6.1 BIO-MEDICAL INSTRUMENTATION

L T P

Periods/ Weeks **4 - 0 – 4**

Unit:- I **(10 Periods)**

Human Physiology

Elementary ideas of cell structure, Heart and circulatory system, Central Nervous system. Muscle action, Respiratory system, Body temperature.

Unit:- II **(10 Periods)**

Overview of Medical Electronics Equipment

Classification, Application of diagnostic, therauptic and clinical laboratory instruments with example in diagnostic-Blood Pressure Measurement.

Unit:- III **(14 Periods)**

Electrodes and Medical Transducers

Bio-electric signals, Bio-electrodes. Electrodes-tissue interface, Contact impedance, Effects of high contact impedance, Types of Electrodes:(a) Electrodes for ECG,(b) Electrodes for EEG,(c) Electrodes for EMG, Pressure transducers, Type of pressure transducers, Flow transducers, Temperature transducers:(a) Thermocouples, (b) Thermistors (c) Pulse sensors.

Unit:- IV **(16 Periods)**

Bio-Medical Recorders and Medical Display Systems

Principle of physiological, pre amplifier and specialized amplifiers. Generalized block diagram of a Bio-medical recorder, ECG machine, Block diagram of ECG machine, ECG leads, EEG machine, EEG leads EMG machine, Cardio scope, Cardio scope as sub system, Multi-channel display system.

Unit:- V **(14 Periods)**

Patient Monitoring System

Concept, block diagram and working. Microprocessor application in patient monitoring

LIST OF PRACTICALS

1. Study of electrodes.
2. Measurement of BP.
3. Measurement of PH.
4. Study of EEG, ECG, CAT-SCAN.
5. Visit to Pathological Lab.
6. Hospital visit to see demonstration of EEG, ECG, and CAT-SCAN.

RECOMMENDED BOOKS

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

Suggested Distribution of Marks

Unit	Time Allotted (Periods)	Marks Allocation %
I	10	15
II	10	15
III	14	20
IV	16	25
V	14	25
TOTAL	**64**	**100**

6.2 NON-CONVENTIONAL ENERGY SOURCES

L T P
Periods/ Weeks **4 - 0 – 4**

RATIONALE

Energy is a crucial input in the process of economic, social and industrial development. High energy consumption has traditionally been associated with higher quality of life, which in turn is related to Gross National Project (GNP). Since the conventional energy resources are under depletion, it is high time to tape the non conventional energy sources like solar and bio- energy. Uttarakhand is rich in hydro energy and lot of potential for self employment exists in setting up Micro Hydro plant. This subject is included to take care of special need of the state.

DETAILED CONTENTS

Unit:- I **(5 Periods)**

Non-Conventional Sources of Energy : An overview

Importance of Non conventional sources of energy, Present Scenario, Future Prospects, Economic Criteria. Types of non-conventional energy sources.

Unit:- II **(5 Periods)**

Solar Energy

Physical Principal of the conversion of Solar radiation into heat, Photo-voltaic cell, Electricity generation, Solar water heaters, Solar Furnaces, Solar cookers, Solar Stills solar pumping.

Unit:- III **(10 Periods)**

Wind Energy

Wind Energy Conversion, Wind mills, Electricity generation from wind- Types of wind mills, local control, energy storage.

Unit:- IV **(15 Periods)**

Bio-energy & Chemical Energy Sources

Bio-mass Conversion Technologies- wet and dry processes. Methods for obtaining energy from Biomass. Power Generation by using gasifiers. Design and operating principles of a fuel cell, conversion efficiency, work output and emf of fuel cells, types, applications.

. **Unit:- V** **(15 Periods)**

Geo-thermal and Tidal Energy

Geo-thermal sources, Ocean thermal electric conversion, open and closed cycles, hybrid cycles. Steam Generation and electricity generation.

