UNIVERSITY OF RWANDA

College of Science and Technology

African Center of Excellence in Energy for Sustainable Development (ACE-ESD)

P.O.BOX 3900, Kigali

CURRICULUM

ACE-ESD

African Center of Excellence in Energy for Sustainable Development

Master of Science in Electrical Power Systems Degree

PROGRAMME SPECIFICATION

(July, 2017)

Master of Science in Electrical Power Systems Degree

1. PROGRAMME DETAILS

The table in this section sets out the programme details. It shows the title, which is also the highest qualification obtainable from the programme. The title was selected with the aim to make the programme look both academically sound and useful for employment. In addition, in the table we specify the exit awards, the mode of attendance and the resource group. For the resource group in particular, we opt *a part classroom/part laboratory.* According to the National Qualification Framework, such a class corresponds to category 5 with a staff/student ratio of 1:15.

<table>
<tr><td><u>1.1 Programme Title</u></td><td colspan="4">Master of Science in Electrical Power Systems</td></tr>
<tr><td>1.2 <u>Exit Awards</u></td><td colspan="4"><table><tr><td></td><td>Credits</td></tr><tr><td>• Postgraduate Diploma in Electrical Power Systems
• Master of Science in Electrical Power Systems</td><td>120

240</td></tr></table></td></tr>
<tr><td rowspan="3"><u>1.3 Modes of Attendance</u></td><td>Part-time</td><td>X</td><td>Full-time</td><td>X</td></tr>
<tr><td>Distance Learning</td><td></td><td>Work-based Learning</td><td></td></tr>
<tr><td>Other (please specify)</td><td></td><td>Short course</td><td></td></tr>
<tr><td rowspan="4"><u>1.4 Resource group</u></td><td>1</td><td></td><td>5</td><td>X</td></tr>
<tr><td>2</td><td></td><td>6</td><td></td></tr>
<tr><td>3</td><td></td><td>Other (write in)</td><td></td></tr>
<tr><td>4</td><td></td><td></td><td></td></tr>
<tr><td rowspan="2"><u>1.5 First year of presentation</u></td><td colspan="3">2017-2018</td><td>X</td></tr>
<tr><td colspan="3"></td><td></td></tr>
<tr><td><u>1.6 Programme Leader</u></td><td colspan="4">Prof. Etienne Ntagwirumugara, Director, ACE-ESD</td></tr>
</table>

<u>1.7 Programme Development Team</u>

Name	**School/Institution**
Prof. Ntagwirumugara Etienne	School of Engineering/CST
Prof. Ntagwirumugara Etienne	School of Engineering/CST
Prof. Ijumba Nelson	Deputy Vice-chancellor for Academic Affairs/ University of Rwanda
Dr. Ignace Gatare	Principal/College of Science and Technology
Dr. Ernest Mazimpaka	School of Engineering/CST
Dr. Anastase Rwigema	School of Sciences/CST

Dr. Denis Ndanguza	School of Sciences/CST
Dr. Philibert Nsengiyumva	School of Engineering/CST
Prof. Bonfis Safari	School of Sciences/CST
Prof. Wilson Bryan	University of Colorado/USA
Dr. Burnet Mkandawire	Head of Department/ University of Malawi
Odax Ugirimbabazi	School of Engineering/CST
JMV Bikorimana	School of Engineering/CST
Fabien Mukundufite	School of Engineering/CST
Geoffrey Gasore	School of Engineering/CST
Yousouf Singirankabo	School of Engineering/CST
Michael Asinyaka	School of Engineering/CST
Dr. William GBoney	RURA, Expert in Energy Economics
Eng. Alfred Byigiro	RURA, HoD of Energy Department

1.8 School/Centre Administratively responsible for the Program	African Center of Excellence in Energy for Sustainable Development (ACE-ESD)

2. PROGRAMME FUNDING AND NEED FOR RESOURCES

2.1 Programme Development Team

The team is composed of the Programme Leader, eleven academic staff from UR-CST and two experts from Rwanda Utilities Regulatory Authority who were involved in the writing and planning of the module descriptors. Also included were representatives from private and public sector such as Rwanda Energy Group (REG) and Ngali Energy Ltd. The Programme leader who is also the Director of the ACE-ESD will be present throughout the planning process, including the validation meetings. ACE-ESD has partners from Colorado and other institutions in the region (Malawi, Tanzania) who have been involved in the development of the programme by online communication.

