ADVANCES IN WELDING TECHNOLOGY

CourseCode		Year		Semester	
Course Category	HONORS	Branch	ME	Course Type	Theory
Credits	3	L – T – P	3 – 0 – 0	Prerequisites	Production Technology
Continuous Internal Evaluation	30	Semester End Evaluation	70	Total Marks	100

Course Outcomes: Upon successful completion of the course, the student will be able to

	Statement	Skill	BTL	Units
CO1	Illustrates the basic concepts of different types of welding techniques	Understand Communication	L2	1,2,3,4,5
CO2	Understand solid state welding processes and applications and advancements.	Understand Communication	L2	1,2
CO3	Illustrate basic principle of electron beam, laser beam and plasma arc processes and its application.	Apply, Communication	L3	3,4
CO4	Discuss residual stresses in weld joints and methods of minimizing.	Apply, Communication	L3	3,4,5

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3:High, 2: Medium, 1:Low)

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

Syllabus

UNIT	Contents	Mapped COs
I	**Solid state welding:** classification of solid state welding processes, explosive, diffusion, and Ultrasonic welding – working principle, operation, process characteristics and application. Adhesive bonding, advantages and applications. Principles and operational considerations of pressure welding processes	CO1, CO2
II	**Friction welding:** Friction welding process variables, welding of similar and dissimilar materials, Defective analysis of friction welded components, Friction welding of materials with inter layer. **Friction stir welding:** Processes parameters, tool geometry and materials, advantages, limitations and applications. Advancements in Friction stir welding: Under water, Cryogenic, Ultrasonic assistance.	CO1, CO2
III	**Electron Beam welding (EBW):** Introduction, Electron Beam welding process parameters, Defective analysis of Electron beam welds and Electron Beam welding dissimilar materials. **Laser Beam welding (LBW):** Laser Beam welding process parameters,	CO1, CO3, CO4

	atmospheric affect and Laser Beam welding of steels, Processes parameters, Keyhole formation, power densities, forces acting in keyhole, pressure balance for a generalized keyhole, heat transfer in laser and electron beam welding processes. Applications, Defective analysis of Laser Beam welds and Laser beam welding of dissimilar alloys.	
IV	**Plasma Arc Welding**: Concepts, processes and applications, keyhole and puddle-in mode of operation, low current and high current plasma arc welding and their applications; Magnetically impelled arc butt (MIAB) welding. **Ultrasonic welding,** ultrasonic spot welding, line welding, continuous seam welding , welding of plastic and Induction welding of plastics, process description, application, advantages and limitations.	CO1, CO3, CO4
V	**Welding residual stresses** - causes, occurrence, effects and measurements - thermal and mechanical relieving; types of distortion - factors affecting distortion - distortion control methods - prediction - correction, jigs, fixtures and positioners.	CO1, CO4

Learning Resources
Text books
1.Modern Welding Technology, Howard B. Cary,Printice Hall, 1998 2.R.S.Mishra, Friction stir welding and processing, ASM International, 2007. 3.Sindo Kou: Welding Metallurgy, Wiley, 2002
Reference books
1. Cnnur L.P., “Welding Handbook Vol I & II”, American Welding Society, 1989. 2. Hauldcraft P.T, “Welding Process Technology”, Cambridge University Press, 1985 3. J. Norrish: Advanced welding Processes, Woodhead publishing, 2006 4. . F. Lancaster: The Physics of welding, Pergamon, 1986 5. R. W. Messler: Principles of Welding, John Wiley and Sons, 1999. 6. W Steen: Laser Material Processing, Springer-Verlag, 1991.
E- Resources & other digital material
1. https://onlinecourses.nptel.ac.in/noc20_me65/course#