



**COMPUTER PROFESSIONALS (REGISTRATION COUNCIL OF NIGERIA)**

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**SYLLABUS FOR EXAMINATIONS AND CERTIFICATIONS**

**NEWLY REVIEWED SYLLABUS**

**February 2021**

## **Syllabus for Examinations and Certifications**

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## **Foreword**

The Computer Professional Examination is the benchmark for admission into professional practice in the Information Technology Industry in the country. The examination was conceived and designed with the candidate's career prospects in mind. The structure and nature of the examination allow every interested candidate an opportunity to earn a professional qualification that is accepted and recognized in the industry.

It is an accepted fact that the Information Technology industry is a very dynamic one. This makes it important for the syllabus, which is the outline and summary of topics/subjects to be covered for the examination, reflect this dynamism. There is also a need to ensure that graduates of the examination are globally competitive.

The syllabus identified the current global trends in IT, national needs and goals, industry requirements and provided for them accordingly. The syllabus also looked at the IT syllabi at various levels of education in the country, with a view to bridging observed gaps and limitations between them and the professional examination, bearing in mind industry needs and current global trends.

The syllabus is also intended to provide the basis for the sustenance and improvement of the competence and skills needed to attain professionalism in the Computing, Information and Communications Technology industry in the country.

The syllabus has basically three (3) levels i.e. the Computer Literacy Examination (CLE), the Computer Foundation Examination (CFE) and the Computer Professional Examination (CPE). The CLE is for non-core IT Practitioners who need some IT skills in their professions and also desire some certification. The CFE is the introductory level those who want to make a career out of IT, while the CPE is for IT or related discipline graduates who desire to be chartered professionals. So the syllabus has taken into consideration the educational needs, national goals and industry demands at all levels of the examination.

It is therefore my greatest pleasure to present the syllabus of the Computer Professional Examination to the Nigerian public

**Prof. Charles Onuoha Uwadia**  
PRESIDENT & CHAIRMAN IN COUNCIL

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## INTRODUCTION

The Computer Professional Examination (CPE) is the benchmark for admission into professional practice in the Information Technology Industry in the country. The examination was conceived and designed with the candidate's career prospects in mind. The structure and nature of the examination allow every interested candidate an opportunity to earn a professional qualification approved by government, accepted and recognized in the industry.

The Computer Professional Examination (CPE) is also designed to accommodate non-core IT Professionals who desire to enhance their skills and competencies using IT and also acquire a recognized certification.

As shown in the Table 1, the examination is divided into three (3) categories: Computer Literacy Examination (CLE), Computer Foundation Examination (CFE) and Computer Professional Examination (CPE)

Table 1: Examination Categories and Job Placements

Category		Certification	Job Placement
A	Literacy	1.1 Computer Literacy Examination (CLE)	GL04
B	Foundation	2.1 ComputerFoundation Examination I (CFE I)	GL05
		2.2 ComputerFoundation Examination II (CFE II)	GL06
C	Professional	3.1 Computer Professional Examination I (CPE I)	GL07
		3.2 Computer Professional Examination II (CPE II)	GL08
		3.3 Computer Professional Examination III (CPE III)	GL10

The Computer Literacy Examination is for non-core IT Professionals who desire to enhance their skills and competencies using IT. The examination is designed to suit the requirements of the various individuals who use IT in their daily activities.

The Computer Foundation Examination is the entry level to those aspiring to be core IT Professionals. The courses at this level are meant to expose the candidates to the fundamentals of the professional level.

The Computer Professional Examination is intended for core IT Professionals who want to acquire skills and competencies necessary to enhance their career prospects as Chartered IT Professionals.

The Examinations hold twice a year: April and October. Candidates are expected to pass all the courses at whatever level of examination and are advised to attend a CPN-Accredited training institution in preparation for the examination.

There are different entry requirements for the examination based on the level to be written. These requirements are clearly stated, but exemptions from some courses and levels are granted based on certain considerations.

The graduates of the examination are expected to be ready for the industry and globally competitive.

## **LEVEL 01- Computer Literacy Examination (CLE)**

### Objectives

The Computer Literacy Examination is targeted at those desirous of being computer literate, with official recognition of the attained competencies. They are designed for those with basic education at the level of SSCE. However, graduates of other disciplines with interest of becoming computer literate are welcomed. This examination sets out the essential concepts and skills relating to the use of devices, file creation and management, graphics, networks, internet, IoT, introduction to programming, application packages, hardware basics and data base management.

### Learning Outcomes

On completion of this course, the candidate should be able to:

- demonstrate knowledge of key concepts relating to ICT, computers, devices, graphics, start up and shut down a computer,
- work effectively on the computer desktop using icons, windows,
- adjust the main operating system settings and use built-in help features,
- create documents and print an output,
- know about the main concepts of file management and be able to efficiently organise files and folders,
- explain key storage concepts and use utility software to compress and extract large files
- understand network concepts and connection options and be able to connect to a network
- understand the importance of protecting data and devices from malware, and the importance of backing up data

### CONTENTS – Computer Literacy Examination (CLE)

The literacy certification examination consists of six modules which must be passed by the candidate before a Literacy certificate is awarded. The modules are as detailed below:

CLE 111 – Computer Systems and Programming

CLE 112 – Computer Software Packages

CLE 113 – Multimedia Document Prod. and Graphics Design

CLE 114 – Business Data Handling Processing

CLE 115 – Network and Computer security

CLE 116 – Web Design Technologies

DETAILED SYLLABUS

### **CLE 111 - Computer Systems and Programming**

- **Computer as a Tool of Information Technology:**

**Working with Computers for the first time:** Booting - Cold and Warm booting –Starting/Shutting down Computer Systems; System Information and their meaning. Working with settings - Keyboard Setting, Mouse Setting; Desktop Settings/Control panel; **Introduction**

**to Computer Software:** Operating System (OS) – Types of OS and their Uses; Unix/Linux OS options – Advantages and Disadvantages; **Introduction to Software Interface** – Window basics – windows features, Working with windows features(Desktop, Icons, Recycle bin, File management with Window Explorer); File Management using Window Explorer to create Directories/Folders

**Hardware** - Types of Computer Hardware (Processing Unit, Memory, Input Devices, Output Devices, Storage Devices, Backup/Restore); Types of Computer, Main Parts of a Personal Computer. Computer Activities;

**Software** - Types of Software (System – Operating System (**Graphical User Interface**) and Application Software -), Forms, configuration, functions;

**Computer Network** - Types of Computer networks (LAN, WAN), Internet/Extranet. Different between Internet and Extranet; Uses of Computer Networks. The Telephone Network in Computing, Types of telephone; Safety and precautions - Health and Safety, Environment;

**Information Security** - Computer Viruses, Types of Computer Viruses, prevention; Legal Issues of Privacy Data Storage and Dissemination; Guidelines and Specifications for buying Desktop Computers;

- **Internet Basics:** Concepts /Terms: The Internet – Understanding the World Wide Web (www). Components and Services/Internet addresses; Hardware and Software Requirements, covering Open Source Browser Software Alternatives; Internet Connectivity Options; Possibilities for Abuse in the area of Cyber Crime; **E-mail Applications;** Introduction to the Concepts/Terms, e-mailing basics, setting up e-mail address or account.

How to work with e-mail. Chatting on Internet; **Internet Searching:** What is a Search Engine? Types and examples of Search Engines; Using the search Engine – Boolean Method Downloading Materials on Internet. Sourcing for free Textbooks and Learning Materials; **Web Navigation: Downloading and Uploading;** Using Bookmarks Organizing Bookmarks; **Contacts and e-mail Management:** Mail Management Techniques; Using Address Books Organizing Messages; Internet Security, caches and cookies; Printing from the Internet

- **Computer Programming:** Programming with Basic, Programming with C++

### CLE 112 - Computer Software Packages

- **Introduction to Word Processing:** Basic concepts. Types of word processors. Uses. Elements of Interface; Loading and Exploring; Screen Features, Creating the first document/ Open/Close an existing document; **Working with editing features** – Spell Check, delete, copy and paste, Highlighting, Grammar error check; Formatting – Page setup, Paragraphing, Margin – Gutter margin, Paper Orientation; **Formatting** – Text: Working with format Commands menu – Font/Font size, Colours, Bold/ Italic, Underlines and Alignments, creating text effects; Working with other formatting features – Change case, Drop cap, Bullet and Numbering, Backgrounds, Border and shading; Working with Watermarking, Header and footer, footnote and endnotes, Creating a Newspaper **columns;** **Tables** – Creating tables (Drawing and Inserting) working with tables. Delete/Insert/Select table, column, rows – Merge cell, text direction, split table – Formatting table; Working with Pictures – Using picture formatting bar; Mail Merge basics – Printing a Document
- **Introduction to Spreadsheet :** Uses, New features and Model- Exploring Excel Screen, Navigating within Excel Screen; **Basic Terms:** Workbook, Cell, rows, Columns cell Reference, Range etc; **Managing Workbook:** Starting, Opening entering data, Saving and closing Files, Workbook, Managing Worksheets; **Working with a worksheet:** Changing Worksheets and Rearranging data cutting copying and pasting inserting cells drag and drop etc; **Formatting data and worksheets:** Formatting Worksheets cells merge cell, format row and columns, format painter, auto format Hiding cell gridlines, freeze panes title) text rotation format text and dates etc ; **Functions and Formula:** Different between functions and formula – Arithmetic Formulas Cell Referencing; Working with functions, Alignments, Border, effects etc; **Working with objects,** Charts and pictures/Printing worksheets

- **Introduction to Database Management System (DBMS);** Definition. Types and Examples of Database, Merits of Electronic Database. **Structure of Database,** Types of Database Application; **Designing Databases:** Interacting with DBMS Software, Creating a Database in different modes; Tables and Field; **Working with database tables:** Viewing Tables-Datasheet and Design Views, Adding fields to a table using Design View; **Entering records:** Data into the datasheet view using the already created table; **Creating Tables** by Wizard, Entering data, General Formatting; **Creating a Forms** - Working with form, creating forms (from the previous created table) by using Auto Form, Wizard and Design view Navigating a form, finding records in a form, **Retrieving Information:** Browsing, Sort Records/Filter – Ascending/Descending records; **Types of Queries:** Working with query, creating queries by using Wizard and Design view; **Working with Reports:** Creating Report (wizard) from an existing document; **Prepare Outputs** – Print, Print Options
- **Introduction to Computer Graphics:** Types of Graphics Software, Types and Uses of Graphic File Formats, Working with Colours, Drawing with Computers – Capturing Images; **Presentation Graphic Basics – Creating a presentation,** Screen elements-Designing effective slides, Creating presentation in different modes (Blank Design/Template); Presentation Views; **Text Formatting** - Working with text slides (Font/Font size, shadow, etc) Entering text in normal view using place holder, Text box. Working with Slides/ Selecting Layouts, Using Templates, Working with Master Slide - Text Input; **Working with Images and Charts:** Inserting Pictures: from clip arts or from file/camera; **Creating Objects:** Using Charts/Organization charts/Drawn Objects; **Planning and Delivering Presentation:** Slide show effects, working with animation, Slide Transitions – effects options, Delivering a Presentation and Printing

### **CLE 113 - Multimedia Document Production and Graphics Design**

- Desk Top Publishing (DTP) using Open Office (OO) Writer, Open Office Draw or MS Word - Arithmetic and Measurement Systems; Fonts and Typefaces; **Editing** Text, Paragraphs, Templates, Group Editing of Documents; **Document Design:** Master Document, Table of Contents, Sections, Columns; **Document Management:** Referencing and Field Codes, Footnotes and Endnote; Protecting Documents from others; **Advanced Document Design:** Tables, Forms, Text boxes; Spreadsheets/Images and drawing Captions; **Special Tools:** Mail Merge, Macros; **Printing**
- Producing Presentations using OO Impress or MS PowerPoint - **Design Considerations:** Audience and Environment, Assimilation, Delivery, **Slides**

**and Slide Masters:** Setup, Exporting; **Pictures, Images, Drawn Objects:** Manipulation, Effects, Editing Images; **Charts/ Graphs:** Using Charts, Graphs, Flowcharts; **Multimedia:** Sound, Video, Animation; **Managing Presentation:** Slide Show Control, Customized Shows; **Relating Information:** Linking, **Macros:** Record, Assign; **Printing:** Printing setup

- **Basic Web Design - Web Concepts:** Introduction, Basic Terms, Information on the Web; **HTML:** Fundamentals of HTML, Building a Simple Page; **HTML Editor :** Using the application, Text Inputting and Formatting, Paragraph and page Formatting, Hyperlinks; **Working with Objects:** Tables, Frames; Designing Simple Forms; **Images:** Image Formats and Size, Save, Manipulate Images, Upload a Website; **Managing Web Business,** Printing from the web

- **Computer graphics fundamentals**

**Designing with Color:** The dimensions of color; color perception; key color systems and terminology used in graphic art; color theories in contemporary design; color psychology, symbolism and cultural influences; strategies for choosing color schemes; the impact of color in composition; Colour in Context and Practice; Three-Dimensional Colour

**The Language of Design:** Design as a visual language; how unity, variety, hierarchy and proportion affect the design composition as a whole; how scale, balance, rhythm, repetition, economy and proximity affect design relationships; using shape, space, line, size, color, texture and typography; Perception, Dynamic Balance, and Gestalt Principles

**Managing Effective Design:** Graphic devices and techniques that support visual organization; key visual relationships; the impact of the human factor on design decisions; the foundations and functions of communications; demystifying the design process; Text Type, Layout, Illustration, and Photography in Design.

**Typography in Design:** Typographic terms and measurement systems; how to select typefaces appropriate to communication goals; how type can lend expression to a design; harmonious combinations of types with imagery; using type judiciously when legibility is a factor.

**Imagery in Design:** Symbols, logos and representational and informational imagery; enhancing a communication message with photos and illustrations; using iconographic symbols to communicate information at a glance; logo design; identity and wayfinding systems; using charts and graphics.

**Corporate Design:** basic guidelines and best practices for developing brand design skills, Introduction to Branding, Creating Brands, Showcasing Brands.

**Portfolio Development :** preparation of verbal and visual presentations including cover letters, resumes and the physical portfolio, Types of Portfolios, Portfolio Design Fundamentals, Interface Design, Portfolio Presentation and the Interview.

#### **CLE 114 - Business Data Handling and Processing**

- **Advanced Spreadsheet Processing using OO Calc or MS Excel: Editing** Data, Display, Protection and file Security; **Data Handling:** Data Sorting, Querying/Filtering, Linking, Templates, Charts & Graphics; **Functions and Formulas;** **Analysis:** Pivot Tables / Dynamic Crosstab, Scenarios /Versions, Auditing; **Special Tools:** Macros.
- Database Management Using OO Base, MS Access or MySQL: **Structure of Databases:** Loading and Exploring Ms Access window features, **Designing** Databases, Interacting with Access, creating a Database in different modes; **Table Design:** Field and Columns, Relational Tables, Relationship/Joins; **Query Design:** Query Types, Query Formulas, Refine a Query; **Form Design:** Types of forms, Controls, Sub-forms; **Report Design:** Calculations, Presentation, **Macros:** Record & Assign, **Import, export and link data, Printing.**

#### **CLE 115 – Network and Computer Security** **Networking Basics**

- **Network Theory:** Networking Terminology, Network Building Blocks, Standard Network Models, Physical Network Topologies, Logical Network Topologies, Network Categories.
- **Network Communications Methods:** Transmission Methods, Media Access Methods, Signaling Methods
- **Network Data Delivery:** Data Addressing and Delivery, Delivery Techniques
- **Network Media and Hardware:** Bounded Network Media, Unbounded Network Media, Noise Control, Network Connectivity Devices, Wiring Distribution Components

- **Network Implementations:** The OSI Model, Ethernet Networks, Token Ring Networks, Fiber Distributed Data Interface (FDDI) Networks, Wireless Technologies and Standards
- **Networking with TCP/IP:** Families of Protocols, The TCP/IP Protocol, IP Address Basics, Custom IP Addresses, The IP Version 6 Protocol, Topic 6F: The TCP/IP Protocol Suite
- **TCP/IP Services:** IP Address Assignment Methods, Host Name Resolution, TCP/IP Utilities, TCP/IP Upper-Layer Services, TCP/IP Interoperability Services
- **Local Area Network Infrastructure:** Bridges and Switches, IP Routing Static IP Routing, Dynamic IP Routing, Control Data Movement with Filters and VLANs

### **Network Operations**

- **WAN Infrastructure:** WAN Switching Technologies, WAN Transmission Technologies, WAN Connectivity Methods, Voice Over Data Systems
- **Network Security:** Computer Security Basics, Authentication, Data Encryption, Protect Network Traffic with IP Security (IPsec), Internet Security, Local Security, Common Threats, Threat Mitigation Techniques, Intrusion Detection and Prevention, Education of Users
- **Remote Networking:** Remote Network Architectures, Remote Access, Networking Implementations, Virtual Private Networking, Remote Control Computing
- **Disaster Recovery:** Examine Configuration Management Documentation, plan for Disaster Recovery, Fault Tolerance Methods, Data Backup
- **Network Data Storage:** Enterprise Data Storage, Network-Attached Storage (NAS), Storage Area Network (SAN) Implementations, Clustering
- **Network Operating Systems:** UNIX and Linux Operating Systems, Apple Mac OS X, Microsoft Operating Systems, Novell Open Enterprise Server
- **Network Management:** Monitoring Tools, Network Baselineing, Network Optimization
- **Network Troubleshooting:** Troubleshooting Models, TCP/IP Troubleshooting Utilities, Hardware Troubleshooting Tools, Common Connectivity Issues

### **Computer Security**

Introduction to the basics of computer security; encryption and cryptography, authentication and key exchange protocols, software security, trusted systems, database security, network security, security policy.

## **CLE 116 – Web Design Technologies**

This Course is about the development of visual graphic and information design skills required to create compelling web sites, based on the syllabus of the International Webmasters Association (IWA). It teaches how to plan, organize, and create a web site from start to finish. Two broad skill sets to be examined as follows:

### **Web Graphics**

- **Raster/Image Processing Basics:** Files and Image types, Resolutions, Image sizes and their optimisations; Working with Image handling software such as Adobe Photoshop or Fireworks to select, enhance, distort, colour, scale, and create or manipulate images and artworks.
- **Colour Theory:** development of appropriate colour systems for graphic design projects; principles, terminology, and applications of colour theory, with an emphasis on manipulating colour. A working knowledge of the expression and perception of colour, and colour interaction, lends credibility and sophistication to a designer's work
- **Fundamentals of Typography:** anatomy of the letterform, the distinguishing features of different typefaces, and creative applications of type.
- **HTML Editors;** e.g. Dreamweaver: design of sites, creation of advanced layouts using Cascading Style Sheets, typography, colours, data tables, and frames.
- **Web Design Basics:** understanding of a systematic professional approach to Web design; use of site maps, wireframes, HTML/CSS layouts, comps, colour palettes, usability tests, and other tools and concepts

### **Web Programming**

- **Programming HTML: Creating a Web Page with HTML:** Create a Global Structure, Add a Page Title, Modify the, Page Background, Create Paragraphs, Embed Images class; **Structuring Content in HTML:** Create Headings, Create Lists, Notate Code, Insert Horizontal Rules, Control Line Breaks, Group Elements class; **Linking Web Pages with HTML:** Create

Local Links, Create Remote Links, Create Image, Links class; **Formatting Text with HTML:** Apply Bold and Italics, Modify Font Styles, Create an Embedded Style Sheet, Insert HTML Entities class; **Creating Tables with HTML:** Create the Table Body, Create Table Headers, Modify the Table Structure, Align Table Content, Modify Table Background Colors class

- **Programming CSS: Controlling Color and Typography with CSS:** Create an Embedded Style Sheet, Apply Color, Comment Your Code, Modify Text Styles, Modify Font Styles, Create a Linked Style Sheet; **Designing with the Cascade in CSS:** Create Class Styles, Create ID Styles, Create Contextual Styles, Target Styles to Elements with Specific Attributes, Create Style Sheets that Cascade, Import Style Sheets, Create Inline Styles; **Designing Content Sections within CSS:** Control Margins and Padding, Create Borders, Control Element Dimensions , Create Floating Elements, Control Content Overflow; **Controlling Layout with Positioning with CSS:** Control Layout with Absolute Positioning, Create a Fixed Multi-Column Layout, Create a Fluid Multi-Column Layout, Control Layout with Relative Positioning, Control the Display of Layered Elements, Apply Fixed Positioning; **Enhancing an Existing Design with CSS:** Customize Cursors, Customize Link Styles, Customize Forms, Work with Background Images, Customize Lists, Create Generated Content; **Creating Alternate Style Sheets with CSS,** Create Accessible Style Sheets, Apply User-Defined System Fonts and Colors, Create a Print Style Sheet
- **Programming JavaScript: Getting Started with JavaScript:** Create a Basic JavaScript Script, Execute a Script, Add Comments to a Script; **Managing the Browser Window:** Display Messages on the Status Bar, Open a Linked Page in a New Window; **Managing the Document:** Write Content to a Document, Create a Dynamic Document; **Manipulating Data and Functions:** Create a Form, Create a Function, Store Data Using Variables, Manipulate Data Using Operators, Convert Data Types; **Validating Statements Using Control Constructs:** Validate Statements, Execute Statements Iteratively; **Calculating Numerical Values:** Calculate Numerical Values; Manipulate String Values, Manipulate Date Values; **Using Regular Expressions and Understanding Ajax:** Use Regular Expressions to Match Patterns in Strings, Understand the Basics of Ajax.

