

RAMAKRISHNA MISSION VIVEKANANDA CENTENARY COLLEGE, RAHARA, KOLKATA**End Semester Examination 2019****IInd Semester B.Sc. Computer Science Honours****Core Course IV****Full Marks: 50****Time: 2 hours****Section-A (Answer any 20 questions)** **$20 \times 1 = 20$**

1. Define infinite set with example.
2. Why recurrence relation is useful?
3. What is closed walk?
4. How many elements in $A \times B$ and $B \times A$ are common if 3 elements are common to A and B?
5. What is spanning tree?
6. What is chromatic number of graph?
7. Write Inclusion-Exclusion principle for two sets.
8. Give the statement of Harmonic series.
9. What does $O(1)$ complexity mean?
10. The function $\frac{2}{1-2x} + \frac{1}{1-x}$ generates the sequence $\{a_n\}$ where a_n equal to ____.
11. Let R and S be two equivalence relations on a set consider the following assertions.
 - a) $R \cup S$ is an equivalence relation.
 - b) $R \cap S$ is an equivalence relation.
 Then which of the following is true.
 - i) only (a)
 - ii) both (a) and (b)
 - iii) only (b)
 - iv) none of above.
12. How many minimum friends you must have to guarantee that at least five of them will have birthdays in the same month?
13. There are 10 lamps in a hall. Each one of them can be switched on independently. The number of ways in which the hall can be illuminated is ____.
14. Give the asymptotic upper bound of n^2+7n+3 .
15. What is the Cartesian product of $(A \times B \times C)$ where $A=\{0, 1\}$, $B = \{1, 2\}$, $C = \{0, 1, 2\}$.
16. State the generating function for $(1+z)^n$.
17. Give the recurrence relation for Fibonacci series.
18. Give an example of Hamiltonian path.
19. What is the complexity of searching an element from a set of n element using binary search algorithm?
20. What is the number of edges present in a complete graph having n vertices?
21. Translate the following statement into mathematical logic “some real numbers are rational.”
22. State the graph coloring problem.
23. What is tautology?
24. What is the remainder when 4^{119} is divided by 9?

Section-B (Answer any 3 questions) **$3 \times 10 = 30$**

1. a) Give an example of function from N to N that
 - i) One-to-one but not onto.
 - ii) Onto but not one-to-one.

- iii) Both onto and one-to-one.
 iv) Neither onto nor one-to-one.
 b) how many five digit numbers can be formed using 0 to 9, if each number starts with 59, for example 59124, 59729 etc. and no digits appears more than once.
 c) State the application of graph coloring.

$$4 + 4 + 2 = 10$$

2. a) Prove that the following proportion is Tautology

$$[(p \vee q) \wedge (p \rightarrow r) \wedge (q \rightarrow r)] \rightarrow r.$$

- b) Determine the generating function of the sequence $\{n^2\}$, $n \geq 1$.

- c) Let $H = \{n \in \mathbb{N} : \sin n\pi = 0\}$. Prove that $H = \mathbb{N}$.

$$5 + 2 + 3 = 10$$

3. a) Use the method of generating function to solve the recurrence relation

$$a_n = 4a_{(n-1)} + 3n2^n ; n \geq 1, \text{ given that } a_0 = 4.$$

- b) If we select 10 points in the interior of an equilateral triangle of side 1, show that there must be at-least two points whose distance apart is less than $1/3$.

- c) A house has 4 doors and 10 windows. In how many ways can a burglar rob the house by entering through a window and exiting through a door.

- d) How many numbers are there between 100 and 1000 such that at least one of their digits is 3?

$$4 + 2 + 2 + 2 = 10$$

4. a) Find the value of S for the following geometric series:

$$S = \sum_{j=0}^3 2(4)^j$$

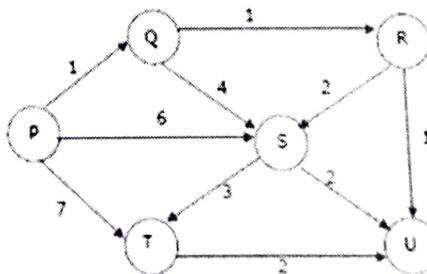
- b) State and explain the Konigsberg bridge problem with proper diagrams.

- c) What is a Propositional variable and logical expression?

- d) What is a planer graph?

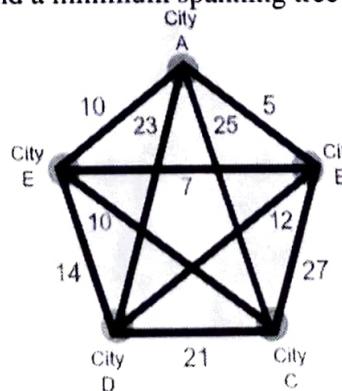
$$4 + 3 + 2 + 1 = 10$$

5. a) Find the shortest paths using Dijkstra algorithm with starting node P for the following graph. Explain it and draw proper diagrams.



- b) Explain if Dijksta algorith can be used in case of negative weighted graphs?

