In Class Problems Chapter 1
Develop the Pseudocode and MATLAB code for the following Problems
Problem 1

In fluid mechanics, the Reynolds number (Re) is a dimensionless quantity that helps predict flow patterns in different fluid flow situations. It is defined as:

$$Re = \frac{\rho\, v\, L}{\mu}$$

where:
ρ is the density of the fluid (in kg/m³),
v is the flow velocity (in m/s),
L is the characteristic length (in meters),
μ is the dynamic viscosity of the fluid (in Pa·s).

The flow is considered laminar if Re < 2000, transitional if 2000 ≤ Re ≤ 4000, and turbulent if Re > 4000.

Write a MATLAB script that:

a. Prompts the user to input the values of ρ, v, L, and μ.
b. Calculates the Reynolds number based on the input values.
c. Determines the type of flow (laminar, transitional, or turbulent) based on the calculated Reynolds number.
d. Displays the calculated Reynolds number and the type of flow.

Your code should have the following aspects:

- Input Parameters:
  - Prompt the user to input the values for ρ, v, L, and μ.
- If-Else-If Statements:
  - Use if-else-if statements to determine the type of flow based on the calculated Reynolds number.
- Output:
  - Display the Reynolds number along with the corresponding flow type.

Check Outputs

For the following user Inputs : ρ = 1000 kg/m³ ,v = 2 m/s, L = 0.05 m, μ = 0.001 Pa·s
Your code should Display
"The Reynolds number is 100000.00, indicating Turbulent flow."
For the following user Inputs of ρ = 1000 kg/m³ ,v = 0.5 m/s, L = 0.01 m, μ = 0.001 Pa·s
Your code should Display
"The Reynolds number is 5000.00, indicating Turbulent Flow."

Problem 2

In thermodynamics, the Carnot efficiency of a heat engine is defined as the maximum possible efficiency that a heat engine can achieve operating between two reservoirs at temperatures *T_h* (temperature of the hot reservoir) and *T_c* (temperature of the cold reservoir). The Carnot efficiency η is given by:

$$\eta = 1 - \left(\frac{T_c}{T_h}\right)$$

where *T_h* and *T_c* are in Kelvin. (Kelvin = Celsius+273.15)

However, in real-world applications, engines do not operate at Carnot efficiency. The actual efficiency (η_actual) is usually lower and can be defined by the equation:

$$\eta_{actual} = \eta \times \left(1 - \frac{\Delta P}{P\_inital}\right)$$

where:

− η is the Carnot efficiency,
- ΔP is the pressure loss in the system,
- *P*_initial is the initial pressure.

Write a MATLAB script that:

a) Prompts the user to input the temperatures T_h and T_c (in Celsius), the initial pressure P_initial (in Pascals), and the pressure loss ΔP (in Pascals).
b) Converts the temperatures from Celsius to Kelvin.
c) Calculates the Carnot efficiency using the provided formula.
d) Calculates the actual efficiency using the provided formula.
e) Compares the actual efficiency to the Carnot efficiency and determines the efficiency loss in percentage terms.
f) Displays the Carnot efficiency, actual efficiency, and the percentage efficiency loss.

Your code should have the following aspects:

- Input Parameters:
  Prompt the user to input the values for *T_h, T_c, P_initial, and ΔP.*
- Temperature Conversion:
  Convert temperatures from Celsius to Kelvin.
- Efficiency Calculations:
  Calculate both the Carnot and actual efficiencies.
- Percentage Loss Calculation:
  Determine the percentage efficiency loss.
- Output:
  Display the Carnot efficiency, actual efficiency, and the percentage efficiency loss.

Check Outputs

For the following user Inputs: *T_h=600℃, T_c=100℃, P_initial=100000 Pa, and ΔP=20000Pa.*

Your code should Display

“ The Carnot efficiency is 57.26%.”

“ The actual efficiency is 45.81%.”

“ The efficiency loss is 20.00%.”

Problem 3

A company manufactures and sells three different models of laptops: Model A, Model B, and Model C. The pricing and specifications of these models are given in the table below:

Model	Processor Speed (GHz)	RAM (GB)	Storage(GB)	Battery Life (hours)	Price ($)
Model A	2.4	8	256	10	700
Model B	2.8	16	512	8	1000
Model C	3.2	32	1024	6	1500

Write a MATLAB script that:

a) Prompts the user to input their budget in dollars.
b) Determines which laptop models are affordable within the given budget.
c) Displays the specifications (Processor Speed, RAM, Storage) and price of each model that is within the user's budget
d) If none of the models are affordable, inform the user that none of the models fit within their budget.

Your code should have the following aspects:

- Input Parameters:
  Prompt the user to input their budget in dollars.
- If-Else-If Statements:
  Use if-else-if statements to determine which models can be purchased within the provided budget
- Display the specifications and price of each affordable model, or inform the user if none are affordable.

Check Outputs

- For the following user Inputs: Budget: $1200

  The output will be:

  "With a budget of $1200.00, you can afford the following models: Model B: Processor = 2.8 GHz, RAM = 16 GB, Storage = 512 GB, Price = $1000"

- For the following user Inputs: Budget: $1600
  The output might be:

  "With a budget of $1600.00, you can afford the following models: Model C: Processor = 3.2 GHz, RAM = 32 GB, Storage = 1024 GB, Price = $1500"

- For the following user Inputs: Budget: $600

  The output might be:

  "With a budget of $600.00, none of the models are within your budget."