



Høgskolen i Telemark

Faculty of Technology at Telemark University College

By Finn Haugen (finn.haugen@hit.no)

25. March 2010

Report from visit at University of Moratuwa in Sri Lanka in March 2010

Introduction

From 11. to 22. March 2010 I visited University of Moratuwa in Sri Lanka to teach the course *Process Control* in the master study in *Sustainable Process Development*.

This activity is a part of a collaborative project between Telemark University College, Faculty of Technology (TUC), and University of Moratuwa (UM). The main aim of the project is to develop master studies at UM with emphasis on environmental and industrial projects. The project is funded by Norad's Programme for Master Studies (NOMA). The main activities in the project are Sri Lankan students taking their master studies at TUC and UM, TUC staff planning and lecturing courses at UM, and UM staff visiting TUC. The project has been going on since 2006, and is recently prolonged until 2013. The budget of the total period is 6.3 mill. NOK. Professor Rune Bakke at TUC and Dr. P. G. Rathnasiri at UM are project coordinators.

During the visit in Sri Lanka I also contributed to the workshop *Modern Process Control for Sustainable Process Development* offered by UM to industry in Sri Lanka. My colleague Associate Professor Britt Halvorsen and Sri Lankan PHD student Amaranath Kumara at TUC also contributed to this workshop.

The visit was successful. We were very well received and got a good response about our contributions. Further cooperation between TUC and UM about research and development within bioenergy was discussed. The climate (a little above 30 degrees) and a few clouds was perfect. Hope to come back in not too far future ☺

In the following is more information about both the workshop and the Process Control course. There are also pictures from a few other activities.

Workshop:

Process Control for Sustainable Process Development

This workshop was held at UoM 17. and 18. March. There were about 40 participants from industry and research and academic institutions. Below are the brochure, detailed agenda and some pictures from the workshop. The Powerpoint slides presented at the workshop are available at the following web address:

<http://home.hit.no/~finnh/srilanka/workshop>.

Workshop on Modern Process Control for Sustainable Process Development

Objective

To support Sri Lankan Process Industries to apply process control and automation systems in their processes and educate process engineers about automation of new processes and understanding new control systems.

Who Should Attend?

Engineers in process industries who are interested in Process Control & Automation System, including plant managers, production managers, mechanical engineers, process engineers. This workshop can be helpful for companies who intend to automate their processes.

Outline of the Workshop

- Basic concepts in process control
- Feedback, feed-forward and Sequential control
- LabVIEW based control system
- Monitoring and Control of pilot bioreactor process
- Control devices and systems
- Industrial fluidized bed application & CFD simulation

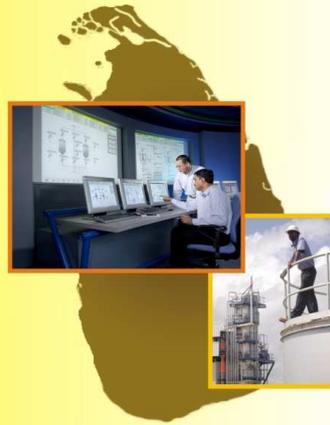


How to Register

Please fill the attached registration form and mail it to the Workshop Coordinator.

More Information

Dr. P.G. Rathnasiri
Workshop Coordinator,
Department of Chemical and Process Engineering,
University of Moratuwa
Mobile: 0716827343
Email: ratnasiri@cheng.mrt.ac.lk



WORKSHOP ON MODERN PROCESS CONTROL FOR SUSTAINABLE PROCESS DEVELOPMENT

Organized By
Dept. of Chemical And Process Engineering,
University of Moratuwa, Sri Lanka
In Collaboration with
Telemark University College, Norway

17th & 18th of March
at Department premises



Høgskolen i Telemark Department of
Chemical & Process Engineering
University of Moratuwa, Sri Lanka

M.Sc. Program on sustainable process development

Postgraduate Diploma / M.Sc. in Sustainable Process Development in collaboration with Telemark University College, Norway

This course is offered by the Chemical and Process Engineering Department.

The program is designed to help you meet the technological challenges of the present global industry, which is strong focus on best practices, the latest knowledge and skills and their real applications in the Sri Lankan context. In brief, it aims to provide a professional toolkit and to import necessary soft skills with the objective of improving the Sri Lankan industry to sustain in the current atmosphere of extreme global competition whilst enabling the smooth flow of triple bottom line.