- c) Use Prim's algorithm to find a minimum spanning tree of the following graph:



$$5 + 2 + 3 = 10$$

RAMAKRISHNA MISSION VIVEKANANDA CENTENARY COLLEGE, RAHARA, KOLKATA

**End Semester Examination 2019
IInd Semester B.Sc. Computer Science Honours
Core Course III**

Time: 2 hours

Full Marks: 50

$18 \times 1 = 18$

Section A (Answer any 18 out of 23)

1. Write MySQL syntax for update table statement.
2. The signature of the method to draw an ellipse in Graphics class is:
`void drawOval (int left, int top, int width, int height)`
 What is the condition to be satisfied to draw a circle?
3. Why can't you inherit a superclass when declaring an enum?
4. What is the condition a resource should satisfy for it to be used with try-with-resources statement?
5. When do you use **throws** clause in Exception Handling?
6. When you use multiple **catch** statements, exception subclasses must come before any of their super classes. Why?
7. If you want to allow a member of a class to be seen outside your current package, but only to classes that subclass your class directly, then declare that member _____.
8. Why is it illogical to declare a class as both **abstract** and **final**?
9. Consider the statement:
`System.out.println("Dimensions of Box: " + s);`
 where **s** is a **Box** object.
 What methods are invoked during the execution of this statement?
10. Write a comment that contains an applet tag that will run an applet TestDemo in a window that is 300 pixels wide and 400 pixels high.
11. What is the difference between the **InputStream** methods:
`read()` and `read(byte b[]) ?`
12. Consider a class **Box**. Explain briefly what exactly happens when the statement below is executed and what is **mybox** ?
`Box mybox = new Box();`
13. What is the need of parenthesis around $10 > 9$ in the statement:
`System.out.println("10 > 9 is " + (10 > 9));`
14. Consider the segment of the code:
`for (int x = 0, y = 20; x < 10; x++)`

y = y - 2;

What is value of **y** at the end of the **for** statement?

15. int nums [] = { 1, 2, 3, 4 };
 for (int x : nums) { x = x + 10; }
 int sum = 0;
 for (int x : nums) { sum += x; }
 System.out.println(sum);

What is the output of the above code ?

16. Consider a piece of Java code:

```
if (denom == 0)
    ratio = 0;
else
    ratio = num / denom;
```

Express the above code using ternary operator?

17. Which one of the following is NOT a valid java.lang.String declaration?

- a) String myString = new String ("Hello");
- b) String myString = new String(5);
- c) String cde = "cde";
- d) String myString = new String();

18. What is the advantage of importing a package?

19. How can you prevent a method to be overwritten?

20. Can a class be super class and a subclass at the same time? Give an example.

21. When a lot of changes are required in data, which one should be a preference to be used?
 String or StringBuffer.

22. What will be the output of the following segment of code?

```
class Main {
    public static void main(String args[ ]){
        System.out.println(fun( ));
    }
    int fun( ) {
        return 20;
    }
}
```

23. The method used in Java which waits for the thread to die is:

- a) wait()
- b) destroy()
- c) die()
- d) join()

Section B**(Answer any 4 out of 7)** **$4 \times 8 = 32$**

Write Java programs to demonstrate the following concepts:

1. Extend Java interfaces and implement the methods.
2. Copy a text file to another file using FileWriter and FileReader classes.
3. Use of Adapter class and inner class, MouseListener and WindowListener interface, overriding only mousePressed and windowClosing methods.
4. An applet program that shows the order of execution of its methods init(), start(), stop(), destroy(), and paint(). Output is to be displayed on the applet window and system window.
5. Write a program in Java to explain the roll of all access modifiers available in Java in the context of package.
6. What is threading? Explain how you can synchronize multiple threads in Java.
7. Write a Java class ComLineTest to print the number of arguments passed on the command line as well as the 1st letter of the arguments. For example, if the command line arguments are "Simple Object Robust", the output will be:

No. of arguments: 3

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End Semester Examination 2018
Ist Semester B.Sc. Computer Science Honours
Core Course II

Full Marks: 50**Time: 2 hours****Group A**

- 1.** Choose the correct alternatives for questions (i)-(vi) and answer the remaining.
(ANY EIGHT out of TWELVE) **$8 \times 1 = 8$**
- The circuit used to store one bit of data is known as

a) Register	c) Decoder
b) Encoder	d) Flip-flop
 - $(2FA0C)_{16}$ is equivalent to

a) $(195084)_{10}$	c) Both a) and b)
b) $(0010111101000001100)_2$	d) None of these
 - In a basic computer, after fetching an instruction from memory, the binary code of the instruction is stored in

a) Address Register	c) Instruction Register
b) Program Counter	d) Accumulator
 - For transferring data from keyboard to attached computer, the preferred mode of transfer is

a) Direct memory access	c) Hardware interrupt-driven I/O
b) Programmed I/O	d) Software interrupt-driven I/O
 - Floating point representation is used to store

a) Integers	c) Real numbers
b) Boolean Values	d) Whole numbers
 - Using which one of the following logic circuits can you implement an array multiplier to multiply two 16-bit numbers?

a) 256 AND gates and 15 16-bit adders
b) 16 AND gates and 16 16-bit adders
c) 512 AND gates and 16 16-bit adders
d) 32 AND gates and 32 32-bit adders
 - State the distribute law of Boolean algebra.
 - How can you use a XOR gate as a NOT gate?
 - What is the use of program counter in CPU?
 - Why address bus is always unidirectional?
 - What is meant by locality of reference?
 - What is busy waiting in program controlled I/O?

Group-B **$3 \times 4 = 12$** **2. Answer any three questions :**

- Simplify the Boolean expression:

$$f(A,B,C,D) = \sum m(0, 2, 4, 5, 7, 12) + \sum d(1, 6, 14).$$

4

- Obtain the 9's complement of the decimal number 123456789. Perform the subtraction with the following unsigned decimal numbers by taking 10's complement of the subtrahend: $1753 - 8640$. **1 + 3**

- iii) Explain why following micro-operations cannot be executed during single clock pulse for a common bus system in a basic computer. Specify a sequence of micro-operations that will perform the operation:
- $AC \leftarrow AC + TR$
 - $DR \leftarrow DR + AC$ (AC will not change)
- iv) a) How many references to memory are needed for direct and indirect address instructions to bring an operand into processor register?
 b) What are the two instructions needed in the basic computer in order to set end-carry flip-flop E to 1?
 v) Write a short note on Direct Memory Access (DMA).

