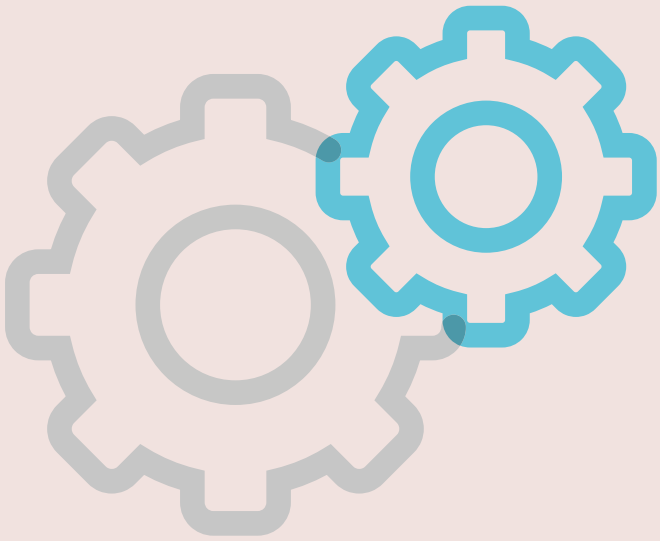
ME 212 PROJECT



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OBJECTIVE

To solve the below solid mechanics problem using MATLAB software

TECHNOLOGIES USED

MATLAB software and its Live Script functionality is used to solve the problem.

PROBLEM STATEMENT

Sketch the shear force and bending moment diagrams and label the corresponding values for the simply supported beam as shown in Figure 2.

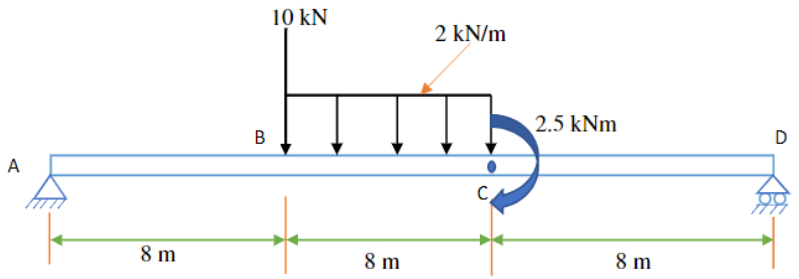
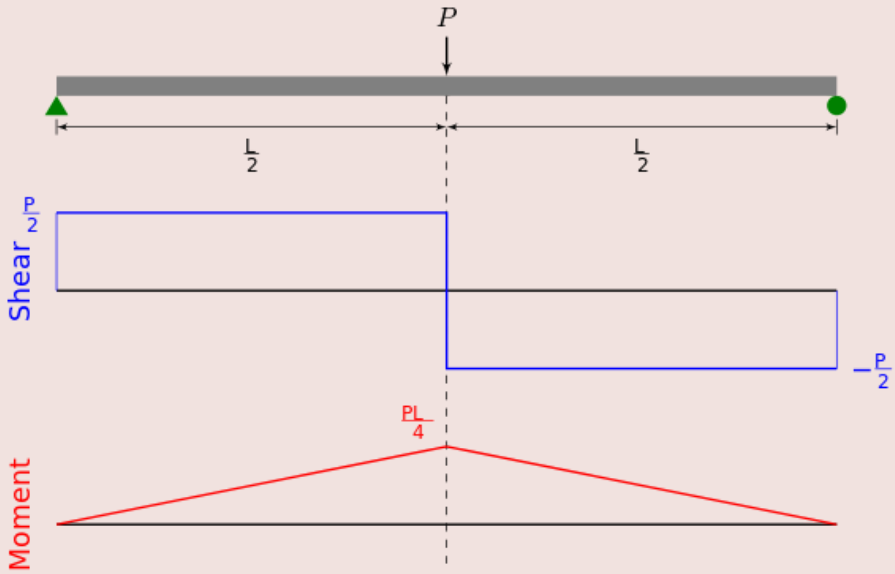
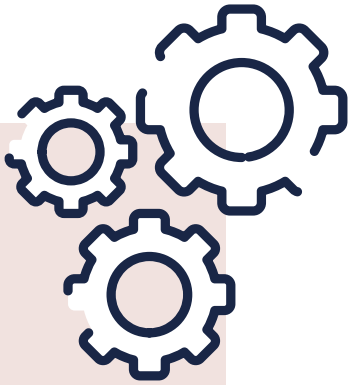