If you are looking for a career in the Process industry sector, or to enhance existing career prospects, through part-time study or need a technology update this is an ideal opportunity. You will also be joining a pioneering group of professionals who will be looking at Sri Lanka, while adding value to our natural resources in an optimal manner.



Department of CPE

Department of Chemical and Process Engineering

The Department of Chemical Engineering will engage in activities with the theme 'MAKING THE FUTURE HAPPEN'. We are committed to making the department a place of excellence in teaching and research in Chemical and Process Engineering.

The Department has well qualified and trained staff and well equipped sophisticated laboratories to conduct research and teaching. The number of research projects undertaken by the Department in collaboration with the industry has also grown significantly during the past few years. The aim of the Department is to provide knowledge to students and help the Sri Lankan Chemical and Process industry to grow and gear them towards achieving economical development in an environmentally friendly manner. Our graduates are involved in research, production and plant design in Chemical Industries such as petroleum, food and beverages, paper, salt, agrochemical, soap and detergents, pharmaceuticals and cosmetics, paints and coatings, bio technology, water and waste water, etc. They also become experts in various other Engineering fields in Sri Lanka.



Norwegian Resource Persons



Associate Prof. Finn Haugen

He has a Masters degree in Engineering Cybernetics from the Norwegian Institute of Technology in Trondheim in Norway in 1985. He engaged in various activities with his own one-man company **TechTeach**. He has taught various university courses, covering control and automation, signal processing, mathematical modelling, and simulation, and courses for practising engineers and teachers. **LabVIEW** has become his main tool for programming, analysis, design, simulation and practical implementation of measurement and control systems. He is currently involved in automation, monitoring and control of biological reactors in Norwegian farms.



Associate Prof. Britt Halvorsen

Associate Professor Britt Halvorsen obtained a PhD degree on "An experimental and computational study of flow behaviour in bubbling fluidized beds" from the Norwegian University of Science and Technology (NTNU) in 2005. She is presently working as an associate professor at Telemark University College, Norway. Her main research area focuses on experimental and computational study of fluidized beds. In addition, she has experiences on membrane gas separation and reverse osmosis. She is working with multiphase flow application in offshore oil and gas industry and acts as a consultant for 'Statoil', the largest oil company in Norway.

Workshop agenda

Session 1- 17th Wednesday, March 2010

- 8.00 – 9.00 Registration of invitees
- 9.00 – 9.10 Lighting oil lamp
Welcome Speech by Coordinator of the Workshop
Dr. Rathnasiri P.G.
- 9.10 – 9.15 Speech by the Head of the Department
Dr. Jagath Premachandra
- 9.15 – 9.30 Speech by the Vice Chancellor of the University of Moratuwa
Prof. Malik Ranasinghe
- 9.30 – 10.30 Process Control - Principles and Technology
Associate prof. Finn Haugen
- 10.30 – 10.45 Tea Break
- 10.45 – 12.00 Process Control - Principles and Technology
Associate prof. Finn Haugen
- 12.00 – 12.15 Presentation on M.Sc/PG dip on sustainable process development
Dr. Rathnasiri P.G.
- 12.15 – 1.00 Lunch Break
- 1.00 – 3.00 Process Control - Principles and Technology
Associate prof. Finn Haugen
- 3.00 – 3.15 Tea Break
- 3.15 – 4.15 LabVIEW based control system for pilot scale anaerobic reactor with remote operation
Associate prof. Finn Haugen
- 4.15 – 5.00 Ideas for application of process control principles in participants' company. (Workshop participants are actively involved.)
Associate prof. Finn Haugen
- 5.00 End of the Session 1

Session 2- 18th Thursday, March 2010

- 9.00 – 9.30 Implementation of Process Control in Polymer Product Manufacturing Industry
Dr. Olga Gunapala
- 9.30 – 10.30 University /Industry Partnership

Associate Prof. Britt Halvorsen

10.30 – 10.45 Tea Break

10.45 – 12.30 **Basic Concepts in Fluidization and Industrial applications**
Associate Prof. Britt Halvorsen

12.30 – 1.00 Lunch Break

1.00 – 3.00 **Modeling and simulations of fluidized bed using CFD**
Associate Prof. Britt Halvorsen

