LUSAKA SOUTH
UNIVERSITY COLLEGE
Dream. Explore. Acquire

Bachelor in Communication Technology (BICT)

Course Description

Year 1

Course Code	Course Name
COM 111	Computer Applications
COM 112	Computer Programming 1
COM113	Fundamentals of Computer Systems
COM 114	Foundation Mathematics 1
BA115	Business and Academic Communication
COM115	Data Structures
COM122	Physics
COM123	Computer Programming 2

Year 2

Course Code	Course Name
COM211	Systems Analysis and Design
COM 212	Intro. To Databases
COM 213	Networking and Data Communication 1
COM 214	Operating Systems
COM215	Discrete Mathematics
COM 221	Digital Logic
COM222	Parallel and Distributed systems
COM223	Networking and Data Communication 2
COM224	Real Time and Embedded systems
COM 225	Computer Architecture and Organization

Year 3

Course Code	Course Name
COM311	Software Engineering
COM312	Algorithms and Complexity
COM313	Clusters and high Performance Computing
BBA314	Entrepreneurship
COM315	Information Assurance and Cyber Security
COM321	Web Applications Development
COM322	Advanced Database management systems
BA323	Research Methodology
COM324	Artificial Intelligence

Year 4

Course Code	Course Name
COM411	Programing Languages
COM412	Platform based development
COM413	Mobile Applications Development
COM414	Computer Ethics
COM 415	Systems Project Management
COM 421	Graphics and visualization
COM 425	Dissertation
COM 422	Industrial Placement

E1.0 Description of First Year Courses

E1.1 COM 111 Computer Applications (15 Credits)

E1.1.1 Rationale

The course "COM111 Computer Applications" is designed to empower students with practical skills in using essential computer applications. As technology continues to play a crucial role in academic and professional settings, this course aims to provide students with the necessary knowledge and proficiency to utilize common computerapplications effectively. The focus is on fostering digital literacy, problem-solving skills, and ethical considerations in technology use.

E1.1.2 Learning Outcomes

Upon completion of this course, students should be able to:

Demonstrate Proficiency: Effectively use word processing, spreadsheet, and presentation software for academic and professional tasks.

Problem-Solving Skills: Apply computer applications to solve real-world problems andanalyze data.

Ethical Awareness: Understand the ethical considerations related to information sharing, privacy, and responsible use of technology.

Critical Thinking: Evaluate and select appropriate computer applications based on therequirements of specific tasks.

Effective Communication: Create clear and engaging documents, spreadsheets, and presentations.

E1.1.3 Course Contents Topics for Computer Applications

1: Introduction to Computer Applications

- Overview of common applications (Microsoft Office, Google Workspace)
- Importance of digital literacy
- Basics of word processing

2: Spreadsheet Analysis

- Data entry and manipulation in spreadsheets
- Formulas, functions, and charts
- Collaborative data analysis

3: Presentation Design

- Principles of effective presentations
- Creating engaging slides
- Delivery techniques and best practices

4: Ethical Considerations in Computer Applications

- Data privacy and security
- Intellectual property and plagiarism
- Responsible use of technology

5: Project Work and Review

- Applying learned skills
- Reviewing and revising documents, spreadsheets, and presentations

E1.1.4 Teaching and Learning Methods

Lectures for theoretical concepts Hands-on

practical sessions

Group projects and case studies

Class discussions on ethical considerations

E1.1.4 Assessment

Continuous assessment through assignments and quizzesIndividual and

group projects

Midterm and final examinations covering theoretical and practical aspects

E1.1.5 Prescribed Readings

Laura Gomez, (2021). "Office Productivity: A Guide to Using Microsoft Office"Mark R. Thompson

(2019)."Digital Literacy: A Primer"

Karen L. Smith (2020)."Ethics in the Digital Age" **E1.1.6**

Recommended Readings and 3 Journals Jane Doe,

(2022)."Google Workspace for Dummies"John Johnson (2018).

"Effective Presentation Skills"

"Data and Goliath, (2015). The Hidden Battles to Collect Your Data and Control YourWorld" by Bruce Schneier

E1.1 COM112 Computer Programming 1 using C++ (15 Credits)

E1.1.1 Rationale

The course "COM113 Computer Programming 1 using C++" serves as an essentialintroduction to the field of computer programming, emphasizing the use of theC++ programming language. In the rapidly evolving landscape of computing,the ability to design and implement efficient and reliable software is crucial. This course aims to equip students with foundational programming skills, fostering a comprehensive understanding of programming concepts and practices.

E1.1.2 Learning Outcomes

Upon completion of this course, students should be able to:

a) Programming Foundations: Understand the basics of computer programming, its history, and the evolution of programming languages.

b) Language Proficiency: Gain proficiency in C++, a versatile and widelyused programming language.

c) Problem-Solving Skills: Develop effective problem-solving strategies usingprogramming techniques.

d) Program Design and Development: Comprehend the program development process, from problem definition to testing and debugging.

e) Sequence, Selection, and Iteration: Apply fundamental programming structures, including sequence, selection (if statements), and iteration(loops).

f) Data Structures: Utilize arrays, strings, and structures to organize andmanipulate data effectively.

E1.1.3 Course Contents Topics for 15 weeks COM113 Computer Programming 1using C++

1: Introduction to Computer Programming

Overview of programming concepts Importance of

programming in computing

2: Generations of Computer Languages

Historical development of programming languages Evolution from machine language to high-level languages

3: Interpreted and Compiled Languages

Distinction between interpreted and compiled languagesAdvantages and disadvantages of each approach

4: Data Types

5: Program Design and Development Process

Steps in the program development life cycle Understanding the role of design in effective programming**6: Problem Definition, Pseudo-code, and Flowcharting** Defining programming problems

Using pseudo-code and flowcharts for problem-solving

7: Code Modularization

Principles of code modularization

Enhancing code maintainability through modular design

8: Coding, Testing, and Debugging

Best practices in coding

Strategies for effective testing and debugging

9: Control Structures

Sequence, Selection, and Iteration Patterns Understanding sequence in programming Implementing selection and iteration patterns in C++ **10: Functions**

Math Library FunctionsFunctions

Function Definitions
Function Prototypes
Header Files

Calling Functions: Call by Value and Call by Reference

11: Arrays

Introduction to arrays

Manipulating array elements in C++

12: Pointers

Pointer Variable Declarations and Initialization Pointer Operators

Pointer Expressions and Pointer Arithmetic

13: Strings

Working with strings in C++

String manipulation and operations

14: Structures

15: Structures

Defining and using structures in C++

Creating and manipulating complex data structures

E1.1.4 Teaching and Learning Methods

Lectures for theoretical concepts

Hands-on programming sessions and coding exercisesGroup projects and collaborative coding

Code reviews and debugging sessions

E1.1.4 Assessment

Continuous assessment through coding assignments, quizzes, and participation Midterm and final programming projects

Practical exams assessing problem-solving skills and code implementation

E1.1.5 Prescribed Readings

Deitel, P.J. (2010). **C++ How to Program**, 7th Edition. Deitel & Association Inc, Prentice Hall. ISBN-13: 978-0-13-612356-9.

Stanley B. Lippman, Josée Lajoie, Barbara E. Moo,(2012). "C++ Primer",Addison-Wesley, ISBN: 978-

0321714114

Bjarne Stroustrup, (2014), "Programming: Principles and Practice Using C++",Addison-Wesley

ISBN: 978-0321992789

E1.1.6 Recommended Readings

"ACM Transactions on Computing Education" Association for

Computing Machinery (ACM) "C/C++ Users Journal" CMP

Media

E1.1 COM113 Fundamentals of Computer Systems (15 Credits)

E1.1.1 Rationale

Information systems are interconnected hardware and software systems designed toallow ease of sharing resources within a work place by people who are connected using network based computer protocols.

This course on ICT is designed to analyze all the important categories of technologiesthat exist, methods of acquiring or developing them, how to use them to run businessesand thereby acquaint the students with different approaches to the principles and ethical usage of information and communication technologies (ICTs).

During the semester, we will consider the types and quality of information needed by organisation, organization hierarchy, types of information systems used at each level of the organization, as well as analyze and recommend the appropriate technologies touse based on case studies. The theory part, will involve reading a mixture of classic and modern information systems, computing and innovation texts. Applying theory to practice we will also engage in a series of entrepreneurial case studies examining investment justification, business cost reduction and profit maximization using major and dissenting opinions, technologies and approaches. Ultimately, we will explore the practical implications of learning and using ICT skills in business practices.

By the end of the semester, you will have a basic familiarity with the vocabulary, practical skills and concepts used in the field of ICT but not expert knowledge on thedesign of actual systems. The main objective of the course is to develop critical thinking,innovative management skills, and ICT skills, in the students and sharpen their businessand entrepreneurial skills using ICTs.

E1.1.2 Learning outcomes

a) Knowledge and Understanding:

- Demonstrate a comprehensive understanding of the fundamental principles andcomponents of computer systems.
- Explain the theoretical foundations of computer architecture, includingprocessor design, memory management, and input/output systems.
- Illustrate a critical understanding of the role and function of operating systems incomputer systems.

b) Intellectual Skills (Cognitive and Creative Skills):

- Apply knowledge of computer system principles to analyze and solve complexproblems.
- Evaluate and compare different computer system architectures and theirsuitability for specific tasks.
- Create and implement solutions to practical problems using concepts learned inthe course.
- Analyze and critically assess the impact of emerging technologies on computersystems.

c) Subject Specific Skills (Professional Skills):

- Configure and optimize computer systems for specific purposes, consideringperformance, security, and reliability.
- Demonstrate proficiency in using industry-standard tools for system administrationand maintenance.

- Design and implement a basic computer system, considering the specific needsof users and applications.
- Troubleshoot and resolve hardware and software issues in a professionalenvironment.

d) Reflexive Skills:

- Demonstrate autonomy in identifying, analyzing, and solving problems related tocomputer systems.
- Take accountability for decisions and actions related to the design, implementation, and maintenance of computer systems.
- Exercise sound judgment in selecting appropriate technologies andmethodologies for specific computing tasks.
- Adapt to changes in technology by continuously updating knowledge and skillsin computer systems.

e) Transferable Skills:

- Communicate effectively, both orally and in writing, about complex computersystem concepts and solutions.
- Demonstrate numeracy skills in analyzing data related to computer systemperformance and resource utilization.
- Collaborate with team members to solve problems and complete projectssuccessfully.
- Apply time management skills to efficiently complete tasks and projects.
- Demonstrate effective self-learning skills, enabling continuous professionaldevelopment in the field of computer systems.

E1.1.3 Course content

1: Information Needs of an Organization:

- Understanding the concept of information needs in the context of decision-making.
- Identifying and prioritizing information requirements at various levels of the organization.
- Recognizing the role of information in strategic planning and operationalefficiency.

2: Types of Information Systems:

- Overview of different types of information systems (Transaction Processing Systems, Management Information Systems, Decision Support Systems, ExecutiveSupport Systems).
- Understanding the purpose, functions, and scope of each type.
- Examples of real-world applications for each type of information system.

3: Hardware Systems:

- Components of a computer system (CPU, memory, storage devices,input/output devices).
- Understanding the role and function of each hardware component.
- Exploring advancements in hardware technology and their impact oncomputing.

4: Software Systems:

- Differentiating between system software and application software.
- Overview of operating systems and their functions.
- Understanding software development life cycle and methodologies.

5: Communication, Networks, and Internet of Things (IoT):

- Basics of data communication and networking.
- Understanding network topologies, protocols, and security.
- Introduction to the Internet of Things and its applications.

7: Systems Analysis and Design Techniques:

- Overview of systems analysis and design.
- Techniques for gathering system requirements.
- Modelling tools and methods for system design.

8: Information Security:

- Understanding the importance of information security.
- Implementing security measures (firewalls, encryption, access controls).
- Identification and mitigating security risks.

9: IT Disaster Planning and Recovery:

- Developing disaster recovery plans.
- Implementing backup and recovery strategies.
- Understanding the role of IT in business continuity.

10: E-commerce:

- Introduction to electronic commerce and its evolution.
- Types of e-commerce (B2B, B2C, C2C).
- Payment systems, security, and legal considerations in e-commerce.

11: Computer Graphics:

- Basics of computer graphics and its applications.
- Graphic file formats and compression techniques.
- Introduction to 2D and 3D graphics.

12: Geographic Information Systems (GIS):

- Understanding the concept of GIS.
- Applications of GIS in mapping and spatial analysis.
- Integration of GIS with other information systems.

E 1.1.4 Teaching and Learning Methods

Capstone Project	Full –time / Distance Learning
Physical lectures	Full –time / Distance Learning
Virtual lectures	Full –time / Distance Learning
Tutorial	Full–time / Distance Learning
Group Discussion	Full–time / Distance Learning
Independent Study	Full–time / Distance Learning
Case Studies	Full–time / Distance Learning

E1.1.5 Assessment

- Assignment
- Continuous Assessments
- Projects Defense
- Tests
- Exam

E1.1.5 Prescribed Readings

- Amy Phillips (2015), Information Technology: business driven information systems (Amazon Press)
- Kenneth Laudon and Jane Laudon (2019), Management information systems:managing the digital firm (16th ed. Pearson eBooks)
- Keri E. Pearlson, Carol S. Saunders, Dennis F. Galletta (2019), Managing and UsingInformation Systems: A Strategic Approach (Amazon Press)
- Ralph Stair, George Reynolds (2017), Fundamentals of Information Systems(Amozon Press)
- Kang-Tsung Chang (2019) Introduction to Geographic Information Systems: (McGraw-Hill)
- Anuradha, J., Tripathy, B. K (2018) Internet of things (IoT) : technologies, applications, challenges and solutions (CRC Press;Taylor & Francis) download for freeat: https://b-ok.global/book/3419078/472f62
- Reynolds, George Walter, Stair, Ralph M. (2018), Principles of information systems(Cengage Learning Press) download for free at: https://b- ok.global/book/3515246/c4ab9b

E1.1.6 Recommended Readings

Articles and Journals

- *OMICS – A journal of Integrated Biology: Özdemir, Vural, Hekim, Nezih;* Birth of Industry 5.0: Making Sense of Big Data with Artificial Intelligence, "The Internet of Things" and Next-Generation Technology Policy (Jan 2018): download forfree at: https://booksc.org/book/67790896/517516
- Journal of Cyber Security and Mobility: *Abomhara, Mohamed, K�ien, Geir M. ; Cyber Security and the Internet of Things: Vulnerabilities, Threats, Intrudersand Attacks: (2015) Vol 4.; Iss 1.* download for free at: https://booksc.org/book/71697250/425c10
- IEEE Internet of Things Journal: Ahmed, Nurzaman, De, Debashis, Hussain, Md.Iftekhar; *Internet of Things (IoT) for Smart Precision Agriculture and Farming in Rural Areas* (2018) Vol 10 ; Iss 1109: download for free at: https://booksc.org/book/73194535/bf5635
- Communications of the association for information systems: Mendling, Jan, Decker, Gero, Hull, Richard, Reijers, Hajo A., Weber, Ingo: *How do Machine Learning, Robotic Process Automation, and Blockchains Affect the Human Factor in Business Process Management?:* (2018) Vol 10; Iss 17705. Downloadfor free at: https://booksc.org/book/73010190/c1f54a

Case Studies

- *Agility in responding to disruptive digital innovation*: Case study of an SME(Aug, 2018) found at: https://booksc.org/book/71982800/b11176
- *Characterizing the Propagation of Situational Information in Social MediaDuring COVID-19 Epidemic*: A Case Study on Weibo (2020) found at: https://booksc.org/book/81495322/4f3476
- Importance of software testing in the design stage case study of McAfee Anti-Virus: https://acasestudy.com/mcafee/
- Using Internet to changing consumer demands and international competition. https://acasestudy.com/ford-business-analysis/
- Case study of Motorola Inc. IT tools for Project Management
- Case of NHS England for structures systems development and IT projectfailures

E1.1 COM114 Foundation Mathematics 1 (15 Credits)

E1.1.1 Rationale

The course "COM114 Foundation Mathematics 1" is designed to provide students with a solid foundation in mathematical concepts essential for further studies in computing. Mathematics serves as a fundamental tool inproblem-solving and algorithmic thinking. This course aims to establish a strong mathematical base by covering key topics such as sets, complex numbers, functions, trigonometry, and vectors.

E1.1.2 Learning Outcomes

Upon completion of this course, students should be able to:

Demonstrate understanding of basic concepts in Sets, relating to functionsand Vectors Mathematics techniques in the preceding Engineering and Science courses

Demonstrate understanding of basic concepts in linear algebra, relatingto sets

Apply logical thinking to problem-solving in context. Use appropriate technology to aid problem-solving.Demonstrate skills in writing mathematics.