## METHOD OF DELIVERY

Lectures, discussions, practicals and tutorials are to be used to prepare candidates for this examination. **It is expected that those presenting themselves for this qualification must have undergone formal training for at least 90 hours out of**

**which 60 hours must be dedicated for practicals in a CPN Accredited institution.**

#### **FORMAT AND DURATION OF THE EXAMINATION**

The examination lasts for three hours per module and is based on the syllabus in this document. No materials are allowed into the examination room. Examinations are held twice a year, April and October, and are undertaken in normal examination conditions with one or more duly appointed invigilators. **The pass mark is 40%.**

#### **Level 02- Foundation Examinations**

The foundation examinations are designed as entry level path for those ultimately desirous of being chartered IT Professionals. The contents comprise courses that embody the stipulations specified for the National Diploma Certificates and equivalents obtainable in the Polytechnic and Colleges of Education.

There are two levels of qualifications to be certified under the category of Pre-Professional Certificates. These are:

1. CPN Foundation Examination I (CFE I)
2. CPN Foundation Examination II (CFE II)

The body of knowledge contained in the CFE is intended to introduce IT Basics at levels roughly equivalent to that of anyone who may have successfully completed 2 semesters at ND I level in a formal institution. The CFE is also equivalent to having completed an additional 2 semesters at ND II level. The table below highlights the relative academic and career weights to be accorded the two CPN qualifications.

<b>CPN Certifications</b>	<b>Academic Placement</b>	<b>Civil Service Placement</b>
CFE I	ND I Level - Polytechnic	GL 05
CFE II	ND II Level - Polytechnic 200 Level-University	GL 06

### **Entry Requirements for CFE I**

- Credit pass in minimum of 5 O'Level (WAEC/SSCE/NECO) subjects including English Language and Mathematics.
- Graduates of other disciplines other than computer science or related courses.

### **Entry Requirements for CFE II**

- Pass in CFE I

Candidates who pass both the CFE I and CFE II are thus hereby deemed to have an equivalent of National Diploma based on the National Board of Technical Education (NBTE) Standard and Curriculum and can seek direct entry admission into 200 level in Universities.

### **Course Outline**

#### **CPN Foundation Examination I (CFE I) Examination**

- CFC 2110 - Basic Computing Concepts
- CFC 2120 - Principles of Programming / System Analysis and Design
- CFC 2130 - Operating Systems
- CFC 2140 - Data Structures and Algorithm

CFC 2150 - Multimedia Techniques  
CFC 2160 - Digital Electronics/ Basic Hardware Maintenance  
CFC 2170- Network Design Topology and Protocols

### **CPN Foundation Examination I (CFE II) Examination**

CFC 2210 - Management Information System  
CFC 2220 - Introduction to Programming Languages and Database  
CFC 2230 - Computer Architecture  
CFC 2240 - Multimedia Programming/Digital Film Animation  
CFC 2250 - Network Technologies/ Security  
CFC 2260 - Entrepreneurship Development  
CFC 2270 - Computer and Society, Code of Ethics and Professional Conduct

### **CPN Foundation Examination I (CFE I) Courses**

#### **CFE 2110 - Basic Computing Concepts**

##### **Objectives**

- Enable students understand basic concepts in computing

##### **Learning Outcomes**

- Understand the history, classification and impact of computers
- Know the Concept of Computer Hardware, Software
- Understand Computer Data Processing Systems and modes
- Know the Procedures for Computer and Data Preparation Method
- Understand Security and Safety Procedures within a Computer Environment
- Understand the Concept of a computer Network
- Understand the use of the Internet

##### **Indicative Content**

- Define the computer. Describe the development of computers, in particular Abacus, Pascal, Babbage, Hollerith and ENIAC.
- Classify computers according to generations
- Distinguish between analogue, digital, and hybrid computers
- Explain the social implication of computers on society in particular privacy.
- List the benefits of computers to the society.
- Describe computer hardware configuration.

- List some input and output devices
- Describe the function of the input and out-put devices
- Describe the function of Central Processing Unit (CPU)
- List some auxiliary Units. Describe the function of the auxiliary memory
- Define bits, byte, nibble, and word and storage size.
- Explain software and its various types. Distinguish between the low-level and high-level languages.
- Explain source and object programs.
- Define a translator.
- Explain types of translators: assembler, compiler, and interpreter.
- Explain the use of package programs.
- Explain how to operate a computer system
- Explain the initialization and formatting of storage media
- Describe data control techniques, and operating procedure of a computer installation.
- Explain safety regulations in computer installations.
- State methods of preventing hazards such as fire, flooding and sabotage
- Explain security methods in computer installation and the need for user passwords
- Explain network concept.
- Describe different types of network organization such as star, ring and bus
- Explain LAN and WAN
- Explain internet resources. Explain the processes involved in searching the internet for materials
- Explain the concept of E-mail

## **CFE 2120 - Principles of Programming/System Analysis and Design**

### **Objectives**

- To acquaint students with the basic principles of programming

### **Learning Outcomes**

- Understand the basis of programming, algorithm and flow charting
- Understand the principles of designing algorithms for common programming problems
- Understand the general modular program design principles
- Understand the procedure in solving programming problems

- Understand the various levels of programming languages
- Understand the concept of debugging and managing programs
- Understand the good programming practices
- Understand the concept of object oriented programming
- Understand the process of feasibility study
- Know the stages of system analysis
- Understand systems implementation process
- Understand systems design, understand data base design
- Understand input and output design
- Understand system implementation, evaluation and maintenance process

### **Indicative Content**

- Define a program and identify the features of good program.
- Identify the syntax and semantics of the programming
- Define algorithm; features of an algorithms, methods of algorithm.
- Describe main ANSI flowcharts.
- Draw flowcharts to implement some simple programming tasks
- Design algorithm for problems involving.
- Design sequence control structure
- Explain selection control structure, iteration control structure
- Explain modular programming concept; top-down design technique.
- Illustrate program design with program structure charts, hierarchical Network
- Explain machine language, low-level language and High level languages with examples
- Explain the distinguishing features of languages
- Distinguish between system comments and program statements
- Define debugging, identify sources of bugs in a program and explain syntax, runtime and logical errors.
- Identify techniques of locating bugs in a program; Employ structured approach to both flowcharting and program development.
- Define interactive processing. Explain the concept of OO programming.
- Describe the features of OO programming and explain the concept of properties, events, objects and classes.
- Explain Systems analysis and logical stages of systems development.
- List systems development process, planning, control and coordination
- Carry out feasibility study, its objectives, and major factors.

- Explain features of feasibility study report.
- Explain concept of Data flow diagram. Analysis specification
- Explain fact finding techniques.
- List ideal system selection Resources requirements of a system
- Explain System design. Explain System specification. Explain Program specification
- Explain System documentation
- Describe Database design. Explain the similarities and differences between conventional and database files
- Explain the design of the structures of a database file
- Describe Input to a system. List Methods used for data capture
- Identify Current trends in automatic data collection technology.
- Explain the concept of prototyping and design of computer inputs
- Explain the principles and guidelines of output design
- Explain the different types of outputs
- Describe output media and formats.
- Explain the concept of prototyping and design of computer output.
- Describe system implementation
- Describe how to generate test data
- Explain the importance of data bank
- Explain the process of hardware and software installation.
- List the methods used in system testing
- List the methods used in system evaluating, amendments and cost analysis.
- Explain the importance of system evaluation.
- Explain the following: Program amendment, request, and system amendment
- Explain the concepts of systems maintenance and standards.
- Explain the importance of system maintenance, user's role in system maintenance
- State various system standards

## **CFC 2130 – Operating Systems**

### **Objectives**

- Enable students acquire basic skills in operating systems

## Learning Outcomes

- Understand the concept of operating systems and the various types in use.
- Know how to perform the basic operating system settings and system management.
- Know how to share documents and folders and set security features.
- Know basic storage management across the various Operating System platforms.
- Know how to create and manage user accounts.

## Indicative Content

- Define Operating System (O/S)
- List the functions of O/S
- Explain the concept of operating system
- Describe the features of Windows Operating System
- Explain the functions, operations and classifications of the various operating systems e.g. (UNIX, LINUX and Windows)
- Describe sequential processes, concurrent processes and processor management
- Describe Microsoft Management Console. Define the Control Panel
  - Change system settings
  - Add/Remove Hardware
  - Add/Remove Software
  - Display property
- Describe Windows disk and storage management
  - Basic and dynamic storage
  - Managing disks and volumes
  - Compressing Files and Folders
  - Encryption (Files and Folders)
- Describe managing Users and Groups
  - ⊖ User Accounts in Windows
    - Creating, deleting modifying user accounts
    - Implementing Groups
- Define o/s nucleus {kernel}
- Describe the components of o/s nucleus: BIOS dispatcher, Basic I/O system, I/O system dispatcher etc

## CFE 2140 - Data Structures and Algorithm

### Objectives

- Understand Concepts of data structure and tools for studying

### Learning Outcomes

- Know tools for studying data: symbols, relations, and graph
- Know sets relations and string structure
- Know data life cycle, data representation, properties of ordered and occupancy
- Know the properties of ordered and linear list
- Know non-linear structures;
- Understand different sorting and searching techniques

### Indicative Content

- Define data structure. Define data attributes; name, value range, data types.
- Define units for identifying data character, fields, sub fields, records, files.
- Define symbols, relations and graph.
- Explain the symbols for expressing relations among data.
- Explain position relation cell contents, record location, transfer key.
- Explain order relation; record rank, cell rank.
- State properties of graph: routes, edge, sequences, directed and non-directed.
- Describe operations such as proceeds, less than points to, move to, search, change, entry
- Define sets and relation, elements of set, subsets, super sets, Universal set and null set.
- Describe set operations, Define relations, equivalence and composite relation.
- Define string. Explain representation: character, string length and string values.
- Explain basic operation on string assignment, sub string selection, insertion and sub string retrieval, deletion concatenation and replacement;
- Explain set representation
- Describe storage mapping techniques for string variables.
- Explain the term occupancy leans, empty loose.

- Define and Enumerate the differences between birth, death and change of data. Define a sequential list. Explain the differences between fixed and variable length fields. Implement fixed and variable fields. Define ordered and linear list. Explain operations that can be performed on an ordered list: append, search (including delete, sort, selection and exchange, merge, including multiway merge and balance merge.). Describe different types of linked list array, double linked list, queues, stack, deques, trees. Explain the use of pointers. Describe storage mapping for linked lists. Define a tree. State the properties of tree. Describe different types of tree. (General tree, binary tree); Explain binary tree representation; 8.5 Define graph, its types and properties
- Define sorting and the various sorting techniques. Explain sorting and the various sorting techniques

## **CFE 2150 - Multimedia Foundation Concepts/Multimedia Techniques**

### **Objectives**

- designed to enable the student understand the concepts, tools, techniques and methods of working in print and publishing, websites development and various multimedia jobs. Multimedia Techniques module is designed to upgrade students with digital age skill like 2D animation, 3D text, video editing, etc

### **Learning Outcomes**

- Understand the concept of Multimedia
- Know how to create prints items
- Know how to explore image editing application
- Understand the enhancement of Visuals
- Understand the creation animation sequences
- Know how to create a simple Web page
- Know how to package the Portfolio
- Know multimedia presentations
- Understand the general overview of a network
- Understand analysis document
- Know how to create storyboard for interactive presentation
- Know how to create a video log and edit video footage
- Understand graphical user interface
- Know how to integrate media with lingo program
- Know how to record and edit sound for presentation

- Understand interactive shockwave games
- Know how to create animation for the presentation

### **Indicative Content**

- Identify multimedia technologies
- List multimedia file formats; Describe compression techniques
- Describe video conferencing; Format texts and graphics
- Apply styles and effects to objects; Identify changes of objects
- Differentiate between cut and copy of objects
- Identify Multimedia Applications; Produce movie from pictures
- Identify shockwave on the web; Plan Video projects
- Analyze Video projects; Produce shockwaves
- Select sound for the visuals; Identify Animation
- List types of animations
- Identify website-design fundamentals
- Define HTML; Apply Dreamweaver; Select images from CorelDraw
- Identify package concepts; Apply package concepts
- Produce a portfolio Package; Apply applications for presenting information
- Identify slides in PowerPoint; Produce slide shows; View images
- Explain the following terms:- Network – LAN – MAN – WAN – Client – Server
- Identify the types of Network; IP addresses; Identify Networks protocols and Topology;
- Identify analysis Documents; Select analysis documents; Prepare analysis documents
- Produce analysis Documents
- Identify storyboards for interactive presentations; Select where to create storyboard
- Produce storyboards
- Identify video log and edit video footage; Select video log; Prepare video footage
- Produce video log
- Identify graphical user interface; Select graphical user; Prepare graphical user
- Interface; Identify Multimedia with lingo program; Integrate Multimedia with lingo program Write lingo scripts; Produce the multimedia Objects

- Identify sounds for presentation; Edit sounds for presentation; Select recorded sounds
- for presentation; Produce sound for Presentation; Identify interactive shockwave games
- Write scripts for shockwave games; Move scripts to form video
- Produce shockwave games on the web
- Identify animation for presentation; Identify animations (2D and 3D); Apply animations in industries music, films, communicating complex ideas, cutout, etc
- Apply step by step method using Photoshop and Adobe Image Ready
- Produce animation for presentation

## **CFE 2160 - Digital Electronics and Hardware Maintenance**

### **Objectives**

- This is designed to enable the trainee have a working knowledge of Basic Electronics and Digital Electronics
- Provide the learner with the structural and functional features of the computer system and its components
- To equip students with knowledge and tools needed to perform hardware maintenance

### **Learning Outcomes**

- Understand the concept of basic electronics.
- Understand diodes technology
- Understand power supplies concept {half wave and full wave}
- Understand the phenomenon of wave optics.
- Understand related concepts of Convolution.
- Know the Concepts of Digital Systems and Data / Information in Digital Systems.
- Know the structure and Development of Digital Systems
- Understand Numbering System.
- Know the Internal Structure of Computer Processing Unit.
- Understand the basic principles of Microelectronics and Optoelectronics.
- Understand the concept and development of Simple programs for a Microprocessor
- Understand the function of circuit components
- Comprehension of basic electric theory
- Understand the function of circuit components

- To be able to use basic general measuring equipments
- To understand integrated circuits and terminologies
- Understand preventative maintenance of hardware components
- Understand diagnostic techniques involved in corrective maintenance
- Understand system installation procedure

### **Indicative Content**

- Describe the fabrication of semi-conductor; Describe Diodes technology (P-Type, N-Type, PN-junction, minority carriers, majority carriers, junction voltage).
- Define Diode bias (forward and reverse-bias, PIV voltage)
- Identify the circuit symbols for diode
- Physically identify various types of diodes
- Describe the energy levels in materials
- Differentiate between conductors, semiconductors and insulators, using Fermi level concept.
- Define Fermi energy levels. Describe valence and conduction bands
- Describe P-N junction diode; Sketch forward and reverse characteristics of the P-N junction diode; Outline silicon and Germanium diode characteristics
- Define zener diode; Identify the circuit symbols for diode; Physically identify various types of diodes
- Describe the operations of Tunnel diode, and Photo diode
- Describe Diode types and applications (LEDs, PN, photodiodes, zener, verator).
- Describe Basic Power Supplies (half-wave and full wave, rectification, capacitor, filtering, shunt zener diode, three- terminal regulators)
- Analyze Types (PNP and NPN) and basic current and voltage amplification equations.
- Describe basic transistor applications (switch, amplifier, relay and output drivers).
- Define the term waves. Differentiate between mechanical wave and electromagnetic waves.
- Distinguish between the two types of waves: Longitudinal and transverse waves.
- List examples of wave; Define wave parameters; e.g. frequency, wavelength, wave
- Describe signals by impulse functions. Describe Impulse and step response of linear systems.

- Describe Discrete-time Convolution. Identify other aspects of convolution.
- Define Discrete Signals and Systems. Identify the different codes used in digital system.
- Describe basic digital functions. Describe the concept of data / Information presentation in digital system. Describe the various methods of minimization required to simplify digital combinational circuits. Identify the various types of transistors, Field Effect Transistors [FET], Bi-Polar junction.
- Describe the families of Transistor Logic Gates [TTL]. Describe cascading for transistors.
- Describe Fan in and out.
- Define Number System. Describe the various types of number systems.
- Define Binary System. Convert numbers from other base to binary. Convert numbers from binary to other bases.
- Describe Binary Comparators. Describe the concept of Error Detection. Define the Central Processing Unit. Outline the functions of the C P U components [Motherboard, Processor, RAM Memory, Disk Drives, Power Pack, Cables,
- Slots: Peripheral Component Interconnect [PCI], International Standard Architecture [ISA].
- Describe the concept of Jumpers and Caps. Describe Memory Circuits. Identify the types of signals within the C. P. U. [Electrical and interface]. Describe the flow of signals with the C. P. U Describe Microelectronics. Describe Integrated Circuit. Describe the concept of Wafer. State the Concept of Tantalum. Identify types of Integrated Circuits. Describe the concept of 8/16/32 bits Computer architecture. Define Microprocessor. List examples of Microprocessors [386, 486, Pentium I to IV] . Define Program. Identify types of
- Programming languages; Define Language Translator; Describe the various types of translator [Assembler and Compiler]. Outline the steps involved in developing a program.
- Describe Internal Working of the Microprocessor as it relates to Fetching and Moving Instructions between registers
- State Ohm's law. Analysis the principles of Ohm's law using circuit diagrams
- State Kirchof's law and The venin theory. Analyze using circuit diagrams.

- Identify the function of circuit components. Explain the application of passive circuit components
- Explain the application of active circuit components. Identify the operations and principles of basic measuring instruments. Explain the operation of maintenance tools such as multimetres, oscilloscopes and signal generators.
- Explain how to use maintenance tools to measure current, voltage, resistance, inductance and frequency. Explain how diagnostic operations are performed in fault-finding
- Describe Integrated Circuit and Terminologies. Explain terminologies for characterising logic circuits.
- Explain different attributes of logic families. Explain the importance of preventive measures in system maintenance and Hardware care. Explain the properties of drives. State the steps in dust prevention procedures. Explain the procedures to repair and restore hardware functionality.
- Explain the methods of testing integrated circuits (IC). Explain the importance of diagnostic programs
- Explain the background and procedures needed for system installation. State the requirement for equipment inventory. Explain modular testing procedures. State the advantages of modular testing procedures.

## **CFE 2170- Network Design Topology and Protocols**

### **Objectives**

- To produce technically competent manpower to meet the National requirements in the areas of designing, installation, maintenance and management of local, wide area and wireless network environment

### **Learning Outcomes**

- Understand the General Over View of a Network.
- Know Types of Network.
- Know OSI Model
- Know IP Addresses.
- Know Types Of Network.
- Know Networking Devices
- Understand Network Design, Deployment and Implementation.
- Know The Various Types Of Network Topology.

- Understand the Difference Between the different Network Topologies (BUS, RING, STAR, MESH, FULL MESH and Wireless Network Topologies.)
- Know The Most Fault-tolerant Topology.
- Understand Data Link Layer Protocols

### **Indicative Content**

- Define Network; LAN; WAN. Explain the terms Client and Server.
- State the advantages of a network. Describe the difference between Router and Gateway.
- Explain the advantages of WAN over LAN. Explain the importance of network. Define point to point network; peer to peer network; Client/Server based network.
- Identify point to point network, peer to peer network and client server based network.
- State advantages of client/server based networks over point to point and peer to peer networks. Discuss the following Server reliability; Server high availability.
- Define OSI Model. List the various layers of OSI. State the various functions of OSI. Explain the concept of IP, IP addressing. Explain the term IPV 4. State and describe the classes of IP addresses. List and explain the range of IP address classes. Describe VLSM/Subnetting IPPV4. Explain IPV6. Define Intranet, Extranet, Internet, difference between Intranet and Extranet. List the various types of internet connectivity. Explain hub. Describe the types and application of hubs. Explain repeaters. Explain the importance of repeaters. Explain the use of bridges and switches. Explain the use of routers. Describe the function of a NIC.
- Define Network Design and Implementation. State the characteristics of Network Design.
- Differentiate between Network Design and topology.