Figure 2

THEORY

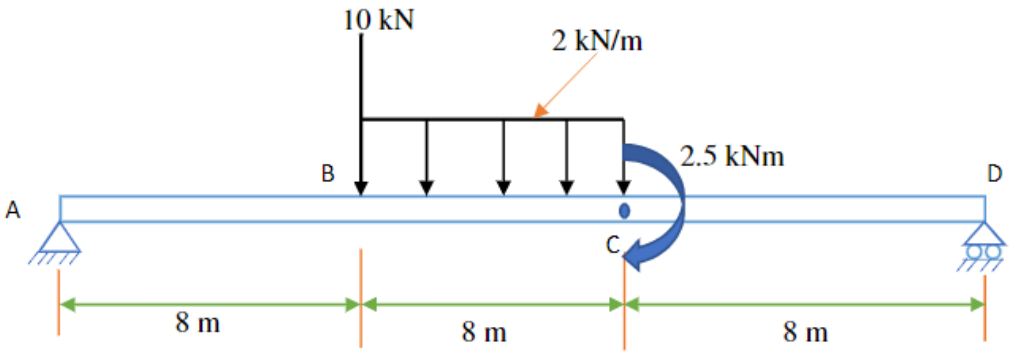
Shear and bending moment diagrams are analytical tools used in conjunction with structural analysis to help perform structural design by determining the value of shear force and bending moment at a given point of a structural element such as a beam. These diagrams can be used to easily determine the type, size, and material of a member in a structure so that a given set of loads can be supported without structural failure. Another application of shear and moment diagrams is that the deflection of a beam can be easily determined using either the moment area method or the conjugate beam method.





SOLUTION USING MATLAB LIVE SCRIPT

Solution:



Finding out Reaction Forces at A and D

Since the beam is in equilibrium in y direction, the net force in y direction will be 0.

Σ Fy = 0

A + D – 10 – 16 = 0

Now the moment of all forces about A is 0

Σ MA = 0

(10*8) + (12*2*8) + 2.5 – (D * 24) = 0

```
syms a d
eqn1 = a + d - 10 - 16 == 0;
eqn2 = (10*8) + (12*2*8) + 2.5 - (d * 24) == 0;
%%%% Solving the 2 equations to find reaction at a and d %%%%
sol = solve([eqn1, eqn2], [a , d]);
```

```
%%%% A and D are reaction forces at a and d respectively %%%%
A = sol.a
```

```
A =
```

$$\frac{233}{16}$$

```
D = sol.d
```

```
D =
```

$$\frac{183}{16}$$

Shear Force diagram:-

- When x is between A to B:-

```
%%%% F1 is the shear force at a position x between A and B %%%%
syms x F
eqn = A - F == 0;
F1 = solve(eqn,F)
```

F1 =

$$\frac{233}{16}$$

- When x is between B to C:-

```
%%%% F2 is the shear force at a position x between B and C %%%%
syms x F
eqn = A - 10 - 2*(x - 8) - F == 0;
F2 = solve(eqn,F)
```

F2 =

$$\frac{329}{16} - 2\,x$$

- When x is between C to D:-

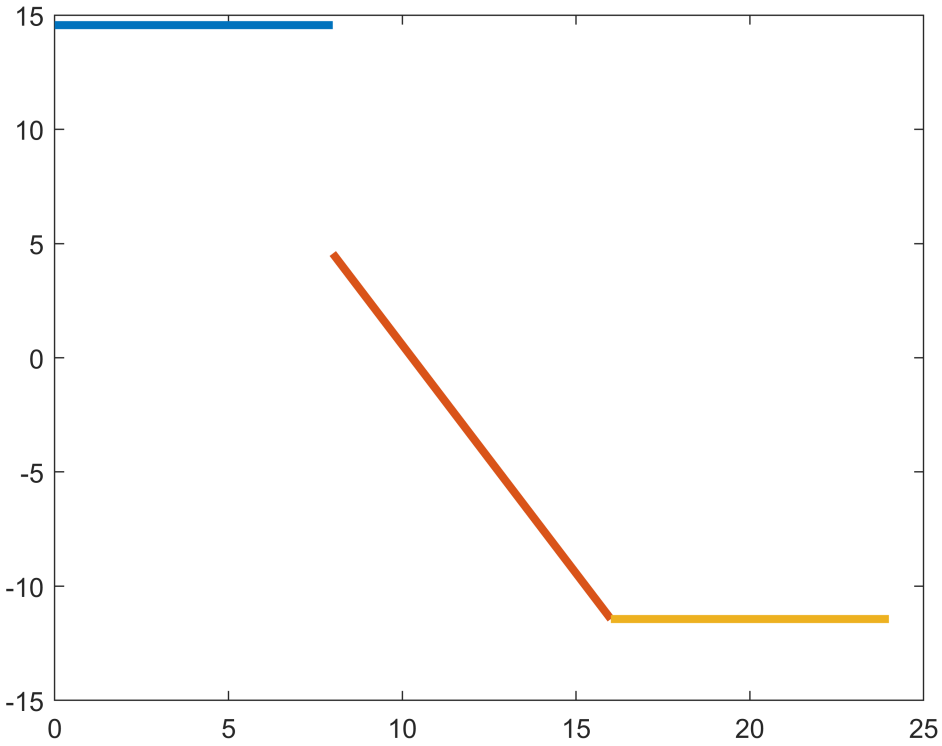
```
%%%% F3 is the shear force at a position x between C and D %%%%
syms x F
eqn = A - 10 - 2*8 - F == 0;
F3 = solve(eqn,F)
```

