B.E.

Sixth Semester Examination, May-2009

Telementary, Data Processing & Recording (ic-304-E)

Note : Attempt any five questions. All questions carry equal marks

Q. 1. Discuss the various types of instrumentation system. Explain the block diagram and applications of typical instrumentation system.

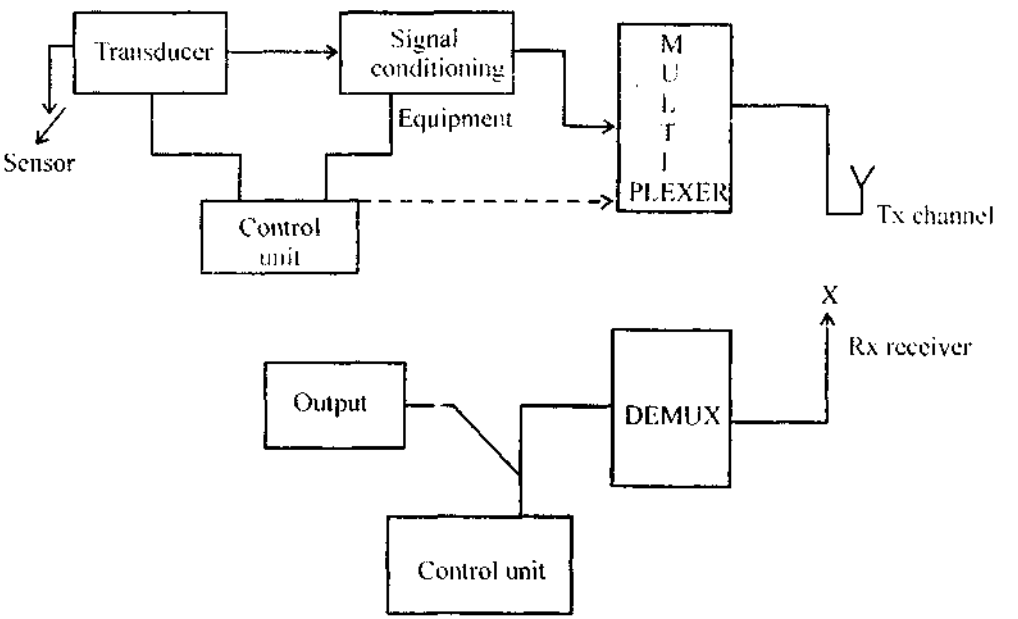
Ans. Instrumentation System : An instrumentation system is an aggregation or assembly of devices united by some form of regular interaction or an interdependence. It is a group of device unit or device so combined by nature or by an art to form air. Integral whole and to function, operate or move in unison and often in obedience to some form of control.

Types of Instrumentation System : The instrumentation system may be classified in two distinct categories :

1. Analog System : These systems deal with information in analog form. An analog signal may be defined as continuous function such as a plot of voltage versus time or displacement versus function.

2. Digital System : A digital quantity may consist of a number of discrete or discontinuous pulses. Whose time relationship contains information about the magnitude and the nature of quantity under measurement.

Basic Blocks of Instrumentation System :



1. Transducer : Transducer converts other on of energy into electrical signal suitable for management. Let thermocouple, through of other building blocks are :

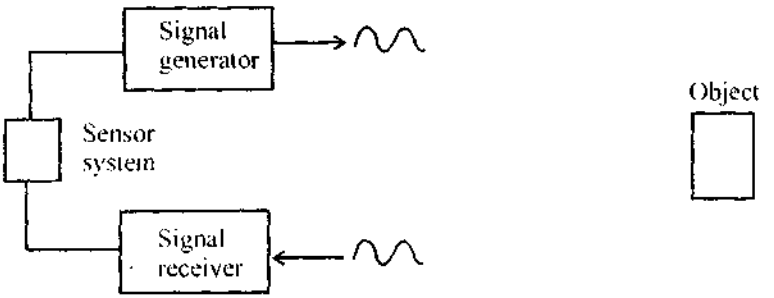
1. **Signal conditioning unit :** Remove distortion of signal.

2. **Control unit :** Controls the operation of system.
3. Multiplexer.
4. Transmitter and tx-channel
5. Receives.
6. Demux.
7. Output.

