4.1 SIGNAL RECORDING & DISPLAY

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DETAILED CONTENT

1. Signal Recording and Display **(40 Periods)**

- **1.1** Recording Requirements
- **1.2** Analog Recorders
- **1.3** Graphics Recorders
- **1.4** Strip Chart Recorders
- **1.5** Types of Strip Chart Recorders
- **1.6** Galvanometer Type Recorders
- **1.7** Null Type Recorders
- **1.8** Potentiometric Recorders
- **1.9** X-Y Recorders
- **1.10** Direct Recording
- **1.11** Digital Recording
- **1.12** Digital Display Methods
- **1.13** Digital Display Units
- **1.14** Segmental Displays
- **1.15** Dot Matrices
- **1.16** Rear Projection Display
- **1.17** LCD display
- **1.18** LED display

2. Data Acquisition System **(24 Periods)**

- **2.1** Introduction
- **2.2** Objective of DAS
- **2.3** Single Channel Acquisition System
- **2.4** Multi-Channel DAS
- **2.5** Computer Based DAS
- **2.6** Data Loggers

LIST OF PRACTICALS

1. To operate the following recorders.

- Analog Recorders
- Graphics Recorders
- Strip Chart Recorders
- Galvanometer Type Recorders
- Null Type Recorders
- Potentiometric Recorders
- X-Y Recorders
- Digital Recorder

2. To operate the following display device

- Segmental Displays
- Dot Matrices
- Rear Projection Display

- LCD display
- LED display

3. Experiment on DAS, DATA LOGGERs, & Sensors Based Computer Data Systems

RECOMMENDED BOOKS

1. Electronic Instrumentation; by H.S.Kalsi; McGraw-Hill Education India Pvt.Ltd.
2. Principles of Measurement Systems by John P.Bently (Pearson)
3. Electrical and Electronic Measurements and Instrumentation by A.K.Sawhney; DhanpatRai& Co.
4. Instrumentation measurement and Analysis by B.C. Nakra, K.K.Chaudhary
5. Optoelectronics An Introduction to Materials and Devices by Singh Jasprit;McGraw Hill
6. Instrumentation Devices and Systems by C.S.Ranjan; Tata McGraw Hill

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted for Lecturers and Tutorials (Period)	Marks Allotted
1.	40	30
2.	24	20
TOTAL	64	50

4.2 OPERATION AND MAINTENANCE OFCLINICAL/MEDICAL INSTRUMENTS

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DETAILED CONTENT

1. Classification, application and specifications of diagnostic, therapeutic and clinical laboratory equipment, methods of operations. **(08 Periods)**

2. Electrodes:- Bio electric signals, Bio electrodes, electrode tissue interface , contact impedance, electrode used for ECG and EEG. **(08 Periods)**

3. Transducer : Typical signals from physiological parameters, pressure transducer, flow transducer, temperature transducer, Pulse sensor, respiration sensor **(08 Periods)**

4.

4.1 Operation of ECG Recorders, Operation of ECG Monitors, defibrillatr, pulse oximeter, NIBP Machine

4.2 Block diagram of ECG recorder, Common PCB's and identification of PCB's, fuses in the PCB

4.3 Performance of ECG Recorder – study of symptoms and finding out the faulty PCB, fuses in the PCB

4.4 Block diagram of ECG Monitor, Common PCB's and identification of PCB's, fuses in the PCB

4.5 Performance of ECG Monitor – study of symptoms and finding out the faulty PCB, fuses in the PCB

4.6 Block diagram of pulse Oximeter , Common PCB's and identification of PCB's, fuses in the PCB

Performance of Pulse Oximeter – study of symptoms and finding out the faulty PCB, fuses in the PCB **(08 Periods)**

5. Operation of EEG recorder and monitors with its block diagram common PCB and different faults occurred in EEG machine their detection and removal

6. Operation of EMG recorder and monitors with its block diagram common PCB and different faults occurred in EMG machine their detection and removal **(08 Periods)**

