5.1 PROCESS INSTRUMENTATION-II

L T P
4 - 2

RATIONALE

This course will enable the students to evaluate the complexity of different process variables in industry, which includes different process measuring instruments and related transducers. The course includes the measurement of parameters most commonly used in industry like flow, level, temperature, pressure, density, pH, viscosity, humidity etc.

DETAILED CONTENTS

1. Measurement of Flow (14 hrs)

   Construction and working principle of measurement with orifices, venturimeter, nozzle, pitot-tube, ultrasonic, vortex flow meters, turbine flow meters, electromagnetic flow meters and rotameter.

2. Measurement of Level (10 hrs)
   Construction, working principle and application of float, visual, purge, resistance probes, capacitance probes, ultrasonic.

3. Measurement of Temperature (12 hrs)
   Concept of temperature smeasurement devices, Constructional details, working principle and application of temperature sensors-thermocouple, RTDs, bimetallic, thermistors, radiation pyrometers.

4. Measurement of Pressure (16 hrs)
   Concept of absolute, gauge and differential pressure. Construction, working principle and application of pressure sensors-Bourden tube, bellows, diaphragm, capsules, manometers, pirani gauge, dead weight tester.

5. Measurement of density, pH, humidity, moisture and viscosity. (12 hrs)

LIST OF PRACTICALS

1) To measure flow using rotameter.
2) To measure flow using orifice.
3) To measure temperature using thermocouple.
4) To measure pH value of a given solution.
5) To measure temperature using RTD.
6) Study of various pressure elements & measurement of pressure using bourden tube.

7) To measure humidity by hygrometer.

8) Measurement of temperature using optical pyrometer.

9) Application of thermostat / bimetallic switch.

10) To measure level

INSTRUCTIONA STRATEGY:

Since the subject is of practical nature, it is suggested that teacher must take the students for visit of nearby process industry and show them different measurement devices. It is also recommended that various measurement devices may be brought in the lab for demonstration purpose. Student may be encouraged to explore the information on the Net.

RECOMMENDED BOOKS

1. Mechanical measurements by AK Sawhney; Dhanpat Rai and Co.,New Delhi

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

3. Process Control Instrumentation Technology by Johnson Curtis D ; John Wiley and Sons, New Delhi

4. Handbook of Applied Instrumentation by DM Considine

5. Mechanical measurement by Becwith and Buch ; Pearson

SUGGESTED DISTRIBUTION OF MARKS FOR FACILITATING THE PAPER SETTER

Sr. No.	Topic	Time Allotted (hrs)	Modified Percentage Weightage
1.	Measurement of Flow	14	25
2.	Measurement of Level	10	15
3.	Measurement of Temperature	12	20
4.	Measurement of Pressure	16	25
5.	Measurement of density, pH, humidity, moisture and viscosity.	12	15
Total		**64**	**100**

5.2 BIO-MEDICAL INSTRUMENTATION

L	T	P
4	-	2

RATIONALE

Recent advances in medical field have been fuelled by the instruments developed by the Electronics and Instrumentation Engineers. Pacemakers, ultrasound machine, medical diagnostic systems are few names, which have been contributed by engineers. Now health care industry uses many instruments, which are to be looked after by instrumentation engineers. This subject will enable the students to learn the basic principles of different instruments/equipment used in health care industry. The practical work done in this area will impart skill in the use, servicing and maintenance of these instruments/equipment. Proficiency in this area will widen the knowledge and skill of diploma holders in the field of biomedical instrumentation.

DETAILED CONTENTS

1. Introduction to Biomedical Instrumentation (06 hrs)

   Introduction, development of biomedical instrumentation, man-instrumentation system: its components, research and clinical instrumentation, in-vivo and in-vitro measurements.

2. Physiology (12 hrs)

   Introduction, physiological systems of the body: cardiovascular system, respiratory system, nervous system and bio-chemical system.

