

**University of Asia Pacific**  
**Department of Computer Science and Engineering**  
**Program: B.Sc. in CSE**

**Final Examination**

**Fall-2022**

**1<sup>st</sup> Year 2<sup>nd</sup> Semester**

**Course Code: CSE 103**

**Course Title: Structured Programming**

**Credit: 3**

**Time: 3.00 Hour.**

**Full Mark: 150**

**Instructions:**

1. There are Six (6) Questions. Answer all of them. All questions are of equal value. Part marks are shown in the margins.
2. Non-programmable calculators are allowed.
3. Suppose you are answering the OR part of any question, please mention it as "Answer to the question no: <question no> (OR)".

*For example: Answer to the question no - 1(OR)*

- X. a. What is the difference between "H" and 'H' ? [5] CO1
- b. What is the output of the following program? [5] CO3

```
char s1[30] = "Den";
char s2[30] = "Marking";
strncat(s1, s2, 4);
printf("%s", s1);
```

- c. Write down a program that will take a word as input and determine whether the word is a palindrome or not. A palindrome is a word that reads the same way backward as forward. [15] CO5

Examples of palindrome words: MOM, EYE, DAD, LEVEL etc.

**OR**

- a. What is the difference between a character array and a string? Explain both with a suitable example. [5] CO1
- b. What is the output of the following program? [5] CO3

```
char s1[30] = "Bad";
char s2[30] = "Good";
strncpy(s1, s2, 2);
printf("%s", s1);
```

- c. Write down a function that compares two strings and returns 1 if they are the same and 0 otherwise. [15] CO5

Write down a structure named "employee" that can store an employee's record having three [25] CO1  
attributes -

employeeID (integer)  
salary (double) and  
age (integer)

Using this structure take  $N$  employees' information as input where  $N$  will also be input to your program. Then find the maximum salary of the employees who are at least 40 years old. Also, calculate and show the size of the "employee" structure.

OR

Write down a structure named "star" that can store a movie star's records having three [25] CO4  
attributes -

starID (integer)  
name (string) and  
age (integer)

Using this structure take  $N$  movie stars' information as input where  $N$  will also be input to your program. Then, find the age of the youngest movie star in the film industry. Also, calculate and show the size of the "star" structure.

3. a. What will be the value of  $b$ ,  $c$ , and  $d$  after executing the following piece of codes? [10] CO1

```
int a [] = {3, 2, 7, 8, 6, 4};  
int i = 2, b, c, d;  
b = ++a[i];  
c = a[i++];  
d = a[i];
```

b. Write down a program that counts and prints the number of odd numbers in a given array. [15] CO5  
The number of elements and all elements of the array will be input to your program.

Input: Number of elements: 10

Input: Input array elements: 5 9 30 15 40 0 7 11 16 100

Output: Number of odd numbers: 5

4. a. What is function prototype? Why they are needed? [5] CO1

b. What is the purpose of header files in C? [5] CO5

c. Write down a function that will take three integers as parameters and will return maximum [15] CO3  
of three.

- 57 a. Suppose we declared an array like below:

[5] CO1

```
int a [3][4] = {{2, 3, 5, 1}, {7, 2, 9, 8}, {9, 1, 2, 6}};
```

Can we omit both row size (3) and column size (4) while declaring the above array? Why or why not?

- b. Suppose a 2D array has been created using the statement below:

[5] CO4

```
int m [][] = {{4, 1, 0, 2}, {-1, 2, 4}, {0, -1}};
```

Show the content of the array by filling out the following table:


- c. Write a program that fills out an  $N \times M$  two-dimensional array with integer inputs. Both  $N$  and  $M$  will also be input to your program. Your program should then take another integer  $X$  as input and will search  $X$  in the 2D array. If  $X$  is found then print first position of  $X$  found in the array. While printing first position print both row index and column index.

[15] CO4

For the 2D array shown below, if  $X = 2$  then your program should print "Found at Row index = 1 and Column index = 2". Print "Not Found" if  $X$  does not appear in the array.

5	5	8	8	7
1	0	2	4	6
7	4	4	5	6
9	3	9	4	2
7	1	3	1	8

6. a. Consider the following declaration:

[10] CO2

```
int x[5] = {15, 6, 2, 98, 1};  
int *p;  
p = &x[0];
```

Suppose address of  $x$  is 500. What are the values of the followings?

