KATHMANDU UNIVERSITY
End Semester Examination [C]
December, 2024

Marks Scored:

Level : B.E.
Year : II

13 DEC 2024

Course : CIEG 203
Semester : I

Exam Roll No. :

Time: 30 mins.

F. M. : 10

Registration No.:

Date : 13 DEC 2024

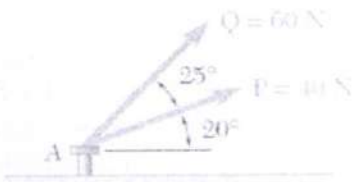
SECTION "A"

[20Q. × 0.5 = 10 marks]

Choose and encircle the most appropriate option from each set of choices.

1. Which part of mechanics is not within engineering mechanics?
   a. Mechanics of deformable bodies.
   b. Mechanics of compressible fluids.
   c. Mechanics of rigid bodies.
   d. Mechanics of bodies close to speed of light.

2. The resultant of the figure shown below is
   a. 100 N and angle of 45 degree with horizontal
   b. 100 N and angle of 35 degree with horizontal
   c. 95 N and angle of 35 degree with horizontal
   d. 95 N and angle of 45 degree with horizontal



3. If moment of inertia about its axis is I and if the effective sectional area is A, then radius of gyration r is given by
   a. $\sqrt{\frac{I}{2A}}$ b. $\sqrt{\frac{I}{A}}$ c. $\sqrt{\frac{A}{I}}$ d. $\sqrt{\frac{2I}{A}}$

4. A force F, has the components $F_x = 20$ N, $F_y = -30$ N, and $F_z = 60$ N, then
   a. Magnitude of F is 70 N and it makes angle 73.4° with y-axis.
   b. Magnitude of F is 70 N and it makes angle 73.4° with z-axis.
   c. Magnitude of F is 70 N and it makes angle 73.4° with x-axis.
   d. Magnitude of F is 70 N and it makes angle 73.4° with all co-ordinate axes.

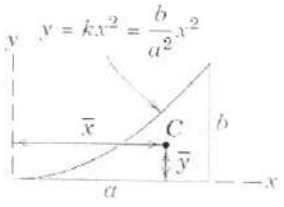
5. The equation of a particle starting from rest along a straight line is $x = t^3 - 3t^2 + 5$. The ratio of the acceleration after 5 second and 3 second will be
   a. 2 b. 3 c. 4 d. 5

6. **INCORRECT** Statements is
   a. A vector of unit magnitude is known as unit vector.
   b. Concurrent forces can always be reduced to a single force.
   c. Center of gravity cannot be found by integration method.
   d. Center of mass is the point where the entire mass of a body may be assumed to be concentrated.

7. **CG** of the semicircular arc is
   a. $(2r/\pi)$ above the base
   b. $(4r/3\pi)$ above the base
   c. $(3r/8)$ above the base
   d. $(r/2)$ above the base

8. **CORRECT** Statements about the MOI is
   a. For rectangle ($BD^3/3$) about CG
   b. For rectangle ($BD^3/12$) about Base
   c. For triangle ($BH^3/12$) about CG
   d. For Solid Circle ($\pi D^4/64$) about CG

9. Area of the Given sub parabolic area is
   a. (ab/3)
   b. (ab/4)
   c. (ab/5)
   d. (ab/6)



10. The maximum BM introduced due to UDL of 4 (kN/m), if the span of the cantilever is 1.8 meter is
    a. 2.16 kNm b. 1.08 kNm c. 5.48 kNm d. 6.48 kNm

11. A beam is hinged at both ends and loaded with a triangular load having maximum intensity of (W) at center, maximum bending moment and shear force are:
    a. ($WL^2/12$), ($WL/10$)
    b. ($WL^2/12$), ($WL/4$)
    c. ($WL^2/10$),($WL/10$)
    d. ($WL^2/10$),($WL/4$)

12. In a cantilever beam a point load is applied at free end. Choose the **CORRECT** statement
    a. SF varies linearly from free end to fixed end
    b. SF is uniformly throughout the beam
    c. BM is uniformly throughout the beam
    d. Nature of the BM is parabolic.

