

**University of Asia Pacific**  
**Department of Computer Science and Engineering**  
**Semester Final Examination, Spring – 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 (8) questions. Answer any six (6) questions including Question 1-4. Figures in the right margin indicate marks.]

1. For the circuit given in figure 1, where all resistances are of equal value,  $R = 5\Omega$ , find:

- i) The equivalent resistance  $R_{eq}$ .
- ii) The current  $I_s$ .
- iii) The current  $I_1$  &  $I_2$ .
- iv) The voltage  $V_o$ .

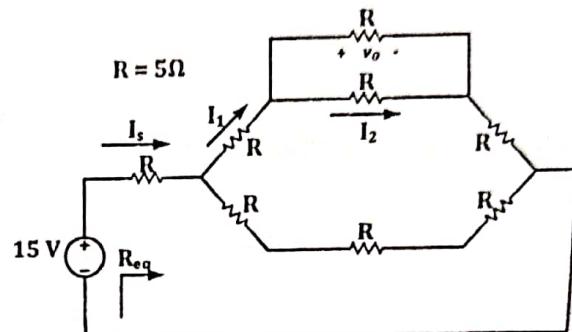


Figure 1

[25]

2. a. Using nodal analysis, find all the node voltages in figure 2.

[12.5]

- b. Using mesh analysis, find all the mesh currents in figure 2.

[12.5]

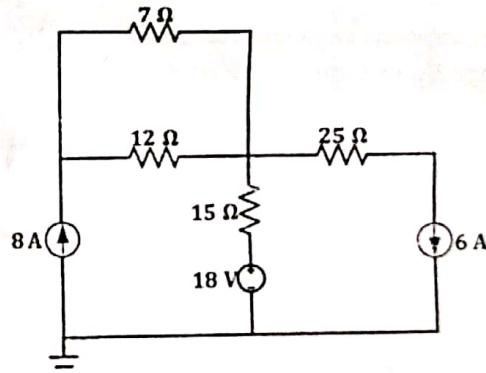


Figure 2

[12.5]

3. a. Calculate the equivalent capacitance  $C_{eq}$  in figure 3.

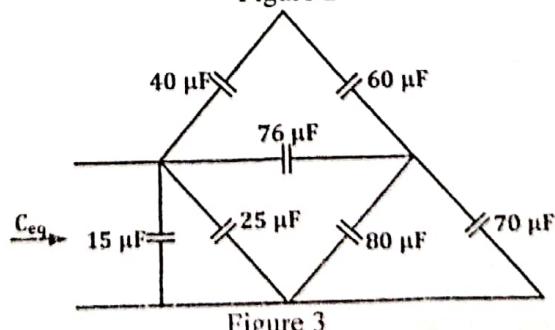


Figure 3

- b. For figure 4,
- Find the value of  $i_L$  and  $v_c$ .
  - Calculate the energy stored in the inductor.
  - Calculate the energy stored in the capacitor.

[12.5]

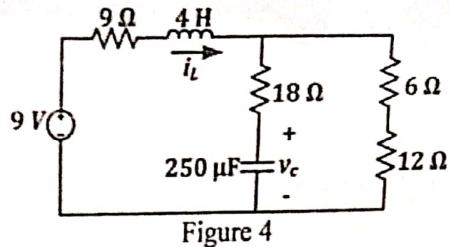


Figure 4

4. For the series magnetic circuit given in the figure 5, find:
- the current  $I$  required to develop a flux of  $\varphi = 8 \times 10^{-4} Wb$ .
  - Determine  $\mu_r$  of the materials.