3. Bioelectric Signals and Electrodes (10 hrs)

   Study of bio-electric potentials, resting and action potentials. Bio-electrodes, electrode- tissue interface, contact impedance, types of electrodes.

4. Diagnostic Instruments (16 hrs)

   Brief study of the following:

   - Electro cardiograph(ECG)
   - Electro encephalograph (EEG)
   - Electro myograph (EMG)
   - Pacemakers
   - Defibrillators
   - spirometer, pulse oxymeter SPO2, NIBP (non invasive blood pressure), Glucometer

5. Bio-telemetry – Introduction. (03 hrs)

6. Intensive Care Unit (05 hrs)
Introduction, elements of intensive care unit (ICU).

7. Computer applications in biomedical devices. Computerized Axial Tomography(CAT) scanners.
(08 hrs)

8. Application of embedded system in Bio-medical instrumentation (04 hrs)

Note Field visits be arranged for students during the semester for exposure and better understanding of the subject

LIST OF PRACTICALS

1. To measure blood pressure of a person using analog and digital B.P. gauge.
2. To study the various physiological systems of the body.
3. To study the electrode-tissue interface and contact impedance.
4. To study the concept of EEG.
5. To study the concept of EMG.
6. Visit of Intensive Care Units (ICUs) of a hospital and to prepare a report.
7. Measurement of blood sugar of a patient using glucometer.
8. Measurement of heart beat with ECG machine using cardio-scope / ECG machine.
9. To study spirometer concepts & automation in diagnosis.

INSTRUCTIONAL STRATEGY

In addition to classroom teaching, maximum stress may be given on practical exposure in nearby hospitals, clinics, biomedical laboratories etc. Expert lectures may be arranged from field/organization related to biomedical instruments

RECOMMENDED BOOKS

1. Biomedical Instrumentation and Measurements by Cromwell; Prentice Hall of India, New Delhi.
2. Hand book of Medical Instruments by RS Khandpur.
3. Medical Electronics and Instrumentation by Sanjay Guha-University Publication.
4. Bio-Medical Instruments by KR Nahar

5. Introduction to Biomedical Equipment Technology by Carr, Pearson Education, Sector-62, Noida
6. Servicing Medical and Bio-electronic Equipment by Carl JJ.
7. Electronics for Medical Personnel by Buckstein

SUGGESTED DISTRIBUTION OF MARKS FOR FACILITATING THE PAPER SETTER

Sr. No.	Topic	Time Allotted (hrs)	Marks Allocation
1.	Introduction to Biomedical Instrumentation	6	05
2.	Physiology	12	25
3.	Bioelectric Signals and Electrodes	10	15
4.	Diagnostic Instruments	16	25
5.	Bio-telemetry – Introduction.	03	5
6.	Intensive Care Unit	05	10
7.	Biomedical computer applications. Computerized Axial Tomography (CAT) scanners. Application of embedded system in Bio-medical instrumentation	08	10
8.	Application of embedded system in Bio-medical instrumentation	04	5
Total		**64**	**100**

Elective – I

5.3 (a) ANALYTICAL AND ENVIORONMENTAL INSTRUMENTS

L	T	P
4	-	2

RATIONALE

Today the whole world is facing the problem of pollution. The pollution may be of air, water and noise. Whenever installation of a new industry takes place, problems of wastes and gases come in picture. It becomes essential to study different methods of analyzing the air and water in order to know their contaminants. Students will measure and check the different harmful constituents in air and water. After studying this subject, a student will be in a position to analyze and control the harmful pollutants.

DETAILED CONTENTS

1. Introduction (04 hrs)
   Fundamental blocks of analytical instruments (brief details)

2. Spectroscopic analysis (10 hrs)

   - Absorption spectroscopy
   - NMR spectroscopy
   - Mass spectroscopy

   (Brief concepts of all these methods)

3. Gas analysis (10 hrs)

   - Infra-red gas analyzer
   - Paramagnetic oxygen analyzers
   - Thermal conductivity analysis

   (Principles of working of these analyzers and block-diagram explanation only)

4. Gas Chromatography (09 hrs)

   - Introduction
   - Related instruments like injectors, oven, column and detectors.
   - Infra-red analyzers.

