INTERNATIONAL UNIVERSITY OF EAST AFRICA
'Learning to Succeed'

FACULTY OF ENGINEERING

END OF SEMESTER EXAMINATIONS - APRIL 2025

PROGRAMME: BACHELOR IN CIVIL ENGINEERING

YEAR/SEM: 2/2

COURSE CODE: BCE2203

NAME: COMPUTING FOR CIVIL ENGINEERING

DATE: 23rd/04/2025
TIME: 9:00am- 12:00pm

Instructions to candidates:

- Attempt **any FIVE questions** for full marks (100 marks)
- Do not open this examination until you are told to do so
- All rough work should be in your answer booklet
- The time allowed for this examination is strictly three hours

- On the first page of your answer booklet
  - Write your registration number properly
  - Write the course name and course code
  - Write examination venue
  - Do not write, draw or scratch anything else on the first page
  - Writing unnecessary information like phone numbers in the first page shall annul your exam
  - Answer booklets that do not carry the required information, or that have unnecessary writing in the first page shall not be marked

SPECIFIC INSTRUCTIONS TO THIS PAPER

- DON'T FORGET TO WRITE YOUR REG NUMBER IN THE FIRST SCRIPT
- THE INPUT AND OUTPUT SHOULD BE COPIED AND PASTED IN A WORD DOCUMENT, WHICH WILL THEN BE CONVERTED INTO PDF WHICH WILL BE SUBMITTED.
- IN THE CASE OF A GRAPH AS THE OUTPUT, COPY THE GRAPH AND THE SCRIPT (OR SCREENSHOT)
- IN CASE OF THE OUTPUT IN THE COMMAND WINDOW, TAKE A SCREENSHOT OF THE SCRIPT INCLUDING THE OUTPUT IN THE COMMAND WINDOW.
- **OR USE PUBLISH COMMAND TO GENERATE A PDF**
- **Submit to barozi.victor@iuea.ac.ug**

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Question 1 (20 marks)

A simply supported beam of length L = 10 m carries a uniformly distributed load (UDL) of $w = 15\text{kN/m}$.
The beam is made of steel, with the following properties:

- Young's Modulus: E = 70GPa
- Moment of Inertia: I = 0.0008 m^4

The beam experiences deflection and shear force at various positions x along its length.
Formulae:

1 Deflection Equation:

$$y(x) = \frac{w}{24EI}(x^4 - 2Lx^3 + L^3x)$$

- Where $y(x)$ is the vertical deflection at point x.

2 Shear Force Equation:

$$V(x) = \frac{wL}{2} - wx$$

- Where $V(x)$ is the shear force at point x.

Task: Write a MATLAB script that

1 Defines given parameters: L, w, E, I.
2 Computes and plots the deflection curve $y(x)$ for $x = 0$ to L.
3 Computes and plots the shear force diagram $V(x)$ for $x = 0$ to L.
4 Uses a 1×2 subplot layout:
- First subplot: Deflection curve $y(x)$ (blue line).
- Second subplot: Shear force diagram $V(x)$ (red line).
5 Highlights key points:
- Marks the maximum deflection on the plot.
- Marks the point of zero shear force.
6 Adds appropriate labels, titles, and legends for clarity.

Question 2 (20 marks)

a. Use the wind pressure formula:

$$p = kv^2$$

where $k = 0.0006$ and v (wind speed) varies from 0 to 50 km/h.

Compute wind load acting on the building façade for different wind speeds.

Plot wind speed vs. wind pressure using MATLAB's plot function. **(10 marks)**

b. Compare compressive strength of three materials:
   - Concrete (30 MPa)
   - Steel (250 MPa)
   - Brick (10 MPa)

   Use a bar chart to visually compare the strengths. Label the axes and add a title & legend. **(10 marks)**

Question 3 (20 marks)

a. Given a foundation load of 5000 kN, calculate the required footing area using:

$$A = p/q$$

where P is the applied load and q is the soil bearing capacity (assume $q = 250\ kN/m2$).

Compute the foundation width for a square footing.

Display the result using fprintf (). **(10 marks)**

b) Write a script using 'If – elseif-else' statement that:

- Takes a user input number. (Any number of your choice)
- Checks if the number is positive, negative, or zero.
- Displays the appropriate message. **(10 marks)**

Question 4 (20 marks)

A civil engineer wants to analyze the deflection of a simply supported beam under a uniformly distributed load (UDL). The beam follows the standard deflection formula:

$$y(x) = \frac{wL^4}{384EI}(-x^4 + 2Lx^3 - L^3x)$$

where:

- $y(x) =$ Deflection at position x along the beam (m)
- $w =$ Load intensity ($\mathrm{kN/m}$)
- $L =$ Beam span (m)
- $E =$ Young's modulus (Pa)
- $I =$ Moment of inertia (m^4)
- $x =$ Position along the beam (m), from 0 to L

Task:

Write a MATLAB script that:

1. Defines parameters for a beam of length $15\ \mathrm{m}, \mathrm{w} = 15\mathrm{kN/m}, \mathrm{E} = 210\mathrm{GPa}$, and $\mathrm{I} = 0.0008\ \mathrm{m}^4$.
2. Computes and plots the deflection curve $y(x)$ from $x = 0$ to $x = L$.
3. Labels the axes properly and adds a title.
4. Highlights the maximum deflection on the graph using a marker.

Question 5 (20 marks)

Write a MATLAB script that:

1. Takes the age of a building (in years) as input from the user.
2. Uses if statements to classify the building as:
    - New Building (Age < 10 years)
    - Moderately Aged Building (10 ≤ Age ≤ 50 years)
    - Old Building (Age > 50 years)
3. Displays an appropriate message indicating the category of the building.

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Question 6 (20 marks)

A civil engineering firm monitors the load distribution (in kN) on a bridge at different spans:

spans = {'A1', 'A2', 'A3', 'A4', 'A5', 'A6'};

load = [160, 190, 175, 210, 225, 215];

Task:

Write a MATLAB script that:

1 Creates a 1×2 subplot layout.

2 In the first subplot:

- Displays the load distribution across the spans using a horizontal bar plot.

3 In the second subplot:

- Plots the same load data using a dashed line plot with circular markers.

4 Enhances the plots by:

- Adding titles, axis labels, and legends for clarity.
- Setting different colors for the plots to improve readability.

Question 7 (20 marks)

A reinforced concrete beam must carry an applied load safely. The beam's capacity is calculated as:

$$P_n = 0.85 f_c' A_g + f_y A_s$$

where:

- $f_c' = 30\text{MPa}$ (Concrete strength)
- $f_y = 500\text{MPa}$ (Steel yield strength)
- $A_g = 0.3 \times 0.5\ \text{m}^2$ (Gross area)
- $A_s = 0.005 \times A_g$ (Steel reinforcement area)
- P_n is the beam capacity (in kN)

Task:
Write a MATLAB script that:

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1. Computes the beam capacity P_n.
2. Takes user input for the applied load P_{applied} in kN.
3. Checks if the beam is safe ($P\_n >= P\_\{\text{applied}\}$) and displays a message.