of limiting friction
- c) coefficient
- d) Equal tangent friction**
- 12 Which of the following kinetic friction is smaller?
- a) Limiting friction
- b) Static friction
- c) Rolling friction**
- d) Sliding friction
- 13 A cubical block rests on an inclined plane of  $\mu = 1/\sqrt{3}$ , determine the angle of inclination when the block just slides down the inclined plane?
- a)  $40^\circ$
- b)  $50^\circ$
- c)  $30^\circ$**
- d)  $20^\circ$
- A mass of 4kg rests on a horizontal plane. The plane is gradually inclined
- 14 until at an angle  $\theta = 15^\circ$  with the horizontal, the mass just begins to slide. What is the coefficient of static friction between the block and the surface?
- a) 0.814
- b) 0.27**
- c) 1.5
- d) 3.5
- 15 A scooter weighs 120kg f. Brakes are applied so that wheels stop rolling and start skidding. Find the force of friction if the coefficient of friction is 0.4.
- a) 60kg f
- b) 48kg f**
- c) 25kg f
- d) 32kg f
- 16 How is friction due to air reduced?
- a) Streamlining**
- b) Lubrication
- c) By using ball bearings
- d) By polishing
- 17 Friction can be increased by \_\_\_\_\_
- a) Using air cushion
- c) Using sand**

- b) Lubricants  
d) Using ball bearings
- 18 When moving along a curved path, he \_\_\_\_\_  
a) **Leans inwards**  
b) Leans outwards  
c) Is still  
d) Leans sideways
- A train has to negotiate a curve of radius 400m. By how much should the  
19 putter rail be raised with respect to inner rail for speed of 48 km/h? The  
distance between the rails is 1m.  
a) 0.20m  
b) **0.0454m**  
c) 0.45m  
d) 0.020m
- 20 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**
- 21 The coefficient of friction depends on  
a) Area of contact  
b) Shape of surfaces  
c) Strength of surfaces  
d) **Nature of surface**
- 22 The ratio of limiting friction and normal reaction is known as  
a) **Coefficient of friction**  
b) Angle of friction  
c) Angle of repose  
d) Sliding friction
- 23 The center of gravity of a uniform lamina lies at  
a) the Centre of heavy portion  
b) The bottom surface  
c) **The mid-point of its axis**  
d) All of the above
- 24 If a rigid body is in equilibrium under the action of three forces, then  
a) These forces are equal  
b) The lines of action of these forces meet in a  
point  
c) The lines of action of  
these forces are parallel  
d) **(B) and (C) above**
- 25 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**
- 26 The units of moment of inertia of mass are  
a) **Kg-m<sup>2</sup>**  
b) m<sup>4</sup>  
c) Kg/m<sup>2</sup>  
d) Kg/m
- 27 Pick up the incorrect statement from the following:  
a) the cG. of a circle is at its Centre

- b) the CG. of a triangle is at the intersection of its medians  
c) the CG. of a rectangle is at the intersection of its diagonals  
**d) the CG. of a semicircle is at a distance of  $r/2$  from the Centre**
- 28 The maximum frictional force which comes into play when a body just begins to slide over another surface is called  
**a) Limiting friction** c) Rolling friction  
b) Sliding friction d) Kinematic friction
- 29 The necessary condition for forces to be in equilibrium is that these should be  
a) Coplanar **c) Both (A) and (B) above**  
b) Meet at one point d) All be equal
- 30 If three forces acting in different planes can be represented by a triangle, these will be in  
**a) Non-equilibrium** c) Full equilibrium  
b) Partial equilibrium d) Unpredictable
- 31 The CG. of a plane lamina will not be at its geometrical centre in the case of a  
**a) Right angled triangle** c) Square  
b) Equilateral triangle d) Circle
- 32 The M.I. of hollow circular section about a central axis perpendicular to section as compared to its M.I. about horizontal axis is  
a) Same c) Half  
**b) Double** d) Four times
- 33 The angle which an inclined plane makes with the horizontal when a body placed on it is about to move down is known as angle of  
a) Friction **c) Repose**  
b) Limiting friction d) Kinematic friction
- 34 A ladder resting against a wall will never slip irrespective of where man stands on it, if the ladder makes an angle  
**a) Not greater than friction angle with vertical**  
b) Equal to friction angle with vertical  
c) Greater than friction angle with vertical  
d) Any angle irrespective of friction angle
- 35 The total friction that can be developed is  
**a) Independent of the magnitude of the area of contact**  
b) Proportion to the magnitude of the area of contact  
c) Proportional to square of area of contact  
d) None of the above.