Q. 2. Explain the working of position and voltage telemetering systems in detail.

Position and Voltage Telemetering System : Position and voltage telemetring system is used to det[illegible]sition of any object with respect to any specified location with the help of variation in amplitude of voltage.

As diagram shows how it is works.



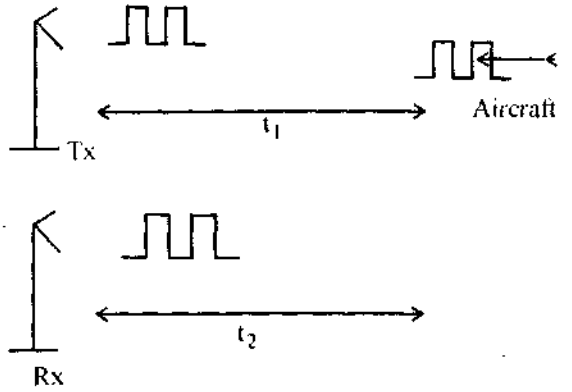
Initially the signal source generates a standard voltage signal and transmitts it into space when signal strikes to any object in space. It reflected back towards sender source and there is a receiver system which sense the reflected signal.

After reception of signal the received signal is prospect and the variation is amplitude of voltage is measured.

Due to distortion is signal and variation in voltage amplitude. The position of object is determined.

The working of position and voltage telemeting systems can be easily understand with the help of RADAR or GPS system.

As shown in figure how pulsed radar works.



Total time taken by pulse $= t_1 + t_2$

Velocity of pulse $= 0$

Distance of object form refer =

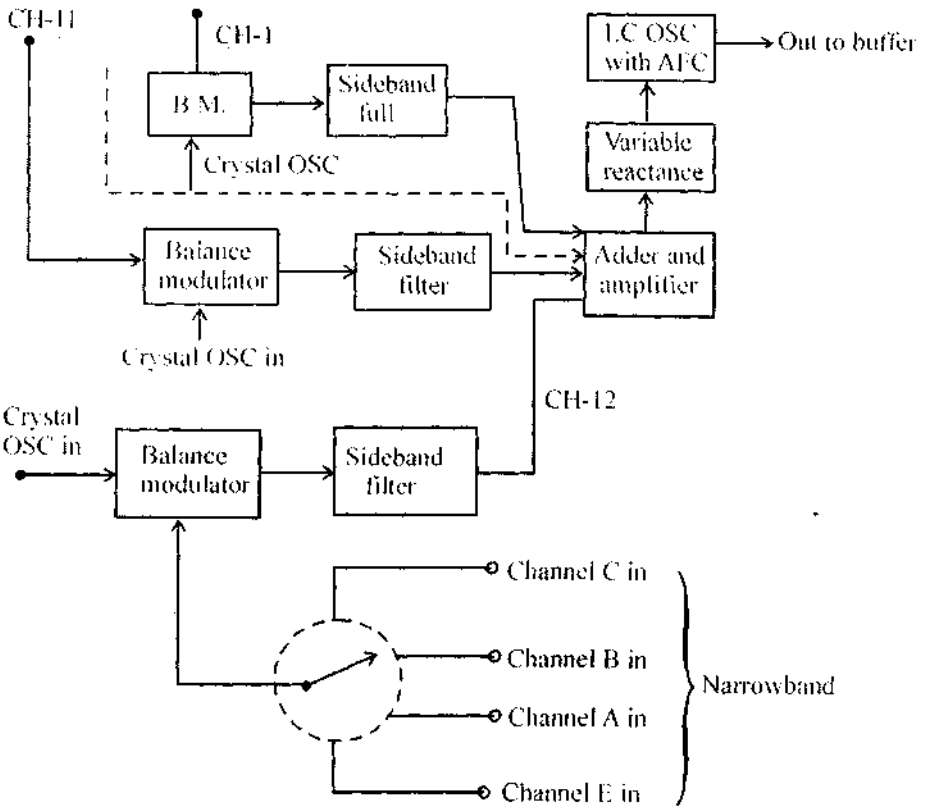
$$d = \frac{(c).(t_1 + t_2)}{2}$$

And it also can be such in map with the help of satellites in GPS system.

