

**SHIVAJI UNIVERSITY KOLHAPUR**



**COMMUNITY COLLEGE**

**Syllabus**

*For*

**Diploma in Cast Iron Foundry Technology**

**To be implemented from Academic Year 2014-2015 onwards**

**Diploma in Cast Iron Foundry Technology**

## **STRUCTURE OF SYLLABUS:**

**To be implemented from the academic year 2014-2015**

### **1. Title of the course: DIPLOMA IN CAST IRON FOUNDRY TECHNOLOGY**

#### **2. Preamble of the syllabus:**

The proposed curriculum is with the view to make it more contextual, industry affable and suitable to cater the needs of society and nation in present day context. The committee examined the nature of the existing syllabus of various courses in foundry technology and after analysing other curricula of existing universities in respective subjects in terms of content, relevance, quality and pattern of teaching and examination, has synthesized the present proposal. After guidance from industry professionals, consultants and senior faculty, feedbacks from the core faculty and intensive discussions the syllabus is suitably finalized.

The syllabus needs revision in terms of preparing the student for the professional scenario with relevance to practical needs and requirements. A holistic approach includes providing industry training via on job training/internships, handling live projects, visits to foundry units. Regular expert's interaction will help to build a bridge between students and industry.

Technical advancement is the key to a substantial teaching system in today's world and thus a great responsibility lies on the curriculum to prepare students to rise to meet global standards and align seamlessly to changing trends.

#### **3. Objectives:**

To enable the students-

- To promote understanding of basic facts and concepts in foundry process while retaining the excitement of foundry industry.
- To make students capable of studying foundry technology in academic and Industrial courses.
- To expose the students to various emerging new areas of foundry technology and apprise them with their prevalent in their future studies and their applications in various spheres of manufacturing technology.
- To develop problem solving skills in students.
- To expose the students to different processes used in Foundry Industries and their applications.
- To develop ability and to acquire the skill and knowledge of terms, facts, concepts, processes, techniques and principles of foundry industries.
- To develop ability to apply the skill and knowledge of contents of principles of foundry technology.
- To inquire of new skill and knowledge of foundry technology and developments therein.
- To expose and to develop interest in the fields of foundry technology.

#### 4. Duration:

The duration of the Diploma Course will be of **one year**. The final Diploma certificate will be awarded only after completion of one year course.

The suggested credits for each of the award are as follows:

| Awards                                      | Normal calendar duration  | Skill Component Credits | General Education Credits |
|---|---------------------------|-------------------------|---------------------------|
| Certificate in Foundry Technology.          | Three Months              | 09                      | 06                        |
| Advanced Certificate in Foundry Technology. | Six Months (One Semester) | 18                      | 12                        |
| Diploma in Foundry Technology.              | One Year (Two Semesters)  | 36                      | 24                        |

As per UGC guidelines General Education Component should not exceed 40% of the total curriculum.

Credits can be defined as the workload of a student in

1. Lectures
2. Practicals
3. Seminars
4. Private work in the Library/home
5. Examination
6. Other assessment activities.

The following formula should be used for conversion of time into credit hours.

- a) One Credit would mean equivalent of 15 periods of 60 minutes each, for theory, workshops / labs and tutorials;
- b) For internship /field work, the credit weightage for equivalent hours shall be 50% of that for lectures/workshops;
- c) For self-learning, based on e-content or otherwise, the credit weightage for equivalent hours of study should be 50% or less of that for lectures/workshops.

#### 5. Eligibility:

The eligibility condition for admission shall be **10+2 or equivalent**, in any stream from any recognized board or university.

#### 6. Medium of Instruction:

The medium of instruction of the course will be **English/Marathi**.

#### 7. Pattern: Semester Pattern.

## 8. Examination:

### A. Scheme of examination:

- The semester examination will be conducted at the end of each term (both theory and practical examination)
- Theory paper will be of 50 marks for semester examination. The practical examination will be of 150 marks and industrial practical training/project work of 50 marks in the practical.
- Question papers will be set in the view of the entire syllabus and preferably covering each unit of the syllabus.

