

BACHELOR OF SCIENCE IN COMPUTER SECURITY AND FORENSICS

1. INTRODUCTION

Computer security is constantly in the news. From high-profile hacking incidents and controversies surrounding lost data, to identity theft and insecure public computer systems, it is impossible to ignore the importance of computer security. Moreover, given the increasing reliance on computers and networks in almost all areas of human activity, individual and corporate, security is absolutely essential. Furthermore, the accessibility of information technology has ensured that the fields of commerce and industry operate in a more effective and efficient manner, but it has also provided criminals with a new way of committing crime – the digital crime. The worldwide web makes it easier to commit digital crimes, but more difficult to trace and prosecute offenders. This course is designed to meet the new and growing demand for specialists in the prevention, detection, correction, and conviction of digital crimes. This new discipline is based on computer digital forensic and computer security technologies, and involves the application of scientific methods for the collection, analysis, interpretation, and presentation of potential evidence to the courts. Law enforcement, military agencies and the intelligence community have traditionally used computer digital forensics extensively for the prosecution or protection of individuals – and these are the concepts you'll learn in this programme.

2. OBJECTIVES

The overall objectives of the course is to prepare students for current and emerging technological trends supporting a wide range of information assurance and security concerns within public, private, and governmental and non-governmental organizations. The specific objectives are:

- a) To equip students with advance training in computer security and digital forensics technology.
- b) To equip students with knowledge of computer crime, law-enforcement and forensic methods, and the legal requirements for collecting, preserving and presenting evidence to court.
- c) To train and motivate students to gain an understanding of how to manage security within an organization and appreciate the security needs of networks, users and applications within that organisation.

- d) To provide the students with understanding of computer security implementation standards, best practices, technologies and methods, which will enable them to effectively secure and manage the business environment.
- e) To equip students with relevant techniques required in identification, analysis, assessment and evaluation of information system threats and vulnerabilities and their impact on an organization's critical information infrastructures.
- f) To provide students with technical knowhow needed to identify management, technical, personnel, operational and physical security controls in the enterprise.

3. ADMISSION REQUIREMENT

Candidates must satisfy the minimum entry requirements of Jaramogi Oginga Odinga University of Science and Technology. In addition, they should meet the following requirements:

) Have at least a mean grade of C+ in Kenya Certificate of Secondary Education (KCSE). In addition, candidates are expected to have at least a grade C or above in Mathematics, Physics or Physical Science

OR

) Have two principal passes in science subject in KACE and at least a credit in pass in Mathematics.

OR

) Have a Higher Diploma or Diploma in IT or any other related discipline from a recognized university or college.

OR

) Have a degree from a recognized University.

4. CREDIT TRANSFER

- a) Transfer of academic credits shall be accepted on individual basis for courses undertaken and successfully completed by students at accredited universities/institutions who request to transfer the same to the university, for incorporation into the degree course and final classification of the degree.

- b) The relevant academic body as approved by the University Senate shall make official evaluation and transfer of credits.
- c) The number of hours, content and grading of courses for which credit transfer is sought should be similar to the courses offered at the University.
- d) Only grades of C and above will be transferred.
- e) Only a maximum of 1/3 or equivalent of the study programme at the university can be transferred.
- f) Such courses are to satisfy the requirements of the first and second years of study only.

5. COURSE STRUCTURE AND DURATION

- a) The Degree course shall normally take four academic years covering 8 semesters.
- b) A candidate will be deemed to have passed an academic year after successful completion of all the units offered in that year. A Diploma Certificate may be issued after a successful completion of the first two years of studies (four semesters).
- c) Courses shall be offered in units. A course unit is defined as that part of a semester subject described by coherent syllabus and taught normally over a period of a semester. It is designated as a total of 42 hours. For this purpose, one 1-hour lecture is equivalent 2-hours tutorial or 3-hours practical or any combination as may be approved by the Board of the School of Informatics and Innovative Systems.
- d) Part-time students shall be allowed to take not less than 50% of the courses prescribed for the year.
- e) All course units will be taught for a total of 42 contact hours, including examinations except industrial attachment which will take 480 hours of practical work in a relevant industry.

- f) Students shall be required to undertake Informatics Industrial Attachment of 480 hours at the end of third year semester.

6. EXAMINATIONS REGULATIONS

University Examinations rules and regulation shall apply.

7. COURSE DISTRIBUTION

YEAR ONE: SEMESTER ONE

Course Code	Course Title	Contact Hours			Weight (Units)
		Lecture	Practical	Total	
IIT 3111	Introduction to Computer Systems	28	14	42	1C
IIT 3112	Introduction to Programming	28	14	42	1C
IIT 3113	PC Security and Privacy	28	14	42	1C
IIT 3114	HTML Programming and Internet Tools	28	14	42	1C
SMA 3113	Logical Functions	42	0	42	1R
SMA 3114	Analytical Methods for Computing	42	0	42	1R
EEL 3115	Communication Skills	42	0	42	1R
SBI 3114	HIV and AIDS	42	0	42	1R
Total		280	56	336	8

YEAR ONE: SEMESTER TWO

Course Code	Course Title	Contact Hours			Weight (Units)
		Lecture	Practical	Total	
IIT 3121	Data Communication Principles	28	14	42	1C
IIT 3122	Systems Building	28	14	42	1C

IIT 3123	Computer Systems Architectures	28	14	42	1C
IIT 3124	Circuit Theory and Basic Electronics	28	14	42	1C
IIT 3125	Emerging Threats, Attacks and Defenses	28	14	42	1C
IIT 3126	Computer, Law, Ethics and Society	28	14	42	1C
SLB 3111	Development Studies	42	0	42	1R
ESD 3121	Social Ethics and Integrity	42	0	42	1R
Total		252	84	336	8

YEAR TWO: SEMESTER ONE

Course Code	Course Title	Contact Hours			Weight (Units)
		Lecture	Practical	Total	
IIT 3211	Operating Systems	28	14	42	1C
IIT 3212	Computer Forensics I	28	14	42	1C
IIT 3213	Database Administration and Design	28	14	42	1C
IIT 3214	Web Application Technologies	28	14	42	1C
IIT 3215	Systems Analysis and Design	28	14	42	1C
IIT 3216	TCP/IP Network Administration	28	14	42	1C
IIT 3217	Network Design and Implementation	28	14	42	1C
IIT 3218	Introduction to Number Theory	28	14	42	1C
Total		224	122	336	8

YEAR TWO: SEMESTER TWO

Course Code	Course Title	Contact Hours			Weight (Units)
		Lecture	Practical	Total	

IIT 3221	Computer and Network Security	28	14	42	1C
IIT 3222	Information Technology Policy and Strategy	28	14	42	1C
IIT 3223	Systems Programming	28	14	42	1C
IIT 3224	Criminalistics/Forensic Science Lab	0	42	42	1C
IIT 3225	Ethical Hacking and Penetration Testing	28	14	42	1C
IIT 3226	Digital Electronics	28	14	42	1C
IIT 3227	Computer Systems and Networking Lab	0	42	42	1C
BCM 3226	Entrepreneur Business Process	42	0	42	1R
Total		182	154	336	8