- 36 Least force that starts a body along a plane acts at an angle with the plane
- a) **Equal to the angle of friction**
  - b) Little more than angle of friction
  - c) Little less than angle of friction
  - d) Of zero degree
- 37 \_\_\_\_\_ friction is the force of friction experienced by a body when it is at rest.
- a) Dynamic
  - b) **Static**
  - c) Sliding
  - d) Rolling
- 38 \_\_\_\_\_ friction is the value of the limiting friction just before slipping occurs.
- a) Dynamic
  - b) **Static**
  - c) Sliding
  - d) Rolling
- 39 \_\_\_\_\_ friction is the force of friction experienced by a body when it is in motion.
- a) **Dynamic**
  - b) Static
  - c) Sliding
  - d) Rolling
- 40 \_\_\_\_\_ friction is the value of frictional force after slipping has occurred)
- a) **Dynamic**
  - b) Static
  - c) Sliding
  - d) Rolling
- 41 When a body slides over another, the frictional force experienced by the body is known as \_\_\_\_\_ friction.
- a) **Sliding**
  - b) Rolling
  - c) static
  - d) None of the mentioned
- 42 When a body rolls over another, frictional force experienced by the body is known as \_\_\_\_\_ friction.
- a) Sliding
  - b) **Rolling**
  - c) static
  - d) None of the mentioned
- 43 Co-efficient of rolling friction is \_\_\_\_\_ than co-efficient of sliding friction.
- a) Greater
  - b) Equal to
  - c) **Lesser**
  - d) None of the mentioned
- 44 Which of the following produces least friction?
- (a) Sliding friction
  - (b) **Rolling friction**
  - (c) Composite friction
  - (d) Static friction



## 6. Centroid and Center of Gravity

Position in Question Paper

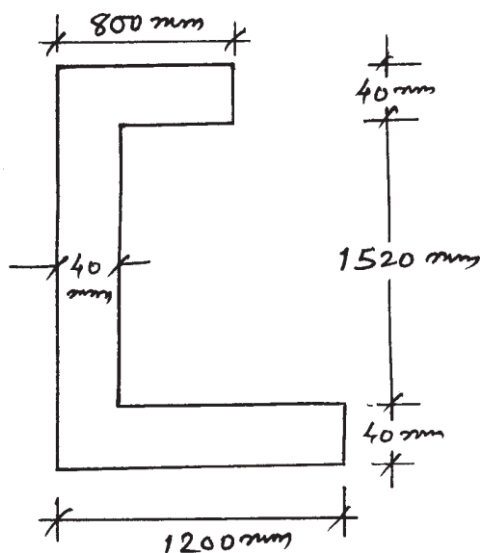
Total Marks-12

Q.4. c) 6-Marks.

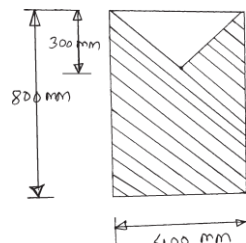
Q.6. d) 6-Marks.

