6.1 MEDICAL INSTRUMENTATION

	L	T	P
Periods/week	4	-	3

RATIONALE

Instrumentation has brought a new revolution in the field of medical science. An instate into human body could become possible on account of introduction of various bio instrumentation and cure of various impossible deceases could become possible. An instrumentation engineer is now a days equally useful for industry as well as medical field.

DETAILED CONTENTS

1. **Human Physiology:**
   - 1.1 Elementary ideas of cell structure.
   - 1.2 Heart and circulatory system.
   - 1.3 Central Nervous system.
   - 1.4 Muscle action.
   - 1.5 Respiratory system.
   - 1.6 Body temperature.

2. **Overview of Medical Electronics Equipment:**
   Classification, Application of diagnostic, therauptic and clinical laboratory instruments. With example in diagnostic-Blood Pressure Measurement.

3. **Electrodes:**
   - 3.1 Bio-electric signals
   - 3.2 Bio-electrodes.
   - 3.3 Electrodes-tissue interface.
   - 3.4 Contact impedance.
   - 3.5 Effects of high contact impedance.
   - 3.6 Types of Electrodes:
     - (a) Electrodes for ECG.
     - (b) Electrodes for EEG
     - (c) Electrodes for EMG

4. **Medical Transducers:**
   - 4.1 Pressure transducers
   - 4.2 Type of pressure transducers
   - 4.3 Flow transducers
   - 4.4 Temperature transducers
     - (a) Thermocouples
     - (b) Thermistors
     - (c) Pulse sensors.

5. **Bio-Medical Recorders:**
   Principle physiological pre amplifier and specialized amplifiers. Generalized block diagram of a Bio-medical recorder.
   - 5.1 ECG machine
   - 5.2 Block diagram of ECG machine
   - 5.3 ECG leads
   - 5.4 EEG machine, EEG leads
   - 5.5 EMG machine.

6. **Medical Display Systems:**
   - 6.1 Cardio scope
   - 6.2 Cardio scope as sub system
   - 6.3 Multi-channel display system.

7. **Patient Monitoring System**
   - 7.1 Concept, block diagram and working.
   - 7.2 Microprocessor application in patient monitoring.

8. **Ultrasound Instrumentation:**
   - 8.1 Basic Principles of Ultra-Sonics
   - 8.2 Doppler principle
   - 8.3 Feotal Monitor
   - 8.4 Pulse-echotechnique
   - 8.5 Pulse-echoinstrument and imaging system, scanners.

9. **Defibrillator and Pace Makers:**
   Block diagram and principle of
   - 9.1 DC defibrillator
   - 9.2 Synchronized defibrillator
   - 9.3 Pace makers.

10. **Physiotherapys:**
    - 10.1 Short wave diathermy machine
    - 10.2 Control of output power
    - 10.3 Application Techniques.

11. **Low Voltage Therapy Instruments:**
    - 11.1 Diagnostic stimulators.
    - 11.2 Therapy stimulators.
    - 11.3 Constant current/Constant voltage stimulators.

PROCESS CONTROL LAB

1. To calibrate the control valves.
2. To draw the characteristics of valve positioner and actuator.
3. To study the working and construction of a D.P. cell and plot the input output characteristics.

4. To study the working of On/Off level controller and plot the time response chart and calculate time constant.
5. To draw the characteristics curve of proportional temperature controller.
6. To calibrate the given PI pneumatic controller by varying proportional percentage and integral time.
7. To draw the instrumentation diagram of a typical flow process.
8. To study closed loop automatic control set up and draw its block or circuit diagram.

RECOMMENDED BOOKS

1. Hand Book of Medical Instruments by RS Khandpur.
2. Medical Electronics and Instrumentation by Sanjay Guha-University Publication.
3. Servicing Medical and Bio-electronic Equipment by Cart JJ.
4. Electronics for Medical Personnel Buckstein.

SUGGESTED DISTRIBUTION OF MARKS

Topic	Time Allotted (Period)	Marks Allocation (%)
1	9	10
2	6	8
3	6	8
4	6	8
5	9	10
6	6	8
7	9	10
8	9	10
9	6	8
10	9	10
11	9	10
Total	84	100

6.2 ADVANCED MICROPROCESSORS

	L	T	P
Periods/ Weeks	4	-	4

RATIONALE

The complex systems require high through put that at times is not met with 8-bit microprocessor system. So, 16 bit up based system become suitable. They provide better facilities to personal computers and other automatic process control systems.

