4.1 MICROPROCESSORS, MICROCONTROLLERS AND THEIR APPLICATIONS

L T P
4 - 3

RATIONALE

A diploma holder in industry is called upon to design, modify and troubleshoot such control circuits. Microprocessors and microcontrollers are being extensively used in the field of instrumentation and control. The students studying this subject will understand the architecture of typical microprocessor and a microcontroller and their application in control systems. In addition, Microcontrollers have also assumed great significance in field of electrical and electronics engineering. It is very easy and cost effective to operate a device using microcontroller. They are even replacing microprocessors. The knowledge of architecture, software and interfacing techniques leads to understanding of CPU in a microcomputer. The course will deal with the architecture, instruction sets and control application of 8085 microprocessor and 8051 microcontroller.

DETAILED CONTENTS

Microprocessors

1. Introduction – evolution, importance and application. (04 hrs)

2. Architecture of a Microprocessor- 8085 (12 hrs)

   a) Concept of a bus and bus organization.
   b) Functional block diagram and function of each block.
   c) Pin details of 8085 and related signals.
   d) Demultiplexing of address/data bus and memory read/write cycles.

3. Programming (with respect to 8085 microprocessor) (12 hrs)

   a) Brief idea of machine and assembly languages, Machines and Mnemonic codes.
   b) Instruction format and Addressing modes. Identification of instructions as to which addressing mode they belong.
   c) Concept of Instruction set. Explanation of the instructions of the following groups of instruction set
   d) Data transfer groups, Arithmetic Group, Logic Group, Stack, I/O and Machine Control Group.
   e) Programming exercises in assembly language. (Examples can be taken from the list of experiments).

4 Interfacing and Data Transfer Schemes (08 hrs)

   a) Memory mapped I/O and I/O mapped schemes.
   b) Interrupts of 8085, maskable and non-maskable interrupts, software interrupts, marking of interrupts

5. I/O Chips (08 hrs)

   a) 8255 : pin configuration & block diagram
   b) 8259: pin configuration & block diagram
   c) 8257: pin configuration & block diagram

Micro controllers

6. Introduction (10 hrs)

Ccomparison of microcontroller and microprocessor, Architecture of 8051, hardware I/O pins, ports, connecting external memory, counters, timers serial port, I/O interrupts.

7. Instruction set and Addressing Modes (06 hrs)

- Addressing Modes and its types
- Basic Instruction like: - Data Transfer, Conditional and Arithmetic)

8. Assembly Language Programming (04 hrs)

- Assemblers and Compilers
- Programming based on basic instructions

LIST OF PRACTICALS

1. Familiarization with 8085 based kit.
2. Familiarization of micro-controller (8051) based kit
3. Application of 8051 instruction set to develop various programs regarding arithmetic, data transfer and conditional operations (two experiments each)
4. Testing of general Input/output on Micro controller Board.
5. Use of software development tools like KEIL Compiler.

RECOMMENDED BOOKS

1. Microprocessors Architecture, Programming and Applications by Gaonkar; New Age Publications, New Delhi.
2. An introduction to Microprocessors by AP Mathur; Tata McGraw Hill Publishers, New Delhi.
3. Fundamentals of Microprocessors and Microcomputers by B Ram
4. 8051 Microprocessors, Architecture, Programming and Applications by Udaykumar, Pearson Education, Sector 62, Noida
5. Microprocessor and Interfacing, Programming and Hardware by Douglas V.Half.
6. 8051 Microcontroller Architecture and Programming by Ayalar Penram; International Publications.
7. Design with Microcontroller by C Nagra, Murthy, S Rampal Joshi,B Peatman; Tata McGraw Hill Publishers, New Delhi.
8. 8051 Architecture, Programming and design by Kennith J. Ayala
9. 8051 Microcontrollers by Mackenzie, Pearson Education, Sector 62, Noida
10. 8051 Microcontrollers, Architecture, Programming and Applications by Uma Rao, Pearson Education, Sector 62, Noida

SUGGESTED DISTRIBUTION OF MARKS FOR FACILITATING THE PAPER SETTER

Sr. No.	Topic	Time Allotted (hrs)	Modified Percentage Weightage
Microprocessors			
1.	Introduction	4	5
2.	Architecture of a Microprocessor- 8085	12	20
3.	Instruction Set for Intel 8085	12	20
4.	Programming (with respect to 8085 microprocessor)	08	15
5.	I/O Chips	08	15
Microcontrollers			
6.	Interfacing and Data Transfer Schemes	10	15
7.	Instruction set and Addressing Modes	06	10
8.	Assembly Language Programming	04	10
Total		**64**	**100**

4.2 TRANSDUCERS AND SIGNAL CONDITIONING

L T P
3 - 3

RATIONALE

Signal conditioning is an integral part of any instrumentation system. This subject gives an introduction to various methods of processing a signal available from a transducer to make it worth displaying or computer compatible. Telemetry is an advanced application of communication for instrumentation which lays the foundation for modern means of information transmission and reception like digital data, satellite based communication.

