Bharati Vidyapeeth Institute of Technology

A Laboratory Manual for

Consumer Electronics

(22425)

Semester- IV

Diploma in Electronics Group Engineering

(EJ)

Certificate

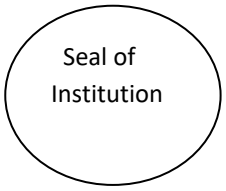
This is to certify that, Mr./ Ms. …….

Roll No. …… of Second Semester of Diploma in Electronics & Telecommunication Engineering of Bharati Vidyapeeth Institute of Technology Navi Mumbai (Inst.code:0027) has satisfactorily completed the term work in the subject **Consumer Electronics (22425)** for the academic year 20…. to 20…. as prescribed in the MSBTE curriculum.

Place: ……... Enrollment No. : ……

Date:……. Exam. Seat No. : …….

Subject Teacher **Head of the Department** **Principal**



LIST OF EXPERIMENTS AND PROGRESSIVE ASSESSMENT FOR TERMWORK(TW)

ACADEMIC YEAR 20 - 20

Course & code :- **Sub & Code : Consumer Electronics (22425)**

Name of Candidate : **Enrollment No :** **Roll No :**

Marks : **Max :** **Min :** **Name of Faculty :**

Sr. No.	Title	Date of performance	Date of submission	Marks	Sign of teacher
1	Test the performance of the given speaker.				
2	Identify any three different faults by voltage analysis method for Hi-Fi Audio amplifier.				
3	Measure voltage levels to sketch composite video signal at different stages of TV receiver.				
4	Use multimeter to measure voltage at various test points of colour TV receiver a) chroma section, n) Picture tube.				
5	Use multimeter to test various test points at horizontal section of colour TV.				
6	Use multimeter to test various test points at vertical section of colour TV.				
7	Suggest the remedy for created fault and in the given colour TV trainer kit for the following faults a) No colour b) Red colour only c) Green colour only d) No sound.				
8	Suggest the remedy for the following faults in given colour TV a) Fault in HSYNC section b) Fault in VSYNC				

	section.				
9	Suggest the remedy for the following faults in given colour TV a) Fault in SYNC separator b) Fault in video amplifier.				
10	Test the various sections of LED television receiver.				
11	Test the various sections of LCD television receiver.				
12	Test the various features of the given type of printer.				
			Total marks out of 120		
			Marks out of 25		

Experiment no. 1

Title: Test the performance of speaker.

Apparatus:

PA Speaker System, Multimeter.

Theory :

The loudspeaker is an electro-acoustic transducer which converts an electrical audio signal into corresponding sound signal. The speakers which are designed for high frequencies called as tweeter, the speakers designed for mid-frequencies called as squawker and those designed for low frequencies called as woofer.

Smaller loudspeakers are found in devices such as radios, television, portable audio player, computers and electronic musical instruments. Larger loudspeaker systems are used for music, sound reinforcement in theatres and concerts and in public address systems.

Procedure:

1. Identify the loudspeaker.
2. List the specifications of given speaker.
3. Test the performance of speaker.

Specification table:

Parameter	**specifications**
Input Power	
Configuration	
Frequency Response	
Low frequency Speaker	

SPL(1W/1m)	
Max Rated SPL	
Nominal Impedance	
Port	
Input Connectors	
Dimensions	
Weight	

Observation:

1. Continuity Test…….

……

2. Impedance Test: Observed value……. Standard value…….

Conclusion:

1. Continuity Test shows …….. (continuity/ discontinuity). So speaker is …….. (ok/ not ok).
2. Impedance test shows…….Ω. This value is……(lesser than/equal to/greater than) standard value. So speaker is ……(ok/not ok).
3. …….&……type of speaker is used in low & mid frequency.
4. ……is the speaker which is used for high frequency.

Assignment Questions:

1. Give the frequency range of woofer and squawker .
2. Which type of sound effect is produced in bass control?
3. Give the range of Human system of hearing.
4. .Give the value of impedance of loud speaker used in circuit.
5. What are the possible faults in loud speaker gives humming?

Solution:

Marks Obtained			Dated signature of staff
Process Related(15)	**Product Related(10)**	**Total (25)**	

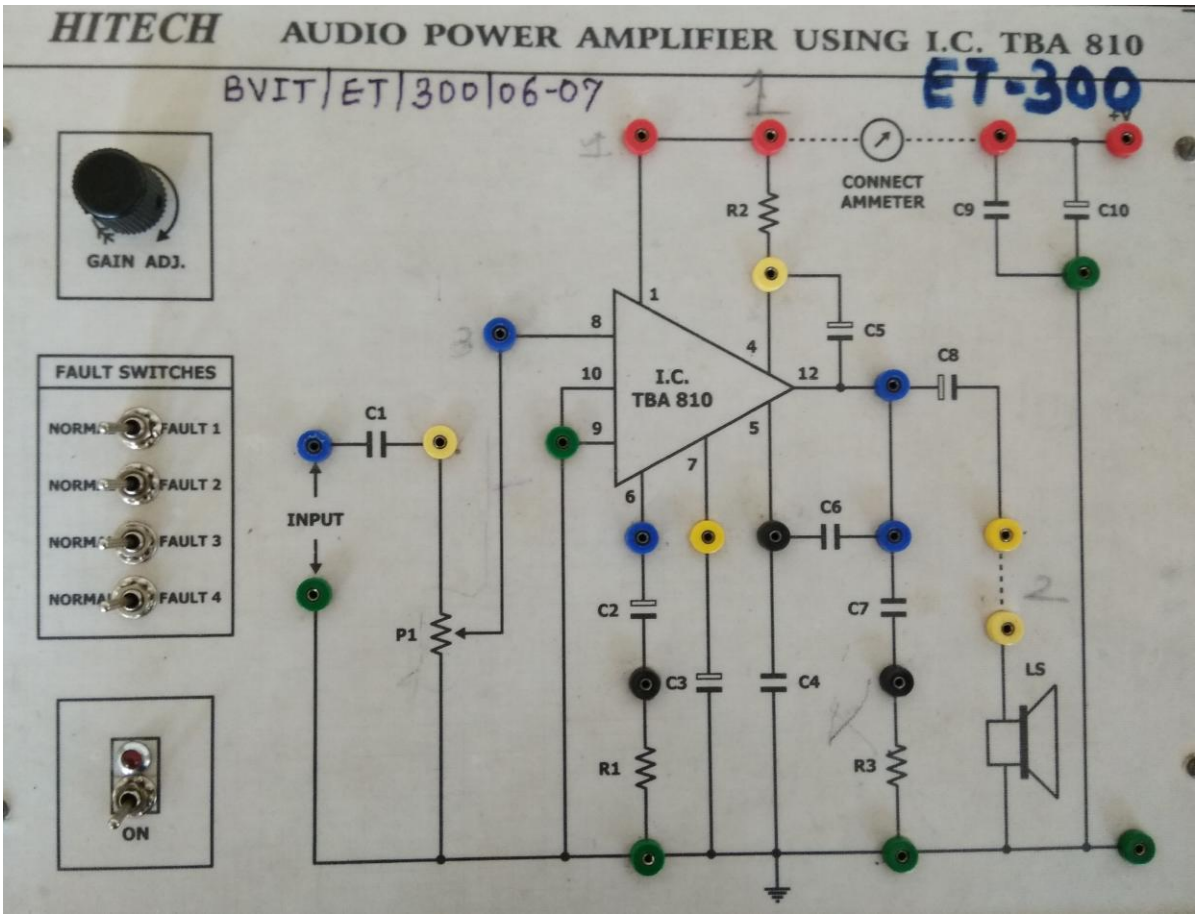
Experiment no. 2

Title: Identify any three different faults by voltage analysis method for Hi- Fi Audio amplifier.

Apparatus:

Experimental kit of Hi-Fi Audio amplifier, Power supply, DMM.

Circuit Diagram of Hi-Fi Amplifier:



Theory :

An audio power amplifier (or power amp) is an electronic amplifier that reproduces low-power electronic Fidelity means faithfulness or exactness. In audio system it is used to indicate faithful reproduction of sound. Hi-Fi system stands for high fidelity stereophonic reproducing system. Such a Hi-Fi sound can be obtained from recorded stereo tape or live systems from the microphones.

High fidelity reproduction is essentially sound reproduction such that the most critical person can listen intensity to it without any distortion. High Fidelity can be achieved by using low noise components and proper design of the circuits and devices.

