National Institute of Technology Patna

Dept of Computer Science and Engineering

Mid Semester Examination July – Dec , 2023

B. Tech (CSE), 1st Semester

Course Name: **Programming in C** Course Code: **CS14102 / CS17101**

Max Marks: **30** Time Allowed: **2 Hours**

Instructions:

1. Section 3 CSE and Mathematics students should attempt all questions from Part 1. Section 1 and 2 CSE students should attempt all questions from Part 2. All sub-questions must be answered sequentially in one place.

2. Assume missing data if any.

3. If you require to calculate m^n, you may use function pow(m,n).

Part 1 (Section 3 CSE and Mathematics Students Only)

S.N.	Questions	Marks	CO	BL
1.	What are the characteristics of an algorithm? Draw a flowchart to show the steps in compilation of a high level language.	5	CO1	Remember
2. a)	Illustrate the difference between ***while*** and ***do-while loop*** using flowchart. Write their general syntax?	4	CO2	Understand
b)	Why high level language is used in programming? Mention the limitations of low-level language.	2		
3.	How switch statement can be used for arithmetic operations?	5	CO2	Understand
4. a)	Write a C program to compute the largest of two numbers using conditional operator.	2	CO3	Apply
b)	How break differs from continue statement?	2	CO2	Understand
5.	Write a C program to find the first and second highest marks of fifty students of a class.	5	CO3	Apply
6.	Write a C program to reverse the elements of an array.	5	CO3	Apply

Part 2 (Section 1 and 2 CSE students only)

1. Write a C program to set (make the bit 1) or reset (make the bit 0) a given bit of binary representation of a decimal number and print the corresponding decimal output. Your program should input three values: first, the number on which the operation has to be done; second, the bit position, which will be set or reset; and third, if the user wants a set operation or reset operation (char S for set operation and R for reset operation). For example, if the user inputs 12 as value, 3 as bit position, and R as reset operation, the program should output 4. 12 in binary will be 1100, and on resetting the 3rd bit, it will become 0100, i.e., 8 in decimal. **[10 points]**[CO1,2][BL6]

2. Write a C program to calculate age in years, months, and days. The program will ask the user to input the date, month, and year of his date of birth, and the program will compute his age as of 12th October 2023. The program should handle invalid input properly. **[5 Points]**[CO1,2][BL3]

3. Will the following code snippet compile, if so what will be output. Explain your answer in all cases.[1+2+2 = **5 Points**][CO1,2][BL3]

a) int a = 1;
a>>1;
if(a){
printf("I am inside IF")
}
	b)
	#include<stdio.h>
	int main(){
	int a = 10;int b = 0;
	if(b && (a = 20)){
	printf("%d %d",a,b); }
	else {
	printf("%d %d",a,b);}
	}

c) int x = 5;
x = x << x;
pintf("%d", x);	

4. Will the following code snippet compile, if so what will be output. Explain your answer in all cases.**[1+1 = 2 Points]**[CO1,2][BL3]

a) int a =20, b = 40; printf("%d %d",a);	b) int a =20, b = 40; printf("%d ",a,b);

5. Assuming the integer data type consumes 3 bytes of memory, calculate the range of unsigned and signed integer data types.**[2 Points]**[CO1,2][BL3]

6. For storing integer values, C programming has multiple datatypes viz. int, char, short, long, etc. Explain the reason behind having so many data types to store just integer values with an illustrative example. **[3 Points]**[CO1,2][BL2]

7. Explain how 9 is different from '9' in C programming language. **[1 Point]**[CO1,2][BL2]

8. Mark the following as a valid or invalid identifier. Give a reason if it is invalid.**[2 Points]**[CO1,2][BL2]
   a) $salary b) _salary c) salary_ e) 9salary f)salary9

NATIONAL INSTITUTE OF TECHNOLOGY PATNA
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
MID-SEMESTER EXAMINATION, OCTOBER 2023

BTech: CSE, 1st Semester | **Section: I, II, and III**
Course Name: Information Technology Workshop | **Course Code: CS14106**
Maximum Time: 2 hours | **Maximum Marks: 30**

Instruction:

- Answer all questions
- **sub-questions must be answered sequentially in one place.**
- Assume any suitable data, if necessary.
- The Marks, Course Outcome, and Bloom's Level related to questions are on the right-hand margin.