Q. 3. (a) Explain the operation of FDM in telemetering systems.

Ans. Operation of FDM In Telemetering System : Since several channel must be sent simultaneous in radiotelemetry and it is impracticable to use a different radio link for each, either FDM multiplexing or TDM multiplexing is always used or both as in figure.

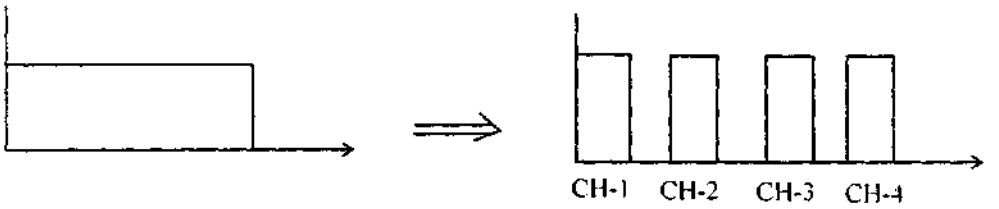
If for example, telemetry is used with a plotters aircraft, not all the telemetered variables change at the same rate. Air speed and attitude change relatively slowly, whereas wings flutter and attitude may change quite rapidly. As a result, these is need for both narrowband channel for handling slow variation and wideband channel for faster variation. This achieved by a process subcommunication as in figure.



Radiotelemetry Using FDM :

What is FDM : The frequency band divided is small frequency band channel and can carry different data

together called FDM.



Q. 3. (b) Derive the expression of amplitude modulated wave and also draw its spectra in frequency domain.

Ans. Amplitude Modulated Wave : Let a system having modulating signal : $V_m \sin w_m t$ and carrier signal is $V_c \sin w_c t$.

Modulated wave amplitude is

$$V = V_c + V_m = V_c + V_m \sin w_m t$$

$$= V_c\left[1 + \frac{V_m}{V_c}\sin w_m t\right]$$

And $\frac{V_m}{V_c}$ is known as modulation index.

$$\Rightarrow \qquad V = V_c(1 + m\sin w_m t)$$

Hence, instantaneous voltage is,

$$V = V\sin w_c t$$

$$= V_c(1 + m\sin w_m t)\sin w_c t \qquad ...(i)$$

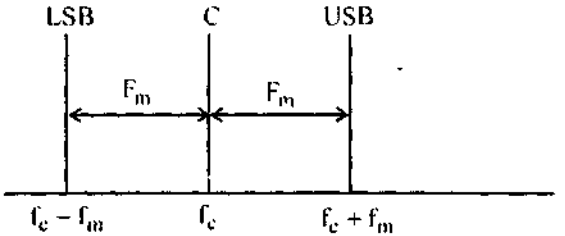
Now, using trigonometric relation,

$$\sin x \sin y = \frac{1}{2}\left[\cos(x-y) - \cos(x+y)\right] \text{ to give}$$

$$V = V_c \sin w_c t + \frac{mV_c}{2}\cos(w_c - w_m)t - \frac{mV_c}{2}\cos(w_c + w_m)t \quad ...(ii)$$

From the above equation we can conclude that there are two sideband at $f_c + f_m$, $f_c - f_m$.

Frequency Spectrum :



Q. 4. (a) A 93.2 MHz carrier is frequency modulated by a 5 KHz sine wave. The resultant FM signal has a frequency deviation of 40 KHz (a) Find the carrier swing of FM signal (b) What are the highest and lowest frequencies attained by the frequency modulated signal (c) Calculate the modulation index for wave.

Ans. Given that $f_c = 93.2\,MHz$

$f_m = 5\,KHz$

$\Delta f = 40\,KHz$

(a) Carrier Swing : $= 2\Delta f$

$= (2 \times 40)\,KHz$

$= 80\,KHz$

(b) Highest and Lowest Frequency :