Procedure:

1. Identify different stages of Hi-Fi amplifier with test points in available experimental kit and identify impedance of loudspeaker.
2. Apply input to both channels.
4. Measure voltages at a given test points.
5. Create fault at least three test points and measure the voltage at same.
6. Compare voltages in step 4 (faulty voltage) with step 3 (reference voltage). Identify the faulty component.

Observation table:

Sr.no.	Test Points	Faulty stage	Standard Voltage	Observed Voltage	Remark
1					
2					
3					
4					

Conclusion:

1. Audio amplifier used in experimental kit has _____ feedback (Negative / Positive).
2. IC _____ is used as power amplifier.
3. Impedance of speaker used in experimental kit is _____.
4. Fault created in speaker and volume control gives the result as _____and _____respectively.

Assignment Questions:

1. How will you locate the fault in preamplifier?
2. What is the value of coupling capacitor at output stage of loud speaker?
3. What is the rating of power supply used for power amplifier circuit?
4. Name the type of microphone used in laboratory.
5. Write the model number of Hi-Fi system available in laboratory.

Solution:

Marks Obtained			Dated signature of staff
Process Related(15)	**Product Related(10)**	**Total (25)**	

Experiment no. 3

Title: Measure voltage levels to sketch composite video signal at different stages of TV receiver.

Apparatus:

Colour TV receiver set up and multimeter.

Theory:

The video signal containing the horizontal and vertical sync and blanking pulses is called as Composite Video Signal. In Television, the composite signal consist of :

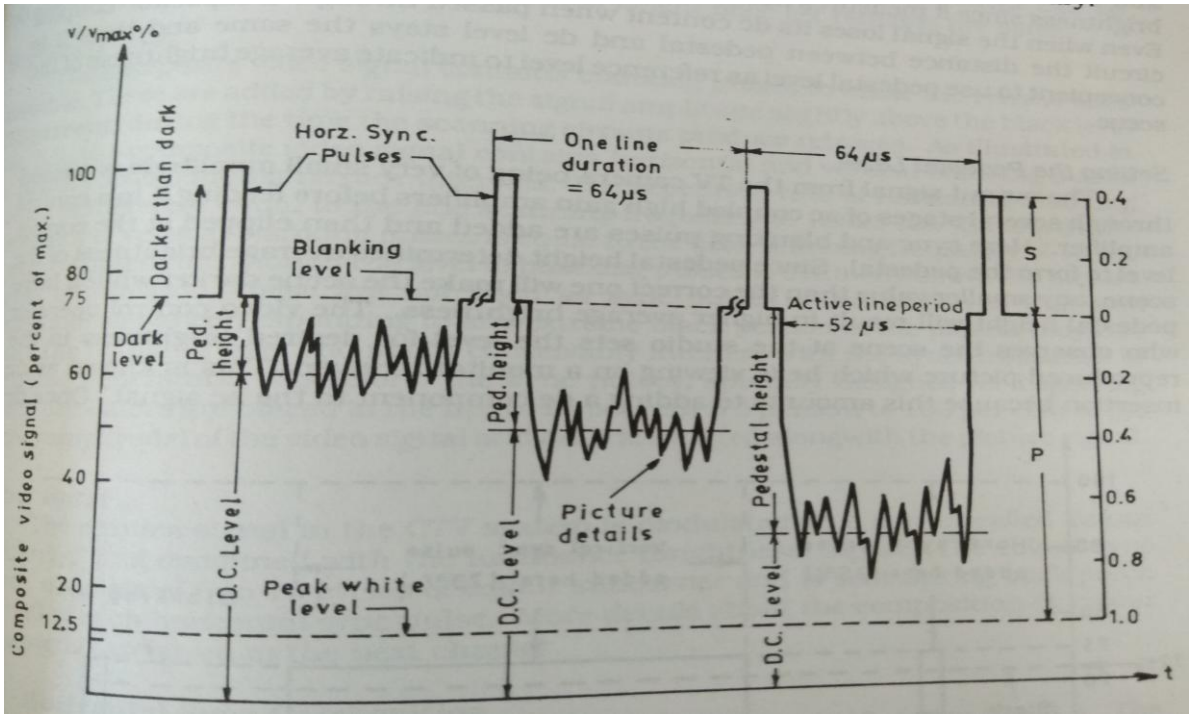
a) Camera signal corresponding to light intensity in the picture.

b) Blanking pulses to make retrace invisible.

c) Synchronizing pulses to keep scanning at receiver in synchronous with transmitting end.

In colour Television, the composite video signal has additional information about colours and colour sync to synchronize colour reception.

Diagram of Composite Video Signal:



Procedure:

1. Switch on the colour TV receiver.
2. Observe the VIF section of colour TV receiver.
3. Measure the voltages at given points of VIF section.

Observation table:

Sr. no	Test Point	Standard voltage	Observed voltage	Within Acceptable Range Y/N
1				
2				

Conclusion:

1. Composite Video signal is composition of…… and ……..…….
2. Picture information vary between ……% to ……% of composite video signal.
3. The voltage level at points…….……of VIF section helps to sketch CVS.

Assignment Questions:

1. Define: a) Pedestal height. b) Blanking pulses c)Synchronizing pulses
2. Which section of colour television gives output as composite video signal.
3. Give the time duration of horizontal blanking pulse.
4. Give the time duration of front porch, sync pulse and back porch.
5. What is colour burst signal? Draw composite video signal.

Solution:

Marks Obtained			Dated signature of staff
Process Related(15)	**Product Related(10)**	**Total (25)**	

Experiment no. 4

Title: Use multimeter to measure voltage at various test points of colour TV receiver.

a) Chroma section b) Picture Tube

Apparatus:

Colour TV receiver set up and multimeter.

Theory:

A) Chroma Detector

Chroma signal is a colour information with burst signal. The main function of chroma or colour decoder is to recover U and V colour difference signals which later combined with Y to obtain R,G and B video signals. For this chroma decoder has to perform following function:

a) Seperation of U and V signal phasors by using delay line technique.

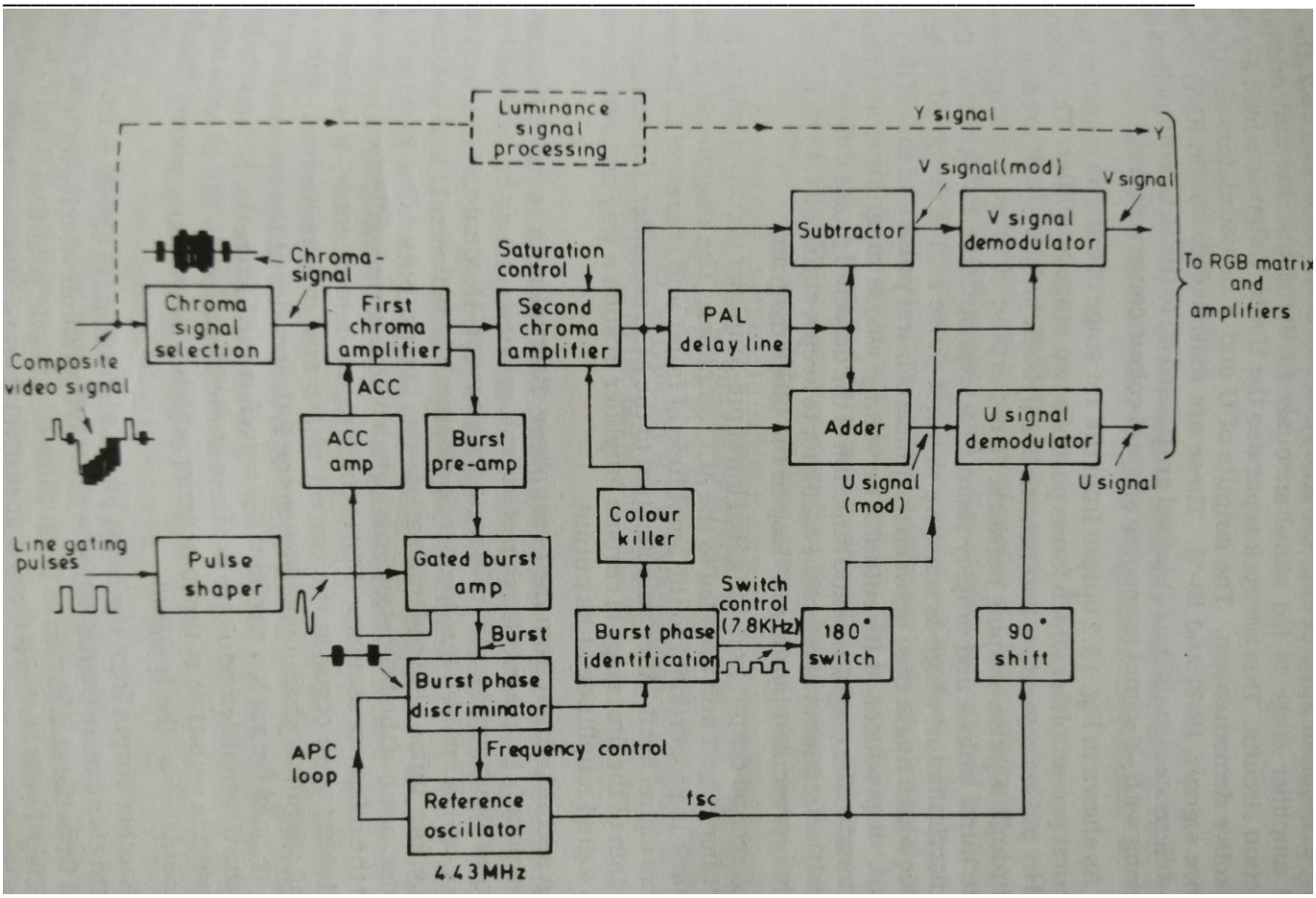
b) Demodulation of U and V phasors to recover colour-difference signal.

