

CURRICULUM

FOR

DIPLOMA PROGRAMME

IN

INSTRUMENTATION ENGINEERING

3rd Year (i.e. 5th & 6th semester)

FOR THE STATE OF HIMACHAL PRADESH

(To be implemented from session 2013-2014)



(Implemented w.e.f. Session 2014-15)

Prepared by:-

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PREFACE

India, in last two decades, has made significant progress in all major spheres of activity. Since 1947, the Technical Education System has grown into fairly large sized system, offering opportunities for education and training in wide variety of trades / disciplines at different levels. Needless to say that well trained technical manpower is the backbone of any growing economy in the era of fast industrialization. It has been the endeavor of the Technical Education Department to take decisive steps to enhance the capacities of technical institutions with major emphasis on quality and excellence in technical education .Our country is the only country in the world which has 50% population below the age of 25 years whereas America has 30% and China 40%.Working Age Population (WAP) is increasing in India whereas it is decreasing in other parts in the world. Challenge before us is to train this WAP for the world of work .Updated curriculum is one of the most powerful tools to improve the quality of training.

Curriculum Document is a comprehensive plan or a blue print for developing various curriculum materials and implementing given educational programme to achieve desired and formally pre-stated educational objectives. Moreover it (the document) is the output of exhaustive process of curriculum planning and design, undertaken by the implementers under the expert guidance of curriculum designer.

While working out the detailed contents and study and evaluation scheme, the following important elements have been kept in mind:

- i) Major employment opportunities of the diploma holders.*
- ii) Modified competency profile of the diploma holders with a view to meet the changing needs due to technological advancement and requirements of various employment sectors.*
- iii) Vertical and horizontal mobility of diploma pass outs for their professional growth.*
- iv) Pragmatic approach in implementing all the curricula of diploma programmes in engineering and technology in the state of H.P.*

The document is an outcome of the feedback received from field organizations/ industry of different categories viz. small, medium and large scale which offer wage employment for the diploma pass outs. In every stage of planning and designing of this curriculum, suggestions and advice of experts representing industry, institutions of higher learning, research organizations etc. were sought and incorporated as per the requirement of curriculum . The document contains the study and evaluation scheme and detailed subject/course contents to enable the H.P. Polytechnics to implement revised curriculum and to achieve the desired objectives.

Time has specifically been allocated for undertaking extra-curricular activities. Emphasis has been laid on developing and improving communication skills in the students for which Communication Lab has been introduced during the first year itself.

We hope that this revision will prove useful in producing competent diploma holders in the state of Himachal Pradesh. The success of this curriculum depends upon its effective implementation and it is expected that the managers of polytechnic education system in Himachal Pradesh will make efforts to create better facilities, develop linkages with the world of work and foster conducive and requisite learning environment.

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3rd YEAR OF THREE YEAR DIPLOMA PROGRAMME IN INSTRUMENTATION ENGINEERING

1. SALIENT FEATURES

- 1) Name of the Programme : Three year Diploma Programme
Instrumentation Engineering
- 2) Duration of the Programme : Three years (06 Semesters)
- 3) Entry Qualification : As prescribed by H.P. Takniki
Shiksha Board
- 4) Intake : As approved by H.P. Takniki
Shiksha Board
- 5) Pattern of the Programme : Semester Pattern
- 6) Curriculum for : 3rd year of Three year Diploma
Programme(Technical Stream)

7) **Student Centred Activities:**

A provision of 2-4 hrs per week has been made for organizing Student Centred Activities for overall personality development of students. These activities will comprise of co-curricular & other activities such as expert lectures, games, seminars, declamation contests, educational field visits, NCC, NSS and cultural activities & hobby classes like photography, painting, singing etc.

2. GUIDELINES

2.1 GUIDELINES FOR ASSESSMENT OF STUDENT CENTRED ACTIVITIES (SCA)

Distribution of 25 marks for SCA will be as follows:

- i. 5 Marks shall be given for general behaviour
- ii. 5 Marks for attendance shall be based on the following distribution:
 1. Less than 75% Nil
 2. 75-79.9% 3 Marks
 3. 80-84.9% 4 Marks
 4. Above 85% 5 Marks
- iii. 15 Marks shall be given for the Sports/NCC/Cultural and Co-curricular activities/other activities after due consideration to the following points:
 1. For participation in sports/NCC/Cultural/Co-curricular activities at National or above level, shall be rewarded with minimum of 10 marks
 2. For participation in sports/NCC/Cultural/Co-curricular activities at Inter-polytechnic level, shall be rewarded with minimum of 08 marks
 3. For participation in two or more of the listed activities, 5 extra marks should be rewarded

Note: *Head of Department shall ensure that these marks are conveyed to the H.P. Takniki Shiksha Board, Dharamshala at the end of semester along with sessional record.*

2.2 GUIDELINES FOR SESSIONAL ASSESSMENT

- The distribution of marks for Internal Assessment in theory subjects and drawing shall be made as per the following guidelines:
 - i. 60% of internal assessment shall be based on the performance in the tests. At least three tests shall be conducted during the semester out of which at least one should be house test. 30% weightage shall be given to house test and 30% to class test(One best out of two).
 - ii. 20% marks shall be given to home assignments, class assignments, seminars etc.
 - iii. 20% marks shall be given for attendance/punctuality in the subject concerned.
- The distribution of marks for Internal/External Assessment in practical subjects shall be made as per the following guidelines:
 - i. 60% marks shall be awarded for performance in practical.
 - ii. 20% marks shall be given for Report/Practical book and punctuality in equal proportion.
 - iii. 20% marks shall be for Viva-voce conducted during the practicals.
- The distribution of mark for internal assessment in drawing subjects shall be as per following guidelines:-
 - (i) 60% marks for sheets
 - (ii) 40% for test.

