



**GENERAL INSTRUCTIONS TO THE CANDIDATES**

1. Candidates are instructed to answer the questions as per Bloom's Taxonomy knowledge level ( $K_1$  to  $K_6$ )
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 2016**

(Regulation 2015)

Second Semester

**U15MET202: ENGINEERING MECHANICS**

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

**COURSE OUTCOMES**

**After successful completion of this course, the students should be able to**

- CO1: Explain the concept of equilibrium of particles and rigid bodies.
- CO2: Apply the concepts of equilibrium and moment of inertia for various shape sections.
- CO3: Make use of various concepts of friction.
- CO4: Solve problems using the concepts in kinematics.
- CO5: Solve problems in kinematics.

**Time: Three Hours**

**Maximum Marks: 100**

**Answer all the Questions:-**

**PART A (10 x 1 = 10 Marks)**

1. When two forces each equal to  $P$  act on a particle at  $90^\circ$  to each other, then the resultant will be CO1 [K<sub>2</sub>]
  - a)  $P$
  - b)  $\sqrt{2} P$
  - c)  $\frac{P}{\sqrt{2}}$
  - d)  $2P$

2. Consider the following statements CO1 [K<sub>2</sub>]
1. The translatory effect of a couple on a body is zero.
  2. A couple can be balanced by a couple of opposite sense.
  3. The moment of a couple about any point is the same.
- Which of these statements is/are correct.
- a) 2 and 3 b) 3 only  
 c) 1 and 2 d) 1, 2 and 3
3. If a body is subjected to two forces, then the body will be in equilibrium if the two forces are CO2 [K<sub>2</sub>]
- a) Equal in magnitude and opposite in direction b) Equal in magnitude and collinear forces  
 c) Equal in magnitude, opposite in direction and collinear d) Equal in magnitude
4. A load, acting at a point on a beam is known as a CO2 [K<sub>1</sub>]
- a) Uniformly varying load b) Point load  
 c) Uniformly distributed load d) Couple
5. Polar moment of inertia is CO2 [K<sub>2</sub>]
- a) The moment of inertia of an area about an axis parallel to centroid axis b) Equal to moment of inertia  
 c) The moment of an area about an axis which is not lying in the plane of the area d) The moment of inertia of an area about a line or axis perpendicular to the plane of the area
6. Sequence the effect of friction on the state of the object (from rest to motion) CO3 [K<sub>2</sub>]
- A. Maximum frictional force proportional to normal reaction.  
 B. Coefficient of kinetic friction less than the static friction.  
 C. No frictional force.  
 D. Frictional force increases with the applied force.
- a) A – C – D – B b) C – B – D – A  
 c) A – B – C – D d) C – D – A – B
7. The centroid of a semi-circle lies at a distance of \_\_\_\_\_ from its base measured along the vertical radius. CO2 [K<sub>1</sub>]
- a)  $\frac{3\pi}{4r}$  b)  $\frac{4r}{3\pi}$   
 c)  $\frac{3\pi r}{4}$  d)  $\frac{3r}{4\pi}$

8. Assertion (A): At a position of zero velocity, the body will have zero acceleration. CO4 [K<sub>2</sub>]  
Reason (R): Acceleration represents the rate of change of velocity.
- a) Both Assertion and Reason are true and the Reason is correct explanation of the Assertion.      b) Both Assertion and Reason are true, but Reason is not correct explanation of the Assertion.  
c) Assertion is true, but the Reason is false.      d) Assertion is false, but the Reason is true.

9. Which of the following situations constitutes projectile motion. CO4 [K<sub>2</sub>]
- a) Lifting of a balloon.      b) Taking off an aircraft.  
c) Throwing of a cricket ball from one player to another.      d) Launching of a satellite.

10. Match List I with List II and select the correct answer using the code given below: CO4 [K<sub>2</sub>]

List I	List II
A. Two parallel forces acting on a body moving with uniform velocity	i. Posseses Kinetic energy
B. A moving object with mass 'm'	ii. Study of motion considering in the force
C. Two coplanar parallel forces equal in magnitude and opposite in direction acting on a body	iii. Forces in equilibrium
D. Kinetics	iv. Couple

&  
CO5

- |    | A   | B   | C  | D  |
|----|-----|-----|----|----|
| a) | i   | iii | iv | ii |
| b) | iii | ii  | i  | iv |
| c) | iii | i   | iv | ii |
| d) | iii | iv  | i  | ii |

**PART B (10 x 2 = 20 Marks)**

**(Answer not more than 40 words)**

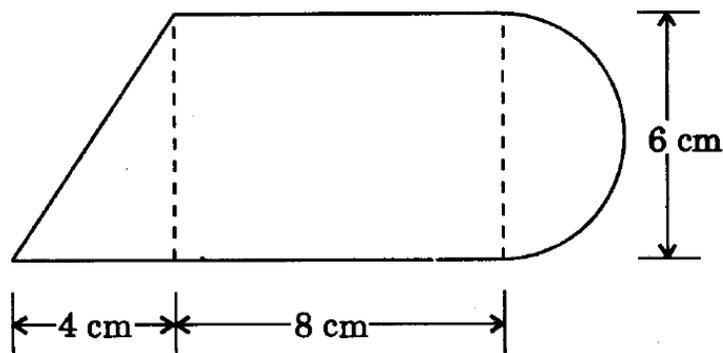
11. List the characteristics of force. CO1 [K<sub>2</sub>]
12. List the different types of system of forces. CO1 [K<sub>2</sub>]
13. How to resolve a force into force couple system? Discuss with an example. CO1 [K<sub>2</sub>]
14. List the requirements for the stable equilibrium of rigid bodies in two dimensions. CO1 [K<sub>2</sub>]
15. State parallel axis theorem. CO2 [K<sub>1</sub>]
16. Define centroid and how do you locate the centroid of an symmetrical section? CO2 [K<sub>2</sub>]
17. What do you understand by angle of repose? CO3 [K<sub>2</sub>]

