

ADVANCES IN WELDING TECHNOLOGY

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|---------------------------------------|----------|--------------------------------|-----------|----------------------|-----------------------|
| CourseCode | 20ME6503 | Year | III | Semester | I |
| Course Category | HONORS | Branch | ME | Course Type | Theory |
| Credits | 4 | L – T – P | 3 – 1 – 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 |

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|----|---|---------------------|
| | 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. Cnmur 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#