3.00 – 3.15 Tea Break

3.15 – 4.00 **Department – Industry Interactions by Staff Members DCPE**
Dr. Shantha Amarasinghe, Dr. Shantha Walpola, Dr. Marliya Ismail

4.00 – 4.15 **Presentation by MSc Student**
Mr. Dilantha Warnasooriya

4.15 – 5.00 **Feedback from industrial participants**

5.00 **End of the Workshop**



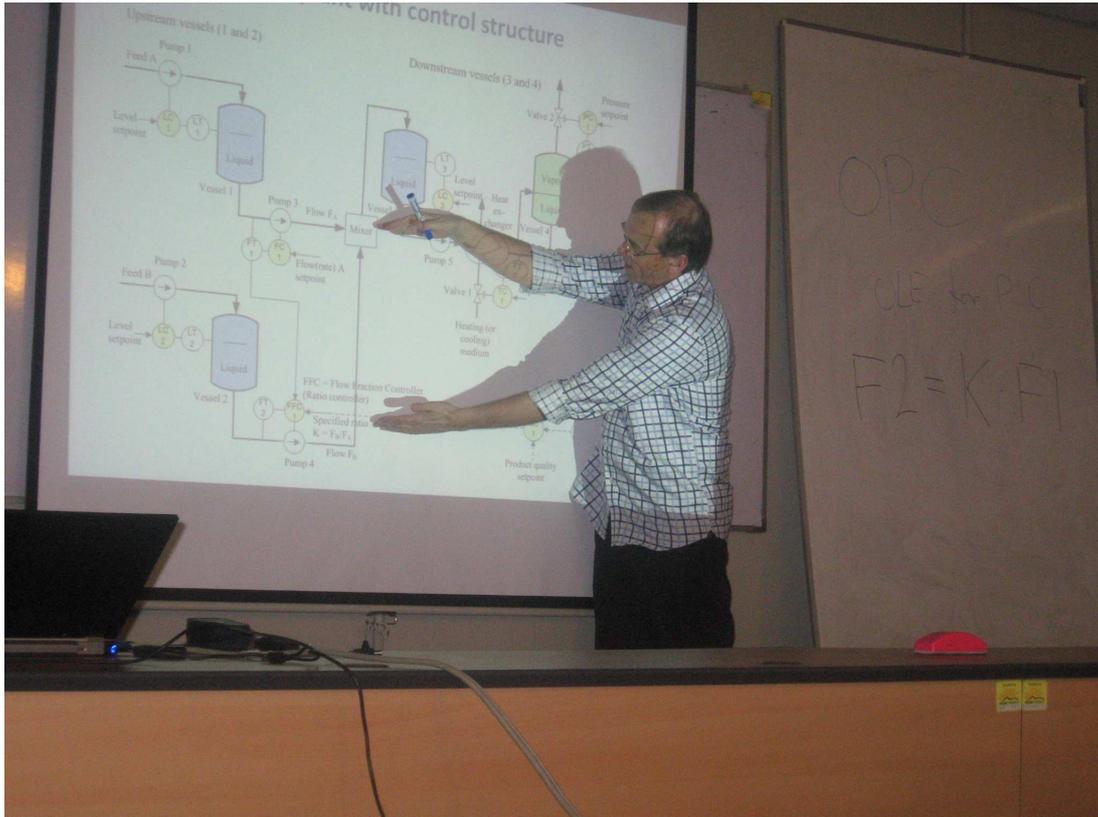
Some of the participants at the workshop