- i.  $p+3$
- ii.  $*p+1$
- iii.  $*(p+1)$
- iv.  $*(p+1) - *p$
- v.  $--(*p)$

- b. When we declare a pointer we usually use the following syntax:

[5] CO1

```
datatype *variable_name;
```

Following are some examples:

```
char *c;
```

```
int *ip;
```

What does the data type in front of the declaration indicate?

- c. Suppose the address of **a** is 300 and address of **b** is 400. Fill out the following table [10] CO2 showing the value of the variables after executing each line of codes.

	a	b	a_p	b_p
int a = 5, b = 10;			-	-
int *a_p = &a, *b_p = &b;				
a = b + *a_p;				
a_p = b_p;				
b = (*a_p) * (*b_p);				
*b_p = a / b;				
*a_p = a % b;				

**University of Asia Pacific**  
**Department of Computer Science and Engineering**  
**Program: B.Sc. in CSE**

**Final Examination**

**Fall-2022**

**1<sup>st</sup> year 2<sup>nd</sup> Semester**

**Course Code: CSE 105**

**Course Title: Discrete Mathematics**

**Credit: 3.0**

**Time: 3.00 Hours.**

**Full Mark: 150**

**Instructions:**

1. Answer Q1 or Q2, Q3 or Q4, Q5, Q6, Q7, and Q8. Marks are shown in the margins.
2. Non-programmable calculators are allowed.

1. a.  $A = \{x \in N \mid x \text{ is even, } x < 11\}$   
 $B = \{x: x \text{ is a multiple of 3 and } x < 21\}$

[2+8= CLO1  
10]

Find:

- i)  $A \cup B$
- ii)  $A \cap B$
- iii)  $A^C \oplus B$
- iv)  $A \setminus B$

- b. Consider the  $Z$  of integers and an integer  $m > 1$ . We say that  $x$  is congruent to  $y$  modulo  $m$ , written as  $x \equiv y \pmod{m}$  if  $x - y$  is divisible by  $m$ . Show that this defines an equivalence relation on  $Z$ .

[15] CLO1

**OR**

2. a. i) Find out the adjacency matrix from the graph in Figure 1.  
 ii) What will be in-degree and out-degree of each vertices of the graph in Figure 1?  
 iii) What is the relation between degrees of the vertices and the number of edges in a directed graph?

[5+5+  
5 =  
15] CLO1

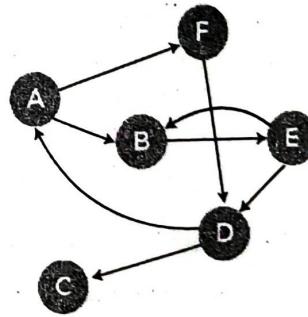


Figure 1

- b. i) State the differences between Graph and Tree.  
 ii) Traverse the tree in Figure 2 using the following methods:  
 Preorder, Postorder, Inorder.

[4+6 = 10] CLO1

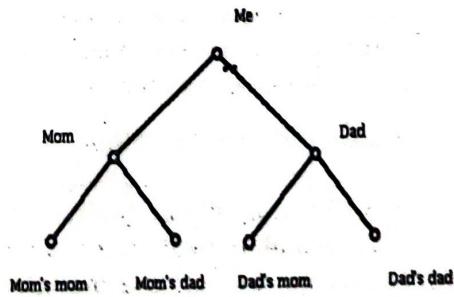


Figure 2

3. a. i) What is tautology and contradiction? [2+8=10]  
ii) Verify that the proposition  $(p \wedge q) \wedge \neg(p \vee q)$  is a contradiction.
- b. Write the logic expression for the following statement: [5]
- A student must complete either 36 credits, or at least 18 credits along with a master's thesis, and receive a grade no lower than "B" in all required courses, to receive a master's degree.
- c. Simplify the expression  $(a + b)(a + c)$  using the laws of Boolean algebra. [10] CLO2
- OR**
4. a. i) What is logical argument? [2+8=10]  
ii) Determine the validity of the following logical argument:  
If 7 is less than 4, then 7 is not a prime number.  
7 is not less than 4.
- 
- 7 is a prime number.
- b. Write the logic expression for the following statement: [5] CLO2
- You can access the Internet from campus only if you are a CSE student and you are not a first-year student.
- c. Construct an argument using rules of inference to show that the hypotheses [10] CLO2  
  - All humans are mortal,
  - All philosophers are humans, and
  - Socrates is a Greek philosopher
Imply the conclusion that,  
  - Socrates is mortal.
5. a. What is Universal Quantifier and Existential Quantifier? [5] CLO2
- b. Translate the following statements into logical notation: [10] CLO2  
i) The sum of two positive integers is always positive  
ii) The square of every negative real number is positive.  
iii) There exists a positive integer that is less than 5.  
iv) There exists a pair of negative integers such that their product is 6. Find an example showing that this assertion is true.
- c. Test the validity of the following argument: [10] CLO2  
If I study, then I will not fail mathematics.  
If I do not play basketball, then I will study.  
But I failed mathematics.  
Therefore, I must have played basketball.