DETAILED CONTENTS

1. The 8086 Microprocessor (08 Periods)
   - Internal Architecture of 8086.
   - Memory organisation: Memory segmentation & physical address generation.
   - 8086 Flags

2. 8086 Signal (12 Periods)
   - Pins and Signals description.
   - CLK circuitry.
   - 8086 Address and Data bus Concept
   - Maximum & Minimum mode.
   - Memory and I/O Interface block diagram
   - Types of interrupts and interrupt priority. (Brief Idea)

3. 8086 Instruction set (12 Periods)
   - Instruction Format : Example on Mov instruction only.
   - Instruction : Data transfer, Arithmetic, Bit & Logical manipulation, String, Program transfer and processor control instructions.
   - Addressing mode & its types.
   - Macros , Procedure.

4. Directives and Programming (12 Periods)
   - Editor, Assembler, Emulators, Directives.
   - Programs: Addition, Subtraction, Multiplication, Division, Shifting of data right / Left, Increment, Decrement, Complement, Block movement of data.

5. Interrupts (12 Periods)
   - 8086 Interrupt.
   - Interrupt Vector table, Vector & Non Vector Interrupt.
   - Predefined Interrupts (0 – 4)
   - User defined Software/Hardware Interrupts.

6. Latest Microprocessor (08 Periods)
   Introduction to 32 bit Microprocessor, Features and advantages of Pentium processor/ Dual core processor and RISC processor

LIST OF PRACTICALS

1. To Study the Architecture of 8086 microprocessor.
2. Familiarization of different keys of 8086-microprocessor kit and its memory map.
3. Steps to enter, check /modify data or program and to execute a program on 8086 Microprocessor kit.
4. Addition of two 8 bit numbers.
5. Addition of two 16 bit numbers
6. Subtraction of two 8 bit numbers.
7. Subtraction of two 16 bit numbers
8. Multiplication of two 8 bit numbers
9. Division of two 8 bit numbers
10. Program for And, OR, X-OR & its complement.
11. Determine the Hex code of Mov instruction for various addressing mode.
12. Determine the Physical address for different segments.

INSTRUCTIONAL STRATEGY

Advanced Microprocessor gives the knowledge of 8086 and latest microprocessors. So, the teaching process require the theoretical study of microprocessors and also practical implementation using the microprocessor kits.

RECOMMENDED BOOKS

1. Microprocessor and Application by D.V. Hall.
2. Microprocessor 8086/88 by B.B. Brey
3. Microprocessors & Micro controllers by Dr. B.P. Singh
4. Microprocessor by Rajiv Sapra, Ishan Publications, Ambala
5. Microprocessor by Naresh Grover
6. Microprocessors and Microcomputers and their Applications by AK Mukhopadhyay
7. Microprocessors and Applications by Uffenback
8. Introduction to Microprocessor by Adithya Mathur, Tata McGraw Hill Publishing Co, New Delhi
9. Microprocessor Architecture, Programming and Applications with 8085 by RS Gaonkar, Wiley Eastern Ltd, New Delhi
10. Microprocessor and Applications by B Ram
11. Microprocessor by SK Goel

SUGGESTED DISTRIBUTION OF MARKS

Topic	Time Allotted (Periods)	Marks Allotted (%)
1	08	10
2	12	20
3	12	20
4	12	20
5	12	20
6	08	10
Total	**64**	**100**

6.3 MICRO CONTROLLERS AND EMBEDDED SYSTEM

	L	T	P
Periods/ Weeks	4	-	4

RATIONALE

In industry, many manufacturing processes demand a sequence of operation, which are to be performed repetitively. Early automation systems were mechanical in design, timing and sequencing being effected by gears and cams. Slowly these design concepts were replaced by electrical drives which were controlled by relays and now by programmable logic controllers (PLCs).

DETAILED CONTENTS

1. Microcontroller series (MCS) – 51 Overview (16 Periods)

   - Pin details
   - I/O Port structure
   - Memory Organization
   - Special Function Registers (SFRS)
   - External Memory

2. Instruction Set; Addressing Modes, Instruction types (12 Periods)

   - Timer operation
   - Serial Port operation
   - Interrupts

3. Assembly language programming (10 Periods)

   - Assembler directives
   - Assembler operation

4. Design and Interface (10 Periods)

   - keypad interface, 7- segment interface, Switches etc

5. Embedded Systems (16 Periods)

   Introduction, Embedded design concept, Brief description and architecture of AVR and PIC, Application of embedded system, case study of embedded system. General Idea of Robotics, Different types of Robots, Their working principles and elements used in robotics.

