INDIAN INSTITUTE OF SPACE SCIENCE AND TECHNOLOGY
Department of Avionics
AV121 – Basic Electronics
First Year (common to all branches)

10/02/2015

Quiz #1 (II semester)

Maximum Marks: 30

Answer **ALL** Questions

Part- A (10 marks)

1. Complete the chart (Table 1) by converting the given number to each of the other number systems.

[4 marks]

Octal	Hexadecimal	Binary	Decimal	BCD
36				
	A9	10101001		
63		10010		
		1100011	99	1001 1001
				00110011

2. Add (A+B) and subtract (A-B) following binary numbers. Clearly indicate carry and borrow in your answers. **Do not use calculators. [3 Marks]**

A	B
1111	1011
1001001	111010
110100	11011

99.

3. Design a circuit to implement the truth table shown in following Table 2 [3 marks]

Inputs			Output
C	B	A	Y
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	1
1	0	1	1
1	0	0	0
1	1	1	0
1	1	0	1
		1	0

Part- B (20 marks)

4. Calculate the current through the 10KΩ resistor in Fig 1. Assume that the Zener diode have ideal voltage source characteristics with $V_Z=5$ V. [3 marks]
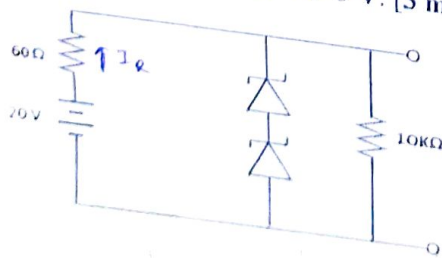
Fig. 1

$I_R = I_Z + I_L$

20

$V_i = V_Z = I_R$

0110 0011
6   3

1010 1001
A 9

2. Design a circuit to obtain the following output in Fig.2 from triangular wave input of 20Vpp using only diodes (use silicon diode with 0.7V drop). [4 marks]
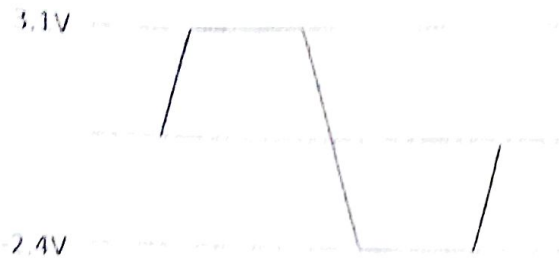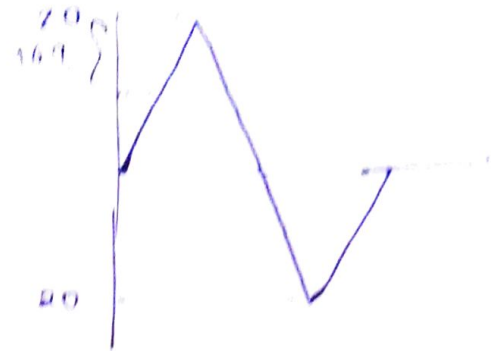
3.1V

-2.4V

Fig.2

3. What is the significance of Peak Inverse Voltage? If the output voltage of a bridge rectifier is 100V, calculate the PIV of diode? [3 marks]

$0.636\ V_m$

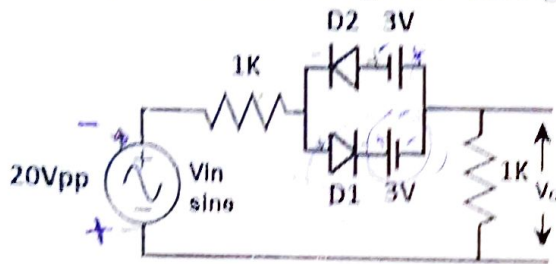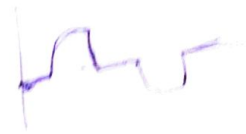4. Draw the output waveform of the given circuit Fig.3? (Assume silicon diode with 0.7V drop) [4 marks]