### **Define Network topology. List the various types of Network topology.**

- State the topology that is used for the internet.
- Differentiate between the token ring and token bus
- Differences between Bus and Ring Topology
- Difference between Star and Mesh topology
- Describe wireless topology.
- Defining Mesh network topology

- Differentiate between Full mesh and Perfidies Mesh.; Define Full mesh.
- Differences between Full Mesh and Star Topology
- Define Fault tolerance as related to networking.
- Explain the most fault tolerance as related to networking.
- Define Fault tolerant as related to networking.
- Explain the least and the most fault tolerant as related to networking.
- Explain the function of data link layer protocol.
- Describe Ethernet. Explain the different DIX/IEEE standards/specification of Ethernet in terms of speed, type, cable type etc.
- Explain ring basic; Explain FDDI basics; Differentiate between Ethernet, ring basics and FDDI basics

## METHOD OF DELIVERY

- Lectures, discussions, practical sessions and tutorials are to be used to prepare candidates for this examination. It is expected that those presenting themselves for this qualification must have undergone formal training for at least 90 hours out of which 60 hours must be dedicated for practical sessions in a CPN accredited institution.

## CPN Foundation Examination II (CFE II) Examination Courses

### CFE 2210 - Management Information System

#### Objectives

- To equip student with knowledge and skills for information management and systems development

#### Learning Outcomes

- Know different systems
- Understand systems theory
- Understand the concept of management information
- Know the features of management information systems (MIS)
- Understand the concept of transaction processing
- Understand the concept of office automation
- Understand the different applications of MIS
- Understand the principles of decision making

- Know the development cycle of an MIS
- Understand the principles of project management
- Understand total systems

### **Indicative Content**

- Understand a system and its characteristics. Understand the taxonomy of systems; deterministic, probabilistic, static, dynamic etc.
- Understand organization and business education as make-up of systems or subsystems
- Understand closed and open loop systems. Understand feedback control in a system
- Understand a system model. Understand how to represent a system
- Understand management and its functions, information needs of management levels; Understand attributes of Information. Understand an information system and its characteristics. Understand a management information system. Appreciate the importance of MIS to business organizations. Recognize features of information systems. Understand the concept of data and information. Understand data capture. Understand verification and validation. Understand data processing stages. Understand the concept of a database management system (DBMS), including insertion, delete and update operations.
- Understand office automation and its components, e-mail, voice mail, fax machine, teleconferencing. Understand telecommuting. Understand the importance of office automation (OA) to an organization. Understand various types of information systems and their objectives. Recognize the elements required for any information system
- Understand reports required for any types of information system. Understand sources of data for each type of information system. Understand the information needs, strategic technical and operational advantages of MIS. Understand the stages in decision making
- Understand various approaches to decision making. Undertake application of some decision making techniques. Understand the need for information system development
- Understand the phases and importance in the development cycle of MIS. Understand project management and its objectives. Understand some tools used in project management and their application. Understand the objectives of a total system

- Understand rationalization of information flows, timing and accuracy of destination of output. Understand the effect of time lag on inputs. Understand the effect of deviating from standards

## **CFE 2220 - Introduction to Programming Languages, SQL & RDBMS**

### **Objectives**

- To equip student with knowledge and skills of programming languages and uses
- To enable students acquire skills needed to perform structural query language
- To equip students with the tools and practical experience needed to perform structured query language tasks
- To empower students with the tools, knowledge and practical experience needed to perform Oracle database tasks (including installation, configuration and maintenance)
- To equip student with practical experience needed to use Java

### **Learning Outcomes**

- Know various programming languages available and uses
- Understand the essential components and tools for SQL server
- Know how to manage database. Understand the control of server and database security
- Understand the importance of SQL Server integration services
- Understand the functions of backup and recovery
- Understand the procedures for Implementing Database mirroring
- Understand the operations of SQL Server agent. Understand the concept of Replication
- Understand SQL server monitor. Understand Oracle architecture
- Understand the method of creating and managing tables
- Understand the procedures for writing executable statements
- Understand procedures for controlling user access
- Understand the significance of interacting with the Oracle Server.
- Understand the procedure for Managing Oracle instance
- Understand the procedures for managing Database Storage Structures
- Understand the procedures for managing schema objects
- Understand the procedures for managing Data and concurrency
- Understand object oriented programming with Java
- Understand java constructs

- Understand java abstractions
- Understand input/output processing
- Understand java database connectivity
- Understand graphics and image processing
- Understand graphic user interface and events
- Understand networking with java
- Understand multithreading and collections

### **Indicative Content**

- Understand the various programming languages available
- List the various components of SQL Server e.g. Services, Editions, System and user databases. List the various tools used in SQL server e.g. Management studio, Transact SQL, Surface area configuration, configuration manager.
- Explain disk structures. Explain space management strategies: Dynamic database growth. Describe SQL Server authentications. Describe how to enforce password policy.
- Explain the concept of database security. Explain the use of packages.
- State the uses of packages features and control flows, data flows and connections.
- Explain business intelligence development studio.
- Describe the features of transaction log architecture.
- Explain the concept of backup and recovery.
- Explain the implementation of database mirroring.
- Describe how to configure agent.
- Describe the set-up of database mail.
- Explain the use of alerts and operators.
- State the features of public/subscribe metaphor.
- Describe replication types.
- Describe replication agents.
- Describe replication models. Explain in detail various components of SQL Server monitor. Describe health and history tool in SQL Server. Describe the features of Repository architecture and its main components. Explain the Oracle instance architecture. State the procedures for creating an Oracle database. Identify the tools for creating Oracle database
- Describe the main database objects. Describe the data types that can be used when specifying column definition. Describe other database objects and their uses. State the significance of the executable section.

State the rules of nested blocks. Describe constraints, state the tools required for controlling user access, describe the data type and size of a PL/SQL variable dynamically. State the outcome of SQL DML Statements

- Describe the stages of database start up. Describe the database shutdown options.
- Describe how table row data is stored in blocks. State the purpose of table spaces and data files. Explain space management in table spaces. Explain key features and Define constraints. Explain state of constraints. Describe triggers and triggering events.
- Define levels of locking. List possible causes of lock conflict
- Identify the basic components of JAVA environment (JDK, JRE, VM). Explain classes, methods, variables and key words. Explain inheritance, polymorphism and data abstraction. Explain with graphical illustrations the following; Object, Classes, Superclass, Sub-classing. Explain various JAVA IDEs. Describe the process of creating and running Java programs. Explain data types (primitives and referential). Explain in details access modifiers for methods, classes and variables.
- Define arithmetic expressions using precedence rules. Describe how memory allocation works for objects and primitive data value. Explain in details control structures, selections and conditional or unconditional statements. Explain strings, string processing and string tokenization. Explain with skeletal codes; static initializers, abstract classes, inner classes. Explain the JAVA garbage collector and the finalise method. Explain the try-catch-finally block and constructors. Describe parameter passing in method definitions. Describe the following with code samples; File reader/writer, Stream reader/writer, Byte reader/writer, Character reader/writer, Pipe reader/writer
- Describe how to Read from file, Read from keyboard, The system error, Buffered reader/writer. Describe the JDBC design. Explain with code samples SQL with JAVA, Installing JDBC, JDBC programming concepts, Executing queries, Result sets
- Introduce the JAVA transaction API. Explain the swing package, frame and panel
- Describe creation of shapes, colours, images 2D text and font. Describe image manipulation and clipboard activities. Describe the model view-controller pattern.
- Explain and demonstrate form controls, menu and dialogue boxes using the layout managers. Demonstrate applets with sample codes.

Explain the AWT package and events. Create lists, trees and tables. Explain the various event Handlers. Explain the JAVA.NET package and how to connect to servers. Demonstrate how to send e-mails

- Explain advanced socket programming. Create URL objects and a sample browser application to fetch URLs and to post form data, threads, thread priority, multithreading,
- synchronisation and deadlocks. Explain the collection framework, collection interface, legacy collection and algorithms

## **CFE 2230 - Introduction to LAN/WAN Technologies/System Architecture 11**

### **Objectives**

- This course is designed to provide the learner with advanced working knowledge of System Architecture

### **Learning Outcomes**

- Know the concept of optoelectronics
- Understand the concept of the various operations in a personal computer
- Know the concept of SCSI adapters and troubleshooting
- Understand storage devices and operations of computer memory
- Know the concept of basic network architectures and access.
- Understand Wide Area Network (WAN).
- Know Very Small Aperture Terminal (VSAT).
- Understand KU and C band.
- Understand Inter-Networking Operating System (IOS).
- Understand Base Station and Repeater Station

### **Indicative Content**

- Define WAN. Define scaling. Define PPP. Explain ATM. Define ISDN.
- Explain Frame relay. Describe the technology behind V-sat. Define BUC, LNB.
- Distinguish the various types of V-sat. Explain the technology in KU band.
- Define the technology in C band. List the advantages of C band over Ku band in Sub Saharan Africa. Define Internetworking operating system.
- State an example of vendors that uses IOS. Differentiate between IOS and Server.

- Operating System; Explain the terms base station, Repeater station.
- Differentiate between Repeater station and base station.
- Describe the concept of Light Emitting Diodes. [LED]. Outline rules needed when using LED. Describe Photo-sensitive devices [Photo resistor, photodiodes, Phototransistors, photosensitive ICs.]. Describe Fiber Optic Systems. Outline the advantages of Fiber Optics over Copper cables. Define Personal Computer. Itemize advantages of Personal Computer. Describe the various applications of computer. Define the Microprocessor
- Define SCSI Variations concept. Describe the concept of Bus Length. Define Terminators. Describe SCSI Bus Operations. Define Computer Memory Describe the Random-Access Memory concept. Describe the Cache RAM Memory concept.
- Describe the Hard disk drive. Describe the Floppy Disks. Define the Compact Disk.
- Define the concept of optical disks. Describe the Flash disk.
- Describe the various labels for each computer memory. Describe the various Topologies.
- Describe the Cable Basics. Describe Ethernet. Describe FDDI Basics

## **CFE 2240 - Multimedia Programming/Digital Film Animation**

### **Objectives**

- This course is designed to equip students with programming and scripting skills required to develop special purpose multimedia software and will enable the student to create and execute a planned animation project

### **Learning Outcomes**

- Understand the basics of programming languages and scripting skills
- Know visual basic programming codes
- Know how to use action scripts for interactive flash programming
- Know how to use Java scripts for building special motion graphics and animations
- Know how to use scripts for Adobe effects programming
- Understand various kinds of animation techniques used in the industry
- Know basic skills in drawing
- Know how to characters based on human and animal anatomy
- Understand animated sequence

- Understand background and scene composition
- Know how to write a script for the animation and transform it to storyboard
- Understand 3D models and apply them to photo realistic textures

### **Indicative Content**

- Identify programming. Identify Java programming. Distinguish between programming and multimedia authoring. Identify frames with Lingo. Identify visual basic programming
- Write visual basic codes. Select visual basic codes for multimedia. Apply the codes with their scripts. Identify the various action scripts for different animations. Identify action scripts for picture and text animation. Apply scripts in shockwaves. Produce interactive flash programming. Identify the Java scripting codes for motion graphics and animations
- Write the Java scripts. Apply Java scripts. Produce multimedia Scripts. Identify scripts needed to create video effects and text/picture animation. Write the scripts. Apply the scripts to create video effects. Produce scripts to create video effects. Identify animation projects. List animation projects; Select animation projects. Write animation projects
- Demonstrate the Projects. Identify basic drawing techniques. Produce some drawings.
- Move the drawings. Apply the drawings in Shockwaves. Identify characters based on human and animal anatomy. Define the characters. Itemize some of these characters
- Write the characters. Describe animated sequence. List animated sequence. Apply animated sequence. Produce animated sequence. Identify background and scene composition. Select good background. Apply the background. Move the background
- Write script for animation. Move scripts to story board. Identify the scripts. Produce story board with scripts. Apply 3D models to photo realistic textures. List the steps to 3D Models. Produce 3D models. Describe 3D models. Demonstrate 3D models

### **CFE 2250 - Data & Network Security**

#### **Objectives**

- This course is designed to enable students acquire adequate skills in data and network security

## **Learning Outcomes**

- Understand System Security and Challenges.
- Know Types of Threats and Attacks to data security.
- Understand security breach and the types of Security Breaches.
- Understand hacking and the types of hacking
- Understanding the Internet and the Internet Protocol (IP)
- Know types and sources of network threats.
- Understand Protective and Recovery Strategies.
- Know Fire-walling for networks defense

## **Indicative Content**

- Enumerate the importance of security of data to an organization. Describe the challenges faced in securing data in an organization. Explain threats to data security.
- Describe the different types of threats and attacks: System integrity loss, Denial of service, Computer viruses, Trojan horses, Data manipulation, Data fraud, Data theft, Data destruction, Program manipulation. Identify security breaches to a network
- Explain the types of security breaches; Packet Sniffing, Spoofing, Jamming, Code Injection. Exploiting Flaws, Password and Key Cracking
- Explain the term hacking. Describe who a hacker is. Explain the various types hacking: Political Hacking, Commercial Hacking, Social Hacking, Financial Hacking, individual hacking
- Explain the World Wide Web (Internet). Explain TCP/IP Basics. Explain the Internet
- Protocol (IP) and how it works. Describe how IP is being attacked. Describe the following and how they impact network performance: TCP, Guaranteed Packet Delivery,
- UDP, Lower Overhead than TCP.
- Describe the following types of network threats: Denial-of-Service, Unauthorized Access, Executing Commands Illicitly, Confidentiality Breaches, Destructive behaviour
- Identify the sources of these network threats: Denial-of-Service, Unauthorized Access, Executing Commands Illicitly, confidentiality Breaches, Destructive behaviour
- Explain various Protective and Recovery Strategies as listed below: Backups of data. Avoiding systems with single points of failure; Updating Operating System patches.

- Heeding to Relevant Security Advisories; Appointing a Security Administrator.
- Define Firewall. Describe the types of firewalls available for network defense; Application Gateways, Packet Filtering, Hybrid Systems.

## **CFE 2260 - Entrepreneurship Development**

### **Objectives**

- To stimulate Entrepreneurship skills in the candidates

### **Learning Outcomes**

- Understand the nature of Small-scale Enterprises
- Know the definition, types and functions of Management
- Understand the legal framework for small-scale enterprises
- Understand the role of governments in small-scale enterprises in Nigeria
- Understand a business plan for a small-scale business enterprise
- Understand marketing management in a small business enterprise
- Understand the general concept of production management
- Know human capital needs for an enterprise

### **Indicative Content**

- Define the range and scope of a small business. Explain the importance of a small business. Describe the problems associated with small business operations. Describe types of businesses that could be run on a small scale. Describe the merits and demerits of being self-employed. Identify the starting problems and signs of failure of a small business. Explain the types of business organization. Identify the legal form of business. Describe the environmental factors of business – law of sales, licenses, failure signs, etc.
- Explain regulatory status and formation of small business. Explain government policies for small enterprises development.
- Explain the effects of government policies on direct and indirect assistance to small businesses.
- State the role of the following institutions in promoting small enterprises; Industrial Development Centre (IDC), State Ministries of Commerce and Industries, State Export Promotion Committees, Centre for Management Development (CMD), National Directorate of Employment (NDE), NAPEP, CIRD, NERFUND, ACRDB, NEPC, NASSI, NASME, etc
- Explain business plan. Explain the purpose of business plan.

- Identify the components of a business plan from project development up to project cost. Explain the following: proposals, request for proposals, tenders, bid, need for proposals.
- Differentiate types of proposals. State the necessary steps in carrying out financial analysis and planning for a small business. Compare personal goal and business goals. Identify influences of family goals in business goals.
- Understand the basic concept of marketing. Identify the steps in conducting market surveys to determine demand and supply for particular products. Identify markets.
- Identify channels of distribution for a selected product or service. Explain the promotional and sales activities for a selected product or service. Explain appropriate pricing strategies.
- Explain the basic concepts of production. Explain choice of appropriate technology. Identify types and sources of machinery and equipment. Explain the installed capacity.
- Explain the utilized capacity. Identify sources of raw materials. Describe factory location and factors in the selection of site. Describe factory layout.
- Explain plant and machinery maintenance.
- Explain Plan and Scheduling. Explain quality control issues. Explain factory safety measures.
- Identify problems of production in the Nigerian situation. Explain how to cope with production problems in Nigeria. Identify human capital needs for an enterprise.
- Explain recruitment procedures. Explain need for training of workers. Explain how to motivate workers.
- Explain how to compensate workers.
- Explain organization of a work force, organizational chart.
- Explain problems of human capital management in small business enterprises.
- Explain how to cope with the problems of human capital management

## **CFE 2270 – Computers and Society, Code of Ethics & Professional Conduct**

### **Objectives**

- To equip candidates' knowledge of the roles, applications of IT in the society and the ethics and code of conduct expected from IT professionals

## **Learning Outcomes**

- Understand the role and application of computer in the society
- Understand the role of professional societies and the implications for professionals of their codes of ethics and practice, in particular the CPN code of ethics and code of professional conduct and professional practice
- Understand the ethics and social responsibilities associated with being an information technology professional
- Investigate current issues associated with the use and abuse of information technology
- Develop skills in analyzing the social and ethical impact of information technologies
- Understand how computing and information systems give rise to social issues and ethical dilemmas
- Be familiar with some of the issues you may face as a member of a complex technological society
- Be able to discuss the benefits offered by computing technology in many different areas and the risks and problems associated these technologies
- Understand some social, legal, philosophical, political, constitutional and economic issues related to computers and the historical background of these issues
- Be able to explore the arguments on all sides of a controversial issue and argue convincingly for the position you select
- Have an increased awareness of current social and legal developments related to computers

## **Indicative Content**

- The role and applications of computer in modern society
- Application of computer to different areas of Human endeavors: Education, Health, Industry, Telecommunication, Military, Government and Business etc.
- Definition of Computer Ethics
- Framework for making ethical decisions
- Major ethical models
- Codes of ethics and professional responsibility for computer professionals
- Identifying stakeholders in concrete situations
- Identifying ethical issues in concrete situations
- Applying ethical codes to concrete situations

- Identifying and evaluating possible courses of action
- Database and personal privacy; Internet, piracy and privacy issues
- Communication systems and risks
- Software reliability and critical systems
- Software as intellectual property
- Social implications of artificial intelligence and robotics
- Computers and the law; Computer crime; Computers and work; Equity and access issues
- Social Media and implications

#### METHOD OF DELIVERY

Lectures, discussions, practical sessions and tutorials are to be used to prepare candidates for this examination. It is expected that those presenting themselves for this qualification must have undergone formal training for at least 90 hours out of which 60 hours must be dedicated for practical sessions in a CPN Accredited institution.

## **Level 03- Computer Professional Examination (CPE)**

The CPN Professional Examination (CPE) is designed for those that are desirous to be ultimately certified as full-fledged IT Professionals through a combination of formal and informal training. The emerging trend in the world of Information Technology knowledge acquisition is moving towards specialization areas.

Consequently, the CPE examinations now have five (5) tracks to deliver expertise in the following specialization areas:

- Multimedia Technology (MMT)
- Computer Information Systems (CIS)
- Software Engineering (SEN)
- Computer Engineering (CEN), and
- Telecommunication and Network Security (TNS)

### **Description of Tracks**

#### **Multimedia Technology (MMT)**

Multimedia Technology (MMT) track encompasses a variety of disciplines such as digital arts, recording arts, visual communication, animation, and Information Technology (IT). The track also includes a number of internet-related courses like design and creation of websites. It prepares candidates to work with computers and use the skills they gain to create graphic models for a variety of delivery media: **Digital Publishing:** paper, plastic, textile and the web. It will also prepare candidates for career progression in recording sounds, video and animations.

Typical technologies expected for mastery include: Java; C#; JavaScript; ASP; PHP; HTML; WML; Flash; Director; Final Cut Pro/Adobe Premiere; DVD Studio Pro/DVD Production; Sound/Music Production; Desktop Publishing; 3D Animation/Modelling; Content Management Systems. The MMT track has two inherent specializations.

- Graduates of the Digital Media Design specialization are expected to transform their respective passions for graphic design and animation into a career dedicated to interactive multimedia creation. They are expected to learn how to navigate with ease today's most leading-edge industry digital design software, such as Photoshop®, Illustrator®, Dreamweaver®, Flash®

and Blender to build user-friendly and engaging graphics, render motion graphics, and create interactive media projects.

- Web Technologies Specialists are expected to demonstrate abilities for the creation of new, engaging, and effective web-based media; using multimedia software tools such as Dreamweaver®, Fireworks, HTML/CSS, PHP/MySQL and in Content Management Systems environments. Graduates are expected to have an extensive understanding of web design strategies and tactics, as well as a professional portfolio of digital design work, towards profitable careers as Web designer and managers.

