

Branch Name:	Mechanical Engineering (Production Technology)
Program Code:	ET209
Course Name:	Advance Welding Technology
Course Code:	2ET2090201T
Pre-requisite Course:	Workshop and Welding Technology

Course Objectives:

1. To perform on different welding techniques and gain knowledge of the concepts, operating procedures, applications, advantages and limitations of various welding processes.
2. Define the problem that occurs on the arc welding and recognize the type of metal, electrode, and tools that are used in arc welding
3. To know safety measure when use the welding machine along the welding process and understand the various codes and standards on welding applications

Teaching and Examination Scheme:

Credit	Teaching Scheme Hours per week				Evaluation Scheme (Marks)								
					Theory (Marks)				Practical (Marks)				Total (Marks)
	L	T	P	Total	SEE		CCA		SEE		CCA		
					Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
3	3	-	-	3	24	60	16	40	-	-	-	-	100

Subject Contents				
Sr. No	Topic	Total Hours	Weightage (%)	
1	Physical aspects of Welding: Classification and Factors affecting for selection of manufacturing processes, Emission and ionization of arc, arc characteristics, Welding power sources, arc blow, Duty cycle, Metal Transfer and thermal aspects of welding.	04	20	
2	Advanced Fusion welding Processes: Activated arc welding processes, Pulse gas tungsten arc welding and pulse gas metal arc welding, Cold metal transfer narrow groove welding, hot-wire arc welding, selection of electrodes, Electron Beam Welding, Laser beam welding, Hybrid welding processes. Mechanical properties of joints: hardness, tensile, corrosion, fatigue, welding economics, welding design, welding defects	06	25	
3	Solid State welding Processes: Comparison of Fusion and Solid-state Welding, Microstructure Evolution in solid-state welding, Friction welding, Friction stir welding, Ultrasonic welding, Explosion welding, and Diffusion bonding. Similar and dissimilar material welding by solid-state welding. Recent trends in solid-state welding.	06	25	
4	Welding Metallurgy: Heat flow in welding, Metallurgical transformation in and around weldment, Implication of cooling rates, Heat affected zone (HAZ), Weldability of plain carbon steels, Stainless steels, Cast iron, Aluminium and its alloys. Design of weldments, Joint design, Residual stresses and distortion, Testing of welded joints, Destructive Tests and Non-destructive tests (NDT).	04	15	

5	Welding Defects and Testing: Type of defects in weldments, causes and remedies of defects. Repair of defective welds, Destructive testing like tensile, bend, impact and non-destructive testing like leak test, X-ray and gamma ray radiography, magnetic particle test, liquid dye penetration test, ultrasonic etc.	04	15
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Review Presentation: The student is expected to spend minimum 2 hours per week (as mentioned in the teaching and evaluation scheme) to refer at least two peer reviewed journal papers related to this domain/subject. The student is expected to identify issues/challenges and emerging trends in the domain/subject. Student is supposed to explore various video lectures (E.g. NPTEL) available in the domain/subject. Student is required to make a review-presentation on the work carried out for the same. Recommended sites for journal papers are (1) asmedigitalcollection.asme.org (2) springer.com (3) sciencedirect.com (4) ieeexplore.ieee.org (5) scholar.google.co.in or others of similar repute.

List of Reference Books:

1. Dr.R.S.Parmar “Welding processes and technology” Khanna Publishers
2. P.N. Rao, Manufacturing Technology Vol 1, McGraw Hill India.
3. S. Kalpakjian and S.Schmid, Manufacturing Processes for Engineering Materials, 6th Edition, Pearson.
4. M.P. Groover, Fundamentals of Modern Manufacturing: Materials, Processes, and Systems, 7th edition, Willey.
5. A. Ghosh and A. K. Mallik, Manufacturing Science, East west press, New Delhi, 2006.

Course Learning Outcomes (CLO): On completion of this course, the students will be able to:

CLO	Description	Bloom’s Taxonomy Level
CLO1	Able to intelligently select the appropriate welding process for a particular application	4 Analyzing 1 Remembering
CLO2	To evaluate joint performance of different combinations of materials.	5 Evaluating 6 Creating
CLO3	Demonstrate their ability to check the weldment quality using various inspection and testing methods	4 Analyzing
CLO4	To Learn and Evaluate metallurgical aspect of welding processes	2 Understanding
CLO5	Students will be able to describe the basic metallurgy of the melted and heat-affected zone of a metal or alloy.	3 Applying
CLO6	Identify the cause of welding defects and avoid them.	1 Remembering

Mapping of CLOs with POs & PSOs:

Course Learning Outcomes	Program Outcomes (POs)												Program Specific Outcomes(PSOs)	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CLO1	H		M		H	L						L		L
CLO2	M	H		M				L			L		H	
CLO3			M				M		L				M	
CLO4	H				H	M				M				M
CLO5		H	M	L			L				L	M		H
CLO6	M				H				L				M	

H: High, M: Medium, L: Low