

Course: B. Tech

Branch: Common To All Branches

Semester: I

Subject Code & Name: BTES103 - Engineering Mechanics

Max Marks: 60

Date: 22-06-2026

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.

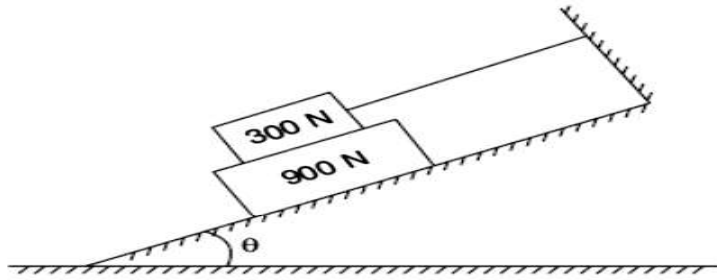
	Marks
Q. 1 Objective type questions. (Compulsory Question)	12
1 The primary objective of engineering mechanics is to study: A) Chemical reactions B) Behavior of bodies under the action of forces C) Electrical circuits D) Heat transfer only	1
2 A Free Body Diagram (FBD) is used to show: A) Internal structure of a body B) External forces acting on an isolated body C) Material properties D) Manufacturing details	1
3 According to Varignon's theorem, the moment of a resultant force about a point is equal to: A) Product of force and distance only B) Sum of moments of individual forces about the same point C) Difference of moments of forces D) Zero always	1
4 For a body in static equilibrium, the resultant force and resultant moment must be: A) Maximum B) Minimum C) Zero D) Equal	1
5 The centroid of a plane figure is also known as its: A) Neutral axis B) Geometric center C) Shear center D) Support point	1

6	Moment of inertia of a section indicates its resistance to:	1
	A) Translation	
	B) Compression	
	C) Bending	
	D) Friction	
7	The method of joints is based on the equilibrium of:	1
	A) Entire truss only	
	B) Individual joints	
	C) Supports only	
	D) Sections only	
8	A simply supported beam has:	1
	A) Two fixed supports	
	B) One fixed and one roller support	
	C) One pin support and one roller support	
	D) Two roller supports	
9	Kinematics deals with the study of motion without considering:	1
	A) Velocity	
	B) Acceleration	
	C) Forces causing motion	
	D) Displacement	
10	The SI unit of acceleration is:	1
	A) m/s	
	B) m^2/s	
	C) m/s^2	
	D) km/h	
11	Kinetic energy of a body depends on:	1
	A) Mass and velocity	
	B) Mass and density	
	C) Velocity and pressure	
	D) Force and time	
12	According to the law of conservation of energy, energy can neither be:	1
	A) Measured nor calculated	
	B) Created nor destroyed	
	C) Stored nor transferred	
	D) Converted nor transformed	
Q. 2	Solve the following.	12
A)	Explain types of supports and loads with neat free body diagrams.	6
B)	Explain force systems, resolution and composition of forces.	6
Q.3	Solve the following.	12
A)	The following forces are acting at a point:	6
	(i) 20 N inclined at 30° from East to North,	

- (ii) 25 N towards North,
- (iii) 30 N inclined at 45° from North to West,
- (iv) 35 N inclined at 40° from West to South.

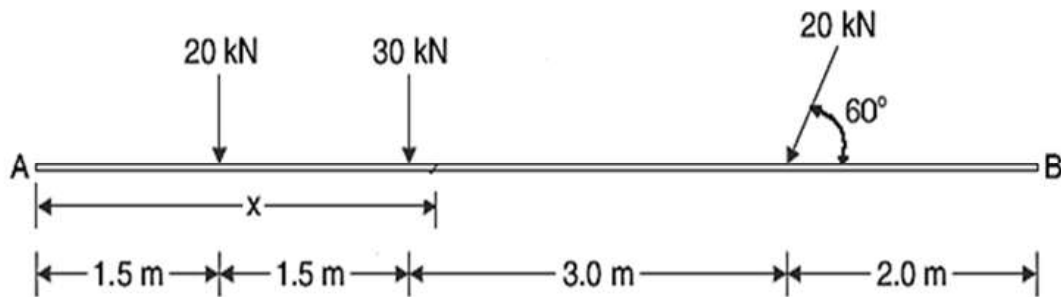
Find the magnitude and direction of the resultant force.

- B) What should be the value of θ that will make the motion of 900 N block down the plane to impend? The coefficient of friction for all contact surfaces is $1/3$. (Note: Upper block weighs 300 N)

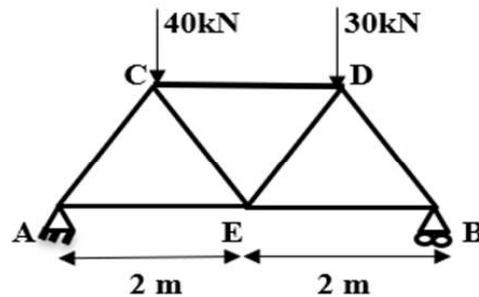


Q. 4 Solve Any Two of the following.

- A) Explain assumptions made in truss analysis. Compare the method of joints and method of sections.
- B) Determine the resultant of the system of forces acting on a beam.



- C) Find out forces in all the members of truss. (All angles are 60°)



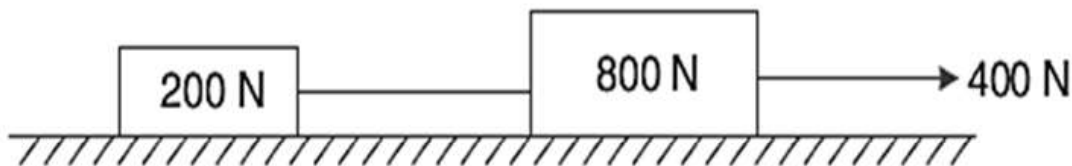
Q.5 Solve Any Two of the following.

- A) An object moves along a straight line and its acceleration 'a' which varies with time is given by $a = 2 - 3t$. Five seconds after the start of the observations, its velocity is found to be 20 m/sec. Ten seconds after the start of the observation, the body is at 85 m from the origin. Determine its acceleration, velocity and distance from the origin.
- B) 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.
- a) In what time, it will reach the maximum height?
 - b) How high above the building will the ball rise?

- C) Two ships move from a port at the same time. Ship A has velocity of 30 kmph and is moving in North 30° West 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. 6

Q. 6 Solve Any Two of the following. 12

- A) State and prove work energy principle. 6
- B) 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 the impulse momentum equation. 6
- C) 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



*** End ***