LIST OF PRACTICALS

1. Familiarization of Micro Controllers (8051) kit
2. Assembly Language Programming
3. Testing of general input/output on Micro controller board

4. Development of Electrical , Instrumentation applications using 8051 micro-controller
5. Study of interfacing ADC, Infra red Sensor, RS 232, DAC with 8051.
6. Case study of embedded system

RECOMMENDED BOOKS

1. B. B. Brey: The Intel Microprocessors, Architecture, Programming and Interfacing, Pearson Education.
2. Liu Gibson: Microcomputer Systems: The 8086/8088 Family- Architecture, Programming And Design , PHI
3. D. V. Hall: Microprocessors and Interfacing, TMH.
4. Mazidi and Mazidi: The 8051 Microcontroller and Embedded Systems, Pearson Education.
5. Ayala Kenneth:- The 8051 microcontroller, Third Edition, Cengage Learning
6. A. V. Deshmukh: Microcontroller (Theory and Application), TMH.
7. Raj Kamal: Embedded Systems- Architecture, Programming and Design, TMH, New Delhi.
8. V. Udayashankara and M. S. Mallikarjunaswamy: 8051 Microcontroller, TMH, New Delhi.
9. Digital Electronics by Malvino Leach, Tata McGraw-Hill Publishing, New Delhi

SUGGESTED DISTRIBUTION OF MARKS

Topic	Time Allotted (Periods)	Marks Allotted (%)
1	16	25
2	12	20
3	10	15
4	10	15
5	16	25
Total	**64**	**100**

6.4 VIRTUAL INSTRUMENTATION

	L	-	P
Periods/week	4	-	3

RATIONALE

Virtual instrumentation is One of the latest emerging techniques in the field Of instrumentation. Because of its numerous advantages Over traditional instruments, VI is being used in almost every field, Knowledge of this Subject Will enable diploma Students to make them aware of hardware, of hardware, Software and interfacing devices and its importance in the field of instrumentation.

DETAILED CONTENTS

1. **Introduction to Virtual Instrumentation:**
   Historical perspective, advantages of virtual instruments over conventional/traditional instruments, block diagram and architecture of virtual instruments.

2. **Laming Lab View:**
   Introduction, Front panel, Block diagram, Menus, Palettes, VI, Editing and Debugging VI Structures, Arrays, duster, charts &Graphs, Data acquisition, Instrument control, signal processing examples

3. **Data Acquisition Basics:**
   ADC, DAC, DIO, connectors and timers, PC hardware structure, Introduction to various Data Acquisition Cards.

4. **Common Instrumentation Interfaces:**
   Introduction to RS232/RS485, GPIB, USB, Instrumentation buses (introduction such as inter bus).

5. Applications of VI in process control like pressure, temperature control etc

LIST OF PRACTICALS

1. G-programming using LAB view/flex pro.
2. (a) Create a simple VI consisting of a dial and a thermometer .
   (b) Developing VI for converting temperature in degree Centigrade to degree Fahrenheit.
3. Creation of sub-VI using above VI as sub VI to convert the temperature in degree Kelvin.
4. Application of LABVIEW/flex pro.
5. Simulation of Process control System using computer simulation.
6. Acquisition of signals from transducers such as temperature, acceleration or function generator using USB interface and transfer the same to PC.

RECOMMENDED BOOKS

1. LABVIEW GRAPHICAL Programming by Gary Johnson; Tata McGraw Hill Publishing Co. New Delhi
2. Basic Concepts of LABVIEW 4 by SOKO Ioft; PHI
3. Learning with View 7 by Robert H. Bishop, Pearson Education.
4. Lab view for Every One by Jeffrey Tran's, Pearson Education.

SUGGESTED DISTRIBUTION OF MARKS

Topic	Time Allotted (Period)	Marks Allocation (%)
1	8	15
2	22	30
3	20	30
4	8	15
5	6	10
TOTAL	64	100

6.5 PROGRAMMABLE LOGIC CONTROLLERS

	L	T	P
Periods/ Weeks	4	-	4

RATIONALE

This subject deals with the various instruments, their construction and working which control the various parameters and operations in any industry. A diploma holder in the field of Electronics employed for maintenance of electronic equipment/ gadgets is required to diagnose faults, rectify them and test the total system for good performance. Thus there is a need of introducing diploma holders to the basics of Instrumentation.

