UNIVERSITY OF NAIROBI

SCHOOL OF ENGINEERING

ANNUAL REPORT - 2011/2012

Introduction

The School of Engineering is located on the main campus, along Harry Thuku Road, directly opposite the main administration building of the University. Nearby landmarks include the Central Police Station, the Norfolk Hotel, and the Kenya National Theatre.

The School has five departments namely:

- Department of Civil and Construction Engineering
- Department of Electrical and Information Engineering
- Department of Mechanical and Manufacturing Engineering
- Department of Environmental and Biosystems Engineering
- Department of Geospatial and Space Technology

The School is the oldest in the University, having started way back in April 1956 as the then Royal Technical College, which evolved into the University of Nairobi by 1970. To date approximately 8,000 graduates have been awarded the BSc Engineering degree as well as numerous Master of Science and PhD degrees.

Academic Programmes

All the five departments offer a five-year undergraduate study program leading to a Bachelor of Science degree in the respective fields of study. They also offer a Master of Science degree running for two years, as well as PhD programmes. The School has been running a self-sponsored programme since 1998 which runs concurrently with the government sponsored programme.

The academic year runs from October to July with the graduation ceremony taking place every September.

Admission Requirements into undergraduate program

The following will be eligible to apply for a course in any of the five departments:

i) K.C.S.E. Applicants or Equivalent: For KCSE holders a minimum aggregate of C+ (plus). Additionally a grade of C+ in each of the cluster subjects, as follows:

   Physics
   Chemistry
   Mathematics
Biology/Geography/any group IV Subject*

**Group IV Subjects**

- Home Science: Building Construction
- Art and Design: Power Mechanics
- Agriculture: Electricity
- Woodwork: Drawing and Design
- Metalwork: Aviation Technology

* Home Science is no longer acceptable for admission

**ii)** Advanced Level Certificate Holders: A minimum of 2 principal passes in mathematics and physics and a subsidiary level pass in Chemistry

**iii)** Higher National Diploma (HND) or Equivalent: Candidates with Higher National Diploma in the following broad areas of study;

- Environmental and Biosystems Eng.
- Civil Engineering
- Electrical Engineering
- Mechanical Engineering
- Surveying
- Geospatial Engineering etc.

**iv)** Ordinary Diploma or Equivalent: Candidates with a credit pass in the areas indicated in ©.

**v)** Diploma from Science/Technical Teacher Training Colleges

Candidates from Teacher Training Colleges with a Science Diploma in Mathematics and Physics.

**vi)** BSc/B.Ed. (Science) degrees or any other relevant degrees

Candidates with Bachelor of Science or Education degrees (in Physics and Mathematics) from recognized institutions or any other relevant degree from a recognized institution.

The following are the Annual Reports from four departments of the five departments in the School.
Department of Civil & Construction Engineering

Teaching and Learning

The Department of Civil and Construction Engineering offers a range of programs at both graduate and undergraduate levels.

At the undergraduate level, after completing their first year courses, students are offered courses in applied mechanics, hydraulics, surveying, materials, structures, engineering management, geotechnical engineering, transportation engineering, environmental health engineering and water resources engineering. Courses in mathematics, computer programming and non-technical subjects are also obligatory in the programme.

At the graduate level, the course is intended for engineers with suitable qualifications and/or professionals experience who wish to study further or expand their range of expertise in specified field of civil engineering. The specialized options offered are:

Geotechnical Engineering
Dealing with properties and behavior of the ground, interactions between structures and their foundations.

Structural Engineering
Focusing on the built environment, including structural design, materials, reliability, construction and the management of ageing infrastructure.

Transportation Engineering
Focusing on transportation planning, pavement design, traffic design and control operations, transportation safety and pollution control.

Environmental Health Engineering
This deals with supply of safe water through treatment and the disposal of such liquid or solid wastes as may be generated from activities in the living environment.

Water Resources Engineering
Focuses on water supply and distribution as well as other fluids like oil and their required structures. It also includes water resources management and administration.

- Course offered: Bachelor of Science in Civil Engineering
  Master of Science in Civil Engineering

- Enrolled students
  - BSc. level: 656
  - Master level: 34
  - PhD. Level: 3

- Number of graduands:
  - BSc. Level: 90
  - Master level: 2
  - PhD level: 1
Service Delivery

Metrocount pneumatic vehicle classifier system training for the following technical staff by KURA on 23rd – 27th July, 2012 at Sports View Hotel-Kasarani.

1. Martin Mburu
2. Kenneth Kaunda
3. Sammy Gatimu
4. Charles Kirui
5. Stephen Ochieng’
6. Roselyn Masoni

Fire marshalls and fire drills skills at the St. John House.

1. Maxwell Odira
2. Stephen Ochieng’
3. Wairimu Njuguna – trained on HIV/AIDS and breast cancer

- Mr. S. Osano Mr. J. Kanyugo has been trained on Research and Project Grant writing.
- W. Njuguna has been trained on Customer Care.

Research, Innovation and Consultancy

Research /Publications activities undertaking:

Research papers by Prof. S. K. Mwea, S. Osano

Title: Root tensile strength of 3 typical plants and their contribution to soil shear strength - Journal of Civil Engineering Research and Practice Vol. 8 No. 1 pp 57 - 73

Authors: Osano Simpson Nyambane, Sixtus Kinyua Mwea

Title: A Study on the Engineering Behaviour of Nairobi Subsoil Journal – Vol 6 No. 7 July 2011 ISSN 1819 - 6608

Authors: Onyancha m , C., Mathu, E., Mwea, S., & Ngecu, W.

Title: “Pull-Out Resistance Of 3 Different Plant Species And Their Application In Slope Stabilization Works Journal Of Engineering Indian Centre For Advanced Scientific And Technological Research ” (ICASTOR) Volume 5, No. 1 January 2012

Authors: Osano S, Mwea S.K and Gichaga F J
By Dr. Simeon Dulo-Assessment of urban water supply: case study of Athi River Town.

