DEBRE BERHAN UNIVERSITY

COLLEGE OF COMPUTING

STUDY PROGRAM

MASTER OF SCIENCE (M.Sc)

IN

INFORMATION SYSTEMS

CURRICULUM REVISION

June 2018

DEBRE BERHAN

DEBRE BRHAN UNIVERSITY

COLLEGE OF COMPUTING, Information Systems Program

DEBRE BERHAN, ETHIOPIA

Study Program for Master of Science (M.Sc) Information Systems

The study program is revised by the curriculum development committee of the department of Information Systems in collaboration with COLLEGE OF COMPUTING DEBRE BRHAN UNIVERSITY

All the curriculum revision committees are organized from Debre Berhan University, College of Computing, Information Systems Department.

1. Dr. Kindie Biredagn, Assistance professor   Chairperson
2. Dr. Mishrah,Assistance Professor   Member
3. Mr. Kindie Alebachew   Memeber

June. 2018

EXECUTIVE SUMMARY

Name of the degree program:	**Information Systems**

Name of the degree to be awarded:	**"Master of Science in Information Systems"**

Degree to be awarded by:	**DEBRE BERHAN UNIVERSITY, Subjected to the Approval of the Senate**

Standard period of study:	**Two years with Four Semesters**

Commencement of the program:	**Each year starts as per the academic calendar of the university**

Fees / charges:	**Government and Self-Sponsored**

List of acronyms

BI	Business Intelligence
CAC	College Academic committee
CGPA	Cumulative Grade Point Average
DBU	Debre Berhan University
DC	Department Committee
DSS	Decision Support System
EIS	Excutive Information System
ES	Expert Systems
GP	Graduate Program
HTML	Hyper Text Markup Language
ICT	Information Communication Technology
IS	Information Systems
IT	Information Technology
MSIS	Master of Science in Information Systems
OLAP	Online Analytical Process
OOD	Object Oriented Design
OOSAD	Object Oriented System Analysis and Design
SGPA	Semester Grade Point Average
UML	Unified Modeling Language

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1. BACKGROUND PROFILE OF THE PROGRAME

Information Systems (IS) as a field of academic study began in the 1960s, a few years after the first use of computers for transaction processing and reporting by organizations. As organizations extended the use of information processing and communication technology to operational processes, project management, decision support, and enterprise and industry strategy, the academic field also grew in scope and depth.

Professionals in the IS 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 a need to constantly upgrade and integrate information technology solutions and business processes to meet the information needs. There is also need in providing 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. Debre Berhan University is working hard towards establishing a research led institution that will attract learners from all corners of the world.

Information Systems continue to be a critical part of the products, services, operations, and management of organizations. Indeed, information systems and information technology can be so critical as to disrupt classic business models, threatening traditional revenue streams, and even driving industry sectors to extinction. The effective and efficient use of information and communications technologies is an important element in maintaining or achieving competitive advantage for business organizations and excellence in service for government and non-profit organizations. The information technology/information systems strategy is an integral part of organizational strategy. Information systems support management processes at all levels—operational, tactical, and strategic management. Information systems are vital to problem identification, analysis, and decision making. The importance of information technology and information systems to organizations and the need for well-educated professionals in the field is the basis for a strong link between educational programs and the professional community of information systems (IS) practitioners.

Further, the rate of growth of Information and Communication Technology (ICT) in Ethiopia 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 labour force to cater for the sophisticated ICT-jobs. Currently, Debre Berhan University, College of Computing is striving to be the main ICT training, research and consultancy center in Ethiopia. Although the college produces highly educated people in Information Technology, Information Systems, Software Engineering and Computer Science in first degree, talented people with advanced knowledge for managing information systems are a scarce resource. It is the objective of the MSc program to fill this gap by providing the needed education.

2. Expected Competency of Information Systems

As per **MSIS2016** document, the three major competencies to develop MSIS program are the following
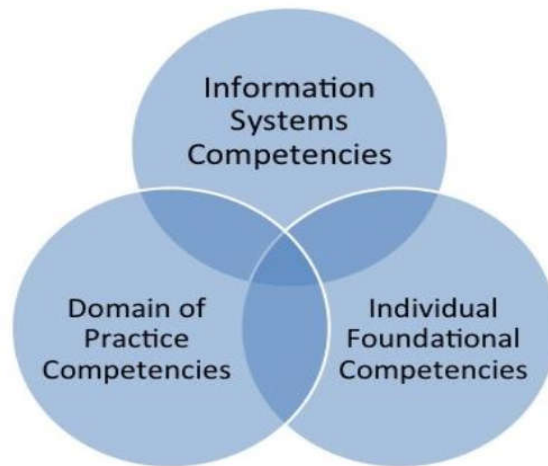
2.1) Information Systems Competencies

Information systems competency comprises of nine areas:

    1.1)   Business Continuity and Information Assurance (BC&I)

    1.2)   Data, Information, and Content Management (DI&CM)

    1.3)   Enterprise Architecture (EA)

    1.4)   Ethics and Sustainability (ES)

    1.5)   Innovation, Organizational Change, and Entrepreneurship (IOC&E)

    1.6)   IS Management and Operations (ISM&O)

    1.7)   IS Strategy and Governance (ISS&G)

    1.8)   IT Infrastructure (ITI)

    1.9)   Systems Development and Deployment (SD&D)

2.2) Individual Foundational Competencies

Individual Foundational Competency includes the following areas of individual foundational competencies:

    2.1)   Critical Thinking

    2.2)   Creativity

    2.3)   Collaboration and Teamwork

    2.4)   Ethical Analysis

    2.5)   Intercultural Competency

    2.6)   Leadership

    2.7)   Mathematical and Statistical Competencies

    2.8)   Negotiation

    2.9)   Oral Communication

    2.10)   Problem Solving

    2.11)   Written Communication.

2.3) Domain of Practice Competencies

Information systems programs can be and have already been built to be aligned with many other domains (such as

➢   Healthcare

➢   Law

➢   Government

➢   Education, etc.

The MSIS2016 document specifies four different levels of competency category attainment: **Awareness**, **Novice**, **Supporting** (role), and **Independent** (contributor).

Awareness level, a graduate knows that the competency category exists and is aware of the reasons why it is important for the domain of practice and individual organizations that use information systems to achieve their goals.

Novice level, a graduate can effectively communicate regarding matters related to the competency, perform component activities under supervision, and develop on-the-job experience related to the competency.

Supporting (role) level, a graduate has achieved a level of knowledge and skill that allows him/her to collaborate effectively in a supporting role with colleagues who have achieved a higher level of the competency to produce the desired outcomes.

Independent (contributor) level, a graduate has achieved a level of knowledge and skills that allows the graduate to perform without continuous support/supervision the tasks required to produce the desired competency outcomes.

3. THE SCOPE OF INFORMATION SYSTEMS

Information Systems as a field of academic study encompasses the concepts, principles, and processes for two broad areas of activity within organizations: (1) Management, and strategy for information technology resources and services (the information systems function; IS strategy, management, and acquisition; IT infrastructure; enterprise architecture; data and information) and (2) packaged system acquisition or system development, operation, and evolution of infrastructure and systems for use in organizational processes (project management, system acquisition, system development, system operation, and system maintenance). The systems that deliver information and communications services in an organization combine both technical components and human operators and users. They capture, store, process, and communicate data, information, and knowledge.

The information systems function in an organization has a broad responsibility to plan, develop or acquire, implement, and manage an infrastructure of information technology (computers and communications), data (both internal and external), and enterprise-wide information processing systems. It has the responsibility to track new information technology and assist in incorporating it into the organization's strategy, planning, and practices. The function also supports departmental and individual information technology systems. The technology employed may range from large centralized to mobile distributed systems. The development and management of the information technology infrastructure and processing systems may involve organizational employees, consultants, and outsourcing services (both domestic and offshore).

The activity of developing or acquiring information technology applications for organizational and inter-organizational processes involves projects that define creative and productive use of information technology for transaction processing, data acquisition, communication,

coordination, analysis, and decision support. Design, development or acquisition, and implementation techniques, technology, and methodologies are employed. Processes for creating and implementing information systems in organizations incorporate concepts of systems analysis and process design, innovation, quality, human-machine systems, human-machine interfaces, e-business design, socio-technical systems, and change management.

Information systems professionals work with information technology and must have sound technical knowledge of computers, communications, and software. Since they operate within organizations and with organizational systems, they must also understand organizations and the functions within organizations (administration, accounting, finance, marketing, operations, human resources, and so forth). They must understand concepts and processes for achieving organizational goals with information technology. In addition to sound technical knowledge and organizational understanding, they must possess systems thinking, the ability to analyze business problems, communication skills, and teamwork skills in face-to-face and virtual settings. The academic content of an Information Systems degree program, therefore, includes information technology, information systems strategy and management, information systems development and implementation, organizational functions, and concepts and processes of organizational management.

Professionals in the Information Systems 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.

4. HIGH-LEVEL IS CAPABILITIES (GRADUATE PROFILE)

In this revised IS curriculum the IS graduating expected to create change in the business area. The following are high level capabilities but not limited to this only. will give a more detailed description of each capability.

4.1 Improving Organizational Processes

This revised curriculum assumes that understanding and improving organizational processes is one of the key capabilities of all IS graduates. This requires the graduates to attain the following objectives:

1. Understand the fundamental concepts related to organizational processes.
2. Analyze existing organizational processes.