YEAR THREE: SEMESTER ONE

Course Code	Course Title	Contact Hours			Weight (Units)
		Lecture	Practical	Total	
IIT 3311	Computer Forensics II	28	14	42	1C
IIT 3312	Distributed Systems	28	14	42	1C
IIT 3313	Legal Issues, Ethics and Incident Response in IT Security	28	14	42	1C
IIT 3314	Organisation and Project Management	28	14	42	1C
IIT 3315	Fundamentals of Cryptography and Steganography	28	14	42	1C
IIT 3316	Protocols and Systems for Internet and Web Security	28	14	42	1C
BLB 3113	Law of Crime	42	0	42	1R
BBM 3111	Principles of Accounting	42	0	42	1R

Total		252	84	336	8
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YEAR THREE: SEMESTER TWO

Course Code	Course Title	Contact Hours			Weight (Units)
		Lecture	Practical	Total	
IIT 3321	Enterprise Systems Management & Security	28	14	42	1C
IIT 3322	Computer Security, Risk Management and Control	28	14	42	1C
IIT 3323	Information Systems Control and Audit	28	14	42	1C
IIT 3324	Wireless Networks and Mobile Computing	28	14	42	1C
IIT 3325	Management Information Systems	28	14	42	1C
IIT 3326	Programming Distributed Components	28	14	42	1C
IIT 3327	Artificial Intelligence	28	14	42	1C
BCM 3112	Elements of Management	42	0	42	1C
Total		238	98	336	8

YEAR THREE: SEMESTER THREE

Course Code	Course Title	Contact Hours			Weight (Units)
		Lecture	Practical	Total	
IIT 3331	Industrial Attachment	0	480	480	1C

YEAR FOUR: SEMESTER ONE

Course	Course Title	Contact Hours	Weight
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Code		Lecture	Practical	Total	(Units)
IIT 3411	IT Security Architecture and Design	28	14	42	1C
IIT 3412	Information Security Policy and Compliance	28	14	42	1C
IIT 3413	Operating Systems Security	28	14	42	1C
IIT 3414	Cybercrime Investigation	28	14	42	1C
IIT 3415	Network Management & Security	28	14	42	1C
IIT 3416	Computer Graphics	28	14	42	1C
BLB 3216	Law of Evidence	42	0	42	1R
	Electives (Any 3 Electives)*				

***ELECTIVES**

Any 3 Electives

Course Code	Course Title	Contact Hours			Weight (Units)
		Lecture	Practical	Total	
IIT 3431	Java Security	28	14	42	1E
IIT 3432	Forensic Computing Capstone Research	28	14	42	1E
IIT 3433	Embedded Systems Programming I	14	28	42	1E
IIT 3434	Technology Project Management	28	14	42	1E
IIT 3435	Technologies in National Cyber-Security	28	14	42	1E
IIT 3436	Fraud and Forensic Accounting	28	14	42	1E
IIT 3437	Legal and Ethical Issues in Cybercrime and Prosecution	42	0	42	1E
IIT 3438	Financial Issues in Managing a Secure Operation	42	0	42	1E

IIT 3439	Mobile Phone Cybercrime	42	0	42	1E
IEX 3421	Critical Thinking	42	0	42	1E

YEAR FOUR: SEMESTER TWO

Course Code	Course Title	Contact Hours			Weight (Units)
		Lecture	Practical	Total	
IIT 3421	Information Warfare	28	14	42	1C
IIT 3422	Project	0	42	42	1C
IIT 3423	Cybercrime and the Law	28	14	42	1C
	Electives (Any 6 Electives)*				

*ELECTIVES

Any 6 Electives

Course Code	Course Title	Contact Hours			Weight (Units)
		Lecture	Practical	Total	
IIT 3441	Advanced Linux/UNIX System Administration	28	14	42	1E
IIT 3442	Distributed Applications Development	28	14	42	1E
IIT 3443	Social Network Computing	28	14	42	1E
IIT 3444	HPC Cluster, Virtualization and Cloud Computing	28	14	42	1E
IIT 3445	Secure e-Business	28	14	42	1E
IIT 3446	Embedded Systems Programming II	28	14	42	1E
IIT 3447	Digital Defense: Issues in Security, &	28	14	42	1E

	Critical Infrastructure Protection				
IIT 3448	Biometric Authentication Technologies	28	14	42	1E
IIT 3449	Advanced Topics in Information Assurance, Security & Auditing	28	14	42	1E
BBM 3125	Business Law	42	0	42	1E
BCM 3222	Financial Management	42	0	42	1E
BLB 3227	Legal Systems and Legal Methods	42	0	42	1E

C: Core course, which is central to the discipline of study.

R: required course, which is supportive or beneficial to the programme.

E: Elective course, optional courses central to the discipline of study.

8. COURSE DESCRIPTION

YEAR ONE: SEMESTER ONE

IIT 3111 Introduction to Computer Systems (42 hrs)

Fundamental concepts of computers and computing: number systems, hardware, architecture, information processing, operating systems, networks (including the Internet) and web design. Additionally, students will complete significant projects utilizing contemporary word processing, spreadsheet, and presentation graphics software. Fundamentals of programming will be explored using modern programming languages. Other software applications may be examined during the semester.

IIT 3112 Introduction to Programming (42 hrs)

Fundamental principles of computing using a standard object-oriented programming language e.g., Java, using both a simple text editor such as EditPlus and an interactive development environment: NetBeans and Eclipse IDEs. Basic data types, operators and expressions. Compiling and running programs. Methods and parameter passing. Classes and objects. GUI programming. Selection and iteration. Arrays and collections. Exception handling. Simple I/O and database connectivity. Unit testing. Inheritance. Use of relevant online documentation (e.g., JAVA API documentation). Programming style: layout, commenting and documentation. A

design approach appropriate for the programming language, e.g. UML, will be used throughout. Basic elements of object oriented programming are introduced. Concepts of code re-use and software quality. The use of inheritance is shown for code re-use.

IIT 3113 PC Security and Privacy (42 hrs)

Introduction, basic concepts of computer security and privacy: PC basics, networking basics, confidentiality, integrity, and availability of data, authentication, cryptography, threats to computer security such as viruses, computer security controls: antivirus software and firewalls, Host intrusion protection and prevention, Malware detection and removal; and security and privacy on the Internet. PC security best practices and standards and awareness of computer security issues and security defense mechanism.

IIT 3114 HTML Programming and Internet Tools (42 hrs)

Introduction, Basic Network and Web Concepts: Internet standards, TCP and UDP protocols, URLs, MIME. CGI, Introduction to SGML. Java Programming: Java basics, I/O streaming. Files. Looking up Internet Address: Socket programming, client/server programs, E-mail client, SMTP and POP3 programs; Web page retrieval: protocol handlers, content handlers, applets, image handling, Remote Method Invocation. Scripting Languages: HTML, forms, frames, tables, web page design; JavaScript introduction: control structures, functions, arrays, objects, simple web applications. Dynamic HTML: Dynamic HTML, Introduction, cascading style sheets, object model and collections, event model, filters and transition, data binding, data control, ActiveX control, handling of multimedia data. Server Side Programming: Servlets, deployment of simple servlets, web server (Java web server / Tomcat / Web logic); HTTP GET and POST requests, session tracking, cookies; JDBC: simple web applications, multi-tier applications.

