4.1 DIGITAL ELECTRONICS

L	T	P
3	-	2

RATIONALE

The objective of this subject is to enable the students to know the basic concepts of digital electronics and gain familiarity with the available IC chips. The students will learn about number systems, logic gates, various codes, parities, Boolean algebra, mux and demux, filp-flop, counters, shift registers. This will form a broad base for studying digital system design, advanced microprocessors and further studies.

DETAILED CONTENT

1. Introduction (01 hrs)
   a) Define digital and analog signals and systems, difference between analog and digital signals
   b) Need of digitization and applications of digital systems
2. Number Systems (06 hrs)
   a) Decimal, binary, octal, hexadecimal number systems
   b) Conversion of number from one number system to another including decimal points
   c) Binary addition, subtraction, multiplication, division, 1's and 2's complement method of subtraction
   d) BCD code numbers and their limitations, addition of BCD coded numbers, conversion of BCD to decimal and vice-versa
   e) Concept of parity, single and double parity, error detection and correction using parity
3. Logic Gates (04 hrs)
   a) Logic gates, positive and negative logic, pulse waveform, definition, symbols, truth tables, pulsed operation of NOT, OR, AND, NAND, NOR, EX-OR, EX-NOR gates
   b) NAND and NOR as universal logic gates
4. Logic Simplification (06 hrs)
   a) Rules and laws of Boolean algebra, logic expression, Demorgan's theorems, their proof
   b) Sum of products form (minterm), Product of sum form (maxterms), simplification of Boolean expressions with the help of Rules and laws of Boolean algebra
   c) Karnaugh mapping techniques upto 4 variables and their applications for simplification of Boolean expression

5. Arithmetic Circuits (03 hrs)

a) Half adder, full adder circuits and their operation

b) Parallel binary adder, 2-bit and 4-bit binary full adder, block diagram, working

6. Multiplexer/Demultiplexer (02 hrs)

a) Basic functions, symbols and logic diagrams of 4-inputs and 8-inputs multiplexers,

b) Basic functions, symbol and logic diagram of 4 output and 8 output demultiplexers

7. Decoders, Display Devices and Associated Circuits (03 hrs)

a) Basic Binary decoder, 4-line to 16 line decoder circuit

b) BCD to decimal decoder, BCD to 7-segment decoder/driver, LED/LCD display

8. Encoders and Comparators (03 hrs)

a) Encoder, decimal to BCD encoder, decimal to BCD priority encoder, keyboard encoder

b) Magnitude comparators, symbols and logic diagrams of 2-bit and 4-bit comparators

9. Latches and Flip-Flops (04 hrs)

a) Latch, SR-latch, D-latch, Flip-flop, difference between latch and flip-flop

b) S-R, D flip-flop their operation using waveform and truth tables, race around condition

c) JK flip-flop, master slave and their operation using waveform and truth tables

10. Counters and Shift Registers (06 hrs)

a) Asynchronous counter, 4-bit asynchronous counter

b) Synchronous counter, 4-bit synchronous binary counter

c) Ring counter, counter applications

d) Shift registers functions, serial-in-serial out, serial-in-parallel-out, parallel-in-serial-out, parallel-in-parallel out

e) Universal shift register, shift register counter and applications of shift registers

11. Memories (06 hrs)

Memory organization, classification of semi conductor memories, ROM, PROM, DROM, EPROM, RAM, CCD memories, content addressable memory, programmable logic devices, programmable logic array (PLA), programmable array logic(PAL), field programmable gate array (FPGA), familiarization with common ICs.

12. Arithmetic Logic Unit (04 hrs)

Basic idea about arithmetic logic unit w.r.t. IC 74181 and applications, implementation of binary multiplication, division, subtraction and addition.