FIFTH SEMESTER (INSTRUMENTATION ENGINEERING)

SR NO	SUBJECTS	STUDY SCHEME Hrs/Week		MARKS IN EVALUATION								Total Marks of Int. & Ext.
				INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT					
		Th	Pr	Th	Pr	Total	Th	Hrs	Pr	Hrs	Total	
5.1	Industrial Instrumentation	5	2	30	20	50	100	3	50	3	150	200
5.2	Digital Signal Processing	5	2	30	20	50	100	3	50	3	150	200
5.3	Process Control System	5	2	30	20	50	100	3	50	3	150	200
5.4	Data Acquisition and Network	5	2	30	20	50	100	3	50	3	150	200
5.5	Elective-I(MMT/EM)	5	2	30	20	50	100	3	50	3	150	200
5.6	*Practices in Communication Skills	0	2	-	50	50	-	-	50	3	50	100
	Industrial Training	-	-	-	50	50	-	-	50	3	50	100
	Student Centred Activities	-	3	-	25	25	-	-	-	-	-	25
	Total	25	15	150	225	375	500	-	350	-	850	1225

* Common with other diploma programmes in sixth semester.

SIXTH SEMESTER (INSTRUMENTATION ENGINEERING)

SR. NO	SUBJECTS	STUDY SCHEME Hrs/Week		MARKS IN EVALUATION									Total Marks of Int. & Ext.
				INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT						
		Th	Pr	Th	Pr	Total	Th	Hrs	Pr	Hrs	Total		
6.1	*Basics of Management	3	-	50	-	50	100	3	-	-	100	150	
6.2	Analytical and Biomedical Instruments	5	2	30	20	50	100	3	50	3	150	200	
6.3	Advance Control System	5	2	30	20	50	100	3	50	3	150	200	
6.4	Process Control Components	4	2	30	20	50	100	3	50	3	150	200	
6.5	Elective-II(IE/MTS)	4	2	30	20	50	100	3	50	3	150	200	
6.6	Major Project	-	8	-	100	100	-	-	100	3	100	200	
	Student Centred Activities	-	3	-	25	25	-	-	-	-	-	25	
Total		21	19	170	205	375	500	-	300	-	800	1175	

**Common with other diploma programmes.*

5.1 INDUSTRIAL INSTRUMENTATION

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5 - 2

RATIONALE:

Measurement of different parameters in the field of Instrument Engineering is very important, hence the syllabus has been designed in two parts to give through in sight in the measurements of parameters. Different methods of measurement and their appropriate selection with limitation have also been considered to bring the students to a level where they will be able to solve practical problems faced in the field.

DETAILED CONTENTS

1. TEMPERATURE

- 1.1. Importance of temperature measurements in an Industry.
- 1.2. Seeback effect.
- 1.3. Temperature scales and conversions.
- 1.4. Principle and working, material of construction, advantages and limitation of Vapour filled, gas filled, Liquid filled, mercury filled in glass thermometers.
- 1.5. Bimetallic thermometers.
- 1.6. Pressure spring thermometers.
- 1.7. Thermistors.
- 1.8. Radiation pyrometers.
- 1.9. Optical promoters.
- 1.10. Lead wire compensation.

2. LEVEL

- 2.1 Importance of level measurement.
- 2.2 Working principles, materials for construction,
- 2.3 advantages and limitations of:-
 - 2.3.1 Visual level indicator.
 - 2.3.2 Ordinary Flood type using strings and pulleys.
 - 2.3.3 Measuring level by Purge method.
 - 2.3.4 Measuring level by Buoyancy method.
 - 2.3.5 Level limit switches.
- 2.4 Resistance probes for level measurements.
- 2.5 Capacitance probes for level measurements.
- 2.6 Ultrasonic level measurements.
- 2.7 Gamma ray level measurements.

3. FLOW:-

- 3.1 Mechanical Flow Meters:-
 - 3.1.1 Displacement type- Principle of working and constructional features, Reciprocating piston, rotating discs, oscillating piston, helix & oval gears.
 - 3.1.2 Interferential type. Principle of operation. Rotating vane, propeller type.
- 3.2 Differential Pressure Meters.
 - 3.2.1 Types, constructional features, working and applications, Orifice plate, venturi tube, Dall tube, flow nozzle, Pitot tube. Differential pressure Transmitters.
 - 3.2.2 Venturi flow meters for liquids and gases.
 - 3.2.3 Variable area flow meters :Rotameters.
 - 3.2.4 Electromagnetic and ultrasonic flow meters.

3.2.5 Mass flow meters. Target flow meter and turbine flow meters.

4. PRESSURE:

4.1 Principle of Measurement of absolute and gauge pressure.

4.2 Unit of pressure and conversion-different types of manometers, principle of working of bellows, Bourdon tube, capsule and diaphragm type. Pressure switches- vacuum gauges-Pirani gauge.-Calibration of pressure gauges,- dead weight testers.