$$f_h = f_c + \Delta f\ ,\ f_l = f_c - \Delta f$$

$\Rightarrow$ $f_h = 93.2 \times 10^3 kH + 80\,kHz$

$= 93280\,KHz$

And $f_l = 93.2 \times 10^3 KH - 80\,KHz$

$= 93120\,KHz$

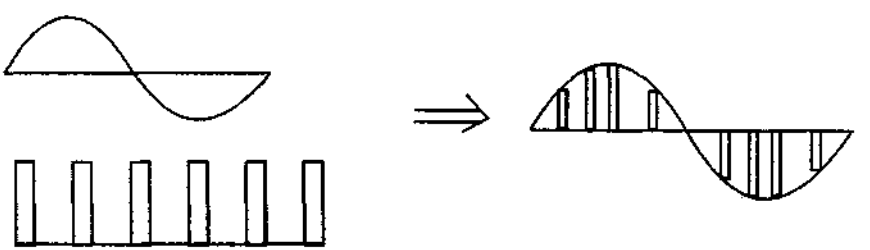
(c) Modulation Index :

$$m_f = \frac{\Delta f}{f_m} = \frac{40}{5} = 8$$ **Ans.**

Q. 4. (b) Explain the various types of pulse modulation systems in detail.

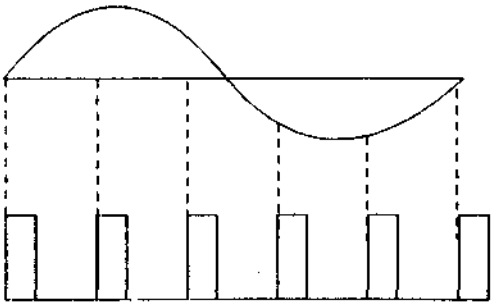
Ans. Pulse Modulation : Pulse modulation may be used to transmit analog information such as continuous speech or data. It is a system in which continuous waveform are sampled at a regular internal. Pulse modulation may be broadly categories in analog and digital are following types :

1. Pulse Amplitude Modulation : It is simplest of modulation as shown in fig.



2. Pulse Time Modulation : In this technique pulse time duration is modulated according to applied signal.

3. Pulse Width Modulation : With of pulse modulated according to signal as in figure.

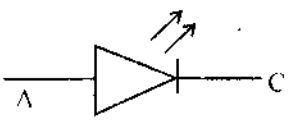


4. Pulse Position Modulation : Here the starting position of pulse changes according to signal.

5. Pulse Code Modulation : Pulse code is modulated according to applied signal according to quantization line.

Q. 5. (a) Explain the theory and working of LEDs. Discuss its advantages.

Ans. LED :



A Light Emitting Diode is a semiconductor light source. LEDs are used an indicator lamps in many devices.

The LED based on the semiconductor diode. When diode is forward biased (switch on), electron are able to recombine with holes within the device releasing energy in the form of photon, the effect is called electroluminescene."

Applications of LEDs fall into three major categories :

1. Visual signal application where the light goes more or less directly from the LED to the human eyes to convey message or meaning.
2. Illumination where LED light is reflected from a object to give visual response to these objects.
3. Generate light for measuring and interacting.

Advantages :

1. Low cost as compare to other.
2. Quick response time.
3. Reliable.
4. Low power consumption etc.
5. Useful on may electron device.

Q. 5. (b) Explain the various display methods in brief.

Ans. Display : The rapid growth of electronics harding of numerical data has bought with it a great demand for simple system to display the data in a readily understandable form.

Classification of Displays : Commonly used displays as below :

1. Cathode ray tube (CRT)
2. Light emitting diode (LED)
3. Liquid crystal display (LCD)
4. Gas discharge plasma display.
5. Electro-luminescent (RL) display.
6. Incandescent display.
7. Electrophoretic image display (EPID)
8. Liquid vapour display (LVD)

We can also classify on the method of conversion.

(a) Active Display : [Example incadement display, i.e., due to temperature.]

(b) Passive Display :

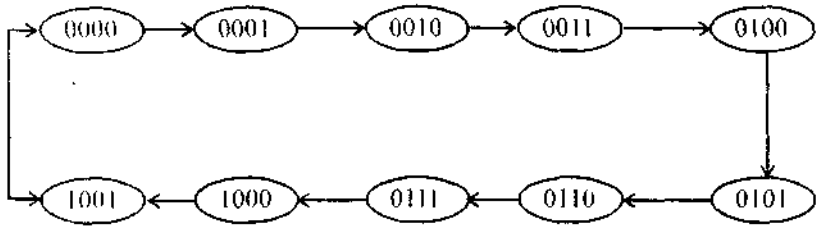
LCD etc.

