
BITS, PILANI – DUBAI, ACADEMIC CITY, DUBAI
SECOND SEMESTER 2012 – 2013
EEE C417 COMPUTER BASED CONTROL SYSTEMS
COMPRE (CLOSED BOOK)

MAXIMUM MARKS: 80
DATE: 04/06/13

WEIGHTAGE: 40%
DURATION: 180 MINUTES

1. Explain the working of Fibre optic displacement transducer with neat sketch. Draw the response curve of a later displacement. **[7marks]**

2. Draw and explain the position algorithm flow chart and derive the relationship between position and velocity algorithm. **[6marks]**

3. (i) Explain the design of Leeds and Northup Max-1 system with neat sketch. **[6marks]**
(ii) Draw the behavior of different feedback control actions for P, PI and PID. **[2 marks]**

4. (i) List the types of valves and briefly explain the working of conventional ball valve with neat sketch. **[5marks]**
(ii) Explain the working of Reed Relay with neat sketch. **[2marks]**

5. Explain in detail about the modeling aspects of kiln automation system in a cement plant. **[7marks]**

6. Using micro C programming, design a micro controller which will convert parallel input into serial output. **[5 marks]**

- 7.(i) Explain briefly about Intel i860 processors and bit slice processors. **[3 marks]**
(ii) Explain the working of feedback and feed forward control system through simple water heating control system. **[4 marks]**

- 8.(i) Explain SCADA architecture with neat sketch. **[5marks]**
(ii) List the different types of embedded control systems based on their applications with examples. **[3 marks]**

9. (i) With diagram explain the empty slot operation in data communications between multi processor systems. **[5marks]**
(ii) Explain the working of optical biosensors **[2marks]**