LIST OF PRACTICALS

1. Study of logic breadboard with verification of truth table for AND, OR, NOT, NAND, EX-OR, NOR gate
2. Verification of NAND and NOR gate as universal gates
3. Construction of half-adder and full adder circuits using EX-OR and NAND gate and verification of their operation
4. Verify the operation of
   a) multiplexer using an IC
   b) de-multiplexer using an IC
5. a) Verify the operation of BCD to decimal decoder using an IC
   b) Verify the operation of BCD to 7 segment decoder using an IC
6. Verify operation of SR, JK, D-flip-flop master slave JK filp-flop using IC
7. Verify operation of SISO, PISO, SIPO, PIPO shift register. (universal shift register)
8. Verification operation of ring counter
9. Verify the logical operation, arithmetic operation of binary numbers using IC 74181
10. Testing of digital ICs using IC tester

RECOMMENDED BOOKS

1. Digital Electronics and Applications by Malvino Leach, Tata McGraw Hill, New Delhi
2. Digital Logic Designs by Morris Mano, Prentice Hall of India, New Delhi
3. Digital Fundamentals by Thomas Floyds, Universal Book Stall
4. Digital Electronics by RP Jain, Tata McGraw Hill, New Delhi
5. Digital Electronics by KS Jamwal, Dhanpat Rai & Co., New Delhi
6. Digital Electronics by Rajiv Sapra, Ishan Publication, Ambala

7. Digital Electronics by BR Gupta, Dhanpat Rai & Co., New Delhi
8. Digital Systems: Principles and Applications by RJ Tocci, Prentice Hall of India, New Delhi
9. Digital Electronics by Rajaraman V., Prentice Hall of India, New Delhi

INSTRUCTIONAL STRATEGY

The Digital Electronic – 1 has significant importance in the field of Electronics. Adequate competency need to be developed by giving sufficient practical knowledge in microprocessor, A/D, D/A, convertors and other topics. Help may be taken in the form of charts, simulation packages to teach of the subject.

SUGGESTED DISTRIBUTION OF MARKS FOR FACILITATING THE PAPER SETTER

Sr. No.	Topic	Time Allotted (hrs)	Marks Allocation
1.	Introduction	01	04
2.	Number Systems	06	10
3.	Logic Gates	04	10
4.	Logic Simplification	06	10
5.	Arithmetic Circuits	03	10
6.	Multiplexer/Demultiplexer	02	06
7.	Decoders, Display Device and Associated Circuits	03	06
8.	Encoders and Comparators	03	08
9	Latches and Flip Flops	04	08
10.	Counters and shift Registers	06	10
11.	Memories	06	10
12.	Arithmetic and Logic unit	04	08
Total		**48**	**100**

4.2 DC and AC MACHINES

L	T	P
4	-	2

RATIONALE

This subject deals with various types of electrical machines being employed in industry, power stations, domestic and commercial appliances etc. It is envisaged that after studying the subject, students will gain competence in operation, repair and maintenance of such machines and give suggestions for improvement in their performance. The students will study three phase supply, transformer, a.c. and d.c. motors. The practicals will enable students to perform various tests necessary for installation and commissioning of such machines.

DETAILED CONTENTS

1. Three Phase Supply (06hrs)

   a) Advantages of 3 phase system over single phase system

   b) Star delta connections

   c) Relation between phase voltage and line voltage, phase current and line current in a 3 phase system

   d) Power and power factor(p.f.) in 3 phase system and their measurements, importance of p.f. (simple problems)

2. D.C. Generators (08 hrs)

   Principle of D.C. Generator, Construction of D.C. Generator

   e.m.f. equation of D.C. Generator, Armature Reaction

3. DC Motor (08 hrs)

   Principle, significance of back emf, types of motors and their construction, motor characteristics for shunt and series, speed control of DC motors and factors controlling the speed. Starting methods, construction and working of 3 point starter, applications (simple problems)

4. Three Phase Induction Motors (10 hrs)

   Principle, construction, concept of slip, torque and characteristics, effect of motor resistance on torque (running and starting), rotor current, output power, different methods of speed control. Starting methods and constructional and working of 3 point starter, applications (simple problems)

5. Synchronous Motors (08 hrs)

Principle, construction and working, effect of load and excitation on synchronous motor. Starting of motor and their applications

6. Single Phase Motors (08 hrs)

Principle, construction, working speed, control, starting and applications of the following motors:

a) Induction motor

b) Universal motor

7. Alternators (08 hrs)

Principle of Alternator, Construction of Alternator

e.m.f. equation of Alternator,

8. Stepper Motor and Servo Motor (08 hrs)

Types, construction, working and their applications

(**Note**: No derivation of any formula)

LIST OF PRACTICALS

The students to perform following experiments in the lab:

1. DC machines

   1.1 Speed control of dc shunt motor (i) Armature control method (ii) Field control method

   1.2 Study of dc series motor with starter (to operate the motor on no load for a moment)

2. To measure power and power factors in 3 - phase load using two wattmeter method.

3. To connect a dc shunt motor with supply through 3 - phase starter and to run the motor at different speech with the help of a field regulator.

