

DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE

Bachelor of Technology (Electronics and Computer Engineering) SEMESTER - 1 Summer 2025 (Supply.)

Course :Bachelor of Technology (Electronics and Computer Engineering) Branch : Engineering and Technology

Semester : SEMESTER - 1

Subject Code & Name: 24AF1EMES104 - ENGINEERING MECHANICS

Time : 3 Hours]

[Total Marks : 60

Instructions to the Students:

1. Each question carries 12 marks.
2. Question No. 1 will be compulsory and include objective-type questions.
3. Candidates are required to attempt any four questions from Question No. 2 to Question No.6
4. Use of non-programmable scientific calculators is allowed.
5. Assume suitable data wherever necessary and mention it clearly.

Q1. Objective type questions. (Compulsory Question)

12

- 1 The primary objective of engineering analysis and design is to:
 - a) Increase material usage
 - ☒ b) Idealize real problems
 - c) Achieve costlier solutions
 - d) Avoid simplification
- 2 Composition of forces means:
 - a) Replacing a force by two or more components
 - ☒ b) Replacing multiple forces by their resultant
 - c) Ignoring all forces
 - d) Drawing the free body diagram
- 3 The algebraic sum of the moments of a force system about a point is equal to the moment of the resultant force about the same point. This statement is known as:
 - a) Lami's theorem
 - ☒ b) Varignon's theorem
 - c) Pascal's theorem
 - d) Newton's first law
- 4 For a body to be in static equilibrium, the following condition(s) must be satisfied:
 - a) Sum of all forces must be zero
 - b) Sum of all moments must be zero
 - ☒ c) Both a and b
 - d) Only sum of moments must be zero
- 5 According to Coulomb's laws of dry friction, the frictional force is:
 - a) Proportional to the cube of normal reaction
 - b) Always greater than normal reaction
 - c) Independent of normal reaction
 - ☒ d) Proportional to the normal reaction

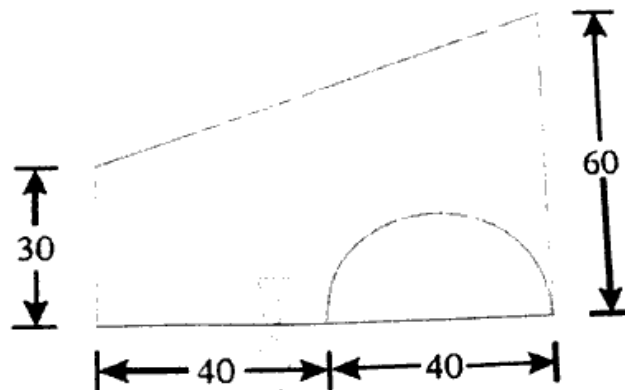
- 6 The condition of equilibrium for coplanar non-concurrent forces includes:
- Sum of horizontal components must be zero
 - Sum of vertical components must be zero
 - Sum of moments about any point must be zero
 - ☒ All of the above
- 7 Which of the following is not a type of load acting on beams?
- Point load
 - Uniformly distributed load (UDL)
 - Uniformly varying load (UVL)
 - Circular load
- 8 The method of sections is useful to:
- Find all member forces at once
 - Find forces in specific members quickly
 - Draw shear force diagram
 - Calculate moments of inertia
- 9 The first law of motion states that:
- $F = ma$
 - To every action there is an equal and opposite reaction
 - A body continues in its state of rest or uniform motion unless acted upon by an external force
 - Force is proportional to rate of change of momentum
- 10 Motion under gravity, neglecting air resistance, has:
- Constant acceleration upwards
 - ☒ Constant acceleration downwards equal to g
 - Variable acceleration
 - No acceleration
- 11 In linear motion, the work-energy equation is expressed as:
- Work done = rate of change of acceleration
 - ☒ Work done = change in kinetic energy
 - Work done = change in momentum
 - Work done = constant
- 12 The product of force and velocity is called:
- Work
 - ☒ Power
 - Energy
 - Momentum

Q2. Solve the following.

- What are the types of loads and supports and explain them in details with neat sketches? 6
- The forces 20 N, 30 N, 40 N, 50 N and 60 N are acting at one of the angular points of a regular hexagon, towards the other five angular points, taken in order. Find the magnitude and direction of the resultant force. 6

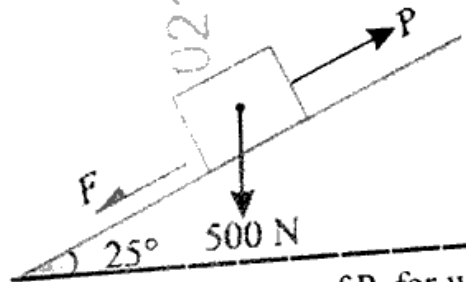
Q3. Solve the following.

- A) A semicircular area is removed from a trapezium as shown in figure (dimensions in mm) 6



Determine the centroid of the remaining area (shown hatched). Let left face and base of the trapezium be the axes of reference.

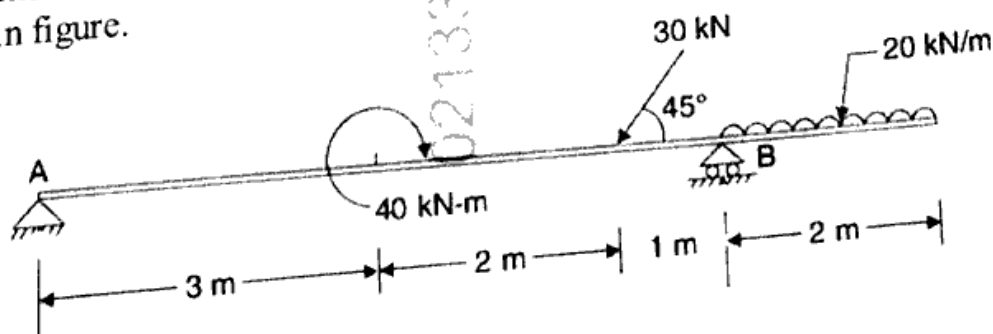
- B) A body of weight 500 N is lying on a rough plane inclined at an angle of 25° with the horizontal. It is supported by an effort (P) parallel to the plane as shown in figure. 6



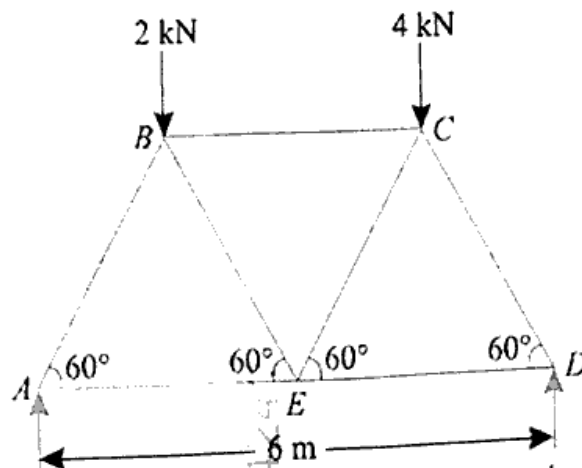
Determine the minimum and maximum values of P, for which the equilibrium can exist, if the angle of friction is 20° .

- Q4. Solve Any Two of the following.

- A) Determine the reactions developed at supports A and B of overhanging beam shown in figure. 6



B)



Above figure shows a Warren girder consisting of seven members each of 3 m length freely supported at its end points. Find the forces in all the members of the girder, indicating whether the force is compressive or tensile.

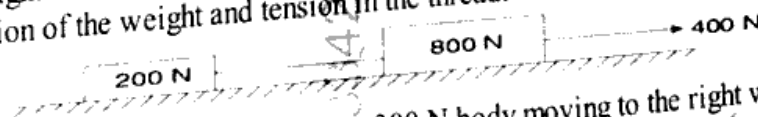
- C) What are the assumptions made, while finding out the forces in the various members of a framed structure? 6

Q5. Solve Any Two of the following.

- A) A body moves along a straight line and its acceleration 'a' which varies with time is given by $a = 2 - 3t$. Five seconds after start of the observations, its velocity is found to be 20 m/sec. Ten seconds after start of the observation, the body is at 85 m from the origin. Determine its acceleration, velocity and distance from the origin. 6
- B) Two ships leave a port at the same time. The first steams North-West at 32 kilometers per hour and the second 40° South of West at 24 kilometers per hour. 6
- (a) What is the velocity of the second ship relative to the first in km per hour?
- (b) After what time, they will be 160 km apart?
- C) A body is projected at such an angle that the horizontal range is three times the greatest height. Find the angle of projection. 6

Q6. Solve Any Two of the following.

- A) State and prove work energy principle. 6
- B) Two weights 800 N and 200 N are connected by a thread and they move along a rough horizontal plane under the action of a force of 400 N applied to the 800 N weight as shown in figure. The coefficient of friction between the sliding surface of the weights and the plane is 0.3. Using D'Alembert's principle, determine the acceleration of the weight and tension in the thread. 6



- C) Direct central impact occurs between a 300 N body moving to the right with a velocity of 6 m/s and 150 N body moving to the left with a velocity of 10 m/s. Find the velocity of each body after impact if the coefficient of restitution is 0.8. 6

*** End ***

Time : 3 Hours]

[Total Marks : 60

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12

Q1. Objective type questions. (Compulsory Question)

- 1 A uniformly distributed load (UDL) acts over:
 - a) A single point
 - b) A specific length with uniform intensity
 - c) The entire structure with varying intensity
 - d) A concentrated section of the structure
- 2 In a free body diagram, the weight of the object is usually represented as acting:
 - a) Horizontally
 - b) At the centroid vertically downward
 - c) At the support points
 - d) Tangentially
- 3 When two or more forces acting at a point are combined into a single force, it is called:
 - a) Equilibrant
 - b) Resultant force
 - c) Couple
 - d) Load factor
- 4 A body is in static equilibrium if:
 - a) The resultant force and resultant moment are both zero
 - b) The resultant force is positive
 - c) The moment is greater than zero
 - d) The net force equals mass times acceleration
- 5 The centroid of a rectangle is located at:
 - a) One-fourth of the height and one-fourth of the width
 - b) At the intersection of diagonals
 - c) At the midpoint of any side
 - d) One-third of the height from the base

- 6 When a body is just about to move, the frictional force acting on it is called:
 - a) Sliding friction
 - b) Rolling friction
 - c) Limiting friction
 - d) Dynamic friction
- 7 In a Hinged or Pinned Support, how many reactions are developed?
 - a) Two
 - b) Three
 - c) Four
 - d) Six
- 8 In the formula for truss analysis $m=2j-3$, the variable 'm' stands for:
 - a) Number of supports
 - b) Number of members
 - c) Number of joints
 - d) Number of reactions
- 9 If an object is thrown upward with an initial velocity u , the velocity at the highest point is:
 - a) Equal to u
 - b) Zero
 - c) Infinite
 - d) Equal to acceleration
- 10 According to D'Alembert's principle, the equation of motion can be written as:
 - a) $F-ma=0$
 - b) $F+ma=0$
 - c) $F=ma$
 - d) $F=m/v$
- 11 The principle of work and energy for a rigid body in translation states that:
 - a) Work done = Change in kinetic energy
 - b) Work done = Change in potential energy
 - c) Work done = Force \times Distance
 - d) Work done = Momentum \times Velocity
- 12 The kinetic energy of a moving object depends on:
 - a) Velocity and mass
 - b) Acceleration and mass
 - c) Force and displacement
 - d) Work and power

Q2. Solve the following.

- A) State and explain Newton's three laws of motion. Enlist idealisations made in engineering mechanics. 6
- B) State and prove Varignon's theorem. 6

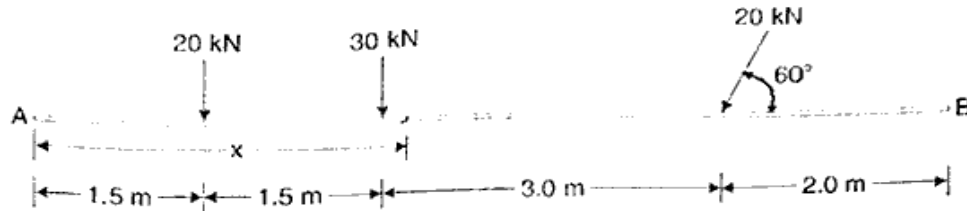
Q3. Solve the following.