Dr. Ezekiel Nyangeri-Visionary and knowledge management in strategic development of water services
- International links and collaborations

Consultancies
Prof. Mwea: Civil & Mr. S. K. Mutua Structural services to
- Agriculture Building – Upper Kabete
- Appointed External Examiner at Jomo Kenyatta University of Agriculture and Engineering
- Appointed External Examiner at Mombasa Polytechnic University College.
- Extension to Kenyatta National Hospital Library
- Extension to teaching facilities at Dental School
- Investigation of Top Plaza for the Pensions Department – University of Nairobi

Prof. Mwea: Consultant for Howard Humphreys East Africa Limited

Papers presented at conferences

Proposed project proposal by Dr. Mumenya

<table>
<thead>
<tr>
<th>S/N</th>
<th>TITLE/NAMES OF THE ARTICLE</th>
<th>AUTHOR/S</th>
<th>NAME OF JOURNAL/PUBLICATION</th>
<th>DATE OF PUBLICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.</td>
<td>Direct shear box and ring shear test comparison: why does internal angle of friction vary</td>
<td>Dr. S. Osano</td>
<td>ICASTOR Journal of Engineering</td>
<td></td>
</tr>
</tbody>
</table>

Any other Activities
Community Service


Prof. F. J. Gichaga
- Chairman of National Council for Science and Technology
- Appointment as Fellow of the Kenya National Academy of Sciences
- Appointed as a BOG member – Kagumo High School

Prof. S.K. Mwea attended a stakeholders’ workshop to provide comments on the developed policy guidelines for an internship programme for graduate engineers.

Eng. D. Koteng’ attended a conference on Regional Infrastructure.

Eng. J. Mwero attended a workshop on Material Scientists.
Prof. S. K. Mwea: Guest of Honor at St. Benedict’s Kithimu

Prof. F. Gichaga Speech during 19th Graduation Ceremony at Jomo Kenyatta University of Agriculture & Technology

Prof. F. J. Gichaga - Speech during inauguration of JKUAT Arusha Campus.

- Speech during county governance certificates award ceremony- Safari park hotel.

Prof. F. J. Gichaga - Speech during the inauguration of Multi Media University College

On 28th November, 2012

- Speech on 20th graduation ceremony at JKUAT on 30th November, 2012

Prof. S. K. Mwea - Moderation of 1st semester examinations results for 2012/2013 academic year.

- Invitation to E.S.A- Huawei technologies ltd sports day
- Awarded a certificate for presenting paper titled “Variation of Groundwater static levels in Nairobi City since 1927”.

Dr. S. W. Mumenya - Attended a workshop at Institute of Trade Development on Training courses on the design of low cost technologies for water and wastewater on 29th October – 2nd November, 2012.

Seminars & Graduation by MSc. & PhD Students

Seminar by Barrack Okoya – MSc. Student & Graduate Assistant

Seminar by James Odongo - MSc. Student

Seminar by Clive Kiage Temu - MSc. Student

Seminar by Meshack Onyango - PhD. Student

Seminar by Kipyator Franklin- MSc. student

Seminar by Richard Manjanja - MSc. student

Graduation for a PhD student – Osano Simpsons

Graduation for MSc. students – Clive Temu Kiage, Adoyo Felix Otieno & Agwaro Paul Ogutu
DEPARTMENT OF ELECTRICAL AND INFORMATION ENGINEERING

INTRODUCTION:
The department runs B.Sc., M.Sc. and Ph.D. programs in Electrical & Electronic Engineering. The undergraduate B.Sc. program consists of five years of study, and contributes to knowledge in both fundamental and applied areas of Electrical Engineering. It provides a diverse curriculum that instills in our students the skills, talents and creativity necessary for the varied and rapidly changing requirements. This enables them to serve a wide variety of other fields that require leadership, teamwork, decision making and problem solving abilities.

COURSES

BSC COURSE

GENERAL
The undergraduate students complete a total of 76 course units distributed as follows (including laboratories):

<table>
<thead>
<tr>
<th>Year</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>First Year</td>
<td>14</td>
</tr>
<tr>
<td>Second Year</td>
<td>16</td>
</tr>
<tr>
<td>Third Year</td>
<td>16</td>
</tr>
<tr>
<td>Fourth Year</td>
<td>16</td>
</tr>
<tr>
<td>Fifth Year</td>
<td>14</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>76</strong></td>
</tr>
</tbody>
</table>

Each semester course unit has a total of 45 contact hours including lecturers and tutorials, while a laboratories course unit has 60 hours per semester. The program incorporates a practical “fourth term” assignment of eight weeks at the end of the second year of study. For the third and fourth years of study, there is industrial attachment during the long vacations.

In the course codes, the first integer after FEE denotes the year study. The second integer denotes as far as is possible, the subject area while the last integer denotes the semester in which the course is taught; 1 for the first and 2 for the second semester. Where the last integer is 0 it means that this is a course which is done throughout the two semesters such as the Engineering Project in the fifth year of study.

In order to cover this syllabus, service courses shall be provided by the following Departments.

1. Civil Engineering and Construction Engineering FEE 252
2. Mechanical and Manufacturing Engineering  
   FEE 241/2, FEE 251, FEE 261/2, FEE 121/2.  
3. School of Mathematics  
   FEE 111/2, FEE 121/2, FEE 271/2, FEE 471/2, FEE 571  
4. Department of Physics  
   FEE 101/2  
5. Board of Common Undergraduate Courses (BCUC).  
   CCS 001, CCS 008, CCS 010

