



GENERAL INSTRUCTIONS TO THE CANDIDATES

1. Candidates are instructed to answer the questions as per Bloom's Taxonomy knowledge level (K₁ to K₆)
2. Candidates are strictly instructed not to write anything in the question paper other than their roll number.
3. Candidates should search their pockets, desks and benches and handover to the Hall Superintendent/ Invigilator if any paper, book or note which they may find therein as soon as they enter the examination hall.
4. Candidates are not permitted to bring electronic watches with memory, laptop computers, personal systems, walkie-talkie sets, paging devices, mobile phones, cameras, recording systems or any other gadget / device /object that would be of unfair assistance to him / her.
5. Corrective measures as per KCT examination policies will be imposed for malpractice in the hall like copying from any papers, books or notes and attempting to elicit the answer from neighbours.

B.E/B.TECH DEGREE EXAMINATIONS: JUNE 2015

(Regulation 2014)

Second Semester

U14MET201: ENGINEERING MECHANICS

(Common to AERO/AUTO/CE/MCT/ME & TXT)

Time: Three Hours

Maximum Marks: 100

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1. Which of the following can be a set of fundamental quantities? [K₁]
 - a) length, velocity, time
 - b) momentum, mass, velocity
 - c) force, mass, velocity
 - d) momentum, time, frequency
2. Match list **I** with list **II** and select the correct answer using the codes given below. [K₁]

- a) Both A and R are true and R is the correct explanation of A b) Both A and R are true and R is NOT the correct explanation of A
- c) A is true but R is false d) A is false but R is true
8. The tension in a cable supporting a lift [K₂]
- a) is less when the lift is moving downwards b) is more when the lift is moving downwards
- c) is less when the lift is moving upwards d) is constant whether the lift moves upwards or downwards
9. Which of the following statements regarding laws governing the friction between dry surfaces are correct? [K₁]
- A. The friction force is dependent on the velocity sliding.
- B. The friction force is directly proportional to the normal force
- C. The friction force is dependent on the materials of the contact surfaces.
- D. The friction force is independent of the area of contact.
- Select the correct answer using the codes given below:
- a) B, C and D b) A and C
- c) B and D d) A, B, C and D
10. A particle is projected vertically upward with an initial velocity u . If g is the acceleration due to gravity, then which one of the following is the greatest height attained by it? [K₁]
- a) $h = 2u^2 / g$ b) $h = u^2 / g$
- c) $h = u^2 / 2g$ d) $h = u^2 / 4g$

PART B (10 x 2 = 20 Marks)

(Answer not more than 40 words)

11. A stake is being pulled out of the ground by means of two ropes as shown in **Fig. 1**. Knowing that the tension in one rope is 120 N, determine the magnitude and direction of the force **P** so that the resultant is a vertical force of 160 N. [K₂]

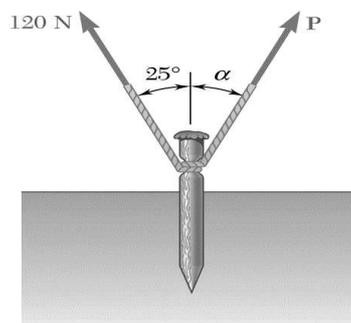


Fig. 1.

12. State the Principle of Transmissibility of forces with a simple sketch. [K₁]
13. A force of 800 N acts on a bracket as shown in **Fig. 2**. Calculate the moment of the force about B. [K₄]

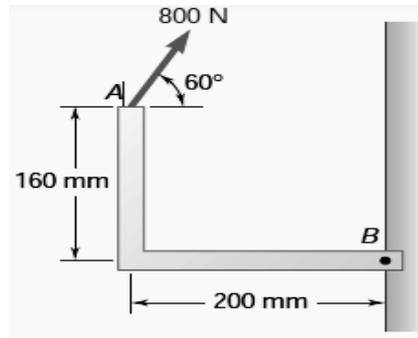


Fig. 2.