5. Liquid Analysis (09 hrs)

   - Principle of pH measurement

- Electrodes for pH measurement
- Electrochemical analyzer

6. Environmental pollution monitoring instruments (09 hrs)

- Air quality standards
- Types and measurement of concentration of various gas pollutants in atmosphere
- Dust measurement

7. Electrochemical instruments (09 hrs)

- Electrochemical cell
- Types of electrodes
- Conductivity meters
- Aqua meters

8. Instrumentation used for water and noise pollution and their monitoring (04 hrs)

LIST OF PRACTICALS

1. To find conductivity of a given solution
2. To measure total dissolved solutions in water
3. To measure oxygen content dissolve in water
4. Demonstration of mass spectrometer
5. Demonstration of gas chromatograph
6. To measure noise level
7. To study spectrometer
8. To study thermal conductivity gas analyzer.

INSTRUCTIONAL STRATEGY

Efforts should be made to keep relevant instruments in the laboratory. It will be preferred of students are taken to pollution control laboratories and shown the equipment used in the field.

RECOMMENDED BOOKS

1. Handbook of analytical instruments by R.S.Khandpur; Tata Mc Graw Hill Publishing Co. New Delhi

2. Principles of Instrumental Analysis by Dr DA Skoog

3. Introduction to Instrumental Analysis by Chhatwal

4. Handbook of Applied Instrumentation by DM Considine

5. Mechanical and Industrial Measurements by RK Jain; Khanna Publisher, New Delhi

SUGGESTED DISTRIBUTION OF MARKS FOR FACILITATING THE PAPER SETTER

Sr. No.	Topic	Time Allotted (hrs)	Marks Allocation
1.	Introduction	4	5
2.	Spectroscopic analysis	10	15
3.	Gas analysis	10	15
4.	Gas Chromatography	9	15
5.	Liquid Analysis	9	15
6.	Environmental pollution monitoring instruments	9	15
7.	Electrochemical instruments	9	15
8.	Instrumentation used for water and noise pollution and their monitoring	4	5
Total		**64**	**100**

Elective - I
5.3 (b) ROBOTICS

L	T	P
4	-	2

RATIONALE

Robotics is an important field of industrial automation involving instrumentation for sensor based intelligent robotics and example of application of instrumentation and control. Hence, the students are required to know this subject and its different applications.

DETAILED CONTENTS

1. Introduction To Robots (04 hrs)

   Fixed and flexible automation, definition of robot, history of robotics, advantages of robotics.

2. Fundamentals of robot technology (08 hrs)

   Robot anatomy, end-effectors, wrist; robot configuration, work space and work volume; hydraulic, pneumatic and electric driven, their applications; robot control systems – point to point control, continuous path control; Intelligent robot – spatial resolution, accuracy and repeatability of motion.

3. Robot control components (08 hrs)

   Position sensors – potentiometers, resolvers, encoders; Velocity sensors – tachometer; Actuators – pneumatic and hydraulic actuators, stepper motors, servomotors.

4. Robot end-effectors (08 hrs)

   Different types of end effectors – grippers, gripper mechanism, gripper force; consideration in gripper selection and design.

5. Robot sensors . (08 hrs)

   Tactile sensors-touch sensors, force/torque sensors, slip sensors; Proximity and range sensors – optical sensors, acoustic sensors, eddy current sensors

6. Robot programming (08 hrs)

   Robot programming techniques, defining position in space, motion interpolation, various commands, branching.

7. Robot languages (10 Hrs)

First generation, second generation and future generation languages, robot language structure, motion commands, end-effecter and sensor commands, communication and data processing, illustration of language features using robot language.