SMA 3113 Logical Functions (42 hrs)

Overview of basic algebra: Extracting relationships from data, manipulation, solving simple equations, rearranging formulae. Number: Number types and their representation in computing. Number bases, binary and hexadecimal, and arithmetic operations. Sets: definitions, laws of operation, Venn diagrams, product set and projection mappings. Propositional logic: Translation between natural language and logic, truth tables, laws of propositional calculus. Validity of arguments; Boolean algebra: application to circuits. Predicate logic: Predicate Logic as Generalised Propositional Logic, Scope of quantifiers, N-place predicates. Application of logic in programming. Statistics: Interpreting results, discrete and continuous distributions, measures

of average and range, graphical presentation. Formal Languages: The structure of formal languages, Syntax, Semantics.

SMA 3114 Analytical Methods for Computing (42 hrs)

Functions: definitions and types, function composition and inversion. Logarithmic, exponential and trigonometric functions. Introduction to Algorithms: Structure and interpretation of algorithms. Issues of computability, efficiency, complexity. Matrices and Vectors: Vectors, matrices and arrays. Applications of matrices e.g. to solve equations and to effect 2D graphical transformations. Graphs and Networks: Definitions, Spanning trees, Algorithms, Application to paths and searches. Calculus: Definitions of integration and differentiation. Manipulation of simple functions. Application to area under a curve and gradient. Complex numbers: Definition of i . Manipulation of complex numbers. Representation on the Argand diagram.

EEL 3115 Communication Skills (42 hrs)

Study Skills: planning study time, making references, filing notes; preparing for examinations. Library Skills: organizations; classification, shelving; using reference books, listening in lectures, speeches and instructions, understanding lectures, note taking, speaking skills, asking and answering questions in lectures and seminars, making and defending arguments, agreeing and disagreeing, explaining points clearly, academic reading skills, skimming and scanning, understanding footnotes and bibliographical references.

SBI 3114 HIV and AIDS (42 hrs)

Introduction, historical background and magnitude of HIV/AIDS, general organization of the human body, immune system (human physiology) and other factors; sex and sexuality; the biology of the human immunodeficiency virus and viral transmission; stages of infection and the development of HIV/AIDS; opportunistic infections; HIV/AIDS prevention and infection control; peer education for HIV; treatment options and vaccine development; blood transfusion and HIV/AIDS; Factors that influence the spread of HIV/AIDS in Africa; case studies in selected countries in Africa; HIV/AIDS as a national disaster impacts; myths and emerging issues on HIV/AIDS.

YEAR ONE: SEMESTER TWO

IIT 3121 Data Communication Principles (42 hrs)

Introduction to data communication; Data transmission system components: DTEs, DCEs and Channels; Data transmission media; The OSI reference model; Data encoding; Basic serial communications interfacing standards; Analysis and synthesis of wave forms; Channel characteristics, Bandwidth, data rates, capacity; Transmission modes, Modulation and Multiplexing; Synchronization; Error control: detection and correction; Data security; Data encryption and compression; Introduction to Network topologies; Data link layer: Line configurations, flow control, error control, bit oriented link control, simplex and sliding window protocols. Data communication standards and best practices.

IIT 3122 Systems Building

(42 hrs)

Introduction, Project Management (PM): Systems Development Life Cycle (SDLC) phases and techniques; major activities and deliverables; the iterative approach, prototyping, RAD and extreme; CASE tools. Fundamentals of requirements capture: requirements elicitation techniques, data versus functional approach, control and audit, specifications, the HCI as an elicitation tool, role playing. Systems structure; Subsystems, support systems, audit systems, business organisations; software layers, partitioning interfaces, data/program representation and structure, models, controls (validation), control (drivers) and views. Data oriented approach: ER modelling, introduction to database design and development; relationships, keys, dependencies, normalisation, degree, multiplicity, inclusiveness SQL. Functional approach: algorithms, development and depiction. Fundamental data types: structure and manipulation. Top-down versus bottom-up PM. Building Object Oriented (OO) Systems: Basic concepts of OO and OOAD; introduction to UML; use case, class, sequence and state diagrams; dependencies, generalisation, composition, aggregation, abstraction, implementation, interfaces, messages, triggers, guards, actions.

IIT 3123 Computer Systems Architectures

(42 hrs)

Introduction to Operating Systems, Practical exposure to Windows, DOS, Linux/UNIX. User Interface GUI's and Shells. Functions of operating systems; Process Management, Multitasking, Processes and Threads, Scheduling, Exclusion and Synchronisation, Memory Management, Virtual Memory RAID File Access, Security, Task Communication, Filing Systems. FAT, FAT32 NTFS, UFS Operating Systems design issues: open source versus closed source, efficiency, robustness, flexibility, portability, security, compatibility. Fundamentals of Digital Logic: Logic gates, Boolean circuits, flip flops, register, memory and counter implementation. Computer Systems Organisation and Architectures, CPU architectures, Fetch Execute, Memory and Storage, Physical Memory and Physical Addressing, Caches and Caching, Input/output Concepts and Terminology, Buses and Bus Architecture, Programmed and Interrupt Driven I/O, Parallelism, Pipelining, Assessing Performance, Embedded Systems and Assembly

Programming: Overview of low level computer systems concepts: structure and function of machines and systems. Instruction types and algorithmic implementation. Von Neumann and Turing Machines, Finite state machines. Data and instruction representation in the real machine.

IIT 3124 Circuit Theory and Basic Electronics (42 hrs)

Passive circuit: parameters, equilibrium, conditions, Kirchoff's law; representation by differential equations; solutions; impedance and reactance. LCR Circuits: frequency domain analysis, resonance and phases. Vector representation, resonance, and circuit diagrams. Network equations, signal flow graphs. Theorems: superposition, reciprocity, Thevenin, Norton, maximum power transfer. Solutions using Laplace transformations: transient and steady state response. Transfer functions: poles and zeros. Physics of semiconductors physics: P-N junction diodes, V-I characteristics; Zener diodes; BJT; FET; MOSFET. Equivalent circuit for diodes, transistors, FETs. Operational amplifier (OPAMP).

IIT 3125 Emerging Threats, Attacks and Defenses (42 hrs)

Introduction, focus on describing and providing a technical walk-through of several emerging computer threats: next-generation phishing, drive-by-pharming, online extortion, multi-application botnets, crimeware, mobile worms, and VoIP security threats. Computer security threat and defense topics: countermeasures to Internet attacks, insider threats, economics of information security and security usability. Focus on emerging defenses such as mechanisms included in Windows Vista. Overview of how the next generation defenses may mitigate growing threats, and where they fall short.

IIT 3126 Computer, Law, Ethics and Society (42 hrs)

Overview of the legal and ethical implications in computing in today's workplace: interaction between people and computers. Legal implications of writing computer programs for sale (copyright, contracts, warranties, patents, software protection, liabilities), hardware and software procurement, computer system failures, data security, privacy, and personnel management. Computer crime, psychology and human-computer interaction, health issues in relation to use of computers, impact of computer use on society in the local and global communities, both now and in the future. Ethical concerns: particularly with regard to employer and the employee's ethical responsibilities in using computer facilities.

