

DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE

Regular & Supplementary Summer 2026

Course: B. Tech

Branch: Common to All

Semester: II

Subject Code & Name: BTES203 & Engineering Mechanics

Max Marks: 60

Date:14/07/2026

Duration: 3 Hr.

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

	Marks
Q. 1 Objective type questions. (Compulsory Question)	12
1 Lami's theorem is applicable to a body in equilibrium under:	1
A) Three concurrent, coplanar, and non-parallel forces	
B) Two parallel forces	
C) Four non-concurrent forces	
D) Any number of forces	
2 According to Varignon's theorem, the moment of a resultant about a point is equal to:	1
A) The algebraic sum of moments of its component forces about the same point	
B) The product of all forces	
C) Zero in every case	
D) The sum of the magnitudes of forces	
3 Two perpendicular forces of 30 N and 40 N act at a point. Their resultant is:	1
A) 35 N	B) 50 N
C) 70 N	D) 120 N
4 A block weighing 500 N rests on a horizontal surface. If the coefficient of friction is 0.2, the limiting friction is:	1
A) 50 N	B) 100 N
C) 200 N	D) 250 N

- 5 The angle of friction is the angle between: 1
- A) Resultant reaction and normal reaction at limiting friction
 - B) Friction force and contact surface
 - C) Applied force and horizontal direction
 - D) Weight and normal reaction
- 6 For a coplanar force system to be in static equilibrium: 1
- A) $\Sigma F_x = 0$, $\Sigma F_y = 0$ Only
 - B) $\Sigma F_x = 0$ and $\Sigma M = 0$ Only
 - C) $\Sigma F_x = 0$, $\Sigma F_y = 0$, and $\Sigma M = 0$
 - D) ΣM must be maximum
- 7 A simply supported beam of span 4 m carries a central point load of 20 kN. The reaction at each support is: 1
- A) 15 kN
 - B) 40 kN
 - C) 20 kN
 - D) 10 kN
- 8 A simple plane truss is generally composed of: 1
- A) Solid plates only
 - B) Circular members only
 - C) Curved beams only
 - D) Triangular arrangements of members
- 9 The slope of a displacement-time graph represents: 1
- A) Force
 - B) Acceleration
 - C) Velocity
 - D) Momentum
- 10 A body is dropped freely from rest. Taking $g=10 \text{ m/s}^2$, its velocity after 3 seconds is: 1
- A) 10 m/s
 - B) 20 m/s
 - C) 30 m/s
 - D) 45 m/s
- 11 The work-energy principle states that the net work done on a body is equal to the change in its: 1
- A) Potential energy only
 - B) Kinetic energy
 - C) Momentum only
 - D) Mass
- 12 A machine performs 1000 J of work in 5 seconds. Its power is: 1
- A) 50 W
 - B) 100 W
 - C) 200 W
 - D) 5000 W
- Q. 2 Solve the following.** 12
- A) Explain types of supports and loads with neat free body diagrams. 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. 6

Q.3 Solve the following. 12

- A) An I-section has the following dimensions in mm units: 6

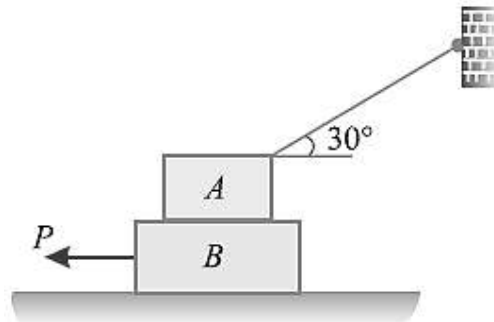
Bottom flange = 300×100

Top flange = 150×50

Web = 300×50

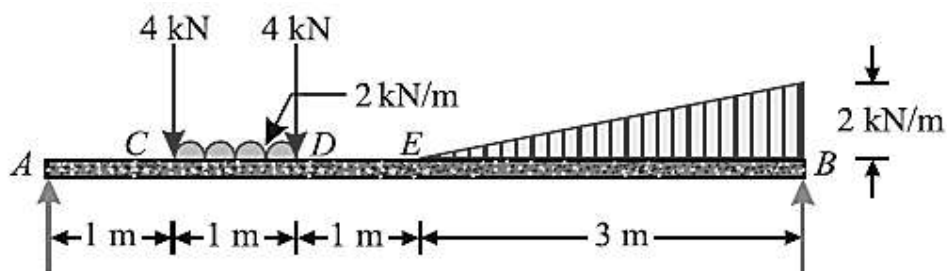
Determine mathematically the position of centre of gravity of the section taking bottom of the bottom flange be the axis of reference.

- B) Two blocks A and B of weights 1 kN and 2 kN respectively are in equilibrium position as shown in figure. If the coefficient of friction between the two blocks as well as the block B and the floor is 0.3, find the force (P) required to move the block B. 6

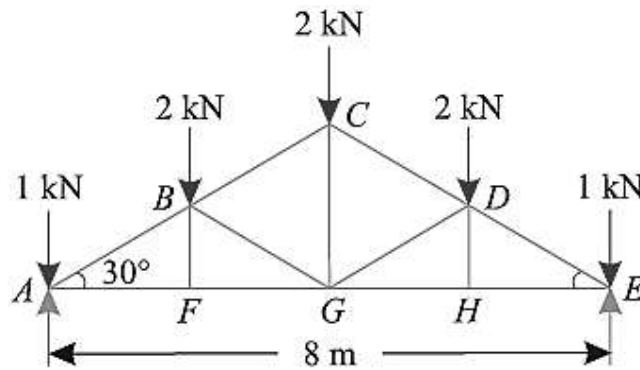


Q. 4 Solve Any Two of the following. 12

- A) Explain assumptions made in truss analysis. Compare the method of joints and method of sections. 6
- B) A simply supported beam AB of 6 m span is subjected to loading as shown in figure. Find the support reactions at A and B. 6



- C) A king post truss of 8 m span is loaded as shown in figure. Find the forces in each member of the truss and tabulate the results. 6



Q.5 Solve Any Two of the following.

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- A)** 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.
- B)** Two ships leave a port at the same time. The first steams North-West at 32 kilometres per hour and the second 40° South of West at 24 kilometres per hour.
- (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.

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Q. 6 Solve Any Two of the following.

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- A)** Explain 1) Coefficient of Restitution, 2) Direct Central Impact, 3) Oblique Impact
- B)** A 750 N crate rests on a 500 N cart. The coefficient of friction between the crate and the cart is 0.3 and between cart and the road is 0.2. If the cart is to be pulled by a force P such that the crate does not slip, determine: (a) the maximum allowable magnitude of P and (b) the corresponding acceleration of the cart.
- C)** A man wishes to move wooden box of 1 metre cube to a distance of 5 m with the least amount of work. If the block weighs 1 kN and the coefficient of friction is 0.3, find whether he should tip it or slide it.

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