

FOUNDRY TECHNOLOGY

UNIT – I: PATTERN, MOULDING AND CORE MAKING

Introduction - Foundry as a manufacturing centre, Scope and development of foundry, Types of foundries; **Pattern** - Types of patterns, Pattern materials, Pattern allowances, Pattern layout, Pattern making; **Moulding and Core Making** - Types of moulding equipment, Moulding materials - Moulding sands - Properties and selection of materials and additives used- Core and core making.; **Testing of Foundry Sand** – Strength, Permeability, Moisture content, Shatter Index, Mouldability, Compactability, Loss on ignition, Clay content, AFS grain fineness number.

UNIT – II:CASTING PROCESSES

Green sand moulding process - Dry sand moulding process - CO₂ moulding process - No bake moulding process - Shell moulding process - Investment casting - Permanent moulding - Pressure die casting - Gravity die casting – Continuous casting - Electroslag casting- Squeeze casting - Slush casting - Thixocasting and rheocasting processes - Cosworth process - Magnetic moulding - Impulse moulding - High pressure moulding - Vacuum sealed moulding process -

UNIT – III:PRINCIPLES OF SOLIDIFICATION

Thermodynamics of solidification – liquid phase, cooling curve analysis of pure metal and alloy, thermal undercooling, molar free energy; **Kinetics of solidification** – nucleation phenomena, homogeneous nucleation, heterogeneous nucleation, nucleating sites and agents, controlled nucleation, dynamic nucleation; **Growth during solidification** – structure of the Interface, normal growth, growth by surface nucleation, growth on imperfections; formation of planar, cellular, dendritic and equiaxed structures; **Solidification of alloys** – short range and long range solidifying alloys, constitutional undercooling, eutectic growth, factors influencing freezing and control of alloy constituents; **Solidification defects** – segregation, shrinkage, porosity, hot tears, cold cracks.

UNIT – IV: CASTING HYDRODYNAMICS, HEAT TRANSPORT AND DESIGN

Fluid dynamics – Fluidity, measurement of fluidity, effects of various parameters on fluidity, capillary flow, feeding mechanisms, centreline feeding resistance, principles of fluid flow; **Gating** – elements of gating system and their characteristics, aspiration of gases in gating system, filling time calculation, design of gating system, pouring basin, spure, sprue base well, runner, ingates; slag trap and filters, gating ratios; **Heat transport**– solidification in sand mold, solidification in metal mold; **Risering** – risering practice, blind and atmospheric risers, riser size and location, risering curves, caine’s method, NRL method and modulus methods, feeding distance, optimum risering practice, feeding aids, chills, padding.

UNIT –V: CASTING PRACTICES AND POST TREATMENTS

Foundry furnaces – crucible furnace, arc furnace, open hearth furnace, Induction furnace,

Cupola furnace, converters; **Melting practices** – cast iron, steel, aluminium alloys, copper alloys and magnesium alloys; **Finishing operations** – fettling, cleaning, finishing; **Analysis of Casting defects** – Surface defects, Discontinuity, Dimensional defects, Internal defects; **Inspection** – visual inspection, dimensional checking, surface flaw detection, internal flaw detection, chemical analysis, mechanical properties, metallurgical structure; **Heat treatment of casting** – stress relieving, annealing, normalizing, hardening and tempering, austempering, martempering, solution treatment and precipitation hardening; **Welding** – salvaging of defective casting, different welding techniques for casting repair and joining, metallurgical difficulties in weld deposit and heat affected zone.

UNIT – VI: ADVANCES IN METAL CASTING

Foundry Mechanisation – need for mechanization, areas for mechanization, plant lay out of mechanized foundry; **Casting Design** - Considerations, functional design, simplification of foundry practices, metallurgical design; **Computer Aided Metal Castings** - Use of softwares for foundry applications.

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2. Peter Beelay. Foundry Technology. London: Butterworth-Heinemann, 2001.
3. Ramana Rao, T.V. Metal Casting Principles and Practice. New Delhi: New Age International (P) Limited, 2003.
4. Srinivasan, N. K. Foundry Technology. New Delhi: Khanna Publications, 2001.
5. Heine, R. W. Loper, C.R. and Rosenthal, P.C. Principles of Metal Casting. New Delhi: Tata McGraw Hill Publishers, 2003.
6. Jain.P.L. Principles of Foundry Technology. New Delhi: Tata McGraw- Hill Publishing Co., Ltd, 1995.