3.1 INSTRUMENTATION

L	T	P
4		3

RATIONALE

This subject deals with the various electronic instruments, their construction and working which control the various parameters and operations in different industries. Electrical supervisor employed in maintenance of electrical equipment, machinery is required to diagnose faults, rectify them and test the total system for satisfactory performance. Thus there is a need of introducing diploma holders to the basics of Instrumentation.

DETAILED CONTENTS

1. Measurements

Importance of measurement, Basic measuring systems, advantages andlimitations of each measuring systems, generalized measurement system,signal conditioning and display devices **(06 Periods)**

2. TransducersTheory,

Construction and use of various transducers such as (resistance inductance, capacitance, electromagnetic, piezo electric, optical etc.) Introduction to smart transducers **(10 Periods)**

3. Measurements of Displacement and Strain

Displacement Measuring Devices: wire wound potentiometer, LVDT, straingauges, different strain gauges such as inductance type, resistive type, wireand foil etc. **(08 Periods)**

4. Pressure Measurement (08 Periods)

Bourdon pressure gauges, electrical pressure pick ups and their principle,construction ,application and use of pressure cells.

5. Measurement of Temperature (08 Periods)

Bimetallic thermometer, pressure thermometers, thermoelectric thermometers,resistance thermometer, thermocouple, thermisters and pyrometer **(08 Periods)**

6. Anatomy and physiology (06 Periods)

- Elementary ideas of cell structure
- Heart and circulatory system.
- Central nervous system
- Muscle action
- Respiratory system
- Body temperature and reproduction system

7. Overview of Medical Electronics Equipments, **(06 Periods)**

classification, application and specifications of diagnos tic, therapeutic and clinical laboratory equipment, method of operation of these instruments

8. Electrodes **(06 Periods)**

Bioelectric signals, Bio electrodes, Electrode, Electrode tissue interface, contact impedance, Types of Electrodes, Electrodes used for ECG , EEG

9. X-rays Machines **(06 Periods)**

9.1 Types of X-rays Machines

1) General purpose X-Rays machines
2) Dental X-Ray machine
3) Mobile X-Ray units

LIST OF PRACTICALS

1) Measurement and plot of characteristics of optical devices like photodiodes photocells
2) Characteristics of light operated switch using photo transistor and LDR
3) Measurement of strain using strain gauge
4) Measurement of pressure using pressure cell
5) Measurement of sound level using sound level meter
6) Measurement of temperature using themistor and thermocouples

Anatomy and Physiology

1. Measurement of skins contact impedance and techniques to reduce it.
2. Determine the contact impedance of following electrodes ECG, EEG and EMG Machines.
3. Observe the wave shapes on CRO the output of these transducers. Study of physiological transducers including pressure transducers, temperature transducers and pulse sensors

X-ray Equipment

1. Operation and function of all the controls of Hospital based X-rays machines
2. Operation and functions of all the controls of dental X-rays machines.
3. Operation and functions of all the controls of mobile X-ray units.
4. Identification of different blocks/sub-systems of circuits in X-ray machines.

RECOMMENDED BOOKS

1. Electronic Measurement and Instrumentation by Dr Rajendra Prasad
2. Electrical and Electronics Measurement and Instrumentation by AK Sawhney, Dhanpat Rai and Co., New Delhi
3. Electronic Instrumentation and Measurement Techniques by WD Cooper, AD Helfrick Prentice Hall of India Pvt. Ltd. New Delhi
4. Electronics Tests and Measurement Techniques by Rajiv
5. Handbook of biomedical Instrumentation by RS Khandpur
6. Biomedical Instrumentation by Cromwell,
7. Modern Electronics Equipment by RS Khandpur, TMMH, New Delhi
8. Introduction to BioMedical Electronics by Edward J. Perkstein; Howard Bj, USA

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted for (Practical Period)	Marks Allotted
1.	06	04
2.	10	08
3.	08	06
4.	08	06
5.	08	06
6.	06	05
7.	06	05
8.	06	05
9.	06	05
TOTAL	64	50

3.2 ELECTRONICS CIRCUIT

L T P
4 – 4

RATIONALE

Having attained basic knowledge of electronic devices like diodes, transistors, and elementary circuits, in second semester, this course will enable the students to learn about the use of transistors in analog circuits like power amplifier, multistage amplifier, oscillators, wave shaping circuits and in multivibrators etc. It also gives information about timer, operational amplifier, voltage regulator, ICs and their applications for effective functioning in the field of electronic service industry.