[25]

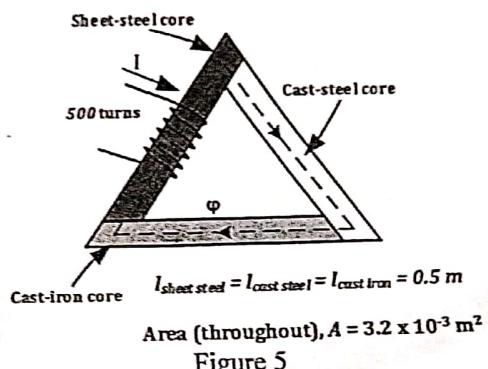


Figure 5

5. Using superposition theorem, find voltage  $V_o$  in figure 6.

[25]

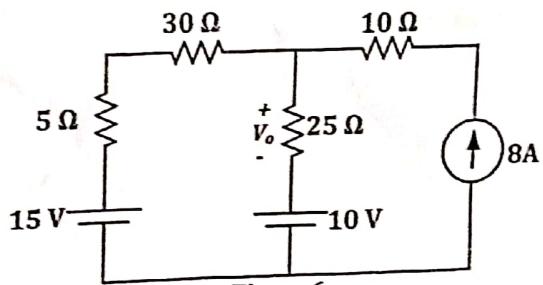


Figure 6

OR

6. For the circuit given in figure 7,
- Draw the Thevenin's equivalent circuit at the terminal marked  $a$  and  $b$ . ( $a - b$  are the load terminals)
  - Draw the Norton's equivalent circuit.
  - Find the value of  $R_L$  for maximum power transfer and the value of maximum power.

[25]

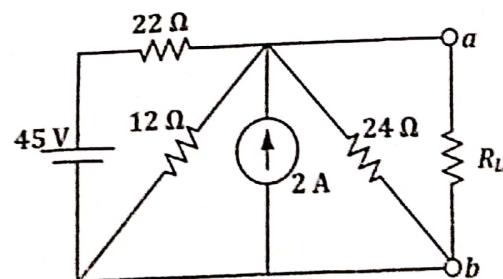


Figure 7

- a. The current through an capacitive reactance,  $X_C = 5 \Omega$  is given by,

$$i = 40 \sin(100t + 20) A$$

[12.5]

- i) Find the expression for the voltage,  $v$ .  
 ii) Sketch  $v$  and  $i$  on the same axis.

- b. Find the average and the R.M.S value of the wave shape given in figure 8.

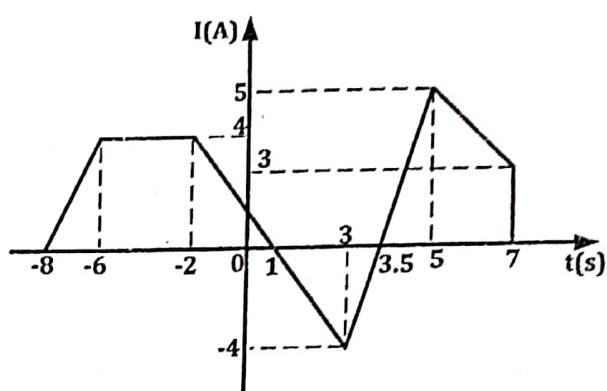


Figure 8

OR

8. For the circuit given in Figure 9, find:

- i)  $Z_T$
- ii)  $I_s$
- iii)  $I_L$
- iv)  $v_c$
- v) Power delivered to the circuit
- vi) Power factor

[25]