E1.1.3 Course

Contents1 - SETS

Definition of sets

Set operations (union, intersection, complement)Venn diagrams
and applications

2 - COMPLEX NUMBERS

Basics of complex numbers

Arithmetic operations with complex numbersPolar form and applications

3 - SURDS

Introduction to surds Simplification of surds Operations involving surds

4 - FUNCTIONS

Basics of functions

Domain, range, and inverse functions Composite functions and applications

5 - QUADRATIC FUNCTIONS

Quadratic equations and inequalitiesGraphs of quadratic functions Applications of quadratic functions

6 - INEQUALITIES

Linear inequalities Quadratic inequalitiesSystems of inequalities

7 - TRIGONOMETRY

Trigonometric functions Trigonometric identities Applications of trigonometry

8 - EXPONENTIAL AND LOGARITHMIC FUNCTIONS

Exponential functions and their properties Logarithmic functions and their properties Solving exponential and logarithmic equations

9 - POLYNOMIALS

Polynomial functions and their propertiesSynthetic division and factorization Remainder and factor theorems

10 - VECTORS

Definition and representation of vectors

Vector operations (addition, subtraction, scalar multiplication)Applications of vectors in computing

11 - VECTORS

Cross product and dot product Vector equations of lines and planes

Applications of vector operations in computing

E1.1.4 Teaching and Learning Methods

Lectures for theoretical concepts Problem-solving sessions and tutorials

Practical applications through computational exercisesGroup discussions and collaborative problem-solving

E1.1.4 Assessment

Continuous assessment through quizzes, assignments, and classparticipation

Final examinations covering theoretical and problem-solving aspectsProject work incorporating mathematical concepts into computing applications

E1.1.5 Prescribed Readings

Bird. J. (2017). **Higher Engineering Mathematical**, 8th Edition. Published byElsevier

Clifford Stein, Robert L. Drysdale, and Kenneth H. Rosen(2014), "Mathematics for Computer Scientists" , Pearson. ISBN: 978-0321194048

E1.1.6 Recommended Readings

Edward Hughes (2008). **Calculus: Electrical and Electronic Technology**,10th Edition. Pearson Education Limited. ISBN-13- 978-0-13.

Eric Lehman et al. (2017) **Mathematics for Computer Science**

"Journal of Mathematical Sciences and Mathematics Education"

E1.1 COM115 Data Structures (15 Credits)

E1.1.1 Rationale

The course "COM115 Data Structures" is designed to provide students with a solidfoundation in the principles and applications of data structures. Data structures are essential components in information and communication technology, enabling efficient storage, retrieval, and manipulation of data. This course aims to equip students with the knowledge and skills to analyze, design, and implement various data structures, fostering an understanding of their strengths and limitations in different computing scenarios.

E1.1.2 Learning Outcomes

Upon completion of this course, students should be able to:

Understanding Data Structures: Develop a deep understanding of various datastructures and their characteristics.

Implementation Skills: Demonstrate proficiency in implementing data structures using programming languages.

Algorithmic Thinking: Apply algorithmic thinking to solve problems related todata manipulation and organization.

Analysis of Data Structures: Evaluate the efficiency and suitability of different data structures for specific tasks.

Problem-Solving with Data Structures: Apply data structures to solve real-worldcomputing problems efficiently.

E1.1.3 Course Contents

1: Introduction to Data Structures

Definition and importance of data structuresOverview of common data

structures

Basic operations and terminology

2: Array-Based Lists and Linked Lists

Array-based lists: arrays, dynamic arrays, and array-based implementationLinked lists: singly linked, doubly

linked, and circular linked lists

3: Skip Lists and Hash Tables

Skip lists: structure and implementation

Hash tables: concepts, collision resolution, and probing techniques

4: Recursion and Binary Trees

Recursion: principles and applications

Binary trees: representation and traversal techniques

5: Advanced Binary Trees

Scapegoat trees: principles and advantagesRed–black trees: properties and balancing Heaps: types, operations, and applications

6: Sorting Algorithms, Graphs, and Binary Trees

Sorting algorithms: comparison-based and non-comparison-basedGraphs: representation, traversal, and common algorithms Advanced binary tree applications

E1.1.4 Teaching and Learning Methods

Lectures for theoretical concepts

Coding sessions and programming exercises for hands-on implementationGroup projects and case studies for practical application

Problem-solving sessions and algorithmic analysis

E1.1.4 Assessment

Continuous assessment through programming assignments and quizzes

Individual and group projects focusing on data structure implementations Midterm and final examinations covering theoretical and practical aspects

E1.1.5 Prescribed Readings

Clifford A. Shaffer (2010), A Practical Introduction to Data Structures and Algorithm Analysis, Industrial Press, Inc.

Mark Allen Weiss, (2018). "Data Structures and Algorithm Analysis in Java"Pearson, ISBN: 978-

0132576277

Elliot B. Koffman and Paul A. T. Wolfgang, (2005) , "Data Structures: Abstractionand Design Using Java" Wiley, ISBN: 978-0471469135

E1.1.6 Recommended Readings

Michael T. Goodrich and Roberto Tamassia, (2016), "Data Structures andAlgorithms"

, Wiley, ISBN: 978-1118771334

E1.1 BA111 CRITICAL THINKING AND MINDSET FOR BUSINESS (7.5 Credits)

Pre-requisite: None

E1.1.1 Rationale

The course in Critical Thinking and Mindset for Business is designed to address the imperative need for individuals to develop and enhance critical thinking and creative problem-solving skills in the context of contemporary business challenges. In an era marked by globalization, evolving socio-political landscapes, and the pursuit of social innovation, fostering critical thinking abilities becomes paramount. This course aims to challenge students to evaluate and elevate their own thinking processes, enabling them to scrutinize issues ranging from global phenomena to ethical considerations withdepth and insight. By delving into the characteristics and mindset of a critical thinker, exploring various thinking styles, and providing practical tools for critical and creative analysis, the course equips students to navigate complex business environments. Furthermore, the emphasis on media analysis, ethical reflection, and the articulation ofwell-reasoned arguments prepares students to engage intelligently with diverse perspectives and contribute meaningfully to contemporary discourse on business- related issues. Overall, the course seeks to empower students with the cognitive skills essential for success in the dynamic and multifaceted world of business.

E1.1.2 Learning Outcomes

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

- Evaluate and enhance their own critical and creative thinking skills enablingthem to think logically and significantly
- Interpret, analyze, and evaluate information communicated via a rangeof media
- Express their thinking clearly and check for accuracy and precision
- Discuss controversial topics intelligently and insightfully

E1.1.3 Course Content

1: Introduction to Critical Thinking

- What is CT?
- Why is CT important?

- Emotions & emotional intelligence
- Subjectivity & Objectivity
- Worldviews, beliefs, & paradigms

2: Feature and Characteristics of CT

- Benefits of critical thinking in the workplace
- Critical thinking as a management skill
- What are the characteristics of a critical thinker?

3: Other Types of Thinking

- 5 Different thinking styles

4: A Critical Thinker's Mindset

- Can you develop a critical thinker's mindset?

5: The Critical Thinking Process

- Step 1 - Identifying the problem
- Step 2 - Gather and evaluate your information
- Step 3 - Generate alternative solutions
- Step 4 - Select and implement a solution
- Step 5 - Evaluate your solution
- Reflection

6: Developing Critical Thinking Skills

- Asking questions
- Active listening
- Challenging assumptions

7: Creative Thinking Techniques

- Brainstorming

- Imagining the opposite
- Mind mapping
- De Bono's thinking hats

8: Root Cause Analysis Techniques

- Identifying the cause of a problem
- Ishikawa Diagram (Fishbone Diagram)
- 5 Whys technique
- SWOT analysis

9: Using Your REACH Profile to Support Critical Thinking

- Adapting your profile

10: Presenting Your Recommendations

- Seeking approval from decision makers and stakeholders

11: introduction to patterning & graphical organization

- How to persuade & avoid being manipulated

12: intro to rhetorical techniques

- Lateral thinking and challenging assumptions

E1.1.4 Teaching and Learning Methods

Lectures, Case Study, Group Discussion, Presentation

E1.1.5 Assessment

Mode of Assessment			Weight
Continuous Assessment	**Assignments**	10%	**40%**
	Tests	30%	
Examination			**60%**
Total			**100%**

E1.1.6 Prescribed Readings:

1. Paul, R., & Elder, L. (2013). Critical Thinking: The Nature of Critical and CreativeThought. Journal of Developmental Education, 37(2), 2-9.
2. Kahneman, D. (2011). Thinking, Fast and Slow. Farrar, Straus and Giroux.
3. de Bono, E. (2009). Lateral Thinking: Creativity Step by Step. Harper Perennial.

E1.1.7 Recommended Readings:

1. West, R., & Turner, L. H. (2014). Understanding Interpersonal Communication: Making Choices in Changing Times. Cengage Learning.
2. Heath, C., & Heath, D. (2013). Decisive: How to Make Better Choices in Life andWork. Crown Business.
3. Goleman, D. (2011). Emotional Intelligence: Why It Can Matter More Than IQ. Bantam.

E1.4 BA114 BUSINESS AND ACADEMIC COMMUNICATION (7.5 Credits)

Pre-requisite: None

E1.4.1 Rationale

The module offers a foundation in communication and study skills which is required for students to excel on university degree programs. The module equipsstudents with all aspects of written, electronic and oral communications, including how to study, note taking, essay writing and critical reading.

Additionally, the students are introduced to the various research methods used by social and business researchers. They are guided to manage their time effectively to cope with demanding pressure and they are helped in their reportwriting. Above all, the students are encouraged to embrace the use of information technology as a way to help them improve in their studies. When their syllabus is fully covered, then they are helped in their revision of the topicscovered.

E1.4.2 Learning Outcomes

After completing this course the student should be able to:

1. Apply scholarly skills in writing as well as oral presentation.
2. Recognize the key dynamic forces driving study skills.
3. Differentiate types of communication relevant to any situation.
4. Explain the way books and other publications are organized in the library

E1.4.3 Course Content

1. Business Communication, an introduction

- Communication and its importance
- Forms and types of communication
- Emotional Intelligence (EI)
- The Communication Process
- Barriers to Effective Communication
- Tenets of quality Communication

2. Communication in Academic Situations

- Plagiarism and Referencing
- Rules and fundamental principles of referencing

- Referencing and reading Skills
- Understanding the spoken and written word

- Note taking and Note making
- Necessary tools for writing
- Punctuation marks
- Numbering, bullets and indentation
- Academic Writing
- Reports- Academic and other types of reports
- Academic Essay

3. Communication in the Business Environment

- Business Letter
- Resume and CVs
- Job descriptions
- Business reports
- Minutes
- Presentations

E1.4.4 Teaching Method

Lectures, Case Study, Group Discussion, Presentation

E1.4.5 Assessment

Mode of Assessment			**Weight**
Continuous Assessment	**Assignments**	10%	**40%**
	Tests	30%	
Examination			**60%**
Total			**100%**

E1.4.6 Prescribed Readings:

1. Guffey, M. E., & Loewy, D. (2020). Essentials of Business Communication.Cengage Learning.

E1.4.7 Recommended Readings:

1. Locker, K. O., & Kaczmarek, S. T. (2019). Business Communication: BuildingCritical Skills.

McGraw-Hill Education.

2. Lannon, J. M., & Gurak, L. J. (2019). Technical Communication. Pearson.

3. Ober, S. (2020). Contemporary Business Communication. Oxford UniversityPress.

E2.1 COM211: System Analysis & Design

E2.1.1 Background and Rationale

Systems analysis and design are core, interlocking, elements of system development.Systems analysis is the process of turning a set of user requirements into a logical systemspecification. Systems design takes the logical specification and converts it into a set of designs that can be implemented to create a working application. There is a range ofactivities that are carried out during these processes. Traditional approaches have attempted to create carefully defined procedures that, if adhered to rigorously, shouldresult in high quality applications. This approach is now challenged by more 'agile' approaches that stress the need to avoid overly bureaucratic, rigid, and costly development practices. Candidates need to be more familiar with the principles and applicability of both approaches. Systems analysis and design is to improve organizational systems, typically through applying software that can help employees accomplish key business tasks more easily and efficiently.

E2.1.2 Learning Objectives

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

- Initiate, specify and prioritise information systems projects.
- Determine various aspects of feasibility of information systems projects.
- Clearly define problems, opportunities, or mandate that initiate projects.
- Understand the types of business needs that can be addressed using informationtechnology – based solutions.

E2.1.3 Learning Outcomes

At the end of this course, students should be able to:

- Describe principles, concepts and practice of System Analysis andDesign process
- Explain the processes of constructing the different types of information system
- Apply object oriented concepts to capture a business requirement
- Design and Develop of Information Systems in real world business environment

E2.1.4 Prerequisites

None

E2.1.5 Course contents

1: Introduction to Systems Analysis and Design

1.0. Over View of System Analysis and Design

1.1. Business System Concepts

1.2. Characteristics of a System

1.3. Elements of a System

1.4. Types of Systems

1.5. Systems Model

2: The design process and lifecycle models

a. Compare the underlying assumptions and uses of a predictive and an adaptivesystem development life cycle (SDLC)

b. Describe the key activities and tasks of information system support

c. Explain what comprises a system development methodology the SDLC as well asmodels, tools, and techniques

d. Describe the two overall approaches used for software construction andmodelling the structured approach and the object oriented approach

e. Describe the key features of Agile development

3: Requirements elicitation

a. Introduction to Requirements Elicitation

b. Requirements Elicitation Using Joint Application Design

c. Safety constraints and Requirements

d. Requirements Elicitation by Interviewing

e. Requirements Elicitation Using the PIECES Framework

4: Software Requirements Specification

3.1. Contents of the Requirements Specification

3.2. Documenting the Requirements

3.3. Requirements Validation

3.4. How to Proceed

3.5. Presenting the Requirements Specification

5: Modelling techniques- Process Models

5.1. Describe a process model

5.2. Using Data Flow Diagram (DFD) and data dictionary for process modelling

5.3. Create Logic Modelling

5.4. Systems Proposals and its role in Systems Analysis

6: Modelling techniques2- Data Models

6.1. Review the role of conceptual data modelling in overall design and analysis ofan information system

6.2. Learn to draw Entity-Relationship (E-R) Diagrams

6.3. Understand basic and advanced concepts of ER Diagrams

6.4. Understand various types of relationships, such as unary, binary, and ternary thatcan exist

7: Introduction to Object Oriented Analysis and Design

7.1. Concepts of object-oriented

7.2. UML notations

7.3. Design patterns

7.4. Object-Oriented analysis and design using UML and Patterns.

7.5. Practical projects

8: Unified Modelling Language 1 (Use Case Modelling)

8.1. Define key concepts of use-case modelling.

8.2. List the benefits of use-case modelling.

8.3. Find actors and use cases.

8.4. Describe their relationships to each other.

8.5. Define functional decomposition.

8.6. Read and draw a use-case diagram

9: Unified Modelling Language 2 (Class Diagrams)

9.1. What is UML?

9.2. Do people really use UML?

9.3. What is a UML class diagram?

9.4. What is a UML class diagram?

9.5. What kind of information goes into it?

9.6. How do I create it?

9.7. When should I create it?

10: Prototyping

10.1. Understand the uses of different types of prototypes for different kinds ofdesigns and be able to choose appropriately

10.2. Know the basic techniques for low-fidelity prototyping

10.3. Be able to determine and apply the relevant techniques for your project

11: Verification and Validation

11.1. Be able to define both Verification and Validation and their differences

11.2. Identify the appropriate activities and their classification as either Verification and Validation

12: User Cantered Design

12.1. Appreciate the importance of user-centered design (user error =designerror)

12.2. Distinguish between User Centered design and Design as art

12.3. List the major steps of UCD

E2.1.6 Course Delivery

- Lectures
- Discussions
- Weekly problem sets
- Laboratory

E2.1.7 Assessment

Component of assessment	Number	Contribution to overall grading (%)
1. Continuous assessment		
Assignment 1	1	10

Assignment 2 / Presentation		10

Test	1	20
2. Final examination	1	60
Total Marks		**100**

E2.1.8 Prescribed readings

1. Satzinger, J., Jackson, R. and Burd, S. (2015). ***SystemsAnalysis and Design in a Changing World***. Boston, MA: Cengage Learning.
2. Dennis, A., Wixom, B.H., Teagarten, D. (2015). **Systemsanalysis and design: an object oriented approach with UML**. Wiley 5th Edition.

E2.1.9 Recommended readings

1. Bennett, S., McRobb, S., and Farmer, R. (2010). **Object-oriented systems analysisand design using** UML. McGraw-Hill (4thEdition)
2. Avison, D. and Fitzgerald, G. (2012). **Information systems development: methodologies, techniques and tools**. McGraw-Hill (4th Edition).

E1.1 COM212 Introduction to Databases (15 Credits)

E1.1.1 Rationale

The course "COM212 Introduction to Databases" is designed to provide studentswith a foundational understanding of databases and their essential principles.
Databases are a critical component of information systems, and this course aimsto equip students with the knowledge and skills required for effective database design, management, and querying. It explores the relational data model, database design process, and SQL as fundamental tools for handling and manipulating data.

E1.1.2 Learning Outcomes

Upon completion of this course, students should be able to:

Understand Database Concepts: Comprehend the fundamental concepts ofdatabases, including the relational data model.

Relational Algebra and Calculus: Apply relational algebra and calculus to manipulate and query data within a relational database.

SQL Proficiency: Demonstrate proficiency in using SQL for database management and querying.

Normalization Techniques: Understand and apply functional dependency and normalization concepts for efficient database design.

Database Design Process: Follow the systematic database design process to create well-structured and normalized databases.