### BSC COURSE UNITS

#### FIRST YEAR

<table>
<thead>
<tr>
<th>Course</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>FEE 101</td>
<td>Physics A</td>
</tr>
<tr>
<td>FEE 111</td>
<td>Applied Mathematics A</td>
</tr>
<tr>
<td>FEE 121</td>
<td>Pure Mathematics A</td>
</tr>
<tr>
<td>FEE 131</td>
<td>Computer Science I</td>
</tr>
<tr>
<td>FEE 141</td>
<td>CCS 001: Communication Skills</td>
</tr>
<tr>
<td>FEE 151</td>
<td>CCS008: Elements of Philosophy</td>
</tr>
<tr>
<td>FEE 161</td>
<td>Mechanical Workshop Technology</td>
</tr>
<tr>
<td>FEE 102</td>
<td>Physics B</td>
</tr>
<tr>
<td>FEE 112</td>
<td>Applied Mathematics B</td>
</tr>
<tr>
<td>FEE 122</td>
<td>Pure Mathematics B</td>
</tr>
<tr>
<td>FEE 132</td>
<td>Computer Science II</td>
</tr>
<tr>
<td>FEE 142</td>
<td>Electrical Measurements</td>
</tr>
<tr>
<td>FEE 152</td>
<td>CCS010: HIV/AIDS</td>
</tr>
<tr>
<td>FEE 162</td>
<td>Electrical Workshop Technology</td>
</tr>
</tbody>
</table>

#### SECOND YEAR

<table>
<thead>
<tr>
<th>Course</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>FEE 201</td>
<td>Physical Electronics A</td>
</tr>
<tr>
<td>FEE 221</td>
<td>Electrical Circuit Theory I A</td>
</tr>
<tr>
<td>FEE 231</td>
<td>Computer science III</td>
</tr>
<tr>
<td>FEE 241</td>
<td>Engineering Drawing A</td>
</tr>
<tr>
<td>FEE 242</td>
<td>Engineering Drawing B</td>
</tr>
<tr>
<td>FEE 251</td>
<td>Thermodynamics for EE</td>
</tr>
<tr>
<td>FEE 252</td>
<td>Fluid Mechanics for EE</td>
</tr>
<tr>
<td>FEE 261</td>
<td>Mech. of Mach. &amp; Str. of Mat. A</td>
</tr>
<tr>
<td>FEE 271</td>
<td>Mathematics II A</td>
</tr>
<tr>
<td>FEE 272</td>
<td>Mathematics II B</td>
</tr>
<tr>
<td>FEE 281</td>
<td>Laboratory IIA</td>
</tr>
<tr>
<td>FEE 282</td>
<td>Laboratory IIB</td>
</tr>
</tbody>
</table>

#### THIRD YEAR

<table>
<thead>
<tr>
<th>Course</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>FEE 301</td>
<td>Analogue Electronics A</td>
</tr>
<tr>
<td>FEE 321</td>
<td>Electrical Circuit Theory IIA</td>
</tr>
<tr>
<td>FEE 331</td>
<td>Digital Electronics A</td>
</tr>
<tr>
<td>FEE 341</td>
<td>Electrical Machines I A</td>
</tr>
<tr>
<td>FEE 351</td>
<td>Electromagnetic Fields A</td>
</tr>
<tr>
<td>FEE 361</td>
<td>Mechanical Engineering for EE</td>
</tr>
<tr>
<td>FEE 371</td>
<td>Mathematics III A</td>
</tr>
<tr>
<td>FEE 381</td>
<td>Laboratory III A</td>
</tr>
<tr>
<td>FEE 302</td>
<td>Analogue Electronics B</td>
</tr>
<tr>
<td>FEE 322</td>
<td>Electric Circuit Theory IIB</td>
</tr>
<tr>
<td>FEE 332</td>
<td>Digital Electronics B</td>
</tr>
<tr>
<td>FEE 342</td>
<td>Electrical Machines I B</td>
</tr>
<tr>
<td>FEE 352</td>
<td>Electromagnetics Fields B</td>
</tr>
<tr>
<td>FEE 362</td>
<td>Instrumentation</td>
</tr>
<tr>
<td>FEE 372</td>
<td>Mathematics III B</td>
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</table>
FEE 382  Laboratory III B

FOURTH YEAR
FEE 401  Electronics A
FEE 411  Control System A
FEE 421  Telecomms. &Electroacoustics A
FEE 431  Electrical Power Systems I A
FEE 441  Electrical Machines II A
FEE 451  Electrodynamics & Ins. Mat. A
FEE 471  Statistics
FEE 481  Laboratory IV A
FEE 402  Electronics B
FEE 412  Control System B
FEE 422  Telecomms. &Electronicoustics B
FEE 432  Electrical Power Systems I B
FEE 442  Electrical Machines II B
FEE 452  Electrodynamics & Ins. Mat. B
FEE 472  Numerical Methods
FEE 482  Laboratory IV B

FIFTH YEAR
FEE 501  Applied Electronics A
FEE 511  Control Engineering A
FEE 560  Engineering Project
FEE 571  Mathematical Methods
FEE 591  Laboratory V A
FEE 502  Applied Electronics B
FEE 512  Control Engineering B
FEE 560  Engineering Project
FEE 582  Management for Engineers
FEE 592  Laboratory V B
Elective Courses in Fifth Year (two per Semester)

Light Current
FEE 521  Telecommunications A
FEE 551  Microwaves and Antennas A
FEE 522  Telecommunications B
FEE 552  Microwaves and Antennas B

Heavy Current
FEE 531  Electrical Power Systems II A
FEE 541  Power Electronics & Variable Machine Drives A
FEE 532  Electrical Power Systems II B
FEE 542  Power Electronics & Variable Machine Drives B
MSC. COURSE

GENERAL
The MSc students complete a total of 9 course units in Part I of the program, distributed as follows:

<table>
<thead>
<tr>
<th>Common</th>
<th>Option</th>
<th>Total</th>
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<tbody>
<tr>
<td>First Semester</td>
<td>2</td>
<td>3</td>
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<tr>
<td>Second Semester</td>
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<td>3</td>
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<td>TOTAL</td>
<td>6</td>
<td>3</td>
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</table>

Each semester course unit has a total of 60 contact hours including lecturers and tutorials. The students proceed to Part II (Thesis phase) after successfully completing Part I by passing all the course units for their option.

Course codes have the first integer after FEE as 6 denoting Masters. The other digits are applied as shown in the next section.