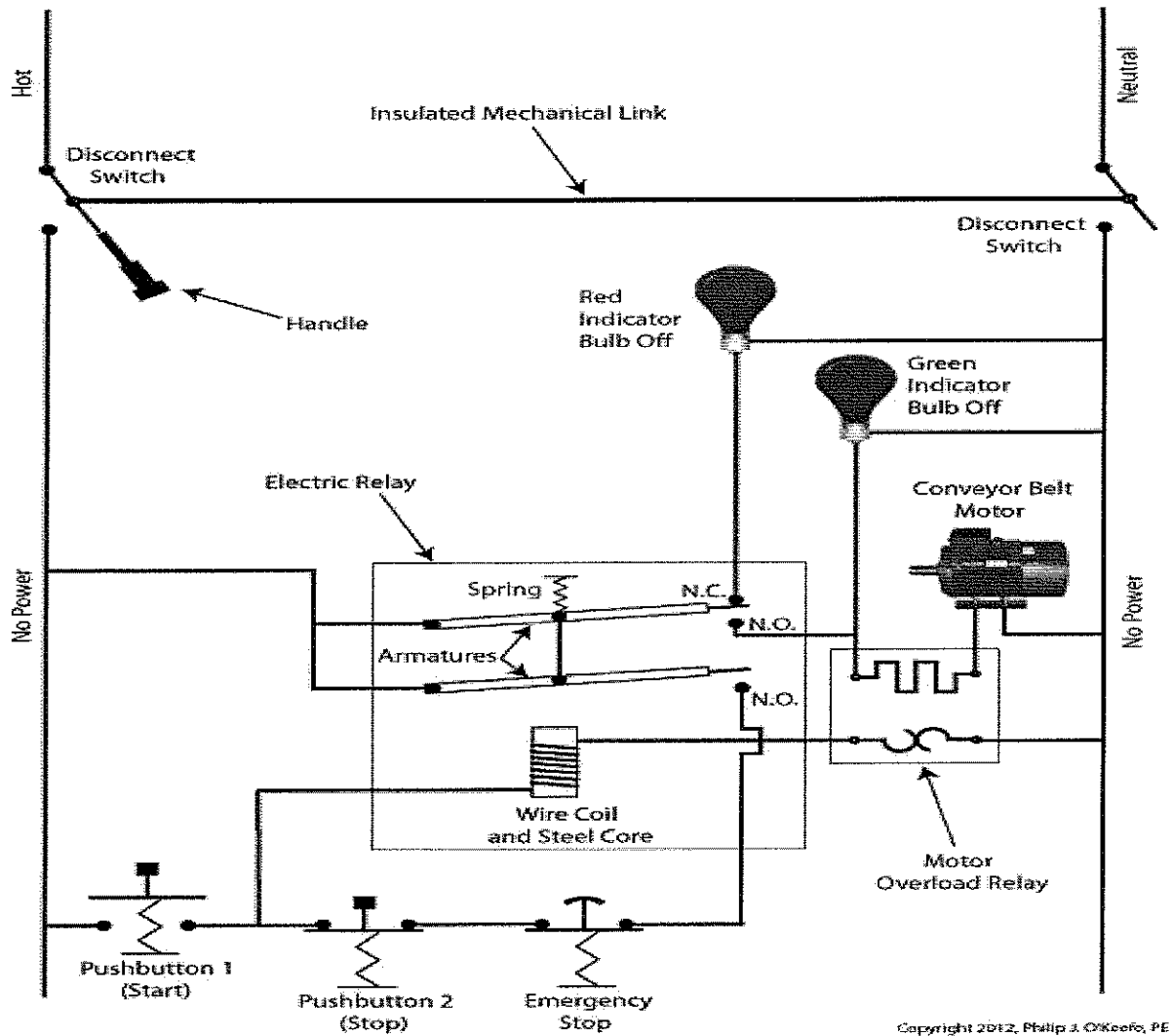
PTO

11. (i) Explain two different display methods and scanning in CRT display. **[3 marks]**

(ii) Define pneumatic actuation and hydraulic actuation. Explain the working of single acting pneumatic cylinders with neat sketch. **[4 marks]**

12.(i) Explain the various levels of distributed control system based on AEG-Telefunken Log stat. **[3marks]**

(ii) Draw the complete ladder diagram for the motor control system given in Figure 1. **[4 marks]**



13. Simplify the following and implement the original and simplified equations with ladder logic. **[4 marks]**

$$A + (\bar{B} + \bar{C} + \bar{D}) \cdot (B + \bar{C}) + A \cdot B \cdot (\bar{C} + \bar{D})$$

Answer Scheme

COMPRE, EEE417 - COMPUTER BASED CONTROL SYSTEMS.

FINAL YEAR - ELECTIVE

① FIBRE DISPLACEMENT TRANSDUCER :-

DIAGRAM - [2M]

RESPONSE CURVE - [2M]

WORKING PRINCIPLE - [3M]

② POSITION ALGORITHM FLOWCHART :-

→ FLOWCHART - (2M)

→ DERIVATION → (2M)

→ Relationship between position & velocity algorithm - [2M]

(c) Design of Leeds & Northrup max-2 System :-

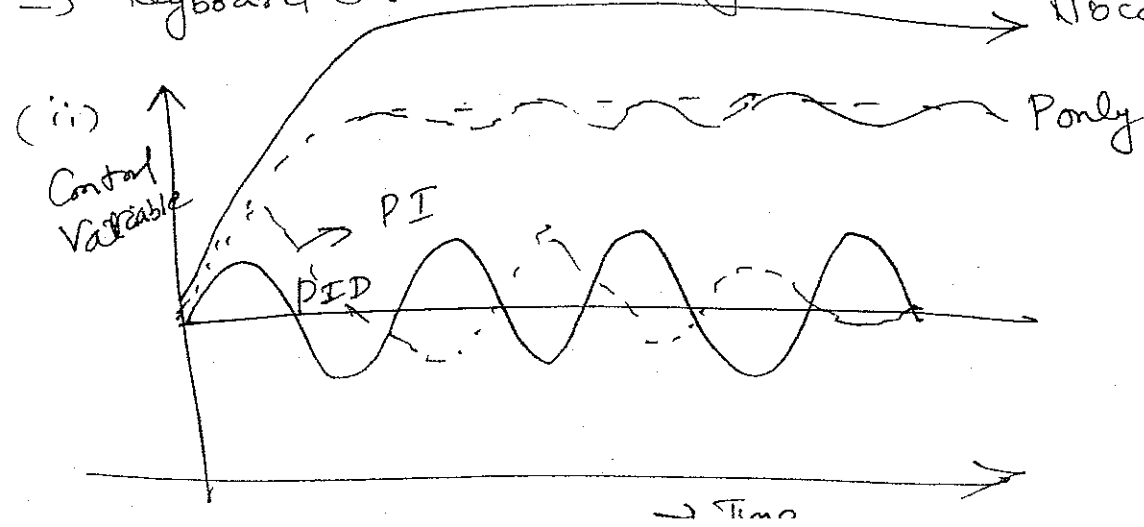
→ Diagram → 1mark

→ Basic components of the system - 2mark

→ Explanation about processors & specifications - 1mark.