14. A single overhanging beam ABC is supported at the left end A and at B, the right end C being free. [K₁]
 AB= 4m and BC = 2m. UDL of 20 kN/m acts over ABC along with a concentrated load of P at C. If the support reactions at A and B are equal, find P.
15. If a plane area has an axis of symmetry, show that the centroid of the area must lie on this axis. [K₂]
16. For an isosceles triangular lamina of base 'b' and height 'h', the ratio of the moment of inertia about [K₁]
 its centroidal axis parallel to the base to the moment of inertia about the centroidal axis perpendicular to the base is found to be 12. What is the ratio between 'h' and 'b'?
17. Angle of repose is equal to the angle of limiting friction. Prove. [K₃]
18. A block of weight 500 N is just moved along a rough horizontal plane by a push of 200 N inclined [K₁]
 at 20° to the horizontal. Find the magnitude of the pull inclined at 20° to the horizontal required to just move the block.
19. A train running at 80 kmph is brought to halt after 60 seconds. Find the retardation and distance [K₂]
 traveled by the train before it comes to a halt.
20. What is impulse-momentum principle? Write the equation. [K₁]

Answer any FIVE Questions:-

PART C (5 x 14 = 70 Marks)

(Answer not more than 300 words)

Q.No. 21 is Compulsory

21. Determine the moment of inertia (M.I.) of the I section shown in **Fig. 3** with respect to its [K₂]
 horizontal centroidal axis and thereby find the M.I. about an axis passing through its base.

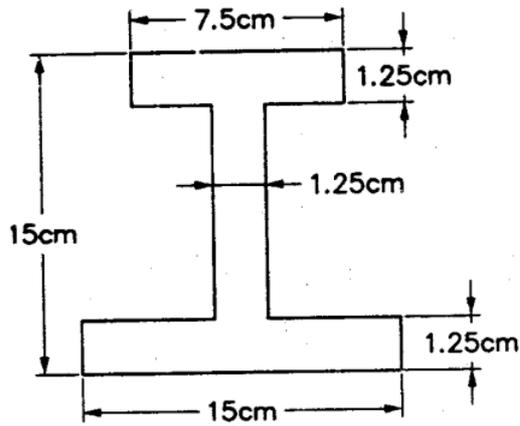


Fig. 3

22. (i) The resultant of the force system shown in Fig. 4 is 520 N along the negative direction of Y-axis. Determine P and θ . (10) [K₁]

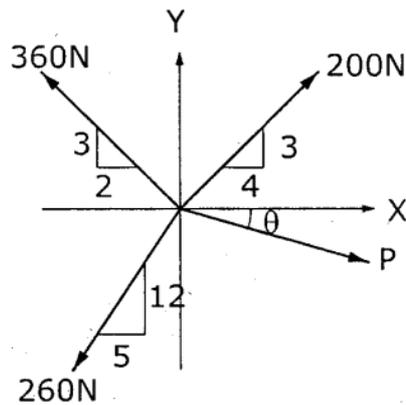


Fig. 4

- (ii) An electric fixture weighing 10 N hangs from a point O by two strings AO and BO. AO is inclined at an angle of 60° to the horizontal ceiling and BO is inclined at 45° to the vertical wall as shown in Fig. 5. Find the forces in the strings AO and BO. (4) [K₁]

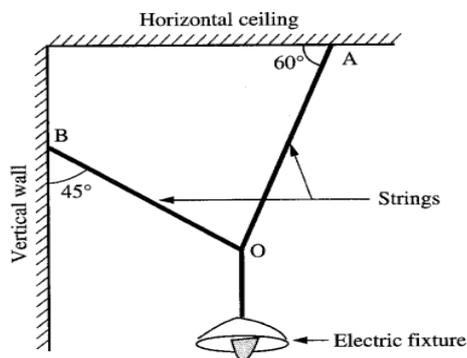


Fig. 5.

23. (i) The three forces and a couple of magnitude, $M = 18 \text{ Nm}$ are applied to an angle bracket (10) [K₂] as shown in **Fig. 6**. (a) Find the resultant of this system of forces. (b) Locate the points where the line of action of the resultant intersects line AB and BC.

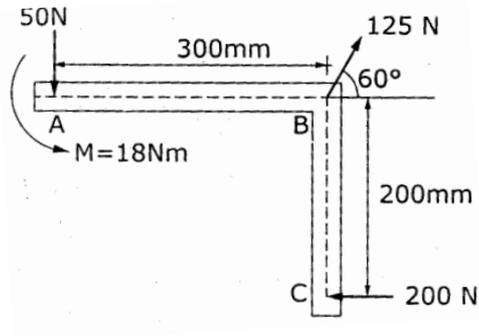


Fig. 6.

- (ii) A beam supports a distributed load as shown in **Fig. 7**. Determine the reactions at the (4) [K₁] supports.

