MAKERERE UNIVERSITY

FACULTY OF COMPUTING AND INFORMATION TECHNOLOGY

DEPARTMENT OF INFORMATION SYSTEMS

P.O. BOX 7062, KAMPALA, UGANDA

REVISED PHD PROGRAMME IN INFORMATION SYSTEMS

September 2009

DAY / EVENING PROGRAMME

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1. INTRODUCTION

1.1 Background to the Faculty of Computing and Information Technology

The rate of growth of Information and Communication Technology (ICT) in Uganda in particular and the African region in general is enormous. In order to sustain its high growth and usefulness to the economy, there is need for highly skilled and specialized ICT labor force to cater for the sophisticated ICT-jobs. Today Makerere University Faculty of Computing and Information Technology (CIT) is the main ICT training, research and consultancy centre in Uganda. CIT was established by the University Council at its 100th meeting held on 15th December 2004 by upgrading the Institute of Computer Science into a faculty with four departments of computer science, networks, and information technology and information systems. The Institute of Computer Science, which was established by the University Council in 1985, grew out of the University Computer Centre.

CIT's Value Statement: The Faculty of Computing and Information Technology is an innovative and industry-oriented Faculty, pursuing excellence in teaching, learning, cutting edge value-added research and consultancy, community outreach, as well as providing a vibrant student life.

Vision: To be a leader in Computing and ICT training, research and services internationally.

Mission Statement: To provide first class teaching, research and services in computing and ICT responsive to national and international needs.

Department of Information System (IS) is one of the four academic departments at the Faculty of Computing and Information Technology. The department provides both undergraduate and postgraduate courses. Some areas of the study and research in IS include System Analysis and Design, Data warehouses, Databases, Health Informatics, Management Information Systems and Decision Support Systems. These provide students with a thorough knowledge of the field thus providing an enduring foundation for future professional growth. Information System students learn to become problem solvers in organizations, institutions, the economy and society. The department currently has two dynamic research groups namely: Simulation and Modelling Group and Visualization group.

The Faculty has been running a PhD by research since 2002 and continues to do. Specifically the Department of Information Systems runs the following graduate Programmes:

- PhD in Information Systems (PhDIS)
- Master of Information Systems
- Postgraduate Diploma in Information Systems

1.2 Objectives

The objectives of the PhD in Information Systems by Coursework and Research programme are to: -

a. Build human resource capacity in the area of information systems in both the public and private sectors, especially in universities;
b. Develop research capacity in the area of information systems;
c. Address the increasing demand for PhD holders in the area of Information systems;
d. Strengthen capacity and institutional building in the area of information systems discipline in tertiary institutions, private and public sectors.
e. Provide those masters holders with potential for PhD with opportunities to develop skills in formulating, conducting and presenting their own scholarly research through the production of a research-based dissertations and publications.
f. Foster initiative and potential for independent self-study that will develop the students' motivation and ability to continue updating their knowledge and skills after completion of the course of study in relation to scholarship and research.
g. Enable the students to be able to demonstrate a critical awareness and reflection on research-based information as a basis for problem solving and practice in professional contexts.
h. Enable students to be able to demonstrate ability to interpret and report research findings in areas relevant to their field of study.
i. Enable students to be able to demonstrate the ability to formulate research questions and problems, design and carry out their own small scale research projects and present their findings orally and in writing.
j. Equip students with research and publication skills to enable them publish research from high quality dissertations in reputable journals and/ or presentation of their research findings at academic conferences.

1.3 Justification

Professionals in the information system discipline are primarily concerned with the information that computer systems can provide to aid an enterprise in defining and achieving its goals, and the processes that an enterprise can implement or improve using information technology. With dynamic changes in businesses and other enterprises, there is need to constantly upgrade and integrate information technology solutions and business processes to meet the information needs. There is also need to revise curriculum to provide students with the research skills and techniques to advance information systems as well as equip candidates with knowledge on the state of the art in their areas of research so as to ease the process of research. It is not to forget also that Makerere University is working hard towards establishing a research led institution that will attract learners from all corners of the world. The design of the new curriculum has given a special emphasis on this university mission.