Q. No.	Question	Marks	CO	BL
1	a) What are the major categories of computer software? Briefly explain each of them with a suitable example.	3	C02	Understand
	b) What are the different categories of printers? Explain each of them in brief with suitable examples.	3	CO1	Remember
	c) Convert $(B1C.5A9)_{16}$ into the following: i. Binary number ii. Octal number	4	CO1	apply
2	a) Explain the working of a magnetic disk. Define the terms *seek time*, *latency time*, *data transfer rate*, and *access time*.	4	CO1	Remember
	b) Differentiate the following: i. Analog and digital computer ii. Interpreter and Compiler	2	C02	Understand
	c) What is cache memory? How many levels of cache memory are used by today's processor? Is there any necessity for such kind of memory in the computer system? If yes, then why? Explain.	2	CO2	Apply
	d) What is a register? Explain the use of the following registers: i. Accumulator ii. IR iii. MAR iv. PC	2	CO2	Remember
3	a) What are the types of memories available in the computer system? How are they organized in a hierarchy?	3	CO2	Remember
	b) List the different memories available in the computer in order of their hierarchy with respect to the CPU.	3	CO1	Understand
	c) What do you mean by sequential access and direct access device? Give an example of the sequential access device and direct access device.	4	CO1	Understand

Wish you all the best

National Institute of Technology Patna
MID SEM Exam July-Dec 2013

Sub: Engineering Chemistry
Code: CH1410I
Course: B.Tech (CSE-3) & Dual Degree

Time = 2 Hours
F.M. = 30

Answer all questions

$4\frac{1}{2} + 3 = 7\frac{1}{2}$

100
3.6
25.7
9.54
61.36

[1] (a) How can you determine percentage of nitrogen, Sulphur and ash by Ultimate analysis.

(b) 2.5 g of air dried Coal sample was taken in a Silica Crucible, after heating it in an electric oven at 110°C for one hour, the residue was weighed 2.410 g. The residue was heated in a Silica Crucible covered with vented lid at temperature 950°C for exactly Seven minutes. After cooling the weight of residue was found to be 1.78 g. The residue was ignited at 750°C to a constant weight of 0.246 g. Calculate results of proximate analysis.

$1+1+4\frac{1}{2}+2+2 = 7\frac{1}{2}$

[2] (a) What do you understand by Specific Conductance, Equivalent Conductance & Kohlrausch's law.

(b) The molar conductivity of 0.05 M solution of $MgCl_2$ is 194.2 $Scm^2 mol^{-1}$ at 25°C. A cell with electrodes that are 1.50 cm^2 in surface area and 0.50 cm apart is filled with 0.05 M $MgCl_2$ solution. How much current will flow when the potential difference between the two electrode is 5.0 volt?

0.1456

(c) The molar conductivity at infinite dilution of $AgNO_3$, NaCl and $NaNO_3$ is 116.5, 110.3 and 105.2 $Scm^2 mol^{-1}$ respectively. The Conductivity of AgCl in water is 2.4×10^{-6} Scm^{-1} and of water used in experiment is 1.16×10^{-6} Scm^{-1}. Find out the solubility of AgCl in g/dm³.

1.463×10^{-3}

$1\frac{1}{2} + 2 + 4 = 7\frac{1}{2}$

[3] (a) Explain Bent's rule & VSEPR Theory.

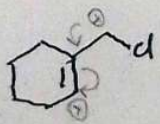
(b) Write & Draw structure & shape of:

SOF_4, SF_4, PCl_3F_2, XeO_3F_2.

$3\frac{1}{2} + 2 + 2 = 7\frac{1}{2}$

[4] (a) Explain SN^1 & E^1 reaction mechanism.

(b) Write reaction mechanism for the most stable product of the following:



(c) ~~Action of 1-Bromo-2,2-dimethyl~~

When 1-Bromo-2,2-dimethyl cyclopentane is heated at high temperature in ethanol, which product is produced? Also write its reaction mechanism.

National Institute of Technology Patna

Department of Mathematics

MID-SEM-EXAMINATION: 18th October, 2023.

Course Name: **Linear Algebra** Course Code:MA14102

Program: B.Tech(CSE) Full Marks:30

Duration: 2 Hrs.

