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### ASSIGNMENT-3.3

SCHOOL OF COMPUTER SCIENCE AND ARTIFICIAL INTELLIGENCE		DEPARTMENT OF COMPUTER SCIENCE ENGINEERING	
Program Name: B. Tech		Assignment Type: Lab	Academic Year:2025-2026
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Course Code	23CS002PC304	Course Title	AI Assisted Coding
Year/Sem	III/I	Regulation	R23
Date and Day of Assignment	Week 2 - Wednesday	Time(s)	23CSBTB01 To 23CSBTB52
Duration	2 Hours	Applicable to Batches	All batches
Assignment Number: 3.3(Present assignment number)/24(Total number of assignments)			

Q.No.	Question	Expected Time to complete
1	<p><b>Lab 3: Application for TGNPDCL – Electricity Bill Generation Using Python &amp; AI Tools</b></p> <p><b>Lab Objectives</b></p> <ul style="list-style-type: none"> <li>To design a real-world electricity billing application using Python</li> <li>To use AI-assisted coding tools for logic generation and optimization</li> <li>To understand conditional logic and arithmetic operations</li> <li>To generate structured billing output similar to utility bills</li> </ul> <p><b>Lab Outcomes (LOs)</b> After completing this lab, students will be able to:</p>	Week2 - Wednesday

## ASSIGNMENT-3.3

- Read and validate user input in Python
- Apply conditional logic for tariff-based billing
- Use AI tools to assist in program development
- Calculate and display electricity bill components
- Build a complete real-time application

**Task 1: AI-Generated Logic for Reading Consumer Details****Scenario**

An electricity billing system must collect accurate consumer data.

**Task Description**

Use an AI tool (GitHub Copilot / Gemini) to generate a Python program that:

- Reads:
  - Previous Units (PU)
  - Current Units (CU)
  - Type of Customer
- Calculates units consumed
- Implements logic directly in the main program (no functions)

**Expected Output**

- Correct input reading
- Units consumed calculation
- Screenshot showing AI-generated code
- Sample input and output

```

C:\Users\shash> shash > AAC A (3.3).py > ...
1 # Simple electricity consumer data reader and units calculator
2
3 # Read inputs
4 previous_units = float(input("Enter Previous Units (PU): "))
5 current_units = float(input("Enter Current Units (CU): "))
6 customer_type = input("Enter Type of Customer (Domestic/Commercial/Industrial): ")
7
8 # Calculate units consumed
9 units_consumed = current_units - previous_units
10
11 # Output the result
12 print(f"Units Consumed: {units_consumed}")
  
```

```

PS C:\Users\shash> & 'c:\Users\shash\anaconda3\envs\Shashidhar\python.exe' 'c:\Users\shash\vs
231' '-' 'c:\Users\shash\AAC A (3.3).py'
Enter Previous Units (PU): 150
Enter Current Units (CU): 280
Enter Type of Customer (Domestic/Commercial/Industrial): Domestic
Units Consumed: 130.0
PS C:\Users\shash>
  
```

**Task 2: Energy Charges Calculation Based on Units Consumed****Scenario**

Energy charges depend on the number of units consumed and customer type.

**Task Description**

Review the AI-generated code from Task 1 and extend it to:

- Calculate **Energy Charges (EC)**
- Use conditional statements based on:
  - Domestic
  - Commercial
  - Industrial consumers
- Improve readability using AI prompts such as:

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- "Simplify energy charge calculation logic"
- "Optimize conditional statements"