For each award the scheme of examination will be as below.

| Paper Number | Title of the Paper<br>(For Semester I) | Certificate<br>Course Marks. | Advance Certificate<br>Course Marks<br>Semester -I |
|--------------|--|------------------------------|--|
| I            | English for Business Communication-I   | 25                           | 50   |
| II           | Introduction to Foundry                | 25                           | 50   |
| III          | Engineering Materials.                 | 25                           | 50   |
| IV           | Pattern Construction Technology.       | 25                           | 50   |
| V            | Moulding Technology.                   | 25                           | 50   |
| TOTAL        |  | 125                          | 250  |

A. The practical examination for **Certificate Course** will be of 100 marks.

| Sr. No. | Practical examination | Marks | Internal Assessment      | Marks |
|---------|-----------------------|-------|--------------------------|-------|
| 1       | Practical             | 60    | Projects/ Industry Visit | 25    |
| 2       | Journal               | 10    |                          |       |
| 3       | Oral                  | 05    |                          |       |
| Total   |                       | 75    |                          | 25    |

B. The practical examination for **Advance Certificate Course** will be of 200 marks.

| Sr. No. | Practical examination | Marks | Internal Assessment      | Marks |
|---------|-----------------------|-------|--------------------------|-------|
| 1       | Practical             | 120   | Projects/ Industry Visit | 50    |
| 2       | Journal               | 15    |                          |       |
| 3       | Oral                  | 15    |                          |       |
| Total   |                       | 150   |                          | 50    |

The total weightage of first term i.e. one semester is of 450 marks, the details of which are-

| Sr. No. | Title                     | Marks |
|---------|---------------------------|-------|
| 1       | Theory Examination 50 X 5 | 250   |

|   |                        |            |
|---|------------------------|------------|
| 2 | Practical Examination. | 150        |
| 3 | Internal Assessment    | 50         |
|   | <b>TOTAL</b>           | <b>450</b> |

- For the **Certificate** course of three months duration, the examination will be conducted by the college. **The certificate will be awarded by the college.**
- For the **Advance Certificate** course of six months duration, the examination will be conducted by Shivaji University as Semester-I Examination and the **certificate will be awarded by the college.**
- For the Diploma course of one year duration, the examination will be conducted by Shivaji University as Semester-I and Semester-II and the **Diploma will be awarded by the college.**

### **B. Nature of question paper:**

For the **papers II to V** there will be in all **SEVEN** questions in each paper of which any **FIVE** should be solved. All questions will carry equal marks i.e. each question will be of 10 marks.

General nature of the question paper will be:

| <b>Question Number</b> | <b>Type</b>  |                      |
|------------------------|--------------|----------------------|
| Q.1                    | Short answer | Any two out of three |
| Q.2,3,4,5,6            | Long answer  | No internal options. |
| Q.7                    | Short notes  | Any two out of three |

### **C. Standard of Passing:**

To pass the examination a candidate must obtain at least 35% (i.e 18 marks out of 50) in individual subjects, in internal assessment and University examination each in all theory and practical subjects.

**D. External Students:** Not applicable as this is a practical oriented course.

**9. University Term:** As per academic calendar of the university

**For the first year i.e. Diploma in Foundry Technology practical examination and theory paper assessment will be done at college level.**

### **10. List of equipment and instruments:**

1. Universal sand testing machine
2. Sieve analyser.
3. Mold hardness teller.
4. Molding meter.
5. Demonstrative Cupola
6. Rapid moisture teller.

7. Electric Muffle (1000<sup>o</sup>c)
8. Muller (Sand mixing)
9. Metallurgical Microscope = 5/6
10. Metallurgical Microscope with image analysis software = 1
11. Belt abrasive grinder.
12. Bend saw.
12. Cut- off wheel.
13. Lapping wheel for metallography.
14. Coal fired /Gas fired Furnace.

### 11. Workload:

Each skill based paper will have **three theory** periods per week. There are **four practical** per week. Each practical will be based on skill based papers i.e. paper no. II, III, IV and V. The practical batch will have 20 students.