5. HUMIDITY:

5.1 Absolute humidity, relative humidity, Dew point. Principle of instruments to measure humidity.

PRACTICALS

1. Study of radiation and optical pyrometer used to measure high temperature.
2. Determine the temperature coefficient of a resistance thermometer and thermistor.
3. study the operation of level limit switch.
4. To calibrate a rotameter.
5. To dismantle and assemble a Bourbon's pressure gauge.
6. To calibrate a pressure gauge using a dead weight tester.
7. To verify the working of different types of pressure gauges.
8. To determine the relative humidity by wet bulb and dry bulb method.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Alloted (Hrs)	Marks Allotted(%)
1	18	25
2	17	25
3	17	25
4	10	15
5	08	10
Total	70	100

5.2 DIGITAL SIGNAL PROCESSING

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5 - 2

DETAILED CONTENTS

1. **Introduction to Discrete time signals and systems:** Signal & System, Z Transform, Frequency response Implementation to Discrete time systems: Block diagrams, and signals flow graphs, Realization structure for FIR and IIR systems Software.
2. **Analysis and design of discrete time systems in the frequency domain:** Computation of the frequency response function linear time invariant systems as frequency selective filters, Design of filters in the Z domain.
3. **IIR Filter design:** Impulse invariance technique, Bilinear transformation, Frequency sampling method, Matched Z Transform technique.
4. **FIR filter design:** Window functions, Computer aided design. Discrete Fourier transform on the unit circle, DFT and symmetry Properties, FFT algorithms.
5. **Multi rate digital signal processing:** Decimation, Interpolation, Sampling rate conversion, Multi state implementations of sampling rate conversion.
6. **Error in Digital Filters:** Quantization and recursion noise, Effect of coefficient quantization, finite word length, rounding errors.
7. **Introduction to Wavelets:** Discrete Wavelet Transform, Applications of wavelet Transform.
8. **Applications of DSP:** Speech Processing, Image Processing, Dual tone multi-frequency (DTMF)

LIST OF PRACTICALS

1. *Plot the I/p & O/p of the FFT on 5509 Software.*
2. *Plot the I/p & O/p of the Timer on 5509 Software.*
3. *Plot the I/p & O/p of the Amplitude Modulation on 5509 Software.*
4. *Plot the I/p & O/p of the Frequency Modulation on 5509 Software.*
5. *Plot the I/p & O/p of the IIR Filter on 5509 Software.*
6. *Plot the I/p & O/p of the FIR Filter on 5509 Software.*
7. *Plot the I/p & O/p of the Universal Asynchronous Receiver Transmitter (UART) on 5509 Software.*
8. *Plot the I/p & O/p of the LCD on 5509 Software.*

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted(Hrs)	Marks Allotted (%)
1	09	12
2	12	18
3	08	12
4	13	18
5	08	12
6	09	12
7	06	08
8	05	08
Total	70	100

5.3 PROCESS CONTROL SYSTEM

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5 - 2

RATIONALE:

The subject enables the students to study in detail different types of control systems used in instrumentation. The contents of the syllabus lead the students to appreciate the importance and limitation of different types of process controls. Knowledge of tuning of a process control loop is covered in depth. It deals with operation and characteristics of various controllers and with actual controlling aspect involved in process control loops.

DETAILED CONTENTS

1 Basic control loops and characteristics(Simple processes like):

- 1.1 Single capacity pressure system.
- 1.2 Single capacity temperature system.
- 1.3 Single capacity level system.
- 1.4 Single flow loop system.
- 1.5 Dead time, process lag, 1st order approximation of process systems.

2 Basic controller modes and characteristics.

- 2.1 Concept of on-off and throttling controls.
- 2.2 on off, proportional
- 2.3 Single speed floating.
- 2.4 Integral and derivative action and their combinations and their response to step, ramp and sinusoidal test input
- 2.5 Example of on off control system.
- 2.6 Example and P+I+D modes of control. Suitable of various control action for different applications.

3 Multi Loop Control

- 3.1 Introduction to feed forward
- 3.2 cascade and ratio control.

4 Controller Adjustment

- 4.1 Alignment
- 4.2 tuning, Auto tuning
- 4.3 Self tuning feature of controller
- 4.4 Ziegler
- 4.5 Nichols methods.

5 Case Study

- 6.1 Boiler control
- 6.2 Distillation column control.

PRACTICAL WORK

1. *To study and set a pneumatic PID controller.*
2. *To determine the output response of a thermal PID control systems for a step input when P+I action is provided.*
3. *To study a control loop of tank level control.*
4. *To study the control loop of a boiler for temperature control.*
5. *To study the control loop of a system of flow control.*
6. *To study the control loop of a system of pressure.*
7. *To study the feed forward, cascade and ratio control in a multi loop control System*

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Alloted(Hrs)	Marks Allotted(%)
1	14	22
2	13	22
3	10	14
4	17	28
5	16	14
Total	70	100

5.4 DATA ACQUISITION AND NETWORK

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5 - 2

RATIONALE:

In the modern plants total data regarding temperature, pressure , voltage, current etc. from the different selections is centrally recorded and controlled for recording and transmitting the data from different sections, knowledge of data transmission, and data acquisition by an technician is essentially required. The knowledge of this subject will help him in transferring the data and its acquisition in sophisticated plants.

DETAILED CONTENTS

1. Data Transmission:-

- 1.1 Introduction to data transmission.
- 1.2 Method of data transmission.
- 1.3 Electrical and Electronic methods of data Transmission.
- 1.4 i) Land line ,Voltage, Current, Position telemetry System
ii) Radio Frequency ,Phase, Pulse Amplitude, Pulse Code Modulation telemetry.

2. Transmission Channels and Media:

- 2.1 Wire line channels.
- 2.2 Radio channels.
- 2.3 Micro wave channels.
- 2.4 Power line channels.
- 2.5 Radio link
 - 2.5.1 Receiving antenna.
 - 2.5.2 Receiver.
- 2.6 Telemetry hard ware and applications.

3. Data Acquisition

- 3.1 Introduction
- 3.2 Single channel data acquisition system.
- 3.3 Multichannel data acquisition system.
- 3.4 Multiplexer and sample hold circuits.
- 3.5 Components of digital and analog data acquisition system.

