COURSE NAME	**COMPUTER PROGRAMMING**
COURSE CODE	BENC 1133
CREDIT HOURS	3
PREREQUISITE	None
COURSE SYNOPSIS	Topics covered: basic programming principles such as syntax, variables, basic data type, operator, rules / condition, looping, function, array, sequences, file, structure and pointer.
LEARNING OUTCOMES	At the end of this course, students should be able to: 1 define the fundamental principles of C programming language. PO1 C1 2 apply basic programming principles and algorithms using C programming structure. PO2 C3 3 analyze small to medium scale problems and develop solutions. PO3 C4 4 design and develop well-structured and reliable program in C programming language. PO4 C5 5 present development of application program in the form of standard report. PO7 A2
REFERENCES	1.Michael A. Vine, C Programming 2nd Edition for The Absolute Beginner, Thomson Course Technology, USA, 2008. 1.B.A. Forouzan and R.F. Gilberg, Computer Science: A Structure Programming Language Approach Using C++, 1st edition, California, USA.: Brooks/Cole, 2000. 2.Nor Haizan Mohamed Radzi, siti Zaiton Mohd Hashim and Paridah Samsuri, Pengaturcaraan C, 1st edition, Malaysia, Mc Graw Hill, 2001

COURSE NAME	**LOGIC CIRCUIT**
COURSE CODE	BENM 1143
CREDIT HOURS	3
PREREQUISITE	None
COURSE SYNOPSIS	This subject aims to provide the students with a thorough understanding of the principles and practical aspects of modern digital circuits and systems. It will cover the following topics: number systems and codes, logic gates and Boolean algebra, combinational logic circuits, MSI logic circuits and flip flops, and integrated circuit logic families.
LEARNING OUTCOMES	At the end of this course, students should be able to: 1 describe the basic concepts related to digital systems. PO1 C1 2 solve calculations and conversions related to various number systems. PO3 C3 3 classify optimized combinational and sequential logic circuits. PO3 C4 4 design and evaluate performance of sequential logic circuits. PO4 C5 5 work efficiently as individual or in group to complete tasks and assignment. PO8 A3
REFERENCES	1.Thomas L. Floyd, *Digital Fundamentals,* Prentice Hall, 2003. 2. Ronald J Tocci, *Digital Systems*, *Principles and Applications*, Prentice Hall. 3. Albert, Malvino and Donald Leach, *Digital Principles and Applications*, Mc Graw Hill. 4.Roger L. Tokheim, *Digital Electronics, Principles and Applications*, Mc Graw Hill.

COURSE NAME	**MICROPROCESSOR TECHNOLOGY**
COURSE CODE	BENM 2123
CREDIT HOURS	3
PREREQUISITE	Sequential
COURSE SYNOPSIS	Topics covered: Practical introduction to microprocessors, assembly language programming, hardware interfacing design and microprocessor system design considerations. This course is essentially divided into three sections. The first part covers on Microprocessor-based Systems and Introduction to 68000 Microprocessor. The second part deals with the topic The 68000 Assembly Language Programming that briefly explain the microprocessor instruction set. The last segment examines topics on The 68000 Hardware Architecture, Memory System Design and Input/output System Design.
LEARNING OUTCONE	At the end of this course, students should be able to: 1 explain fundamental concepts of microprocessor architecture and operations — PO1 C2 2 apply the interfacing circuitry of microprocessor-based systems and its supporting components by the assembly language programming — PO3 C3 3 design an 68K microprocessor memory decoding circuits — PO4 C5 4 work effectively in given tasks and assignment by managing different information from multiple resources — P10 A4
REFERENCES	1.James L. Antonakos , *The 68000 Microprocessor Hardware and Software Principles and Applications*, Fourth Edition, Prentice Hall Inc., 2004. 2.Alan Clements, *Microprocessor Systems Design 68000 Hardware, Software, and Interfacing***,** Third Edition, PWS Publishing Company, 1997. 3.Alan Clements, *68000 family Assembly Language*, PWS Publishing Company, 1994.