- a. Show that if  $n$  is even, then  $n^2$  is even. [5] CLO3
- b. Prove using mathematical induction for every natural number,  $n$  that  

$$2+4+6+\dots+2n = n(n+1)$$
 [10] CLO3
- c. i) What is big O, big Omega ( $\Omega$ ), big Theta ( $\Theta$ )?  
ii) Prove that  $n(n+1) = O(n^2)$  [5+5=10] CLO3
7. a. What is Sum rule, Product rule, and Pigeon hole theorem? State with example. [15] CLO4
- b. There are 12 singers and 7 dancers in a group. For the upcoming Cultural Program, the group leader wants to select 7 singers and 5 dancers. How many possible configurations are there? [5] CLO4
- c. How many ways are there for 7 boys and 9 girls to stand in a line so that no two boys stand next to each other? [5] CLO4
8. a. i) What is Conditional Probability? Explain with example.  
ii) In a country 50% of all teenagers own a cycle and 30% of all teenagers own a bike and cycle. What is the probability that a teenager owns bike given that the teenager owns a cycle? [5+5=10] CLO4
- b. i) State the principle of inclusion-exclusion.  
ii) What is the probability of a positive integer selected at random from the set of positive integers not exceeding 100 to be divisible by 3 or 5? [5+10=15] CLO4

**University of Asia Pacific**  
**Department of Basic Sciences and Humanities**  
**Program: B.Sc. in CSE**

**Final Examination**

**Fall-2022**

**1<sup>st</sup> year 2<sup>nd</sup> Semester**

**Course Code: MTH 103**

**Course Title: Math II: Linear Algebra**

**Credit: 3**

**Time: 3.00 Hours**

**Full Marks: 150**

**Instructions:**

1. There are SIX (6) questions. Answer all of them. All questions are of equal value. Part marks are shown in the margins.
2. Non-programmable calculators are allowed.

**1/** Consider the matrix

**[25] CO4**

$$A = \begin{pmatrix} 1 & -3 & 4 & -2 & 5 & 4 \\ 2 & -6 & 9 & -1 & 8 & 2 \\ 2 & -6 & 9 & -1 & 9 & 7 \\ -1 & 3 & -4 & 2 & -5 & -4 \end{pmatrix}.$$

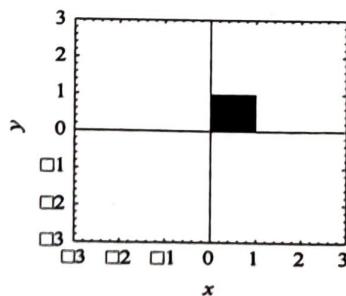
- (i) Find bases for row space, column space and nullspace of the matrix  $A$ .
- (ii) Find rank and nullity of the matrix  $A$ .
- (iii) Verify that  $\text{rank}(A) + \text{nullity}(A) = \text{no. of columns of } A$ .

**2/** Let  $A = \begin{pmatrix} 1 & 4 \\ 2 & 3 \end{pmatrix}$ . Find all eigenvalues and bases of eigenspace. Is  $A$  diagonalizable? **[25] CO2**

If so, find an invertible matrix  $P$  such that  $P^{-1}AP$  is diagonal. Find eigenvalues and eigenvectors of  $A^5$  and compute  $A^5$ . Verify the Caley-Hamilton theorem and hence find  $A^{-1}$ .

**3/** The accompanying figure is a view of a square with vertices **[25] CO3**  $(0, 0, 0), (1, 0, 0), (1, 1, 0)$ , and  $(0, 1, 0)$ .