13. Degree of static indeterminacy (DSI) of structure depend on
    a. Loading
    b. Types of materials
    c. Cross Section of the member
    d. Types of joint/Support

14. A pin jointed frame with J number of joints and N number of members will be a perfect frame if
    a. $N+3 > 2J$ b. $N+3 < 2J$ c. $N-3 = 2J$ d. $N+3 = 2J$

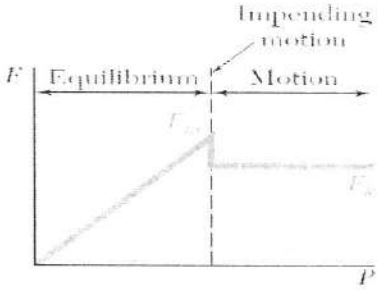
15. The analysis of a structure is
    a. Deciding material of the member
    b. Deciding the dimension of the member
    c. Planning of the structure
    d. Calculating the magnitudes and nature of various straining actions at salient points of the structure

16. The statically indeterminate structure can be solved by
    a. Using static equations an compatibility equations
    b. Using the equation of the statics alone
    c. Equation of compatibility alone
    d. Ignoring all the reactions and assuming the structure to be rigid

17. The position of a particle is defined by $x = t^3 - 6t^2 - 15t + 40$, then the time at which velocity becomes zero is
    a. 2 seconds b. 5 seconds c. 3 seconds d. 1 seconds

18. Shown is a graph of Frictional Force (F) with an action of External force (P), F_k Kinetic friction force depends on

a. Coefficient of static friction
b. Coefficient of kinetic friction
c. Mass of the body
d. Area of the body

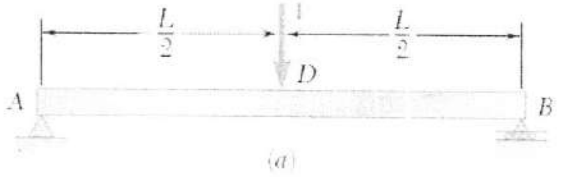


19. Shown is a graph of Frictional Force (F) with an action of External force (P), F_k Kinetic friction force depends on

a. Coefficient of static friction
b. Mass of the body
c. Area of the body
d. Coefficient of kinetic friction

20. For the beam and loading shown

a. SFD is rectangular
b. SFD is parabolic
c. BMD is parabolic
d. BMD is cubic



(a)

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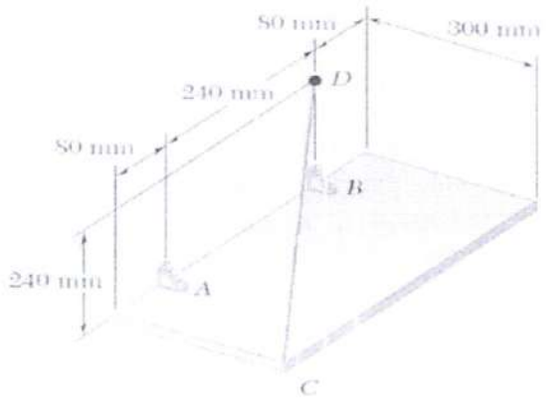
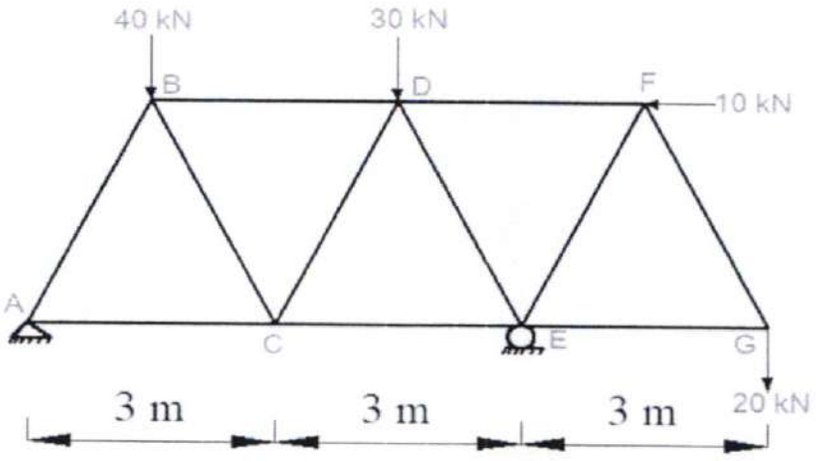
SECTION "B"
[40 marks]

Attempt ALL questions. Assume suitable data if necessary.