→ Keyboard Selection display classifications - 1mark.

→ No control



4(i) Conventional Ball Valve :-

- Classifications of Valve - [1M]
- Working Principle of Ball valve - [2M]
- Advantages [1M]
- Diagram [1M]

4(ii) Reed Relay :-

- Diagram - (1M)
- Working - (1M)

5) Kiln automation :-

- Heart of any cement plant is the Kiln. Kiln is used for converting raw meal to clinker with desired Properties. Hence Kiln should be controlled for optimized Kiln o/p, min fuel consumption & improved kiln lining life.
- I/p Parameters & Control Parameters list → (1M)
- Clinker burning control with Schematic → (2M)
- Kiln control Schematic with explanation → (2M)
- Clinker cooling control Schematic " " → (2M)

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```
#include<reg51.h>
sbit sout = P0^0; // serial out on P0.0
sbit D0 = P1^0; // parallal input from P1 (D0-D7)
sbit D1 = P1^1;
sbit D2 = P1^2;
sbit D3 = P1^3;
sbit D4 = P1^4;
sbit D5 = P1^5;
sbit D6 = P1^6;
sbit D7 = P1^7;
int i;
void delay(void); // 1 ms delay
main()
{
for(i=0;i<8;i++) // rotate loop for 8 times
{
sout = D0; // first bit out
D0 = D1; // shift all bits in sequence
D1 = D2;
D2 = D3;
D3 = D4;
D4 = D5;
D5 = D6;
D6 = D7;
delay(); // generate 1 ms delay after each bit shifted
}
}
void delay()
{
int k
for(k=0;k<1000;k++);
}
```

(i) Intel i860 processors:-

> It is 64 bit microprocessors that delivers the kind of power and capability associated with Super Computers. It integrates Super Computer features like 64 bit architecture, Parallelism and vector processing and takes full advantage of advantage design techniques like reduced Instruction set Computing, pipelining etc.

[L.S.M].

Bit slice processors:-

- Am2901 bit slice processor is available in a slice of 4bits, Depending on the word size required, more than one slices can be ~~processed~~ connected to form a higher bit processor. i.e. 8bit processor can be obtained by connecting two slices, 12bit processor by connecting three slices and so on. [1.5M]

ii) feedback control - [1M]

feedforward control - ~~[2M]~~

Diagram - [1M]

working - [2M]

SCADA

8(i) SCADA Architecture:-

- Diagram - SCADA architecture [1M]
