General Instructions:
1. All questions are compulsory.

a) What is the function of typedef in C++. Also give a suitable C++ code to illustrate it.

b) Name the header file(s) that shall be needed for successful compilation of the following C++ code:

```cpp
void main()
{
    char Text[] = "Welcome";
    cout << "Remaining SMS Chars:" << 140 - strlen(Text) << endl;
}
```

c) Rewrite the following program after removing the syntactical errors (if any). Underline each correction.

```cpp
#include <iostream.h>
struct Pixels
{
    int Color, Style;
}

void ShowPoint(Pixels P)
{
    cout << P.Color << "" << P.Style << endl;
}

void main()
{
    Pixels Point1 = {5, 3};
    ShowPoint(Point1);
    Pixels Point2 = Point1;
    Point1 += 2;
    ShowPoint(Point2);
}
```

d) Find the output of the following program:

```cpp
#include <iostream.h>
#include <ctype.h>
void Encrypt(char T[])
{
    for(int i = 0; T[i] != '\0'; i++)
        if(T[i] == 'A' || T[i] == 'E')
            T[i] = '#';
        else if(islower(T[i]))
            T[i] = toupper(T[i]);
        else
            T[i] = '@';
}
void main()
{
    char Text[] = "GLOBAL WArmiNg";
    Encrypt(Text);
    cout << Text << endl;
}
```
(e) Find the output of the following program:
#include<iostream.h>

void in(int x, int y, int &z)
{
    x+=y;
    y--;
    z=(x-y);
}
void out(int x, int &y, int x)
{
    x*=y;
    y++;
    z=(x+y);
}

void main()
{
    int a=20, b=30, c=10;
    out(a,c,b);
    cout<<a<<""<<b<<""<<c<<""<<d<<endl;
    in(b,c,a);
    cout<<a<<""<<b<<""<<c<<""<<d<<endl;
    out(a,b,c);
    cout<<a<<""<<b<<""<<c<<""<<d<<endl;
}

(f) Study the following program and select the possible output(s) from (i) to (iv). Also write the least value and highest value assigned to variable number.
#include<iostream.h>
#include<stdlib.h.h>

void main()
{
    randomize( );
    int array[10]={1, 2, 3, 4, 5, 6, 7, 8, 9, 10};
    int N=6;
    int number = random(array[N]);
    for(int i=number; i>=0; i--)
    {
        cout<<i;
        if(i==1) cout<<',';
    }
}

Output:
(i) 7,5,3,2,1
(ii) 4,3,2,1
(iii) 7,5,3,2
(iv) 7,6,5,4,3,2,1

2. (a) Write any two similarities between Constructors and Destructors. Write the function headers for constructor and destructor of a class Flight.
answer the question (i) and (ii) after going through the following class:

class Book
{
    int BookNo; char BookTitle[20];
    public:
    Book();          //Function 1
    Book(Book &);   //Function 2
    Book(int, char[ ]);  //Function 3
    void Buy();       //Function 4
    void Sell();      //Function 5
};
void main()
{

}

(i) Name the feature of Object Oriented Programming demonstrated by Function 1, Function 2 and Function 3.

(ii) Write statements in C++ to execute Function 3 & Function 4 inside the main() function.

Define a class Seminar with the following specification:

private members
SeminarId  long
Topic      string of 20 characters
VenueLocation string of 20 characters
Fee        float
CalcFee()  function to calculate Fee depending on VenueLocation

<table>
<thead>
<tr>
<th>VenueLocation</th>
<th>Fee</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outdoor</td>
<td>5000</td>
</tr>
<tr>
<td>Indoor Non-AC</td>
<td>6500</td>
</tr>
<tr>
<td>Indoor AC</td>
<td>7500</td>
</tr>
</tbody>
</table>

public members
Register() function to accept values for SeminarId, Topic, VenueLocation and call CalcFee() to calculate Fee
CalcFee() function to calculate fee
ViewSeminar() function to display all the data members on the screen.