3. Understand how the very large amounts of dataset collected by modern organizations can be used to review, redesign, and improve processes

4. Identify and capture the essential findings from the large amount of dataset.

5. Research and apply industry reference models and best practices in order to improve process designs

6. Use analysis results as a basis for designing revised processes based on the graduates' strong understanding of both organizations and information technology

7. Simulate proposed processes and revising them as necessary

8. Negotiate solutions that satisfy the political requirements for new processes

9. Understand the limitations of what can be achieved with available technology, financial resources, and organizational capabilities

10. Lead the implementation of new processes

11. Customize processes to address cultural and ethnic needs

The specification of high-level IS capabilities does not include a particular set of process improvement methods or techniques, but the graduates are expected to be aware of and benefit from at least one such method.

4.2 Exploiting Opportunities Created by Technology Innovations

Graduates of Information Systems programs should be experts in seeing how organizations can benefit from technology capabilities, converting opportunities created by information technology innovations into sustainable organizational value through systematic processes. An essential element of this high-level capability is the ability to understand both information technology and the needs of an organization within a specific domain at such a deep level that IS graduates see new opportunities to create value faster and with greater clarity during various analysis processes than their non-IS counterparts. Achieving a high level of performance related to this capability requires in-depth knowledge of technology and the domain, skills in analyzing problems and designing solution alternatives, ability to analyze the strengths and weaknesses of various alternatives, understanding issues related to the feasibility of possible solutions, as well as demonstrable skills in sourcing, designing, and implementing technology solutions.

4.3 Understanding and Addressing Organizational Information Requirements

Another key capability of all IS graduates is the ability to analyze and document organizational information requirements at various levels, starting from those of individual knowledge

workers responsible for specific tasks and ending with very high level institutional requirements. IS graduates are able to analyze information needs of an individual, organizational unit, or an organization in order to determine how information technology-based solutions can best be designed to support these information needs. Increasingly, the core capabilities in this area are related to effective utilization and integration of data that is generated in a rich variety of organizational systems and includes multiple types and formats.

4.4 Designing and Managing Enterprise Architecture

Information Systems graduates should be experts in high level design and management of IT capabilities that are fully aligned with general organizational goals. These capabilities are typically organized and presented as enterprise architecture, consisting of high-level internally compatible representations of organizational business models, data, applications, and information technology infrastructure. One of the knowledge and skill areas that is directly derived from this high-level IS capability is related to IT infrastructure, including networking technology, data centers, and so on.

4.5 Identifying and Evaluating Solution and Sourcing Alternatives

Graduates of IS programs are capable of producing high-level design alternatives for various organizational IT-based solutions. There are always a large number of ways to achieve a specific set of organizational capabilities using information technology, but not all approaches are feasible in a specific context. An essential high-level capability that IS graduates have is an ability to identify a small subset of operationally, financially, and technically feasible solution alternatives and the mechanisms through which an organization can acquire these technology resources. Most IT projects require reusing or building on the existing components (such as modules, reusable objects, databases, information architectures, etc.) used in the current systems, and, therefore, it is essential that graduates have the capability to understand a variety of technologies and their integration.

4.6 Securing Data and Infrastructure

It has been increasingly important for organizations to ensure that their data and IT infrastructure resources are protected from a variety of security threats, which can potentially create significant financial liabilities as well as damage the organizational image. Understanding these threats and identifying high-level solutions to protecting the organization are essential capabilities of all graduates of Information Systems postgraduate degree program.

4.7 Understanding, Managing and Controlling IT Risks

MSIS graduates should have strong capabilities in understanding, managing, and controlling organizational risks that are associated with the use of IT-based solutions (e.g., security, disaster recovery, obsolescence, etc.). At this level, the emphasis should be on in-depth understanding of a variety of risks. Because IT solutions are so closely integrated with all aspects of a modern organization, it has become essential to manage the risks related to their use in a highly systematic and comprehensive way.

5. CAREER PATHS

The MSIS program is designed to support both traditional and emerging career opportunities. The number of available career paths for IS professionals include (but are not limited to):

- Consulting
- Data Administration
- Systems Integration
- Networking, Telecom, and Infrastructure
- Managing Sourcing and Global Projects
- Project Management

The career opportunities in Information Systems require students to know both the technology and the business and environment in which they will work.

6. THE EMPLOYER'S VIEW

As information systems become more complex and technology expands its capabilities globally, the skills required for IS professionals continue to increase. Students graduating with an MS degree should possess the skills that they will need to take on responsible positions and to serve as mentors to people with less sophisticated education and experience.

Typical job objectives of MSIS graduates are:

- Specialist (technical, web)
- System Analyst / Designer
- Network Manager / Analyst
- Business Analyst
- Database Administrator
- Liaison between IT and Business Functions

7. MISSION OF THE PROGRAM

The mission of the Master of Science in Information Systems program is to prepare future leaders in the area of information systems and technology management. Graduates of this program will help companies manage their information systems and technology resources efficiently and effectively to attain organizational goals and objectives.

8. GOALS OF THE PROGRAM

Students graduating from the MSIS program should be prepared to provide leadership in the Information Systems field.

Graduates will have the following skills, knowledge, and values:

- A core of IS management and technology knowledge
- Integration of IS and business foundations
- Broad business and real world perspective
- Communication, interpersonal, and team skills
- Analytical and critical thinking skills
- Specific skills leading to a career

9. PROGRAM OBJECTIVES

The MSc in Information Systems Degree programme offers a course of study leading to the Master of Science in Information Systems (MSIS) by focusing on areas described in IS competency such as data management, strategic management for business information systems, systems modelling and technology issues. The course takes on two main tracks: information systems management and information systems technology which provide students with an option of specializing in management or technological issues. The program is designed

- Develop human resource capacity in information systems discipline for both the public and private sectors;
- Generate a pool of highly qualified candidates for the PhD in information systems program.
- Develop professionals with theoretical and practical skills in the ICT sector.

The above mentioned human resources/ Ph D candidate/ ICT professionals is developed with the responsibility of:

- Demonstrating an understanding of a range of theoretical and academic underpinnings of Information Systems.

- Applying intellectual and communication skills appropriately for a career in Information Systems.
- Demonstrating core Information Systems knowledge and skills.
- Analyzing business problems and defining effective Information Systems solutions.
- Evaluating and exploiting the rapid technological advances in Information Systems and choosing and applying appropriate tools and techniques to solve problems in new areas.
- Explaining and evaluating the professional, ethical and moral issues relevant to an Information Systems-related career.
- Recommending feasible Information Systems solutions to new problem areas.
- A mastery of basic and advanced information systems tools, techniques, and methodologies.
- In-depth knowledge of organizational structures, employee behavior, and the impact of change on organizations.
- A developed proficiency in the skills necessary to manage information systems development projects.
- The analytical skills necessary to identify organizational strategic advantages within an organization's information systems/IT function.
- A foundation for lifelong learning, professional development, research, and/or further graduate study.

10. THE PROGRAMME

10.1 Target Group

For the foreseeable future, it is anticipated that Information System (IS) programs will continue to attract students with a wide range of backgrounds. In traditional graduate programs, it is assumed that students enrolled have a common background obtained through an undergraduate degree in that or related field. The MSIS Programme may also attract experienced individuals including IT professionals and people seeking career changes. The architecture of the Programme accommodates this wide diversity of backgrounds and learning environments. Specifically it is appropriate for:

- Graduates with bachelor degrees in Information Systems, Computer Science, Information Technology, Software Engineering, Computer Engineering, Business with an IS

concentration, and any other degree with evidence of having taken acceptable courses in information systems.

- Experienced Information System professionals seeking to upgrade skills and to understand management issues.
- Experienced management professionals seeking skills in managing technology.
- Professionals from many engineering fields seeking a change in careers.

10.2   Admission Requirements

To qualify for admission, a candidate must fulfill the general Debre Berhan University entry requirements for master's degrees, and in addition the candidate must be a holder of either

- A Bachelor's degree in Information Systems, Computer Science, Software Engineering, Information Technology or Computer Engineering from a recognized University/ Institution; or
- Any other degree with evidence of having taken acceptable courses in information systems.

10.3   Nature of the Programme

The MSIS will be run as a day/evening/summer programme with government or privately sponsored students. The duration of the day programme is two years consisting of four semesters, the duration of evening program is three years and the duration of summer Programme is four years.

10.4   Tuition Fees

Tuition fees payable by the students will enable the University sustain the program. Any student from Ethiopia has to pay tuition fees according to Debre Berhan University tuition fee rate standard.

11. PROPOSED CURRICULUM

The proposed curriculum is designed to fulfill the expected competency of the Information Systems as per MSIS2016. It considers seven broad knowledge areas that make up practical and resourceful information systems. The seven knowledge areas are:

1. Data, Information and Content Management
2. Research and Development
3. Policy, Strategy and Management
4. Security Issues

5. Information Systems in Business
6. Web Computing Technologies
7. Systems Modeling

The table below shows the proposed courses that fulfills the IS competencies.

Course Code	Course Title
IS 7100	Object Oriented Systems Analysis and Design
IS 7111	Management Information Systems (MIS)
IS 7116	Research Methodology
IS 8109	Data mining and Data Warehousing
IS 8117	Business Process Modeling and Analysis
IS 7212	Advanced Networking and System Administration
IS 8110	Information Systems Security
IS 7226	Seminar Series
IS 7219	Soft Computing
IS 7209	Project and Organization Change Management
IS 7217	Web Engineering and Analytics
IS 7215	IT Strategic Planning and Management
IS 8110	Selected Topics in Information Systems
IS 8111	Digital Image Processing
IS 8204	Master's Thesis in Information Systems
IS 8203	Master's Project in Information Systems

11.1   Mapping of the proposed curriculum to IS competency

Mapping of the proposed courses to the IS competency is shown in the next page.

