Subject: Computer Science[1] (COSC)			
General			
	Course Units	**Status**	**Pre-requisite**
Year 1 Sem 1	COSC 11014 Theoretical Foundations of Computer Science	C	A/L
Year 1 Sem 2	COSC 12025 Introduction to Programming and Program Design	C	COSC 11014
Year 2 Sem 1	COSC 21015 Data Structures and Algorithms	C	COSC 12025
Year 2 Sem 2	COSC 22025 Database Management Systems	C	COSC 11014
	COSC 22035 Object Oriented Programming	O	COSC 12025
Year 3 Sem 1	COSC 31014 Data Communication and Networks	C	COSC 11014
	PRPL 31012 Professional Placement	O	All COSC compulsory course units offered in Levels 1 & 2
Year 3 Sem 2	COSC 32025 Web and Internet Technologies	O	COSC 11014
	COSC 32035 Visual Programming	O	COSC 12025

[1] Restricted enrolment.

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COMPUTER SCIENCE

Level 1

Course Code : **COSC 11014**
Course Title : Theoretical Foundations of Computer Science
Pre -requisites : G.C.E (A/L)
Co-requisites : None

Learning Outcomes: At the end of this course module the student should be able to explain the fundamental theoretical aspects of Computer Science.

Course Content :
Main components of a Computer: I/O devices, CPU, Memory; Organization of a Computer, Secondary Storage devices and types of Secondary Storage; Classification of Computers; Generations of Computers; Software: Systems Software and Application Software; Operating Systems, functions and types of operating systems; Utility Programs, Translators (compilers, interpreters, assemblers); Application Software Packages; Application Programs: Algorithms, Computer programs, Computer programming Languages, Generations of programming languages; Number Systems: Decimal, Binary, Octal and Hexadecimal; Conversions between number systems; Use of number systems; Binary addition and subtraction; Representation of Characters: ASCII, EBCDIC, Unicode; Representation of Numbers: Whole numbers and Floating-point numbers, Sign-magnitude form, Two's complement form, Scientific form, Standard form; Introduction to Computer Networks: LAN, MAN, WAN; Types of Computer networks: Bus, Star, Ring and Tree topologies; Advantages and disadvantages of computer networks; Networking and Internetworking devices and their functions; Need for standard protocols; Data transmission; Introduction to the Internet; Services available on the Internet: World Wide Web (WWW) and E-mail; Web browsers and Search engines; Effective use of e-mail; Information Systems: Types of Information Systems, Systems Development Life Cycle (SDLC); Social, Ethical, Legal and Economic impacts of the use of computers; Computer crime.

Method of teaching and learning: A combination of lectures, tutorials and assignments.

Assessment: End of semester examination and assignments.

Recommended reading:
1. Peter Norton, *Introduction to Computers* (2006, 6th Edition), Tata McGraw-Hill Publishing Company Limited, India.
2. June Jamrich Parsons and Dan Oja, *New Perspective on Computer Concepts* (2003, 6th Edition), Course Technology a division of Thomson learning Inc.
3. B. Ram, *Computer Fundamentals*: *Architecture and Organization* (2005, 3rd Edition), New Age Publications, India.

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Course Code : **COSC 12025**
Course Title : Introduction to Programming and Program Design
Pre -requisites : COSC 11014
Co-requisites : None

Learning Outcomes: At the end of this course module the student should be able to demonstrate skills in structured computer programming concepts, algorithm designing and writing structured programs using a procedural language.

Course Content :
Introduction to Programming: A brief history and types of programming languages.
Program Design: Introduction to software development, Algorithms, Algorithm specifications (flow charts, N-S diagrams and pseudo code), Modular programming concepts, Elegance in program design, Implementing an algorithm using a programming language, Program testing and program documentation.
The C programming language: Data types, Constants, Identifiers, Variables, Expressions and assignment, Input and output, Control structures, Functions, Storage classes, Pointers, Scope of arguments, Structured data types (arrays, structures, unions), Programmer defined data types, Recursion, File processing, Multi-file programming, Bit manipulation and enumerations, C preprocessor and advanced features of C language.

Practical Sessions: Programming using C.

Method of teaching and learning: A combination of lectures, tutorials and practical sessions.

Assessment: End of semester examination, practical examination and assignments.

Recommended reading:
1. Gottfried, B.S. *Schaum's Outline of Theory and Problems of Programming in C* , (2001, 2nd Edition), McGraw Hill Professional Publishing.
2. Kelly, A. and Pohl, I. *A Book on C*: *Programming in C*, (1999, 4th Edition), Addison Wesley Longman Inc.
3. Rajaraman, V. , *Computer Programming in C* (2004, 6th Edition), Prentice Hall.