**Expected Output**

- Correct EC calculation
- Clear conditional logic
- Original and improved versions (optional)
- Sample execution results

```

1  # Simplify energy charge calculation logic
2  # Optimize conditional statements
3
4  previous_units = float(input("Enter Previous Units (PU): "))
5  current_units = float(input("Enter Current Units (CU): "))
6  customer_type = input("Enter Type of Customer (Domestic/Commercial/Industrial): ")
7
8  # Calculate units consumed
9  units_consumed = current_units - previous_units
10
11 # Calculate Energy Charges (EC) based on type and slabs
12 if customer_type == "Domestic":
13     if units_consumed <= 100:
14         ec = units_consumed * 1.0
15     elif units_consumed <= 200:
16         ec = 100 * 1.0 + (units_consumed - 100) * 2.0
17     else:
18         ec = 100 * 1.0 + 100 * 2.0 + (units_consumed - 200) * 3.0
19 elif customer_type == "Commercial":
20     if units_consumed <= 100:
21         ec = units_consumed * 1.5
22     elif units_consumed <= 200:
23         ec = 100 * 1.5 + (units_consumed - 100) * 2.5
24     else:
25         ec = 100 * 1.5 + 100 * 2.5 + (units_consumed - 200) * 4.0
26 elif customer_type == "Industrial":
27     if units_consumed <= 100:
28         ec = units_consumed * 2.0
29     elif units_consumed <= 200:
30         ec = 100 * 2.0 + (units_consumed - 100) * 3.0
31     else:
32         ec = 100 * 2.0 + 100 * 3.0 + (units_consumed - 200) * 5.0
33 else:
34     ec = 0 # Invalid type
35     print("Invalid customer type!")
36
37 # Output
38 print(f"Units Consumed: {units_consumed}")
39 print(f"Energy Charges (EC): ${ec:.2f}")

```

PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL PORTS

```

Enter Previous Units (PU): 150
Enter Current Units (CU): 280
Enter Type of Customer (Domestic/Commercial/Industrial): Domestic
Units Consumed: 130.0
PS C:\Users\shash> cd 'c:\Users\shash'; & 'c:\Users\shash\anaconda3\envs\Shashi\python.exe' 'c:\Users\shash\sh\AAC A (3.3).py'
Enter Previous Units (PU): 150
Enter Current Units (CU): 280
Enter Type of Customer (Domestic/Commercial/Industrial): Domestic
Units Consumed: 130.0
Energy Charges (EC): $160.00
PS C:\Users\shash>

```

**Task 3: Modular Design Using AI Assistance (Using Functions)****Scenario**

Billing logic must be reusable for multiple consumers.

**Task Description**

Use AI assistance to generate a Python program that:

- Uses user-defined functions to:
  - Calculate Energy Charges
  - Calculate Fixed Charges
- Returns calculated values
- Includes meaningful comments

**Expected Output**

- Function-based Python program
- Correct EC and FC values
- Screenshots of AI-assisted function generation
- Test cases with outputs

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```
C:\Users\shash > AAC A (3.3).py > ...
1  # Modular Electricity Billing System
2
3  def calculate_energy_charges(customer_type, units_consumed):
4      """
5      Calculate Energy Charges based on customer type and units consumed.
6      Slabs: Domestic (1/2/3), Commercial (1.5/2.5/4), Industrial (2/3/5) per unit tiers.
7      """
8      if customer_type == "Domestic":
9          if units_consumed <= 100:
10             return units_consumed * 1.0
11          elif units_consumed <= 200:
12             return 100 * 1.0 + (units_consumed - 100) * 2.0
13          else:
14             return 100 * 1.0 + 100 * 2.0 + (units_consumed - 200) * 3.0
15      elif customer_type == "Commercial":
16          if units_consumed <= 100:
17             return units_consumed * 1.5
18          elif units_consumed <= 200:
19             return 100 * 1.5 + (units_consumed - 100) * 2.5
20          else:
21             return 100 * 1.5 + 100 * 2.5 + (units_consumed - 200) * 4.0
22      elif customer_type == "Industrial":
23          if units_consumed <= 100:
24             return units_consumed * 2.0
25          elif units_consumed <= 200:
26             return 100 * 2.0 + (units_consumed - 100) * 3.0
27          else:
28             return 100 * 2.0 + 100 * 3.0 + (units_consumed - 200) * 5.0
29      return 0 # Invalid type
30
31 def calculate_fixed_charges(customer_type):
32     """
33     Calculate Fixed Charges based on customer type.
34     Domestic: $100, Commercial: $200, Industrial: $300.
35     """
36     if customer_type == "Domestic":
37         return 100.0
38     elif customer_type == "Commercial":
39         return 200.0
40     elif customer_type == "Industrial":
41         return 300.0
42     return 0 # Invalid type
43
44 # Main program
45 previous_units = float(input("Enter Previous Units (PU): "))
46 current_units = float(input("Enter Current Units (CU): "))
47 customer_type = input("Enter Type of Customer (Domestic/Commercial/Industrial): ")
48
49 units_consumed = current_units - previous_units
50 ec = calculate_energy_charges(customer_type, units_consumed)
51 fc = calculate_fixed_charges(customer_type)
52
53 print(f"Units Consumed: {units_consumed}")
54 print(f"Energy Charges (EC): ${ec:.2f}")
55 print(f"Fixed Charges (FC): ${fc:.2f}")

