UTTARAKHAND BOARD OF TECHNICAL EDUCATION
JOINT ENTRANCE EXAMINATION AND TRAINING, RESEARCH DEVELOPMENT CELL, DEHRADUN
STUDY AND EVALUATION SCHEME FOR DIPLOMA PROGRAMME

BRANCH NAME– INSTRUMENTATION CONTROL ENGINEERING   **SEMESTER – VI**

Subject Code	Subject	L	T	P	TOT	Internal Theory Max Marks	Internal Practical Max Marks	External Theory Max Marks	External Theory Hrs.	External Practical Max Marks	External Practical Hrs.	Total Marks	Credit Point
		Period/Weeks											
326001	Bio-medical Instrumentation	4	-	4	8	25	20	100	2.5	50	3.0	195	7
086001	Non-conventional Energy Sources	5	-	3	8	20	30	50	2.5	50	3.0	150	7
096001	Microcontrollers and Embedded System	4	-	3	7	25	20	75	2.5	50	3.0	170	7
326002	PLC & Basics of SCADA	4	-	4	8	25	20	75	2.5	50	3.0	170	7
326003	Major Project	-	-	9	9	-	40	-	-	150	3.0	190	4
326052	Industrial Exposure (assessment at Inst. Level) +	-	-	-	-	-	25	-	-	-	-	25	1
016054	General Proficiency#	-	-	4	4	-	25	-	-	-	-	25	1
016055	Employability Skills	4	-	-	4	25	-	50	2.5	-	-	75	1
	Total	21	-	27	48	120	180	350	-	350	-	1000	35

\#   General Proficiency will comprise of various co-curricular activities like games, hobby clubs, seminars, declamation contests, extension lectures, NCC, NSS and cultural activities, elementary mathematics, G.S. & G.K. etc.

\+   Industrial visit compulsory at minimum 2 Industries or Department.

Note: 1- Each period will be 50 minutes. 2- Each session will be of 16 weeks. 3- Effective teaching will be at least 12.5 weeks.

Branch Code - 32

SIXTH SEMESTER
INSTRUMENTATION & CONTROL ENGINEERING

BIO-MEDICAL INSTRUMENTATION

L	T	P
4	-	4

Subject Code : 326001

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 Instruments 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**

NON-CONVENTIONAL ENERGY SOURCES

L	T	P
5	-	3

Subject Code : 086001

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 Principle 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.

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

Geo-thermal and Tidal Energy

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

Unit:- VI   **(10 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, Specification of turbine, generator and Governor System used in small and micro hydro electric power plant. Overview of Automation, Control and Monitoring of Micro Hydro Electric Power Plants, Efficiency and Limitations. Erection and commissioning, operation and maintenance of micro hydro electric power plant

Unit- VII   **(04 Periods)**

Chemical Energy Sources

Design and operating principles of a fuel cell, conversion efficiency, work output and emf of fuel cells, types, applications.

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	10	15
VII	04	04
TOTAL	**64**	**100**

MICROCONTROLLERS AND EMBEDDED SYSTEM

Subject Code : 096001

L	T	P
4	-	3

RATIONALE

Embedded systems and Micro-controllers have also assumed a great significance in the electronic and consumer goods industry and are a very vital field. The subject aims expose students to the embedded systems besides giving them adequate knowledge of Micro controllers.

DETAILED CONTENTS

1. **Microcontroller series (MCS) – 51 Overview**   **(18 Periods)**
   - Architecture of 8051 Microcontroller
   - Pin details
   - I/O Port structure
   - Memory Organization
   - Special Function Registers (SFRS)
   - External Memory

2. **Instruction Set; Addressing Modes, Instruction types**   **(10 Periods)**
   - Timer operation
   - Serial Port operation
   - Interrupts

3. **Assembly/ C language programming**   **(10 Periods)**
   - Assembler directives
   - Assembler operation
   - Compiler operations
   - De bugger
   - Simulator

4. **Design and Interface**   **(08 Periods)**
   - keypad interface, 7- segment interface, LCD, stepper motor. A/D, D/A, RTC interface with programming.