- A) An I-section has the following dimensions in mm units: 6
 Bottom flange = 300×100 , Top flange = 150×50 , Web = 300×50
 Determine mathematically the position of centroid of the section. Take bottom of the bottom flange be the axis of reference.

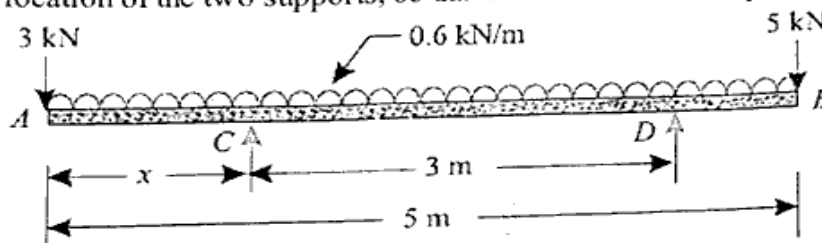
- B) A body, resting on a rough horizontal plane, required a pull of 180 N inclined at 30° to the plane just to move it. It was found that a push of 220 N inclined at 30° to the plane just moved the body. Determine the weight of the body and the coefficient of friction. 6

Q4. Solve Any Two of the following.

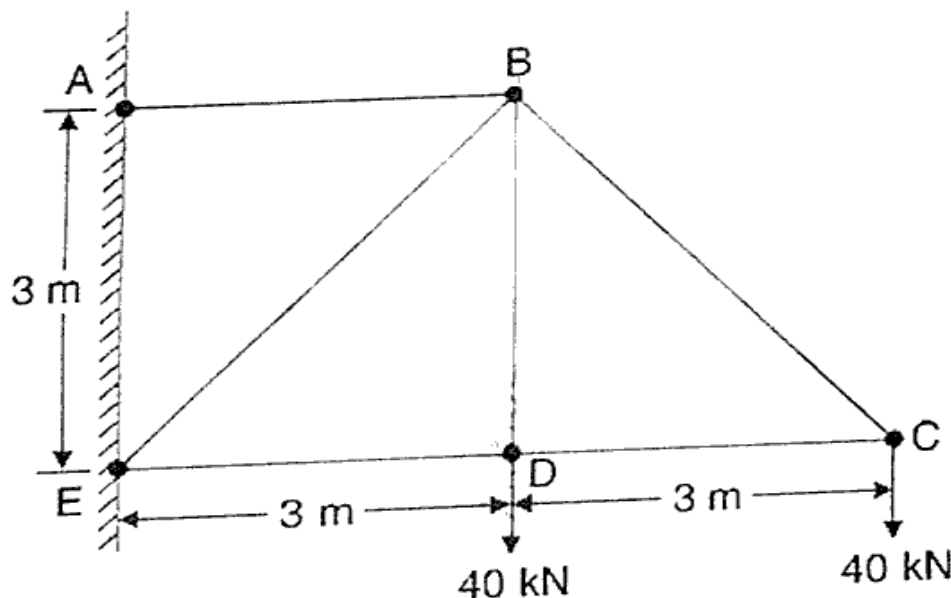
- A) Determine the resultant of the system of forces acting on a beam. 6



- B) A beam AB 5 m long, supported on two intermediate supports 3 m apart, carries a uniformly distributed load of 0.6 kN/m. The beam also carries two concentrated loads of 3 kN at left hand end A, and 5 kN at the right hand end B. Determine the location of the two supports, so that both reactions are equal. 6



- C) Find the forces in all the members of the truss shown in figure. Tabulate the results. 6



Q5. Solve Any Two of the following.

- A) A small steel ball is shot vertically upwards from the top of a building 25 m above the ground with an initial velocity of 18 m/sec. 6
 a) In what time, it will reach the maximum height?
 b) How high above the building will the ball rise?
- B) A ball is dropped from the top of a tower 30 m high. At the same instant a second ball is thrown upward from the ground with an initial velocity of 15 m/sec. When and where do they cross and with what relative velocity? 6

- C) If a particle is projected inside a horizontal tunnel which is 5 meters high with velocity of 60 m/s, find the angle of projection and the greatest possible range. 6

Q6. Solve Any Two of the following.

- A) State and prove work energy principle. 6
- B) i) Define Direct Impact, Oblique Impact 6
ii) State Impulse and Momentum Principle
iii) State Law of Conservation of Momentum
- C) A 1500 N block is in contact with a level plane, the coefficient of friction between two contact surfaces being 0.1. If the block is acted upon by a horizontal force of 300 N, what time will elapse before the block reaches a velocity of 16 m/sec starting from rest? If 300 N force is then removed, how much longer will the block continue to move? Solve the problem using impulse momentum equation. 6

*** End ***

DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE

RAIGAD -402 103

Mid Semester Examination – Summer - 2018

Subject with Subject Code:- Engineering Mechanics (ME 202)

Sem:- II

Branch: Group A

Marks: 20

Date:- 13/03/2018

Time:- 1 Hr.

Instructions:- Assume the appropriate data if not given

(Marks)

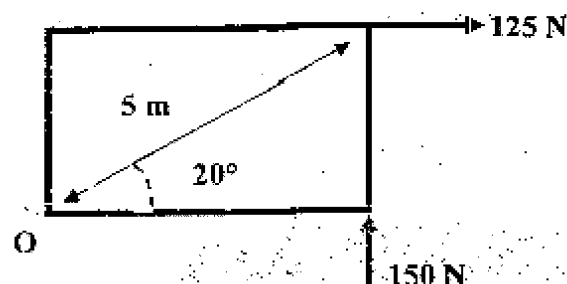
Q.No.1 Multiple choice Questions

(06)

I. The component of a Vector is

- a) always less than its magnitude
- b) always greater than its magnitude
- c) always equal to its magnitude
- d) none of these

II. What is the moment about point O?



- a. 291 Nm
- b. 219 Nm
- c. 419 Nm
- d. 491 Nm

III. Uniformly distributed load of 5 kN acts on a simply supported beam of length 10 m.

What are the reactions at end points of the beam?

- a. 12.5 kN
- b. 25 kN
- c. 50 kN
- d. None of the above

IV. A 1 Kg of block is resting on a surface with coefficient of friction $\mu = 0.1$. A force of 0.8 N is applied to the block as shown in the figure. The friction force is:

0.8



- a) Zero
- b) 0.8 N
- c) 0.89 N
- d) 1.2 N

V. For a five member perfect truss, the no of joints will be

- a) 7
- b) 8
- c) 4
- d) 3

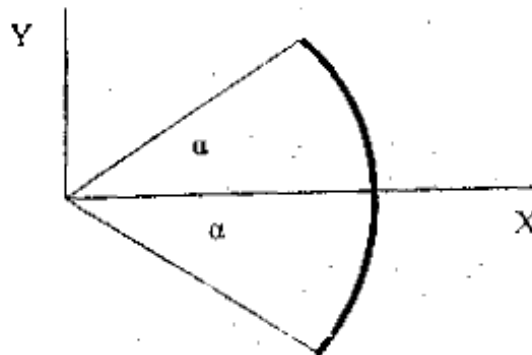
VI. For a rod made up of homogeneous material and having uniform thickness the location centre of gravity and centroid will have.....location.

- a) Same
- b) Different
- c) outside
- d) None of these

Q.No. 2 Attempt any one of the following:

(06)

a.) Determine the centroid of the area of the sector shown in figure of radius R and central angle 2α .



b.) Forces 2, 3, 5, 3 and 2 kN respectively act at one of the angular points of a regular hexagon towards five other angular points.

Determine the magnitude and direction of the resultant force.

Q.No 3. Attempt any two of the following

(08)

A) State and prove Varignon's theorem.

B) Derive the relation between angle of friction and angle of repose.

C) What is the difference between perfect, deficient and redundant trusses?

*****End*****

Dr. Babasaheb Ambedkar Technological University, Lonere

Supplementary Examination Summer 2024

Course: B. Tech. Branch: Common to All Branches

Subject Code & Name: Engineering Mechanics BTES103

Semester: I

Max Marks: 60

Date: 04/07/2024

Duration: 3 Hrs.

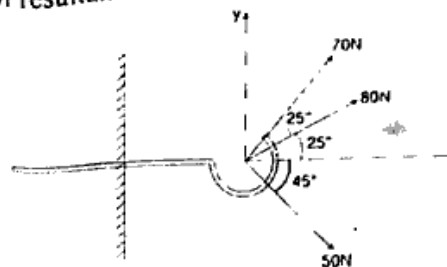
Instructions to the Students:

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3. Use of non-programmable scientific calculators is allowed.
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(Level/CO) Marks

Q. 1 Solve any two of the following.

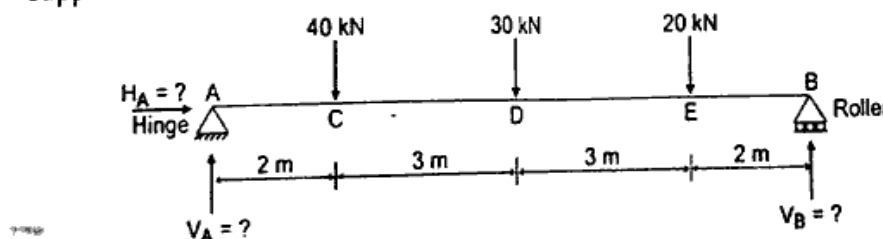
- A) Classify the system of forces with neat sketches & explain them in detail? Remember 06
- B) Calculate the magnitude and position of resultant of the three forces acting on a hook as shown in figure below. CO2 06



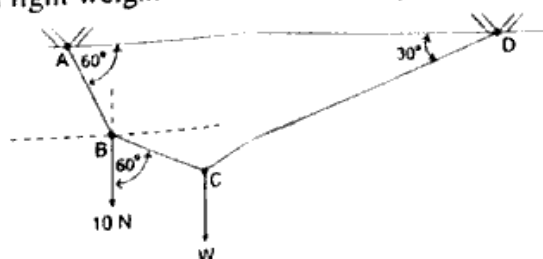
- C) Explain the types loads in detail with neat sketches? Remember 06

Q. 2 Solve any two of the following.

- A) A simply supported beam of span 10 m carries three points loads of 40 kN, 30 kN and 20 kN from left hinge support at the distance 2 m, 5 m and 8 m respectively in downward direction. The right-hand support is roller. Find support reaction for the beam. CO3 06



- B) A smooth sphere of radius r 150 mm and weight W 20 N is hung by string whose length equal the radius of sphere with contact to smooth vertical wall. Find inclination and tension in string as well as reaction of wall. CO2 06
- C) Find the value of W if a light weight chain ABCD is suspended as shown in below figure below. Application 06



Q. 3 Solve any two of the following.

- | | | |
|--|----------|----|
| A) Define: a) Static Friction, b) Dynamic Friction, c) Angle of Friction, d) Angle of repose. | Remember | 06 |
| B) A body is resting on a rough horizontal plane. The coefficient of friction between the body and the plane is 0.2 and the limiting friction force that is acting on the body is 80 N. Given that R is the resultant of the force of friction and the normal reaction force, find the magnitude of R. | CO2 | 06 |
| C) A Warren girder consisting of seven members each of 3 m length freely supported at its end points. The girder is loaded at B and C as shown. Find the forces in all the members of the girder, indicating whether the force is compressive or tensile. Use method of joints. | CO2 | 06 |

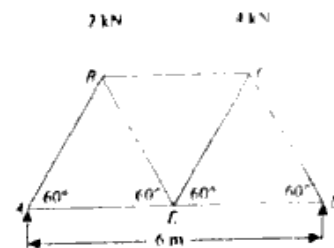


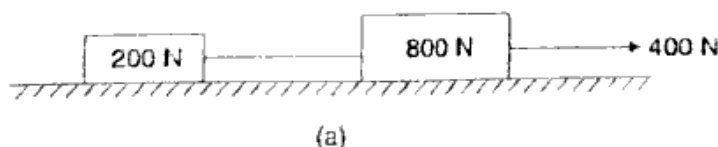
Fig 3.1 (C)

Q. 4 Solve any two of the following.

- | | | |
|--|------|----|
| A) The equation of motion of an engine is given by $s = 2t^3 - 6t^2 - 8$, where (s) is in meters and (t) in seconds. Calculate (i) displacement and acceleration when velocity is zero; and (ii) displacement and velocity when acceleration is zero. | CO 5 | 06 |
| B) The horizontal component of the velocity of a projectile is twice its initial vertical component. Find the range on the horizontal plane, if the projectile passes through a point 20 m horizontally and 4 m vertically above the point of projection. | CO 4 | 06 |
| C) A Passenger train 500 m long, moving with a velocity of 108 kmph, overtakes a goods train moving on a parallel path in the same direction, completely in 45 seconds. If the length of the goods train is 250 m, Determine the speed of the goods train? | CO 4 | 06 |