E1.1.3 Course Contents

1: Introduction to Databases

Definition and importance of databases

Overview of database management systems (DBMS)Types of

databases

2: Relational Data Model

Entity-Relationship (ER) modelBasics

of relational databases

Keys and relationships in a relational model

3: Relational Algebra and Calculus

Relational algebra operations (selection, projection, join, etc.)Relational calculus basics

Query optimization techniques

4: SQL (Structured Query Language)

Basic SQL commands (SELECT, INSERT, UPDATE, DELETE)

SQL joins and subqueries Views and

stored procedures

5: Functional Dependency and Normalization

Understanding functional dependencies Normalization and its

importance

Normal forms (1NF, 2NF, 3NF)

6: Database Design Process

Steps in the database design process Data

modeling and schema design Case studies and

real-world applications**E1.1.4 Teaching and**

Learning Methods Lectures for theoretical

concepts

Practical exercises and demonstrations using a relational database systemGroup projects for

hands-on experience in database design

Case studies and discussions on real-world database applications

E1.1.4 Assessment

Continuous assessment through assignments, quizzes, and practical exercises Individual and group projects focusing on database design and implementation Midterm and final examinations covering theoretical and practical aspects **E1.1.5 Prescribed Readings**

Connolly, T. and Begg, C. (2015), Database Systems: A Practical Approach to Design, Implementation and Management, 6th Edition: Pearson Education Limited. ISBN-13: 978-0-13-294326-0

Abraham Silberschatz, Henry F. Korth, and S. Sudarshan. (2019). "Database SystemConcepts", McGraw-Hill Education ISBN: 978-1260248012

Markus Winand, (2012) . "SQL Performance Explained" , Markus WinandISBN: 978-3950307828

E1.1.6 Recommended Readings

Water Shields (2019) SQL QuickStart Guide: The simplified beginner's guide tomanaging, analyzing and manipulating data with SQL.

Michael J. Hernandez ,(2013). "Database Design for Mere Mortals"Addison-
Wesley
ISBN: 978-0321884497

E1.1 COM214 Operating Systems (15 Credits)E1.1.1 Rationale

The course "COM214 Operating Systems" is designed to provide students witha comprehensive understanding of the fundamental principles and functionsof operating systems. Operating systems serve as the backbone of computersystems, managing hardware resources and providing an interface for user applications. This course aims to equip students with the knowledge and skillsto comprehend, design, and manage operating systems effectively.

E1.1.2 Learning Outcomes

Upon completion of this course, students should be able to:

Understanding Operating System Concepts: Develop a deep understandingof the fundamental concepts and components of operating systems.

Operating System Design and Architecture: Comprehend the architectureand design principles underlying modern operating systems.

Resource Management: Understand the principles of resource management,including CPU scheduling, memory management, and file systems.

Process and Thread Management: Explore the concepts of process andthread management, including synchronization and interprocess communication.

Security and Protection: Learn about security mechanisms and protectionstrategies implemented by operating systems.

E1.1.3 Course Contents

1: Introduction to Operating Systems

Definition and functions of operating systems

Historical evolution of operating systems

Types of operating systems (Batch, Multiprogramming, Time-sharing,Distributed)

2: Operating System Architecture

Kernel and user mode System

calls and APIs Interrupts and

system traps**3: Process**

Management

Process concept and process scheduling

4: Scheduling Algorithms

FCFS, SJF, Round Robin

5: Process synchronization and deadlock preventionInterprocess

communication (IPC)

6: Memory Management

Memory hierarchy and addressingVirtual memory

and paging

Memory allocation and deallocation

7: File Systems

File concepts and organization

File system implementation and structureDisk

management and storage

8: Security and Protection

Authentication and authorization Security policies

and mechanisms

Protection mechanisms and access control**E1.1.4**

Teaching and Learning Methods Lectures for

theoretical concepts

Hands-on lab sessions for practical implementation and experimentationCase studies on real-world operating system architectures and issues Group discussions and problem-solving sessions

E1.1.4 Assessment

Continuous assessment through assignments, quizzes, and lab reports Midterm and final examinations covering theoretical and practical aspects

Project work on designing and implementing components of an operatingsystem

E1.1.5 Prescribed Readings

Abraham Silberschatz, P.B. Galvin, G. Gagne, Operating System Concepts,Addison-Wesley, 10th Edition. 2021. John Wiley & Sons

ISBN: 978-1119593443

W. Stallings, Operating Systems: Internals and Design Principles, Prentice-Hall,9th Edition. 2017.

Andrew S. Tanenbaum and Herbert Bos, “Modern Operating Systems”Prentice Hall, 4th Edition. 2014. ISBN: 978-0133591620

E1.1.6 Recommended Readings

Robert Love, (2010)."Linux Kernel Development" Addison-WesleyISBN: 978-0672329463

Mark Russinovich, David A. Solomon, and Alex Ionescu, (2012). "Windows Internals", Microsoft Press

ISBN: 978-0735648739

MOOC-supplement

https://www.nesoacademy.org/operatingsystems

https://www.coursera.org/learn/operatingsystems "Operating System Concepts"

E2.1.0 COM215 Computer Organisation and Architecture (15 Credits)E2.1.1 Rationale

The course "COM215 Computer Organisation and Architecture" is designed toprovide students with a comprehensive understanding of the fundamental principles and components that constitute computer systems. By delving into the intricacies of computer organization and architecture, students will gain insights into the logical design, internal structure, and functioning of computersystems. This knowledge is essential for anyone aspiring to work in the field of information technology or computer science.

E2.1.2 Learning Outcomes

Upon completion of this course, students should be able to:

Understand the principles of combinational and sequential logic, and theirapplication in computer systems.

Grasp the architecture and functioning of memory systems in computers.

Comprehend the role and organization of bus structures in connecting differentcomponents of a computer.

Understand the design and operation of input/output systems in computerarchitecture.

Analyze the organization of the Central Processing Unit (CPU) and itscomponents.

Differentiate between various processor types and understand instruction sets.

Explore process management, including processes, threads, synchronization,CPU scheduling, and handling deadlocks.

Understand the principles of memory management, covering main memoryand virtual memory.

Explore mass-storage structure, file-system interfaces, file-system implementation,and I/O systems.

Analyze the concepts of protection and security in computer systems.

E1.1.3 Course Contents

1: Combinational Logic

Basic principles of combinational logic circuitsDesigning combinational

circuits

2: Sequential Logic

Introduction to sequential logic circuits Designing sequential

circuits and state machines**3: Memory Systems**

Types of memory systems (RAM, ROM, Cache)Memory hierarchy and

organization

4: Bus Structure

Purpose and organization of bus structures

Interconnecting components using buses **5:**

Input/Output Systems

Input/output devices and their interfacesDesigning

efficient I/O systems

6: CPU Organisation

Structure and components of the Central Processing Unit (CPU)Control unit and ALU design

7: Processor Types and Instruction Sets

Different processor architectures (CISC, RISC) Understanding instruction

sets and addressing modes**8: Process Management**

Processes and threads in operating systems Process

synchronization and CPU scheduling

9: Memory Management, Storage Management, Protection, and Security

Principles of memory management and virtual memory

Mass-storage structure, file-system interfaces, and implementationConcepts of protection and security in computer systems

E1.1.4 Teaching and Learning Methods

Lectures for theoretical concepts and principles

Practical sessions for hands-on experience with logic design and architecturesimulation

Case studies and real-world examples for practical applicationGroup projects for in-depth exploration of specific aspects **E1.1.4 Assessment**

Continuous assessment through assignments, quizzes, and participation Midterm and final examinations covering theoretical and practical aspects Group projects evaluating the application of concepts in real-world scenarios**E1.1.5 Prescribed Readings**

Patterson D. A. and Hennessy J. L. (2010). Computer Organization and Design;2nd Edition, Prentice-Hall.

John L. Hennessy et al. (2017) Computer Architecture: A Quantitative Approach. Morgan Kaufmann, ISBN: 978-0128119051

David A. Patterson, John L. Hennessy, (2017). "Computer Organization andDesign:

The Hardware/Software Interface", Morgan Kaufmann, ISBN: 978-0128122754

E1.1.6 Recommended Readings

"ACM Transactions on Computer Systems"

Publisher: Association for Computing Machinery (ACM)

COM 211 DIGITAL LOGIC (15 Credits) RATIONALE

The course addresses the concepts, principles and techniques of designing digital systems. The course teaches the fundamentals of digital systems applyingthe logic design and development techniques.

COURSE OBJECTIVES:

1. To teach various number systems, binary codes and their applications

2. To familiarize the students the importance of error detection and errorcorrection codes.

3. To inculcate concepts of K-MAP to simplify a Boolean expression

4. To facilitate students in designing a logic circuitCOURSE

OUTCOMES:

At the end of the course students will be able to:

1. Use number systems and complements

2. Identify the importance of canonical forms in the minimization or other optimization of Boolean formulas in general and digital circuits.

3. Minimize functions using any type of minimizing algorithms (Boolean algebra, Karnaugh map or Tabulation method).

4. Analyze the design procedures of Combinational and Sequential circuits.

5. Design the finite state machine using algorithmic state machine charts andperform simple projects with a few flip-flops.

1: Boolean Algebra Introduction to

Boolean Algebra Definition and basic

operations Boolean laws and theorems

Boolean Functions and SimplificationBoolean expressions

Karnaugh maps (K-maps) for simplification

2: Logic Gates and NetworksBasic Logic

Gates

AND, OR, NOT gates NAND,

NOR, XOR gates

Universal Gates and De Morgan's Theorems

3: Verilog/System Verilog HDL

Introduction to Hardware Description Languages (HDLs) Purpose and

significance

Overview of Verilog and System Verilog Verilog/System

Verilog Syntax and Structure**4:** Module declaration and

instantiation Behavioral and structural modeling

5: Combinational Logic Circuit Synthesis and OptimizationCombinational Circuit

Synthesis

Multiplexers and demultiplexersEncoders

and decoders

Circuit Optimization TechniquesKarnaugh

map optimization

6: Number Representation and Arithmetic CircuitsBinary Number

Systems

Binary, octal, and hexadecimalBinary

arithmetic basics Arithmetic Circuits

7: CMOS Technology and Programmable Logic Devices

Introduction to CMOS Technology Basics of

CMOS transistors

CMOS logic gates

Programmable Logic Devices (PLDs)

Implementation of combinational and sequential logic using PLDs

8: Flip-flops, Registers, and CountersFlip-flops

SR, JK, D, and T flip-flopsFlip-flop

applications

9: Registers and Counters

10: Finite State Machines

Introduction to Finite State Machines (FSMs) Basics of state

machines

Types of FSMs

FSM Design and Optimization State

diagram and state table

11: Synchronous Sequential Circuits Introduction to

Synchronous Sequential Circuits Basic concepts and applications

State transition diagrams

Analysis and Design of Synchronous Sequential Circuits

12: Digital System Design Overview of Digital

System DesignBuilding blocks of digital systems

Microprocessors and microcontrollersDesign

Methodologies

13: Asynchronous Sequential Circuits

Introduction to Asynchronous Sequential Circuits Basics of asynchronous circuits

Hazards in asynchronous circuits

Design and Analysis of Asynchronous Sequential Circuits

14: Testing and Testability of Logic CircuitsIntroduction to Testing

Basics of testing in digital logic

Fault models and testing techniques

Testability Analysis and Design for Testability (DFT)Testability measures

Teaching and Learning Methods

Lectures for theoretical concepts

Hands-on lab sessions for practical implementationSimulation exercises using HDL

Group projects and case studies

Assessment

Continuous assessment through lab reports and assignmentsIndividual and group projects

Midterm and final examinations covering theoretical and practical aspects

E1.1.5 Prescribed Readings

John F. Wakerly, (2017). "Digital Design: Principles and Practices", Pearson"Digital Systems: Principles and Applications"

Ronald J. Tocci, Neal S. Widmer, and Gregory L. Moss, (2020). Pearson

M. Morris Mano and Michael D. Ciletti, (2018)."Digital Logic and ComputerDesign"

E1.1.6 Recommended Readings

M. Morris Mano and Charles R. Kime, (2017)."Logic and Computer DesignFundamentals"

Brian Holdsworth and Clive Woods, (2019)."Digital Logic Design"

Stephen Brown and Zvonko Vranesic ,(2021). "Fundamentals of Digital Logic withVHDL Design"

E2.2.0 COM222 Parallel and Distributed Systems (15 Credits)

E2.2.1 Rationale

This course is designed to provide students with a solid foundation in parallel and distributed systems, enabling them to address complex computational problems andcontribute to the advancement of computing technologies.
Students shall acquire comprehensive understanding of the principles, models, andtechnologies underlying parallel and distributed computing.

The course encompasses theoretical foundations, practical applications, and contemporary models such as Google's distribution model. Students will gain hands-onexperience through labs and projects, preparing them for the challenges and opportunities in designing, implementing, and optimizing parallel and distributed systems.

Students will gain an in-depth understanding of the architectural paradigms, algorithms,and tools used in the development of systems that harness parallel processing and distributed computing. The course will cover both theoretical concepts and practical implementations, emphasizing real-world applications and contemporary models, such as the Google distribution model.

E2.2.2 Learning outcomes

Upon successful completion of this course, students will be able to:

Knowledge and Understanding:

- Demonstrate a comprehensive understanding of parallel and distributedcomputing concepts.
- Explain the fundamental principles of parallel processing and distributed systems.
- Analyze various architectural models used in parallel and distributed computing.

Intellectual Skills (Cognitive and Creative Skills):

- Apply parallel algorithms to solve computationally intensive problems.
- Design and implement distributed systems, considering scalability and faulttolerance.
- Evaluate the performance of parallel and distributed applications.

Subject-Specific Skills (Professional Skills):

- Implement parallel algorithms using programming languages such as MPI (Message Passing Interface) and OpenMP.
- Design and deploy distributed systems using modern frameworks like ApacheHadoop and Apache Spark.
- Apply modeling techniques for performance analysis and optimization of paralleland distributed systems.

Reflexive Skills:

- Demonstrate autonomy and judgment in selecting appropriate parallel anddistributed computing models for specific applications.
- Take accountability for the design, implementation, and optimization of paralleland distributed systems.
- Adapt to changes in technology by staying current with emerging trends in thefield.

Transferable Skills:

- Communicate complex concepts related to parallel and distributed systemseffectively.

- Collaborate with peers on the development of parallel and distributedapplications.
- Apply problem-solving skills to address challenges in parallel and distributedcomputing.

E2.2.3 Course content

1: Introduction to Parallel and Distributed Systems

- Overview of parallel and distributed computing.
- Historical context and evolution of parallel processing.

2: Parallel Processing Architectures and Models

- Flynn's taxonomy and classification of parallel processing systems.
- SIMD, MIMD, and hybrid architectures.

3: Distributed Systems Architecture

- Characteristics of distributed systems.
- Client-server and peer-to-peer models.

4: Parallel Algorithms and Programming Models

- Design and analysis of parallel algorithms.
- Programming models: MPI, OpenMP, CUDA.

5: Distributed Computing Models

- Introduction to Google distribution model and MapReduce.
- Apache Hadoop and its ecosystem.

6: Fault Tolerance and Scalability

- Techniques for fault tolerance in distributed systems.
- Scalability challenges and solutions.

7: Emerging Trends and Future Directions

- Overview of contemporary trends such as edge computing and serverlessarchitectures.
- Ethical considerations and challenges in parallel and distributed systems.

E2.2.5 Prescribed Readings

"Distributed Systems: Principles and Paradigms" by Andrew S. Tanenbaum and Maartenvan Steen. "Parallel Programming: Concepts and Practice" by Gregory R. Andrews. Research papers and case studies on Google's distribution model and relatedtechnologies.

E2.2.6 Recommended Readings

1. Hwang, K., Dongarra, J., & Fox, G. C. (2011). Distributed and Cloud Computing: FromParallel Processing to the Internet of Things. Morgan Kaufmann.
2. Snir, M., Otto, S. W., Huss-Lederman, S., Walker, D. W., & Dongarra, J. J. (1998). MPI: The Complete Reference (Vol. 1). MIT Press.
3. Gropp, W., Lusk, E., & Skjellum, A. (1999). Using MPI: Portable Parallel Programming with the Message-Passing Interface. MIT Press.
4. Kevin Dowd, and Andrew Fitz Gibbon
5. Kevin Dowd, and Andrew Fitz Gibbon: "High Performance Computing" by CharlesSeverance, Edition: O'Reilly Media; 1st edition (December 1998)
6. Hager and Gerhard Wellein: "Introduction to High Performance Computing for Scientists and Engineers" by Georg Edition: CRC Press; 1st edition (May 2010)
7. Barry Wilkinson and Michael Allen , "Parallel Programming: Techniques and Applications Using Networked Workstations and Parallel Computers" : Prentice Hall;2nd edition (July 1999)

COM223. Networking and Data Communication (15 Credits)

E2.2.1 Background and Rationale

This module introduces basic networking, LAN, WAN, Ethernet, Wireless technology,basic topologies, internet, intranet, extranet and VLAN technology. Computer networking is the engineering concerned with communication between computers, that is, share data and resources. Computer networks have become an essential tool enabling users to communicate with other systems and to co-operate on applications.It will cover the design and operation of both local and wide area networks, illustratedwith typical practical examples in widespread use. This course is make student comprehend the basic concepts of data communication, networking and the usageof protocols, also to understand and apply the basic concepts of Data flow, Topologiesand Transmission Media. IT also aims at introducing the ISO/OSI model and the impact of the concept of Error Detection and Error Correction so that students are initiated about Network Concepts and be enriched with the Security techniques in Networks.

E2.2.2 Learning Objectives

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

- Explain how networks impact daily life
- Explain how packets are routed from a device on one network to a device on adifferent network
- Describe the role of data networking in the human network.
- Analyse network traffic
- Describe opportunities and challenges posed by converged networks.
- Compare and contrast the main characteristics of common networkarchitectures

E2.2.3 Learning Outcomes

At the end of this course, students should be able to:

- Construct a straight through and a crossover cable.
- Design an addressing scheme for a network.