The total workload for one batch will be:

|   |   |                       |
|---|---|-----------------------|
| 1. <b>One Paper</b> on General Education:             | = | 06 Theory Periods.    |
| 2. <b>Four Papers</b> on skill based Education: 4 X 3 | = | 12 Theory Periods.    |
| 3. <b>Four Practical</b> work per week: 4 X 4         | = | 16 Practical periods. |
| 4. <b>Project Work</b> per batch per week:            | = | 02 Periods            |

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**TOTAL            36 Periods.**

Working hours will be 5 hours (300 minutes) per day i.e. six periods each of 50 minutes.

### 12. Laboratory Safety Equipments:

#### Part I: Personal Precautions:

1. All persons must wear safety Goggles at the time of Practicals/Training times.
2. Must wear **Lab Aprons / Lab Jacket** and proper shoes.
3. Except in emergency, over – hurried activities is forbidden.
4. Fume cupboard must be used whenever necessary.
5. Eating, Drinking and Smoking in the laboratories strictly forbidden.

#### Part II: Use of Safety and Emergency Equipments:

1. First aid Kits
2. Sand bucket
3. Fire extinguishers (dry chemical and carbon dioxide extinguishers)
4. Material Storage cabinet with proper ventilation
5. Material Safety Date sheets.
6. Management of Local exhaust systems and fume hoods.
7. Sign in register if using instruments.

### 13. MEMORANDUM OF UNDERSTANDING (MOU):

The purpose of this MOU is to clearly identify the roles and responsibilities of each party (i.e. college and industry partner) as they relate to the implementation of the **Diploma in Foundry Technology** at the college.

It is recommended to sign at least **TWO MOU** with the industry partners in the related field.

## **Diploma in Cast Iron Foundry Technology- Course structure**

### **General Structure:**

The diploma course has two semesters; each one is of 450 marks. There will be five theory papers for each semester having 50 marks each.

### **SEMESTER – I**

- |   |             |
|---|-------------|
| 1) Paper-I: Business Communication- I         | - 50 Marks. |
| 2) Paper-II: Introduction to Foundry          | - 50 Marks. |
| 3) Paper-III: Engineering Materials.          | - 50 Marks. |
| 4) Paper-IV: Pattern Construction Technology. | - 50 Marks. |
| 5) Paper-V: Moulding Technology.              | - 50 Marks. |

### **SEMESTER – II**

- |   |             |
|---|-------------|
| 1) Paper-I: Business Communication-II     | - 50 Marks. |
| 2) Paper-II: Quality Control              | - 50 Marks. |
| 3) Paper-III: Melting Technology.         | - 50 Marks. |
| 4) Paper-IV: Gating System and Riserling. | - 50 Marks. |
| 5) Paper-V: Casting Processes.            | - 50 Marks. |

There will be practical examination for each semester. The practical examination will be conducted in **two days** each of six hours. It will be of 150 marks of which 30 marks are reserved for oral and journal. The internal assessment includes industry training via internships, handling live projects, visits to foundry units etc.

### **SYLLABUS**

N. B.

- (i) Figures shown in bracket indicate the total lectures required for the respective units.
- (ii) The question paper should cover the entire syllabus. Marks allotted to questions should be in proportion to the lectures allotted to respective to units.
- (iii) All units should be dealt with S.I. units.
- (iv) **Industrial training / tour / visit per semester is compulsory.**
- (v) Use of recent editions of reference books is essential.
- (vi) Use of Scientific calculator is allowed.

## SEMESTER – I

### GENERAL EDUCATION:

#### **Paper – I: Business Communication-I**

**Total Workload:** 06 lectures per week of 60 mins.

#### **Distribution of Workload:**

Theory: 04 lectures per week

Practical: 02 lectures per week per batch of 20 students

#### **Units Prescribed for Theory:**

40 Marks.

#### **Unit 1: Use of English in Business Environment**

##### **Topics:**

Business Vocabulary: Vocabulary for banking, marketing and for maintaining public relations

What is a sentence?

