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| SUBJECT----- **welding metallurgy- PhD student**  **Dr.shawnim R.jalal**  Part 1: Course Information  Description  1. Describe basic physical metallurgy starting at the atomic level, with  bonding, defect structure, phase diagrams and diffusion and moves  towards the development of metal microstructure.  2. Describe how metals solidify, how phases nucleate and grow, and the  mechanisms by which metal alloys are strengthened. Describe the  development of the fusion and heat-affected zones during the welding  of metales.  3. Describe how weld variables such as pool shape, travel speed, cooling  rate and other variables affect the subsequent weld microstructure.  4. Determine how the weld variables and weld microstructure affect the  mechanical properties of the weld will be able to identify the microstructure of acceptable welds. |  | |  | |  |
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| **Part 2 --- Objective**  Provide an overview of joining processes; discuss in detail the weld the welding process and the physics of welding. Introduce students to different welding processes weld testing and advanced processes to be able to appreciate the practical applications of welding. Each student will be able to correctly answer a minimum of 70% of the questions regarding the aspects of  welding metallurgy on minor and major quizzes.Each student will have a basic understanding of fundamentals and practical experiences in as many welding  processes as possible | | | | | |
| **Part 3---- Learning Outcomes:**  a. Apply fundamental principles of metallurgy to the metals and manufacturing industry.  b. Distinguish between properties of various metals.  c. Classify metals based on industry requirements and metallurgical properties.  d. Explain the adverse effects of welding and thermal processes on metals.  **Part4---- References**  1. A Ghosh and A K Mallik, *Manufacturing Science*, Wiley Eastern, 1986.  2. P Rao, *Manufacturing Technology: Foundry, Forming And Welding*, Tata McGraw Hill, 2008.  3. M.P. Groover, *Introduction to manufacturing processes*, John Wiley & Sons, 2012  4. Prashant P Date, *Introduction to manufacturing technologies Principles and technologies*, Jaico publications, 2010 (new book)  5-. J S Campbell, *Principles Of Manufacturing Materials And Processes*, Tata McGraw Hill, 1995.  6. P C Pandey and C K Singh, *Production Engineering Sciences*, Standard Publishers Ltd., 2003.  7. S Kalpakjian and S R Schmid, *Manufacturing Processes for Engineering Material*s, Pearson education, 2009.  8-Modern welding technology by Howard.B.cary 2002.  9-Welding metallurgy vol.1 by George E.lInnert,2004.  10-Eng.metallurgy part1 by Higgins 2009. | | | | | |

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| **Part 5----COURSE DETAIL** |
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