c) Generation of suitable sub carriers for the two demodulators.

d) To develop “Ident” signal for V channel switching and bias voltage for colour killer circuit.

e) Chroma signal and colour burst are separated from incoming composite colour video signal by chroma signal selection circuit. On separation the chroma and burst signals are amplified by the chroma amplifier.

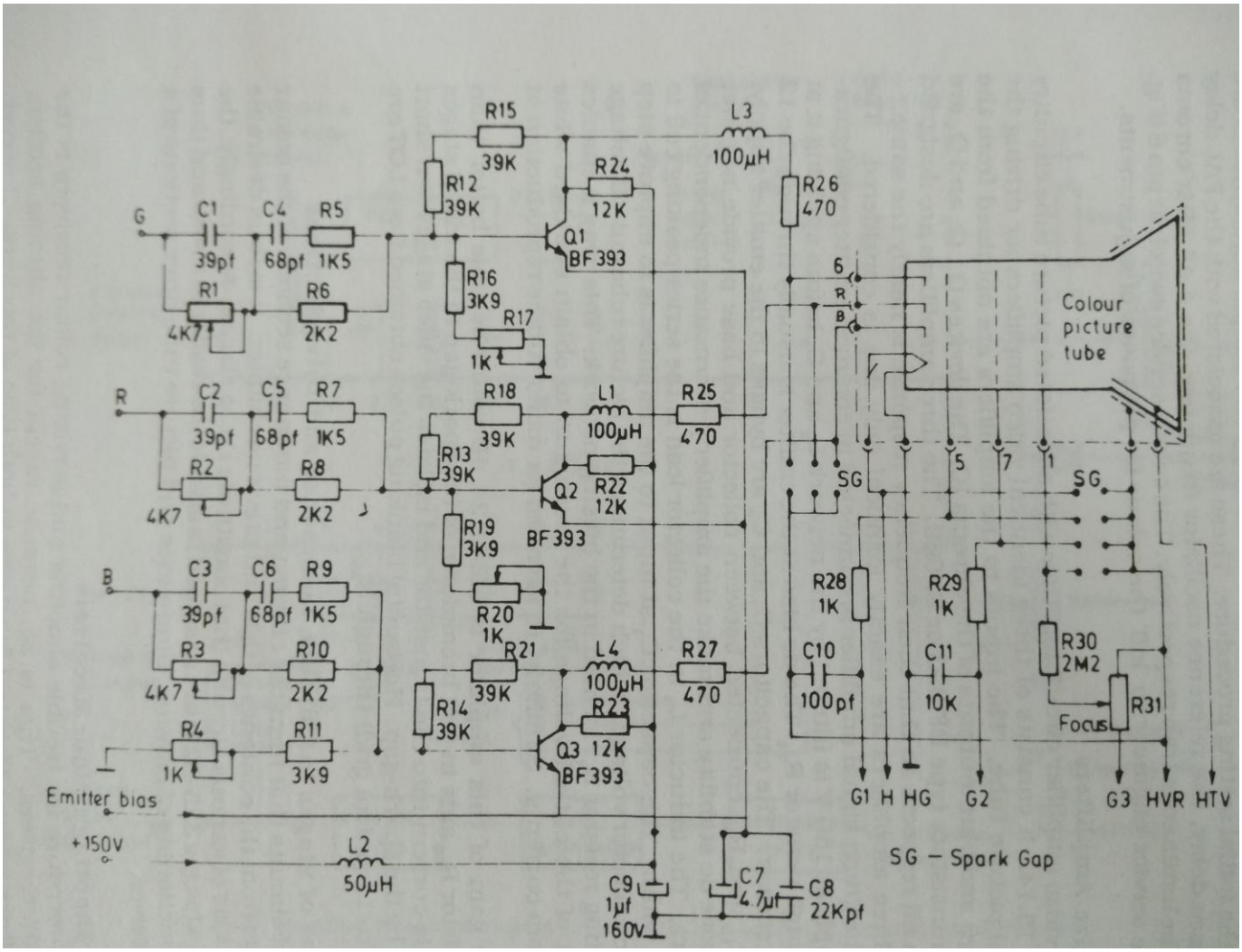
Block Diagram of PAL-D Decoder:



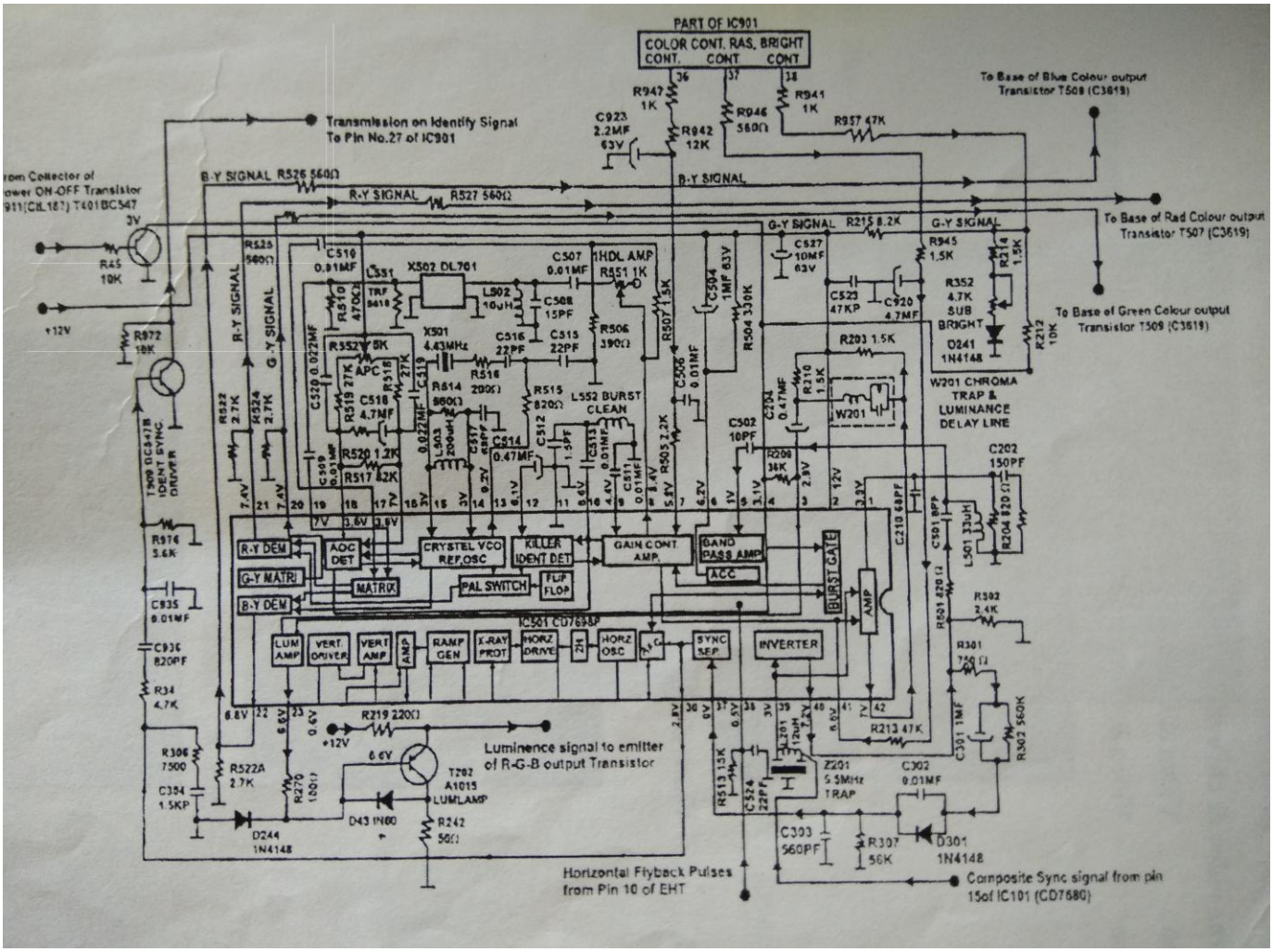
B) Picture Tube :

The colour picture tube stage consists of the picture tube along with the deflection coil assembly and colour purity and cantering magnets placed on its neck. The colour picture tube displays the R,G and B signals given to its three cathodes in the form of colour picture with the help of two deflection coil assembly.