<b>CPE I</b>	<b>CPE II</b>	<b>CPE III</b>
CIS 3101 - Management Information Systems (MIS)	CIS 3201 - Information Systems Development	GCC 3301 - Evolving Information Technologies
MMT 3101 - Visual Studies and Web Media	MMT 3201 - Digital Media Production	GCC 3302 - IT Project Management
MMT 3102 - Digital Media Foundation and Computing	MMT 3202 - User Interface Design	GCC 3303 – Technical Report
MMT 3104 - Interaction Design	MMT 3203 - Design for Moving Image	GCC 3304-Strategic Planning and Innovation
MMT 3105 - Information and Content Management	MMT 3204 - Computers and Music / Sound Design	MMT 3301 - e-Business Strategy
	MMT 3205 - Web Technologies	MMT 3302 - Multimedia Television
	MMT 3206 - Web Applications Development	MMT 3303 - Advanced Modeling and Character Animation
		MMT 3304 - Enterprise Web Software Development



## Computer Information Systems (CIS)

This programme is designed for those who wish to become business analysts, designers and managers of information systems in business and industry. It develops the personal and professional skills necessary to work with organizations in the analysis, design, building and management of information systems.

Students learn how to:

- use industry-standard system building tools and packages;
- develop skills in database design, development and implementation;
- effectively use current analysis and design techniques for the development of information systems;
- examine the role of new and emerging technologies in areas such as the internet, e-commerce and distributed information systems;
- use project management techniques and explore issues relating to the management and development of information systems;
- put personal and professional skills and ideas into practice, working both individually and in teams, preparing for careers in industry and commerce.

<b>CPE I</b>	<b>CPE II</b>	<b>CPE III</b>
CIS 3101- Management Information Systems (MIS)	MMT 3205 - Web Technologies	GCC 3301 - Evolving Information Technologies
CIS 3102- Information Technology Planning	CIS 3201- Information Systems Development	GCC 3302 - IT Project Management
CIS 3103- Computer Systems and Internet Technologies	CIS 3202- Information and Content Management	GCC 3303 – Technical Report
CIS 3104- Computer Programming	CIS 3203- Web Database Applications	GCC 3304-Strategic Planning and Innovation
CIS 3105- Database Techniques	CIS 3204- Information Analysis/Information Requirement Analysis	MMT 3301 - e-Business Strategy
		CIS 3301- Database

		Management & Administration  CIS 3302- IS Development, Frameworks and Methods  CIS 3303- Data Warehousing
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## Software Engineering (SEN)

This track is designed for individuals wishing to pursue careers as software engineering professionals. They are expected to have abilities to employ the latest technologies and programming languages, develop a sound theoretical understanding and in-depth practical experience of designing, constructing and modifying a wide range of software systems.

CPE I	CPE II	CPE III
CIS 3101 - Management Information Systems (MIS)	CEN 3202 - Data Communications & Computer Networks	GCC 3301 - Evolving Information Technologies
CEN 3102 - Computer Systems Architectures	SEN 3201 - Software Engineering Process	GCC 3302 - IT Project Management
SEN 3101 - Operating Systems	SEN 3202 - Operations Research/Quantitative Techniques in Business	GCC 3303 – Technical Report
SEN 3102 - Computer Programming		GCC 3304-Strategic Planning and Innovation
SEN 3103 - Analytical Methods for Computing	SEN 3204 - Business Systems Applications	CIS 3301 - Database Management & Administration
SEN 3104 - Logical Foundations / Embedded Systems Development	SEN 3205 - Advanced Computer Simulation & Modeling	SEN 3301 - Database Design and Implementation
	SEN 3206 - Algorithms & Design	SEN 3302 - Programming Distributed Components
	SEN 3207 - Application Development for Mobile Devices	

		SEN 3303 - Software Engineering Management and Practice
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## Computer Engineering (CEN)

The Computer Engineering Track introduces the latest technologies to develop a sound theoretical understanding and in-depth practical experience of advanced networking together with the design and management of modern distributed computer systems. It is intended to provide a solid background in computer science to enable an in depth study of security and forensics, thereby introducing the participant to the latest generation of tools and technologies employed by the police high-tech crime units and forensic laboratories.

The track substantially covers the subject areas specified for industrial examinations such as Cisco, Microsoft and Sun certifications.

CPE I	CPE II	CPE III
CIS 3101 - Management Information Systems (MIS) SEN 3101 - Operating Systems SEN 3102 - Basic Programming Techniques CEN 3101 - Digital Electronic and Logic Design CEN 3102 - Computer Systems Architectures CEN 3103 - Network Technologies	CEN 3201 - VLSI System Design CEN 3202 - Microprocessors and Microcontrollers CEN 3203 - Advanced Computer System Repairs and Maintenance CEN 3204 - Mobile Devices and Applications CEN 3205 - Computer Electronics II / Embedded Systems Development	GCC 3301 - Evolving Information Technologies GCC 3302 - IT Project Management GGCC 3303 – Technical Report GCC 3304-Strategic Planning and Innovation SEN 3301 - Database Engineering CEN 3301 - Digital System Testing and Testable Design CEN 3302 - Artificial intelligence and Robotics

## **Telecommunication and Network Security (TNS)**

The Telecommunications and Network Security domain is one of the most detailed and comprehensive domains of study. This domain includes the structures, transmission methods, transport formats, and security measures that provide confidentiality, integrity, availability, and authentication for transmissions over private and public communications networks and media. This domain is the information security domain that is concerned with protecting data, voice, and video communications and ensuring the following: Confidentiality, Integrity and Availability. The Telecommunications Security domain of information security is also concerned with the prevention and detection of the misuse or abuse of systems, which poses a threat to the tenets of Confidentiality, Integrity, and Availability (C.I.A.)

The student should fully understand the following:

- Communications and network security as it relates to voice, data, multimedia, and facsimile transmissions in terms of local area, wide area, and remote access networks
- Communications security techniques to prevent, detect, and correct errors so that integrity, availability, and the confidentiality of transactions over networks may be maintained
- Internet/intranet/extranet in terms of firewalls, routers, gateways, and various protocols
- Communications security management and techniques that prevent, detect, and correct errors so that the confidentiality, integrity, and availability of transactions over networks may be maintained

CPE I	CPE II	CPE III
CIS 3101 - Management Information Systems (MIS) SEN 3101 - Operating Systems CEN 3101 - Computer Electronics 1 CEN 3102 - Computer Systems Architectures TNS 3101 - Introduction to Telecommunications and Network Security	CEN 3205 - Computer Electronics and Embedded Systems Development TNS 3201 - Network Security Technologies and Implementation TNS 3202 - Network Design and Implementation TNS3203- Computer Forensics TNS 3204 - Wireless Communication	GCC 3301 - Evolving Information Technologies GCC 3302 - IT Project Management GCC 3303 – Technical Report GCC 3304-Strategic Planning and Innovation CEN 3302 - Artificial Intelligence and Robotics TNS 3301 - Computer Forensics 2

## Career Prospects

### Multimedia Technology

The Course is focused on developing the visual graphic and information design skills required to create compelling web sites, based on the syllabus of the International Webmasters Association (IWA)

### Computer Information Systems

CIS professionals play a vital role in solving strategic business problems by designing computer-based operations. They have to analyze the existing business systems and explore novel ideas to optimize technological performance in an organization.

### Software Engineering

Quality IT graduates will find high-tech careers in converging telecommunications, multimedia, computing and Internet information industries as Internet application engineers, Analyst programmers, systems designers, embedded software systems designers, network designers, web content developers, multimedia games developers and more

## **Computer Engineering**

IT graduates with a major in computer technology pursue careers in computer product manufacturing as internet applications engineers, analyst programmers, computing systems designers, embedded software systems designers, network designers, and network switching and protocol designers.

## **Telecommunication and Network Security**

Telecommunication and network security (TNS) field is a fast growing domain as more businesses and individuals are storing sensitive data electronically. Professionals in this field specializes in protecting company's data and other information; they build firewalls, install anti-virus software on servers and computers within a network, and monitor networks for breaches in security. Their goal is to ensure the smooth operation of communication networks in order to provide maximum performance and availability for their users, such as staff, clients, customers and suppliers.

## **Entry Qualifications**

### **Computer Professional Examination I (CPE I)**

Credit pass in minimum of 5 O'Level (WAEC/SSCE/NECO) subjects including English Language and Mathematics, plus any of the following:

- A pass in the CFE II or Credit Pass in a 2-year Diploma/ND/Diploma/ND granted by a CPN accredited Institution.
- NCE/ND/Diploma in Computer Science, Information Technology, Management Information Systems, Electrical/Electronics and Computer Engineering, Computer Communications, Information Systems and any other IT related discipline obtained from recognised Institutions.
- Professional qualifications up to Intermediate level of the Council's internationally recognized chartered bodies e.g., IDPM/MIS/BCS etc.

### **Computer Professional Examination II (CPE II)**

- A Credit pass in CPE I plus one year relevant Industrial experience OR
- A pass in CPE I plus two years relevant industrial experience OR
- University/Polytechnic/CPN tertiary accredited Higher Diploma, Advanced Diploma, Higher National Diploma and B.Sc, B-Eng, B.Ed in Computer Science, Electronics and Computer Engineering, Information Systems, Information Technology, Data Processing and Data Communications obtained from CPN accredited institution with at least a Lower Credit/Third Class/Division OR
- University/Polytechnic/CPN tertiary accredited Higher Diploma, Advanced Diploma, Higher National Diploma and B.Sc., B.Eng., B.Ed. in Computer Science, Electronics and Computer Engineering, Information Systems, Information Technology, Data Processing and Data Communications obtained from CPN accredited institution with at least a Pass plus one year relevant industrial experience.

## Computer Professional Examination III (CPE III)

- Pass in CPE II
- Holders of HND, B.Sc., M.Sc. MTech, Ph.D. There is no direct admission to the Profession. Applications to the membership of NCS and CPN must take the final examinations, write a Technical Report and successfully defend same during the project defence interview.

### Course Contents

#### Course Title

#### **GCC 3301 - Evolving Information Technologies**

The aim of the course is to make candidates aware of current trends in Computer Science, Information Systems and Information and Communication Technology to enable chartered professionals consult effectively to clients.

#### Objectives

On the completion of this course the student should be able to:

- Understand the concept and practice of the emerging ICT- driven technologies.
- Know the concept of tele-working, e-Commerce and website development.
- Know about confravision, teleconferencing, EDI, Internet, Intranet and automated Factories of the 21<sup>st</sup> century.
- Know about the possible convergence of PCs and Television
- Motion Analysis, Artificial Intelligence Using Agents and Nano Technology

#### Course Content:

- a. Concept of smart cities, Grid computing, Cloud computing, Big data analytics, Internet of things (IoT), green computing, block chain etc.
- b. **Concept of Tele-Working, E-Commerce and Website Development:** Tele-working, e-commerce and website development and deployment, e-economy, confravision, teleconferencing, EDI, globalization, e-governance, Internet, Intranet, Extranet, automated factories of the 21<sup>st</sup> century.

- c. **Confravision, Teleconferencing**, Edi, Internet, Intranet and Automated Factories of the 21<sup>st</sup> Century.
- d. **Convergence Technology**: Convergence of PCs and Television through multi-media Technology
- e. **Motion Analysis, Artificial Intelligence using agents and Nano-Technology**: On the Cutting Age of Technology Motion Analysis, Artificial intelligence Using Agents, Nano-technology, Smart Materials, 3-D Animation with Ray Tracing, Virtual Reality, Liquid Graphics, and Advanced Simulation.

## **GCC 3302 - IT Project Management**

### **Objectives**

Designed for anyone working in a project team environment or engineers who see an increasing management component in their work, this course will equip you with general project management skills to help you to deal with problems that can occur. It's applicable to any field of work, especially those with a high technological content. You'll also gain practical experience of using project management techniques, including the use of a software tool, with a real project of your own. The topics covered include project initiation, risk, estimating and contracts, planning, human factors, project execution, and standard methods.

### **Course Contents**

- project management principles
- defining the project, definition document, PID
- project roles and responsibilities
- software development lifecycle phases
- planning user resources for IT projects
- estimating
- planning and scheduling
- getting stakeholder buy in and commitment
- risk management
- tracking and controlling

- status reporting
- issue management
- change management
- quality management
- stage and project completion
- post implementation review
- independent project assurance
- project management route map

### **GCC 3303 – Technical Report**

Candidates are expected to submit 3 topics out of which one will be approved by the supervisor. Based on the approved topic, the candidate is expected to write a technical report to be submitted for defense before panel of examiners constituted by the council.

### **GCC 3304 STRATEGIC PLANNING AND INNOVATION**

#### **Objectives**

The business environment is dynamic. Organizations that must keep pace with the rapidly changing environment must be creative and very strategic. Strategy and Innovation offer the insight and understanding needed to lead organizations in a complex global business environment.

The aim of this course is to provide the requisite competencies to make strategic decisions and innovate for competitive advantage.

#### **Learning Outcomes**

At the end of training, Students will be able to:

- state the concepts of strategic planning and innovation;
- explain the basics of strategic planning and innovation;
- develop good vision and mission Statements;
- analyse the strengths, weaknesses, opportunities and threats in their organization;

- interpret the internal and external forces shaping the future; and
- prepare, motivate and guide their organizations, units or teams towards their vision and mission.

### **Course Content:**

- Concepts of strategic planning and innovation
- Strategic planning VS strategic thinking
- Strategic planning process
- Strategic planning framework
- Strategic planning tools
- Vision, Mission, Goals, Values and Objectives
- Strategic Leadership for managing change
- Transactional and Transformational Leadership
- Leadership roles, qualities and function
- Organizational structure and types
- Formulating Policies and procedures for strategy implementation
- Problem solving and Decision making
- Innovation and Creativity
- Conflict Resolution and Management

### **Computer Engineering Courses**

#### **CEN 3101 - Digital Electronic and Logic Design**

To enable the candidates understand the basic principles, construction and application of electronic components, as well as troubleshoot and solve simple hardware problems and to acquire basic knowledge of hardware maintenance

#### **Course Objectives:**

On the completion of these courses the student should be able to:

- Know principles and fundamentals of Boolean Algebra, logic gates and characteristics of multi-vibrator circuits, codes and conversion; Understand

the principles of the counter and data transfer registers, features of different transistor logic gates, attributes of different families;

- Understand the principle of operation and use of basic electronic measuring instruments;
- Understand the principles of basic electric current theory, logic circuit; Know the use of Maintenance tools, preventive maintenance of hardware components; Know diagnostic techniques involved in corrective maintenance and how to install a computer system.

### **Course Content:**

- Principles and Fundamentals of Boolean Algebra, Logic Gates and Characteristics of Multivibrator Circuits, Codes and Conversion: Basic microelectronics – Boolean algebra, logic gate, multi-vibrator circuit, and their characteristics
- Principles of the Counter and Data Transfer Registers, Features of Different Transistor Logic Gates, Attributes Of Different Families: Codes and conversion, principles of the counter and data transfer register, addition operation in the computer, different transistor logic, gates, features and attributes of the different logic gates and their families.
- Principles of Operation and use of Basic Electronic Measuring Instruments: Pin connections and operation and manufacture data sheets. Construction of basic circuits using logic gate, principles and operations of multi-meters and oscilloscopes. Measurements of currents, voltage, resistance, capacitance and inductance using multi-meter. Observation and measurement of pulse using oscilloscope. Diagnose fault using multi-meter and oscilloscopes.
- Principles of Basic Electric Current Theory, Logic Circuit: Basic hardware maintenance – Basic Electric Current Theory, basic logic circuit, use of maintenance tool, preventive maintenance of hardware components, diagnostic techniques involved in corrective maintenance. Computer configuration, installation and batch programming. Identify and utilize maintenance tools such as electronic multi-meter, oscilloscope, test etc.
- Use of Maintenance Tools, Preventive Maintenance of Hardware Components: Basic instrumentation – Principle of operation and use of basic electronic measuring instrument such as Digital Multi meter and

Oscilloscope to measure currents, voltage, resistance, capacitance and inductance and to diagnose fault.

- Diagnostic Techniques involved in Corrective Maintenance and How to Install a Computer System: Corrective maintenance describe the method of troubleshooting, testing ICS with appropriate tools. Need for diagnostic program, explain the need for equipment inventory and modular testing. Use of installation manuals in computer installations procedure.

## **CEN 3102 - Computer Systems Architecture**

### **Objectives**

To enable the students do the following:

- Describe the basic hardware and software components of a computer system
- Describe the representations of data types and
- Use a computer's instruction set.

### **Learning Outcome:**

The wide range of computing devices in use requires programmers to have a systems-oriented understanding of the machine level of computer operation that is universally applicable. In turn, this needs to be underpinned by the concepts of the structure, organization and function of digital systems and the concept of stored program execution

### **Course Content:**

- **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 Synchronization, 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 Organization 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.

## **CEN 3103 - Network Technologies**

### **Objectives**

The aim of this course is to:

- instill a thorough and practical understanding of existing network technologies, their operational characteristics, strengths and failures.
- be able to critically evaluate technologies and to compare and contrast amongst alternatives.
- enable the student to choose the appropriate technologies and configuration to meet an organization's needs.

### **Learning Outcomes**

At the end of this course candidates should:

- have a sound working knowledge of network types, protocol architectures, hardware and software components, and critical appreciation of their pros and cons.
- be aware of the ways in which various network technologies can be integrated to achieve required configurations and end-end systems.
- be capable of configuring network devices (e.g. routers and switches) and technologies (e.g. wireless networks).

### **Course Content**

- **Overview of material covered in levels 4 and 5:** Communication basics, network types, functions (e.g. transmission, switching, multiplexing, routing,

addressing, error recovery, congestion control); layered architectures (OSI, TCP/IP, IEEE 802.x); standards and bodies.

- LANs, Ethernet, FDDI, TCP/IP suite of protocols, IPv4, IPv6, TCP, UDP; ARP, ICMP, DHCP, Frame relay, ATM.
- **Routing algorithms**, protocols RIP, OSPF, IGRP, EIGRP, BGP.
- **Wide Area Networks**, IP WANs, IP over ATM, IP over Frame Relay.
- **Wireless networks**.
- **Router and switch configuration**.

## **CEN 3201 - VLSI System Design**

### **Objectives**

This course focuses on

- Familiarity with modern VLSI design techniques with an emphasis on *system-level* design issues.
- Knowledge of design flow and design automation tools used.
- Practical experience in VLSI design through small project.

### **Learning Outcomes**

On the completion of this course, the student should be able to:

- Understand key components in VLSI designs
- Become familiar with design tools (Cadence)
- Understand design flows
- Understand behavioural, structural, and physical specifications
- Be able to apply VLSI design practices
- Be able to contribute to an industry digital VLSI design project

## Course Content:

- **Introduction to CMOS circuits:** MOS Transistors, MOS transistor switches, CMOS Logic, The inverter, Combinational Logic, NAND gate, NOT Gate, Compound Gates, Multiplexers, Memory-Latches and Registers.
- **Processing Technology:** Silicon Semiconductor Technology- An Overview, wafer processing, oxidation, epitaxy deposition, Ion-implantation and diffusion, The Silicon Gate Process- Basic CMOS Technology, basic n-well CMOS process, p-well CMOS process, Twin tub process, Silicon on insulator, CMOS process enhancement-Interconnect, circuit elements, 3-D CMOS. Layout Design Rule: Layer Representations, CMOS n-well Rules, Design Rule of background scribe line, Layer Assignment, SOI Rule.
- **Power Dissipation:** Static dissipation, Dynamic dissipation, short-circuit dissipation, total power dissipation. Programmable Logic, Programmable Logic structure, Programmable interconnect, and Reconfigurable Gate Array: Xilinx Programmable Gate Array, Design Methods: Behavioural Synthesis, RTL synthesis
- **Placement:** placement: Min-cut based placement – Iterative improvement placement simulated annealing. Routing: Segmented channel routing – maze routing – routability and routing resources – net delays.
- **Verification and Testing:** Verification Versus Testing, Verification: logic simulation design validation – timing verification – Testing concepts: failures – mechanisms and faults – fault coverage – ATPG methods – types of tests – FPGAs – programmability failures – design for testability.

## **CEN 3202 - Microprocessors and Microcontrollers**

### **Objectives**

This course is designed to provide the student with an understanding of the application of embedded microcontrollers. Also, introduces the concept, analysis, design, and application of microprocessor-based digital systems.

### **Learning Outcomes**

- Mastery of the topics associated with using a microcontroller in an embedded system environment.
- Familiarity with differences between instruction sets, characteristics of instruction sets, RISC vs. CISC distinction and attributes
- Application of 68HC11 assembly language programming including but not limited to addressing modes, polled interrupt and DMA I/O, interrupt service routines, and using on-board I/O systems.
- Exposure to integrated circuit design and manufacture, focused on ASICS and microprocessors.

### **Course Content:**

- Introduction to 8085A CPU architecture-register organization, addressing modes and their features. Software instruction set and Assembly Language Programming. Pin description and features.
- Instruction cycle, machine cycle, Timing diagram.
- Hardware Interfacing: Interfacing memory, peripheral chips (IO mapped IO & Memory mapped IO).
- Interrupts and DMA.
- Peripherals: 8279, 8255, 8251, 8253, 8237, 8259, A/D and D/A converters and interfacing of the same.
- Typical applications of a microprocessor.
- 16 bit processors: 8086 and architecture, segmented memory has cycles, read/write cycle in min/max mode. Reset operation, wait state, Halt state, Hold state, Lock operation, interrupt processing. Addressing modes and their features.