PROBLEMS  OUTPUT  DEBUG CONSOLE  TERMINAL  PORTS

sh\AAC A (3.3).py
Units Consumed: 130.0
Energy Charges (EC): $160.00
PS C:\Users\shash> cd 'c:\Users\shash'; & 'c:\Users\shash\anaconda3\envs\Shashidhar\python.exe' 'c:\Users\shash\AAC A (3.3).py'
sh\AAC A (3.3).py
Enter Previous Units (PU): 150
Enter Current Units (CU): 280
Enter Type of Customer (Domestic/Commercial/Industrial): Domestic
Units Consumed: 130.0
Energy Charges (EC): $160.00
Fixed Charges (FC): $100.00
PS C:\Users\shash>

Welcome  SubSetSum.java  lab - 2.html  # lab - 2.css  JS lab - 2.js  resume dev

C:\Users\shash > AAC A (3.3).py > ...
3  def calculate_energy_charges(customer_type, units_consumed):
25      elif units_consumed <= 200:
26          return 100 * 2.0 + (units_consumed - 100) * 3.0
27      else:
28          return 100 * 2.0 + 100 * 3.0 + (units_consumed - 200) * 5.0
29      return 0 # Invalid type
30
31 def calculate_fixed_charges(customer_type):
32     """
33     Calculate Fixed Charges based on customer type.
34     Domestic: $100, Commercial: $200, Industrial: $300.
35     """
36     if customer_type == "Domestic":
37         return 100.0
38     elif customer_type == "Commercial":
39         return 200.0
40     elif customer_type == "Industrial":
41         return 300.0
42     return 0 # Invalid type
43
44 # Main program
45 previous_units = float(input("Enter Previous Units (PU): "))
46 current_units = float(input("Enter Current Units (CU): "))
47 customer_type = input("Enter Type of Customer (Domestic/Commercial/Industrial): ")
48
49 units_consumed = current_units - previous_units
50 ec = calculate_energy_charges(customer_type, units_consumed)
51 fc = calculate_fixed_charges(customer_type)
52
53 print(f"Units Consumed: {units_consumed}")
54 print(f"Energy Charges (EC): ${ec:.2f}")
55 print(f"Fixed Charges (FC): ${fc:.2f}")

PROBLEMS  OUTPUT  DEBUG CONSOLE  TERMINAL  PORTS

PS C:\Users\shash> cd 'c:\Users\shash'; & 'c:\Users\shash\anaconda3\envs\Shashidhar\python.exe' 'c:\Users\shash\AAC A (3.3).py'
sh\AAC A (3.3).py
Fixed Charges (FC): $100.00
PS C:\Users\shash> cd 'c:\Users\shash'; & 'c:\Users\shash\anaconda3\envs\Shashidhar\python.exe' 'c:\Users\shash\AAC A (3.3).py'
sh\AAC A (3.3).py
Enter Previous Units (PU): 0
Enter Current Units (CU): 250
Enter Type of Customer (Domestic/Commercial/Industrial): Commercial
Units Consumed: 250.0
Energy Charges (EC): $600.00
Fixed Charges (FC): $200.00
PS C:\Users\shash>
```

## ASSIGNMENT-3.3

**Task 4: Calculation of Additional Charges****Scenario**

Electricity bills include multiple additional charges.

**Task Description**

Extend the program to calculate:

- **FC** – Fixed Charges
- **CC** – Customer Charges
- **ED** – Electricity Duty (percentage of EC)

Use AI prompts like:

- *"Add electricity duty calculation"*
- *"Improve billing accuracy"*

**Expected Output**

- Individual charge values printed
- Correct duty calculation
- Well-structured output
- Verified intermediate results