. **Unit:- VI** **(14 Periods)**

Micro Hydel Plants

Small and Micro Hydro Electric Power Plants: An Overview, Advantages and Disadvantages of Small and Micro Hydro Schemes. Layout of a Micro Hydro Scheme. Main Elements of a Micro Hydro Plant
Water turbines. Turbine Classifications, Characteristics and Selection. Generators, Overview of Automation, Control and Monitoring of Micro Hydro Electric Power Plants, Efficiency and Limitations.

Practical: Students should be taken to site of Micro Hydro Plant and Non Conventional Energy Sources units. They may be asked to prepare report of the visits and make presentation in the class.

RECOMMENDED BOOKS

1. Solar Energy – Principles of thermal collection and Storage SP Sukhatme, Tata McGraw Hill Publication, New Delhi.
2. Solar Energy Utilization; GD Rai; Khanna Publishers, New Delhi.
3. Reviews of Renewable Energy Sources, Vol. 3, Edited by MS. Sodha, S.S. Mathur, MAS Malik, TC Kandpal ; Wiley Eastern Limited, New Delhi.
4. Renewable Energy Sources and Conversion Technology by NK Bansal,Manfred Kleemann, Michael Meliss, Tata McGraw Hill Publishing Co. Ltd New Delhi.
5. Energy Today and Tomorrow; Maheshwar Dayal; Publications Division, Ministry of Information and Broadcasting, Govt. of India, New Delhi.
6. Energy Technology (non-conventional, renewable and conventional) by S Rao and BB Parulekar, Khanna Publishers, New Delhi
7. Non Conventional Energy Sources by B.H Khan, A tata McGraw Hill Publication New Delhi
8. Micro Hydel Design Manual by Adam Harvey, Intermediate technology Publication

Suggested Distribution of Marks

Unit	Time Allotted (Periods)	Marks Allocation %
I	5	08
II	5	08
III	10	15
IV	15	25
V	15	25
VI	14	19
TOTAL	**64**	**100**

6.3 MICROCONTROLLER & EMBEDDED SYSTEM

L T P
Periods/ Weeks **4 - 4**

Unit:- I **(15 Periods)**

MICROCONTROLLER SERIES (MCS)-51

- Introduction & features of microcontroller,
- Pin details
- I/O Port structure
- Memory Organization
- External Memory

Unit:- II **(15 Periods)**

INSTRUCTION SET

- Different instruction groups
- Addressing Modes
- Instruction types

Unit:- III **(15 Periods)**

Special Function Registers (SFRS)

- Timer operation
- Serial Port operation
- Interrupts

Unit :- IV **(8 Periods)**

ASSEMBLER DIRECTVES & INTERFACING

- Different types of Assembler directives
- Interfacing of Switches and 7- segment display.

Unit:- V **(11 Periods)**

EMBEDDED SYSTEM

- Introduction, Embedded design concept.
- AVR:ATMEGA 16
  - Pin description & features.
  - Memory structure
  - Architecture

- Interfacing examples of AVR board: LED, 7- segment, LDR, Stepper motor, IR module, Temperature sensor

LIST OF PRACTICALS

1. Familiarization of Micro Controllers (8051) kit
2. Write ALP for two 8 bit Addition.
3. Write ALP for two 8 bit Subtraction.
4. Write ALP for finding the greatest number out of 10 nos.
5. Write ALP for finding the smallest number out of 10 nos.
6. Write ALP for Ascending and Descending order sorting of 10 numbers.
7. Interfacing of switch with 8051.
8. Study of interfacing LED, 7- segment, LDR, Stepper motor, IR module, Temperature sensor.