Q. 5 Solve any two of the following. <https://www.batuonline.com>

- | | | |
|--|------|----|
| A) Two weights 800 N and 200 N are connected by a thread and they move along a rough horizontal plane under the action of a force of 400 N applied to the 800 N weight as shown in Fig. below. The coefficient of friction between the sliding surface of the weights and the plane is 0.3. Using D'Alembert's principle determine the acceleration of the weight and tension in the thread. | CO 5 | 06 |
|--|------|----|

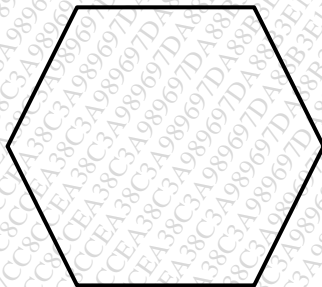
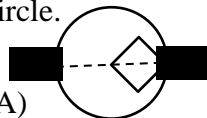
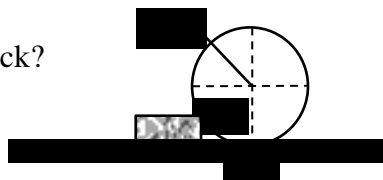


- | | | |
|---|------|----|
| B) A man wishes to move wooden box of 1 meter cube to a distance of 5 m with the least amount of work. If the block weighs 10 kN and the coefficient of friction is 0.3, find whether he should tip it or slide it. | CO 5 | 06 |
| C) A ball of mass 100 kg moving with a velocity of 20 m/s impinges directly on a ball of mass 200 kg at rest. The first ball, after impinging, comes to rest. Find the velocity of the second ball after the impact and the coefficient of restitution. | CO 5 | 06 |

*** End ***

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	(Level/CO)	Marks
Q. 1 Solve Any Two of the following.		
A) Classify the system of forces with neat sketches & explain them in detail?	Remember	6
B) A system of forces such as 1 kN, 2 kN, 3 kN, 4kN, 5 kN and 6 kN acting along the sides of Regular Hexagon respectively taken in order. Find the resultant of all the system of forces.	CO2	6
 <p>Fig 1.1 (B)</p>		
C) C.1) What are the types loads and explain them in detail with neat sketches? C.2) What are the types of 2D supports and explain them in detail with neat sketches?	Remember	6
Q. 2 Solve Any Two of the following.		
A) A square hole is punched out of circular lamina, the diagonal of the square being the radius of the circle as shown in Fig 2.1 (A) below Find the centre of gravity of the remainder, if 'r = 4 cm' as the radius of the circle.	CO3	6
 <p>Fig 2.1 (A)</p>		
B) A Uniform wheel of 1200 mm diameter weighing 10 kN rests against a rigid rectangular block of 300 mm height as shown in figure below. Find the least force (P) through the centre of the wheel required just to turn the wheel over the corner A of the block. Also find the reaction at corner A of the block?	CO2	6
 <p>Fig 2.1 (B)</p>		
C) State and explain the Lami's theorem and prove that?	Understand	6

Q. 3 Solve Any Two of the following.

- A) Define: a) Static Friction, b) Dynamic Friction, c) Angle of Friction, **Remember** **6**
d) Angle of repose. What are the Coulomb's laws of dry friction?
- B) A ladder 5 meters long rests on a horizontal ground and leans against a smooth vertical wall at an angle 70° with the horizontal. The weight of the ladder is 900 N and acts at its middle. The ladder is at the point of sliding, when a man weighing 750 N stands on a rung 1.5 meter from the bottom of the ladder. Calculate the coefficient of friction between the ladder and the floor. **CO2** **6**
- C) A Warren girder consisting of seven members each of 3 m length freely supported at its end points. The girder is loaded at B and C as shown. Find the forces in all the members of the girder, indicating whether the force is compressive or tensile. Use method of joints. **CO2** **6**

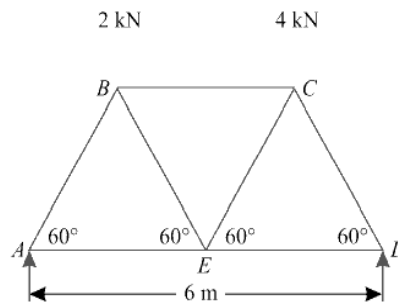


Fig 3.1 (C)

Q. 4 Solve Any Two of the following.

- A) The equation of motion of an engine is given by $s = 2t^3 - 6t^2 - 5$, where (s) is in meters and (t) in seconds. Calculate (i) displacement and acceleration when velocity is zero; and (ii) displacement and velocity when acceleration is zero. **CO 5** **6**
- B) A Projectile is aimed at a target on the horizontal plane and falls 12 m short when the angle of projection is 15° , while it overshoots by 24 m when the angle is 45° . Find the angle of projection to hit the target. **CO 4** **6**
- C) A Passenger train 300 m long, moving with a velocity of 108 kmph, overtakes a goods train moving on a parallel path in the same direction, completely in 45 seconds. If the length of the goods train is 250 m, Determine the speed of the goods train? **CO 4** **6**

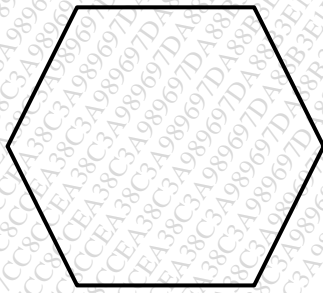
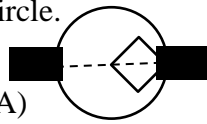
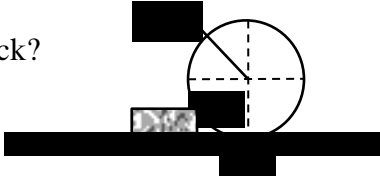
Q. 5 Solve Any Two of the following.

- A) A motorist travelling at a speed of 70 kmph suddenly applies a breaks and **CO 5 6**
halts after skidding 50 m. Determine A) The time required to stop the car, B)
The coefficient of friction between the tyres and road.
- B) An automobile is moving at a speed of 70 kmph, when the breaks are fully **CO 5 6**
applied causing all four wheels to skid. Determine the time required to stop
the automobile, a) On concrete road, coeff. of friction = 0.75
b) On ice for which coeff. of friction = 0.08
- C) A ball of mass 10 kg moving with a velocity of 20 m/s impinges directly on a **CO 5 6**
ball of mass 20 kg at rest. The first ball, after impinging, comes to rest. Find
the velocity of the second ball after the impact and the coefficient of
restitution.

***** End *****

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B) A system of forces such as 1 kN, 2 kN, 3 kN, 4kN, 5 kN and 6 kN acting along the sides of Regular Hexagon respectively taken in order. Find the resultant of all the system of forces.	CO2	6
		
Fig 1.1 (B)		
C) C.1) What are the types loads and explain them in detail with neat sketches? C.2) What are the types of 2D supports and explain them in detail with neat sketches?	Remember	6
Q. 2 Solve Any Two of the following.		
A) A square hole is punched out of circular lamina, the diagonal of the square being the radius of the circle as shown in Fig 2.1 (A) below Find the centre of gravity of the remainder, if 'r = 4 cm' as the radius of the circle.	CO3	6
		
Fig 2.1 (A)		
B) A Uniform wheel of 1200 mm diameter weighing 10 kN rests against a rigid rectangular block of 300 mm height as shown in figure below. Find the least force (P) through the centre of the wheel required just to turn the wheel over the corner A of the block. Also find the reaction at corner A of the block?	CO2	6
		
Fig 2.1 (B)		
C) State and explain the Lami's theorem and prove that?	Understand	6

Q. 3 Solve Any Two of the following.

- A) Define: a) Static Friction, b) Dynamic Friction, c) Angle of Friction, **Remember** **6**
d) Angle of repose. What are the Coulomb's laws of dry friction?
- B) A ladder 5 meters long rests on a horizontal ground and leans against a smooth vertical wall at an angle 70° with the horizontal. The weight of the ladder is 900 N and acts at its middle. The ladder is at the point of sliding, when a man weighing 750 N stands on a rung 1.5 meter from the bottom of the ladder. Calculate the coefficient of friction between the ladder and the floor. **CO2** **6**
- C) A Warren girder consisting of seven members each of 3 m length freely supported at its end points. The girder is loaded at B and C as shown. Find the forces in all the members of the girder, indicating whether the force is compressive or tensile. Use method of joints. **CO2** **6**

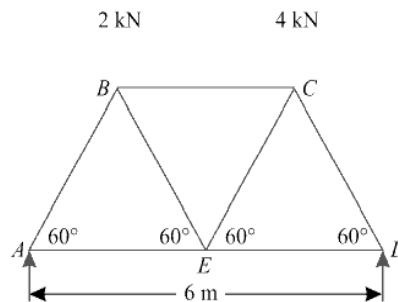


Fig 3.1 (C)

Q. 4 Solve Any Two of the following.

- A) The equation of motion of an engine is given by $s = 2t^3 - 6t^2 - 5$, where (s) is in meters and (t) in seconds. Calculate (i) displacement and acceleration when velocity is zero; and (ii) displacement and velocity when acceleration is zero. **CO 5** **6**
- B) A Projectile is aimed at a target on the horizontal plane and falls 12 m short when the angle of projection is 15° , while it overshoots by 24 m when the angle is 45° . Find the angle of projection to hit the target. **CO 4** **6**
- C) A Passenger train 300 m long, moving with a velocity of 108 kmph, overtakes a goods train moving on a parallel path in the same direction, completely in 45 seconds. If the length of the goods train is 250 m, Determine the speed of the goods train? **CO 4** **6**

Q. 5 Solve Any Two of the following.

- A) A motorist travelling at a speed of 70 kmph suddenly applies a breaks and halts after skidding 50 m. Determine A) The time required to stop the car, B) The coefficient of friction between the tyres and road. **CO 5 6**
- B) An automobile is moving at a speed of 70 kmph, when the breaks are fully applied causing all four wheels to skid. Determine the time required to stop the automobile, a) On concrete road, coeff. of friction = 0.75 **CO 5 6**
b) On ice for which coeff. of friction = 0.08
- C) A ball of mass 10 kg moving with a velocity of 20 m/s impinges directly on a ball of mass 20 kg at rest. The first ball, after impinging, comes to rest. Find the velocity of the second ball after the impact and the coefficient of restitution. **CO 5 6**

***** End *****

Course: First Year B. Tech.

Branch: Group A / Group B

Subject Name: Engineering Mechanics

Subject Code: BTES203

Max Marks: 60

Date:19-01-24

Duration: 3 Hr.

Instructions to the Students:

1. All the questions are compulsory.
2. The level of question/expected answer as per OBE or the Course Outcome (CO) on which the question is based is mentioned in () in front of the question.
3. Use of non-programmable scientific calculators is allowed.
4. Assume suitable data wherever necessary and mention it clearly.

(Level/CO) Marks

Q. 1 Solve Any Two of the following.

12

A) Define characteristics of system of forces.

Remember

6

B) The forces 20 N, 30 N, 40 N, 50 N and 60 N are acting at one of the angular points of a regular hexagon, towards the other five angular points, taken in order. Find the magnitude and direction of the resultant force.

CO2

6

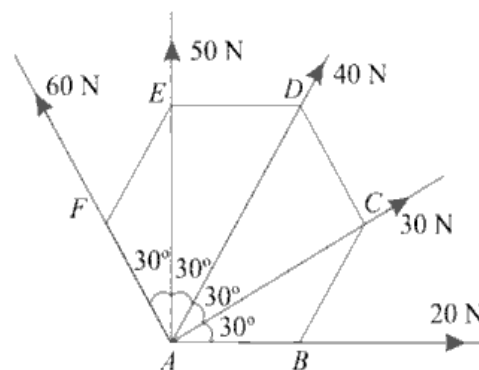


Fig. 1

C) A uniform wheel of 600 mm diameter, weighing 5 kN rests against a rigid rectangular block of 150 mm height as shown in Fig. 2.