4. To run a 3 - phase squirrel cage Induction motor with the help of a star delta starter.

5. To change the direction of rotation of induction motor.

6. To run a synchronous motor with a.c. supply and to measure speed to verify the relation $N = \frac{120\,f}{p}$

INSTRUCTIONAL STRATEGY

For conceptual understanding a field/industrial visit (preferably Transformer Factory) may be organised to give live exposure to students. For this the teacher should visit first to understand the assembly line-up which could be followed by a visit of the students, where the teacher can give an idea of the working of the factory without much seeking assistance of the factory staff. In addition, emphasis may be given on field applications and simple numerical problems.

RECOMMENDED BOOKS

1) Electrical Machine by SK Bhattacharya, Tata McGraw Hill Education Pvt Ltd, New Delhi

2) Electrical Machines by Nagrath and Kothari, Tata McGraw Hill Education Pvt Ltd, New Delhi

3) Experiments in Basic Electrical Engineering: by S.K. Bhattacharya, KM Rastogi: New Age International (P) Ltd. Publishers, New Delhi

4) Electrical Machines by SK Sahdev, Uneek Publications, Jalandhar

5) Electrical Engineering by JB Gupta, SK Kataria & Sons, New Delhi

6) Electrical Machines by DR Arora, Ishan Publications, Ambala city

7) Electrical Technology Vol. - I and II B.L. Thareja, S Chand and Co. New Delhi

SUGGESTED DISTRIBUTION OF MARKS

Sr. No.	Topic	Time Allotted (hrs)	Marks Allocation
1.	Three phase Supply	6	12
2.	DC Generator	8	12
3.	DC Motor	8	12
4.	3 Phase Induction Motors	10	18
5.	Synchronous Motors	8	12
6.	Single Phase Motors	8	12
7.	Alternators	8	12
8.	Stepper Motor and Servo Motor	8	12
Total		**64**	**100**

4.3 INSTRUMENTATION

L	P
3	2

RATIONALE

This subject deals with the construction and working of various transducers which sense various parameters and control operations in industry. A diploma holder looking after the operations of various instruments and gadgets is required to diagnose faults, rectify them and ensure the best performance from the system. Thus, there is a need of introducing diploma holders to the basics of instrumentation.

DETAILED CONTENTS

1. Measurements: (3 hrs)

   Importance of measurement, basic measuring systems, advantages and limitations of each measuring systems and display devices

2. Transducers: (6 hrs)

   Theory, construction and use of various transducers (resistance, inductance, capacitance, electromagnetic, piezo electric type)

3. Measurement of Displacement and Strain: (6 hrs)

   Displacement Measuring Devices: wire wound potentiometer, LVDT, strain gauges and their different types such as inductance type, resistive type, wire and foil type etc. Gauge factor, gauge materials and their selections. Use of electrical strain gauges, strain gauge bridges and amplifiers.

4. Force and Torque Measurement: (6 hrs)

   Different types of force measuring devices and their principles, load measurements by using elastic transducers and electrical strain gauges. Load cells, measurements of torque by brake, dynamometer, electrical strain gauges, speed measurements; different methods, devices.

5. Pressure Measurement: (5 hrs)

   Bourdon pressure gauges, electrical pressure pick ups and their principle, construction and applications. Use of pressure cells.

6. Flow Measurement: (4 hrs)

   Basic principles of magnetic, ultrasonic flow meters and laser Doppler

7. Measurement of Temperature: (5 hrs)

   Bimetallic thermometer, thermoelectric thermometers, resistance thermometers, thermocouple, thermisters and pyrometer. Temperature recorders

8. Measurement of other non electrical quantities such as humidity, pH, liquid level, sound level, viscosity and vibrations (5 hrs)

9. Data Acquisition system: Input amplifiers, signal conditioners, output amplifiers. (4hrs.)

10. Output Devices and Displays: (4 hrs)

    Basic principles of operation, construction features and application of LED, LCD displays, Graphic Recorder, X-Y recorder, Computer Monitor

