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 of 8055, concept of stack
   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) (10 hrs)

   a) Brief idea of machine and assembly languages, Machines and Mnemonic codes.
   b) Instruction format and Addressing modes. Examples of instructions to illustrate addressing mode
   c) Instruction of 8085 set. Explanation of the instructions of the following groups of instruction set. Data transfer groups, Arithmetic Group, Logic Group, Stack, I/O and Machine Control Group.
   d) 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 I/O schemes.
   b) Interrupts of 8085, maskable and non-maskable interrupts, software interrupts, masking of interrupts

5. Peripherral Chips (08 hrs)

   a) 8255 : block diagram and I/O modes
   b) 8259 : functional description
   c) 8257 : functional description

d) 8253 : Block diagram and modes
e) 8251 : Block diagram and modes

Writing control words for above devices. Interfacing of 8085 with peripheral chips. Simple diagrams to illustrate function of these devices

Micro controllers

6. Introduction (06 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 set: - Data Transfer, Conditional and Arithmetic) etc.

8. Programming of Microcontroller 8051 (10 hrs)

- Assembly Language Programming
- Assemblers and Compilers
- "C" based Programming of 8085

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.

INSTRUCTIONAL STRATEGY

Microprocessors and microcontrollers have gained significant importance in the area of electronics. Adequate competency needs to be developed by giving sufficient practical knowledge in microprocessors and microcontrollers (programming as well as interfacing). For this the te3achers may identify small projects get them designed and implemented. Help may be taken from simulation packages to develop clear concepts of the subject. More emphasis may be given to practical work. Programming exercises may be given to the students. In addition, visit to industry may be arranged.

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

Topic	Time Allotted (hrs)	Marks Allotted (%)
1.	4	5
2.	12	15
3.	10	15
4.	08	15
5.	08	15
6.	06	10
7.	06	10
8	10	15
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 (2 hrs)

   - Definition and classification of transducers, selection criteria, characteristics

2. Variable Resistance Transducers (6 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 (6 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 (8 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 (8 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 (8 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
- Thermocouples

7. Principle of Analog Signal Conditioning (10 hrs)

- D/A and A/D converters
- 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

INSTRUCTIONAL STRATEGY

Subject teachers must 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.

RECOMMENDED BOOKS

1. Mechanical and industrial measurements by RK Jain, Khanna Publishers,New Delhi
2. Electronic Instrumentation by H S Kalsi, Tata McGraw Hill, New Delhi
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

Topic	Time Allotted (hrs)	Marks Allocation (%)
1.	2	5
2.	6	15
3.	6	15
4.	8	15
5.	8	15
6.	8	15
7.	10	20
Total	**48**	**100**

4.3 LINEAR AND DIGITAL INTEGRATED CIRCUITS

L T P
3 - 3

RATIONALE

The physical world is inherently analog, indicating that there is always need for analog circuitry. Today the growth of any industry depends upon electronics to a great extent. Integrated circuit is basics in electronics. This subject acquaints students with general analog principles and design methodologies using practical devices and applications.

DETAILED CONTENTS

1. Introduction to Operational Amplifiers (06 hrs)

   - Introduction to op-amp
   - block diagram representation of a typical op-amp
   - schematic symbol
   - development of integrated circuits
   - integrated circuit package types, pin identification,
   - Package types
   - pin identification

2. Interpretation of Data sheets and Characteristics of an Op-amp (04 hrs)
   - the ideal op-amp
   - equivalent circuit of an op-amp
   - ideal voltage transfer curve
   - open loop op-amp configuration
   - the differential amplifier
   - the inverting amplifier
   - the non-inverting amplifier

3. Op-amp with Negative Feedback (04 hrs)

   - block diagram representation of feedback configuration
   - introduction voltage-series feedback amplifier
   - introduction voltage-shunt feedback amplifier
   - introduction differential amplifiers
   - differential amplifiers with one op-amp
   - differential amplifiers with two op-amp

4. Practical Op-amp (04 hrs)

   - input offset voltage
   - input bias current
   - total output offset voltage
   - thermal drift

- common mode configuration
- common mode configuration

5. General Linear Application (06 hrs)

- summing, scaling, and averaging amplifiers
- inverting configuration
- non-inverting configuration
- differential configuration
- instrumentation amplifier

6. Active Filters (06 hrs)

- introduction of filters
- active filters
- Low pass Filter
- High pass Filter
- band-pass filter
- band reject filters
- all pass filter

7. Comparators (04 hrs)

- introduction basic comparator
- Schmitt trigger

8. Timer and Multivibrator (06 hrs)

- 555 time IC Pin diagram
- the 555 as a monostable multivibrator
- the 555 as an astable multivibrator
- phase-locked loop

9. Digital ICs (08 hrs)

Gates, encoders, decoders, multiplexers, demultiplexers, flip-flops, shift, registers, counters, ADC and DAC comparator

LIST OF PRACTICALS

1. Identification of the Operational Amplifiers IC 741
2. Inverting Configuration of Op amp
3. Non Inverting Configuration of Op amp
4. Op amp as a Summing Amplifier
5. Op amp as a Integrator
6. Op amp as a Differentiator
7. Pin identification of 555 Timer