### Descriptive Question

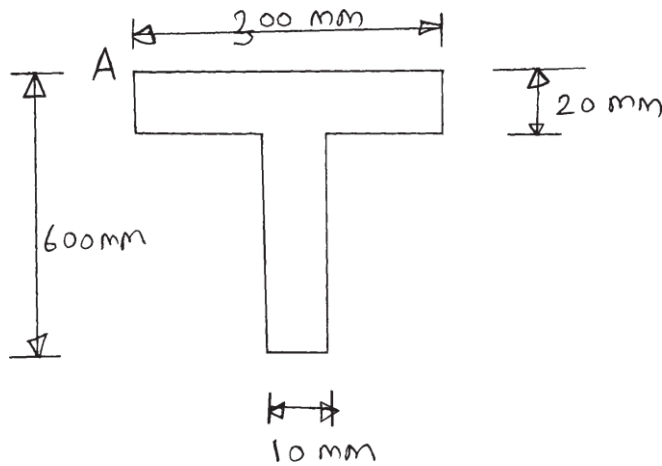
1. Define centre of gravity.
2. Locate the position of centroid for the section shown in Figure



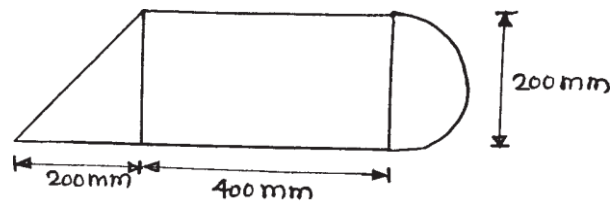
3. Locate the position of centroid for the section shown in Figure



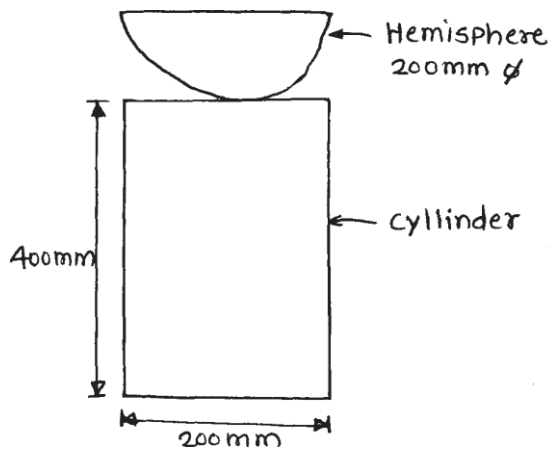
4. Locate the position of centroid for the section shown in Figure



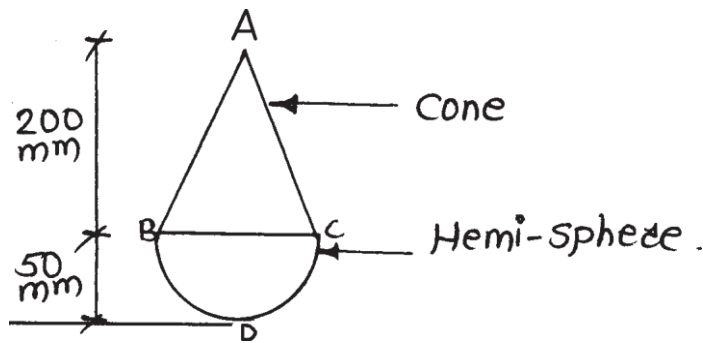
5. Locate the position of centroid for the section shown in Figure



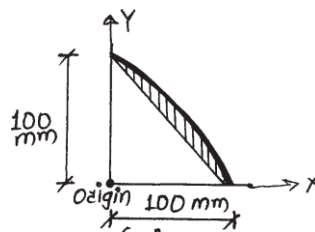
6. Find the centre of gravity for the solid shown in Figure



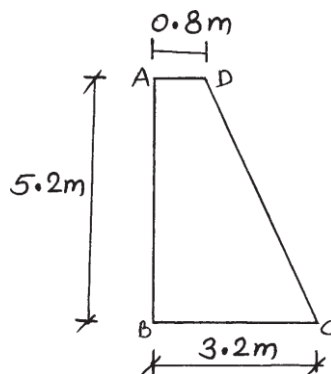
7. Find the centre of gravity for the solid shown in Figure



8. Find the centre of gravity for the solid shown in Figure



9. Calculate the position of centroid from bottom left corner 'B' for a retaining wall as shown in fig



## MCQ Question

(Total number of Question=Marks\*3=12\*3=36)

Note: Correct answer is marked with **bold**.