Further, the rate of growth of Information and Communication Technology (ICT) in Uganda in particular and the African region in general is enormous. In order to sustain the high growth useful to the economy, there is need for highly skilled and specialized ICT labor force to cater for the sophisticated ICT-jobs. Today Makerere University Faculty of Computing and Information Technology (CIT) is the main ICT training, research and consultancy centre in Uganda.

1.4. Collaboration Partners on PhD by Coursework and Research Implementation

1.4.1. Univ. of Groningen, Radboud Univ. Nijmegen and Eindhoven Univ. of Technology

The Netherlands Government through the Netherlands Organization for International Cooperation in Higher Education (Nuffic) provided a 5.7 million euro grant for a project on 'Strengthening ICT Training and Research Capacity in the Four Public Universities in Uganda'. This project commenced on 1st June 2007 and will end on 31st May 2011. One of the objectives is to build ICT human resource capacity through staff development and implementation of graduate programmes (M.Sc. and Ph.D.) and 30 PhD students (10 registered at the above institutions in the Netherlands and 20 at Makerere University) are supervised by PhD holders from University of Groningen, Radboud University Nijmegen, Eindhoven University of Technology and Makerere University with support from the project. Out of the 5.7 million Euros about 2.5 million Euros is to support 10-15visits by Professors from the Institutions in Netherlands per year in a bid to support training and research in Uganda.

1.4.2. University of Bergen

On 18th November 1999 a time frame agreement on research collaboration, scientific competence building, student and staff exchange, and institutional development was signed between University of Bergen and Makerere University in Kampala, Uganda. The agreement has a time frame of fifteen years.

Makerere University Faculty of Computing and Information Technology has an active student and staff exchange with the Department of Informatics and the Department of Information Science and Media at the University of Bergen (UiB) under this collaboration agreement. The staff from UiB has over the years conducted lectures in areas where the Faculty of Computing and Information Technology lacks local expertise.

1.4.3. London South Bank University

In 2005 Makerere University and London South Bank University signed a Memorandum of Understanding (MOU) in which the two universities agreed to:

(a) Develop joint degree programmes (Masters Level) in the following areas: M.Sc. Information Systems; and M.Sc. in Human Resources (International).

(b) To look at the feasibility of developing a distance learning PhD programme to include a cost model and that the programme will be designed with the view of implementation in the Faculty of Computing and Information Technology, Makerere University initially and then extended to the rest of the University in due course.

(c) Identify and seek funding for PhD studentships from the Common Wealth Scholarship Fund, British Council and other funding bodies.

(d) Explore various avenues for research funding, which particularly focus on the development needs of Uganda.

(e) Identify ways in which best practice can be shared in the areas of Teaching and Learning.

(f) Collaborate on quality assurance whereby London South Bank University will develop a proposal and costing model to help Makerere University develop mechanisms and procedures to support effective quality assurance and research monitoring at both institutional and subject levels.

A lot has been achieved under the MOU between Makerere University and London South Bank University that is still in force.

1.5 Computing Equipment

The Faculty of Computing and IT has put in place specialized research laboratories (e.g. the Multimedia Laboratory, Geographical Information Systems Laboratory, Mobile Computing Laboratory, Networking and Systems Laboratory, Software Incubation Laboratory, Computer Engineering Laboratory and E-learning Laboratory) and plans are under way to establish more laboratories using funds available under donor funded projects and internally generated funds. For example, under the project on 'Strengthening ICT Training and Research Capacity in the Four Public Universities in Uganda' there is approximately 800,000 Euros reserved for specialized equipment and software for the Faculty for Computing and Information Technology Centre of Excellence. This specialized equipment and software will be availed to the PhD students and their supervisors.

Every PhD student in the Faculty of Computing and Information Technology is given a laptop and personal computer for the whole duration of the programme. Each member of academic staff has a laptop and personal computer in the office.

1.6 Physical Facilities

The Faculty has sufficient offices for both staff and PhD students, lecture rooms, seminar rooms and computer laboratories in the faculty buildings.

1.7 Financial Resources

Tuition fee per student shall be 3,000,000 Uganda Shillings per annum for Ugandans and 3000 US Dollars per annum for Non-Ugandans.