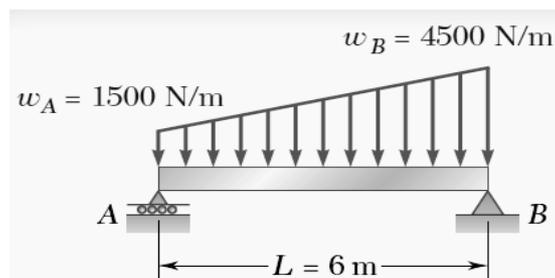


Fig. 7.

24. A projectile is fired from the edge of a 150-m cliff with an initial velocity of 200 m/s at an angle of (K₁) 30° with the horizontal as shown in **Fig. 8**. Neglecting air resistance, find (a) the horizontal distance from the gun to the point where the projectile strikes the ground, (b) the total time required for the flight of the projectile and (c) the greatest elevation above the ground reached by the projectile.

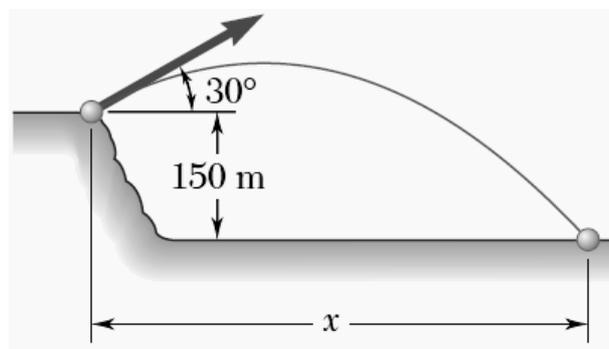


Fig. 8.

25. (i) What should be the value of the angle θ , so that motion of the 390 N block impends down the inclined plane as shown in **Fig. 9**? The co-efficient of static friction μ for all surfaces is 0.33. (10) [K₂]

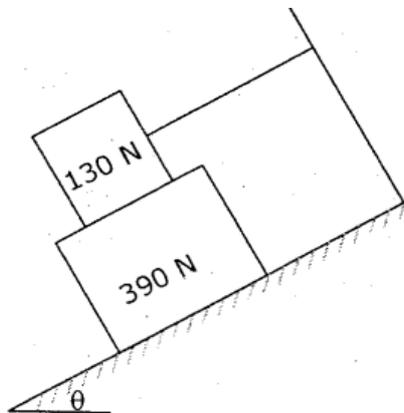


Fig. 9

- (ii) Determine the magnitude and direction of the friction force acting on the 100-kg block shown in **Fig. 10** if $P = 100$ N. The coefficient of static friction is 0.20, and the coefficient of kinetic friction is 0.17. The forces are applied with the block initially at rest. (4) [K₂]

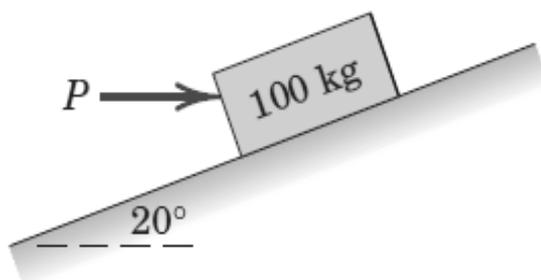


Fig. 10

26. (i) A body of mass 1 kg is resting on an inclined plane which makes an angle of 30° with the horizontal. It is connected with a weight of 20 N by a light string passing over a smooth pulley as shown in **Fig. 11**. Find (a) the acceleration of the system (b) the time taken by the hanging weight 20 N, to lower by 2 m. The coefficient of friction between the 1 kg mass and the inclined plane is 0.15. Both the bodies are initially in rest. (10) [K₁]

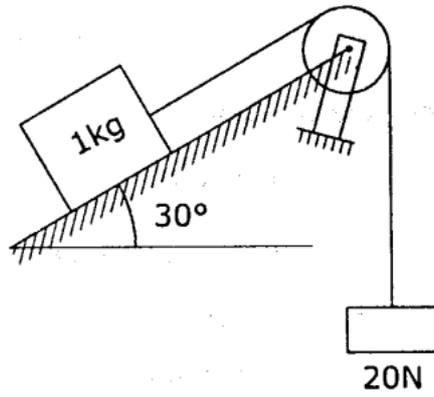


Fig. 11

(ii) A ball of mass 45 g is dropped onto a rigid floor from a height of 3 m. Find the maximum height attained by the ball after the first impact. The coefficient of restitution is 0.81. (4) [K₁]