DETAILED CONTENTS

1. **FET, MOSFET & UJT** **(12 Periods)**
   Construction, operation and characteristics of FET and its application Construction,operation and characteristics of MOSFET in Depletion and Enhancement modes and its applications FET amplifier circuit and its working principle. (No analysis) Construction, operations and application of UJT.

2. **Amplifiers** **(08 periods)**
   Single Stage Amplifier, Muti Stage Amplifier RC Coupled Amplifier.Direct Coup[led Amplifier Large Signal Amplifier
   • Class A, Class B, Class AB, and Class C amplifiers,

3. **Feedback in Amplifiers** **(08 periods)**
   • Basic principles and types of feedback
   • Effect of feedback (negative) on gain, stability, distortion and bandwidth of an amplifier

4. **Sinusoidal Oscillators** **(08 periods)**
   • Classification of oscillators
   • Tuned collector, Hartley, Colpitts, phase shift, Wien's bridge Oscillator . Their working principles (no mathematical derivation)

5. **Wave Shaping Circuits** **(06 periods)**
   • General idea about different wave shapers
   • RC and RL integrating and differentiating circuits with their applications
   • Diode clipping and clamping circuits

6. **Multivibrator Circuits** **(12 periods)**
   • Concept of multi-vibrator: astable, monostable, and bistable and their applications
   • Block diagram of IC555 and its working and applications
   • IC555 as monostable and astable multi-vibrator

7. **Operational Amplifiers** **(10 periods)**
   • Characteristics of an ideal operational amplifier and its block diagram
   • Operational amplifier as an inverter, scale changer, adder, subtractor, differentiator, and integrator

LIST OF PRACTICALS

1.To plot V-I characteristics of FET Transistor
2.To Plot the V-I Characteristics of UJT & use of UJT as relaxation oscillator.
3. Plot the frequency response of two stage RC coupled amplifier and calculate the bandwidth and compare it with single stage amplifier
4. Plot the frequency response curve of Hartley and Colpitts Oscillator
5. Plot the frequency response curve of phase shift and Wein bridge Oscillator
6. To observe the output waveforms of series and shunt clipping circuits
7. To observe the output for clamping circuits
8. Use of IC 555 as monostablemultivibrator and observe the output for different values of RC
9. Use of IC 555 as astablemultivibrator and observe the output at different duty cycles
10. To use IC 741 (op-amplifier) as
i) Inverter, ii) Adder, iii) Subtractor iv) Integrator

RECOMMENDED BOOKS

1. Basic Electronics and Linear Circuits by NN Bhargava, Tata McGraw Hill, New Delhi
2. Electronic Principles by Sahdev, DhanpatRai and Sons, New Delhi.
3. Electronics Principles by Malvino, Tata McGraw Hill, New Delhi
4. Electronic Devices and Circuits by Millman and Halkias, McGraw Hill, New Delhi
5. Electronics Devices and Circuits by BhupinderjitKaur,modern Publishers, Jalandhar
6. Basic Electronics by Grob, Tata McGraw Hill, New Delhi
7. Art of Electronics by Horowitz
8. Electronic Circuit Theory by Boylstead
9. Electronic Devices and Circuits by BL Theraja, S Chand and Co Ltd. New Delhi
10. Operational Amplifiers and Linear Integrated Circuits by Ramakant A. Gaykwad

11. Electronics Devices and Circuits by Rama Reddy, Narosa Publishing House Pvt. Ltd., New Delhi
12. Electronics Devices and Circuits-II by Rajesh Kumar, Eagle Prakashan, Jalandhar

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted for (Practical Period)	Marks Allotted
1.	12	08
2.	08	06
3.	08	08
4.	08	06
5.	06	04
6.	12	10
7.	10	08
TOTAL	64	50

3.3 PRINCIPLE OF DIGITAL ELECTRONICS

L	T	P
5		3

RATIONALE

This syllabus has been designed to make the students know about the fundamental principles of digital electronics and gain familiarity with the available IC chips. This subject aims to give a background in the broad field of digital systems design and microprocessors.