On the basis of use : 1. Analog display 2. Digital display

Q. 6. Explain the working of decade counter. Implement decade counter using JK flip-flop.

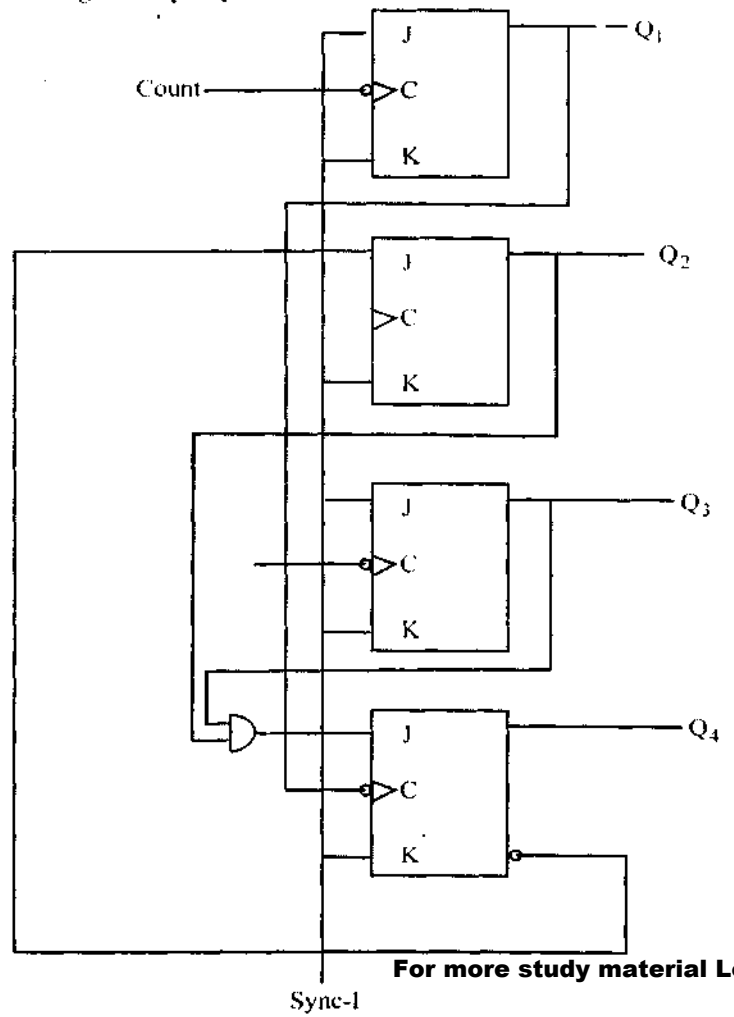
Ans. Decade Counter : The sequential circuit which counts from 0 to 9 is said to be decade counter. If we need to count 0 to 99 we need to count two decade counter.

For example BCD counter is called decade counter.



State Diagram of BCD Decade Counter

Implementation Using J-K Flip-flop :



Q. 7. (a) A 4½ digit voltmeter is used for voltage measurements (a) Find its resolution (b) How would 12.98v be displayed on 10 v range (c) How would 0.6973 be displayed on 1V range? (d) How would 0.6973 be displayed on 10v range?

Ans. A $4\frac{1}{2}$ digit voltmeter is used for voltage measurement.

1. Resolution $= \frac{1}{10^4} = \frac{1}{10^3} = 0.0001$

$4 \rightarrow$ Full digits

2. There are 5 digit places, hence 12.98V would be displayed as 12.980.

Resolution on 1V range is $1V \times 0.0001 = 0.0001$ any reading up to 4th decimal can be displayed. Hence, $0.6973 \rightarrow$ displayed on $\rightarrow$ 0.6973.

3. Resolution on 10V range $= 10V \times 0.0001 = 0.001V$

Hence, upto 3rd decimal is displayed.

$0.6973 \rightarrow$ displayed as = 0.697 **Ans.**

Q. 7. (b) Draw the logic diagram and draw up the truth table for conversion of 8321 BCD code to 7 segment code using 7447 chip.