Elements of a sentence

Types of sentence: Simple, compound, complex

#### **Unit 2: Writing a Letter of Application and CV/ Resume**

##### **Topics:**

Structure of a letter of application for various posts

CV/ Resume and its essentials

#### **Unit 3: Presenting Information/Data**

##### **Topics:**

Presenting information/data using graphics like tables, pie charts, tree diagrams, bar diagrams, graphs, flow charts

#### **Unit 4: Interview Technique**

##### **Topics:**

Dos and don'ts of an interview

Preparing for an interview

Presenting documents

Language used in an interview

#### **Practical: Based on the theory units**

10 Marks.

#### **Reference Books:**

Sethi, Anjane & Bhavana Adhikari. *Business Communication*. New Delhi: Tata McGraw Hill Tickoo, Champa & Jaya Sasikumar. *Writing with a Purpose*. New York: OUP, 1979.

Sonie, Subhash C. *Mastering the Art of Effective Business Communication*. New Delhi: Student Aid Publication, 2008.

Herekar, Praksh. *Business Communication*. Pune: Mehta Publications, 2007.

Herekar, Praksh. *Principals of Business Communication*. Pune: Mehta Publications, 2003.



Rai, Urmila & S. M. Rai. *Business Communication*. Mumbai: Himalaya Publishing House, Pradhan, N. S. *Business Communication*. Mumbai: Himalaya Publishing House, 2005. Pardeshi, P. C. *Managerial Communication*. Pune: NiraliPrakashan, 2008.

**Pattern of a Question Paper**

**B. Voc. Part-I**

**Business Communication-I**

**Semester –I Paper: I**

**Time: 2 hours**

**Total Marks: 40**

- |      |  |    |
|------|--|----|
| Q. 1 | Do as directed. Question items on <b>Unit 1</b> to be asked.<br>(10 out of 12)                               | 10 |
| Q. 2 | Write a letter of application.<br>OR<br>Draft a CV/ Resume for a particular post.                            | 10 |
| Q. 3 | Present a given information or data using a table/ chart/ pie diagram, etc<br>(Any one diagram to be drawn.) | 10 |
| Q. 4 | Fill in the blanks in the given interview.   | 10 |

**Practical Evaluation:**

**10 Marks**

Oral and Presentation based on the units prescribed.

**SKILL BASED PAPERS:**

**Paper –II: INTRODUCTION TO FOUNDRY**

**1.0. Foundry equipment:**

**10 Hrs.**

Molding lines, mould and metal handling equipment, mullers, pollution control equipment, Ladles, furnaces

**2.0 Foundry automation:**

**10 Hrs.**

Automated equipment like Intensive sand mixtures, Metal charging devices like skip hoist, EOT, Bucket charging, Metal pouring from ladles, Monorails and cranes etc.

**3.0 Raw Materials:**

**10 Hrs.**

Basic information about foundry, Raw materials- Sand, Scrap, ferrous and non-ferrous alloys, Constituent of moulding sand, additives, binder, Kinds of moulding sand/properties of moulding sand.

**4.0. Furnaces:**

**20 Hrs.**

Principle of induction furnace, Furnaces for melting of Iron-Induction furnace , Purpose of heat treatment, various heat treatment processes hardening, tempering, annealing, normalizing, case hardening(elementary idea),Furnaces for heat treatment, Furnace Structure, lining material& lining procedure for furnace, furnace efficiency, furnace atmosphere.

**Reference Books:**

**Recommended Books**

| <b>Title</b>                                   | <b>Author(s)</b> | <b>Publisher</b>          |
|--|------------------|---------------------------|
| <b>Text</b><br>Principle of Foundry Technology | PL Jain          | S. Chand & Co, New Delhi  |
| <b>Reference</b><br>Workshop Technology        | Chapman          | Pitman Publishers, London |
| Foundry Technology                             | Srivastava       | SK Kataria and Sons       |
| Foundry Technology                             | Gupta            | Charotar Publishing       |

**Paper –III: ENGINEERING MATERIALS**

**1.0. Ferrous metals: 10Hrs.**

Physical and mechanical properties viz. strength, elasticity, ductility, toughness, malleability, brittleness, hardness, stiffness, fatigue, Classification of iron and steel; pig iron, cast iron, wrought iron, steel, alloy steel, stainless steel and carbon steels.