2. REGULATIONS

2.1. Entrance Requirements

To qualify for admission, a candidate must fulfil the general Makerere University entry requirements for a Doctoral Programme. In addition, to be admitted to the PhD (Information Systems) a candidate must be a holder of a master's degree in information systems, information technology or its equivalent.

2.2. Duration

The duration of the PhD Programme is four academic years (8 semesters).

2.3. Credit Units (CU)

The weighting unit is a credit unit. One credit unit is one contact hour per week per semester.
One contact hour can be defined as equivalent to 2 tutorial hours or 2 practical hours.

2.4. Core and Elective Courses

A major is the subject/ field/ programme of specialization. A core course is compulsory course for the major and an elective course is an optional course for the major.

2.5 Graduation Requirements

To qualify for the award of the degree of Doctor of Philosophy (Information Systems), a candidate is required to obtain a minimum of 18 credit units for courses passed including all the compulsory courses and the PhD Dissertation within a period stipulated by Makerere University Senate/ Council.

Let LH, CH, and CU stand for Lecture Hour, Contact Hour, and Credit Unit respectively.

2.6 Curricula Review

The major changes in the revised curricula include:

(a) The semester load in first year has been reduced from 12 CU to 9 CU to allow students more time to undertake individual study.

(b) The MCS 9100- Philosophy of Computing and IT has been merged with MCS 9200-Philosophy of Science and Computing Research to form PCS9101 Philosophy of Computing.

(c) MCS 9102 - Advanced Research Methods in Computing and IT has been strengthened by including other research methods to form PIT 9201- Advanced Research Methods.

(d) Three new Specialised Information Systems courses were developed to cater for the specialised research areas within the department

2.7 The Curriculum for Doctor of Philosophy (Information Systems)

Code	Name	Assessment Method	LH	CH	CU
Semester I					
PCS 9101	The Philosophy of Computing	Presentations 40% Scientific review paper -60%	45	45	3
PIT 9102	Advanced Research Methods	Presentations 40% Scientific research proposal - 60%	45	45	3
PIS 9101	Advanced Research in Information Systems : Facilitation of Collaborative Problem Solving	Coursework 40% Research project 60%	45	45	3
Semester II					
PIS 9201	Advanced Research in Geographical Information Systems	Coursework 50% Exam 50%	45	45	3
PIS 9202	Advanced Research in Systems Modelling and Analysis	Project 60% Scientific paper 40%	45	45	3
PIS 9203	Presentations, Scientific Writing and Research Ethics	Presentations 40% Scientific review paper -60%	45	45	3

In addition to the lecture hours (LH) the students will put in several hours of individual and group study for each course. The proposed curriculum will be a flagship for the faculty, especially towards the presence of a strong research focus.

2.8. Grading of Courses

a) Each Course will be graded out of a maximum of 100 marks and assigned an appropriate letter grade and a grade point as follows:

MARKS	LETTER GRADE	GRADE POINT	
90 - 100	A+	5.0	Exceptional
80----89	A	5.0	Excellent
75 – 79	B+	4.5	Very Good
70 – 74	B	4.0	Good
65 – 69	C+	3.5	Fairly Good
60 – 64	C	3.0	Pass
55 – 59	D+	2.5	Marginal Fail
50 – 54	D	2.0	Clear Fail
45 – 49	E	1.5	Bad fail
40 – 44	E-	1.0	Qualified Fail
Below 40	F	0.0	Qualified Fail

b) The following additional letters will be used, where appropriate: -

W - Withdraw from Course;
I - Incomplete;
P - Pass;
F - Failure.

2.9. Minimum Pass Mark

A minimum pass grade for each course shall be 3.0 grade points.

2.10. Calculation of Cumulative Grade Point Average (CGPA)

The CGPA shall be calculated as follows: -

$$CGPA = \frac{\Sigma^{n}_{i=1}(GP_i * CU_i)}{\Sigma^{n}_{i=1} CU_i},$$

Where GP_i is the Grade Point score of a particular course i;
CU_i is the number of Credit Units of course i; and
n is the number of courses so far done.