MSC. COURSE UNITS

a. Core courses  FEE 600-607,650
b. Electronic Engineering Option  FEE 610-618
c. Electrical Engineering Option  FEE 620-629
d. Control Engineering Option FEE 630-635

Common Core Courses
FEE 600 Engineering Mathematics
FEE 601 Software Engineering
FEE 650 Research Methodology

Core Courses in Electronic Engineering
FEE 602 Analogue Electronics

Core Courses in Electrical Engineering
FEE 603 Digital Electronics
FEE 604 Signal Analysis
FEE 605 Electrical Power Systems
FEE 606 Electrical Machines
FEE 607 Power Electronics

Options in Electronic Engineering

Option 1: Optics, Fields and Waves
FEE 610 Optical Electronics and Lasers
FEE 611 Antennas and Wave propagation
FEE 612  E/M Theory and High Frequency Devices

**Option 2: Telecommunications**
FEE 613 Communication Systems
FEE 614 Digital Transmission
FEE 615 Computer Communication Network

**Option 3: Electronics**
FEE 616 Digital Signal Processing
FEE 617 Computer Architecture
FEE 618 Electronic Instrumentation

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**Options in Electrical Engineering**

**Option 1: High Voltage, Switchgear & Insulation**
FEE 620 High Voltage Engineering
FEE 621 Switchgear and Protection
FEE 622 Insulating Materials

**Option 2: Electrical Power Systems Operations & Planning**
FEE 623 Electrical Power Systems, Operation and Control
FEE 624 Electrical Power Transmission and Distribution Systems
FEE 625 Electrical Power Systems Planning and Management

**Option 3: Electronic Machine Design, Control and Power Plants**
FEE 626 Electrical Machine Design
FEE 627 Electrical Machine Drives and Control
FEE 628 Electrical Power Plant Equipment and Auxiliaries

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**Options in Control Engineering**

**Option 1: Optimal, Linear and Non-linear Control**
FEE 630 Linear Control Systems
FEE 631 Optimal Control
FEE 632 Non-Linear Control and Stability

**Option 2: Automation, Digital and Adaptive Control**
FEE 633 Digital Control
FEE 634 Adaptive Control, Learning Systems and Estimation
FEE 635 Robotics and Automation
## STUDENT ENROLMENT

### UNDERGRADUATE

<table>
<thead>
<tr>
<th>Year</th>
<th>Male</th>
<th>Female</th>
<th>Total</th>
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<tbody>
<tr>
<td>First</td>
<td>135</td>
<td>30</td>
<td>165</td>
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<tr>
<td>Second</td>
<td>127</td>
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<tr>
<td>Fifth</td>
<td>79</td>
<td>17</td>
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<tr>
<td><strong>TOTAL</strong></td>
<td>596</td>
<td>104</td>
<td>700</td>
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### MSC

<table>
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<tr>
<td>Second</td>
<td>19</td>
<td>1</td>
<td>20</td>
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<td><strong>TOTAL</strong></td>
<td>26</td>
<td>2</td>
<td>28</td>
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### Ph.D

<table>
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### INTERNATIONAL STUDENTS

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<tbody>
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<tr>
<td>MSc</td>
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<td>Ph.D</td>
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NUMBERS OF GRADUANDS

Undergraduate

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<tr>
<th>Graduated</th>
<th>Male</th>
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<tbody>
<tr>
<td></td>
<td>80</td>
<td>16</td>
<td>96</td>
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Masters

<table>
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<tr>
<th>Graduated</th>
<th>Male</th>
<th>Female</th>
<th>Total</th>
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<tbody>
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</table>

Ph.D

<table>
<thead>
<tr>
<th>Graduated</th>
<th>Male</th>
<th>Female</th>
<th>Total</th>
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</thead>
<tbody>
<tr>
<td></td>
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<td>1</td>
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</table>

RESEARCH

Some of the reported publications and conference presentations are listed below

<table>
<thead>
<tr>
<th>Title</th>
<th>Authors</th>
<th>Journal</th>
<th>Conference</th>
</tr>
</thead>
<tbody>
<tr>
<td>No.</td>
<td>Title</td>
<td>Authors</td>
<td>Journal/Conference</td>
</tr>
<tr>
<td>-----</td>
<td>-----------------------------------------------------------------------</td>
<td>----------------------------------------------</td>
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**DEPARTMENTAL FULL-TIME STAFF**

- 1. Associate Professor 4
- 2. Senior Lecturer 8
- 3. Lecturer 4
- 4. Graduate Assistant 6
- 5. Technologist 16
- 6. Secretary 2
- 7. Cleaner 2
- **TOTAL** 42

**OTHER NOTABLE ACTIVITIES**

(i). **Change of Head of Department**: In March 2012 Prof. Vitalice K Oduol was succeeded by Dr. H Ouma Absaloms, after successfully completing two terms as the department head.

(ii). **Curriculum Development**: Department was involved into exploration of starting programs in Biomedical Engineering, Petroleum and Mining Engineering and Instrumentation and Control.

(iii). **Curriculum Review**: The review of the BSc and MSc programs was taken a further notch with the initial draft being put together for discussion in the first quarter of 2013.
(iv). **Collaborations**: Initial discussions for collaborations with several institutions were carried out. The institutions included: Centurion Systems, Siemens, African Cotton & Textile Industries Federation (ACTIF) Centre of Excellence, Johns Hopkins University- Centre for Bioengineering Innovation and Design,

**DEPARTMENT OF ENVIRONMENTAL AND BIOSYSTEMS ENGINEERING**

1. **Introduction.**

The Department of Environmental and Biosystems Engineering programme prepares its graduates for careers requiring application of physical, biological, and engineering sciences to problems that involve environment and living systems. The scope of Environmental and Biosystems Engineering is broader and encompasses agriculture, the environment, food, forestry, aquaculture and bio-based production and processing systems in industries and rural development.

Our Curriculum is student centered and balances theory and practice. Unlike the traditional engineering courses that provide linear intervention, our curriculum prepares our graduates to provide evolving solutions in a closed loop and thus continual improvement and sustainability.