Circuit Diagram of Colour Picture Tube:



C) Circuit Diagram of Chroma Section available in your Laboratory:



Procedure:

1. Switch on the colour TV receiver
2. Observe the chroma section and picture tube circuit of colour TV receiver.
3. Measure the voltages at given points of chroma section and picture tube circuit.

Observation table:

A) For Chroma Section:

Sr. no	Test Point	Standard voltage	Observed voltage	Within Acceptable Range Y/N
1	TP26	+12V		
2	TP34	+10V		
3	TP 37	4.43MHz		
4	TP38	+12V		

B) For Picture Tube

Sr. no	Test Point	Standard voltage	Observed voltage	Within Acceptable Range Y/N
1	Collector of T508	+185V		

Conclusion:

1. Chroma section seperates the U and V signal and give the output as …… ..& ……. And G-Y signal which is fed to grid of picture tube.
2. Picture tube converts the electrical signal to ……(Audio/Video signal)

Assignment Questions:

1. Give the IC number of chroma and luminance section.
2. Which signal is incoming to chroma section?
3. Which signal is coming as a output from chroma section?
4. Write the function of colour killer circuit in chroma section.
5. State the function of picture tube.

Solution:

Marks Obtained			Dated signature of staff
Process Related(15)	**Product Related(10)**	**Total (25)**	

Experiment no. 5

Title: Use multimeter to test voltages at various test points of Horizontal section of colour TV receiver.

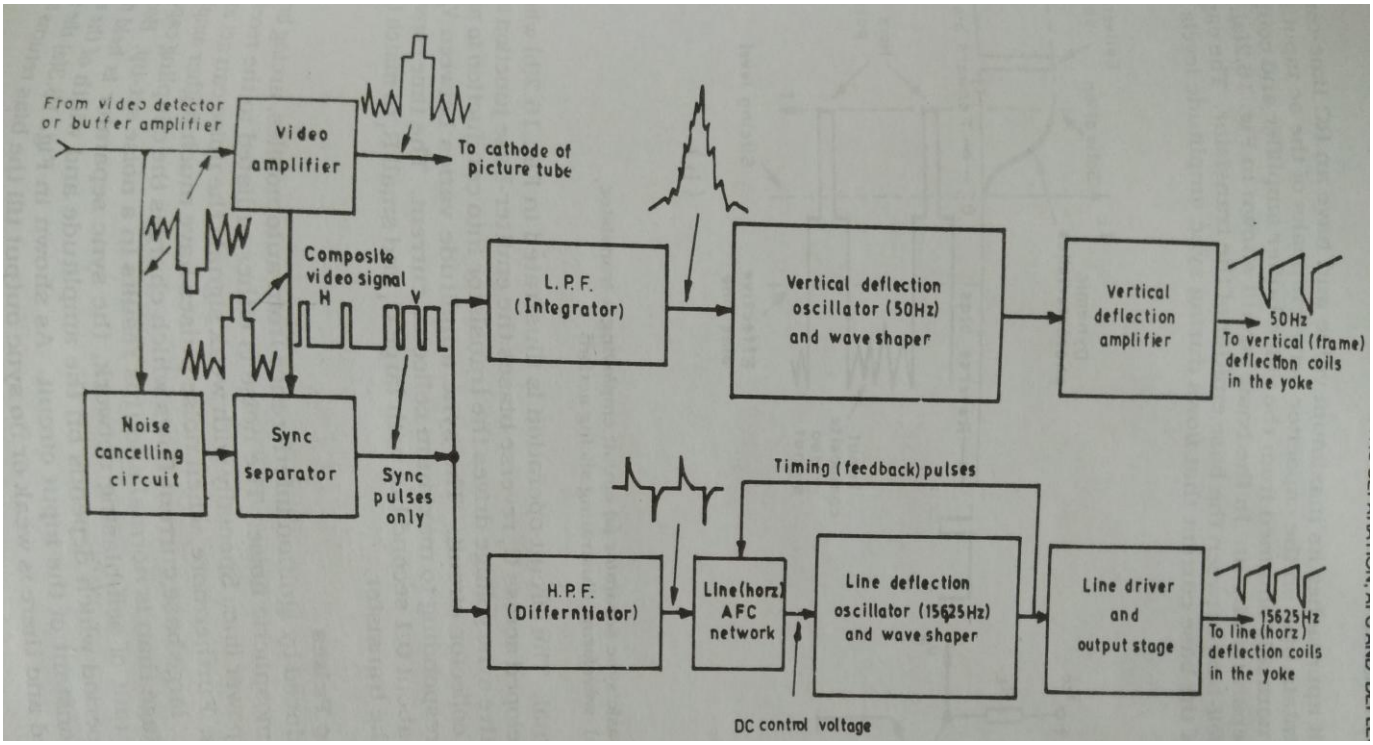
Apparatus:

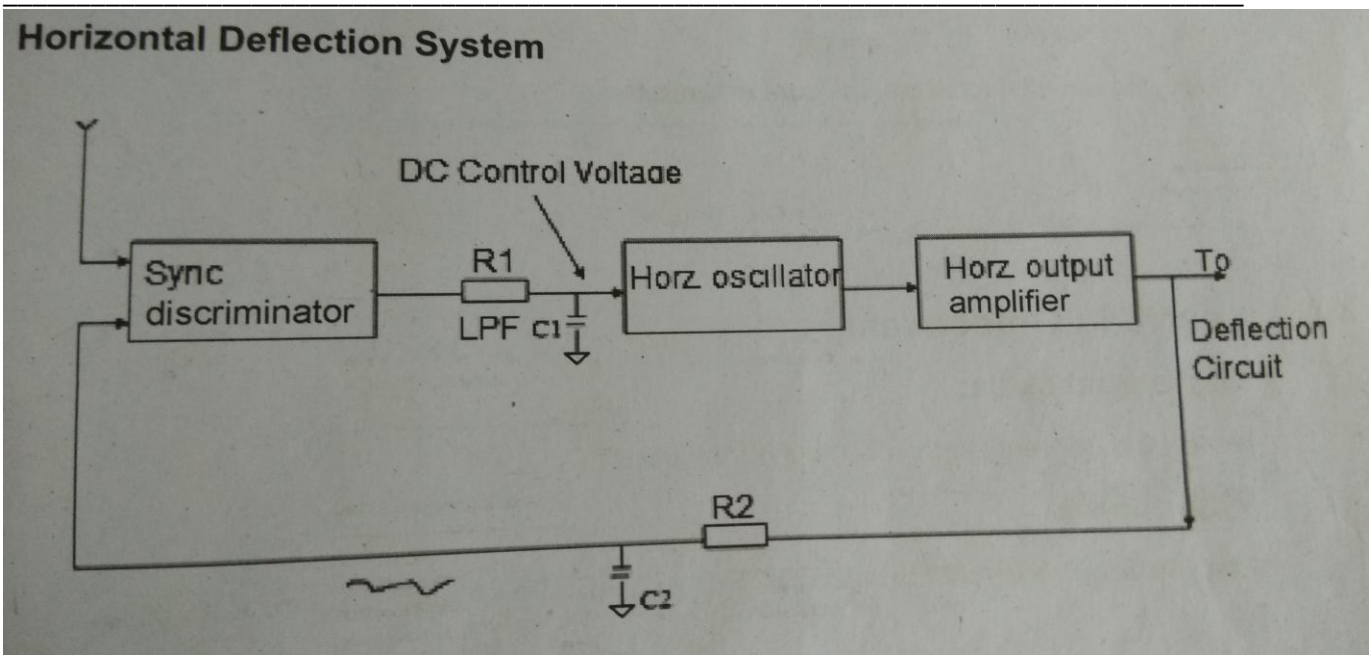
Colour TV receiver set up and multimeter.