2.11. Progression

Progression through the programme shall be assessed in three ways:

2.12. Normal Progress

This occurs when a student passes each course taken with a minimum Grade Point of 3.0.

2.13. Probationary

This is a warning stage and occurs if either the cumulative grade point average (CGPA) is less than 3.0 and/ or the student has failed a core course. Probation is waved when these conditions cease to hold.

2.14. Discontinuation

A student shall be discontinued from the program if

(i) He/she fails to get a grade point of at least 3.0 from any course unit for three sittings
(ii) By the end of the third semester, he/she does not have an approved research proposal
(iii) Without a credible reason, he/she fails to submit the two 6 monthly consecutive progress reports
(iv) The candidate shows no substantial progress for two academic years
(v) Overstays on the program for more than two years
(vi) Fails to pass on the third submission of the dissertation

2.15. Re-taking a Course

A Student may re-take any course when it is offered again in order to pass if the student had failed the course. A Student may take a substitute elective, where the Student does not wish to re-take a failed elective.

2.16. PhD Dissertation

Students are required to demonstrate their ability to independently formulate a detailed dissertation proposal, as well as develop and demonstrate their dissertation thoroughly.

a. A candidate shall be allowed to formally start on the dissertation after registration.
b. A candidate shall submit a dissertation proposal to the Faculty of Computing and Information Technology Higher Degrees Committee during the second semester of the first academic year.
c. The candidate shall execute the dissertation after acceptance of the dissertation proposal.
d. The candidate shall submit a dissertation report before the end of the third year (6th semester).

2.17. Passing of a Dissertation

To pass the Dissertation, the candidate shall satisfy the Internal Examiner, External Examiner, and Viva Voce Committee independently.

2.18. Revised Dissertation

A candidate, who fails to satisfy the examiners, shall re-submit a Revised Dissertation in accordance with the standing University guidelines for the PhD dissertation examinations.

3. PhD by Coursework and Research: PhD (Information Systems)

The research in information systems focuses on areas such as theory and intellectual development of information systems in organizations, institutions, the economy and society. It also focuses on other areas such as Advanced Geographical Information Systems, Advanced Research in Systems Modeling and Analysis and Advanced Research in Information Systems: Facilitation of Collaborative Problem Solving.

A PhD in Information Systems has a minimum of 18 credit units for the two semesters in Year one.

Code	Name	LH	CH	CU
Year One	Semester I: 3 Core Courses			
PCS 9101	The Philosophy of Computing	45	45	3
PIT 9102	Advanced Research Methods	45	45	3
PIS 9101	Advanced Research in Information Systems : Facilitation of Collaborative Problem Solving	45	45	3
Year One	Semester II: 3 Core Courses			
PIS 9201	Advanced Research in Geographical Information Systems	45	45	3
PIS 9202	Advanced Research in Systems Modelling and Analysis	45	45	3
PIS 9203	Presentations, Scientific Writing and Research Ethics	45	45	3
	Semester III, IV, V, VI, VII and VIII			

	Independent Research, Publication and Dissertation Compilation			

4. Detailed Curriculum

4.1. PCS 9101: Philosophy of Computing (3CU)

a) Description:

This course explorer the philosophical foundations of the computing field. It explores the computational understanding of the major parameters that make up and support the computing field. It explores their foundations and philosophical underpinnings.

b) Aims and Objectives

The aims of the course are:

- To give students an avenue of exploring the philosophical foundations of computing as an academic field
- To give students the historical foundation of computational thinking and interpretation
- To expose students to the philosophical thinking of the different areas of computing

c) Learning Outcomes

By the end of the course, the students should be able to:

- Explain the philosophical foundations of computing
- Explain the foundations of theoretical thinking and interpretations
- Explain the philosophical thinking of the different fields of computing

d) Teaching and Learning patterns

Teaching will be by lectures, group work, group discussions and presentations

e) Indicative content

- Mind and Artificial Intelligence (AI): The philosophy of artificial intelligence and its critique, computationalism, connectionism and the philosophy of mind
- Real and virtual worlds: Ontology, virtual reality, the physics of information, physics as a traditional model of the ideal science of the philosophy of science, cybernetics and artificial life
- Language and knowledge: Information and content, knowledge, the philosophy of computer languages, hypertext.
- Logic and probability: probability in artificial intelligence, game theory – Nash equilibrium

f) Assessment

Assessment will be by take-home assignments and presentations. Students will be given tasks to read and write about then present in class. The lecturer will award marks for each write up of a scientific review paper.