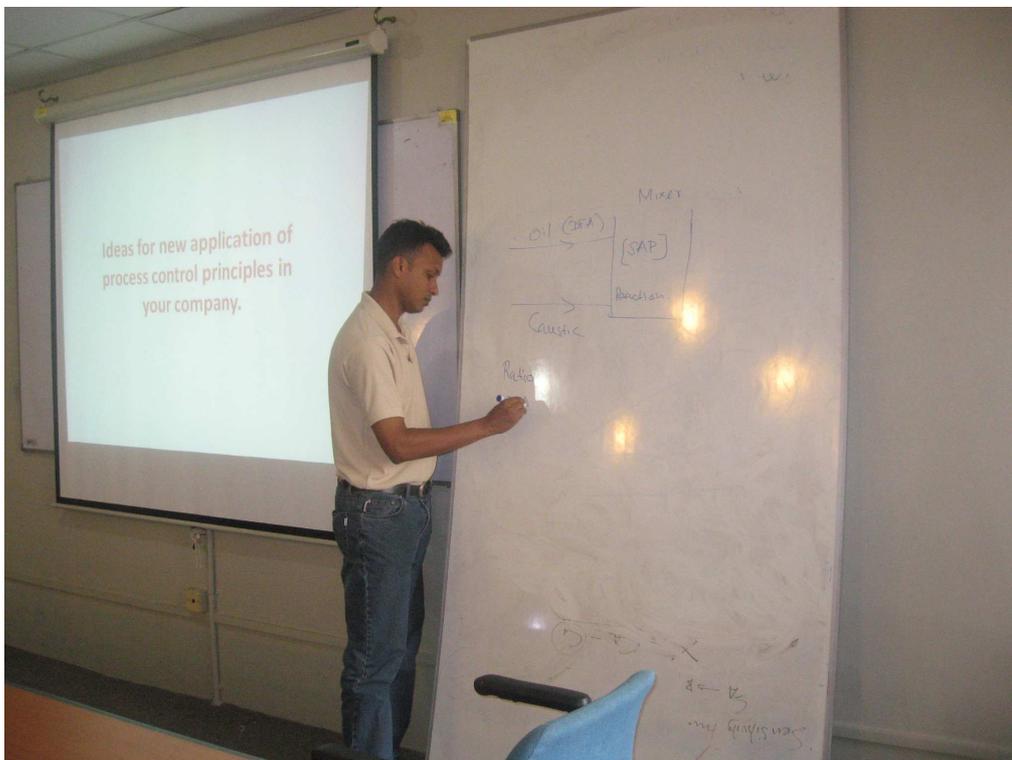
Lighting the Lamp before the workshop begins, bringing good luck to the event.



Participants at the workshop



Finn talking about plantwide control principles



One of the participants describes in plenum control problems existing in his factory



Britt talks about collaboration between Telemark University College and industry in Norway



Lunch time. Eating with fingers – no problem



Dr. Marilya from UM talks about university-industry collaboration in Sri Lanka



Britt handing out certificates on the last day of the workshop

The Process Control course

The Process Control course covered five days. Previous years Dr. Olga Gunapala at University of Moratuwa has given the course. This year four air heaters of “desktop” size were shipped from TUC to be used in the course to give the students practical experience with PC-based measurement and control with the LabVIEW software by National Instruments. These lab stations were funded by the NOMA project. The lab stations will remain at UM.

Below are the home page of the Process Control course (the students used this web page actively during the course), student list, and some pictures.

Homepage of the Process Control course:



Høgskolen i Telemark



Telemark University College (TUC), Norway

University of Moratuwa (UOM), Sri Lanka

Homepage of the course CH5405 Process Control, year 2010

- **Literature:**
 - [Basic Dynamics and Control](#), TechTeach/Finn Haugen, 2009.
 - [Exercises to Basic Dynamics and Control](#), TechTeach/Finn Haugen, 2009
- **Instructor:**
 - Associate Professor [Finn Haugen](#). E-mail: finn.haugen@hit.no. Tel.: +47 97019215

Teaching plan

Time	Activity
Jan/Feb (By Dr. Olga Gunapala)	<p>Lecture: Introduction to process control [Literature: Chapter 1]</p> <p>Lecture: Block diagrams of differential equation models [Literature: Chapter 2]</p> <p>Lecture: Laplace transforms and Transfer functions [Literature: Ch. 4 and 5]</p> <p>Lecture: Dynamic characteristics [Literature: Ch. 6]</p>
Sat 13. March 8.30 - 12 am and 1 - 4 am (By Finn)	<p>Lecture: Feedback control (with PID controller) [Ch. 1 (revisited); Ch. 7 (except 7.4)]</p> <p>During the lecture the following SimView-simulators are run in plenum:</p> <ul style="list-style-type: none"> • Level control of wood chip tank • Reverse and direct action of a PID controller

