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# राष्ट्रीय प्रौधोगिकी संस्थान गोवा
# NATIONAL INSTITUTE OF TECHNOLOGY GOA

Department of Applied Sciences
Programme Name: B.Tech
Mid Semester Examination, February-2019

B.Tech 1st yr (Batch A)

Course Name: Materials Science
Date: 28/02/2019
Duration: 1 Hour 30 Minutes

Course Code: PH150
Time: 9.30– 11.00 AM
Max. Marks: 50

ANSWER ALL QUESTIONS

1. What is Madelung constant? Show that the Madelung constant for a one-dimensional array of ions of alternating sign with a distance between two successive ions is equal to 2 log2. (8M)

2. Assume that the energy of two particles in the field of each other is given by the following function: (10M)

$$U(r) = -\frac{a}{r} + \frac{b}{r^8}$$

Where $a$ and $b$ are constants and $r$ is the distance between the centers of the particles.

a) Show that if the particles are pulled apart, the molecule will break as soon as

$$r = r_0 = \left(\frac{8b}{a}\right)^{1/7} = r_0[4.5]^{1/7}.$$

b) Prove that in the stable configuration, the energy of attraction is 8 times the energy of repulsion.

c) Show that the minimum force required to break the molecule is $\frac{a^{9/7}}{\left(36b^{2/7}\right)}\left[1 - \frac{8}{36}\right]$

3. (a) Derive planar density expressions for FCC (100) and (111) planes in terms of the atomic radius R.
(b) Compute and compare planar density values for these same two planes for nickel (atomic radius for nickel is 0.125 nm) (5M)

4. If the average energy required for producing a Schottky defect is 1.97 eV in the ionic crystal NaCl, calculate the density of Schottky defects at 27 °C . Given that the interatomic distance is 2.82 Å. (4M) (8 M)

5. Explain the following with proper diagram.
   a) Line Defects
   b) Edge dislocation
   c) Screw dislocation
   d) Grain boundaries

6. What is meant by "Symmetry elements" in crystals? Discuss the various types of symmetry elements and symmetry operations present in a cubic crystal. (5M)

7. What are crystal defects? Mention the different kinds of crystal imperfection. Obtain an expression for the equilibrium concentration of Frenkel defects at a given temperature in an ionic crystal. (6M)

8. Copper has FCC structure and the atomic radius is 0.1278 nm. Calculate the interplanar spacing for (111) and (321) planes. (4M)

*** *All the best*** ***

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# National Institute of Technology Go

Mid-Semester Examination

B.Tech. Programme, 2018-2019

B.Tech (Batch A & B) 1st Yr

Course Name: Mathematics - II

Date: 27-02-2019

Duration: 90 Minutes.

Course Code: MA150

Time: 9.30 AM

Max. Marks: 50

ANSWER ALL QUESTIONS

1. Solve: $(x^2y^2 + y)dx + (2x^3y - x)dy = 0$. [4]

2. Solve the differential equation: $(1 - x^2)y' + xy = y^3 \sin^{-1} x$. [4]

3. If the temperature of the air is 20°C and the temperature of the body drops from 100°C to 80°C in 10 minutes. What will be its temperature after 20 minutes. When will be the temperature 40°C. [4]

4. Discuss the existence and unique solution for the IVP [4]

$$y' = 2y/x, y(x_0) = y_0.$$ [4]

5. Solve the following initial value problem by reducing into first order equation

$$y'' - y' - 2y = 0, y(0) = \alpha, y'(0) = 2.$$ [4]

Find $\alpha$ so that the solution approaches zero as $t \to \infty$.

6. Prove that: "All bases for a vector space have the same number of vectors." [2.5]

7. Find two vectors $\vec{v}$ and $\vec{w}$ that are perpendicular to $(1, 0, 1)$ and to each other. [2.5]

8. For each integer $n$, let $A_n = \begin{pmatrix} 1-n & -n \\ n & 1+n \end{pmatrix}$ prove that $A_nA_m = A_{n+m}$. Find the inverse of $A_n$.

