

## 5.1 PROCESS INSTRUMENTATION AND CONTROL

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### RATIONALE

This subject gives the knowledge of various instruments used to measure various process parameters. This course will impart knowledge on working principle, construction, repair and use of these instruments

### DETAILED CONTENTS

1. Introduction (32 hrs)
 

Importance of instruments in chemical process industry, general classification of instruments, indicating and recording type instruments, static and dynamic characteristics of instruments.

Description and construction details, working principle, range and application of following instruments:

  - a) Pressure and vacuum gauge: manometers, bourdon tube gauge, mcLeod gauge, pirani gauge (6 hrs)
  - b) Thermometer and Pyrometer: liquid expansion thermometer, bimetallic thermometer, thermocouple, resistance thermometer, optical and radiation pyrometer (8 hrs)
  - c) Liquid level meter: visual indicator, float actuated level meter, bubbler system, diaphragm box system (5 hrs)
  - d) Flow meters: Orifice meter, Venturimeter, Pitot tube, Rota meter (4 hrs)
  - e) Analyzers: pH meter, chemical composition analyzer, various types of analyzers i.e. oxygen analyzer, infra red analyzer, orsat analyzer (5 hrs)
2. Transmission (6 hrs)
 

Pneumatic and electrical transmission (Induction Transmission only) and their fields of application
3. Process Instrumentation (6 hrs)
 

Control centre, instrument diagrams, instrumentation in modern chemical plant
4. Basic concept of automatic process control, advantages of automatic control (6 hrs)
5. Types of feedback controllers: Proportional, Integral, Derivative and their combination and their applications in chemical industry (10 hrs)

6. Types of control valves-pneumatic: air to open, air to close, electronic, hydraulic  
(04 hrs)

### LIST OF PRACTICALS

1. Calibration of a pressure gauge
2. Calibration of a resistance thermometer
3. Calibration of a thermocouple
4. Study of on-off controller for temperature control
5. Study the characteristics of pneumatic control valve
6. Characteristics of a flapper nozzle system
7. Study of constructional detail of chart recorder
8. Study of constructional details of strip chart recorder

### INSTRUCTIONAL STRATEGY

The subject gives the knowledge of various process, instruments and controls to measure process parameters. So the theoretical knowledge of this subject should be properly imparted to the students with the help of practical examples. Each topic should be supplemented with examples.

### RECOMMENDED BOOKS

1. Industrial Instrumentation by Donald P Eckman, Wiley Eastern Publication
2. Principles of Industrial Instrumentation by D Patranabis, Tata McGraw Hill Publication, 2<sup>nd</sup> Edition, 1999
3. Process System Analysis and Control by Coughnour, McGraw Hill Publication, 2<sup>nd</sup> Edition, 1991
4. Industrial Instrumentation by SK Singh, Tata McGraw Hill Publication, 2<sup>nd</sup> Edition, 2007
5. Process Instruments and Controls Handboook by Considine, 2<sup>nd</sup> Edition, McGraw Hill , 1974
6. Process instrumentation and control by A.P Kulkarni, Nirali Publications

### SUGGESTED DISTRIBUTION OF MARKS

| Topic No. | Time Allotted (Hrs) | Marks Allotted (%) |
|-----------|---------------------|--------------------|
| 1         | 32                  | 50                 |
| 2         | 06                  | 10                 |
| 3         | 06                  | 10                 |
| 4         | 06                  | 10                 |
| 5         | 10                  | 15                 |
| 6         | 04                  | 05                 |
| Total     | <b>64</b>           | <b>100</b>         |

## 5.2 PLASTIC PROCESSING TECHNIQUES - II

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### RATIONALE

The purpose of this subject is to equip the students with the knowledge and competence in major industrially practiced processing techniques.

### DETAILED CONTENTS

1. Extrusion (14 hrs)

Basic principles, extrusion process, types and general features of extruders, types of screw, drive mechanism, die type, heating and cooling system, flow mechanism, process variables, extrusion process of blown and cast film, oriented and multilayer films, tube/pipe extrusion, material selection, downstream equipments in film and pipe extrusion, comparison of single and twin screw extrusion, venting system, factors affecting output of an extruder, fault-cause and remedies.
2. Blow Moulding (14 hrs)

Basic principles, process, material requirement, specification, types of blow moulding, processing parameters, parison programming, machine features, design guideline for product performance and appearance, cycle time, limitation, part trimming and handling, blowing the parison, melt behaviour, clamping, heating and cooling system, mould venting, fault; causes and remedies.
3. Compression Moulding and Transfer Moulding (14 hrs)

Principle, process, machine specification, material recommendation, bulk factor, moulding powder, reforms and preheating techniques, process variables, flash mould, positive mould, semi-positive mould, flow characteristics and curing time, mould heating and cooling system, types of processes, trouble shooting, moulding of thermoplastics and thermoset material.

Principles of Transfer Moulding- Machine and Mould used, moulding cycle, press capacity, types of transfer moulding, heating requirement, fault-causes and remedies.
4. Rotational Moulding (08 hrs)

Basic principle, material selection, types of machine, process variables, charge size, wall thickness control, heating and cooling system, process requirement for the moulding of water tank- dust bin etc., application of rotational moulding, ejection and finishing, fault-causes and remedies.