8. Robot Cells (04 Hrs)

Cell layouts, mobile robot cells, work cell control, interlock mechanisms, error detection and recovery.

9. Robot Applications (04 Hrs)

Material transfer, pick and place operations, machine loading/unloading applications, welding applications, assembly and inspection.

10. Social Implications (02 Hrs)

LIST OF PRACTICALS

1. To study different body and wrist joints of robot.
2. To study and realize robot motions such as point-to-point and continuous path motions.
3. To study the gripper mechanism by electrical/pneumatic drive system depending on the type of robot.
4. To develop small programs on a trainer robot for
   a) Pick and place an object.
   b) Pick and place work pieces of different kinds.
   c) Motion of robot in three axes i.e. X,Y & Z.
   d) Various control commands.

INSTRUCTIONAL STRATEGY

Realizing the pretty well the high cost of equipment in robotics Lab, it is suggested to use the similar lab existing in any of the nearby institutions or else visual lab may be established with the help of available technology/ software. Visit to related industries will certainly be a great help to students.

RECOMMENDED BOOKS

1. Industrial Robotics- Technology, Programming and Applications by Mike P Groover, Roger N Nagel; McGraw Hill International Editions.

2. Robotics-Control, Sensing, Vision and Intelligence by Fu Gonzalez, Lee by McGraw Hill Book Company.

3. Robotic Technology and Flexible Automation by SR Deb; McGraw Hill

SUGGESTED DISTRIBUTION OF MARKS FOR FACILITATING THE PAPER SETTER

Sr. No.	Topic	Time Allotted (hrs)	Mraks Allocation
1.	Introduction To Robots	4	5
2.	Fundamentals of robot technology	8	10
3.	Robot control components	8	15
4.	Robot end-effectors	8	10
5.	Robot sensors	8	15
6.	Robot programming	8	15
7.	Robot languages	10	15
8.	Robot Cells	4	5
9	Robot applications	4	5
10.	Social Implications	2	5
Total		**64**	**100**

5.4 PROCESS CONTROL

L	T	P
5	-	2

RATIONALE

This course will enable the students to study in detail different types of control devices used in instrumentation and will provide understanding of basic control loops and characteristics of various controllers.

The course also introduces various control mechanisms, modes and devices which are necessary to understand simple control systems in a process plant. The contents of the course have been selected and arranged so as to treat it in a logical manner, to understand the important laws of operation of industrial automatic control systems, to provide practical background of theory and to evaluate the effect of changes in process parameters on the control response.

DETAILED CONTENTS

1. Basic Control Loops and Characteristics (14 hrs)

   Basics of process control, process variables, single and multi capacity processes, single capacity level, pressure, temperature and flow loop systems. Process lag, measurement lag, transmission lag and dead time.

2. Controller Modes and Characteristics (14 hrs)

   Concept of on-off , proportional, integral, derivative, P+I,P+D and P+I+D controls, their examples and merits and demerits.

3. Electrical Control Elements (16 hrs)

   Construction and principle of operation of solenoids, stepper motor, limit switches, relays, auto transformer and magnetic amplifier.

4. Pneumatic and Hydraulic Control Elements (16 hrs)

   Pneumatic pressure supply, pneumatic actuator, pneumatic relay, electro-pneumatic relays, flapper-nozzle system and bellows. Hydraulic actuators and valves.

5. Control Valves (20 hrs)

   Principle of operation and constructional details of solenoid valve, diaphragm operated valve, butterfly valve, valve positioners. Control valve characteristics, their sizing and selection of valves.
   Temperature switches, Flow switches, Pressure switches, interlocking and sequencing circuits

Note:

Field visits to relevant industries or laboratories may be arranged for the students to show them control components physically. The teacher should also explain the salient features of control scheme used there.