4. Introduction to GPS(Global Positioning System):

- 4.1Block Diagram
- 4.2Working of GPS
- 4.3 Applications

5. Computer Network model (OSI/TCP):

- 5.1 Comparison of OSI model with TCP/IP Model
- 5.2 Description of Layers
- 5.3 Function of Layers

LIST OF PRACTICALS

1. (a) To conserve an AM wave or CRO produced by a standard signal generator using internal and external modulation.
(b) To Measure the modulation index of the wave obtained in the above practical.
2. To observe the sampled signal and compare it with the analog input signal. Not the effect of varying the sampling pulse with and frequency on the sampled output.
3. To time division multiplex the two given signals.
4. To observe and note the impulse modulated signals (PAM, PPM PWM) and compare them with the corresponding analog input signal.
5. To study the process of data modulation/demodulation.
6. To study pulses code modulation and its effectiveness for data communication.
7. To study the use of multiplexer and demultiplexers in data communication.
8. To study and Measurement of modulation index of an amplitude modulated circuit using C.R.O.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Alloted(Hrs)	Marks Allotted(%)
1	21	28
2	10	16
3	10	16
4	14	20
5	15	20
Total	70	100

5.5.1 MICROPROCESSOR /MICROCONTROLLER TECHNIQUES

L T P
5 - 2

DETAILED CONTENTS

1. **Microprocessor in PC** : 8086/8088 architecture, organization, bus structure and timings, floating point arithmetic.
2. **8086/8088 and 8087**: Instruction set, assembly language programming, interrupts structure of 8086, Memory structure and interfacing 8086/88, DRAM/SRAM Interfacing.
3. **Basic I/O interfacing concepts**: Memory mapped I/O and I/O mapped I/O, interrupts handling, ISR, Parallel I/O's and interfacing applications using programmable peripheral devices.
4. **Micro Controllers**: MCS-51 (8051), architecture, instruction set.
5. **Special Features of architecture of advanced microprocessors (32 bits)**:Pentium Processor, (Introductory).

List of Practical's

1. *Programs on assembly language programming (8086/8088).*
2. *Two experiments on interfacing peripherals.*
3. *Two experiments on interfacing ADC/DAC.*
4. *Four Experiments on PIC Microcontroller.*
5. *Designing PID controller using Microcontroller.*
6. *Designing logic functions using Microcontroller.*

Reference Books

1. *Micro Processor and Interfacing, Programming and Hardware by Douglas V.Hall*
2. *Micro Controller by Ahyle Penram.*
3. *Designing with Microcontrollers – Peatman.*
4. *Intel Manuals on Microprocessors and Microcontrollers. Intel Manuals.*
5. *80486 and Pentium and processor= B.B. Brey (PHI) 4th Ed; Prentice Hall Inter National Publication*
6. *Microcomputer systems – Liu and Gibson (PIU) 2nd Ed. Prentice Hall International Publications. 306261Microprocessor/Microcontroller Techniques.*

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Alloted(Hrs)	Marks Allotted(%)
1	10	16
2	16	22
3	15	22
4	12	18
5	17	22
Total	70	100

5.5.2 ELECTRICAL MACHINES

L T P
5 - 2

DETAILED CONTENTS

Unit I

Introduction: Basic Principle, Types and constructional features of electrical machines, torque, torque angle, basic electromagnetic laws, Induced EMF, Network Theorems, Superposition, Thevenin's, Norton's, Maximum Power Transfer, Reciprocity.

Transformers: Basic principle turns ratio, types and parts of a transformer, ideal transformer, transformer on no load & on load, phasor diagram, transformer reactance and equivalent circuit, losses, efficiency, all day efficiency, regulation, basic concept of 3 phase transformer.

Unit II

DC Machines: Principle, Constructional features, Types of DC machines, EMF and torque equations, circuit model, armature reaction, commutation, Types of armature winding, characteristics of dc motors, characteristics of dc generators, starting (3 point. & 4 point. starters), speed control methods, efficiency and applications.

Unit III

Induction Machines: Concept of rotating magnetic field in three phase, Construction & principle of operation. slip frequency, rotor currents, rotor MMF and torque production, equivalent circuit; torque slip characteristics, max. torque, starting torque, max. power output, starting; Principle of single phase induction motors, double field revolving theory, types of single phase induction motors.

Unit IV

Synchronous Machines: Construction and types, EMF equation, synchronous reactance, V-curve, OCC, SCC, SCR, Short circuit loss, conditions for parallel operation.

Special Motors: AC series motor, universal motor, reluctance motor, hysteresis motor, Brushless Motors, Switched reluctance motor and their applications.

RECOMMENDED BOOKS:

Author	Title	Publisher
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Text Books

Nagrath, Gopal	Theory of Electric Machines	TMH
B L Thareja	Electrical Machines, VOL II	S.Chand

Reference Books

Fitzgerald Kingsley	Electrical Machines	McGraw Hill
I J Nagrath & D P Kothari	Electrical Machines	TMH

List of Practical's

1. To find out the copper losses in Transformer (short circuit test).
2. To find out the Iron losses in Transformer (open circuit test).
3. To Plot the characteristics of DC motor.
4. To verify the Kirchhoff's Laws.
5. To verify the max power transfer theorem.
6. To verify the characteristics of Stepper Motor.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Alloted(Hrs)	Marks Allotted(%)
1	14	20
2	18	26
3	18	26
4	20	28
Total	70	100

5.6 PRACTICES IN COMMUNICATION SKILLS

L T P
- - 2

RATIONALE

For successful completion of diploma programme, the students should possess adequate command on language and communication skills so that they are able to express themselves with ease and felicity. The language used by the students should be appropriate to objectives and occasion. The contents of this subject shall provide them practical training through language laboratory.