**2.0. Non- ferrous metals: 10Hrs.**

Non- ferrous metals, Introduction to metals aluminium, copper, zinc, lead, tin, nickel and magnesium and their alloys; physical and mechanical properties of all the above alloys.

**3.0. Engineering plastics and fiber: 10Hrs.**

Important sources of plastics, Classification – thermoplastic and thermosetting, Various trade names of engineering plastics, Fiber and their classification: Inorganic and organic fibers, Usage of fiber. Plastics; Introduction, types of plastics, properties, composition and their applications.

**4.0. Insulating material 10Hrs.**

Various heat insulating material and their usage like asbestos, glass wool, cork, puf, china clay, thermocole, various electrical insulating material and their use like china clay, leather, bakelite, ebonite, glass wool, rubber felt. Composite materials: Introduction, properties and application.

**5.0. Refractories: 10Hrs.**

5.1. Definition, classification and properties of Refractories.

5.2. Manufacture of Refractories.

5.3. Testing of refractories

- Specific gravity



10. Fundamental of metal casting by P.C.Mukherji
11. Introduction to foundry technology by Ekay Winter
12. Foundry technology - O.P. Khanna S. Chand & Co
13. Workshop Practice II – HazraChaudharyKhanna Publisher.

**Paper – V: MOULDING TECHNOLOGY**

**1.1 Conventional Sand moulding: 6Hrs.**

Hand moulding with green sand using natural binders like clay, use of mechanical ramming aids & mould manipulation dry sand process, loam sand moulding, use of cow dung, Bentonites dextrin core oils & molasses as binder, mould washers Skin drying of moulds.

**1.2 Moulding Machine: 7Hrs.**

Use of moulding machines, jolt squeeze, jolt squeeze & slinger, insertion of cores, power computation, type of flask equipment, preparation of sand cycle, mulling of the sand, flow charting special moulding/core making process, Use of plaster of Paris & cement as a moulding material carbon dioxide process, shell moulding & metal moulds, gravity & pressure die casting, V moulding processes.

**1.3 Mould Quality: 6Hrs.**

Role of quality & packaging of sand. Mould hardness variation, Strength of mould & core enforcement, core floatation, use of chaplets for supporting cores, use of chills, mass hardness & hard spots. Defects like scabs & rat tails, storage of mould & moisture pick up.

**1.4 Functions & design of mould: 6Hrs.**

Function of cavity, components of mould, gating system & risers, Directional solidification of metals, streamlined pouring of mould, maintenance of metal purity, Rigging and shake out, recycling of sand, reclamation of sand.

**2.0. Core Making: 25Hrs.**

- 2.1 Importance and requirement of cores, Core making materials.
- 2.2 Core sand, its ingredients and properties.
- 2.3 Binders & machines used in core making.
- 2.4 Types of Cores, Core making processes.
- 2.5 Core venting, Core baking by different methods.
- 2.6 Finishing of Cores. Core setting chaplets.
- 2.7 Core sand disposal.

**Reference Books:**

1. Principles of Metal casting - R. Heine & Rosenthal, TMH
2. Foundry Engineering - Howard F. Taylor, Wiley Eastern Ltd.
3. Test book of foundry technology - M.Lal & O.P. Khanna, Dhanpat Rai & Sons.
4. Foundry Engineering - T.R. Banga, R.L. Agrawal & T. Manghnani
5. Foundry technology - K.P. Sinha & D.B. Goel, Standard Publishers & Distributors.
6. Foundry Engineering - P.L. Jain. TMH.
7. Applied metallurgy - S. Burton.