g) References

I. Floridi, Luciano (1999) *Philosophy and Computing: An Introduction*. Routledge: London / New York.

II. Bynum, Terrel Ward; Moor, James H. (2000) *The Digital Phoenix: How Computers are Changing Philosophy*. Blackwell Publishers: Oxford, UK.

III. Colburn, Timothy R. (2000) *Philosophy and Computer Science*. M.E. Sharpe: Armonk, NY, USA.

4.2. PIT 9102 Advanced Research Methods (3 CU)

(a) Course Objectives: the objectives of this course are to provide:

- Philosophical underpinnings of research in computing and IT
- Practical aspects on doing research

(b) Learning outcome: At the end of the course the students will be able to apply computing and IT research methods in their research.

(c) Course Content: The first part of the course is devoted to the philosophical underpinnings of research, which crucially influence choice of research methods and interpretations of data. The course then moves on to the more practical aspects of 'doing research' - looking at developing a research strategy as well as ways of collecting data, analysing data and communicating research findings. This course will also give guidance to students on how to identify a research problem. Students will be presented with various research paradigms and models of methodology and assisted with designing an appropriate method for their research. Students will be trained in the analysis and presentation of results, exposition of processes and methods used and conclusions drawn.

Key philosophical and epistemological bases for research are explored, and alternative methodologies are examined in relation to varied theoretical approaches. Selected sets of methods and techniques are critically appraised, while the range and scope of techniques with which students are familiar is extended. The structure of the course aims to achieve a balance between

theory and practice. Considerable emphasis is therefore placed upon the logistics of setting-up, doing and disseminating research. The course not only introduces a range of research ideas and skills central to sound socio-environmental enquiry in general, but also acts as a critical and practical research forum where discussion and preparation for the PhD dissertation takes place.

(d) Teaching and Learning pattern: Classes are held as a group discussion. Reading material which includes journal papers is distributed a week in advance, and students take it in turns to research and present new topics. The lecturer addresses questions to the students to encourage them to think about and understand the material. Each student undertakes a review of the different research methodologies and makes a presentation before the class. The students will identify researchable problems from which they will apply the concepts taught in class with an aim of producing research proposals by the end of the semester. The students will be required to build on their proposals on a weekly basis in line with the new concepts that will be taught. The students will make presentations of their draft proposal for critique and feedback from both the students and the lecturer.

(e) Assessment method: Evaluation shall be based on presentations from a variety of reviewed papers and a research proposal produced by the end of the semester.

(f) References

I. Michael Quinn Patton, (2002). Qualitative research and evaluation methods, 3rd Edition,; SAGE, ISBN 0761919716, 9780761919711; 598 pages.

II. Jerome L. Myers, Arnold D. Well, and Robert F. Lorch, (2002). Research Design & Statistical Analysis, Third Edition Routledge; ISBN: 978-0-8058-4037-7 pp. 736

III. Donald C Gause and Gerald M Weinberg, (1990). *Are Your Lights On? How to Figure out what the Problem Really* Dorset House, USA,

IV. Bordens, K.S. & Abbott, B.B. (1988) Research design and methods: A process approach. Mayfield.

4.3. PIS 9101 Advanced Research in Information Systems: Facilitation of Collaborative Problem Solving (3CU)

a) Description: The course focuses on the facilitation of collaborative problem solving and decision making processes. Students learn how to design and facilitate collaborative workshops, with support from both paper-based and electronic meeting tools. The course is hands-on and experiential, with students working in small teams to conduct real workshops.

b) Aims and objectives: Students will be able.