- (i) What is the coordinate matrix of View square?
- (ii) What is the coordinate matrix of View square after it is scaled by a factor  $1\frac{1}{2}$  in the x-direction and  $\frac{1}{2}$  in the y-direction? Draw a sketch of the scaled View square.



- (iii) What is the coordinate matrix of **View square** after it is translated by the vector  $\begin{bmatrix} -2 \\ -1 \\ 3 \end{bmatrix}$ ? Draw a sketch of the translated **View square**.
- (iv) What is the coordinate matrix of **View square** after it is rotated through an angle of  $-30^\circ$  about the z-axis? Draw a sketch of the rotated **View square**.
4. Let  $T_1: \mathbb{R}^2 \rightarrow \mathbb{R}^2$  and  $T_2: \mathbb{R}^2 \rightarrow \mathbb{R}^2$  be the linear operators defined by the formula [25] CO2  
 $T_1(x, y) = (x + y, x - y)$  and  $T_2(x, y) = (2x + y, x - 2y)$ .  
Find formula for  $T_1^{-1}$ ,  $T_2^{-1}$  and  $(T_2 \circ T_1)^{-1}$ .

5. Assume that the vector space  $\mathbb{R}^3$  has the Euclidean inner product. Apply the Gram-Schmidt process to transform the basis vectors [25] CO2  
 $u_1 = (1, 1, 1), u_2 = (-1, 1, 0), u_3 = (1, 2, 1)$   
into an orthogonal basis  $S = \{v_1, v_2, v_3\}$ , and then normalize the orthogonal basis vectors to obtain an orthonormal basis  $\{q_1, q_2, q_3\}$ . Find the coordinate vector  $[v]_S$  for  $v = (-1, 0, 2)$ .

OR

Find the least squares solution, the least squares error vector, and the least squares error of the linear system [25] CO2

$$\begin{aligned} x_1 - x_2 &= 2 \\ 2x_1 + 3x_2 &= -1 \\ 4x_1 + 5x_2 &= 5 \end{aligned}$$

6. Find an LU-decomposition of the coefficient matrix, and then solve the system [25] CO2

$$\begin{bmatrix} 6 & -2 & 0 \\ 9 & -1 & 1 \\ 3 & 7 & 5 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} 8 \\ 12 \\ 6 \end{bmatrix}.$$

OR

Let  $v_1 = \begin{bmatrix} 1 \\ 3 \end{bmatrix}, v_2 = \begin{bmatrix} -1 \\ 4 \end{bmatrix}$ , and let  $A = \begin{bmatrix} 1 & 3 \\ -2 & 5 \end{bmatrix}$  be the matrix for  $T: \mathbb{R}^2 \rightarrow \mathbb{R}^2$  [25] CO2 relative to the basis  $B = \{v_1, v_2\}$ .

- (i) Find  $[T(v_1)]_B, [T(v_2)]_B$ .  
(ii) Find  $[T(v_1)], [T(v_2)]$ .  
(iii) Find a formula for  $T\left(\begin{bmatrix} x_1 \\ x_2 \end{bmatrix}\right)$ .

**University of Asia Pacific**  
**Department of Basic Sciences and Humanities**  
**Program: B.Sc. in CSE**

**Final Examination**

**Fall-2022**

**1<sup>st</sup> year 2<sup>nd</sup> Semester**

**Course Code: CHEM 111**

**Course Title: Chemistry**

**Credit: 3.00**

**Time: 3.00 Hours**

**Full Marks: 150**

**Instructions:**

1. There are six (6) questions. Answer all of them. All questions are of equal value. Part marks are shown in the margins.
2. Non-programmable calculators are allowed.

1. a. Discuss how you can determine the position on an element in the periodic table. [10] CO1
- b. Write short notes on the followings: [15] CO1
- i. Metals
  - ii. Metalloids
  - iii. Non-Metals
  - iv. Transition Metals
  - v. Inert gases