Group-C

3. Answer any three questions :

$3 \times 10 = 30$

- i) A majority function is generated in a combinational circuit when the output is equal to 1 if the input variables have more 1's than 0's. The output 0 otherwise. Design the simplified Boolean expression of the output of 4-input majority function. Also implement the corresponding logic using NOR gates only. $6 + 4$
- ii) a) A computer has a memory unit with 256 K words of 32 bits each. A binary instruction code is stored in one word of memory. Instruction has four parts: an indirect bit, an operation code, a register code part to specify one of 64 registers and an address part.
- A. How many bits are there in the operation code, the register code part and the address part
 B. Draw the instruction word format and indicate number of bits in each part.
 C. How many bits are there in the data and address inputs of the memory?
 b) Explain various phases of an instruction cycle in a basic computer. $5 + 5$
- iii) a) Differentiate between hardwared and micro-programmed controls. Draw a basic hardwared control organization with two decoders, one sequence counter and a number of control logic gates. $2 + 3$
 b) Write assembly language to add two numbers (stored in the memory) using mano machine. Use direct addressing modes. 5
- iv) a) What is cache memory? 1
 b) What are the different types of cache memory mapping? 2
 c) Explain 2-way set associative cache mapping technique. 5
 d) Draw the memory hierarchy table. 2
- v) Show that direct mapping and associative mapping are special cases of set associative mapping. A two-way set associative cache has lines(blocks) of 16 bytes each and a total cache size of 8 KB. The 256 MB main memory is byte addressable. What is the number of bits in the memory address? Calculate the number of bits in each of the TAG, INDEX and OFFSET fields of the main memory address. $2 + 2 + 6$

RAMAKRISHNA MISSION VIVEKANANDA CENTENARY COLLEGE, RAHARA, KOLKATA

End Semester Examination 2018
Ist Semester B.Sc. Computer Science Honours
Core Course I

Full Marks: 50**Time: 2 hours**

Section A Answer 10 out of 15 questions. **10 x 1 = 10 Marks**

Find error(s) in the following C/C++ code segments:

```
1. #include <stdio.h>
void Main( ) {
    int a = 10;
    printf("%d", a);
}
```

```
2. int main( ) {
    int i = 0;
    for ( i = 0; i < 3; i++);
    {
        printf("loop");
        continue;
    }
    getchar();
    return 0;
}
```

```
3. int main( ) {
    extern int i;
    i = 20;
    printf("%d", i);
    return 0;
}
```

```
4. int main( ) {
    int a, b, c;
    a + b = c;
    return 0;
}
```

```
5. #include <iostream>
using namespace std;
```

```
class Test {  
    int value;  
public:  
    Test(int v);  
};  
  
Test::Test(int v) {  
    value = v;  
}  
  
int main( ) {  
    Test t[100];  
    return 0;  
}  
  
6. cout << "x = " x;  
7. char s1[20], s2[20] = "Computer Science";  
    strncpy(s1, s2, 5);  
    cout >> s1;  
8. int a[10], b = 10;  
    int *pa = &b;  
    a = pa;  
9. Date *create_date (int day, int month, int year) {  
    Date *d;  
    d->day = day;  
    d->month = month;  
    d->year = year;  
    return d;  
}  
10. int a, b;  
    int &c = a;  
    int &c = b;  
11. consider the function prototypes:  
    void f(int, double = 0.0, char *);           // statement 1  
    void g(int, double = 0, char * = NULL);      // statement 2  
12. // temperature conversion from celsius to fahrenheit  
    double ct, ft;  
    cin >> ct;  
    ft = 9 / 5 * ct + 32;
```

```

13. char s[] = "this is a character array";
   for (; *s != '\0'; ++s) {
       cout << *s << " ";
   }

14. void printResults(int x, int y) {
   cout << "The sum is " << x + y << '\n';
   return x + y;
}

15. /* The following is a definition of class Example: */
class Example {
public:
    Example (int y = 10) : data (y) { }
    int getIncrementDate() const {
        return ++data;
    }
private:
    int data;
};

```

Section B Answer all questions Indicate **True / False** **$5 \times 1 = 5$ Marks**

1. A static variable has the visibility of a local variable but the lifetime of an external variable.
2. Reference data members can be declared as mutable.
3. It is possible to initialize any data member inside a structure in C.
4. Member function defined inside a class specifier does not become inline function by default.
5. A stream cannot be connected to more than one file at a time.

Section C Answer 10 out of 15 questions. **$10 \times 1 = 10$ Marks**

Fill in the blanks or provide one line answers.

1. What is the arithmetic operator that is applicable to integers but not float / double.
2. Indicate the steps in the evaluation of the expression using numbers 1, 2, .. below the operators
 $a + b * c * d / e - f / g$
3. The largest integer value that can be stored on a 32-bit machine is _____.
4. if (a > b)
 $x = a;$

else

x = (b - 5);

Rewrite above if – else statement using ternary operator ?:.

5. C++ allows operator _____ and operator _____ to dynamically allocate and de-allocate memory.
6. Class provides _____ for members to enforce data hiding that separates implementation from interface.
7. Why is it important to close an output file?
8. Classes for which objects can be instantiated are called _____ classes.
9. What is a pure virtual function?
10. int *p(char *a);
In the above statement, what is p?
11. If p is a pointer to type T and n is an integer, p+n increases the value of p by _____.
12. What are mandatory parts in function declaration in C?
 - (a) return type, function name
 - (b) return type, function name, parameters
 - (c) both a & b
 - (d) none of the mentioned
13. What is the index number of the last element of an array with 9 elements in C/C++?
 - (a) 9
 - (b) 8
 - (c) 0
 - (d) Programmer-defined
14. What is the syntax of inheritance of class?
 - (a) class name
 - (b) class name : access specifier
 - (c) class name : access specifier class name
 - (d) None of the mentioned

15. The value of j at the end of the execution of the following C program:

```
int incr (int i) {  
    static int count = 0;  
    count = count + i;  
    return (count);  
}  
int main( ) {  
    int i, j;  
    for (i = 0; i <= 4; i++)  
        j = incr(i);  
    return 0;  
}  
  
(a) 10  
(b) 4  
(c) 6  
(d) 7
```

Section DAnswer any 3 out of 5 questions.3 x 5 = 15 MarksPrograms based on C language.