8. 555 timer as monostable multivibrator
9. 555 timer as astable multivibrator
10. Study of PLL
11. Study of Encoder IC's
12. Study of Counter IC
13. Study of Latexes
14. Study of Decoder

INSTRUCTIONAL STRATEGY

Efforts should be made to keep relevant instruments in the laboratory. It will be preferred if students are taken to electronic industry where they can see the equipment used in the field. Accordingly field visits may be arranged

RECOMMENDED BOOKS

1. Operational Amplifiers and Linear Integrated Circuits by Ramakant A. Gaykwad
2. Basic Electronics and Linear Circuits by NN Bhargava, Tata McGraw Hills, New Delhi
3. Electronics Principles by Malvino, Tata McGraw Hills, New Delhi
4. Electronic Devices and Circuits by Millman and Halkias, McGraw Hills, New Delhi
5. Basic Electronics by Grob, Tata McGraw Hills, New Delhi
6. Electronic Principles by Sahdev, Dhanpat Rai and Sons, New Delhi.

SUGGESTED DISTRIBUTION OF MARKS

Sr No	Time Allotted (Hrs)	Marks Allotted (%)
1	06	15
2.	04	10
3.	04	10
4.	04	10
5.	06	10
6.	06	10
7.	04	05
8.	06	15
9.	08	15
Total	**48**	**100**

4.4 COMMUNICATION AND 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. Introduction (08 hrs)

- Need for modulation and demodulation in communication system
- Basic schemes of modern communication system

2. Modulation (12 hrs)

- Amplitude Modulation Definition, derivation of expression for an A.M. component modulation index,
- Frequency Modulation Definition, modulation index, Comparison of FM and AM in communication system
- Phase Modulation, Definition Comparison with FM
- Pulse Modulation (PAM, PWM, PPM), basic idea of pulse amplitude modulation (PAM), pulse width modulation (PWM) and pulse position modulation Basic concept of TDM and FDM

3. Data Communication (8hrs)

- Modulation and Demodulation of signals using
- Aptitudes Shift keying
- Modulation and Demodulation of Signals using
- Frequency Shift keying
- Phase Shift keying

4. Introduction to Telemetry (8hrs)

- Land line telemetry
- Pneumatic system
- Flapper nozzle
- Pilot relay

- Non bleed type
- Bleed types feed back

5. Electric system (6hrs)

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

6. Transmitters (6hrs)

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

LIST OF PRACTICALS

1. To observe the AM wave
2. To observe the FM wave
3. To observe the PAM wave
4. To observe the PPM wave
5. To observe the PWM wave
6. Measurement of pressure using pneumatic transmitter
7. Study of hydraulic transmitter
8. Study of magnetic tape recorder.
9. To demonstrate the synchro characteristic and use a synchro pair as error detector

INSTRUCTIONAL STRATEGY

Efforts should be made to expose the students relevant equipment and instruments in the laboratory. It will be preferred if Field visits may be arranged for the students to electronic industry where they can see the equipment being used. Emphasis my also be given to practicals and laboratory work

RECOMMENDED BOOKS

1. Fundamentals of Instrumentation by A.E. Fribance
2. Gawekward
3. Instrumentation by AK Sawhney; Dhanpat Rai & Co., New Delhi.

SUGGESTED DISTRIBUTION OF MARKS

Sr No	Time Allotted (Hrs)	Marks Allotted (%)
1	08	15
2.	12	20
3.	08	15
4.	08	20
5.	06	15
6.	06	15
Total	**48**	**100**

4.5 ELECTRONICS AND INSTRUMENTATION WORKSHOP

L	T	P
-	-	4

RATIONALE

A diploma holder is required to work with his own hands. He has to calibrate different instruments and maintain all the instruments for measurement and control in the good working condition. One should know the details of maintaining all the instruments. Thus the study of this subject is essential. After study of this subject the diploma holder will be able to keep all the instruments in good working condition. Since Drawing is the language of an engineer through which he can express technical ideas. The knowledge of this subject has to be imparted to the students so that he can use it for drawing component layouts and also use drawing efficiently in the industry.

DETAILED CONTENTS

1. Identification of Electrical symbols
2. Identification of Electronic symbols
3. Identification of Pneumatic symbols
4. Use of Multimeter to measure voltage, Current, Resistance, Frequency
5. Use of C.R.O. to measure different quantities component
6. Testing of component like diode, Transistor, Different SCRs, Relay, Contractors.
7. Testing of linear ICs using IC tester
8. Practically making of PCB, Different stages involving in making PCB such as Power supply, Timers, Amplitude and soldering
9. Component mounting of jobs taken in practical number 7.
10. Testing and functioning of jobs.
11. To make extension board with 3 sockets.
12. To make a simple ckt using a relay.
13. Study of different gauges such as Vacuum, Pressure, Temperature, strain.
14. Calibration exercise for voltmeter and ammeter.

Of the above mentioned jobs minimum 10 jobs are compulsory

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 (18 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 (10 hrs)

Introduction to MATLAB tool box and its various windows and tools

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

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
12. MALTAB by AMOS GILAT, Wiley
13. Basics of MATLAB by Rudrapratap.

SUGGESTED DISTRIBUTION OF MARKS

Topic	Time Allotted(hrs)	Marks Allocation
1.	4	10
2.	18	70
3.	10	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.