Fig.3

5. Can the circuit in Fig.4 work as a regulator? What is the power dissipated in the regulator circuit? [Given V=50V; R=150Ω; R_L=75Ω ; Vz=15V].[3 marks]
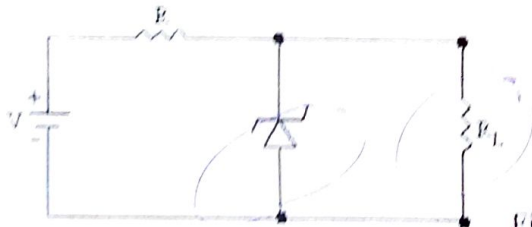

Fig.4

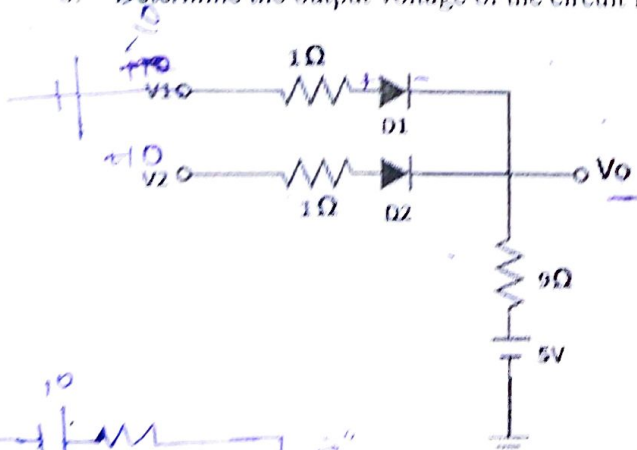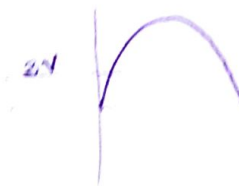6. Determine the output voltage of the circuit in Fig.5 if $V_1=V_2=10V$.(assume diodes are ideal). [3 marks]

Fig.5

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B.Tech Quiz I Examination - February 2015

MA121 - Vector Calculus and Differential Equations

Time: 9.00 am - 10.00 am   Date: 12/02/2015   Max. Marks: 15

(Attempt ALL questions)

1. (a) Find an interval on which the following initial-value problem has a unique solution [2]

$$\frac{dy}{dx} = x^2 + y^2, y(0) = 0$$

   (b) Solve the following differential equation $(e^y - 2xy)\frac{dy}{dx} = y^2$ [2]

2. Let f_1 and f_2 be differentiable functions on an interval I. Prove or disprove: [4]

   (i) If f_1 and f_2 are linearly dependent then $W(f_1, f_2) = 0$ on I.

   (ii) If $W(f_1, f_2) = 0$ for some $x_0 \in I$, then f_1 and f_2 are linearly dependent on I.

3. (a) Find the general solution of $(D + 1)^4 y = 12e^{-x}$, where $D \equiv \frac{d}{dx}$.   [3]

   (b) Find the largest interval on which the following initial value problem has a unique solution.   [2]

$$(x^2 - x - 6)\frac{d^3y}{dx^3} + (x^2 + 4)\frac{d^2y}{dx^2} + \frac{1}{2x + 3}y = e^{-x}.$$

$$y(2) = 0, y'(2) = 4, y''(2) = 3$$

   Explain your answer.

4. Consider the following equations

$$x^2\frac{d^2y}{dx^2} - x\frac{dy}{dx} + 8(x^2 - 1)y = 0$$

   Discuss whether two linearly independent Frobenius series solutions around $x = 0$ exist or do not exist. (No need to find solution.)

END

PH121: Physics - II

Marks : 30   Quiz-1   Date : 11/02/2015

(Answer any **five** questions. All questions carry equal marks)

1) a. Find a unit vector normal to the surface $x^2 y + xz = 3$ at the point $(1, -1, 1)$.
b. Find the angle between the surfaces $x^2 + y^2 + z^2 = 1$ and $z = x^2 + y^2 - 1$ at the point $(1, +1, -1)$.