Answer the questions (i) to (iv) based on the following:

class FaceToFace
{
    char CenterCode[10];
    public:
    void Input();
    void Output();
};
class Online
{
    char Website[50];
    public:
    void SiteIn();
    void SiteOut();
};
class Training : public FaceToFace, private Online
{
    long Tcode;
    float charge;
    int period;
    public:
    void Register();
    void Show();
};
(i) Which type of inheritance is shown in the above example?
(ii) Write names of all the member functions accessible from Show() function of class Training.
(iii) Write names of all members accessible through an object of class Training.
(iv) Is the member Website accessible inside the function Show()? Justify your answer.

3. (a) Write code for a function OddEven(int s[], int N) in C++, to add 5 in all the odd values and 10 in all the even values of the array S.
Example: If the original content of the array S is

<table>
<thead>
<tr>
<th>50</th>
<th>11</th>
<th>19</th>
<th>24</th>
<th>28</th>
</tr>
</thead>
</table>

The modified content will be:

| 60 | 16 | 29 | 29 | 38 |

(b) Each element of a two-dimensional array (with 5 rows and 4 columns) is stored in one memory location. If A(1,1) is at location 2000, what is the address of A(4,4). The arrangement is column-major. Use a suitable formula for the calculation.

(c) Write the definition of a member function PUSH(), to add a new game detail in a dynamic stack of GAMES considering the following code is already included in the program:

```cpp
struct GAMES
{
    char GameName[30];
    int NumOfPlayer;
    GAMES *next;
};
class STACK
{
    GAMES *Top;
    public:
    STACK() { Top=NULL; }
    void PUSH();
    void POP();
    ~STACK();
};
```

(d) Write a function DISPLAY(X[4][4]) in C++ to display the elements which do not lie on the diagonals. For example, if the content of array is as follows:

<table>
<thead>
<tr>
<th>15</th>
<th>12</th>
<th>56</th>
<th>45</th>
</tr>
</thead>
<tbody>
<tr>
<td>13</td>
<td>91</td>
<td>94</td>
<td>87</td>
</tr>
<tr>
<td>51</td>
<td>63</td>
<td>11</td>
<td>46</td>
</tr>
<tr>
<td>23</td>
<td>61</td>
<td>81</td>
<td>72</td>
</tr>
</tbody>
</table>

The function should display the elements: 12, 56, 13, 87, 51, 46, 61, 81.
Evaluate the following postfix expression (show status of Stack after each operation)
100, 40, 8, /, 20, 10, -, +, *

j) What is the output of the following C++ code if the file content before the execution of the program is the string “ABC”. (note that “ ” are not part of the file)
void main()
{
    char ch='D';
    ofstream fout("data.dat", ios::app);
    fout<<ch;
    int p=fout.tellg();
    cout<<p;
}

k) Write a function in C++ to count the number of “Me” or “My” words in a text file “DIARY.TXT”.
   For example, if the file contains:
   My first book was Me and My family. It gave me a chance to be known to the world.
   The output of the function should be:
   Count of Me/My in the file : 4

Assuming a class PLAYER as declared below, write a function in C++ to read the objects of PLAYER from a binary file SPORTS.DAT and display the details of those players whose rank is above 500.
class PLAYER
{
    char PNO[10];
    char Name[20];
    int rank;
public:
    void EnterData( )
    {
        gets(PNO); gets(Name); cin>>rank;
    }
    void DisplayData( )
    {
        cout<<PNO<<endl;
        cout<<Name<<endl;
        cout<<rank<<endl;
    }
    int Ret_rank( ) { return rank; }
};

a) What is the difference between candidate key and alternate key? Give examples.

b) Consider the following tables EMPLOYEE and DEPARTMENT and answer (a) and (b) parts of this question.