CO2

6

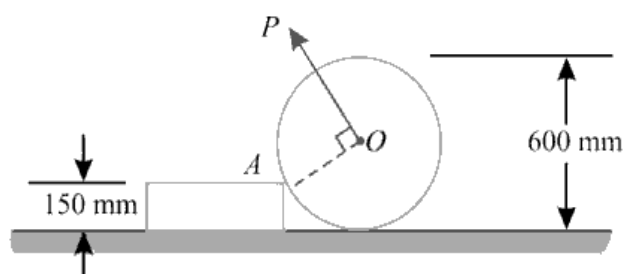


Fig. 2

Find the least pull, through the centre of the wheel, required just to turn the wheel over the corner A of the block. Also find the reaction on the block. Take all the surfaces to be smooth.

Q.2 Solve Any Two of the following.

12

A) a) What are the characteristics of a couple?

CO1

6

b) Fig. 3 shows a crank-lever ABC with a tension spring (T). The lever weighs 0.2 N/mm. Determine the tension developed in the spring, when a load of 100 N is applied at A.

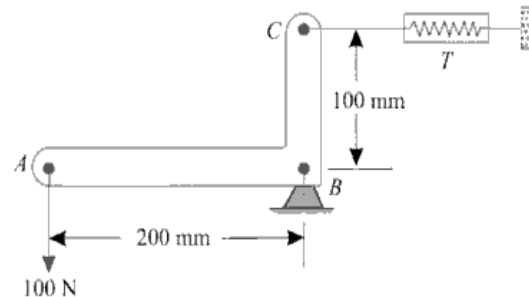


Fig. 3

B) A light string ABCDE whose extremity A is fixed, has weights W_1 and W_2 attached to it at B and C. It passes round a small smooth peg at D carrying a weight of 300 N at the free end E as shown in Fig. 4

CO2

6

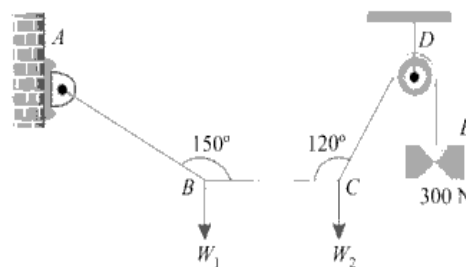


Fig. 4

If in the equilibrium position, BC is horizontal and AB and CD make 150° and 120° with BC, find

- Tensions in the portion AB, BC and CD of the string and
- Magnitudes of W_1 and W_2

C) A semicircular area is removed from a trapezium as shown in Fig. 5 (dimensions in mm).

CO3

6

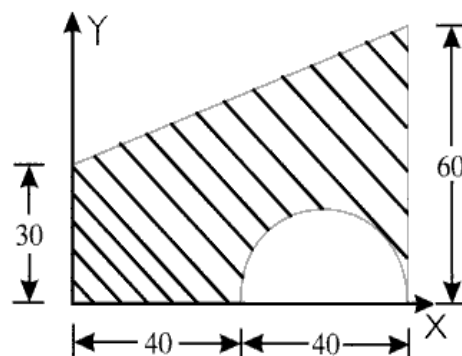


Fig. 5

Determine the centroid of the remaining area (shown hatched).

Q. 3 Solve Any Two of the following.**12****A) i. Define Following****CO1****6**

- a. Static Friction
- b. Dynamic Friction
- c. Coefficient of Friction

- ii. Find the horizontal force required to drag a body of weight 100 N along a horizontal plane. If the plane, when gradually raised up to 15° , the body will begin to slide.

B) Fig. 6 shows a Warren girder consisting of seven members each of 3 m length freely supported at its end points.

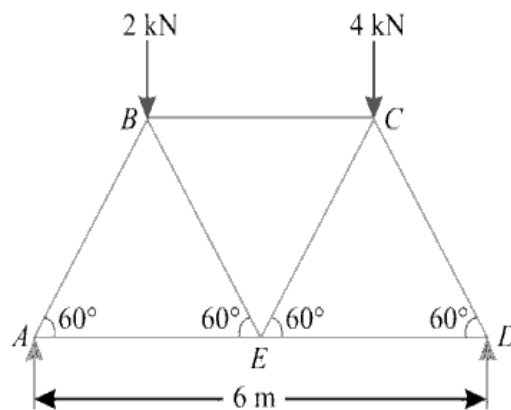
CO2**6**

Fig. 6

The girder is loaded at B and C as shown. Find the forces in all the members of the girder, indicating whether the force is compressive or tensile.

C) A simply supported beam AB of span 5 m is loaded as shown in Fig. 7.

CO5**6**

Using principle of virtual work, find the reactions at A and B.

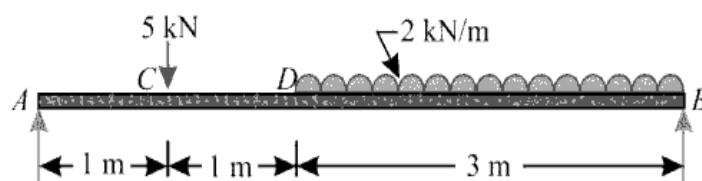


Fig. 7

Q.4 Solve Any Two of the following. <https://www.batuonline.com>**12**

A) i. Define D'Alembert's Principle and write down its equation.

CO1**6**

- ii. Define Newton's First, Second and Third Law of Motion.

B) Two electric trains A and B leave the same station on parallel lines. The train A starts from rest with a uniform acceleration of 0.2 m/s^2 and attains a speed of 45 kmph., which is maintained constant afterwards. The train B leaves 1 minute after with a uniform acceleration of 0.4 m/s^2 to attain a maximum

CO4**6**

speed of 72 kmph., which is maintained constant afterwards. When will the train B overtake the train A?

- C) A car moves along a straight line whose equation of motion is given by $s = 12t + 3t^2 - 2t^3$, where (s) is in metres and (t) is in seconds. Calculate
(i) velocity and acceleration at start, and
(ii) acceleration, when the velocity is zero.
- CO4 6**

Q. 5 Solve Any Two of the following. **12**

- A) Derive equation of the path of a projectile and write equation of time of flight, horizontal range, and maximum height of a projectile. **CO5 6**
- B) A flywheel is making 180 r.p.m. and after 20 sec it is running at 120 r.p.m. How many revolutions will it make and what time will elapse before it stops, if the retardation is uniform? **CO4 6**
- C) A bullet of mass 20 g is fired horizontally with a velocity of 300 m/s, from a gun carried in a carriage, which together with the gun has mass of 100 kg. The resistance to sliding of the carriage over the ice on which it rests is 20 N. Find
a) velocity, with which the gun will recoil,
b) distance, in which it comes to rest, and
c) time taken to do so. **CO5 6**

*** End ***

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Instructions to the Students:

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3. Use of non-programmable scientific calculators is allowed.
4. Assume suitable data wherever necessary and mention it clearly.

(Level/CO) Marks

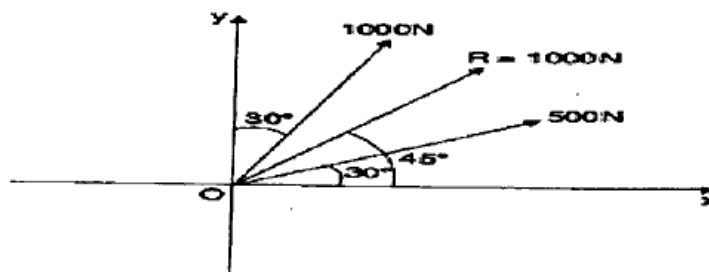
Q.1 Solve Any Two of the following.

12

- A) Two forces acting on a body are 500 N and 1000 N as shown in Figure below. Determine the third force F such that the resultant of all the three forces is 1000 N directed at 45° to x-axis.

CO1

6



- B) Find the magnitude of the two forces, such that if they act at right angles, their resultant is $\sqrt{10}$ N. But if they Act at 60° , their resultant is $\sqrt{13}$ N.

CO1

6

- C) a) What is the difference between coplanar concurrent forces and non concurrent forces?

CO1

3+3=

6

- b) Give an example of Free Body Diagram for a beam subjected to UDL and point load. Assume suitable support conditions.

Q.2 Solve Any Two of the following.

12

- A) Explain Angle of Friction and Angle of Repose with diagram.

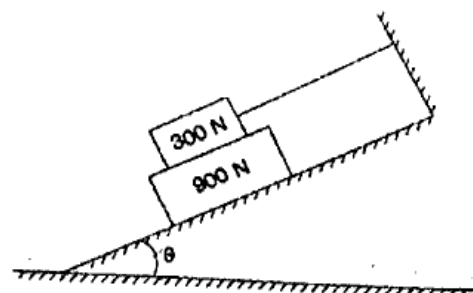
CO2

6

- B) What should be the value of θ in Figure below that will make the motion of 900 N block down the plane to impend? The coefficient of friction for all contact surfaces is $1/3$.

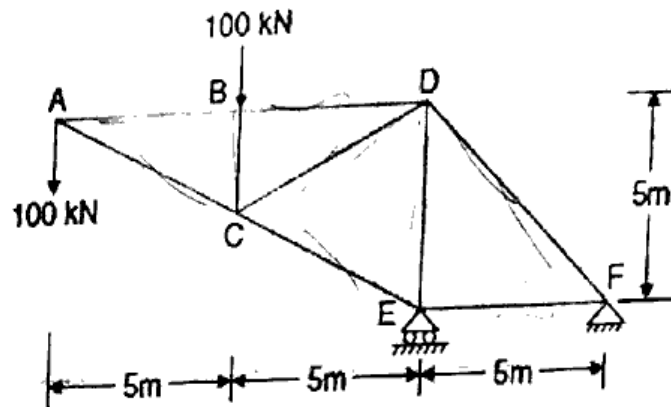
CO2

6



C) Find any 6 member force of following truss. Assume suitable data if required.

CO2



Q.3 Solve Any Two of the following.

12

A) A small steel ball is shot vertically upwards from the top of a building 25 m above the ground with an initial velocity of 18 m/sec.

CO3 3+3=

6

(a) In what time, it will reach the maximum height?

(b) How high above the building will the ball rise?

B) A wheel rotating about a fixed axis at 20 revolutions per minute is uniformly accelerated for 70 seconds during which it makes 50 revolutions. Find the (i) angular velocity at the end of this interval and (ii) time required for the velocity to reach 100 revolutions per minute.

CO3 6

C) Two ships move from a port at the same time. Ship A has velocity of 30 kmph and is moving in N 30° W while ship B is moving in south-west direction with a velocity of 40 kmph. Determine the relative velocity of A with respect to B and the distance between them after half an hour.

CO3 6

Q.4 Solve Any Two of the following.

12

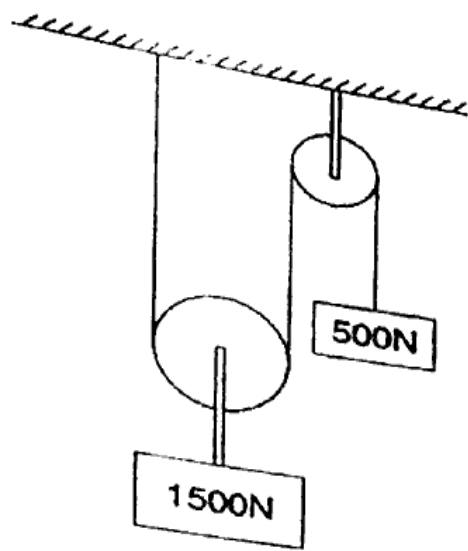
A) Explain Mass moment of inertia and D'Alembert's principle with suitable example.

CO4 3+3=

6

B) Determine the tension in the string and accelerations of blocks A and B weighing 1500 N and 500 N connected by an inextensible string as shown in Figure below Assume pulleys as frictionless and weightless.

CO4 6



- C) A flywheel weighing 50 kN and having radius of gyration 1m loses its speed from 400 rpm to 280 rpm in 2 minutes. Calculate
- the retarding torque acting on it
 - change in its kinetic energy during the above period
 - change in its angular momentum during the same period.

CO4 2+2+
2=6

Q. 5 Solve Any Two of the following.

- A) A block weighing 2500 N rests on a level horizontal plane for which coefficient of friction is 0.20. This block is pulled by a force of 1000 N acting at an angle of 30° to the horizontal. Find the velocity of the block after it moves 30 m starting from rest. If the force of 1000 N is then removed, how much further will it move? Use work energy method.

