COMPUTER AIDED ENGINEERING LAB [ME404]

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ARITHEMATIC OPERATIONS

- Addition of Matrix
- Subtraction of Matrix
- Multiplication of Matrix
- Power of Matrix
- Transpose of Matrix
- Inverse of Matrix

ADDITION OF MATRICES

- E.g

```
A = [1 2; 3 4];
B = [5 6; 7 8];

C = A + B
```

```
ans
C =
     6     8
    10    12
```

```
A = [1 2 3; 4 5 6;7 8 9];

B = [9 8 7; 6 5 4;3 2 1];

C = A + B
```

```
Ans
C =
    10    10    10
    10    10    10
    10    10    10
```

Subtraction of Matrix

- E.g

```
A = [5 6; 7 8];
B = [1 2; 3 4];

C = A - B


ans
C =
     4     4
     4     4
```

```
A = [9 8 7; 6 5 4;3
2 1];

B = [1 2 3; 4 5 6;7
8 9];

C = A - B
Ans
C =
     8     6     4
     2     0    -2
    -4    -6    -8
```

Multiplication of Matrix

- E.g

Simple Multiplication

```
A = [1 2; 3 4];
B = [5 6; 7 8];

C = A * B
```

Ans

```
C =
    19    22
    43    50
```

Element-wise Multiplication

```
A = [1 2; 3 4];
B = [5 6; 7 8];

C = A .* B
```

Ans

```
C =
     5    12
    21    32
```

Transpose of Matrix

- E.g

```
A = [1 2; 3 4];

A_transpose = A'


Ans
A_transpose =
     1     3
     2     4
```

```
A = [1 2 3;
     4 5 6;
     7 8 9];

A_transpose =
A'

  Ans
  A_transpose =
       1     4     7
       2     5     8
       3     6     9
```

Inverse of Matrix

- E.g Shortcut Method

```
A = [2 1; 5 3];

A_inv = inv(A)
```

Ans

```
A_inv =
    3   -1
   -5    2
```

Conventional Method

```
A = [2 1; 5 3];

Det_A = det(A);
Adj_A = adjoint(A);

A_inv_c = Adj_A /
Det_A
```

Power of Matrix

- E.g. Simple Power

```
A = [2 1; 1 2];

A_squared = A^2
```

```
Ans
A_squared =
     5     4
     4     5
```

Element-wise Power

```
A = [2 3;
     4 5];

B = A.^2
```

```
Ans
B =
     4     9
    16    25
```

CONTROL LOOPS

For Loop:

- It is used when the number of iterations are **known**.
- E.g.

```
for i = 1:5
    disp(i)
end
```

ans = 1 2 3 4 5

While Loop:

- It is used when the number of iterations are **unknown.**
- The loop runs as long as a **logical condition is true**.
- E.g.

```
i = 1;
while i <= 5
    disp(i)
    i = i + 1;
end
```

Ans = 1 2 3 4 5

CONDITION

❑ If Condition :

- The if statement is used to **make decisions** in MATLAB. It checks a **logical condition**, and **executes a block of code** only when the condition is true.
- It’s commonly used in:
  - Comparing values
  - Conditional operations
  - Decision-making logic
- E.g.

```
x = 10;
if x > 5
    disp('x is greater than 5’);
end

ans = x is greater than 5
```

FUNCTION

- Anonymous Function:
  - Simple and used for quick mathematical calculations.
  - Defined in single line without using the word **function.**
  - E.g.

f = @(arguments)
expression;

$$f = @(x)x^3 + 4x^2 - 0.5 * \exp(x);$$
$$result = f(4);$$

Ans =?

Cylinder Area and perimeter (r,h,pi)

- function [out1, out2] = func(arg1, arg2)

- out1 =
- out2 =
- end

User-defined Function:

- Multi-line function in separate file i.e. (.m).
- Used when the complex expressions, logics are used.
- It is defined using **function** keyword at the beginning of the file.
- E.g.

```
function result = addTwoNumbers(a, b)
    result = a + b;
end
```

```
x = addTwoNumbers(5, 8);
```

```
 ans = 13
```

EXERCISE

- Create two matrices A and B of equal size. Perform addition, subtraction and multiplication on them.
- Create a matrix, A of 3 x 4 size with natural numbers starting from 1.
- Retrieve a particular column / row.
- Append a row
- Append a column
- Delete a row
- Delete a column
- Replace a number in the matrix
- Replace a row in the matrix

- Create a vector v = [1 2 3 4 5 6 7 8] using: operator.
- Find $v^2, v/2, v^7$.

FUNCTION

- Computation with multiple anonymous functions: Create three anonymous functions corresponding to the following expressions:
- i. $f\ (x) = x^4 - 8x^3 + 17x^2 - 4x - 20$
- ii. $g(x) = x^2 - 4x + 4.$
- iii. $h(x) = x^2 - 4x - 5.$
- (a) Evaluate *f(x) - g(x) h(x)* at x = 3.
- (b) Evaluate *f(x) - g(x) h(x)* at x = [1 2 3 4 5].
- (c) Evaluate *f(x)/g(x) - h(x)* for any x.

- A thin-walled cylindrical pressure vessel is used in an industrial setup to store compressed air. For safety and durability analysis, you are tasked with calculating the hoop stress and the longitudinal stress developed in the cylinder wall due to the internal pressure. The internal pressure is 8MPa. Diameter of the pressure vessel is 500mm and the wall thickness is 0.01m. Now find the Hoop stress and Longitudinal Stress by using User-defined function.

- Using if-else loop write a script file that calculates the tip in a restaurant according to the amount of the bill. If the bill is less than Rs.10 the tip is Rs.1.80. between Rs.10 and Rs 60 the tip is 18% of the bill. Above Rs.60 the tip is 20% of the bill.