5.1 EMPLOYABILITY SKILLS – I

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RATIONALE

The present day world requires professionals who are not only well qualified and competent but also possess good communication skills. Our diploma students not only need to possess subject related knowledge but also soft skills to get good jobs or to rise steadily at their work place. The objective of this subject is to prepare students for employability in job market and survive in cut throat competition among professionals.

DETAILED CONTENTS

1. Writing skills (08 hrs)

   i) Official and business correspondence
   ii) Job application - covering letter and resume
   iii) Report writing - key features and kinds

2. Oral Communication Skills (20 hrs)

   i) Giving advice
   ii) Making comparisons
   iii) Agreeing and disagreeing
   iv) Taking turns in conversation
   v) Fixing and cancelling appointments

3. Generic Skills (04 hrs)

   i) Stress management
   ii) Time management
   iii) Negotiations and conflict resolution
   iv) Team work and leadership qualities

5.2 POWER ELECTRONICS

L T P
3 - 3

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 (12 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, BJT, IGBT.
   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. (12 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 (10 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

c) μc based AC/DC drive control

5. Power Electronics Applications (06 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

Topic	Time Allotted (Hrs)	Marks Allotted%
1	12	30
2	08	15
3	12	25
4	10	20
5	06	10
Total	**48**	**100**

5.3 ANALYTICAL AND ENVIORONMENTAL INSTRUMENTS

L	T	P
4	-	3

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)

   - Theory of working of gas chromatograph8y and its components like injectors, oven, column and detectors

5. Liquid Analysis (09 hrs)

   - Principle of pH measurement
   - Electrodes for pH measurement

6. Control of Air Pollution by Equipment (09 hrs)

- Air and water quality standards
- Study of construction of working of cyclones, electrostatic precipitators, scrubbers, wet collectors

7. Electrochemical instruments (09 hrs)

- Measurement of smoke using Ringelnaur chart
- 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

6. Air Pollution and Control by M N Rao, Tata McGraw Hill

7. Air Pollution, Causes Effects and control by PK Goel, New Age.

SUGGESTED DISTRIBUTION OFMARKS

Topic	Time Allotted (hrs)	Marks Allocation (%)
1.	4	5
2.	10	15
3.	10	15
4.	9	15
5.	9	15
6.	9	15
7.	9	15
8.	4	5
Total	**64**	**100**

5.4 PROCESS INSTRUMENTATION

L	T	P
4	-	3

RATIONALE

With the advent of technological developments, more and more automation has been introduced in the modern industries. Industrial process is an emerging area in the field of Instrumentation. Industrial process measurement forms a key subject in this course of study. The inputs imparted through this subject will enable the students apprehend the various types of measurement techniques used in industrial process. The syllabus of this course has been designed in to provide insight to the students in the measurement of different process parameters in industry. The course contains different methods of measurement, their selection and limitations.

DETAILED CONTENTS

1. Introduction (10 hrs)

   Measurement of length, angle, area, working principle of vernier calipers, micrometer, comparator. Least count of each instrument

2. Measurement of Pressure , Torque, Power, Speed and Force (14 hrs)

   Various methods

3. Measurement of Stress and Strain (12 hrs)

   Strain gauges, their types, gauge factor, load cells, temperature compensation.

4. Measurement of Motion (8 hrs)
   Displacement, velocity, acceleration; seismic pickups.

5. Thickness Measurement (12 hrs)
   Thickness measurement by using:

   - Resistive method
   - Inductive method
   - Capacitive method
   - Ultrasonic method

6. Measurement of Density, pH, Humidity and Viscosity (8 hrs)

Note: Visits may be arranged in concerned industries.

LIST OF PRACTICALS

1. Measurement of speed using Tachometer.
2. Measurement of stress and strain using strain gauge/ load cell.
3. Study of various types of strain gauge and their construction.
4. To study the measurement system of pressure using Bouraion tube method
5. Study of torsion dynamometers for measurement of torque.
6. Measurement of acceleration torque by accelerometer.
7. Measurement of thickness using capacitive transducer.
8. To measure the pH value of given solution

INSTRUCTIONAL STRAGEGY

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 and Industrial Measurements by RK Jain, Khanna Publishers,New Delhi
2. Mechanical Measurement and Instrumentation by AK Sawhney, Dhanpat Rai and Co, NewDelhi
3. Electronic Instrumentation by H S Kalsi; Tata McGraw Hill.

SUGGESTED DISTRIBUTION OF MARKS

Topic	Time Allotted (hrs)	Marks Allocation (%)
1.	10	20
2.	14	30
3.	12	20
4.	8	10
5.	12	10
6.	8	10
Total	**64**	**100**

5.5 PROCESS CONTROL

L T P
4 - 3

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 (12 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 (8 hrs)

   Concept of on-off , proportional, integral, derivative, P, PI and PID controls, their examples, merits and demerits.