In industry, many manufacturing processes demand a sequence of operation, which are to be performed repetitively. Early automation systems were mechanical in design, timing and sequencing being effected by gears and cams. Slowly these design concepts were replaced by electrical drives which were controlled by relays and now by programmable logic controllers (PLCs). A PLC is a solid state device, designed to operate in noisy industrial environments and can perform all logic functions. PLCs are widely used in all industries for efficient control operations. A diploma holder in industry is called upon to design , modify and troubleshoot such control circuits. Looking at the industrial applications of PLCs in the modern industry, this subject finds its usefulness in the present curriculum.

DETAILED CONTENTS

1. Introduction to PLCs (05 Periods)

   What is PLC, limitations of relays. Advantages of PLCs over electromagnetic relays, Different programming languages, PLC manufacturer etc.

2. Working of PLC (14 Periods)

   - Basic operation and principle of PLC,
   - Architectural details – Processor
   - Memory structure, I/O Structure
   - Programming terminal, Power Supply

3. Instruction Set (15 Periods)

   - Basic instructions like latch, master control self holding relays.
   - Timer instructions like on-delay timers, off-delay timers, retentive timers, resetting of timers.
   - Counter instructions like up-counter, down counter, resetting of counters.
   - Sequencers, output sequencers, input sequencers time driven and event driven sequencers masking etc.
   - Comparison instruction like equal, not equal, greater, greater than equal, less than, less than equal mask equal, limit etc.

4. Ladder diagram programming (15 Periods)

Programming based on Basic instructions, timer counter, sequencer to comparison instruction using ladder diagrams.

5. Applications of PLCs (15 Periods)

- Car parking
- Doorbell operation
- Traffic light control
- Microwave Oven
- Washing machine

LIST OF PRACTICALS

1. Familiarization with the working of PLC
2. Components/sub-components of a PLC, learning functions of different modules of a PLC system
3. Introduction to programming language, ladder diagram concepts, instruction list for module 5.
4. Basic logic operations, AND, OR, NOT, functions
5. Logic control systems with time response as applied to clamping operation
6. Sequence control system e.g in lifting a device for packaging and counting
7. Writing, entering and testing programs using a hand-held programmer and computer for the following operations
   - Ladder Logic
   - Timers
   - Counters
   - Sequencers

INSTRUCTIONAL STRATEGY

The teacher should explain the scope of various measuring devices and their practical application in the field. The transducers and measuring devices must be shown to the students and they should be trained in the selection, operation, maintenance and calibrations. Frequent visits to nearby process industries will be of immense help to the students. The inputs shall start with theoretical inputs to architecture, instruction set, assembly language programming, Small projects may be identified, be designed and implemented. PLC ladder diagram and programming should be supplemented with visits to industry. More emphasis may be given to practical work.

RECOMMENDED BOOKS

1. Programmable Logic Controller by Job Dan Otter; P.H. International, Inc, USA
2. Introduction to PLCs by Gary Dunning. McGraw Hill
3. Module on PLCs and their Applications by Rajesh Kumar, NITTTR Chandigarh
4. Module on "Allen Bradlag PlC (SLC 500), Institution set-1, by Rajesh Kumar, NITTTR, Chandigarh
5. Module on "PLC Applications based on SLC 5/03" By Rajesh Kumar, NITTTR Chandigarh

SUGGESTED DISTRIBUTION OF MARKS

Topic	Time Allotted (Periods)	Marks Allocation (%)
1.	05	05
2.	14	20
3.	15	25
4.	15	25
5.	15	25
Total	**64**	**100**

6.6 EMPLOYABLE SKILLS

	L	T	P
Periods per week	-	-	4

RATIONALE

Diploma holders are required to not only possess subject related knowledge but also soft skills to get good jobs and to rise steadily at their workplace. This subject is included to develop employability skills amongst the students.

DETAILED CONTENTS

1. Industrial Scenario Engineering Education and expectations of competences from an engineer by employer (04 periods)

2. Personality types, characteristic and features for a successful engineer (04 periods)

3. Professional Engineer desirable values and ethics and their development. Relation between engineering profession, society and environment (04 periods)

4. Managing project (16 periods)

   - Leadership
   - Motivation
   - Time management
   - Resource management
   - Computer Software
   - Interpersonal relationship
   - Engineer economics and fundamentals

5. Effective Communication (08 periods)

   - Listening
   - Speaking
   - Writing
   - Presentation Technique/Seminar
   - Group discussion

6. Preparing for Employment (08 periods)

   - Searching for job/job hunting
   - Resume Writing
   - Interview technique in personal interview telephonic interview, panel interview, group interview, video conference