2) (a) Show that $\vec{F} = (2xy + z^2)\hat{\imath} + x^2\hat{\jmath} + 2\pi z \hat{k}$ is a conservative force field.
(b) Find the scalar potential.
(c) Find the work done in moving a unit mass in this field from the point $(1, 0, 1)$ to $(2, 1, -1)$.

3) (a) Prove that the curl of gradient is zero.
(b) Prove that the divergence of a curl is zero.
(c) Find which one of the following two is incorrect electric field.
     i) $xy\hat{\imath} + 2yz\hat{\jmath} + 3xy\hat{k}$
     ii) $y^2\hat{\imath} + (2xy + z^2)\hat{\jmath} + 2yz\hat{k}$

4) Consider a sphere of radius "a" with charge density function as $\rho(r) = k/r^2$. A concentric spherical shells of uniform surface charge distribution and radius b surrounds the sphere $(b > a)$.The charge densities are such that the total charge with the inner sphere is equal an opposite that of total charge on the outer sphere. Derive the electric field and potential at three places. Namely, inside the inner sphere, between the sphere and shell and outside the outer sphere. Draw the magnitude of electric field and potential as a function of distance from the centre of the shells.

5) A sphere of radius R carries a charge density of $\rho(r) = cr$ (where c is constant). Find the energy of the configuration by two methods. First by using the electric field alone and second by using the resulting potential.

6) If the electric field is $\vec{E} = 30e^{-r}\hat{r} - 2z\hat{k}$ in cylindrical coordinates, then prove divergence Gauss theorem for a volume (cylinder) enclosed by r =2, z= 0 and z=5.

7) Find whether $\vec{E} = r^2 sin\theta\hat{r} + 4r^2 cos\theta\hat{\theta} + r^2 tan\theta\hat{\phi}$ obeys Gauss divergence theorem or not.

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Quiz I – February 18, 2015
CH 121- Materials Science and Metallurgy
Second Semester

Time: 1 h

Max. Marks: 30

Answer all questions

1. Aswin and Ajith were to prepare polystyrene by polymerization of styrene in presence of BPO. To get a higher molecular weight polymer, Ajith performed the reaction for 3 h, while Aswin performed the reaction for 2 h keeping all other conditions same. Will Ajith get higher molecular weight polymer than Aswin? Explain your answer. Derive all the necessary kinetic equations.   (5 marks)

2. Which of the following monomers can be polymerized to high molecular weight polymer using the initiator (BF_3+H_2O)? Justify your answer. Write down the possible mechanism of reaction with any of the suitable monomer.

    (i) $CH_2=CH$ (C_6H_5) (ii) $CH_2=CH$ (CN) (iii) $CH_2=C(CH_3)_2$ (iv) NH_2 $(CH)_6COOH$

    $C = \overset{\oplus}{C} - ph$ ·   × $C = \overset{\oplus}{C} \overset{c}{\underset{c}{<}}$ ·   (1+3 marks)

3. A 0.08 mol/lit solution (7 ml) of n-butyl lithium in toluene was added to a solution of styrene (8.4 g) in toluene (400 ml). After complete conversion, the reaction was completed by addition of 0.05 mol/lit solution (5.6 ml) of dichloromethane in toluene.

    (a) Calculate the degree of polymerization of the final polymer
    (b) Write down the complete mechanism of the reaction   (3+3 marks)

4. (a) Give an example to show that the van der Waals bonding affect the properties of materials.

    (b) What are smart materials? Give two examples   to   sense &   Peso electric - +voltage, strain.
    ability to   respond. (3+2 marks)

5. (a) Explain how the thermal expansion coefficient and Young's modulus of a material is predicted from chemical bonding.

    (b) What is fatigue of a material?   (3+2 marks)

6. (a) What are glass ceramics? How are they prepared?

    (b) Which is a stronger metal Mg or Na? Why?   (3+2 marks)

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First Year B. Tech. - Quiz I
MA122-Computer Programming and Applications

13.02.2015   Time: 09:00-10.00   Maximum Marks: 30

SECTION A

Each questions carry 2 marks.