DETAILED CONTENTS

1. Introduction (02 period)

- Comparison between analog and digital signal
- Applications and advantages of digital signals

2. Number System (05period)

- Binary, octal and hexadecimal number system: conversion from decimal and hexadecimal to binary and vice-versa
- Binary addition, subtraction, multiplication and division including binary points. 1's and 2's complement method of addition/subtraction, sign magnitude method of representation, floating point representation

3. Codes and Parity (05period)

- Concept of code, weighted and non-weighted codes, examples of 8421, BCD, excess-3 and Gray code
- Concept of parity, single and double parity and error detection code.

4. Logic Gates (06period)

a) Concept of negative and positive logic
b) Definition, symbols and truth tables of NOT, AND, OR, NAND, NOR, EXOR Gates, NAND and NOR as universal gates

5. Logic Simplification (04period)

- Postulates of Boolean algebra, De Morgan's Theorems. Various identities. Formulation of truth table and Boolean equation for simple problem. Implementation of Boolean (logic) equation with gates
- Karnaugh map (upto 4 variables) and simple applications in developing combinational logic circuits
- Concept of POS & SOP.

6. Arithmetic circuits (04period)

- Half adder and Full adder circuit, design and implementation.
- Half and Full subtracter circuit, design and implementation.

7. Decoders, Multiplexer and De Multiplexer](07period)

- Four bit decoder circuits for 7 segment display and decoder/driver ICs.
- Multiplexers and De-Multiplexers
- Basic functions and block diagram of MUX and DEMUX. Different ICs

8. Latches and flip flops (08period)

- Concept and types of latch with their working and applications
- Operation using waveforms and truth tables of RS, T, D, Master/Slave JK flip flops.
- Flip flop ICs

9. Counters (08period)

- Introduction to Asynchronous and Synchronous counters
- Binary counters
- Up/down counter
- Counter ICs

10. Shift Register (06period)

- Introduction and basic concepts including shift left and shift right.
- Serial in parallel out, serial in serial out, parallel in serial out, parallel in parallel out.

LIST OF PRACTICALS

1) Verification and interpretation of truth tables for AND, OR, NOT NAND, NOR and Exclusive OR (EXOR) and Exclusive NOR(EXNOR) gates
2) Realisation of logic functions with the help of NAND or NOR gates
3) To design a half adder & full adder using XOR and NAND gates and verification of its operation
4) Realisation of 4 bit adder/subtractor using IC
5) Verification of truth table for positive edge triggered, negative edge triggered, level triggered IC flip-flops (At least one IC each of D latch , D flip-flop, JK flip-flops)
6) Verification of truth table for encoder and decoder ICs, Mux and DeMux
7) To design a 4 bit SISO, SIPO, PISO, PIPO shift registers using JK/D flip flops and verification of their operation
8) Asynchronous Counter ICs
   Verification of truth table for any one universal shift register IC
   Use of IC 7490 or equivalent TTL (a) divide by 2 (b) divide by 10 Counter

OR

Use of IC 7493 or equivalent TTL (a) divide by 2 (b) divide by 8 (c) divide by 16 counter

Note: Above experiments may preferably be done on Bread Boards.

RECOMMENDED BOOKS

1. Digital Electronics and Applications by Malvino Leach, Tata McGraw Hill Education Pvt Ltd, New Delhi.
2. Digital Logic Designs by Morris Mano, Prentice Hall of India, New Delhi.
3. Digital Electronics by Soumitra Kumar Mandal, Tata McGraw Hill Education Pvt Ltd.
4. Digital Electronics by V K Sangar , Raj Publishers, Jalandhar.
5. Digital Electronics by Tokheim, Tata McGraw Hill Education Pvt Ltd.
6. Digital Fundamentals by Thomas Floyds, Universal Book Stall.
7. Digital Electronics by RP Jain, Tata McGraw Hill Education Pvt Ltd, New Delhi.
8. Digital Electronics by KS Jamwal, DhanpatRai and Co., New Delhi.
9. Digital Electronics by Rajiv Sapra, Ishan Publication, Ambala.
10. Digital Electronics by BR Gupta, DhanpatRai& Co., New Delhi.
11. Digital Systems, Principles and Applications by RJ Tocci, Prentice Hall of India, New Delhi.
12. Digital Electronics by Rajaraman V., Prentice Hall of India, New Delhi.
13. Fundamentals of Digital Electronics by Naresh Gupta, Jain Brothers, New Delhi.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted for Lecturers and Tutorials (Period)	Marks Allotted
1.	02	05
2.	05	10
3.	05	05
4.	08	10
5.	06	10
6.	05	05
7.	08	10
8.	06	10
9.	08	10
10.	06	05
11.	08	10
12.	06	05
13.	06	05
TOTAL	**80**	**50**