2.2 Students numbers:

Intake per year into Level 6: 15 students/intake
Eventual population, all years: 40 students

2.3 Adequacy of Infrastructure

The programme will be resourced from the existing resources of the College of Science and Technology Campuses. The classrooms and computer laboratories are adequate for the program. A special state of the art Micro-Grids laboratory will be set up by the ACE-ESD –World Bank funds to further enhance infrastructure.

2.4 Adequacy of Staff Resource

Here the numbers and level of staff working on the programme in each year are given with the objective to show how the staff resource is adequate in terms of numbers and seniority as well as to cost the programme in financial terms. The staff figures given in the table are full time equivalents.

Year	**2017/18**	**2018/19**	**2019/20**	**2020/21**	**SOURCE OF FUNDS**
Academic Staffing					
Full professors	0	1	1	2	UR/ACE-ESD
Associate professors	1	2	3	4	UR/ ACE-ESD
Senior lecturers	2	4	5	6	UR/ ACE-ESD
Lecturers	3	4	5	6	UR/ ACE-ESD
Support Staff	4	4	6	8	UR/ ACE-ESD
Technical & Other Staff	2	2	2	2	UR/ ACE-ESD

2.5 General accommodation requirements

The figure in this section serves to give an idea on the number and size of rooms that will be needed by the programme.

- Two classrooms and two computer laboratories for at least 30 students are available.
- One smart-grid laboratory
- One Advanced Photovoltaics System (PV) with one phase synchronization, one Small wind power plant System (off-grid) with battery storage and single-phase sinus-converter 230V, one Industrial Photovoltaics with three phase synchronization, one Wind power plant with DFIG and three phase synchronization, one Micro-grid stand-alone with synchronization, one Smart Grid Distribution, one Energy Management laboratory**,** one Mini Hydro Power, one High voltage transformers lab, one High voltage transmission line Three phase and DC with line protection lab, one Power electronics for renewable energies lab,
- Students will, however, be encouraged to bring their own devices, thus enabling them to access online materials and lectures.

3. PROGRAMME AIMS AND RATIONALE

This program specification has been produced to conform to the Rwandan National Qualifications Framework for Higher Education Institutions. The programme has well been made after assessing the need of Electrical Power Systems Engineers referring to Energy skills Assessment report 2015 from National Commission of Science and Technology, and to United Nations Economics Commission for Africa (UNECA), 2014 Energy Access and Security in Eastern Africa report.

3.1 Programme Rationale

To improve capabilities for innovation and higher productivity and to become globally competitive we should invest in higher education and training in Science Technology and Innovation (STI).

The Eastern and Southern Africa sub-region lacks sufficiently trained energy professionals with specialized knowledge in power systems engineering and technology required to generate the innovations needed to boost productivity in the energy sector and scale up energy adoption (especially in rural areas). The development challenge therefore is to build the critical mass of African scientist and engineers in energy in higher education, research and training. Such training is required to develop and provide home grown solutions by developing expertise in power systems engineering especially as they relate to micro-grid and distributed power generation using alternation or renewable energy sources.

Hence, the African Centre of Excellence in Energy for Sustainable Development (ACE-ESD) is proposing a Master program in Electrical Power Systems to educate and train African researchers in the field of energy generation and distribution. The MSc in Electrical Power Systems has in total 240 credits with 13 core modules of 160 credits and the Master thesis of 80 credits. These modules are to introduce the whole area of energy systems for the generation, transmission and distribution as well as the economics assessment of energy systems.