- Explain the differences between an Ethernet hub and an Ethernet switch
- Describe ARP and it's operation
- Create a physical design of a simple Ethernet LAN

E2.2.4 Prerequisites

1. None

E2.2.5 Course content

1: Network Security

1 Confidentiality

2 Integrity

3 Availability

4 Authenticity

2: Firewalls

1 Definition

2 Features of firewalls3

How firewalls work 4

Types of firewalls

3: Virtual Private Networks1

Definition

2 How does VPN work

3 Is VPN traffic encrypted

4: Wireless Network Standards

Wi-Fi Standards (IEEE 802.11):

- 802.11a: Operates in the 5 GHz frequency band
- 802.11b: Operates in the 2.4 GHz frequency band
- 802.11g: Also operates in the 2.4 GHz frequency band

- 802.11n: Works in both 2.4 GHz and 5 GHz frequency bands
- 802.11ac: Operates exclusively in the 5 GHz band, providing even higher data rates and improved performance compared to 802.11n. Utilizes widerchannel bandwidths and advanced MIMO.

- 802.11ax (Wi-Fi 6): Designed to operate in both 2.4 GHz and 5 GHz bands, improved efficiency, crowded environments, increased data rates,better powermanagement.

5: Wireless Personal Area Network (WPAN) Standards:

- Bluetooth: Enables short-range wireless communication between devices.Various versions include Bluetooth 1.x, 2.x, 3.x, 4.x, and 5.x, each with improvements in range, data rate, and power consumption.
- Zigbee (IEEE 802.15.4): A low-power, short-range wireless communication standard commonly used in home automation and industrial applications.

6: Cellular (Mobile) Network Standards:

- 5G (Fifth Generation)
- 4G LTE (Long-Term Evolution):
- 3G (Third Generation):
- Combines two or more different types of network topologies.
- Offers flexibility and scalability.
- Commonly used in large enterprise networks.

7: Network Design, implementation and maintenance

- Design a network architecture
- Implement Network plans
- Plan for future troubleshooting of a network
- Implement troubleshooting of maintenance plan

- Design network maintenance manuals

8: Group Project

- Design a network
- Plan for future maintenance
- Implement a network based on known standards
- Test the network throughput and error rates
- Configure network for improved performance
- Documentation

E3.2.6 Course Delivery

1.0. Lectures,

2.0. Tutorials,

3.0. Group Presentations

E3.2.7 Assessment

Component of assessment	Number	Contribution to overall grading (%)
Continuous assessment		
Assignments	1	10
Presentation	1	10
Tests	1	20
Final examination	1	60
Total Marks		100

E3.2.8 Prescribed readings

1. Curt M. White (2013), **Data Communications and Computer Networks: A Business User's Approach**, Edition: 7th: ISBN-978-1-133-62721-0
2. Jerry FitzGerald et al. (2020) **Business Data Communications and Networking.**

E3.2.9 Recommended Readings

1. Willian Stallings (2011). **Data and Computer Communications**, 10th Edition.Pearson Education.
2. Olifer, N. & Olifer, N, (2012). **Computer Networks: Principles, Technologies andProtocols for Network Design**. J. Wiley & Sons

E2.2.0 COM224 Real Time and embedded Systems (15 Credits)

E2.2.1 Rationale

This course in Real-Time and Embedded Systems is designed to provide students with acomprehensive understanding and practical skills in the design, development, and implementation of real-time and embedded systems. The course covers fundamental concepts, principles, and methodologies essential for creating systems that meet stringent timing and performance requirements.

E2.2.2 Learning outcomes

Upon successful completion of this course, students will be able to:

- Understand the Principles of Real-Time Systems
- Master Embedded Systems Design
- Learn Real-Time Operating Systems (RTOS)
- Programming for Embedded Systems
- Real-Time Communication Protocols
- Hardware-Software Co-Design

E2.2.3 Course content

1: Understand the Principles of Real-Time Systems:

- Define real-time constraints and requirements.
- Analyze and classify real-time systems.
- Examine the challenges and considerations in designing systems with real-timeconstraints.

2: Master Embedded Systems Design:

- Explore the architecture and components of embedded systems.
- Understand the role of microcontrollers and microprocessors in embeddedsystems.
- Design and implement embedded systems for specific applications.

3: Learn Real-Time Operating Systems (RTOS):

- Analyze the characteristics and requirements of RTOS.
- Evaluate different RTOS architectures and functionalities.
- Develop applications using RTOS for real-time environments.

4: Programming for Embedded Systems:

- Acquire proficiency in low-level programming languages such as C andassembly.
- Develop, test, and debug embedded software applications.
- Explore methodologies for optimizing code in resource-constrainedenvironments.

5: Real-Time Communication Protocols:

- Study communication protocols suitable for real-time systems.
- Analyze the performance of different communication protocols.
- Design and implement communication interfaces for real-time applications.

6: Hardware-Software Co-Design:

- Explore co-design methodologies for integrating hardware and softwarecomponents.
- Understand the challenges and benefits of co-design in embedded systems.
- Develop practical skills in hardware-software co-design.

7: System Verification and Validation:

- Explore techniques for verifying and validating real-time and embeddedsystems.
- Develop and execute test plans to ensure system correctness.
- Analyse and troubleshoot real-time system failures.

8: Security in Embedded Systems:

- Understand security challenges in embedded systems.

- Implement security features and protocols.
- Analyze and mitigate security risks in real-time environments.

E 2.2.4 Teaching and Learning Methods

Capstone Project	Full –time / Distance Learning
Physical lectures	Full –time / Distance Learning
Virtual lectures	Full –time / Distance Learning
Tutorial	Full–time / Distance Learning
Group Discussion	Full–time / Distance Learning
Independent Study	Full–time / Distance Learning
Case Studies	Full–time / Distance Learning
laboratory sessions	Full–time
Guest Lecturer	Full–time / Distance Learning

E2.2.5 Assessment

- Assignment
- Continuous Assessments
- Projects Defence
- Tests
- Exam

E2.2.5 Prescribed Readings

- Jane W. S. Liu, "Real-Time Systems"
- Jonathan Valvano, "Embedded Systems: Introduction to ARM Cortex-M Microcontrollers"
- Michael Barr, "Programming Embedded Systems in C and C++"
- Raj Kamal, "Embedded Systems: Architecture, Programming and Design"
- Phillip A. Laplante, "Real-Time Systems Design and Analysis: An Engineer'sHandbook"
- Jonathan Valvano, "Embedded Systems: Real-Time Operating Systems for ARMCortex-M Microcontrollers"

E2.2.6 Recommended Readings

Case Studies

8. Jack Ganssle,"Embedded Systems: World Class Designs"
9. Alan Burns and Andy Wellings, "Real-Time Systems and Programming Languages:Ada, Real-Time Java, and C/Real-Time POSIX"John W. McCormick and Frank Singhoff, "Building Parallel, Embedded, and Real-Time Applications with Ada"
10. Jean J. Labrosse, "MicroC/OS-II: The Real-Time Kernel"

E2.2.1 COM225 Discrete Mathematics (15 Credits)

E2.2.2 Rationale

The course "COM225 Discrete Mathematics" provides a foundational understanding of discrete mathematical structures and their applications, with aspecific focus on their relevance in ICT. Discrete mathematics is essential for problem-solving and forms the basis for various algorithms and data structures used in ICT.

E2.2.3 Learning Outcomes

Upon completion of this course, students should be able to:

Understand the Foundations: Grasp the fundamental concepts and principles ofdiscrete mathematics.

Apply propositional logic to analyze and construct logical arguments.

Work with sets and set operations, including Cartesian products and power sets. Understand relations and functions, their types, and properties.

Apply counting principles, permutations, and combinations in problem-solving.Use mathematical induction to prove statements and solve problems.

Understand the basics of graph theory, including types of graphs and graphrepresentations.

Implement graph algorithms such as Breadth-First Search (BFS) and Depth-First Search (DFS), as well as shortest path algorithms.

Explore the properties of trees, tree traversal algorithms, and Binary Search Trees(BST).

Explore elementary number theory, divisibility, prime numbers, and modulararithmetic.

Master various formal proof techniques, including direct proof and proof bycontrapositive.

E2.2.5 Course Contents

1: Introduction to Discrete Mathematics

Definition and importance Applications in ICT

and other fields

2: Propositional Logic

Propositions and logical connectives Truth tables and

logical equivalencesImplications and quantifiers

3: Set Theory

Sets and OperationsBasic

set operationsCartesian

product Power set

4: Relations and Functions

Definition of relations

Types of relations (reflexive, symmetric, transitive)Functions and their

properties

5: Counting Principles

Multiplication and addition principlesPermutations and

combinations

6: Mathematical Induction

A First Form of Induction

Template for Constructing Proofs by Induction Application: Fibonacci

Numbers

7: Graph Theory

Introduction to Graphs Definitions and

basic concepts

Types of graphs (directed, undirected, weighted)Graph

representations

8: Graph Algorithms and Trees

Breadth-First Search (BFS) and Depth-First Search (DFS)Shortest path

algorithms (Dijkstra's, Bellman-Ford) Trees, Binary trees, and Binary Search

Trees (BST)

E2.2.6 Teaching and Learning Methods

Lectures: Theoretical concepts and principles

Problem-Solving Sessions: Practical application of conceptsGroup Discussions:

Collaboration on problem-solving

Hands-On Exercises: Application of counting principles, graph algorithms, andproof techniques

E2.2.7 Assessment

Continuous Assessment: Assignments, quizzes, and participation

Midterm and Final Examinations: Theoretical and problem-solving assessmentsProjects: Graph algorithms

implementation, proof construction

E2.2.8 Prescribed Readings

Kenneth H. Rosen, (2022), "Discrete Mathematics and its Applications"McGraw-Hill Education,

ISBN: 978-1260091991

Authors: Ronald L. Graham, Donald E. Knuth, Oren Patashnik, (2021), "ConcreteMathematics: A Foundation for Computer Science", Addison-Wesley

ISBN: 978-0201558029

Richard J. Trudeau, (2018), "Introduction to Graph Theory", Dover Publications ISBN: 978-0486678702

E2.2.9 Recommended Readings

"Journal of Discrete Mathematics"

Publisher: Hindawi

"Discrete Mathematics: An Open Access Journal"Publisher: MDPI

E3.1.0 COM311: Software Engineering (Group Project) (15 Credits)

E3.1.1 Background and Rationale

This module provides a student with the opportunity to employ the skills necessary to develop a computing programs, systems and applications. It involves research, analysis,design, coding, testing and project management knowledge and skills

The module is also a combination of project sessions, extensive private study and supervision. Students will produce for assessment a proposal, report, demonstration andpresentation of their project.

E3.1.2 Learning Objectives

By the end of this module, students should be able to:

- Analyze the changes in a functional unit that can be performed in order to meetprescribed requirements for maintenance.
- Correct the extent to which software meets its specified requirements.
- Reuse the extent to which a module can be used in multiple applications.

E4.3.3 Learning Outcomes

- At the end of this course, students should be able to:
- Apply the software engineering lifecycle by demonstrating competence in
- Communication, planning, analysis, design, construction, and deployment
- Possess an ability to work in one or more significant application domains
- Work as an individual and as part of a multidisciplinary team to develop and
- Deliver quality software
- Demonstrate an understanding of and apply current theories, models, and
- Techniques that provide a basis for the software lifecycle
- Demonstrate an ability to use the techniques and tools necessary for

- Engineering practice

E4.3.4 Course content

1. Purpose, Objective, Materials, and Methods:

1.1 Defining Purpose and Objectives:

- Clarifying the purpose of software engineering in software development.
- Setting specific, measurable, and achievable course objectives.

1.2 Materials and Tools Used:

- Introduction to software development tools (IDEs, version control, project management tools).
- Overview of programming languages and frameworks used in the course.

1.3 Software Engineering Methods:

- Explanation of various software engineering methodologies (Agile, Waterfall,Scrum).
- Introduction to software development life cycle models.

2. Problem Description, Scope, and Limitation:

2.1 Defining the Problem:

- Identifying and articulating a real-world problem or project.
- Describing the significance and relevance of the chosen problem.

2.2 Scope of the Project:

- Defining the boundaries and extent of the project.
- Outlining the functionalities and features within the project's scope.

2.3 Limitations of the Project:

- Identifying potential constraints, challenges, and limitations.
- Managing expectations regarding what the project may not address.

3. Laboratory or Simulation Work, Case Study, or Field Work:

3.1 Laboratory or Simulation Work:

- Hands-on exercises using development environments.
- Simulating real-world scenarios to apply theoretical concepts.

3.2 Case Study:

- Analyzing real-world examples of software engineering successes andchallenges.
- Understanding the application of software engineering principles in industrycases.

3.3 Field Work (if applicable):

- Engaging with external projects or industry partners.
- Applying software engineering concepts in a practical, real-world context.

4. Presentation of Achieved Results:

4.1 Project Demonstration:

- Showcasing the developed software or solution.
- Highlighting key features and functionalities.

4.2 Documentation:

- Creating user manuals and technical documentation.
- Ensuring comprehensive documentation for future reference.

5. Discussion about the Validity and Reliability of the Results:

5.1 Validation of Results:

- Ensuring that the software meets the specified requirements.
- Verifying that the project objectives have been achieved.

5.2 Reliability Assessment:

- Evaluating the robustness and stability of the software.
- Conducting testing procedures and addressing potential vulnerabilities.

6. Analysis and Conclusion of the Work:

6.1 Data Analysis:

- Analyzing data collected during the software development process.
- Assessing the performance and efficiency of the developed solution.

6.2 Drawing Conclusions:

- Summarizing key findings and insights.
- Reflecting on the overall success of the project.

7. Project Report:

7.1 Structure of the Project Report:

- Introduction, problem statement, and objectives.
- Methods, materials, and tools used.
- Results, analysis, and discussion.

7.2 Formatting and Documentation Guidelines:

- Following proper citation and referencing styles.
- Ensuring clarity, coherence, and professionalism in the report
  - PowerPoint Presentation
  - User Manuals

8: Group Project

E4.3.5 Course delivery

- Class Presentations
- Discussions
- Group work
- Laboratory work

E4.3.6 Assessment

Component of assessment	Number	Contribution to overall grading (%)
Continuous assessment		
Fact Finding Tools	1	10

developed		
Presentation of Systems Requirements	1	10
System Tests of completed system components	1	20
Project Defense	1	60
Total Marks		**100**

E1.1 COM312 Algorithms and Complexity (15 Credits)

E1.1.1 Rationale

The course "COM312 Algorithms and Complexity" is designed to provide studentswith a profound understanding of algorithmic design, analysis, and the theoretical aspects of computational complexity. Algorithms are fundamental to computer science, and a deep comprehension of their design principles and efficiency is crucial for solving complex computational problems. This course aims to equip students with the knowledge and skills needed to design efficient algorithms, analyze their time and space complexity, and comprehend the theoretical foundations of algorithmic problems.

E1.1.2 Learning Outcomes

Upon completion of this course, students should be able to:

Demonstrate proficiency in designing algorithms for various computationalproblems.

Analyze the time and space complexity of algorithms using asymptotic notation(Big-O, Omega, Theta).

Understand the theoretical foundations of computational complexity, includingP vs. NP problems.

Implement and analyze the efficiency of sorting and searching algorithms.

Apply algorithms to solve problems related to graphs, including traversal,shortest paths, and spanning trees.

Comprehend and apply dynamic programming techniques to solveoptimization problems.

Understand and implement divide-and-conquer algorithms for efficientproblem-solving.

Apply greedy algorithms to solve optimization problems.

E1.1.3 Course Contents

1: Introduction to Algorithms and Complexity Analysis

Basics of algorithmic design

Asymptotic notation (Big-O, Omega, Theta)Time and space

complexity analysis

2: Sorting and Searching Algorithms

Comparison-based and non-comparison-based sorting algorithmsEfficiency analysis of sorting

algorithms

Searching algorithms and their applications

3: Graph Algorithms

Graph representation and basic graph algorithms Depth-first search (DFS)

and breadth-first search (BFS)Shortest path algorithms (Dijkstra's and

Bellman-Ford) **4: Dynamic Programming**

Principles of dynamic programming Applications in

optimization problems Memoization and tabulation

techniques**5: Divide and Conquer**

Divide-and-conquer strategies

Application in sorting and searching problems

Efficiency analysis

6: Greedy Algorithms

Principles of greedy algorithms Applications in

optimization problems

Huffman coding and Minimum Spanning Tree (MST) algorithms

7: Computational Complexity

Introduction to computational complexity theory

P vs. NP problems and the importance of complexity classes

8: Review and Advanced Topics

Review of key concepts

Discussion of advanced algorithmic topics based on student interest

E1.1.4 Teaching and Learning Methods

Lectures for theoretical concepts and algorithmic principles

Practical sessions for hands-on implementation and analysis of algorithmsProblem-solving sessions

and coding exercises

Group projects for real-world application of algorithms

E1.1.4 Assessment

Continuous assessment through assignments, coding exercises, and quizzesFinal examinations covering

theoretical and practical aspects

Algorithm design projects and presentations

E1.1.5 Prescribed Readings

Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, (2009),"Introduction to Algorithms", The MIT Press, ISBN: 978-0262033848

Robert Sedgewick, Kevin Wayne, (2011 "Algorithms", Addison-WesleyISBN: 978-0321573513

Sanjeev Arora, Boaz Barak, (2009), "Computational Complexity: A ModernApproach"

Cambridge University Press, ISBN: 978-0521424264

E1.1.6 Recommended Readings

"Journal of the ACM (JACM)"

Publisher: Association for Computing Machinery (ACM)

E4.3.7 Prescribed readings

1. Sommerville I. (2011), Software Engineering, Addison-Wesley, 9th Edition; ISBN-13:978-0-13-703515-1
2. Titus Winters et al. (2020) Software Engineering at Google: Lessons Learned fromProgramming Over Time
3. 4.3.8 Recommended readings
4. Roger S. Pressman (2010) Software Engineering: A Practitioner's Approach, 7thEdition; Publisher: McGraw-Hill Companies, ISBN ISBN 978–0–07–337597–7
5. Dawson, C. (2011), Project in Computing and Information Systems: A Student'sGuide, Publisher: Pearson Addison Wesley.