1. List the errors in the following program

```cpp
#include <iostream>;
int main
{
    // prints "n=22";
    n = 22;
    cout << "n = << n << endl;
}
```

2. What is wrong with the following loop:

```cpp
while (n <= 100)
    sum += n*n;
```

3. What values does the following program print?

```cpp
#include<iostream>
int main()
{
    using namespace std;
    cout<<2*3/4+3/3+7-1+6/7<<endl;
    int a=10;
    int b=11;
    a=a+=b+=a;
    cout<<a<<endl;
    return 0;
}
```

1

4. Arrange in order of precedence (highest first) the following kinds of operators: logical, unary, arithmetic, assignment, relational.

⑤. ④   ①. ③

5. What is the output of the following program?

```
1  #include <iostream>
2  int main()
3  {
4      using namespace std;
5      float fValue1 = 2.345f;
6      float fValue2 = 1.123f;
7      float fTotal = fValue1 + fValue2;    =   3.468
8
9      if (fTotal == 3.468)
10         ;   cout << "fTotal=3.468";
11     else
12         cout << "fTotal!=3.468";
13     return 0;
14 }
```

6. What values does the following program prints?

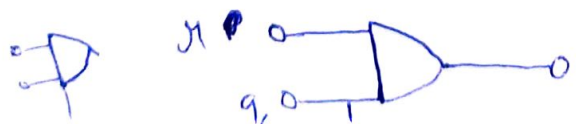```
1 #include <iostream>
2 int main()
3 {
4   using namespace std;
5   float y=6.5;
6
7   int x = 10;
8   {
9   cout << x << endl;
10   int x = 100;
11   cout << x << endl;
12   int y=5;
13   cout << y << endl;
14   }
15   cout << x << endl;
16   cout << y << endl;
17   return 0;
18 }
```

# SECTION B

Each questions carry 3 marks.

7. What value does the following program print?

```
1  #include <iostream>
2  int add(int, int);
3  int multiply(int, int);
4  int main()
5  {
6      using namespace std;
7      cout << add(3, 6) << endl;
8      cout << multiply(2, 3) << endl;
9      int a = 5;
10     cout << add(a, a) << endl;
11     cout << add(1, multiply(2, 3)) << endl;
12     cout << add(1, add(2, 3)) << endl;
13     return 0;
14 }
15 int add(int x, int y)
16 {
17     return x + y;
18 }
19
20 int multiply(int z, int w)
21 {
22     return z * w;
23 }
```

8. State whether each of the following is true or false. If false, tell why.

    a. !(p || q) is the same as !p || !q

    b. !!!p is the same as !p

    c. p && q || r is the same as p && (q || r)

9. Write a program to find and print the best score of 6 students in a class and the student id of the best student. Students scored the following marks: 56, 67, 97, 74, 36, 89 and there student's id are 1, 2, 3, 4, 5 and 6 respectively. The program template is given below. Initialise the marks of the students in the array variable 'scores' at line no. 6. Fill the lines 8, 9, 10 and 11 to get the desired result. Your answer sheet should contain only the numbered statements at line numbers 6, 8, 9, 10 and 11.

```
1  #include <iostream>
2  int main()
3  {
4      using namespace std;
5      const int NumStudents = 6;
6
7      int MaxScore = 0;
8
9
10
11
12     return 0;
13 }
```

10. Use for loops to construct a program that displays a pyramid of Xs on the screen. The pyramid should look like this

```
        X
       XXX
      XXXXX
     XXXXXXX
    XXXXXXXXX
```

11. Write a program that reads a six digit integer and prints the sum of its six digits.

12. Write a program which takes a nonzero positive integer n from user and uses a while loop to compute and print sum of squares of integers from one to n. (For example, if 5 is input, then program will calculate $1^1 + 2^2 + 3^2 + 4^2 + 5^2$ and print 55.)

q	$\sim p$	$\sim q$	$p \vee q$	$\sim(p \vee q)$	$\sim p \vee \sim q$
1	0	0	1	0	0
0	0	1	1	0	1
1	1	0	1	0	1
0	1	1	0	1	1

p
1
1
0
0

$1+1 = 5$

$x < 9$ $x = 1$ $x = 8 + 2$) $n > 0$