As ACE-ESD is a collaborative Project with Regional and International partners from Academia, Industry and Research Institutions funded by the World Bank to build STI capacity in the ESA region, the MSc of Science in Electrical Power Systems program will target regional students from within Rwanda, the ESA region and Africa as a whole.

The Master of Science in Electrical Power Systems introduces and explore a number of electrical engineering issues involved in the planning, designing, operating, controlling power generation, transmission, and distribution system in electrical engineering. The programme will seek to ground students' knowledge in both theoretical and practical computational approaches in power systems while pointing the student in the direction of seeking more information and developing advanced skills as required. Students on the programme would also acquire broad knowledge of power generation systems, their economic operation, transmission and distribution. In addition, students would be exposed to techno-economic approaches that enable them to solve complex energy related challenges involving national power grids as well as for distributed grids. Lastly, issues to do with regulation of power systems and markets will be addressed as part of the programme through studies in regulatory economics and policy. Thus, this program also concentrates on the modules offering knowledge in power system operation and control, power quality, modelling and optimization.

A key component of the program is projects or practical application exercises that students will undertake. These are designed to enable students to demonstrate their skills and ability to solve real-life problems while gaining more detailed knowledge of a particular topic. Projects should be simulation-based or experimental. In all cases, students are expected to show innovation and an ability to come up with their own solutions.

3.2 Educational Aims

The main thematic basis of the programme is to provide students the basic skills needed for planning, designing, operating and controlling power generation, and transmission and distribution systems. Broader impacts include more effective and reliable use of power systems technologies for problem-solving in enabling access to energy and energy services within the African region in various sectors such as Agriculture, Health, Energy and Education.

The programme has the following educational aims:

- To apply knowledge of advanced principles to the analysis of electrical and computer engineering problems.
- To apply the appropriate industry practices, emerging technologies, state-of-the-art design techniques, software tools, and research methods of solving electrical systems problems.
- To expose students to a wide range of test beds available for projects, such as power system control using SCADA, network analysis using advanced computer tools.
- To develop a broad technical understanding of the power systems technologies and their application for development & business in a real world perspective;
- To develop communication, interpersonal, and team building skills.

4. PROGRAMME LEARNING OUTCOMES

A. Knowledge and Understanding

At the end of the programme students should be able to demonstrate knowledge and understanding of the:

A1. Advanced concepts, principles and theories of power system components
A2. Theory of power system operation
A3. Power system protection techniques
A4. Describe and classify power quality issues in a power system
A5. Understand and effectively use standards for quantifying power quality
A6. Analyses of power systems harmonics and transient through multiple methods
A7. Recognize symptoms of power quality deviations or distortions associated with three phase systems
A8. Load forecasting and optimal load scheduling for secure energy supply and use
A9. Working principles of FACTs and HVDC system and AC power transmission improvement by use of FACTs

B. Cognitive/ Intellectual Skills/ Application of Knowledge

At the end of the programme students should be able to:

B1. Identify appropriate methodology to investigate power quality issues
B2. Apply appropriate power quality standards to quantify power quality in systems
B3. Apply skills in investigating power quality issues in distributed systems
B4. Apply acquired skills for power quality systems
B5. Identify and design solutions for power quality improvements
B6. Manage continuous energy supply and use
B7. Apply professional knowledge to operate power system components
B8. Identify types of disturbances that can happen in power system
B9. Mitigate the time and effects of disturbances in power systems
B10. Identify the different types of FACTs and HVDC systems in electrical power systems.