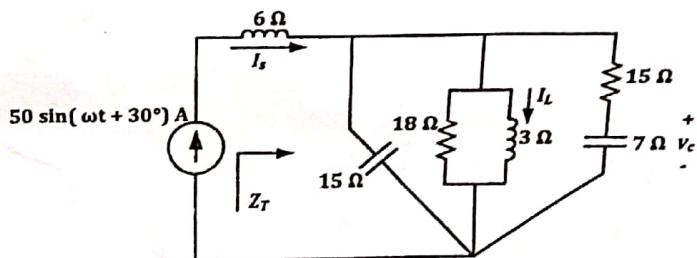
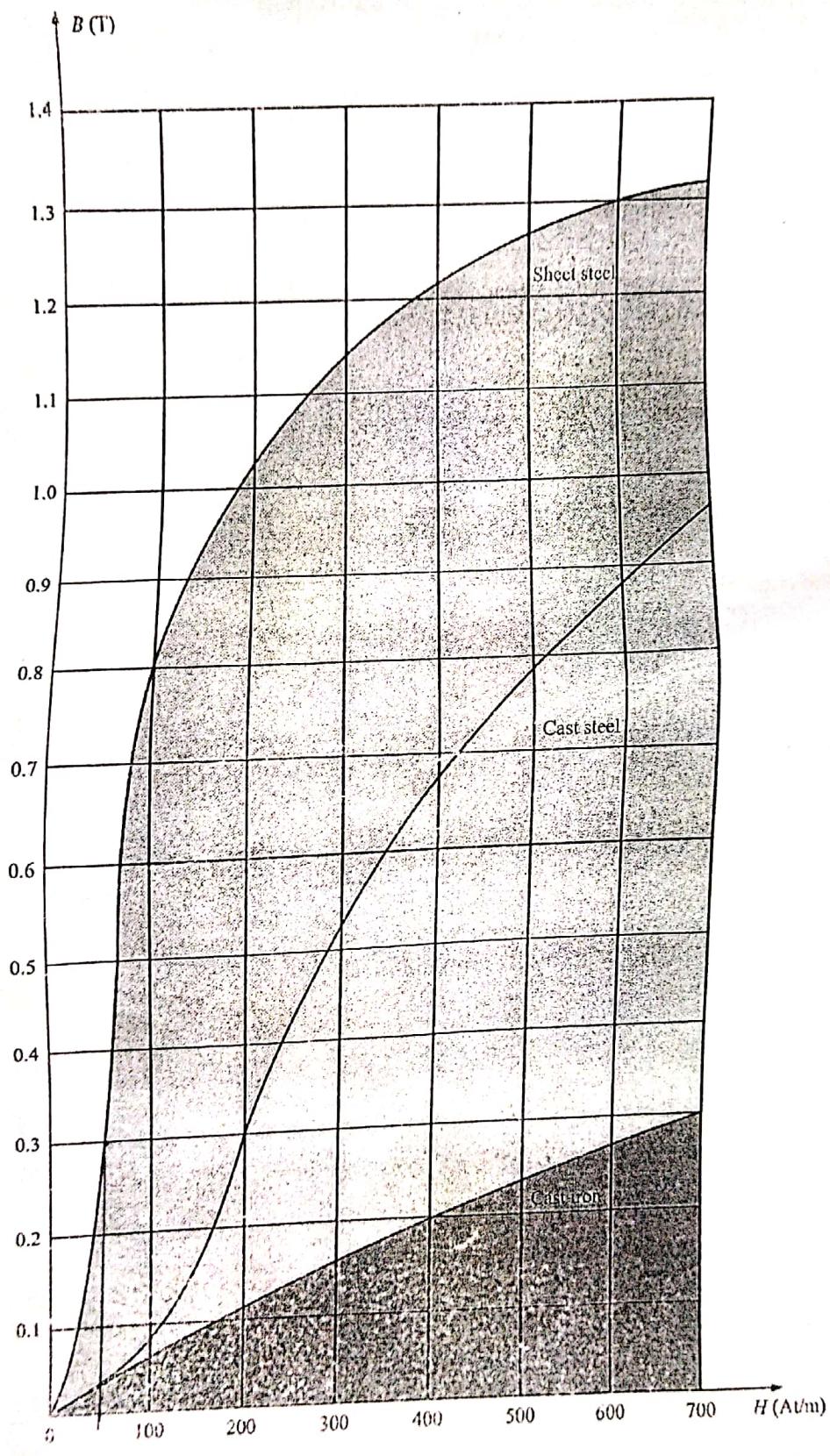