7. Managing Self (06 periods)

- Managers body, mind, emotion and spirit
- Stress Management
- Conflict resolution

8. Continuing professional development (04 periods)

- Organising learning and knowledge
- Use of computer for organising knowledge resource

9. Creativity, Innovation and Intellectual property right (06 periods)

- Concept and need in present time for an engineer

10. Basic rules, laws and norms to be adhered by engineers during their working (04 periods)

6.7 MAJOR PROJECT WORK

	L	T	P
Periods/week	-	-	4

RATIONALE

Project plays an important role in the final stage of learning for assimilation of all what has been learnt till now. It also gives an opportunity to the students to show their innovation capabilities. In addition, it gives a confidence in handling different technical situations faced in the world of work. In this syllabus, topics of projects have been listed. The faculty is advised to encourage new projects to be cultivated by the students themselves.

SUGGESTED LIST OF PROJECTS

1. Controls of Thermal Power station and Cement Plant. Prepare process flow and piping and instrumentation diagram of a section. Identify their various instruments, systems and control parameters, ranges, specifications and making of each item.
2. Design and rigging up of a simple control loop for example temperature control in an oven, maintaining constant temperature in hot water tank, level control in a water tank, flow control in a pipe line, control of pressure in a pressurized vessel by injection (acid or alkali).
3. Design and making a simple on/off controller for temperature using ICs, capacitors, resistors on a printed circuit board.
4. Design an alarm annunciation scheme for motor control (trip, supply, failure, overheating) and realizing the same in a control panel using lamps.
5. Design and making a DC regulated power supply.
6. Design and fabricate a digital combination lock.
7. Design and fabricate a digital frequency counter.
8. design and fabricate a digital stop watch.
9. Design and fabricate a digital timer.
10. To dismantle and lap a control valve. Assemble and test it hydraulically.
11. Design and fabricate a simple measuring instruments for temperature, pressure, flow or level.
12. Design and fabricate a signal converter.
13. Design and fabricate a signal transmitter.
14. Use of PLC for DAS controls.
15. Design, construction and implementation of load cell in a given problem.
16. Design, and construction of pressure transducers for industrial implementation.
17. ECG analyzer while taking a case.
18. Spiro data analysis for a given case.
19. PLCs based and implementation for industrial control system.
20. Study and analysis of a plant Digital Distribution Control (DDC).
21. Study and analysis of a plant SCADA.
22. Study and analysis of automation of a cement plant, sugar plant and Regional Research Laboratory.
23. Study and analyze automation of textile/refinery.
24. Study and analyze distributed control system (DCS).

25. Data acquisition and handling for industrial problems.
26. Waveform Generation using 8085.
27. Measurement of Certain parameters in CNC Latte/Milling Controller.
28. Trouble shooting of industrial plant operations.
29. Estimation and costing of control system design in an industrial plant.
30. Production scheduling and control technology in an industrial plant instrumentation.
31. Stepper motor control using 8-bit micro-controller/microprocessor.
32. 2x16 alphanumeric LCD interface using 8-bit micro-controller/microprocessor.
33. EPROM programmer using 8051 series micro-controller/microprocessor.
34. Real time clock using 8-bit micro-controller/microprocessor.
35. Temperature control using 8- bit micro-controller/microprocessor.
36. Draw specifications, diagrams of various equipment systems and accessories used in a process control system . Prepare cost and time estimates.

NOTE:

1. The list is only the guideline for selecting a project, however a student is at liberty to select any other related project of his choice independently under guidance of his teacher.
2. The quality of end-product and process adopted by the students in its execution should be taken into consideration along with other parameters while evaluating the students.

A suggestive criteria for assessing student performance by the external (personnel from industry) and internal (teacher) examiner is given in table below.

Sr. No.	Performance criteria	Max Marks	Rating Scale				
			Excellent	very good	Good	Fair	Poor
1	Selection of project assignment	10%	10	8	6	4	2
2	Planning and execution of Considerations	10%	10	8	6	4	2
3	Quality of performance	20%	20	16	12	8	4
4	Providing solution of the problems or production of final product	20%	20	16	12	8	4
5	Sense of responsibility	10%	10	8	6	4	2
6	Self expression/communication skills	5%	5	4	3	2	1
7	Interpersonal skills/human relations	5%	5	4	3	2	1
8	Report writing skills	10%	10	8	6	4	2
9	Viva voce	10%	10	8	6	4	2
TOTAL MARKS		100	100	80	60	40	20