- Software instruction set (including specific instructions like string instructions, repeat, segment override, lock prefizers and their use) and Assembly Language programming with the same.
- Brief overview of some other microprocessors (eg. 6800 Microprocessor)

## **CEN 3203 - Advanced Computer System Repairs and Maintenance**

### **Objectives**

This course is designed to prepare students to service and maintain modern personal computers and peripherals. Basic networking concepts and functions will also be covered. Students will become adept at troubleshooting and diagnosing problems, as well as performing routine maintenance on PCs. Students will learn to install and replace the major hardware components of the system, maintain and repair those components, as well as build a complete system. Students will also install, configure and troubleshoot various operating systems, including DOS and Windows. Various peripherals; such as printers/scanners, as well as portable devices will also be examined.

## Learning Outcomes

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

- Describe how the PC works; identify all the connectors and devices on a typical PC system unit; discuss the major internal components of a PC.
- Describe the basic functions of a network, including identifying common devices and connectors; discuss the differences between a LAN and a WAN and the importance of TCP/IP; perform basic resource sharing.
- Identify the core components of a CPU; describe the relationship of CPUs and memory; explain the varieties of modern CPUs; select and install a CPU; troubleshoot CPUs.
- Identify the different types of DRAM packaging; explain the varieties of RAM; select and install RAM; perform basic RAM troubleshooting.
- Explain the function of BIOS; distinguish among various CMOS setup utility options; describe option ROM and device drivers; troubleshoot the power-on self test (POST); maintain BIOS and CMOS properly.
- Explain how motherboards work; recognize modern expansion buses; upgrade and install motherboards; troubleshoot motherboard problems.
- Explain the basics of electricity; describe the details about powering the PC; install and maintain power supplies; understand power supply troubleshooting and fire safety.

## Course Content

- Repair, Servicing and Maintenance Concepts: Introduction to servicing and maintenance concepts. Meantime between failure (MTBF), meantime the repair maintenance policy, potential problems preventive maintenance and corrective maintenance. Circuit tracing techniques. Concept of shielding grounding and power supply requirements and considerations of computers and its peripherals.
- Fundamental Trouble Shooting Procedure: Fault location, Fault finding aids, Service Manuals, Test and measuring instruments, Special tools
- Hardware and Software Faults: Trouble shooting techniques. Different trouble shooting techniques and methods, Functional area approach, Split half method, Divergent, convergent and feedback path circuits, analysis measured techniques.
- Trouble shooting of computers, component and peripherals: Mother Board, FDD, HDD, CD ROM/DBD, Printers, Modems, Monitors, SMPs

- Specification, Maintenance and Repair of CVTs and UPS
- Environmental requirements of computer system and peripherals
- Sight preparation and design of computer rooms. Testing specifications and installation of computer systems and peripherals.

## **CEN 3204 - Mobile devices and applications**

### Objectives

This course is designed to enable the student to

- Understand and use the fundamentals of programming for mobile devices
- Be able to make intelligent design decisions considering devices limitations.

### Learning Outcomes

At the end of this course the student should be able to

- Define mobile computing and the types of mobile devices.
- Give Detailed history of mobile computing.
- Explain the basic theory behind networks and cellular networks.
- Write HTML and JavaScript code for mobile devices.
- Discuss user interface design considerations.
- Explain the differences between HTML5 and HTML.
- Develop apps for Android devices.
- Develop apps for IOS devices.

### **Course Content**

- Differences on programming for mobile devices from desktop applications: how to plan a mobile system;
- Challenges on mobile systems programming: limited resources (screen, storage and processor), battery usage, communications issues.
- GUI application programming interfaces: graphical resources for high-level programming;
- Persistence: how to store and access information stored in a mobile device using SQLite database

- Networking: usage of HTTP and sockets for communication between mobile devices and remote servers.
- Context-aware services: using sensors and location.
- Implementation using Android.

## **CEN 3205 - Computer Electronics II/Embedded Systems Development**

### **Objectives**

- Provide a theoretical and practical basis for embedded systems architectures and techniques.
- Familiarize the student with mainstream tools and techniques for the implementation and programming of embedded systems.
- Enable the student to use modern application programming interfaces in a variety of embedded contexts. Introduce programming techniques for the building and manipulating of systems employing complex I/O requirements.
- Provide an appreciation of the type, scope and importance of applications to which embedded computing applies.

### **Learning Outcome**

This course will allow the students to build on their programming and computer systems skills to learn to build embedded systems using a variety of approaches. Drawing on the student's previous experience in programming at chip level this course will introduce the student to low level programming with C as well as programming with assembly language, and Object Oriented programming with Java, they will attain a level of competence required for further study of embedded systems.

Also, on the completion of this course the student should be able to:

- Understand the constructional features and configurations of semi-conductor switching circuits
- Understand the constructional features and configurations of different integrated circuit device.
- Understand constructional features and configurations of digital IC systems

- Understand the design principles of combinational circuits using small-scale integrated (SSI) circuits
- Understand elementary digital computer architecture

## Course Contents

- **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.
- **Define a pulse**, explain pulse shaping. Define rise time, fall time, pulse circuits, duration, overshoot, and undershoot. Explain the structural action of multi-vibration, mono-stable, A-stable and B-stable. Explain the constructional features of the R-S and J-K flip-flops. Apply the R-s and J-K flip-flop to solve problems. Explain the operations of shift registers.
- Describe the application of integrated circuit in the field of digital system design. Explain the characteristic and implication of using ATL, TTL, DTL, ECL, and HTL gates.
- Explain the constructional features of binary and decode countries; straight binary shift even, shift odd, sign and preset. Describe the configuration of the countries
- Synthesize a 4-bit adder, Synthesize a NBCD adder, Synthesize code-converting circuits, integrated (SSI) circuit e.g, BCD to gray. Design a 4-decade excess 3-adder code converting circuits. Solve problems of combinational circuit designs.

- **Explain the various WORD formats;** explain the Neumann's configurations of digital computers, arithmetic logic units, and its basic registers, the basic registers of the engineers control unit, the basic registers of the I/O units, the basic registers of memory control units. Describe the four, three and two address machines and various methods of addressing.

## **CEN 3301 - Digital System Testing and Testable Design**

### **Objectives**

Course will contain topics related to VLSI testing, such as logic simulation, fault modeling, fault simulation, ATPG, BIST, etc.

### **Learning Outcomes**

On completing this course, students should understand the essential testing algorithms and tools, be able to design for testability in general and be capable of reading critically the recent literature.

### **Course Content**

- **Circuit Modelling** - Basic Concepts, Functional Modelling at Logic and Register levels, Structural Models.
- **Logic Simulation** - Simulation based Design Verification, Delay Models, Gate level Event Drive Simulation.
- **Fault Modelling** - Logical Fault Models, Fault Detection, Equivalence and Dominance, Single and Multiple Stuck - Fault Model.
- **Fault Simulation** - General Fault Simulation Techniques, Fault Simulation for Combinational Circuits, Fault Sampling.
- **Testing:** Algorithms for Testing Single Stuck Fault and Bridge Faults, Automatic Test Generation Concepts, Functional Testing, Random Test Generators, Encoding techniques.
- **Design for Testability:** Scan Based Design, Boundary Scan Techniques, Compression Techniques, LFSRs, Built-in Self Test (BIST), BIST Architectures and Advanced BIST Concepts.
- **Formal Verification:** Model Checking, Equivalence Checking and Theorem Proving, Design of tools for Formal Verification.

## **CEN 3302: Artificial Intelligence and Robotics**

### **Objectives**

This course is designed to enable the student have an in depth knowledge of the Artificial intelligence and Robotics Systems and the role of this new knowledge base in the automation of both business and industrial systems

### **Learning Outcomes**

On the completion of this course the student should be able to:

- Know the basic concept of computer graphics, interactive graphics, raster graphics, input/output devices and available graphics facilities and software packages.
- Know artificial intelligence and expert systems
- Understand the concept of Neural Network
- Know about Robotics as an intelligence tool for industrial efficiency

### **Course Content**

- Basic concepts of computer graphics, interactive graphics, raster graphics, input/output devices and available graphics facilities and software packages: Define a graphic systems, explain the origin of computers graphics, define a picture element block pixel line and basic techniques of clipping geometry transformation and incremental methods. Explain interactive graphics, two basic types of graphical and interactions pointing and positioning, event handling, polling, interrupts and event queue; functions of dragging and fixing, hit detection and on-line character recognition. Explain raster graphic fundament. Generate raster image, describe useful operation for manipulating a raster; write rectangle, write mask, write colour, copy raster, invert mask and invert rectangle. Describe graphics input devices, output devices, mouse tablets, the light pen. Explain three dimensional input devices, acoustics and mechanical devices, graphic output devices; plotters, visual display units and oscilloscopes. Explain block graphics characters and the codes. Design a set of graphic character suitable for use by a program to give an animation effect. Explain the use of graphics commands, write programs to display; an isosceles triangle, regular hexagon, an a circle, the graphics facilities available on computer. Describe graphics package and support the writing of application programs in graphics packages.

- Know Artificial Intelligence and Expert Systems: Explain the fundamental concept of stimulation, perception and recognition. Describe the basic components and functioning of the human brain and the central nervous systems, problem-solving in terms of recognition of pattern, objects, images. Express game playing and puzzles as form of pattern recognition. Introduce the concept of automatic closed-loop feedback systems. Apply man-machine interactions and the simulation of the former by machine. Define cybernetics, bionics, artificial neuron and robotics. Explain self-adjusting systems and learning machines. Define expert system, explain the role of the expert systems, knowledge engines and their use in systems development. Explain knowledge representation and knowledge bases. Explain expert system shell (or the inference engine). Explain backward and forward chaining. Apply expert systems to real-life problems. AI & Expert systems industry and applications today. Basics of Expert Systems, building AI and Expert Systems, developing a small-scale expert system. Getting knowledge into the computer, searching through knowledge for answers, how the computer reads knowledge. The promise of expert systems, application of AI/ES to Robotics engineering, sensor, manipulators and pattern recognition, languages, software and CAD, Vision, Object representation, shape and solid modeling. Robot systems, control with mobility, robotics and AI application in industry and medicine.
- Understand the Concept of Neural Network: Know what a Neural network is know what differentiates a Neural network from conventional LAN, WAN, WAN.
- Know about Robotics as an Intelligence Tool For Industrial Efficiency: Understand what robots can and cannot do, know about components of robots. Actuation mechanism, vision systems, control, end-effectors, know some manufacturers of robot components. Types of robots and where they are applied. The economic drive behind robot deployment in the advanced countries. Reasons for adoption of robots in Africa, research efforts in robotic development.

## **Computer Information Systems Courses**

### **CIS 3101- Management Information Systems**

#### **Objectives**

The aim of this course is to:

- develop an understanding of typical business systems and the data that flows between people and sub systems.
- develop an awareness of the reasons for and the role of an analyst coming into such an organization.
- explore the nature and importance of information gathering and requirements analysis
- develop an understanding of information gathering and requirements analysis methods and suitability.
- recognise the importance and nature of modelling techniques used by industry (UML).

#### **Learning Outcomes:**

- A. Discuss the nature and function of a range of contemporary business systems.
- B. Identify reasons for an analyst coming into such an organization.
- C. Understand the need for, and nature of, information gathering and requirements analysis.
- D. Use appropriate information gathering and requirements analysis methods to help solve a business problem.
- E. Use the language of systems analysis.
- F. Understand the importance and concept of modelling data and processes and be able to interpret and discuss basic UML models.

#### **Indicative Content:**

- Business Systems: the concept of a system; types of typical service and manufacturing businesses; levels of management and business functions; types and forms of data generated and required by sub-systems.

- The role of the Analyst: the concept of a need for change; reasons for and the roles of a systems analyst coming into an organization;
- the relationship with users and managers at different levels of the organization.
- Information gathering and requirements analysis: the stages of requirements analysis and their deliverables; Different type of information sources; different information gathering and requirements analysis techniques and their suitability; methodologies and guidelines for using these techniques; analysis of findings.
- Modelling and UML: the concept of modelling with a range of real life examples; different approaches to modelling from a range of methodologies; the concepts of data and process modelling; the UML approach - exposure to elementary class, use case and state transition examples.

## **CIS 3102 - Information Technology Planning**

### **Objectives**

The aim of this course is to enable candidates understand the process of initiating and developing an information technology system which helps the organization achieve its objectives.

### **Learning Outcomes**

- Discuss the role and significance of information technology planning
- Explain the activities involved in the stages of developing an information technology system.
- Evaluate the methods and techniques used to plan an information technology system.

## **Indicative Content:**

- Types of information technology systems; planning for hardware and software; enterprise and functional information technology systems; acquiring information technology systems; initiating the development process; project management; planning the analysis;
- Planning the design; systems building; systems implementation.
- Ethical, Legal, Social & Professional Issues: this course deals with a variety of ELSP issues including, information and data privacy; external and internal risks such as security, viruses and hacking; software copying; moral, legal and ethical dilemmas;
- Professional conduct in a working environment.
- Personal and Professional Skills: a range of personal and professional skills will be developed during the course. The coursework typically will focus on an appropriate case study and involve the application of a range of skills developed during the course. This will allow for the development of comprehension, synthesis, analysis and critical evaluation abilities.
- Tutorials will involve case study analysis to be carried out individually or in teams and will allow for the development of communication skills, problem solving, presentation, and critical evaluation.

## **CIS 3103- Computer Systems and Internet Technologies**

### **Objectives**

Internet technologies are rapidly becoming central to modern computing and information systems that support modern business. The communication and presentation of information in a business-to-customer, business-to-business or intranet mode is essential to the effective operation of modern business organisations. Internet technologies provide the infrastructure for the effective deployment and use of information and knowledge systems to support most business activities and enable the organisation to compete effectively in the market place.

- A computing or information systems graduate must be able to appreciate the significance of internet powered information systems in the modern world, and understand how information systems can both support and enhance information needs in society. The internet technologies supporting modern

information systems are evolving rapidly, and a computing or information systems graduate must be well versed in the theory, and practical application of these technologies.

- This course aims to present the concept of "information" in a practical perspective, giving the student an understanding of its significance as a resource in today's society. Further to this, the course will provide the student with an overview of how information systems support society (and in particular business) in a variety of different ways. The ethos of the course will be to introduce the student to pertinent concepts with the support of relevant, up-to-date case studies and examples.
- This course will also introduce the student to the internet technologies supporting modern business information systems, such as basic data communications and networking concepts. In addition to this, it will explore in more practical depth WEB-related and media-related technologies, which are helping to shape the future design of internet enabled computing and information systems.

### **Learning Outcomes:**

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

- Discuss the impact that growing sources of information such as the Internet are having on society.
- Identify and discuss examples of legal, ethical, security and privacy issues relating to the use of Internet based computer systems.
- Demonstrate an understanding of modern Internet tools and be able to create simple web sites including JavaScript scripting, forms and the use of Web-enabled Databases.

### **Indicative Content:**

- Historical development of business information systems. Understanding information as a resource including, legal, ethical and privacy issues and security aspects. Categories of information systems and the level of support that they provide. How business transactions take place. The growth of electronic commerce.
- An introduction to the importance of the Internet and its various aspects including the Web and email. The architecture of the Web, URL, web

servers and HTTP. Practical introduction to HTML - creating Web pages incorporating media. HTML forms and basic use of client side scripting (such as JavaScript) for input validation. Introduction to client side, in terms of a simple Web-enabled Database.

- Theoretical overview of the client server environment, to support the practical use of HTML, JavaScript, and Access Databases detailed above.

## **CIS 3104 - Computer Programming**

### **Objectives**

As a basis for learning more advanced programming concepts at level two, candidates need a firm foundation in simple program coding and design at level one. Therefore, this course is aimed to provide students with a solid foundation of fundamental programming and program design skills.

### **Learning Outcomes:**

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

- Code non-trivial programs in an object-oriented programming language;
- Design non-trivial programs using appropriate design methods;
- Apply principles of code design for flexibility and re-use; and
- Design and code object-oriented programs.

### **Indicative Content:**

- The course presents the fundamental principles of computing using a standard object-oriented programming language such as Java, using both a simple text editor such as EditPlus and an interactive development environment such as NetBeans. 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 (eg JAVA API documentation). Programming style including 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. The issues of code re-use and software quality are discussed. The use of inheritance is shown for code re-use.

## **CIS 3105 - Database Techniques**

### **Objectives:**

Information Systems students need to understand the fundamentals of designing and building robust and flexible database applications. This course aims to start to develop the student's ability to apply system building tools and techniques in order to eventually construct high quality systems to meet the need of business. The course is practically based and uses a case study approach to give students the grounding they require to take courses at a higher level.

### **Learning Outcomes:**

- Prepare a database design to model a given user requirement.
- Map a database model to a database schema
- Use the basic facilities of a Relational Database Management System to construct a database.
- Build and test a variety of database queries
- Construct effective and efficient computer user interfaces.
- Develop, test and document simple small programs and modules in a procedural programming language to a given specification.
- Apply basic quality assurance techniques to software product development.

### **Indicative Content:**

- Basic Database modelling (ERD).
- Relational Database Management Systems; tables, attributes, relationships, keys.
- Database schema design, Implementation (e.g. MS-Access).
- Querying techniques (Grid based; SQL, PHP).

- Elements of an event-driven system: forms, reports, visual controls, events.
- Screen and report design; Graphic User Interface concepts and terminology.
- Event-driven scripting (e.g. VBA).
- Testing and Documentation.
- Data protection. Fostering ethical client-developer relationships, by, for example, making reasonable attempts at future-proofing of designs.
- Producing high quality interfaces and reports.

## **CIS 3201- Information Systems Development**

### **Objectives:**

The overall aim of this course is to show the need for good design and quality management throughout the development lifecycle of an information system. It builds on the knowledge and skills gained at level 1 and provides a firm foundation for further study in this area. Specifically:

- To develop an increasing awareness of the complexity of information systems and to use object oriented tools and techniques to model systems.
- To formally analyse and recognise the principles of good interaction design to systems development.
- To explore different project management strategies to show the quality of a system is dependent upon the way a project is managed.
- To integrate the skills taught in other core courses in the implementation of an information system and to reflect on the development process.

### **Learning Outcomes:**

- Use project management tools and techniques in the development of information systems.
- Identify the benefits of taking an object oriented approach to systems development.
- Apply object oriented analysis and design techniques to systems development.

- Investigate and use good interaction design principles for systems development.
- Implement a system using suitable development tools.

### **Indicative Content:**

- Object Analysis and Design concepts: systems development using an object approach; (how it differs from structured approach); object diagramming techniques; identifying and modelling objects; events, states and state transition; the dynamic model; the functional model; introduce and use UML as an object modelling language; design issues using objects.
- Managing a Project: introduce the key features of a method and project management tools; managing the analysis and design of a system in an object environment; managing the implementation of an information system; use techniques for determining IS requirements & prioritizing IS developments; examine and use suitable tools and techniques for managing projects.
- Interaction Design: understanding the problem space; analysing types of users and user needs; designing the interaction; error handling; screen layout; task analysis; consistency; user centered design; strategies for evaluation and testing of design.
- Plan and Manage a project through: identification and application of appropriate project management tools; requirements acquisition and determination; investigation into the user group and relevant principals and guidelines to support user interaction; analysis and design using appropriate modelling methods; the use of quality standards to include testing and evaluation.

### **CIS 3202- Information and Content Management**

#### **Objectives:**

- To develop the necessary knowledge and skills to manage the content of enterprise-wide data-driven web sites and intranets and their related databases.
- To extend student's knowledge of the technical and managerial issues affecting the management of large-scale content management systems.

- To develop critical awareness of issues relating to the content management of web sites and intranets.

### **Learning Outcomes:**

- Design and build Enterprise Content Management Systems.
- Critically evaluate the implementation and management of security in web environments.  
C. Appraise the legal, ethical and social aspects of web-based systems.
- Critically evaluate Quality Assurance in web-based Content Management Systems.
- Understand how information is used and stored in large enterprises; Understand how to develop information and retention policies for enterprises.

Personal and Professional Skills: The student will be able to:

- Form an information and retention policy;
- Build a enterprise content management system to a given specification.

### **Indicative Content:**

- Information as a resource in large enterprises;
- Information Architecture of enterprise web sites and intranets;
- Security issues in Content Management Systems; Information Management Policies; Accessibility issues;
- Requirements specifications and Testing for Content Management;
- Legal, ethical and social issues.

## **CIS 3203- Web Database Applications**

### **Objectives:**

- The course aims to develop student's ability to analyse and design solutions to business problems.
- This course is also aimed to develop the candidates' ability to apply systems building tools and techniques in order to construct high quality systems to meet the needs of business. The course is practical and builds on the skills gained at level1 and introduces higher level concepts.