8. Metal Casting Technology - P.C. Mukherjee, Oxford & IBH
9. Principal of foundry technology by P. L. Jain
10. Fundamental of metal casting by P.C.Mukherji
11. Introduction to foundry technology by Ekay Winter

## **SEMESTER II**

### **GENERAL EDUCATION PAPER:**

#### **B. Voc. Part-I (Diploma) Business Communication-II**

**Semester –II                      Paper: VI**

**Total Workload: 06 lectures per week of 60 mins.**

**Distribution of Workload:**

Theory:            04 lectures per week  
Practical:        02 lectures per week per batch of 20 students

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**Units Prescribed for Theory:**

**Unit 5:            Group Discussion**

**Topics:**

Preparing for a Group Discussion  
Initiating a Discussion  
Eliciting Opinions, Views, etc.  
Expressing Agreement/ Disagreement  
Making Suggestions; Accepting and Declining Suggestions  
Summing up.

**Unit 6: Business Correspondence**

**Topics:**

Writing Memos, e-mails, complaints, inquiries, etc.  
Inviting Quotations  
Placing Orders, Tenders, etc.

**Unit 7: English for Negotiation**

**Topics:**

Business Negotiations  
Agenda for Negotiation  
Stages of Negotiation

**Unit 8: English for Marketing**

**Topics:**

Describing/ Explaining a Product/ Service  
Promotion of a Product  
Dealing/ bargaining with Customers  
Marketing a Product/ Service: Using Pamphlets, Hoardings, Advertisement,  
Public Function/ Festival

**Practical:        Based on the theory units**

**Reference Books:**

Herekar, Praksh. *Business Communication*. Pune: Mehta Publications, 2007.  
Herekar, Praksh. *Principals of Business Communication*. Pune: Mehta Publications, 2003.  
John, David. *Group Discussions*. New Delhi: Arihant Publications.

Kumar, Varinder. *Business Communication*. New Delhi: Kalyani Publishers, 2000.  
Pardeshi, P. C. *Managerial Communication*. Pune: NiraliPrakashan, 2008.  
Pradhan, N. S. *Business Communication*. Mumbai: Himalaya Publishing House, 2005  
Rai, Urmila& S. M. Rai.*Business Communication*. Mumbai: Himalaya Publishing House, 2007.  
Sethi, Anjane&BhavanaAdhikari.*Business Communication*. New Delhi: Tata McGraw Hill.  
Soni, Subhash C. *Mastering the Art of Effective Business Communication*. New Delhi: Student Aid Publication, 2008.  
Tickoo, Champa& Jaya Sasikumar.*Writing with a Purpose*. New York: OUP, 1979.  
Whitehead, Jeffrey & David H. Whitehead. *Business Correspondence*. Allahabad: Wheeler Publishing, 1996.

**Pattern of a Question Paper**  
**B. Voc. Part-I**  
**Business Communication-II**

**Semester –II**                      **Paper: VI**

**Time: 2 hours**

**Total Marks: 40**

- |      |  |    |
|------|--|----|
| Q. 1 | Fill in the blanks in the following Group Discussion.<br>(On <b>Unit 5</b> ) (10 out 12)             | 10 |
| Q. 2 | Attempt <b>ANY ONE</b> of the following ( <b>A</b> or <b>B</b> ):<br>(On <b>Unit 6</b> )             | 10 |
| Q. 3 | Fill in the blanks with appropriate responses:<br>(On <b>Unit 7</b> )                                | 10 |
| Q. 4 | Attempt <b>ANY ONE</b> of the following ( <b>A</b> or <b>B</b> ):<br>(On <b>Unit 8</b> ) (10 out 12) | 10 |

**Practical Evaluation:**

**10 Marks**

Oral and Presentation based on the units prescribed.

## SKILL BASED PAPERS:

### **Paper –II: INSPECTION TESTING AND QUALITY CONTROL:**

**1.1 Inspection:** Introduction, Types of Inspection, Macro and Micro Inspection, Charting the Inspection Program. **04 Hrs.**

**2.0 Dimensional Metrology:** Measuring Instruments such as Verniercaliper, Micrometer, Vernier height gauge, Dial indicator their principles and working, Least count etc. **05 Hrs**

**3.0 Destructive Testing:** Tensile Test, Hardness test and Impact test, casting defects their causes and remedies. Comparison between Destructive and non-destructive testing. **08 Hrs**

**4.0 Non Destructive Testing:** Ultrasonic testing, radiographic testing, dye penetrate test, Magnetic particle testing their principles and working **08 Hrs.**

**5.0 TESTING IN FOUNDRY** **25 Hrs.**

- Spectrometer machine for chemical composition checking.
- Hardness testing machine for hardness test Metallurgical microscope
- Portable microscope, field microscope
- Techniques for microscopic observation For sand testing-Permeability meter
- Sieve shake, core hardness tester, hot shell tensile tester
- Stick point core gas determinator, stick point tester
- Clay washer, sand rammer, peel back.