COURSE NAME	**DIGITAL SYSTEM**
COURSE CODE	BENM 2133
CREDIT HOURS	3
PREREQUISITE	Sequential BENM 1143
COURSE SYNOPSIS	This subject provides students solid theoretical to the sequential logic circuits. It also covers the introduction to memory, programmable logic devices and microcomputer systems. Students will learn topics on Latches and Flip-Flops, Counters, Shift Registers, Sequential Logic Design, Memory Devices, Programmable Logic Devices and Introduction to Microprocessors, Computers and Buses
LEARNING OUTCONE	After attending this couse the student will be able to 1 describe the operation of latch and flip-flop. PO1 C1 2 describe Microprocessor, Computers and Buses. PO1 C1 3 explain Memory and Programmable Logic Devices. PO1 C2 4 analyze Asynchronous and Synchronous counter using Finite State Machine. PO3 C4 5 design digital system using combinational and sequential logic. PO4 C5 6 present assignment by managing relevant information from multiple sources. PO7 A2
References	1.Thomas L.Floyd, *Digital Fundamentals,Prentice Hall*, 2003. 2.Ronald J.Tocci, Neal S. Widmer, Gregory L.Moss, Digital Systems : Principles and Applications,Pearson Prentice Hall, 2004. 3.Willaim Klietz, *Digital and Microprocessor Fundamentals : Theory and Applications*, Prentice Hall, 2003.

COURSE NAME	**DATA STRUCTURES**
COURSE CODE	BENC 3123
CREDIT HOURS	3
PREREQUISITE	None
COURSE SYNOPSIS	This course will expose the students to the fundamental knowledge of data structures and algorithm analysis. The topics that will be covered in the course include the introduction to data structures and algorithm analysis, revision of C++ programming language, Array, List, Stack, Queue, Trees, Sorting and Searching algorithms. Apart from the theory, students are asked to apply the data structures and algorithms through a small application that is developed in a team.
LEARNING OUTCOMES	At the end of this course, students should be able to: 1 explain the concept of data structures, algorithm analysis and efficiency. PO1 C2 2 analyze the problems of computer data performance by using appropriate data structures and algorithms PO3 C4 3 organize tasks to evaluate the benefits and drawbacks of data structures in terms of memory and run time efficiency PO4 C5 4 perform effectively as individual or in group to complete tasks and assignment. PO7 A2
REFERENCES	1.Jeffrey S. Childs, C++ Classes & Data Structures, Pearson Prentice Hall, 2008. 2.Jeff Salvage, The C++ Coach Essentials for Introductory Programming, Addison Wesley. 3.D. S. Malik, Data Structures Using C++, Thomson Course Technology. 4.Elliot B. Koffman & Bruce R. Maxim, Software Design & Data Structure in C++, Addison Wesley. 5.H.M. Deitel & P.J. Deitel, C++ How To Program, Prentice Hall.