After studying the course the students will be able to identify different types of sensors and transducers and their applications in the field of instrumentation and control. The students will be able to select appropriate transducers relating to a process and will also get the relevant technical know how about the conditioning of a signal from a transducer for the purpose of control. Subject teachers are advised to show the students different types of sensors and transducers while teaching the various topics of this course. Further, teachers may give some assignment problems related to industrial signal processing and applications which calls for use of specific transducer and signal conditioning equipment in specifications.

DETAILED CONTENTS

1. Basic concepts (02 hrs)

   - Definition and classification of transducers, selection criteria, characteristics

2. Variable Resistance Transducers (06 hrs)

   Construction, working principle, selection criteria and application of

   - Potentiometer, strain gauge, load cell
   - Hot wire anemometer, photo resistors
   - Resistive temperature transducers
   - Thermistors
   - Carbon Microphones
   - Accelerometer advantages, disadvantage and limitation

3. Variable Inductance transducer (06 hrs)

   Construction, working principles and application of

   - Electromagnetic pick up
   - Induction potentiometer

- Linear variable differential transformer
- Synchronous transmitter and receivers, advantages, disadvantages and limitations

4. Variable capacitance Transducers (08 hrs)

Construction, basis principle selection criteria and application of

- Capacitance pick up
- Condenser microphone
- Differential capacitor pick up advantages, disadvantages and limitations

5. Piezoelectric Transducers (08 hrs)

Construction, basic principle, selection criteria and application of
- Piezoelectric Transducer
- Seismic pick up
- Ultrasonic Transducer
- Advantage, disadvantages and limitations

6. Other types of transducers (08 hrs)

- Transducers based upon hall effect
- Optical transducers-photo diode, photo transistor LDR and LED
- Digital transducer-single shaft encoder
- Techo generator
- Advantage and disadvantage and limitations
- Magnetostrictive transducers

7. Principle of Analog Signal Conditioning (10 hrs)

- Linearization
- Various types of conversions (from V to F, from F to V, V to I converters and I to V converters)
- Filtering and impedance matching

Note: Visits may be arranged to concerned industries

LIST OF PRACTICALS

1. Study of strain gauge and measurement of strain for a given sample
2. Study of piezoelectric pressure transducer
3. Study of RTD (Resistance Temperature detector)
4. Study of thermistors and Measurement of temperature
5. Study of calibration of LVDT

6. Study of capacitive transducer and measurement of angular displacement
7. Study of magnetic pick up
8. Study and draw the characteristics of a capacitance transducer
9. Study of thermocouple
10. To study and draw the characteristics of following
    - LDR
    - Photo diode
    - Photo transistor
    - Capacitance transducers

RECOMMENDED BOOKS

1. Mechanical and industrial measurements by RK Jain, Khanna Publishers, New Delhi
2. Modern Control Engineering by OGATA
3. Fundamentals of Instrumentation by AE Fribance
4. Transducers by Peter Norton
5. Mechatronics by Bolton, Prentice Hall of India, New Delhi
6. Electronics Measurement and Instrumentation by AK Sawhney, Dhanpat Rai and Co, New Delhi

SUGGESTED DISTRIBUTION OF MARKS FOR FACILITATING THE PAPER SETTER

Sr. No.	Topic	Time Allotted (hrs)	Marks Allocation
1.	Basic concepts	02	5
2.	Variable Resistance Transducers	06	15
3.	Variable Inductance transducer	06	15
4.	Variable capacitance Transducers	08	15
5.	Piezoelectric Transducers	08	15
6.	Other types of transducers	08	15
7.	Principle of Analog Signal Conditioning	10	20
Total		**48**	**100**

4.3 ADVANCED CONTROL SYSTEM

L	T	P
3	-	3

RATIONALE

This course will enable students to study in detail the different types of advanced control systems used in instrumentation and will provide understanding of basic control loops and characteristics of various controllers. The students will appreciate the importance of and limitations of process control and actual controlling aspects. Hence this subject.