2. **Courses offered.**

The Department offers B.Sc., MSc. and PhD in Environmental and Biosystems Engineering

3. **Enrollment of undergraduates and postgraduates**

<table>
<thead>
<tr>
<th>UNDERGRADUATES</th>
</tr>
</thead>
<tbody>
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</tr>
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</tr>
<tr>
<td>2.</td>
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<td>3.</td>
</tr>
<tr>
<td>4.</td>
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<td>5.</td>
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<td>TOTAL</td>
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</table>

* One International student (Male)
<table>
<thead>
<tr>
<th>NO</th>
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<th>MALE</th>
<th>FEMALE</th>
<th>TOTAL</th>
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<tr>
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<td>11*</td>
<td>1</td>
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<td>2.</td>
<td>Part II</td>
<td>43</td>
<td>7</td>
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<td>TOTAL</td>
<td>54</td>
<td>8</td>
<td>62</td>
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* One International student (Male)

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<th>MALE</th>
<th>FEMALE</th>
<th>TOTAL</th>
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<tbody>
<tr>
<td>1.</td>
<td>First Year</td>
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<td>-</td>
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<td></td>
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<td>-</td>
<td>7</td>
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</table>

### 4. Research Interests
- Agricultural / Aquatic Machinery
- Agricultural Process / Food Engineering
- Concrete and Fibre Reinforced Concrete
- Conservation Agriculture
- Egg Incubation
- Environmental Control and Simulation
- Environmental Impact Assessment and Environmental Audit
- GIS and GPS Mapping
- Granular mechanics
- Industrial Safety
- Land Husbandry and Landscape Engineering
- Landscape and Biomass mapping using remote sensing and GIS
- Occupational Health and Safety
- Produce Drying
- Rain Water Harvesting
- Reinforced Concrete
- Renewable Energy
- Rural Power, Transport and Access
- Soil and Water Engineering
- Soil Tillage and Fertility Management
- Timber and Animal Housing
- Waste water management
- Water Resources Engineering
- Water Systems Engineering
5. Research activities

<table>
<thead>
<tr>
<th>TITLE OF RESEARCH PROJECT</th>
<th>YEAR</th>
<th>RESEARCHERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water harvesting, Environment, Health and nutritional sustainability I Kitui west (NCST).</td>
<td>2012</td>
<td>A.N. Gitau</td>
</tr>
<tr>
<td>(In progress)</td>
<td></td>
<td></td>
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<tr>
<td>Post-harvest control of aflotoxin contamination in stored maize using super absorbent</td>
<td>2012</td>
<td>Dr. D. O. Mbuge</td>
</tr>
<tr>
<td>polymers (STTPs) in improved and affordable design of storage structures. (funds from</td>
<td></td>
<td></td>
</tr>
<tr>
<td>NCST) (In progress)</td>
<td></td>
<td></td>
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<tr>
<td>A Three Dimensional Environmental Simulation Model of a Greenhouse System</td>
<td>2012</td>
<td>J. O. Agullo</td>
</tr>
</tbody>
</table>

6. International Links and Collaborations:

- Department of Environmental Health, safety and Emergency management (EHSEM) - Harvard University & Department of Environmental and Biosystems Engineering - UoN
- Africa Biofuel and Emission Reduction (East Africa) Ltd. & Department of Environmental and Biosystems Engineering - UoN
- Department of Environmental and Biosystems Engineering - University of Nairobi/EURA Innovation GmbH (2012)
- Food and soft laboratory, ETH Zurich, Department of health science SWTZERLAND, and University of Nairobi (ICIPE) (2011 to date)
- Biofuel Africa & Department of Environmental and Biosystems Engineering - UoN The Department also has a consultancy unit. (2011 to date)
- Department of Environmental and Biosystems Engineering - University of Nairobi / University of Siegen - Germany
- Department of Environmental and Biosystems Engineering - University of Nairobi / EurA Innovation GmbH
- Department of Environmental and Biosystems Engineering - University of Nairobi / Department of Agri-Food Science and Technology - University Of Bologna (EDULINK II) on Energy-agro food synergies in Africa: New Educational Models for Universities.
Publications (Books/Journals)

<table>
<thead>
<tr>
<th>TITLE</th>
<th>YEAR</th>
<th>AUTHOR</th>
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<tbody>
<tr>
<td>Optimizing the Performance of a Manually Operated Groundnut (Arachis hypogaea) Decorticator</td>
<td>2012</td>
<td>A.N. Gitau</td>
</tr>
<tr>
<td>Viscoelastic Properties of Bulk Groundnuts</td>
<td>2012</td>
<td>K.V. Too, E.B.K. Mutai, J.M. Mutua, D.A. Mutuli and D.O. Mbuge</td>
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7. Staff and their designation

<table>
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<tr>
<td>Professor</td>
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<tr>
<td>Associate Professor</td>
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<tr>
<td>Senior Lecturer</td>
<td>6</td>
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<tr>
<td>Lecturer</td>
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<tr>
<td>Assistant Lecturer</td>
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</tr>
<tr>
<td>Part Time Lecturer</td>
<td>8</td>
</tr>
<tr>
<td>Chief technologist</td>
<td>2</td>
</tr>
<tr>
<td>Senior Technologist</td>
<td>-</td>
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<tr>
<td>Technologist</td>
<td>4</td>
</tr>
<tr>
<td>Technical Assistant Grade IV</td>
<td>3</td>
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</table>
Secretary | 3  
---|---
Driver | 1  
Subordinate staff | 2  

8. Number of granduands (diploma, bachelors, postgraduate diploma, masters, and PhD)

<table>
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<tr>
<th>NO</th>
<th>LEVEL OF STUDY</th>
<th>MALE</th>
<th>FEMALE</th>
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<td>3.</td>
<td>PhD</td>
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<tr>
<td>TOTAL</td>
<td></td>
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<td>5</td>
<td>32</td>
</tr>
</tbody>
</table>

9. Number of papers presented in conferences

- *Illustration of the process involved in data preparation for a watershed hydrologic model* J. P. O. Obiero*, M. A. Hassan* and J. Sang. At the Department of Biomechanical and Environmental Engineering, Jomo Kenyatta University of Agriculture and Technology.
- Eng. Gichuki Muchiri delivered a talk on “The Role of Mechanization in Agriculture” at Jomo Kenyatta University of Agriculture and Technology (JKUAT) on Friday 24th February, 2012 from 9.30. am to 1100.am.