12
CO5 6

- B) A ball of mass 2 kg, moving with a velocity of 3 m/s, impinges on a ball of mass 4 kg moving with a velocity of 1 m/s. The velocities of the two balls are parallel and inclined at 30° to the line of joining their centres at the instant of impact. If the coefficient of restitution is 0.5, Explain

CO5 3+3=
6

I. Direction, in which the 4 kg ball will move after impact;

II. Velocity of the 4 kg ball after impact;

- C) State and prove work energy principle.

CO5 6

*** End ***

**DR. BABASAHEB AMBEDKAR TECHNOLOGICAL
UNIVERSITY, LONERE**

Winter End Semester Examination – Dec 2019

Course: B. Tech.

Sem: I B

Subject Name: Engineering Mechanics EM1203

Max Marks: 60

Date: 20/12/2019

Duration: 3 Hrs.

Instructions to the Students:

1. All 05 questions are compulsory, however there may be internal choice for few questions.
2. Use of non-programmable scientific calculators is allowed.
3. Assume suitable data wherever necessary and mention it clearly.

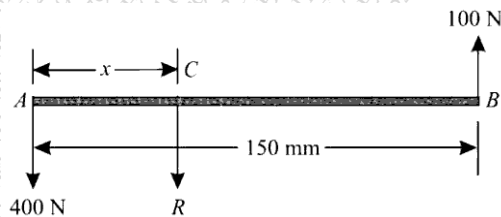
Marks

Q.1 A) Define the following: Statics, Dynamics, Equilibrant, Lami's theorem.

(4)

Or

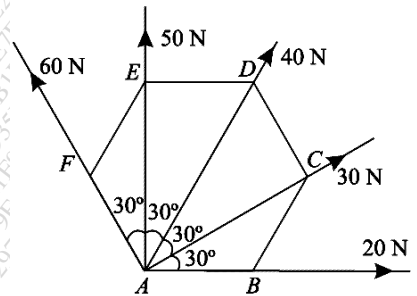
- A)** Two unlike parallel forces of magnitude 400 N and 100 N are acting in such a way that their lines of action are 150 mm apart as shown in figure. Determine the magnitude of the resultant force and the point at which it acts.



(4)

- B)** Find the magnitude and direction of the resultant force for the number of forces acting at a common point as shown in figure.

The forces 20 N, 30 N, 40 N, 50 N and 60 N are acting at one of the angular points of a regular hexagon, towards the other five angular points, taken in order.



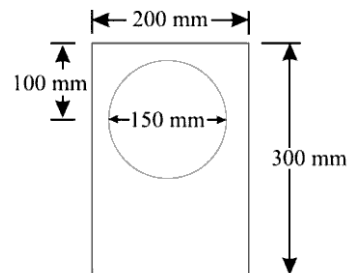
(8)

Q.2 Answer any two from the following:

- A)** What is meant by friction? Mention the laws of static friction.

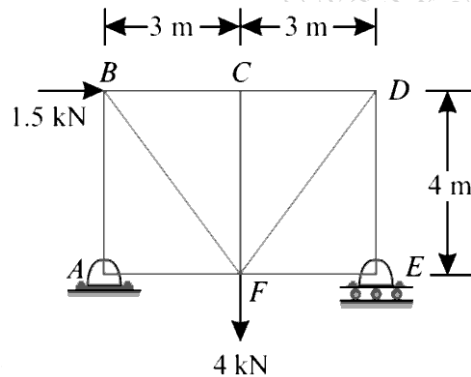
(6)

- B)** Determine the coordinates x_c and y_c of a plane lamina as shown in figure. A circular portion of diameter 150 mm is cut symmetrically about y direction through a rectangular plate of size 200 mm x 300 mm.



(6)

- C) Determine the forces in all the members of a truss shown in figure and tabulate the results in magnitude and direction. Support A is hinge while support E is roller.



- Q.3 A) A wheel increases its speed from 45 r.p.m. to 90 r.p.m. in 30 seconds. Find (i) angular acceleration of the wheel, and (ii) no. of revolutions made by the wheel in these 30 seconds. (6)
- B) A particle is projected inside a horizontal tunnel with a velocity of 60 m/s. The height of tunnel is 5 metres. Find the angle of projection and the greatest possible range. (6)
- Q.4 A) A vehicle, of mass 500 kg, is moving with a velocity of 25 m/s. A force of 200 N acts on it for 2 minutes. Find the velocity of the vehicle : (6)
- (i) when the force acts in the direction of motion, and
- (ii) when the force acts in the opposite direction of the motion.
- B) At a certain instant, a body of mass 10 kg, falling freely under the force of gravity, was found to be falling at the rate of 20 m/s. What force will stop the body in (i) 2 seconds, and (ii) 2 metres? (6)
- Q.5 A) State with mathematical equation: i) Law of conservation of momentum, (8)
- ii) Newton's law of collision of elastic bodies. ()

Or

- A) State and prove the law of conservation of energy. (8)
- B) A railway engine of mass 20 tonnes is moving on a level track with a constant speed of 45 km.p.h. Find the power of the engine, if the frictional resistance is 80 N/t. Take, efficiency of the engine as 80 %. (4)

***** End of Paper*****

**DR. BABASAHEB AMBEDKAR TECHNOLOGICAL
UNIVERSITY, LONERE**

Winter End Semester Examination – Dec 2019

Course: B. Tech.

Sem: I B

Subject Name: Engineering Mechanics EM1203

Max Marks: 60

Date: 20/12/2019

Duration: 3 Hrs.

Instructions to the Students:

1. All 05 questions are compulsory, however there may be internal choice for few questions.
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3. Assume suitable data wherever necessary and mention it clearly.

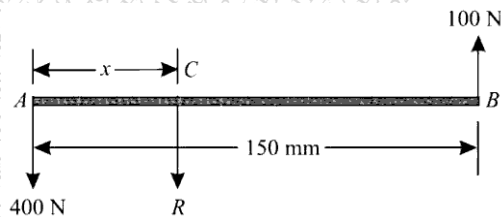
Marks

Q.1 A) Define the following: Statics, Dynamics, Equilibrant, Lami's theorem.

(4)

Or

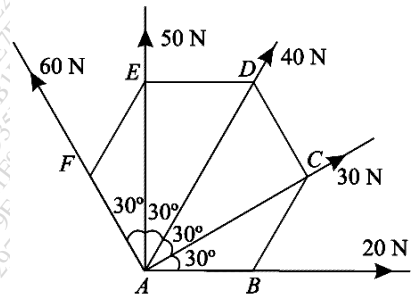
- A)** Two unlike parallel forces of magnitude 400 N and 100 N are acting in such a way that their lines of action are 150 mm apart as shown in figure. Determine the magnitude of the resultant force and the point at which it acts.



(4)

- B)** Find the magnitude and direction of the resultant force for the number of forces acting at a common point as shown in figure.

The forces 20 N, 30 N, 40 N, 50 N and 60 N are acting at one of the angular points of a regular hexagon, towards the other five angular points, taken in order.



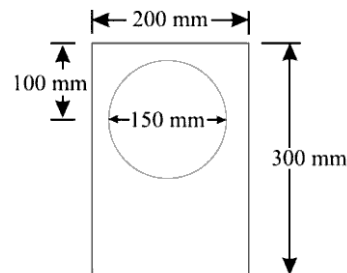
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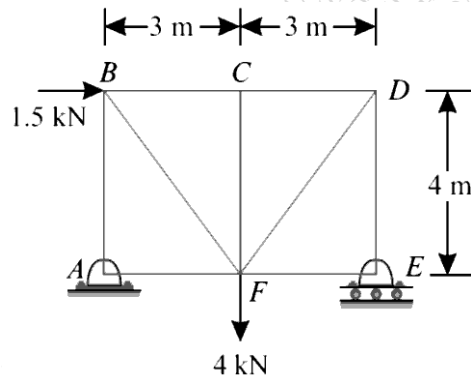
(6)

- B)** Determine the coordinates x_c and y_c of a plane lamina as shown in figure. A circular portion of diameter 150 mm is cut symmetrically about y direction through a rectangular plate of size 200 mm x 300 mm.



(6)

- C) Determine the forces in all the members of a truss shown in figure and tabulate the results in magnitude and direction. Support A is hinge while support E is roller.



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- B) A particle is projected inside a horizontal tunnel with a velocity of 60 m/s. The height of tunnel is 5 metres. Find the angle of projection and the greatest possible range. (6)
- Q.4 A) A vehicle, of mass 500 kg, is moving with a velocity of 25 m/s. A force of 200 N acts on it for 2 minutes. Find the velocity of the vehicle : (6)
- (i) when the force acts in the direction of motion, and
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- B) At a certain instant, a body of mass 10 kg, falling freely under the force of gravity, was found to be falling at the rate of 20 m/s. What force will stop the body in (i) 2 seconds, and (ii) 2 metres? (6)
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- B) A railway engine of mass 20 tonnes is moving on a level track with a constant speed of 45 km.p.h. Find the power of the engine, if the frictional resistance is 80 N/t. Take, efficiency of the engine as 80 %. (4)

***** End of Paper*****

DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE

End Semester Examination – Summer 2019

Course: B. Tech.

Sem: I/II

Subject Name: Engineering Mechanics

Subject Code: EM1203

Max Marks: 60

Date: 13-05-2019

Duration: 3 Hrs

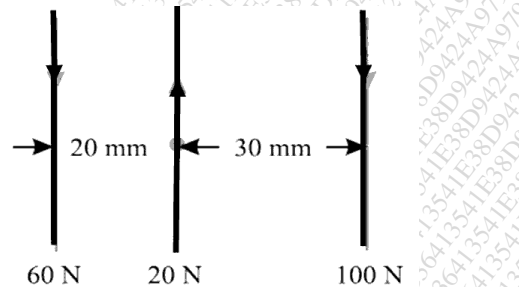
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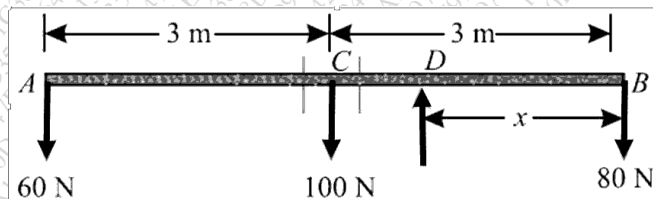
Marks

Q. 1 Solve any three from the following.

- A) Define the following: Principle of Transmissibility of Forces, Equilibrant, and Dynamics. (4)
- B) Compute the resultant in magnitude and direction of a parallel force system shown in figure. (4)



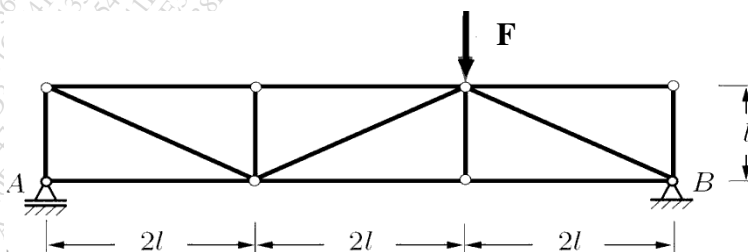
- C) A uniform beam AB of weight 100 N and 6 m long had two bodies of weights 60 N and 80 N suspended from its two ends as shown in Fig. Find analytically at what point the beam should be supported, so that it may rest horizontally. (4)



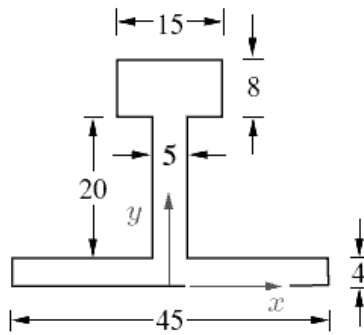
- D) Define a couple and write the characteristics of a couple. (4)

Q.2 Solve any two from the following.

- A) Explain in brief with neat sketch the different types of loads studied in engineering mechanics. (6)
- B) Determine the support reactions and forces in all the members of the truss subjected an external force F as shown in figure. (6)



- C) Determine the centroid of the area shown in figure. (All dimensions are in mm) (6)



Q. 3 Solve the following.

- A) Obtain an expression for maximum height of a projectile projected from a horizontal plane. (6)
- B) A stone is thrown vertically upwards, from the ground, with a velocity 49 m/s. After 2 seconds, another stone is thrown vertically upwards from the same place. If both the stone strike the ground at the same time, find the velocity, with which the second stone was thrown upwards. (6)

Q.4 Solve the following.