DETAILED CONTENTS

1. Single and Multiloop Control System (14 hrs)

   Introduction to single and multiloop control system and its types like feedback, feedforward, cascade, ratio, split range, control system. Study of each of above control system with a suitable example, three element drum level control.

2 Non-Linear Control System (18 hrs)

   Introduction, behaviour of non-linear control system. Different types of non-linearities, saturation, backlash, hysteris, dead zone, relay, fiction, characteristics of non-linear control system, limit cycles, jump resonance, jump phenomenon. Difference between linear and non-linear control system.

3. Introduction to Artificial Intelligence and Robotics, Fuzzy Logic and neuro fuzzy logic in control system, Artificial Neural Networks, Robotics, degree of freedom, the robot arm configuration (16 hrs)

Note: Visit to industries such as Cement Plant, Thermal Plant, Pharmaceutical Plant etc.

LIST OF PRACTICALS

1. To perform of non-Linearity in a relay
2. To perform of dead- zone non-linearity
3. To perform cascade control system
4. To perform ratio control system
5. To perform feedforward control system
6. To perform split-range control system

INSRUCTIONAL STRATEGY

Since the knowledge of this subject is required to have good grasp of the control techniques. The subject teacher is required to lay more emphasis on providing information about practical applications. The students may be given exposure to laboratory exercises and process industry and shown various controls and latest software used in the field of Instrumentation and Control.

RECOMMENDED BOOKS

1. Control System Engineering by Bhattacharya, Pearson Education, Sector 62, Noida
2. Chemical Process Control by George Stephanopolous: EEE edition, PHI Publishers, New Delhi
3. Process Control by Peter Harrot, Tata Mc Graw Hill Publishing Co. New Delhi
4. Control System by Nagrath Gopal
5. Control System: Theory and Practice by Ghosh, Pearson Education, Sector 62, Noida
6. Control Engineering by Ganesh Rao, Pearson Education, Sector 62, Noida
7. Control System by RC Shukla
8. Introduction to Fuzzi Logic by Bo-Yuan
9. PLC by Botton

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	14	25
2	18	40
3	16	35
Total	**48**	**100**

4.4 PRINCIPLES OF TELEMETRY

L	T	P
3	-	3

RATIONALE

Telemetry is an advanced application of communication engineering for instrumentation professionals. This subject gives introduction to the basic telemetry techniques which forms a foundation for understanding practical methods used in this field in the industries. Study of Digital Data communication is essential for modern means of information transmission and reception like fax, mobile and other satellite based communication. Communication transducer measurements may also be implemented using the same principles which is the main objective of instrumentation engineer.

DETAILED CONTENTS

1. Land line telemetry (12 Hrs)

- Pneumatic system
- Floppernozzle
- Pilot relay
- Non bleed type
- Bleed types feed back
- Limitations

Electric system
- Current system
- Impulse system
- Position system or Ratio system
- Frequency system
- Voltage system

RF Communication
- Amplitude modulation
- Frequency modulation
- Phare modulation
- Pulse modulation
- Pulse code modulation

2. Transmitters (10 Hrs)

- Pneumatic Transmitter
- PDPT bellow type
- PDPT diaphragm type
- Electric transmitters
- Electronic force balance DPT
- Hydraulic transmitter

3. Transmission Channels (10 Hrs)

- Wireline channels
- Radio Channels
- Multiplexing channels
- Time division multiplexing
- Frequency division multiplexing

4. Data Communication (10 Hrs)

Modulation & demodulation of signals using
- Amplitude shift keying
- Frequency shift keying
- Phase shift keying

Errors and correction in above systems

5. Instrumentation Buses (06 Hrs)

- General view of instrumentation buses
- Field programmable buses
- Interbus

LIST OF PRACTICALS

1. Realization of various process logs
2. Measurement of pressure using preumatic transmitter
3. Measurement of differential pressure using PDPT
4. Realization of electric transmitter
5. Study of hydraulic transmitter
6. Study of different types of pilot relays
7. To observe AM & FM waves on CRO
8. To calculate modulation index m for AM & FM
9. To observe waveforms of PAM, PPM, PWM on CRO

INSTRUCTIONAL STRATEGY

The Teacher should explain the background and importance of the subject. Lay emphasis on the meaning of various terms, working of telemetry and communication and their applications may be explained to students. Reinforce theory with practicals.

