



**Two-week GIAN course
on
DEVELOPMENT OF DRONES FOR FAST GOODS TRANSPORT ACROSS
HILLY MIZORAM TERRAIN**



Overview

Several areas of India, such as Mizoram, have hilly forested terrains that make ground transportation slow and expensive. Drones or Unmanned Aerial Vehicles (UAVs) can provide an economic alternative, by delivering 1-5 kg packages across straight line distances of 10 km within 10 minutes or less, without requiring runways. This can be a game changer for growers of time-critical high-value specialty crops, but requires developing an appropriately trained workforce for implementation. Therefore, this course aims at offering students a hands-on training with current practice of UAV design, and experience actual flight operations with payloads under challenging terrain and gusty weather. It will be a conceptualize-design-build-fly-modify experience through group projects with deliverables.

Objectives

The course introduces an approach for developing specifications for UAV platforms for selected mission requirements, and for matching/modifying existing UAVs to selected missions. Of particular interest will be the transport of packages across wooded mountainous terrains. Starting with general requirements and a survey of existing fixed and rotary wing drones, multiple potential UAV applications will be considered. These will then

be subject to additional constraints driven by availability, technological maturity and cost of critical components. One or more solution will then be selected for detailed design and prototyping. To minimize cost, the prototyping will involve using selected off the shelf components typically used by radio-controlled aircraft hobbyists and do-it-yourself drone enthusiasts and using ready to fly quad copters and fixed wing configurations. Components include flight motors, controllers, auto-pilots, sensors/telemetry equipment and cameras. This will be followed by developing and executing a flight test plan. Test data from the flights and in particular the analysis of mishaps and crashes will be especially emphasized. The goal will be to teach the students how to use such data to remove design flaws and demonstrate through re-tests an improved final prototype.

Course Contents		
Date December 17 th - 28 th , 2019	Day 1	<p><u>Introduction to UAVs and Drones</u></p> <p>Lecture 1 Introduction to UAVs and Drones (1) What is a Drone? Types of Drones (fixed wing types, rotorcraft types, advantages of each type, history of the progression in drones) Overview the Advantages and Challenges in using Drones for Transport over hilly wooded terrain typical in Mizoram</p> <p>Tutorial 1 Tutorial/Lab 01: Flight test training UAV model demonstration, Formation of teams; start work on construction, work on flying (hands on for every participant)</p>
	Day 2	<p>Lecture 2 Aerodynamics and Lift Generation, Basic Concepts of Lift and Drag. Wings vs Props, developing mission specifications for UAVs, Sensors and Payloads for Missions (3) Design of a Drone: The Interplay of Different Parts (Walkthrough of how the aerodynamics, structures, propulsion, sensors, and electronics interplay, walkthrough of different configurations maximizing one area over all the others)</p> <p>Tutorial 2 Teams work on analyzing existing design and suitability for mission. Discuss and finalize team's plans for final design</p>
	Day 3	<p>Lecture 3 Why use Fixed wing UAVs, (4) Aero (5) Propulsion Efficiency and stability. Performance constraints lead to configuration/size; Why use Rotary Wings: Vertical Take Off and Landing, Hovering and Hybrids.</p> <p>Tutorial 3 Modifying configurations for selected mission segments; Building and Flying continue.</p>

	Day 4	<p>Lecture 4 Natural vs Artificial stability and control. How to build in natural stability. Human Factors; Limits of Human Operators; accidents and regulations</p> <p>Tutorial 4 Tutorial/Lab 04: Flight Demonstrations exploring flight envelope in terms of stability and control. Flight training continues. Building continues</p>
	Day 5	<p>Lecture 5 Basics of PID Controllers and UAV Autopilots, Human Factors; Limits of Human Operators; accidents and regulations</p> <p>Tutorial 5 Examination, Reactions and aspirations from the participants</p>
	Day 6	<p>Lecture 6 Propulsion fundamentals. Electric propulsion of UAVs. Selection of batteries, motors and propellers. Propulsion considerations for Fixed versus Rotary wings. Benefits and Challenges in Hybrid Design.</p> <p>Tutorial 6 Flight demonstration of stability and control</p>
	Day 7	<p>Lecture 7 Designing a Mission Specific UAV. Comparing Design Alternatives and Maximizing Utility. Economic considerations: Best Technical solution versus best Market Acceptable Solution</p> <p>Tutorial 7 Teams perform their own integration and pre-flight checks</p>
	Day 8	<p>Lecture 8 How to interpret and analyze results of Test Flights</p> <p>Tutorial 8 Teams conduct Test Flights with help from instructors</p>
	Day 9	<p>Lecture 9 UAV Flight safety, regulatory issues and training</p> <p>Tutorial 9 Modifying UAV designs based on flight tests</p>
	Day 10	<p>Lecture 10 Final Presentation of UAV designs or modifications by teams</p> <p>Tutorial 10 Final Flight Demonstration by UAV Teams</p>
	Date of Examination: December 28th, 2019	

<p>You should attend if you are...</p>	<ul style="list-style-type: none"> ❖ PG/PhD students, Faculty members with research focus in Manufacturing, Production and Design Fields (Mechanical Engineering) ❖ Consulting Engineers working in Manufacturing and Design Fields ❖ Pre-Final/Final year Undergraduate students (Mechanical Engineering)
<p>Registration Fees</p>	<p>Participants from Abroad: US \$500 Industry/ Research Organizations: Rs. 10,000/- Faculty Members: Rs. 8000/- Students (Pursuing PhD / Master/ Bachelor Courses): Rs. 6000/- NIT Mizoram: Free (Faculty / Student / Researcher)</p> <ul style="list-style-type: none"> ❖ 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

Registration

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

Course Faculty



Dr. Sumon K. Sinha
 Founder and President of Sinhatech,
 Aerospace and Fluid Dynamics Research and Development Company
 U.S.A

Dr. Sumon K. Sinha, a B.Tech., in Mechanical Engineering from IIT Kharagpur and MS and Ph.D. in Fluid Thermal Sciences from the University of Miami, is the Founder and President of Sinhatech, an Aerospace and Fluid Dynamics Research and Development company based in U.S.A. Dr. Sinha has over 30 years' experience in academia and industry investigating turbulent and unsteady flows and in devising solutions to practical flow problems using his inventions. His solutions have been used for enhancing performance of FAI record breaking "green" electric aircraft, increasing fuel efficiency of cars and trucks, reducing broadband wind noise and maximizing heat transfer in compact heat exchangers. His publications and patents range from aerodynamic flow control, heat transfer enhancement, quantitative unsteady full-field flow diagnostics, aeroacoustics and turbulent mixing in environmental

flows. He is a former tenured professor in Mechanical Engineering at the University of Mississippi. He has also held faculty posts at the University of Nebraska, Florida International University and the University of Miami. Dr. Sinha's research has been supported by the National Science Foundation, NASA, US Army and Air Force as well as large and small corporations. Dr. Sinha is now focusing on developing UAV systems for acquiring much needed meteorological data during weather events, as well as UAV based rapid transport of critical items over challenging terrain and under gusty weather conditions.

Course Coordinator



Dr. Basil Kuriachen

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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. Bidesh Roy

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A
Two Week GIAN Course
on
DEVELOPMENT OF DRONES FOR FAST GOODS TRANSPORT ACROSS
HILLY MIZORAM TERRAIN

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

December 17th - 28th, 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.