LIST OF PRACTICAL EXERCISES

1. Exercises on phonetics
2. Group Discussion
3. Exercises on self-assessment using tools like SWOT analysis.
4. Internet communication
5. Correspondence
 - i) Resume writing
 - ii) Covering letter
 - iii) Follow-up correspondence
 - iv) Business Correspondence
6. Practice on listening skills.
7. Speaking exercises with emphasis on voice modulation (reading and extempore)
8. Demonstration and practice on Body language and Dress sense.
9. Exercises on etiquettes and mannerism in difficult situations like business meetings, table manners, telephone etiquette and manners related to opposite gender.
10. Mock interviews (telephonic/personal)
11. Cross-cultural Communication
12. Role play for effective Communication.
13. Exercises on wit and humor in conversations and creating lively environment.

6.1 BASICS OF MANAGEMENT

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3 - -

RATIONALE:

Diploma holders are expected to take up middle level managerial positions, their exposure to basic management principles is very essential. Some topics like Structure and ownership of Organization, Leadership, Motivation, Customer Relationship Management (CRM), Legal Environment of Business, Environmental Management, Accident and Safety: Total Quality Management (TQM), Intellectual Property Rights (IPR) etc. have been included in the subject.

DETAILED CONTENTS

1. **Introduction:** (12 hrs)
Definition and concept of management, functions of management- planning, organizing, staffing, coordinating and controlling. Various areas of management-
 - a. Human Resource Management(HRM)-Manpower recruitment and selection, induction , training and development and performance appraisal.
 - b. Financial Management- Meaning of financial management, its importance, various sources of finance- long term and short term. Concept of Internal Rate of Return(IRR), Net Present Value (NPV) and Average Rate of Return.
 - c. Marketing Management- Product life cycle, concept of pricing, promotion strategies- advertising, sales promotion and market research.
 - d. Material Management – Inventory management, concept of economic order quantity and waste management.

2. **Structure and Ownership of Organization:** (04 hrs)
Concept and structure of an organization, hierarchical management structure (top, middle and lower level management), functional management structure and matrix organizational structure. Types of business ownership (salient features)- Sole Proprietorship, Partnership, Joint Stock Companies and Cooperative Ownership.

3. **Leadership:** (02 hrs)
Meaning, importance , types of leadership and qualities of a good leader.

4. **Motivation:** (04 hrs)
Concept and importance of motivation-drives and incentives, types of motivation and theories of motivation- Abharam Maslow Theory and Herzberg Two Factor Theory.

5. **Customer Relationship Management:** (04hrs)
Need, various types of customers, customer satisfaction, Customer Satisfaction Index(CSI) and its significance in playing effective role of engineers in changing scenario.

6. **Legal Environment and Business:** (08 hrs)
 - a) Various labour laws and its necessity. Salient features of Income Tax Act – computation of income tax on salary income, Sales and Excise Tax Act-VAT & Excise duty and Factory Act. 1948.

- b) Labour Welfare Schemes including wage payment-types, system of wage payment and incentives.
- c) Intellectual Property Rights(IPR)- Concepts, infringements and remedies related to patents, copy rights, trademarks and designs.
- d) Accident and Safety- Meaning and concept of accident and safety, causes, safety precautions and various measures after accidents.

7. **Total Quality Management:** (04 hrs)
 Meaning and concept of Total Quality Management(TQM), various factors/measures to achieve TQM in an organization. Standards and Codes-National & International.

8. **Environmental Management:** (04 hrs)
 Concept of ecology and environment, factors contributing to air pollution, water pollution and noise pollution. Different measures to control pollution. Disaster management-features and measures.

INSTRUCTIONAL STRATEGY:

Generally the diploma holders occupy middle level managerial positions in an organization, therefore, their exposure to basic management principles is very essential. Accordingly students may be given conceptual understanding of different topics related to management. Some of the topics may be taught using question answer, assignment or seminar. The teacher will discuss success stories and case studies with students, which in turn, will develop appropriate managerial qualities in the students. In addition, expert lectures may also be arranged from within the institutions or from management organisations. Appropriate extracted reading material and handouts may be provided.

RECOMMENDED BOOKS:

1. *Principles of Management by Philip Kotler TEE Publication*
2. *Principles and Practice of Management by Shyamal Bannerjee: Oxford and IBM Publishing Co, New Delhi.*
3. *Financial Management by MY Khan and PK Jain, Tata McGraw Hill Publishing Co:: 7, West Patel Nagar , New Delhi.*
4. *Modern Management Techniques by SL Goel: Deep and Deep Publications Pvt Limited , Rajouri Garden, New Delhi.*
5. *Management by James AF Stoner, R Edward Freeman and Daniel R Gilbert Jr. : Prentice Hall of India Pvt Ltd, New Delhi.*
6. *Essentials of Management by H Koontz, C O' Daniel , Mc Graw Hill Book Company, New Delhi.*
7. *Marketing Management by Philip Kotler, Prentice Hall of India, New Delhi*
8. *Total Quality Management by Dr DD Sharma, Sultan Chand and Sons, New Delhi.*
9. *Intellectual Property Rights and the Law by Dr. GB Reddy.*
10. *Service Quality Standards, Sales & Marketing Department, Maruti Udyog Ltd.*
11. *Customer Relationship Management: A step-by-step approach, Mohamed & Sagadevan Oscar Publication, Delhi*
12. *Customer Relation Management, Sugandhi RK, Oscar Publication, Delhi*
13. *Environment Engineering by GN Pandey & GC Pandey, Tata McGraw Hill Publication.*