10. Corporate social responsibility activities

- Environmental and Biosystems Engineering Students open day held on 21st April 2012 at upper Kabete Campus. (photos attached)
- Represented the School of Engineering at the Annual Tree Planting Event at the University Farm Kanyariri on 2nd November 2012
- Ploughing contests for seedbed preparation for improved agricultural production through the Kenya Ploughing Organization (KPO) e.g. participated at the National Ploughing contest on 5th Nov 2012 at UoN Farm Kanyariri
- Environmental And Biosystems Engineering Students Association EBESA visited Nairobi Children’s Home On 8th December 2012
11. Other activities

- **Dr. A. N. Gitau** participated in evaluation of consultants for GEF SGP Baseline Assessment in Laikipia County.
- **Mr. Januarius Ondiek Agullo** recruited by Training Centre in Communication (TCC) to train participants on the use of R statistical package for data analysis. (12th - 16th March 2012)
- **J. P. Obiero** Invited to participate as a consultant (Resource person) in the training of international students in a 6 month postgraduate diploma course on integrated water resources management at Egerton University, An initiative between Egerton University and ITC Netherlands. I was resource person to handle module on GIS-based catchment modeling on 12-16th March 2012.
- **J. P. Obiero** Convened an annual general meeting (AGM) for the Nairobi Branch of the Kenya Ploughing Organization, a subcommittee of the Agricultural Society of Kenya (ASK) on 9th January 2012 To review 2011 activities, and plan for the 2012 activities that include ploughing competitions, etc. He is the current Chairman of KPO (Nairobi Branch).
- **J. P. Obiero** participated at the AGM for the National office of the Kenya Ploughing Organization (KPO) on 23rd March 2012 at the Show Ground, Nairobi.
- **J. P. Obiero** Participated at the executive committee meeting of the ASK held on 16th February 2012 to discuss planned construction projects proposed for the show ground that include wall fence, rehabilitation of water infrastructure etc.
- Training on seed drying, processing and storage for professionals working in seed production in Sub-Saharan Africa in collaboration with the Faculty of Agriculture - Dr. A. N. Gitau, Dr. D. O. Mbuge, Eng. J. M. Mutua, E. M. Mwachoni, R. M. Mathenge - May 2012 (photos attached)
- Environmental and Biosystems Engineering 5th year Students dinner held on 31st May 2012 at Kabete Vet golf Club. (photos attached)
- IEK exhibition at KICC on May 11, 2012 - E. B. K. Mutai (photos attached)
- **J. P. O. Obiero** Organized Nairobi Branch Ploughing contest coordinated by the Agricultural Society of Kenya (ASK-Nairobi branch) in which the department was a participant.
- **J. P. O. Obiero** Participated in the planning of the 2012 Nairobi International Trade Fair (NITF) as an executive committee member. (27th October 2012)
- **Prof. G. R. A MCHAU** Dean, School of Agriculture from the University of Venda (South Africa) visited SoE and the department on a Benchmarking tour.
- Visitors from Reckoning International visited our department on 31st July 2012 for possible cooperation on the use of conservation tillage equipment.
- Keller Joegeno from University of Siegen - Germany visited our department on 18th Dec 2012 seeking possible cooperation.
Visitors from Reckoning International (Daniel and James) in a discussion Chweya, Wamutitu & Mathenge during their tour to our workshops on 31st July 2012

EBE students on a visit to African Diatomite Company Kariandusi on 20th July 2012
Department of Geospatial and Space Technology

01. INTRODUCTION

The Department of Geospatial and Space Technology changed its name from Department of Surveying in 2004. Several name changes have occurred since the Department was started in early 1960’s. The new name was necessitated by the emergence of modern technology and tools, especially satellite positioning techniques and computer applications including geographical information systems (GIS).

Geospatial Engineering is a professional discipline concerned with the measurement, analysis and graphic representation of dimensional geo-spatial relationships, as well as with design, construction, maintenance, and the use of geospatial databases. It has its roots in surveying and mapping and encompasses the specialized areas of geodesy, surveying, topometry, hydrography, geoinformatics and navigation.

The Department continues to offer the 5-year curriculum leading to award of the degree, B.Sc. in Geospatial Engineering. The 3rd batch of students under this program graduated in September 2011. They were 37 students of whom 7 were female students. The Department is also offering a masters degree program – MSc. (GIS) and in the year under review, students graduated. The degree program – MSc. (Surveying) graduated 1 (one) candidate. There were a total of 3 Ph.D registered candidates in the year under review. Two are expected to graduate in the following year.

3. STUDENT ENROLMENT

A. UNDERGRADUATE
   First Year 35
   Second Year 39
   Third Year 37
   Fourth Year 34
   Fifth Year 30

B. POSTGRADUATE (M.Sc. GIS)
   First Year 9
   Second Year 8

C. POSTGRADUATE (M.Sc. Surveying)
5. RESEARCH INTERESTS, INTERNATIONAL LINKS & COLLABORATIONS

A. Research Interest

Our members continued carrying out research in various fields as outlined below:

Geodetic Science

Mulaku, G.C.; The Kenyan Cadastre and Spatial Data Infrastructure.

Musyoka, S.M.; Modernization of the Kenyan Geodetic Network.

Rostom, S.R.; Aerial Triangulation by Digital Photogrammetry

Macoco, D.K.; Challenges in Indoor Positioning

Karanja, F.N.; Earth Observations for Natural Resource Management,

Gender – Disaggregate Spatial databases and Applications,

Application of GIS in Poverty Reduction.