1. Given a number N and a digit d. Write a program to find the total number of occurrences of digit d in number N.
Constraints: $0 \leq N \leq 10000000$
2. Write a program to divide an array of size N into two arrays of even and odd elements.
Write a separate print function that takes an array and size as the arguments. Use it to print the contents of all the three arrays.
Constraints: $1 \leq N \leq 100$
3. Write a program that prompts user for two files, one containing a line of text known as source file and other, an empty file known as target file and then copies the contents of source file into target file.
4. Write a program that asks the user to enter an integer and checks if it is odd. If the entered number is odd then outputs the number of 1's in its binary representation.
5. Write a program to eliminate multiple spaces in a string.

2 x 5 = 10 Marks

Section E Answer any 2 out of 4 questions.
Programs based on C++ language.

1. Create an abstract class Student. Create a pure virtual function as **info**. Accept the name and rollNo of the student in the function. Create two derived classes Marks and Sports. In Marks accept marks of three subjects. In Sports enter marks scored in sports. Calculate the total marks. Then create another derived class Result. In this, display name, rollNo, total marks of the student.
2. Create a Complex class with private data members **re** and **im** of type double corresponding to real and imaginary parts. Write the required member functions to implement the main function shown below. Also include a print function that prints the elements of the complex number in the form (a + jb) where a and b are real and imaginary parts.

```
int main() {
    Complex c1 (2.5, 3.5), c2;
    c2 = c1;
    return 0;
}
```

3. Write a program to create a 2-dimensional array of size m x n using the pointer **int **p**. Allocate required memory dynamically. Enter array values and print them. Deallocate the memory at the end.
4. Create two text files COUNTRY and CAPITAL. COUNTRY file contains names of at least five countries and CAPITAL file contains names of the corresponding capitals . Write a program to get the output in the following form:

The Capital of India is New Delhi

and so for others.

RAMAKRISHNA MISSION VIVEKANANDA CENTENARY COLLEGE, RAHARA, KOLKATA
End Semester Examination 2019
IInd Semester
Generic Elective – II : Physics

Full Marks: 50**Time: 2 hours**

The figures in the margin indicate full marks

Candidates are required to give their answers in their own words as far as practicable.

All sub-sections/parts of each question must be answered in correct serial order.

(Symbols have their usual meanings)

Group-A

1. Answer any 10 questions:

$10 \times 2 = 20$

- a) Construct AND gate using NOR gate.
- b) Convert $(1011.011)_2$ to decimal number.
- c) State De-Morgan's theorem in Boolean algebra.
- d) Distinguish between Ideal and Practical OP-AMP.
- e) What do you mean by Open loop voltage gain in OP-AMP?
- f) What is Zener breakdown?
- g) Can you construct a BJT by placing two p-n diode in series? Justify.
- h) Design a comparator circuit using OP-AMP.
- i) What is cut-in voltage of a p-n junction diode.
- j) Design a unity gain buffer using OP-AMP.
- k) What do you mean by early effect in BJT.
- l) How does a LED emits light?
- m) Can you subtract binary numbers using adder circuit? Justify.
- n) What do you mean by ripple factor in rectifier circuit.

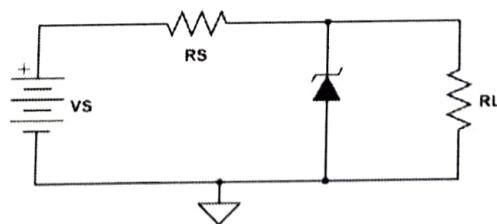
Group-B

Answer any 3 questions:

$3 \times 10 = 30$

2.

a)



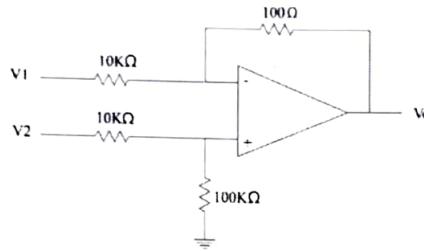
In the above circuit $V_s=12$ V, $R_s=1\text{k}\Omega$, $R_L=1\text{k}\Omega$ and breakdown voltage of the Zener diode is 5.6 V. Calculate the amount of current flowing through R_L and the Zener diode.

- b) Design a Half wave rectifier circuit and draw the input and output waveforms.
- c) What is Barrier potential of a p-n junction diode? Can you measure this using volt meter? Justify your answer.

$3 + 3 + 4$

3.

- a) Design adder circuit using OP-AMP and derive the equation of output.
- b) What is virtual ground in OP-AMP? How is it different from ordinary ground?
- c)



In the above circuit $V_1=0.5$ V and $V_2=0.3$ V. Calculate the output voltage.

3 + 3 + 4

4.

- a) Write down first ten decimal numbers (0 to 9) using a number system of base 3.
- b) Subtract $(1011.011)_2$ from $(11001.01)_2$ using 1's complement method.
- c) Show that NOR gate is a universal gate.

4 + 3 + 3

5.

- a) Draw the current components inside BJT.
- b) Draw the output characteristics of BJT operating in CE mode mentioning Cut-off, saturation and active regions.
- c) Construct a half adder circuit using NAND gates.

3 + 4 + 3

6.

- a) State the Barkhausen's criterion for self-sustained oscillator.
- b) Design differentiator circuit using OP-AMP. Hence derive the expression for output voltage.
- c) Construct EX-OR gate using basic gates. Can you use EX-OR gate in half adder circuit? Justify.

