



JOINING TECHNOLOGIES FOR METALS

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INTENDED AUDIENCE : It is a core course for UG/PG students, practicing engineers.

COURSE OUTLINE :

It is proposed to include following joining technologies of commercial importance under different groups of processes.

A) Fundamentals of Metal Joining Technologies: mechanisms for obtaining metallic continuity: fusion, deformation, diffusion, chemical interactions

B) Fusion based processes: principle of fusion welding processes, oxy-fuel has welding, common arc welding processes, high energy beam welding processes, resistance welding processes, newer variants of fusion welding processes

C) Solid-liquid joining processes: brazing and soldering, braze welding, cold metal transfer welding,

D) Solid state joining processes: friction welding and its variants, diffusion bonding, ultrasonic welding and explosive welding and

E) Adhesive joining: design, procedure, and applications

F) Metallurgical Aspects of Welding: weld thermal cycle, solidification of weld metal

G) Weldability of carbon steel, alloys steel, stainless steels; Fe-C, TTT, CCT and schaffler diagram for understanding the metallurgical transformation in weld and heat affected zone., basics of residual stresses H) Common issues related with joining technologies their causes and remedies: hardening and softening of heat affected zone, porosity, cracking,

ABOUT INSTRUCTOR :

Prof. D K Dwivedi obtained BE (mechanical engineering) , in 1993 from GEC Rewa, ME (welding engineering) Univ. of Roorkee in 1997 and PhD in Met. Engineering from MNIT, Jaipur in 2003. He has about 9 years teaching experience at NIT Hamirpur and 19 years at IIT Roorkee of subjects related with manufacturing at UG level and welding engineering related subjects at PG level. He has published more than 132 research papers in SCI/SCIE indexed journals and undertaken 24 sponsored research and 54 industrial consultancy projects. Instructor has authored five books entitled "Production and Properties of Cast Al-Si Alloys with New Age International, New Delhi (2013), Surface Engineering, Springer Nature (2018), Fundamentals of Metal Joining, Springer Nature (2021), Materials Engineering, AICTE (2022), Dissimilar metal joining, Springer Nature (2023)

COURSE PLAN :

Week 1: Fundamentals of Metal Joining Technologies

Week 2: Fusion Welding Process: Principle of fusion welding processes, oxy-fuel has welding, SMAW and GTAW

Week 3: Newer variants of GTAW processes, physics of arc welding, GMAW, SAW, LBW, ESW-EGW

Week 4: Solid-Liquid Joining Processes: brazing and soldering, braze welding, resistance welding

Week 5: Adhesive joining, weld-bonding, solid state joining fundamentals : diffusion bonding, ultrasonic welding

Week 6: Explosive welding, magnetic pulse welding, weld thermal cycle, HAZ,

Week 7: Solidification of weld, metallurgical transformation in weld and heat affected zone, residual stresses, cold cracking, solidification cracking

Week 8: Weldability of metal, metal properties and weldability, hardenability and weldability

Week 9: Weldability of precipitation hardened, work hardened , transformation hardened

Week 10: Weldability of carbon, alloy steel low carbon and mild steel

Week 11: Weldability of medium carbon, and high carbon alloy steel, heat treatable alloy alloy and Cr-Mo steel

Week 12: Weldability of pre-coated steel and stainless steel