### **Learning Outcomes:**

- Appreciate the functions required of common business information systems
- Employ problem solving techniques to deal with complex systems
- Prepare data models and map them to database schemas
- Demonstrable problem solving skills involving integration of a range of technologies (including server-side programming and database integration) and standardisation of technologies where appropriate
- Construct efficient user interfaces for a variety of users
- Apply security, testing and quality assurance techniques to software product development

### **Indicative Content:**

- Common business systems and their functionality (e.g. stock control, payroll)  
Advanced database modelling (ERD) including temporal and semantic aspects; states
- Programming implementation concepts
- Client and server-side web programming (e.g. VB, Java or C#); Recordsets;
- Functions; Procedures
- Application of XHTML and CSS
- Complex queries; SQL, PhP

- Implementation and testing in an Integrated Development Environment (e.g. Visual Studio)
- Documentation; user manuals

### **CIS 3204- Information Analysis/Information Requirement Analysis**

- **Objectives:**

To understand the concept of quality information and its significance in effective decision making and to develop skills in the production of quality information for an appropriate business information system.

- Explore the concept of information, data and meaning within the context of organizational culture and world views.
- Develop an understanding of user participation approaches in systems development.
- Demonstrate the impact of human factors on the success of an information system.
- Study several 'soft' approaches (such as SSM and ETHICS) as a means of identifying human issues in the development of an information system.

### **Learning Outcomes:**

- Explain and discuss the elements of quality information.
- Design and build a suitable information system.
- Develop and produce quality information.
- Evaluate different models of understanding information and data.
- Appreciate the impact of organizational culture and world views on the development of information systems
- Use and critically evaluate different approaches to requirements analysis and modelling.

### **Indicative Content:**

- Elements and Models of data and information; the need for quality systems and decision making; the effects of poor quality data and information;

managing and improving quality systems; presentation of information; production of quality information; use of appropriate software.

- ELSP issues concerning the security and confidentiality of data and information; the risks involved in the storage and distribution of information; the need for appropriate management and control of personal data, skills in the development of documentation, the presentation and interpretation of information, and the communication of information orally and visually.
- Understanding different views of information, systems and information systems; overview of a semiotic framework; the impact on system design when considering social world, pragmatic and semantic views of the world. The impact of organizational cultures. World views.
- Modelling user requirements using a range of tools, Concepts of modelling and abstraction,
- Techniques for modelling user requirements - use case modelling, prototyping, unified approach etc. Understanding and modelling Human Activity Systems,
- The influence of systems theory/soft systems theory, Checkland's Soft Systems Method (SSM): background to the method, the seven stages in summary, rich pictures as a technique, CATWOE and root definitions, Conceptual models,
- Participation when gathering information requirements, The concept of a participative approach; an overview of different models of motivation theory; (e.g. the ETHICS methodology),
- Ethical issues relating to modelling and using information and data in organizations, Understanding the social impact of information, how different types of systems and applications affect information use, building in privacy, accountability, and authority.

## **CIS 3301- Database Management & Administration**

### **Objectives:**

- The aim of this course is to introduce more advanced database concepts and provide the necessary knowledge and practical skills of creating and maintaining the database including database objects and data. It also teaches how to protect the database by designing a backup and recovery strategy; diagnose and tune common database performance problems.

### **Learning Outcomes:**

- Critically evaluate the concepts and tools of the database management system.
- Demonstrate systematic knowledge of the database architecture.
- Design database backup and recovery strategy.
- Develop critical awareness of issues relating to database management and practical skills to solve common database administration problems.
- The students are expected to be able to:
  - Develop management strategies for enterprise databases;
  - Design backup, recovery and contingency plans for enterprise information;
  - Produce database management documentation.

### **Indicative Content:**

- Exploring the database architecture; Creating the database; Managing the database instance;
- Managing database storage structures;
- Managing transactional processing and locking mechanism;
- Database security; Monitoring the database and using the advisors;
- Backup and recovery concepts;
- Investigating, reporting, and resolving problems.

## **CIS 3302- Information Systems Development, Frameworks and Methods**

### **Objectives:**

Quality Information systems are critical to the success of many organizations. Underpinning the development of such quality systems is the application of pertinent development methodologies. An understanding of how Information systems methodologies can support the development of quality applications is an important skill required by any IS professional.

The main aims of this course are to:

- Consider the underlying components of a generic development methodology and its place in the modern environment.
- Consider the significance of Rapid Applications Development (RAD) techniques within a modern development environment.
- Explore the future direction of development methods in industry.
- Consider the professional and ethical issues relating to information systems development.

### **Learning Outcomes:**

- Critically evaluate the significance of a methodology/framework within an IS development environment.
- Apply the principles, concepts and techniques of a RAD methodology to a given development environment.
- Appreciate the issues impacting upon the future development and use of methods in industry.
- Discuss professional and ethical issues relating to information systems development.

### **Indicative Content:**

- Systems development methodologies: The concept of a methodology, method development, problems with methods. The human dimension, organizational aspects, the need for a methodology, requirements of an Information systems methodology, criteria for selection of a methodology.

- Rapid Applications Development/Agile techniques: General RAD concepts - prototyping, time boxing DSDM method: background to the method, framework of the method, DSDM principles, time versus functionality, when to use the method, technology support. The agile approach, relationship to RAD, managing an agile approach.
- The future of methods: The problem with methods. Issues impacting upon use of methods in industry
- Professional and ethical issues: The role of the professional in IS development, understanding different ethical approaches, the need for codes of ethics/codes of conduct.

## **CIS 3303- Data Warehousing**

### **Objectives:**

- The aim of this course is to apply the principles of database applications and technologies to solve realistic technical and managerial problems in organizations and, in so doing, contribute to those organizations' strategies.

### **Learning Outcomes:**

- Design and implement a data warehouse.
- Solve business problems requiring the querying of data derived from a warehouse.

### **Indicative Content:**

- Operational and informational systems.
- Warehouse architecture.
- Dimensional Analysis.
- Data Marts.
- Data cleansing / ETL.
- Trends & Historical Data.
- Performance issues.

- The course will take advantage of the wide range of legal publicly available information from government and other sources.
- Personal and Professional Skills:

## **Multimedia Technology Courses**

### **MMT 3101 - Visual Studies and Web Media**

#### **Objectives:**

The aim of this course is to:

- introduce the concepts of design, layout and illustration
- promote understanding of how graphic imagery is utilised across popular media and multimedia presentation
- introduce students to the technical aspects of web design and development.

#### **Learning Outcomes:**

- demonstration of an understanding of colour theory in composition and layout;
- creation and manipulation of images and text;
- development of visual solutions in various formats to written briefs;
- demonstration of an understanding of the history and evolution of design;
- demonstration of understanding of the use of imagery in advertising, TV and film;
- construction of a web site using appropriate HTML which incorporates animation;
- using appropriate programming techniques in the construction of a website;
- demonstration of an understanding of web accessibility issues.

#### **Indicative Content:**

- Use of graphic design materials and software.
- Delivery of graphic imagery, including research, development and finishing.
- Creating imagery using mixed media, transfer to digital hardware and edit.
- Integrating text with imagery.
- XHTML and CSS.
- Production of web graphics. Discussion of web site design principles, including navigation systems.

- Browser and platform compatibility.
- Use of industry standard HTML editors.
- Use of industry standard web development environments, including Web accessibility software.

## **MMT 3102 – Computing and Digital Media Foundations**

### **Objectives:**

The aim of the course is to:

- introduce the fundamental operational principles of computers and computer systems.
- introduce commonly used software for communicating effectively.
- equip an individual with transferable skills to use application software.
- teach basic principles of software design.
- teach programming in a commonly used language.
- examine the potential of a variety of media in the digital domain;
- introduce students to research practices & the critical evaluation of information & artefacts;
- provide experience of the production of digital media assets and their combination for digital and printed delivery;
- provide experience of industry-standard software for digital media manipulation & production;
- foster appropriate levels of academic practice;
- introduce students to business skills.

### **Learning Outcomes:**

- Explanation of commonly used computing terms used in digital media.
- Usage of common software to communicate effectively.
- Import and modify images on a computer.
- Describe how the law impacts on computing issues.
- Use basic software design and implementation techniques.
- Explain the basic terminology used in programming.
- Create small interactive applications using common programming constructs.
- Creation of original digital media artefacts such as still images, animation, audio tracks & video.

- Creation and presentation of digital media products for print & digital display.
- Utilization of research techniques to inform product development.
- Appraisal of professional media products.
- Application of appropriate planning & project management techniques to product development.

### **Indicative Content:**

- Understanding of appropriate computer hardware.
- Effective communication using word processors, spreadsheets and presentation packages (Office software).
- Operating Systems : (Windows, Unix, MacOS, command v GUI).
- Investigate file types and appropriate methods of compression in imaging, video and sound.
- How the internet works and how to use it to gather information. (e.g. TCP/IP, Email, FTP, WWW).
- Digital photography; Digital manipulation of still images; Typography;
- Desktop publishing; Vector graphics; 2D animation;
- Basic digital sound recording, editing & manipulation;
- Shooting video, video editing & manipulation; Video compression techniques for multimedia delivery; Combining digital media in an authored interactive application;
- Basic academic skills; research strategies, summarising, comparing and contrasting written material;
- Professional communication skills; report writing and presentation techniques.
- Practical techniques within a context of current practices & visual & sonic languages, alongside appropriate planning & production management techniques.

## **MMT 3104 - Interaction Design**

### **Objectives:**

This course is aimed to:

- provide students with an in-depth knowledge of how users interact with products and how we can design better interactive systems;
- enable students to gain an appreciation of established design principles and methodologies to solve interaction design problems;
- provide a comprehension of how complex multimedia systems can be designed and implemented.

### **Learning Outcomes:**

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

- demonstrate a critically level of comprehension of the nature of cognitive psychology and how it influences the ways in which users interact with computer systems;
- use established design principles and methodologies to solve interaction design problems;
- develop multimedia applications which incorporate the critical selection and use of advanced interaction design techniques;
- demonstrate the synthesis of theory and application;
- demonstrate a critical evaluation of current issues in Interaction Design.

### **Indicative Content:**

- Usability engineering and evaluation: interaction design and evaluation methodologies; architectures; input/output modes and devices; construction skills; interaction styles; metaphors and conceptual models; standards, guidelines, principles, and theories; accessibility.
- User models: cognition; human psychology and actions; ergonomics; human-information processing.
- Human-computer applications: including virtual and connected environments (inc. mobile); games; visualisation; multimedia; affective computing; systems for users with special needs.

## **MMT 3105 - Information and Content Management**

### **Objectives:**

The objectives of this course are to:

- develop the necessary knowledge and skills to manage the content of enterprise-wide data-driven web sites and intranets and their related databases.
- extend student's knowledge of the technical and managerial issues affecting the management of large-scale content management systems.
- develop critical awareness of issues relating to the content management of web sites and intranets.

### **Learning Outcomes**

The student will be able to:

- Design and build Enterprise Content Management Systems.
- Critically evaluate the implementation and management of security in web environments.
- Appraise the legal, ethical and social aspects of web-based system
- Critically evaluate Quality Assurance in web-based Content Management Systems.
- Understand how information is used and stored in large enterprises;
- Understand how to develop information and retention policies for enterprises.
- Personal and Professional Skills:
  - Form an information and retention policy;
  - Build a enterprise content management system to a given specification.

### **Indicative Content:**

Information as a resource in large enterprises; Information Architecture of enterprise web sites and intranets; Security issues in Content Management Systems; Information Management Policies; Accessibility issues; Requirements specifications and Testing for Content Management; Legal, ethical and social issues.

## **MMT 3201 - Digital Media Production**

### **Objectives:**

The objective of this course are to:

- Advance skills in content creation & programming;
- Develop a broader knowledge & understanding of creative practices;
- Develop innovative approaches to developing media rich applications;
- Develop awareness of professional production practices;
- Prepare students for employment in the digital media industries;
- Provide experience of team & individual project management, from research & planning through to delivery & evaluation;
- Practice industry standard communication skills of documentation & presentation.

### **Learning Outcomes:**

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

- Critically investigate the cultural domain influencing current professional practices;
- Identify & apply appropriate creative techniques using a range of digital media;
- Develop artefacts that utilise the opportunities provided by advanced scripting for media rich applications;
- Devise, plan, produce & evaluate the production of an interactive narrative;
- Effectively communicate an idea using methods appropriate to the digital media industries;
- Apply the skills required to successfully manage & deliver a team project.

### **Indicative Content:**

- Research & documentation techniques.
- The evaluation of information & authored material.
- Ideas, inspiration & innovation, where does it all come from?
- The position of digital media production within current & historical modes of entertainment & information delivery.
- The creative opportunities particular to digital media production, i.e. interactivity, navigation, agency & engagement.

- Advanced techniques in the production, preparation & combination of digital media content.
- Advanced scripting for interactive digital media applications.
- Pre-production, production and post-production methods in the creation of media rich interactive applications.
- Project management; working to a brief, team work, corporate identity, pitching, presenting, planning time, resources & tasks, documentation, delivery, reflection & evaluation.
- Research into employment possibilities, CV & portfolio development.

## **MMT 3202 - User Interface Design**

### **Objectives:**

The objectives of this course are to:

- provide students with an understanding of the current practice in human computer interface development and evaluation.
- provide students with the knowledge of how user-centred design helps to build user interfaces which are accessible, easy to learn and friendly to use.
- enable students to gain an appreciation of the concepts of colour theory, font terminology, layout and graphic design elements in terms of visual user interface design.

### **Learning Outcomes:**

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

- understand the issues involved in developing and evaluating interfaces to interactive applications;
- demonstrate an awareness of human-computer interface standards and guidelines;
- apply the principles, concepts and models of user-centred design methods to the development and evaluation of interactive system interfaces;
- apply the concepts of colour theory, font terminology, layout and graphic design elements in terms of visual user interface design.

### **Indicative Content:**

- Managing Design Processes;
- Evaluating Interface Designs; Quality of Service;
- Interface Styles and Devices;
- Standards, Guidelines, Principles, and Theories;
- Accessibility; Contemporary Interactive Technologies.

## **MMT 3203 - Design for Moving Image**

### **Objectives:**

The objectives of this are to:

- investigate the fundamental concepts, definitions and techniques of graphic design within digital media.
- examine the creative process and the development of design ideas.
- investigate and practice graphics as a systematic presentation of objective information and as a vehicle for personal expression.
- examine audience reading and interpretation.
- provide a comprehensive overview of the skills required for Motion Graphics, including professional relationships and language.
- introduce fundamental concepts for Motion Graphics.
- discuss and evaluate Motion Graphics styles, communication of meaning and audience.
- develop studentscreativity and skills through learning and applying diverse methods of creating Motion Graphics.
- research, develop and evaluate design presentations, moving image compositions, graphic transitions and audio.

### **Learning Outcomes:**

- Creation of a portfolio of digital work showing a wide range of personal graphic design skills and understanding.
- Examination of the use of different styles and techniques, including the role of audio, used to create Motion Graphics.
- Construction and presentation of Motion Graphics paying close attention to individual aspects in detail.
- Use pre-production methods, including visual research and storyboarding
- Creatively use visual and aural elements in Motion Graphics.

### **Indicative Content:**

- Graphic Design and Motion Graphics for Broadcast Design and Advertising:

Media as communication.

Design issues for digital media.

Abstract design problems: objective presentation and personal expression

Social Semiotics; metaphors; new approaches to complexity; contemporary

critical theory

Turning ideas into Storyboards.

Use of colour, layout, fonts and consistency in design.

Experience of industry standard software.

Layering graphics and applying effects such as different blending and overlays.

Animating Graphics, exploring different styles of motion: continuous, smooth, sudden changes, erratic, repetitive.

Animating to Audio; how to analyse the drama of a soundtrack and make the animation complement it.

Presenting Motion Graphics, how to display the key elements and core concepts effectively.

## **MMT 3204 - Computers, Music and Sound Design**

### **Objectives:**

Computer-based music production techniques are widely used in the world of multimedia as well as in the music recording industry. Sound plays an important role in multimedia applications such as interactive CD-ROMs, computer-based learning, and incidental music for film and web site development/broadcasting. An understanding of both MIDI and digitally recorded music, and the operation of related music software, will allow students to take a creative approach to adapting, creating and performing professional quality audio content for use in multimedia productions.

Sound is also a vital part of moving image media playing a major role in enhancing narrative techniques & engaging the audience. This course aims to provide a significant understanding & experience of sound production for moving image media. There will be a balance of creative & technical skills taught in the context of moving image production. These skills will be transferable to film, television, games and animation.

### **Learning Outcomes:**

- Use MIDI connections correctly and explain the fundamentals of the current MIDI specification.
- Explain various aspects of multi-timbral synthesisers and control them through MIDI.
- Analyse simple pieces of music in terms of structure, instrumentation and production techniques.

- Explain the basics of music theory and apply them in a music sequence
- Manipulate digital audio through the use of hard disk recording and editing techniques.
- Explain basic concepts of audio sampling.
- Select and justify the use of appropriate features of an industry-standard software sequencing package to create sound / music sequences.
- Explore ways to combine various multimedia elements including sound.
- Investigation & discussion of creative professional practice in sound design.
- Investigation & application of the use of music to compliment visual storytelling.
- Identification & application of appropriate recording techniques for designing sound effects & foley.
- Identification & application of appropriate techniques for professional voice recording and ADR.
- Investigation & application of sound design techniques to the planning, recording & post production of a soundtrack for video, animation or game production.

### **Indicative Content:**

- Listening & editing to rhythm & mood:
- Critical listening to music/ soundtracks;
- Use of video editing software to edit with rhythm and pace;
- Exploring and analysing musical rhythm, motif and atmosphere.
- Building soundtracks:
- Critical listening to soundtracks / the sonic environment;
- Creating sonic rhythm & mood;
- Sound mapping; Sound/music sequencing;
- Using professional recorders, microphones & mixers; Recording & creating FX;
- Soundtracks & post production.
- Sound as part of the production process: Sound & narrative; The voice & dialogue;
- Sound cleaning / manipulation & foley; Working with the director/editor;
- Pre-production, planning the sound elements of a moving image production;

- Production - ambient / diageitic sound, recording to video & hard disk recorder;
- Post production - manipulating recorded sound, adding non-diageitic sound;
- Creating a separate music & effects track; Enhancing the recorded voice.
- MIDI: Basic MIDI principles (channels, program changes), GM/GS MIDI, hardware and software requirements, Multi-timbral MIDI synthesis, operation of MIDI units (soundcard, keyboard, PC).
- Construction of MIDI messages, both simple and system exclusive, MIDI implementation charts.
- Operation of MIDI units in combination with studio recording technologies (sound modules, drum machines, alternative input devices).
- MIDI Sequencing: Real time/step time, play and record features (e.g. projects, tracks, parts). Editing features (e.g. list, piano roll MIDI), processing features (e.g. quantizing, transposition, tempo), arranging and structuring (e.g. cut, copy, paste, move, merge, save, load), controls (e.g. volume, pan, pitch bend, modulation, mixing).
- General: Virtual instruments, sound synthesis, basic music theory and music appreciation.
- Hard Disk Recording & Sequencing.
- Creating and editing WAV files using WAV editing software, sampling, manipulation of sound using filters and plug-ins, mixing desks, recording and understanding analogue sound.
- Layering and creative use of samples using WAV editor software, sound and the web, digital sound file formats (creation and use).
- Combining MIDI, samples and audio recording within a sequence to produce a stereo mixdown.
- Video synchronisation techniques.

### **Learning and Teaching Activities:**

- Taught time will include a series of lectures, screenings to expose students to current & past practice, creative & technical processes
- Practical experience in studio space & labs to provide the necessary skills
- Tutorials to provide further guidance, develop ideas & keep track of student progress
- The ratio of lectures & screenings to practical work will alter over the course with lectures & screenings diminishing as the course progresses.

- Students are expected to put in a minimum of 7 hours per week of independent study.

## **MMT 3205 - Web Technologies Application and Development**

### **Objectives:**

A significant number of websites are now powered by databases generating dynamic content, often as content management systems (CMS). This course provides students with an understanding of both client and server side technologies to help them design a CMS. The course also presents the students with the concepts of database design and implementation as applied to the construction and understanding of data driven websites. A range of solutions will be looked at, but with a focus on open source technologies.

This course will allow the students to build on their basic programming and software engineering skills to learn to make effective use of an industrially relevant object-oriented programming language (such as Microsoft C#.NET, Javascript, PHP etc.). Programming techniques will be taught following a problem solving, case-study based approach to learning programming skills.

### **Learning Outcomes:**

- Build interactive applications with a GUI interface using an object-oriented programming language and an interactive development environment.
- Design, write and test programs that make appropriate use of object-oriented facilities common to many object-oriented languages such as classes, message passing, overloading.
- Use of data structures such as arrays and collections.
- Develop applications using an event driven programming approach.
- Build stand-alone and web applications that make use of persistent storage.
- Discuss the current and emerging internet and web technologies.
- Develop a web application with database connectivity using a variety of technologies specially PHP, MYSQL and JavaScript.
- Explain and implement the theory and practice of database technology, design and implementation on at least one web platform.
- Critically analyze internet related business problems.
- Discuss issues surrounding internet and intranet technologies, such as browser dependency, accessibility, legal and security.