SLB 3111 Development Studies (42 hrs)

Development studies as an autonomous discipline; the concept of development the theories and paradigms of development; the relationship between economic growth and development; science and technology in development; developed and developing countries; issues in development; Social, economic and political; actors in development: The state, national and international

NGO's, bilateral and multilateral institutions, multinational corporations (MNC's) and social movements.

ESD 3121 Social Ethics and Integrity (42 hrs)

Definitions and concepts; categories of ethics; national cohesion; integrity; unity; structural injustices; ethnicity: positive ethnicity, negative ethnicity; peace: peace making, peace building, peace transformation, stakeholders in national cohesion.

YEAR TWO: SEMESTER ONE

IIT 3211 Operating Systems (42 hrs)

Memory, cache, hierarchical memory systems, memory management, garbage collection. Storage devices, hard disks, segmentation, file systems. Virtual memory, segments, pages, caches, replacement policies, virtual address translation. Processes, threads, resources, implementation and scheduling. Dynamic linking, Shared libraries and objects. OS Architectures: the kernel, I/O, device drivers, traps, interrupts, monolithic and microkernel. Concurrency, starvation and deadlock. Directory services and security, LDAP, Active Directory, Kerberos.

IIT 3212 Computer Forensics I (42 hrs)

Basic computer forensic principles and concepts. Introduction: computer forensic tools (EnCase, FTK, Hex editors, etc.). Conducting computer forensic investigation; Incident life cycle: Collecting digital evidence in an objective way, while maintaining the chain of evidence. Overview and concepts: disk architecture and disk-based investigations. Information and data hiding techniques: Steganography. Creating read only bit-wise copy of a storage device. Disk structures: Windows file systems (FAT and NTFS), Linux file systems. Importance of deleted files and the artefacts left by the Windows OS. Introduction to the Law and court procedures for Expert Witness testimony.

IIT 3213 Database Administration and Design (42 hrs)

Fundamental models of databases: entity-relationship, relational, deductive, object-oriented. Normalization. Relational Database Systems: Relational algebra and calculus, query languages. Data storage, caching, indexing, and sorting. Locking protocols and other issues in concurrent and distributed data-bases. File Organization for Physical Database Design. Database security. Transaction processing. Query Processing: Basic algorithms for query processing, approach to optimisation. Network models, object-oriented design, Datalog, temporal databases, Advanced topics: data warehousing, knowledge discovery, data mining, middleware etc. Case Study Oracle / MySQL.

IIT 3214 Web Application Technologies (42 hrs)

Introduction, Web clients and client side technologies: Firefox, IE, XHTML, CSS, JavaScript, DOM, cookies. Web servers and server-side technologies: Apache, IIS, PHP, ASP.NET sessions, database connectivity. XML technologies and web services: DTD, XSD, XSLT, DOM, SAX, SOAP, REST, WSDL, UDDI, AJAX. Web site development tools: EditPlus, FTP, Firefox, Visual Studio. Web site design issues: HTTP, state preservation, usability, accessibility, standards and best practices, Web2.0 and its security.

IIT 3215 Systems Analysis and Design (42 hrs)

Introduction, methodical approach to developing computer systems: systems planning, analysis, design, testing, implementation and software maintenance. Overview of strategies and techniques: systems analysis and design for producing logical methodologies for dealing with complexity in the development of information systems. Identification and Structuring of IT-based opportunities into projects; Project conceptualization and feasibility of IS projects; Business process management and improvement; Analysis of business requirements; Analysis and specification of system requirements: Data collection methods, Methods for structuring and communicating requirements: Modeling, Data and Process Specification, presentation; Feasibility analysis of technical alternatives; System Design: Factors affecting user experience, User interface design, System data requirements, Factors affecting security, Ethical considerations; Organizational implementation of a new information system.

IIT 3216 TCP/IP Network Administration (42 hrs)

Overview and concepts of TCP/IP protocol: environment in which TCP/IP networking is generally used; overall architecture of the TCP/IP protocol suite and IP addressing & subnetting; TCP/IP Transport and Application Layers, multicasting architecture, routing protocols, Internetworking with TCP/IP Network Management and IPv6. Selected topics: internetworking concepts, the functional layers of TCP/IP architecture, the addressing mechanism used to identify computing systems in a TCP/IP internet; TCP/IP error and control messages. Network management, administration, and troubleshooting procedures that system and network administrators employ in keeping a TCP/IP internet running; Enterprise routing protocols.

IIT 3217 Network Design and Implementation (42 hrs)

Networking Media, Structured Cabling, Cable Testing. Communication basics, network types, functions (e.g., transmission, firewalls, switching, multiplexing, routing, addressing, error recovery, congestion control); layered architectures (OSI, TCP/IP, IEEE 802.x); standards and bodies. Applications: data, telephony, music, image, video; traffic characteristics, requirements, characterisation and parameters. Network performance: concepts and parameters. Performance prediction techniques: simple queueing theory, simulation, reliability and availability. LANs: overview of Ethernet, FDDI; emphasis on QoS support. TCP/IP suite of protocols. Frame relay, ATM: operation, leaky bucket, token bucket for traffic shaping. Routing algorithms & protocols. IP routers: address filtering, IP QoS, IntServ, RSVP, DiffServ, queue management, congestion control. WANs; IP WANs, IP over ATM, IP over Frame Relay, MPLS. Router configuration based on Cisco routers. Troubleshooting network configurations. Wireless networking systems: configuration and security. Performance issues on networks. Diagnostic tools for network.

IIT 3218 Introduction to Number Theory (42 hrs)

Fundamentals of number theory: number system, prime numbers, modular arithmetic, the Euclidean algorithm, algebraic numbers, Fermat's last theorem, Euler's theorem, Euler's Phi function and approximation of numbers by rationals. Concepts of divisibility, congruences, quadratic reciprocity, arithmetical functions, irrational numbers, simple continued fractions and Diophantine equations, multiplicative functions, primitive roots, pseudo-random numbers. Application of number theory: Caesar and affine ciphers, the Chinese Remainder Theorem, Cryptography and data security, Elements of cryptanalysis techniques.

YEAR TWO: SEMESTER TWO

IIT 3221 Computer and Network Security (42 hrs)

IIT 3224 Criminalistics/Forensic Science Lab (42 hrs)

Introductory, concepts and exposure to numerous aspects of the various forensic science disciplines, including both digital and non-digital methods. Topics: the history of forensic science, digital forensic, physical evidence, digital evidence, evidence collection, crime scene management, fingerprints technology, forensic toxicology, serology, firearms, forensic psychology, and DNA.

IIT 3225 Ethical Hacking and Penetration Testing (42 hrs)

Introduction, advances and techniques for securing information systems against cybercrime attacks. Application of concepts learned in previous classes to both defend and compromise a network and computer system. Various tools for managing and compromising network systems; safeguarding ancillary systems to prevent collateral damage during testing procedures. Legal and ethical issues associated with penetration testing. Institutional and organizational network security policies.

IIT 3226 Digital Electronics (42 hrs)

Overview of digital electronics: classical switching theory, Boolean algebra, logic minimization, algorithmic state machine abstractions, and synchronous system design. Areas of applications: digital electronic design. Techniques of logic implementation, from small scale integration (SSI) through application-specific integrated circuits (ASICs). Laboratory exercises in digital design project: designing and building large systems using computer-aided design (CAD) and construction techniques for digital systems.