ANSWER ALL SIX QUESTIONS

1. Find the condition on a, b and c so that $v = (a, b, c)$ in $\mathbb{R}^3$ belongs to $W = \text{span}(u_1, u_2, u_3)$ where $u_1 = (1, 2, 0)$, $u_2 = (-1, 1, 2)$ and $u_3 = (3, 0, -4)$. [5M]

2. Let W be the subspace of $\mathbb{R}^4$ spanned by the vectors $u_1 = (1, -2, 5, -3)$, $u_2 = (2, 3, 1, -4)$ and $u_3 = (3, 8, -3, -5)$. Find the basis and dimension of W. [5M]

3. Find the basis and dimension of the null space of the following matrix:

$$A = \begin{bmatrix} 1 & 3 & 1 & -2 & -3 \\ 1 & 4 & 3 & -1 & -4 \\ 2 & 3 & -4 & -7 & -3 \\ 3 & 8 & 1 & -7 & -8 \end{bmatrix}.$$ [5M]

4. Find the rank of the matrix: $A = \begin{bmatrix} 2 & 0 & 4 & 2 \\ 3 & 2 & 6 & 5 \\ 5 & 2 & 10 & 7 \\ 0 & 3 & 2 & 5 \end{bmatrix}$. [5M]

5. Determine the conditions for which the system of equations

$$x + y + z = 1$$
$$x + 2y - z = b$$
$$5x + 7y + az = b^2$$

admits of (i)only one solution (ii) no solution (iii) many solutions [5M]

6. If $P_3(t)$ be a vector space of polynomials of degree ≤ 3. Find the co-ordinates of vector $v = 3t^3 - 4t^2 + 2t - 5$ relative to the basis $S = \{(t-1)^3, (t-1)^2, t-1, 1\}$. [5M]

NATIONAL INSTITUTE OF TECHNOLOGY PATNA

PATNA, BIHAR

MID-TERM EXAMINATION-2023

COURSE: B.TECH. **BRANCH: CSE** **SEM: I**

DIGITAL DESIGN (EC14102)

TIME: 2 HOURS **MAXIMUM MARKS: 30**

1. Convert the following numbers: (1 × 5) [CO-1]

   (a) $(675.675)_{10} = (?)_2$

   (b) Signed 2's complement: $(11010111)_2 = (?)_{10}$

   (c) $(DE)_{16} + (AC)_{16} = (?)_{16}$

   (d) $(1001)_{Gray} = (?)_{Binary}$

   (e) Convert the following single-precision floating-point number to sign-magnitude binary number:

   1 10000001 01001001110001000000000

2. Minimize the following Boolean expression by using Boolean algebra: (1 × 5) [CO-1]

   (a) (A + B + C) (A + B' + C) (A + B + C')

   (b) (A + B) (A + B') (A' + B) (A' + B')

   (c) AB + A'C + BC

   (d) (ABC + A'BC + AB'C)'

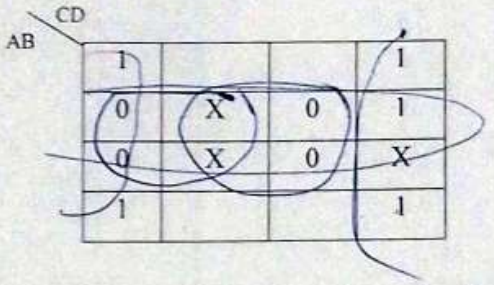
   (e) A'B'C' + A'BC' + A'BC + ABC'

3. Do the followings: (2.5 × 2) [CO-1]

   (b) Minimize the following SOP by using K-Map:

$$F(A,B,C,D) = \sum m(0,1,2,8,10,12,) + d(9,14)$$

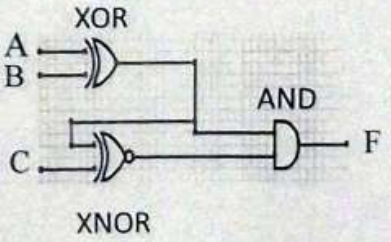
(a) For the following K-Map minimize POS expression:



4. Minimize the following SOP by using Quine Mcclusky method: (5 × 1) [CO-1]

$$F(A,B,C,D,E) = \sum m(4,6,12,14,17,19,25,27)$$

5. Find the minimized output of the following logic circuit: (5 × 1) [CO-1]



6. Draw the switching circuit equivalent of the following Boolean expressions: (1 × 5) [CO-1]

   (a) (A+B)(C+D)E

   (b) AB + CD + E

   (c) A'B' + AB

   (d) A'B + AB'