- A) State and explain in brief D'Alembert's principle. (6)
- B) A flywheel of mass 8 tonnes starts from rest, and gets up a speed of 180 r.p.m. in 3 minutes. Find the average torque exerted on it, if the radius of gyration of the flywheel is 60 cm. (6)

Q. 5 Solve the following.

- A) State and prove the law of conservation of energy. (8)
- B) Calculate the work done in pulling up a block of mass 200 kg for 10 m on a smooth plane inclined at an angle of 15° with the horizontal. (4)

OR

- B) A spring is stretched by 50 mm by the application of a force. Find the work done, if the force required to stretch 1 mm of the spring is 10 N. (4)

*** End ***

DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE

End Semester Examination – Summer 2019

Course: B. Tech.

Sem: I/II

Subject Name: Engineering Mechanics

Subject Code: EM1203

Max Marks: 60

Date: 13-05-2019

Duration: 3 Hrs

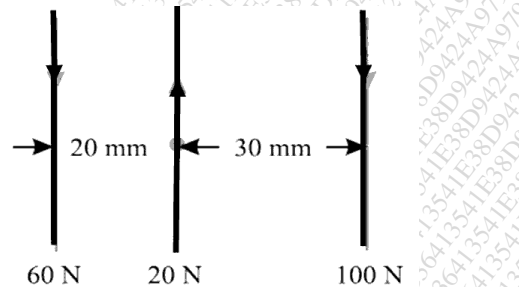
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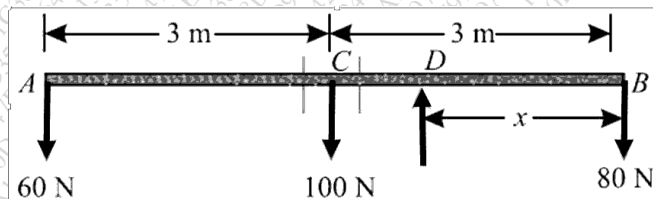
Marks

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- B) Compute the resultant in magnitude and direction of a parallel force system shown in figure. (4)



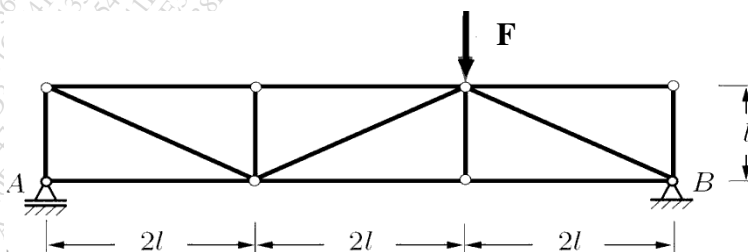
- C) A uniform beam AB of weight 100 N and 6 m long had two bodies of weights 60 N and 80 N suspended from its two ends as shown in Fig. Find analytically at what point the beam should be supported, so that it may rest horizontally. (4)



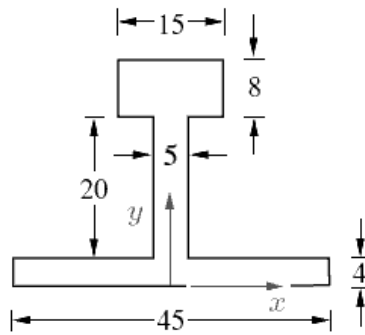
- D) Define a couple and write the characteristics of a couple. (4)

Q.2 Solve any two from the following.

- A) Explain in brief with neat sketch the different types of loads studied in engineering mechanics. (6)
- B) Determine the support reactions and forces in all the members of the truss subjected an external force F as shown in figure. (6)



- C) Determine the centroid of the area shown in figure. (All dimensions are in mm) (6)



Q. 3 Solve the following.

- A) Obtain an expression for maximum height of a projectile projected from a horizontal plane. (6)
- B) A stone is thrown vertically upwards, from the ground, with a velocity 49 m/s. After 2 seconds, another stone is thrown vertically upwards from the same place. If both the stone strike the ground at the same time, find the velocity, with which the second stone was thrown upwards. (6)

Q.4 Solve the following.

- A) State and explain in brief D'Alembert's principle. (6)
- B) A flywheel of mass 8 tonnes starts from rest, and gets up a speed of 180 r.p.m. in 3 minutes. Find the average torque exerted on it, if the radius of gyration of the flywheel is 60 cm. (6)

Q. 5 Solve the following.

- A) State and prove the law of conservation of energy. (8)
- B) Calculate the work done in pulling up a block of mass 200 kg for 10 m on a smooth plane inclined at an angle of 15° with the horizontal. (4)

OR

- B) A spring is stretched by 50 mm by the application of a force. Find the work done, if the force required to stretch 1 mm of the spring is 10 N. (4)

*** End ***

**DR. BABASAHEB AMBEDKAR TECHNOLOGICAL
UNIVERSITY, LONERE**

Winter End Semester Examination Dec 2019

Course: B. Tech

Sem: I B

Subject Name: Engineering Mechanics FM1203

Max Marks: 60

Date: 20/12/2019

Duration: 3 Hrs.

Instructions to the Students:

1. All 05 questions are compulsory, however there may be internal choice for few questions.
2. Use of non-programmable scientific calculators is allowed.
3. Assume suitable data wherever necessary and mention it clearly.

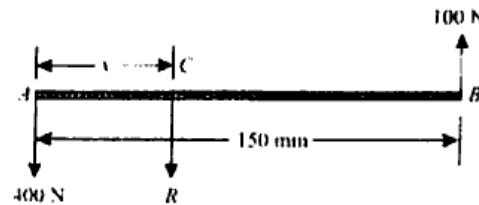
Marks

- Q. 1 A)** Define the following: Statics, Dynamics, Equilibrant, Lami's theorem.

(4
)

Or

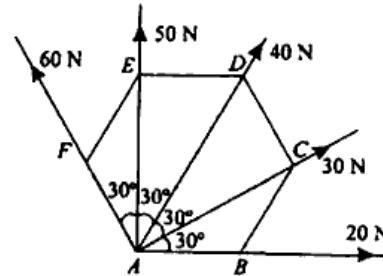
- A)** Two unlike parallel forces of magnitude 400 N and 100 N are acting in such a way that their lines of action are 150 mm apart as shown in figure. Determine the magnitude of the resultant force and the point at which it acts.



(4
)

- B)** Find the magnitude and direction of the resultant force for the number of forces acting at a common point as shown in figure.

The forces 20 N, 30 N, 40 N, 50 N and 60 N are acting at one of the angular points of a regular hexagon, towards the other five angular points, taken in order.



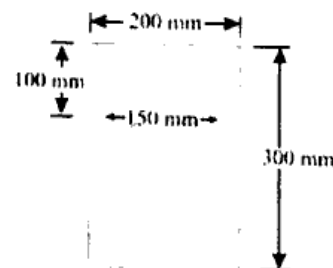
(8
)

Q. 2 Answer any two from the following:

- A)** What is meant by friction? Mention the laws of static friction.

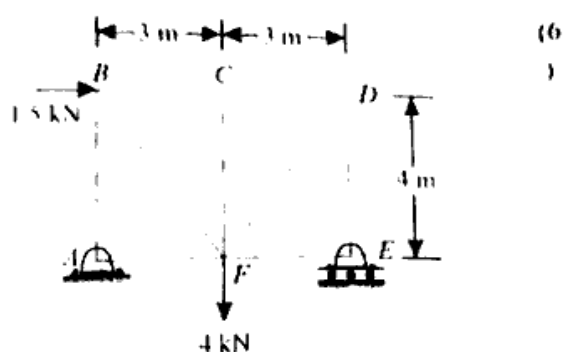
(6
)

- B)** Determine the coordinates x_c and y_c of a plane lamina as shown in figure. A circular portion of diameter 150 mm is cut symmetrically about y direction through a rectangular plate of size 200 mm x 300 mm.



(6
)

- C) Determine the forces in all the members of a truss shown in figure and tabulate the results in magnitude and direction. Support A is hinge while support E is roller.



- Q.3 A) A wheel increases its speed from 45 r.p.m. to 90 r.p.m. in 30 seconds. Find (i) angular acceleration of the wheel, and (ii) no. of revolutions made by the wheel in these 30 seconds. (6)
- B) A particle is projected inside a horizontal tunnel with a velocity of 60 m/s. The height of tunnel is 5 metres. Find the angle of projection and the greatest possible range. (6)
- Q.4 A) A vehicle, of mass 500 kg, is moving with a velocity of 25 m/s. A force of 200 N acts on it for 2 minutes. Find the velocity of the vehicle : (6)
- (i) when the force acts in the direction of motion, and
- (ii) when the force acts in the opposite direction of the motion.
- B) At a certain instant, a body of mass 10 kg, falling freely under the force of gravity, was found to be falling at the rate of 20 m/s. What force will stop the body in (i) 2 seconds, and (ii) 2 metres? (6)
- Q.5 A) State with mathematical equation: i) Law of conservation of momentum, (8)
- ii) Newton's law of collision of elastic bodies. ()

Or

- A) State and prove the law of conservation of energy. (8)
- B) A railway engine of mass 20 tonnes is moving on a level track with a constant speed of 45 km.p.h. Find the power of the engine, if the frictional resistance is 80 N/t. Take, efficiency of the engine as 80 %. (4)

***** End of Paper*****

Dr. Babasaheb Ambedkar Technological University, Lonere-Raigad
Supplementary Examinations Nov 2018

Course: B. Tech (All Courses)

Semester: I/II

Subject Name with Subject Code: Engineering Mechanics (ME102/ME202)

Date: 28/11/2018

Time: 3 Hours

Max Marks: 60

Instructions to the Students:

1. Attempt ANY FIVE Questions from Question No 1 to Question No 6.
2. Illustrate your answers with neat sketches, diagrams etc. wherever necessary.
3. Necessary data is given in the respective questions. If such data is not given, it means that the knowledge of that part is a part of examination.
4. Use of non-programmable scientific calculators is allowed.

Q.1. Attempt the following.

(06X2=12)

- A) What do you understand by resolution of forces and calculate the resultant of following forces shown in figure 1?

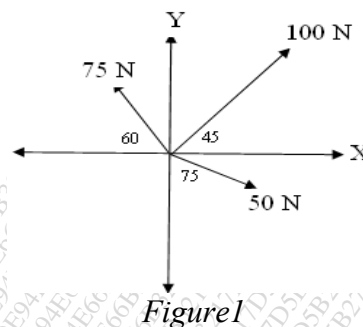


Figure 1

- B) What are the components of accelerations for the curvilinear motion? How will you calculate these components? Explain with some examples.

Q.2. Attempt the following.

(06X2=12)

- A) Define constraint, action, reaction and types of supports and support reactions with free body diagram.
- B) Three identical right circular cylinders A, B and C, each weight W are arranged on smooth inclined surface as shown in figure 2. Determine the least value of angle θ that will prevent the arrangement from collapsing.

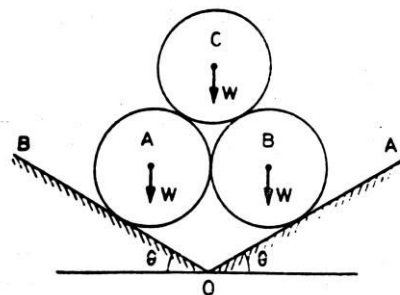


Figure 2

Q.3. Attempt the following.

(06X2=12)

- A) Three spherical balls of mass 2 kg, 6 kg and 12 kg are moving in the same directions with velocities 12 m/s, 4 m/s and 2 m/s respectively. If the ball of mass 2 kg impinges with the ball of mass 6 kg which in turn impinges with the ball of mass 12 kg prove that the balls of masses 2 kg and 6 kg will be brought to rest by the impact. Assume the balls to be perfectly elastic.

- B) What do you understand by trusses and frames? How will you determine the axial forces in the members? Explain method of Joints and method of sections.

Q.4. Attempt the following.

(06X2=12)

- A) What force P must be applied to the weightless wedges shown in fig 3. to start them under the 1000N block? The angle of friction for all contact surfaces is 10 degree.

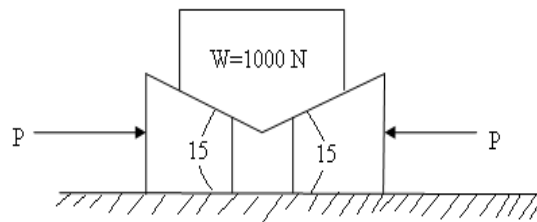


Figure 3

- B) Locate the centroid of the shaded area obtained by removing semicircle of diameter ' a ' from a quadrant of a circle of radius ' a ' as shown in Figure 4.