COURSE NAME	**COMPUTER NETWORK AND SYSTEM**		
COURSE CODE	BENC 3173		
CREDIT HOURS	3		
PREREQUISITE	None		
COURSE SYNOPSIS	This course will introduce the concept of Computer Communication, Computer Networking. Network: Models, Components, Topology, Technology And Applications. Data Communications, Analogue and Digital Signals, Coding Schemes, Transmission, Bandwidth, Digital Signal Encoding, Error Detection Methods, Switching, Multiplexing. Interconnection, Standard Organizations And OSI Model, Error And Flow Control, Networking Equipments: Repeaters, Bridges, Routers, Gateway, Transmission medium, Networked services, Network Structures, Local Area Network (LAN), IEEE 802 Standard Committee Standards, LAN operation, technology, Wide Area Network (WAN), Private and public networks, architecture, Packet switching networks, Internetworking, Internet Protocol: IP Services, Addresses, IPv4, IPv6. Transport Protocols TCP, UDP, Application protocol, Network Security And Integrity.		
LEARNING OUTCOMES	At the end of this course, students should be able to:		
	1	explain the concept of the computer system network, the communication model, network models (PAN, LAN, MAN, WAN), network components and devices (repeaters, hubs, bridges, routers, gateways), network topology (star, ring, bus, mesh, tree), network types, network technology (IEEE 802.x), network applications, OSI model, circuit switching and packet switching networks.	PO1 C2
	2	explain the transmission system model, transmission modes, receiver, distortion, interference, noise, transmission impairments, signal-to-noise ratio (SNR) performance parameter, modulation and coding, multiplexing and capacity fundamental limits; Shannon-Hartley.	PO1 C2
	3	apply the concept of frames and packets, frame synchronization in flow control techniques, and in error detection and correction techniques.	PO1 C3
	4	analyze the major medium access control (MAC) protocols for wired and wireless networks.	PO3 C4
	5	analyze Internet Protocol (IP); IPv4 and IPv6, TCP and UDP service models and connection establishments, and major routing protocols used in wired and wireless networks.	PO3 C4
	6	work effectively in given tasks and assignment as individual or in group	PO8 A3

REFERENCES	[1] W. Stallings, Data and Computer Communication, 8th Ed. Prentice Hall, 2007. [2] B. A. Forouzan, Data Communication & Networking, 4th Ed. McGraw Hill, 2007. [3] D. E. Comer, Computer Networks and Internet with Internet Application, 4thEd. Prentice Hall 2004. [4] W. Stallings, Computer Networking with Internet Protocol and Technology, Prentice Hall 2004. [5] B. A. Forouzan, TCP/IP Protocol Suite, 4th Ed. McGraw Hill, 2010.

COURSE NAME	**IC DESIGN & PROCESS**
COURSE CODE	BENM 3133
CREDIT HOURS	3
PREREQUISITE	None
COURSE SYNOPSIS	Introduction to IC Design Technology, CMOS: Complementary Metal Oxide Semiconductor, CMOS Characteristics & Analysis Design, Subsystem Design and IC Packaging.
LEARNING OUTCOMES	At the end of this course, students should be able to:: 1 describe the basic principles of IC design. PO1 C1 2 explain the design process of IC fabrication. PO1 C2 3 explain ICs based on CMOS technology. PO1 C2 4 select design rules to circuit topology. PO3 C4 5 design subsystem circuits. PO4 C5 6 demonstrate and identify IC packaging technologies. PO10 A3
REFERENCES	1.Sung-Mo Kang, Yusuf Leblebici, CMOS Digital Integrated Circuits, McGraw Hill,2005. 2.Masuri Othman,Analisis dan Rekabentuk Sistem VLSI, Dewan Bahasa dan Pustaka,1995. 3.Wayne Wolf, Modern VLSI Design: System on Chip Design, Prentice Hall, 2002. 4.Behzad Razavi,Design of Analog CMOS Integrated Circuits, Mc Graw Hill, 2001. 5.Burhanuddin Yeop Majlis, Teknologi Fabrikasi Litar Bersepadu, Penerbit UKM, Bangi, 2001.