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	12	20
2	4	10
3	2	08
4	4	12
5	4	10
6	8	18
7	4	10
8	4	12
TOTAL	42	100

6.2 ANALYTICAL AND BIOMEDICAL INSTRUMENTS

L T P
5 - 2

Rationale

Analytical and Biomedical Instruments branch is used in the industries for checking and testing incoming or final product for quality and required specifications. The latest techniques such as laser, radioactive isotopes etc. have been included. Bio Medical Instruments are very important for the human treatment as they help to find the actual diseases in the human body. After careful inspection and real results doctors are able to treat the patient rightly. Bio-medical instrumentation industry is developing day by day, as well as these instruments are being installed in number of Public/Private medical centres. The instrumentation technician is the person who is to work with Bio-medical instruments and has to repair and maintain them in the medical centers. The knowledge gained in this subject will help the students to work in this field.

DETAILED CONTENTS

1. **INTRODUCTION:** Types of analytical methods, instruments for analysis, electromagnetic radiation, its properties and interaction with matter. Emission of radiation, its properties and interaction with matter.
2. **SPECTROSCOPY:** an introduction to absorption, spectroscopic, photometry, Beer Lambert, law. Application of photometry to analysis, UV, visible spectra photometry theory and instrumentation, application of UV, visible spectro photometry to qualitative and quantitative analysis. (Infrared spectro photometry theory and instrumentation IR instrument components, Single beam, Double beam recording type. Application to quantitative analysis, some typical instruments.
3. **FLAME EMISSION AND ATOMIC ABSORPTION SPECTROSCOPY: principles,** Instrumentation, Flames and Flame temperatures, Interferences, standard addition and internal standard methods of evaluation.
4. **Nuclear Magnetic Resonance spectroscopy:** Principles of NMR, Wavelength NMR, NMR Spectra, Chemical shift and hyper fine splitting, applications
5. **Electro-Mechanical Device.**
 - 5.1 Stethoscope-Construction, working and application.
 - 5.2 Blood Pressure Measuring equipment.-Construction, working, applications and trouble shooting.
 - 5.3 Microscope- construction, working and its applications in clinic labs.
 - 5.4 Incubators- construction, working and applications and troubleshooting.
 - 5.5 Pulse Monitor- Construction working, applications and troubleshooting.
6. **Electronic Equipment's.**
 - 6.1 ECG Machine-Construction, Block diagram, working, application and trouble shooting.
 - 6.2 EEG Machine- Construction, Block diagram, working application and trouble shooting.
 - 6.3 EMG Machine- construction, Block diagram, working application and trouble shooting.
 - 6.4 Cat Scanning- Principle of working, main components and applications.
 - 6.5 Clinic Analyzer- Analysis of blood, urine, cough etc.

7. **Study of Ultrasound equipments in the field of Bio -medical.**
Block diagram, Components, Generation of ultrasound

8. **Other Equipments.**

8.1 Pacemaker.

8.2 Defibrillator.

8.3 Centrifuge.

LIST OF PRACTICALS

1. Study of filter photometer.
2. Study of flame photometer.
3. Study of Spectrophotometer(visible and infra-red region).
4. Study of single beam spectrometer for U.V. VIS range.
5. Study of double beams spectrometer for U.V. VIS range.
6. Study of ECG Machine.
7. Study of EMG.
8. Study of EEG Trainer.
9. Study of Pulse Rate Monitor

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Alloted(Hrs)	Marks Allotted(%)
1	07	10
2	14	20
3	07	10
4	07	10
5	11	15
6	10	15
7	07	10
8	07	10
Total	70	100

6.3 ADVANCE CONTROL SYSTEM

L T P
5 - 2

RATIONALE:

The Subject enable the Students to study a broad range of Techniques and Technologies (PLC,DCS,SCADA) implemented in Industrial Process Control System .This is Usually deployed in addition to basic Process Controls and typically added subsequently to address particular Performance or economic improvement opportunities in the Process.

DETAILED CONTENTS

1 Programmable Logic Controllers:- Introduction, comparison with relay logic, solid state architecture, AC/DC input modules, AC/DC output modules, analog I/O cards with detailed specifications, Typical wiring to I/O modules, point to point wiring diagram, PLC configuration, drawing PLC power supplies, rack and slot configuration, PLC specifications.

2. PLC Programming:

2.1 Development of ladder diagram and flow diagrams for simple process like bottle filling, drill machine control, material handling, elevators, oven control, stirred tank reactor, Motor starting and dynamic braking of motor.

2.2 *PLC Programmer:* Interfacing to PC and PLC, programmer specifications (basic, logic, comparison, data, handling and math instructions) programming for typical applications, interfacing of PLC to Hydraulic and pneumatic system.

3. Distributed Control System (DCS):

- 3.1 DCS elements and applications
- 3.2 Functional Flow Block Diagrams (FFBD)
- 3.3 Advanced Regulatory Control (ARC)
- 3.4 Batch Process Control (ANSI/ISA-88)

4. Supervisory Control and Data Acquisition System(SCADA): SCADA System, Remote Terminal Unit (RTU),Telemetry System, Data Acquisition Server, HMI(Human Machine Interface),Supervisory System, Communication Infrastructure.