	<p>Exercises: In the exercise book: 7.1, 7.2, 7.3, 7.6, 7.9, 7.10, 7.11, 7.16, 7.17.</p> <p>Relevant videos lectures (TechVids): (Information about access to the videos in the computer room will be given by Danushka.)</p> <ul style="list-style-type: none"> • Feedback control • Reverse or direct action in the PID controller? • How a control system may become unstable
<p>Sun 14. March</p> <p>9 - 12 am and 1 - 4 am</p> <p>(By Finn)</p>	<p>Lecture: Feedforward control [Ch. 8.1, 8.2]</p> <p>Lecture: Controller equipment [Ch. 9]</p> <p>Pictures:</p> <ul style="list-style-type: none"> • Various equipment • Industrial automation system <p>Lecture: Tuning of PID controllers [Literature: 10.1, 10.2, 10.3, 10.5, 10.6, 10.7]</p> <p>During the lectures the following SimView-simulators are run in plenum:</p> <ul style="list-style-type: none"> • Feedforward control • Temperature control (for controller tuning) • Gain Scheduling <p>Exercises: 8.1, 9.1, 9.2, 10.1, 10.2, 10.3, 10.6, 10.7, 10.8.</p> <p>Relevant video lectures (TechVids):</p> <ul style="list-style-type: none"> • Feedforward control • PID controller tuning with the Good Gain method • PID controller tuning with Ziegler-Nichols' oscillations method • Gain Scheduling
<p>Fri 19. March</p> <p>9 - 12 am and 1 - 4 am</p> <p>(By Finn)</p>	<p>Hands-on video-based course: <i>Learning LabVIEW</i>. Follow the instructional video LabVIEW Quickie! (You must use headphones.)</p> <p>Hands-on video-based course: <i>Analog voltage I/O</i>. Follow the video Analog voltage I/O with NI USB-6008 and LabVIEW. (The contents after 40 min 35 sec is not relevant for our applications.) There will be a number of I/O-devices available, so you can try the loopback test described in the video.</p> <p>Self-study: <i>PID controller in LabVIEW</i>. Make yourself familiar with PID control with LabVIEW by reading the tutorial PID Control with LabVIEW and trying the simulator of the PID control system described in the tutorial.</p>
<p>Sat 20. March</p> <p>9 - 12 am</p> <p>(By Finn)</p>	<p>Lecture: Cascade control; Ratio control; Plantwide control [Ch. 11.1 (except 11.1.4), 11.2, 11.5]</p> <p>During the lecture the following SimView-simulator is run in plenum:</p> <ul style="list-style-type: none"> • Cascade control <p>Relevant video lectures (TechVids): Cascade control</p>

<p>Sat 20. March</p> <p>1 - 4 am</p> <p>(By Finn)</p>	<p>Alternating:</p> <ul style="list-style-type: none"> • 4 groups with 2 students in each group: Lab: Temperature control with PC and LabVIEW • Rest of the class: <ul style="list-style-type: none"> ○ Exercises: 11.1, 11.3, 11.4, 11.5, 11.7 ○ Project (to be accomplished individually or in the same group as in the lab): Describe briefly - with a Process & Instrumentation diagram (P&ID) and some text - one real or possible application of process control based on the control structures you have learnt about in this course. The application should be relevant to your work. You should send a short report including the P&ID and the description to Finn.Haugen@hit.no no later than 4 pm, Sunday 21. March. (Finn will comment your report.)
<p>Sun 21. March</p> <p>9 - 12 am</p> <p>(By Finn)</p>	<p>Alternating:</p> <ul style="list-style-type: none"> • 4 groups with 2 students in each group: Lab: Temperature control with PC and LabVIEW • Rest of the class: <ul style="list-style-type: none"> ○ Exercises: 11.1, 11.3, 11.4, 11.5, 11.7 ○ Project: See above.
<p>Sun 21. March</p> <p>1 - 4 am</p> <p>(By Finn)</p>	<p>Alternating:</p> <ul style="list-style-type: none"> • 3 groups with 2 students in each group: Lab: Temperature control with PC and LabVIEW • Rest of the class: <ul style="list-style-type: none"> ○ Exercises: 11.1, 11.3, 11.4, 11.5, 11.7 ○ Project: See above.

Participants in the Process Control course.
Most of them are students in the MSc/PG Diploma study in
Sustainable Process Development.
(The list was made by Bernt Lie.)