Course Title	Course Code	1. Information Systems Competencies									2. Individual Foundational Competencies										
		BC&IA	DIC&M	EA	E&S	IOC&E	ISM&O	ISS&G	ITI	SD&D	Critical Thinking	Creativity	Collaboration & TW	Ethical Analysis	Intercultural Comp.	Leadership	Math & Stat Comp.	Negotiation	Oral Communication	Problem Solving	Written Communication
Object Oriented Systems Analysis and Design	IS 7100	✓							✓	✓	✓	✓	✓	✓					✓	✓	✓
Management Information Systems (MIS)	IS 7111	✓	✓				✓		✓		✓		✓	✓	✓	✓	✓	✓	✓	✓	✓
Research Methodology	IS 7116	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓
Data mining and Data Warehousing	IS 8109		✓		✓				✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Business Process Modeling and Analysis	IS 8117	✓		✓		✓	✓			✓	✓	✓	✓	✓	✓	✓				✓	✓
Advanced Networking and System Administration	IS 7212	✓					✓		✓		✓		✓	✓					✓	✓	✓
Information Systems Security	IS 8110	✓	✓	✓							✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Seminar Series	IS 7226	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓					✓	✓	✓
Soft Computing	IS 7219		✓		✓	✓				✓	✓	✓	✓	✓	✓			✓	✓	✓	✓
Project and Organization Change Management	IS 7209						✓				✓	✓	✓	✓	✓				✓	✓	✓
Web Engineering and Analytics	IS 7217		✓								✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
IT Strategic Planning and Management	IS 7215	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓				✓	✓	✓
Selected Topics in Information Systems	IS 8110	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Digital Image Processing	IS 8111		✓		✓				✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓
Master's Thesis in Information Systems	IS 8204	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Master's Project in Information Systems	IS 8203	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

11.2 Course Distribution in Each Semester

Course Code	Course Name	Credit Hours	Lec.	Lab.	Remarks
	Year I, Semester I				
IS 7100	Object Oriented Systems Analysis and Design	3	3	0	
IS 7111	Management Information Systems (MIS)	2	2	0	
IS 7116	Research Methodology	3	3	0	
	Electives:- (1 Elective Course)				
IS 7219	Soft Computing	3	2	3	Elective Courses
IS 8117	Business Process Modeling and Analysis	3	3	0	
	Total Credit Hour Per Semester	**11**			
	Year I Semester II				
IS 7212	Advanced Networking and System Administration	3	3	0	
IS 8110	Information Systems Security	2	2	0	
IS 7226	Seminar Series	2	2	0	
	Electives:- (1 Elective Course)				
IS 8109	Data Mining and Data Warehousing	3	3	0	Elective Courses
IS 7209	Project and Organization Change Management	3	3	0	
	Total Credit Hour Per Semester	**10**		3	
	Year II, Semester I				
IS 7217	Web Engineering and Analytics	3	3	0	
IS 7215	IT Strategic Planning and Management	3	3	0	
	Electives:- (1 Elective Course)				
IS 8110	Selected Topics in Information Systems	3	3	0	Elective Courses
IS 8111	Digital Image Processing	3	3	0	
	Total Credit Hour Per Semester	**9**			
	Second Semester Year II				
	Elective of thesis/Project				
IS8204	Master's Thesis in Information Systems	6			
IS8203	Master's Project in Information Systems	6			Electives
	Total Credit Hour Per Semester	**6**			
	Total Credit Hours	**36**			

12. DETAILED CURRICULUM

IS 7100   Object Oriented Systems Analysis and Design   3Cr.H

a) **Description:** Object Oriented Approach, at present, is the method of choice for the industry to develop different software. It is a marked shift, in the way a software solution is conceived and implemented, from the structured/procedural design paradigm. Instead of viewing the problem domain as a sequence or set of procedures, the emphasis in OOSAD is on entities that interact with one another while making a design closer to the problem domain and the way human beings think and understand the real world.

b) **Aims and objectives:** In this course the students will learn to perform analysis on a given domain and come up with an Object Oriented Design (OOD). Various techniques will be discussed and practiced which are commonly used in analysis and design phases in the software industry. Unified Modeling Language (UML) will be used as a tool to demonstrate the analysis and design ideas and an object oriented programming language such as Java would be used to implement the design. Various cases studies will be used throughout the course to demonstrate the concepts learned in theory.

At the end of this course, students are expected to:

- Have a sound understanding of the fundamental concepts of the OOSAD paradigm
- Gain a comfortable level of using UML notation to describe OOSAD.
- Understand and apply the different common practices used in software industry for the analysis, design and production of software.
- Analyze, design and implement practical systems of UP to average complexity with in a team.
- Become familiar with different tools used for software development process.
- Understanding the role of Use cases in functional requirements, design, and testing and project estimation.
- UML: Use case , Use case diagrams, Activity diagrams, Sequence Diagram (System level)

c) **Teaching and learning patterns:**

- Lectures, tutorial/practical sessions as well as demonstrations.
- Individual and group-based tutorial.

- Wide range of computer-based learning and other tools will be used to support the student's learning process.
- Use of real life case studies

d) Indicative content:

- Classes, Class Relationships, explore the various kinds of relationships among classes, which provide the foundation for the structure of a new system. The focus is on the three major relationship types: associations, aggregations, and dependencies.
- Class and Object Diagrams, provides various examples of the diagrams that show classes and their relationships. also discusses object diagrams.
- Use Cases, describes the primary means by which you can use the UML to capture functional requirements. These requirements are expressed in terms of the specific actions that external entities and the system perform in executing required and optional behavior. Also offers on how to write robust use case text.
- Packages, describes the means by which you can use the UML to group various model elements that are conceptually related.
- Events, Actions, and Activities, begins the exploration of the dynamic side of the UML in terms of the various ways by which object behaviour is initiated, the UML's *action language* (which defines the individual, primitive functions that serve as the lowest level of behavior specification), and activities, which provide control and data sequencing constraints among actions as well as nested structuring mechanisms for control and scope.
- State Machines, the UML constructs that you can use to model discrete object behavior in terms of the states that an object can reside in and the transitions that can happen between those states.
- Interactions, the various aspects of interactions. The focus is on the messages that pass back and forth between objects during system execution. Also provides examples of the four types of interaction diagrams that UML 2.0 supports.
- Components, Deployment, and Higher-Level Modelling, focuses on the modelling of autonomous units within a system or subsystem that the modeller can use to define software systems of arbitrary size and complexity. Also discusses the modelling of the deployment of those units. Profiles, Templates, and Information Flows, discusses topics that don't quite fit into the preceding concepts, yet are

important elements of the UML. The focus is on profiles, which are stereotyped packages that contain elements customized for a particular domain or purpose, and templates, which provide ways to create families of model elements such as classes, packages, and collaborations.

e) Assessment method: The assessment will be in form of tests and assignments (50%) and final written exam (50%)

f) Reference List:

- Craig Larman ,Applying UML and Patterns 3rd ed.
- Simon Bennet, Steve McRobb, Object oriented Systems Analysis and Design Using UML 2nd ed. McGraw-Hill, 2002
- Grady Booch, James Rumbaugh, Ivar Jacobson, The Unified Modeling Language User Guide 2nd ed, Addison Wesly.2005.
- O'Docherty,Mike, Object Oriented System Analysis and Design: Understanding System Development Using UML 2.0.
- Hamilton, Kim and Miles, Russell, Learning UML 2.0, April 2006.
- Professional UML with Visual Studio .NET—Unmasking Visio for Enterprise Architects. Filev,Andrew ,Loton,Tony,etal.wrox press.

IS 7111   Management Information Systems   2Cr.H

a) Description: There are several trends occurring in the world today, among many is the movement to computer based information systems. Managers need to be informed about the trends in information systems and hence participate fully in its development and management. This course studies the range of information systems needed to provide support for management in decision-making, planning and control. The starting point, therefore, is the set of potential managerial problems and opportunities, and the associated information requirements. Organizational diagnostics are considered for problem/opportunity identification. Solution approaches are developed and used as the basis for describing the structure, characteristics and management of generic categories of systems such as Decision Support Systems (DSS), Executive Information Systems (EIS) and Expert Systems (ES).

b) Aims and objectives: This course provides an enables students to identify information systems needs and participate in its development in order to create a business competitive advantage. It facilitates students to become aware of the benefits and limitations of different kinds of computer-based IS commonly used in business, such as

database management systems, decision support and executive information systems, and expert systems. Students are able to gain a sophisticated awareness of the rich variety of managerial issues raised by information systems and information literacy by attending to the managerial ramifications of selected additional topics, such as the utilization of information systems for competitive advantage; technologies (hardware, software, network technologies); outsourcing; and the process of systems development (building an IS).

c) **Learning outcomes:** At the end of the course the students should be able to:
- Define different types of information systems and their role in today's competitive business environment.
- Address what an information system is. What managers need to know about information systems.
- How information systems transform organizations and management.
- Indicate how the Internet and Internet technology has transformed business.
- Identify the major management challenges in building and using information systems.
- Participate in structured information systems developments as a knowledgeable person from planning, feasibility study, information requirement analysis, design, implement, maintain, and evaluate. Identify other information systems development, their advantages and Disadvantages, when they are appropriate and when they should not be used.

d) **Teaching and learning patterns:** Suggested pedagogical approaches to delivering the course:
- Lectures
- Case discussions to demonstrate management issues
- Team projects
- In-class student presentations

e) **Indicative content:**

- ***Introduction to Information Systems***: Definitions, Types, Basic features of information systems, Components of Information systems, Information quality, Data resource management, Database, Data models,

- **Information Systems and Management**: Describe the concept of management, Function of management, Levels of management, Information systems for each levels of management.

