

KATHMANDU UNIVERSITY  
End Semester Examination  
September 2024

Marks Scored:

Level : B.E.

Course : CIEG 102

Year : I

Semester : II

Exam Roll No. :

Time: 30 mins.

F. M. : 10

Registration No.:

Date :

17 SEP 2024

SECTION "A"

[20Q.  $\times$  0.5 = 10 marks]

**Choose and encircle the most appropriate answer. Symbols have their usual meanings.**

1. The moment of inertia of a rectangular section about an axis passing through its centroid and parallel to the base is:  
a.  $\frac{bd^2}{12}$                       b.  $\frac{bd^2}{32}$                       c.  $\frac{bd^2}{8}$                       d.  $\frac{db^2}{12}$
2. The term "d'Alembert's principle" is primarily associated with:  
a. Statics                      b. Dynamics                      c. Fluid Mechanics                      d. Thermodynamics
3. The unit of angular velocity is:  
a. rad/sec                      b. meters/sec                      c. Newton-meters                      d. Joules
4. The motion of a rigid body in which every particle moves in a circle about a single line is known as:  
a. Translatory motion                      b. Rotatory motion  
c. Oscillatory motion                      d. Simple harmonic motion
5. A body of mass 2 kg is moving with a velocity of 3 m/s. What is its kinetic energy?  
a. 9 J                      b. 3 J                      c. 18 J                      d. 6 J
6. The condition for equilibrium of a particle is when:  
a. The sum of all forces acting on the particle is zero  
b. The sum of all torques acting on the particle is zero  
c. The net force is equal to the net torque  
d. The net force and net torque are both zero
7. The acceleration of a particle moving with simple harmonic motion is:  
a. Directly proportional to the displacement  
b. Directly proportional to the square of the displacement  
c. Inversely proportional to the displacement  
d. Independent of the displacement
8. In a perfectly elastic collision, the relative velocity of approach before impact is:  
a. Equal to the relative velocity of separation after impact  
b. Greater than the relative velocity of separation after impact  
c. Less than the relative velocity of separation after impact  
d. Zero after impact
9. A couple produces:  
a. Translatory motion                      b. Rotatory motion  
c. Linear motion                      d. Oscillatory motion
10. The principle of superposition is valid in systems that are:  
a. Linear                      b. Non-linear                      c. Elastic                      d. Rigid

11. In a simply supported beam subjected to a uniform load, the maximum bending moment occurs at:
  - a. Mid-span
  - b. One-fourth of the span from either end
  - c. At the supports
  - d. One-third of the span from either end
12. Shear force at any section of a cantilever beam subjected to a point load at its free end:
  - a. Is zero throughout the length of the beam
  - b. Varies linearly with distance from the free end
  - c. Is maximum at the free end
  - d. Is constant along the length
13. A determinate frame is one in which:
  - a. The number of members equals the number of joints
  - b. The number of unknown forces equals the number of equilibrium equations
  - c. The structure is statically indeterminate
  - d. The structure is kinematically indeterminate
14. A frame is said to be statically indeterminate if:
  - a. The number of unknown forces exceeds the number of equilibrium equations
  - b. The number of equilibrium equations equals the number of unknown forces
  - c. The number of unknown forces is less than the number of equilibrium equations
  - d. The frame can collapse under any loading
15. The method of joints is used for:
  - a. Determining the displacement of a truss
  - b. Determining the internal forces in the members of a truss
  - c. Calculating the moment of inertia of a truss
  - d. Analyzing the deflection of a truss
16. A truss is considered statically determinate when:
  - a.  $m=2j-3$
  - b.  $m=2j-2$
  - c.  $m=3j-2$
  - d.  $m=j-2$
17. The centroid of a composite shape made up of several simple shapes can be found by:
  - a. Averaging the centroid locations of all the simple shapes
  - b. Taking the weighted average of the centroid locations of all the simple shapes based on their areas.
  - c. Adding the centroid locations of all the simple shapes
  - d. Dividing the total area by the sum of the centroid locations
18. For a simply supported beam with a point load at its mid-span, the shear force at the mid-span is:
  - a. Maximum
  - b. Zero
  - c. Minimum
  - d. Equal to the point load
19. The moment of inertia of a T-section about the horizontal axis passing through its centroid is calculated by:
  - a. Using the parallel axis theorem for each component
  - b. Simply adding the moment of inertia of the flange and the web
  - c. Subtracting the moment of inertia of the flange from the web
  - d. Doubling the moment of inertia of the flange
20. In a truss, the force in a zero-force member can be identified when:
  - a. Two non-collinear members meet at a joint unstressed by external loads or supports
  - b. The number of members equals twice the number of joints minus three
  - c. The truss is symmetric
  - d. The truss is subjected to a uniform load