List of Practicals

1- Operation and maintenance of different diagnostic, therapeutic and clinic instruments in a clinical laboratory
2- Measurement of skins contact , Impedance & techniques to reduce it.
3- To determine the contact impendence of ECG and EEG electrodes
4-Observe the output of physiological, transducer , including pressure, temperature and pulse transducer and the wave shapes on CRO
5-Test the performance of ECG Recorder , study symptoms & Identify the faulty PCB
6-Test the performance of ECG Monitor, study symptoms & Identify the faulty PCB
7-Test the performance of pulse oximeter, study symptoms & Identify the faulty PCB
8-Test the performance of NIBP Machine, study symptoms & Identify the faulty PCB
9-List out the tools required for performing intermediate level maintenance

10-Follow dismantling procedure open the equipment and replace the faulty board
11-Remove, test and replace blown fuse in the PCB
12-EEG Machines frequency response, observation of EGG
13-To perform different operation on EEG Machine.
14-Trouble shooting and maintenance of EEG Machine
15-To perform different operation on EMG Machine.
16-Trouble shooting and maintenance of EMG Machine

Recommended Books

1- Medical Instruments by S.Ananthi, New Age International
2- Bio medical instrumentation by, Cromwell
3- Introduction to Bio medical Electronics by Edward J. Perkstein
4- Electrical & Electronics Measurement by A.K.Shawhney, Dhanpat Rai & Co.
5-Manuals of Different Clinical Equipments
6-Hand book of Bio medical Instrumentation by R.S.Khandpur

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted for Lecturers and Tutorials (Period)	Marks Allotted
1.	08	06
2.	08	06
3.	24	20
4.	08	06
5.	08	06
6.	08	06
TOTAL	64	50

4.3 MAINTENANCE & REPAIR OF ELECTRONIC TEST EQUIPMENT.

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DETAILED CONTENTS

(1) Analog Multimeter: (16 Periods)

- Cleaning the dust, Cleaning the switch contacts by switch cleaning solution.
- Testing the fuse.
- Testing moving coil meter assembly.
- Test & repair the DC voltage measurement circuit by doing measurement at the test points provided.
- Test & repair the AC voltage measurement circuit by doing measurement at the test points provided.
- Test & repair the DC current measurement circuit by doing measurement at the test points provided.
- Test & repair the Resistance measurement circuit by doing measurement at the test points provided.
- Check the battery voltage used in ohms range.
- Check for proper operation of mechanical zero adjustment with the help of a screwdriver.
- Repair the test leads/probes if found Defective
- Replace the of battery if required.
- Maintaining the test leads in proper condition. Cleaning of the switches etc.
- Replacing the open Fuse with correct rating.

(2) Digital Multimeter: (16 Periods)

- Cleaning the dust, Cleaning the switch contacts by switch cleaning solution.
- Testing the fuse.
- Testing the 7 segment LED display. Testing the LCD display module.
- Check the DC voltages & waveforms at the test point of the IC commonly used in 31/2 digit digital multimeter.
- Troubleshoot DC voltage, AC voltage, DC current, AC current & Resistance measurement circuit by doing measurement at the test points provided.
- Check the battery used in the digital multimeter.
- Repair of test leads/probes if found defective.
- Replacing the open Fuse with correct rating.
- After repair test the digital multimeter for its performanceFamiliarization with front panel control.

(3) Function Generator: (16 Periods)

- Cleaning the dust, Cleaning the switch contacts by switch cleaning solution.
- Testing the fuse, Power cable & ON/OFF switch.
- Test & repair the Power supply circuit, waveform generator circuit amplifier circuit by doing voltage measurement at the test points provided.
- Effect of DC-offset control on the waveform.
- Replacing the open Fuse with correct rating

(4) CRO: (16 Periods)

- Familiarization with front panel controls and measurements
- Cleaning the dust, Cleaning the switch contacts by switch cleaning solution.
- Testing the fuse, Power cable & ON/OFF switch.