E1.1 COM313 Clusters and High Performance Computing (15 Credits)

E1.1.1 Rationale

High-Performance Computing (HPC) relies on a variety of software tools and libraries toenable efficient parallel computing, optimization, and management of large-scale computational tasks. Course allows for a comprehensive exploration of the key concepts and practical skills in this field. These tools and libraries play a crucial role in the development, optimization, and execution of HPC applications across various domains, including scientific research, engineering, and data analysis. The choice of specific tools may depend on the application requirements, hardware architecture, and user preferences.

E1.1.2 Learning outcomes

a) Knowledge and Understanding:

- Demonstrate critical understanding of the fundamental principles and conceptsunderlying cluster computing and high-performance computing architectures.
- Explain the theoretical foundations of parallel processing and how it is applied inhigh-performance computing systems.
- Evaluate the different types of clusters and their suitability for specificcomputational tasks.

b) Intellectual Skills (Cognitive and Creative Skills):

- Apply parallel programming techniques to design and implement efficientalgorithms for high-performance computing applications.
- Analyze and optimize the performance of parallelized code in a clustercomputing environment.
- Create innovative solutions for complex computational problems usingadvanced

clustering and parallel computing approaches.

c) Subject-Specific Skills (Professional Skills):

- Design and configure high-performance computing clusters tailored to specificcomputational workloads.
- Develop and implement strategies for efficient data storage, retrieval, andcommunication within a cluster.
- Execute performance profiling and tuning techniques to enhance the overallefficiency of high-performance computing systems.

d) Reflexive Skills:

- Demonstrate autonomy in troubleshooting and resolving issues related to clusterand high-performance computing.
- Exercise accountability in decision-making processes regarding the selectionand implementation of cluster technologies.
- Apply critical judgement in adapting cluster computing solutions to accommodate changes in computational requirements or technologicaladvancements.

e) Transferable Skills:

- Communicate complex technical concepts related to clusters and high-performance computing effectively, both orally and in writing.
- Utilize numeracy skills to analyze and interpret performance metrics andbenchmarks in a cluster computing context.
- Collaborate with interdisciplinary teams, demonstrating the ability to integrateand apply knowledge in diverse professional settings.

E3.1.3 Course content

1: Introduction to Clusters and HPC

- Overview of High-Performance Computing
- Importance of Clusters in HPC

- Historical perspective and evolution of HPC

2: Basic Concepts

- Parallel and Distributed Computing
- Flynn's Taxonomy
- Message Passing Interface (MPI)

3: Cluster Architecture

- Cluster Components and Architecture
- Network Topologies (e.g., bus, ring, mesh, tree)
- Cluster Interconnects (e.g., InfiniBand, Ethernet)

4: Parallel Programming Models

- Shared Memory Models (OpenMP)
- Distributed Memory Models (MPI continued)
- MPI-based Libraries: Libraries built on top of MPI for specific tasks (e.g., parallel I/O). Example: PETSc (for scalable linear algebra operations), HYPRE (for solving large,sparse linear systems).
- Hybrid Models (Combining OpenMP and MPI)
- Message Passing Interface (MPI) is a standard for parallel programming in distributed memory systems. Examples: Open MPI, MPICH, Intel MPI.

5: Performance Optimization

- Performance Metrics and Measurement
- Load Balancing and Scalability
- Parallel Algorithms and Optimization Techniques

6: Advanced Topics

- GPU Computing and Accelerators
- Cloud Computing for HPC
- Big Data and HPC Integration

7: Applications and Future Trends

- Real-world Applications of HPC
- Emerging Technologies and Trends in HPC
- Ethical and Societal Considerations in HPC

E 3.1.4 Teaching and Learning Methods

Capstone Project	Full –time / Distance Learning
Physical lectures	Full –time / Distance Learning
Virtual lectures	Full –time / Distance Learning
Tutorial	Full–time / Distance Learning
Group Discussion	Full–time / Distance Learning
Independent Study	Full–time / Distance Learning
Case Studies	Full–time / Distance Learning

E3.1.4 Assessment

- Assignment
- Continuous Assessments
- Projects Defense
- Tests
- Exam

E3.1.5 Prescribed Readings

11. Dongarra, J. J., Meuer, H. W., & Strohmaier, E. (Eds.). (2021). TOP500 SupercomputerSites. Retrieved from https://www.top500.org
12. Hwang, K., Dongarra, J., & Fox, G. C. (2011). Distributed and Cloud Computing: FromParallel Processing to the Internet of Things. Morgan Kaufmann.
13. Snir, M., Otto, S. W., Huss-Lederman, S., Walker, D. W., & Dongarra, J. J. (1998). MPI: The Complete Reference (Vol. 1). MIT Press.
14. Gropp, W., Lusk, E., & Skjellum, A. (1999). Using MPI: Portable Parallel Programming with the Message-Passing Interface. MIT Press.
15. Kevin Dowd, and Andrew Fitz Gibbon
16. Kevin Dowd, and Andrew Fitz Gibbon: "High Performance Computing" by CharlesSeverance, Edition:

O'Reilly Media; 1st edition (December 1998)

17. Hager and Gerhard Wellein: "Introduction to High Performance Computing for Scientists and Engineers" by Georg Edition: CRC Press; 1st edition (May 2010)

18. Barry Wilkinson and Michael Allen , "Parallel Programming: Techniques and Applications Using Networked Workstations and Parallel Computers" : Prentice Hall;2nd edition (July 1999)

19. Charles Y. Charles Yun, John Levesque: "High-Performance Computing: Programming and Applications" Morgan Kaufmann; 1st edition (September 2010)

20. "Parallel Programming in C with MPI and OpenMP" by Michael J. Quinn; McGraw-Hill Education; 1st edition (December 2003)

E3.1.6 Recommended Readings

- Foster, I., & Kesselman, C. (1999). The Grid: Blueprint for a New ComputingInfrastructure. Morgan Kaufmann Publishers.
- Sterling, T., Becker, D. J., Savarese, D. F., & Dorband, J. E. (1995). Beowulf: A Parallel Workstation for Scientific Computation. In Proceedings of the 24th International Conference on Parallel Processing (ICPP '95), Santa Barbara, CA,USA.
- Foster, I., Zhao, Y., Raicu, I., & Lu, S. (2008). Cloud Computing and Grid Computing 360-Degree Compared. In Grid Computing Environments Workshop(GCE '08), Austin, TX, USA.
- Buyya, R., Yeo, C. S., & Venugopal, S. (2008). Market-Oriented Cloud Computing:Vision, Hype, and Reality for Delivering IT Services as Computing Utilities. In Proceedings of the 10th IEEE International Conference on High-Performance Computing and Communications (HPCC '08), Dalian, China.
- Turilli, M., & Floridi, L. (2009). The Ethics of Information Transparency. Ethics andInformation Technology, 11(2), 105–112.
- Berman, F., Fox, G., & Hey, A. (Eds.). (2012). Grid Computing: Making the GlobalInfrastructure a Reality. John Wiley & Sons.

E3.1 COM314 Human-Computer Interaction (HCI) (15 Credits)

E3.1.1 Rationale

Human-Computer Interaction (HCI) course cover essential topics to computer science students, while providing students with a comprehensive understanding of the field. Thiscourse provides a balanced coverage of foundational HCI concepts, practical skills, and emerging trends. Guest lectures or case studies from industry professionals will be used to enhance the practical relevance of the course.

E3.1.2 Learning outcomes

a) Knowledge and Understanding:

- Demonstrate a critical understanding of fundamental principles and theories in Human-Computer Interaction, including user-centered design, usability, and user experience.
- Explain the key concepts related to interface design, interaction models, andinformation architecture in various computing environments.

b) Intellectual Skills (Cognitive and Creative Skills):

- Apply user-centered design principles to create effective and efficientinteractive systems.
- Analyze and evaluate the usability of interactive products through heuristicevaluation, usability testing, and user feedback.
- Synthesize and creatively apply HCI concepts to solve real-world problems in technology design and user experience.

c) Subject-Specific Skills (Professional Skills):

- Design and develop interactive prototypes and interfaces using relevant toolsand technologies.
- Conduct usability testing sessions and interpret the results to inform designimprovements.
- Collaborate effectively in multidisciplinary teams to develop user-friendlysoftware applications or systems.

d) Reflexive Skills:

- Demonstrate autonomy in problem-solving by reflecting on and adapting designdecisions based on user feedback and changing project requirements.
- Exhibit accountability by justifying design choices and recognizing the ethicalconsiderations in HCI, such as user privacy and accessibility.
- Exercise judgment in selecting appropriate HCI methods and techniques for specific design challenges.

e) Transferable Skills:

- Communicate HCI concepts and design decisions clearly and persuasively, bothin written and oral formats.

- Utilize numeracy skills to analyze quantitative data related to user behavior andsystem performance.
- Adapt to technological changes by staying informed about emerging trends inHCI and integrating new tools and methodologies into the design process.

E3.1.3 Course content

1: Introduction to HCI Week 1:

Overview of HCI

- Definition and scope of HCI
- Historical perspective
- Importance of HCI in technology development

2: Human Factors and Ergonomics

- Basics of human cognition and perception
- Ergonomic principles
- Anthropometry and user diversity

3: Usability Principles

- Learnability, efficiency, memorability, errors, and satisfaction
- Nielsen's heuristics

4: Interaction Design Models

- The design process: ideation, prototyping, evaluationUser-centered design

5: User Research and Analysis

- Surveys, interviews, observations
- Personal development

6: Data Analysis for HCI

- Qualitative and quantitative data analysis
- Affinity diagrams, journey maps

7: Prototyping Techniques

- Paper prototyping, wireframes, interactive prototypes
- Design tools (e.g., Figma, Sketch)

8: Usability Testing

- Planning and conducting usability tests
- Analyzing and interpreting usability test results

9: Advanced Interaction Techniques

10: Gestural and Tangible Interaction

- Touchscreens, gestures, and tangible interfaces
- Emerging technologies

11: Voice Interaction and Natural Language Processing

- Voice user interfaces (VUI)
- Conversational interfaces

12: User Experience (UX) Design

13: Introduction to UX

- Defining UX, user journey mapping
- Emotional design

14: Information Architecture and Navigation

- Site maps, card sorting, navigation design
- Accessibility in HCI

15: Special Topics and Future Trends

16: HCI and Emerging Technologies

- AR/VR, AI in HCI
- Ethical considerations in HCI

17: Capstone Project and Future Directions

- Group project applying HCI principles
- Reflection on the future of HCI

E 1.1.4 Teaching and Learning Methods

• Capstone Project	Full –time / Distance Learning
• Physical lectures	Full –time / Distance Learning
• Virtual lectures	Full –time / Distance Learning
• Tutorial	Full–time / Distance Learning
• Group Discussion	Full–time / Distance Learning
• Independent Study	Full–time / Distance Learning

- Case Studies   Full–time / Distance Learning

E1.1.4 Assessment

- Assignment

- Continuous Assessments
- Projects Defense
- Tests
- Exam

E1.1.5 Prescribed Readings

Books:

1. Cooper, A., Reimann, R., & Cronin, D. (2007). About Face 3: The Essentials ofInteraction Design. Wiley.

2. Dix, A., Finlay, J., Abowd, G., & Beale, R. (2004). Human-Computer Interaction. Pearson Education.

3. Shneiderman, B., & Plaisant, C. (2010). Designing the User Interface: Strategies for Effective Human-Computer Interaction. Pearson.

Journal Articles:

4. Norman, D. A. (2002). The Design of Everyday Things. Basic Books.

5. Nielsen, J., & Molich, R. (1990). Heuristic evaluation of user interfaces. Proceedings of the SIGCHI conference on Human factors in computing systems.

6. Carroll, J. M. (2003). HUMAN-COMPUTER INTERACTION: Psychology as a Science of Design. Annual Review of Psychology, 54(1), 491–516.

E1.1.6 Recommended Readings

1. Conference Papers:

2. Card, S. K., Moran, T. P., & Newell, A. (1980). The keystroke-level model for user performance time with interactive systems. Communications of the ACM, 23(7),396–410.

3. Nielsen, J. (1993). Usability engineering. Academic Press.

4. Online Resources:

5. ISO 9241-210:2010. Ergonomics of human-system interaction — Part 210: Human- centred design for interactive systems. International Organization for Standardization.

6. ACM Digital Library - Human-Computer Interaction Journals and Proceedings. https://dl.acm.org/

E3.1. BA314 ENTREPRENEURSHIP (15 Credits)

Pre-requisite: None

E3.1.1 Rationale

The "Entrepreneurship" course is designed to empower students with the essential skills, knowledge, and values required to initiate, manage, and expand their enterprises. In a dynamic economic landscape, fostering an entrepreneurial mind set is crucial for students to contribute to economic development and job creation. The course covers foundational concepts of entrepreneurship, various types of entrepreneurs, and the roleof entrepreneurship in economic development. Students will explore personal and practical aspects of becoming an entrepreneur, focusing on competencies, characteristics, attitudes, self-motivation, positive thinking, creativity, innovation, and networking for enterprise development.

E3.1.2 Learning Outcomes

At the end of the course students will be expected to:

1. Demonstrate an understanding of the concepts and processes of entrepreneurship
2. Demonstrate that they have developed some entrepreneurial competencies
3. Demonstrate that they can Identify business opportunities
4. Demonstrate understanding of how to Interpret the Entrepreneurial Environment
5. Demonstrate that one understands how to Prepare Business Plan and Establish theEnterprise
6. Explain how to Manage finances in an enterprise
7. Demonstrate that one can Apply Enterprise Management Skills
8. Demonstrate that once has the knowledge to Sustain and Grow an Enterprise

E3.1.3 Course Content

- Introduction to Enterprise and The Concepts of Entrepreneurship
- Entrepreneurial Concepts
- Types of Entrepreneurs
- Role of Entrepreneurship in Economic Development
- Forms of Business organisations
- Common Business Start-ups
- Becoming an Entrepreneur and Developing

Entrepreneurial Competencies

- Entrepreneurial Competencies, characteristics and Attitudes
- Review personal backgrounds of foreign and local Entrepreneurs
- Self-Motivation and Positive Thinking
- Creativity and Innovation
- Networking for enterprise development and other success
- PRACTICAL APPLICATIONS
- Students should be given group assignments that require raising actual moneyfor a social cause (social enterprise). After UNITS 1 and 2.

i. Students should be given practical exercises to identify actual business opportunities, develop business models, undertake feasibility study and develop a business plan. After UNIT 4
ii. Students should be exposed to different types of entrepreneurs –social, aesthetic, family, business, etc. through guest entrepreneurs on how theystarted, challenges and what made them succeed.
iii. Relevant government departments should be involved in exposing studentsto the process of business registration, financing opportunities, taxation incentives and processes etc.
iv. Local and International Case studies should be used so that students appreciate entrepreneurial competencies in practice.

- STARTING A BUSINESS
- Identifying Business Opportunities
- Interpreting the Entrepreneurial Environment
- Business Planning and Establishing the Enterprise
- ENTERPRISE SUCCESS AND GROWTH
- Managing Finances
- Applying Enterprise Management Skills
- Sustaining and Growing Enterprise

E3.5.4 Teaching Method

Lectures, Case Study, Group Discussion, Presentation

E3.5.5 Assessment

Mode of Assessment			**Weight**
Continuous Assessment	**Assignments**	20%	**40%**
	Tests	20%	
Examination			**60%**
Total			**100%**

E3.5.6 Prescribed Textbooks:

1. Hisrich, R. D., Peters, M. P., & Shepherd, D. A. (2019). Entrepreneurship. McGraw-Hill Education.
2. Kuratko, D. F., & Covin, J. G. (2020). Corporate Entrepreneurship and Innovation.Cengage Learning.
3. Burns, P. (2019). Entrepreneurship and Small Business: Start-up, Growth andMaturity. Palgrave Macmillan.

E3.5.7 Recommended Textbooks:

1. Bygrave, W. D., & Zacharakis, A. (2020). Entrepreneurship: The Engine of Growth.Emerald Publishing Limited.
2. Shane, S., & Eckhardt, J. (2020). Entrepreneurship: A Process Perspective.Cengage Learning.
3. Zimmerer, T. W., & Scarborough, N. M. (2018). Essentials of Entrepreneurship andSmall Business Management. Pearson.

E3.1.0 COM315 Information Assurance and Cyber Security (15 Credits)

E3.1.1 Rationale

This course introduces students to cyber security, management concepts regarding Cybersecurity, including security operations, risk management, security engineeringand security architecture, as well as provide guidance on different career paths specialising in cybersecurity. Common attack and defence strategies for software, web applications, networks, operating systems, cryptographic systems and humans.This course focuses on hand-on activities, and students are encouraged to participate in public and industry cybersecurity challenges.