5. Forming (06 hrs)  
Thermoforming and vacuum forming basic methods, laminate forming, high pressure and low pressure laminates, types of sheets, multi product formation, fault and remedies.
6. Calendaring (04 hrs)  
Process, material used, advantages of calendaring over extrusion, types of calendar, coating by calendaring, surface finishing
7. Fibre Re-inforced Plastics (04 hrs)  
Introduction, different processes used in FRP, advantages of FRP, different types fillers used in FRP (Carbon fibers, boron fibers, natural fibers, manmade fibers, glass fibers and fibre materials)

### **LIST OF PRACTICALS**

1. To study the moulding of various products by compression moulding
2. To study the compression moulding machines
3. To study the moulding of various products by Transfer moulding
4. To study the Transfer moulding machines
5. To study the vacuum forming machine and make a product using this machine.
6. To study the thermoforming machine and make product on this machine
7. To study the casting of nylon/anylin/polyster materials
8. To study the process of FRP and make a product using hand lay up process
9. To make a sheet using the process of calendaring
10. To study the effect of various parameters on compression and transfer moulding

### **INSTRUCTIONAL STRATEGY**

Local industry visit should be undertaken.

### RECOMMENDED BOOKS

1. SPI Engineering Hand book by Frados
2. Plastic processing by Radian
3. Moulding of plastics by NM Bekalis
4. Plastic Engineering Hand book by Michael L. Berins
5. Plastic processing Data Hand book by Rosato and Rosato
6. Plastic processing by Groth and Schott
7. Surface coatings by Swaraj Paul.

### SUGGESTED DISTRIBUTION OF MARKS

| Topic No.    | Time Allotted (Hrs) | Marks Allotted (%) |
|--------------|---------------------|--------------------|
| 1            | 14                  | 20                 |
| 2            | 14                  | 20                 |
| 3            | 14                  | 20                 |
| 4            | 08                  | 10                 |
| 5            | 06                  | 10                 |
| 6            | 04                  | 10                 |
| 7            | 04                  | 10                 |
| <b>Total</b> | <b>64</b>           | <b>100</b>         |

### 5.3 COMPUTER APPLICATION IN POLYMER INDUSTRY

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#### RATIONALE

During the past decade, the use of computers in education has been growing at fast rate. The time has now come when engineering technician has to familiarize himself with computers to enable him to cope with inevitable computerization of a significant portion of his job. This subject is very helpful for the students who want to pursue their carrier in the field of designing.

#### DETAILED CONTENTS

1. 3D Design:  
3D views, 3D Modelling, Solid Toolbar, Solid editing tool bar, concept of surface modeling (using Auto CAD with latest version)
2. Interface with mould flow and mould creator software: surface modeling, core cavity generation, analysis on assemblies..
3. Interface with solid works software: Sketching and creation of solids, assemblies of different parts, creating different mould designs..
4. Advanced CAD/CAM Technology: NC, DNC, CNC systems, benefits of CAD, steps involved in CAM & Tool Design.

#### RECOMMENDED SOFTWARE

1. AutoCAD latest version
2. Solid works/cosmes works
3. Mould Creator
4. Mould Flow

## 5.4 ENGINEERING AND SPECIALITY POLYMERS

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### RATIONALE

This subject gives a detailed description of polymeric materials in category of thermoplastics, thermosets and elastomers. The student acquires the knowledge of advanced engineering and speciality polymers so that he/she can select the right type of materials for processing to make the product.

### DETAILED CONTENTS

1. Advanced thermosets, epoxies: their raw material, reactions involved, chemical structure and applications, polyurethanes (10 hrs)
2. Raw materials, chemical structure and applications of engineering thermoplastics – polycarbonates, polyamides, PEEK, poly phenylene oxide, acetals (10 hrs)
3. Reinforced plastics – principles of composite reinforcement, types of reinforcements (particulate, fibres and layered materials), effect of reinforcement on strength of plastics. Role and nature of binders and coupling agents, properties and applications of fibres in reinforcement (glass and carbon). Miscellaneous fillers (Talc, mica, Calcium Carbonate  $\text{CaCO}_3$ , glass, beads). Properties and applications of FRPs (un-saturated polyesters, epoxies, PU, nylon) (14 hrs)
4. Polymer blends and alloys – Definition, advantages of polymer blends and alloys, role of composition, properties and applications of parameters for compability, PVC – Nitrile rubber, ABS-PVC and PP-EPDM (06 hrs)
5. High performance polymers – polytetrafluoroethylene, Teflon, polysulphones, liquid crystalline polymers, polyphenyl sulphide. (10 hrs)
6. Preliminary concept of new materials such as conducting polymers, bio-polymers, octo-electronic plastics, nano-polymeric materials and plastics in biomedical applications, interpenetrating polymer networks, polymer concretes (14 hrs)

### INSTRUCTIONAL STRATEGY

Speciality polymers should be shown to the students in the classroom or the products manufactured from them, their application should be explained to students.