Figure 9



**Department of Computer Science & Engineering**  
**University of Asia Pacific (UAP)**

Final Examination Spring 2022 2<sup>nd</sup> Year 2<sup>nd</sup> Semester

**Course Code: CSE 105**

**Course Title: Discrete Mathematics**

**Credits: 3**

**Full Marks: 150**

**Duration: 3 Hours**

**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. Determine the validity of the following argument:  $p \rightarrow \neg q, r \rightarrow q, r \vdash \neg p$ . [10]  
b. Test the validity for the following argument:  
If I do not study, then I will fail.  
If I play, then I will not study.  
But I must have played.  
-----  
Therefore I have failed.
  2. a. Suppose m and n denote positive integers. Suppose a function A is defined recursively as [10] follows:  
If  $m=0$ , then  $A(m,n) = n+1$ ,  
If  $m \neq 0$  but  $n=0$ , then  $A(m,n) = A(m-1,1)$ ,  
If  $m \neq 0$  and  $n \neq 0$ , then  $A(m,n) = A(m-1, A(m,n-1))$ ,  
Find  $A(2,2)$ .
  - b. What is complete binary tree? Write down the properties of heap tree. Draw a heap tree by using [15] the following elements: 50, 300, 500, 220, 600, 550, 77, 550 and 1000.
  3. a. Given that  $U = \{x: x \text{ is an integer and } 4 \leq x \leq 22\}$ ,  $A = \{x: x \text{ is a multiple of 5}\}$ ,  $B = \{x: x \text{ is a prime number}\}$  and  $C = \{x: x \text{ is a factor of 30}\}$ , list the elements of [10]  
i)  $B \cap C$ .  
ii)  $(A \cup C)' \cup B$ .
  - b. 168 adult Singaporeans were asked to vote for their favorite TV program(s): Money Mind(M), Talking Points(T) and Pyramid Game(P). They were allowed to vote for more than one program if they wished to. 26 people voted for T only and 23 people voted for P only. The number of people who voted for all three program was same as that who voted for T and P but not M, half that who voted for M and T but not P. The results showed that M was the winner with 72 votes, T was second with 42 votes and P was third with 37 votes. Draw the Venn diagram to illustrate [15]

the data and find the number of people who

- (i) Voted for M only.
- (ii) Did not vote for any of the program.
- (iii) Voted for M and P but not T.

4. a. Define the following terms about graph with a suitable example:

[10]

- i) Adjacent matrix of graph.
- ii) Path matrix of graph.
- iii) Simple path.
- iv) Indegree and outdegree of node for directed graph.

b. Suppose the following sequences list the nodes of a tree T in postorder and inorder, respectively: [15]

Postorder: D, F, E, B, G, L, J, K, H, C, A

Inorder: D, B, F, E, A, G, C, L, J, H, K

- i) Draw the tree T.
- ii) Find: Depth d of T; Descendants of B; List the terminal nodes of T.

5. a. When Don plays tennis, 65% of his first serves go into the correct area of the court. If the first serve goes into the correct area, his chance of winning the point is 90%. If his first serve does not go into the correct area, Don is allowed a second serve, and of these, 80% go into the correct area. If the second serve goes into the correct area, his chance of winning the point is 60%. If neither serve goes into the correct area, Don loses the point. [10]

(i) Draw a tree diagram to represent this information.

(ii) Using your tree diagram, find the probability that Don loses the point.

(iii) Find the conditional probability that Don's first serve went into the correct area, given that he loses the point.

b. A committee of 5 people is to be chosen from 6 men and 4 women. In how many ways can this be done [15]

- (i) if there must be 3 men and 2 women on the committee
- (ii) if there must be more men than women on the committee
- (iii) if there must be 3 men and 2 women, and one particular woman refuses to be on the committee with one particular man?

OR

a. When Andrea needs a taxi, she rings one of three taxi companies, A, B or C. 50% of her calls are to taxi company A, 30% to B and 20% to C. A taxi from company A arrives late 4% of the time, a taxi from company B arrives late 6% of the time and a taxi from company C arrives late 17% of the time. [10]

(i) Draw a tree diagram to represent this information.

(ii) Using your tree diagram, find the probability that, when Andrea rings for a taxi, it arrives late.

(iii) Given that Andrea's taxi arrives late, find the conditional probability that she rang company B.

b. The six digits 4, 5, 6, 7, 7, 7 can be arranged to give many different 6-digit numbers. [15]

- (i) How many different 6-digit numbers can be made?  
(ii) How many of these 6-digit numbers start with an odd digit and end with an odd digit?
6. a. What do you understand by Tautology and Contradictions? Verify that the proposition  $p \vee \neg(p \wedge q)$  [10] is a tautology.
- b. A shop sells old video tapes, of which 1 in 5 on average are known to be damaged. [15]  
(i) A random sample of 15 tapes is taken. Find the probability that at most 2 are damaged  
(ii) Find the smallest value of n if there is a probability of at least 0.85 that a random sample of n tapes contains at least one damaged tape.

