

Subject Code: 01ME0703

Subject Name: Rapid Casting-1

B.Tech. IV Year – (Sem-7)

Type of course: Engineering

Prerequisite: Manufacturing Process, Computer aided Manufacturing,

Rationale: The course aims to impart basic understanding and practice of casting process using newly developed chemicals and machines.

Course Outcome

- 1 To get the knowledge of casting allowance on to identify pattern making material specific product fabrication.
- 2 To get knowledge of riser and gating computation
- 3 To get an inside view of modern machines uses for pattern making

Teaching and Examination Scheme:

Teaching Scheme(Hours)			Credits	Evaluation Scheme					Total Marks
Theory	Tutorial	Practical		Theory Marks			Practical Marks		
				ESE(E)	IA	CSE	Viva(V)	Term Work (TW)	
2	0	4	4	50	30	20	25	25	150

Content

Sr. No	Course Content	Total Hours	% Weightage
1	Pattern Making and Design	15	51
	Types of pattern, allowances for patterns, pattern materials (metal, wood, plastic, thermocol, etc.) pattern making methodologies (Machining, and 3D printing),		
	Use of VMC in pattern making, specification of VMC machine, control of VMC machine, Introduction of G codes/ M codes used in VMC; Introduction of parametric programming.		

	Types of 3D printing technologies, applications of 3D Printing technology in pattern making, use of 3D printer in pattern making, specification of 3D printing machine, working of 3D printing machine.		
2	Moulding Process Design	8	28
	Types of sand used in metal casting, sand testing, properties of sand, types of molds, core making, design consideration in core making, Design considering in mold making		
3	Pouring and Feeding	6	21
	Feeder/riser design, optimum cavity layout, different feed aids, effect of feed aids on metal casting. Types of furnace, calculation on heat required for melting, design of furnace (Resistance heating furnace), comparison of various furnaces for efficiency on melting;		
	Methods of pouring: manual, semi-automatic, automatic pouring, effect of different pouring methods on quality of casting, gating system design		

Distribution of Theory Marks:

R Level	U Level	A Level	N Level	E Level	C Create
10	20	25	25	20	-

Legends: R: Remembrance; **U:** Understanding; **A:** Application, **N:** Analyze, and **E:** Evaluate

Reference Books:

- 1 Joan Horvath (auth.) - Mastering 3D Printing-Apress (2014)
- 2 D.T. Pham and S.S Dimov, Rapid Manufacturing: The Technologies and Applications of Rapid Prototyping & Rapid Tooling, Springer, 2001.
- 3 Peter Hilton and Paul F Jacobs, Rapid Tooling Technologies and Industrial Applications, Marcel Dekker Inc, New York, 2001
- 4 Wanlong Wang, Henry W. Stoll and James G. Conley, Rapid Tooling Guidelines for Sand Casting, Springer, 2010.
- 5 Chua C K, Leong K F, Chu S L, Rapid Prototyping: Principles and Applications in Manufacturing, World Scientific.
- 6 Gibson D W Rosen, Brent Stucker., Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing, Springer.

- 7 Noorani R, Rapid Prototyping: Principles and Applications in Manufacturing, John Wiley & Sons.
- 8 Hilton P, Jacobs P F, Rapid Tooling: Technologies and Industrial Applications, CRC press.
- 9 Rafiq Noorani - 3D Printing_ Technology, Applications, and Selection-CRC Press (2017)
- 10 Metal casting-B.Ravi-PHI
- 11 PRINCIPLES OF METAL CASTING 2nd Edition by Richard W. Heine,,Carl Loper,Philip c Rosenthal
- 12 Manufacturing Science 2nd Edition Ghose and Mallik

List of Experiments

1. Calculate the mesh size of moulding sand using Sieve analysis.
2. Calculate the permeability of green sand moulding.
3. To study the effect of mesh size and permeability on casting.
4. Computation of Feeder size
5. Computation of Gating System
6. To perform the mold making process using green sand moulding.
7. To perform the mold making process using chemical moulding.
8. Develop a 3D Model for Additive manufacturing.
9. Fabrication of a casting pattern by 3D Printer.
10. Fabrication a casting pattern of wood & thermocol by VMC Machine
11. Reverse Engineering: Prepare a 3D model by 3D Scanner.
12. Reverse Engineering to Additive Manufacturing: 3D Scanner to 3D Printer.

Major Equipment:

- 1) 3D Scanner
- 2) 3D Printer
- 3) VMC Engrave Machine
- 4) Induction Furnace
- 5) Sieve Shaker
- 6) Permeability tester

List of Open Source Software/learning website:

1. <https://nptel.ac.in/courses/112104195/30>
2. <https://nptel.ac.in/courses/112102103/16>
3. <https://nptel.ac.in/courses/112107258/>
4. <https://www.autodesk.com/products/fusion-360/students-teachers-educators?mktvar002=1063629>