- Basic functions of SCADA Explanation - [2M]
- Explanations about polling [1M]
- Explanation about Interrupt Scanning [2M]
- Conversion to Engg units [1M]

9(ii). Diff types of embedded Systems:-

~~Types~~ Types of embedded systems - [1.5M]

Applications Examples - [1.5M]

9(i) Empty Slot operation in data communications

→ Diagram - (2M)

→ Working Principle of operation - (3M)

(ii) optical biosensors:-

Explanation & working - (2M)

1)(i) Two methods of display - (1M)

Explanation about each graphics display [1M]

" " Scanning used in CRT [1M]

(ii) Definition pneumatic actuation [1M]

→ " hydraulic " [1M]

→ Single acting pneumatic cylinders ~~(1M)~~ [1.5M]

Diagram [0.5M]

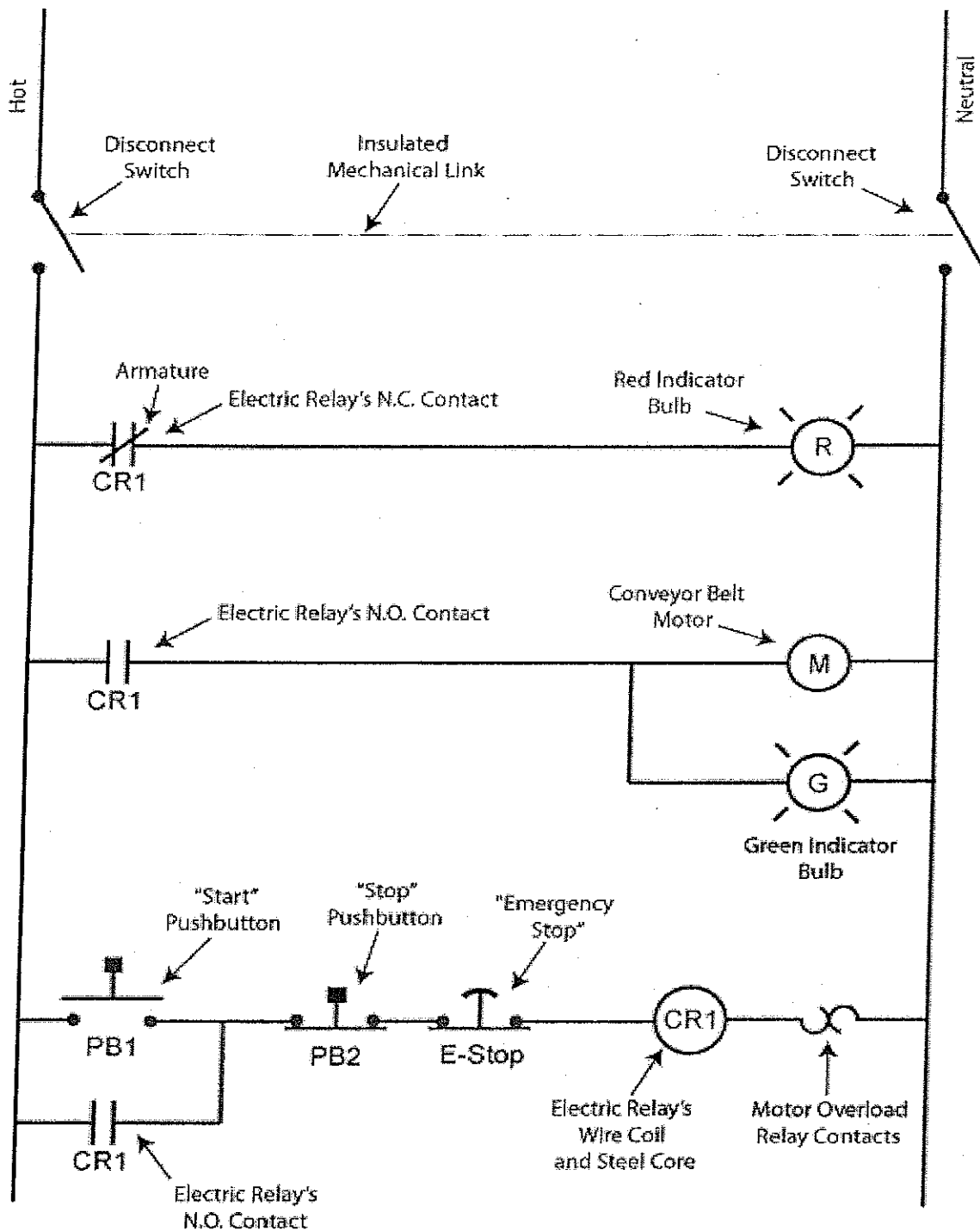
2)(i) Various layers of DCS - AEG - Telefunken Logistex

→ Diagram [1M]

→ Various levels &

Explanation for five process levels [2 marks].

12 (ii)



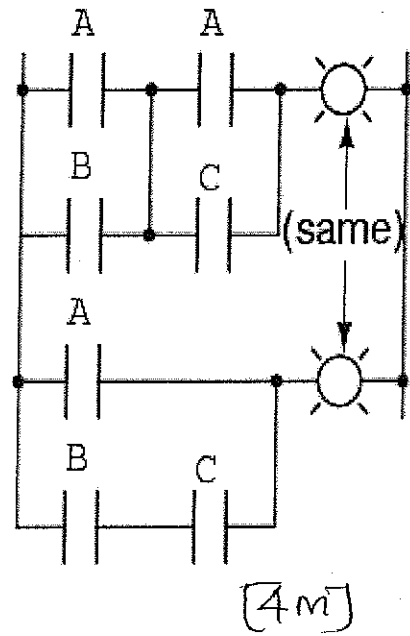
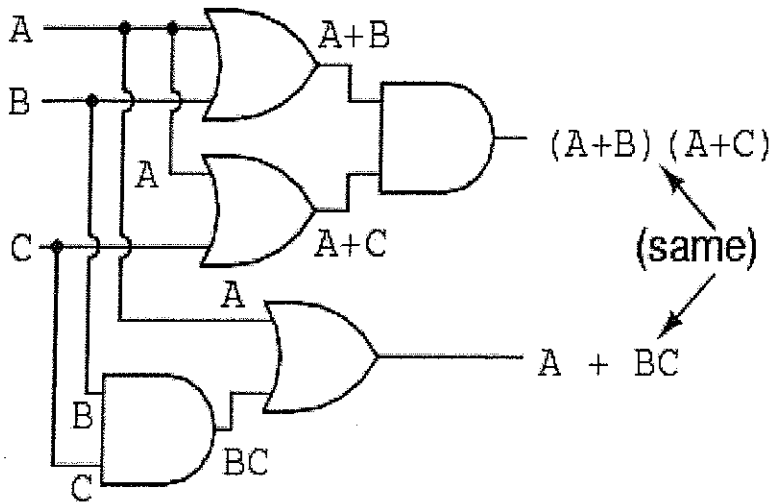
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[4M]

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$$(A + B)(A + C) = A + BC$$



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SECOND SEMESTER 2012 – 2013
EEE C417 COMPUTER BASED CONTROL SYSTEMS
TEST 2 (OPEN BOOK)

MAXIMUM MARKS: 20
DATE: 28/04/13

WEIGHTAGE: 20%
DURATION: 50 MINUTES

1. Design a micro controller for generating rectangular wave for the time period of 60 milliseconds and 45 milli sec as Ton & Toff respectively using C/Assembly language program. **[5 marks]**

2. Design a micro controller for blinking LED in Port 2 (all eight bits) in sequence for every one second using C/Assembly language program. **[5marks]**

3. a) Draw the ladder diagram for the XOR gate connected with lighting load. Use Input switches as A & B (NO or NC). **[3marks]**

(b) Write down the steps involved in code fusion procedure of a micro controller. **[2 marks]**

4. (a) Draw the ladder diagram for the Boolean expression given below.
$$Q = A+B(A+C)+ A.C$$
 [2.5marks]

(b) Explain, how position algorithm and velocity algorithm responds to shut down or failure condition. **[2.5marks]**

TEST-2 Answer Scheme
EEEC417- Computer based Control Systems.

