

# Fusion Welding Processes and Methodologies

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## Overview

The modern material assemblies require the combined use of metals for a given commercial application. Welding technologies are of critical importance for the construction of virtually all components of the assemblies. This course aims to elaborate the physical principles of arc, plasma, laser, resistance spot and electron beam welding processes. This includes, physical properties of molten weld pool, fluid and magneto fluid dynamics of weld pool, physics of electric arc-plasma, engineering the arc-plasma for welding, metal transfer and mass flow in the weld pool, laser/electron beam - material interactions, pressure and force balance in keyhole mode power beam welding, fundamentals of heat generation by Joule heating and process principles and overview on types of resistance welding processes. This course also aims to provide details about the advances that are made in mathematical modelling the physical phenomena that governs the heat generation and conduction during welding.

Course participants will learn these topics through lectures, case studies and assignments to stimulate research motivation of participants.

<b>Modules</b>	<p><b>Lecture 1 and 2: Introduction to the physics of arc : December 16, 2019</b>  <b>Lecture 3 , 4 and 5: Introduction to arc welding processes : December 16, 2019</b>  <b>Lecture 6 and 7: Introduction to laser and electron beam welding processes : December 18, 2019</b>  <b>Lecture 8, 9 &amp; 10 Heat transfer and metal transport in arc welding : December 19, 2019</b>  <b>Lecture 11 and 12: Mathematical modelling of weld phenomena : December 20, 2019</b>  <b>Lecture 13 and 14: Fundamentals of resistance welding : December 20, 2019</b></p> <p><b>Number of participants for the course will be limited to fifty.</b></p>															
<b>You Should Attend If...</b>	<ul style="list-style-type: none"> <li>▪ you are an practising welding engineer or research scientist interested in understading the fundamentals of welding processes,</li> <li>▪ you are metallurgist or mechanical engineer or design engineer interested to learn welding technology,</li> <li>▪ you are a student or faculty from academic institution interested in learning the fundamentals of welding processes.</li> </ul>															
<b>Fees</b>	<p>The participation fees for taking the course is as follows:</p> <table data-bbox="467 1543 982 1690"> <tr> <td><b>Participants from abroad</b></td> <td>:</td> <td><b>US \$ 100</b></td> </tr> <tr> <td><b>Student participants</b></td> <td>:</td> <td><b>INR ₹ 1000</b></td> </tr> <tr> <td><b>Faculty participants</b></td> <td>:</td> <td><b>INR ₹ 5000</b></td> </tr> <tr> <td><b>Industry</b></td> <td>:</td> <td><b>INR ₹ 6000</b></td> </tr> <tr> <td><b>Govt. Research Organizations</b></td> <td>:</td> <td><b>INR ₹ 5000</b></td> </tr> </table> <p><b>Participants should pay an additional 18% GST or as applicable. (Note: The GST is not applicable for the Students Participants)</b></p> <p>The above fee include all instructional materials, tutorials and assignments. Tea and refrehsments will be provided two times a day. Candidate should make their own arrangements for lunch, dinner and accommodation. In view of severe shortage of water in IIT Madras campus, hostel accommodation is limited. Participants are encouraged to arrange their own accommodation.</p>	<b>Participants from abroad</b>	:	<b>US \$ 100</b>	<b>Student participants</b>	:	<b>INR ₹ 1000</b>	<b>Faculty participants</b>	:	<b>INR ₹ 5000</b>	<b>Industry</b>	:	<b>INR ₹ 6000</b>	<b>Govt. Research Organizations</b>	:	<b>INR ₹ 5000</b>
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	<p><b>Modes of payment:</b></p> <p><u>Online transfer:</u></p> <p>Account Name: CCE IIT Madras  Acc. No: <b>3640111110</b> Branch: SBI, IIT Madras Branch, Chennai  IFSC Code: SBIN0001055 Swift Code: SBININBB453</p> <p>Note: The participants should be mentioned the purpose of GIAN while the transaction and have to send the transaction details to <a href="mailto:cceoffice@iitm.ac.in">cceoffice@iitm.ac.in</a></p> <p style="text-align: center;"><b>OR</b></p> <p>Demand draft in favour of “<b>CCE IIT Madras</b>” payable at <b>Chennai</b>. The demand draft is to be sent to the course coordinator at the address given below.</p> <p><b><u>Address of the Course Coordinator:</u></b>  Dr. Murugaiyan Amirthalingam,  Department of Metallurgical and Materials Engineering,  Indian Institute of Technology (IIT) Madras,  Chennai – 600 036,  Phone – 044- 2257 4784,  Email – <a href="mailto:murugaiyan@iitm.ac.in">murugaiyan@iitm.ac.in</a>.</p>
<b>Accommodation</b>	<p>The participants may be provided with hostel accommodation, depending on availability, on payment basis. Request for hostel accommodation may be submitted through the link:  <a href="http://hosteldine.iitm.ac.in/iitmhostel/">http://hosteldine.iitm.ac.in/iitmhostel/</a></p>
<b>Registration Procedure</b>	<p>Please follow the following steps for the registration:</p> <ol style="list-style-type: none"> <li>1. Go to GIAN website (<a href="http://www.gian.iitkgp.ac.in/GREGN/index">http://www.gian.iitkgp.ac.in/GREGN/index</a>) First time users need to register and pay a one-time fee of INR 500 /</li> <li>2. Enroll for the course: <b>Fusion Welding processes and Methodologies</b>. Once you enroll for the course, an Enrollment/Application number will be generated, and the course coordinators will be notified.</li> </ol>

## The Faculty



**Prof. I.M. Richardson** is currently heading the joining and additive manufacturing research group in the Department of Materials Science and Engineering (MSE) in Delft University of Technology (TU-Delft), the Netherlands. He is well-known for his teaching and research work in the area of (i) Physics of Welding, (ii) Arc and Laser welding Processes, (iii) Welding at Elevated Pressures and (iv) Influence of welding on materials.



**Dr. Murugaiyan Amirthalingam** is an Assistant Professor and Head of Joining and Additive Manufacturing Lab in the department of Metallurgical and Materials Engineering. His teaching and research area include (i) Welding Processes (ii) Welding Metallurgy (iii) Metal Additive Manufacturing and (iv) Mathematical Modelling of Weld Phenomena.

## Course Co-ordinator

**Prof. Murugaiyan Amirthalingam**

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<http://www.gian.iitkgp.ac.in/GREGN>