C. Communication/ICT/Numeracy/Analytic Techniques/Practical Skills

At the end of the programme students should be able to:

C1. Apply the appropriate techniques of power quality analysis they have learned to review and critically analyse power quality problems and propose appropriate solutions
C2. Identify and describe the sources of practical power quality issues
C3. Demonstrate an awareness of power quality indices, standards and models in selected case studies
C4. Demonstrate awareness of power quality deviation symptoms and effectively communicate same
C5. Identify and describe, at each time, the running condition of power
C6. Compare available energy supply to load, and take appropriate measures in case of inequality between energy supply and use
C7. Demonstrate an awareness of troubleshooting procedures in power systems
C8. Demonstrate strong technical skills in power protection
C9. Simulate FACTs or HVDC systems with appropriate software

D. General transferable skills

At the end of the programme students should be able to:

D1. Effectively apply their knowledge of power quality in different power systems including distributed systems
D2. Work effectively as a research team member in the implementation power quality improvements
D3. Show sufficient knowledge and understanding the social impact of power quality issues

D4. Balance energy supply end use
D5. Use competently the tools and techniques of protection to short and long time disturbances in power systems
D6. Improve AC transmission and distribution systems
D7. Get enough knowledge of understanding of the use of FACTs or HVDC systems;
D8. Efficiently disseminate scientific research findings within the community and outside, to the research sphere for inter-disciplinary cooperation for increased visibility;

5. PROGRAMME STRUCTURE

Students are required to obtain 240 credits as stated in "Rwandan National Qualification Framework for Higher Education Institutions and University of Rwanda regulation". Duration of the programme is two academic year. As specified in "Rwandan National Qualification Framework for Higher Education Institutions", the academic years will be divided into four semesters of 15 weeks each during two years as indicated in the University of Rwanda regulation. A semester will consist of twelve weeks of learning and teaching, one week for revision and consolidation and two weeks during which examinations take place. Academic work and assessments will be carried out within the month in which the module is taught and completed.

Semester 1					
Module Code	Module	Credits	Contacts hours	Level	Achievement of Programme Outcomes
ENE 6161	Mathematical Analysis and Matrix Theory	10	36	6	A2, A3, A4, A7, A8, A9, B1, B2, B3, C2, C3, D1-D6
ENE 6162	Power and Energy Systems	10	36	6	A1, A2, A4, A5, A6, A7, A8, C1, C2, D1-D6
ENE 6163	Energy Systems modelling and optimization	15	48	6	A1, A2, A3, A4, A5, A6, A7, A8, A9, B1, B2, B3, C1, C2, C3, D1-D6
ENE 6164	Research methodology	10	36	6	A6, A7, A8, A9, A10, A11, B1, B2, B3, B4, B5, B6, C4, C5, D1-D6

ENE 6165	Microeconomics of the energy sector	10	36	6	A4, A5, A6, A7, A10, C3, C4, D1-D6
	Sub-total	55	192	-	
Semester 2					
Module Code	Module	Credits	Contacts hours	Level	Achievement of Programme Outcomes
ENE 6261	Advanced Power Electronics	10	36	6	A1, A2, A3, A4, A6, A7, A8, A9, B1, D1-D6
ENE 6262	Corporate Finance and Business Communication	10	36	6	A4, A5, A6, A7, A10, C4, C5, D1-D6
PSE 6261	Advanced electrical network analysis	15	48	6	A1, A2, A3, A7, A8, C1, C2, D1-D6
PSE 6262	Power systems operation, control and protection	15	48	6	A1, A2, A3, A8, A9, C1, C2, C3, D1-D6
PSE 6263	FACTS and HVDC power systems	15	48	6	A1, A2, A5, A7, A8, C1, C2, D1-D6
	Sub-total	65	216	--	
Semester 3					
Module Code	Module	Credits	Contacts hours	Level	Achievement of Programme Outcomes
PSE 6361	Signal processing for power systems	10	36	6	A1, A2, A3, A4, A5, A6, A7, A8, A9, B1, B2, C1, C2, C3, D1-D6
PSE 6362	Electrical power quality	15	48	6	A1, A2, A3, A7, A8, A9, B1, C2, C3, D1-D6
ENE 6361	Smart-grid systems	15	48	6	A1, A2, A3, A4, A5, A6, A7, A8, A9, B1, B2, B3, C1, C2, C3,