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Level 2

Course Code : **COSC 21015**
Course Title : Data Structures and Algorithms
Pre -requisites : COSC 12025
Co-requisites : None

Learning Outcomes: At the end of this course module the student should be able to explain abstract data types in structured programming, implement and analyze commonly used searching and sorting algorithms.

Course Content :
Introduction to Data structures: A general introduction to data structures, The need for data structures in programming, Data types, Data structures and abstract data types, Homogeneous and heterogeneous structures, Static and dynamic structures;
Structures to be considered: Stacks, Queues, Deques, Lists, Trees and Graphs.
Searching Technique: Linear Search and Binary Search;
Sorting Techniques: Internal and External Sorting, Exchange (Bubble) Sort, Insertion Sort, Selection Sort, Shell Sort, Quick Sort, Heap Sort, Merge Sort and Radix Sort;
Hashing Techniques;
Analysis of Algorithms: Analysis of searching and sorting algorithms, Efficiency of various sorting algorithms and the need for external sorting.

Method of teaching and learning: A combination of lectures, tutorials and practical sessions.

Assessment: End of semester examination, practical examination and assignments.

Recommended reading:
1. Kelley, AI & Pohl, Ira, *A Book on* C, (l998, 4th Edition) Addison-Wesley.
2. Kruse R.L., Leung B. P. and Tondo C. L., *Data Structures and Program Design in C,* (2001, 2nd Edition), Pearson Education (Singapore) Pte. Ltd.
3. Gottfried, B., *Programming with* C. (l999, 2nd Edition), Tata McGraw-Hill Company Ltd.
4. Rajaraman, V., *Computer Programming in* C, (1994), Prentice-Hall of India (Pvt) Ltd.
5. Langsam Y., Augenstein M. J. and Tenenbaum A. M., *Data Structures using C and C++* (2002, 2nd Edition), Pearson Education (Singapore) Pte. Ltd.

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Course Code	**:**	**COSC 22025**
Course Title	:	**Database Management Systems**
Pre -requisites	:	**COSC 11014**
Co-requisites	**:**	None

Learning Outcomes: At the end of this course module the student should be able to demonstrate the theoretical knowledge of basic concepts of Database Management Systems and practical skills on applications of them.

Course Content :
Introduction to database systems: Database system concepts and architecture, Three tire architecture and mapping; Data Modeling: Entity-Relationship (ER) model and Enhanced Entity-Relationship (EER) model; Relational model: Introduction to the relational model, Relational constraints, Normalization approach for relational database design (first, second, third and BCNF normal forms), Advantages and disadvantages of the normalization approach; Logical database design: ER to relational mapping and EER to relational mapping, Data Manipulation: Relational algebra and relational calculus, Data Manipulation using SQL, Query Processing and Optimization; Security and integrity in databases; Physical database design: Introduction to transaction management in databases, Storing data and primary file organization, File organization and indexes (primary, secondary, clustering and multilevel indexes), Dynamic index structure B+ trees; Web based Database Design and Implementation: XML Data, XML Data Model, XPATH Language, XQuery Language, XML and Relational Databases, Normal Form for XML Data, Web based Database Applications.

Method of teaching and learning: A combination of lectures, tutorials and practical sessions.

Assessment: End of semester examination, practical examination and assignments.

Recommended reading:

1. Ramez Elmasri and Shamkant B. Navathe, *Fundamentals of Database Systems* (2006,5th Edition),Addison-Wesley Longman Publishing Co., Inc.
2. Fred R. McFadden, Jeffrey A. Hoffer, and Mary B. Prescott, *Modern Database Management* (2006, 8th Edition), Pearson Education Series.
3. Ramakrishnan G, *Database Management Systems*, (2002, 3rd edition), McGraw-Hill.
4. Gary W. Hansen and James V. Hansen, *Database Management and Design* (2nd Edition, 2002), Prentice Hall.
5. Michael Brundage, *XQuery: The XML Query Language* (2004), Addison Wesley Longman Publishing Co., Inc.

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Course Code : **COSC 22035**
Course Title : Object Oriented Programming
Pre -requisites : COSC 12025
Co-requisites : None

Learning Outcomes: On successful completion of this course module the student should be able to explain the theoretical concepts of object–oriented systems, be able to demonstrate how an object-oriented programming language upholds object-oriented concepts and effectively use an industry relevant object-oriented programming language.