• Identify & testing a CRO's Power supply Vertical amplifier circuit , horizontal amplifier & Sweep generator circuit etc.
• Check by feeding the CAL signal to the channel in use for accurate measurement.
• Test the circuit by doing voltage & waveform measurement at the test points provided.
• Check all functions AUTO/NORMAL, LINE, CH-1 or CH-II, EXT, selection of AC-DC-GND etc.
• Maintaining the test probes in proper condition.
• Use of CRO probes wth & without attenuation (X1, X10).
• Replacing the open Fuse with correct rating.
• Time base switch – its functions, operation and repair

LIST OF PRACTICAL

1.Familiarisation with operation of controls of VOM.
2.Trouble shooting Analog multimeter
3.Identify & testing a Function Generator Power supply circuit and test at the test points provided for correct outputvoltages.
4.Test the waveform generator circuit output waveforms at the test point provided with the help of a CRO.
5.Test the Function selector switch for its proper contacts.
6.Test the output amplifier circuit by doing voltage & waveform measurement at the test points provided.
7.Study & Trouble shooting technique of CRO's Power supply circuit, vertical amplifier, horizontal amplifier & Sweep generator circuit etc.
8.Test the by doing voltage & waveform measurement at the test points provided.
9.Check for proper operation of AUTO/NORMAL, LINE, CH-1 or CH-II,EXT etc.
10. Check the calibration of the CRO for accurate measurement by feeding the CAL signal to each channel.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted for Lecturers and Tutorials (Period)	Marks Allotted
1.	16	12
2.	16	12
3.	16	12
4.	16	14
TOTAL	64	50

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4.4 REPAIR AND MAINTENANCEOF POWER SUPPLY,UPS AND INVERTER

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DETAILED CONTENT

1- Basics of electricity **(04 Periods)**

1.1-Basic Electrical quantities and units of measurements
1.2-Define DC, AC practical measuring units of voltage, current, resistance
1.3-Types of transformers – its construction,
1.4-Testing of proper earth & fuses

2- Basic Electronics **(04 Periods)**

2.1- FET, MOSFET, UJIT – precautions when handling Applications of transistor –their uses
2.2- Op-Amp – Introduction, applications, construction, comparators
2.3-Voltage Regulator and their types
2.4-DIAC, SCR, TRIAC – applications

3- Single phase and three phase system **(04 Periods)**

Single phase and three phase Connection, current and voltage in single and three phase

4- Power supply **(08 Periods)**

Block diagram of Power Supply, regulator IC and its testing. Concept of Regulated/Multi output .Power Supply Tests Details of SMPS

5- UPS and Inverter - **(12 Periods)**

Different types of inverter, UPS, Working principle, specifications, explanation with the help of block diagram.Basic principle of working of power switches, testing methods, discussions of various faults

6- Trouble shooting/Repairing of faults **(08 Periods)**

6.1-Fault diagnosing methods
6.2-rectifying common faults

7- Batteries **(04Periods)**

7.1-Battery terminologies
7.2-Need for energy storage
7.3-Selecting batteries for UPS/Inverters
7.4-Battery Testing
7.5-Identifying battery testing instruments

8- Installation of UPS, Installation of Inverter **(04 Periods)**

8.1-Install UPS/ INVERTER,
8.2-Connect it with Wiring
8.3-Connect Batteries
8.4-Testing Of Earthing

9- Electrical and personal safety
Introduction to Specific Hazards & Personal Safety

List of Practicals

1-Testing of transformers
2- Testing of line voltage and current
3- Assemble a power amplifier circuit (ce, emitter follower)
4-FET, MOSFET, UJIT – precautions when handling Applications of transistor – their uses
5-Assemble and test an audio power amplifier (buzzer)
6-Measurement of current and voltage in single phase and 3 phase system
7-Testing of unregulated and regulated power supplies Fault Finding in different stages
8-Testing and repairing of SMPS
9-Opening & dismantling of different section of UPS and Inverters and identifying the major parts
10-Testing of major components, identifying transformers and checking ,
11-Checking of power modules,
12-Fault finding of different parts
13-Assembly/Fabrication practices of atleast one UPS and inverter of different rating.