RECOMMENDED BOOKS

1. Mechanical and industrial measurements by R.K. Jain
2. Modern Control Engineering by Ogata
3. Fundamentals of Instrumentation by A.E. Fribance

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	12	25
2	10	20
3	10	20
4	10	20
5	06	15
Total	**48**	**100**

4.6 INSTRUMENTATION DRAWING

L T P
- - 4

RATIONALE

Since drawing is the of language of engineers through which they can express technical ideas of this subject, students will be able to draw component layouts and interpret the actual drawings used in the field of Instrumentation.

Note: This subject is like Engineering Drawing. Question paper will be set by the Board of Technical education. The students will work on Drawing Sheets. External examiner will conduct viva examination after the students complete their question paper.

DETAILED CONTENTS

1. Study of Symbols (08 hrs)

   - Electronic symbols
   - Process instrumentation symbols
   - Schematic symbols
   - Balloon symbols
   -Graphical symbols for pipe fittings, valves and piping.

2. Line symbols, colour coding of lines and flow sheet codes. Instrument identification. (06 hrs)

3. Introduction to various diagrams (10 hrs)

   Block diagram, schematic diagram, wiring diagram, graphical panel diagram and blow up diagrams (Exploded views).

4. Installation instrument systems, study of installation procedure of instrument and check-list of good installation procedures. (08 hrs)

5. Instrumentation drawing of a power plant and draw sketches in block diagram or flow chart forms. (06 hrs)

6. Printed Circuit Board (PCB) (06 hrs)

   Introduction to PCBs, their classification-single sided and double-sided boards, PCB layout designing.

7. Sketches of process controllers such as pneumatic, hydraulic and PI etc, control valves and plugs. (10 hrs)

8. Schematic diagrams (10 hrs)

Schematic diagrams of various hydraulic and pneumatic components such as single acting cylinder, double acting cylinder, tandom valve, shuttle valve, spring return cylinder, SOL-SOL valve, pneumatic relay.

INSTRUCTIONAL STRATEGY

The teacher should lay emphasis on identification of symbols, draw sketches, wiring diagrams. Demonstrate different views, working drawings for interpretation. Make students aware of handbooks, data books and manuals for reference.

RECOMMENDED BOOKS

1. Applied Instrumentation by WG Andrews

2. Instrumentation Engineers Hand Book by BG Liptik Vol.2

3. Handbook of Applied Instrumentation by DM Considine

4. Mechanical and Industrial Measurements by RK Jain, Khanna Publishers,New Delhi

SUGGESTED DISTRIBUTION OF MARKS

Topic	Time Allotted (hrs)	Marks Allocation
1.	08	15
2.	06	10
3.	10	10
4.	08	10
5.	06	10
6.	06	10
7.	10	15
8.	10	20
Total	**64**	**100**

4.6 COMPUTER PROGRAMMING AND APPLICATIONS

L	T	P
2	-	4

RATIONALE

Computers play a very vital role in present day life, more so, in the professional life of diploma engineers. With the extensive use of Information Technology in large number of areas, the diploma engineers should be well conversed with these environments. In order to enable the students to use the computers effectively in problem solving, this course offers the modern programming languages like C along with exposition to various engineering applications of computers.

DETAILED CONTENTS

1. Information Storage and Retrieval (4 hrs)

    1.1 Need for information storage and retrieval

    1.2 Creating data base file

    1.3 Querying database file on single and multiple keys

    1.4 Ordering the data on a selected key

    1.5 Programmming a very simple application

2. Programming in C (22 hrs)

    2.1 Basic structure of C programs

    2.2 Executing a C program

    2.3 Constants, variables, and data types

    2.4 Operators and expressions

    2.5 Managing Input-Output operations like reading a character, writing a character, formatted input, formatted output through print, scan, getch, putch statements etc.

    2.6 Decision making and branching using if - else, switch, go to statements

    2.7 Decision making and looping using do-while, and for statements

    2.8 Arrays - one dimensional and two dimensional

    2.9 Functions

    2.10 Concept of pointers, structures and Files

3. Computers application overview (6 hrs)

Demonstration of various applications software related Instrumentation and Control Engineering such as:
Matlab, Allenbradely, SLC 100 on PLCs, DCS software etc.

