GANPAT UNIVERSITY

FACULTY OF ENGINEERING & TECHNOLOGY

Programme	Bachelor of Technology	Branch/Spec.	Mechanical Engineering
Semester	VII	Version	2.0.0.1
Effective from Academic Year	**2025-26**	Effective for the batch Admitted in	**July 2022**
Course Code	**2ME72PE3**	Course Name	**Advance Welding Technology (Professional Elective V)**

Teaching Scheme						Examination Scheme (Marks)			
(Per week)	Lecture(DT)		Practical(Lab.)		Total		CE	SEE	Total
	L	TU	P	TW					
Credit	3	0	1	0	4	Theory	40	60	100
Hours	3	0	2	0	5	Practical	30	20	50

Pre-requisites:

Knowledge of welding processes

Course Outcomes:

CO1	**Classify** various welding processes, **understand** their principles and select appropriate processes for different applications.
CO2	**Analyze** the electrical characteristics of welding arcs, design welding power sources and optimize welding parameters to achieve desired weld quality.
CO3	**Design** weld joints, consider metallurgical aspects and implement techniques to minimize defects and improve weld integrity.
CO4	**Apply** automation techniques in welding, conduct welding inspections and adhere to relevant codes and standards.

Theory syllabus

Unit	Content	Hrs
1	**Introduction to welding processes:** Classification of welding processes, Gas welding, Manual metal arc welding, Tungsten inert gas welding, Metal Inert gas welding, Submerged Arc welding, Electron Beam welding, Laser beam welding, Resistant welding, Friction Welding, Plasma welding, Underwater welding methods, materials used in underwater welding, designed equipment, processes and Safety concerns in underwater welding. Selection of electrode and advanced electrode coatings and their impact on weld integrity, Welding defects, Effect of process parameters.	12
2	**Welding arc and power sources:** Definition of Arc, Structure and characteristics, Arc efficiency, Arc blow, Electrical characteristics of arc, Types of welding arcs, Mechanism of arc initiation, Requirement of an arc welding power sources, Basic characteristics of power sources for various arc welding processes, Duty cycles, Selection of a static Volt-Ampere characteristic for a welding process, AC/DC welding power source.	5
3	**Weld joint design and repair of weldment:** Position, Groove and edge preparation, Design consideration for best weld, Repair process for weld defects, Design of welded joints for specific applications, Special considerations in weld joint design.	5
4	**Metallurgical aspects of welding:** Importance of controlling the HAZ to prevent material failure, Methods to minimize HAZ size and control its properties by optimizing welding parameters, Metal solidification, Residual stress and distortion, Methods to control and reduce distortion, Dilution, Pre heat and post heat treatment, Methods to relieve welding stresses.	6
5	**Automation in welding:** Types of weldment holding devices, Equipment productivity in welding, Temperature considerations, and Duty cycle of drives in welding, Future trends and advances in welding automation.	4
6	**Welding Inspection and Testing:** Introduction, Destructive and Non-Destructive testing methods, Visual Inspection, Dye Penetrant testing, Ultrasonic testing, Radiographic testing, Magnetic Particle testing, Eddy Current testing, Welding codes and standards.	7
7	**Advanced welding process:** Friction stir welding, Narrow gap welding, Activated TIG welding, Orbital welding, Hybrid Laser-Arc welding.	6

Practical Content	
The term work shall be based on experimental and analytical work on topics mentioned above.	
Text Books	
1	R.S. Parmar, “Welding Technology”, Khanna Publisher, Delhi. 2nd Revised Edition.
2	O.P.Khanna, “Welding Technology”, Dhanpat rai publications, New Delhi.
Reference Books	
1	Newnes, “Fusion Welding and Brazing of Copper Alloys”, Buttchworths, London, 2006.
2	H. G. Ranjon, “Welding Metallurgy”, Jaico Publishing House, Mumbai.2007.
3	L. M. Goyrd, “Principle of Welding Technology”, Viva Books Pvt. Ltd, New Delhi.2006.
4	David Widgery, “Tubular Wire Welding”, Jaico Publishing House, Mumbai. 2009.
5	Rechard L. Little, “Welding and Welding Technology”, Mc Graw Hill, New Delhi. 2004.
6	S.P.Tewari, “Advanced welding technology”, S.K. Kataria & Sons publications.
ICT/MOOCs references	
1	https://nptel.ac.in/courses/112/103/112103263/ (Fundamental of Welding Science and Technology)
2	https://nptel.ac.in/courses/112/103/112103244/ (Welding Metallurgy)
3	https://nptel.ac.in/courses/112/107/112107213/ (Joining Technologies for metals)
4	https://nptel.ac.in/courses/112/107/112107089/ (Welding Power Source)
5	https://archive.nptel.ac.in/courses/112/103/112103305/ (Welding applications)

Mapping of CO with PO and PSO:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	1	2	0	0	1	0	0	0	2	0	1	3	2	0	1
CO2	2	2	2	2	2	0	0	0	1	0	2	0	3	1	0
CO3	3	2	3	2	2	0	0	0	0	0	1	2	3	0	1
CO4	1	2	2	2	3	0	0	1	2	0	2	1	2	2	2