E3.1.2 Learning outcomes

Upon successful completion of this course, students will be able to:

- Demonstrate a deep understanding of the principles and concepts ofInformation Assurance and Cyber Security
- Analyse, select, and apply relevant security frameworks to design andimplement effective security strategies for organizations.
- Evaluate and enhance security governance models, ensuring alignment withorganizational goals and compliance requirements.
- Conduct comprehensive risk assessments, identifying potential threats,vulnerabilities, and impacts on information systems.
- Devise and implement risk mitigation strategies, considering the impact onbusiness operations and continuity.
- Execute and manage security operations, including incident response, threatdetection, and continuous monitoring.
- Apply vulnerability management techniques to identify, prioritize, andremediate security weaknesses in systems and networks.
- Design and implement secure network architectures, considering principles ofsegmentation, isolation, and defense-in-depth

- Evaluate and enhance security mechanisms within operating systems to protectagainst unauthorized access and malicious activities

E3.1.3 Course content

1. Foundational Knowledge:

- Demonstrate a deep understanding of the principles and concepts of Information Assurance and Cyber Security, including the legal and ethicalconsiderations in the field.

2. Security Frameworks and Governance:

- Analyse, select, and apply relevant security frameworks to design andimplement effective security strategies for organizations.
- Evaluate and enhance security governance models, ensuring alignment withorganizational goals and compliance requirements.

3. Cyber Security Management:

Governance and Compliance:

- Regulatory compliance frameworks
- Security policies and procedures
- Security governance models

Incident Response and Management:

- Incident response planning
- Cybersecurity incident types and severity levelsIncident

response team roles and responsibilities

- Security Awareness and Training:
- Developing security awareness programs
- Training employees on security best practices
- Conduct comprehensive risk assessments, identifying potential threats,vulnerabilities, and impacts on information systems.
- Devise and implement risk mitigation strategies, considering the impact onbusiness operations and continuity.

4. Cybersecurity Operations:

- Execute and manage security operations, including incident response, threatdetection, and continuous monitoring.
- Apply vulnerability management techniques to identify, prioritize, and remediatesecurity weaknesses in systems and networks.

5. Network Security:

- Design and implement secure network architectures, considering principles ofsegmentation, isolation, and defence-in-depth.
- Analyse and deploy network security technologies, such as firewalls, intrusion detection/prevention systems, and virtual private networks (VPNs).

6. Application and Operating System Security:

- Assess and implement secure coding practices in application development,mitigating common security vulnerabilities.
- Evaluate and enhance security mechanisms within operating systems to protectagainst unauthorized access and malicious activities.

7. Security Engineering:

- Apply security engineering principles to design, develop, and test securesystems, software, and hardware solutions.
- Implement security architectures that address the confidentiality, integrity, andavailability of information.

8. Cryptography and Secure Communications:

- Apply cryptographic techniques to secure data at rest and in transit.
- Implement secure communication protocols, including encryption, digitalsignatures, and key management.

9. Human Factors and Social Engineering:

- Analyze and address human-related risks, including social engineering attacksand user awareness.
- Develop and deliver security awareness training programs for organizations.

10. Compliance and Legal Considerations:

- Understand and navigate the legal and regulatory landscape related to cybersecurity, ensuring compliance with relevant laws and standards.
- Evaluate the ethical implications of cybersecurity decisions and actions.

11. Hands-On Skills and Practical Application:

- Participate in practical, hands-on activities, such as simulated cyber exercises,penetration testing, and security assessments.

- Apply theoretical knowledge to real-world scenarios, demonstrating problem-solving skills.

12. Communication and Collaboration:
    - Effectively communicate cybersecurity risks, strategies, and solutions to bothtechnical and non-technical stakeholders.
    - Collaborate with multidisciplinary teams to address cybersecurity challenges andimplement solutions.

13. Continuous Learning and Professional Development:
    - Engage in continuous learning, keeping up-to-date with evolving threats,technologies, and industry best practices.
    - Pursue professional development opportunities, certifications, and membershipsin relevant cybersecurity organizations.

14. Ethical Hacking and Defensive Strategies:
    - Apply ethical hacking techniques to identify and exploit vulnerabilities for thepurpose of securing systems.
    - Develop and implement defensive strategies to protect against common cyberthreats and attacks.

E 3.1.4 Teaching and Learning Methods

Capstone Project	Full –time / Distance Learning
Physical lectures	Full –time / Distance Learning
Virtual lectures	Full –time / Distance Learning
Tutorial	Full–time / Distance Learning
Group Discussion	Full–time / Distance Learning
Independent Study	Full–time / Distance Learning
Case Studies	Full–time / Distance Learning
laboratory sessions	Full–time
Guest Lecturer	Full–time / Distance Learning

E3.1.5 Assessment

- Assignment

- Continuous Assessments
- Projects Defence

- Tests
- Exam

E3.1.6 Prescribed Readings

E3.1.7 Recommended Readings

E3.2.1 COM321 Web Apps Development (15 Credits)
E3.2.2 Rationale

The course "COM321 Web Apps Development" is designed to provide students with a comprehensive understanding of web application development, encompassing bothclient-side and server-side technologies. With a focus on modern web development frameworks and best practices, this course aims to equip students with the skills necessary to design, develop, and deploy dynamic and secure web applications.

E3.2.3 Learning Outcomes

Upon completion of this course, students should be able to:

Design and create visually appealing and responsive web interfaces using HTML 5 andCSS.

Understand and apply server-side web development concepts, including thefundamentals of PHP and SQL.

Implement asynchronous communication between the client and server using AJAX.

Incorporate security best practices to protect both client and server-side components of web applications.

Develop server-side logic and interact with databases using PHP and MySQL.

Build complete and functional web applications, covering the entire developmentlifecycle from design to deployment.

E1.1.3 Course Contents Topics

1: Introduction to Web Development

Overview of web development technologies

Introduction to HTML 5 and CSS for front-end development

2: Server-Side Web Development with PHP

PHP fundamentals and syntax Interaction with

databases using SQL

3: Fundamentals of Asynchronous JavaScript and XML (AJAX)

Introduction to AJAX and its applications

Implementing asynchronous communication in web applications

4: Client and Server-side Security

Security considerations in web development

Best practices for securing both client and server-side components

5: PHP and MySQL Integration

Integration of PHP and MySQL for dynamic web applications Database interactions and manipulation using PHP

6: Advanced Web Development Concepts

Introduction to advanced web development frameworks Building scalable and maintainable web applications

7: Web Site Development Project

Group or individual project to design and develop a complete web applicationImplementation of learned concepts in a real-world scenario

8: Deployment and Maintenance

Deployment strategies for web applications Maintenance and ongoing development considerations**E1.1.4 Teaching and Learning Methods**

Lectures for theoretical concepts and best practices

Hands-on coding sessions for practical application of web development technologiesGroup projects for collaborative learning and real-world application

Case studies of successful web applications and industry practices

E1.1.4 Assessment

Continuous assessment through coding assignments and quizzes

Midterm and final examinations covering theoretical and practical aspectsWeb application development project assessment

E1.1.5 Prescribed Readings

Jon Ducket, (2011). "HTML and CSS: Design and Build Websites"Wiley, ISBN: 978-1118008188

Luke Welling, Laura Thomson, (2013), "PHP and MySQL Web Development"Addison-Wesley, ISBN: 978-0321833891

David Sawyer McFarland, (2014). "JavaScript and jQuery: The Missing Manual"O'Reilly Media, ISBN: 978-1491947074

E1.1.6 Recommended Readings

"Journal of Web Development" Publisher:

Taylor & Francis

E1.1 COM322 Advanced Database Management Systems (15 Credits)

E1.1.1 Rationale

The course "COM322 Advanced Database Management Systems" aims to provide students with an in-depth understanding of advanced concepts andtechniques in the field of database management. As businesses and organizations increasingly rely on complex and distributed data systems, this course equips students with the knowledge and skills necessary to design, implement, and manage advanced database systems. The focus is on preparing students for the challenges posed by modern database environments, including distributed databases and object-oriented databasemanagement systems.

E1.1.2 Learning Outcomes

Upon completion of this course, students should be able to:

Understand the broader context of databases in real-world scenarios,considering factors such as scalability, performance, and security.

Master the principles of the relational model and apply them to design efficientand normalized databases.

Demonstrate proficiency in using SQL for database querying, manipulation, andmanagement.

Design and implement Entity-Relationship (ER) models, with a focus onadvanced concepts for complex data relationships.

Apply advanced normalization techniques to ensure the efficiency and integrityof relational databases.

Understand and manage functional dependencies within databases to ensuredata consistency.

Grasp the principles of transaction management, ensuring the integrity andreliability of database transactions.

Explore the challenges and solutions related to distributed databases, includingdata distribution, consistency, and fault tolerance.

Understand the principles and applications of Object-Oriented DatabaseManagement Systems (OODBMS) in modern information systems.

E1.1.3 Course Contents 1: Database Environment

Introduction to advanced database environments Considerations for scalability, performance, and security

2: The Relational Model

Advanced concepts in the relational model Design principles for efficient relational databases

3: SQL (Structured Query Language) Advanced SQL queries and operations Optimization techniques for database queries

4: ER Models and Enhanced Entity–Relationship Modeling

Advanced ER modeling techniques Implementing complex relationships in databases

5: Normalization and Advanced Normalization

Normalization beyond the basics

Strategies for advanced database normalization

6: Functional Dependencies

Managing and resolving functional dependencies

Ensuring data consistency through functional dependencies

7: Transaction Management

Principles of transaction management ACID properties and transaction control

8: Distributed DBMSs

Challenges and solutions in distributed databases Consistency, fault tolerance, and data distribution

9: Object-Oriented DBMSs

Introduction to Object-Oriented Database Management Systems (OODBMS) Applications and advantages of OODBMS in modern systems

E1.1.4 Teaching and Learning Methods

Lectures for theoretical concepts and principles

Practical sessions involving the design and implementation of advanceddatabase features

Case studies and real-world examples for practical applicationGroup projects for in-depth exploration of specific aspects

E1.1.4 Assessment

Continuous assessment through assignments, quizzes, and participation Midterm and final examinations covering theoretical and practical aspects Group projects evaluating the application of advanced database concepts inreal-world scenarios

E1.1.5 Prescribed Readings

Connolly, T. and Begg, C. (2015), **Database Systems: A Practical Approach toDesign**,

Implementation and Management, 6th Edition: Pearson Education Limited. ISBN-13: 978-0-13-294326-0

Water Shields (2019) SQL QuickStart Guide: The simplified beginner’s guide tomanaging, analyzing and manipulating data with SQL.

Stefano Ceri, Giuseppe Pelagatti, (1985) , "Distributed Database Systems"Prentice Hall, ISBN: 978-0132142281

E1.1.6 Recommended Readings

Authors: Abraham Silberschatz, Henry F. Korth, S. Sudarshan, (2019),"DatabaseSystem Concepts", McGraw-Hill Education

ISBN: 978-1260261895

"Journal of Database Management"

"ACM Transactions on Database Systems", IGI Global

E3.4 BA323 BUSINESS MARKETING RESEARCH METHODS (15 Credits)

Pre-requisite: None

E3.4.1 Rationale

The "Business Marketing Research Methods" course is designed to equip students with the knowledge and skills necessary for effective marketing decision-making in the dynamic business environment. This course takes a proactive approach to the management of marketing information, emphasizing the application of research concepts and techniques to marketing decisions. Understanding the nature and role ofmarketing research, its importance, and the inhibiting factors in the Zambian context isessential for making informed strategic decisions. The course covers the entire marketing research process, from problem formulation to research design, data collection methods, sampling concepts, fieldwork, data analysis, and interpretation. Emphasis is also placed on ethical considerations in marketing research.

E3.4.2 Learning Outcomes:

At the end of the course, students are expected to;

- Understand the nature and role of marketing research: Appreciate the significanceof marketing research and its application in marketing management.
- Master the marketing research process: Acquire a comprehensive understanding of the marketing research process, including problem formulation, research design,and data collection methods.
- Gain insights into attitude measurement: Understand the concept of attitude, its importance in marketing, and methods of measuring attitude.
- Explore types and methods of data collection: Differentiate between secondary and primary data, understand the importance of questionnaires and observation,and grasp the distinctions between qualitative and quantitative research.
- Comprehend sampling concepts: Understand the concept of sampling, reasons for sampling, types of sampling, and the process of determining sample size.
- Analyze data and interpret results: Develop skills in editing, coding, tabulations, hypothesis testing, and interpretation of data using statistical packages such as SPSSand Strata.
- Master the research report writing: Gain proficiency in writing a comprehensive research report, covering various sections like introduction, literature review, methodology, data findings, analysis, conclusion, and recommendations.
- Understand the importance of ethics in marketing research: Define ethics in the context of marketing research and identify ethical issues, emphasizing values, stakeholders, and avoiding unethical practices like sugging and frugging.

- Apply knowledge in a research project: Conduct a research project on a marketing problem or opportunity, and present findings through powerpoint presentations, enhancing practical application of the learned concepts.

E3.4.3 Course Content

1. Nature of Marketing Research

1.1 Nature and role of marketing research

1.2 Importance of marketing research

1.3 Inhibiting factors to growth in Marketing Research in Zambia

1.4 Scope of marketing research

2. The marketing Research Process and Problem Formulation

2.1 Overview of the marketing research process

2.2 Problem formulation

3. Research Design

3.1 Exploratory research

3.2 Descriptive research

3.3 Causal Research Design

3.4 Experimental research

4. Attitude measurement

4.1 The concept of Attitude

4.2 Importance of Attitude in Marketing

4.3 Concept of Measurement

4.4 Methods of measuring attitude

5. Types and Methods of collecting Data

5.1 Secondary and Primary data

5.2 Questionnaire and observation

5.3 Types of research: Qualitative and Quantitative

5.4 Validity and Reliability issues

6. Sampling Concepts and Procedures

6.1 The concept of sampling

6.2 Reasons for sampling

6.3 Sample versus census

6.4 The Sampling Process

6.5 Types of Sampling

- Probability Sampling
- Non-Probability sampling

6.6 Sample size determination

7. Fieldwork and Non-Sampling Error

7.1 The concept of Non-sampling error

7.2 Types of Non-Sampling Errors

8. Data analysis and interpretation

8.1 Editing, Coding and Tabulations

8.2 Hypothesis testing and interpretation

8.3 Statistical packages

9. The research Report

9.1 Guidelines to writing a good research report

9.2 Format of the Report

- Title Page
- Declaration
- Table of contents
- Abstract
- Introduction
- Literature Review and Theoretical Framework
- Conceptual Framework
- Methodology
- Data Findings and analysis
- Conclusion and Recommendations
- Reference
- Appendices

10. Marketing Research and code of ethics

- Definition of ethics
- Ethical issues in marketing research

-Value oriented

-stakeholder oriented

-sugging and frugging

11. Statistical packages

- SPSS
- Strata

RESEARCH PROJECT

You are required to carry out a research on a marketing problem or opportunity youwant to solve or exploit in any company and/or industry of your choice.

Power point presentations in groups

Each group is required to submit a spiral bound copy on the date to be communicated

E3.4.4 Teaching Method

Lectures, Case Study, Group Discussion, Presentation

E3.4.5 Assessment

Mode of Assessment			Weight
Continuous Assessment	Assignments	20%	40%
	Tests	20%	
Examination			60%
Total			100%

E3.4.6 Prescribed Textbooks:

1. Malhotra, N. K. (2017). Basic Marketing Research: Integration of Social Media. Pearson.
2. Churchill, G. A., & Brown, T. J. (2019). Basic Marketing Research. CengageLearning.
3. Zikmund, W. G., Babin, B. J., Carr, J. C., & Griffin, M. (2019). Business ResearchMethods. Cengage Learning.

E3.4.7 Recommended Textbooks:

1. Hair, J. F., Wolfinbarger, M., Money, A. H., Samouel, P., & Page, M. J. (2019).Essentials of Business Research Methods. Routledge.
2. Cooper, D. R., & Schindler, P. S. (2019). Business Research Methods. McGraw-HillEducation.
3. Burns, A. C., & Bush, R. F. (2020). Marketing Research: Online ResearchApplications. Pearson.

E3.2.1 COM324 Artificial Intelligence (15 Credits)

E3.2.2 Rationale

Artificial Intelligence (AI) is a field that has a long history. It is still actively growing, now more than ever on the back of improved computing power, smarter algorithms, andlots of data. In this course, you will learn the basics of modern AI. Along the way, we hope to excite you about the numerous applications and huge possibilities in this fieldwhich continues to expand human capability beyond our imagination.

In addition, research in Artificial Intelligence has produced interesting programming techniques (knowledge representation, search methods, object-orientation), useful programming languages (Lisp, Scheme, Prolog etc.) and practical systems (expert systems, intelligent agents). Its dependence on Machine Learning has led to the extensive use of Python in building machine learning models and we hope that you willlearn some along the way.

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E3.2.3 Learning Outcomes

Upon completion of this course, students should be able to:

1. Explain what constitutes "Artificial" Intelligence and how to identify systems with Artificial Intelligence.
2. Explain how Artificial Intelligence enables capabilities that are beyond conventional technology, for example, chess-playing computers, self- driving cars, drones.
3. Describe classical Artificial Intelligence techniques, such as classification algorithms, regression, and neural networks.
4. Ability to apply Artificial Intelligence techniques for problem solving.
5. Explain the limitations of current Artificial Intelligence techniques.
6. Discuss the ethical aspects of Artificial Intelligence.