3.4 COMMUNICATION AND OPTICAL FIBER HANDLING

RATIONALE

L	T	P
4	-	3

The study of principles of communication systems leads to further specialized study of audio and video systems, line communications and microwave communication systems. Thus the diploma holder in Electronics and Communication Engineering shall find employment in areas of R and D,production, servicing and maintenance of various communication systems. The students should understand the advantage and limitations of various analog and digital modulation systems, transmitters, receivers and antennas relate to them while studying practical communication systems.

DETAILED CONTENT

COMMUNICATION

1.

Introduction:- Need for modulation,. Amplitude modulation. Expression for Amplitude modulated wave, Carrier and side band components. Modulation index. Spectrum and BW of AM Wave. Relative power distribution in carrier and side bands. Elementary idea of DSB-SC, SSB-SC, ISB and VSB modulations, their comparison, and areas of applications. **(08 Periods)**

2.

Frequency modulation Expression for frequency modulated wave and its frequency spectrum, Modulation index, maximum frequency deviation and deviation ratio, BW and FM signals. Phase modulation, modulation index, comparison with frequency modulation. **(08 Periods)**

OPTICAL FIBER HANDLING

1. Introduction to Fibre Optics (08 Periods)

- Fibre Optic Advantages and Applications
- Terminology
- The Fundamentals of Light Propagation
- Scales of Measurement and the Spectrum
- Characteristics of Single mode and Multimode

2. Cables (06 Periods)

- Cable Types, Construction and Specifications
- Selection Criteria

3. Connectors and Terminations (08 Periods)

- Temporary and Permanent Connections

- Connector Types
- Mechanical and Environmental Considerations
- Performance Specifications
- Connector Loss Issues

4. Splicing (08 Periods)

- Cable Marking
- Fusion Splicing
- Mechanical Splicing
- V-Grooved splicing
- Splicing Applications

1. Optical Sources & Detectors (08 Periods)

Characteristics of light used in optical communication, principle of operation of LED, different types of LED structures used and their brief description, Injection laser diode, principle of operation, different injection laser diodes, comparison of LED and ILD. Characteristics of photo detectors used in optical communication; PIN diode and Avalanche photo diode (APD), Noise in detectors .

2. Loses in optical fibre cable (04 Periods)

- Absorption Losses: Scattering Losses, Radiation losses, Connector losses, Bending losses.
- Dispersion: Types and its effect on data rate.

3. Installation (04 Periods)

- Planning and Standards
- Premise/LAN Methods
- Installation Tools and Equipment

LIST OF PRACTICALS

1. To observe an AM wave on CRO produced by a standard signal generator using internal and external modulation& to measure the modulation index of the wave obtained
2. To obtain an FM wave and measure the frequency deviation for different modulating signal
3. To observe PAM ,PPM and PWM signal and compare it with the analog input signal
4. Introduction to various components and tools used in optical fibre communication
5. Cable preparation, cleaning and cleaving
6. Prepare, splice and assemble a splice closure
7. Prepare, splice and assemble a multimode fibre LAN link
8. Fusion and mechanical splicing
9. Perform optical loss testing using an OTDR
10. Testing effectiveness of joining

11.Carry out inspection of route plan and obtain necessary clearances
12. Coordinate trenching, cable laying, jointing and cable blowing activities
13. Setting up of fibre analog link
14. Setting up to optic digital link
15. Measurement of bending losses in optical fibres

Hands-On Workshop – The hands-on workshop is designed for those who desire more intensive hands-on training for immediate entry into their specific field of study