- **Information analysis and design tools** : Decision tools, Decision Table, Structured Analysis, Dataflow Analysis, Tools for dataflow strategy, Developing dataflow diagrams, Leveling, Data dictionary, Structured flow chart, HIPO, Warnier/ORR diagram

- **Information Systems in the Enterprise**: Describe what enterprise systems are how they have evolved. Explain how organizations support business activities by using information technologies. Understand and utilize the keys to successfully implementing enterprise systems. Identify some of the strategies employed to lower costs or improve service. Discuss how organizations justify the need for information systems. Define the types of roles, functions, and careers available in information systems. Information System Application in marketing, Information System Application in manufacturing, Information System Application in HRM, Information System Application in Accounting and Finance.

- **Information Systems implementation & Applications:** Planning & implementation of Information Systems, Transaction Processing Systems, Executive information Systems, Decision Support Systems, Expert Systems, Knowledge Management systems. Decision support system versus management information systems, Decision support model, Executive support systems, Expert systems, Group support systems

- **Hardware & Software**: Describe how to select and organize computer system components to support information system objectives and business organization needs. Discuss how applications software can support personal, workgroup, and enterprise business objectives.

- **Telecommunications**: Identify types of communications media and discuss the basic characteristics of each. Identify several types of telecommunications hardware devices and discuss the role that each plays. Identify the benefits associated with a telecommunications network.

- **Data and Knowledge Management** Explain how organizations are getting the most from their investment in database technologies. Describe what is meant by

knowledge management and knowledge assets as well as benefits and challenges of deploying a knowledge management system

f) **Assessment method:** The assessment will be in form of tests and assignments (50%) and final written exam (50%)

g) **Reading List:**

- Decision Support Systems and Intelligent Systems, Efraim Turban and Jay E. Aronson, Sixth Edition
- Management Information Systems, A Managerial End User Perspective (1999), James A. O' Brien, 4th Edition, Irwin/McGraw Hill
- Management Information Systems, Managing Information technology in Business Enterprise (2004), James A. O' Brien, 6th Edition, TATA -McGraw Hill
- Management Information systems: Managing the Digital firm by K.C. Laudon and J.P. Laudon, Prentice Hall.
- Management Information systems: Organization and Technology by K.C. Laudon and J.P. Laudon, Prentice Hall.

IS 7116   **Research Methodology**   **3Cr.H**

a) **Course Description**: In this course, guidance will be given to students on how to identify a research problem. Instructions will be provided which will enable students to perform effective literature reviews. Students should be warned against plagiarism. Students will be presented with various research paradigms and models of methodology and assist 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. Guidelines outlining the preparation and writing of a research dissertation and or a project will be provided at the conclusion of the course.

b) **Aims**: The aims of the course are:

- To provide students with a firm foundation/underpinnings of research from which they can undertake a research problem.
- To provide students with a number of separate, but related practical skills associated with the research process

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

- Identify the aims of the research
- Select appropriate methodological approach,

- Select implementation methods, data collection and analysis techniques and its interpretation, and how all this fits within the literature.

In other words, the students will produce a research proposal as a blue print for the whole research dissertation and or project.

d) **Teaching and Learning Pattern:** Lectures will be given through out the semester. Group work and discussions to perform literature reviews will be done to enable understanding and application of concepts. This will involve identification and reading material which includes journal papers to be distributed to students a week in advance. The lecturer addresses questions to the students to encourage them to think about and understand the material. The students will identify researchable problems from which they will apply the concepts taught in class with an aim of producing research/project 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) **Indicative Content:** The course will cover the following topics:
- Introduction to Research Methodology (Definition, Purpose of research, Research Paradigms in Computing and Information Systems, Types of research Methods)
- Research Design (Approaches of research problem, Objective of the research, Sampling frame, Sampling Techniques, Data collection instruments,
- Literature reviews; Selection of overall methodological approach; Selection of suitable data collection and analysis techniques; Interpretation and conclusion of the research; and Presentation of research findings.
- Writing research proposal (Introduction, Problem statement, General Objective, Specific Objectives, Scope and delimitation, proposed research methodology, Significance of the research, Time plan, budget plan, References)
- Descriptive statistics (frequency, mean, median, standard deviation, cross-classified table among others)
- Inferential statistics (population distribution, sample distribution, central limit theorem, hypothesis testing, p-value, and confidence interval, t-test, chi-square test, and simple linear regression)
- Research report writing. Journal paper, conference paper, Thesis
- Research Ethics/ Plagiarism

f) Assessment Method: Assessment will categorized as follows:

- Progressive assessment 50% (Presentation on literature reviews, thesis review, abstract rewriting, research proposal writing)
- Final written Exam 50%

g) Reference books

- CR Kothari 2004, **Research Methodology Methods and Techniques**, New Age International (P) Limited, Publishers, New Delhi
- Yogesh Kumar Singh 2006, **Fundamentals of Research Methodology and Statistics**, New Age International (P) Limited, Publishers, New Delhi
- Paul D. Leedy, Jeanne E. Ormrod, Jeanne Ellis Ormrod 2004 **Practical Research: Planning and Design**, Prentice Hall
- Smith, Robert V., Llewellyn D. Densmore, and Edward F. Lener. 2016 **Graduate research: A guide for students in the sciences**, Academic Press, 2016.
- Graziano, A. M., & Raulin, M. L. 1993 **Research methods: A process of inquiry**, Prentice Hall

IS 8109　　　Data Mining and Data Warehousing　　　3Cr.H

a) Description: This course introduces data mining technologies and their functionalities for business intelligence. It also includes various factors involved in developing data warehouse. Students will learn how to analyze the business needs for knowledge discovery in order to create competitive advantages and how to apply data mining technologies appropriately in order to realize their real business value. Students will gain hands-on experience through assignments and a real world project or a term paper. The course will cover the following topics:

b) Aims and objectives: Data Mining and Data ware housing is a broad category of applications and technologies for gathering, storing, analyzing, and providing access to data to help enterprise users make better business decisions. BI applications include the activities of decision support systems, query and reporting, online analytical processing (OLAP), statistical analysis, forecasting, and data mining. Students will learn the concepts, techniques, and applications of data mining for business intelligence through lectures, class discussions, hands-on assignments, and term paper presentations. Data mining and business intelligence is a very important topic for students in the IS area. It will help students to advance in their future career.

c) Course learning outcomes: Upon completion of this course, students will be able to complete the following key tasks:

- Understand the basic concept of business intelligence
- Understand the basic concept and the process of data mining
- Understand the data warehouse development process.
- Learn basic data mining technologies
- Learn how to use business intelligence to solve business problems

d) Teaching and learning patterns: Teaching will be in terms of lectures, case studies and group work. This course is often taught as a case-based course near the end of the student's MSIS program. By that time, the student has developed a broad perspective on IS and knows about it at a detailed level.

e) Indicative content:

- *Introduction* to business intelligence, data mining objectives, Data mining process (KDD, CRSIP), Data types
- *Data preprocessing* (Handling missing values and noisy data, Data integration, Attribute selection)
- *Data warehousing* (OLTP vs. OLAP, Data warehouse architecture, Schema)
- *Association Rule Discovery* (Appriori algorithm, Frequent pattern algorithm)
- *Classification* and *Prediction* (Decision tree, Bayesian, nearest neighbor, Regression, Artificial neural network)
- *Clustering* and *outlier analysis* (Partitioning, hierarchical, density based)
- *Introduction to Mining Complex Data* (text mining, web mining, image processing, spatial-temporal data mining)

f) Assessment method: The assessment will be in form of tests and assignments (50%) and final written exam (50%)

g) Course reference list:
- Galit Shmueli, Nitin Patel, and Peter Bruce, Data Mining for Business Intelligence: Concepts, Technologies, and Applications in Microsoft Office Excel with XLminer, John Wiley & Sons, Inc. 2006, (ISBN 0-470-08485-5)
- Han, J, Kamber, M & Pei, J 2012, Data Mining Concepts And Techniques, 3rd ed., Elsevier, India (Used as a Text Book).
- Efraim Turban, Ramesh Sharda, Jay E. Aronson, David King 2008, Business Intelligence: A Managerial Approach, Pearson Prentice Hall.

- Larose, D. T. (2014). Discovering Knowledge in Data: an Introduction to Data Mining. John Wiley & Sons.

- Giudici, P. (2005). Applied Data Mining: Statistical Methods for Business and Industry. John Wiley & Sons.

- Berry, M. W., & Browne, M. (2006). Lecture Notes in Data Mining. World Scientific.

- Edelstein, H. A. (1998). Introduction to data mining and knowledge discovery. Two Crows.

- Olson, D. L., & Delen, D. (2008). Advanced data mining techniques. Springer Science & Business Media.