LIST OF PRACTICALS

1. *Develop a ladder logic Program for elevator.*
2. *Develop a ladder logic Program for oven control.*
3. *Develop a ladder logic Program for Stirrer Tank Control.*
4. *Develop a ladder logic Program for Drill Machine Control.*
5. *Develop a ladder logic Program for Switching of Lights.*
6. *Study of basic SCADA system.*
7. *Study of basic Flow lines & Electrical diagrams of DCS system.*

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Alloted(Hrs)	Marks Allotted(%)
1	23	32
2	22	32
3	12	18
4	13	18
Total	70	100

6.4 PROCESS CONTROL COMPONENTS

L T P
4 - 2

RATIONALE:

This curriculum contents has been designed to make the students know about the process control components. The relation between the final and primary components, functioning of various components. Wide coverage is given to various types of control valves and their applications. Knowledge of specification of various process components will help the students in industry for procurement.

DETAILED CONTENTS

1. **Principle of operation, constructional details and transfer function:** limit switches, potentiometer, synchro , auto transformer, servo motors(DC & AC), stepper motor, Magnetic amplifiers.
2. **Pneumatic Component:** Like flapper-nozzle system, bellow and Relay ,Lock up relays.
3. **Hydraulic components:** Principle of operation of hydraulic amplifier.
4. **Electro pneumatic relay:** Construction and application of relays.
5. **Control valves and actuators:**
 - 5.1 Concept and types of control valves. Characteristics of control systems.
 - 5.2 Principle of operation and constructional details of
 - 5.3 Solenoid Valves: Motor operated Valves, Diaphragm operated valves, power cylinders,-piston operated valves.
 - 5.4 Hand wheel actuator, control valve bodies and trim valves positioned ,sizing of control valves and it application.
 - 5.5 Symbols and Line Diagram of Process Control Instruments

PRACTICALS

- 1) *To demonstrate a simple system the principle of working of synchro.*
- 2) *To rig up driver, circuits for a stepper motor and verify its working by varying its speed.*
- 3) *To study an electro pneumatic relay.*
- 4) *To obtain the Input/ Output of an auto transformer.*
- 5) *To determine the characteristics of a control valve with positioner and without positioner.*

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted(%)
1	10	15
2	11	20
3	11	20
4	11	20
5	13	25
Total	56	100

6.5.1 INDUSTRIAL ELECTRONICS

L T P
4 - 2

RATIONALE:

Electronics adapted to industrial plant, in terms of timings action switching and action or parameter control, is called. Industrial Electronics. other common areas of application where electronics is increasing its interface with other branches of engineering include temperature control, welding control, speed regulation of motor and soldering. The student should study this subject with a view to understand the use of electronics to bring about faster and more accurate responses in industrial plants.

DETAILED CONTENTS

1. Thyristors: working principle-I characteristics, ratings and gate ratings. turn on methods - DC gate, AC Gate, Pulse gate triggering and R-C trigger circuits. turn off methods - Natural and forced turn off methods.
2. Internal power dissipation and need for heat sinks in thyristors. Definition of following terms and their relationship with the power dissipation of the device (no derivation).
 - 2.1 Heat sink efficiency
 - 2.2 Heat sink transfer co-efficient
 - 2.3 Heat dissipating area of a Heat Sink. Concept of thermal resistance of heat sinks. Various types of Heat Sinks and techniques of mounting device on heat sinks.
3. Principle of operation and working of the following switching circuits, using SCRs and Triacs
 - 3.1 Automatic Battery charger
 - 3.2 Voltage regulator
 - 3.3 Emergency light
 - 3.4 Alarm circuit
 - 3.5 Time delay relay circuit
 - 3.6 Circuits for over voltage and over current
4.
 - 4.1 Explanation of the working of a 3 phase half wave and full wave bridge rectifier with the help of waveforms.
 - 4.2 Explanation of working of following controlled rectifier using SCRs and resistive and inductive loads with the help of wave forms and appropriate mathematical expression (No. derivations).
 - 4.2.1 Single phase; half wave, full wave and bridge rectifier
 - 4.2.2 Three phase, half wave, full wave and bridge rectifier.
5. Principle of working of AC phase control circuit using triac and its applications.
6. Application of phase controlled rectifications and AC phase control circuits in:
 - 6.1 Illumination Control
 - 6.2 Fan speed control
 - 6.3 Temperature Control
 - 6.4 Speed control of DC and small AC motors
7. Principles of operation of Basic inverter circuits. Basic series and parallel commutated inverters.

8. Principle of working DC Chopper & AC Cycloconverter circuit using SCR and its applications.

LIST OF PRACTICALS

1. *V-I characteristics of SCR & TRIAC*
2. *Observation of wave shape and measurement of voltage relevant points of an SCR based single phase half wave controlled rectifier circuit using resistive (in phase gate triggering circuit).*
3. *Observation of wave shapes and measurement of voltages at relevant points of an SCR based single phase half wave controlled rectifier circuit using R-C phase shift gate triggering circuit.*
4. *Observation of wave shapes and measurement of voltages at relevant points of an SCR based single phase half wave controlled rectifier circuit using UJT relaxation oscillator for gate triggering.*
5. *Observation of wave shapes and measurement of voltage at relevant points of an SCR based single phase full wave controlled rectifier circuit.*
6. *Observation of wave shapes and measurement of voltage at relevant points of an SCR based single phase controlled bridge rectifier circuit.*
7. *Observation of wave shapes and measurement of voltage at relevant points in a triac based AC phase control circuit used for lamp intensity and/or AC fan speed control.*
8. *Observe the waveforms and measure voltages at various points of a circuit for over voltage protection using SCR*

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Alloted(Hrs)	Marks Allotted(%)
1	06	10
2	08	14
3	08	14
4	08	14
5	06	10
6	08	14
7	06	12
8	06	12
Total	56	100

6.5.2 MAINTENANCE AND TROUBLESHOOTING

L T P
4 - 2

RATIONALE:

The Subject enables the Students to have a wide exposure on Various Maintenance Procedures and developing troubleshooting skills .The Methods adopted for regular and Systematic Inspection ,replacement of Worn parts, materials and systems ensures good working order and high efficient output of the system. Troubleshooting helps in minimize Failure, saving time and money of organization also it is a learned skill based on Knowledge and personal experience .