RECOMMENDED BOOKS

1. Electronics Communication System by Kennedy, Tata McGraw Hill Education Pvt Ltd, New Delhi
2. Fundamentals of Communication System by Fitz, Tata McGraw Hill Education Pvt Ltd, New Delhi
3. Principles of Communication Engineering by Taub, Tata McGraw Hill Education Pvt Ltd,
4. Electronics Communication by KS Jamwal, DhanpatRai and Co, New Delhi
5. Radio Engineering by GK Mittal, Khanna Publishers, New Delhi
6. Principles of Communication Engineering by DR Arora, Ishan Publications, Ambala
7. Communication Engineering by A Kumar
8. Principles of Communication Engineering by Manoj Kumar, SatyaPrakashan, New Delhi
9. Principles of Communication Engineering by Anokh Singh, S.Chand and Co., New Delhi
10. Principles of Communication Engineering by Roody , Coolin

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted for Lecturers and Tutorials (Period)	Marks Allotted
1.	08	08
2.	08	08
3.	08	06
4.	06	04
5.	08	06
6.	08	06
7.	08	06
8.	04	03
9.	04	03
TOTAL	64	50

3.5 ELECTRONICS IN INDUSTRY

L	T	P
4	-	3

DETAILED CONTENT

1. Thyristors and Other Power Electronics Devices (32 Periods)

1.1 Introduction
1.2 Applications
1.3 Symbolic Representations
1.4 Specifications
1.5 Principle of Operating of an SCR
1.6 Two-Transistor Analogy of SCR
1.7 DIAC
1.8 TRIAC
1.9 Basic Triggering circuits for Thyristors
1.10 Rectifier Circuits using SCR
1.11 Construction and working of Gate Turn Off (GTO) thyristor
1.12 Characteristics of Programmable Uni-junction Transistor (PUT), ASCR, LASCR, RCT,SCS
1.13 Construction and Working of MOSFET, IGBT, MLT

2. Power Electronics Circuits (16Periods)

2.1 Commutation Circuits
2.2 Inverters series and parallel
2.3 Choppers: Step up, Morgan's, Jones's
2.4 Single phase and Three Phase Converters.

3. Operational Amplifier 741 (16 Periods)

3.1 Introduction, pin diagram, characteristics, specifications
3.2 Application of IC 741 – Integrator, differentiator, Adder, comparator, Instrumentation Amplifier

LABORATORY EXPERIMENTS:

1. Firing Characteristic of an SCR
2. Half-wave Gate-controlled Rectifier using One SCR
3. Single-phase Half-controlled Full-wave Rectifier using Two SCRs and Two Diodes
4. Illumination/ Fan Control using SCR
5. Firing Characteristic of a Triac
6. Application of a Triac for Illumination Control
7. Unijunction Transistor Characteristic
8. SCR Controlled Emergency light
9 Study of Integrator using OPAMP 741

10. Study of Differentiator using OPAMP 741
11. Study of Adder using OPAMP 741
12. To visit at least two Industries mentioned at module 04.

RECOMMENDED BOOKS:

1. Industrial Electronics: S.K. Bhattacharya / S Chatterjee, Tata McGraw-Hill Publishing Company Limited
2. Industrial Electronics: James Humphries, Leslie Sheets, 4e - Delmar Publications
3. Industrial Electronics: Biswanath Paul PHI
4. Industrial Electronics for Technicians: J.A.Sam Wilson Joseph Rissi , Prompt Publications
5. Thyristors and its Application by Ramamurthy, East West New Delhi
6. Modern Digital Electronics by R.P. Jain, McGraw Hill Publication
7. Op-amp and linear integrated circuits by Gaikwad, Eastern co. Edition PHI
8. Electrical and Electronic Measurements by A. K. Sawhney, Dhanpat rai & Sons New Delhi
9. Power Electronics by P.C. Sen, Tata McGraw-Hill Publishing, New Delhi
10. Digital Electronics by Malvino Leach, Tata McGraw-Hill Publishing, New Delhi

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted for Lecturers and Tutorials (Period)	Marks Allotted
1	32	15
2	16	10
3	16	05
TOTAL	**64**	**50**