   (e) (AB + A'B)C

END

SEM

National Institute of Technology Patna
Department of Computer Science and Engineering
End Semester Examination July-Dec, 2023

Branch: CSE (B.Tech. & DD) 1st Semester | **DOE: 06/12/2023**

Course Name: Programming in C | **Course Code: CS14102/CS17101**

Max. Marks: 60 | **Time Allowed: 3 Hours**

Instructions:

1. **This questions paper has two parts, Part I and part II. Students from section 3 CSE and Mathematics have to attempt all questions from part I only. Students from section 1 and section 2 have to attempt all questions from part II only.**
2. All sub-question of a question must be answered at one place only, else examiner may apply penalty.
3. Assume missing data if any.

Part I (For Section 3 CSE and Mathematics students only)

S.N.	Questions	Marks	CO	BL
1.	How to differentiate the following: a) Formatted and non-formatted input/output functions b) Arrays and pointers c) Recursion and iteration d) Structure and union e) *do-while* and *for* loop	10	CO1	Remember
2. a)	Illustrate the use of while loop to count the number of negative, zero and positive integers?	2	CO2	Understand
b)	Why pseudocode is used to represent an algorithm? Draw a flowchart to find the largest of four numbers.	3		
3. a)	How strcpy() and strcat() can be used to manipulate strings?	5	CO2	Understand
b)	How to open and close a file in C programming. Specify the general file program.	5		
4. a)	Write a C program to compute the factorial of a number by recursive and iterative method.	5	CO3	Apply
b)	How function declaration differs from function definition? Mention fundamental rules of function parameters in C programming.	5	CO2	Understand
5. a)	How to store and access different attributes of different data types?	5	CO3	Apply
b)	Why pointer is used in C programming? Illustrate the use of indirection operator and pointer type data declaration. Mention valid arithmetic operations of pointers using suitable examples.	5		
c)	How to use malloc() and calloc() functions are used in dynamic memory allocation?	5		
6. a)	How to access elements of two-dimensional array? Write a C program to find transpose of matrix.	6	CO3	Apply
b)	Write a C program to swap two numbers using pointer as function arguments.	4		

Part I ends here

Course Outcome, and Bloom's Level related to questions are on the right-hand margin

Part II (For students of CSE section 1 and 2 only)

Q1. **[1 Point][CO3,BL1]** Write a C program to print the Instructions number 1 given at start of the question paper.

Q2.This question is related to your Institute roll number, which is in the format of 2306xxx.

a. Convert your Institute roll number to the corresponding Hex representation. Your answer should show the process of conversion. **[2 Points][co1, BL2]**

b. Compute the minimum number of bits required to store your roll number.**[1 Point][co3, BL3]**

c. Compute the range of values that can be stored in the number of bits you have calculated in part (b) above, both in the case of signed and unsigned version.**[1 Point][co3,BL3]**

d. Considering your number is stored in an int data type, what will be its Little Endian and Big Endian representation?**[2 Points][co3,BL1]**

e. Write a C program that should take input an integer and convert it to the corresponding Hex representation. **[3 Points][co2, BL3]**
Note: For (f) and (g) below, conversion to decimal and back to hex approaches not allowed. You are not required to take input the hex value, rather you can initialize a variable with the hex value computed in part (a)

f. Write a program to reverse the byte order of the hex representation you have computed in part (a). For ex: If the hex value in part (a) is 0xABCDEF, after reversing byte order it should become 0xFEDCBA. **[10 points][co2,BL3]**

g. Write a program to rotate the byte order of the hex representation(32 bit) computed in part (a) by x byte, where x = ((right most digit of roll number % 2) + 1). For ex. For roll number 2306008, if the hex representation is 0xABCDEF, value of x = **(8%2) + 1 = 1.** After rotating 0xABCDEF by 3 bytes, it should become 0xFABCDE **[10 Points][co2,BL3]**.

