ME- Subject Area Group Presentation Cairo October 2015

Mohammad Megahed- Cairo university

Shadrick Chama – Copperbelt University

ME-Group Deliberations in Cairo

New Tuners in ME-Group from Ethiopia, Algeria, Tunisia, DRC and Egypt

Review of Earlier ME Activities conducted during 2012-2014 in Yaoundi, Cape Town, Brussels, Nairoubi, Msapouto, Brussels, Dar Es Salam

A Joint M.Sc. Program was Developed in Dar Es-Salam

Programs Jointly Developed in Cairo Meeting

- **Joint M.Sc. In Mechatronics**
- **Bachelor in "Manufacturing and Industrial Engineering"**
- **Joint Ph.D. in "Sustainable Energy"**
- **Professional Master in "Electro-Mechanical Engineering**

Development of A Joint M.Sc. Degree in Mechatronics

ME-Tuning Subject Group

Cairo

14th October 2015

What is Mechatronics

The name stems from mechanical and electronics and is a relatively new approach to product design and development, merging the principles of electrical, mechanical, computer and industrial engineering. It addresses the four interconnected disciplines used for all complex modern devices

Admission Criteria to M.Sc in Mechatronics

Students holding an appropriate Bachelor's degree in Engineering in the following disciplines:

- **Mechanical**
- **Automotive**
- **Agricultural**
- **Aerospace**
- **Electrical**
- **Electronic**
- **Computer**
- **Biomedical**
- **Manufacturing**
- **Process and Chemical.**

Potential Employability of Holders of M.Sc in Mechatronics

Graduates will be employable in a wide range of industries including:

- **Automotive**
- **Manufacturing and industrial automation**
- **Medical facilities**
- **Telecommunications**
- **Aerospace**
- **Defence Systems**
- **Marine Technology**
- **Oil and Gas Technology**
- **Mining Industries**
- **Agricultural mechanisation**
- **Energy systems**
- **Food processing**
- **Chemical processes, etc.**
- **Research and Development Institutions**

Graduate Profile of Holders of M.Sc. In Mechatronics- Generic Competencies

- Capacity to synthesise knowledge on the fundamental principles of mechanical, electrical, electronic and computer engineering relevant to complex industrial systems
- Ability to apply methodological approaches to analysis and evaluation of engineering systems with a view to optimising their operation regarding precision, reliability, and repeatability.
- Ability to interface mechanical, electrical, and electronic systems in a programmable manner
- Capacity to conceive and design systems by utilising relevant and emerging technologies
- Capacity to critically review existing systems and develop innovative solutions to problems.

Graduate Profile of Holders of M.Sc. In Mechatronics- Specific Competencies

- Capacity to synthesise knowledge on the fundamental principles of mechanical, electrical, electronic and computer engineering relevant to complex industrial systems
- Ability to apply methodological approaches to analysis and evaluation of engineering systems with a view to optimising their operation regarding precision, reliability, and repeatability.
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- Capacity to critically review existing systems and develop innovative solutions to problems.

Main Characteristics of the M.Sc Joint Program in Mechatronics

- FOUR Semester program: A Semester is 15-16 Weeks
- First 3 Semesters devoted to courses
- Last semester devoted to a Thesis
- Each Semester is worth 30 ECTS Credit Points
- Student Workload is worth 750 hours per semester
- Total Degree Credit Points = 120 ECTS
- ENGLISH is the Language of Instruction
- Program is divided into modules, each module is composed of 1-2 short courses
- Elective courses are about 15 % of the credit points

M.Sc in Mechatronics-Compulsory Modules
1 ECTS = 15 hours lectures + 10 hours self-study

Compulsary Modules						
#	Module	Semesters				Total ECTS
		1	2	3	4	
C-1	Data acquisition and signal processing	3		3		6
C-2	Control systems		3	3		6
C-3	Microprocessors and microcontrollers	3	3			6
C-4	Robotics and automation		3			3
C-5	Sensors and actuators	3	3			6
C-6	Programmable Logic Controllers	3		3		6
C-7	Hydraulics and Pneumatics	3				3
C-8	Applied Mechanics	3	3			6
C-9	Mechanisms – synthesis and analysis	3				3
C-10	Electrical systems		3	3		6
C-11	Measurement and Instrumentation	3	3			6
C-12	Computer Integrated Manufacturing			3		3
C-13	Business Modelling and Entrepreneurial skills			3		3
C-14	Project Management			3		3
C-15	Research Methodology, Patents and Intellectual Property Law and Seminar		3	3		6
C-16	Research thesis				30	30
	Total Compulsary	24	24	24	30	102

M.Sc in Mechatronics-Elective Modules
1 ECTS = 15 hours lectures + 10 hours self-study