**RECOMMENDED BOOKS**

1. Polymer Science & Technology by Premamoy Ghosh
2. Polymer Blends and Alloys by Arends
3. Polymers Science & Technology by JR Fried
4. Plastics Materials by Brydson, PHI Publication
5. Engineering Polymers by Dyson, PHI Publication
6. Polymer Materials and Processing by Jean Michael Charrier

**SUGGESTED DISTRIBUTION OF MARKS**

| <b>Topic No.</b> | <b>Time Allotted (Hrs)</b> | <b>Marks Allotted (%)</b> |
|------------------|----------------------------|---------------------------|
| 1                | 10                         | 10                        |
| 2                | 10                         | 15                        |
| 3                | 14                         | 25                        |
| 4                | 06                         | 10                        |
| 5                | 10                         | 15                        |
| 6                | 14                         | 25                        |
| <b>Total</b>     | <b>64</b>                  | <b>100</b>                |

## 5.5 MOULD DESIGN-II

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### RATIONALE

A diploma holder in Plastic Technology is engaged in manufacturing Plastic components for which design of moulds and dies is essential. This subject will impart them requisite knowledge and skills in design of moulds and dies.

### DETAILED CONTENTS

1. Compression moulds: Method of feeding by weights, by volume and pellets or pre form. (04 hrs)
2. Multi impression compression mould: cavity calculation and number of impression: curing time, breathing time, Temperature range. (08 hrs)
3. Types of compression mould: Positive, semi positive and open flash type mould. (04 hrs)
4. Transfer mould: Its type, pot type, plunger type (bottom plunger & top plunger) requirement of transfer mould over compression mould, pot calculation, cull, bulk factor. (08 hrs)
5. Methods of moulds heating : By filament heater, cartage heater, band heater, induction heating, oil heating, calculation for heating cap. (06 hrs)
6. Blow mould: extrusion blow mould, design of blow mould, neck, cavity and pinch-off. mould shrinkage: mould cooling and different mould material (ferrous and nonferrous) (06 hrs)
7. Stretch blow mould: Pre-form and its design , neck and cavity design. (06 hrs)
8. Vacuum forming, thermo forming, mould design, mould material and cavity design. Rotational mould design, regular and irregular. (06 hrs)

### LIST OF PRACTICALS (Minimum Drawing Sheets-9)

1. Compression mould design, positive and semi-positive and open flash type with detail and assembly. (minimum drawing sheets- 3 nos.)
2. Transfer mould design with detail and assembly. (minimum drawing sheets- 3 nos.)
3. Blow mould design with detail and assembly. (minimum drawing sheets- 3 nos.)

## INSTRUCTIONAL STRATEGY

Students should gather practical knowledge about designing of electrical switches, plastic bottles and other liquid packaging plastic containers.

## LIST OF RECOMMENDED BOOKS

1. Compression and Transfer Moulding, by Bobb
2. Injection and Transfer Moulding and Plastic Mould Design, by Boven and Robinson.
3. Plastic Processing Data Handbook by Rosato and Rosato.
4. Blow Moulding by Fischer, Itiffe London, Publication.
5. Extrusion of Plastics by Fisher, Itiffe Landon Publication

## SUGGESTED DISTRIBUTION OF MARKS

| Topic No.    | Time Allotted (Hrs) | Marks Allotted (%) |
|--------------|---------------------|--------------------|
| 1            | 04                  | 10                 |
| 2            | 08                  | 15                 |
| 3            | 04                  | 10                 |
| 4            | 08                  | 15                 |
| 5            | 06                  | 15                 |
| 6            | 06                  | 15                 |
| 7            | 06                  | 10                 |
| 8            | 06                  | 10                 |
| <b>Total</b> | <b>48</b>           | <b>100</b>         |

## 5.6 MINOR PROJECT WORK

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Minor project work aims at exposing the students to field practices, size and scale of operation at practical sites. For this purpose, students are required to solve preferably an industrial problem related to plastic industry.

### LIST OF INDUSTRIES

1. DIPLAST, Mohali
2. Clear Plastic Ltd., Baddi
3. Time Packaging Ltd; Baddi
4. Nikon Plastic Ltd; Baddi
5. Adinath dyeing Ludhiana
6. Polyfibre Chandigarh
7. Bakelite Hylam , Delhi
8. Umitech Plastic Ltd., Kurali
9. Flex industries, Noida
10. Hitkari Industries Ltd., Parwanoo, Distt. Solan, HP
11. Polyplastics, Industrial Area, Yamunanagar, Punjab

A detailed project report of the problem solved is to be prepared. The students should be supervised and guided by respective subject teachers. Each teacher may guide a group of four to five students.

This minor project work will carry 100 marks and it is to be evaluated by the subject teacher along with the HOD/expert from industry. The components of evaluation will include the following:

- |    |                                   |     |
|----|-----------------------------------|-----|
| a) | Punctuality and regularity        | 15% |
| b) | Initiative in learning new things | 15% |
| c) | Relationship with peers           | 15% |
| d) | Project report                    | 55% |

### **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 Interview' 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