## 4.1 MICROPROCESSORS AND APPLICATIONS

| L | T | P |
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**RATIONALE**

Microprocessors are being excessively used in the field of instrumentation and central. The students are studying the subject are supposed to learn the architecture of a typical microprocessor and also get general information about microprocessor based control systems. The course in addition, will provide relevant knowledge of microprocessor based circuits being used in industrial process applications. The subject will deal in detail the configurations and instructional pair configuration systems and working of various peripheral interface chips. The course will cover 8085 in detail with sufficient exposure to the industrial applications. The course will also deal with the architecture, instruction sets and introduction to 8086.

DETAILED CONTENTS

1. Instruction to microprocessor (54 hrs)

- Architecture of 8085
- Pin Diagram of 8085
- Timing Diagram
- Instruction set of 8085
- Interrupts
- Programming of 8085
- Interfacing and I/O ports
- PPI e.g. 8255 A
- Programming of 8255A
- 8155 in detail
- 8257 in detail
- Serial I/O data communication
- Introduction to 16-bit microprocessor
- Introduction to Microcomputers
- Introduction of 8086
- Block Diagram of 8086
- Microprocessors based development system

2. Microprocessor applications (6 hrs)

- Industrial application of 8257

3. Programming exercises can be performed available kits

## LIST OF PRACTICALS

1. Familiarization with 8085 kits
2. Verification of arithmetic and logic operations using the above kits (at least five programs)
3. Development of interfacing circuits for various control applications based on 8085
4. Application of assembly language using 8057 instruction set to develop various programs
5. Application of data movement instruction to develop relevant program

## LIST OF RECOMMENDED BOOKS

1. Microprocessor Architecture, Programming and Applications with 8085 by RS Gaonkar
2. Microprocessor and Applications by B Ram
3. Comprehensive Study of Microprocessor by Naresh Grover
4. Introduction to Microprocessor by Adithya P Mathur, Tata McGraw Hill Publishers, New Delhi
5. Microprocessor by SK Goel
6. 8051 by Mcakenzie, Prentice Hall of India, New Delhi

## 4.2 TRANSDUCERS AND SIGNAL CONDITIONING

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**RATIONALE**

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

2. Variable Resistance Transducers Construction, working principle, selection criteria and application of (10 hrs)

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

3. Variable Inductance transducer construction, working principles, selection criteria and application of (8 hrs)

   - 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 microprocessor
   - Differential capacitor pick up advantages, disadvantages and limitations

5. Piezoelectric Transducers (6 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

7. Principle of analog signal conditioning (10 hrs)

   - Linerarization
   - 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
   - Advantages, disadvantages and limitations

8. Digital signal conditioning

   - A/D conversion
   - D/A conversion
   - Multiplexer/Demultiplexer
   - Encoder/Decoder
   - Sample and hold
   - Data Acquisition system(DAS)

**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
5. Study of calibration of LVDT
6. Study of capactive 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

**LIST OF RECOMMENDED BOOKS**

1. Electrical and Electronics Measurement and Instrumentation by A.K. Shawney, Dhanpat Rai and Co., New Delhi
2. Mechanical and industrial measurement by R.K. Jain, Khanna Publishers, New Delhi
3. Transducers by Peter Norton
4. Mechatronics by Bolton, Prentice Hall of India, New Delhi

## 4.3 COMPUTER PROGRAMMING AND APPLICATIONS

| L | T | P |
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| 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 use the computers effectively in problem solving, this course offers the modern programming language like C along with exposition to various engineering applications of computers.

**Note:** Instructions may be imparted in the computer centre itself which the students are doing practice on computer.

**DETAILED CONTENTS**

1. Information Storage and Retrieval

    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 Programming a very simple application

2. Programming in C

    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 File

3. Computers Application Overview

3.1 Commercial and business data processing application

3.2 Engineering computation

3.3 CAD, CAM, CAE, CAI

4. Typical Applications:

Students will be required to make a small programme for analysis of circuits design in Electrical Engineering components or any other area.

5. Internet

Basics, world wide web, e-mail and other applications/uses

**LIST OF PRACTICALS**

1. Creating database.

2. Querying the database.

3. Report generation.

4. Programming in dbase

5. Use of spread sheets/Matlan/Mathematica/Eureka (or any other package) for engineering computers.

6. Use of design packages (appropriate design packages may be selected depending upon the availability) on Estimating and Costing, Analysis of rates and other areas