- To learn underlying concepts and theories of facilitation and problem solving in the context of group meetings.
- To learn how to design and moderate group meetings in which complex issues are addressed collaboratively.
- To learn how to apply facilitation techniques and patterns to stimulate and focus group efforts.
- To learn how to apply electronic meeting systems for participative problem solving.

c) Learning outcomes: Students learn to design approaches & agendas for teams to create a joint product. Students learn techniques to help groups to diverge, converge, organize, evaluate and build consensus. Students learn how to use Group Support Systems to support these techniques.

d) Teaching and learning patterns

- The primary teaching methods are lectures, discussion, and in-class workshops.
- Student role in the course. The student attends lectures, participates in discussions and completes assignments. In particular, the students prepare and facilitate two collaborative workshops in-class and prepare and present one group project.

e) Indicative content: Topics that are covered include:

- Working and problem solving in groups
- Group Support Systems
- Tasks and responsibilities of facilitators
- Groupware and the meeting software GroupSystems
- Reasons for meeting failures; fundamental assumptions behind workshops
- ThinkLets: building blocks for concerted collaboration
- Designing meeting plans and scripts
- Techniques for collaborative divergence, convergence, organization, evaluation, and consensus building
- Design and execution of facilitated workshops
- Field experiences with facilitation
- Collaboration Engineering

f) Assessment method

Assessment will be in terms of course work and scientific review paper. The evaluation of the student's report will give significant emphasis to research-oriented details.

g) References

Textbooks and/or other required readings used in course. The course material will consist of three parts:

I. Robert O. Briggs and Gert-Jan de Vreede (2005). Manual : ThinkLets: Building Blocks for Concerted Collaboration

II. Gwendolyn Kolfschoten, and Gert-Jan de Vreede, (2006). Manual: Designing with ThinkLets

4.4. PIS 9201 Advanced Research in Geographical Information Systems (3CU)

a) Description: GIS provides a means of integrating information in ways that help us understand and address pressing problems facing us today, such as tropical deforestation, rapid urbanization, spread of diseases, and impacts of climate This course offers a very in-depth set of materials on spatial database management, including materials on the tools needed to work in spatial database management, and the applications of that data to real-life problem solving. Exercises and tools for working with SQL, as well as sample database sets, will be provided.

b) Aim: By the end of the course, students are expected to have a thorough understanding of GIS functionality, methodology for implementing the technology, and its potential usefulness in geographic and environmental studies.

c) Learning outcomes:

The first half of the course focuses on learning spatial database management techniques and methods:

- finding, understanding and structuring digital spatial data that are available on the Internet using various browsing, visualization, and data management tools;
- considerable work with relational database technologies and the Structured Query Language (SQL) to design, construct, query, and update urban planning databases;
- some experience with so-called 'client/server' and 'enterprise GIS' technologies for facilitating distributed access to complex spatial data and urban planning applications;
- advanced GIS topics such as 3D visualizations and geospatial web services.

The second half of the course will treat the classroom like a professional planning office:

- formulating an implementation plan for a real client;
- designing a simple web-based tool for understanding problems;
- engaging constituents and stakeholders in a real setting;

- integrating theory and practice by evaluating the role of technology in community development;
- learning to communicate effectively within a group and with a professional consultant;
- working with such tools as the WWW, Oracle, ArcView, ArcIMS, SDE, etc.

d) Teaching and learning patterns: The course will be broken into instructor led lectures and demos, student led presentations, and lab working sessions. In-class and out-of-class computer exercises will be completed on a weekly basis. These exercises are designed to provide advanced, hands-on experience with GIS technology and a methodology for implementing a GIS project.

e) Indicative content:

(i) Spatio-Temporal Information Systems
- Conceptual Modeling of Geographic Applications
- Spatial Query Languages
- Spatio-temporal data structures and indexing
- Geographical Information Applications Over the Net
- Precision Farming and Geographic Systems
- Biodiversity Information Management
- Issues in Spatio-Temporal Databases Systems: Data Models, Lanquages and Moving Objects

(ii) Interacting with GIS- From Paper Cartography to Virtual Environments
- Detail Filtering in Geographic Information Visualization
- Human-Information Interaction: Technology and Theory
- Cartographic Generalization: Interface Issues
- Interaction Issues and Decision Support in Intelligent GIS

