

Course code	Course Name	L-T-P-Credits	Year of Introduction
ME366	ADVANCED METAL JOINING TECHNOLOGY	3-0-0-3	2016
<b>Prerequisite : Nil</b>			
<b>Course Objectives</b>			
<ul style="list-style-type: none"> <li>To expose the students to the fundamental concepts of advanced welding technologies and their relevance</li> </ul>			
<b>Syllabus</b>			
Radiant energy welding, Electron beam and Laser beam welding, Plasma arc welding, Micro plasma welding, Magnetically impelled arc butt welding, Underwater welding, Explosive welding, Adhesive bonding, Friction welding, Friction stir welding, Friction stir processing, Diffusion welding, Cold Pressure welding, Ultrasonic welding, Vacuum brazing.			
<b>Expected outcome</b>			
<ul style="list-style-type: none"> <li>The students will be able to understand the advancements in welding technologies and processes, their significance, application areas etc. leading to the development of products and processes.</li> </ul>			
<b>References Books:</b>			
<ol style="list-style-type: none"> <li>1. ASM Metals Hand Book “Welding and Brazing”, Vol. 6, ASM, Ohio, 1988.</li> <li>2. Parmar R.S., “Welding Processes and Technology”, Khanna Publishers, Delhi, 1998.</li> <li>3. Parmer R. S., Welding Engineering and Technology“, Khanna Publishers, 1997</li> <li>4. Rossi, Welding Engineering, McGraw Hill, 1954.</li> <li>5. Schwartz M.M., “Metals Joining Manual”, McGraw-Hill Inc., 1979.</li> <li>6. Udin et al., Welding for Engineers, John Wiley &amp; Sons, New York, 1967.</li> <li>7. Welding Engineers Hand Book- ASHE Vol . I, II, III and IV.</li> </ol>			
<b>Course Plan</b>			
Module	Contents	Hours	End Sem. Exam Marks
I	Radiant energy welding: Electron Beam Welding- Background of the Process, Guns, Weld Environment, Welding in Different Degrees of Vacuum, Equipment and Safety, Joint Design, Applications, Laser Beam Welding, Physics of Lasers, Types of Lasers, Process Parameters, Applications and Limitations.	7	15%

<b>II</b>	Diffusion Welding- theory and Principle of Process, Key Variables, Intermediate Materials, Deformation Welding, Equipment and Tooling, Joint Design, Economics, Advantages and Limitations, Materials and Applications, Cold Pressure Welding- Process, Equipment and Setup, Applications	6	15%
<b>FIRST INTERNAL EXAM</b>			
<b>III</b>	Explosive Welding- theory and Key Variables, Parameters, Weld Quality, Equipment and Tooling, Advantages and Limitations, Joint Design, Materials and Applications, Adhesive Bonding- theory and Key Parameters, Physical Characteristics, Metal Adhesive, Equipment, Design, Economics of Process, Materials and Applications.	7	15%
<b>IV</b>	Ultrasonic welding-Principles of operation, Process Characteristics and Applications, Vacuum brazing-Theory, Mechanisms and Key Variables, Equipment and Tooling, Stop-Off and Parting Agents, Advantages, Limitations, Economics Materials and Applications.	6	15%
<b>SECOND INTERNAL EXAM</b>			
<b>V</b>	Plasma arc welding: Plasma Arc Welding- theory and Principles, Transferred arc and Non-Transferred arc Techniques, Equipment and Tooling, Joint Design Advantages, Disadvantages, Economics, Materials and Applications, Needle Arc Micro Plasma Welding - Characteristics of Process, Operating Characteristics, Fixturing and Joint Design, Shielding, Weld Penetration and Shape, Applications, Magnetically impelled arc butt (MIAB) welding, Under Water Welding- Wet and Dry Under Water Welding	8	20%
<b>VI</b>	Friction Welding- Basic Principles, Process Variants, Different Stages of Friction Welding, Mechanism of Bonding, Influence of Process Parameters, Weld Quality and Process Control, Joining of Dissimilar Materials, Advantages, Limitations and Applications, Friction Stir Welding-Metal flow phenomena, tools, process variables and applications, Friction Stir Processing- Process, Application	8	20%
<b>END SEMESTER EXAM</b>			

## Question Paper Pattern

**Maximum marks: 100**

**Time: 3 hrs**

The question paper should consist of three parts

### **Part A**

There should be 2 questions each from module I and II

Each question carries 10 marks

Students will have to answer any three questions out of 4 (3x10 marks =30 marks)

### **Part B**

There should be 2 questions each from module III and IV

Each question carries 10 marks

Students will have to answer any three questions out of 4 (3x10 marks =30 marks)

### **Part C**

There should be 3 questions each from module V and VI

Each question carries 10 marks

Students will have to answer any four questions out of 6 (4x10 marks =40 marks)

Note: Each question can have a maximum of four sub questions, if needed.