**OR**

- a. What is logical equivalence? Show that  $\neg(p \vee (\neg p \wedge q))$  and  $\neg p \wedge \neg q$  are logically equivalent. [10]
- b. A manufacturer makes two sizes of elastic bands: large and small. 40% of the bands produced are large bands and 60% are small bands. Assuming that each pack of these elastic bands contains a random selection, calculate the probability that, in a pack containing 20 bands, there are [15]  
(i) equal numbers of large and small bands,  
(ii) more than 17 small bands.

**University of Asia Pacific**  
**Department of Basic Sciences & Humanities**  
**Semester Final Examination, Spring 2022**  
**Program: B. Sc. in Engineering (CSE)**  
**(1<sup>st</sup> Year / 2<sup>nd</sup> Semester)**

**Course Title:** Math II: Linear Algebra    **Course No:** MTH 103

**Credit:** 3.00

**Time:** 3.00 Hours.

**Full Mark:** 150

There are Eight Questions. Answer Six questions including Question 1, 2, 3 & 4. All questions are of equal value. Figures in the right margin indicate marks.

1. Consider the matrix

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$$A = \begin{pmatrix} -1 & 2 & 0 & 4 & 5 & -3 \\ 3 & -7 & 2 & 0 & 1 & 4 \\ 2 & -5 & 2 & 4 & 6 & 1 \\ 4 & -9 & 2 & -4 & -4 & 7 \end{pmatrix}.$$

- (i) Find bases for row space, column space and null space 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.

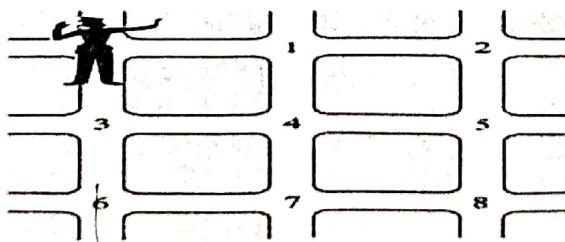
Let  $A = \begin{pmatrix} -1 & 3 \\ 2 & 0 \end{pmatrix}$ . Find all eigenvalues and bases of eigenspace. Is  $A$  diagonalizable? If so, find an invertible matrix  $P$  such that  $P^{-1}AP$  is diagonal. Find eigenvalues and eigenvectors of  $A^{10}$  and compute  $A^{10}$ .

25

3.

(a) A traffic officer is assigned to control the traffic at the eight intersections indicated in the accompanying figure. She is instructed to remain at each intersection for an hour and then to either remain at the same intersection or move to a neighboring intersection. To avoid establishing a pattern, she is told to choose her new intersection on a random basis, with each possible choice equally likely. For example, if she is at intersection 5, her next intersection can be 2, 4, 5, or 8, each with probability  $1/4$ . Every day she starts at the location where she stopped the day before. Find the transition matrix for this Markov chain.

15



- (b) Consider the transition matrix  $P = \begin{bmatrix} .8 & .3 & .2 \\ .1 & .2 & .6 \\ .1 & .5 & .2 \end{bmatrix}$ . State why P is regular and find its steady-state vector. 10

4. (a) Show that the transformation  $T: \mathbb{R}^2 \rightarrow \mathbb{R}^2$  defined by  $T(x, y) = (x + y, x)$  is linear. 10

- (b) Consider the basis  $S = \{v_1, v_2, v_3\}$  for  $\mathbb{R}^3$ , where  $v_1 = (1, 1, 1)$ ,  $v_2 = (1, 1, 0)$ ,  $v_3 = (1, 0, 0)$ . Let  $T: \mathbb{R}^3 \rightarrow \mathbb{R}^2$  be the linear transformation for which  $T(v_1) = (1, 0)$ ,  $T(v_2) = (2, -1)$ ,  $T(v_3) = (4, 3)$ . Find a formula for  $T(x_1, x_2, x_3)$ , and then use that formula to compute  $T(2, -3, 5)$ . 15

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

$$u_1 = (1, 1, 1), u_2 = (0, 1, 1), u_3 = (0, 0, 1).$$

into an orthogonal basis  $S = \{v_1, v_2, v_3\}$ , and then normalize the orthogonal basis vectors to obtain an orthonormal basis  $\{q_1, q_2, q_3\}$ .

