# Daffodil International University

### B. Sc. in Civil Engineering
### Midterm Examination, Fall - 2024

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| Course Code: CE 311 | Course Title: Structural Analysis | |
| Section: BN1, BN2 | Level-Term: 3-1 | Teacher's Initial: MR |
| Full Marks: 25 | Date: September 30, 2024 | Time: 1.5 Hours |

*Note: There are three questions in total. Answer all of them. Assume any reasonable value if not provided. The figures in the right-hand margin indicate full marks.*

1. a). Calculate the maximum shear force and maximum moment at point "C" of a simply supported beam having 60 ft length due to the multiple wheel loads as shown in Figure-01. *[CO3, C3]* [06]
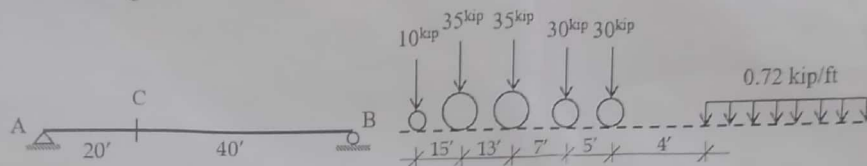


Figure-01

b). Illustrate the influence lines with ordinate for the beam shown in Figure-02. [04]
(i) Vertical reactions at points B and D, (ii) Shear forces at just left and right of support D, (iii) Vertical reaction at point D and shear force at point E and (iv) Moments at C and E. *[CO3, C3]*
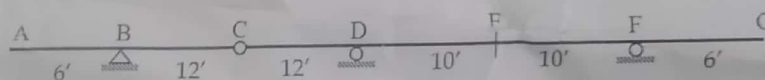


Figure-02

2. a). Calculate the vertical displacement of joint A of the truss shown in Figure-03 using the method of virtual work. Each bar is made of steel and has a cross-sectional area of 600 mm² and E= 200 GPa. *[CO4, C4]* [06]

The virtual-work equation for the truss is, $1. \Delta = \Sigma \frac{nNL}{AE}$
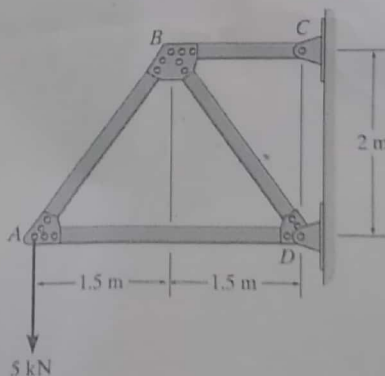


Figure-03

1

b). Calculate the displacement of point B of the steel beam shown in Figure-04 using [04] the method of virtual work. Take $I = 500 \times 10^6$ mm$^4$ and $E = 200$ GPa. [CO4, C4]

The virtual-work equation for the beam is, $1 \cdot \Delta = \int_0^L \frac{mM}{EI} dx$
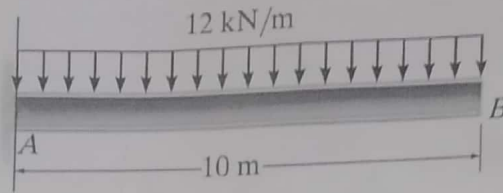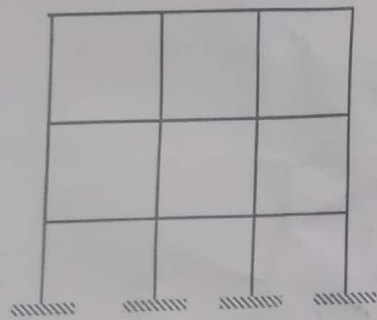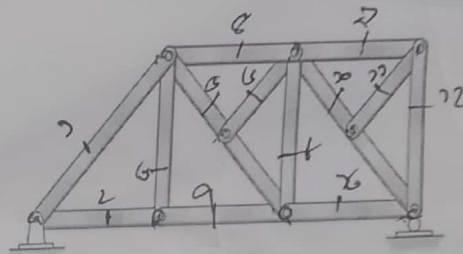
12 kN/m

A

B

—10 m—

Figure-04

3. Explain external, internal and geometrical stability and determinacy of the [05] structures shown in Figure-05. Also identify the DOI of the indeterminate structures. [CO1, C2]
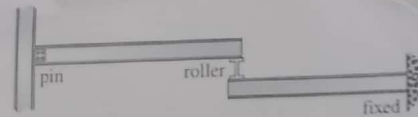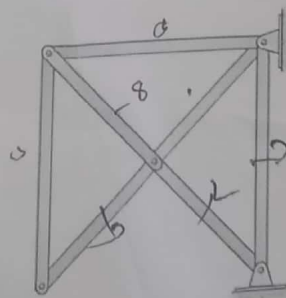
(i)

(ii)

(iii)

(iv)

(v)

Figure-05