Lok Jagruti Kendra University
University with a Difference

Diploma in Mechanical Engineering

LJ Polytechnic

Course Code: 025060405

Welding Technology

Programme / Branch Name			Diploma in Mechanical Engineering			
Course Name	Welding Technology				**Course Code**	025060405
Course Type	HSSC	BSC	ESC	PCC	OEC	PEC

Legends: HSSC: Humanities and Social Sciences Courses BSC: Basic Science Courses
ESC: Engineering Science Courses PCC: Program Core Courses
OEC: Open Elective Courses PEC: Program Elective Courses

1. Teaching and Evaluation Scheme

Teaching Hours / Week				**Evaluation Scheme**			
L	**T**	**P**	**Total Credit**	**CCE**	**SEE (Th)**	**SEE (Pr)**	**TOTAL**
3	0	2	4	50	50	50	150

Legends:
L: Lectures T: Tutorial P: Practical
CCE: Continuous & Comprehensive Evaluation
SEE (Th): Semester End Evaluation (Theory)
SEE (Pr): Semester End Evaluation (Practical)

2. Prerequisites

- ✓ Material science
- ✓ Basic of Mathematics

3. Rationale

Mechanical technologists (diploma holders) have to work with men, machines and materials. With the advancements, newer difficult to welding materials and complex shapes with high strength and properties are the demand of manufacturing and fabrication sector. To welding these materials and also the complex structures with higher properties the student must have the knowledge of different welding processes like gas welding, arc welding, TIG, MIG etc. and also the advance welding processes like LBW, EBW, USW, FSW.

4. Objectives

- ✓ Maintain the welding process to produce complex components of different materials.
- ✓ This course provides student to fundamental knowledge and skill to understand basic and practical approach of different welding processes.
- ✓ Choose relevant welding process to produce different material structure.
- ✓ Choose relevant power source for welding process.
- ✓ Maintain welding machine to produce components effectively.
- ✓ This course provides student to fundamental knowledge and skill to understand basic and practical approach of different welding inspection methods.

5. Contents

Unit No.	Unit Name	Topics	Learning Outcome	% Weightage	Hours
1.	**Introduction to Welding**	1.1. Introduction of welding 1.1.1. Welding as compared to riveting and casting 1.1.2. Importance and applications of welding 1.1.3. Commonly welded base metals 1.2. Classification of welding processes 1.2.1. Advantages of welding 1.2.2. Disadvantages of welding 1.3. Health and safety measures in welding 1.4. Welding power sources 1.5. Metal transfer in arc welding 1.6. Weldability 1.7. Effect of alloying elements on weldability	• State difference between welding, riveting and casting. • Describe classification, advantages, limitations and applications of welding. • Explain welding power sources. • Describe weldability and effect of alloying elements.	12	05
2.	**Welding Processes**	2.1. Gas welding 2.1.1. Welding filler metal rods 2.1.2. Fluxes 2.1.3. Gas welding equipment 2.2. Arc welding 2.2.1. Arc welding equipments 2.2.2. Arc welding methods 2.2.3. Flux shielded metal arc welding (MMAW or SMAW) 2.2.4. Tungsten inert gas welding (TIG) or gas tungsten arc welding (GTAW)	• Explain working principle with sketches procedure of the gas welding process. • Explain working principle with sketches the different arc welding process. • Explain working principle with sketches the given resistance welding processes. • Explain working principle with sketches procedure of the given solid state welding process.	28	12

		2.2.5. Submerged arc welding 2.2.6. Metal inert gas (MIG) or gas metal arc welding (GMAW) 2.3. Resistance welding 2.3.1. Resistance welding methods 2.3.2. Butt welding 2.3.3. Spot welding 2.3.4. Seam welding 2.3.5. Thermit welding 2.4. Solid state welding 2.4.1. Diffusion welding 2.4.2. Friction welding			
3.	**Advance Welding Processes**	3.1. Newer types of welding 3.1.1. Ultrasonic welding 3.1.2. Laser beam welding 3.1.3. Electron beam welding 3.1.4. Friction stir welding 3.2. Brazing 3.3. Soldering 3.4. Cutting	• Explain the working principle, equipment, applications of advance welding processes. • Explain other joining processes like brazing and soldering. • Describe cutting process with sketch and procedure.	20	8
4.	**Weld Design**	4.1. Weld symbols 4.2. Types of weld positions 4.3. Types of weld joints 4.4. Introduction to welding procedure specification (WPS) and welder performance qualification (WPQ) 4.5. Welding defects 4.6. Inspection and testing of weld 4.6.1. Destructive test methods 4.6.2. Non-destructive test methods	• Explain different types of weld symbols, welding positions and weld joints. • Discuss introduction of welding procedure specification and welder performance qualification. • Explain different welding defects and weld testing methods like destructive test & non-destructive test.	28	12
5.	**Cost Estimation of Welding**	5.1. Introduction of costing 5.2. Factors effecting arc welding cost	• Discuss about costing of welding parts.	12	5

		5.3. Factors effecting gas welding cost 5.4. Elements of cost in arc welding 5.5. Elements of cost in gas welding 5.6. Procedure of cost estimation in arc welding 5.7. Procedure of cost estimation in gas welding	• Explain different factors of welding cost for gas and arc welding. • Explain process of costing for gas and arc welding given job.		
				Total Hours	**42**

6. List of Practicals / Exercises

The practicals/exercises have been properly designed and implemented in an attempt to develop different types of skills, so that students can acquire the competencies/programme outcomes. Following is the list of practicals/exercises.