DETAILED CONTENTS

1. INTRODUCTION:

Objective and areas of maintenance , Function and Scope of maintenance, safety at work place ,computerized maintenance information system.

- 1.1 Planned and Unplanned Maintenance
- 1.2 Breakdown and Preventive Maintenance
- 1.3 Calendar and Periodic Maintenance
- 1.4 Corrective and Preventive Maintenance
- 1.5 Opportunity Maintenance

2. MAINTENANCE PLANS: Tools and spares required, listing, procurement and storage, Maintenance plans, check lists, machine schedules and maintenance manuals, history-sheet, equipment log-book, breakdown intimation slip, job order ,work order.

3. MAINTENANCE RECORDS: Need for maintaining records, responsibility of preparing and storing records, time-frames for maintaining records, Importance in keeping the plant running, Effective maintenance and cost savings, Motivation factors in timely maintenance.

4. COMPONENT TESTING:

Component Symbols and Line Diagrams(Electrical, Electronics, Mechanical), Location of faults, checking, Replacement of different fuses ,lamps and lamps holders, switches, cables, cable connectors, relays, Identification and testing of variable components, diodes, Transistors(Active/Passive Components).

5. ENERGY AND ENVIRONMENT MANAGEMENT:

- 3.1 Concept of energy conservation ,neat and clean environment
- 3.2 Energy saving Measures and Devices
- 3.3 Air ,Water ,Noise Pollution
- 3.4 Laws and Acts for Environment
- 3.5 Fire and Prevention(Classification, Types of fire and fire extinguishers)

LIST OF PRACTICALS

1. *Preparation of Maintenance schedule of various shops of Institutional Workshop.*
2. *Maintenance & up keep of Laboratory inventory.*
3. *Maintenance & repair of various lab equipment 's,*
4. *Test and troubleshoot various Active/Passive Components in a circuit.*
5. *Handling of different types of fire extinguishers for different kind of fires.*

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Alloted(Hrs)	Marks Allotted(%)
1	17	30
2	09	15
3	09	15
4	13	25
5	08	15
Total	56	100

6.6 MAJOR PROJECT

L T P
- - 8

RATIONALE:

Major Project Work aims at developing innovative skills in the students whereby they apply in totality the knowledge and skills gained through the course work in the solution of particular problem or by undertaking a project. In addition, the project work is intended to place students for project oriented practical training in actual work situation for the stipulated period with a view to:

- i. Develop understanding regarding the size and scale of operations and nature of field-work in which students are going to play their role after completing the courses of study.
- ii. Develop understanding of subject based knowledge given in the classroom in the context of its application at work places.
- iii. Develop first-hand experience and confidence amongst the students to enable them to use and apply polytechnic/institute based knowledge and skills to solve practical problems related to the world of work.
- iv. Develop abilities like interpersonal skills, communication skills, positive attitudes and values etc.

The individual students have different aptitudes and strengths. Project work, therefore, should match the strengths of students. For this purpose, students should be asked to identify the type of project work, they would like to execute.

The activity of problem identification should begin well in advance (say at the end of second year). Students should be allotted a problem of interest to him/her as a major project work. It is also essential that the faculty of the respective department may have a brainstorming session to identify suitable project assignments for their students. The project assignment can be individual assignment or a group assignment. There should not be more than 3 students if the project work is given to a group. The project work identified in collaboration with industry should be preferred.

This practical training cum project work **should not be considered** as merely conventional industrial training in which students are sent at work places with either minimal or no supervision. This experience is required to be planned in advance and supervised on regular basis by the polytechnic faculty. For the fulfillment of above objectives, polytechnics may establish close linkage with 8-10 relevant organization for providing such an experience to students. It is necessary that each organization is visited well in advance and activities to be performed by students are well defined. The chosen activities should be such that it matches with the curricular interest to students and of professional value to industrial/ field organizations. Each teacher is expected to supervise and guide 5-6 students. Some of the project activities are given below:

- (1) - Study of a large size plant(Power Station, Cement etc.) and its controls.
- Prepare process flow and piping and instrumentation diagram of a section. Identify their various instruments, systems and control parameters, ranges, specification and makes of each item.

- (2) Design and rigging up of a simple control loop e.g.
 - Temperature control in oven.
 - Maintaining constant temperature in hot water tank.
 - Level control in a water tank.
 - Flow control in a pipe line.
 - Control of pressure in a pressurized vessel.
 - Maintaining a constant Ph of a solution by injection (acid or alkali).
- (3) - Design and making a simple on/off controller for temperature using ICs, capacitors, resistors on a printed circuits board
 - Design making simple automatic controller (Electronic/Pneumatic).
- (4) Design and alarm annunciation scheme for motor control (trip, supply, failure, overheating) and relishing the same in a control panel using relays, push button and lamps.
- (5) Design and fabricate a signal transmitter.
- (6) Design and fabricate a signal convertor.
- (7) Speed control of motor using feedback controller.
- (8) Automatic PCB drilling machine.
- (9) To interface the different types of controller/transmitter with computers.
- (10) Develop the software to operate given controller for different application.

NOTE:

The list is only the guideline for selecting a project, however a student is at liberty to select any other related project of his choice independently under guidance of his teacher.