Q3. Assuming no compilation error, what will be output of the following program, if you input your roll number **[3 Points][co3,BL3]**:

```
1.  int main()
2.  {int n,sum=0,m,c = 2,d = 0;
3.  printf("Enter a number:");
4.  scanf("%d",&n);
5.  if((n%10)%2 == 0){d = 1;}
6.  while(n>0)
7.  { m=n%10; n=n/10;
8.    if(d){
9.        if( (m%2)+2 == (c%4)){sum=sum+m;}
10.       else { continue;} }
11. else {
12.       if( (m%2)+2 == (c%4))
      {continue;}
13.       else { sum=sum+m;}
14.     }
15. }
16. printf("Sum is=%d",sum);
17. return 0;
18. }
```

Q4. Guess the operation following two program is trying to do. Will these program run, if so what will be the output, else fix it to make it work and print the output.**[3 + 2 = 5 Points][co3,BL4]**

```
#include<stdio.h>
int main() {
int a[ ] = {1,2,3,4,5}; int b = 0,  i = 0;
while(i<5){b = b - *a; a++; i++;
    if( i == 4) { printf("Output is %d",b); } }
        return 0;}
```

```
#include<stdio.h>
int main()
{const int a = 5; const int *ptr; ptr = &a;
        *ptr = 10;
        printf("%d\n", a);
return 0; }
```

P=P/2

Part II contd. (For students of CSE section 1 and 2 only)

Q5.[**2x4 = 8][co3, BL3**]Guess the output of following programs, assuming there is no compilation error. Explain your answer in maximum two lines:

int main ( ){int a[ ] = {2,3}; int b[ ] = {2,3}
if(a == b){ printf("Array a and b are same") }
else {printf("Array and and b are different")} }
	b.
	int main( ) { int a = 31, b = 21, c = 62;
	if(a > b > c) {printf("condition is True");}
	else { printf("Condition is False"); } }

c.
int main(){
int j[ ] = { digits of your roll number };
//if rollnum is 2306100, then j[] =
{2,3,0,6,1,0,0}
printf("%d",(j+2)[2]);
}
	d.
	int main( ){
	unsigned char a = 240;
	printf("%d",(a+sizeof(int)*sizeof(int));
	}

Q7.[**2+2 = 4 points][co2,BL2**]

a. [**2 Points**]Explain, why we need to pass value to printf function, but address to scanf function. Comment on behavior of a program which has a scanf statement where value of variable has been passed instead of address.

b. For the for loop given below, write a corresponding while and do while loop.

for(;;){ printf("Hello"); }

Q8.[**3 Points][co2,BL4**] The Program below is to input two characters from the user. Comment on, if the program will do the intended work. If yes, what will be output. If No, suggest a fix for the same.

#include<stdio.h>

int main(){ char a,b; printf("Enter First Char"); scanf("%c",&a); printf("Enter second char"); scanf("%c",&b); printf("%c, %c",a,b); return 0; }

Q9.[**2+2+1 = 5 points][co3, BL3**] Will the programs below compile (consider all kind of errors), if so what will be the output, else fix it to get the desired output:

a.
#include<stdio.h>
int main(){
for(int i = 0; i < 2; i++){
printf("%d",j);
for(int j = 0; j < 2; j++){
printf("%d,%d",i,j);
}
printf("%d",i);
}}
	b.
	#include<stdio.h>
	int main(){
	for(int i = 0; i < 2; i++){
	printf("%d",i);
	}
	for(int i = 0; i < 2; i++){
	printf("%d",i);
	}
	}
		c.
		#include<stdio.h>
		int main(){
		int i=10, int i=20;
		printf("%d",i);
		}

Q10. [**2 Points][co3, BL2**] What will be output of program below, explain your output:

#include<stdio.h>

int main(){

int i = 10; int a = 1;

if((i = 20) & (a-=1)){ printf("%d,%d",i,a); }

else{ printf("%d,%d",i,a);}}

NATIONAL INSTITUTE OF TECHNOLOGY PATNA
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
END-SEMESTER EXAMINATION, DECEMBER 2023

Branch: 1st Sem (B.Tech(CSE), B.Tech. Dual Degree(CS, DS) **Section: I, II, and III**
Course: Information Technology Workshop **Course Code: CS14106**
Maximum Time: 3 hours **Maximum Marks: 60**

Instruction:

- Answer all questions
- **Sub-questions must be answered sequentially in one place.**
- Assume any suitable data, if necessary.
- The Marks, Course Outcome, and Bloom's Level related to questions are on the right-hand margin.