					D1-D6
PSE 6461	Dissertation	--	--	6	A1-A11, B1-B6, C1-C5, D1-D6
	Sub-total	40	132	-	
Semester 4					
Module Code	Module	Credits	Contacts hours	Level	Achievement of Programme Outcomes
PSE 6461	Dissertation	80	288	6	A1-A11, B1-B6, C1-C5, D1-D6
	Sub-total	**80**	**288**		
	Total	**240**	**828**	-	

Program Learning outcomes mapping

Semester 1																												
Module Co	Module	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	B1	B2	B3	B4	B5	B6	C1	C2	C3	C4	C5	D1	D2	D3	D4	D5	D6
ENE 6161	Mathematical Analysis and Matrix Theory		x	x	x			x	x	x			x	x	x					x	x			x	x	x	x	x	x
ENE 6162	Power and Energy Systems	x	x		x	x	x	x	x										x	x				x	x	x	x	x	x
ENE 6163	Energy Systems modelling and optimization	x	x	x	x	x	x	x	x	x			x	x	x				x	x	x			x	x	x	x	x	x
ENE 6164	Research methodology,						x	x	x	x	x	x	x	x	x	x	x	x				x	x	x	x	x	x	x	x
ENE 6165	Microeconomics of the energy sector				x	x	x	x			x										x	x		x	x	x	x	x	x
Semester 2																													
Module Co	Module	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	B1	B2	B3	B4	B5	B6	C1	C2	C3	C4	C5	D1	D2	D3	D4	D5	D6
ENE 6261	Advanced Power Electronics	x	x	x	x		x	x	x	x			x											x	x	x	x	x	x
ENE 6262	Corporate Finance and Business Communication				x	x	x	x			x											x	x	x	x	x	x	x	x
PSE 6261	Advanced electrical network analysis	x	x	x				x	x										x	x				x	x	x	x	x	x
PSE 6262	Power systems operation, control and protection	x	x	x					x	x									x	x	x			x	x	x	x	x	x
PSE 6263	FACTS and HVDC power systems	x	x			x		x	x										x	x				x	x	x	x	x	x
Semester 3																													
Module Co	Module	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	B1	B2	B3	B4	B5	B6	C1	C2	C3	C4	C5	D1	D2	D3	D4	D5	D6
PSE 6361	Signal processing for power systems	x	x	x	x	x	x	x	x	x			x	x					x	x	x			x	x	x	x	x	x
PSE 6362	Electrical power quality	x	x	x				x	x	x			x							x	x			x	x	x	x	x	x
ENE 6361	Smart-grid systems	x	x	x	x	x	x	x	x	x			x	x	x				x	x	x			x	x	x	x	x	x
PSE 6461	Dissertation		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Semester 4																													
Module Co	Module	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	B1	B2	B3	B4	B5	B6	C1	C2	C3	C4	C5	D1	D2	D3	D4	D5	D6
PSE 6461	Dissertation	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x

6. LEARNING AND TEACHING STRATEGY

The programme will follow a modular based teaching approach with modules offered in a carefully orchestrated instructor-guided teaching. This could be followed by three weeks of guided, e-learning experiences with self-study of reference materials (primary documents whenever possible). At the end of the final week, an interactive seminar should be held to enable students to strengthen their knowledge and understanding by discussing and resolving problems based on real-life situations. All modules might benefit from exploiting different delivery modes adapted by the Lecturer.

For example, the time allocated to a module might be divided between:

- Classroom teaching and physically attended seminars and workshops.
- Case studies and practical exercises which should be included in all modules.
- Instructor-led remote lectures (live or pre-recorded in some cases).
- Self-study of textbooks and reference material.
- Laboratory experiments.

The 10/15 credits modules will be taught within four and five weeks respectively. The project shall span for over a period of six to eight months with supervision and no classroom teaching until otherwise advised by supervisor in advance.