Do the same for the matrix $B_n = \begin{pmatrix} 1-2n & n \\ -4n & 1+2n \end{pmatrix}$. What is the inverse of $A_nB_m$? [5]

9. Are the vectors $(1, 1, 2, 4)$, $(2, -1, -5, 2)$, $(1, -1, -4, 0)$ and $(2, 1, 1, 6)$ are linearly independent in $\mathbb{R}^4$? Find the basis for the subspace spanned by these vectors. [5]

10. Find the inverse of the matrix: $A = \begin{pmatrix} 1 & 1/2 & 1/3 \\ 1/2 & 1/3 & 1/4 \\ 1/3 & 1/4 & 1/5 \end{pmatrix}$ [5]

11. Suppose $A = \begin{pmatrix} 1 & 0 & 0 \\ 2 & 1 & 0 \\ 3 & 4 & 1 \end{pmatrix} \begin{pmatrix} 4 & 2 & 0 & 1 \\ 0 & 0 & 1 & 3 \\ 0 & 0 & 0 & 0 \end{pmatrix}$ [5]

(a) What is the rank of $A$?

(b) Find the basis and dimension of all the fundamental subspaces of $A$. Justify.

(c) Check that the solutions to $Ax = 0$ are perpendicular to the rows.

12. Using the $LU-$ decomposition, solve the system: [5]

$$x + y + z = 6$$
$$x + 2y + 3z = 14$$
$$x + 3y + 6z = 25$$

*** ALL THE BEST ***

Section : A

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# NATIONAL INSTITUTE OF TECHNOLOGY GOA

**Farmagudi, Ponda, Goa, 403401**

**Programme Name: B.Tech.**

**Mid Semester Examinations, September-2018**

1st year
1st Sem
Section : B

**Course Name: Computer Programming & Problem Solving**
**Date: 25-09-18**
**Duration: 1.5 Hours**

**Course Code: CS100**
**Time: 4.00 PM-5.30 PM**
**Max. Marks: 50**

ANSWER ALL QUESTIONS

**1a. Give the structure of C program. Also explain each section in detail.**

**1b. What will be the output of following program? Explain** **(5+1+1.5+1+1.5)**

PS_Q1b_1

```
#include <stdio.h>
main ( ) {
int x=100;
printf(%d/n", 10 + x++);
printf("%d\n", 10 + x++);
}
```

PS_Q1b_2

```
#include <stdio.h>
int main ( ) {
int i=1;
for (i = 0; i = -1; i = ++1)
{ printf ("%d ", i);
  if (i != 1) break;
 }
 return 0;
}
```

PS_Q1b_3

```
#include <stdio.h>
void main ( ) {
int x=10;
if (x =20) printf ("True");
 else printf (" False")
}
```

PS_Q1b_4

```
#include <stdio.h>
 main ( ) {
char ch = 'a';
switch (ch)
{
 case 'a':
  printf("a");
  case 'b':
  printf ("b");
  default :
   printf ("c");
 }
}
```

**2a. Write a C program to check whether the given year is a leap year or not.**

**2b. Write a program to print the multiplication table from 1 to 20.** **(5+5)**

**3a. Why escape sequences are required in C programming? Explain the following escape sequences:**

**i. \t ii. \v iii. \\ iv. \"**

**3b. Write scanf statements to read the following data list:**

**i. 50, 2.0+e01 ii. B, 60B**

**3c. Explain the following statements with necessary example:** **(5+2+3)**

**i. continue ii. break iii. define**

**4a. Write a C program to compute the Sine(X) upto term accuracy is 0.0001.**

**4b. Write a C program to compute the roots of a quadratic equation.** **(5+5)**

**5a. Explain the bidirectional and muti-directional conditional statements with necessary general syntax. Also, write a C program to convert a given decimal number into its octal equivalent using multi-directional conditional statement.**

**5b. What are the different data types of C programming? Explain each of them. Also, give the control strings used for each of the data types while reading the data using scanf statement.** **(5+5)**

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# National Institute Of Technology Goa

Farmagudi, Ponda, Goa 403 401

**SET 3**

**Programme Name: B. Tech**
**Mid Semester Examinations, September-2015**

**Course Name: Engineering Drawing**
**Date: 01/10/2015**
**Duration: 1 Hour and 30 minutes**

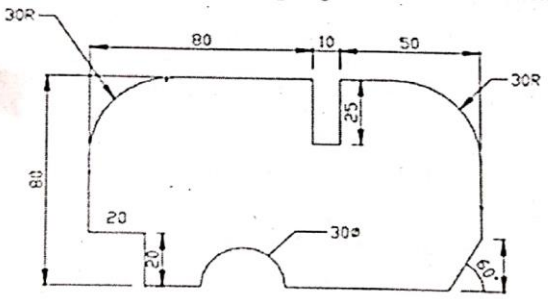
**Course Code: ME 101**
**Time : 2.00-3.30 pm**
**Max. Marks: 50**

**Please read the following instructions before solving:**

All dimensions are in mm
Use first angle projection method
Use aligned dimensioning system
Retain Construction lines
Line work and neatness carries weightage

