MF5103 ADVANCES IN CASTING AND WELDING

DETAILED SYLLABUS

UNIT I CASTING DESIGN

Heat transfer between metal and mould — Design considerations in casting – Designing for directional solidification and minimum stresses - principles and design of gating and risering

UNIT II CASTING METALLURGY

Solidification of pure metal and alloys – shrinkage in cast metals – progressive and directional solidification — Degasification of the melt-casting defects – Castability of steel , Cast Iron, Al alloys, Babbit alloy and Cu alloy.

UNIT III RECENT TRENDS IN CASTING AND FOUNDRY LAYOUT

Shell moulding, precision investment casting, CO2 moulding, centrifugal casting, Die casting, Continuous casting, Counter gravity low pressure casting, Squeeze casting and semisolid processes. Layout of mechanized foundry – sand reclamation – material handling in foundry pollution control in foundry — Computer aided design of casting.

UNIT IV WELDING METALLURGY AND DESIGN

Heat affected Zone and its characteristics – W eldability of steels, cast iron, stainless steel, aluminum, Mg , Cu , Zirconium and titanium alloys – Carbon Equivalent of Plain and alloy steels Hydrogen embrittlement – Lamellar tearing – Residual stress – Distortion and its control . Heat transfer and solidification - Analysis of stresses in welded structures – pre and post welding heat treatments – weld joint design – welding defects – Testing of weldment.

UNIT V RECENT TRENDS IN WELDING

Friction welding, friction stir welding – explosive welding – diffusion bonding – high frequency induction welding – ultrasonic welding – electron beam welding – Laser beam welding – Plasma welding – Electroslag welding- narrow gap, hybrid twin wire active TIG – Tandem MIG- modern brazing and soldering techniques – induction, dip resistance, diffusion processes – Hot gas, wave and vapour phase soldering. Overview of automation of welding in aerospace, nuclear, surface transport vehicles and under water welding.

REFERENCES

1. ASM Handbook vol.6, welding Brazing & Soldering, 2003.

2. ASM Handbook, Vol 15, Casting, 2004.

3. Carrry B., Modern Welding Technology, Prentice Hall Pvt Ltd., 2002.

4. CORNU.J. Advanced welding systems – Volumes I, II and III, JAICO Publishers, 1994.

5. HEINELOPER & ROSENTHAL, Principles of Metal Casting, Tata McGraw Hill, 2000.

6. IOTROWSKI – Robotic welding – A guide to selection and application – Society of mechanical Engineers, 1987.

7. Jain P.L., Principles of Foundry Technology, Tata McGraw Hill Publishers, 2003.

8. LANCASTER.J.F. – Metallurgy of welding – George Alien & Unwin Publishers,1980.

9. Parmer R.S., Welding Engineering and Technology, Khanna Publishers,2002.

10. SCHWARIZ, M.M. – Source book on innovative welding processes – American Society for Metals (OHIO), 1981.

11. Srinivasan N.K., Welding Technology, Khanna Tech Publishers, 2002.

OBJECTIVES

- To study the metallurgical concepts and applications of casting and welding process.
- To acquire knowledge in CAD of casting and automation of welding process.