

## GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT

### COURSE CURRICULUM COURSE TITLE: FOUNDRY TECHNOLOGY (Code: 3342101)

Diploma Programme in which this course is offered	Semester in which offered
Metallurgy Engineering	4 <sup>th</sup> Semester

#### 1. RATIONALE

Casting like forging is one of the oldest methods of production as compared to fabrication and machining. In some situations casting is still preferred method for production as compared to other methods due to its simplicity and low capital cost involved as well as low cost of production. There are varieties of materials, and processes involved in casting. However, this labour intensive process is also moving towards automation for increasing rate of production and reducing cost. Moreover, techniques such as injection moulding have made this process high-tech. Metallurgy engineers are therefore required to have knowledge and skills in this area. Diploma level metallurgy engineers are expected to supervise the foundry operations involving pattern making, sand preparation, mould making, metal melting, alloying and casting, etc. This course focuses on knowledge and skills of various types of casting process, equipment, principle and their relative merit and demerit.

#### 2. COMPETENCY

The course content should be taught and curriculum should be implemented with the aim to develop required skills in students so that they are able to acquire following competencies

- **Plan and supervise production in foundry with quality using knowledge and skills of foundry operations of pattern making, sand preparation, mould making, metal melting, alloying and casting.**

#### 3. COURSE OUTCOMES

The theory should be taught and practical should be carried out in such a manner that students are able to acquire required learning out comes in cognitive, psychomotor and affective domain to demonstrate following course outcomes.

- i. Explain application of casting processes.
- ii. Explain design and allowances of pattern
- iii. Describe the process of core, mould and core, mould making
- iv. Explain solidification of metal & alloy

#### 4 TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	PA	ESE	PA	200
4	0	4	8	70	30	40	60	

**Legends:** L - Lecture; T - Tutorial/Teacher Guided Student Activity; P - Practical; C - Credit; ESE - End Semester Examination; PA - Progressive Assessment

## 5 COURSE DETAILS

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
<b>Unit – I Introduction to Foundry</b>	1a. Describe various casting process 1b. Explain section & layout of foundry process 1c. Explain application of casting process.	1.1 Advantage of casting over other manufacturing processes. 1.2 Introduction, principle and type of foundry 1.3 List the different section and layout of foundry. 1.4 Different raw materials used in foundry. 1.5 Applications of metal casting.
<b>Unit – II Pattern and Pattern making</b>	2a. Describe different types of pattern used in metal casting 2b. Explain design and allowances of pattern 2c. Identify colour code of pattern	2.1 Difference between pattern and casting 2.2 Introduction, function, material used for Pattern making 2.3 Types of patterns used in metal casting. 2.4 Design and allowance of pattern 2.5 Colour codes of pattern.
<b>Unit – III Mould and core making</b>	3a. prepare moulding sand for making mold 3b. perform different type of test on moulding sand. 3c. Describe the process of core and core making 3d. describe process of mould and mould making	3.1 Types, principle and properties of moulding sand. 3.2 Additives and binder used in moulding sand 3.3 Testing of moulding sand like, moisture content test, clay content test, grain fineness test, permeability test, dry and green sand compressive, shear strength test 3.4 Function ,characteristic, process and types of core and core making 3.5 Function, characteristics, process and types of mould and mould making
<b>Unit – IV Gating and riser</b>	4a. Describe the types of gating systems 4b. Explain process of gating systems 4c. Describe process of riser systems	4.1. Requirement, purpose, characteristics of gating system. 4.2. Types of gating system. 4.3. Gating ratio, pressurized and unpressurised gating system. 4.4. Introduction, Function, importance and types of riser.
<b>Unit – V Melting and Solidification</b>	5a. Describe various type of melting furnaces 5b. Explain solidification of metal & alloy 5c. Describe different types of cooling curve for solidification	5.1 Types of melting furnaces like, Cupola, crucible, induction, Electrical 5.2 Principle and application of melting furnaces 5.3 Nucleation and growth during solidification 5.4 Progressive and directional solidification 5.5 Cooling curves of metals and alloys.
<b>Unit – VI Special Casting Techniques</b>	6a. Describe principle and operation of special casting techniques 6b. select casting method according to requirement	6.1 Introduction, principle & operation of different special casting techniques. 6.2 Advantage, disadvantages and application of Die casting. Investment casting. Centrifugal casting, Shell mold casting
<b>Unit – VII Testing and Inspection in Foundry</b>	7a. Describe different type of casting defect 7b. Explain types of destructive testing for casting 7c. Explain types of non-destructive testing for casting	7.1 Identification causes and remedies of casting defects. 7.2 Inspection of casting (visual, dimensional inspection) 7.3 Non-destructive tests to identify casting defects