2 Optional Modules Each Semester, Each module is worth 3 ECTS						
O-1	Computer aided design			x		3
O-2	Micro-electromechanical systems		x			3
O-3	Microelectronics and Micro Systems- Multi-physics Design	x				3
O-4	Micro-electromechanical Systems – MEMS					3
O-5	Signal processing and transmission in embedded systems		x			3
O-6	Artificial intelligence and expert systems	x				3
O-7	Advanced Control			x		3
O-8	Logical Synthesis VHDL					3
O-9	Logical Industrial Network					3
O-10	System Dynamics					3
O-11	Logical synthesis					3
	Total-Electives	6	6	6		18
	Global Total ECTS	30	30	30	30	120

Identification of Partners for the M.Sc. In Mechatronics

- University of Yaounde-I, Cameron
- University of Dar Es-Salaam, Tanzania
- Kwame Nkrumah University of Science and Technology, Ghana
- Malawi University of Science and Technology, Malawi
- Institut Superieur de Techniques Appliquees Kinshasa, DRC
- Egypt-Japan University for Science and Technology EJUST, Egypt

Identification of Partners for the M.Sc. In Mechatronics

- CPUT, South Africa
- Jimma University, Ethiopia
- ENIT: The National Engineering School of Tunisia
- Dilla University, Ethiopia
- Akly Mohand Oulhadj University of Bouira , Algeria
- University of Lubumbashi
- Copper Belt University, Zambia
- Stellenbosch University, South Africa

Challenges Facing Implementation of M.Sc Joint Program in Mechatronics

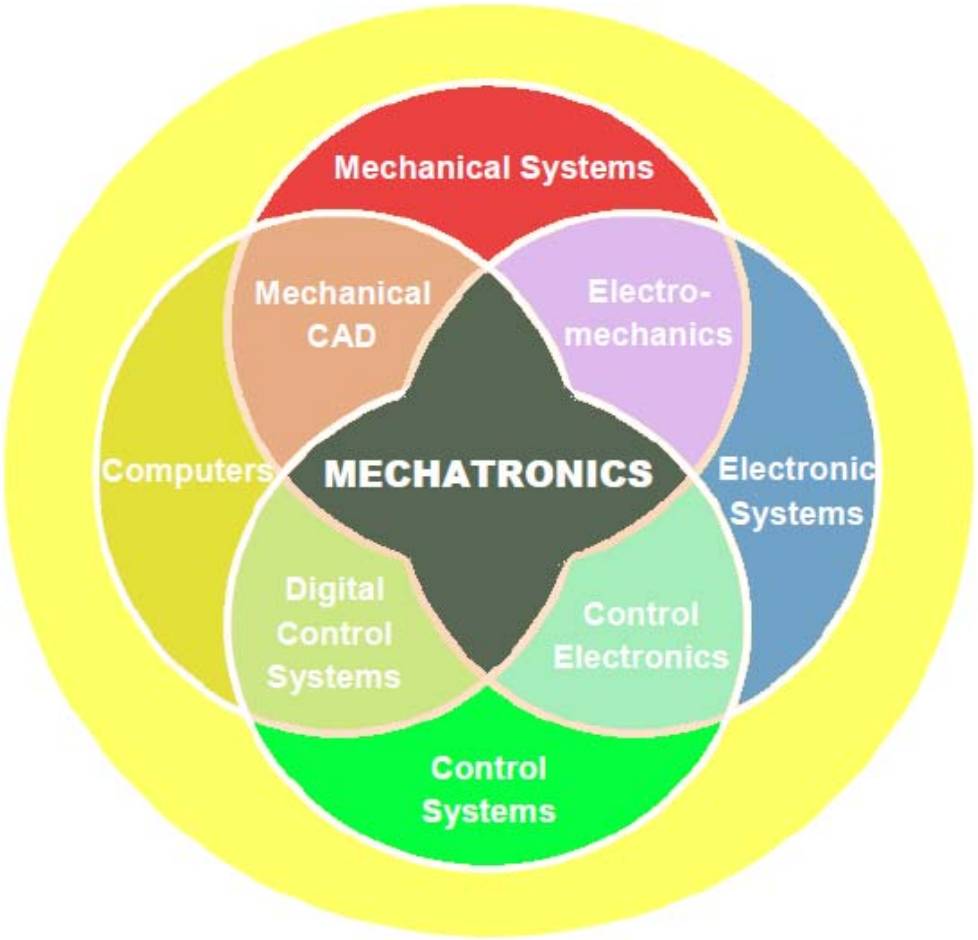
Development of Joint Program in Mechatronics is feasible. However, there are challenges that need to be addressed:

- **The Large Number of Partners is a challenge to Program Management. The Optimum number of partners is between 3-6**
- **Locations of Prominent Academic and Technical Resources are Geographically far apart**
- **Sustainability of Student Mobility has to be insured**

Proposed Solutions:

Focus on Regional Cooperation, Consider Staff Mobility

Meta-Profile of a Joint M.Sc. Program in the Mechatronics



Mechatronics combines electronic, mechanical, computer and control skills

Work will Continue to:

- Get expert advice from Electrical/electronic engineers on the modules
- Do mapping of modules to competencies
- Write learning outcomes for modules
- …….