RECOMMENDED BOOKS

- Mazidi and Mazidi: The 8051 Microcontroller and Embedded Systems, Pearson education.
- Ayala Kenneth:- The 8051 microcontroller, Third Edition, Cengage Learning
- V. Deshmukh: Microcontroller (Theory and Application), TMH.
- Raj Kamal: Embedded Systems- Architecture, Programming and Design, TMH, New Delhi.
- V. Udayashankara and M. S. Mallikarjunaswamy: 8051 Microcontroller, TMH, New Delhi.
- The AVR microcontroller & embedded system using Assembly & C by M A Mazidi, Naimi: Pearson Education India

Suggested Distribution of Marks

Unit	Time Allotted (Periods)	Marks Allocation %
I	15	25
II	15	25
III	15	25
IV	08	10
V	11	15
TOTAL	**64**	**100**

6.4 PLC & BASICS OF SCADA

L T P

Periods/ Weeks **4 - 4**

Unit – I **(15 Periods)**

PLC (Programmable Logic Controller)

- Introduction
- Advantage s of PLC over Electromagnetic Relay.
- General Architecture of PLC & function of it's various blocks
- Working Principle of PLC
- Memory Types
- Input / Output Modules
- PLC Power Supply
- Programming Terminal
- Concept of PLC Scan cycle

Unit – 2 **(10 Periods)**

Instructions for Programming in PLC

- Basic Instructions – NO & NC contacts
- Compare Instructions
- Compute / Math Instructions
- Data Transfer & Logical Instructions

Unit-3 **(20 Periods)**

Programming with PLC

- Programming methods
- Boolean gates – Symbols & truth tables
- Ladder Logic
- Concept of latching & unlatching
- Timers (on-delay timer, off-delay timer, retentive timer).
- Counters (Counter instructions like up-counter, down counter).
- Sequencers, output sequencers, input sequencers time driven and event driven sequencers.

Unit - 4

Applications of PLCs **(09 Periods)**

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

Unit - 5

Introduction to SCADA **(10 Periods)**

- General definition of SCADA.

- SCADA Architecture (Hardware)
- Need & Importance of SCADA in Process.
- Comparison of SCADA with DCS

LIST OF PRACTICALS

1. Familiarization with the working of PLC.
2. Familiarization with the functions of different modules of PLC.
3. Steps to enter, Load & Execute the program in PLC.
4. Practice of Basic Logic operations: AND, OR, NOT etc. on PLC Trainer'
5. Write, enter & execute programs using a computer having the following functions: Timer,Counter & sequencer.
6. Simple program based on basic instructions.
7 . Simple program based on gates.

RECOMMENDED BOOKS

1 Programmable Logic controller by Job Dan otter, PHI
2 Introduction to PLC by Grey Dunning, Mccraw Hill Pub.
3. Module on PLC & their applications by Rajesh Kumar, NITI-TR Chandigarh
4. SCADA by Stuart A. Boyer By Instrument Society of America.
5. PLC & SCADA Theory and Practice by Rajesh Mehra: Laxmi Pub
6. SCADA System: Quick Reference guide

Suggested Distribution of Marks

Unit	Time Allotted (Periods)	Marks Allocation %
I	15	24
II	10	16
III	20	30
IV	9	14
V	10	16
TOTAL	**64**	**100**

6.5 EMPLOYABILITY SKILLS

L T P

Periods/ Weeks **- - 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)**

6.6 MAJOR PROJECT

L	T	P
-	-	8

RATIONALE

Major Project Work aims at developing innovative skills in the students whereby they apply in totality the knowledge and skills gained through the course work in the solution of particular problem or by undertaking a project. In addition, the project work is intended to place students for project oriented practical training in actual work situation for the stipulated period with a view to: i) Develop understanding regarding the size and scale of operations and nature of field-work in which students are going to play their role after completing the courses of study. ii) Develop understanding of subject based knowledge given in the classroom in the context of its application at work places. iii) Develop first hand experience and confidence amongst the students to enable them to use and apply polytechnic/institute based knowledge and skills to solve practical problems related to the world of work. Iv) Develop abilities like interpersonal skill communication skills, positive attitudes and values etc.

