

GUJARAT TECHNOLOGICAL UNIVERSITY

METALLURGY ENGINEERING (21)

FOUNDRY TECHNOLOGY

SUBJECT CODE: 2162106

B.E. 6th SEMESTER

Type of course: Engineering Science

Prerequisite: Knowledge of Elements of Metallurgy and basic science skills

Rationale: Metallurgical engineers need to know different types of Foundry processes for production of intricate part in combination with the accuracy, tolerance & surface finish. The hands on skill as regards to Foundry Technology are must be it at a scale of mass, batch, or unit production. The present course focus on giving the exposure of various Foundry processes for a product whose scale ranges from miniature to extra-large, Moulding-Coring practice, Melting inoculations practices, Quality Control of the casting. This course will help Metallurgical engineer understand the basic underlying principles in various casting processes & apply his/her knowledge in the field of metal casting.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
L	T	P		Theory Marks			Practical Marks			
			ESE (E)	PA (M)		ESE (V)		PA (I)		
				PA	ALA	ESE	OEP			
4	0	2	6	70	20	10	20	10	20	150

Content:

Sr. No.	Content	Total Hrs	% Weightage
1	Introduction Introduction to metal casting and foundry industry in modern industrial scenario. Advantages and limitations of casting methods. Classification of foundries. Different sections in a foundry and their functions. Important cast metals and alloys-their composition, properties and uses.	3	5
2	Patterns: Types of patterns, brief classification of pattern making materials, consideration in selection of pattern materials, color coding, pattern allowances, core boxes, types of core boxes.	10	15
3	Moulding and core making: ingredients of common type of moulding and core making sands, their properties and behavior, testing of sands and clay.	6	10
4	Moulding processes Classification of molding processes and casting processes, brief description of all processes such as green sand dry sand, loam sand floor, pit and machine molding.	5	08
5	Casting processes Shell moulding, Co ₂ silicate process, Investment casting process, permanent moulding process, Gravity and pressure die casting, centrifugal casting process.	8	14
6	Melting Practice Melting of cast iron, Mechanical features of cupola, operational steps and principles of cupola operation, Advanced practices in the cupola operation, melting of aluminum and copper based alloys including mold treatments such as dressing, grain refining, and modification.	8	14

7	Elements of Gating system: Classification, basic consideration in gating design, gating ratio, gating practice for ferrous and nonferrous alloys, pouring equipment.	6	10
8	Rising Practice: function of riser, directional and progressive solidification, centerline feeding resistance, riser efficiency, riser design consideration, rising curves, Chvorinov's, N.R.L and modulus method, feeding distance feeding aids, blind and atmospheric risers.	8	14
9	Quality control in foundry: Casting defects, their causes and remedies. Shop floor quality control tests such as composition control, Wedge test, fluidity, temperature measurement. Casting Modification by different methods like Friction stir processing.	6	10

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
15	30	30	10	10	05

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's 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.

Reference Books:

1. Principles of Metal Casting, R. W. Heine, C. R. Loper and P. C. Rosenthal, (Tata McGraw Hill)
2. Principles of Foundry Technology, P. L. Jain, (Tata McGraw Hill).
3. Fundamentals of Metal Casting Technology, P. C. Mukherjee, (Oxford & IBH)
4. Foundry Technology, P. R. Beeley
5. Foundry Engineering, H. F. Taylor, M. C. Flemings, (Wiley Eastern)
6. Foundry Technology, D. Kumar & S. K. Jain, (CBS Pub.)

Course Outcome:

After learning the course the students should be able to:

1. Express Knowledge about the fundamentals of the casting, basic terminology related to casting process.
2. Decide the alternative method for the manufacturing of component for engg. Applications.
3. Prepare the methoding of the casting.
4. Decide correct melting practice of different cast alloy & different melt-treatments.
5. Minimize to defects generated during casting.
6. Explain various temperature measurement and inoculations treatments
7. Select the relevant refractory material for the foundry.
8. Demonstrate the ability to select the proper molding material, type of furnace with relevant refractory material, use appropriate casting design and temperature measurement device to obtain quality cast products.

List of Experiments:

1. Introduction to Foundry Laboratory.
2. To determine AFS fineness no. and distribution coefficient of given sand sample.
3. To demonstrate the working of Sand Muller.
4. To determine clay content of given sand sample.
5. To prepare standard samples under identical condition for checking important physical properties of foundry sand.
6. To determine compression strength of foundry sand.

7. To determine permeability number of green sand, core sand and raw sand.
8. To find out the hardness of dried cores made out of core sands.
9. To find out the green mold hardness of the sand mold.
10. To Study Aluminum Melting and Casting.

Design based Problems (DP)/Open Ended Problem:

1. Chart of different Patterns, Moulding boxes & core boxes.
2. Problems based on Pattern allowances.
3. Problems based on Gating & risering system
4. Model preparation of cupola from waste material.
5. Chart of casting defects with cause & remedies.
6. Chart of different furnaces used in foundry
7. Collection and Study of different inoculations materials.
8. Group discussion and Presentations on recent advancement in foundry technology.
9. Any other problem decided by faculty based on syllabus.

Major Equipment:

1. Mechanical Sieve shaker with sieve set
2. Weighing balance
3. Sand Muller
4. Clay washer
5. Sand rammer
6. Centrifugal casting machine
7. Universal Strength Machine
8. Shatter Index Tester.
9. Permeability meter
10. Rapid Moisture teller.
11. Core hardness tester
12. Mould hardness tester
13. Natural gas fired furnace

List of Open Source Software/learning website:

1. <http://nptel.iitm.ac.in/>
2. www.ocw.mit.edu

ACTIVE LEARNING ASSIGNMENTS: Preparation of power-point slides, which include videos, animations, pictures, graphics for better understanding theory and practical work – The faculty will allocate chapters/ parts of chapters to groups of students so that the entire syllabus to be covered. The power-point slides should be put up on the web-site of the College/ Institute, along with the names of the students of the group, the name of the faculty, Department and College on the first slide. The best three works should submit to GTU.