

GUJARAT TECHNOLOGICAL UNIVERSITY

PRODUCTION ENGINEERING

METAL JOINING TECHNOLOGY

SUBJECT CODE: 2162506

B.E. 6th SEMESTER

Type of course: Core

Prerequisite: Enthusiasm to learn the subject

Rationale: Production engineers need to know different types of metal joining processes for production of intricate part in combination with the accuracy, tolerance & surface finish. The present course intends to give the exposure of various joining processes for a product whose scale ranges from miniature to extra-large. Since joining of metals is an important manufacturing route to fabricate bulk storage and processing equipment's. The subject focuses on knowledge and understanding of various joining process and equipment's, the underlying principles and their relative merits and demerits. Basic understanding regarding weldability of different metals and alloys is also duly emphasized. It also helps them to understand the advancement of technology in manufacturing.

Teaching and Examination Scheme:

Teaching Scheme			Credits C	Examination Marks						Total Marks
L	T	P		Theory Marks			Practical Marks			
			ESE (E)	PA (M)		PA (V)		PA (I)		
				PA	ALA	ESE	OEP			
4	0	2	6	70	20	10	20	10	20	150

Content:

Sr. No.	Subject Contain	Total Hrs.	Wodule Weightage
1	Metal Joining Processes Introduction, classification of welding processes as per AWS, commonly welded base metals, advantages and disadvantages of welding. Welding as compared to riveting and casting. Soldering, brazing, adhesive bonding processes, welding of dissimilar metals.	6	10
2	Gas Welding Processes Introduction, oxy-acetylene welding, oxy-hydrogen, air-acetylene welding. Principle of operation, types of welding flames, Lighting the torch, flame adjustment, gas welding techniques .welding techniques- leftward & rightward. Filler metals and fluxes, gas welding equipments, applications.	8	15
3	Arc Welding Processes Introduction, Principle, Working, Specifications, Equipments, Merits and demerits, applications of Carbon arc welding, Flux Shielded Metal arc Welding, Gravity Welding, Sub Merged Arc Welding, GTAW Welding, GMAW Welding, CO2 Welding, Flux Cored Arc	12	20

	Welding(FCAW),Electro Slag welding, Electro Gas welding, Plasma Arc Welding. Source of Power Supply: AC/DC & their characteristics		
4	Resistance Welding Processes Introduction, Principle, Working, Specifications, Equipments, Merits and demerits, applications of Spot welding, Seam welding, Projection Welding, Upset welding, Flash Butt welding, Percussion Welding.	6	10
5	Solid State and Thermo chemical and Processes Introduction, Principle, Working, Specifications, Equipments, Merits and demerits, applications of Solid State welding Processes like Cold (or pressure welding), Diffusion(Bonding), Explosive welding, Friction ,Inertia and forged welding. Thermo chemical welding processes like thermit welding, atomic hydrogen welding.	6	10
6	Weld Defects & Tests Introduction, type of defects in weldments, causes and remedies of defects. Repair of defective welds, Visual examination of welding, Fabrication Weldability tests , Hydrostatic Pressure testing and Hydraulic or Gas Pressure testing for leakage, Use of NDT for weldments, Pre and post weld heat treatment, safety standards	10	15
7	Arc Welding Electrodes Types, Details , Categories of welding electrodes, Ingredients of coating and their functions, Selection of Electrodes, Classification and Coding of mild steel and low alloy steel electrodes as per Indian and American System.	6	10
8	Weld Joints & Metallurgy Various types of weld joints & weld symbols, Standard location of elements of welding symbols. Heat affected zone and its properties.	6	10

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
14	21	7	14	14	0

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

1. Welding Technology by O. P. Khanna, Dhanpat Rai & Sons
2. Welding Processes and Technology by R.S.Parmar, Khanna
3. Welding and Welding Technology by Little, McGrawhill
4. Welding Technology for Engineers by Rai, Narosa
5. WS welding Handbook, Vol 1 to 4 AWS

Course Outcome:

After learning the course the students should be able to:

- Indicate which types of Welding Processes are suited for production.
- Determine various gas, arc, solid state, thermo chemical welding processes with their process parameters.
- Identify various advanced welding processes.
- Determine various Nondestructive testing for weldments.
- Identify the various types of electrodes used for welding processes
- Identify the various Weld Joints & Metallurgy

List of Experiments:

1. To Study about Metal Joining Processes (02 hours)
2. To Study about Gas Welding Processes (02 hours)
3. To Study about Arc Welding Processes (04 hours)
4. To Study about Resistant Welding Processes (02 hours)
5. To Study about Solid State Welding Processes (02 hours)
6. To Study about Thermo Chemical Welding Processes (04 hours)
7. To Study about Welding Defects & Distortion (02 hours)
8. To Study about Arc Welding Electrodes (02 hours)
9. To Study about Weld Joints & Metallurgy
10. Industrial Visit with student's individual report (8 Hrs)

Design based Problems (DP)/Open Ended Problem:

1. Design & Draw detailed drawing of different types of welded joints.
2. Design & Draw assembly & detailed drawing of the given machine component to be fabricated using welding process.

List of Open Source Software/learning website:

<https://www.engineering.osu.edu>
www.aws.org
www.weldingalloys.com
www.themanufacturinginstitute.org
www.asme.org
www.weldingdesign.com

ACTIVE LEARNING ASSIGNMENTS: Preparation of power-point slides, which include videos, animations, pictures, graphics for better understanding theory and practical work – The faculty will allocate chapters/ parts of chapters to groups of students so that the entire syllabus to be covered. The power-point slides should be put up on the web-site of the College/ Institute, along with the names of the students of the group, the name of the faculty, Department and College on the first slide. The best three works should submit to GTU.