Sr. No.	Practical / Exercises	Key Competency	Hours
1.	Prepare job containing minimum 2 parts using arc welding. This includes cutting of raw material and preparation of pre-weld parts and use tacks and continuous welding in job.	• Sketch part with dimensions. • Set up arc welding machine. • Identify consumables for welding. • Prepare and set material for welding. • Prepare job using arc welding process.	4
2.	Prepare job using gas cutting and gas welding. This includes cutting of raw material and preparation of pre-weld parts. Minimum 2 parts for job should be taken and should include tacks and continuous welding.	• Sketch part with dimensions. • Set up gas welding equipments. • Identify consumables for welding. • Prepare and set material for welding. • Prepare job using gas welding process.	4
3.	Prepare a job using spot resistance welding. This also includes cutting of raw material and preparation of pre-weld parts.	• Sketch part with dimensions. • Set up spot resistance welding machine.	4

		• Prepare and set material for welding. • Prepare job using spot resistance welding process.	
4.	Demonstration metal inert gas welding process with preparation of a job.	• Set up metal inert gas welding machine. • Identify consumables for welding. • Demonstrate using metal inert gas welding process.	2
5.	Demonstration tungsten inert gas welding welding process with preparation of a job.	• Set up tungsten inert gas welding welding machine. • Identify consumables for welding. • Demonstrate using tungsten inert gas welding welding process.	2
6.	Complex job as mini project work: fabricate one complex job by using welding processes in group of 4 to 6 students. This includes followings: a. Sketches. b. Bill of material. c. Steps to fabricate. d. Method employed for weld edge preparation. e. Selection of welding process and process parameters. f. List of consumables used with specifications and quantity. g. Pre and/or post weld heat treatment processes used. h. Presentation including photographs/video of actual work being carried out.	• Sketch part with dimensions. • Prepare bill of material. • Set up for fabrication. • Prepare and set material for welding. • Prepare job as mini project using different welding process.	10
7.	Liquid penetrate testing: a. Demonstrate liquid penetrate testing of weldment. b. Write specification of test liquid. c. List steps followed. d. Write conclusion with interpretation. e. Attach photograph	• Set up for liquid penetration testing. • Prepare and set material for testing. • Identify different defects.	2
		Total Hours	**28**

7. Suggested Specification Table for Evaluation Scheme

Unit No.	Unit Name	Distribution of Topics According to Bloom's Taxonomy					
		R %	U %	Ap %	C %	E %	An %
1.	Introduction to welding	26	40	20	-	7	7
2.	Welding processes	21	21	21	11	11	15
3.	Advance welding processes	13	27	27	13	7	13
4.	Weld design	18	28	22	9	9	14
5.	Cost estimation of welding	30	19	25	-	13	13

Legends: R: Remembering U: Understanding
App: Applying C: Creating
E: Evaluating An: Analyzing

8. Textbooks

1) Welding Technology by O.P. Khanna, Dhanpat Rai Publications, New Delhi
2) Welding Engineering and Technology by R.S. Parmar, Khanna Publishers, New Delhi
3) Mechanical Estimating and Costing by T.R. Banga and S.C. Sharma (Khanna Publishers)

9. Reference Books

1) Welding Technology by Little R. L., Tata McGraw Hill, New Delhi
2) Production Technology by R.K. Jain, Khanna Publishers, New Delhi
3) Welding Principles and Practices by Edwars R. Bohnart, McGraw Hill Education

10. Open Sources (Website, Video, Movie)

1) https://www.youtube.com/watch?v=44Db1Z59_eo
2) https://www.youtube.com/watch?v=n_DuzHRZ4JI
3) https://www.youtube.com/watch?v=4iPF0pMjKjA
4) https://www.youtube.com/watch?v=AvXoEp53zAY&list=PLSGws_74K019IqR1NmlxuhvKYq1IjuCXW
5) https://www.youtube.com/watch?v=1L4BSJIJuvM
6) https://www.youtube.com/watch?v=xQc8EdLwqRc
7) https://www.youtube.com/watch?v=3nJKO3NdWDo
8) https://www.youtube.com/watch?v=avyy_iEJKxY
9) https://www.youtube.com/watch?v=gAyceJb5OWc
10) https://www.youtube.com/watch?v=YICHGl4te4k
11) https://www.youtube.com/watch?v=u53YCsroOC4
12) https://www.youtube.com/watch?v=jCe8-QYKZf4
13) https://www.youtube.com/watch?v=P4IjzDdIIi0
14) https://www.youtube.com/watch?v=5Iz09h6YI5E