7. Use of CAI packages.

8. Programming for DAS and control.

9. Exercises on data acquisition.

1. Exercises on control - on/off switch, and proportional control.

11. Programming exercise on executing C program

12. Programming exercise on editing C program

13. Programming exercise on defining variables and assigning values to variables.

14. Programming exercise on arithmetic and relational operators.

15. Programming exercise on arithmetic expressions and their evaluation.

16. Programming exercise on reading a character.

17. Programming exercise on writing a character.

18. Programming exercise on formatting input using print.

19. Programming exercise on formatting output using scan.

20. Programming exercise on simple if statement.

21. Programming exercise on IF .... else statement.

22. Programming exercise on switch statement.

23. Programming exercise on go to statement.

24. Programming exercise on do-while statement.

25. Programming exercise on for statement.

26. Programming exercise on one-dimensional arrays.

27. Programming exercise on two-dimensional arrays.

28. Exercises on
    - Internet use/application
    - Typical application on Electrical Engineering

**RECOMMENDED BOOKS**


1. Programming in C by Sachaum Series, McGraw Hills
2. Programming in C by Kerning Lan and Riechie Prentice Hall of India, New Delhi
3. Programming in C by Balaguru Swamy, Tata McGraw Hill, New Delhi
4. Let us C – Yashwant Kanetkar, BPB Publications, New Delhi
5. Vijay Mukhi Series for C and C++
6. Programming in C by R Subburaj, Vikas Publishing House Pvt. Ltd., Jangpura, New Delhi
7. Programming in C by Kris A Jansa, Galgotia Publications Pvt. Ltd., Daryaganj, New Delhi
8. Programming in C by BP Mahapatra, Khanna Publishers, New Delhi
9. Elements of C by MH Lewin, Khanna Publishers, New Delhi

# 4.4 ADVANCED CONTROL SYSTEM

| L | T | P |
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## 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. Multiloop Control System (12 hrs)

   Introduction to multiloop control system and its types, feedforward, cascade, ratio, split range, control system. Study of different processes using above mentioned control systems

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 Fuzzy Logic, Artificial Intelligence, Robotics (15 hrs)

4. Computer Control System (15 hrs)

   Introduction to DDC, DCS (Distributed Control System) and their applications in industry.

## LIST OF PRACTICALS

1. To study DCS System
2. To study DDC System
3. Study of non-Linearity in a relay
4. Study of dead- zone non-linearity
5. To study cascade control system
6. To study ratio control system
7. To study feedforward control system

8. To study split-range control system
9. Design of PID controller

**RECOMMENDED BOOKS**

1. Control System by Nagrath Gopal
2. Chemical Process Control by Stephenalphadis
3. Control System by RC Shkla

# 4.5 PRINCIPLES OF TELEMETRY

| L | T | P |
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| 4 | - | 2 |

**RATIONALE**

Telemetry is an advanced application of communication engineering for instrumentation professionals. This subject gives introduction to the basic telemetry techniques whichforms 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

   - 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

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

3. Transmission Channels

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

4. Data Communication

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

   Errors and correction in above systems

5. Instrumentation Buses

   - 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

**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

# 4.6 INSTRUMENTATION WORKSHOP

| L | T | P |
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**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.

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. Calibrate the Various Temperature Indicators

    - Calibrate the Sec. Instrument of R.T.
    - Calibrate a Pressure Gauge
    - Calibrate a P.D.P.T
    - Calibrate a Electronic D.P.T.
    - Connect a Pneumatic Primary instrument to a Secondary Instrument with the Help of Feural Fitting

2. Make Simple Contractor Control Circuit Using the Following:

    - Simply relay
    - T.D.R
    - Sequencing of Motors
    - Inter locking connections for Motors
    - Inter locking connections for various parameters.

3. Study of Calibration Tools and Instruments:

    - Pneumatic calibrator
    - Electronic calibrator
    - Dead Weight tester
    - Constant temperature bath

4. Preparation of Following Drawing Sheets:

    - Symbols of electrical components
    - Symbols of electronic components

- Symbols of pneumatic fittings
- Symbol of process components
- Symbol of control components
- Colour coding of pipes and service lines and their identification

5. Study the installation and commissioning procedure of instruments and prepare for any two loop of the following gringing

- Panel drawing
- Instrument location plan
- Electrical wiring details

6. Process and Control Schemes of the Following Industries:

Thermal Power Plant
- Furnace drought
- Drum level control(two element and three element)
- Turbine steam pressure control

Paper Industry
- Moisture Control
- Thickness control
- Pulp washing control
- Refinery
- Distillation colour control

Sugar
- P H Control
- Exporter control
- Crystalizer control

**RECOMMENDED BOOKS**

1. Applied Instrumentation in process Industries Vol. I by Andrewes
2. Practical Process Instrumentation & Control Vol. II by Sh. Jaymal
3. Hand Book of Industrial Instrumentation by G.C. Carrol
4. Hand Book of Applied Instrumentation by D.M. Considine
5. Instrumentation Process Industires by Bela G. Liptik

# ENTREPRENEURIAL AWARENESS CAMP

This is to be organized at a stretch for two to three days during second year. Lectures will be delivered on the following broad topics. There will be no examination for this subject

1. Who is an entrepreneur?
2. Need for entrepreneurship, entrepreneurial career and wage employment
3. Scenario of development of small scale industries in India
4. Entrepreneurial history in India, Indian values and entrepreneurship
5. Assistance from District Industries Centres, Commercial Banks. State Financial Corporations, Small industries Service Institutes, Research and Development Laboratories and other financial and development corporations
6. Considerations for product selection
7. Opportunities for business, service and industrial ventures
8. Learning from Indian experiences in entrepreneurship (Interaction with successful entrepreneurs)
9. Legal aspects of small business
10. Managerial aspects of small business