

# GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT

## COURSE CURRICULUM COURSE TITLE: ADVANCE FOUNDRY (COURSE Code: 3352107)

Diploma Programme in which this course is offered	Semester in which offered
Metallurgy Engineering	5 <sup>th</sup> Semester

### 1. RATIONALE

Different type of castings find application in one or other form in almost every walk of life. Modern casting methods in foundry have made it possible to produce quality and durable castings. For a specific casting, different modern casting techniques are to be adopted depending upon shape, size, material and use. Therefore in modern age it is very essential for metallurgical engineers to know about different types of ferrous and non ferrous alloys castings applications

### 2. LIST OF COMPETENCY

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

- **Plan and supervise production processes in foundry.**

### 3. COURSE OUTCOMES

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

- Explain solidification process for different metals
- Construct structure properties relationship for pure metals
- Design riser and getting system for castings of different shapes
- Explain the Investment casting, Shell moulding and Die casting processes in steel manufacturing.
- Explain costing processes for non ferrous metals

### 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	150
3	0	2	5	70	30	20	30	

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

## 5. COURSE CONTENT DETAIL

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
<b>Unit – I Introduction to advance foundry</b>	1a. State Advances in - material handling systems of foundry - Quality - Pollution control	1.1 Advancement in material handling systems in foundry. 1.2 Quality aspects in foundry. 1.3 Pollution control in foundry.
<b>Unit – II Solidification Process</b>	2a. Describe the characteristics of liquid metal 2b. Explain Inoculation 2c. Construct structure properties relationship 2d. Explain structure of pure metals 2e. Describe solidification of alloys. 2f. State characteristics of liquid metal	<b>Solidification:</b> 2.1 Structure of pure metals. 2.2 Solidification of alloys. 2.3 Construct structure properties relationship. 2.4 Characteristics of liquid metal. 2.5 Inoculation and other treatment.
<b>Unit – III Riser and Gating System</b>	3a. State Riser design parameters 3b. Calculate riser , Feeding distance, 3c. State Gating types 3d. Calculate Gating ratio	<b>Riser and Gating System</b> 3.1 Castings design. 3.2 Riser design parameters. 3.3 Riser calculation. 3.4 Feeding distance. 3.5 Gating types : Pressurised and non pressurised. 3.6 Gating calculation. 3.7 Gating ratio.
<b>Unit – IV Open Hearth and Electric Arc Furnace Steel Making</b>	4a. State special Casting Methods 4b. Describe Investment casting, Shell moulding and Die casting processes in steel manufacturing	<b>Special Casting Methods:</b> 4.1 Investment casting. 4.2 Shell moulding. 4.3 Die casting
<b>Unit – V Casting of Ferrous Metals</b>	5a. State the properties of green sand mould for steel casting 5b. Describe solidification of steel casting 5c. Explain the gating and riser for steel casting 5d. Describe production of S. G. Iron	<b>Casting of Ferrous Metals:</b> 5.1 Properties of green sand mould for steel casting. 5.2 Solidification of steel casting. 5.3 Gating and riser for steel casting. 5.4 Steel melting. 5.5 Production of S.G.Iron.
<b>Unit – VI Casting of Non Ferrous Metals</b>	6a. Explain principle aluminium alloying 6b. State the engineering properties of Al casting alloys 6c. Describe Al and Cu casting practices	<b>Casting of Non Ferrous Metals:</b> 6.1 Aluminium alloying principle. 6.2 Aluminium alloys castings properties. 6.3 Engg. properties of Al casting alloys. 6.4 Cu alloys foundry practice. 6.5 Al casting practice.

## 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
i.	Introduction to advance foundry	04	04	02	02	08
ii.	Solidification Process	06	06	03	03	12
iii.	Riser and Gating System	12	06	06	08	20
iv.	Open Hearth and Electric Arc Furnace steel making	08	04	06	04	14
v.	Casting of Ferrous Metals	08	02	04	04	10
vi.	Casting of Non Ferrous Metals	04	02	02	02	06
<b>Total</b>		<b>42</b>	<b>24</b>	<b>23</b>	<b>23</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/course outcomes. Following is the list of practical exercises for guidance.

*Note: outcomes in psychomotor domain are listed here 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 members 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.*

SR NO.	UNIT	PRACTICAL EXERCISE	APPROXIMATE HRS REQUIRED
1	V	Prepare Simple pattern for steel castings.	4
2	VI	Prepare mould and measure of mould hardness by mould hardness tester.	4
3	V	Melt and cast given Aluminium for an object.	4
4	V	Measure fluidity of casting metals.	4
5	V	Observe microstructure of cast steels.	4
6	V	Measure the graphite flakes size and type in C.I.	4

7	VI	Identify and understand various casting defects with their causes and remedies.	2
8	V and VI	Determine the effect of hardness and moisture on permeability of sand.	2
9	VI	Determine the effect of grain size and clay content on permeability of sand.	2
		<b>Total</b>	<b>30</b>

## 8 SUGGESTED LIST OF STUDENT ACTIVITIES

- Students may prepare layout of integrated advance foundry plant by exploring internet.
- May undertake Industrial visit of any advance foundry plant.

## 9. SPECIAL INSTRUCTIONAL STRATEGIES (if any)

- Arrange industrial visit of any modern foundry plant
- Show Video/animation films and Photographs of different casting processes.
- Seminar by group of students on problems, issues and new trends in foundry industry.

## 10. SUGGESTED LEARNING RESOURCES

### A. List of Books:

S. No.	Title of Books	Author	Publication
1	1. Principles of metal casting. by Heine & Rosenthal.	Heine & Rosenthal.	
2	2. Foundry practice. by Salman & Simons.	Salman & Simons.	
3	3. Foundry technology. by M.Lal.	M. Lal.	
4	4. Fundamentals of metal casting. by P. Mukerji	P. Mukerji	
5	5. Foundry engineering by N.K.Shrinivasan.	N.K.Shrinivasan.	

### B. List of Software/Learning Websites

Searching engine could be used to locate steel manufacturing related sites, such as:

- <http://www.industry.siemens.com/verticals/metals-industry/en/metals/steelmaking/ld-steelmaking/Pages/home.aspx>
- [http://www.carbonandgraphite.org/pdf/steel\\_production.pdf](http://www.carbonandgraphite.org/pdf/steel_production.pdf)
- <http://corporate.arcelormittal.com/who-we-are/from-ore-to-steel>
- <http://www.topforge.co.uk/Processes.htm>
- <http://en.wikipedia.org/wiki/Steelmaking>

- vi. <http://www.steel.org/Making%20Steel/How%20Its%20Made/Processes/Processes%20Info/The%20Basic%20Oxygen%20Steelmaking%20Process.aspx>
- vii. [http://www.steelconstruction.info/Steel\\_manufacture](http://www.steelconstruction.info/Steel_manufacture)

## 11. COURSE CURRICULUM DEVELOPMENT COMMITTEE

### **Faculty Members from Polytechnics**

- **Prof. Smt B. H. Goyal**, I/c. Head of Department of Metallurgy, Dr S and S.S Ghandhy college of Engg. and Technology
- **Dr. G.H Upadhyay**, Professor of Metallurgy, Department of Mechanical Engineering, L.D.College of Engineering, Ahmedabad

### **Coordinator and Faculty Members from NITTTR Bhopal**

- **Dr. C.K Chugh**, Professor, Department of Mechanical Engineering
- **Dr. Shashi Kant Gupta**, Professor and Coordinator for State of Gujarat.