IIT 3227 Computer Systems and Networking Lab (42 hrs)

Lab 1: Fundamental concepts of designing and building secure network. Students are expected to plan, design and setup a secure network environment using firewall, routers, switches, IPsec VPN and proxy servers. Understand the concept of subnetting. Installation, configuration, operation, and troubleshooting medium-size routed and switched networks; Understand the basic mitigation of security threats and defense; Introduction to wireless networking performance and security; Network protocols: IP, Enhanced Interior Gateway Routing Protocol (EIGRP), Serial Line Interface Protocol Frame Relay, Routing Information Protocol Version 2 (RIPv2), VLANs, Ethernet, access control lists (ACLs).

BCM 3226 Entrepreneur Business Process**(42 hrs)**

Effective business planning is the cornerstone of success. This course teaches entrepreneurs to state their business passion in practical terms with methods for analyzing their market and competition, setting achievable goals and focusing on a strategic business plan. Understanding the probability of risks, along with developing crisis management, disaster recovery and business continuity plans, provide entrepreneurs with a solid basis to sustain their business and achieve their vision.

YEAR THREE: SEMESTER ONE**IIT 3311 Computer Forensics II****(42 hrs)**

Data Storage and Network forensics: Network architecture, devices, OSs and platforms, NTFS vs. FAT32 vs. UNIX file systems and data storage, varieties of data storage devices, operation and how these devices contain and conceal evidence. Capture critical system data from computer disks, mirror imaging. CF hardware and software tools. Lexical analysis. Data mining techniques. Capture critical information from a network incident. Reversing images. Analysis of evidence. Preservation and preparation of evidence. Forensics and computer security, management: Threats and vulnerabilities to which a computer system/network may be exposed. Policies and associated controls that provide appropriate incident response. Identify intellectual property: patents, copyrights, critical or confidential information from which a computer incident might arise. Identify forensic tools and resources for system administrators and information systems security officers. Preparing evidence for a tribunal. Law and Ethics: laws, rules, regulations, rights and controls for recovering and preserving data and equipment. Identify ethical and legal issues relating to intellectual property, patents, copyright, etc. Apply the rules of evidence to an electronic crime scene and to obtaining computer evidence. (i.e., recognize what can and cannot be seized.) Discuss the methods of ensuring the chain of custody of evidence is appropriately managed.

IIT 3312 Distributed Systems**(42 hrs)**

Latest state-of-the-art of practical distributed systems: distill design principles for building large network-based computational systems. Dynamic packet routing, global namespace systems, component architectures, ontologies, resource allocation strategies, distributed security and authentication protocols, fault-tolerant databases, distributed artificial intelligence, and virtual worlds. Types of distributed systems: distributed systems, Clusters, Grids, sensor networks etc; Distributed system Architectures: system architectures: centralized, multi-tiered, peer-to-peer etc; Middleware; Communication: RPC, Group Communication, Message oriented

partner(s), Introduction to Corporate Accounting; Issue of Shares and Debentures; Preparation of Financial Statements of Limited Liability Companies.

YEAR THREE: SEMESTER TWO

IIT 3321 Enterprise Systems Management & Security (42 hrs)

Introduction and concepts of enterprise security: Installation, administration and security in Windows and Linux/UNIX. Server hardware, energy management, virtual machines and Hypervirtualization, HPC & cloud computing. Principles of authentication and access control, Kerberos, MAC, DAC and RBAC. Directory services, LDAP, NIS, Windows Active Directory, permissions, users, groups and roles. TCP, DNS (BIND) servers,. Web server installation, administration and security, Apache, IIS, proxy servers and web clients. Web security: SSL and TLS, creating and installing certificates; Crypto-security: RSA, DSA, DES, MD5 and blowfish. Telnet, rsh, SSH and tunnels. FTP server installation, administration and security, SFTP. Database server installation, administration and security with MS SQL Server, MySQL and PostgreSQL. Email, SMTP, MUA, MTA, MSA, MDA, Sendmail, Procmal, Postfix, Exchange, POP, IMAP and Majordomo. System recovery: Backup technology, Storage Area Network (SAN), Network Attached Storage (NAS), Raid, Data Replication.

IIT 3322 Computer Security, Risk Management and Control (42 hrs)

Fundamentals of IT security risk management and control. Explore the threats and risks present in organizations due to the pervasive use of technology. Concepts of risk evaluation techniques, identify security and control techniques used to minimizing threats and risk to the organization's network infrastructure. Selected topics: computer and information security, threat techniques, protective techniques, risk analysis, contingency planning and incidence response plan, password techniques, encryption, network protocol, and intercept devices. Case studies of latest risk associated with cyber-attacks and cyber-crime activities. Botnet activities & threat. Capstone term project/paper research on network cyber-activities.

IIT 3323 Information Systems Control and Audit (42 hrs)

Trends and advances in information systems audit and controls. Cryptographic algorithms, protocols and applications. Secure e-commerce. Cryptosystems: basic hash checksums,

symmetrical and asymmetrical cryptography algorithms, basic protocols and standards like RSA and SSL, digital signatures and digital cash, the concept of a PKI and X509 certificates, and various crypto-software applications. Computer security and controls to information systems: authentication and access control, protection against malicious code and coders, database security, formal models, and policy issues, Computer crime and abuse, Risk management. Layered protection mechanisms for secure web-based client/server systems on the Internet. Auditing processes; auditing transaction databases: auditing methodology, evaluation of secure financial transactions, and detections of unauthorised access.

IIT 3324 Wireless Networks and Mobile Computing (42 hrs)

Introduction, cellular and wireless networks and their components. First generation analog cellular phone systems; traffic engineering; mobility management; intersystem operation; second generation digital cellular standards: GSM, IS-95 (cellular CDMA); short message service (SMS); Cellular networks: from 1 to 5G Networks; location technology, wireless local area networks (802.11a to n), wireless personal area networks (e.g., Bluetooth, Zigbee), wireless metropolitan networks (WiMax), and satellite systems; Mobile Ad Hoc and Sensor Networks; Platforms to Support Mobile Applications: Architecture of Mobile devices, Mobile IP, Wireless middleware (WAP, iMode, J2ME, BREW, MMIT); Mobile Applications: M-Business, M-Government, M-Life, Positional Apps; Mobile threats, Security, Integration & Management Issues.

IIT 3325 Management Information Systems (42 hrs)

Fundamentals of Management Information Systems (MIS): theoretical underpinnings of the competitive advantage of information systems, information systems development process, the practical and policy aspects of information systems planning, and the ethical issues in information systems. Selected topics: application of people, documents, technologies, and procedures by managers to solve business problems, tied to the automation or support of human decision making. Discuss: Executive Information Systems (EIS) and Decision Support Systems (DSS).

IIT 3326 Programming Distributed Components (42 hrs)

Component and distributed Component Design; Framework and Container Architectures illustrated with examples from technologies: J2EE and EJB, Struts; Transactions, Security, Asynchronous Messaging, Load Balancing etc.; Web forms and Web Form Components technologies: Servlets, JSPs and .NET Web Forms; Web Services (in a language such as Java

and .Net); Remote Objects exemplified by technologies such as RMI and .NET Remoting; Design Patterns; Principles of Object Serialization and examination of approaches: Java Serialization, .Net Serialization, XML, JAXB, JDBC, ADO.NET.; Reflection and Introspection; Testing and Refactoring; Other technologies may be included as their innovative content dictates.