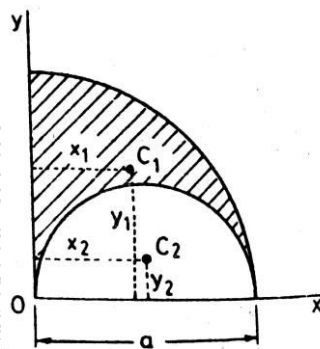


Figure 4

Q.5. Attempt the following.

(06X2=12)

- A) Explain the direct central impact, nature of impact and coefficient of restitution.
- B) A gun of mass 3000 kg fires horizontally a shell of mass 50 kg with a velocity of 300 m/s. What is the velocity with which the gun will recoil? Also determine the uniform force required to stop the gun in 0.6 m. In how much time it will stop.

Q.6. Attempt the following.

- A) Define and explain the D'Alemberts principle. Write and elaborate the equation of this, for rectilinear and curvilinear motion. (04)

- B) If the coefficient of kinetic friction is 0.25 under each body in the system shown in fig. 5, how far and in what direction will body B move in 5 sec. starting from rest. Pulleys are frictionless. (08)

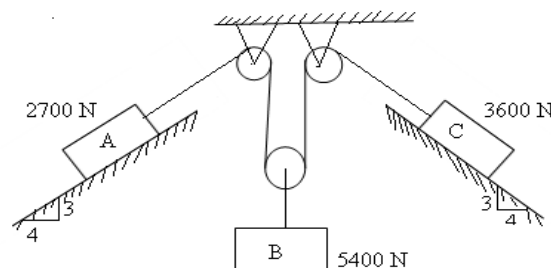


Figure 5

END

**DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE –
RAIGAD – 402 103
Winter Semester Examination – December – 2019**

Branch: B. Tech. (Group A / Group B)

Subject with Subject Code: Engineering Mechanics (ME102/ME202)

Date: 20 / 12 / 2019

Semester: I/II

Marks: 60

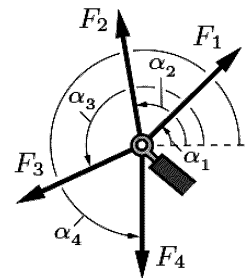
Time: 3 Hrs.

Instructions: 1] Attempt any **5 Questions**. Each Question Carry **12 Marks**.
2] Figures to the right indicate full marks.
3] Assume suitable data, if necessary. Neat diagrams must be drawn wherever necessary.

Q. No. 1 Solve any two:

A) Define: Rigid body, Statics, and Line of action of force. (6)

B) An eyebolt is subjected to four forces as shown in figure. $F_1=12$ kN, $F_2=8$ kN, $F_3=18$ kN, $F_4=4$ kN that act at angles of $\alpha_1=45^\circ$, $\alpha_1=45^\circ$, $\alpha_2=100^\circ$, $\alpha_3=205^\circ$, $\alpha_4=270^\circ$. Determine the magnitude and direction of the resultant force (6)

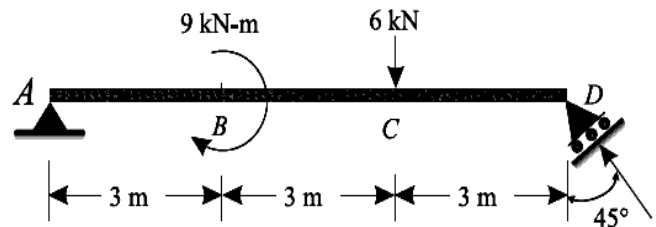


C) State: Parallelogram law of forces. (6)

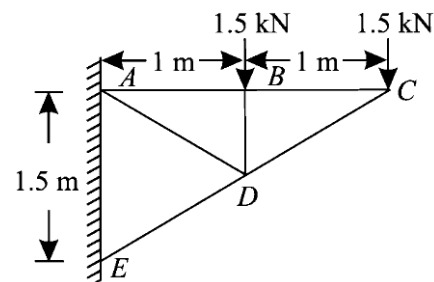
Solve: Two persons are pushing a box so that the net force on the box is 12 N to the east. If one of the person is applying a force 5 N to the north, what is the force applied by the other person.

Q. No. 2 Find the support reactions for a simply

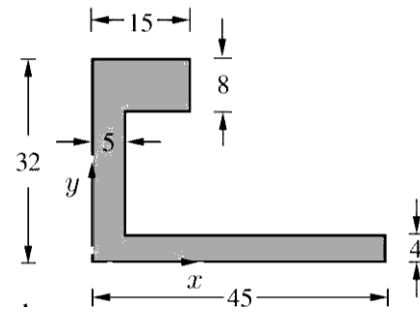
A) supported beam shown in figure. (6)



B) Determine the forces in the various members of a pin-jointed frame as shown in figure. Tabulate the result stating whether they are in tension or compression. (6)

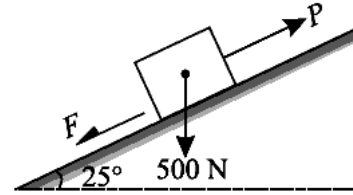


- Q. No. 3** Determine the coordinates x_c and y_c of a plane lamina as shown in figure.
A)



(6)

- B)** A block of weight 500 N is lying on a rough plane inclined at an angle of 25° with the horizontal. It is supported by a pull (P) parallel to the plane as shown in figure. The angle of friction is 20° . Determine the minimum and maximum values of P, for which the equilibrium can exist.



(6)

- Q. No. 4** A ball is projected upwards with a velocity of 60 m/s and reaches a maximum height of 5 metres above ground level. Determine the angle of projection and point where it hits the ground.
A)

- B)** A wheel increases its speed from 45 r.p.m. to 90 r.p.m. in 30 seconds. Find (a) angular acceleration of the wheel, and (b) no. of revolutions made by the wheel in these 30 seconds. (6)

- Q. No. 5** At a certain instant, a body of mass 10 kg, falling freely under the force of gravity, was found to be falling at the rate of 20 m/s. What force will stop the body in (i) 2 seconds and (ii) 2 metres?
A)

- B)** State and explain in brief D'Alembert's principle. (6)

- Q. No. 6** A railway engine of mass 20 tonnes is moving on a level track with a constant speed of 45 km.p.h. Find the power of the engine, if the frictional resistance is 80 N/t. Take, efficiency of the engine as 80 %.
A)

- B)** What is meant by Newton's law of collision of elastic bodies? Write its mathematical expression. (4)

- C)** State: The work-energy principle for a system of particles. (4)

----- END OF PAPER -----

**DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE –
RAIGAD – 402 103
Winter Semester Examination – December – 2019**

Branch: B. Tech. (Group A / Group B)

Subject with Subject Code: Engineering Mechanics (ME102/ME202)

Date: 20 / 12 / 2019

Semester: I/II

Marks: 60

Time: 3 Hrs.

Instructions: 1] Attempt any **5 Questions**. Each Question Carry **12 Marks**.

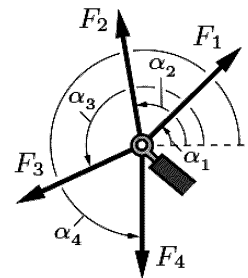
2] Figures to the right indicate full marks.

3] Assume suitable data, if necessary. Neat diagrams must be drawn wherever necessary.

Q. No. 1 Solve any two:

A) Define: Rigid body, Statics, and Line of action of force. (6)

B) An eyebolt is subjected to four forces as shown in figure. $F_1=12$ kN, $F_2=8$ kN, $F_3=18$ kN, $F_4=4$ kN that act at angles of $\alpha_1=45^\circ$, $\alpha_1=45^\circ$, $\alpha_2=100^\circ$, $\alpha_3=205^\circ$, $\alpha_4=270^\circ$. Determine the magnitude and direction of the resultant force (6)

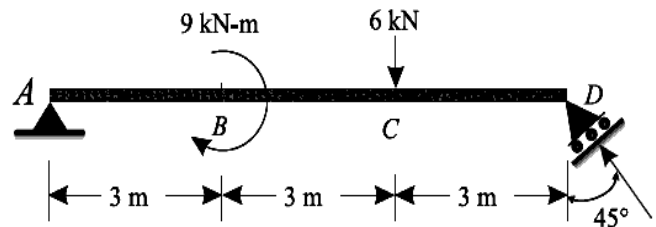


C) State: Parallelogram law of forces. (6)

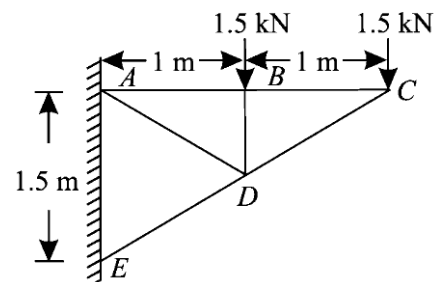
Solve: Two persons are pushing a box so that the net force on the box is 12 N to the east. If one of the person is applying a force 5 N to the north, what is the force applied by the other person.

Q. No. 2 Find the support reactions for a simply (6)

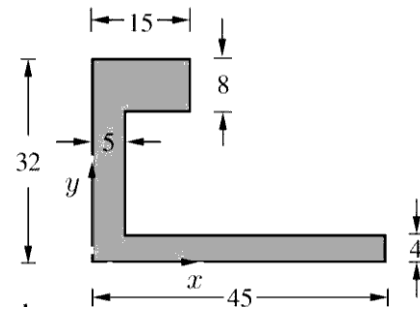
A) supported beam shown in figure.



B) Determine the forces in the various members of a pin-jointed frame as shown in figure. Tabulate the result stating whether they are in tension or compression. (6)

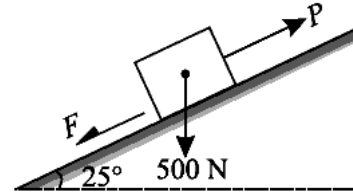


- Q. No. 3** Determine the coordinates x_c and y_c of a plane lamina as shown in figure.
A)



(6)

- B)** A block of weight 500 N is lying on a rough plane inclined at an angle of 25° with the horizontal. It is supported by a pull (P) parallel to the plane as shown in figure. The angle of friction is 20° . Determine the minimum and maximum values of P, for which the equilibrium can exist.



(6)

- Q. No. 4** A ball is projected upwards with a velocity of 60 m/s and reaches a maximum height of 5 metres above ground level. Determine the angle of projection and point where it hits the ground.
A)

(6)

- B)** A wheel increases its speed from 45 r.p.m. to 90 r.p.m. in 30 seconds. Find (a) angular acceleration of the wheel, and (b) no. of revolutions made by the wheel in these 30 seconds.

(6)

- Q. No. 5** At a certain instant, a body of mass 10 kg, falling freely under the force of gravity, was found to be falling at the rate of 20 m/s. What force will stop the body in (i) 2 seconds and (ii) 2 metres?
A)

(6)

- B)** State and explain in brief D'Alembert's principle.

(6)

- Q. No. 6** A railway engine of mass 20 tonnes is moving on a level track with a constant speed of 45 km.p.h. Find the power of the engine, if the frictional resistance is 80 N/t. Take, efficiency of the engine as 80 %.
A)

(4)

- B)** What is meant by Newton's law of collision of elastic bodies? Write its mathematical expression.

(4)

- C)** State: The work-energy principle for a system of particles.