LIST OF PRACTICALS

1. To find the differential gap of on-off control system
2. To rig up an electronic proportional controller unit
3. To rig up an electronic proportional integrated controller unit
4. To rig up an electronic PID controller and verify its working
5. To study the characteristics and controller specifications of different types of control valves and their repair and maintenance
6. To obtain the output of an electronic PID controller for a step, and ramp input for a proportional band of 50 percent
7. To study and obtain the input/output relationship of a pneumatic relay
8. To determine the characteristics of a control valve with positioner and without positioner
9. To determine the differential gap, amplitude, frequency of oscillation of an on-off thermal system
10. To determine the output response of a thermal PID control system for a step input when PI action is provided.
11. To study a control loop of tank level control using on-off control
12. To study the control loop of a boiler for temperature control
13. To study the control loop of a system of a flow control
14. To study the control loop of a system of pressure control
15. To study the feed forward, cascade and ratio control in a multi-loop control system

INSTRUCTIONAL STRATEGY

Along with theoretical inputs, visits to process plants must be organized where the students will be exposed to various types of control actions. Small projects in the form of control loops may be identified and given to students as assignments.

RECOMMENDED BOOKS

1. Process Control by Peter Harrot, Tata McGraw Hill Publishers, New Delhi
2. Automatic process control by Erckman DP ; John Wiley and Sons, New Delhi
3. Instrument Engineers Handbook by Liptik BG
4. Process Control Instrumentation Technology by Johnson Curtis D; John Wiley and Sons, New Delhi
5. Process Measurement and Analysis by Liptik BG
6. Handbook of Applied Instrumentation by DM Considine

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

8. PLC Botton

SUGGESTED DISTRIBUTION OF MARKS FOR FACILITATING THE PAPER SETTER

Sr. No.	Topic	Time Allotted (hrs)	Marks Allocation
1.	Basic Control Loops and Characteristics	14	15
2.	Controller Modes and Characteristics	14	20
3.	Electrical Control Elements	16	15
4.	Pneumatic and Hydraulic Control Elements	16	20
5.	Control Valves	20	30
Total		**80**	**100**

5.5 POWER ELECTRONICS

L	T	P
4	-	2

RATIONALE

Diploma holders in Electronics, Instrumentation and Control, and related fields are required to handle a wide variety of power electronic equipment used in process control Industry. This subject will provide the student basic understanding of the principles of their working. The practical training will further reinforce the knowledge and skill of the students.

DETAILED CONTENTS

1. Introduction to thyristors and other Power Electronics devices (18 hrs)

   a) Construction, working principles of SCR, two transistor analogy of SCR, V-I characteristics of SCR.
   b) SCR specifications and ratings.
   c) Different methods of SCR triggering.
   d) Different commutation circuits for SCR.
   e) Series & parallel operation of SCR.
   f) Construction & working principle of DIAC, TRIAC & their V-I characteristics.
   g) Construction, working principle of UJT, V-I characteristics of UJT. UJT as relaxation oscillator.
   h) Brief introduction to Gate Turn off thyristor (GTO), Programmable uni-junction transistor (PUT), MOSFET.
   i) Basic idea about the selection of Heat sink for thyristors.
   j) Applications - such as light intensity control, speed control of universal motors, fan regulator, battery charger.

2. Controlled Rectifiers (08 hrs)

   a) Single phase half wave controlled rectifier with load (R, R-L)
   b) Single phase half controlled full wave rectifier (R, R-L)
   c) Fully controlled full wave bridge rectifier.
   d) Single phase full wave centre tap rectifier.

3. Inverters, Choppers, Dual Converters and Cyclo converters. (16 hrs)

a) Principle of operation of basic inverter circuits, concepts of duty cycle, series and parallel. Inverters & their applications.

b) Choppers: Introduction, types of choppers (Class A, Class B, Class C and Class D). Step up and step down choppers.

c) Dual Converters and cyclo converters: Introduction, types and basic working principle of dual converters and cyclo converters and their applications.