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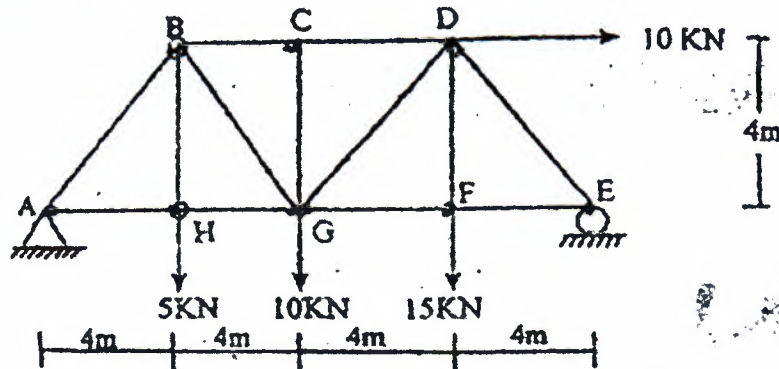
17 SEP 2024

Course : CIEG 102  
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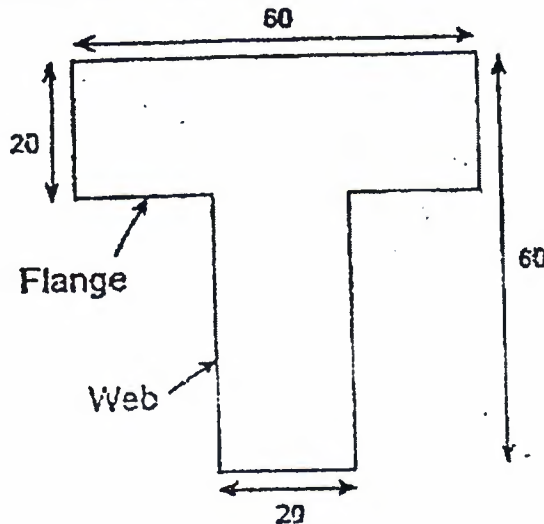
SECTION "B"

Attempt ALL Questions.

1. A projectile is fired from the edge of 150m cliff with an initial velocity of 180m/s, at an angle of  $30^\circ$  with the horizontal. Neglecting air resistance, find the horizontal distance from the gun to the point where the projectile strikes the ground and the greatest elevation above the ground reached by the projectile. [5]
2. Describe in brief about static indeterminacy of structures. Calculate the member forces developed in members BC, BG, HG and GD of the given truss. [2+8=10]



3. Prove the parallel axis theorem. Determine the principal MOI about centroidal axes for the given section of beam. All Dimensions are in cm. [2+6=8]

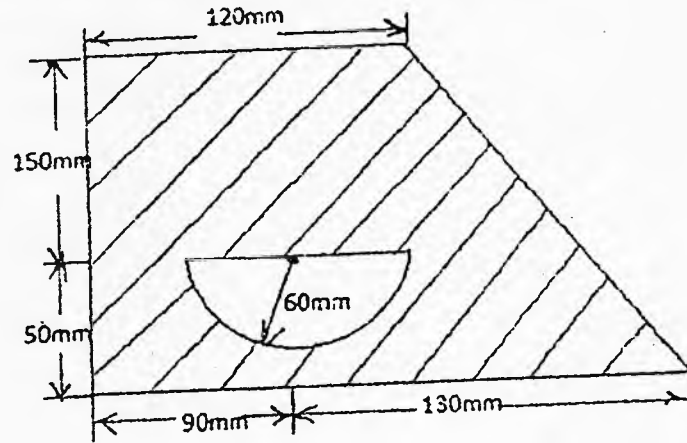


4. Define Rectilinear and Curvilinear Motion with examples.  
Car A when at a distance of 32.5m north of a crossing was observed to start from rest and travelling towards the crossing with a constant acceleration of  $1\text{m/s}^2$ . At the same instant another car B was observed to be just at the crossing and travelling east at a constant speed of 36kmph. Find the position, velocity and acceleration of car A relative to car B, 5 seconds after the observation. [2+4=6]

P.T.O.

5. Define centroid. Determine the centroid of the given figure

[1+6=7]



6. Define Virtual displacement and virtual work. What is the principle of virtual work for rigid bodies? Derive with needed expressions.

[1.5+2.5=4]