5. Embedded Systems   (18 Periods)

Introduction, Embedded design concept, Brief description and architecture of AVR and PIC, Application of embedded system such as washing machines, photocopier, cars etc., 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 with Micro Controllers (8051) kit
2. Familiarization with Assembly Language Programming
3. C Language Programming- (PC Based)
4. Testing of general input/output on Micro controller board
5. Development of Electrical, Instrumentation applications using 8051 micro-controller
6. Programming for LCD interface.
7. Programming for A/D converter, result on LCD.
8. Programming for D/A converter, result on LCD.
9. Programming for serial data transmission from PC to Kit or Vice versa.
10. Programming to Interface Sensors

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. Mallikarjun aswamy: 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 Allocation (%)
1	18	25
2	10	20
3	10	20
4	08	10
5	18	25
Total	**64**	**100**

PLC & BASICS OF SCADA
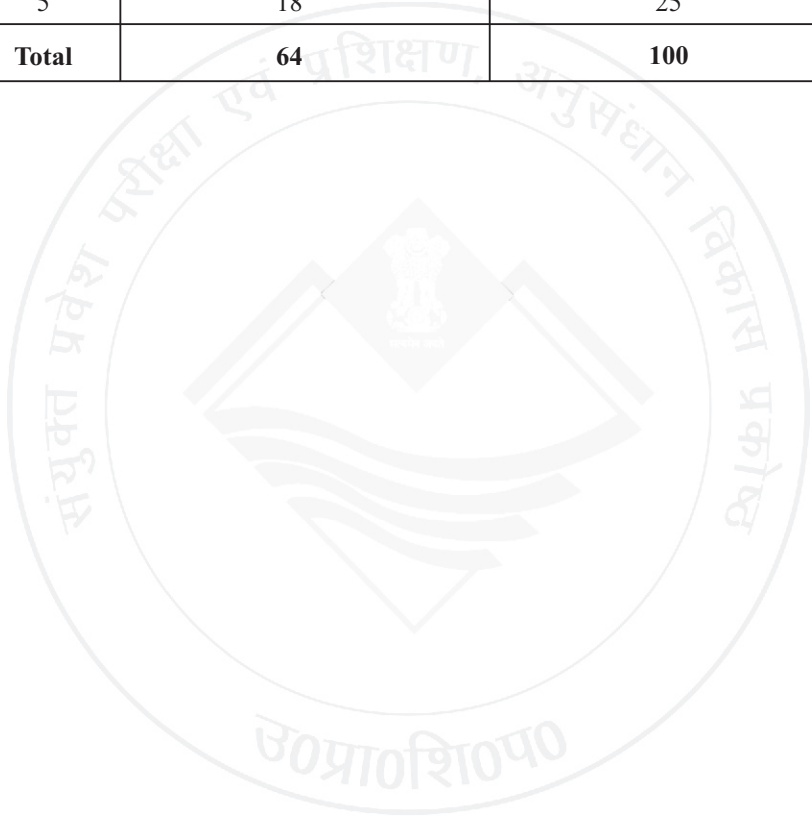
Subject Code : 326002

L	T	P
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   (09 Periods)

Applications of PLCs

- Car parking

- Doorbell operation
- Traffic light control
- Microwave Oven

Unit - 5   (10 Periods)

Introduction to SCADA

- 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

MAJOR PROJECT

Subject Code : 326003

L	T	P
-	-	9

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:

Sr. No.	Performance criteria	Max. marks	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	**100**	**100**	**80**	**60**	**40**	**20**

EMPLOYABILITY SKILLS

Subject Code : 016055

L	T	P
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

Unit I: **(06 periods)**
- Technical Education & Industrial scenario.
- Competency required of an engineer.

Unit II: **(06 periods)**
- Professional Engineer desirable values and ethics and their development.
- Relation between engineering profession, society and environment

Unit III: **(12 periods)**
Effective Communication
- Reading & Active Listening Skills
- Speaking
- Writing
- Presentation Technique/Seminar
- Group discussion

Unit IV: **(12 periods)**
Managing project
- Leadership
- Motivation
- Time management
- Resource management
- Interpersonal relationship

Unit V: **(10 periods)**
Preparing for Employment
- Searching for job/job hunting

- Resume & CV Writing
- Interview technique in personal interview telephonic interview, panel
- Interview, group interview, video conferencing

Unit VI: (08 periods)

Self Management
- Self awareness
- Stress Management
- Conflict resolution

Unit VII: (06 periods)
- Creativity, Innovation and Intellectual property right
- Concept and need in present time for an engineer

Unit VIII: (04 periods)

Rules & Ethics
- Basic rules, laws and norms to be adhered by engineers during their working

LIST OF PRACTICAS
- Steps how to effectively write different types of Letters.
- Steps to make a Presentation in Power Point.
- Steps to make a Resume more effective.
- Steps to conduct Telephonic/On-line Interview (Through skype/Google Hangout).
- Study of Different Techniques of Stress Management.
- Study of Rules & Ethical practices to be followed at Workplace.