IS 8117   Business Process Modelling and Analysis   3Cr.H

a) **Description**: With increased globalization, companies are facing stiffer competition and successful companies cannot afford to harbor inefficiencies if they are to be competitive. Furthermore, customers are becoming more demanding. Business processes must be designed to ensure that they are effective and meet customer requirements. A well-designed process will improve efficiency and deliver greater productivity. This unit will survey the analytical tools that can be used to model, analyze, understand and design business processes. Students will also gain hands-on experience in using simulation software as a tool for analyzing business processes.

b) **Aims and objectives:**

- To develop students' awareness of the theoretical aspects of process modeling and business systems development

- To develop an understanding of business organization operations and their relationships and functional structure and the advantage of considering the process oriented view of organizations;

- Gain a thorough knowledge of business process, management systems, their structure and how processes fit in to the overall organisation objectives;

- Acquire knowledge of the analytical tools that can be used to model, analyse, understand, and design business processes;

- Acquire skills to use simulation software as a tool for analyzing business processes.

c) **Learning outcomes:** On completion of the course, students are expected to develop and demonstrate knowledge and understanding, skills and other attributes in the following areas:

- Knowledge and understanding: Information Systems modeling in business, Business Process Management Systems, Systems Implementation and development, Enabling IT tools and technologies

- Intellectual skills: Formulate and express problems in the IS/IT and the business domain, Analyze and evaluate academic literature within IS/IT and computing, Develop an independent and strategic viewpoint within the IS/IT and computing domain.

- Practical skills: Plan and implement IS/IT projects, Write reports, Analyse, design, implement and evaluate IT systems, Use a variety of IT and computing tools and techniques to solve systems problems.

- Transferable skills: Communicate, Work independently, evaluate one's work objectively, Develop and demonstrate the capacity to learn in unfamiliar situations.

d) **Teaching and learning patterns:** The course will be taught through:

- Lectures, tutorial/practical sessions as well as demonstrations.

- Individual and group-based tutorial.

- Use of real life case studies and individual literature review of current developments in the business process modelling filed.

- Seminars and debates.

- Coursework will be a practical-based case study.

- Coursework will be based on continuous and progressive assessment for all learning outcomes.

e) **Indicative content:**

- Introduction to Business Processes.

- Evolution of Enterprise Systems architectures

- Introduction to Business Process Modelling

- Approaches to Business Process Modelling and Analysis

- Business process management Systems

- Business Modelling with Unified Modelling Language

- Business Process Methodology

f) Assessment method: The assessment will be in form of tests and assignments (50%) and final written exam (50%).

g) Reading list:

- Business Process management by Mathias and Weske 2007.
- Business Process Analysis by Geoffrey Darnton with Moksha Darnton.
- Workflow Patterns - Wil M.P. van der Aalst, AHM ter Hosftede.
- Business Process Management Demystified: A Tutorial on Models, Systems and
- Standards for Workflow Management Wil M.P. van der Aalsts.
- Eriksson, H and Penker, M (2000) Business Modelling with UML: Business Patterns at Work OMG Press.
- Leffingwell, D and Wirig, D (2000) Managing Software Requirements: A Unified
- Approach, Object Technology Series Addison- Wesley.
- Darnton, G and Darnton, M. (1997) Business Process Analysis. Thomson Business Press.
- Harrington. J. H, Esseling. EK.C and van Nimwengen, H (1997) Business Process Improvement: WorkbookMcGraw-Hill.

IS 7212   Advanced Networking and System Administration   3Cr.H

a) Course Description: Advanced Networking and System Administration is a course designed to give students the skills they need in telecommunications fundamentals including data, voice, image, and video; the concepts, models, architectures, protocols, standards, and security for the design, implementation, and management of digital networks; server architectures, server farms, data centre design and implementation to serve organizational needs in a rapidly changing competitive and technological environment.

b) Learning Objectives: At the end of the course the students should be able to:

- Understand the concepts, models, architectures, protocols, standards, and security for the design, implementation, and management of digital networks,
- Understand server architectures, server farms and data centre concepts in computer networking and system administration,
- Design, implement and manage data centre to serve organizational needs in a rapidly changing competitive and technological environment,

- Design, implement and manage security and disaster recovery plans and business continuity from an overall organizational perspective,
- Provide an understanding of managerial issues in computer networking and system administration.
- Understand the product strategies of major hardware, software, and telecommunications vendors
- Analyze business processes and data of an organization to model its information processing needs.

c) **Course Content**

I. **Theory Session**

Introduction, Managing Workstations / Desktops/, Managing Servers, Managing Services; Booting, Processes, Disks, Partitions, Volumes, File systems, Files, Printing, Accounts, Service Monitoring, People, Help Desk, Debagging, Directories, Data Centers, Namespaces, DNS; Networking, Network Architecture

Management Practices and Administration Fundamentals (Reading Assignment)

- Organizational Structures
- A Guide for Technical Managers
- A Guide for Nontechnical Managers
- Hiring System Administrators
- Firing System Administrators

II. **Lab session**

Using the Linux and the Shell; OS Installation; RPMs, updates, and installing packages, Schedule a periodic job with cron, Try out signals iv) Startup script, Resizing the home file system, Software RAID, Additional swap, Resizing a volume

d) **Course Assessment**

- Continuous Assessment   50%
- Final Exam   50%

e) **References**

- Computer Networking: A Top-Down Approach, 6th edition by James F. Kurose, Keith W. Ross (2013).
- The Practice of System and Network Administration, 2nd edition by Limoncelli A. Thomas, Hogan J. Christina, Chalup R. Strata (2007) (Text Book)

- Required: UNIX and Linux System Administration Handbook, 4th Ed., by Nemeth, Snyder, Hein and Whaley (Prentice Hall, 2010)
- The Practice of Cloud System Administration, by Limoncelli, Chalup, and Hogan (Addison-Wesley, 2015).

IS 8110   Information Systems Security   2Cr.H

a) **Description:** Information system security (ISS) has become an important area of concern for all organizations as threats to information system resources rapidly grow and its impact ranges from serious workflow disturbances to economic damage. Hence, individuals with knowledge of information systems security are now considered to be an important part of most IT infrastructure teams. Roles cover a range of activities spanning from analysis, to design and implementation of security systems, to security monitoring and countermeasures. Therefore, this course is designed to provide students with an understanding and appreciation of a range of information system security components, principles, policies, and strategies. Information security philosophies are discussed along with methods, models, techniques and controls, including risk analysis, qualitative and quantitative matrices, access controls, contingency planning and damage control. Occasionally, training, overseeing, auditing, probing and surveillance are part of the IS security concept as well. Hence, this course presents an overview over these issues in the context of systems design, systems development and systems administration along with security policy. Information security is also considered in the area of communications security, data security, networking security and from the standpoint of ethical and legal issues, as well as computer crime. The course also addresses current issues and future trends in information security.

b) **Course learning outcomes:** By providing students this ISS course to understand and value the essence of ISS within the context of information systems, it will enable students more efficient and skillful. Therefore, at the completion of this course the students will:

- have knowledge of current security philosophies, security methodologies, security analysis and design methods and techniques, security, and management
- have an understanding of the ethical, legal and criminal issues relating to the security of information systems

- have the skills to apply security analysis and design methods and techniques in the analysis of threats, risks, and breaches to an information system resources, and in the design of suitable security control measures

- have developed attitudes which enable them to demonstrate ethically sound viewpoints with respect to the protection of information resources in regard to maintaining a secure IS framework; in relation to ISS requirements such as confidentiality, integrity, availability, non-repudiation, in the professional development of information systems

- Have Knowledge of the processes that are used to create a business continuity and disaster recovery plan and strategies for critical resource recovery.

c) **Indicative content:**

- **Brief overview of Introduction to IS Security in organizations** (Introduction definition, critical concepts of Information Systems Security; History of computer security and Information Security; Security/Privacy, Threats. Vulnerabilities)

- **Fundamentals of IS security** (Fundamentals, components, principles of Information system security; Secure design principles (Least-privilege, fail-safe defaults, complete mediation, separation of privilege); IS Security Policy and User Training; Plan, Design and Implement IS Security; Legal and Ethical Issues (Intellectual property, copyright, patent, trade secret, Privacy, identity theft)).

- **Attack types and protection schemes** (Categories of Attack Types and Security threats; Vulnerabilities of Information Systems; Malicious Security Threats; Social Engineering; Categories of Security controls)

- **Risk Management and Analysis** (Business continuity plans (BCP) and disaster recovery; Disaster Recovery planning and execution; Disaster recovery policies and procedures

- **Security Technologies and Recent Trends of ISS** (Cryptography (Private and Public Key cryptosystems, Data Encryption Standards(DES) and Advanced Encryption Standards(AES) Digital Signature; Access Control (Firewalls, Intrusion Detection Systems (IDS), Authentication, Current issues and future trends in IS Security))

d) **Reading list:**

- Ciampa, M. (2005). Security+ Guide to Network Security Fundamentals, (2nd Edn). Boston, Massachusetts: Thomson Technology.

- Erbschloe, M. (2003). Guide to Disaster Recovery. Boston, Massachusetts: Thomson Technology.
- Maiwald, E. (2004). Fundamentals of Network Security. New York: McGraw-Hill.
- Palmer, M. (2004). Guide to Operating Systems Security. Boston, Massachusetts: Thomson Technology.
- Panko, R. R. (2004). Corporate Computer and Network Security. New Jersey: Pearson Education International.
- Quirk, P. & Forder, J. (2003). Electronic Commerce and the Law (2nd Edn). Singapore: John Wiley & Sons Australia, Ltd.
- Whiteman, M. E. & Mattord, H. J. (2005). Principles of Information Security (2nd Edn). Boston, Massachusetts: Thomson Technology.
- Hassler, V. (2001). Security Fundamentals for E-Commerce. London: Arteck House.
- Reynolds, G. W. (1998). Information Systems for Managers. Minneapolis: West. Publishing Company
- Schneider, G.P. & Perry, J. T. (2001). Electronic Commerce (2nd Edn). UK: Thomson Learning Inc
- Wood C. C. (1990). "Principles of Secure Information Systems Design". Computers and Security, Vol 9, No 1.