### **Paper – III MELTING TECHNOLOGY**

**1.1 Melting of primary and secondary metals:** **10Hrs.**

Basics of melting scrap and smelting, handling and characterization of scrap, cleaning and bailing charge preparation control and charge balance, general methods of charging in furnaces, changes for SG cast iron.

**1.2 Melting technology:** **10Hrs.**

Role of flux; Reducing agents; Air reductants and chemical additives, in the furnaces; types and, selection of furnaces suitable for specific metals; cupola, induction, rotary, pit furnaces-their operation and nature\characteristics of product there from; role of temperature and superheat; acid, basic and neutral operations; post melting treatment and air furnaces; melting of various types of cast iron, steel, aluminum, brass, SG cast iron.

**1.3 Composition control and melt quality:****10Hrs.**

Importance of metal cleanliness; endogenous and exogenous inclusions; need of formation of right quality and nature of slag; oxygen, chlorine or argon blowing to improve melt quality; role of temperature and super heat.

**1.4 Efficient Operation:****10Hrs.**

Control of fuel consumption, quality of fuel coke in context to sulphur and ash, use of hot blast cupola; method of producing hot blast. Use of recuperators and regenerators, regulation control of power input into the furnaces, comparison of power input into different furnaces.

**1.5 Handling of liquid metal:****10Hrs.**

Different methods to consume liquid metal, ingot, pigging, power production, casting etc. economical output, management of liquid metal; handing devices, preheating of ladles ; use of vacuum assisted equipment for degasification, killing and rimming of steels, inoculation in SG cast iron and its control.

**Paper – IV GATING SYSTEM AND RISERING:****1.0 GATING SYSTEM:****25Hrs.**

- 1.1: Components of gating system- Pouring basin, down sprue, sprue well, runner bar, skimbob and ingates : Significance and function.
- 1.2: Types of gating: Top gate, bottom gate and parting gates.
- 1.3: Steps in design of gating area, calculations of pouring time, Runners and ingates for ferrous and non-ferrous alloys.
- 1.4: Importance and determination of dimensions of passages i.e gating ratio.

**2.0 RISERING SYSTEM:****25Hrs.**

- 2.1 Function of risers/ feeders in compensating shrinkage in metals and alloys during solidification.
- 2.2 Riser types, shapes, sizes and locations.
- 2.3 Designing of risers using Cain's method, modulus method, Inscribed circle method.
- 2.4 Directional solidification: Use of padding, exothermic material, use of chills. Riser neck.

**Paper –V CASTING PROCESSES:****1.0 CASTING****35Hrs.**

- 1.1 Sand Casting,
- 1.2 Advantages of special casting techniques over sand casting method.
- 1.3 Plaster mold casting,



- 1.4 Permanent mold casting,
- 1.5 Die casting - Gravity and pressure die casting, Hot chamber and cold chamber.
- 1.6 Centrifugal casting,
- 1.7 Shell mold casting,
- 1.8 Investment casting,
- 1.9 CO<sub>2</sub> process of casting,
- 1.10 Continuous process.

## **2.0 CASTINGS DEFECTS:**

**15Hrs.**

Causes and remedies of following defects

- 2.1 Blow holes, Gas holes, Pin holes,
- 2.2 Scabs, Hots tears, Cold cracks, Shrinkage cavity.