```
1. #include <reg51.h> // include 8051 register file
    sbit pin = P1^1; // declare a variable sbit for P1.1
    main()
    {
        P1 = 0x00; // clear port
        TMOD = 0x09; // initialize timer 0 as 16 bit timer
        loop: TL0 = 0xBF; // load value 15535 = 3CAh so after
        TH0 = 0x63; // 50000 counts timer 0 will be overflow
        pin = 1; // send high logic to P1.0
        TR0 = 1; // start timer
        while(TF0 == 0) {} // wait for first overflow for 50 ms
        TL0 = 0xCF; // again reload count
        TH0 = 0x8A;
        pin = 0; // now send 0 to P1.0
        while(TF0 == 0) {} // wait for 50 ms again
        goto loop; // continue with the loop
    }
```

→ [5m]

```
2. #include <reg51.h> /* Include 8031 / 8051 SFR definition header file */

    unsigned char num[8] = {0x01, 0x02, 0x04, 0x08, 0x10, 0x20, 0x40, 0x80};

    void wait (void)
        {for (j = 0 ; j <= 500 ; j ++ )
          }

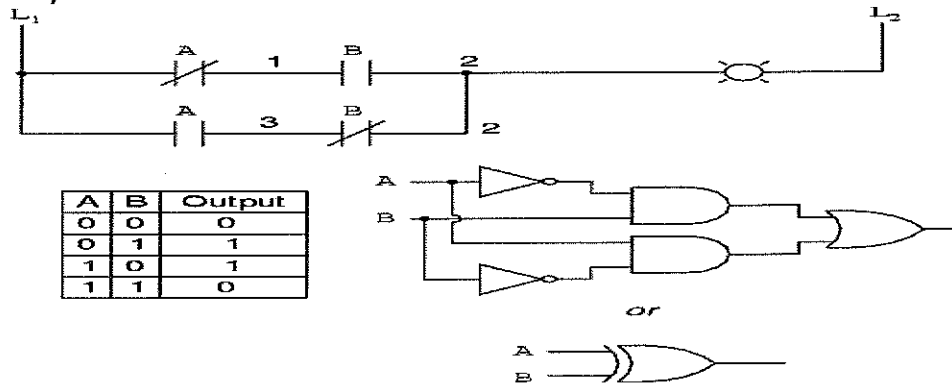
    void main( )
        {
            unsigned char j ;

            while( 1 )
            {
                /* Loop forever */
                for (j = 8 ; j <= 0 ; j -- )
                { /* Blink LED 0,1,2,3,4,5,6,7 */