18. List any two application where friction is desirable, List any two application where friction is undesirable. CO3 [K<sub>2</sub>]
19. Define impulse momentum principle. CO4 [K<sub>2</sub>]
20. A car runs with an initial velocity of 30 m/s and uniform acceleration of 3 m/s<sup>2</sup>. Find its velocity after 5 seconds. CO4 [K<sub>3</sub>]

**Answer any FIVE Questions: -**  
**PART C (5 x 14 = 70 Marks)**  
**(Answer not more than 300 words)**

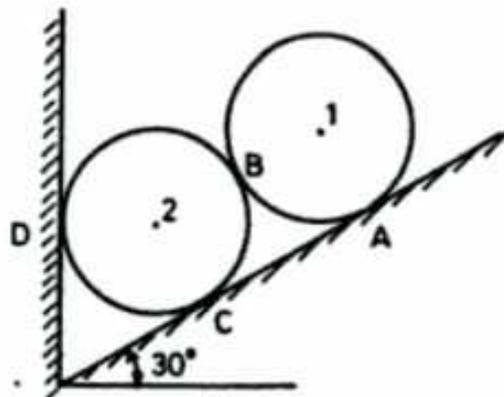
**Q.No. 21 is Compulsory**

21. Calculate the moment of inertia of the section shown in Figure 1 about the axis passing through the centroid CO4 [K<sub>3</sub>]



**Figure 1**

22. Two identical rollers each of weights 100 N are supported by an inclined plane and a vertical wall as shown in Figure 2. Assuming all contact surfaces are smooth, find the reactions induced at the points of supports A, B, C and D. CO1 [K<sub>3</sub>]



**Figure 2**

23. An over-hanging beam is on rollers at A and is hinged at B and is loaded as shown in Figure 3. Determine the reactions at A and B. CO1 [K<sub>3</sub>]

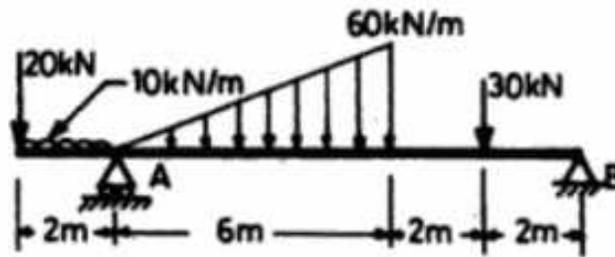


Figure 3

24. A ladder of length 6 m rests against a wall, the angle of inclination is 45°. If the coefficient friction is 0.5 on all contacts. What will be the maximum distance on ladder to which a man whose weight is 1.5 times the weight of the ladder can ascend before the ladder begins to slip? Assume the weight of the ladder as 400 N CO3 [K<sub>4</sub>]
25. The horizontal distance of a target to be hit by a projectile is 10000m. The shell leaves the gun with a velocity of 600 m/s as shown in Figure 4. What must be the angle of projection of the gun if a mountain of 2000 m high intervening midway between the gun and the target is to be cleared? CO2 [K<sub>3</sub>]

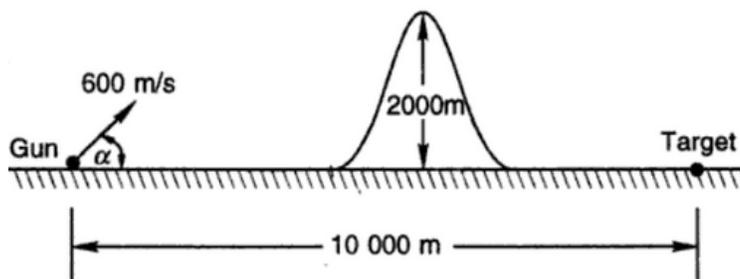


Figure 4

26. i) A ball of mass 8 kg moving with a velocity of 10 m/sec impinges directly on another of mass 24 kg moving at a speed of 2 m/sec in the opposite direction. If Co-efficient of restitution  $e = \frac{1}{2}$  find the velocities of the ball after impact. (7) CO5 [K<sub>3</sub>]
- ii) Two stones are thrown vertically upwards one from the ground with a velocity of 30 m/sec and another from a point 40 m above with a velocity of 10 m/sec. When and where will they meet? (7) CO4

27. Four Coplanar forces equal to 20 N, 30 N, 50N and 70N are acting on square body of each side equal to 1 m as shown in Figure 5 below. Determine the magnitude direction and position of the resultant which will keep the body in equilibrium.

CO3 [K<sub>4</sub>]

**Figure 5**

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