



Second Semester 2018-2019 Course Handout (Part II)

07.01.2019

In addition to Part I (General Handout for all courses appended to the time table) this portion further gives specific details regarding the course.

| | |
|----------------------------------|----------------------------|
| Course No. | : MF F343 |
| Course Title | : CASTING AND WELDING |
| Instructor-in-charge | : Dr. Amrita Priyadarshini |
| Instructor (Tutorial/Laboratory) | : Dr. Amrita Priyadarshini |

1. Course Description:

Fundamentals of Metal casting and metallurgy. Solidification and its' influence on casting quality. Riser and runner design, casting techniques applied to common metals and alloys. Modern casting processes, control of casting defects and application of casting processes.

Fundamentals of Metal welding and metallurgy, various welding processes and influence of process parameters on welding. Welding defect control, testing of weldments.

2. Scope and Objective of the Course:

The course aims at developing the theoretical and practical knowledge base about the casting and welding processes. It will be helpful to analyze these two broad and versatile manufacturing processes and its importance in manufacturing engineering.

3. Text Books:

- 1) Richard W. Heine, Carl R. Loper and Philip C. Rosenthal, "Principles of Metal casting", Tata McGraw-Hill Publication, II Edition, 2004.
- 2) P. N. Rao, "Manufacturing Technology Vol-1", Tata McGraw-Hill Publications, III Edition, New Delhi.
- 3) Richard L. Little, "Welding and Welding Technology", Tata McGraw-Hill Publications, I Edition, New Delhi.

4. Reference books:

- 1) Ghosh A. and Mallik, A. K., "Manufacturing Science", East-West Press Private Limited, New Delhi, 2008.
- 2) Nadkarni.S.V., "Modern Arc Welding Processes", Oxford and IBH Publishing company, II Edition 2005.
- 3) Lancaster.J.F., "Metallurgy of Welding", VI Edition, 1993.
- 4) ASM Metals Hand book, Casting, Volume 15.
- 5) ASM Metals Hand book, Welding, Brazing and Soldering, Volume 6.



Please Do Not Print Unless Necessary





6) Abbaschian R, Abbaschian L, Reed-Hill R E, Physical Metallurgy Principles, Fourth Edition, Cengage learning, 2010.

5. Course Plan:

5a. Course Plan for Casting

| Lect. No. | Topic | Objective(s) | Chapter(s) |
|-----------|---|--|---|
| 01 | Introduction | Course overview. The features of casting problem and scope of foundry industry | Chapter 1 (TB1), Chapter 1(TB2) |
| 02-05 | Casting Processes | Introduction, Pattern and Mould, Molding processes and materials, Equipments and mechanization, Cores | Chapter No. 2-7 (TB1), Chapter 3 (TB2), Chapter 2 (2.1, 2.2) (R1) |
| 06-10 | Cooling and Solidification | Solidification of pure metals and alloys, nucleation and growth in alloys, progressive and directional solidification, rate of solidification, Chvorinov's rule | Chapter 8 (TB1), Chapter 2 (2.5) (R1), Chapter 14 (R6) |
| 11-15 | Gating & Riser Design | Gating systems and their characteristics; the effects of gates on aspiration; turbulence and dross trap | Chapter 9 (TB1), Chapter 4(TB2), Chapter 2 (2.4)(R1), Lecture notes |
| 16-18 | Molding and core making process | High pressure molding; full mold process; flaskless molding, hot and cold box molding; ceramic shell molding; V-process; continuous casting; squeeze and pressed casting; Nishiyama process; Shaw process; Anitoch process | Chapter 3 & 4 (TB1), Lecture notes |
| 19-21 | Internal stresses, Defects and surface finish, Inspection | Residual stresses; hot tears and cracks in castings; stress relief; defects; and their causes and remedies X-ray and gamma ray radiography; magnetic particle; penetrant and ultrasonic inspections | Chapter 4 (TB1), Chapter 5 (TB2), Chapter 2 (R1) |





5b. Course Plan for Welding

| Lect. No. | Topics | Objective | Text Book |
|-----------|-----------------------------|--|---|
| 22 | Introduction | Evolution of welding and classification of welding processes | Chapter 1 (TB3), Chapter 5 (5.1-5.4) (R1), Chapter 1 (R3) |
| 23-25 | Gas Welding | Introduction, equipments, operations, joining processes, ferrous welding, nonferrous metals, gas cutting. | Chapter 1-7 (TB3) |
| 26-31 | Arc welding processes | Consumable electrode welding processes. Manual metal arc (MMA) welding; Gas metal arc welding; pulsed MIG welding; Submerged arc welding; Electroslag welding; Gas tungsten arc welding; Plasma arc welding | Chapter 8-11;15-18 (TB3), Chapter 3 (TB3) |
| 32-34 | Other Welding Processes | Solid state bonding, Electron beam welding, Laser Welding, Thermit Welding, Explosive welding | Chapter 19-26 (TB3), Chapter 5 (5.5) (R1) |
| 35-37 | Design of weld joints | Type of welds and weld joints; description of welds: terminology, definitions and weld symbols; edge preparation; sizing of welds in structure; Design for Static loading, Weld Calculations in lap, butt and fillet welds | Chapter 12 (TB3), Lecture notes |
| 38-40 | Weldability of metals | Solidification of weld metal; heat affected zone (HAZ), factors affecting properties of HAZ; weldability; definition, factor affecting the weldability of steel Carbon equivalent. Weldability of steel, cast iron and aluminium alloys of commercial importance, failure analysis of welded joints. | Chapter 27-29 (TB3), Lecture notes |
| 41-42 | Weld Defects and Inspection | Weld defects, Destructive and NDT methods | Chapter 5 (TB3), Chapter 5 (5.6) (R1) |





BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, Pilani Hyderabad Campus

6. Lab Practical:

Various experimentations about casting and welding will be conducted in practical classes and list of experiments will be given separately.

7. Evaluation Scheme:

| Components | Duration | Weightage (%) | Date | Remarks |
|---------------------------|----------|----------------|-------------------------|---|
| Mid-Semester Test | 90 min | 20 | 16/3 11.00 -12.30 PM | Closed Book |
| Quiz | | 10 (Best 5) | - | Closed Book |
| Tutorial | | 10 (Best 8) | | Partially Open Book (Class Notes only) |
| Lab experiments / Project | | 20 | - | Open Book |
| Comprehensive Examination | 3 hrs. | 40 | 13/05 AN | Closed Book |

8. Chamber Consultation Hours:

To be announced in the class. Chamber: E 118

9. Notices:

All notices related to this course will be put on CMS only.

10. Make-up Policy:

Make-up will be granted **ONLY** in genuine cases with **prior permission**. The request application for make-up test must be reached to the Instructor-in-charge before commencement of the scheduled test (documentary proof is essential).

Academic Honesty and Integrity Policy: Academic honesty and integrity are to be maintained by all the students throughout the semester and no type of academic dishonesty is acceptable.

Instructor in Charge



Please Do Not Print Unless Necessary