                    P1 = num[j] ;          /* Output to LED Port */
                    Wait () ;
                }
            }
        }
```

→ [5m]

3. a)

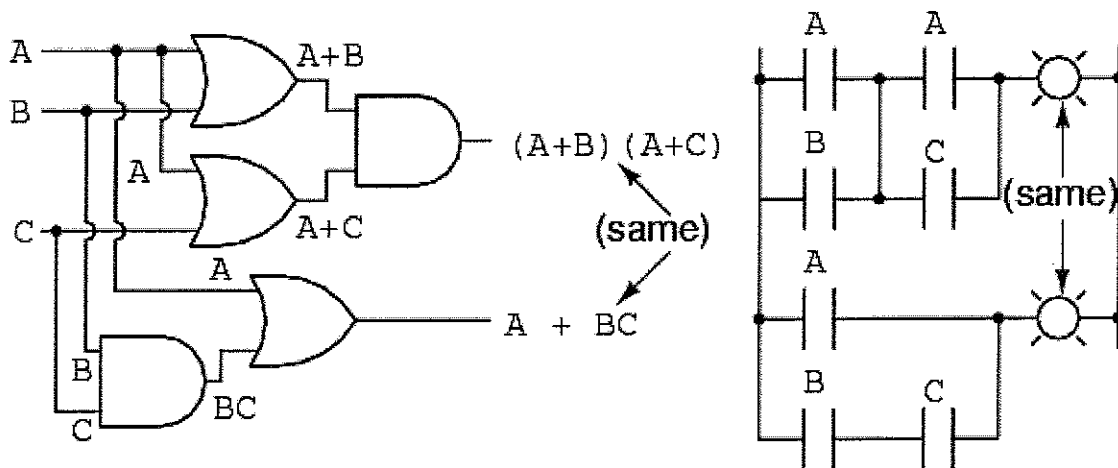


- 3marks

3(b) – 3 major steps about cross compiler and emulators [2marks]

4. (a)

$$(A + B) (A + C) = A + BC$$



[2.5 M]

4(b) Shut down procedure for Position and Velocity algorithm. [2.5 M]

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SECOND SEMESTER 2012 – 2013
EEE C417 COMPUTER BASED CONTROL SYSTEMS
TEST 1 (CLOSED BOOK)

MAXIMUM MARKS: 25
DATE: 10/03/12

WEIGHTAGE: 25%
DURATION: 50 MINUTES

1. (a) Draw the response graph of the P, PI and PID controller. **[2marks]**
(b) Explain about pyrometers and working of automatic optical pyrometers with neat sketch **[5 marks]**

2. Explain the working principle of Thermistors with neat sketch and its response graph. **[5 marks]**

3. (i) Explain the about backward chaining expert system. **[3 marks]**
(ii) Draw the total plant hierarchical control system with various levels. **[2marks]**

4. (i) Explain the working of Fibre optic pressure transducers with neat sketch and its response graph. **[3 marks]**
(ii) Draw liquid level sensor which measures level of conductive liquid. **[2 marks]**

5. (i) Explain Piezoelectric Bio Sensor. **[2 marks]**
(ii) Explain feed forward control with neat sketch. **[3 marks]**

EEE C417 COMPUTER BASED CONTROL SYSTEMSTEST-1

- 1) a) Diagram [2 marks]
- b) Diagram [1 mark] - Automatic Optical Pyrometer
- Pyrometers definitions. [1/2 mark]
- 1) Radiation and Pyrometry - Explanation [1/2]
- 2) Optical Pyrometers - Explanation [1/2]
- Diagram [1/2]
-) Diagram [1 mark]
- Oxides and sulphides of Cu, Co, Mn etc are used in the manufacturing of thermistors. The bead, rod and disc type thermistors are more common. The thermistor range for common purpose is specified as from 100 to 300°C. However special thermistors made of Al_2O_3 cover a high temp range from 800°C to 1000°C [2M]

Thermistors are semi-conducting resistance temp transducers, with large coefficient of resistance. The negative thermistors are more common in the industry than positive

thermistors. The non-linear scale over the entire range of operation may be made linear by applying various compensation schemes. A single low resistance in parallel to the thermistor will reduce the sensitivity but increase the linearity. [2M]

3) (i) Diagram [1 mark]

The backward chaining logic pattern is "goal oriented". The logic of this kind of system is accumulation of facts which will satisfy certain specific references of "goals". This logic is easier to computerise because the goals "inferred facts or conclusions" are already known and the system is concerned only with facts which will support a logical inference. This technique starts with a goal to be proven and works backwards to resolve it. Backward chaining expert systems direct user sessions by asking very specific questions. Facts unrelated to a current specific goal are not normally accepted. [2 marks]

(ii) Diagram [2M]

4).

(i) Diagram [1 m]

Graph [0.5 m]

Pages