Q. No.	Question	Marks	CO	BL
1(a)	Briefly explain Linker, Loder, Assembler, Compiler, Open-source software, and Virus and Worms.	6	CO1	2
1(c)	Explain briefly regarding input/ output devices of computers with their functions, considering three examples of each. How do these devices work with computers, even if their underlying technology and functionality vary?	6	CO2	1,2
2(a)	List various units that help in measuring the computer memory.	4	CO2	1
2(b)	How many bytes will be there in a 20 GB hard disk?	4	CO2	3
2(c)	Represent $(-45)_{10}$ in its 2s complement form.	4	CO2	2
3(a)	Explain in brief simplex, half-duplex, and full-duplex transmission modes. Provide examples of situations where each transmission mode is most appropriate.	6	CO4	1
3(b)	What are LAN topologies? Explain in brief the different types of LAN topologies and their uses. How many cable segments are required in ring topology if you have 50 computers?	6	CO4	2
4(a)	Security mechanisms deal with three things from a security attack. What are they? Explain each of them in brief.	6	CO5	1,2
4(b)	There are some common terms used in cryptography. What are they? Explain each of them in brief.	6	CO5	1,2
5	Write a latex code to create a sample document as given below (Consider that when code is compiled, a similar document needs to be generated). Also, consider that the image used in the document is named "circle.png".	12	CO3	3

My Latex Report
December 2023

The **digital computer** shown in Fig. 1 has the following components:

1. Monitor
2. Central Processing Unit

Fig. 1: Circle

The standard equation of a *circle* is given as follows:

$$(x-h)^2 + (y-k)^2 = r^2$$

Wish you all the best

NATIONAL INSTITUTE OF TECHNOLOGY PATNA

END SEM EXAM 2023 (July-Dec)

BRANCH: B. Tech (CSE), B. Tech - M. Tech Dual Degree (Data science & Cyber security)

TIME = 3 HOURS

F.M. = 60

SUB: ENGINEERING CHEMISTRY

CODE: CH1401

ANSWER ALL QUESTIONS

5+5+5 = 15 CO1

1. (a) WHAT IS HCV ? HOW CAN YOU DETERMINE HCV BY BOMB CALORIMETER?

(b) HOW FLUE GAS IS ANALYSED BY ORSAT'S APPARATUS ?

(c) CALCULATE THE GROSS & NET CALORIFIC VALUE OF A COAL SAMPLE HAVING THE FOLLOWING COMPOSITION:

C = 80%, H = 7%, O = 3%, S = 3.5%, N = 2.1% AND ASH = 4.9%.

5+5+5 = 15 CO2

2. (a) ESTABLISH NERNST EQUATION.

(b) CALCULATE THE MAXIMUM WORK THAT CAN BE OBTAINED FROM THE CELL.

$Zn \mid Zn^{2+}(M) \,||\, Ag^{+}(M) \mid Ag$

WHERE $E^{\circ}_{Zn} = -0.76\ V$ AND $E^{\circ}_{Ag} = 0.80\ V$

(c) EQUILIBRIUM CONSTANT (Kc) FOR THE GIVEN CELL REACTION IS 10. CALCULATE E°_{cell}:

$A(s) + B^{2+}(aq) \rightleftharpoons A^{2+}_{(aq)} + B(s)$

5+5+5 = 15 CO3

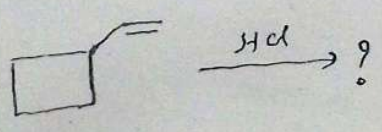
3. (a) EXPLAIN MAGNETIC MOMENT AND STABILITY OF $K_4[Fe(CN)_6]$ AND $K_4\{FeF_6\}$.

(b) FIND CFSE FOR HIGH SPIN AND LOW SPIN COMPLEX OF d^4 system (d-four).

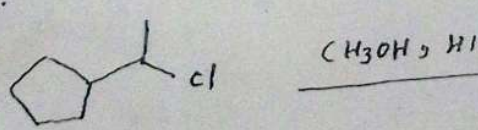
(c) FOR THE $\{Cr(H_2O)_6\}^{2+}$ ion, THE MEAN PAIRING ENERGY, P, IS FOUND TO BE 23,500 cm^{-1}. THE MAGNITUDE OF Δ_o IS 13,900 cm^{-1}. CALCULATE CFSE FOR THIS COMPLEX ION CORRESPONDING TO HIGH SPIN AND LOW SPIN STATE.