IIT 3327 Artificial Intelligence (42 hrs)

Introduction; Predicate logic: language, interpretation, inference, horn clauses and unification. Symbolic programming using PROLOG with applications to search and planning. Graph search, blind search, heuristic search, optimisation and search, adversarial search and a-B pruning. Planning: goal stack planning, situation calculus, non-linear planning. One "advanced" reasoning technique from: Bayesian reasoning, temporal logic or spatial reasoning. Machine learning: Statistical concepts, inductive bias and the fitting of data. Induction of logical conjunctions, decision trees, neural networks and sets of rules. Applications to data mining. Analytical learning and instance based learning. The use of a genetic algorithm as a stochastic search tool. Distributed Artificial Intelligence: Agent interactions and co-operation, communication, standard environments. Selected applications of AI.

BCM 3112 Elements of Management (42 hrs)

Management Introduction - Meaning, nature and characteristics of Management - Scope and functional areas of management, Planning: Nature importance and purpose of planning. Organizing and Staffing: Nature and purpose of organization, Principles of organization, Directing: Meaning and nature of directing, Leadership styles, Controlling: Meaning and steps in controlling - Essentials of a sound control system.

YEAR THREE: SEMESTER THREE

IIT 3331 Industrial Attachment (480 hrs)

Students will liaison with their designated departmental supervisor and the respective onsite supervisor at the designated industrial attachment organization, to determine a suitable project or task to be pursued during the industrial attachment. Students' may also work in groups on a predetermined project/task. During the Industrial Attachment, students will work under company supervision. Students will maintain a logbook of daily activities and will be required to submit a comprehensive final report for assessment at the beginning of the following semester. Students will be visited at their work place twice by their Lecturers.

YEAR FOUR: SEMESTER ONE

IIT 3411 IT Security Architecture and Design (42 hrs)

Fundamentals of IT Security Architecture concepts and practices: organization-wide enterprise architecture as context; Ensure proper levels of information in place: confidentiality, integrity, and availability are provided for an organization's information and data. Implementation of Security Architecture Framework under enterprise and system-level security requirements: information security governance, operations security, personnel security, information and data security, systems security, application development security, infrastructure security, and physical security.

IIT 3412 Information Security Policy and Compliance (42 hrs)

Latest advances in organizational security policy and compliance. Historical view of networking and security, security issues, trends, security resources, and the role of policy, people, and processes in information security. Security Policy frameworks: practices, and procedures, business practice disclosures, Policy authority and practices, information security practices, personal and physical security practices, operation management practices, PKIs and key management schemes, key generation, key storage, backup, recovery and distribution, XML frameworks for security policy specification, certificate management life cycle. Identification of information security risks, creation of an information security policy, and identification of processes to implement and enforce policy ad compliance. Implementation of techniques for establishing and implementing an organization-wide security policy designed to protect the information assets. Legal and privacy issues; Evaluation tools: standards and best practices. Techniques: install, monitor and audit key information security regulatory requirements: SOX, PCI, HIPAA, GLBA & best practices like COBIT, ITIL and ISO17799.

IIT 3413 Operating Systems Security (42 hrs)

Study of operating system security with particular reference to Windows and Unix/Linux operating system. Overview of the security risk and management of the specified operating systems, and the preventive efforts to use the security features built-in within the systems and third-party applications. Understanding of various essentials reference sources available on the subjects on computer security, including organizations such as Cyber Security & Incidence Response (CERT).

IIT 3414 Cybercrime Investigation**(42 hrs)**

Introduction to cybercrimes investigations techniques: unauthorized access, mischief to data, possession of hacking tools, possession of child pornography. Legal aspects: organization legal issues, Kenyan judicial system, computer crime laws, rights of citizens, common law, mutual legal assistance treaty, search warrants, production and assistance orders, international laws, upcoming legal changes; Investigation process: search planning, acquisition methods, environment recognition, evidence identification. Reporting process: investigation and analysis reports, notes taking; Authority of seizure; Forensic Interviews; Computer crime trials: witness preparation, court sentencing, rebuttal witness, cross-examination, testimony, credibility attacks; Real world issues case studies. Students will undertake a capstone research project on cybercrime activities in Kenya and laws that govern it.

IIT 3415 Network Management & Security**(42 hrs)**

Network Management Fundamentals, Network Management Requirements Network Monitoring Architecture (Traffic Monitoring, Performance Monitoring, Fault Monitoring, Accounting Monitoring), Configuration Control, Security Control, SNMP Concepts (SNMPv1, SNMP Management Information and structures, SMI, SNMP operations, MIBs, MIB-II, Transport-Level Support, System Group, Interfaces Group, IP Groups, ICMP Group, TCP Group, UDP Group, Transmission Group, SNMP Group, Extensions to MIB-II, Remote Network Monitoring (RMON). Basic Concepts, statistics Group, history Group, host Group, hostTopN Group, matrix Group, tokenRing Extensions to RMON, Remote Network Monitoring: Alarms and Filtering, alarm Group, filter Group, Packet capture Group, event Group.

IIT 3416 Computer Graphics**(42 hrs)**

Image Processing as Picture Analysis, advantage of interactive graphics, representative uses of computer graphics, classification of applications, development of hardware and software for computer graphics, conceptual framework for interactive graphics. Hierarchy of graphics software; Line generation algorithms e.g., DDA, Bresenham's; Using a graphics API; Simple color models (RGB, HSB, CMYK); Homogeneous coordinates; Affine transformations (scaling, rotation, translation); Viewing transformation; Clipping; Font generation: outline vs. bitmap; Light-source and material properties; Ambient, diffuse, and specular reflections; Phong reflection model; Rendering of a polygonal surface; .at, Gouraud, and Phong shading; Texture mapping, bump texture, environment map; Introduction to ray tracing; image synthesis, sampling techniques, and anti-aliasing.

BLB 3216 Law of Evidence**(42 hrs)**

Evidence rules constrain proof at criminal and civil trials. Kenya Rules of Evidence, related case law, and those constitutional concepts that limit proof at criminal trials. Comprehensive study of the rules of evidence, particularly as applied to digital and physical evidence. Topics: judicial notice, presumptions, relevance, character evidence, hearsay rules, confessions, admissions, scientific evidence and expert testimony, scientific proof, and privileges. Focus on criminal law applications.

IIT 3431 Java Security**(42 hrs)**

Introduction; comprehensive coverage of the security aspects of the Java platform. Fundamentals of Java's security model and the VM and language features that support security. Java APIs relevant to development of secure software. Practical aspects of using Java APIs; Java Cryptography APIs is addressed and material on security in J2EE (Java 2 Enterprise Edition) is presented. Selected topics: java.security, packages, the Java Cryptography Architecture and Java Cryptography Extension (JCA and JCE), Java Secure Sockets Extension (JSSE), Java Authentication and Authorization Service (JAAS), Java Generic Security Services (Java GSS-API), and the Java Certification Path API.

IIT 3432 Forensic Computing Capstone Research**(42 hrs)**

Forensic Computing Capstone Research: provides students with an opportunity to gather knowledge and skills learned from the program coursework and to conduct a research project with industrial applications. Students are expected to do a research in literature review and to develop a set of hypotheses for a research project in IT security. A research proposal outlining alternative remedies to the problem and hypotheses should be submitted to the designated research school advisor by the end of the course semester.