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The scheme developed uses a pair of optical polarizers as light valve to rotate the plane polarized light or to change the plane of polarization. The first polarizer allows half the optical power to enter the glass block with well defined polarization status. The second polarizer is located behind the glass block. It is aligned in the cross state relative to the first polarizer. Thus in normal situation, resultant light at the output optical fibre will be nil. When pressure is applied to glass block, the polarization is changed by photoelastic effect, resulting in light in output fibre. [1.5 marks]

(i) Diagram [2 marks]

(i) The functioning of piezoelectric biosensors is based on the principle of measurement of change in resonant frequency of piezoelectric crystal as a result of mass changes on its surface. These changes are caused by the interaction of test species with a biospecific agent, immobilized on the crystal surface. Such sensors normally operate by propagation of acoustoelectric waves along the surface of the crystal and are

commonly referred as Surface Acoustic Wave (SAW) devices.

(ii) Diagram [1 M]

Explanation [2 M]

Pasey

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EEE C417 COMPUTER BASED CONTROL SYSTEMS
Quiz 2 (CLOSED BOOK)

MAXIMUM MARKS: 14
DATE: 16/05/13

WEIGHTAGE: 7%
DURATION: 15 MINUTES

1. Define Contrast ratio in CRT display [1 mark]

2. Name two types of scanning used in CRT applications. [2 mark]

3. List out the measure problems exhibit in velocity algorithm [1 mark]

4. Define MTBF & MTTR [2 marks]

5. Name the DCS system used for frequent data communications. [1 mark]

6. Define HTD in Honey well TDC 2000 system architecture [1 mark]

7. List at least four qualitative parameters of display systems in control systems. [2 marks]
8. List the various video screen selections through keyboard in Leeds & Northrup DCS system. [1 mark]
9. Write the modes of working for RTU. [1 mark]
10. List the basic functions of SCADA [1mark]
11. _____ architecture has program memory and data memory separately. [1mark]

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Quiz 2 (CLOSED BOOK)

Answers
Suhana

MAXIMUM MARKS: 14
DATE: 16/05/13

WEIGHTAGE: 7%
DURATION: 15 MINUTES

1. Define Contrast ratio in CRT display

[1 mark]

About CRT - (2M)

2. Name two types of scanning used in CRT applications.

[2 mark]

1. Interlacing
2. non Interlacing

3. List out the measure problems exhibit in velocity algorithm

[1 mark]

Controller drift

Integral overshoot

4. Define MTBF & MTTR

[2 marks]

MTBF – Mean time between failures

MTTR – Mean time to Repair

5. Name the DCS system used for frequent data communications.

[1 mark]

Control Bailey Micro Z System

6. Define HTD in Honey well TDC 2000 system architecture

[1 mark]

Highway Traffic Director.

7. List at least four qualitative parameters of display systems in control systems. [2 marks]

1. Legibility
2. Brightness
3. Display resolution
4. Cost per character

8. List the various video screen selections through keyboard in Leeds & Northrup DCS system. [1 mark]

1. Group key

2.

9. Write the modes of working for RTU. [1 mark]

Two modes.

10. List the basic functions of SCADA [1 mark]

Scanning
Polling

Harvard

11. RISC architecture has program memory and data memory separately. [1 mark]

12/12/13

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EEE C417 COMPUTER BASED CONTROL SYSTEMS