Preparation for Implementation

- **Apply for IntraACP mobility scheme by a consortium composed from ME subject Area Group, to fund realization of Joint programs through Mobility**
- **The proposal will called "MECHANIZE AFRICA)**
  - **M = Mechanical, E= Engineering,**
  - **C= Competency, H = Harvesting**
  - **A = Advanced, N=Niche Areas**
  - **I = IndustrialiZation, E= Economic Development**
- **Jimma University, Ethiopia will be the Project Coordinator**

Ph.D in Sustainable Energy

- **Within MECHANIZE AFRICA project, a joint Ph.D. Program is being contemplated**
- **The Area of Sustainable Energy is the priority Area for Ph.D. Research**
- **Full Ph.D. Scholarship and Doctoral Mobility can sustain continuity of the Joint Masters Program**

Development of a Bachelor of Engineering Program in Manufacturing & Industrial Engineering

ME-Tuning Subject Group

Cairo

12-14th October 2015

Rationale for the Program

- We live in an age of rapid innovation, complex technology and sustainability.
- Need for diverse analytical skills, especially skills in integrating technology with commercial and organisational solutions.
- Need for value addition and promotion of the “Made in Africa” brand .
- Need for quality improvement for the competitive edge

Potential Employability of Holders of BEng in Manufacturing & Industrial Engineering

- **Graduates of this programme can find employment in a wide range of industries including:**
  - **Automotive**
  - **Manufacturing**
  - **Medical facilities**
  - **Power plants**
  - **Aerospace**
  - **Agricultural mechanisation**
  - **Energy systems**
  - **Food processing**
  - **R&D institutions**
  - **Chemical processes, etc.**

Generic Competencies

- Ability for conceptual thinking, analysis and synthesis
- Professionalism, ethical values and commitment to UBUNTU (respect for the well-being and dignity of fellow human beings)
- Capacity for critical evaluation and self-awareness
- Ability to translate knowledge into practice
- Objective decision making and practical cost effective problem solving
- Capacity to use innovative and appropriate technologies
- Ability to learn to learn and capacity for lifelong learning
- Flexibility, adaptability and ability to anticipate and respond to new situations

Generic Competencies ….Cont.

- Ability for creative and innovative thinking
- Leadership, management and team work skills
- Communication and interpersonal skills
- Environmental and economic consciousness
- Ability to work in an intra and intercultural and/or international context
- Ability to work independently
- Ability to evaluate, review and enhance quality
- Self-confidence, entrepreneurial spirit and skills
- Commitment to preserve African identity and cultural heritage

Specific Competencies

- **Ability to develop, maintain and effect continuous improvement of manufacturing processes, procedures, machinery and tooling to maximize manufacturing quality, safety and reduce costs.**
- **Ability to provide solutions to manufacturing problems and deficiencies.**
- **Ability to manage process performance data to identify and determine manufacturing process improvements to enhance manufacturing yield, runtime, quality and safety and reduce manufacturing costs**
- **Capacity to read and interpret drawings and formulate manufacturing process planning.**
- **Capacity to design and implement new technologies, systems, and processes to improve plant production and efficiency**
- **Capacity to devise efficient plant layouts for enhanced productivity.**

Specific Competencies …. Cont..

- Ability to conduct studies in operations to maximize work flow and spatial utilization to ensure facility efficiency and workplace safety
- Capacity to analyse operating environments in order to effect waste reduction and production improvement
- Ability to understand and manage the supply chain, logistics and distribution, quality as well as environmental and life-cycle analysis. Ability to transform locally available raw materials into products and services
- Ability to employ manufacturing systems engineering approach in resource utilisation and optimisation
- Ability to manage human and material resources
- Ability to apply knowledge of the basic and applied sciences of engineering

Main Characteristics of the BEng in Manufacturing & Industrial Engineering

- 10 Semester program: A Semester is 15-16 Weeks
- 9 Semesters devoted to courses
- 1 semester devoted to a Industrial Attachment/Internship
- Each Semester is worth 30 ECTS Credit Points
- Student Workload is worth 750 hours per semester
- Total Degree Credit Points = 300 ECTS
- ENGLISH is the Language of Instruction
- Program Covering wide range of Manufacturing and Industrial Engineering resources
- Program is divided into modules, each module is composed of 1-3 short courses

Meta-Profile

Way forward

- Develop modules
- Do mapping of modules to competencies
- Write learning outcomes for modules
- Validation of curriculum with stakeholders

Thank You