IIT 3433 Embedded Systems Programming I**(42 hrs)**

Programming concepts, introduction to tools and equipment, cross assemblers and cross compilers writing structured code, libraries and header files. Microprocessors, microcontrollers, memory and storage. Use of assembler and C on the Atmel platform and Java on the Lego Mindstorms platform. Special registers, interfacing and controlling peripherals, parallel and serial ports. Timers, counters, polling, busy loops, interrupts, interrupt handlers, priority assignment, masking responsiveness. Analog-to-Digital converters and analog comparators. Serial communication via Universal Asynchronous Receiver Transmitter (UART). Sensor types and their use: temperature, vibration, accelerometer, GPS, light activated switches, reed switches, sound activated switches, light intensity sensors, pressure switches. Power consumption, power sources, practicalities of deployment, energy saving operation modes, measuring power consumption.

IIT 3434 Technology Project Management**(42 hrs)**

Fundamentals of Project Management; Project life cycle: initiation, develop a project charter, create a scope statement, create management plans, develop a statement of work, create a project schedule, manage project relationships, execution, implement a project, acceptance, support and closure. Selected topics: project selection, planning, scheduling and controlling associated with applications such as new product development, technology implementation e.g., ICT etc. Elements of a disciplined Project Management process along with interpersonal skills required by an effective Project Manager are presented. Introduction to project management and ICT: the ICT project management process; Project management methodologies and tools; ICT project management standards; Change management; Case studies of ICT project management.

IIT 3435 Technologies in National Cyber-Security**(42 hrs)**

Introduction to the current and emerging technologies used in national cyber-security and the practitioners who use them. National Cyber-network defense; bank fraud, security of equipment, physical and cyber security systems, communications and information technologies, information assurance, robotics, simulation, exercise, and training technologies. Introduction; national security information systems management; Concepts and framework for understanding: the needs, types, capabilities and applications of national MIS. Overview of existing national security information systems and its implications for the future national needs. Impact of science and technology upon our national security agencies and how information management systems will prepare us for 21st century challenges are analyzed. The role Internet technology plays in protecting the national security.

IIT 3436 Fraud and Forensic Accounting**(42****hrs)**

Introduction; forensic accounting and fraud examination techniques, interview techniques, rules of evidence relating to fraud, internal control methodology, asset misappropriation, and financial statement misrepresentation and fraud; corruption and false representation; Fraud and forensic in a digital environment. The rules of evidence as they relate to several different fraudulent activities including illegal activities such as wagering, money laundering, cash skimming and embezzlement.

IIT 3437 Legal and Ethical Issues in Cybercrime and Prosecution(42 hrs)

Overview of legal and ethical issues in cybercrime investigation and prosecution. Explore the legal and ethical issues that judges, legislators, prosecutors, and defense attorneys are confronting as they respond to the recent explosion in computer-related crime. Consideration of how crimes in cyberspace challenge the traditional approaches to the investigation, prosecution, and defense of crime that have evolved from our experience with crimes in physical space. Selected topics: the Kenya's new Constitutional Amendment in relation to cyberspace, the law of electronic surveillance, computer hacking and other computer crimes, encryption, online economic espionage, cyberterrorism, botnets & malware, the Kenya's legal system in cyberspace, and its relations in the enforcement of computer crime laws, and Citizens Right, civil liberties online.

IIT 3438 Financial Issues in Managing a Secure Operation (42 hrs)

Overview and concepts of risks (financial, reputation, business, and third party), costs, ROI, and other business issues concerned in planning and managing a secure operation. Selected topics: disaster recovery, outsourcing issues; service level agreements; evaluating external security service providers; assessing security total cost of ownership; audit procedures; financial integrity; cost/benefit analyses; back-up and recovery provisions; insurance protection; contingency, business recovery and business continuity plans; qualitative and quantitative risk analysis; monitoring the security of the enterprise; information economics; performance reporting; automated metrics reporting; responses to threats; effects of security policies and practices on business and customers; preparing a business case for information security investments; and developing cost effective solutions given constraints in money, assets, and personnel. Case studies and exercises will be used to illustrate financial planning and evaluation of security operations.

IIT 3439 Mobile Phone Cybercrime (42 hrs)

Introduction, overview of mobile phone security; Understanding mobile phone cyber-attacks and cybercrime activities; mobile phone and law enforcement; Types of cellular records: Understanding cellular records, Methods to acquire cellular records; Proven ways to display cellular records in court of law, Understanding the usage and manner in cellular tower records, Overview of commercially available software that effectively displays cellular records, Difference types of cell phone technologies, and how to identify them, Cell phone connection hardware, Cell phone software, cell phone data/evidence seizure, Legal issues and case law pertaining to cell phone data seizure.

IEX 3421 Critical Thinking (42 hrs)

Overview and concepts of critical thinking and informal logic with focus that help students develop the ability to reason clearly and critically. Introduction to the fundamentals disciplines of inductive and deductive logic, fallacious reasoning, and problem-solving techniques. Emphasis is placed on the identification and management of the perception process, use of assumptions, emotional influences, and language in various forms of business communication.

YEAR FOUR: SEMESTER TWO

IIT 3421 Information Warfare (42 hrs)

Nature of information warfare: computer crime and information terrorism; Threats to information resources: national security and economic espionage, communications eavesdropping, computer break-ins, denial-of- service, destruction and modification of data, distortion and fabrication of information, forgery, control and disruption of information flow, cyber-attacks, electronic bombs, and psyops and perception management. Countermeasures: authentication, encryption, auditing, monitoring, intrusion detection, and firewalls, and the limitations of those countermeasures. Cyberspace law and law enforcement, information warfare and the national security, and intelligence in the information age. Information warfare policy and ethical issues.

IIT 3422 Project (42 hrs)

Students will liaison with their designated departmental supervisor to determine a suitable project to be undertaken by the respective student. Students' may also work in groups on a predetermined project/task.

IIT 3423 Cyber crime and the Law (42 hrs)

Introduction to Cybercrime and the Law: national laws that address cybercrimes; network and computer intrusion. Focus on: key legal issues raised by cybercrimes, and skills needed to understand the constantly evolving cyber law concepts. Selected topics: protection of computer software; computer network: authentication, information access and control, privacy and security. Explore specific problems in applying the law to cyberspace in a variety of areas: content control, and the bounds of jurisdiction.

IIT 3441 Advanced Linux/UNIX System Administration (42 hrs)

Overview and concepts of DNS (domain name system) servers and the Apache Web server (httpd). Fundamental concepts of LDAP (lightweight directory access protocol) directory queries and authentication; LDAP Id management & SSO. Administration and configuration of server-side programming tools (e.g., CGI, mod_perl, PHP, JSP, Jakarta Tomcat, and Java SDK). Setup and configure: SAMBA, FTP, Telnet, and SQUID proxy servers. SMTP (simple mail transfer protocol) theory implemented via Sendmail and Postfix e-mail systems. E-mail protocols such as IMAP and POP are configured; spam filtering techniques. Discuss next generation networks, applications, and services: Voice over IP (VoIP), Instant Messaging (IM), Streaming media (unicast, broadcast, and multicast), and peer-to-peer networking.