Quiz 1 (CLOSED BOOK)

MAXIMUM MARKS: 16
DATE: 21/03/13

WEIGHTAGE: 8%
DURATION: 20 MINUTES

1. Name the sensor which uses colour comparison to detect temperature.
[1 mark]

2. Draw the diagram for reflective optical sensor. [1 mark]

3. Explain in short about bit slice processors [1 mark]

4. Define piezoelectric effect and Name at least four piezoelectric materials.
[2 marks]

5. Name the sensor using surface Acoustic wave for sensing. [1 mark]

6. Write down the correction equation for PID controller. [1 mark]

7. The simplest and cheapest form of automatic control which is -----
used in process control. [1 mark]

8. Name the type of the control used in steam flow versus air flow in boiler. [1 mark]

9. Define Interrupt in micro processors. [1 mark]

10. Define dead time in process control system. [2 marks]

11. Draw the diagram of the LVDT transducer with sample response graph [2 marks]

12. To avoid skewing of bits ----- data transfer preferred in micro
processors. [1mark]

13. Which controller action is called automatic reset? [1 mark]

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EEE C417 COMPUTER BASED CONTROL SYSTEMS
Quiz 1 (CLOSED BOOK)

Answer
Scheme

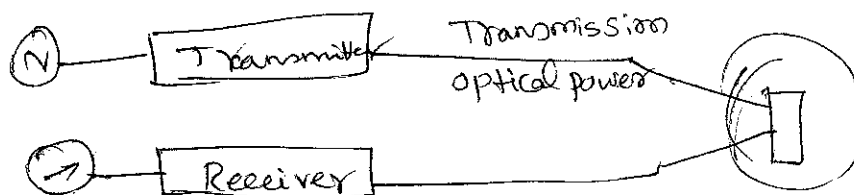
MAXIMUM MARKS: 16
DATE: 21/03/13

WEIGHTAGE: 8%
DURATION: 20 MINUTES

1. Name the sensor which uses colour comparison to detect temperature. [1 mark]

Optical pyrometer

2. Draw the diagram for reflective optical sensor. [1 mark]



3. Explain in short about bit slice processors [1 mark]

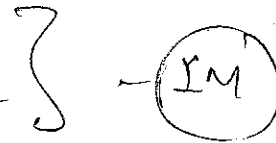
Am 2901 available in a slice of 4 bits. Depends on the word size required, more than one slices can be connected to form a higher bit processors. Ex! 8 bit processor obtained by connecting two slices

4. Define piezoelectric effect and Name at least four piezoelectric materials. [2 marks]

→ A class of solid polycrystalline dielectric materials when deformed by the application of force generate electric charges & vice versa. This is known as piezoelectric effect.

1. *quartz, Rochelle salt*

2. *lithium sulphate, ammonia, phosphate*



5. Name the sensor using surface Acoustic wave for sensing. [1 mark]

Piezoelectric bio sensor

6. Write down the correction equation for PID controller. [1 mark]

$$PID = \frac{100}{P.R} e + Q_0 + \frac{1}{K.I} e dt + K.D \frac{de}{dt}$$

7. The simplest and cheapest form of automatic control which is Two-position used in process control. [1 mark]

8. Name the type of the control used in steam flow versus air flow in boiler. [1 mark]

Ratio controller

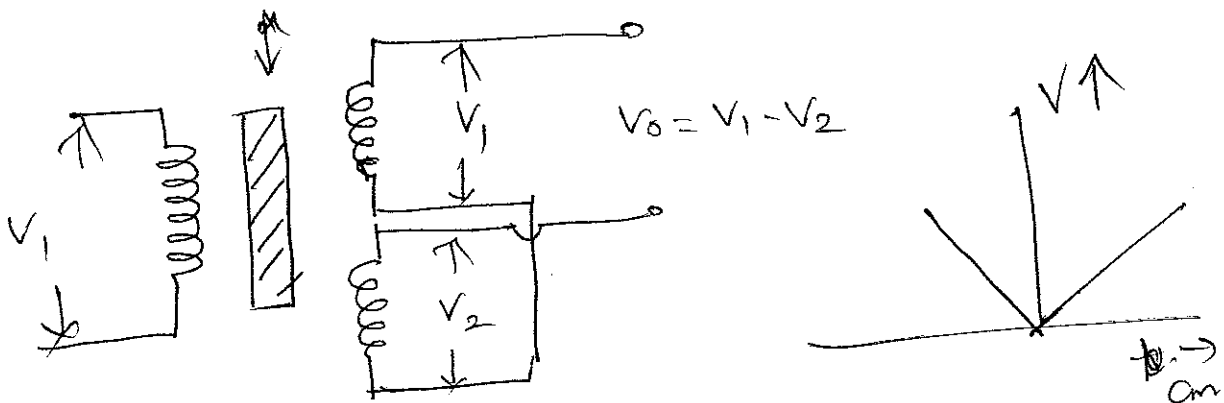
9. Define Interrupt in micro processors. [1 mark]

Interrupt is a facility provided by the μp to the outside environment by which attention of μp can be diverted to do some high priority job.

10. Define dead time in process control system. [2 marks]

Time taken by the process control system to detect the impact of small disturbance ~~is called~~ on o/p is called dead time.

11. Draw the diagram of the LVDT transducer with sample response graph [2 marks]



12. To avoid skewing of bits Serial data transfer preferred in micro processors. [1 mark]

13. Which controller action is called automatic reset?

[1 mark]

Integral