**OR**

- a. CH<sub>4</sub>, NH<sub>3</sub> and H<sub>2</sub>O all the three molecules have tetrahedral geometry yet their bond angles are different. -explain. [15] CO1
- b. Draw the molecular orbital diagrams of O<sub>2</sub> and NO. Comment on their bond order and magnetism. [10] CO1
2. a. Discuss main features of the phase diagram of water system. [15] CO2
- b. Find out the number of degrees of freedom in the following systems: [10] CO3
- i. Sulphur (l) ↔ Sulphur (vap)
  - ii. CaCO<sub>3</sub>(s) ↔ CaO (s) + CO<sub>2</sub>(g)
  - iii. H<sub>2</sub>O(s) ↔ H<sub>2</sub>O (l) ↔ H<sub>2</sub>O (g)
  - iv. Na<sub>2</sub>SO<sub>4</sub>.10H<sub>2</sub>O (s) ↔ Na<sub>2</sub>SO<sub>4</sub> (s) + 10H<sub>2</sub>O(g)
  - v. H<sub>2</sub>O (s) ↔ H<sub>2</sub>O (g)

**OR**

- a. "On progressive dilution, specific conductance of an electrolyte decreases but molar conductance increases" - discuss. [15] CO2
- b. 0.5 Normal solution of a salt placed between two platinum electrodes, 20 cm apart and of area of cross-section 4.0 sq cm, has a resistance of 25 ohms. Calculate the equivalent conductance of the solution. [10] CO3

3. ~~a~~ Derive the integrated Arrhenius equation of activation energy. Find the energy of [15] CO2 activation from the plot.
- b. The rate law for the decomposition of  $\text{N}_2\text{O}_5$  (l) is: rate =  $k [\text{N}_2\text{O}_5]$  where  $k = 6.22 \times 10^{-4} \text{ sec}^{-1}$ . Calculate half-life of  $\text{N}_2\text{O}_5$  (l) and the number of seconds it will take for an initial concentration of  $\text{N}_2\text{O}_5$  (l) of 0.100 M to drop to 0.0100 M. [10] CO3
4. ~~a~~ Explain the structure of the following molecules on the basis of hybridization: [15] CO1  
 $\text{SF}_6$  and  $\text{PCl}_5$
- ~~b~~ A buffer solution contains 0.25 M  $\text{NH}_3$  and 0.40 M  $\text{NH}_4\text{Cl}$ . Calculate the pH of the [10] CO3 solution.  $K_b$  for ammonia =  $1.8 \times 10^{-5}$ .
5. ~~a~~ Define buffer solutions. Derive Henderson's equation to calculate the pH of an acidic [15] CO2 buffer and basic buffer solution.
- ~~b~~ Find the pH of a buffer solution containing 0.20 mole per litre  $\text{CH}_3\text{COONa}$  and 0.15 [10] CO3 mole per litre  $\text{CH}_3\text{COOH}$ .  $K_a$  for acetic acid is  $1.8 \times 10^{-5}$ .
6. ~~a~~ Define order of a reaction, molecularity of a reaction and half-life period. Show that [15] CO2 for first order reactions the half-life period is independent of the initial concentration.
- ~~b~~ 50% of a first order reaction is complete in 23 minutes. Calculate the time required to [10] CO3 complete 90% of the reaction.

**University of Asia Pacific**  
**Department of Computer Science and Engineering**  
**Semester Final Examination, Fall – 2022**  
**Program: B.Sc. in CSE (1<sup>st</sup> Year, 2<sup>nd</sup> Semester)**

Course Title: Electrical and Electronic Engineering I Course Code: EEE 121 Credit Hours: 3.00  
 Time: 3 hours Full Marks: 150

[There are **eight** questions. Answer any **six** including **Q1 to Q4**. Figures in the right margin indicate marks. Symbols have their usual meanings.]

1. Calculate the followings for the circuit shown in Figure 1, where three light bulbs are connected to a 9-V battery.
- the total current supplied by the battery.
  - the current through each bulb.
  - the resistance of each bulb.