Wakoli, P.C.; Application of Photogrammetry to Detection & Monitoring of Structural Deformations.

Kiema, J.B.K.; Use of GIS in Business Decision Planning

Governance and Partial Information Management

Use of Space Technology in Water Management.

B. International Links and collaborations

The Department formalized its links with the Department of Geography at the University of Helsinki which has seen 1 Ph.D partial scholarship awarded to one potential member of staff.
6. PUBLICATIONS/ CONSULTANCIES

A. Publications


7. NUMBER OF GRADUANDS

A: Masters

<table>
<thead>
<tr>
<th>Course</th>
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<th>Female</th>
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<td>MSc. (GIS)</td>
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<tr>
<td>MSc. Surveying</td>
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B: Undergraduates

<table>
<thead>
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<th>Male</th>
<th>Female</th>
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<tbody>
<tr>
<td>BSc. (Geospatial Engineering)</td>
<td>30</td>
<td>7</td>
<td>37</td>
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Department of Mechanical and Manufacturing Engineering

The Department of Mechanical and Manufacturing Engineering is one of the five departments in the School of Engineering and its history dates back to 1956 when the Royal Technical College was started. In 2003, the University of Nairobi Senate ratified the change of name of the department from the initial name of Department of Mechanical Engineering to the present name of the Department of Mechanical & Manufacturing Engineering offering the same undergraduate BSc. degree in Mechanical Engineering. The department also offers 5 MSc. degree programs as well as PhD programs.

The department has an undergraduate student enrollment of about 564 and postgraduate student enrolment of 23 with an Academic Staff establishment of 23 and Technical Staff Establishment of 20.

2. COURSES OFFERED

(a) BSc. degree Mechanical Engineering
• Basic Applied Sciences (Physics, Chemistry & Mathematics) in the 1st year of study
• Mathematics (in 2nd, 3rd and 4th year)
• Courses in Humanity (Philosophy, Communication Skills, HIV/AIDS) in the 1st year of study
• Thermodynamics
• Solid Mechanical
• Fluid Mechanics
• Mechanics of Machines
• Computing
• Production Engineering & Industrial Management
• Engineering Drawing
• Engineering Design
• Materials Science & Metallurgical Engineering
• Engineering Project (in the 5th and Final Year)

(b) MSc. degrees in Mechanical Engineering

(i) **Advanced Thermo-Fluids Engineering**

**First Year**

**Compulsory course units – Thermal Engineering**

FME 660 – Advanced Thermodynamics I
FME 661 – Advanced Heat Transfer
FME 662 - Advanced Fluid Mechanics
FME 663 – Mass Transfer
FME 690 – Mathematics Methods
FME 692 – Research Methodology

**Plus from course units chosen from the following:**

FME 665 – Advanced Thermodynamics II
FME 666 - Advanced Refrigeration
FME 667 – Combustion Theory
FME 668 – Renewable Energy Technology
FME 669 - Direct Energy conversation
FME 670 – Drying Processes
FME 671 – Advanced Conductive Heat Transfer
FME 672 – Two-phase Flow
FME 673 – Theory of Turbulence
FME 674 – Environmental Fluid Mechanics and Pollution
FME 691 – Numerical Methods

**Compulsory Course Units – Fluids Engineering (options)**

FME 660 – Advanced Thermodynamics I
FME 661 – Advanced Heat Transfer
FME 662 – Advanced Fluid Mechanics
FME 664 – Boundary Layer Theory
FME 690 – Mathematics Methods
FME 692 – Research Methodology

**Plus from course units chosen from the following:**

FME 671 – Advanced Conductive Heat Transfer
FME 672 – Two-phase Flow
FME 673 – Theory of Turbulence
FME 674 – Environmental Fluid Mechanics and Pollution
FME 675 – Advanced Gas Dynamics
FME 676 – Hydrodynamic Lubrication
FME 677 – Experimental Fluid Mechanics
FME 678 – Computational Fluid Mechanics
FME 691 – Numerical Methods

**Second Year for both of the above options**

A suitable research project supervised by at least one member of staff and submitted as a thesis written in accordance with University regulations.
(ii) Advanced Applied Mechanics

First Year

**Compulsory course units**

FME 640 – Continuum Mechanics I
FME 641 – Continuum Mechanics II
FME 642 – Vibration Engineering
FME 643 – Experimental Stress Analysis
FME 690 – Mathematics Methods
FME 692 – Research Methodology

**Plus from course units chosen from the following:**

FME 644 – Engineering Plasticity
FME 645 – High Pressure Engineering
FME 646 – Theory of Elasticity
FME 647 – Control Engineering
FME 648 – Properties and Testing of Materials
FME 649 – Finite Elements Methods
FME 626 – Chemical Metallurgy
FME 691 – Numerical Methods

**Second Year**

A suitable research project supervised by at least one member of staff and submitted as a thesis written in accordance with University regulations.

(iii) Industrial Engineering

First Year
Compulsory course units

FME 600 – Operation Research
FME 601 – Management Information Systems
FME 603 – Engineering Vibration
FME 604 – Work Systems Design and Measurement
FME 690 – Mathematics Methods
FME 692 – Research Methodology

Plus from course units chosen from the following:

FME 604 – Human Performance Mechanisms
FME 605 – Industrial Psychology
FME 606 – Work Incentives and Organization
FME 607 – Healthy and Safety
FME 608 – Ergonomics and Man-Machine Systems
FME 609 – CAD/CAM
FME 610 – Industrial Data Processing Systems
FME 611 – Production Systems Design and Analysis
FME 612 – Decision Theory
FME 613 – Risk Theory
FME 614 – Mathematical Programming
FME 615 – Mathematical Optimizations
FME 616 – Energy Utilizations
FME 617 – Quality Control and Reliability
FME 618 – Maintenance Management
FME 619 – Production Planning, Scheduling and Control
FME 691 – Numerical Methods
(iv) Materials Science and Metallurgical Engineering