4. Thyristorised Control of Electric drives (14 hrs)

a) DC drive control
   i) Half wave drives.
   ii) Full wave drives
   iii) Chopper drives (Speed control of DC motor using choppers)

b) AC drive control
   i) Phase control
   ii) Constant V/F operation
   iii) Cycloconverter/Inverter drives.

5. Uninterrupted Power supplies (08 hrs)

a) UPS, on-line, off line & its specifications

b) Concept of high voltage DC transmission

c) Concept of SMPS

LIST OF PRACTICALS

1) To plot VI characteristic of an SCR.
2) To plot VI characteristics of TRIAC.
3) To plot VI characteristics of UJT.
4) To plot VI characteristics of DIAC.
5) Study of UJT relaxation oscillator. And observe I/P and O/P wave forms
6) Observation of wave shape of voltage at relevant point of single-phase half wave controlled rectifier and effect of change of firing angle.
7) Observation of wave shapes of voltage at relevant point of single phase full wave controlled rectifier and effect of change of firing angle.
8) Observation of wave shapes and measurement of voltage at relevant points in TRIAC based AC phase control circuit for .
9) Varying lamp intensity and AC fan speed control.

10) Installation of UPS system and routine maintenance of batteries.
11) Speed control of motor using SCRs

INSTRUCTIONAL STRATEGY

Power Electronics being very important for industrial controls requires a thorough know how about industrial devices. Teacher should take to the class various SCRs and other semiconductor devices to demonstrate these to the students. The teacher may encourage students to perform practical simultaneously for better understanding of the subject and verification of theoretical concepts. So industrial visit in between the course is a must.

RECOMMENDED BOOKS

1) Power Electronics by P.S. Bhimbhra, Khanna Publishers, New Delhi
2) Power Electronics by P.C. Sen, Tata Mc Graw Hill Education Pvt Ltd. New Delhi
3) Power Electronics – Principles and Applications by Vithayathi, Tata Mc Graw Hill Education Pvt Ltd. New Delhi
4) Principles of Power Electronics by Kassakian, Pearson Education, Sector 62, Noida.
5) Power Electronics by M.S. Berde, Khanna Publishers, New Delhi.
6) Power Electronics by MH Rashid
7) Industrial Electronics and Control by SK Bhattacharya and S. Chatterji, New Age Publications. New Delhi
8) Power Electronics by S Rama Reddy, Narosa Publishing House Pvt. Ltd., New Delhi
9) Power Electronics by Sugandhi and Sugandhi
10) Power Electronics – Principles and Applications by J Michael Jacob, Vikas Publishing House, New Delhi

SUGGESTED DISTRIBUTION OF MARKS FOR FACILITATING PAPER SETTER

Sr No	Topic	Time Allotted (Hrs)	Marks Allotted%
1	Introduction to thyristors and other power electronics devices	18	30
2	Controlled Rectifiers	08	15
3	Inverters, Choppers, Dual Converters and Cyclo converters.	16	25
4	Thyristorised Control of Electric drives	14	20
5	Uninterrupted Power supplies	08	10
	Total	**64**	**100**

5.6 GENERIC SKILLS AND ENTREPRENEURSHIP DEVELOPMENT

L	T	P
3	-	-

RATIONALE

Generic Skills and Entrepreneurship Development is one of the courses from "Human Science" subject area. Generic skills have emerged as an important component of employability skills, which enable an individual to become and remain employable over lifetime and to lead happy and prosperous life. Entrepreneurship development aims at developing conceptual understanding for setting-up one's own business venture/enterprise. This aspect of Human Resource Development has become equally important in the era, when wage employment prospects have become meager. Both the subject areas are supplementary to each other and soft skills are required to be developed in diploma passouts for enhancing their employability and self confidence.

DETAILED CONTENTS

1. Introduction to Generic Skills (4 hrs)

   1.1 Importance of Generic Skill Development (GSD)
   1.2 Global and Local Scenario of GSD
   1.3 Life Long Learning (LLL) and associated importance of GSD.