```

C:\Users\shash > AAC A (3.3).py > ...
1  # Extended Electricity Billing with Additional Charges
2
3  def calculate_energy_charges(customer_type, units_consumed):
4      """
5      Calculate Energy Charges based on customer type and units consumed.
6      Slabs: Domestic (1/2/3), Commercial (1.5/2.5/4), Industrial (2/3/5) per unit tiers.
7      """
8      if customer_type == "Domestic":
9          if units_consumed <= 100:
10             return units_consumed * 1.0
11          elif units_consumed <= 200:
12             return 100 * 1.0 + (units_consumed - 100) * 2.0
13          else:
14             return 100 * 1.0 + 100 * 2.0 + (units_consumed - 200) * 3.0
15      elif customer_type == "Commercial":
16          if units_consumed <= 100:
17             return units_consumed * 1.5
18          elif units_consumed <= 200:
19             return 100 * 1.5 + (units_consumed - 100) * 2.5
20          else:
21             return 100 * 1.5 + 100 * 2.5 + (units_consumed - 200) * 4.0
22      elif customer_type == "Industrial":
23          if units_consumed <= 100:
24             return units_consumed * 2.0
25          elif units_consumed <= 200:
26             return 100 * 2.0 + (units_consumed - 100) * 3.0
27          else:
28             return 100 * 2.0 + 100 * 3.0 + (units_consumed - 200) * 5.0
29      return 0 # Invalid type
30
31  def calculate_fixed_charges(customer_type):
32      """
33      Calculate Fixed Charges based on customer type.
34      Domestic: $100, Commercial: $200, Industrial: $300.
35      """
36      if customer_type == "Domestic":
37          return 100.0
38      elif customer_type == "Commercial":
39          return 200.0
40      elif customer_type == "Industrial":
41          return 300.0
42      return 0 # Invalid type
43
PROBLEMS  OUTPUT  DEBUG CONSOLE  TERMINAL  PORTS
conda : The term 'conda' is not recognized as the name of a cmdlet, function, script file, or operable program
+ FullyQualifiedErrorId : CommandNotFoundException

PS C:\Users\shash> & "c:\Users\shash\anaconda3\envs\Shashi\python.exe" "c:\Users\shash\.vscode\extensions\ms-python.python\python\python.exe"
Enter Previous Units (PU): 150
Enter Current Units (CU): 200
Enter Type of Customer (Domestic/Commercial/Industrial): Domestic
Units Consumed: 130.0
Energy Charges (EC): $160.00
Fixed Charges (FC): $100.00
Customer Charges (CC): $50.00
Electricity Duty (ED): $16.00
PS C:\Users\shash>

```

The screenshot shows a VS Code editor with a Python script named `AAC A (3.3).py`. The script defines functions for calculating fixed charges, customer charges, electricity duty, and the total bill. It also includes a main program that takes user input for previous units, current units, and customer type, then calculates and displays the bill components and total.

```

31 def calculate_fixed_charges(customer_type):
32     if customer_type == "Domestic":
33         return 100.0
34     elif customer_type == "Commercial":
35         return 200.0
36     elif customer_type == "Industrial":
37         return 300.0
38     return 0 # Invalid type
39
40 def calculate_customer_charges():
41     """Fixed Customer Charges: $50 for all types."""
42     return 50.0
43
44 def calculate_electricity_duty(ec):
45     """Electricity Duty: 10% of Energy Charges."""
46     return 0.10 * ec
47
48 # Main program
49 previous_units = float(input("Enter Previous Units (PU): "))
50 current_units = float(input("Enter Current Units (CU): "))
51 customer_type = input("Enter Type of Customer (Domestic/Commercial/Industrial): ").strip()
52
53 if customer_type not in ["Domestic", "Commercial", "Industrial"]:
54     print("Invalid type! Defaulting to Domestic.")
55     customer_type = "Domestic"
56
57 units_consumed = current_units - previous_units
58 ec = calculate_energy_charges(customer_type, units_consumed)
59 fc = calculate_fixed_charges(customer_type)
60 cc = calculate_customer_charges()
61 ed = calculate_electricity_duty(ec)
62
63 # Print individual charges
64 print(f"Units Consumed: {units_consumed}")
65 print(f"Energy Charges (EC): ${ec:.2f}")
66 print(f"Fixed Charges (FC): ${fc:.2f}")
67 print(f"Customer Charges (CC): ${cc:.2f}")
68 print(f"Electricity Duty (ED): ${ed:.2f}")
69
70 # Calculate Total Bill
71 total_bill = ec + fc + cc + ed
72 print(f"Total Bill Amount: ${total_bill:.2f}")

```

The terminal output shows the execution of the script with the following inputs and results:

```

PS C:\Users\shash> & "c:\Users\shash\anaconda3\envs\Shashidhan\python.exe" "c:\Users\shash\vscode\extens
Enter Previous Units (PU): 150
Enter Current Units (CU): 280
Enter Type of Customer (Domestic/Commercial/Industrial): Domestic
Units Consumed: 130.0
Energy Charges (EC): $160.00
Fixed Charges (FC): $100.00
Customer Charges (CC): $50.00
Electricity Duty (ED): $16.00
PS C:\Users\shash>

```

### Task 5: Final Bill Generation and Output Analysis Scenario

The final electricity bill must present all values clearly.

#### Task Description

Develop the final Python application to:

- Calculate total bill:
- Total Bill = EC + FC + CC + ED
- Display:
  - Energy Charges (EC)
  - Fixed Charges (FC)
  - Customer Charges (CC)
  - Electricity Duty (ED)
  - Total Bill Amount
- Analyze the program based on:
  - Accuracy
  - Readability
  - Real-world applicability

#### Expected Output

- Complete electricity bill output
- Neatly formatted display
- Sample input/output
- Short analysis paragraph

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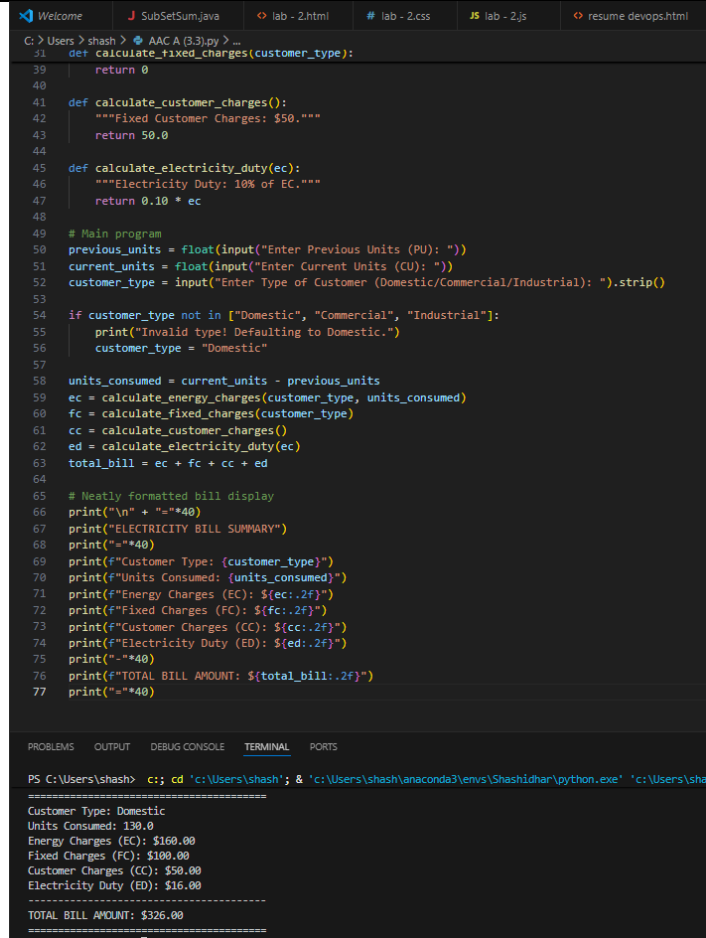
```
C: > Users > shash > AAC A (3.3).py > ...
1 # Final Electricity Bill Generator
2
3 def calculate_energy_charges(customer_type, units_consumed):
4     """
5     Calculate Energy Charges based on customer type and units consumed.
6     Slabs: Domestic (1/2/3), Commercial (1.5/2.5/4), Industrial (2/3/5) per unit tiers.
7     """
8     if customer_type == "Domestic":
9         if units_consumed <= 100:
10             return units_consumed * 1.0
11         elif units_consumed <= 200:
12             return 100 * 1.0 + (units_consumed - 100) * 2.0
13         else:
14             return 100 * 1.0 + 100 * 2.0 + (units_consumed - 200) * 3.0
15     elif customer_type == "Commercial":
16         if units_consumed <= 100:
17             return units_consumed * 1.5
18         elif units_consumed <= 200:
19             return 100 * 1.5 + (units_consumed - 100) * 2.5
20         else:
21             return 100 * 1.5 + 100 * 2.5 + (units_consumed - 200) * 4.0
22     elif customer_type == "Industrial":
23         if units_consumed <= 100:
24             return units_consumed * 2.0
25         elif units_consumed <= 200:
26             return 100 * 2.0 + (units_consumed - 100) * 3.0
27         else:
28             return 100 * 2.0 + 100 * 3.0 + (units_consumed - 200) * 5.0
29     return 0
30
31 def calculate_fixed_charges(customer_type):
32     """Fixed Charges: Domestic $100, Commercial $200, Industrial $300."""
33     if customer_type == "Domestic":
34         return 100.0
35     elif customer_type == "Commercial":
36         return 200.0