PRACTICAL EXERCISES

1. To measure the level of a liquid using a transducer
2. To measure temperature using a thermo-couple
3. Study and use of digital temperature controller
4. Use of themistor for temperature measurement
5. Study of variable capacitive transducer
6. Draw the characteristics of a potentiometer
7. To measure linear displacement using LVDT
8. To study the use of electrical strain gauge
9. To study weighing machine using load cell
10. To study pH meter.
11. Measurement and plotting the characteristics of photo diodes
12. To assemble and test instrumentation amplifier to find out its gain, input and output impedance
13. Measurement of flow rate
14. Measurement of pressure using Bourdon Tube
15. Study X- Y recorder/ graphic recorder

INSTRUCTIONAL STRATEGY

The teacher should explain the scope of various measuring devices and their practical applications in the field. The transducers and measuring devices must be shown to the students and they should be trained in the reaction, operation, maintenance and calibrations. Frequent visits to nearby process industries will be of immense help to the students.

RECOMMENDED BOOKS

1. Electronic Measurement and Instrumentation by Dr Rajendra Prasad
2. Electronic Measurement and Instrumentation by JB Gupta, SK Kataria and Sons, New Delhi
3. Electrical and Electronics Measurement and Instrumentation by AK Sawhney, Dhanpat Rai and Co., New Delhi

4. Electronic Instrumentation and Measurement Techniques by WD Cooper, AD Helfrick Prentice Hall of India Pvt. Ltd. New Delhi
5. Industrial Instrumentation by Umesh Rathore, SK Kataria and Sons, New Delhi

SUGGESTED DISTRIBUTION OF MARKS FOR FACILITATING THE PAPER SETTER

Sr. No	Topic	Time Allotted (hrs)	Marks Allocation (%)
1	Measurements	3	6
2	Transducers	6	12
3	Measurement of Displacement and Strain	6	12
4	Force and Torque Measurement	6	12
5	Pressure Measurement	5	12
6	Flow Measurement	4	8
7	Measurement of Temperature	5	12
8	Measurement of other non electrical quantities	5	10
9	Data acquisition system	4	8
10	Output Devices and Displays	4	8
	Total	**48**	**100**

4.4 ELECTRICAL AND ELECTRONIC INSTRUMENTATION AND MEASUREMENT

L	T	P
3	-	3

RATIONALE

In the real world of work the technician is required to handle wide variety of instruments while testing, trouble shooting, calibration etc. the study of this subject will help students to gain the knowledge of working principles and operation of different instruments. During practical sessions, he will acquire the requisite skills.

DETAILED CONTENTS

1. Basics of Measurements (02 hrs)

   Measurement, methods of measurement, types of instruments

   Specifications of instruments: Accuracy, precision, sensitivity, resolution, range, Errors in measurement, sources of errors, limiting errors, Loading effect, Importance and applications of standards and calibration

2. Introduction to Electrical measuring Instruments (06 hrs)

   - Types of electrical measuring instruments

     Indicating, Integrating and recording type instruments

   - Essentials of indicating instruments: Deflecting, controlling and damping torque

3. Voltage Current and Resistance Measurement

   - Principles of operation and construction of permanent magnet moving coil (PMMC) instruments
   - Moving iron type instruments, measurement of d.c voltage and current, measurement of d.c voltage and current, milli-volt measurement. Block diagram, working principle, application and comparison of Analog and Digital multimeter
   - Specifications of multimeter and its applications
   - Limitations with regard to frequency and input impedance.

4. Cathode Ray Oscilloscope (10 hrs)

   - Construction and working of Cathode Ray Tube(CRT)
   - Block diagram, description of a basic CRO and triggered sweep oscilloscope, front panel controls.
   - Specifications of CRO and their explanation.
   - Measurement of voltage, current, frequency, time period and phase using CRO.
   - CRO probes, special features of dual beam, dual trace, delay sweep.
   - Digital storage oscilloscope (DSO) : block diagram and working principle.

5. Signal Generators and Analytical Instruments (06 hrs)

- Explanation of block diagram specifications of low frequency and RF generators, pulse generator, function generator
- Wave analyzer, distortion measurement and spectrum analyser

6. Impedance Bridges and Q Meters (06 hrs)

- Wheat stone bridge
- AC bridges: Maxwell's induction bridge, Hay's bridge, De-Sauty's bridge, Schering bridge and Anderson bridge
- Block diagram description of laboratory type RLC bridge, specifications of RLC bridge
- Block diagram and working principle of Q meter
- Study of LCR meter and its applications.