RECOMMENDED BOOKS
- Employability skills by Kapil Dev, Vishnu P. Singh Asian Pub. New Delhi
- Employability skills for Diploma students by Dr. S.K. Singh, Vayu Education, New Delhi

SUGGESTED DISTRIBUTION OF MARKS

Unit No.	Time Allotted (Periods)	Marks Allotted(%)
1	06	10
2	06	10
3	12	18
4	12	18
5	10	16
6	08	12
7	06	10
8	04	6
Total	**64**	**100**

IMPLEMENTATION

ASSESSMENT

LEARNING OUTCOMES

IMPACT
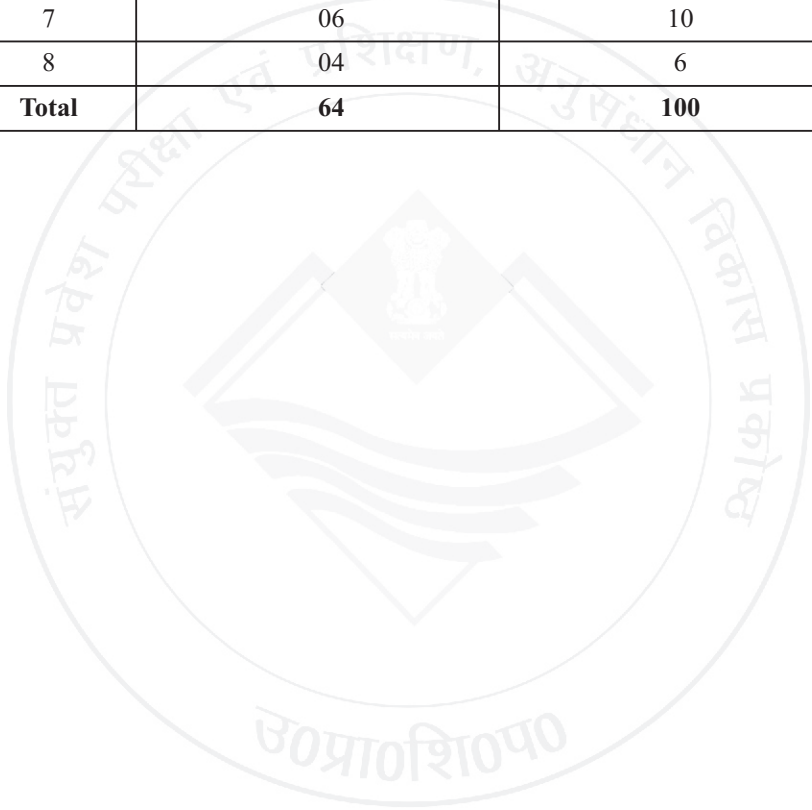
LEARNING OUT COMES AND MEANS OF ASSESSMENT

BRANCH NAME – INSTRUMENTATION AND CONTROL ENGINEERING　　　　　**SEMESTER – VI**

S.N0.	Title of Subject/Unit	Learning Outcomes	Means of Assessment
1	Biomedical Instrumentation	This subject gives a comprehensive idea about the Human physiology. It provides overview of medical electronics equipments, electrodes and medical transducers, Biomedical recorders etc.	Assignments, Quizzes, Seminars, Class Test, Power Point Presentation, Mid Term Examination & Semester examination.
2	Non- conventional Energy Sources	At the end of the course, the student will be able to understand basics of different non conventional types of power generation & power plants in detail so that it helps them in understanding the need and role of Non-Conventional Energy sources.	Assignments, Quizzes, Seminars, Class Test, Power Point Presentation, Mid Term Examination & Semester examination.
3	Microcontrollers and Introduction of Embedded systems	At the end of the course, the student will be able to Program, build and test a microcontroller system and the use of embedded system in differ rent sectors.	Assignments, Quizzes, Seminars, Class Test, Power Point Presentation, Mid Term Examination & Semester examination.
4	PLC & Basic of SCADA	At the end of the course, the student will be able to understand automated industrial process controls, Brief idea about SCADA.	Assignments, Quizzes, Seminars, Class Test, Power Point Presentation, Mid Term Examination & Semester examination.
5	Employability Skills	At the end of the course, the student will be able to enhance soft skills of students to get good jobs and future prospects at the workplace.	Assignments, Quizzes, Seminars, group discussion, personality development sessions.
6	Major Project	Project work aims at developing skills in the students whereby they apply in totality the knowledge and skills gained through the course in the solution of a practical problem undertaken as a project.	Time to time assessment of project work at every stage of project development