## 6. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

Unit	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
1	Introduction to Foundry	06	04	01	01	06
2	Pattern and Pattern making	10	08	03	01	12
3	Mould and core making	09	07	04	01	12
4	Gating and risering	05	05	02	01	08
5	Melting and Solidification	10	06	04	02	12
6	Special Casting Techniques	10	05	04	03	12
7	Testing and Inspection in Foundry	06	03	02	03	08
<b>TOTAL</b>		<b>56</b>	<b>38</b>	<b>20</b>	<b>12</b>	<b>70</b>

**Legends:** R = Remember; U = Understand; A = Apply and above levels (Bloom's Revised taxonomy)

**Note:** This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

## 7. SUGGESTED LIST OF EXERCISES/PRACTICAL

The practical/exercises should be properly designed and implemented with an attempt to develop different types of skills (**outcomes in psychomotor and affective domain**) so that students are able to acquire the competencies/programme outcomes. Following is the list of practical exercises for guidance.

*Note: Here only outcomes in psychomotor domain are listed as practical/exercises. However, if these practical/exercises are completed appropriately, they would also lead to development of certain outcomes in affective domain which would in turn lead to development of **Course Outcomes** related to affective domain. Thus over all development of **Programme Outcomes** (as given in a common list at the beginning of curriculum document for this programme) would be assured.*

*Faculty should refer to that common list and should ensure that students also acquire outcomes in affective domain which are required for overall achievement of Programme Outcomes/Course Outcomes.*

S. No.	Unit No.	Practical/Exercise (Outcomes' in Psychomotor Domain)	Approx. Hrs. Required
1	I	Prepare the layouts of foundry.	04
2	II	Demonstrate different type of pattern	08
3	III	Measure green sand compressive strength by universal sand testing machine as per IS code.	04
4	III	Measure dry sand compressive strength by universal sand testing machine as per IS code.	04
5		Measure green and dry shear strength by universal	04

S. No.	Unit No.	Practical/Exercise (Outcomes' in Psychomotor Domain)	Approx. Hrs. Required
	III	sand testing machine as per IS code.	
6	III	Measure A.S.T.M. permeability no. of moulding sand by moulding meter.	04
7	III	Measure clay content of moulding sand.	02
8	III	Measure moisture content of moulding sand by weight loss method and rapid	04
9	III	Prepare mould and measure its mould hardness by mould hardness teller.	04
10	III	Determine grain size and distribution of grain size by Sieve analysis.	02
11	V	Demonstrate operation and maintenance of cupola	04
12	All	Make a given job with the help of casting process (This includes pattern making, mould making, casting and finishing)	12
<b>Total Hrs</b>			<b>56</b>

## 8. SUGGESTED LIST OF STUDENT ACTIVITIES

- i. Student will visit local foundry shops and observe pattern making, sand preparation, mould making, metal melting, alloying and casting, etc. and prepare reports.
- ii. Student will prepare report of various materials and tools being used in foundry based on observations.
- iii. Student will visit automated foundry and make a report.

## 9. SPECIAL INSTRUCTIONAL STRATEGIES (If Any)

- i. Show prepared charts/models
- ii. Show video/animation/photographs depicting different processes and casting defects.
- iii. Give internet based assignments and ask students to present in class level seminars
- iv. Arrange visit to nearby casting/foundry industry

## 10. SUGGESTED LEARNING RESOURCES

### A. List of Books

S. No.	Title of Books	Author	Publication
1	Foundry technology	O.P.Khanna	Dhanpatrai
2	Foundry Technology	P.L.Jain	Tata McGraw hill
3	Foundry Technology	D.S.Kumar & S.K.Jain	CBS Publication
4	Foundry Technology	P.R.Beely	
5	Fundamental of metal casting technology	P.C.Mukherjee	Oxford & IBR

**B. List of Major Equipment/Instruments/Materials**

- i. Wooden and metal Patterns
- ii. Moulding Boxes
- iii. Pit furnace
- iv. Crucibles- 1,2,3,5,10 kg capacity
- v. Universal sand testing machine
- vi. Permeability meter
- vii. Clay and moisture content testing machine
- viii. Moulding sand
- ix. Mould Hardness testing machine
- x. Sieve shaker
- xi. Cupola

**C. List of Software/Learning Websites**

- i. [www.nptel.com](http://www.nptel.com)
- ii. <http://en.wikipedia.org/wiki/Foundry>
- iii. <http://www.foundrytechnology.co.uk/plantandmachinery/subcategory.php>
- iv. <http://www.indianfoundry.org/>
- v. <http://www.slideshare.net/NFTN>

**11. COURSE CURRICULUM DEVELOPMENT COMMITTEE****Faculty Members from Polytechnics**

- **Prof. V.C.PATEL**, HOD in Metallurgy, LEC, MORBI
- **Prof. S F. PARMAR**, Lecturer in Diploma Metallurgy, LEC, MORBI

**Coordinator and Faculty Members from NITTTR Bhopal**

- **Dr. C. K. Chugh**, Professor, Department of Mechanical Engineering
- **Prof Shard Pradhan**, Head and Professor, Department of Mechanical Engineering