Theory:

Sync separator seperates horizontal and vertical signals and is fed to deflection plates of picture tube. Horizontal section consists of high pass filter, AFC circuit and Horizontal oscillator to develop sweep drive voltage at 15625Hz.Vertical section consists of low pass filter which triggers the vertical oscillator.

Block Diagram of Sync Seperator:





Procedure:

1. Switch on the colour TV receiver.
2. Observe the Horizontal section of colour TV receiver.
3. Measure the voltages at given points of horizontal section.

Observation table:

Sr. no	Test Point	Standard voltage	Observed voltage	Within Acceptable Range Y/N
1	Horizontal output section for R-G-B video output section (TP 7)	+185V		
2	Horizontal output section for VIF section (TP 6)	+12V		

Conclusion:

1. Sync separator acts as a …….
2. Line Frequency is……..Hz.
3. At the output of horizontal section, TP_6 gives the voltage ……V for …… section and TP_7 gives the voltage ……V for…… section.

Assignment Questions:

1. Give the function of AFC circuit.
2. Why High pass filter is used in horizontal section?
3. Give the time duration of horizontal trace and retrace.
4. Which signal is obtained at the output of horizontal section.
5. State the value of EHT voltage for monochrome TV and colour TV of same size.

Solution:

Marks Obtained			Dated signature of staff
Process Related(15)	**Product Related(10)**	**Total (25)**	

Experiment no. 6

Title: Use multimeter to test voltages at various test points of Vertical section of colour TV receiver.

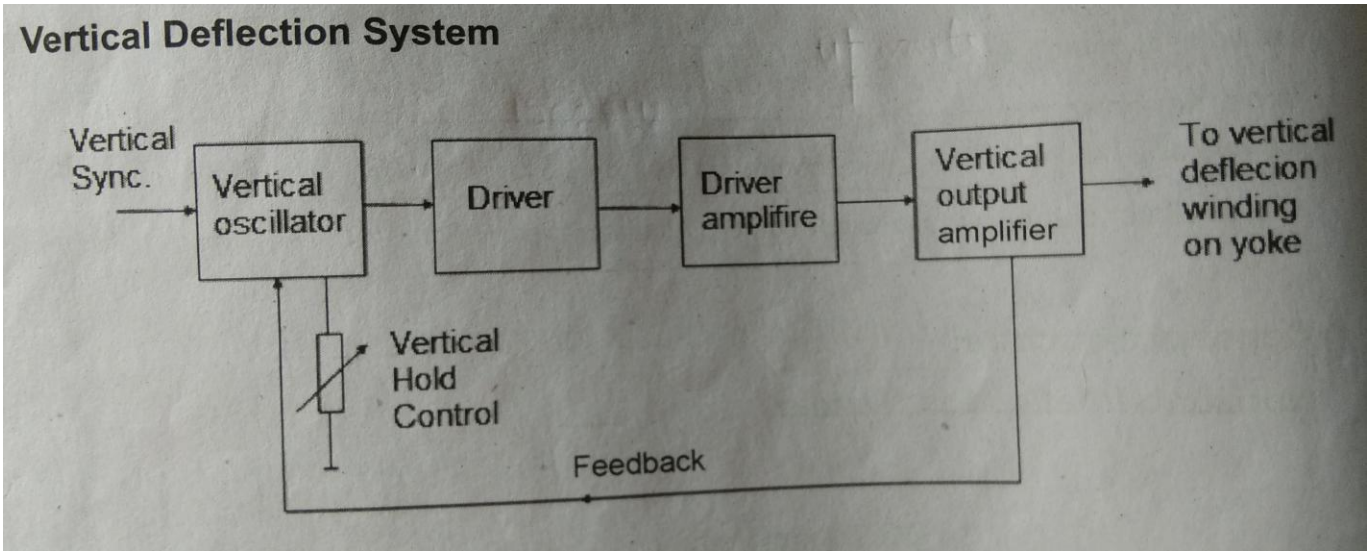
Apparatus:

Colour TV receiver set up and multimeter.

Theory:

Sync separator seperates horizontal and vertical signals and is fed to deflection plates of picture tube.Horizontal section consists of high pass filter, AFC circuit and Horizontal oscillator to develop sweep drive voltage at 15625Hz.Vertical section consists of low pass filter which triggers the vertical oscillator.A vertical hold is provided to remove the noise. The output of vertical oscillator is fed to vertical amplifier, which is fed to vertical deflection coil.

Block Diagram of Sync Seperator:



Procedure:

1. Switch on the colour TV receiver.
2. Observe the Vertical section of colour TV receiver.
3. Measure the voltages at given points of vertical section.

Observation table:

Sr. no	Test Point	Standard voltage	Observed voltage	Within Acceptable Range Y/N
1	Output of Vertical IC(TP41)	+17V		

Conclusion:

1. Sync separator acts as a …….
2. +17 V signal voltage at output of vertical section has field frequency …….Hz.

Assignment Questions:

1. Why Low pass filter is used in vertical section.
2. Why synchronization is necessary in television?
3. Give the time duration of vertical trace and retrace.
4. Which signal is obtained at the output of vertical section.
5. State the need of vertical hold control in vertical section.

Solution:

Marks Obtained			Dated signature of staff
Process Related(15)	**Product Related(10)**	**Total (25)**	

Experiment no. 7

Title: Suggest the remedy for the created fault and in the given colour TV trainer kit for the following faults.

a) No colour b) Red colour only c) Green colour only d) No sound

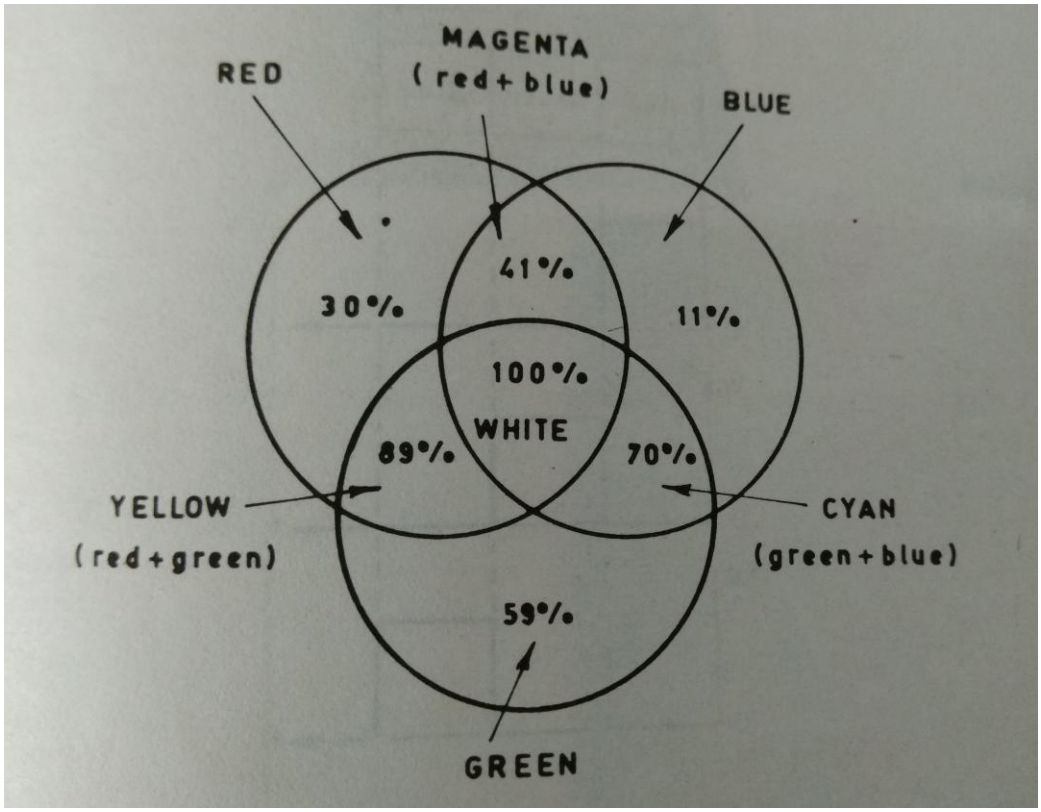
Apparatus:

Colour TV receiver set up and multimeter.