Category 1: Theory course with Practical's or 10/15 credit modules

1) 36/48 contact hours (lectures, tutorials, discussions, seminars, case studies.)
2) 26/42 hours of self-study
3) 38/60 hours' work on written assignments, practical's and mini project (mandatory)

Category 2: Dissertation with 80 credits

800 hours of practical work includes field survey and all previous modules to be passed as the project carried out shall involve the requirement / design / analysis / testing /. provided in all modules taught in semester I, II, and III to link up to a particular working project at the end of this module with Practise oriented to Students thesis.
Note*
(This means meaning is the student shall be provided tentatively with a research project after Research Methodology module, which has to be, carried forward with all other modules as assignment or mini project whatever is applicable depending on theoretical or practical nature of the modules)

7. ASSESSMENT STRATEGY

Apart from the in-class formative assessment, the module evaluation will be based upon individual assessment submitted by the Lecturer at the end of the module. The special tools/software's and strategies will be used to avoid plagiarism, cheating and other malpractices. The specific marking criteria for each module will be provided in individual module descriptions. The Final Exam shall be of 3 hours following general master's programme format as already followed. A tentative guide is provided for lecturer to use for continuous assessment but may vary with different module but at least 2 different elements shall be covered.

Category 1: Theory course with Practical's or 10/15 credit module

The assessment shall include 60% of continuous tests and 40% of the final examination.
The assessments shall be made 50% each for practical and theoretical aspects. A completed module will be considered passed only if a minimum score of 60% or above is achieved during the evaluation.
For Example:
One/two practical assignment (20%), one research seminar or mini project for presentation (20%), one tutorial session (15%) and short practical test (5%) followed by final assessment (40%) of End of Module Examination divided equally into practical viva-voce and theoretical examination.

Category 2: Dissertations with 80 credits

The dissertation will be evaluated by a written report, presentation and oral examination by the external examiner(s) during the Project Defence. The guidelines shall be provided during Research Methodology module.

• Examination.
To evaluate the accomplishment of the module learning outcomes, an examination could be used to assess a complete module, especially the foundation modules where students are either physically present face-to-face or electronic (on-line) tools can be used. However, this method may not be flexible enough to cover advanced modules, where understanding demonstrated through projects and exercises will be much more important. Therefore, the students must be physically present face to face during the examination.

• Essays.
An essay can be used to demonstrate a student's understanding of the content of a particular module. This would demonstrate a student's ability to assimilate a subject in depth and objectively analyze the material that has been provided. However, marking of essays can be time consuming for the course tutor and lead to a degree of subjective assessment which depends, for example, on the student's knowledge of English rather than on their level of knowledge of the subject.

• Projects.
A project can be set which requires the student (or a group of students) to research a subject in more depth than has been provided in the course. The thoroughness with which a project has been completed and the adequacy of the results obtained could be an excellent way to assess whether a student has fully understood the concepts and methods used in the module. Ideally, around 50% of the marks for a particular module should be based on the results of projects or interactive exercises if these can be set in the required context and timescale.
• Research Seminars.
Every module will have a component called Research Seminar. The seminar topic relates to the content of the study course. The students shall work on the topic on their own and then present it for discussion.
• Interactive exercises.

These can be a fun way of quickly allocating marks to a student or a group of students. A problem can be outlined and the student or group of students asked to work out the best way of solving it. Enough scope shall be given to allow the student to come up with innovative ways of solving the problem.

8. STUDENT PROFILE

This degree Masters (MSc in Electrical Power Systems) shall be taken by any professional who has previously graduated with a first-level University degree (e.g. BSc in the field of Mechatronics, Mechanical Engineering, Electrical Engineering, and Electro-Mechanical Engineering, Energy Engineering or Renewable Energy Engineering and others related fields).