E3.2.3 Course Contents

1: Fundamentals of Artificial Intelligence SUBTOPICS:

- Introduction to Artificial Intelligence

- Single and Multi – Agents
- Introduction to supervised and unsupervised learning READINGS:

Books

Rouhianen (2018). Artificial Intelligence - 101 Things you need to know now about our future Pg 1 – 45.

Mitchell (2020). Artificial Intelligence - A guide for Thinking Humans Pg 6 – 13. Video: AI in the World Today (2:12)

Practical activity

- Investigate the different capabilities of ChatGPT.

2: Introduction to MATLAB, Lisp, Prolog, Python, and other Artificial Intelligence
Languages

SUBTOPICS:

- Best programming languages for AI
- Overview of LISP, Prolog and MATLAB
- Preference for Python

READINGS:

Books

Patel (2022) Why Is Python The Best For Artificial Intelligence And Machine Learning?

Video: The 5 best programming Languages in AI (6:48) Practical activity

- Write the SQL statements equivalent of Prolog language statements. 3: Knowledge

representation and inference mechanism.

SUBTOPICS:

- Introduction to Knowledge Representation
- Different types of logic
- Introduction to Propositional Logic

- Introduction to First Order Logic
- Semantic Networks, Frames and Scripts

READINGS:

Books

Russell (2020) Artificial Intelligence: A modern approach. Chapter 8 to 10 (pp. 251 – 388), 314 – 338.

Practical activity

- Describe the difference between the traditional and modern way ofbuilding AI solutions.

4: Machine Learning - RegressionSUBTOPICS:

- Introduction into regression
- Simple Linear Regression
- Multiple Linear Regression
- Non-Linear Regression
- Logistic Regression

Books

Russell (2020) Artificial Intelligence: A modern approach. Chapter 18 – 19 (pp. 599 – 646, 651 – 714).

Video: Simple Vs. Multiple Vs. Polynomial Regression (4:36)Practical activity

- Perform some simple regressions in Google CoLab.5:

Machine Learning - Classification algorithms I SUBTOPICS:

- Terms & Types of algorithms
- Logistic Regression
- Naïve Bayes
- Stochastic Gradient Descent

Books

Russell (2020) Artificial Intelligence: A modern approach. Chapter 18 – 19 (pp. 599 – 646, 651 – 714).

Video: Stochastic Gradient Descent, Clearly Explained!!! (10:52)Practical activity

- Perform some simple classifications in Google CoLab.6: Machine

Learning – Classification Algorithms II SUBTOPICS:

- K-nearest neighbors
- Decision Trees
- Random forest
- Support Vector Machines

Books

Russell (2020) Artificial Intelligence: A modern approach. Chapter 7 (pp. 208 – 247).

Practical activity

- Perform some more advanced classifications in Google CoLab.7: CONTINUOUS

ASSESSMENT TEST 1

8: Neural Networks – Part I

SUBTOPICS:

- History of Neural Networks
- Basic Concepts of Neural Networks and Deep Learning
- Types of activation functions
- Advantages and limitations of Neural NetworksBooks

Russell (2020) Artificial Intelligence: A modern approach. Chapter 19 – 22 (pp. 651 - 819).

Practical activity

- Create basic neural networks in Google CoLab.Video:

Neural Networks in 5 minutes (5:44)

9: Neural Networks – Part II

SUBTOPICS:

- Types of Neural Networks
- Overview of Convolutional Neural Networks
- Overview of Recurrent Neural Networks
- Overview of Generative Adversarial NetworksBooks

Russell (2020) Artificial Intelligence: A modern approach. Chapter 19 – 22 (pp. 651 - 819).

Practical activity

- Create more advanced neural networks in Google CoLab.10:

  Computer Vision

SUBTOPICS:

- What a CNN is
- The promise of deep learning for image recognition
- Comparing and choosing AI libraries
- Explain and using Keras for CNN
- Understanding the data sets that are available
- Other steps to consider for a CNN
- Execute a CNN

Books

Mitchell (2020). Artificial Intelligence - A guide for Thinking Humans Pg 164 – 185.

Video: Neural Networks Part 8: Image Classification with Convolutional Neural Networks (CNNs) (15:23)

Practical activity

- Create a simple Convolution Neural Network in Google CoLab.11:

Natural Language Processing

SUBTOPICS:

- What NLP is, the types and what it is used for
- NLP Pipeline
- Python libraries for NLP
- Example of NLP, BERT, and GPT-3Books

Mitchell (2020). Artificial Intelligence - A guide for Thinking Humans Pg 124 – 163.

Russell (2020) Artificial Intelligence: A modern approach. Chapter 23 – 24 (pp. 823 - 878).

Video: Natural Language Processing in 5 Minutes | What is NLP and How does itwork? (5:28)

Practical activity

- Perform some basic NLP in Google Colab.12:

CONTINUOUS ASSESSMENT TEST 2

13: Industry Adoption of AI

SUBTOPICS:

- The AI landscapes.
- AI industry approach
- Using NLP with virtual agents
- Computer Vision applications
- Future trends of AI

Books

Rouhianen (2018). Artificial Intelligence - 101 Things you need to know now about our future Chapter 2 to 4 (pp 46 – 122).

Russell (2020) Artificial Intelligence: A modern approach. Chapter 26 (pp. 925 -975).

Video: AI in the World today (2:12) Practical

activity

- Identify some real-life applications in Zambia using AI. 14: Design

Thinking for AI

SUBTOPICS:

- General Principles of Design Thinking
- AI Design Thinking
- IBM Design Thinking

Practical activity

- Design a simple AI using Design Thinking. 15:

  Ethics in AI

SUBTOPICS:

- Ethical dilemmas
- Common AI frameworks
- IBM Approach to AI Ethics
- EU – Ethics guidelines for Trustworthy AI

E3.2.4 Teaching and Learning Methods

Lectures for theoretical concepts and principles

Hands-on lab sessions for practical application and troubleshooting exercisesCase studies and discussions on real-world scenarios

Guest lectures from industry experts to provide insights into the latestdevelopments

E1.1.5 Assessment

Continuous assessment through assignments, quizzes, and participation Midterm and final examinations covering theoretical and practical aspectsMobile operating system analysis project

E1.1.6 Prescribed Readings

Books

Mitchell (2020). Artificial Intelligence - A guide for Thinking Humans Pg 85 – 93, 187 – 195.

Rouhianen (2018). Artificial Intelligence - 101 Things you need to know now about our future Pg 233 – 277.

Russell (2020) Artificial Intelligence: A modern approach. Chapter 27 – 28 (pp. 981 - 1018).

Videos: 10 incredible cases, when artificial intelligence shocked. (7:01)

E3.2.7 Recommended Readings

"Journal of Mobile Operating Systems Research", Springer"Mobile Security and

Privacy Journal", Taylor & Francis

Year 4 - 131.6 Units

Term	Subject Area	Course Code	Course Description	Units
Semester 1		**COM411**	Programing Languages	15
		COM412	Platform based development	15
		COM413	Mobile Applications Development	15
		COM414	Computer Ethics	15
		BBA415	Systems Project Management	15
Semester 2		**BBA421**	Graphics and visualization	15
		BBA422	Individual Projects/ Internship	**30**
		BBA423	Cloud Computing	**15**
		BBA424	Individual Projects	**15**
Total				**150**

E4. 0 Description of Fourth Year Courses

E4.1.1 COM411 Programming Language-JAVA (15 Credits)

E4.1.2 Rationale

The programming language JAVA is up-to-date and widely considered as the most promising all round programming language because it contains most of the featuresneeded for present day networked and machine independent software development.This can be achieved by introducing the use of an object-oriented programming language and to promote the skills for writing well-structured programs using Java. The design and implementation of well-structured programs lies at the heart of computerscience. It is a basic skill for which this first course lays the ground work.

This module is to equip the learners the skills of programming in JAVA which is widely considered as the most promising all round programming language because it containsmost of the features needed for present day networked and machine independent software development.

E4.1.3 Learning Outcomes

Upon completion of this course, students should be able to:

Design object- oriented programs to address loosely-defined problems Implement object- oriented programs that reflect established programming and software engineering practice

Develop design documentation for use in program maintenance and end userdocumentation.

Implement object- oriented programs from well-defined specification Understand Container Objects and Applets:

Explore Java applets and Java Database Connectivity (JDBC).

E4.1.3 Course Contents Topics

1: Foundations for Java

Structure of Java platform: JDK, JRE, JVM.Advantages of Java.

Compiling source code into bytecode.

Comments and embedded documentation.

2: Data Types and Operators

Primitive and reference types.

Variables.

Object-oriented programming with Java.

Array declaration, construction, and initialization.

3: Type Conversion, Casting, and Flow Control

Type conversion and casting.

Operators.

Flow control using foreach, return, break, and continue.

4: Work with Text and Enumerated Types

String, StringBuilder, and StringBuffer.StringBuffer vs. StringBuilder.

Enumerated types.

5: Creating New Data Types

Class and method overloading.

Constructors and initialization.

Cleanup: finalization and garbage collection.

6: Access Control, Encapsulation, and Inheritance

Package: the library unit. Java access specifiers.

Encapsulation and reusing classes. Composition, inheritance, delegation.Multiple inheritance.

Upcasting.

7: Interfaces, Inner Classes, and Collections

Method overriding and polymorphism. Interfaces and abstract classes and methods. Inner classes and anonymous inner classes.

Collections: List, Set, Queue, maps, and iterating collections.

8: Container Objects, Networking, and Applets

Container classes and generic forms.Networking fundamentals.

Java and networking: network classes and interfaces.Applets.

Java Database Connectivity (JDBC). **E4.1.6Teaching and Learning Methods** Lectures: Theoretical concepts and principles.

Hands-on Coding Sessions: Practical application of Java concepts.Code Reviews: Collaborative code analysis and improvement.

Assignments and Projects: Application of Java in real-world scenarios.

E4.1.7 Prescribed readings

1. Daniel Liang Y (2013). **Introduction to Java Programming**, 9th Edition, Prentice Hall.ISBN-13-978-0-13-293652-1
2. Herbert Schidt (2018) **Java:The Complete Reference**, 11th Edition.

E4.1.8 Recommended readings

1. Deitel, P. J (2008). **How to Program Java.** 7th Edition; Deitel & Association Inc, Prentice Hall. ISBN-9780136085676
2. David J. Eck (2014), **Introduction to Programming Using Java**, 7th Edition, Hobartand William Smith Colleges.

E4.1.2 COM412: Platform Based Development (15 Credits)

E4.1.3 Rationale

This course covers a broad range of topics to provide students with a solid foundation inboth theoretical concepts and practical skills.

It provides a balanced mix of theoretical knowledge and practical skills necessary forcomputer platform-based development.

The curriculum to align with industry trends and technological advancements.

The delivery of the course incorporating hands-on projects, case studies, and industrycollaborations can enhance the learning experience for students

E4.1.4Learning outcomes

a) Knowledge and understanding:

- Demonstrate a critical understanding of the principles and concepts underlyingplatform-based development, including architecture, APIs, and data management.
- Explain the significance of platforms in the context of software development andarticulate the impact of emerging technologies on platform design and implementation.
- Summarize and compare various platform models and frameworks, consideringtheir strengths, weaknesses, and suitability for different applications.

b) Intellectual Skills (Cognitive and Creative Skills):

- Apply platform development principles to create innovative solutions for real-world problems.
- Analyze and evaluate the performance of different platform architectures,making informed decisions for optimizing system efficiency.
- Synthesize knowledge from various sources to design and implement scalableand secure platform solutions.
- Critically assess and propose improvements to existing platform-based systemsthrough creative problem-solving.

c) Subject-Specific Skills (Professional Skills):

- Develop and implement platform-based solutions adhering to industry bestpractices, standards, and legal considerations.
- Collaborate effectively in a professional development team, demonstrating theability to contribute to the design, implementation, and maintenance of platform solutions.
- Conduct comprehensive testing and debugging of platform-based applicationsto ensure robust and error-free performance.
- Deliver professional documentation and presentations to communicate platformdesign, functionality, and maintenance processes.

d) Reflexive Skills:

- Demonstrate autonomy in decision-making regarding platform architecture anddesign, considering the implications for long-term sustainability.

- Exhibit accountability for the ethical and social considerations associated withplatform-based development, taking responsibility for the impact of technological choices.
- Exercise sound judgement in selecting and adapting platform technologies tomeet evolving project requirements and industry trends.
- Adapt to changes in technology, methodologies, and project requirements, demonstrating flexibility and resilience in the face of evolving circumstances.

e) Transferable Skills:

- Communicate effectively, both in writing and verbally, to convey complexplatform concepts to diverse audiences.
- Demonstrate numeracy skills in analyzing and interpreting data relevant toplatform performance and optimization.
- Collaborate with team members, clients, and stakeholders, fostering effectiveinterpersonal and teamwork skills.
- Utilize problem-solving and critical-thinking skills in a variety of contexts, not limited to platform development.
- Apply time management and organizational skills to plan, execute, andcomplete platform-based projects efficiently.

E4.1.5 Course content

1. Introduction to Computer Science and Programming

   - Overview of computer science concepts
   - Introduction to programming languages (e.g., Python, Java)
   - Problem-solving techniques

2. Data Structures and Algorithms

   - Arrays, linked lists, stacks, queues, trees, graphs
   - Sorting and searching algorithms
   - Algorithm analysis and complexity

3. Object-Oriented Programming (OOP)

   - Principles of OOP (encapsulation, inheritance, polymorphism)
   - Design patterns
   - OOP in practice with a language like Java or C++

4. Web Development

   - HTML, CSS, JavaScript
   - Front-end frameworks (e.g., React, Angular, Vue.js)
   - Back-end development with Node.js, Express, or other server-side technologies

5. Database Management Systems

   - Relational databases (SQL)
   - NoSQL databases
   - Database design and normalization

6. Software Engineering

   - Software development life cycle
   - Version control (e.g., Git)
   - Testing methodologies (unit testing, integration testing)

7. Operating Systems

   - Fundamentals of operating systems
   - Process management, memory management, file systems

8. Computer Networks

- Networking fundamentals
- Protocols (TCP/IP, HTTP, etc.)
- Network security

9. Mobile App Development

- Mobile development platforms (e.g., Android, iOS)
- Mobile app design principles
- Cross-platform development frameworks (e.g., Flutter, React Native)

10. Cloud Computing

- Introduction to cloud services (AWS, Azure, Google Cloud)
- Cloud deployment models (IaaS, PaaS, SaaS)
- Micro services architecture

11. Cybersecurity

- Basics of cybersecurity
- Encryption, authentication, and authorization
- Security best practices in software development

12. Human-Computer Interaction (HCI)

- Principles of HCI
- User interface (UI) and user experience (UX) design

13. Capstone Project

- A major project that integrates knowledge from multiple areas
- Real-world problem-solving and application of skills

E 4.1.4 Teaching and Learning Methods

• Capstone Project	Full –time / Distance Learning
• Physical lectures	Full –time / Distance Learning
• Virtual lectures	Full –time / Distance Learning
• Tutorial	Full–time / Distance Learning
• Group Discussion	Full–time / Distance Learning
• Independent Study	Full–time / Distance Learning
• Case Studies	Full–time / Distance Learning

E4.1.5 Assessment

- Assignment
- Continuous Assessments
- Projects Defense
- Tests
- Exam

E4.1.6 Prescribed Readings

1. Young Won Park : *Business Architecture Strategy and Platform-Based Ecosystems*,2018.
2. Kelvin Sung & Jebediah Pavleas & Fernando Arnez & Jason Pace: *Build your own2D Game Engine and Create Great Web Games: Using HTML5, JavaScript, and WebGL*, 2015. Download link: https://www.pdfdrive.com/build-your-own-2d- game-engine-and-create-great-web-games-using-html5-javascript-and-webgl- e166780734.html
3. Lee Stemkoski : *Java Game Development with LibGDX: From Beginner to Professional*, 2018. Download Link: https://www.pdfdrive.com/java-game-development-with-libgdx-from-beginner-to-professional-e158334261.html

E4.1.7 Recommended Readings

- Wan X, Liu J, Zhao S. Evolutionary game study on the governance and development of online car-hailing based on blockchain technology. Sci Rep.2022 Jun 7;12(1):9388. doi: 10.1038/s41598-022-11741-4. PMID: 35672424; PMCID: PMC9174294.
- Li H, Er Saw P, Song E. Challenges and strategies for next-generation bispecificantibody-based antitumor therapeutics. Cell Mol Immunol. 2020 May;17(5):451-461. doi: 10.1038/s41423-020-0417-8. Epub 2020 Apr 20. PMID: 32313210; PMCID: PMC7193592
- Wang C, Liu R, Liu Y, Hou W, Wang X, Miao Y, He Y, Ma Y, Li G, Wang D, Ji Y, Zhang H, Li M, Yan X, Zong X, Yang T. Development and application of the Faba_bean_130K targeted next-generation sequencing SNP genotyping platform based on transcriptome sequencing. Theor Appl Genet. 2021 Oct;134(10):3195-3207. doi: 10.1007/s00122-021-03885-0. Epub 2021 Jun 12. PMID: 34117907.
- Liu N, Tian T, Su Z, Qi W. Research on Measurement Method of Parachute Scanning Platform Based on MEMS Device. Micromachines (Basel). 2021 Apr5;12(4):402. doi: 10.3390/mi12040402. PMID: 33916450; PMCID: PMC8066745.