Course Content :
Background and motivation of Object Oriented Methods, Concepts of Object-Oriented project management issues, Principles and features of an industry standard Object-Oriented Programming language (e.g.: Java/C++). Specific topics include Class and Object models, Object declaration and creation, Instantiable classes, Visibility modifiers, arrays of objects, Self-referencing pointers, Re-use of code, Static methods, Arithmetic Expressions, Variables, Scope, Event-Driven Input and Output, File Objects and Looping Statements, Primitive and reference types, Strings, Use of String buffer, Passing objects as parameters, Exceptions and Additional Control Structures, Inheritance, Polymorphism, Encapsulation, Selection, collaboration, hierarchical classification, using super, creating multilevel hierarchy, method overriding, using abstract classes, use of final and other relations among classes and objects as well as both static and dynamic system models and implementations.

Practical Sessions: Programming using Java/C++

Method of teaching and learning: A combination of lectures, tutorials and practical sessions.

Assessment: End of semester examination, practical examination and assignments.

Recommended reading:
1. Booch, Rumbaugh and Jacobson., *The Unified Modeling Language User Guide,*(1996) Pearson Education.
2. Eriksson and Penker., *UML Toolkit*, (1998), John Wiley & Sons.
3. Wu, T. *An Introduction to Object-Oriented Programming with Jav,*. (2001, 2nd Edition), McGraw Hill.
4. Gamma et at. , *Design Patterns: Elements of Reusable Object-Oriented Software,* (1995) Addison-Wesley, Reading, MA.

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Level 3

Course Code : **COSC 31014**
Course Title : Data Communication and Networks
Pre -requisites : COSC 11014
Co-requisites : None

Learning Outcomes: At the end of this unit the student should be able to examine the use of computer networks and to identify the forces behind their development, and be able to demonstrate skills on design and implementation of various network topologies, architectures, protocols and algorithms.

Course Content :
Introduction**:** Data Communication, Network structures, Types of networks, The Internet, Protocols and standards, Layers of the OSI model;
The physical layer**:** Transmission media (guided and unguided), analog and digital transmission, Transmission impairment, Encoding techniques, Modulation techniques and Modems, Multiplexing, Circuit switching; Telephone Networks and DSL technology;
The medium access sub-layer**:** Ethernet (CSMA/CD), token bus, token ring and FDDI;
The data link layer**:** Framing, error detection and correction, error control and flow control and data link protocols;
The network layer**:** Addressing, Routing algorithms, Internetworking and network layer protocols;
The transport layer**:** Transport layer protocols (UDP and TCP) and connection management;
The session layer**:** Token management and synchronization.
The presentation layer**:** Data compression, data security and encryption.
The application layer**:** Client-Server model, Application level protocols for File transfer, Electronic mail, Network management, Hypertext transfer and World Wide Web;
Advanced telecommunication services and developments: ISDN, Frame Relay Networks, ATM Networks, packet switching and X.25 Networks;
LAN, MAN , WAN and Networking software;
Networking and Internetworking Devices.

Method of teaching and learning: A combination of lectures, tutorials and assignments.

Assessment: End of course examination, assignments and/or practical examination.

Recommended reading:
1. Forouzan B. A., *Data Communications and Networking*, (2004, 4nd Edition), McGraw Hill.
2. Forouzan B. A., *Local Area Networks*, (2002, 1st Edition), Tata McGraw Hill Edition.
3. Stallings W., *Data and Computer Communications*, (2002, 6th Edition), Pearson Education Inc.
4. Tanenbaum A.S., *Computer Networks*, (1996, 3rd Edition), Prentice-Hall International.

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Course Code :**COSC 32025**
Course Title **:** Web and Internet Technologies
Pre -requisites **:** COSC 11014
Co-requisites **:** None

Learning Outcomes:
At the end of this course module the student should be able to demonstrate the theoretical knowledge of basic concepts of Web and Internet Technologies and practical skills in their usage in critical systems development.

Course Content : Overview of the Internet: 7 Layer Architecture, Addressing, Routing, Control protocols, Application Layer Services etc; Web technologies: Overview of HTTP and Web Servers, HTML, CSS, Client side scripting, Server side scripting, three tier application development; Internet technologies: Overview of Distributed Systems, Theory and Practice of Internet Application Development, Hyper Text Transfer Protocol (HTTP) Programming, Web Servers, Browsers, Downloading Utilities, Proxy Servers, Caching, User Tracking, Site Maintenance, Search Engines, Web Crawlers, Programming using Email Protocols, Application Service Providers (ASPs), Internet Service Providers (ISPs), Firewalls, FTP, Telnet, Tracert, Wireless Web Access, eXtended Markup Language (XML), VoiceXML, ebXML & UBL; Web Services: Overview of Web Services, Web Services Frameworks and their Performance, Simple Object Access Protocol (SOAP), Web Services Description Language (WSDL), Web Services Security, Wireless Web Services; e-Commerce: overview of e-Commerce, e-Business strategies and models, Business and Marketing tools for e-Business, e-Marketing and e-Ethics, e-Business laws

Method of teaching and learning: A combination of lectures, practicals and tutorials.