9. SPECIFIC ADMISSION CRITERIA

To be admitted to MSc. Degree Programme in Electrical Power System, the student must: Have a Bachelor's degree in the areas mentioned in the section eight or other related fields with at least a second class, upper division;
A Bachelor's degree in the same areas/specialisations as above, with second class, lower division, with at least a 2-year relevant working experience. All candidates should demonstrate sufficient ability in English to undertake masters-level work.

10. STRATEGY FOR STUDENT SUPPORT

Each student will be allocated a supervisory team. The students will meet their supervisors on the regular basis in the face-to-face mode (in the case of local lecturers) or in the blended mode - face-to-face and communication through Internet (in case of visiting lecturers). The meetings will take place at least once a week with record keeping as per UR/CST guidelines.

In case of a suspected conflict, bias, discrimination, harassment or any other issues, students are advised to address the Head of Department or the Programme Coordinator. Alternatively, the Director of Research, Innovation and Postgraduate Studies (DRIPGS) shall serve the final verdict in case of any disputes after seeking prior order from the higher authorities being well informed on any such instance if it occurs on individual basis.

All students shall be provided with study materials, assignments, exercises, necessary guidelines, templates and supplementary materials. Those materials will also be posted on e-learning systems of UR/CST. Students will be given an opportunity to interact with lecturers through communication tools embedded into the e-learning system currently under progress. The programme coordinator shall form a committee to monitor the performance of students including quality of supervision.

11. PROGRAMME-SPECIFIC NEED FOR RESOURCES AND UNUSUAL DEMANDS ON UNIVERSITY RESOURCES

UR-CST currently there are a number of scholars possessing academic qualifications (PhD) and expertise in the relevant areas (namely Electronics and Electrical Engineering, Mechanical & Physics Departments). There are four (4) PhD holders with relevant areas of expertise lecturing/co-lecturing on this programme. There are consulted experts during curriculum development from our partner Institutions such as Makerere University, Uganda and Nelson Mandela – African Institute of Science and Technology, Dar es salaam, Tanzania, Colorado State University from USA, University of Agder in Norway, CMU-Africa and much more. PhD students under the centre shall be involved in tutorials, exercises, labs, etc. in collaboration with module leaders.

For each module, the space required includes one lecture room accommodating 15 students or one computer lab with 15 computers. Dedicated Masters' classroom and 2 dedicated labs with 30 computers each are available at UR-CST with the needed LCD projector, smart board, printer and scanner.

12. STRATEGIES FOR CONTINUOUS ENCHANCEMENT AND FUTURE DEVELOPMENT

At the end of each module students will be given evaluation forms and requested to give their feedback on teaching and course content. The student evaluation of modules as well as their performance will be a subject of the discussion on the programme review meeting at the end of the academic year. This may involve changes to the content and timing of the module, the sequence of module delivery, prerequisite courses, the methods of teaching, learning and assessment, and, in some cases, replacement of lecturers/ teaching assistants.

13. STAFF DEVELOPMENT PRIORITIES

Visiting lectures will be invited to boost up manpower in case local staffs are insufficient to handle any of the modules in the programme. The members of the academic staff in the department with relevant Master's degree acting as Teaching Assistants will under study the local and visiting lecturers, thus building their academic capacity. All academic staffs on the programme to pursue higher academic qualification. It is mandatory that academic staff teaching on this programme have a PhD. Resource persons from industry shall be engaged due to their experience. In four years the centre will train five University of Rwanda staff to PhD level who will be module leaders.

14. PROVISIONAL APPROVAL

Members of Approval Panel

Role/ Location	**Dean /Director**	**Date**
1 Principal	Signature	

	Print Name: Dr. Ignace Gatare	
2 ACE Director	Signature	
	Print Name: Prof. Etienne Ntagwirumugara	
3 Master's Coordinator	Signature	
	Print Name	
4	Signature	
	Print Name	
5	Signature	
	Print Name	
	Print Name	

Seen and noted

Library	Signature	
	Print Name	
ICT	Signature	
	Print Name	
Teaching and Learning Enhancement	Signature	
	Print Name	
Finance	Signature	
	Print Name	