E1.1 COM413 Mobile Apps Development (15 Credits)

E1.1.1 Rationale

The course "COM413 Mobile Apps Development" is designed to provide anadvanced understanding of mobile application development, focusing onaccessing device capabilities, adhering to industry standards, and programming for mobile applications using Operating System Software

Development Kits (SDKs). As mobile technology continues to evolve, this courseaims to equip students with the skills necessary to create innovative and user- friendly mobile applications.

E1.1.2 Learning Outcomes

Upon completion of this course, students should be able to:

Understand and utilize various device capabilities, including sensors, cameras,and location services, in mobile application development.

Adhere to industry standards and best practices to ensure compatibility,security, and a positive user experience in mobile applications.

Develop mobile applications for different operating systems, emphasizing thenuances and design principles specific to each platform.

Effectively use Operating System Software Development Kits (SDKs) to streamlinethe development process and optimize mobile applications.

E1.1.3 Course Contents Topics

1: Introduction to Mobile App Development

Overview of mobile development technologies

Emerging trends and innovations in the mobile app industry

2: Accessing Device Capabilities

Leveraging device sensors, cameras, and location services

Integrating augmented reality (AR) and virtual reality (VR) in mobile apps

3: Industry Standards in Mobile App Development

Design principles for a consistent user interface (UI) and user experience (UX)Ensuring accessibility and compliance with mobile app standards

4: Operating Systems for Mobile Apps

In-depth exploration of Android and iOS platforms Platform-specific design considerations and guidelines

5: Software Development Kits (SDKs)

Practical use of Android SDK and iOS SDK

Utilizing third-party SDKs for enhanced functionalities

6: Advanced Mobile App Features

Implementing advanced features like push notifications and in-app purchases Exploring cross-platform development frameworks

7: Mobile App Security and Testing

Best practices for securing mobile applications

Testing methodologies and tools for mobile app quality assurance

8: Capstone Project

Independent or group project to develop a sophisticated mobile application Presentation and demonstration of the developed mobile app

E1.1.4 Teaching and Learning Methods

Lectures for theoretical concepts and industry insights

Hands-on coding sessions using mobile development environments Collaborative projects for practical application and real-world scenarios Guest lectures from industry professionals sharing insights and best practices

E1.1.5 Assessment

Continuous assessment through coding assignments, quizzes, and participation

Midterm and final examinations covering theoretical and practical aspectsEvaluation of the capstone mobile app development project

E1.1.6 Prescribed Readings

John Smith, (2022), "Mobile App Development with React Native", O'Reilly MediaISBN: 978-1492071252

Christian Keur, Aaron Hillegass, (2021), "iOS Programming: The Big Nerd RanchGuide", Big Nerd Ranch Guides, ISBN: 978-0135264027

E1.1.7 Recommended Readings

Bill Phillips, Chris Stewart, Kristin Marsicano,(2021), "Android Programming: The BigNerd Ranch Guide", Big Nerd Ranch Guides, ISBN: 978-0135245125

"Mobile Computing and Communications Review (MC2R)", ACM,"Journal of Mobile

Application Development", Springer

E4.1.0 COM414: Computer Ethics (Social Issues and Professional Practice) (15 Credits)

E4.1.1 Background and Rationale

Information Systems is an area of practical activity, which in different ways, employsand affects a large number of people in society. It is vital that students are aware of themost pressing professional, legal and ethical issues affecting Information Systems. This module develops an understanding of the professional and legal constraints within which computing specialists operate, using a 'discursive' environment as the vehicle where the students will be confronted with social and ethical issues of using technology in place of, or supporting, human abilities. The module develops a mature attitude to working as an ethical, environmentally aware information systems professional, throughcritically reviewing germane issues and professional perspectives such as codes of conduct, professional standards and the dynamics of technology.

This module is to create awareness to students of the most pressing professional, legal and ethical issues affecting Information System and developing an understanding ofthe professional and legal constraints within which computing specialists operate, usinga 'discursive' environment as the vehicle where the students will be confronted withsocial and ethical issues of using technology in place of, or supporting, human abilities. The module also develops a mature attitude to working as an ethical, environmentallyaware information systems professional, through critically reviewing germane issues andprofessional perspectives such as codes of conduct, professional standards and the dynamicsoftechnology.

E4.1.2 Learning Objectives

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

- Ensure the privacy and safety of the Computer users,
- Guarantee that the works that are done by someone did not declare by otherpeople,
- Help people use the computer in the right way

E4.1.3 Learning Outcomes

At the end of this course, students should be able to:

- Identify ethical issues in different enterprise computing settings.
- Review real-life ethical cases and be able to develop ethical resolutions andpolicies.
- Understand laws and regulations related to ethics.
- Understand the consequences of ignoring and non-compliance with ethicalimperatives.
- Learn about the best ethical practices and models.

E4.1.4 Prerequisites

None

E4.1.5 Course content

1. Introduction to Computer Ethics

1.0. What is Ethics?

1.1. What is Computer Ethics?

1.2. Why we need Computer Ethics?

1.3. Why we should study Computer Ethics?

1.4. Identify Ethical Issue

1.5. The relation between Ethics and Law

1.6. Ethical Theories

1.7. Professional code of conduct

2. Ethical theories

a. What are ethical theories?

b. Why are ethical theories used?

c. Understand different ethical theories

d. Be able to apply the theories to cases

3. The Ten Commandments of Computer Ethics

3.1. Analyzing The Ten Commandments of Computer Ethics to help reinforceacceptable online behavior.

4. Professionalism and Ethics

4.1. What is professionalism

4.2. Is Computing a Profession?

5. Security and Privacy

1.1. Why care about privacy?

1.2. What is privacy?

1.3. How to protect your online privacy

1.4. Personal information privacy

1.5. Pretty Good Privacy

6. Intellectual Property Rights

6.1. What is intellectual property?

6.2. Intellectual property legislation

- Copyrights
- Patents
- Trademarks

6.3. Fair use provision

6.4. Software piracy

7. Computer Crimes

7.1. Appreciate the scope and nature of computer crime

7.2. Understand the problems of combating computer crime

7.3. Describe the work of national/international government initiatives to combatcomputer crime

7.4. Appreciate the role of computer security in preventing computer crime

7.5. Have an overview knowledge of protective measures

8. Cyberspace, Cyber Crimes and Internet Issues

8.1. Regulating the Internet, CDA, Free speech, electronic commerce, pornography, gambling, language and the politics of regulation.

9. Globalisation

9.1. Explain the process and drivers of globalisation and the opportunities andchallenges it creates for business.

9.2. Illustrate how the global economy has changed over the past 50 years.

9.3. Justify the labelling of the twenty-first century as the Emerging Markets Century.

9.4. Debate the impact of globalization on issues such as job security, incomeinequality and the environment.

9.5. Compare how the management of international business differs from themanagement of domestic business.

10. Mobile Systems and Their Intractable Social, Ethical and Security Issues

10.1. Discussion of security systems

10.2. Social networking and security

11. Organisational Ethical Codes and Conduct

11.1. BCS codes of conduct

11.2. ACM codes of conduct

12. Looking at the future

12.1. Review and Discussions of issues in the news

12.2. Class Presentations

E4.1.6 Course delivery

1.0. Lectures

2.0. Discussions

3.0. Weekly problem sets

4.0. Laboratory

E4.1.7 Assessment

Component of assessment	**Number**	**Contribution to overall grading (%)**
Continuous assessment		
Assignment 1	1	10
Assignment 2	1	10
Test	1	20
Final examination	1	60

Total Marks		100

E4.1.8 Prescribed readings

1. Joseph M. Kizza. (2011). **Computer Network Security and Cyber Ethics**. 3rd edition, McFarland Publishers.
2. George Reynolds (2018) **Ethics in Information Technology**

E4.1.9 Recommended readings

1. Joseph M. Kizza (2011) **Ethical and Social Issues in the Information Age**. 5thEdition Springer.
2. Joseph M. Kizza, (2012) **Civilizing the Internet: Concerns and Efforts Towards Regulations**. McFarland Publishers.

E4.4 COM415: System Project Management (15 Credits)

E4.4.1 Background and Rationale

The student is assumed to have prior knowledge of the Software Development Lifecycle and to be familiar with some project planning software. MS project will specifically be used for this course. General project management techniques will be explored such as Project scheduling, Risk Management and Software systems maintenance and engineering.

The aim of this module is to enable students learn how to manage, evaluate, demonstrate system project techniques will be explored such as Project scheduling, riskmanagement and software systems maintenance and reengineering.

E4.4.2 Learning Objectives

By the end of this course, students will be able to:

- Critically analyse what project management is and what its application mightbe.
- Analyse what is involved under project identification.
- Demonstrate how project planning is done.
- Analyse and demonstrate project analysis and implementation
- Complete and evaluate a project

E4.4.3 Learning Outcomes

At the end of this module, students should be able to:

- Critically explain how a project can be broken down into stages and what eachstage contributes to the project
- Select appropriate techniques for use in the stages of a project
- Justify the appropriateness of these techniques, and apply them to practicalsituations.
- Critique the limitations of the project approach in developing information/software systems

E4.4.4 Prerequisites

1. System Analysis and Design

E4.4.5 Course contents

1. Introduction to System Project Management:

1.1. The power of project management

1.2. Management versus Project

1.3. Complexity of a project

1.4. Significance of project management

1.5. Project Life Cycle

2. Project Identification

a. Formulation of the project's objectives

b. Development of a project outline

c. Assessment of a project's feasibility

d. Passing a project by means of the Identification Test.

3. Project Planning

3.1. The planning Hierarchy

3.2. The planning parameters

3.3. Developing a strategy framework

3.4. Developing a project breakdown structure

3.5. Planning time and expenses

4. Project Implementation

1.1. Techniques for project implementation.

1.2. Controlling progress of the project

1.3. Monitoring and evaluation of performance

1.4. Regulating progress

1.5. Dealing with conflicts

5. Estimation and Risk Management

5.1. Resources Estimation

5.2. Project Risks

6. Scheduling and Resourcing

6.1. Scheduling various project tasks

6.2. Resource management

7. Project Completion and Evaluation

7.1. The project closing process

7.2. Evaluating a completed project

8. Project leadership

8.1. Behaviour of a project leader

8.2. Conflict resolution

8.3. Motivation of project workers

E4.4.6 Course delivery

1. Lectures
2. Class Presentations
1. Discussions
2. Group work

E4.4.7 Assessment

Component of assessment	Number	Contribution to overall grading (%)
Continuous assessment		
Assignments	1	10
Presentation	1	10
Tests	1	20
Final examination	1	60
Total Marks		**100**

E4.4.8 Prescribed readings

1. Heagney J. (2012) **Fundamentals of Project Management,** 5th Edition, NewYork. ISBN-13: 978-0-8144-1748-5

2. Harold Kerzner (2017) **Project Management: A Systems Approach to Planning, Scheduling, and Controlling**

E4.4.9 Recommended readings

1. Pressman, R. S. (2011). **Software Engineering** (6th Edition) (London, UK: McGraw-Hill). (Essential Reading) (Earlier editions of Pressman, such as the 1994 3rd edition, also cover the material, though the chapter and section numbers maybe different from those given as directed reading)
2. Kemerer, C. F. (2010). **Software Project Management: Readings and Cases** (Chicago: IRWIN). (Essential Text)
3. Paul, R. J. (2012). **Dead Paradigms for Living Systems. In the Proceedings of theFirst European Conference on information Systems,** Henley (Birmingham: Operational Research Society), 29-30 March. (Essential Reading)

E4.2 COM421 Graphics and Visualization (15 Credits)

E4.2.1 Rationale

Graphics and Visualization course covers a range of fundamental and advancedtopics to provide students with a solid foundation in the field of computing.

The course incorporates opportunities for students to engage in research and stayupdated on emerging technologies in graphics and visualization.

E4.2.2 Learning outcomes

a) Knowledge and Understanding:

• Demonstrate critical understanding of fundamental principles in graphics andvisualization, including color theory, design principles, and data representation.

• Explain and apply theoretical concepts related to computer graphics and visualization, including algorithms for rendering, image processing, and datavisualization.

• Analyze and evaluate the historical and contemporary trends in graphics andvisualization, identifying their impact on various industries and applications.

b) Intellectual Skills (Cognitive and Creative Skills):

• Apply creative thinking and problem-solving skills to design visually appealing andeffective graphics for different platforms and purposes.

• Evaluate and critique existing visualizations, identifying opportunities for improvementand innovation in terms of clarity, effectiveness, and user engagement.

• Analyze complex datasets and transform them into meaningful visual representations,demonstrating proficiency in data analysis and interpretation.

c) Subject Specific Skills (Professional Skills):

• Create professional-grade graphics and visualizations using industry-standard tools and software, showcasing competence in graphic design and visualization techniques.

• Develop interactive and user-friendly interfaces, demonstrating proficiency in userexperience (UX) and user interface (UI) design.

• Collaborate with multidisciplinary teams to execute comprehensive visualizationprojects, displaying effective teamwork and project management skills.

d) Reflexive Skills:

• Exhibit autonomy in decision-making related to design choices, taking accountabilityfor the visual impact and effectiveness of graphics and visualizations.

• Demonstrate judgment and adaptability in responding to changes in project requirements, technology, and user feedback, ensuring the ongoing improvement ofvisual outputs.

• Reflect on personal and professional growth in graphics and visualization, recognizingstrengths, weaknesses, and areas for further development.

e) Transferable Skills:

• Communicate complex concepts and design ideas effectively through written, oral,and visual means, addressing diverse audiences.

• Utilize numeracy skills to analyze, interpret, and present quantitative data in graphicalform, enhancing the clarity and impact of visualizations.

• Demonstrate effective time management, organization, and project coordination skillsapplicable across various professional domains.

f) Ethics in Graphics and Visualization:

• Considerations for responsible design

• Privacy and security issues in visualization

E2.2.3 Course content

1: Computer Graphics Fundamentals:

- Introduction to graphics systems
- Basic rendering techniques
- 2D and 3D transformations2:

Computer Vision:

- Image processing
- Feature extraction
- Object recognition

3: **Interactive Computer Graphics:**

- OpenGL/DirectX fundamentals
- Shading languages
- GPU programming4

Data **Visualization:**

- Information design principles
- Visualization tools and techniques
- Storytelling with data5

Computer Animation:

- Principles of animation
- Character rigging and animation
- Motion capture

6 Human-Computer Interaction (HCI):

- Usability principles
- User interface design
- Interaction design
-

7 Virtual Reality (VR) and Augmented Reality (AR):

- VR/AR principles
- Development tools and platforms
- Immersive experience design

8 Computer Graphics Programming:

- Advanced rendering techniques
- Real-time graphics
- Shader programming

8 Game Development:

- Game design principles
- Game engines (e.g., Unity, Unreal)
- Game physics and simulations

9 Video Editing:

- Digital Image Processing:
  - Advanced image manipulation
  - Image compression
  - Image analysis

10 Computer-Aided Design (CAD):

- CAD principles
- 3D modeling techniques
- Parametric design

11 Web Graphics and Visualization:

- HTML5 canvas and SVG
- WebGL
- Web-based data visualization

E 4.2.4 Teaching and Learning Methods

- Capstone Project Full –time / Distance Learning
- Physical lectures Full –time / Distance Learning
- Virtual lectures Full –time / Distance Learning
- Tutorial Full–time / Distance Learning
- Group Discussion Full–time / Distance Learning
- Independent Study Full–time / Distance Learning
- Case Studies Full–time / Distance Learning

E4.2.5 Assessment

- Assignment
- Continuous Assessments
- Projects Defense
- Tests
- Exam

E4.2.6 Prescribed Readings

4. Young Won Park : *Business Architecture Strategy and Platform-Based Ecosystems*,2018.
5. Kelvin Sung & Jebediah Pavleas & Fernando Arnez & Jason Pace: *Build your own2D Game Engine and Create Great Web Games: Using HTML5, JavaScript, and WebGL*, 2015. Download link: https://www.pdfdrive.com/build-your-own-2d- game-engine-and-create-great-web-games-using-html5-javascript-and-webgl- e166780734.html
6. Lee Stemkoski : *Java Game Development with LibGDX: From Beginner to Professional*, 2018. Download Link: https://www.pdfdrive.com/java-game-development-with-libgdx-from-beginner-to-professional-e158334261.html

E4.2.7 Recommended Readings

- Wan X, Liu J, Zhao S. Evolutionary game study on the governance and development of online car-hailing based on blockchain technology. Sci Rep.2022 Jun 7;12(1):9388. doi: 10.1038/s41598-022-11741-4. PMID: 35672424; PMCID: PMC9174294.
- Li H, Er Saw P, Song E. Challenges and strategies for next-generation bispecificantibody-based antitumor therapeutics. Cell Mol Immunol. 2020 May;17(5):451-461. doi: 10.1038/s41423-020-0417-8.

Epub 2020 Apr 20. PMID: 32313210; PMCID: PMC7193592

- Wang C, Liu R, Liu Y, Hou W, Wang X, Miao Y, He Y, Ma Y, Li G, Wang D, Ji Y,Zhang H, Li M, Yan X, Zong X, Yang T. Development and application of the Faba_bean_130K targeted next-generation sequencing SNP genotyping platform based on transcriptome sequencing. Theor Appl Genet. 2021

Oct;134(10):3195-3207. doi: 10.1007/s00122-021-03885-0. Epub 2021 Jun 12. PMID: 34117907.

- Liu N, Tian T, Su Z, Qi W. Research on Measurement Method of Parachute Scanning Platform Based on MEMS Device. Micromachines (Basel). 2021 Apr 5;12(4):402. doi: 10.3390/mi12040402. PMID: 33916450; PMCID: PMC8066745.