- The centre of gravity of a homogeneous body is the point at which the whole  
a) Volume assumed to be concentrated                      c) **Weight of the body**  
b) Area of the surface of the body                          d) All of the above
- Centre of gravity of a thin hollow cone lies on the axis of symmetry at a height of  
a) One-half of the total height above base              c) One-fourth of the total  
b) **One-third of the total height above base**          d) None of these
- The point at which the total area of a plane figure is assumed to be concentrated is called \_\_\_\_  
a) **Centroid**    c) Central point  
b) Centre of gravity    d) Inertial point
- Which method is used to determine centroid of a composite figure?  
a) Analytical method    c) **Both a) and b)**  
b) Graphical method    d) None of the above
- Where will be the center of gravity of an I section will be if the dimension of upper web is 2x10cm, lower web is 2x20 and that of flange is 2x15cm If the y-axis will pass through the center of the section?  
a) 7.611cm    c) 9.31cm  
b) **9.51cm**    d) 11.5cm
- What is the c) G of an isosceles triangle of base 20 cm and side 40?  
a) **12.90 cm**    c) 19.36 cm  
b) 13.28 cm    d) 38.72 cm
- The point through which the whole weight of the body acts is called \_\_\_\_  
a) Inertial point    c) Centroid  
b) **Center of gravity**    d) Central point
- What is the distance of centroid with respect to diagonal shown in diagram below?  
a)  $a/\sqrt{3}$     c)  **$a/\sqrt{18}$**   
b)  $a/\sqrt{2}$     d)  $3a/\sqrt{2}$
- Where will be the centre of gravity of a uniform rod lies?  
a) At its end    c) At its centre  
b) **At its middle point**    d) Depends upon material



- 10 If a material has no uniform density throughout the body, then the position of centroid and center of mass are \_\_\_\_
- a) identical  
b) **not identical**  
c) density  
d) unpredictable
- 11 Where will be the center of gravity of an I section will be if the dimension of upper web is  $2 \times 10$  cm, lower web is  $2 \times 20$  and that of flange is  $2 \times 15$  cm If the y-axis will pass through the center of the section?
- a) 7.611 cm  
b) **9.51 cm**  
c) 9.31 cm  
d) 11.5 cm
- 12 What is the centroid distance of an equilateral triangle of side 2 m?
- a) 0.866 m  
b) 0.769 m  
c) 1.000 m  
d) **0.577 m**
- a) 5 N ( $\uparrow$ )  
b) 10 N ( $\uparrow$ )  
c) 10 N ( $\downarrow$ )  
d) 40 N ( $\downarrow$ )
- 16 Where will be the center of gravity of the L-section shown in the figure?
- a) **(1.28, 2.64)**  
b) (1.45, 3.24)  
c) (1.64, 3.28)  
d) (2.24, 3.68)
- 17 The forces which do not meet at one point and their lines of action do not lie on the same plane are known as
- a) Coplanar concurrent forces  
b) Coplanar non-concurrent forces  
c) Non-coplanar  
d) **None of these**
- 18 Where will be the centre of gravity of the T section shown in the figure?
- a) **At 8.545 cm**  
b) At 6.5 cm  
c) At 5 cm  
d) At 9.25 cm
- 19 A screw jack used for lifting the loads is
- a) A reversible machine  
b) **A non-reversible machine**  
c) An ideal machine  
d) None of these
- 20 Concurrent forces are those forces whose lines of action
- a) Lie on the same line  
b) **Meet at one point**  
c) Meet on the same plane  
d) None of these
- 21 The term 'Centroid' is called
- a) **The same as centre of gravity**  
b) The point of suspension  
c) forces rotate  
d) None of the above
- 22 Density is best given by \_\_\_\_
- a) Product of volume and density  
b) **Ratio of mass to Volume**  
c) mass + density  
d) mass – density