(iii) Spatial Data Management
- GIS Project Planning and Implementation
- Geographic Information Legal Issues
- Spatial Data Quality
- Spatial Data Standards
- GIS and Society

(iv) Introduction to Spatial Decision Support Systems
- Spatial Decision Support Systems: an Overview
- Web-Based Spatial Decision Support: Technical Foundations and Applications
- Integrative Data Structures For Collaborative Modeling and Visualisation in Spatial Decision Support Systems
- SDSS in the Management of Forest Resources

- Spatial Decision Support for Subsidized Housing Location and Residential Mobility

(v) GIS Interoperability, from Problems to Solutions

- Using Ontologies for Geographic Information Integration
- Geospatial Interoperability

f) Assessment method: The assessment will be in form of tests and assignments and a final exam. The project is to be completed using the GIS techniques learned throughout the semester to address a particular problem of interest to the student(s).

g) Reading list:

I. Longley, Paul A., Michael F. Goodchild, David J. Maguire, David W. Rhind. (2005). Geographic Information Systems and Science, Second Edition. John Wiley & Sons, New York. 517pp.

II. Trimble, Harvey J., Jr., and David Chappell. (1989). A Visual Introduction to SQL. New York: John Wiley & Sons.

III. Using ArcView Spatial Analyst. Redlands, CA: Environmental Systems Research Institute, 1996.

IV. Using ArcView 3D Analyst. Redlands, CA: Environmental Systems Research Institute, 1998.

4.5. PIS 9202 Advanced Research in Systems Modeling and Analysis (3CU)

a) Description: The world is becoming increasingly complex with its new technologies, interactions, resource limitations and time delays. Therefore intuitively appealing trial-and-error strategies frequently fail. To identify appropriate policies for such complex, dynamic systems, model based analysis is very useful. The goal of model based analysis is to identify the underlying causes of current and potential problems, to explain these in an intuitive and graphical language, and to spell out the consequences of good and bad policies. Analysis and communication are equally important. The same modeling principles and the same methods of analysis apply whether one investigates problems pertaining to natural resources, national economies, developing countries, medicine, business management, psychology etc. This course covers advanced topics in modeling of complex systems with emphasis on continuous simulation and focuses its attention on development issues, natural resources management, and teaching that promotes insightful learning.

b) Aims and objectives: The learning objectives of the course include transfer of the following analytical and technical knowledge and skills:

(i) *Analytical knowledge and skills:*

- System Dynamics method: knowledge of operational principles for the application of the system dynamics method in development policy settings;
- Behavioral analysis: Ability to analyze alternative policy options, identify optimal strategies, and test their sensitivity to specific assumptions;
- Understanding complexity: understanding of how to manage complexity, and reduce it for the purpose of analysis and reporting

(ii) *Technical knowledge and skills:*

- Software: Knowledge of advanced analysis and reporting techniques with Vensim;
- Modelling: Ability to create models of specific development issues from scratch, and integrate them in multi-sector models;
- Simulation techniques: Ability to run optimization and sensitivity analysis.

c) Learning outcomes: Upon completion of the course the students should be able to :

- Develop proficiency in the application of theories, methods and techniques.
- Develop simulation models of selected development issues from scratch; integrate them in a larger dynamic framework for development planning; and analyze the resulting behavior via advanced techniques, such as sensitivity analysis and optimization.
- Develop skills in the application of computer based tools which include software for systems modeling, simulation and analysis, for building simulation-based interactive learning environments.
- Transfer knowledge from one field to another, and become potential leaders of multidisciplinary work by employing modeling principles and methods of analysis to investigate problems pertaining to natural resources, national economies, developing countries, business management, medicine etc.

h) Teaching and learning patterns

Suggested pedagogical approaches to delivering the course:

- Lectures
- Case discussions / Presentations
- Review of selected publications / Writing publications
- Simulation and modeling practical sessions

i) Indicative content: This course covers advanced topics in model formulation, analysis and validation of models, policy design and evaluation and strategy development based on a variety of methods, techniques and tools

j) Assessment method

Assessment will be in terms of a guided project which covers the full cycle of modelling from problem formulation to policy design and one scientific review research paper.