7. Digital Instruments (06 hrs)

7.1 Comparison of analog and digital instruments

7.2 Working principle of ramp, dual slope and integration type digital voltmeter

7.3 Measurement of time interval, time period and frequency using universal counter/frequency counter

7.4 Working principle of logic probe, logic pulser, logic analyzer, logic comparator, signature analyzer

8. Other Measuring Instruments (02 hrs)

Construction, working Principle and applications of

(a) Meggar (b) Earth tester (c) Tong Tester

LIST OF PRACTICALS

1. Measurement of voltage, resistance, frequency, using digital multimeter
2. Measurement of voltage, frequency, time period and phase using CRO
3. Measurement of rise time and fall time using CRO
4. Measurement of Q of a coil and its dependence on frequency
5. Measurement of voltage, frequency, time and phase using DSO
6. Measurement of resistance and inductance of coil using RLC Bridge
7. Use of logic pulser and logic probe
8. Measurement of time period, frequency, average period using universal counter/ frequency counter
9. To measure the value of earth resistance using earth tester
10. To find the value of unknown resistance lay Wheat Stone Bridge
11. Measurement of voltage, current, frequency with CRO / multimeter using PC interfacing techniques

INSTRUCTIONAL STRATEGY

The subject requires both theory and practical emphasis simultaneously, so that the student can understand the practical significance of the various areas. Visits to instrumentation and communications industries must be carried out, so as to make the students can understand where and how the various instruments are used in the industry.

RECOMMENDED BOOKS

1. Electronics Measurement and Instrumentation by AK Sawhney, Dhanpat Rai and Sons, New Delhi
2. Electronics Instrumentation by Cooper, Prentice Hall of India, New Delhi
3. Electronics Test and Instrumentation by Rajiv Sapra, Ishan Publications, Ambala
4. Electronics Instrumentation by JB Gupta, Satya Prakashan, New Delhi
5. Electrical Measurement and Measuring Instruments by S.K Sahdev; Unique International Publications, Jalandhar
6. Electronics Instrumentation by Umesh Sinha; Satya Publications, New Delhi
7. Electrical Measurement of Measuring Instruments by M.L Anand; S.K Kataria and Sons, New Delhi

SUGGESTED DISTRIBUTION OF MARKS FOR FACILITATING THE PAPER SETTER

Sr. No.	Topic	Time Allotted (hrs)	Marks Allocation %
1.	Basics of Measurements	02	4
2.	Introduction to Electrical Measuring Instruments	06	12
3.	Voltage, Current and Resistance Measurement	10	22
4.	Cathode Ray Oscilloscope	10	22
5.	Signal Generators and Analytical Instruments	06	12
6.	Impedance Bridges and Q Meters	06	12
7.	Digital Instruments	06	12
8.	Other Measuring Instruments	02	4
Total		**48**	**100**

4.5 HYDRAULIC AND PNEUMATIC SYSTEMS

L	T	P
4	-	2

RATIONALE

The subject deals with basic concepts of hydraulic and pneumatics which are required by students for automation purpose. This subject enhances the knowledge and skills of students in the area of hydraulics and pneumatics.

DETAILED CONTENTS

1. Introduction (8 hrs.)

   Need, scope and importance of hydraulic and pneumatic, Hydrostatic and hydrodynamic definitions, properties of fluid, Pascal's law, Continuity equation and Bernoulli's equation. Advantages and limitations of hydraulic and pneumatic systems

2. Hydraulic Elements (20 hrs)

   - Hydraulic Pipes- Type, materials, designations, pressure ratings and selection criteria.
     Piping Layout, Concept, rules/norms.
   - Hydraulic Pump- Type, construction, working applications and selection criteria. Powerpack
   - Control Valves- Type, designation, symbols, working and applications.
   - Hydraulic Actuators- Type, working and applications.
   - Other Elements such as filters, manifold, receivers, coolers and connecters.

3. Fundamentals of Pneumatics (6 hrs)

   Compressible fluid flow, mass flow rate, compressible fluid- Type, properties and applications.

4. Pneumatic Elements (20 hrs)

   - Pipes- Type, designations, applications and properties.
   - Air Compressor- Type (Reciprocating and rotary), working and selection criteria.
   - Pneumatic Cylinders- Type, symbol, cushion, assemblies, mounting and installation.
   - Air Motors- Type, working and applications.
   - Pneumatic Valves- Type, symbols, working, applications and selection criteria.
   - Other elements - Air receivers, filters, pressure regulator, lubricator.