Assessment: End of semester examination, practical examination and assignments.

Recommended reading:

1. Jeffrey C. Jackson, *Web Technologies: A Computer Science Perspective* (2006), Prentice Hall.
2. Alison Cawsey and Rick Dewar, *Internet Technology and E-Commerce* (2003), Palgrave Macmillan.
3. Anders Mller and Michael I. Schwartzbach, *An Introduction to XML and Web Technologies* (2006), Addison-Wesley Longman Publishing Co.
4. Paul J. Deitel, Tem R. Nieto, and Deitel, *The Complete Internet and World Wide Web Programming Training Course* (2nd Edition), Prentice Hall.
5. Simon St. Laurent, Edd Dumbill and Joe Johnston, *Programming Web Services with XML-RPC* (2001, 1st Edition), O'Reilly.
6. Sebesta and Robert W, *Programming the World Wide Web* (4th Edition, 2007), Addison Wesley.
7. Chris Bates , *Web Programming: Building Internet Applications* (2006, 3rd Edition), John Wiley & Sons, Inc
8. Harvey M. Deitel, Paul J. Deitel and Andrew B. Goldberg, *Internet & World Wide Web How to Program* (2003, 3rd Edition), Prentice-Hall, Inc.
9. Matthew W. Guah and Wendy Currie, *Internet Strategy: The Road to Web Services Solutions* (2005), Idea Group Inc (IGI)
10. David Wood and Mark Stone, *Programming Internet Email* (1999), O'Reilly.
11. Jean Andrews, *i-Net+ Guide to Internet Technologies* (2000, 1st Edition), Course Technology.

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Course Code : **COSC 32035**
Course Title : Visual Programming
Pre -requisites : COSC 21015
Co-requisites : None

Learning Outcomes: On successful completion of this course module the student should be able to demonstrate skills on visual computer programming and algorithm designing. They will be able to demonstrate the ability to apply conventional structured programming techniques to the code written for event driven procedures.

Course Content :
Introduction to Visual Programming: A brief history and types of programming languages, use of an Integrated Development Environment, basic language facilities; events, errors and exceptions;
Facilities for building GUI interfaces: Form design, Uses of forms, Controls and control properties, Design of forms;
Event driven programming: Introduction to basic control objects, Branching, Control loops, Procedures and functions, Interacting with the user, stream-based file I/O, Arrays, Jet Database Engine, Database connectivity, Connecting through ODBC, Introduction to Threads, Debugging and Testing;
Querying the Database: Query by example, Query by form, Use of SQL commands;
Reports: Development of a variety of reports including tabular, group totals, sub totals and other standard reports.

Practical Sessions: Programming using VB.NET

Method of teaching and learning: A combination of lectures, tutorials, practical sessions and a group project.

Assessment: End of course examination, practical examination and assignments.

Recommended reading:

1. Dale, N.B., McMillan M.,*Visual Basic .NET: A Laboratory Course*, (2002), John and Bartlet Publishers.
2. Grundgeiger, D., *Programming Visual Basic .NET*, (2002), O'reilly Publications.
3. Vick, P., *The Visual Basic .Net Programming Language*, (2004), Addison-Wesley Professional.
4. Blair, B., Crossland, J., Reynolds, M., Willis, T., *Beginning VB.NET* (2002, 2nd Edition), Wrox Press Ltd.. Birmingham.
5. Deitel, H.M., Deitel, P.J., Nieto,T.R., *Visual Basic.Net How to Program* , (2002, 2nd Edition) Prentice Hall London.
6. Evjen, B., Hollis, B., Lotka, R., McCarthy, T., Pinnock, J., Ramachandran, R., Sheldon, B., *Professional VB.NET* , (2004), Wiley Publishing, Inc. Indianapolis
7. Liberty, J., *Programming Visual Basic.NET*, (2003), O'Reilly and Associates Inc. Sebastopol.
8. Schneider, D., *An Introduction to Programming using Visual Baisc.NET*, (2003), Pearson Education Ltd. London.