k) Reading list

I. John D. Sterman, (2000). *Business Dynamics*, Irwin McGraw-Hill, chapters 21
II. *Vensim Reference Manual*, Ventana Systems, 2003, selected section
III. Selected papers on development issues

4.6. PIS 9203: Presentations, Scientific Writing and Research Ethics (3CU)

a) Description:

Most PhD students struggle with scientific writing and presentations in English, and normally much time in a PhD study is spent revising papers and preparing for conference talks. Given the amount of time that PhD students spend writing and preparing to present, students should invest in a systematic study of scientific writing and presentations. The course deals with the publication process from the perspectives of the author of a scientific paper and the editor of a scientific journal. It is intended for PhD students in the fields of computing and Information technology, engineering and natural sciences.

b) Aims and objectives: The aim is to give the participants the following:

- Awareness of the importance of scientific writing,
- Motivation to write scientific papers, and
- Prerequisites for publishing in first-class scientific journals.

c) Learning outcomes: At the end of this course, students will be able to:

- Make a quality conference presentation
- Write a quality journal article
- Appreciate ethics-related issues when writing a scholarly/scientific paper.
- Understand the prerequisites for choosing the market for publishing

d) Teaching and learning patterns: Classes are held as a group discussion. Reading material which includes books and journal papers on scientific writing and ethics are distributed a week in advance, and students take it in turns to research and present. The students are also given reading material on how to make excellent presentations. The lecturer addresses questions to the students to encourage them to think about and understand the material. The classes will also include viewing of recorded seminar presentations by leading academics in the field.

e) Indicative content:

- Science and writing. Reports and scientific publications. The IMRAD format. Scientific journals. Why, what, when, with whom and where publish?
- Structure of a scientific paper. The different parts of a scientific paper. Language and style. The publication process. Writing a paper. Dealing with editors, reviewers and publishers.
- Critical review of scientific papers by groups of participants.
- General principles of expository writing, pre-writing and planning. Typical formats, structure and language for scientific writing, emphasis on scientific articles as published in (primary) international scientific journals. English grammar essential to scientific papers. Designing tables, figures and graphs for scientific papers. Good style for readability. The refereeing and publishing process, what referees are looking for, how to deal with editors. Paragraphing, linking paragraphs to make the logic clear. Writing informative abstracts and crafting clear titles.
- Ethics: Honesty and credibility in scientific writing.

f) Assessment: Progressive assessment will be based on the quality of presentations in class by each student. The final assessment will be based on a scientific review paper.

g) References:

I. Robert A. Day and Barbara Gastel, (2006). How to write and publish a scientific paper, 6TH Edition, ISBN:0-313-330271

II. Iltis, A.S. (2007). Research Ethics. ISBN: 9780415701587

III. Oliver, P. (2003). The student's guide to research ethics. Open University Press, Philadelpha, PA, ISBN: 0335210872, pp. 156.

5. BUDGET

Income: 5 students each paying UGX 3,000,000 => UGX 15Million.

Expenditure:	UGX	15,000,000
Teaching Materials	UGX	1,250,000
Research Materials	UGX	2,500,000
Teaching allowances	UGX	6,750,000
Administrative allowances	UGX	750,000

Attending conferences	UGX	2,500,000
Expenditure at the centre	UGX	1,250,000

6. STAFF

Code	Name	Assessment Method	Staff
PCS 9101	The Philosophy of Computing	Review Paper - 100%	Dr. John Ngubiri
PIT 9102	Advanced Research Methods	Research proposal 100%	Dr. Josephine Nabukenya
PIS 9102	Advanced Research in Information Systems : Facilitation of Collaborative Problem Solving	Coursework 60% Scientific paper 40%	Dr. Josephine Nabukenya
PIS 9201	Advanced Research in Geographical Information Systems	Coursework 40% Research project 60%	Dr. Patrick Ogao
PIS 9202	Advanced Research in Systems Modelling and Analysis	Project 60% Scientific paper 40%	Dr. Agnes Rwashana Semwanga
PIS 9203	Presentations, Scientific Writing and Research Ethics	Presentations 40% Scientific paper -60%	Dr. Agnes Rwashana Semwanga