<table>
<thead>
<tr>
<th>Tcode</th>
<th>TName</th>
<th>DepCode</th>
<th>Salary</th>
<th>Age</th>
<th>JoinDate</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td>Sameer Sharma</td>
<td>123</td>
<td>75000</td>
<td>39</td>
<td>2007-04-01</td>
</tr>
<tr>
<td>21</td>
<td>Raghinder K</td>
<td>101</td>
<td>86000</td>
<td>29</td>
<td>2005-11-11</td>
</tr>
<tr>
<td>34</td>
<td>Rama Gupta</td>
<td>119</td>
<td>52500</td>
<td>43</td>
<td>2010-05-03</td>
</tr>
<tr>
<td>46</td>
<td>C R Menon</td>
<td>103</td>
<td>67000</td>
<td>38</td>
<td>2004-07-12</td>
</tr>
<tr>
<td>77</td>
<td>Mohan Kumar</td>
<td>103</td>
<td>63000</td>
<td>55</td>
<td>2000-11-25</td>
</tr>
<tr>
<td>81</td>
<td>Rajesh Kumar</td>
<td>119</td>
<td>74500</td>
<td>48</td>
<td>2008-12-11</td>
</tr>
<tr>
<td>89</td>
<td>Sanjeev P</td>
<td>101</td>
<td>92600</td>
<td>54</td>
<td>2009-01-12</td>
</tr>
<tr>
<td>93</td>
<td>Pragya Jain</td>
<td>123</td>
<td>32000</td>
<td>29</td>
<td>2006-08-05</td>
</tr>
</tbody>
</table>
(a) Write SQL commands for the following statements:
   (i) To display all DepName along with the DepCde in descending order of DepCde.
   (ii) To display the average age of Employees in DepCde as 103.
   (iii) To display the name of DepHead of the Employee named "Sanjeev P".
   (iv) To display the details of all Employees who has joined before 2007 from EMPLOYEE table

(b) Give the output of the following SQL queries:
   (i) SELECT COUNT(DISTINCT DepCde) FROM EMPLOYEE;
   (ii) SELECT MAX(JoinDate), MIN(JoinDate) FROM EMPLOYEE;
   (iii) SELECT TName, DepHead FROM EMPLOYEE E, DEPARTMENT D
        WHERE E.DepCde = D.DepCde and Tcode>50;
   (iv) SELECT COUNT(*) FROM EMPLOYEE
        WHERE Salary>60000 AND Age>30;

6. (a) Verify the following using Boolean Laws

   \[ X + Z = X + X'Z + YZ \]

   (b) Draw the logic circuit for the following Boolean Expression:

   \[ Y = (U + V') \cdot (U + W') \]

   (c) Convert the following Boolean expression into its equivalent Canonical Sum of Products form (SOP):

   \[ (X + Y + Z) (X + Y + W') \cdot (X' + Y + W) \cdot (X' + Y' + W') \]

   (d) Reduce the following Boolean Expression using K-Map:

   \[ f(P, Q, R, S) = \sum(0, 2, 4, 5, 6, 7, 8, 10, 13, 15) \]

7. (a) Identify the Domain name and URL from the following:

   http://www.income.in/home/aboutus.html

   (b) Write two characteristics of Wi-Fi.

   (c) Name any two components required for networking.

   (d) Which of the following is not a unit for data transfer?

   (i) bps
   (ii) abps
   (iii) gbps
   (iv) kbps

   (e) Explain any two switching techniques used in networking.

   (f) Vidya Senior Secondary Public School in Nainital is setting up the network between its different wings.

   There are 4 wings named as SENIOR(S), JUNIOR(J), ADMIN(A), AND HOSTEL(H).

   Distance between various wings are given below:

   | Wing A to Wing S | 100m |
   | Wing A to Wing J | 200m |
   | Wing A to Wing H | 400m |
   | Wing S to Wing J | 300m |
   | Wing A to Wing H | 100m |
   | Wing J to Wing H | 450m |
Number of computers installed at various buildings are as follows:

<table>
<thead>
<tr>
<th>Wing</th>
<th>Number of Computers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wing A</td>
<td>20</td>
</tr>
<tr>
<td>Wing S</td>
<td>150</td>
</tr>
<tr>
<td>Wing J</td>
<td>50</td>
</tr>
<tr>
<td>Wing H</td>
<td>25</td>
</tr>
</tbody>
</table>

(i) Suggest a suitable Topology for networking the computers of all wings.

(ii) Name the most suitable wing where the Server should be installed. Justify your answer.

(iii) Suggest the placement of Hub(s)/Switch(es) in the network.

(iv) Which communication medium would you suggest to connect this school with its main branch in Delhi?

*******************************************************************************