IIT 3442 Distributed Applications Development (42 hrs)

Distributed Applications Architectures: Two-tier (Client-Server, Peer-to-Peer), Three-tier, Distributed objects. Communication Strategies: Unicast, Multicast and Broadcast, Group communications; Group coordination, election algorithms, agreement and consensus protocols; Binding between components, service advertisement. Communication complexity and scalability. Communications Technologies: RMI, RPC, MPI, Sockets (Connectionless: UDP, Connection Oriented: TCP); Middleware, Object Request Brokers and object interfaces, CORBA, .NET, Java Beans, SOAP, Web Services; Agent-based, Autonomic and Self-managing software. Specification of interfaces; Interface Definition Language (IDL). Cluster and Grid computing: Parallel processing over clusters; Load sharing and resource management on clusters; Grid services and grid computing. Identification and prioritisation of functional and non-functional requirements of distributed applications. Design of distributed applications and services.

IIT 3443 Social Network Computing (42 hrs)

Fundamental of social computing: computational techniques for collaborative and collective intelligence of group behaviors on the Internet. Social computing: data mining and knowledge discovery of social interactions, signals and data; social media services: search engines, social network sites, blogs, micro-blogs, wikis, etc. Selected technologies: web 2.0, Web data mining, knowledge discovery on the web, web analytics, web information retrieval, ranking algorithms, recommender systems, human computation, models and theories about social networks, large graph and link-based algorithms, social marketing, monetization of the web, security/privacy issues related to social computing, etc. Learning in social networks; Applications.

IIT 3444 HPC Cluster, Virtualization and Cloud Computing (42 hrs)

Introduction to High Performance Computing (HPC), HPC Cluster, Virtualization and Cloud Computing. Building virtual machines using Xen hypervisor and other virtualization technology like: Xen Server, Citrix XenServer, VMware, VirtualPC and VirtualBox. Setup HPC Cluster mimicking supercomputers. Extend Virtualization technology to build Cloud Computing solutions, Cloud computing network and security.

IIT 3445 Secure e-Business (42 hrs)

Overview and evaluation of electronic commerce applications, technologies, and tools used to conduct business on the World Wide Web, assess the impact of e-business on competition and on business-to-customer (B2C) relationships. Designing secure e-business; Analyze and discussion of entry strategies, emerging Web-based business models, Web site design strategies, payment systems, and various other issues: Internet marketing, legal, regulatory, technological, social and ethical relating to electronic business. The role of business-to-business (B2B) commerce, electronic data interchange, Web base marketing, e-supply chains, e-procurement, e-marketplace, customer relationship management, and Web-enabling mobile business. Capstone case studies: research, analyze and speculate on issues raised in e-business case studies and demonstrate the advantages and the challenges these cases raise related to integrating e-commerce applications.

IIT 3446 Embedded Systems Programming II (42 hrs)

Review of microprocessor and microcontroller based embedded systems. Development tools, cross assemblers, cross compilers, ROM emulators, in-circuit emulators. Closed loop control systems, control theory, feedback, hysteresis, oscillation, damping, stability, Nyquist, PID, z-transform, fuzzy logic. Embedded operating systems. Real time clocks. Real-time embedded operating systems, scheduling, concurrency. Analogue and digital Input/Output systems, sampling, aliasing, Nyquist. Motors, power control, PWM, H bridge, optical encoders. Mechatronics, robotics, cybernetics. Power supplies, batteries, power management. Wired and wireless communications. Home automation, ubiquitous computing, security. Autonomic systems. Environmental concerns, operating conditions, rugged systems. RFID, system-on-chip, smart dust, nanoscale systems.

IIT 3447 Digital Defense: Issues in Security, & Critical Infrastructure protection

(42 hrs)

Overview of computer, network and systems threats: Threats of viruses, worms, botnets and malicious codes, etc., models of propagation and their epidemic spread, DoS attacks, defenses against hacking, DDoS, design of scalable testbeds for simulation of attacks against critical infrastructures, architectures for robust and flexible Internet, ubiquitous, dependable and indestructible storage for critical organizations infrastructure. Design of Survivable and Dependable Distributed Systems: Issues in the design of robust distributed systems, distributed OS, high-level protocols, distributed shared memory, OO distributed systems, distributed directory services, fault tolerance issues, issues of survivability, dependability, robustness for key critical infrastructure..

IIT 3448 Biometric Authentication Technologies (42 hrs)

Introduction; biometric technology: biometric authentication, network security systems access controls; monitoring and identification to access control of physical or information assets. Evaluations of the advantages and disadvantages: cost, accuracy, reliability and ability to fool the device, and the relative benefits of biometrics compared to other competing authentication methodologies. Biometric image processing. Ethical concerns: privacy and the multi-modal biometric technologies of the future. Biometric Security: Security via biometrics, Spaced Domain based biometric and recognition techniques; Correlation based biometric filters, Basic theory of Correlation filters; Design of advanced correlation filters that offer tolerance to expected impairments; Methods to implement digital correlations; Applications of correlation filters.

IIT 3449 Advanced Topics in Information Assurance, Security & Auditing

(42 hrs)

Emerging issues in information assurance and security, drawing upon repositories of information that document emerging issues in Information Assurance and Security. Evaluation of information with an eye toward updating mitigation strategies within the context of an organization's business needs. Information assurance, security, auditing and compliance best practices. Recent trends in information assurance, security and auditing best practices.

BBM 3125 Business Law (42 hrs)

Introduction; practical study of Kenyan business law: the legal and administrative systems, torts, contracts, sale of goods and consumer protection, secured transactions, employment, agency, negotiable instruments, debt collection, business ownership and business organizations. Actual

case decisions are used to help develop the skills required for legal analysis and an appreciation of judicial reasoning.

BCM 3222 Financial Management

(42 hrs)

Meaning and definition: Functions, relationship with other functional areas of business, financial decisions. Sources of Finance and Cost of Capital: Classification. Cost of Capital: Computation. Weighted average cost of capital & Marginal cost of capital. Time Value of money: future value and present value, multiple cash flow, annuity and determination of interest rates and growth rate, Loan amortization and computation of effective interest. Capitalization and Capital Structure: Financial Plan, determinants and steps in financial planning. Capitalization: theories of capitalization. Capital Structure and financial Structure: determinants, optimal capital structure, operating and financial average. Basic concepts of working capital: determinants of working capital, working capital forecasting, financing and Investment policies.

BLB 3227 Legal Systems and Legal Methods

(42 hrs)

Legal Systems and Legal Methods concepts: basic structure and operation of the English Legal System, providing students with the basic training and knowledge necessary to effectively undertake other law courses at a deeper and practical level. Lectures will convey information and provide a theoretical understanding on the nature of legal reasoning. The research aspect is concerned with an introduction to locating primary and secondary sources of law in both printed and computerised formats. Familiarisation with the law library and the major sources of legal information is a central pivot with students required to actively participate in a range of tasks from the process of finding cases and statutes to developing trial advocacy skills. Students will be trained in the use of legal materials and introduced to the case law process, the precedent system, the legislative process and approaches to statutory interpretation. Students will acquire and develop basic legal skills such as legal research, legal analysis and legal reasoning.