**ANSWER ALL QUESTIONS**

1. Correct the following figure and redraw it according to general rules for dimensioning. **(10 marks)**




2. Point A 50 mm Below HP, 30 mm Behind VP, and 40 mm from the left PP. Draw its projections on to principal planes **(10 marks)**

3. A line CD, inclined at 25° to the HP, measures 80 mm in TV. The end C is in the first quadrant and 24 mm and 14 mm from the HP and the VP respectively. The end D is at equal distances from both the reference planes. Draw the projections, find TL and true inclination with the VP. Also, locate the traces. **(16 marks)**

4. An equilateral triangle, side 60mm, is perpendicular to both the HP and the VP. One of the corners of the triangle is on the HP and an edge through that corner is inclined at 45° to the HP. Draw the projections of triangle (Right side view, front view and top view). **(14 marks)**

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# National Institute Of Technology Goa

Farmagudi, Ponda, Goa 403 401

**SET 4**

**Programme Name: B. Tech**
**Mid Semester Examinations, September-2015**

**Course Name: Engineering Drawing**
**Date: 01/10/2015**
**Duration: 1 Hour and 30 minutes**

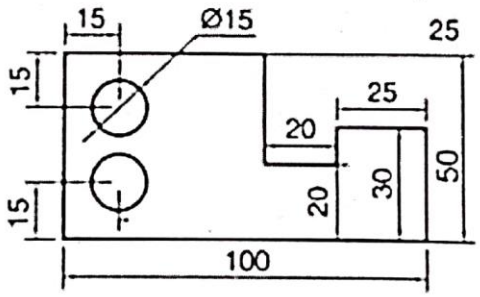
**Course Code: ME 101**
**Time : 2.00-3.30 pm**
**Max. Marks: 50**

**Please read the following instructions before solving:**

All dimensions are in mm
Use first angle projection method
Use aligned dimensioning system
Retain Construction lines
Line work and neatness carries weightage

**ANSWER ALL QUESTIONS**

1. Correct the following figure and redraw it according to general rules for dimensioning. **(10 marks)**




2. Point A 50 mm Behind VP, 40mm above HP, and 30 mm from the left PP. Draw its projections on to principal planes. **(10 marks)**

3. The line joining HT and v (vertical trace projection on the reference line) is 10 mm long and HT is in front of VP. The top view of the line PQ measures 65 mm and is inclined at 45° with' xy' line and the P is 20 mm above HP and 25 mm in front of VP. Draw the projections of the line. Also,find its true length and true angles of inclinations. **(16 marks)**

4. A regular pentagon ABCDE of side 40 mm is inclined at 60° to the VP and perpendicular to the HP. The side AB is perpendicular to the HP. Draw the projections of the pentagon. **(14 marks)**

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# National Institute Of Technology Goa

Farmagudi, Ponda, Goa 403 401

**Programme Name: B.Tech**

**Mid Semester Examinations, September-2015**

**Course Name: Computer Programming and Problem Solving** **Course Code: CS100**

**Date: 28/9/2015** **Time: 9:30am – 11:00am**

**Duration: 1 Hour and 30 minutes** **Max. Marks: 50**

ANSWER ALL QUESTIONS

Q1. Convert the decimal number 63545 to binary and hexadecimal [3M]

Q2. Write the ASCII code for the license plate **GA08-M-3781**
Note that the ASCII code for hyphen is 45 or 0x2d. You may choose any number system. [4M]

Q3. Explain precisely the difference between each of the following. Please provide **examples** to supplement your answers. [15M]

a) little endian format and big endian format
b) compile time error and runtime error
c) printf() and fprintf()
d) logical operator || and bitwise operator |
e) address of operator (&) and dereference operator (*)

Q4. Write a simple C program to return 3 integers from a function using a structure. [6M]

Q5. Write a C program to [8M]

a) Check if a given integer is even or odd.
b) Display the sum of the following series: $1^2 + 3^2 + 5^2 + 7^2 + \ldots + N^2$ where input N is an odd integer.