Express the vector  $v = (-1, 0, 2)$  as a linear combination of  $v_1, v_2$ , and  $v_3$  and find the coordinate vector  $[v]_S$ .

**OR**

6. Find the least squares solution, the least squares error vector, and the least squares error of the linear system. 25

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

7. Let  $T: \mathbb{R}^2 \rightarrow \mathbb{R}^2$  be the linear operator defined by the formula 25

$$T(x_1, x_2) = (2x_1 + x_2, x_1 - 2x_2)$$

Determine whether  $T$  is one-to-one; if so, find  $T^{-1}(x_1, x_2)$ .

**OR**

8. Let  $T: \mathbb{R}^2 \rightarrow \mathbb{R}^2$  be the linear operator defined by  $T \left( \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} \right) = \begin{bmatrix} x_1 - x_2 \\ x_1 + x_2 \end{bmatrix}$  and let 25  
 $B = \{u_1, u_2\}$  be the basis for which

$$u_1 = \begin{bmatrix} 1 \\ 1 \end{bmatrix}, u_2 = \begin{bmatrix} -1 \\ 0 \end{bmatrix}$$

(i) Find  $[T]_B$ .

(ii) Verify that  $[T]_B[x]_B = [T(x)]_B$  holds for every vector  $x$  in  $\mathbb{R}^2$ .

**Department of Computer Science & Engineering**  
**University of Asia Pacific(UAP)**

Final Examination Spring 2022 1<sup>st</sup> Year 2<sup>nd</sup> Semester

Course Code: CSE 103

Course Title: Structured Programming

Credits: 3

Full Marks: 150

Duration: 3 Hours

**Instructions:**

1. There are Six (6) Questions. Answer all of them. Question no. 1 and 6 have alternatives. Questions 2-5 do not have any alternative questions. All questions are of equal value. Part marks are shown in the margins.
2. Non-programmable calculators are allowed.

1. a) Write down a C program where you take an English sentence as input and do the followings: (7+8)

- i. Print all vowels appearing in the sentence.
- ii. Print position of last occurrence of the letter 'L' in the sentence.

Sample input:

Enter string: GOOGLE

Output: ALL VOWELS O O E

Last occurrence of L is at position 4

- b) What is the output of the following code segment? Show the value of the updated strings in each of the line numbers that are explicitly mentioned below: (10)

```
#include <stdio.h>
#include <string.h>
int main() {
    char s1[30] = "Johny";
    char s2[30] = "pa";
    char s3[30] = "yes ";
    char s4[30], s5[30];
    1. strcat(s1, " ");
    2. strcpy(s4, s1);
    3. strcat(s4, s1);
    4. strcat(s4, s3);
    5. strcpy(s5, "");
    6. strcpy(s5, s2);
    7. strncat(s5, s2, 2);
    8. strcat(s4, s5);
    9. printf("%s", s4);
    return 0;
}
```

## OR

- a) Inumaki Toge can use curses to fight enemies. Let's have a look at his curse-using abilities and constraints. (15)

### Abilities:

- Toge can write any curse in string form on a piece of paper and throws it to an enemy and the curse gets activated.

For example: If he writes "shut up", the enemy won't be able to talk for 2 hours.

### Constraints:

- Toge cannot use any capital letters or numbers or any other characters (except space) while writing the curse. If he uses any of those forbidden characters, the curse backfires.

For example: If he writes "Shut Up 100%", then Toge won't be able to talk for the next 30 minutes.

- Toge cannot use more than 10 small letters. If he uses more, the curse also backfires.