	Surname:	Wickramasinghe
	First name:	Manura
	e-mail:	mlw@haycarb.com
	Experience:	Puritas (Pvt) Ltd Environmental Pollution Control & Water Treatment Value added activated carbon products Biomass energy generation Senior Process Engineer
	Surname:	Handaragama
	First name:	Nalaka
	e-mail:	nalaka.handaragama@mccallumbrewingcompany.com
	Experience:	Mcallum Brewing Company (cey) Ltd Manufacturing of Beer Brewing, fermentation maturation and largearing. Packing and maintenance. Water treatment and waste watertreatment. Factory Manager
	Surname:	
	First name:	Samantha
	e-mail:	samanthaba@brandix.com
	Experience:	Brandix Lanka Ltd. Wastewater & water treatment consultant, LEED Consultant
	Surname:	Silva
	First name:	Chamila
	e-mail:	kdccsilva@hotmail.com
	Experience:	
	Surname:	Subasinghe
	First name:	Dilantha
	e-mail:	dilantha@chempro.org
	Experience:	MAS Holdings Polyurethane System Development for intimates garments Development Engineer

	Surname:	Ricaz
	First name:	Yousuff
	e-mail:	ricaz@metroof.lk ; ricaz4u@yahoo.com
	Experience:	Metecno Lanka (Pvt.) Ltd. Production Engineer Manufacturing Polyurethane Sandwich Panel for cold rooms and Roofing. Total roofing solution provider by Using Zinc Alum Product.
	Surname:	Weeranayake
	First name:	Sudam
	e-mail:	Sudam.weeranayake@unilever.com
	Experience:	Unilever Sri Lanka Manufacturing of consumer goods (soap,Detergents... etc) Site SHE Manger
	Surname:	Appuhamy
	First name:	Charles Roshantha
	e-mail:	Charles.Roshantha@holcim.com
	Experience:	Holcim (Lanka) Ltd Manufacturing of cement, and Co processing of Hazardous waste and alternative fuels and raw materials in the cement kilns. Technical Manager (Geocycle)
	Surname:	Rajapakse
	First name:	Amila
	e-mail:	amilaprasad@gmail.com
	Experience:	Holcim (Lanka) ltd Manufacturing of cement and , Combustion and pyro processing, optimization of combustion process (cement kiln burners,Heat balances etc.,) Process Engineer
	Surname:	Karunarathne
	First name:	Sumudu
	e-mail:	sumuduunimrt@gmail.com
	Experience:	Chemical engineer (Aqua Technologies)

		Student Instructor at university of Moratuwa
	Surname:	Batheegama
	First name:	Buddhika
	e-mail:	Buddhika.mrt@gmail.com
	Experience:	Planning executive in a textile printing factory and chemical engineer in industrial water treatment.
	Surname:	Munasinghe
	First name:	Lahiru
	e-mail:	munasinghe1@yahoo.com, lahiru@jetwinghotels.com
	Experience:	Jetwing Hotels Ltd. Process & Energy Engineer. Renewable Energy Developments, Waste Water Treatment, Biogas Systems.
	Surname:	De Silva
	First name:	Chandana
	e-mail:	Chandana.Desilva@holcim.com
	Experience:	Holcim Lanka Ltd., ; Production Manager - Production of Cement and Clinker, Combustion and Pyro processing, optimization of combustion process (Cement kiln burners, Heat balances etc.,) and Co processing of Hazardous waste and alternative fuels and raw materials in the cement kilns.
	Surname:	Pattiyakumbura
	First name:	Suranga
	e-mail:	Surangalakmal@yahoo.com
	Experience:	Production Engineer- Textile Dyeing MAS Active Linea Intimo Produce Seamless Garments
	Surname:	Jayasinghe
	First name:	Kasun
	e-mail:	Kasun.jayasinghe@ifsworld.com
	Experience:	Business system analyst –IFS Engineering Work in famous ERP company in R&D office Srilanka, Co founder of the Graph Creator Ver 2.3 (Graph drawing software)
	Surname:	Rubasingha
	First name:	Sayuri
	e-mail:	Sayurir@masholdings.com
	Experience:	MAS Active(Pvt) Ltd Manufacturing of seamless fabrics & garments.