Refrence Books

1- Electronics Measurement and Instruments by A.K.Sawhny , Dhanpat Rai & Sons New Delhi
2- Electronics Test and Instrumentation by Rajiv Sapra, Ishan Publication, Ambala
3- Principal of Electrical and Electronics Engineering by V.K. Mehta S.Chand & Co. New Delhi.
4- Digital Electronics By R.P. Jain. TMH, New Delhi
5- Basic Electronics & Linear Circuits by N.N.Bhargav, TMH New Delhi
6- Modern Electronic Equipment Trouble Shooting Repair & Maintenance By R.S. Khandpur, TMH, New Delhi

SUGGESTED DISTRIBUTION OF MARKS

Topic	Time Allotted (Periods)	Marks Allocation
1	**04**	**02**
2	**04**	**02**
3	**04**	**04**
4	**08**	**08**
5	**12**	**10**
6	**08**	**08**
7	**04**	**08**
8	**04**	**08**
Total	**48**	**50**

4.5 CONSUMER ELECTRONICS

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RATIONALE

The objective of teaching this subject is to give students an in depth knowledge of various electronic audio and video devices and systems. Further this subject will introduce the students with working principles, block diagram, main features of consumer electronics gadgets/goods/devices like audio-systems, CD systems. TV and other items like microwave ovens, Photostat machines etc. Which in-turn will develop in them capabilities of assembling, fault diagnosis and rectification in a systematic way.

DETAILED CONTENTS

1. Audio Systems: (12 Periods)

1.1. Microphones and Loudspeakers
- a) Carbon, moving coil, cordless microphone
- b) Direct radiating and horn loudspeaker
- c) Multi-speaker system

1.2 Sound Recording
- a) Magnetic Recording
- b) Digital Recording
- c) Optical Recording (CD system and DVD)

1.3 Study of VCD and DVD Player systems.

2. Television

2.1. Monochrome TV **(12 Periods)**
- a) Scanning and its need
- b) Need of synchronizing and blanking pulses, VSB
- c) Composite Video Signal
- d) Picture Tube
- e) Camera Tube : Vidicon and Plumbicon
- f) TV Receiver: Block diagram, function of each block, waveform at input and output of each block.

2.2. Colour Television: **(16 Periods)**
- a) Primary, secondary colours
- b) Concept of Colour Mixing, Colour Triangle
- c) Camera tube
- d) PAL TV Receiver
- e) Concept of Compatibility with Monochrome Receiver
- f) NTSC, PAL, SECAM system (brief comparison)

3. LCD and LED Television: Basic principle and working of LCD & LED TV (**12 Periods)**

4. Cable Television: Concept and Working of Cable TV, DTH, HDTV **(12 Periods)**

LIST OF PRACTICALS

1. To plot the directivity pattern and frequency response of a microphone.

2. To plot the directivity pattern and frequency response of a loudspeaker.
3. Demonstration of VCD/DVD player and study of its transport mechanism.
4. Familiarization with the different sections of B/W TV Receiver.
5. To observe the wave forms and voltage of B/W and colour TV Receiver.

6. Fault finding of colour T.V Receiver.
7. Familiarization with different section of LCD & LED TV
8. Study of cable TV network system.
9. Demonstration and Operation of Control Panel
   (a) Microwave Oven
   (b) DTH System
   (c) Photostat Machine
   (d) Washing Machine

INSTRUCTIONAL STRATEGY

This subject gives the knowledge of the various day-to-day life electronic products. So, the teacher is required to show and demonstrate the gadgets and impart practical knowledge to the students. For that one should give home assignment and frequent industrial visit should be there. Visit to TV studio and TV transmitter station should be arranged to give a practical exposure to the students.

RECOMMENDED BOOKS

1. Audio and Video Systems by RG Gupta, Tata McGraw Hill Education Pvt Ltd, New Delhi
2. Colour Television-Principles & Practice by R.R Gulati , Wiley Eastern Limited, New Delhi
3. Complete Satellite & cable Television R.R Gulati New age International Publisher, New Delhi
4. Colour Television Servicing by RC Vijay BPB Publication, New Delhi
5. Colour Television & Video Technology by A.K. Maini CSB Publishers
6. Colour TV by A. Dhake
7. Service Manuals, BPB Publication, New Delhi
8. Modern Electronic Equipment Trouble shooting, Repair and Maintenance by RS Khandpur, Tata McGraw Hill Education Pvt Ltd, New Delhi

SUGGESTED DISTRIBUTION OF MARKS

Topic	Time Allotted (Periods)	Marks Allocation
1	12	08
2	12	10
2	16	12
3	12	10
4	12	10
Total	**64**	**50**