5+5+5 = 15 CO4

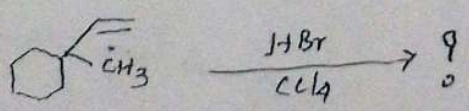
4. (a) GIVE THE PRODUCT OF GIVEN REACTION WITH JUSTIFIED MECHANISM:



(b) WHAT IS THE MOST STABLE PRODUCT OF GIVEN COMPOUNDS, PROCEED WITH MECHANISM:



(c) WRITE PRODUCT WITH REACTION MECHANISM:



National Institute of Technology Patna

Department of Mathematics

END-SEM-EXAMINATION: 13th DEC., 2023

Course Name: **Eng. Mathematics** Course Code: MA14102/MA18101

Program: B.Tech(CSE, Material Science and Eng.) Full Marks:60

Duration: 3 Hrs.

ANSWER ALL QUESTIONS

1. For the function f defined by

$$\begin{aligned} f(x,y) &= xy\frac{x^2-y^2}{x^2+y^2}, \text{ for } (x,y) \neq (0,0) \\ &= 0, \text{ for } (x,y) = (0,0) \end{aligned}$$

Verify $f_{xy}(0,0) \neq f_{yx}(0,0)$. [6M]

2. If $u = \tan^{-1}\{\frac{x^2+y^2}{\sqrt{x}+\sqrt{y}}\}$ then show that $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} = \frac{3}{4}\sin u$ [6M]

3. Expand $x^3 + 3x^2y + 2xy^2$ in powers of x and (y-1) using Taylor series. [6M]

4. Show that the function f defined by

$$\begin{aligned} f(x,y) &= xy\frac{x^2-y^2}{x^2+y^2}, \text{ for } (x,y) \neq (0,0) \\ &= 0, \text{ for } (x,y) = (0,0) \end{aligned}$$

is continuous at origin. [6M]

5. Find all the solutions of the system $x + y + 2z = 3$, $2x - y + 4z = 3$, $4x + 3y + 6z = 1$ by finding all solutions of corresponding homogeneous system. [6M]

6. Show that the following ODE is exact and then solve it:

$$x(x^2 + y^2 - a^2)dx + y(x^2 - y^2 - b^2)dy = 0.$$

[6M]

7. Find the integrating factor of the following ODE and then solve it:

$$(xy\sin xy + \cos xy)ydx + (xy\sin xy - \cos xy)xdy = 0.$$

[6M]

8. Solve the following ODES:

$$x^2(x^2-1)\frac{dy}{dx} + x(x^2+1)y = x^2 - 1,$$

$$(1-x^2)\frac{dy}{dx} - xy = x^2y^2.$$

[12M]

9. Find the matrix P such that $P^{-1}AP = D$(diagonal matrix), where $A = \begin{bmatrix} 1 & 2 & -2 \\ 2 & 1 & -4 \\ 1 & -1 & -2 \end{bmatrix}$. [6M]

*****ALL THE BEST*****

NATIONAL INSTITUTE OF TECHNOLOGY PATNA, BIHAR

END-SEM EXAMINATION (JULY-DEC. 2023)

COURSE: B.TECH. BRANCH: CSE SEM: I

DIGITAL DESIGN (EC14102)

TIME: 3 HOURS MAXIMUM MARKS: 60

Q. 1 $F(A,B,C,D) = AB + A\bar{C} + C + AD + A\bar{B}C + ABC$. Express F in Canonical SOP form. Make a K-map for the function F. Realize the minimized expression using minimum number of NAND gate only. [5]

Q. 2 Design 3-bit Gray code to Binary code conversion using decoder. [5]

Q. 3 A BCD-to-seven-segment decoder is a combinational circuit that accepts a decimal digit in BCD and generates the appropriate outputs for selection of segments in a display indicator used for displaying the decimal digit. The seven outputs of the decoder (a, b, c, d, e, f, g) select the corresponding segments in the display as shown in Fig. 2(a). The numeric designation chosen to represent the decimal digit is shown in Fig. 2(b). Design the BCD-to-seven-segment decoder circuit. [10]