IS 7226   Seminar Series   2Cr.H

a) **Description:** The course helps students to strengthen their ability to do guided research, make a report on technical issues and present these issues in a scientific set up. While lecturers will give the students guidelines on the topics to research on, they will not formally teach them in class. However, what is expected out of the students will be explicitly given to them and examined.

b) **Aims and objectives:** The aims of the course are:
- To develop students' ability to search for scientific academic material.
- To develop the student's skills in technical writing.
- To develop the student's presentation skills.

c) **Learning outcomes:** Successful completion of the module will demonstrate that students are able to:
- Have defined their research questions
- Developed appropriate conceptual and methodological approaches to their research

- Have developed a full proposal for their own research-based dissertation
- Learned how to offer and received constructive comments on their work in progress

D) **Teaching and learning patterns:** Students will be given broad areas of study together with research questions to address by the beginning of the second semester. Each student will be given a senior staff from whom they can get advice and guidance whenever necessary. The student will then be required to address one research problem and make a write up on it. The student will then be required to present his work to the staff and his/her peers. As part of the course, the student will also be obliged to attend all (weekly) research talks in the faculty (for the entire second semester).

d) **Indicative content:** The content is both in terms of skill and technical content:

- Technical content: This depends on the problem addressed. The student is expected to show understanding and comprehension of the subject matter.
- Skill content: a student is expected to show ability to comprehend scientific literature, correctly make a technical report and competently prepare and make an academic presentation.

e) **Assessment method:**

- Attendance of Workshops (40%);
- Presentation of Concept Paper (20%)
- Presentation of 15 page Proposal (40%)

f) **Reference List**

There is no specific reference for the course seminar serious. The students have to search related research papers from different journals. Some of the common search engines to track published research papers are the following

- **www.googlescholars.com**
- **www.sciencedirect.com**
- **www.hindawi.com**
- **www.ieeexlpore.ieee.org**
- **www.doaj.or**
- **www.citeseerx.ist.psu.edu/index**
- **www.academic.microsoft.com**
- **www.scopus.com**

IS 7219   Soft Computing   3Cr.H

a. **Description**: This course introduces the basic soft computing methodologies and their use for obtaining solution to problems quickly, accurately and acceptably. Artificial Neural Network (ANN), Fuzzy logic (FL) and Genetic Algorithm (GA) are the main components of soft computing. A combination of two or more components of soft computing resulted the emergence of a hybrid system like Neuro-fuzzy, Fuzzy-Genetic and Neuro-Genetic used in problem solving for developing of knowledge base system.

b. **Aims and objectives**: Soft computing is an emerging approach to computing helps to exploit the tolerance for approximation, uncertainty, imprecision, and partial truth in order to achieve close resemblance with human like decision making.   The soft computing consists of several computing paradigm with the corresponding aims.

   - ○   Fuzzy set: For knowledge representation via fuzzy
   - ○   Neural networking: For learning and adaptation
   - ○   Genetic Algorithm: For evolutionary approach
   - ○   Rough set: For equivalence class

Students will learn the concepts, techniques, and applications of soft computing through lectures, class discussions, hands-on assignments, and term paper presentations. Soft computing is a very important topic for students in the IS area. It will help students to advance in their future career.

c. **Course learning outcomes**: Upon completion of this course, students will be able to complete the following key tasks:

   - Understand the basic concept of Artificial neural network
   - Understand the basic concept and the process of fuzzy logic
   - Explain the genetic algorithm evolutionary approach.
   - Describe the purpose of rough set theory in decision making and feature selection.
   - Learn hybrid approach methodologies for problem solving.

d. **Teaching and learning patterns:** Teaching will be in terms of lectures, case studies and group work. This course is often taught as a case-based course near the end of the student's MSIS Programme. By that time, the student has developed a broad perspective on IS and knows about it at a detailed level.

e. **Indicative content:**

- **Artificial Neural network** (Feed forward, Radial Basis Function, Competitive Learning Networks, Kohonen Self-Organizing, Learning Vector quantization, Hebbian Learning, Extreme learning machine, deep learning)
- **Fuzzy set theory** (Membership function, Fuzzy relation, Fuzzy inference system, Mamdani Fuzzy Models, Sugeno Fuzzy Models, Tsukamoto Fuzzy Models – Input Space Partitioning and Fuzzy Modeling)
- **Genetic algorithms** (Encoding, Fitness Function, Reproduction, Cross over, Mutation, Convergence Theory; Applications)
- **Rough set theory** (Indiscernibility Relations, Reducts, Rough Approximation)
- **Hybrid Systems** (Fuzzy Inference System (FIS), Adaptive neuro fuzzy inference system (ANFIS), Co-adaptive neuro fuzzy inference system (CANFIS), Genetic algorithm based neural network (GANN))
- **Soft Computing Application Areas**: Handwriting Recognition, Image Processing and Data Compression, Automotive Systems and Manufacturing, Soft Computing to Architecture, Decision-support Systems, Machine Learning Applications, Speech and Vision Recognition Systems

f. **Assessment method:** The assessment will be in form of tests and assignments (50%) and final written exam (50%)

g. **Course reference list:**
- Jang, JSR, Sun, CT & Mizutani, E 2011, Neuro-fuzzy and soft computing-A computational approach to learning and machine intelligence
- Rajasekaran, S & Pai, GAV 2011, Neural networks, Fuzzy logic and Genetic algorithms Synthesis and Applications.
- Sivanandam, SN & Deepa, SN 2012, Principles of Soft Computing, 2nd edition.

IS 7209   Project Organization and Change Management   3Cr.H

a) **Description:** Managing projects within an organizational context, including the processes related to initiating, planning, executing, controlling, reporting, and closing a project. Project integration, scope, time, cost, quality control, and risk management. Software size and cost estimation. Assigning work to programmer and other teams. Monitoring progress. Version control. Managing the organizational change process. Identifying project champions, working with user teams, training, and documentation. The change management role of the IS specialist. The use of sourcing and external procurement; contracts and managing partner relationships.

b) Aims and objectives: Students develop detailed project plans, schedules, and budgets; estimate project resources; allocate/coordinate resources; and interface with management. They are expected to learn tools and techniques of project planning and management, including the use of project management software. The course develops skills in the human and organizational implications of change including understanding the organizational change process; identifying stakeholders; assessing potential impacts of projects; and overcoming resistance, politics, and other human issues.

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

- Develop detailed project plans, schedules, and budgets

- Estimate project resources; allocate/coordinate resources; and interface with management.

- Use tools and techniques of project planning and management, including the use of project management software.

- Have skills in the human and organizational implications of change including understanding the organizational change process; identifying stakeholders;

- Assess potential impacts of projects; and overcome resistance, politics, and other human issues.

d) Teaching and learning patterns: Teaching will be in terms of lectures, case studies and group work.

e) Indicative content:

- **Managing software / technology projects:**
  - ✓ Project lifecycle, Project stakeholders, Project management skills (leading, communicating, negotiating, influencing, and presenting)
  - ✓ Project planning (definition, scope, schedule, cost, quality, resources, and risks)
  - ✓ Estimating software size and cost.
  - ✓ Software work module design, assignment, and control.
  - ✓ Role of repository, project library, and version control.
  - ✓ Contingency planning.
  - ✓ Project reporting and controls (definition, scope, schedule, costs, quality, resources, and risks),
  - ✓ Testing and testing plans; alpha and beta.

- **Managing organization change:**

- ✓ The role of IS specialists as change agents, Envision change and the change process, Diagnose and conceptualize change
- ✓ Deal with the challenges of implementation and understand and cope with resistance
- ✓ Deal with issues of motivation, interpersonal relations, group/team dynamics, and leadership in the change process; implications of cross-organization and international teams.
- ✓ Manage organizational politics
- ✓ The limitations of projects as organizational change initiatives
- ✓ Organizational influences on project success (culture, organizational structure, rewards, and measures)
- ✓ Software project management resources and professional development such as SMI and PMI.
- ✓ Additional activities required to ensure the success of IT projects (training, job redesign, communication, etc.)
- ✓ Manage sourcing partners as well as define contract and relationships
- ✓ Hands-on experience using project management software (e.g., Microsoft Project).

f) Assessment method: The assessment will be in form of tests and assignments (50%) and final written exam (50%)

g) Reading list:

- Project management for information systems, Edited by James Cadle and Donald Yeates, Prentice Hall, 2001.
- Breakthrough technology project management, Bennet P. Lientz, Academic Press, 2001.
- The project manager's desk reference: a comprehensive guide to project planning, scheduling, evaluation, and systems, James P. Lewis, McGraw-Hill, 2000.
- Project management for business and technology: principles and practice, John M. Nicholas, Prentice Hall, 2001.