F3 =

$$-\frac{183}{16}$$

Now plotting the shear force diagram

```
%%%% Plotting shear force diagram %%%%
t = linspace(0,8);
plot(t, subs(F1,t),'LineWidth',3);
hold on;
t = linspace(8,16);
plot(t, subs(F2,t),'LineWidth',3);
hold on;
t = linspace(16,24);
plot(t, subs(F3,t),'LineWidth',3)
hold off;
```



Bending Moment diagram:-

- When x is between A to B:-

```
%%%% M1 is the shear force at a position x between A and B %%%%
syms x M
eqn = M == A*x;
M1 = solve(eqn,M)
```

```
M1 =
```

$$\frac{233\,x}{16}$$

- When x is between B to C:-

```
%%%% M2 is the shear force at a position x between B and C %%%%
syms x M
eqn = M == A*x - 10*(x - 8) - 2*(x - 8)*(x - 8)/2;
M2 = solve(eqn,M)
```

```
M2 =
```

$$-x^2+\frac{329\,x}{16}+16$$

- When x is between C to D:-

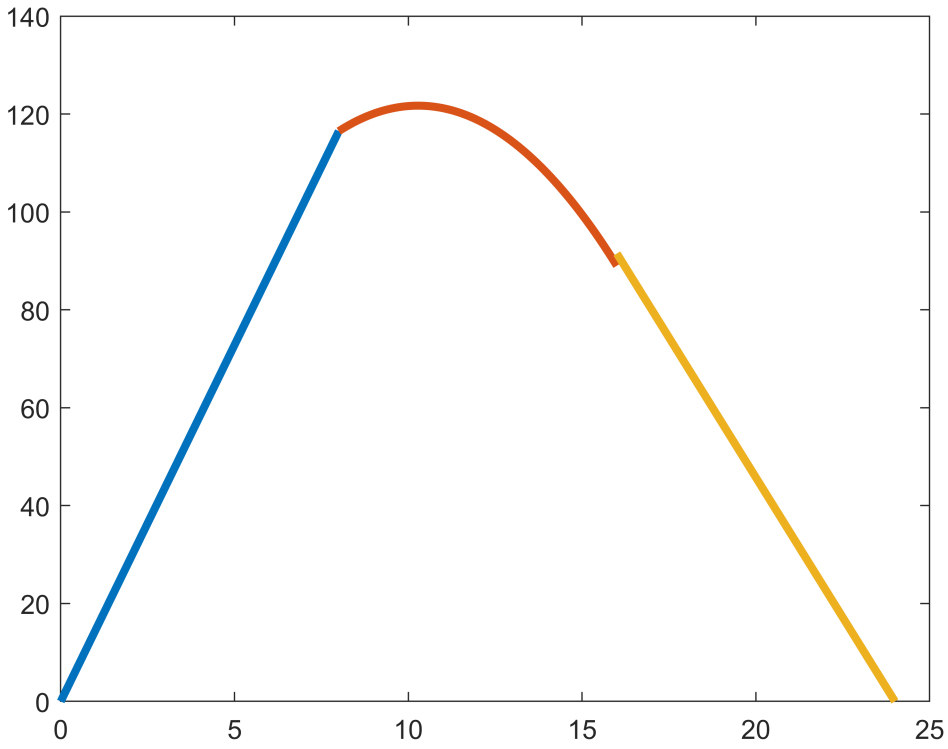
```
%%%% M3 is the shear force at a position x between C and D %%%%
syms x M
eqn = M == A*x - 10*(x - 8) - 2*(8)*(x - 12) + 2.5;
M3 = solve(eqn,M)
```

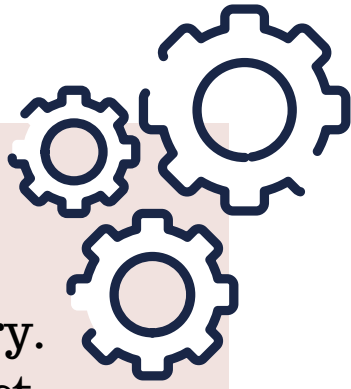
```
M3 =
```

$$\frac{549}{2} - \frac{183\,x}{16}$$

Now plotting the bending moment diagram

```
%%%% Plotting the bending moment diagram %%%%
t = linspace(0,8);
plot(t, subs(M1,t),'LineWidth',3);
hold on;
t = linspace(8,16);
plot(t, subs(M2,t),'LineWidth',3);
hold on;
t = linspace(16,24);
plot(t, subs(M3,t),'LineWidth',3)
hold off;
```





REPOSITORY LINKS

The MATLAB code is hosted in a public repository.
https://github.com/Soumadipdas18/me212-project

CONCLUSION

Here, I have come to the end of the project. I tried my best to include all the necessary points that are required related to the given topic. I do hope that my project will be interesting and may be even knowledgeable.