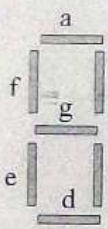


Fig. 2(a): Segment

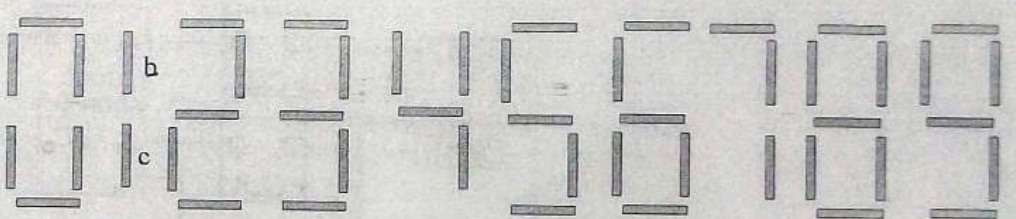
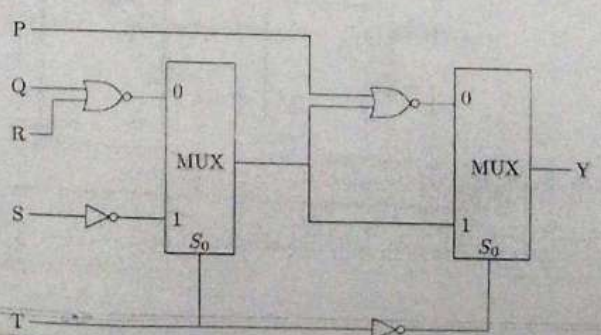


Fig. 2(b): Numerical designation for display

Q. 4 Signals A, B, C, D are available (their compliments are not available). Using only one 8:1 MUX and no other gate, implement expression: $F(A,B,C,D) = BC + AB\bar{D} + \bar{A}\bar{C}D$ [5]

Q. 5 For the circuit shown in the figure, find the minimized Boolean expression for Y. Further, let, the delays of NOR gates, multiplexers and inverters are 2ns, 1.5ns, and 1 ns, respectively. If all the inputs P, Q, R, S, and T are applied at the same time instant, find out the maximum propagation delay (in ns) of the circuit? [10]



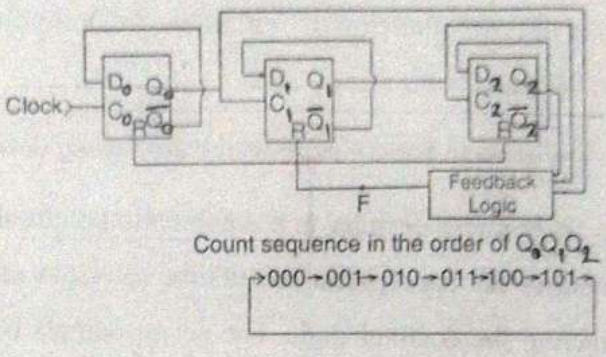
Q. 6 Design Full-Subtractor using MUX [5]

Q. 7 Convert the following flip-flops: [5]

a) SR flip flop to JK flip flop

b) D flip to JK flip flop

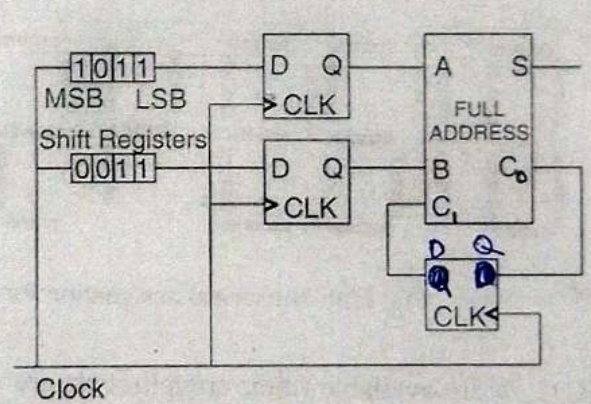
Q. 8 Design the feedback logic for the counter given in the following figure. [5]



Count sequence in the order of $Q_0Q_1Q_2$

→000→001→010→011→100→101→

Q. 9 Two 4-bit PISO shift register loaded with the data are shown in the following figure. Initially, all the flip-flops are in clear state. Find, the timing diagram of S and C_0, for at least six clock cycles. [5]



Q. 10 Assume all the flip-flops are in reset conditions, initially, Find the timing diagram at Q_A at least for 10 clock cycles. [5]