LIST OF PRACTICALS

1. Creating database.
2. Querying the database.
3. Report generation.
4. Programming in dbase
5. Use Instrumentation and Control Engineering related CAI packages Drawing etc.
6. Programming for Data Acquisition System and control.
7. Exercises on data acquisition.
8. Exercises on control - on/off switch, and proportional control.
9. Programming exercise on executing C program
10. Programming exercise on editing C program
11. Programming exercise on defining variables and assigning values to variables.
12. Programming exercise on arithmetic and relational operators.
13. Programming exercise on arithmetic expressions and their evaluation.
14. Programming exercise on reading a character.
15. Programming exercise on writing a character.
16. Programming exercise on formatting input using print.
17. Programming exercise on formatting output using scan.
18. Programming exercise on simple if statement.
19. Programming exercise on IF .... else statement.
20. Programming exercise on switch statement.
21. Programming exercise on go to statement.
22. Programming exercise on do-while statement.
23. Programming exercise on for statement.
24. Programming exercise on one-dimensional arrays.
25. Programming exercise on two-dimensional arrays.
26. Exercises on
    - Internet use/application
    - Typical application of various application softwares such as MATLAB, PSIM, MULTISIM, PSPICE etc. in the field of instrumentation and control engineering.

INSTRUCTIONAL STRATEGY

This is a highly practical and self-study oriented courses. The teachers are expected to explain the theoretical part and then immediately test the student's writs and run the programme based on that topic and read world problems.

RECOMMENDED BOOKS

1. Programming in C by Balaguru Swamy, Tata McGraw Hill, New Delhi
2. Computer programming and applications by Chandershekhar, Unique International Publications, Jalandhar
3. Programming in C by Schaum Series, McGraw Hills
4. The essentials of Computer Organizing and Architecture by Linda Null and Julia Labur, Narosa Publishing House Pvt. Ltd., New Delhi
5. Programming in C by Kerning Lan and Riechie Prentice Hall of India, New Delhi
6. Let us C – Yashwant Kanetkar, BPB Publications, New Delhi
7. Vijay Mukhi Series for C and C++
8. Elements of C by MH Lewin, Khanna Publishers, New Delhi
9. Programming in C by R Subburaj, Vikas Publishing House Pvt. Ltd., Jangpura, New Delhi
10. Programming in C by Kris A Jansa, Galgotia Publications Pvt. Ltd., Daryaganj, New Delhi
11. Programming in C by BP Mahapatra, Khanna Publishers, New Delhi

DISTRIBUTION OF MARKS

Sr. No.	Topic	Time Allotted (hrs)	Marks Allocation
1.	Information Storage and Retrieval	4	10
2.	Programming in C	22	70
3.	Computers Application Overview	6	20
	Total	**32**	**100**

INDUSTRIAL TRAINING OF STUDENTS

(after IV Semester examinations)

It is needless to emphasize further the importance of Industrial Training of students during their 3 years of studies at Polytechnics. It is industrial training, which provides an opportunity to students to experience the environment and culture of industrial production units and commercial activities undertaken in field organizations. It prepares student for their future role as diploma engineers in the world of work and enables them to integrate theory with practice. Polytechnics have been arranging industrial training of students of various durations to meet the above objectives.

This document includes guided and supervised industrial training of a minimum of 4 weeks duration to be organised during the semester break starting after second year i.e. after IV Semester examinations. The concerned HODs along with other teachers will guide and help students in arranging appropriate training places relevant to their specific branch. It is suggested that a training schedule may be drawn for each student before starting of the training in consultation with the training providers. Students should also be briefed in advance about the organizational setup, product range, manufacturing process, important machines and materials used in the training organization.

Equally important with the guidance is supervision of students training in the industry/organization by the teachers. A minimum of one visit per week by the teacher is recommended. Students should be encouraged to write daily report in their diary to enable them to write final report and its presentation later on.

An internal assessment of 50 and external assessment of 50 marks have been provided in the study and evaluation scheme of V Semester. Evaluation of professional industrial training report through viva-voce/presentation aims at assessing students understanding of materials, industrial process, practices in industry/field organization and their ability to engage in activities related to problem solving in industrial setup as well as understanding of application of knowledge and skills learnt in real life situations. The formative and summative evaluation may comprise of weightage to performance in testing, general behaviour, quality of report and presentation during viva-voce examination. It is recommended that such evaluations may be carried out by a team comprising of concerned HOD, teachers and representative from industry.