(4)

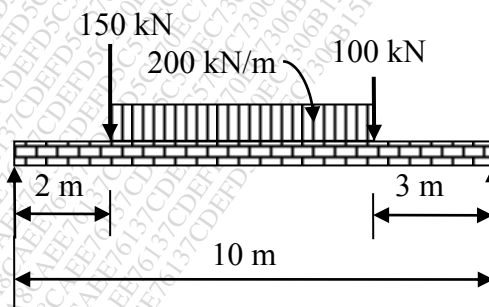
----- END OF PAPER -----

DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE**Semester Examination – May/June 2019****First Year (I/II Semester) B. Tech. (All)****Sub: ENGINEERING MECHANICS (ME102/ME202)****Time: 03 Hours****Date: 01/06/2019****Max Marks: 60****INSTRUCTIONS TO THE STUDENTS**

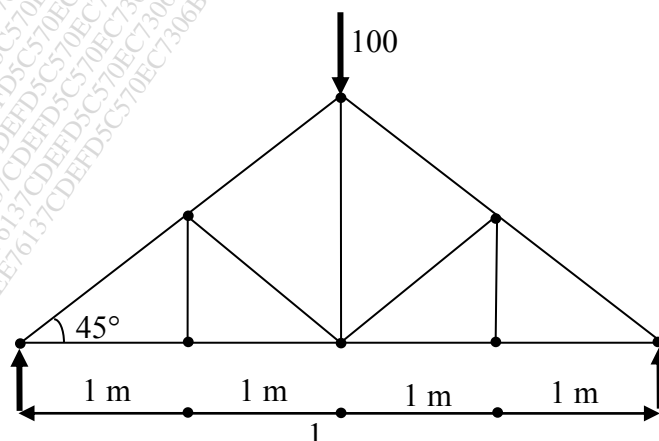
1. Attempt any five questions. Each question carries 12 marks.
2. Illustrate your answers with neat sketches, diagrams etc. where ever necessary.
3. Necessary data is given in the respective questions. If such data is not given, it means that the knowledge of that data is a part of the examination.
4. If some part or parameter is noticed to be missing, you may appropriately assume it and should mention it clearly.

(Marks)

- Q.1. (a) Define: Resultant force, Coplanar forces, and Moment of a force. (6)
- (b) Find the magnitude and direction of the resultant force for a number of forces acting at a common point: (6)
- i) 600 N inclined at 45° towards South of West.
 - ii) 800 N towards South-East,
 - iii) 400 N inclined at 30° towards North of East
 - iv) 300 N towards North-West
 - v) 500 N towards North
- Q.2. (a) List for the following: Types of beams, and types of supports. (4)
- (b) Find the support reactions for a simply supported beam shown in fig. 1. (8)

**OR**

- (b) Find magnitude and nature of forces in members of a truss shown in Fig. (8)



Q.3. (a) Define friction and state laws of static friction and dynamic friction. (6)

(b) A uniform ladder of 4 m length rests against a vertical wall with which it makes an angle of 45° . The coefficient of friction between the ladder and the wall is 0.4 and that between ladder and the floor is 0.5. If a man, whose weight is one-half of that of the ladder, ascends it, how high will it be when the ladder slips? (6)

Q.4. (a) Motion of a particle along a straight line is given by the equation: (4)

$$x = t^3 - 3t^2 - 9t + 12$$

Determine the time, position and acceleration of the particle when its velocity becomes zero.

(b) The distance between two stations A and B is 3.9 km. A train starts from station A and reach its speed 30 kmph in 20 seconds and travels until the speed reaches 36 kmph. This speed is maintained until brakes are applied and the train is brought to rest at the second station B under the retardation of 0.9 m/s^2 . Find the time taken to perform this journey. (8)

Q.5. Solve any two:

(a) State and explain in brief D'Alembert's principle. (6)

(b) A motorist is traveling on a curved road of radius 200 m at a speed of 72 kmph. Find the normal and tangential components of acceleration. (6)

(c) Boat A is moving north-west at a speed of 36 km/h and the boat B is moving east at speed 18 km/h. Find the magnitude and direction of the relative velocity of the boat B with respect to the boat A. (6)

Q.6. Solve any two:

(a) State: The work-energy principle for a system of particles. (6)

(b) A man of mass 60 kg dives vertically downwards into a swimming pool from a tower of height 20 m. He was found to go down in water by 2 m and then started rising. Neglect the air resistance. Find the average resistance of the water. (6)

(c) An army truck of mass 5 tonnes (t) has tractive resistance of 150 N/t. Find the power required to propel the truck at a uniform speed of 36 km.p.h. (a) up an incline of 1 in 100 ; (b) on a level track ; and (c) down an incline of 1 in 100. (6)

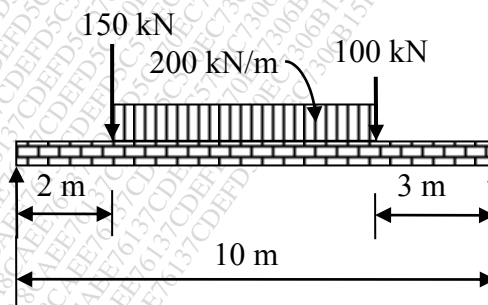
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DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE**Semester Examination – May/June 2019****First Year (I/II Semester) B. Tech. (All)****Sub: ENGINEERING MECHANICS (ME102/ME202)****Time: 03 Hours****Date: 01/06/2019****Max Marks: 60****INSTRUCTIONS TO THE STUDENTS**

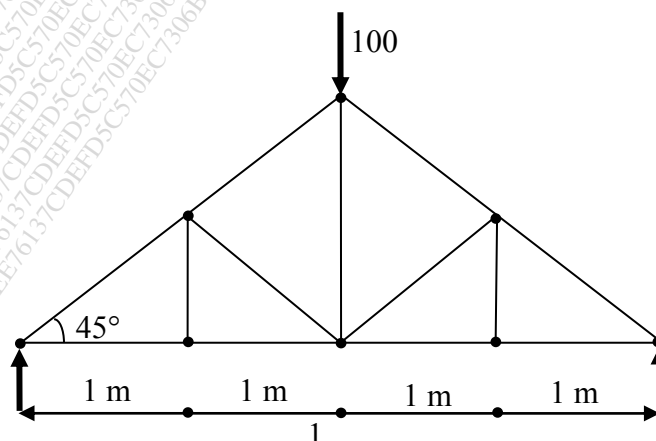
1. Attempt any five questions. Each question carries 12 marks.
2. Illustrate your answers with neat sketches, diagrams etc. where ever necessary.
3. Necessary data is given in the respective questions. If such data is not given, it means that the knowledge of that data is a part of the examination.
4. If some part or parameter is noticed to be missing, you may appropriately assume it and should mention it clearly.

(Marks)

- Q.1. (a) Define: Resultant force, Coplanar forces, and Moment of a force. (6)
- (b) Find the magnitude and direction of the resultant force for a number of forces acting at a common point: (6)
- i) 600 N inclined at 45° towards South of West.
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 - iii) 400 N inclined at 30° towards North of East
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- (b) Find the support reactions for a simply supported beam shown in fig. 1. (8)

**OR**

- (b) Find magnitude and nature of forces in members of a truss shown in Fig. (8)



Q.3. (a) Define friction and state laws of static friction and dynamic friction. (6)

(b) A uniform ladder of 4 m length rests against a vertical wall with which it makes an angle of 45° . The coefficient of friction between the ladder and the wall is 0.4 and that between ladder and the floor is 0.5. If a man, whose weight is one-half of that of the ladder, ascends it, how high will it be when the ladder slips? (6)

Q.4. (a) Motion of a particle along a straight line is given by the equation: (4)

$$x = t^3 - 3t^2 - 9t + 12$$

Determine the time, position and acceleration of the particle when its velocity becomes zero.

(b) The distance between two stations A and B is 3.9 km. A train starts from station A and reach its speed 30 kmph in 20 seconds and travels until the speed reaches 36 kmph. This speed is maintained until brakes are applied and the train is brought to rest at the second station B under the retardation of 0.9 m/s^2 . Find the time taken to perform this journey. (8)

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(c) Boat A is moving north-west at a speed of 36 km/h and the boat B is moving east at speed 18 km/h. Find the magnitude and direction of the relative velocity of the boat B with respect to the boat A. (6)

Q.6. Solve any two:

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(b) A man of mass 60 kg dives vertically downwards into a swimming pool from a tower of height 20 m. He was found to go down in water by 2 m and then started rising. Neglect the air resistance. Find the average resistance of the water. (6)

(c) An army truck of mass 5 tonnes (t) has tractive resistance of 150 N/t. Find the power required to propel the truck at a uniform speed of 36 km.p.h. (a) up an incline of 1 in 100 ; (b) on a level track ; and (c) down an incline of 1 in 100. (6)

#####

**DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE –
RAIGAD – 402 103**

Winter Semester Examination – December – 2019

Branch: B. Tech. (Group A / Group B)

Subject with Subject Code: Engineering Mechanics (ME102/ME202)

Date: 20 / 12 / 2019

Semester: I/II

Marks: 60

Time: 3 Hrs.

Instructions: 1] Attempt any 5 Questions. Each Question Carry 12 Marks.

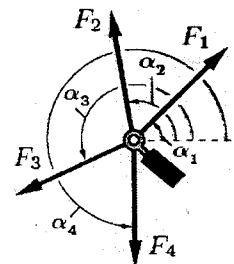
2] Figures to the right indicate full marks.

3] Assume suitable data, if necessary. Neat diagrams must be drawn wherever necessary.

Q. No. 1 Solve any two:

A) Define: Rigid body, Statics, and Line of action of force. (6)

B) An eyebolt is subjected to four forces as shown in figure. $F_1 = 12 \text{ kN}$, $F_2 = 8 \text{ kN}$, $F_3 = 18 \text{ kN}$, $F_4 = 4 \text{ kN}$ that act at angles of $\alpha_1 = 45^\circ$, $\alpha_2 = 100^\circ$, $\alpha_3 = 205^\circ$, $\alpha_4 = 270^\circ$. Determine the magnitude and direction of the resultant force (6)

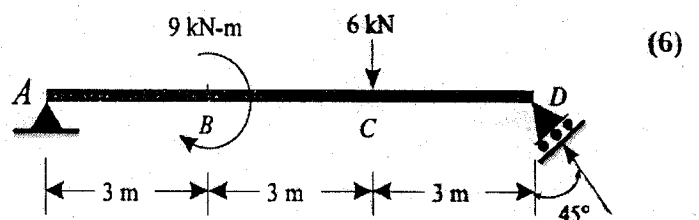


C) State: Parallelogram law of forces. (6)

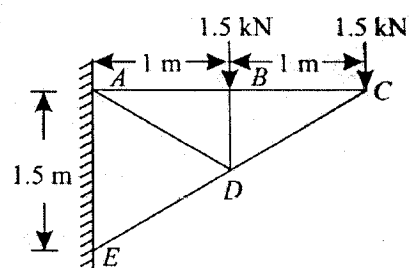
Solve: Two persons are pushing a box so that the net force on the box is 12 N to the east. If one of the person is applying a force 5 N to the north, what is the force applied by the other person.

Q. No. 2 Find the support reactions for a simply supported beam shown in figure. (6)

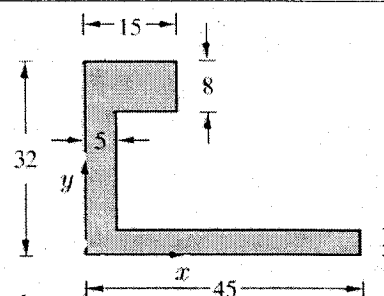
A)



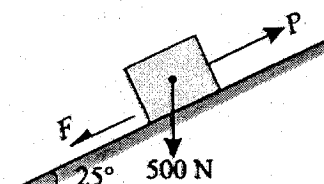
B) Determine the forces in the various members of a pin-jointed frame as shown in figure. Tabulate the result stating whether they are in tension or compression. (6)



- Q. No. 3** Determine the coordinates x_c and y_c of a plane lamina as shown in figure. (6)



- B)** A block of weight 500 N is lying on a rough plane inclined at an angle of 25° with the horizontal. It is supported by a pull (P) parallel to the plane as shown in figure. The angle of friction is 20° . Determine the minimum and maximum values of P , for which the equilibrium can exist. (6)



- Q. No. 4** A ball is projected upwards with a velocity of 60 m/s and reaches a maximum height of 5 metres above ground level. Determine the angle of projection and point where it hits the ground. (6)

- A)** A wheel increases its speed from 45 r.p.m. to 90 r.p.m. in 30 seconds. Find (a) angular acceleration of the wheel, and (b) no. of revolutions made by the wheel in these 30 seconds. (6)

- Q. No. 5** At a certain instant, a body of mass 10 kg, falling freely under the force of gravity, was found to be falling at the rate of 20 m/s. What force will stop the body in (i) 2 seconds and (ii) 2 metres? (6)

- A)** State and explain in brief D'Alembert's principle. (6)

- Q. No. 6** A railway engine of mass 20 tonnes is moving on a level track with a constant speed of 45 km.p.h. Find the power of the engine, if the frictional resistance is 80 N/t. Take, efficiency of the engine as 80 %. (4)

- A)** What is meant by Newton's law of collision of elastic bodies? Write its mathematical expression. (4)

- B)** State: The work-energy principle for a system of particles. (4)

----- END OF PAPER -----