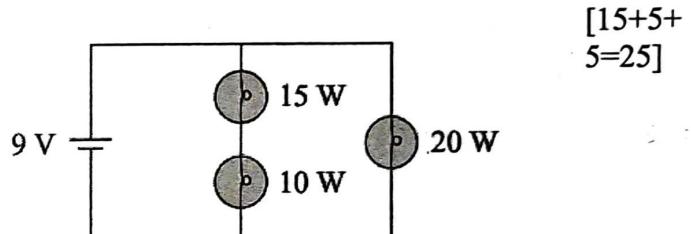


Figure:1

2. Compute  $V_o$  for the circuit shown in Figure 2, using Nodal or Mesh analysis.

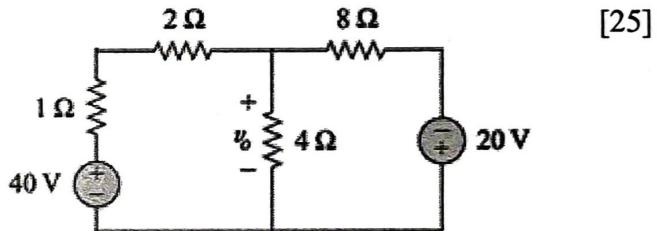


Figure:2

3. Calculate the current  $I$  required to develop a flux of  $\phi = 3 \times 10^{-4} Wb$ . Where the area is,  $A = 1 \times 10^{-3} m^2$  for the series magnetic circuit given in the Figure 3.

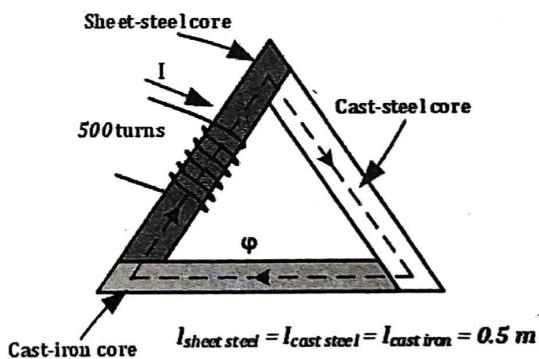
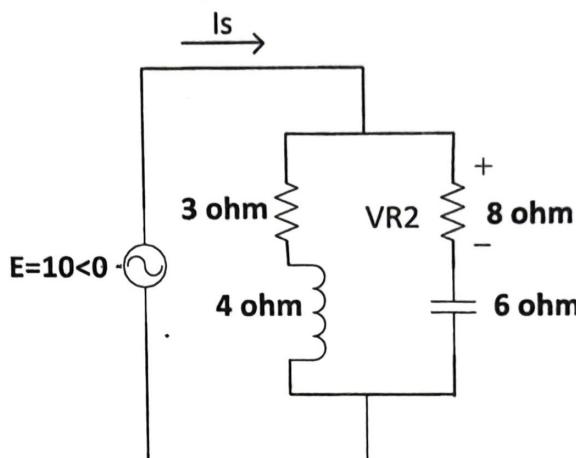


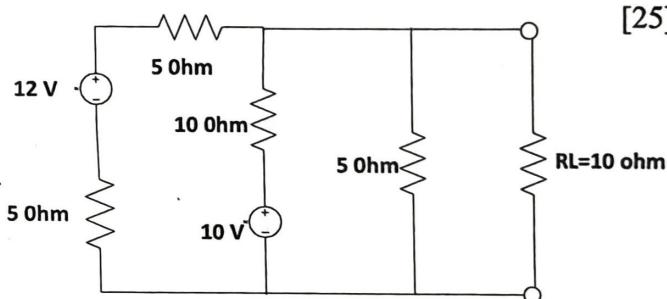
Figure:3

4. Calculate the current  $I_s$  and the voltage  $V_{R2}$  for the circuit displayed in Figure 4.



[25]

5. Construct the smallest equivalent circuit for the circuit given in Figure 5, [one voltage source and a resistor] with respect to the load resistor  $RL$ .



[25]

6. Construct the smallest equivalent circuit for the circuit given in Figure 5, [one current source and a resistor] with respect to the load resistor  $RL$ .

7. Solve the expression for the voltage,  $v$ , considering the current flowing through a capacitive reactance,  $X_C = 7 \Omega$  is given by,

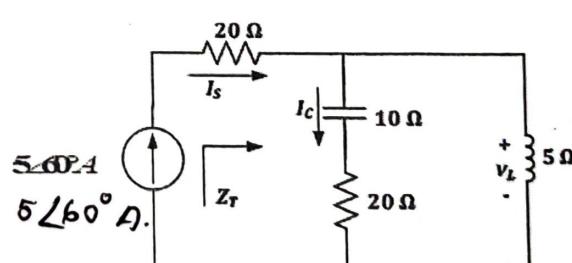
$$i = 20 \sin(80t + 30)A$$

[15+10  
=25]

Also, sketch  $v$  and  $i$  on the same axis.

OR

8. Calculate power factor of the branch with capacitor and  $Z_T$  for the circuit given in Figure 7.



[15+10  
=25]

Figure:7