2. Managing Self (8 hrs)

   2.1 Knowing Self for Self Development
   - Self-concept, personality, traits, multiple intelligence such as language intelligence, numerical intelligence, psychological intelligence etc.

   2.2 Managing Self - Physical
   - Personal grooming, Health, Hygiene, Time Management

   2.3 Managing Self – Intellectual development
   - Information Search: Sources of information
   - Listening: Effective Listening
   - Speaking: Effective Oral Communication
   - Reading: Purpose of reading, different styles of reading, techniques of systematic reading; Note Taking: Importance and techniques of note taking
   - Writing: Correspondence - personal and business

   Note: Practical sessions should be coupled with teaching of effective listening, speaking, reading and writing.

2.4 Managing Self – Psychological

- Stress, Emotions, Anxiety-concepts and significance (Exercises related to stress management)
- Techniques to manage the above

3. Managing in Team (6 hrs)
   - 3.1 Team - definition, hierarchy, team dynamics
   - 3.2 Team related skills- sympathy, empathy, co-operation, concern, lead and negotiate, work well with people from culturally diverse background
   - 3.3 Communication in group - conversation and listening skills

4 Task Management (3 hrs)
   - 4.1 Task Initiation, Task Planning, Task execution, Task close out
   - 4.2 Exercises/case studies on task planning towards development of skills for task management

5. Problem Solving (5 hrs)
   - 5.1 Prerequisites of problem solving- meaningful learning, ability to apply knowledge in problem solving
   - 5.2 Different approaches for problem solving.
   - 5.3 Steps followed in problem solving.
   - 5.4 Exercises/case studies on problem solving.

6. Entrepreneurship
   - 6.1 Introduction (22 hrs)
     - Concept/Meaning and its need
     - Competencies/qualities of an entrepreneur
     - Entrepreneurial Support System e.g., District Industry Centres (DICs), Commercial Banks, State Financial Corporations, Small Industries Service Institute (SISIs), Small Industries Development Bank of India (SIDBI), National Bank of Agriculture and Rural Development (NABARD), National Small Industries Corporation (NSIC) and other relevant institutions/organizations at State/National level.

   - 6.2 Market Survey and Opportunity Identification (Business Planning)
     - How to start a small scale industry
     - Procedures for registration of small-scale industry
     - List of items reserved for exclusive manufacture in small-scale industry
     - Assessment of demand and supply in potential areas of growth.
     - Understanding business opportunity
     - Considerations in product selection
     - Data collection for setting up small ventures.

   - 6.3 Project Report Preparation
     - Preliminary Project Report
     - Techno-Economic Feasibility Report
     - Exercises on Preparation of Project Report in a group of 3-4 students

INSTRUCTIONAL STRATEGY

This subject will require a blend of different teaching and learning methods beginning with lecture method. Some of the topics may be taught using question answer, assignment, case studies or seminar. In addition, expert lectures may be arranged from within the institution or from management organizations. Conceptual understanding of Entrepreneurship, inputs by teachers and outside experts will expose the students so as to facilitate in starting ones own business venture/enterprise. The teacher will discuss success stories and case studies with students, which in turn, will develop managerial qualities in the students. There may be guest lectures by successful diploma holding entrepreneurs and field visits also. The students may also be provided relevant text material and handouts.