1. A rectangular plate is supported by brackets at A and B and by a wire CD. If the tension in the wire is 200 N, Determine the moment about A of the force exerted by the wire on point C. [4]

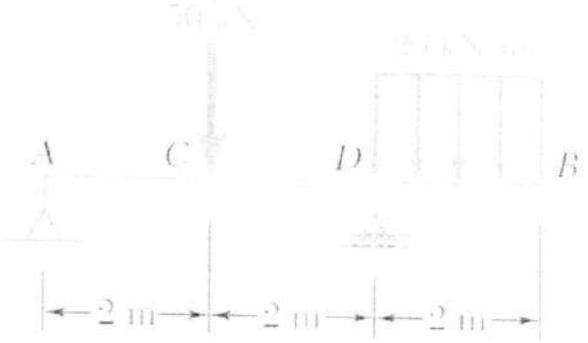


2. For the Given 2D Truss, Determine the member forces (with nature) of the given truss ***(by Joint method).*** Each member are of 3 meter long and each internal angle are of 60 degree. [6]

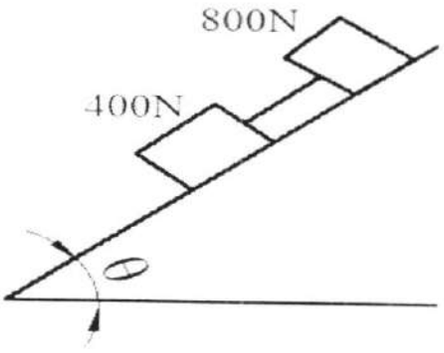


P.T.O.

3. Draw Shear Force Diagram (SFD) and Bending Moment Diagram (BMD) of the given beam showing important points and salient features. [4+4=8]



4. A cord connects two bodies of weights 400 N and 800 N. The two bodies are placed on an inclined plane and cord is parallel to inclined plane. The coefficients of friction for the weight of 400 N is 0.15 and that for 800 N is 0.4. Determine the inclination θ of the plane to the horizontal and tension in the cord when the motion is about to take place down the inclined plane. Body weighing 400 N is below the body weighing 800 N as shown in figure. [4]



5. For the Given Area Determine

i. The centroid of the area Figure 5 (a) [4]

ii. Determine the moment of inertia and the radius of gyration of the area Figure 5 (b) with respect of the x-axis. [4]

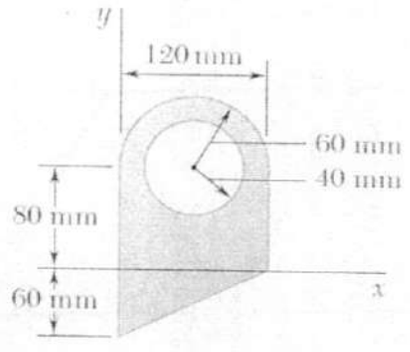


Figure 5 (a)

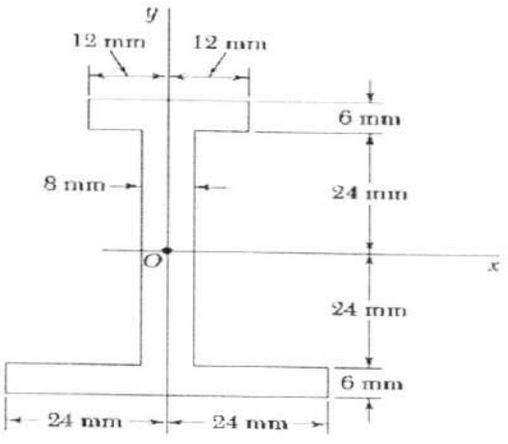


Figure 5 (b)

6. The position of a particle moving along a straight line is defined by the relation $x = t^3 - 6t^2 - 15t + 40$, where x is expressed in feet and t in seconds.

Determine: [4]

a. The time at which the velocity is zero
b. The position and distance travelled by the particle at that time
c. The acceleration of the particle at that time
d. Distance travelled by the particle from t = 4 to t = 6 seconds.

7. A team of engineering students designs a medium size catapult which launches 8-lb steel spheres. The launch speed is 80 ft/sec, the launch angle is 35 degree above the horizontal, and the launch position is 6 ft above the ground level. The students use an athletic field with an adjoining slope topped by an 8 ft fence as in figure. **Determine:**

a. The time duration (T_f) of the flight. [3]
b. The co-ordinates (x , y) of the point of the first impact. [3]