Q6. . Read the code carefully and explain the difference between the two programs in Fig1. and Fig2. i.e what does each program accomplish? [6M]

```
#include <stdio.h>
int main()
{
        int x = 10, y = 5;
        x = x + y;
        y = x - y;
        x = x - y;

        return 0;
}
```

Fig. 1

```
#include <stdio.h>
int main()
{
        int x = 10, y = 5;
        x = x ^ y;
        y = x ^ y;
        x = x ^ y;

        return 0;
}
```

Fig. 2

Q. 6. Promote South Goa as a Tou[illegible]

Q7. Read the code carefully and explain with an example what does the following program accomplish. [8M]
Please break up your explanation as per the statement blocks indicated below:

```
#include<stdio.h>
int main(void)
{
        int a[10];
        int i, j, n, c, min_idx,temp;

        scanf("%d", &n);


        for (c = 0; c < n; c++) {
                scanf("%d", &a[c]);
        }


        for (i = 0; i < n-1; i++)
        {
                min_idx = i;
                for (j = i+1; j < n; j++){
                        if (a[j] < a[min_idx]){
                                min_idx = j;
                        }
                }

                temp = a[min_idx];
                a[min_idx] = a[i];
                a[i] = temp;
        }


        for (i = n-1; i >= 0; i--)
                printf("%d ", a[i]);

}
```

**Block 1**

**Block 2**

**Block 3**

**Block 4**



*** Good Luck ***

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# National Institute of Technology Goa

Programme Name: B.Tech

Mid Semester Examinations, September-2016

**Course Name: Computer Programming and Problem Solving** **Course Code: CS100**

**Date: 21-09-2016** **Time: 2.00 P.M- 3.30 P.M**

**Duration: 1 Hour 30 minutes** **Max. Marks: 50**

ANSWER ALL QUESTIONS

**1a. What will be the output of following program? Explain.**

```
#include <stdio.h>
int main ( )
{ int a = 2, b = 7, c = 10;
   c = a = = b;
printf ("%d", c);
return 0;
}
```

PS_Q1a_1

```
#include <stdio.h>
int main ( )
{
   int x = 100, y = 20, z = 5;
   printf ("%d %d %d");
   return 0;
}
```

PS_Q1a

```
#include <stdio.h>
int main ( ){
int i=1;
for (i = 0; i = -1; i = 1)
{printf ("%d ", i);
 if (i != 1) break;
 }
 return 0;
}
```

PS_Q1a_3

```
#include <stdio.h>
int main ( ){
int i;
for (i = 0; i<= 5; i++);
printf ( "%d", i)
return 0;
}
```

PS_Q1a_4

**1b. Give the general structure of C Program. Also, explain each component of it.** **(5+5)**

**2a. Write a program to reverse a given string.**

Hint: Accept input string character by character. If given input is HAI 123, expected output is 321 IAH.

**2b. Write a program to compute the sum of the digits of a given number.**

Hint: If the given number 1234 then its digits sum is 10 (i.e., 1+2+3+4). Use array construct. **(5+5)**

**3a. What are bitwise operators? Explain. Also, write a function *setbits(x, p, n, y)* that returns *x* with the *n* bits that begin at position *p* set to the rightmost *n* bits of *y*, leaving the others unchanged.**

**3b. Explain the general syntax of an *Else-If* statement. Write a function to compute the binary search.** **(5+5)**

**4a. Write a program to compute and display the sum of all integers that are divisible by 6 but not divisible by 4 and lie between 0 and 50. The program should also count and display the numbers of such values.**

**4b. Explain the general form of a *For* statement with necessary example.**

**4c. What is the importance of an *void* statement. Give the different forms of a *void* statement.** **(4+3+3)**

**5a What is the output of the following program segments:**

```
main ( )
{
int  m[ ] = {1.2.3.4.5}
int x, y = 0;
for (x = 0; x <5; x++)
  y = y + m[x];
printf ("%d", y);
}
```

PS_Q5a_1

```
main ( )
{
 char string[ ] = "HELLO WORLD"
 int m;
 for (m = 0; string [m] != '\0'; m++)
 if (m%2 = = 0)
 printf ("%c", string[m]);
}
```

PS_Q5a_2

```
main ( )
{
 int m = 100,  n = 0;
 while ( n = = 0)
 { if ( m <  10)
    break;
    m= m - 10;
  }
 }
```

PS_Q5a_3

```
main( )
{ char x;   int y;
   x = 100;   y = 125;
   printf("%c\n", x);
   printf("%c\n", y);
   printf("%d\n", x)
}
```

PS_Q5a_4

```
for (m = 0; m <3; ++m)
  printf("%d/n", (m%2)? m: m+2);
```

PS_Q5a_6

**5b. What is the error, if any in the following program segment:**

```
int x = 0;
float  y = 4.25;
x = y % x;
```

PS_Q5b_1

**5c. Write scanf statements to read the following data list:**

**i. 78, TRUE, B** **ii. 1.23, 45A, 21-09-2016**

**( 5+1+4)**

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