- 23 The total motion possessed by a body, is called  
 a) Impulsive force  
 b) Mass  
 c) Weight  
 d) **Momentum**
- 24 Centroid determination involves the calculations of various forces. In that forces are having various properties. That is force is developed by a support that not allows the \_\_\_\_ of its attached member.  
 a) **Translation**  
 b) Rotation  
 c) Addition  
 d) Subtraction
- 25 What is not the condition for the equilibrium for the calculations used for the determination of the centroid in three dimensional system of axis?  
 a)  $\sum F_x=0$   
 b)  $\sum F_y=0$   
 c)  $\sum F_z=0$   
 d)  **$\sum F \neq 0$**
- 26 The wheels of a moving car possess  
 a) Potential energy only  
 b) Kinetic energy of translation only  
 c) Kinetic energy  
 d) **both**
- 27 The coefficient of restitution for inelastic bodies is  
 a) **Zero**  
 b) One  
 c) Between zero and one  
 d) More than one
- 28 The periodic time of a particle with simple harmonic motion is \_\_\_\_ proportional to the angular velocity.  
 a) Directly  
 b) **Inversely**  
 c) Square root  
 d) None of these
- 29 Centroid of a body does depends upon the small weights of tiny particles. Which statement is right for force acting by the small particles of the body having its vector form as  $= A_i + B_j + C_k$ ?  
 a) representation of any vector we have vector  $F = A_i + B_j + C_k$   
 b) representation of any vector we have vector  $F = A_x + b_y + C_z$   
 c) **representation of any vector we have vector  $F = F_x + F_y + F_z$**   
 d) representation of any vector we have vector  $F = F_i + F_j + F_k$
- 30 The centre of \_\_\_\_ is the ratio of the product of centroid and volume to the total volume.  
 a) Centroid axis  
 b) Density  
 c) Mass  
 d) **Volume**
- 31 On what the center of gravity of the uniform rod lies?  
 a) Depends upon its material  
 b) at its end  
 c) its cross-sectional area  
 d) **at its middle point**
- 32 The center of gravity of the circle lies on\_\_\_\_



- a) **At its center** c) Anywhere  
circumference
- b) Anywhere on its diameter d) Anywhere on its radius
- 33 Where will be the center of gravity of an T section will be if the dimension of web is 2x20cm and that of flange is 2x15cm If the y-axis will pass through the center of the section?
- a) 10.5cm c) 12.35cm  
b) **11.45cm** d) 12.85cm
- 34 If the dimension of the upper web is 2x10cm, the lower web is 2x20 and that of the flange is 2x15cm If y-axis will pass through the center of the section. Where will be the center of gravity of the I section?
- a) 11.5cm c) 9.31cm  
b) **9.51cm** d) 7.611cm
- 35 Where will be the center of gravity of an I section will be if the dimension of upper web is 2x8cm, lower web is 2x16 and that of flange is 2x12cm If the y-axis will pass through the center of the section?
- a) 7.611cm c) 6.53cm  
b) **7.44cm** d) 6.44cm
- 36 What is the point called, through which the whole weight of the body acts?
- a) Central point c) Centroid  
b) **Center of gravity** d) Inertial point
- 37 The point at which the total area of a plane figure is assumed to be concentrated is called \_\_\_\_\_
- a) **Centroid** c) Central point  
b) Centre of gravity d) Inertial point
- 38 Where will be the centre of gravity of a uniform rod lies?
- a) At its end c) cross sectional area  
b) **At its middle point** d) Depends
- 39 Where the center of gravity of a circle lies?
- a) **At its centre** c) its circumference  
b) Anywhere on its radius d) on its diameter
- 40 Where will be the center of gravity of an I section will be if the dimension of upper web is 2x10cm, lower web is 2x20 and that of flange is 2x15cm If the y-axis will pass through the center of the section?
- a) 7.611cm c) 9.31cm  
b) **9.51cm** d) 11.5cm
- 41 The center of gravity of a circle of radius 10 cm will be \_\_\_\_\_
- a) **At its center of the diameter** c) on the circumference



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- b) At the center of the radius  
d) Anywhere in its area
- 42 A rectangle has dimensioned of 10cm x 20cm. where will be its center of gravity?
- a) (10, 10)  
c) **(10, 5)**
- b) (20, 5)  
d) (5, 10)