### **Reference Books:**

1. Principles of Metal casting - R. Heine & Rosenthal, TMH
2. Foundry Engineering - Howard F. Taylor, Wiley Eastern Ltd.
3. Test book of foundry technology - M.Lal & O.P. Khanna, Dhanpat Rai & Sons.
4. Foundry Engineering - T.R. Banga, R.L. Agrawal & T. Manghnani
5. Foundry technology - K.P. Sinha & D.B. Goel, Standard Publishers & Distributors.
6. Foundry Engineering - P.L. Jain. TMH.
7. Applied metallurgy - S. Burton.
8. Metal Casting Technology - P.C. Mukherjee, Oxford & IBH
9. Principal of foundry technology by P. L. Jain
10. Fundamental of metal casting by P.C. Mukherji.

### **SUGGESTED LIST OF PRATICALS:**

For each semester, at least 15 practicals related with the theory subjects should be taken. Some of the practicals are suggested below.

1. Study of different foundry tools & their functions.
2. Study of different melting units (furnace) present in the laboratory/industry.
3. Preparation of various types of patterns: Study of types of Patterns. Making of Pattern. Pattern making tools & equipment. Design of pattern & pattern making. At least one wooden pattern with proper calculations.
4. Preparation of moulding sand. Making a green sand mould. One mould each on pit. Moulding & split pattern. At least two for different type of components with core and without core to be made.
5. Preparation of different moulds using different types of patterns.
6. Testing of moulding and core sand. Sand testing experiments to determine:
  - Grain Fineness Number
  - Green Strength

- Permeability Test • Moisture content test

6. Preparation of cores for hollow castings. Making of CO<sub>2</sub> mould and core. Making of shell mould and core. Prepare No-bake mould and core. Demonstration of types of cores.

7. Demonstration of die casting, centrifugal casting process.

8. Study, understanding and working of simple destructive & non-destructive testing Procedures used for castings.

9. Visit to foundry to study foundry processes like furnace operations, pattern making and moulding. Study of automation processes, Layout, Material handling equipment & other processes with preparation of report.

10. Melting of metal in furnace. Study of Oil Fired furnace, Gas Fired furnace, Electrical Heating furnace, Rotary Furnace.

11. Study of Medium Frequency Induction Furnace (Coreless) detailing regarding lining material and crucibles.

12. Study of Vacuum Induction Melting Furnace.

13. Study of Holding Furnace (Indirect Heating)

14. Study of various types of gates.

15. Study of various types of risers.

16. Case study of design of gating system and riser

17. Study of various methods of the S.G. Iron production.

18. Crucible Melting of Al

19. Study of the modification of the Al-Si. Alloys.

20. Foundry practice for Aluminum alloys.

21. Production of Cu and Cu alloy castings

22. Production of Mg & Zn base casting alloys.

### **INDUSTRIAL TRAINING:**

The purpose of industrial training is to offer wide range of practical exposures to latest practices, equipment and techniques used in the field. This training programme will help the student in acquiring hands on experiences of various practices and events required to perform in different job situations. Through the industrial training the students are given an opportunity to develop psychomotor skills and problem solving ability.

The industrial Training has basically the following three components:

1. Orientation Programme
2. Industrial Training in the Industry

### 3. Report Writing and Evaluation

**General Objectives:** The student will be able to,

- Read and Interpret Drawing
- Observe different types of processes in ferrous / non-ferrous foundry.
- Study and develop methoding of casting.
- Identify casting defects and provides remedies.
- Study the available manuals.
- Develop history sheet for various processes/product.

**Activities to be carried out during training:**

1. Student should visit each section of the foundry/foundry department
2. Observe the processes, tools, machinery and equipment used
3. Observe testing of castings at each stage
4. Study drawings and interpret the drawings
5. Study the organisational structure of the company
6. Study the product development from raw material to finished goods
7. Observe safety norms adopted
8. Prepare a report on a case study which includes all the components referred above.

**Training Report:**

The students will have to go for industrial training in all the sections of foundry. After training the student is required to prepare a report on the following points:

- Details of the industry
- Layout of the foundry- different sections
- List of equipments in each section
- Organizational structure of the industry
- Description of major processes
- Quality measures adopted in the industry
- Safety norms and there implementation
- One detailed case study- from component drawing to finished casting.