5. Hydraulic and Pneumatic Circuits (10 hrs.)

   - Concept, Meaning and ISO symbols, Basic hydraulic and pneumatic circuits- Type, circuit diagrams.
   - Rules/ Norms for designing hydraulic and pneumatic circuits.

LIST OF PRACTICALS

1. Study and demonstration of various hydraulic devices/elements.
2. Study and demonstration of various pneumatic devices/elements.
3. Operate hydraulic circuits based on simple system requirement. (at least 3)
4. Operate, pneumatic circuit based on simple systems requirements (at least 3)
5. Visit to a related industry.

INSTRUCTIONAL SRATEGY

1. Teacher should lay emphasis in making the students conversant with concepts and principles of hydraulic and pneumatic systems.
2. Various hydraulic and pneumatic elements should be demonstrated during teaching.

LIST OF RECOMMENDED BOOKS

1. Hydraulics and Pneumatics (A Technician and Engineer Guide) by Andrew Parr; Butterworth Publishers.
2. Hydraulic and Pneumatic Systems by S. R Majumdar; TMH Publishers.
3. Mechatronics by W. Bolton; Pearson.
4. Hydraulic and Hydraulic Machines by R. K. Bansal
5. Industrial Pneumatic control by Z. J Lansky; Marcel Dekker, Inc.
6. Hydraulic and Pneumatic Power and control Design, Performance and Application by Yeaple; McGraw hill.
7. Pneumatic Controls: An Introduction to the Principles by Werner Deppert and Kurt Stoll; Vogel- Verlag

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (hrs.)	Marks Allotted(%)
1	8	15
2	20	30
3	6	10
4	20	30
5	10	15
Total	**64**	**100**

4.6 MECHATRONICS - DESIGN AND DRAFTING

L	T	P
-	-	6

RATIONALE

A diploma holder when employed in an automated plant, power station or a manufacturing unit using automation is expected to read, interpret and understand Instrumentation/Mechatronics drawings. In the proposed course, the students will learn to make and simulate instrumentation/ process/automation drawing. The operation of the plant/automated machines can be understood by reading a sequential flow diagram or a process diagram. Making drawings using software packages allows easy simulation of the complete electromechanical system.

DETAILED CONTENTS

1. Symbols of control valves, actuators, hydraulics and pneumatic components, sources actuators, control elements, pumps, gauges (6hrs)

2. Introduction to a typical computer aided instrumentation drafting and design package. Design environment configuration, File menu, edit menu, view menu, Layout menu (10 hrs)

3. Sequential flow diagrams (SFC) (12 hrs)
   Basic SFC, Creating/drawing SFC, Configuration and animations using SFC, Understanding SFCs structure, control sequences, Functional Boxes

4. Diagram Editor:

   Creating and editing diagrams using inbuilt component libraries, configuring the diagram editor, Simulation of a simple hydraulic/ pneumatic circuit. (12 hrs)

5. Creating a project:

   Configuring the project and diagram settings, map locator, creating a simple circuit, simulation (10 hrs.)

6. Fluid (Hydraulic and Pneumatic) diagrams- control valves, gauges, actuators, sources, pumps, accumulators, proximity sensors. (10 hrs)

7. Electromechanical drawings: Terminals, fastener relays, solenoids, cable drawings, protection components (fuse, circuit breaker, thermal protection element). (14 hrs)

8. Ladder Logic diagrams, symbology, creation of LLDs, multiple wrungs – simulation (10 hrs)

9. Panel drawing: Placement of Display (Touch Panel), HMI Control Switches (10hrs)
10. Wiring diagrams and tags (12 hrs)

Instructional Strategy

This course is to be covered with the help of a software package and through practice session on computers

INDUSTRIAL TRAINING

Industrial training, 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.

For this purpose, students at the end of fourth semester need to be sent for industrial training for a minimum of 4 weeks duration to be organised during the semester break starting 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 teacher may guide a group of 4-5 students. 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. The components of evaluation will include the following.

a) Punctuality and regularity	15%
b) Initiative in learning new things	15%
c) Relationship with workers	15%
d) Industrial training report	55%