37     elif customer_type == "Industrial":
38         return 300.0
39     return 0
40
41 def calculate_customer_charges():
42     """Fixed Customer Charges: $50 """
43
44 PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL PORTS
45
46 PS C:\Users\shash> c:; cd 'c:\Users\shash'; & 'c:\Users\shash\anaconda3\envs\Shashidhar\python.exe' 'c:\V
47 Enter Previous Units (PU): 150
48 Enter Current Units (CU): 280
49 Enter Type of Customer (Domestic/Commercial/Industrial): Domestic
50
51 *****
52 ELECTRICITY BILL SUMMARY
53 *****
54 Customer Type: Domestic
55 Units Consumed: 130.0
56 Energy Charges (EC): $160.00
57 Fixed Charges (FC): $100.00
```

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```
39     return 0
40
41 def calculate_customer_charges():
42     """Fixed Customer Charges: $50."""
43     return 50.0
44
45 def calculate_electricity_duty(ec):
46     """Electricity Duty: 10% of EC."""
47     return 0.10 * ec
48
49 # Main program
50 previous_units = float(input("Enter Previous Units (PU): "))
51 current_units = float(input("Enter Current Units (CU): "))
52 customer_type = input("Enter Type of Customer (Domestic/Commercial/Industrial): ").strip()
53
54 if customer_type not in ["Domestic", "Commercial", "Industrial"]:
55     print("Invalid type! Defaulting to Domestic.")
56     customer_type = "Domestic"
57
58 units_consumed = current_units - previous_units
59 ec = calculate_energy_charges(customer_type, units_consumed)
60 fc = calculate_fixed_charges(customer_type)
61 cc = calculate_customer_charges()
62 ed = calculate_electricity_duty(ec)
63 total_bill = ec + fc + cc + ed
64
65 # Neatly formatted bill display
66 print("\n" + "="*40)
67 print("ELECTRICITY BILL SUMMARY")
68 print("="*40)
69 print(f"Customer Type: {customer_type}")
70 print(f"Units Consumed: {units_consumed}")
71 print(f"Energy Charges (EC): ${ec:.2f}")
72 print(f"Fixed Charges (FC): ${fc:.2f}")
73 print(f"Customer Charges (CC): ${cc:.2f}")
74 print(f"Electricity Duty (ED): ${ed:.2f}")
75 print("="*40)
76 print(f"TOTAL BILL AMOUNT: ${total_bill:.2f}")
77 print("="*40)
```

PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL PORTS

```
PS C:\Users\shash> cd 'c:\Users\shash'; & 'c:\Users\shash\anaconda3\envs\Shashidhar\python.exe' 'c:\Users\shash\...'
Customer Type: Domestic
Units Consumed: 130.0
Energy Charges (EC): $160.00
Fixed Charges (FC): $100.00
Customer Charges (CC): $50.00
Electricity Duty (ED): $16.00
TOTAL BILL AMOUNT: $326.00
```

**Note:** Report should be submitted as a word document for all tasks in a single document with prompts, comments & code explanation, and output and if required, screenshots.