		Industrial Engineer, Process Improvement
	Surname:	Wijesekera
	First name:	Ramya
	e-mail:	lalani35@yahoo.com, ramya@iti.lk
	Experience:	Research Engineer, Industrial Technology Institute (successor to Ceylon Institute of Scientific & Industrial Research), Environmental Pollution control (water and wastewater Treatment system Design & trouble shooting), Solid waste management, R&D (for cost effective water & wastewater treatment systems. Solid waste treatment)
	Surname:	Kandanapitiya
	First name:	Wathsala
	e-mail:	chathurangani.wathsala@gmail.com
	Experience:	Ansell Lanka (pvt) Ltd (Industrial training) Administrative officer (Msc in sustainable process development) Research Assistant (University of Moratuwa)
	Surname:	Kumarage
	First name:	Iroshini
	e-mail:	nawammalie@gmail.com
	Experience:	Planning executive, brandix intimates apparel, trainee engineer, Ceylon glass plc
	Surname:	Dissanayake
	First name:	Hasanthie
	e-mail:	has_sanda@yahoo.com, hasanthie@iti.lk
	Experience:	Research Engineer, Industrial Technology Institute (successor to Ceylon Institute of Scientific & Industrial Research), Air pollution control (Design of APCS, performance assessment & trouble shooting), Air Dispersion Modeling, R&D (cost effective biofilter to treat odorous gas)
	Surname:	Jayatunga
	First name:	Gayani
	e-mail:	gayanikj@yahoo.com
	Experience:	Lecturer (probationary), Institute of Technology. University of Moratuwa. Worked as a research engineer (bio mass based renewable energy sector) in NERD Centre, Sri Lanka.
Not Registered for the MSc		

	Surname:	Kodituwakku
	First name:	Dinithi
	e-mail:	Kdinithi@yahoo.com
	Experience:	Management Trainee in the field of Fabric Knitting. Currently engaged in a fulltime Research Project on Rice bran oil Extraction
	Surname:	Waduge
	First name:	Nuditha
	e-mail:	nuditha@gmail.com
	Experience:	Plant manager. Paper factory
 Not registered under MSc	Surname:	Wickramasinghe
	First name:	Chamila
	e-mail:	chamilacsw@yahoo.com
	Experience:	Energy auditing. Student instructor at university of Moratuwa
	Surname:	Danushka
	First name:	Dodampe
	e-mail:	dgdanushka@gmail.com
	Experience:	Just graduated student in University of Moratuwa Matlab assistant
	Surname:	Aththanayake Mudiyansele
	First name:	Daham Shyamalee
	e-mail:	shamalitex@yahoo.com
	Experience:	Quality,Product Development Executive.Plastic Packaging
	Surname:	Seneviratna
	First name:	Alahakoon Mudiyansele Asanka
	e-mail:	asankaseneviratna@yahoo.com
	Experience:	Chemical Engineer-Water Treatment



The class in the Process Control course



Instructor Finn in action



Lunch time at KFC (Kentucky Fried Chicken)



In the computer room



Teaching assistant Danushka in action



Experiments with temperature controller of air heater using PC with LabVIEW

Miscellaneous



Dr. Rathnasiri conducts research and development on production of methane gas from canteen waste in biogas reactors. Combustion of this gas releases energy which can be used for driving motors in vehicles and generators for production of electrical energy. This is a research area of common interest between TUC and UM.



Master student Nuditha with experiments where biogas production from various raw materials is studied.



Lunch with Dr. Rathnasiri (middle), organizer of workshop and coordinator of the NOMA collaborative project between Telemark University College and University of Moratuwa, and Danushka (left), teaching assistant in Process Control and a real handyman.



Britt and Finn got miniature oil lamps at the final meeting at the university.



Amaranath and Finn in a Buddhist temple outside Colombo. (Amaranath is PHD student at TUC.)



Relaxing Buddha. Part of a statue of 15 meters.



Visiting the Parliament of Sri Lanka



Watching historical objects in the Parliament. Guide is Kashun, Security Officer and Assisting Sergeant of Arms (brother of Chameera who graduated from TUC in 2009)



Britt and Finn visiting Rathnasiri's home



...and Amaranath's home (a corner of the garden)



Saron for Finn, and sari for Britt. Gifts from Amaranath's family.



On the *Norwegian Academic Chair* in Sri Lanka
(at Hotel Mt. Lavinia)