Theory:

Basic colours are Red, Green and Blue. When the image of any picture is scanned by a colour camera separate video signal are developed for these colour. Three electron beam strike a specialy coated phosphor screen to produce the Red,Green and Blue colours which are mixed together by the human eye to produce natural colours of televised scene.

Additive colour mixing:



Procedure:

1. Switch ON colour TV receiver
2. Observe the circuit diagram.
3. Trace out video amplifier colour section.
4. Observe Raster on screen.
5. Identify the fault and faulty location.
6. Measure voltages at identified test points using multimeter.

Observation table:

Sr. no	Test Point	Symptoms Observed on TV screen	Standatd voltage	Voltage at test point	Is standard voltage similar to test point voltage?(Y/N)
1	J28	No Colour	3.5V to 6.5V		
2	J23 &J25	Red Colour Only	+7.2V		
3	J24 &J25	Green Colour Only	+7.2 V		
4	J10	No sound	20V		

Conclusion:

1. If Red colour is absent then _____colour is generated.
2. If Green colour is absent then _____colour is generated.
3. Removing shorting shunt between 2 &3 of jumper …… and placing it between 1 &2 of it gives the picture of normal colour.

Assignment Questions:

1. Write equation for Y signal.
2. Which is the primary colour?
3. State the Grassman's Law.
4. Differentiate between additive and subtractive mixing
5. State the IC used in chroma section
6. Write the operation of colour killer circuit.
7. Draw circuit diagram of U and V separator.

Solution:

Marks Obtained			Dated signature of staff
Process Related(15)	**Product Related(10)**	**Total (25)**	

Experiment no. 8

Title: Suggest the remedy for the following faults in given colour TV

a) Fault in HSYNC section b) Fault in VSYNC section.

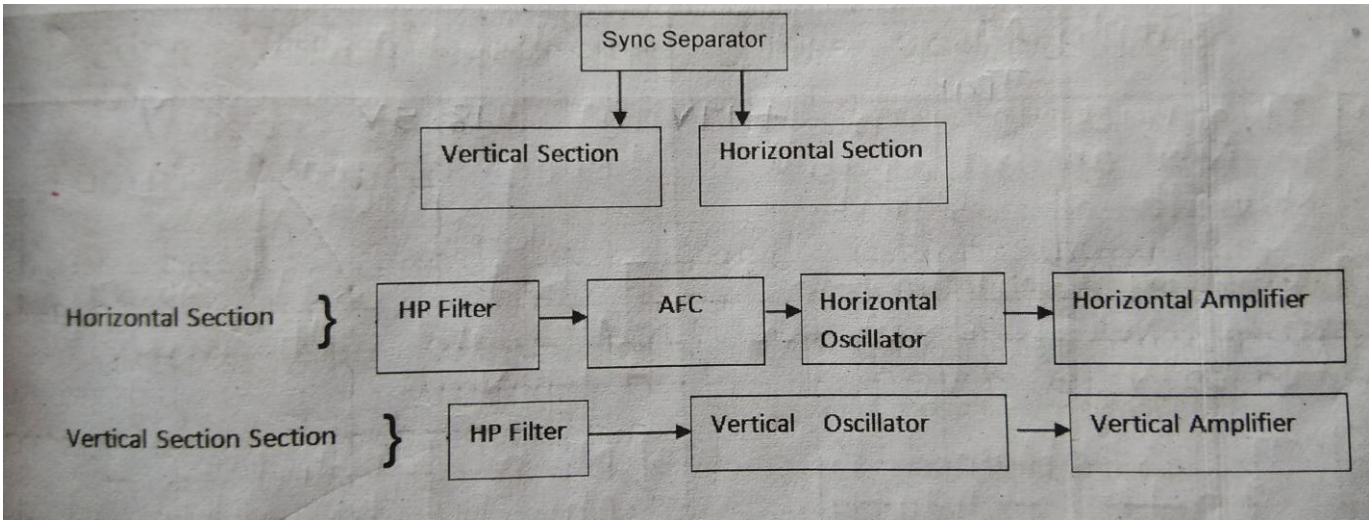
Apparatus:

Colour TV receiver set, multimeter.

Theory:

Sync separator is a clipper circuit which separates the horizontal and vertical sync pulses. The horizontal and vertical synchronous pulses from composite video signal are separated in the synchronous separator. The pulse train from sync separator is fed simultaneously to differentiator and integrator circuit The differentiated output provides sharp pulses for triggering the horizontal oscillator while output from integrator controls the frequency of vertical oscillator.

Block Diagram of Sync separator:



Procedure:

1. Switch ON colour TV receiver
2. Observe the circuit diagram.
3. Trace out synchronous separator section ,video and chroma section.
4. Observe Raster on screen.
5. Identify the fault and faulty location.
6. Measure voltages at identified test points using multimeter.

Observation table:

a) To Locate fault in Horizontal section

Sr. no	Test Point	Symptoms Observed on TV screen	Standatd voltage	Voltage at test point	Is standard voltage similar to test point voltage?(Y/N)
1	PIN 35 of IC 501	Horizontal Shaking	110V		
2	PIN 33 Of IC 501	No picture No sound	6.9V		
3	PIN 39 of IC 501	Horizontal Sync Out	8V		

b) To Locate fault in Vertical section

Sr. no	Test Point	Symptoms Observed on TV screen	Voltage at test point	Standard voltage	Is standard voltage similar to test point

					voltage?(Y/N)
1	Pin 24of IC501	Horizontal Line on screen	+17V		
2	Pin 24 of IC 501	Bottom fold over of the picture on the screen	+17V		
3	PIN 36 of IC501	Vertical Rolling			

Conclusion:

1. If horizontal shaking is observed on raster then fault is in …….(vertical section/horizontal section).
2. Bottom fold over fault is related to fault in ……(vertical section/video section).

Assignment Questions:

1. Draw waveforms of integrator and differentiator circuit.
2. State the number of transistor which generated horizontal and vertical sync pulse.
3. Name the transistor available in vertical output section.
4. What is the input and output of horizontal section.
5. After which section horizontal and vertical sync pulses are separated.

Solution:

Marks Obtained			Dated signature of staff
Process Related(15)	**Product Related(10)**	**Total (25)**	

Experiment no. 9

Title: Suggest the remedy for the following faults in given colour TV

a) Fault in SYNC seperator b) Fault in video amplifier.

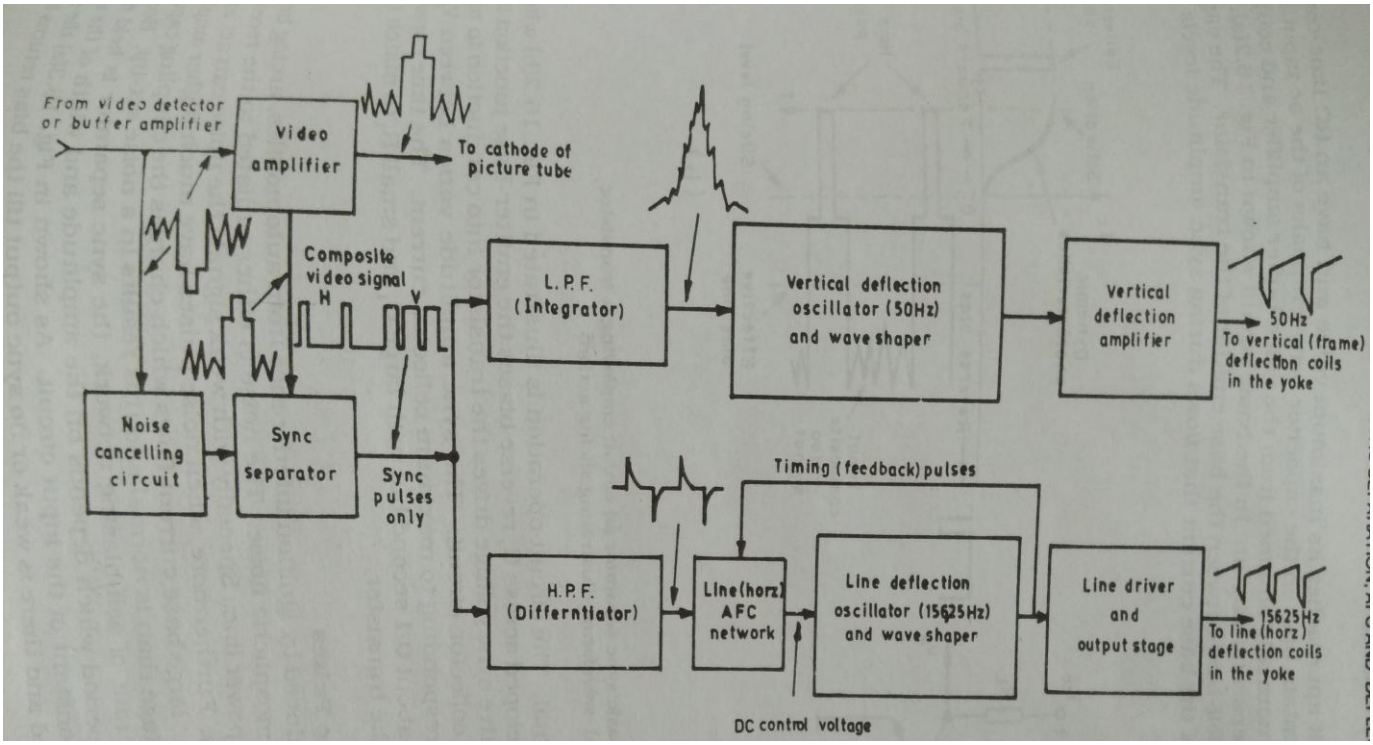
Apparatus:

Colour TV receiver set,multimeter

Theory:

Sync separator is a clipper circuit which seperates the horizontal and vertical sync pulses. The horizontal and vertical synchronous pulses from composite video signal are separated in the synchronous separator. The pulse train from sync seperator is fed simultaneously to differentiator and integrator circuit The differentiated output provides sharp pulses for triggering the horizontal oscillator while output from integrator controls the frequency of vertical oscillator.

Block Diagram of Sync separator:



Procedure:

1. Switch ON colour TV receiver.
2. Observe the circuit diagram.
3. Trace out synchronous separator section ,video and chroma section.
4. Observe Raster on screen.
5. Identify the fault and faulty location.
6. Measure voltages at identified test points using multimeter.

Observation table:

a) To Locate fault in Sync Seperator

Sr. no	**Test Point**	**Symptoms Observed on TV screen**	**Standard voltage**	**Voltage at test point**	**Is standard voltage similar to test point voltage?(Y/N)**
1	PIN 35 of IC501	Total Sync loss or Raster shaking	V		

b) To Locate fault in Video Amplifier

Sr. no	**Test Point**	**Symptoms Observed on TV screen**	**Standard voltage**	**Voltage at test point**	**Is standard voltage similar to test point voltage?(Y/N)**

1	PIN 36 of IC501	Picture is vertically rolling with sound ok			
2	PIN 5 of IC501	No colour with sound ok	+110V		
3	PIN 7 of IC 501	No colour variation	+185V		

Conclusion:

1. If no colour variation on raster then fault is in…… (video and chroma section/Y channel).
2. Frequency of vertical oscillator is…….Hz,and frequency of horizontal oscillator is…….Hz.
3. When pin 36 of IC501 is tested for vertical rolling ……V is required to give stable picture on screen. The observed value is ……V which gives vertical rolling.

Assignment Questions:

1. What is the input of sync separator section.
2. State the function of sync separator section.
3. Which Pin no.s of IC 501 works for horizontal oscillator AFC and sync separator sections.
4. What is the colour subcarrier frequency of video and chroma section.
5. Draw the waveform of horizontal blanking pulse in horizontal output section.

Solution:

Marks Obtained			Dated signature of staff
Process Related(15)	**Product Related(10)**	**Total (25)**	

Experiment no. 10

Title: Test various sections of LED television receiver**.**

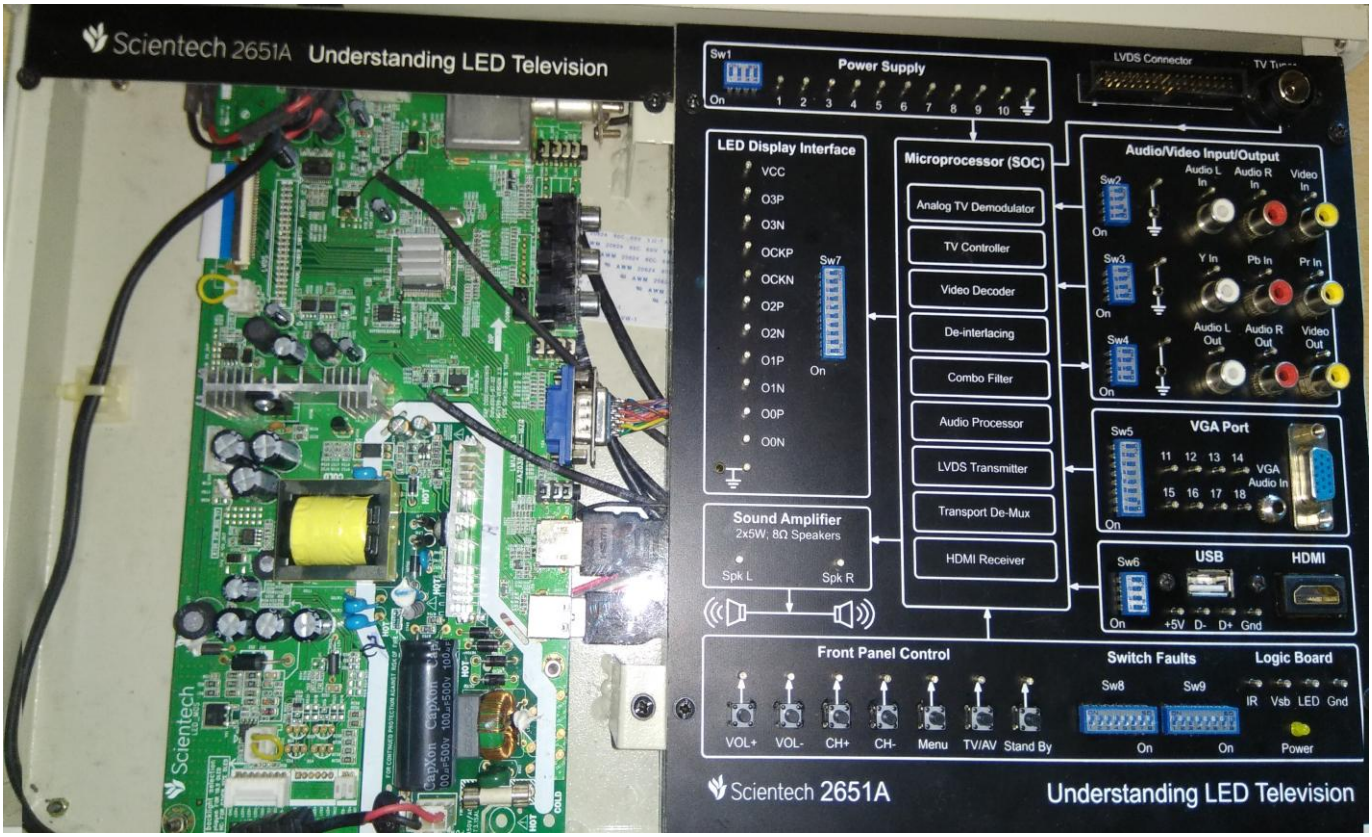
Apparatus:

LED TV receiver set.

Theory:

The LED TV is more advanced version of the LCD TV. It has array of LED's to provide the backlight. LED's consist of small semiconductors, which glow during exposure to electric current. Specifically this current flows between LED anodes which are positively charged electrodes, and LED cathodes which are negatively charged electrodes. LED TV requires less energy and being able to produce brighter on-screen colours than LCD TV.

Block Diagram of LED TV receiver:



Procedure:

1. Identify different stages of given LED TV receiver.
2. Observe the circuit diagram of LED TV.
3. Identify various IC's and write the function in observation table A.
4. Identify various stages of LED TV set and write the function in observation table B.

Observation table:

(A) ICs used and their functions :

ICs No.	Function of the ICs

(B) Stages and their functions:

Sr. no	Name of Stages	Function of stages
1		
2		
3		
4		

Conclusion:

1. Function of LLC is……..

Assignment Questions:

1. List the different sections of LED TV.
2. Specify the IC number of Linear LED controller IC.
3. Specify IC number of Audio OUT.
4. For television ,which is better LED or LCD, why?
5. Give the difference between LED TV and LCD TV.