RECOMMENDED BOOKS

1. Generic skill Development Manual, MSBTE, Mumbai.
2. Lifelong learning, Policy Brief (www.oecd.org)
3. Lifelong learning in Global Knowledge Economy, Challenge for Developing Countries – World Bank Publication
4. Towards Knowledge Society, UNESCO Paris Publication
5. Your Personal Pinnacle of Success by DD Sharma, Sultan Chand and Sons, New Delhi
6. Human Learning, Ormrod
7. A Handbook of Entrepreneurship, Edited by BS Rathore and Dr JS Saini; Aapga Publications, Panchkula (Haryana)
8. Entrepreneurship Development by CB Gupta and P Srinivasan, Sultan Chand and Sons, New Delhi
9. Handbook of Small Scale Industry by PM Bhandari

SUGGESTED DISTRIBUTION OF MARKS FOR FACILITATING THE PAPER SETTER

Sr. No	Topic	Time Allotted (hrs)	Marks Allocation (%)
1	Introduction to Generic Skills	4	5
2	Managing Self	8	15
3	Managing in Team	6	10
4	Task Management	3	10
5.	Problem Solving	5	10
6.	Entrepreneurship	22	50
	Total	**48**	**100**

5.7 MINOR PROJECT WORK

(Preferably Industry Oriented)

L	T	P
-	-	4

Note: The project may be identified at the end of 4th semester

Realising the great importance of students' exposure to world of work for his professional growth, two spells of industry oriented projects-minor and major have been included in the curriculum. It is necessary that teachers to play a pro-active role in planning and guidance of individual students for optimizing the benefits of the activity in stipulated time.

Minor project work aims at exposing the students to industrial/field practices so as to have an appreciation of size, scale and type of operations; and work culture in the industries. Also the students will be able to correlate concepts, principles and practices taught in the classroom with their application in solving field/industrial problems. The work done in minor project work will also prepare them in taking up problem solving at latter stage under major project work.

Depending upon the interests of the students and location of the organization the student may be asked to visit:

1. Process industries like Petrochemical Units/Fertilizers /Paper etc.
2. Various instrumentation industries.
3. Thermal power stations.
4. Electronics and Microprocessor based control system industries.
5. Medical electronics industries.
6. Repair and maintenance workshops.
7. Pressure measuring systems.
8. Digital display systems.
9. Calibration of different types of indicating instruments, measurement of process variables in industry.
10. Repair of different instruments being used in various laboratories.
11. Case study of process industries using PLC or DCS.

List of Minor Projects

1. Clamp switch
2. Power supply design
3. Smoke detector
4. Fine alarm

5. Metal detector
6. Rain Alarm
7. Fastest finger first
8. A Timer
9. Filters
10. Running Light Control
11. Message Display
12. Digital Alarm Clock
13. Street Light Control
14. PCB Design
15. Temperature Controller
16. Power Supply for Mobile
17. Multiple OIP Power Supply
18. Lab Experimental Trainer Board
19. On-Off Control
20. Use of for controlling speed of motors.

(This list is only suggestive, however other problems may also be identified depending on local industries)

For effective planning and implementation of the above, it is suggested that polytechnics / institutes should:

a) Identify adequate number of industrial/field organizations and seek their approval for deputing students for exposure/visits.

b) Prepare a workbook (which can be used by students) for guiding students to perform definite task during the above mentioned exposure.

c) Identify teachers who would supervise the students' activities and provide guidance on continuous basis during the above project work

The components of evaluation will include the following :

	Component	**Weightage**
a)	Punctuality and regularity	10%
b)	Initiative in learning new things	10%
c)	Relationship with others/workers	10%
d)	Project Report/ Technical report	50%
e)	Seminar based on Project	20%

PERSONALITY DEVELOPMENT CAMP

This is to be organized at a stretch for two to three days during fifth or sixth semester. Extension Lectures by experts or teachers from the polytechnic will be delivered on the following broad topics. There will be no examination for this subject.

1. Communication Skills
2. Correspondence and job finding/applying/thanks and follow-up
3. Resume Writing
4. Interview Techniques: In-Person interviews; telephonic interviews, panel interviews; group interviews and video conferencing etc.
5. Presentation Techniques
6. Group Discussions Techniques
7. Aspects of Personality Development
8. Motivation
9. Leadership
10. Stress Management
11. Time Management
12. Interpersonal Relationship
13. Health and Hygiene