



**One-week GIAN course  
on  
DEVELOPMENT OF BIO-INSPIRED COMPONENTS FOR THE FUTURE:  
MULTI-MATERIAL, MULTI-SCALE, MULTI-PHYSICS, MULTI-FUNCTIONAL**



### **Overview**

This course intends to give an overview of the components in the near future. With the advent of 3D printing of metals, ceramics, polymers, composites, etc, components will be constituted by different materials in different locations according to local solicitations. Moreover, as smart materials are also available in the form of powders, they will make part on the new concept of components and these new components will have sensing, communicating, and actuating functions. They will behave as natural components such as arms, legs, etc., where a gradient of materials from inside (bone) to outside (different levels of skin) are mixed with sensoric materials (Meissner corpuscle (for pressure), Pacinian corpuscle (for vibration), etc., a communication system (nerves systems), and actuating areas (sweat glands (for temperature control), etc. Moreover, it is possible to build these complex materials by adding different powders of different materials in different locations thus building a multi-material, multi-scale, multi-physics, and multi-functional components. The course also intends to give highlights on manufacturing approaches that can be used to obtain the components of the near future.

### **Objectives**

The course has the following objectives:

- Understanding how bio materials perform
- Understanding the limitations of existing components and their design approaches
- Understanding the advantages of multi-material, multi-scale, multi-physics, and multi-functional components
- Understanding possibilities for manufacturing of these new components

Course Contents	
<b>Date</b> October 14 <sup>th</sup> - 19 <sup>th</sup> , 2019	<b>Day 1</b> <b>Lecture 1</b> Current trends in design <b>Lecture 2</b> Smart components – lessons from nature
	<b>Day 2</b> <b>Lecture 3</b> Concept of Functionally Graded Materials 1- chemical gradients <b>Lecture 4</b> Concept of Functionally Graded Materials 2- structural gradients
	<b>Day 3</b> <b>Lecture 5</b> The role of smart materials 1 – Shape Memory alloys <b>Lecture 6</b> The role of smart materials 2 – Piezo electric materials
	<b>Day 4</b> <b>Lecture 7</b> The role of different scales on materials design <b>Lecture 8</b> Developing integrated sensoric and actuating functions
	<b>Day 5</b> <b>Lecture 9</b> Developing integrated communicating functions <b>Lecture 10</b> 3D growing of smart integrated components 1 – manufacturing principles
	<b>Day 6</b> <b>Lecture 9</b> 3D growing of smart integrated components 2 – hybrid technologies <b>Lecture 10</b> Proposals for smart components – examples from students (workshop)
	<b>Date of Examination: Oct 19<sup>th</sup>, 2019</b>
<b>You should attend if you are...</b>	<ul style="list-style-type: none"> <li>❖ PG/PhD students, Faculty members with research focus in Manufacturing, Production and Design Fields (Mechanical Engineering)</li> <li>❖ Consulting Engineers working in Manufacturing and Design Fields</li> <li>❖ Pre-Final/Final year Undergraduate students (Mechanical Engineering)</li> </ul>

## Registration Fees

**Participants from Abroad:** US \$500

**Industry/ Research Organizations:** Rs. 8000/-

**Faculty Members:** Rs. 6000/-

**Students (Pursuing PhD / Master/ Bachelor Courses):** Rs. 4000/-

**NIT Mizoram:** Free (Faculty / Student / Researcher)

- ❖ Registration Fee only includes attendance to Sessions, Course material and Lecture notes.
- ❖ UG and PG students need to produce a document as a proof of Student Identification and a letter of Nomination from their Institute/College.
- ❖ The Registration Fee has to be paid by DD drawn in favor of Director, NIT Mizoram, payable at SBI Bawngkawn, Aizawl OR The registration fee can be paid through online transfer (NEFT/RTGS) to the Account Number: **33755447886**, Name of the account holder: **National Institute of Technology Mizoram**, Bank: **SBI**, Branch: **Bawngkawn**, IFS Code: **SBIN0007059**. Candidate's first name and words "GIAN FEE" to be mentioned in the remarks. UTR/Ref. No. should be mentioned in the application form as well as a copy to be enclosed with the application form.

