



KERALA AGRICULTURAL UNIVERSITY
B.Tech.(Agri. Engg.)
I Semester Final Re - Examination - February 2025
2023 & Previous Admissions

Iden.1101

Engineering Mechanics (2+1)

Marks:50
Time: 2 hours

- I** **Choose the correct answer** **(10x1=10)**
1. A Steel Wheel of 600 mm diameter rolls on a horizontal steel rail. It carries a load of 500 N. The coefficient of rolling resistance is 0.3 mm. The force in N, necessary to roll the wheel along the rail is
 1. 0.5
 2. 5
 3. 15
 4. 150
 2. If a System is in equilibrium and the position of the system depends upon many independent variables, the principle of virtual work states that the partial derivatives of its total potential energy with respect to each of the independent variable must be
 1. -1.0
 2. 0
 3. 1.0
 4. 2.0
 3. In a statically determinate plane truss, the number of joints (j) and the number of members (m) are related by
 1. $j = 2m - 3$
 2. $3 = 2j + 1$
 3. $m = 2j - 3$
 4. $m = 2j - 1$
 4. The coefficient of restitution of a perfectly plastic impact is.....
 1. 0
 2. 1
 3. 2
 4. 3
 5. A ball of mass 3 kg moving with a velocity of 4 m/s undergoes a perfectly-elastic direct-central impact with a stationary ball of mass m. After the impact is over, the kinetic energy of the 3 kg ball is 6J. The possible value (s) of m is/are
 1. 6 kg only
 2. 1kg, 9kg
 3. 1kg, 6kg
 4. 1kg only
 6. A free bar of length l uniformly heated from 0°C to a temperature $t^{\circ}\text{C}$, α is the coefficient of linear expansion and E is the modulus of elasticity. The stress in the bar
 1. αtE
 2. $\alpha tE/2$
 3. Zero
 4. None of these

7. The "Jominy test" is used to find
 1. Young's modulus
 2. Hardenability
 3. Yield strength
 4. Thermal conductivity
8. The number of components in a stress tensor defining stress at a point three dimensions is
 1. 3
 2. 4
 3. 6
 4. 9

Fill in the blanks

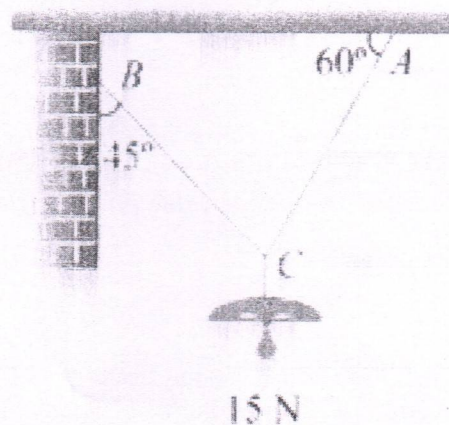
9. A test specimen is stressed slightly beyond the yield point and then unloaded. Its yield strength will.....
10. The total area under the stress-strain curve of a mild steel specimen test up to failure under tension is a measure of.....

II Write short notes on ANY FIVE of the following (5x2=10)

1. What is a free body diagram?
2. What is meant by force-couple system?
3. When is moment of force zero about a line?
4. How many scalar equations can be obtained for equilibrium of rigid body in threedimensions?
5. Define Hook's law.
6. Distinguish between creep and fatigue.
7. What are principal in planes?

III Answer ANY FIVE of the following (5x4=20)

1. Four forces equal to P, 2P, 3P and 4P are respectively acting along the four sides of square ABCD taken in order. Find the magnitude, direction and position of the resultant force.
2. An electric light fixture weighting 15 N hangs from a point C, by two strings AC and BC. The string AC is inclined at 60° to the horizontal and BC at 45° to the horizontal as shown in Fig. Using Lami's theorem, or otherwise, determine the force in the strings AC.



3. A body of weight 300 N is lying on a rough horizontal plane having a coefficient of friction as 0.3. Find the magnitude of the force, which can move the body, while acting at an angle of 25° with the horizontal.

4. 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 750N stands on a rung 1.5 metre from the bottom of the ladder. Calculate the coefficient of friction between the ladder and the floor.
5. What do you mean by limit of proportionality or elastic limit?
6. A Surveyor's steel tape 30 m long has a cross-section of $15 \text{ mm} \times 0.75 \text{ mm}$. With this, line AB is measure as 150 m. If the force applied during measurement is 120 N more than the force applied at the time of calibration, what is the actual length of the line? Take modulus of elasticity for steel as 200 kN/mm^2 .
7. Why deflection of beams is needed for engineering applications like mechanical engineering?

IV

Write an essay on ANY ONE of the following

(1x10=10)

1. The piston rod of diameter 20 mm and length 700 mm in a hydraulic cylinder is subjected to a compressive force of 10 kN due to internal pressure. The piston end of the rod is guided along the cylinder and the other end of the rod is hinged at the cross-head. The modulus of elasticity for piston rod material is 200 GPa. Estimate the factor of safety taken for the piston rod design.
2. A close-coiled helical spring has coil diameter D , wire diameter d and number of turn n . The spring material has a shearing modulus G . Derive an expression for the stiffness k of the spring.