2 + 4 + 4

RAMAKRISHNA MISSION VIVEKANANDA CENTENARY COLLEGE, RAHARA, KOLKATA
End Semester Examination 2018

Ist Semester

Generic Elective – I : Physics

Full Marks: 50

Time: 2 hours

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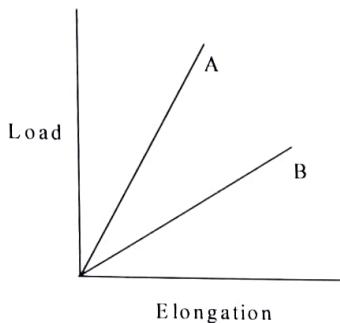
GROUP-A (Answer any ten questions)

$2 \times 10 = 20$

1. Explain the physical significance of gradient of a scalar quantity.
2. A particle moves along a curve $x = 2t^2$, $y = t^2 - 4t$ and $z = 3t - 5$, where t is time. Find its component of velocity at time $t=1$ in the direction $(\hat{i} - 2\hat{j} + 2\hat{k})$
3. If a vector function $\vec{A}(t)$ is constant in magnitude, show that $\frac{d\vec{A}}{dt}$ is perpendicular to $5\vec{A}$.
4. A circular disc of mass 100 gm and diameter 3 cm is rolling down a smooth incline. If the linear velocity of the disc is 100 cm/sec , determine the total energy of the disc.
5. What is the physical significance of moment of inertia?
6. Find the unit vector perpendicular to $\vec{A} = 4\hat{i} - \hat{j} + 3\hat{k}$ and $\vec{B} = -2\hat{i} + \hat{j} - 2\hat{k}$
7. A force $\vec{F} = (-3\hat{i} + \hat{j} + 5\hat{k})$ acts through a point $(7\hat{i} + 3\hat{j} + \hat{k})$. Find the torque of the given force with respect to the point $10\hat{j}$.
8. An elevator of mass 4000 kg is accelerating upwards. If the tension in the supporting cable is 48000 Newton, find the acceleration of the elevator. Take $g = 10 \frac{\text{m}}{\text{s}^2}$.
9. Find the value of b if $\vec{B} = (x + 3y)\hat{i} + (y - 2z)\hat{j} + (x + bz)\hat{k}$ is solenoidal.
10. Find whether $d\phi = (x^3 - 4xy)dx + (x^2 - 2x)dy$ is an exact differential equation?
11. Why is the motion of a planet around the sun greatest at its nearest point (perihelion) on the orbit.
12. Write down the postulates of special theory of relativity.
13. Explain why a moving clock runs slow.

GROUP-B (Answer any three questions) $3 \times 10 = 30$

1. (i) Two wires A and B made of the same material and of same length have load-elongation graph as shown in the figure. Which one of the two wires is thicker? Explain.



- (ii) Four wires of length 4 m and diameter 2 mm each are used to support a platform.

When a person of mass 55 kg stands on it find the elongation. (Given

$$Y = 20 \times 10^{10} \text{ Nm}^{-2} \text{ and } g = 10 \text{ ms}^{-2}$$

- (ii) If Y , k and η represent Young's modulus, Bulk modulus and modulus of rigidity

$$\text{then show that, } Y = \frac{9\eta k}{3k + \eta}.$$

- (iv) Why does a gas possess two types of volume elasticity? 2+3+4+1

2. (i) What is a central force? Show that the areal velocity of a particle moving under a central force is constant.

- (ii) What is geo-synchronous orbit? Find an expression for the orbital velocity at such orbit.

- (iii) Find the height of the geo-synchronous orbit in which an artificial satellite moves round the earth. Given the radius of the earth = 6400 km , acceleration due to gravity at the place of observation = $9.8 \frac{\text{m}}{\text{s}^2}$. (1+3)+(1+2)+3

3. (i) Write down the Lorentz transformation equations. Show that for a velocity $v \ll c$, Lorentz transformation reduces to Galilean transformation..

- (ii) Starting from Lorentz transformation equations obtain the expression for the length contraction.

(iii) The length of a rocket ship is 100 m on the ground. When the rocket ship moves with a velocity of $0.8c$, what will be the length of the rocket ship as observed from the ground. (2+1)+4+3

4. (i) Find the area bounded by the curve $x = a(\theta - \sin\theta)$, $y = a(1 - \cos\theta)$, $a > 0$, and the x axis.
(ii) Obtain the general solution of the differential equation

$$\frac{d^2y}{dx^2} - 3 \frac{dy}{dx} + 2y = x^3$$

(iii) For the scalar field $\phi = \phi(x, y)$, prove that $\frac{\partial^2\phi}{\partial x \partial y} = \frac{\partial^2\phi}{\partial y \partial x}$. 3+4+3

5. (i) Show that $\nabla^2 r^n = n(n+1)r^{n-2}$
(ii) Find the constants a, b, c so that the force field defined by
 $\vec{F} = (x + 2y + az)\hat{i} + (bx - 3y - z)\hat{j} + (4x + cy + 2z)\hat{k}$ is conservative.
(iii) State and prove work energy theorem.
(iv) Find the unit normal vector to the surface $xy^3z^2 = 4$ at (-1,-1,2). 3+2+3+2

6. (i) A particle of mass 2 kg is moving such that at time t , its position, in metre, is given by $\vec{r}(t) = 5\hat{i} - 2t^2\hat{j}$. Find the angular momentum of the particle at $t = 2$ sec about the origin.
(ii) The acceleration of a particle at any time $t \geq 0$ is given by
 $\vec{a} = \frac{d\vec{v}}{dt} = 15 \cos 3t \hat{i} - 10 \sin 3t \hat{j} + 20t \hat{k}$. If the velocity \vec{v} and displacement \vec{r} are zero at $t = 0$, find \vec{v} and \vec{r} at any time.
(iii) Evaluate $\int_C \vec{A} \cdot d\vec{r}$ along the curve $x^2 + y^2 = 1$, $z = 1$ in the positive direction from (0,1,1) to 1,0,1 if $\vec{A} = (yz + 2x)\hat{i} + (xz)\hat{j} + (xy + 2z)\hat{k}$. 3+3+4