For example: If he writes "shut up already", then Toge won't be able to talk for the next 30 minutes.

Write a C program that will take input Toge's curse as a string and print the end result as shown in the following examples by examining the curse.

#### Example 1:

Input: shut up

Output: Curse got activated!

#### Example 2:

Input: Shut Up 100%

Output: Curse backfired!

#### Example 3:

Input: shut up already

Output: Curse backfired!

- b) What is the purpose of strcmp library function. Give an example. What is the difference between strcmp and strcmpi library functions? (10)

2. a) Write down a function that will take an integer as parameter and will return 1 if the integer is a LEAP YEAR and return 0 otherwise. Using this function write down a program that will print all LEAP YEARS between two ranges n1 and n2. Both n1 and n2 will be input to your program. Assume that n1 < n2. Recall that a leap year occurs every four years (those whose number is divisible by four) except for century years whose number is divisible by 100 but not by 400.

#### Sample Input/Output:

Enter n1: 96

Enter n2: 110

96 104 108

- b) Write down a program that will take a string as an input and will determine whether it is a palindrome (10). You are allowed to use any library function you need. A palindrome is a string which remains the same even after reversing it.

3. a) Consider the following declaration:

```
int x[6] = {1, 13, 17, 8, 7, 18};  
int *p;  
p = &x[3];
```

Suppose address of x is 700. What are the values of the followings?

- (i) p+1
- (ii) \*p - 20
- (iii) \*(p+1)
- (iv) \*(p-1) - \*p
- (v) ++(\*p)

- b) Write a code that fills out an  $N \times N$  two-dimensional array with user inputs and then calculates the sum of the main diagonal elements. N will be input to your program. Example: For the 2D array shown below, the main diagonal elements are shown in gray box. Your program should calculate the sum of these diagonal elements, i.e., sum =  $5 + 0 + 4 + 4 + 8 = 21$ . (15)

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

4. a) Write down a program that will take N students' marks in CSE 103 course as input and determine the grade statistics, i.e., the number of students getting each grade. N will also be input to your program. (15)

Assume that the grades are calculated based on the following chart:

- 90 -- 100 A
- 80 -- <90 B
- 70 -- <80 C
- 60 -- <70 D
- 0 -- <60 F

- b) Write down a program that reverses the elements of a given array. The number of elements and all elements of the array will be input to your program. (10)

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

**Output:** Reversed array: 100 16 11 7 0 40 15 30 9 15

5. a) What will be the value of b and c after executing the following piece of codes? (5)

```
int a[ ] = { 2, 3, 0, 1, 9, 5};  
int i = 2, b, c;  
b = a[i] + a[i+1];  
c = a[a[i]];
```

- b) Consider the following printMe(n) function. What will be the output if we execute printMe(5) from the main function? Show the function calling in a block diagram (10)

```
void printMe(int n){  
    if(n <= 0) return;  
    else{  
        printf("%d ",n);  
        printMe(n-2);  
        printf("%d ",n);  
    }  
}
```

- c) Write down a program that will write all even numbers between 1 to n into a text file named "yourname.txt". For example, if your name is Kamal the destination file name should be kamal.txt. n will be input to your program. (10)

6. a) (i) Write down a structure capable of storing the following information about a student registered in a course: (20)

- ID
- Gender
- Class test score
- Mid-term score
- Final Exam score
- Total score

(ii) Use the above structure to take input of N students' information as input in an array of structure. N will also be input to your program.

(iii) In the same program, write down a function that will take students' information (within an array of structure) and the number of the students as parameters and returns how many of them failed. Assume that a student needs to obtain total 40 in order to pass in the exam.

(iv) In the same program, write down another function that will take students' information (within an array of structure) and the number of students as parameters and returns the ID of the student obtaining the highest marks.