- Develop secure web applications.

**Indicative Content:**

- Review of XHTML/CSS, HTML Forms
- Clients and server issues.
- Javascript - DOM and validation, DHTML, JQuery.
- Accessibility and user-testing.
- Databases: creating and updating in MySQL, Normalisation.
- PHP programming.
- Search engine optimisation.
- Open source software.
- Website security.
- Designing and using CMS's.
- Emerging website technologies Ethical, Legal and Social Issues..

**MMT 3301 - e-business Strategy**

**Objectives:**

The course aims to provide an in-depth introduction to electronic business in the private, public and government sectors. The students will obtain an understanding of the Internet based technologies especially understanding strategic information systems, understanding ecommerce within the boundary of ebusiness, procurement, payment systems, products and services.

**Learning Outcomes:**

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

- gain an in-depth knowledge of the strategic perspective of electronic business and how Strategic Information Systems are used in gaining and sustaining competitive advantage.
- understand how new technologies can boost electronic businesses to effectively make decisions from a management perspective and apply strategic tools to real business case scenarios
- evaluate security requirements and apply risk management techniques to assess threats, vulnerabilities and controls to ebusiness systems.
- understand the application of social, legal, ethical and political factors in e-business environments;
- understand the impact and the use of different industry Acts and Standards in an e-Business environment.

- make strategic decision based upon theories learnt in a group environment;
- effectively work in a group to compile and present a technical and a strategic report based upon the findings of a given scenario.

### **Indicative Content:**

- Strategic decision making within e-Business.
- Understanding e-Commerce as a subset of e-Business.
- Understanding different types of e-Business models.
- Global Strategic Information Systems and Competition.
- Project Management Approaches towards SIS implementation.
- Evaluation of internal and external factors that impact e-Business.
- Supply Chain Management, Procurement and Back office processes
- Apply Strategic Tools and Case Analysis using SWOT, SLEPT and CSF.
- e-Business Payment Systems.

### **MMT 3302 - Multimedia Television**

#### **Objectives:**

The intention of this course is to provide a technical and cultural framework for the production and delivery of video that expands on students' understanding of video and digital media production. The course builds on skills acquired, furthering knowledge of the technologies & techniques behind video production for an ever-evolving set of platforms of delivery. Alongside the technical skills students require an understanding of current & emerging modes of digital entertainment considering the creative & practical implications for video within the media industries.

The aims of this course are to:

- provide an understanding of the technologies, processes & techniques underpinning the production of digital video.
- enable students to produce & package videos to the appropriate standards for a variety of digital delivery platforms.
- promote awareness of the current & emerging trends in digital video delivery & their cultural impact.
- advance understanding of, & skills in, digital media, of which video is one aspect.

#### **Learning Outcomes:**

- Plan, rig & produce a multi-camera video shoot.
- Assess & optimize sound for digital video production.
- Evaluate & select appropriate software, compression & creative techniques to produce video wrapped in an authored DVD & multimedia application.
- Evaluate & select appropriate software compression & creative techniques to produce video for web streaming within an authored web page.
- Critically appraise & explain the possibilities & constraints provided by current & emerging methods of digital video delivery.

### **Indicative Content:**

- Video engineering; the construction of the video signal, analogue & digital signal processing, emerging formats, monitoring & optimizing the video signal, equipment & cable management.
- Lighting; qualities of light, electricity & health & safety.
- Planning, installation & recording of a multi-camera, multi-microphone shoot.
- Planning for transmedia delivery.
- Sound engineering; audio signals in a video environment, monitoring & optimising audio signals.
- Post production engineering; video compression, processing audio.
- Authoring; DVD & multimedia and Web delivery.
- The development of video, emerging forms of delivery & their effects on production.

### **MMT 3303 - Advanced Modelling and Character Animation**

#### **Objectives:**

It is the aim of this course to provide students with a chance to identify an area of the animation industry they would like / want to work in, and develop a showreel of work to help them into their chosen industry. To achieve this, examples will be shown of other projects (professional and student) to help identify the areas of work that currently exist. This will range from Games modelling and animation through to motion capture. Key areas of focus include: The student will use advanced techniques, used in industry, to develop character modelling and/or and animation skills.

- provide an advanced and comprehensive understanding of modelling.
- develop the student's use of modelling techniques related to character development and design.
- highlight and discuss current trends in the animation industries.
- use digitalizing techniques to aid the development of 3D models.
- discuss and evaluate animation styles to communicate intended meaning.
- understand and work through the motion capture process in detail, from aligning markers, to cleaning data in Motion builder and Maya

### **Learning Outcomes:**

- Justify the use of a variety of modelling and or animation methods,
- Research and develop pre-production materials that are focused on a specific area of the animation industry
- Research and justify the use of modelling, animation and development of ideas
- Critically evaluate scripting and expressions to control character animation
- Implement a professional showcase of work for peer review and for presentation at a final year show

### **Indicative Content:**

- Investigate appropriate 3D Animation programs (MAX and MAYA).
- Investigate 2D animation methods and programs (ToonBoom, istopmotion).
- Effective character design methods using both pencil and PC/MAC.
- Traditional drawing and 3D Design.
- Investigate a scripting language and expressions to control movement and animation.
- Learn the advanced features of the NURBS and SPLINE editing systems.
- Use software to create a short animation (on time and meeting specified requirements).
- Animation futures and trends - using critical techniques.
- Motion capture and digitizing theory and practice.
- Group work and collaboration.
- Lectures / demonstrations to highlight techniques used in industry.

## **MMT 3304 - Enterprise Web Software Development**

### **Objectives:**

- The objectives of this course are to:
- develop student's knowledge of development of enterprise systems using web technology.
- develop practical skills in high level programming and database design and implementation in an integrated development environment.
- extend student's knowledge of the technical and managerial issues affecting the development of large-scale data-driven web-based systems.

### **Learning Outcomes:**

- Synthesize and manage a wide range of technologies to meet business and security needs.
- Carry out a rigorous requirements analysis and justify its relationship to integration and acceptance testing.
- Appraise the legal, ethical and social aspects of developing web-based systems.
- Have knowledge of security policies as applied to enterprise-wide systems;
- Have understanding of the importance of working to development standards;
- Personal and Professional Skills:
- Evaluate options and produce a specification for an enterprise software development;
- Communicate with clients and technical staff;
- Produce software written to a specification;
- Produce relevant software security documentation.

### **Indicative Content:**

- Information Architecture of enterprise web sites and intranets; Security issues.
- Accessibility issues; Advanced relevant programming concepts; Advanced relevant database concepts; Requirements specifications and Testing; Apply quality assurance techniques to development; Issues in developing and managing large-scale web applications; ASP.NET, AJAX, XML and web services; Legal, ethical and social issues.

## **Software Engineering Courses**

### **SEN 3101 - Operating Systems**

#### **Objectives:**

A modern computer brings together a diverse range of hardware components into a single complex machine. Managing all of these components is a challenging task handled by the operating system. If successfully implemented, a modern operating system will allow people to happily use computer systems without any knowledge of its inner workings. While it is also possible to develop software with little or no knowledge of the operating system which supports a running programme there comes a point where a basic understanding of the principles and the implementation design decisions become necessary. This course aims to provide a theoretical background of operating system architectures with a focus on the implementation and management of memory, storage, devices, processes, file systems and users.

#### **Learning Outcomes:**

On completion of this course the student will be able to:

- Critically describe the main components of a computer and understand how these are managed by the operating system.
- Explain the structure and design decisions involved in the implementation of an operating system.
- Discuss the issues involved in the management and security of an operating system.

#### **Indicative Content:**

- 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.

## **SEN 3102 - Computer Programming**

### **Introduction and Rationale:**

As a basis for learning more advanced programming concepts at level two, students need a firm foundation in simple program coding and design at level one.

### **Objectives:**

The aims of this course are to:

- provide students with a solid foundation of fundamental programming and program design skills.
- Understand the general concepts and principles of algorithms
- Know the building blocks of Java, C, C++, VB, dBase for windows, Oracle, Delphi, SQL, Visual Basic and FoxPro and the rules for using them.
- Understand the basic principles of debugging programs and good programming practices.
- Survey Programming Language Development

### **Learning Outcomes:**

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

- Code non-trivial programs in an object-oriented programming language;
- Design non-trivial programs using appropriate design methods;
- Apply principles of code design for flexibility and re-use; and
- Design and code object-oriented programs.

### **Indicative Content:**

- The course presents the fundamental principles of computing using a standard object-oriented programming language such as Java, using both a

simple text editor such as EditPlus and an interactive development environment such as NetBeans.

- Basic data types, operators and expressions. Compiling and running programs. Methods and parameter passing. Classes and objects.GUIprogramming. Selection and iteration. Arrays and collections. Exception handling. Simple I/O and database connectivity. Unit testing. Inheritance.
- Use of relevant online documentation (eg JAVA API documentation).
- Programming style including 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. The issues of code re-use and software quality are discussed. The use of inheritance is shown for code re-use.

### **SEN 3103 - Software Configuration Management & Maintenance**

**The course is designed to deliver required expertise for management of the software configuration management process-organization context.**

Objectives are to:

- plan for software configuration management,
- explain surveillance of software configuration management;
- explain software configuration identification and software library;
- discuss software configuration control-requesting,
- evaluate software changes,
- implement software changes,
- explain software configuration status accounting- software configuration status information and reporting;
- explain software configuration auditing.
- identify key issues (maintenance cost estimation) in software maintenance measurement;

- explain techniques for maintenance- program comprehension, reengineering, reverse engineering, migration and retirement.

## **SEN 3104 - Analytical Methods for Computing**

### **Objectives:**

This course teaches analytical skills and techniques needed to underpin a rigorous approach to computing. The emphasis will be on developing precise thinking, and analytical, modelling and algorithmic skills in the context of Computing. It extends the knowledge gained in Logical Foundations and give an introduction to discrete and continuous techniques.

### **Learning Outcomes:**

At the end of the course the student should be able to:

- Use functions in the context of computing.
- Design and use simple algorithms.
- Use vectors and matrices in a variety of applications.
- Understand small network graphs and apply them to a variety of problems.
- Understand some basic concepts of differential and integral calculus and apply them in the context of computing.
- Manipulate simple complex numbers.

### **Indicative Content:**

- **Functions:** Function 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.

## SEN 3105a - Logical Foundations

### Objectives:

This course contains the logic and mathematical ideas needed to underpin a rigorous approach to computing. The emphasis will be on developing precise thinking, looking at modelling data and processes, introducing some reasoning techniques and investigating the use of statistics.

### Learning Outcomes:

At the end of the course the student should be able to:

- Develop a facility with algebraic expressions, number types and their manipulation.
- Understand the nature of sets and their use in computing.
- Use logic to reason about statements and apply to practical applications.
- Use simple statistics for data interpretation.

### Indicative Content:

- **Review and revision of basic algebra:** Extracting relationships from data, manipulation, solving simple equations, rearranging formulae.
- **Numbers:** Number types and their representation in computing. Number bases, binary and hexadecimal, and arithmetic operations in these bases.
- **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 and 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.

## **SEN 3105b - Embedded Systems Development**

### **Objectives:**

This course will allow the students to build on their programming and computer systems skills to learn to build embedded systems using a variety of approaches. Drawing on the student's previous experience in programming at chip level this course will introduce the student to low level programming with C as well as programming with assembly language, and Object Oriented programming with Java, they will attain a level of competence required for further study of embedded systems.

This course aims to:

- Provide a theoretical and practical basis for embedded systems architectures and techniques.
- Familiarize the student with mainstream tools and techniques for the implementation and programming of embedded systems.
- Enable the student to use modern application programming interfaces in a variety of embedded contexts.
- Introduce programming techniques for the building and manipulating of systems employing complex I/O requirements.
- Provide an appreciation of the type, scope and importance of applications to which embedded computing applies.

### **Learning Outcomes:**

On completion of this course the student will be able to:

- Design and implement programs using assembler, low level and high level programming paradigms.

- Configure peripheral controllers and I/O ports to interface to a variety of different sensor and actuator types.
- Describe and discuss the architecture and features of embedded systems.  
D. Demonstrate an appreciation of the way embedded computing impacts on and is changing our society.

### **Indicative Content:**

- 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.

### **SEN 3201 – Software Engineering Process**

Goal: The course is designed to equip the students with required knowledge and skill so as to follow the software engineering established framework in developing efficient and reliable software.

Objectives to:

- define software process;

- explain software process management and infrastructure;
- explain software life cycles and categories of software processes software life cycle models;
- discuss software process adaption;
- Explain software process assessment and improvement
- software process assessment methods,
- software process improvement models,
- and continuous and staged software process rating;
- explain software measurement – software process and product measurement, quality of measurement results, and software process measurement techniques;
- explain software engineering process tools.
- Provide an overview of the major components, conceptual, physical and human, in a software systems building environment;
- Place systems building into its wider organizational, social, ethical and legal context.

### Learning Outcomes

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

- define and conceptualize software process;
- understand software process management and infrastructure;
- understand software life cycles and categories of software processes software life cycle models;
- understand software process adaptation;
- understand software process assessment and improvement;
- measure software performance
- understand software engineering process tools.
- have, both as an individual and as a member of a team, basic skills of developing small systems using object-oriented and traditional approaches to

system building with a fundamental understanding of the various issues involved.

- understand how data and other system components are structured and integrated within larger systems and apply this to simple case studies.
- be able to model and document simple systems using suitable techniques and tools.
- understand fundamental data and object-oriented modelling concepts.
- be able to write reports and give presentations on system building projects.

## **SEN 3202 - Operations Research/Quantitative Techniques in Business**

### **Objectives:**

Quality information is at the heart of decision-making and the running of all organizations. Information and data, as corporate resources, are shared between many groups and individuals. This there is a need for these resources to be properly administered and managed. A database system, including a DBMS, is the major component for enabling the achievement of these needs.

The course intends to provide the principles, knowledge, understanding and skills needed by a computing professional to positively contribute to the success of running a business and enabling it to achieve its mission and objectives.

The main aims of this course can be summarised as:

- To introduce students to the requisite theory and practice of database technology and the applications of the technology in generic and specific domains.
- To give students an appreciation of the role of methodologies in designing and implementing information systems, and to consider and compare different methodologies.
- To enable the student to learn and apply methodologies for conceptual, logical and physical database design.
- To enable the student to acquire skills in solving business problems using the fundamentals of database modelling, enterprise analysis and design.

- To provide knowledge of the modelling techniques required to construct fully validated systems and to enable the student to apply these techniques.
- To introduce students to implementation and management issues as well as database programming languages and standards using various database management systems.

### **Learning Outcomes:**

Students will gain understanding and practical experience of the development life cycle of a Database System. The intention is to train students to conduct data analysis, database modelling and database application development, using a suitable database management system. The course will concentrate on a methodology for good database design and will give the student practical experience in designing and implementing standalone database system. The student will gain skills so that they can understand and converse with computing professional, can participate in project development teams, and effectively develop a database system for small to medium size business.

At the end of this course the student will:

- Be able to clearly explain his/her knowledge of database technology, its importance, its architectures, and the central role Database technology plays in Information Systems.
- Understand and be able to apply appropriate development methodologies of data analysis, design and use appropriate modelling techniques for databases.
- Be able to demonstrate query facilities to formulate queries and manipulate the database e.g., Structured Query Language (SQL), Query By Example (QBE).
- Appreciate the issues underlying database implementation in any database.

### **SEN 3204 - Business Systems Applications**

#### **Objectives:**

Modern businesses employ many computer systems to support both core functions

and specialist functions within the organization. It is important for modern computing and information systems professionals to have a good understanding of the role such systems play in the context of modern organizations. Modern organizations need to procure, maintain, change, integrate and manage their systems in the most efficient way to meet their strategic objectives as well as short term targets.

Computer professionals need to be able to contribute into forming an ICT strategy, the management, audit and integration of Computer and Information Systems. This course aims to offer the grounding that enables students to achieve the essential knowledge and skills to allow them to contribute effectively in this area.

### **Learning Outcomes:**

At the end of this course, a learner successfully completing the course should be able to:

- Appreciate why there is a need for an audit and control policy.
- Understand why business functions exist (Finance, Procurement, Sales, Marketing, Operations, Human Resources, Customer Services etc.).
- Develop knowledge about what activities take place within a variety of business functions and how the development of Information Systems can benefit these business functions both individually and collectively.
- Understand how a Customer Relationship Management (CRM) information system is used and what benefits it provides to an organization.
- Reflect on the legal and ethical environment surrounding the users of Information Systems.

### **Indicative Content:**

- Core business functions in modern businesses.
- Business systems that support those business functions.
- Typical systems, formats and standards. Systems integration issues.
- Basics of ICT strategy.
- CRM systems overview.
- Computing Systems Audit, Control and Quality.

- Legal, social, ethical and professional aspects.

## **SEN 3205 - Advanced Simulation & Computer Modeling Applications**

### **Objectives:**

Among the desirable skills that employers ask for in a computing graduate is the ability to decompose a problem into manageable logical components and to use appropriate algorithms to solve the resulting sub-problems. Building on the Level 1 Logical Foundations, this course takes the student through the fundamentals of data structures, algorithms and problem solving through modelling before examining algorithms for sorting and searching, semi-numerical and eventually numerical methods. A wide range of algorithms will be explored through their application to solving a variety of problems by formulating appropriate models in a series of practical exercises.

The course aims to:

Provide a foundation for understanding the fundamentals of algorithms, semi-numerical and numerical methods and their application to modelling and simulation as a means of solving problems.

### **Learning Outcomes:**

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

- Select and employ appropriate data structures.
- Formulate and solve elementary mathematical models.
- Obtain programmatic solutions using appropriate software, including a high-level programming language.
- Describe and discuss the efficiency, complexity, accuracy and limitations of algorithms.

### **Indicative Content:**

- From problem statement to solution.
- Data structures: primitives, composites, arrays, matrices, pointers, linked lists, buffers, stacks, hash tables, trees.
- The nature of algorithms: iteration, recursion, convergence, efficiency, complexity, completeness, Landau notation.

- Sorting and searching.
- Using data: assumptions, errors, floating point, precision, random numbers.
- Solving non-linear equations of a single variable.
- Interpolation, extrapolation, least squares method for curve fitting.
- Calculus and numerical methods.

## **SEN 3206 - Algorithms and Design**

### **OBJECTIVES:**

Among the desirable skills that employers ask for in a computing graduate is the ability to decompose a problem into manageable logical components and to use appropriate algorithms to solve the resulting sub-problems. Building on the Level 1 Logical Foundations, this course takes the student through the fundamentals of data structures, algorithms and problem solving through modelling before examining algorithms for sorting and searching, semi-numerical and eventually numerical methods. A wide range of algorithms will be explored through their application to solving a variety of problems by formulating appropriate models in a series of practical exercises.

The course aims to:

- Provide a foundation for understanding the fundamentals of algorithms, semi-numerical and numerical methods and their application to modelling and simulation as a means of solving problems.

### **Learning Outcomes:**

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

- Select and employ appropriate data structures.
- Formulate and solve elementary mathematical models.
- Obtain programmatic solutions using appropriate software, including a high level programming language.
- Describe and discuss the efficiency, complexity, accuracy and limitations of algorithms.

### **Indicative Content:**

- From problem statement to solution.
- Data structures: primitives, composites, arrays, matrices, pointers, linked lists, buffers, stacks, hash tables, trees.
- The nature of algorithms: iteration, recursion, convergence, efficiency, complexity, completeness, Landau notation.
- Sorting and searching.
- Using data: assumptions, errors, floating point, precision, random numbers.
- Solving non-linear equations of a single variable.
- Interpolation, extrapolation, least squares method for curve fitting.
- Calculus and numerical methods.

## **SEN 3207 - Application Development for Mobile Devices**

### **Objectives:**

Use of mobile devices has been experiencing a very significant increase in recent years. This is driven by the lowering cost of hardware components, service infrastructures as well as software architectures. With the fast expansion of mobile devices, the development of applications for these devices is fast entering the mainstream of software development.

Software developers entering this field need to understand how the characteristics of mobile devices and applications affect decisions about software design and be able to select and use appropriate technologies, standards, APIs and toolkits to build mobile applications.

This course aims to prepare students to work in the area of mobile software development by introducing them to the relevant technologies and equip them with skills in the design and development of mobile applications using up-to-date software development tools and APIs.

### **Learning Outcomes:**

On successful completion of this unit, students will be able to:

- Understand the technical challenges posed by current mobile devices and wireless communications; be able to evaluate and select appropriate solutions.

- Appreciate the need to keep up with rapid changes and new developments; be able to identify current trends in mobile communications technologies and systems.
- Select and evaluate suitable software tools and APIs for the development of a particular mobile application and understand their strengths, scope and limitations.
- Use an appropriate application development to design, write and test small interactive programs for Android, IOS and other mobile devices.