Solution:

Marks Obtained			Dated signature of staff
Process Related(15)	**Product Related(10)**	**Total (25)**	

Experiment no. 11

Title: Test various sections of LCD television receiver**.**

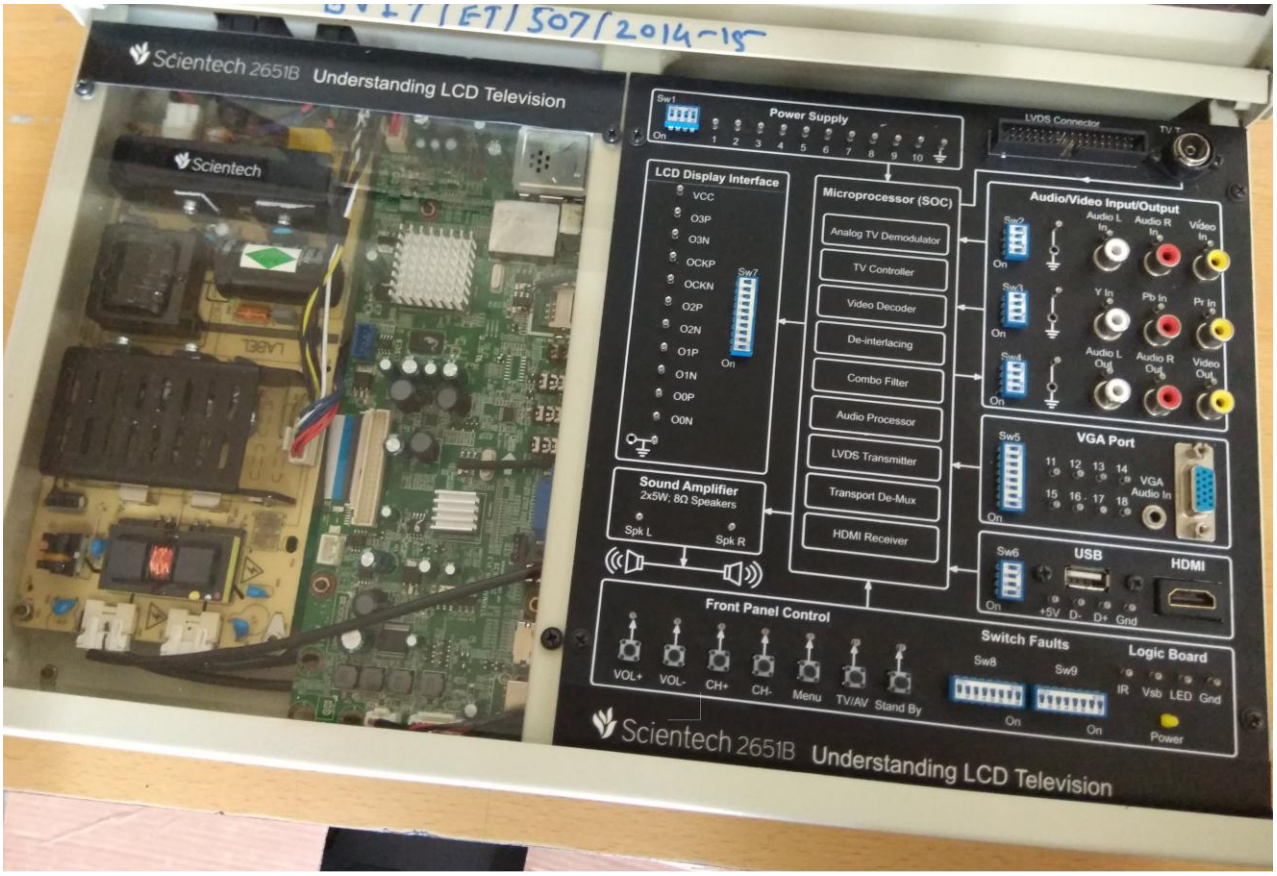
Apparatus:

LCD TV receiver set.

Theory:

LCD stands for liquid crystal display. It has two sheets of polarized glass plates with some liquid crystal solution trapped between them, forcing the liquid crystals into a twisted structural arrangement. In LCD TV the light source is a series of fluorescent tube. Liquid crystals are specialized molecules that flow like liquids but polarize light like solid, crystalline structures.

Block Diagram of LCD TV receiver:



Procedure:

1. Identify different stages of given LCD TV receiver.
2. Observe the circuit diagram of LCD TV.
3. Identify various IC's and write the function in observation table A.
4. Identify various stages of LCD TV set and write the function in observation table B.

Observation table:

(A) ICs used and their functions

ICs No.	Function of the ICs

(B)) Stages and their functions:

Sr. no	Name of Stages	Function of stages
1		
2		
3		
4		

Conclusion:

1. LVDS stands for ……..

2. HDMI stands for……

Assignment Questions:

1. List the different sections of LCD TV.
2. How liquid crystals differs from solid and liquid?.
3. How R, G and B filter in LCD enables producing colour image?
4. How conducting matrix is created within the liquid crystal panel to reach each cell?
5. Give the difference between LED TV and Colour TV.

Solution:

Marks Obtained			Dated signature of staff
Process Related(15)	**Product Related(10)**	**Total (25)**	

Experiment no. 12

Title: Test various features of the given type of printer

Apparatus:

Printer, stopwatch.

Theory:

A computer printer is a piece of hardware for a computer. It allows a user to print items on paper, such as letters and pictures. Mostly a printer prints under the control of a computer. Many can also work as a copying machine or with a digital camera to print directly without using a computer.

An Inkjet printer is a printer for computers. It uses special ink to print on the paper. Another type of printing technology is the Laser printer. Inkjet printers are preferred for printing photos and graphics due to their high-quality color output, whereas laser printers are preferred for printing text due to their high contrast and speed.

Dot-matrix printers are printers for computers. A dot matrix printer creates characters by striking pins against ink ribbons. Each pin makes a dot, and combinations of dots form characters and illustrations. This is much like a typewriter. Each character is made from a matrix of dots. Today, dot matrix printers are not used by many people anymore. They are still in use where forms (with multiple copies) need to be filled out. The print head moves back and forth on the paper like a typewriter and prints the image or text

Procedure:

A) To test printer speed :-

1. **<u>Text speed</u>**

- Open a text document that contains at least five pages. Press "Ctrl-P." Set the radio button under the heading, "Page Range" to "Pages:" and enter "1-5" in the text field. Click "OK" button and start the stopwatch immediately.

- Press the stop watch's "Lap" button when the first page drops into the output bin. Press the "Lap" button again when the fifth page lands in the bin. Stop the stopwatch but do not reset it.
- Write down the two times from the stopwatch. The first time tells you how long a one-page document takes to print. If the second time is greater than one minute, convert the time to seconds and divide seconds by four. The result is the average time, per page, for a long print job. For example, if the second time was 75 total seconds, dividing 75 by four gives you an average print speed of about 19 seconds per page.

2. Graphics Speed

- Open your favorite graphics program.
- Load an image file that takes up a full printed page at a resolution of 300 dots per inch or greater.
- Reset the stopwatch.
- Press "Ctrl-P." Set the number of copies to five. Click "OK" and start the stopwatch immediately.
- Press the "Lap" button on the stopwatch when the first page falls into the output bin. Press the "Lap" button again when the last page falls into the bin. Stop the stopwatch without resetting it.
- Write down the two times from the stopwatch. The first time is how long a single graphic page takes to finish. Divide the second time by four to determine the per-page average time for multiple graphics pages.

Observation table:

	Page	**Time Taken**	**Speed**
Text Speed	1.Single Page (Page 1)		
	2.Long Print Job (Pages 2 to 5)		Average:
Graphics Speed	1.Single Page (Page 1)		
	2.Long Print Job		Average:

	(Pages 2 to 5)		

Conclusion:

1. The speed of printing the single text page is……and longer job average is ……. So single page text takes _____ (longer/shorter) time than longer job.
2. The speed of printing the single text page is……and single graphics page is ……. So single graphics page takes _____ (longer/shorter) time than single text page.
3. The speed of _____ (inkjet/dot matrix/laser) printer is very high.
4. The quality of printing of _____ (inkjet/dot matrix/laser) printer is very good.

Assignment Questions:

1. State types of printer.
2. Define resolution and bit depth.
3. State characteristics of printer.
4. State hardware installation of printer.
5. How does printer sense a paper jam?

Solution:

Marks Obtained			Dated signature of staff
Process Related(15)	**Product Related(10)**	**Total (25)**	