

ME410 Advances in Welding & Casting

L	T	P	Credit	Area		CWS	PRS	MTE	ETE	PRE
3	0/1	2/0	4	DEC/GEC		15/25	25	20/25	40/50	-

Syllabus								Contact Hours
Unit-1	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						6
Unit-2	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, Babbitt alloy and Cu alloy.						6
Unit-3	RECENT TRENDS IN CASTING AND FOUNDRY LAYOUT	Shell moulding, precision investment casting, CO ₂ 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.						8
Unit-4	WELDING METALLURGY AND DESIGN	Heat affected Zone and its characteristics – Weldability 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.						8
Unit-5	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.						8
Unit-6	Overview of automation of welding in aerospace, nuclear, surface transport vehicles and under water welding.							6
	Total							42

Reference Book:

1	ASM Handbook, Vol 15, Casting, ASM International, 2004, ISBN 978-0871707116
2	ASM Handbook vol.6, welding Brazing & Soldering, ASM International, 2003, ISBN 978-0871703828
3	Parmer R.S., Welding Engineering and Technology, Khanna Publishers, 2002, ISBN 9788174090287
4	Srinivasan N.K., Welding Technology, Khanna Tech Publishers, 2002, ISBN 8174091599
5	HEINE, LOPER & ROSENTHAL, Principles of Metal Casting, Tata McGraw Hill, 2001, ISBN 0070993483
6	Jain P.L., Principles of Foundry Technology, Tata McGraw Hill Publishers, 2003, ISBN 0070447608
7	Howard B. Cary, Scott C. Helzer, Modern Welding Technology, Pearson Prentice Hall Pvt Ltd., 2011, ISBN 0131836919
8	J. Piotrowski, W. Randolph, Robotic welding – A guide to selection and application, Society of Manufacturing, 1987, ISBN 0872632660
9	CORNU.J. Advanced welding systems – Volumes I, II and III, Springer Publishing, 2013, ISBN 3662110512
10	LANCASTER.J.F., Metallurgy of welding, Springer Publishing, 1987, ISBN 0046690107

Course Outcomes

CO1	Understand and explain the various moulding, core making and casting processes with their specific applications.
CO2	Design the gating and riser system and explain the melting process of steel, cast iron and non-ferrous metals.
CO3	Examine the defects, their causes and remedies for a casting and summarize the inspection and testing procedure of castings.
CO4	Explain the working principle, advantages, limitations, applications of various joining processes including advance processes and apply knowledge to select appropriate joining process based on the type of industrial application.
CO5	Discuss the weldability criteria of Steels, Cast Iron and Aluminium and explain different welding position and joint configurations.
CO6	Understand the various surface treatment processes and examine the welding defects and associated weld testing techniques.

CO-PO/PSO Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	1	1	2	2	1	1	1	1	2	2	1	3
CO2	3	3	2	2	2	2	2	1	1	1	1	3	3	2	2
CO3	3	3	3	2	2	2	1	1	1	1	1	2	2	1	3
CO4	3	3	3	3	2	2	2	1	1	1	1	2	3	1	2
CO5	3	3	3	3	3	2	2	1	1	1	1	3	3	2	3
CO6	3	3	3	3	3	2	2	2	1	1	1	2	3	2	3