First Year

Compulsory course units

FME 620 – Structure, Properties and Behavior of Materials
FME 621 – Iron and steel Metallurgy
FME 622 – Process Metallurgy
FME 623 – Corrosion and Deterioration of Materials
FME 690 – Mathematics Methods
FME 691 – Research Methodology

Plus from course units chosen from the following:

FME 624 – Non-Destructive Testing and Evaluation
FME 625 – Structure and Properties of Ceramics and glasses
FME 626 – Polymer Science and Engineering I
FME 627 – Polymer Science and Engineering II
FME 628 – Phase diagrams in Materials
FME 629 – Chemical Metallurgy
FME 630 – Composite Materials
FME 631 – Nuclear Materials
FME 632 – Engineering Non-Ferrous Metals
FME 633 – Foundry Technology
FME 634 – Modern Analytical Techniques
FME 691 – Numerical Methods

Second Year

A suitable research project supervised by at least one member of staff and submitted as a thesis written in accordance with University regulations.
(V) Energy Management

Compulsory course units

FME 701 – Energy Sources and Concepts
FME 702 - Energy and Environment
FME 703 – Processes in Energy Management
FME 704 – Project management
FME 705 – Engineering Economics Analysis
FME 715 – Research Methods
FME 717 – Project – 6 course units equivalent

Elective Courses

FME 706 – Refrigeration, Heat pumps and Air-conditioning
FME 707 – Steam generation, utilization and waste heat use
FME 708 – Fluid Flow systems
FME 709 – Maintenance Management
FME 710 – Metering and Tariffs in Energy Management
FME 711 – Electrical Energy utilities
FME 712 – Energy generation and transmission
FME 713 - Instrumentation
FME 714 – Control systems

3. International Students capacity

Undergraduates

Year I – (1) Desai Shaunak Nimish F18/53599/2012 (India)
                Ceesay Mohammed F18/54788/2012 (Gambian)
                Zehra Mustafa F18/54892/2012 (Pakistan)
                Adam Hamza Ahmed F18/53714/2012 (Canada)
Year III – (3) Chol Dhieu Gabriel F18/3474/2010 (Sudanese)

Uduchukwu Christian Kelechi F18/35484/2010 (Nigerian)

Year IV – (4) Samenjo Karl Heinz Tondo F18/29353/2009 (Camerron)

5. International Links & Collaboration

- Through the collaboration established between the Department of Mechanical & Manufacturing Engineering of the University of Nairobi and the National Taiwan University of Science & Technology (NTUST), seven students from the department who got 1st class honours degree are applying for postgraduate MSc. studies and scholarships to NTUST. These are King’ora Kamau, Cherono Sheilah, Odongo Philip, Ochieng David, Mosiria Bwana, Omondi Anthony and Mogaka Davidson Onchana. Two academic members of staff Mr. Kimilu and Mr. Kivindu are finalizing their applications for admission and scholarships for PhD studies in the same institution.

6. Publication for the year

- Book – S.M. MUTULI – Fundamentals of Solid And Structural Mechanics “Accepted for publication at the University of Nairobi Press.


7. Consultations

- Conducting laboratory experiments for Multimedia University (Faculty of Engineering
- Prof. Oduori is carrying out investigations of aircraft docking system for Kenya Airways aircrafts.
- Conducting laboratory experiments for Moi University.

8. Numbers of graduands

- Diploma – None
- BSc. degree in Mechanical Engineering – 55
- MSc. degree – 1
9. Papers presented at conferences -

- Mr. Bernard Odera attended the International Seminar on Heterogeneous Multicomponent Equilibria in Germany 9th – 17th February 2013.

10. Any other Activity

Objectives - Research and Innovation and Consultancy

The department participated in the initiation of a project on the establishment of an NDT Centre for research and training at the Institute of Nuclear Science & Technology of University of Nairobi. An initial support grant of Ksh. 40 Millions has been approved. This project is supporting one student by the name Mr. Birir who is supervised by Prof. Mutuli from Mechanical Engineering and Dr. Gatari from Nuclear Science.

Community Service

- On Saturday 6th October 2012, students from the department participated in the commissioning of a water pump for a borehole at St. Ebrahim School in Kamulu sponsored by Davis & Shirtliff Co. Ltd.

4. RESEARCH ACTIVITIES UNDERTAKEN

- Charles Omondi Oingo – F18/1437/2010 a 1st year student in the Dept. of Mechanical And Manufacturing Engineering has been awarded a Science, Technology And Innovation (ST & I) Grant of Kshs. 400,000/= by the National Council of Science and Technology to carry out more work on his innovation entitled “The Cell phone and Remote – Controlled Lock”.

- Eng. David Masinde Munyasi, Lecturer in the Department of Mechanical and Manufacturing Engineering has been given a grant of KES 250,000 by the Deans Committee to carry out a research on “Assessment of Stone Crushing Characteristics and Optimum Dynamical and Structural Design of a Stone Crusher for Small Scale Entrepreneurs” being his PhD Research Work.

- Prof. Oduori has been awarded a grant from National Council of Science And Technology of Ksh. 800,000/= for commercialization of social Decorticator.

- Mr. Mwaka has been awarded a grant of Ksh. 3.985 million by the National Council of Science And Technology for a project entitled “Small Scale Water Extraction in arid and semi-arid areas by wind power.

- Dr. Hussein Jama was awarded a grant of Kshs. 250,000/- from the Dean’s Committee Research Grant to carry out research entitled “Behaviour of Steel Plates Strengthened with CFRP subjected to Blast and Impact Loads”.

32
• Prof. S.M. Mutuli was awarded a grant of Kshs. 250,000/- from the Dean's Committee Research Grant to carry out research entitled "Design and Fabrication of a Universal Testing Rig for Laboratory Experiments on Beam Deflections - Cases of Simply Supported Beams, Cantilever Beams and Fixed Beams subjected to point loads, distributed loads and couples"

• Dr. Thomas Ochuku Mbuya was awarded a grant of Kshs.250,000/- to carry out research entitled "Development of Recycle Friendly Aluminum Alloys for Automotive and Structural Applications."