=====END=====

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SECOND SEMESTER
B.Sc. COMPUTER SCIENCE HONOURS
CORE COURSE IV

Full Marks: 25**Time: 1 hour****Section A**

1. **Answer any one :** **2 × 1 = 2**
 - a) If A and B are any two sets, prove that $A-B$ and $A \cap B$ are two disjoint sets.
 - b) For the three sets $A=\{p,q,r\}$, $B=\{s,t,u\}$ and $C=\{s,u\}$, verify

$$A \times (B-C) = (A \times B) - (A \times C)$$
2. **Answer any one :** **3 × 1 = 3**
 - a) The following relation is defined on the set \mathbb{R} of real numbers. Find whether this relation is reflexive, symmetric or transitive . apb if and only if $1+ab > 0$
 - b) Give an example of a relation on a set
 - i. which is symmetric but not antisymmetric .
 - ii. which is antisymmetric but not symmetric.
 - iii. which is symmetric and antisymmetric.
3. **Answer any two:** **2½ × 2 = 5**
 - a) Let A and B be two finite sets with $|A|= 5$ and $|B|= 3$. Show that the number of surjective functions from A onto B is 150.
 - b) Show that the function $f: \mathbb{R} \rightarrow \mathbb{R}$ defined by $f(x)= |x|+x$ is neither one-one nor onto.
 - c) Use Mathematical induction to prove that $3^n + 7^n - 2$ is divisible by 8, $n \geq 1$.
4. What is countable set? 1
5. **Answer any one:** **4 × 1 = 4**
 - a) Find a formula for the general term F_n of the Fibonacci sequence 0,1,1,2,3,5,8,13,.....
 - b) Solve the recurrence relation $a_n = 2a_{n-1} + 2^n$; $a_0 = 2$.

Section B**Answer the following:**

6. What are the main measures for complexity analysis of an algorithm? 4
7. Why we dont use runtime analysis for comparing two algorithm? Two algorithms are implemented in some language. Can we measure just the running time for same size problem and conclude which one is better than the other? 2
8. What is a graph? How can we represent a graph? 3
9. What is graph isomorphism? 1

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CORE COURSE III

Full Marks: 25**Time: 1 hour****10 × 1 = 10****Section A: Answer any 10**

1. What is the use of **static** keyword in main() method?
2. In Java, what is meant by whitespace?
3. What is the width and range of Java **char**?
4. Examine the following Java code segment and find error(s) if any?

```
byte a = 10, b = 2, c;
c = a * b;
```
5. What is the output of the following Java code segment?

```
int a = -1; a = a >>> 24;
System.out.println(a);
```
6. What is the difference between the Boolean Logical operators: **&&** and **&**
7. Explain the terms parameter and argument?
8. When using the default constructor, all non-initialized instance variables will have their default values, which are _____, _____, and _____, for numeric types, reference types, and boolean, respectively.
9. Keyword **this** can be used inside any method to refer to the _____.
10. What is Garbage collection?
11. It is legal to declare a class as both **abstract** and **final**. (Yes / No). Why?
12. What is synchronization in a Multithreaded programming?

Section B: Write a program in Java to demonstrate the following:**3 × 5 = 15**

13. Create a thread by implementing Runnable interface.

OR

Using **finally** clause in Exceptional Handling.

14. Interfaces can be extended. Also define a class that implements the methods involved.

OR

Abstract class and method overloading.

15. Single level inheritance, use of super to call superclass constructors and constructor overloading.

OR

Declare a 2-Dimensional integer array of size m × n, input values into the array, and then print the array row-wise using for-each loop.

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CORE COURSE II

Full Marks: 25**Time: 1 hour****Section A****Part 1: Please answer any 2 questions. Each question carries 5 marks.**

1. a) If 4 and 8 are the roots of the quadratic equation $x^2 - ax - 29 = 0$, find the radix of the system, when $a = 11$. [2.0]
 b) What is normalization in floating-point representation? [1.0]
 c) Convert the decimal floating point number -12.125 into hexadecimal number using IEEE-754 32 bit format. [2.0]

2. a) A computer has a memory unit with 256128 words of 32 bits each. An instruction code is stored in one word of memory. The instruction has 4 parts: an addressing mode bit, an operation code, a register code to select one of 64 registers, and an address part.
 i) Show the calculation for number of bits in operation code, register code part and address part? [1.5]
 ii) Draw the instruction word format and indicate bit numbering in each part. [1.5]
 b) What are the instructions to set E flip-flop value to 1? [2.0]

3. a) Which problems are resolved by division-overflow condition? [2.0]
 b) Draw a block diagram of a control unit for a computer which has a 3-bit sequence counter (SC) and a memory unit with 3232 words. Each word is 16 bits. [3.0]

4. a) For a computer that has a memory unit with 3216 words of 16 bits each and opcode of 3 bits, show the block diagrams for different types of instruction formats with number of bits for each part. [3.0]
 b) Explain instruction cycle. [2.0]

Part 2: Please answer any 3 questions. Each question carries 1 mark.