The individual students have different aptitudes and strengths. Project work, therefore, should match the strengths of students. For this purpose, students should be asked to identify the type of project work, they would like to execute. The activity of problem identification should begin well in advance (say at the end of second year). Students should be allotted a problem of interest to him/her as a major project work. It is also essential that the faculty of the respective department may have a brainstorming session to identify suitable project assignments for their students. The project assignment can be individual assignment or a group assignment. There should not be more than 5 students if the project work is given to a group. The project work identified in collaboration with industry should be preferred. This practical training cum project work should not be considered as merely conventional industrial training in which students are sent at work places with either minimal or no supervision. This experience is required to be planned in advance and supervised on regular basis by the polytechnic faculty. For the fulfillment of above objectives, polytechnics may establish close linkage with 8-10 relevant organization for providing such an experience to students. It is necessary that each organization is visited well in advance and activities to be performed by students are well defined. The chosen activities should be such that it matches with the curricular interest to students and of

professional value to industrial/ field organizations. Each teacher is expected to supervise and guide 5-6 students.

Some of the project activities are given below:
a) Projects related to designing small electronic equipment / instruments.
b) Projects related to increasing productivity in electronic manufacturing areas.
c) Projects related to quality assurance.
d) Projects connected with repair and maintenance of plant and equipment.
e) Projects related to design of PCBs.
f) Projects related to suggesting substitutes of electronics components being used.
g) Projects related to design of small oscillators and amplifier circuits.
h) Projects related to design, fabrication, testing and application of simple digital circuits and components.
i) Projects related to microprocessor/microcontroller based circuits/ instruments.

A. SOME OF THE PROJECTS BASED ON ABOVE AREAS ARE LISTED BELOW FOR THE BENEFIT OF STUDENTS

1. Microprocessor/Microcontroller based rolling display/bell and calendar
2. Microprocessor based stepper motor control.
3. Speed control of DC Machines by Microprocessor/Microcontrollers
4. Temperature monitoring using Microprocessor/Microcontroller based systems.
5. Microprocessor/Microcontroller based liquid level indicator and control
6. Fabrication and assembling of digital clock.
7. Fabrication of PCB circuits using ORCAD/ EAGLE Software.
8. Fabrication of ON line/OFF line UPS of different ratings and inverters
9. Design, fabrication and testing of different types of experimental boards
10. Repair of oscilloscope, function generator
11. Design and developing web sites of organizations
12. Installation of computer network (LANS).
13. Microprocessor/Microcontroller based solar tracking system
14. GSM based car or home security system
15. Bank token display using microcontroller
16. Printer sharing unit
17. Microprocessor/Microcontroller Based A/D converter
18. Microprocessor/Microcontroller Based D/A converter
19. Simulation of half wave and full wave rectifiers using Simulation Software
20. Simulation of class A, Class B, Class AB and Class C amplifiers
21. Simulation of different wave forms like sine, square, triangular waves etc.
22. GPS based vehicle tracking system
23. Calculate Bit Error Rate (BER) of various modulation techniques
24. Design ALU using CPLD/FPGA
25. Design Display System using CPLD/FPGA
26. Electronic Weighing Machines

B. FABRICATION AND TESTING:

1 Voltage Stabilizer for Refrigerator, Air-Conditioner
2 Emergency Light using SCR

3 Power amplifier
4 Low cost intercom for home
5 Analog computer
6 Regulated power supply (+ 12V and + 6V) using 7812, 7912 and 7806, 7906
7 Automatic battery charger using SCR
8 Burglar Alarm
9 Automatic street light/dressing table light
10 Inverter circuit 500 watt.
11 Microprocessor/Microcontroller Based A/D converter
12 Microprocessor/Microcontroller Based D/A converter
13 Simulation of half wave and full wave rectifiers using Simulation Software
14 Simulation of class A, Class B, Class AB and Class C amplifiers
15 Inverter/Emergency light circuit using power transistors
16 SCR based automatic battery charger

NOTE: 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

ASSESSMENT OF MAJOR PROJECT

The Criterion for assessing Student performance by External & Internal Examiner will be as given under:

S. N.	Performance Criteria	Maximum 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 skill	5%	5	4	3	2	1
7.	Inter-Personal skills/ Human Relation	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		**100%**	**100**	**80**	**60**	**40**	**20**