- b) When you are opening a file using *fopen* library function, what are the reasons that *fopen* may fail while opening in (i) write mode, and (ii) read mode? (5)

**OR**

- a) (i) Write down a structure *movieStar* that can store the following information about movie stars of the film industry. The gender information must be stored as a character 'M' or 'F' to represent male and female movie stars respectively. (20)
- Name
  - Age
  - Annual income
  - Gender
- (ii) Use the *movieStar* structure to take input of N movie stars' information. N will also be input to your program.
- (iii) Write down a function that will take an array of *movieStar* structure and the number of movie stars as parameters and returns the income of the lowest annual earning movie star.
- (iv) Write down a function that will take an array of *movieStar* structure and the number of movie stars as parameters and returns the age of the oldest movie star in the industry.
- b) When you are opening a file using *fopen* library function, what are the different modes of opening? (5)

**University of Asia Pacific**  
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**Final Examination, Spring-2022**  
**Program: B. Sc. in Engineering (CSE)**  
**(1<sup>st</sup> year/2<sup>nd</sup> semester)**

**Course Code: CHEM 111**

**Course Title: Chemistry**

**Credits: 3.00**

**Full Marks: 150**

**Duration: 3 Hours**

**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. Define order of a reaction, molecularity of a reaction and half-life period. Show that for  $6+9=15$  first order reactions the half-life period is independent of the initial concentration.

b. The rate constant of a reaction is  $1.2 \times 10^{-3} \text{ sec}^{-1}$  at 303 K. Calculate the rate constant at 313 K, if the activation energy for the reaction is  $44.12 \text{ kJ mol}^{-1}$ . 10

**OR**

a. Derive an expression for the rate constant of a second order reaction, involving one reactant only. Also write how the equation you, derive, is employed in the graphical method to confirm second order.  $10+5=15$

b. 50% of a first order reaction is complete in 23 minutes. Calculate the time required to complete 90% of the reaction. 10

2. a. "On progressive dilution, specific conductance of an electrolyte decreases but molar conductance increases" –Explain. 15

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

**OR**

a. Define conductometric titrations. Draw and explain the titration curves for  
(i) strong acid with a strong base  
(ii) Weak acid with a strong base  $2+13=15$

b. The resistance of a N/10 solution of a salt is found to be  $2.5 \times 10^2$  ohms. Calculate the equivalent conductance of the solution. Cell constant =  $1.15 \text{ cm}^{-1}$ . 10

3. a. Derive Henderson's equation to calculate the pH and pOH of acidic and basic buffer solution respectively.  $7.5 \times 2=15$

b. A chemistry student desires to prepare one litre of a solution buffered at pH 9.00. How many grams of ammonium chloride have to be added to one litre of 0.20 M  $\text{NH}_3$  to make such a buffer?  $\text{pK}_b$  value of ammonia is 4.75 in the equation. 10

4. a. Give the thermodynamical derivation of law of chemical equilibrium for a general reaction : 15
- $$aA + bB + \dots \rightleftharpoons lL + mM + \dots$$
- b. The equilibrium constant  $K_p$  for the reaction  $2\text{NH}_3(\text{g}) \rightleftharpoons \text{N}_2(\text{g}) + 3\text{H}_2(\text{g})$  is  $1.22 \times 10^{-3}$  at 298 K and 2.16 at 498 K. Calculate  $\Delta H^\circ$  for the reaction. 10
5. a. Draw graph of water system and explain it in detail. 15
- b. Write short notes on the following:  $2 \times 5 = 10$
- i. Phase
  - ii. Component
  - iii. Degree of freedom
  - iv. Metastable equilibrium
  - v. Triple point
6. a. For a reaction  $K_p = K_c$ . What do you infer from this? 10
- b. State and explain Hess's law of constant heat summation. 10
- c. The standard heats of formation of  $\text{C}_2\text{H}_5\text{OH}(\text{l})$ ,  $\text{CO}_2(\text{g})$  and  $\text{H}_2\text{O}(\text{l})$  are  $-277.0$ ,  $-393.5$  and  $-285.5 \text{ kJ mol}^{-1}$  respectively. Calculate the standard heat change for the reaction:
- $$\text{C}_2\text{H}_5\text{OH}(\text{l}) + 3\text{O}_2(\text{l}) \rightarrow 2\text{CO}_2(\text{g}) + 3\text{H}_2\text{O}(\text{l})$$