Ans. BCD to 7-segment Display :

Truth Table

Decimal or Function	Inputs						$\overline{BI}$ / $\overline{RBO}$	OUTPUTS						
	$\overline{LT}$	$\overline{RB_I}$	D	C	B	A		a	b	c	d	e	f	g
0	H	H	L	L	L	L	H	H	H	H	H	H	H	L
1	H	×	L	L	L	H	H	L	H	H	L	L	L	L
2	H	×	L	L	H	L	H	H	H	L	H	H	L	H
3	H	×	L	L	H	H	H	H	H	H	H	L	L	H
4	H	×	L	H	L	L	H	L	H	H	L	L	H	H
5	H	×	L	H	L	H	H	H	L	H	H	L	H	H
6	H	×	L	H	H	L	H	L	L	H	H	H	H	H
7	H	×	H	L	H	H	H	H	H	H	L	L	L	L
8														
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10			Similarly											
11														
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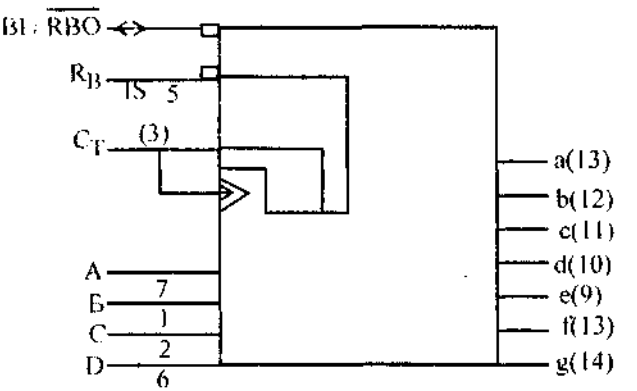


Q. 8. Discuss the following :

(a) Mixie Tube

(b) BCD to dot matrix converter

(c) 5 × 7 LED matrix display.

Ans. (a) Mixie Tube : A nixie tube is an electronic device for displaying numerals or other internation the glass tube contains a wire mesh anode and multiple cathodes. In most tubes, the cathods are shaped like numerals.

Applying power to one cathode surrounds it with a orange glow discharge, the tube is filled with a gas at low pressure. Usually mostly non and often little mercury and /or argon, is a perms mixture. Although it is resembles a vacuum tube in appearance. Its operation does not depends upon the thermonic emission.

Application of Advantages/Drawbacks :

→ Used in early digital voltmeters and a meter.

→ But it have multiple flux mode.

1. Simple brake.
2. Cracks and hermetic seal leaks allow in the atmospheric to enter.
3. Increase similar voltage.

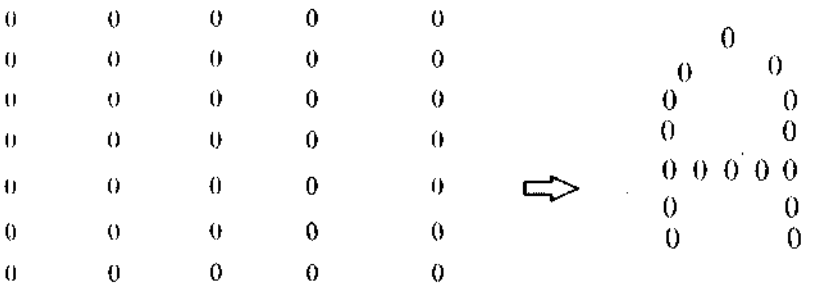
(b) BCD to Dot Matrix Converter : A 3 × 5 dot matrix is required for display of numeric character while display of alphanumeric 5×7 dot matrix is required.

A 4 bit BCD input is required for conversion to appropriate dot selection code which will activate the dots to display the character.

Considering 16 characters are to be accommodated in the input code a converter of 16×15 bit capacity is required. For 3 × 5 dot matrix. While the converter capacity is 16 × 35 bits for a 5×7 dot matrix.

A six bit code is required for display of alphanumeric character as there are 26 alphabets. 10 decimal number and 28 special character. Thus, the capacity of alphanumeric code. Converter is 64 × 35 bits these code conversion are done by special building blade called Read Only Memory call (RAM) call.

(c) **5 × 7 LED Matrix Display :** For display of alphanumeric characters 5×7 dot matrix is used as shown in fig.



This system consist of 35 LED as in form of a matrix having 5-column and 7 rows.

Which help of this dot matrix display numerical values i.e., from 0 to 9 and all alphabets. i.e.. A, B, C, D etc. can be displayed.

These, are used at place where both are required. **For example :** Railway State Display.