BMEE311L	Welding Engineering	L	T	P	C
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Pre-requisite	**BMEE302L, BMEE302P**	**Syllabus version**			
		1.0			

Course Objectives

1. Select their profession as an Engineer in Industries and expand areas of materials, power, and energy-related fields.
2. Practice effectively in the emerging Industrial environment with the lead role and make timely development toward establishing newer technology in welding-related fields or business.
3. Pursue their careers in academia and develop entrepreneur skills.

Course Outcome

At the end of the course, the student will be able to

1. Select a suitable process for producing quality weldments based on materials and applications.
2. Design weld joints that serve under different loading and servicing.
3. Test and evaluate the weldments in various environments.
4. Assess the quality of weldments and suggest methods of producing quality joints.
5. Apply suitable consumables for welding involving different types of materials.
6. Develop and adopt energy-saving and eco-friendly techniques in the welding industry.

Module:1	**Fundamentals and Principles of Arc Welding**	**5 hours**

Classification of welding processes: heat sources, power sources, arc phenomena, arc blow, power source characteristics, V-I, relationship, flux covering, different types of electrodes and their applications, gas welding and cutting, flame characteristics.

Module:2	**Electrical aspects of welding**	**6 hours**

Basic principles, different methods of control of volt-ampere characteristics, operation, volt control, slope control, dual control, resistance welding transformers, welding rectifiers, choice of diode material; use of thyristors, inverters - Measurements of welding current, voltage, temperature, load and displacement.

Module:3	**Welding metallurgy**	**7 hours**

Heat flow in welding: temperature distribution in welding, heat flow equations, simple problems, metallurgical effects of heat flow in welding. Solidification of Metals, - welding of stainless steels (austenitic, ferritic, martensitic, duplex and PH stainless steels), use of Schaffler and Delong diagrams, Welding of Cu, Al, Ti and Ni alloys – microstructures, defects and remedial measures. Preheating and post-heating.

Module:4	**Design of Weldments**	**7 hours**

Joint design based on stresses in the structure; Joint design for structural elements such as bars, beams, plates, slabs, columns, trusses, plate girders, cylindrical shells and pressure vessels and pipe lines. Design for flanged connections, structural hollow sections and branch connections; Welded joint design to control distortion and shrinkage, residual stresses and cracking.

Module:5	**Welding codes and standards**	**6 hours**

Structural Welding Codes: Design requirements, allowable stress values, workmanship and inspection. Petroleum Piping Fabrication: Process and product standards for manufacturing of pipe - welding procedure and welder qualification, field welding and inspection. Pressure Vessel Fabrication: Design requirements, fabrication methods, joint categories, welding and inspection, post weld heat treatment and hydro testing.

Module:6	**Repair welding and Reclamation**	**6 hours**

Engineering aspects of repair, aspects to be considered for repair welding, techno-economics, repair welding procedures for components made of steel casting and cast iron, half bead, temper bead techniques, usage of Ni-base filler metals - Damaged bends in gas

transmission pipeline, heat exchanger repair techniques-explosive expansion, plugging, etc.,		
Module:7	**Welding applications**	**6 hours**
Materials, processes, fabrication and construction, use of automatic welding and systems in the automobile industry - Oil and gas industry - nuclear industry, materials, processes, fabrication, inspection and testing, case studies, recent trends and developments - Materials, processes, fabrication, inspection and testing.		
Module:8	**Contemporary Issues**	**2 hours**
	Total Lecture hours:	**45 hours**

Text Books	
1.	Nadkarni S.V., Modern Arc Welding Technology, 2010, Oxford and IBH Publishing.
2.	Khanna O. P., A Textbook of Welding Technology, 2009, Dhanpat Rai Publishers.
3.	Radhakrishnan V. M. Welding Technology and Design 2005, Revised Second Ed., New Age International Publishers.
Reference Books	
1.	Kou S., Welding Metallurgy, 2002, John Wiley, 2002.
2.	John Norrish. Advanced welding processes Technologies and process control, 2006, Wood head Publishing and Maney Publishing. Cambridge, England.
3.	Bhattacharya M. Weldment Design, Association of Engineers, 1991.

Mode of Evaluation: CAT, Written assignment, Quiz, FAT			
Recommended by Board of Studies	09-03-2022		
Approved by Academic Council	No. 65	Date	17-03-2022