5. The unit which decodes and translates each instruction and generates necessary signals for ALU and other units, is called:
 i) ALU
 ii) Logical unit
 iii) Control unit
 iv) CPU

6. Which register is used to keep track of address of the memory location where next instruction is located?
 i) Instruction Register
 ii) Data Register
 iii) Program Counter
 iv) Address Register

7. In binary division using signed magnitude system, if the dividend is $(11100)_2$ and the divisor is $(10011)_2$, then the quotient is:
 - i) $(00100)_2$
 - ii) $(01100)_2$
 - iii) $(11001)_2$
 - iv) $(10100)_2$
8. If the value, $V(x)$ of the target operand is contained in the address field itself, the addressing mode is:
 - i) Indirect
 - ii) Direct
 - iii) Immediate
 - iv) Implied
9. The bulk of the binary information in digital computer is stored in memory, but all computations are done in:
 - i) Processor Register
 - ii) ALU
 - iii) Control unit
 - iv) Memory Register

Section – B

Part 1: Answer any four of the following:

$4 \times 1 = 4$

1. In parts of the processor, adders are used to calculate

- a) Addresses
- b) Table indices
- c) Increment and decrement operators
- d) All of the Mentioned

2. Controlled inverter is also known as

- a) Controlled buffer
- b) NOT gate
- c) Both controlled buffer and NOT gate
- d) None of the Mentioned

3. Which of the following flip-flops is free from race around problem?

- a) J-K flip-flop
- b) SR flip-flop
- c) Master-Slave Flip-flop
- d) None of the Mentioned

4. Whose operations are more faster among the following?

- a) Combinational circuits
- b) Sequential circuits
- c) Latches
- d) Flip-flops

5. For 8-bit input encoder how many combinations are possible?

- a) 8

- b) 2^8
- c) $\log(2^8)$
- d) $2^{\log 8}$

Part 2: Answer any two of the following: **$4 \times 2 = 8$**

1. Implement the logic function $F(A,B,C,D) = \sum m(3,5,6,7,14,15)$ using a (8-to-1)MUX.
4
2. a. Explain how a decoder can be used to implement any logic function. 2
b. Implement the logic function $F(A,B,C) = \prod m(3,5,6,7)$ using a decoder. 2
3. a. Build a JK flipflop using SR flipflop. Draw its circuit diagram and truth table.
2
b. Describe race around condition of JK flip flop. 2
4. Draw the general register organization of mano machine (Basic computer) which contains seven registers R1 to R7, the ALU unit and MUX as required. Breifly explain it.
4

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CORE COURSE I

Full Marks: 25**Time: 1 hour**

Note: Use C/C++ in writing the programming code.

Section A: Answer any two. **$2 \times 2 = 4$**

1. Write a code snippet using switch statement to print student's grade in an exam according to the following criteria:

90 and above	A grade
70 - 89	B grade
50 - 69	C grade
below 50	Fair
2. Write a program to find the maximum and minimum of the given n numbers.
3. Write a program to find the sum of the first n terms of the following series:
 $S = 1 - 2 + 3 - 4 + 5 \dots$
4. Write a program to reverse a given positive integer.
5. Write a program to validate day and month entries for the leap year using do - while loop. Print the date in the format dd/mm/yyyy.

Section B: Answer any two. **$2 \times 3 = 6$**

1. Write a function to print a two-dimensional array of size 5×4 and its transpose. Function parameters should be given the array, rows and cols.
2. Write a program to input two strings s1 and s2 using getchar(). Join them to form a third string s using string functions strlen, strcpy and strcat. Assume that string length of s1 and s2 is between 10 to 20.
3. Write a program. Declare a structure Marks containing 4 members: RollNo and marks in 3 subjects. Use vector container from standard library to store the data for n students. Print the average marks in each of the 3 subjects for n students.
4. Write a program. Create a two dimensional array of size m x n using the pointer: int **p. Allocate required memory dynamically. Enter array values and print them. Deallocate the memory at the end.
5. Write a program to print the number of 1's in the binary representation of an unsigned integer n using recursion.

Section C: Answer any 10.

10 x 1 = 10

1. Lists and Tables of values can be stored in _____ or _____.
2. An _____ is a consecutive group of memory locations that share the same type.
3. A variable known only within the function in which it is defined is called a(n) _____.
4. The _____ qualifier is used to declare read-only variable.
5. A class's _____ maintain data for each object of the class, and its _____ manipulate the class's data members.
6. When C++ implicitly calls a function of the class, then that function is known as the class's _____.
7. Class members are accessed via the _____ operator in conjunction with the name of an object (or reference to an object) or via the _____ operator in conjunction with a pointer to an object of the class.
8. Member objects are constructed _____ their enclosing class object.
9. A _____ of a class is defined outside that class's scope, yet has the right to access all of the class's members.
10. Dynamic allocation and deallocation of memory in a program is performed with operators _____ and _____.
11. Member function prototype of Unary operator post increment for the class MyType is _____.
12. A static local variable in a function definition exists for the duration of the program but is not visible in the function body. (True / False)
13. Default arguments must be the rightmost (trailing) arguments in a function's parameter list. (True / False)
14. You cannot change the meaning of how an operator works on objects of fundamental types. (True / False)
15. Write four different C++ statements that each adds 1 to an integer variable.
16. State the order of evaluation of the operators in the following C++ statement and show the value of x after the statement is executed.
 $x = (2 * 4 * 2 + (9 * / 3));$
17. What is a Singleton class. Give an example.

Section D: Answer any five.

Find error(s) in the following code segments and explain how to correct it (them).

1. int sum(int n) { // assume n is nonnegative
 if (0 == n)
 returnn 0;
 else
 n + sum(n-1);
2. unsigned int i;
 for (i = 1, i < 10, i += 2)
 cout << i << "\n";
3. The following code shold print the values from 9 to 0.
 unsigned int x = 9;
 while (x > 0)
 cout << x-- << "\n";
4. if (i == 1)
 cout << "A" << endl;
 cout << "B" << endl;
 else
 cout << "C" << endl;
5. while (i <= 10)
 product *= i;
6. Assume that matrix is an array of integers with 3 rows and 3 columns:
 cin << matrix[3][2];
7. double * realPtr;
 long * integerPtr;
 integerPtr = realPtr;
8. char s[] = { "this is a character array." };
 for (; *s != '\0'; ++s) {
 cout << *s << ' ';
9. Consider the following prototype declared in class Date:
 int ~Date(int, int, int);
10. The following is a definition of the class Example:
 class Example {
 private:
 int data;
 static int count;

public:

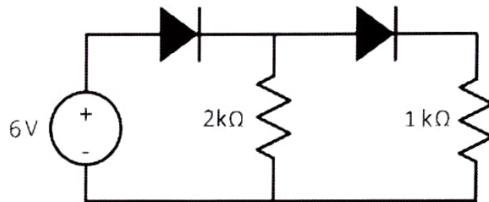
CMSA-UG-S1-MS-CC1-18

```
Example (int y = 10) : data(y) {}  
static int getCount( ) {  
    cout << "Data is " << data << endl;  
    return count;  
}  
};
```

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SECOND SEMESTER
GENERIC ELECTIVE II: PHYSICS

Full Marks: 25**Time: 1 hour****Group-A**

1. Draw the circuit diagram of inverting amplifier using OP-AMP and find the expression of voltage gain. 3

OR

In the above circuit cut-in voltage of both the diodes are 0.7 V. Calculate the amount of current flowing through $1\text{k}\Omega$ resistance. 3

2. 'In a voltage regulator circuit Zener diode is reversed biased'. Explain the reason. 2

OR

Write down the characteristics of an ideal OP-AMP. 2

Group-B

Answer any two questions: **$2 \times 10 = 20$**

3. a) Draw the forward biased I-V characteristics of a p-n junction diode. What is cut-in voltage? Explain the origin of cut-in voltage. 1 + 1 + 2
- b) With proper circuit diagram explain the operation of Bridge-rectifier. What is ripple factor? What is the role of a filter in rectifier? 3 + 1 + 2
4. a) What do you mean by open loop voltage gain in OP-AMP. 2
- b) What is virtual ground in OP-AMP? How is it different from ordinary ground? Can you get virtual ground if no feedback is given to the inverting input? 2 + 1 + 1
- c) With proper circuit diagram explain the operation of a differential amplifier using OP-AMP and find the expression of output voltage. 2 + 2

5. a) Convert the binary number $(10101.101)_2$ to decimal number. 2
b) Subtract $(10111)_2$ from $(11001)_2$. 2
c) Show that NAND gate is a universal gate. 3
d) Draw the logic circuit of XNOR gate using basic gates. 3

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FIRST SEMESTER
GENERIC ELECTIVE I: PHYSICS

Full Marks: 25**Time: 1 hour****GROUP-A**Answer any **three** questions: $3 \times 3 = 9$

1. Solve for y : $\frac{dy}{dx} = \frac{y}{x} + \tan \frac{y}{x}$ 3
2. What is an irrotational vector? Check whether $\vec{A} = (4xy - z^3) \hat{i} + 2x^2 \hat{j} - 3xz^2 \hat{k}$ is irrotational or not? 1+2
3. Find a unit vector perpendicular to the surface $x^2 + y^2 - z^2 = 11$ at the point $(4, 2, 3)$. 3
4. Assuming the planetary orbit in the solar system to be circular, find the period of rotation of Jupiter around the sun. The orbital radii of the earth and the Jupiter respective are 1 A.U and 5.2 A.U . 3

GROUP-BAnswer any **four** questions: $4 \times 4 = 16$

5. (a) Find the complete solution of the differential equation $\frac{d^2y}{dx^2} - 4\frac{dy}{dx} + 13y = 0$ in terms of arbitrary constants A and B .
(b) Find the complete solution of the differential equation $\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + y = 0$ in terms of arbitrary constants A and B . 2+2
6. The acceleration of a particle at any time $t \geq 0$ is given by

$$\vec{a} = \frac{d\vec{v}}{dt} = 15\cos 3t \hat{i} - 10\sin 3t \hat{j} + 20t \hat{k}$$
.
If the velocity \vec{v} and displacement \vec{r} are zero at $t = 0$, find \vec{v} and \vec{r} at any time. 2+2
7. Verify Stoke's theorem for the function $\vec{F} = x^2 \hat{i} - xy \hat{j}$ integrated round the square in the plane $z = 0$ and bounded by the lines $x = 0$, $y = 0$, $x = a$ and $y = a$. 4
8. State the principle of conservation of angular momentum. Show that angular momentum of a particle under the influence of central force always remains constant. 1+3
9. Find the height attained by an artificial satellite at a height h from the earth's surface and moving with an orbital velocity v . What are synchronous satellites? 3+1

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FIRST SEMESTER
ABILITY ENHANCEMENT COMPULSORY COURSE-I: ENGLISH COMMUNICATION

Full Marks: 25

Time: 1 hour

Group A

Answer any three questions from the following. [3 × 5 = 15]

1. Write a letter to the Chairman of your local municipality or to the panchayat Pradhan of your panchayat asking him or her for an awareness campaign on cleanliness.
2. Draw the grape vine pattern of communication and describe its features with example.
3. Write a proposal regarding a publication of a wall magazine in your department.
4. What is an intensive reading technique? Explain its features.
5. What are leadership skills? What qualities are assessed in a Group Discussion?

Group B

Make a poster on any one of the following topics. [10]

- a. Save water save life
- b. Reading is Learning

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**MID SEMESTER EXAMINATION 2017
IST SEMESTER**

ABILITY ENHANCEMENT COMPULSORY COURSE-I : ENGLISH COMMUNICATION

Full Marks: 25

Time: 1 hour

Group A

Answer any three questions from the following. [3x5=15]

1. What do you mean by term Communication? Write about the two elements of Communication.
2. Draw the Communication process model
3. Write about the various process of transmission of encoded messages.
4. Write about the Circular pattern of Communication or Grapevine Pattern of Communication
5. Mention any three barriers of Communication.

Group B

Make a poster on any one of the following topics. [10]

- a. Cleanliness is next to Godliness
- b. Education for All
- c. Let's keep Mosquitoes away