IS 7217   Web Engineering and Analytics   3Cr.H

a) Course description: This course provides necessary knowledge of core principles and technologies of Web design and usability. Overview of Web technologies is dealt with markup languages (HTML, XHTML, XML), Style Sheet Languages (CSS, XSL),

client-side scripting (JavaScript, VB Script), service-side scripting (PHP, ASP) and multimedia technologies (Flash). Other topics focus on practical issues of building effective Web sites in terms of enhancing their usability. Besides from this, newly innovated topics are included that covers the emerging research issues, current web based information system technologies and tools, web usability matter, Research & Applications of web base system and many more novel issues.

b) **Aims:** This course aims to provide students with non-IT educational background with necessary knowledge of core principles and technologies of Web design. Those students who already studied Web technologies being at the bachelor's level this course helps to systemize their knowledge before taking further courses like XML and Web Services.

c) **Learning outcomes:**
- Knowledge and understanding of
  - ✓ Fundamental principles of Web design
  - ✓ Main Web technologies
- Practical skills of
  - ✓ using principles of Web design
  - ✓ Web technologies
  - ✓ building effective (usable) Web sites
- Analytical skills of
  - ✓ Sentiment Analysis
  - ✓ Opinion mining

d) **Teaching and learning patterns:** Since this course is supposed to have both lecture and practical hours, it will form the theoretical knowledge as far as practical skills. To provide students with practical skills, they will be given individual and group assignments to be done within practical and extracurricular hours.

e) **Indicative content:**
- **Web Design and usability (**Fundamental principles of Web design: Information architecture; overview of Web technologies: Markup languages (HTML, XHTML, XML); Style Sheet Languages (CSS, XSL); Client-side scripting (JavaScript, VB Script); service-side scripting (PHP, ASP); Multimedia technologies (Flash). Building effective Web sites in terms of enhancing their usability).

- **Introduction to Web Analytics (**Web content, structure and usage mining, web crawling, Opinion mining, sentiment Analysis)

f) **Assessment method:**
- Continuous Assesment:50% and Final Exams: 50%

g) **Reference books:**
- Fowler, S., Stanwik V. (2003). Web Application Design Handbook: Best Practices for Web-Based Software. Elsevier Inc, Morgan Kaufmann Publishers, San Francisco. ISBN: 1-55860-752-8
- Brink, T., Gergle, D. & Wood, S. (2003) Usability for the Web: Designing Web Sites that Work. Morgan Kaufmann Publishers, San Francisco.
- Spool, J. M., Scanlon, T. et al. (2003) Web Site Usability: A Designer's Guide. Morgan Kaufmann Publishers, San Francisco.
- Johnson, J. (2003). Web Bloopers: 60 Common Web Design Mistakes, and How to Avoid Them. Morgan Kaufmann Publishers, San Francisco.
- Yuen, P.K., Lan, V. (2003). Practical Web Technologies. Pearson Education Ltd. ISBN 0201 750767
- Welling, L., Thomsen, L. (2005). PHP and MySQL Web Development (Third Edition). Sams Publishing. ISBN 0-672-32672

IS 7215   IT Strategic Planning and Management   3Cr.H

a) **Course description**: This course addresses the ways in which managers use modern business information systems and networks to enhance the strategic management process and promote business outcomes. Building on core concepts of the role and function of information systems in the organization, the course focuses on the key areas of management decision making related to investment in and strategic management of information technology resources. The impact of digital networks and communications technology on modern business activities and strategies is a core theme of the course.

b) **Aims of the course:** A student that undertakes this course should:
- Be able to understand concepts relating to the role and function of networked business information systems, and the typical applications found in the modern organization;
- Be able to understand typical activities and decisions involved in the acquisition and/ or development and management of networked business information systems and their impact on organizations;

- Be able to understand information systems and e-Business strategy ;
- Be able to understand the development and use of networked business information systems in the context of promoting overall business objectives, and the place of information technology management within the organization;
- Be able to understand how networked business information system activities are led and managed in the context of the intersecting interests of business executives, IT executives, partner organizations, and IT users.

c) **learning outcomes**: Upon successful completion of the course the student will reliably demonstrate the ability to:
- explain the role of, and comment on a range of modern business applications;
- survey the range of activities involved in, and decisions related to, the acquisition and/or development of a business information system;
- comment critically on information systems and e-Business strategy;
- appreciate the effective use of communications and information technology;
- present a rationale for decision-making around the strategic use of networked business information systems using appropriate supporting data

d) **Teaching and learning patterns:** The course is delivered in the form of lectures, group discussions, teamwork and seminars where participants are required to actively participate both in presentation and discussions and investigate agreed upon topics.

e) **Indicative content:**
- Understanding information, its management, and the history of IT (Data Processing era, management Information Systems era, Strategic information systems era)
- Revision to Management Concepts (Definition and Levels of management, Managerial Function, Vision, Mission, Goals, Strategy, Rules, Procedures)
- Elements of Strategic Management (Environmental scanning, Strategy formulation, Strategy implementation, Evaluation and control)
- Levels of Strategy (Corporate [Growth, Stability and retrenchment], Business/competitive strategy [cost leadership, differentiation] and Functional strategies)
- Business analysis methods (SWOT analysis, Porter Five forces model, PESTLE analysis, value chain analysis)
- Managing IT values, IT resources and emerging technologies

- E-Business strategies : technologies and business models

- Strategic Alignment

- Enterprise and Technology Architecture

- Technology Innovation, Diffusion and Adoption

- IT Outsourcing and Vendor Management

- IT governance and IT Auditing

- Information Technology Project Management

- Innovation driven Knowledge Management

- Strategy for Green Computing

f) **Assessment method:** The assessment will be in form of tests and assignments (50%) and final written exam (50%).

g) **References**

- McNurlin, Barbara C., Ralph Sprague and Tung Bui. 2008. Information Systems Management in Practice. 8th Edition. Prentice Hall. ISBN: 0132437155

- Afuah, Alan and Tucci Christopher L. (2003). Internet Business Models and Strategies: Text and Cases. 2nd ed. McGraw Hill, New York. (Ch 11, pp. 203 – 223)

- Bocij, Paul et al. (2005) Business Information Systems: Technology, Development and Management for the e-business. 3rd Edition. Financial Times / Prentice Hall.

- Eng K., Chew & Petter Gottaschalk, Information Technology Strategy and Management, USA

IS 8210   Selected Topics in Information Systems   3Cr.H

a) **Description:** This unit is designed to provide students with an understanding and appreciation of current trends on research issues. The numerous exploration extents are discussed along with methods, models, and techniques to help the scholars toward arrive into the innovation level and strengthen the investigation in information systems through diversified emerging matters. It includes a variety of researches in the information systems paradigm that can coop with the tremendous change in the technology. The mainstream research areas focus on big-data processing and analytics, Network for Intelligent Transportation System, Automation and data exchange, Modelling and simulation of IoT entities, cloud computing and analytics, cognitive science, Internet of things, information retrieval apps, software defined network, and distributed computing.

b) Course Learning outcomes: At the completion of this unit the students will:

(i)   Have knowledge of:
- Diversified research areas for potential implications
- IT research design, development, and implementation

(ii)   Have an understanding of:
- The current research trends and practices
- Research problem identification and solution implementation

(iii) Have the skills to
- Design and research various research issues
- Apply the mechanisms to research new matter for implementation
- Apply technical and scientific methods, and innovative thinking

(iv)   Have developed attitudes to explore novel research problems that can model through smart architectures, algorithms, tools, and frameworks to accomplish the professional research knowledge in information systems arena.

c) Indicative content:
- Cloud Computing
- Big-data
- Internet of Things
- Grid computing
- Fog computing
- Automation and data exchange
- Problem analysis and application to intelligent systems
- Software defined anything
- Text mining apps

d) Assessment method: The assessment will be in form of tests and assignments (50%) and final written exam (50%).

e) Reference list:
- Negnevitsky, Michael. Artificial intelligence: a guide to intelligent systems. Pearson Education, 2005.
- R. Baeza-Yates and B. Ribiero-Neto, "Modern InformationRetrieval",
- Salton, "Automatic Text Processing", Addison-Wesley, 1989.

IS 8211   **Digital Image Processing**   **3Cr.H**

a) **Course Description:** Digital Image processing is a general term for the wide range of techniques that exist for manipulating and modifying images in various ways. It has applications in many different areas ranging from desktop publishing and healthcare, to the search for natural resources on Earth, or the study of other planets, starts and galaxies in our universe. Digital images may be acquired, stored, enhanced and corrected, manipulated, segmented, and compressed. The aim of this course is not to teach students how to use image editing applications such as Photoshop. Rather, in this course students will learn the underlying techniques and algorithms for the various operations mentioned above using appropriate tool like Java or MatLab.

b) **Aims of the Course:** This course helps the student to understand the basic concepts of digital image processing and various image transforms; to familiarize the student with the image processing facilities in MatLab, to expose the student to a broad range of image processing techniques and their applications, and to provide the student with practical experience using them To appreciate the use of current technologies those are specific to image processing systems; To expose the students to real-world applications of Image Processing

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

- Have a clear impression of the breadth and practical scope of digital image processing and have arrived at a level of understanding that is the foundation for most of the work currently underway in this field.
- Implement basic image processing algorithms using MATLAB tool.
- Explore advanced topics of Digital Image Processing, Ability to Apply and develop new techniques in the areas of image enhancement-restoration segmentation-compression-wavelet processing and image morphology.

d) Make a positive professional contribution in the field of Digital Image Processing

    Teaching and learning Pattern: The course is delivered through Lectures, seminars and independent and group studies/Assignment, Group projects.

e) **Indicative contents**

- *Introduction* (Image, it's representation and properties, Introducing Matlab Image processing toolbox)
- *Image Digitization*: Sampling and quantization.

- Image Transforms: 2-D DSFT and 2-D DFT, 2-D discrete cosine transform (DCT), 1-D and 2-D Karhonen Loeve (KL) or principal component analysis (PCA) and 1-D and 2-D discrete wavelet transforms and relation to filter banks.

- *Image Enhancement*: Point and algebraic operations, edge detection and sharpening, filtering in the spatial and transformed domains.

- *Image Restoration*: Degradation models, inverse and pseudo-inverse filtering, 2-D Wiener filtering and implementation.