### **Indicative Content:**

- Characteristics of wireless, mobile applications - examples, service requirement, technical challenges.
- Programming mobile applications (e.g. using c# python, PHP).
- APIs for mobile devices (e.g. Java ME, .NET CF).
- HCI issues for software design on mobile devices and user interface development.
- Security and maintenance of mobile computing systems.
- Data persistence on mobile devices.
- Networking (e.g., HTTP, Wireless Messaging, Bluetooth).
- Multimedia on mobile devices (graphics, sound, music, video, games).

## **SEN 3301 - Database Design and Implementation**

### **Objectives:**

Information Systems students need to understand the fundamentals of designing and building robust and flexible database applications. This course aims to start to develop the student's ability to apply system building tools and techniques in order to eventually construct high quality systems to meet the need of business. The course is practically based and uses a case study approach to give students the grounding they require to take courses at a higher level. The course emphasizes implementation issues of relational database systems, and provides an insight into some of the recent developments in database technology.

## **Learning Outcomes:**

- Prepare a database design to model a given user requirement.
- Map a database model to a database schema
- Use the basic facilities of a Relational Database Management System to construct a database.
- Build and test a variety of database queries
- Construct effective and efficient computer user interfaces.
- Develop, test and document simple small programs and modules in a procedural programming language to a given specification.
- Apply basic quality assurance techniques to software product development.

## **Indicative Content:**

- Basic Database modelling (ERD).
- Relational Database Management Systems; tables, attributes, relationships, keys.
- Database schema design, Implementation (e.g. MS-Access).
- Querying techniques (Grid based; SQL).
- Elements of an event-driven system: forms, reports, visual controls, events.
- Screen and report design; Graphic User Interface concepts and terminology.
- Event-driven scripting (e.g., VBA).
- Testing and Documentation.
- Data protection. Fostering ethical client-developer relationships, by, for example, making reasonable attempts at future-proofing of designs.
- Producing high quality interfaces and reports.
- understanding the technical standards for developing databases to meet enterprise standards;

- evaluating the information requirements of an enterprise from a requirements specification;
- understanding the issues relating to quality of information and reporting

## **SEN 3302 - Programming Distributed Components**

### **Objectives:**

- To demonstrate and critically evaluate component design, distributed component design and distributed component frameworks.
- To examine current approaches to software engineering, including the use and reuse of software components.
- To give students advanced practical skills in using key technologies for developing software applications.

### **Learning Outcomes:**

On successful completion of this unit, students will be able to:

- Evaluate the notion of a component and the forces requiring component design.
- Compare the design implications of distributing components and to develop strategies to overcome challenges associated with distributed objects.
- Evaluate different distributed frameworks and paradigms.
- Compare distributed programming technologies and assess their applicability at large and small scale.
- Demonstrate, design, implement and deploy software components using one or more of the studied technologies.

### **Indicative Content:**

- Component and distributed Component Design;
- Framework and Container Architectures illustrated with examples from technologies such as J2EE and EJB, Struts;
- Transactions, Security, Asynchronous Messaging, Load Balancing and other aspects;

- Web forms and Web Form Components (e.g. using technologies such as 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 such as 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.

### **SEN 3303 - Software Engineering Management and Practice**

#### **Objectives:**

A software engineer today is required not only to be knowledgeable and well-versed in the principles of software engineering, but also to have a sound grasp of the management practices needed to manage software projects. This course takes a critical look at best current theory and practice in software engineering, in particular the architectural approaches required for building distributed systems and component-based systems. It further examines the issues relating to software management to provide a thorough background in the principles and methods and enable the student to perform a critical analysis of the broader technical and managerial issues that are encountered by software engineers in the software engineering process.

This course aims to:

- Provide a practical understanding of the engineering issues involved in the design and development process of distributed and component-based systems.
- Provide an opportunity to reflect upon and evaluate modern process strategies, patterns and techniques for the quality design of large scale software systems.

- Provide the student with a thorough background in principles and methods of software management and provide an opportunity to research and evaluate current trends in the area.
- Enable the student to perform a critical analysis of the technical and managerial issues encountered by software engineers in the software engineering process.

### **Learning Outcomes:**

On completion of this course the student will be able to:

- Give a critical analysis of the issues and problems associated with the production of large-scale software systems.
- Critically assess and select alternative development strategies.
- Give an account of the management of human resources in a software project.
- Evaluate alternative acquisition and procurement strategies.
- Describe and critically discuss software quality assurance management.
- Demonstrate an understanding of professional ethics, codes of conduct and practice and computer law.

### **Indicative Content:**

- The software development lifecycle, contemporary hybrid processes, comparison of milestone driven and agile approaches.
- Software development teams, human resource management, hygiene and motivation factors.
- Verification and validation, quality assurance and quality management systems.
- Ethics, computer law and professionalism.
- Software acquisition, COTS vs. RYO, deployment, maintenance, migration.
- Critical systems and fault tolerance.
- Software product lines and software factories.

- Security architectures, RBAC, encryption, public and private keys, digital certificates.
- Software design patterns, software reuse, refactoring to patterns.
- Enterprise patterns and processes, layered and tiered architectures, architectural design patterns.

## **Telecommunications and Network Security Courses**

### **TNS 3101 - Introduction to Telecommunications and Network Security**

- This course provides a general introduction to the telecommunications industry from both technical and socioeconomic perspectives. It highlights the radical development in the telecommunications industry including digital convergence, cellular mobile communication and Internet. It also addresses social, regulatory and business implications of telecommunications, such as 3G licensing, e-business, digital divide and universal service. The second aspect of the course covers network securities: Security policy design & management; Security technologies, products & solutions; Secure router design, installation; configuration, & maintenance; AAA implementation using routers; Intrusion Detection (IDS) implementation using routers; VPN implementation using routers

#### **Course Goals:**

- Provide the foundational knowledge of the telecommunications and networking industry.
- Present the basic concepts inherent to the application of data communications and computer networks in the digital age.
- Introduce students to Network on the overall security processes

#### **Course Objectives**

Upon completion of this course, each student should be able to:

- Introduce the role and application of data communication networks hardware and software.
- Describe the network architectures, components, and other key terms associated with the physical layer.

- Discuss the foundational concepts associated with data transmission.
- Discuss networking terms and characteristics, motivations for networking, and the major network applications.
- Implement multiple network designs.
- Discuss LAN and WAN Hardware and Software alternatives and selection.
- Describe LAN and WAN topologies, protocols, and transmission services.
- Discuss WAN implementations and international and global networks.
- Describe network interconnections, shared media technologies, and interconnection utilities.
- Define network management issues, the operations of a network management system, and management tools.
- Discuss the issues related to network security, error detection, backup systems, and recovery plans.
- Identify future trends in data communications and networking.
- Master some protocols for security services.
- Describe fundamentals of cryptography.
- Describe network security threats and countermeasures.
- Discuss network security designs using available secure solutions (such as PGP, SSL, IPSec, and firewalls).
- Discuss advanced security issues and technologies (such as DDoS attack detection and containment, anonymous communications, and security properties testing, verification and design).

## **Course Content**

- Security principles and security threats: i) Security services: privacy, confidentiality, authentication, integrity, availability, non-repudiation, access control, etc ii) Security threats: traffic analysis, IP spoofing, denial of service, routing attacks, information leakage, remote arbitrary code execution, viruses, etc. iii) Social, ethical, policy and legal issues.

- Elements of cryptography: (i) Classic ciphers, modern ciphers and stream ciphers and one-way functions (ii) Secret key (symmetric): DES/AES and public key (asymmetric): RSA
- Protocols for Security Services: (i) Key distribution and management, Diffie-Hellman key exchange and certificate (ii) Non-repudiation and digital signatures, elgamal signature (iii) Authentication and its protocols: Kerberos and Needham-Schroeder (iv) Integrity (v) Privacy (vi) Authorization
- Securing network systems and applications: (i) Email security: Pretty Good Privacy (PGP) (ii) Web security: Secure Sockets Layer (SSL) (iii) IP security and VPN: IPsec (iv) Security in routing: OSPF and BGP (v) Firewalls: intrusion detection
- Advanced security issues and technologies: (i) Large scale attacks on the Internet and their defense (ii) DDoS attack and its defense: types of DoS and DDoS attacks, trace-back and attack containment (iii) Active worm defense (iv) Anonymous communication (v) Wireless security.
- Securing network systems and applications: Security with constrained resources; case studies in sensor networks
- Telecommunications Fundamentals: Introduction to Networking, Introduction to digital network topologies; LAN, WAN, MAN, Introduction to TCP/IP.
- Changes in Telecommunications: The New Public Network, Basic elements of Telecommunications
- Transmission Lines
- Network Connection Types
- Electromagnetic Spectrum
- Analog and Digital Transmission: Multiplexing, Transmission Media; Twisted-Pair Copper Cable, Coaxial Cable, Microwave, Satellite, Fiber Optics
- Internetworking Devices
- Internet Technologies
- Convergence of Technologies
- Implementation of Data Networks
- Design and Implementation of Voice Networks
- Protocols Analysis Network Design
- Establishing Communications Channels, Switching and Networking Modes
- Network Infrastructure: Plesiochronous Digital Hierarchy (PDH) Transport Network Infrastructure, Synchronous Digital Hierarchy (SDH) Transport

Network Infrastructure , Public Switched Telephone Network (PSTN) Infrastructure

- Web Strategies for Business, and Managing Web Technologies

## **TNS 3201 – Network Security Technologies and Implementation**

Objectives:

The main goal of this course is to provide a fundamental understanding of network security principles and implementation. The student will learn about the following:

- The technologies used and principles involved in creating a secure computer networking environment.
- The authentication, the types of attacks and malicious code that may be used against your network, the threats and countermeasures for e-mail, Web applications, remote access, and file and print services.
- Intrusion detection systems, firewalls, and physical security concepts.
- Also, security policies, disaster recovery, and computer forensics are covered.

Aside from learning the technologies involved in security, The student will also get to understand the daily tasks involved with managing and troubleshooting those technologies.

A variety of security topologies are discussed as well as technologies and concepts used for providing secure communications channels, secure internetworking devices, and network medium.

Learning Outcomes:

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

- Demonstrate system security skills through firewall implementation and testing.
- Use system tools, practices, and relevant technologies to implement a security plan.

- Evaluate practices, tools, and technologies to identify security breaches, sources of attacks, and protect mission critical systems.
- Establish an appropriate level of security based on an analysis of security logs.
- Use relevant tools to secure a network, and respond to and follow up on various types of attacks.
- Configure and use secure communication channels, internetworking devices, and network media.
- Understand the daily tasks involved with managing and troubleshooting network security.
- Troubleshoot and fix common security problems.

**Course Content:**

- Orientation and Introduction: Information Security Fundamentals
- Attackers and their Attacks
- Security Basics
- Security Baselines
- Securing the Network Infrastructure
- Web security
- Protecting Advanced Communications
- Scrambling through Cryptography
- Using and Managing Keys
- Policies and Procedures
- Security Management
- Linux and Windows Security
- Advanced Security and Beyond

## TNS 3202 - Network Design and Implementation

### Objectives:

This course discusses the design and implementation of network systems such as Ethernet switches and Internet routers. The course covers design principles and issues of traditional protocol processing systems and network processor technology. Packet processing, protocol processing, classification and forwarding, switching fabrics, network processors, and network systems design tradeoffs.

### Learning Outcomes:

Upon the completion of this course, students should be able to explain the concept behind the design and implantation principles of a network system

### Course Content:

- Review of Networking Basics (network)
- Network Architectural, Design, Implementation Principles
- Case studies: IP multicast and anycast
- Introduction to Multimedia Networking; Overlay, ESM and i3 P2P Networks, Packet Scheduling and QoS, Mechanisms; Basic QoS Theory; Internet QoS Architecture: InterServ vs. DiffServ; RSVP.
- Wrap up Internet QoS; Network Congestion Control, Active Queue Management and Beyond
- Router Design
- Intra-Domain Routing and Traffic Engineering
- Inter-Domain Routing and BGP; BGP Policy Issues;
- Internet Measurement Basics: Traffic, Performances, etc.
- Routing Measurement, Routing Instability and Improvements
- Network Security and Malware
- 802.11, Wireless Mesh Networks; TCP Performance and IP Mobility
- Internet Architecture Revisited

## TNS3203– Computer Forensics

### Objectives:

To prepare students to

- understand why computer forensics is an essential part of Information Security;
- protect the subject computer system during the forensic examination from any possible alteration, damage, data corruption, or virus introduction.
- To discover and recover all files on the subject system. This includes existing normal files, deleted yet remaining files, hidden files, password-protected files, and encrypted files.
- to analyze all possibly relevant data found in special (and typically inaccessible) areas of a disk. This includes but is not limited to what is called 'unallocated' space on a disk (currently unused, but possibly the repository of previous data that is relevant evidence), as well as 'slack' space in a file (the remnant area at the end of a file, in the last assigned disk cluster, that is unused by current file data, but once again may be a possible site for previously created and relevant evidence).
- To prepare a forensic report of the subject computer system, as well as a listing of all possibly relevant files and discovered file data. Further, provides an opinion of the system layout, the file structures discovered, any discovered data and authorship information, any attempts to hide, delete, protect, encrypt information, and anything else that has been discovered and appears to be relevant to the overall computer system examination.
- to utilize the computer forensic technology and tools to digital data collection, recovery, preservation and analysis.

### Learning Outcomes:

This course prepares students to:

- Understand computer forensics
- Prepare for computer investigations
- Understand enforcement agency investigations
- Understand corporate investigations

- Maintain professional conduct
- Understand how to identify needs for computer forensics tools
- Evaluate the requirements and expectations for computer forensics tools
- Understand how computer forensics hardware and software tools integrate
- Validate and test your computer forensics tools

### **Course Content**

- Understanding Computer Investigations and Legal Implications
- Investigation Techniques: The Investigator's Office and Laboratory, Current Computer Forensics Tools, Processing Crime and Incident Scenes
- Digital Evidence Controls
- Working with Windows and DOS Systems
- Macintosh and Linux Boot Processes and Disk Structures
- Data Acquisition
- Computer Forensic Analysis
- Recovering Image Files
- Network Forensics
- E-Mail Investigations
- vendor cooperation and collaboration
- Becoming an Expert Witness and Reporting Results of Investigations

## **TNS 3204 - Wireless Communication**

### **Objectives:**

The objectives of this course are to:

- introduce the concept of wireless/mobile communication using cellular environment.
- make the student know about the various modulation techniques, propagation methods, coding and multi access techniques used in the mobile communication.
- introduce various wireless network system and standards

### **Learning Outcomes**

The objective of the course is that the student develops basic understanding and knowledge of wireless communication systems, to be able to analytically rate different technologies for wireless applications.

Upon the successful completion of the course the student should be able to:

- use and discuss radio systems with commonly used terminology within the subject wireless communication systems
- state present standards in the area of wireless communication systems
- to interpret factors that impact and limit the performance of different wireless communication systems
- handle common methods that are used in wireless communication systems
- handle the content of existing standards in the area of wireless communication systems

### **Course Content**

- Radio Propagation over Wireless Channel Evolution of mobile radio communication fundamentals, fundamentals of wireless communication, bandwidth concept, type of signals, quantization, channel coding, equalization, large scale path loss: propagation models, reflection, diffraction and scattering, Small scale multi path propagation, multi path effect/ fading in land mobile system.

- Wideband Modulation Techniques Spread spectrum modulation techniques: Pseudo-noise sequence, direct sequence spread spectrum (DS-SS), frequency hopped spread spectrum (FH-SS), OFDM (Multi carrier Modulation), Introduction to multiple Access: time division multiple access (TDMA), space division multiple access (SDMA), code division multiple access (CDMA) and frequency division multiple access (FDMA).
- Broadcast Networks Introduction to Broadcast Systems, DAB, Digital Radio Mondiale(DRM), HD Radio Technology, Digital Video broadcasting(DVB), Direct to home(DTH).
- Infrastructure-Based/Cellular Networks Introduction to Mobile Networks, GSM System, GPRS, EDGE, and CDMA based standard, IMT-2000, WLL, Mobile Satellite Communication, 3G and 4G, Cognitive Radio Network (5G).
- Ad Hoc Network, WLAN and WMAN (10) Introduction, Bluetooth, Wi-Fi Standard, WiMAX Standard, Wireless Sensor Networks, IEEE 802.15.4 and Zigbee, Ultra-wideband(UWB), IEEE 802.20.

## **TNS 3205 - MPLS and Carrier Networks**

### **Objectives:**

This course gives a comprehensive introduction to the base technology of MPLS and its key applications, and how recent Ethernet standards improve its scalability, management and resilience for service provider use

### **Learning Outcomes**

#### **Upon the completion of this course students should be able to:**

- Understand the key innovations in MPLS
- Design the MPLS Architecture and process

- Know the MEF, IETF plus ITU-T main beliefs
- Explain resilience plus reinstatement in Carrier Ethernet

### **Course Content**

- Key innovations in MPLS
- MPLS Architecture plus process
- MPLS Packet Forwarding application
- MPLS VPLS Architecture plus process
- MPLS IP-VPN Architecture plus Applications
- MPLS-TE Architecture plus application
- Limitations of Traditional Ethernet in Service Provider network
- MEF, IETF plus ITU-T main beliefs
- Ethernet-based Services
- Scalability plus QoS improvement
- Fault plus Performance Management plus OAM flow
- Resilience plus reinstatement in Carrier Ethernet
- Carrier Ethernet Transport preference
- Carrier Ethernet plus MPLS Inter-working

### **TNS 3301 - Computer Forensics 2**

#### Objectives

This course is a continuation of Computer Forensics I. Topics includes the fundamentals of digital computer acquisition, preservation, and analysis.

#### Learning Outcomes:

The students will be able to:

- describe the features and differences between NTFS and FAT file systems;

- effectively utilize a commercial software tool to recover deleted files from a computer;
- evaluate the strengths and weaknesses of various software tools for data recovery; and
- develop a systematic approach to a computer investigation.
- identify, analyze, and discuss tools used in computer forensics
- describe court admissibility investigative procedures
- explain the boot process
- describe how processes are started and maintained in Windows and Unix
- discuss the attributes of file systems
- identify system log files useful in a forensic investigation and use/develop tools to retrieve useful information from the log files – evaluated through reports generated by tools
- describe sound methods of restarting and shutting down computers to minimize evidential damage – measured through examinations
- write/modify programs to enhance the retrieval of computer forensic evidence
- write scripts to glean desired information from log files

### **Indicative Content**

- Principles of computer forensic investigation:
  - Incident Response
  - Computer forensics process and the legal and ethical implications; Data Collection, Extraction and preservation of evidence, Analysis
  - Windows forensics investigation
  - Unix forensics investigation
  - Availability and testing of tools; Linux/Unix tools, Windows EnCase, Windows Forensics Toolkits (FTK); FTK Imager, AccessData Registry Viewer, Forensic Toolkit, PRTK
- Other devices: Phone/PDA/Memory storage/digicam; OS in use, Investigative issues
- Operating Systems and Forensics Analysis:

- Computer Devices; Disk drives, Memory, Kernel (Loadable kernel module, Loadable kernel module rootkits detection), Peripherals, Safe shutdown.
- Boot procedures; BIOS, Boot Sector, Boot loaders, Booting Multiple Operating Systems, Boot types
- Files; File Formats, File Headers/footers
- Processes; Windows, Unix
- File systems; Creation/Modification/Access times, Windows; FAT16, FAT32 file systems, NTFS, shortcut files, Recycle Bin, Registry, System log files, Spooled file, Application logs and files. Unix file systems; Log files, Scripts, Permissions, History files, Links, Backups; Validating and Restoring
- Programming:
  - Linux programming in C; File Access, Linux System Calls, C Standard Library, I/O Disk dump, Traverse directory, Search keywords
  - EnScript in Windows EnCase environment; EnScript, Filter
- Computer forensic tools development

## **TNS 3302 - Network Management**

### **Objectives:**

The course aims to give knowledge of operation, and maintenance of modern computer and telecom networks. Network Management basics, and standards is described with focus on Internet Management with the aid of SNMP, as well as the application of the same. The course also gives practical knowledge in system and network administration as well as network supervision.

### **Learning Outcome**

- Enable student to understand the principles and concepts of network management

## Course Content

- Problem definition and overview - What is network management, network management business drivers, network management scenarios, examples of management tools
- Basic management concepts and management architectures – agent/manager paradigm, management networks, TMN reference architecture
- Management functions and basic management algorithms – Fault, Configuration, Accounting, Performance, Security (FCAPS) reference model, OAM&P (Operations Administration Maintenance & Provisioning), management lifecycle, management processes and organization
- Management information fundamentals – management information modeling paradigms, Internet management model (SMIv2)
- Management communication fundamentals – Management protocol reference architecture, basic management patterns and their applications, advanced management patterns
- Management protocols – SNMP + management functions provided through MIBs, CLI, syslog, Netconf and YANG, Netflow and IPFIX
- Service level management: service level agreements, service level monitoring and performance measurement, service level assurance
- Network supervision and administration tools i e HP Open View and NI Observer
- Router configuration
- Design project: Design a network, and its supervision for a middle-sized company.