## Registration

Register for the course online at <http://www.gian.iitkgp.ac.in/GREGN/index>. The last date of registration is **1<sup>st</sup> Oct, 2019**. To register or for any questions please send E-mail to [basilkuriachen@gmail.com](mailto:basilkuriachen@gmail.com). **Number of participants for the course is limited to 50.**

## Course Faculty



**Prof. Filipe Samuel Silva**

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Filipe Samuel Silva is a Full professor of Mechanics of Materials at Minho University, Portugal, and researcher at CMEMS-Centre for Micro Electro Mechanical Systems. Filipe Silva has over 150 ISI indexed papers, 5 patents, 5 international awards, and leads or led more than 15 research projects including some with companies. Minho University is in the 75th position in The Times Higher Education ranking for the 100 best universities under 50, in the world, and the best in Portugal. In the CWTS Leiden 2014 Bibliometric Ranking, UMinho was also considered the best university in Portugal ([www.uminho.pt](http://www.uminho.pt)). The CMEMS research centre was recently evaluated by the Portuguese Science and Foundation as an 'excellent' research centre ([www.mems.dei.uminho.pt](http://www.mems.dei.uminho.pt)). For extended details (web link): <https://www.scopus.com/authid/detail.uri?authorId=26029207600>

## Course Coordinator



### Dr. Basil Kuriachen

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Web page: [http://nitmz.ac.in/emp\\_profile.aspx?nDeptID=30140](http://nitmz.ac.in/emp_profile.aspx?nDeptID=30140)

**Dr. Basil Kuriachen** is an Assistant professor in the Department of Mechanical Engineering, National Institute of Technology Mizoram. His vivacity and dexterity towards abiding commitment to sublime work ethic conferred him with the Ph. D and M. Tech degree from NIT Calicut (2015) and M G University, Kottayam (2011) respectively. Prior to his joining at NIT Mizoram, he served as an Associate Professor in the School of Mechanical Science at VIT University, Vellore. His resolute research niches are in the field of micro and nano-machining processes, precision and ultra-precision machining, modeling and analysis in machining of 'difficult to machine' materials, etc. He has to his credit, 45 research publications in international referred journals and conferences alongside with two filed patents. Several M. Tech theses has been efficaciously completed through his versatile contribution and professionalism. In addition, he is an esteemed reviewer of many international journals (SCI) and conferences (AIMTDR) of phenomenal repute.



### Dr. Surender Ontela

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**Dr. Surender Ontela** is an Assistant professor in the Department of Mathematics, National Institute of Technology Mizoram. He completed with excellence, the UG courses from NIT Warangal (Mathematics-I, II, III and Mathematics-IV), NIT Mizoram (Mathematics-I, II, Numerical Methods & Probability Theory, Mathematical Methods) and PG course from NIT Warangal (Numerical & Optimization Techniques). His academic laurels include 19 research publications in International/National referred journals and conferences, qualified for Assistant Professor/Lectureship - SET/SLET (APSET-2012), CSIR International Travel Grant for Research Scholars and so on.

**A**  
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FUNCTIONAL**

(Under the aegis of MHRD- Global Initiative of Academic Networks)

**Oct 14 - 19, 2019 at NIT Mizoram**

**Registration Form**

GIAN Portal Application Number:

1. Name of the Candidate:
2. Category: Academic / Industry /Student:
3. Category of Registration: SC/ ST/ General & OBC:
4. Organization:
5. Address:
  
6. Mobile Number:
7. E-mail:
8. Highest Academic Qualification:
9. Demand Draft Details:

Bank Draft/Ref./UTR Number:

Date:

Amount:

Drawn on:

Signature of the Candidate

Signature of the Head of the Dept. /Institution

**Important Points:**

- ❖ First, **register** in GIAN portal, <http://www.gian.iitkgp.ac.in/GREGN/index>. Get Application Number.
- ❖ Fill in this Registration Form. Take a print out of it. Get it signed by Corresponding Authority.
- ❖ Draw DD (amount specified in brochure) in favor of "**Director, NIT Mizoram**" payable at SBI Bawngkawn, Aizawl – 796012 OR The registration fee can be paid through online transfer (NEFT/RTGS) to the Account Number: **33755447886**, Name of the account holder: **National Institute of Technology Mizoram**, Bank: **SBI**, Branch: **Bawngkawn**, IFS Code: **SBIN0007059**. Candidate's first name and words "GIAN FEE" to be mentioned in the remarks. UTR/Ref. No. should be mentioned in the application form as well as a copy to be enclosed with the application form.
- ❖ Send the hard copy of the filled in Registration Form along with DD/transaction receipt to: **Dr. Basil Kuriachen, Assistant Professor, Department of Mechanical Engineering, National Institute of Technology Mizoram, Chaltlang, Aizawl, Mizoram – 796 012**, Contact: +91-9947187133 and the scanned copy (soft copy) to E-mail: [basilkuriachen@gmail.com](mailto:basilkuriachen@gmail.com).