- *Image Compression* and *Encoding*: Entropy-based schemes, Transform-based encoding, Predictive encoding and DPCM, Vector quantization, Huffman coding.

- *Feature Extraction* and *Segmentation*: Contour and shape dependent feature extraction, textural features, region-based and feature-based segmentation.

- *Pattern Classification*: Standard linear and Bayesian classifiers, supervised vs unsupervised classification, classification performance index.

- *Applications* in satellite, sonar, radar and medical areas

f) **Assessment method:** The assessment will be in form of tests and assignments (50%) and final written exam (50%).

g) **References:**

- R. C. Gonzalez, R. E. Woods, B. R. Masters, and S. L. Eddins, Digital Image Processing using MATLAB. McGraw Hill Education, 2013.

- S. Sridhar, Digital Image Processing, Oxford University Press, 2011. Milan Sonka, Vaclav Hlavac, Roger Boyle, Image Processing, Analysis and Machine Vision, Brooks Cole, Third Edition, 2014.

- Anil K.Jain, Fundamentals of Digital Image Processing, Prentice-Hall India, 1994.

- Madhuri A. Joshi, „Digital Image Processing: An Algorithmic Approach", Prentice-Hall India, 2006.

13. REGULATIONS

13.1 Course Module Assessments

The general assessment of course modules will be based on of 100 total marks with proportions as follows:-

➢ Continuous assessments – 50 marks;
➢ Final Examination – 50 marks.

However, some courses have varying assessment distributions that are described in the detailed course descriptions. A minimum of two course assignments/tests shall be required per course.

13.2   Grading of Courses

Each Course will be graded out of a maximum of 100 marks and assigned an appropriate letter grade and a grade point as follows: Raw Mark Interval Letter Grade and Grade Points.

Raw Mark Interval	Letter Grade	Grade Points
[90, 100]	A +	4.00
[85, 90)	A	4.00
[80, 85)	A	3.75
[75, 80)	B +	3.50
[70, 75)	B	3.00
[65, 70)	B	2.75
[60, 65)	C +	2.50
[50, 60)	C	2.00
< 50	F	0.00

To complete courses in a program and graduate, a candidate needs to obtain a minimum CGPA of 3.00 and a maximum of one "C" grade in all courses. However, students having two "C+" shall be allowed to graduate as long as the CGPA is not below 3.00.

13.3   Withdrawal from and Readmission to the Graduate Program

13.3.1. Withdrawal

a) A student who wishes to withdraw from the GP must consult and explain any reasons to their academic advisor/course coordinator. Any student who withdraws from GP must be informed that the student must have reasonable grounds for withdrawal to be granted readmission.

b) Unless there are compelling reasons, official withdrawal forms shall be completed within 30 days of discontinuation of classes. A candidate who fails to comply with this requirement shall not be eligible for readmission.

13.3.2. Readmission

a) A candidate in good academic standing who discontinues studies with good reason may apply for readmission through the academic unit into the discontinued semester.

b) A candidate suspended for disciplinary reasons qualifies for automatic registration as soon as the student has served the term.

c) A candidate may be readmitted only where the withdrawal is affected owing to any of the reasons specified hereunder.

   i.   If the candidate cannot follow-up the program for medical reasons in which case the health status shall be ascertained by a medical doctor.

   ii.   If the University is unable to carry out the relevant program and advises the candidate accordingly.

   iii.   If the candidate is unable to continue due to force majeure other than those outlined in (i) and (ii) above.

d) A candidate who wishes to withdraw for reasons mentioned under (c) of this Article shall petition the concerned DGC stating the justi cation for, and the duration of, absence sought.

e) A candidate who has been dismissed for academic reasons may apply for readmission on the following grounds:

   i.   If the student at the end of the 1st had obtained a SGPA of not less than 2.00.

   ii.   If the student at the end of 2nd or 3rd semester had obtained a CGPA of not less than 2.5 or 2.75, respectively.

f) No student who has been dismissed on academic grounds shall be readmitted more than once regardless of transfer from other Universities.

g) A candidate who withdraws from the GP without the approval of the concerned DGC as in (d) of this Article shall not be eligible for readmission.

h) Where withdrawal is e ected with the approval of the concerned DGC, a copy of the official withdrawal form submitted to the admission officer shall be accompanied by the minutes of the meeting of the DGC in which permission for withdrawal is granted.

i) Withdrawal made with the approval of the concerned DGC does not imply automatic readmission whenever it is sought. The length of absence and the number of places available shall be taken into consideration.

13.4   The Graduate Thesis

13.4.1 General Requirements

A.   A thesis shall constitute an individual's effort in academic pursuits to identify and analyze problems by applying sound methodology.

B.   A thesis shall constitute a partial fulfillment of the requirement for the Master's Degree, except in a program where it is not required.

13.4.2 Selection and Approval of Thesis Topic

A. The topic for thesis work shall be selected in consultation with, and prior approval of, the thesis advisor. The selection of thesis topic shall be on the basis of the broad needs of the country and/or the priority areas of research topics as determined by the concerned academic unit.

B. The topic of the thesis of each candidate shall be approved by the DGC as early as possible as and not later than the time of the candidate's enrollment into the second half of the program.

13.4.3 Submission of Thesis

A. No candidate may be permitted to submit a thesis in less than one academic year from the date of initial registration except with a special permission of the SC/DGC.

B. A candidate may submit the thesis at any time during or after the last semester of course work and no later than the end of the fourth semester after the initial registration with the exception of candidates allowed for extended residency.

13.4.4 Procedures for Examination and Submission of Thesis

When a candidate, after conferring with the advisor, gives notice of readiness to submit a thesis, the DGC shall appoint an examining Board and select an external examiner. The external examiner should be decided in good time and obtain a copy of the thesis of the candidate at least four weeks before the date set for the defense.

13.4.5 Thesis Evaluation and Rating

A. **Evaluation**

Based on the results of the open defense and assessment of the thesis by each member of the Board of Examiners, the Thesis that is defended shall be evaluated as follows:

B. **Accepted:** The Thesis can:

    A. Accepted with no change,

    B. Accepted with minor changes to be made to the satisfaction of the advisor, or

    C. Accepted with major modification to be made to the satisfaction of the external examiner and the rest of the Board of Examiners.

    Under certain circumstances the external examiner may delegate the Board of examiners if a thesis requires substantial changes in substance, which are to be made

to the satisfaction of members of the examining Board or its designate, the examining Board's report shall include a brief outline of the nature of the changes required and indicate the time by which the changes are to be completed.

C. **Rejected:** A thesis shall be rejected if:

    A. The work does not meet the required standards; or

    B. The work is plagiarized as judged by the examining Board; or

    C. The work has been already used to confer a degree from this or another University.

14. RESOURCES AND INFRASTRUCTURE

The Department of Information Systems and the College of Computing have enough resources and infrastructure to sufficiently run the Programme. The resources for this MSIS program are expected from the University budget.

14.1 Staff

Instructors who teach the courses are organized in permanent, part-time and in a guest manner. Most part-time and guest instructors are from Addis Ababa University. Ethiopian instructors will be paid according to the part-time and guest standards of the University. For instructors from institutions outside Ethiopia, their accommodation will be covered only during their stay in Debre Berhan.

14.2 Lecture and Computer Lab Room

The College of Computing has three buildings which includes lecture rooms together with library and computer laboratories. The MSIS program has its own dedicated lecture room equipped with computer with broadband internet connection, comfortable chair and LCD projector.

14.3 Internet access

The University has local area network with broadband internet connection and Wi-Fi facilities in some areas. The University is on the way to prepare internet pools for the students; but currently students can use internet on their laboratories during lab session. All staffs have Internet access on their office.

14.4 Library and Literature

Students of the college of computing have access to literatures in the library that is dedicated for the college of computing students. The library accommodates latest reference books and literatures that can cope up with the pace of the ICT development. The Library has a digital facility that the student can access and download softcopy books and available research articles. Books, Journals and related references will be gathered by purchasing as well as from donation of different research institutions

14.5 Software

On top of the physical computers, students need software for the different practical. Computers are installed with different software depending on their focus. Most of the software is available as free distributions for academic purposes. The college and department therefore have (and can access) enough software that can run the practical aspects of the Programme.

14.6 Quality Assurances

Several activities will be carried out as quality assurance measures with collaboration with the Quality Assurance Office of College of Computing and Quality Assurance Debre Berhan University so as to:

(i)   Measure the general extent to which the required skills have been achieved.

(ii)   Ascertain the Implementation of the methodological changes proposed.

(iii)   Create a feedback bench mark for possible future revisions in the curriculum.

The activities will be carried out in the process of monitoring and assuring quality in the proposed Programme.

14.7 Feedback from Students

After students are enrolled to the program in the current set up, each class will have a student representative. These representatives are in constant contact with the Head of Department/ Course coordinator in case there is any quality of teaching and learning related matters in a particular class. This set up is to be maintained.

At the end of the semester, samples of students will be given questionnaires to respond to several quality related matters like staff punctuality, delivery mode, course content and the general perceived usefulness of the course unit.

14.8 Class Meetings

The computing college management will make at least 2 meetings with every semester. In this meeting, general quality issues will be addressed. Students will also be given a chance to raise

any questions that will be answered and/or addressed by the school and the department management.

14.9 External Examiners' Reports

Student results will be reviewed every semester by a senior external academician. This is to bring a 'foreign view' of the quality of the Programme. External examiners will write reports on their view of the curriculum/examinations. Some recommendations can be implemented immediately while others have to be implemented in a longer term. The department will make the maximum possible use of external examiners' reports as a means of assuring quality in the revised Programme.