3. Electrical Control Elements (12 hrs)

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

4. Pneumatic and Hydraulic Control Elements (12 hrs)

   Pneumatic pressure supply, pneumatic actuator, pneumatic relay, pneumatic amplifiers, electro-pneumatic actuators, flapper-nozzle system and bellows, air filter and regulator. Hydraulic actuators and valves, electro hydraulic actuators

5. Control Valves (14 hrs)

   Principle of operation and constructional details of solenoid valve, diaphragm operated valve, globe valve, ball valve, butterfly valve, valve positioners. Control valve characteristics, their sizing and selection of valves.

6. Switches (8 hrs)

Temperature switches, Flow switches, Pressure switches, interlocking and sequencing circuits, need of interlocks, anaurciators.

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 PID controller and verify its working
3. To rig up an electronic proportional controller unit
4. To rig up an electronic proportional integrated controller unit
5.
6. To study the characteristics and controller specifications of different types of control valves and their repair and maintenance
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 study a control loop of tank level control using on-off control
10. To study the control loop of a system for a flow control
11. To study the control loop of a system for pressure control
12. To study the construction and working of a pressure switch
13. To study the construction and working of a temperature switch
14. To study the construction and working of a float type of level switch

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

Topic	Time Allotted (hrs)	Marks Allocation (%)
1.	10	15
2.	08	15
3.	12	15
4.	12	15
5.	14	25
6.	08	15
Total	**64**	**100**

5.6 ENVIRONMENTAL EDUCATION

L	T	P
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RATIONALE

Education about environment protection is a must for all the citizens. In addition, a diploma holder must have knowledge of different types of pollution caused by industries and construction activities so that he may help in balancing the eco system and controlling pollution by adopting pollution control measures. He should also be aware of environmental laws related to the control of pollution.

DETAILED CONTENTS

1. Definition, Scope and Importance of Environmental Education (02 hrs)

2. Basics of ecology, biodiversity, eco system and sustainable development (03 hrs)

3. Sources of pollution - natural and manmade, causes, effects and control measures of pollution (air, water, noise, soil, radioactive and nuclear) and their units of measurement (12 hrs)

4. Solid waste management – Causes, effects and control measures of urban and industrial waste (06 hrs)

5. Mining and deforestation – Causes, effects and control measures (04 hrs)

6. Environmental Legislation - Water (prevention and control of pollution) Act 1974, Air (Prevention and Control of Pollution) Act 1981 and Environmental Protection Act 1986, Role and Function of State Pollution Control Board, Environmental Impact Assessment (EIA) (10 hrs)

7. Role of Non-conventional Energy Resources (Solar Energy, Wind Energy, Bio Energy, Hydro Energy) (04 hrs)

8. Current Issues in Environmental Pollution – Global Warming, Green House Effect, Depletion of Ozone Layer, Recycling of Material, Environmental Ethics, Rain Water Harvesting, Maintenance of Groundwater, Acid Rain, Carbon Credits. (07 hrs)

INSTRUCTIONAL STRATEGY

The contents will be covered through lecture cum discussion sessions. In addition, in order to have more appreciation of need for protection of environment, it is suggested that different activities pertaining to Environmental Education like video films, seminars, environmental awareness camps and expert lectures may also be organized.

RECOMMENDED BOOKS

1. Environmental Engineering and Management by Suresh K Dhameja; SK Kataria and Sons, New Delhi.
2. Environmental Science by Dr. Suresh K Dhameja; SK Kataria and Sons, New Delhi.
3. Environmental and Pollution Awareness by Sharma BR; Satya Prakashan, New Delhi.
4. Environmental Protection Law and Policy in India by Thakur Kailash; Deep and Deep Publications, New Delhi.
5. Environmental Science by Deswal and Deswal; Dhanpat Rai and Co. (P) Ltd. Delhi.
6. Engineering Chemistry by Jain and Jain; Dhanpat Rai and Co. (P) Ltd. Delhi.
7. Environmental Studies by Erach Bharucha; UGC University Press.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%
1	02	04
2	03	06
3	12	24
4	06	12
5	04	10
6	10	20
7	04	10
8	07	14
Total	**48**	**100**

5.7 MINOR PROJECT WORK

(Preferably Industry Oriented)

L	T	P
-	-	3

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. Power supply design
2. Smoke detector
3. Fire alarm
4. Metal detector

5. Rain Alarm
6. Fastest finger first
7. A Timer
8. Message Display
9. Digital Alarm Clock
10. Street Light Control
11. PCB Design
12. Temperature Controller
13. Power Supply for Mobile
14. Lab Experimental Trainer Board
15. On-Off Control

(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 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