COURSE NAME	**MICROCONTROLLER TECHNOLOGY**
COURSE CODE	BENM 3223
CREDIT HOURS	3
PREREQUISITE	None
COURSE SYNOPSIS	This subject will provide the students both solid theoretical and practical applications to the microprocessors / microcontrollers based system. Extensive practical-oriented sessions will be given using PIC microcontroller involving program development software, chip programming and debugging. Topics covered are microcomputer system & peripheral design, software and hardware integration; interrupt control system, analog interfacing, subsystem on microcontroller, microcontroller applications and peripheral devices and system control design.
LEARNING OUTCOMES	At the end of this course, students should be able to: 1 describe the microcontroller's architecture and peripheral subsystem of PIC16F877A. PO1 C1 2 classify interrupts and internal registers modifications to solve specific I/O tasks. PO3 C3 3 compare microcontroller subsystem's performance in peripheral interfacing. PO3 C4 4 design and develop a microcontroller-based system with peripheral devices interface. PO4 C5 5 work efficiently as individual or in group to complete tasks and assignment. PO8 A3
REFERENCES	1.Dogan Ibrahim, *Advanced Microcontroller Projects in C*, Newnes Elsevier Ltd., 2008. 2.Richard Barnett, Larry O'Cull & Sarah Cox, *Embedded C programming with the Microchip PIC*, Thomson Delmar Learning, 2004. 3.Han-Way Huang, *PIC Microcontroller to Software and Hardware Interfacing*, Thomson Delmar Learning, 2004. 4.John Morton, *PIC Your Personal Introductory Course*, 2nd Edition, Newnes, 2001.

COURSE NAME	**COMPUTER ORGANIZATION AND ARCHITECTURE**
COUSE CODE	BENC 4113
CREDIT HOUR	3
PREREQUISITE	None
COURSE SYNOPSIS	This course aims primarily to give the students a general understanding of how computer systems work, both internally (ALU, control unit, registers, etc.) and externally (I/O interfaces, networking, etc.). Such understanding will enable the graduates to make intelligent decisions when confronted with computer-related problems at their workplace. The knowledge and skills gained in this course will also enable the graduates to further their studies in the field of computer architecture, organization, and design.
LEARNING OUTCOMES	At the end of this course, students should be able to: 1 describe the history and current state of computer technology. PO1 C2 2 explain the internal structure and function of a computer system. PO1 C2 3 classify the main types of memory and support circuits for a memory system. PO3 C4 4 analyze how input/output systems are implemented in a computer system. PO3 C4 5 explain the operating system support available in a computer system. PO1 C2 6 distinguish the characteristics, addressing modes and formats of any typical instruction set. PO3 C4 7 develop assembly language program segments to accomplish simple tasks for any given instruction set. PO4 C5 8 explain advanced concepts in computer system such as CISC & RISC approaches, pipelining, instruction-level parallelism, etc. PO1 C2 9 complete tasks and assignment effectively as instructed with the use of modern technology through research and case studies PO10 A4
RUJUKAN	1.Stallings, William, *Computer Organization & Architecture: Designing for Performance*, 7th Edition, Pearson Education, 2006. 2.Abd-El-Barr, Mostafa, *Fundamentals of Computer Organization and Architecture*, 1st Edition, John Wiley & Sons, 2005. 3.Berger, Arnold S., *Hardware and Computer Organization*, 1st Edition, Elsevier, 2005.

COURSE NAME	**DIGITAL SIGNAL PROCESSING**
COURSE CODE	BENC 4133
CREDIT HOURS	3
PREREQUISITE	None
COURSE SYNOPSIS	Topics covered: Introduction to DSP, discrete-time signals and systems, spectrum of representation of discrete-time signals, discrete Fourier transform(DFT) , difference equations and discrete-time systems, z-transform and its applications, analysis and design of digital filters and application of digital signal processing.
LEARNING OUTCOMES	At the end of this course, students should be able to: 1 describe the basic theory in digital signal processing. PO1 C1 2 demonstrate the concepts in digital signal processing such in discrete-time signals and systems and spectrum representations. PO3 C3 3 analyze the impulse response, signal flow graph using difference equations, stability determination and z-transform. PO3 C4 4 combine basic digital filter concepts to design digital filters in various conditions. PO4 C5 5 complete tasks and assignment effectively as individual or in group PO8 A4
REFERENCES	1.Norhashimah Mohd Saad, Abdul Rahim Abdullah, Real Time Digital Signal Processing – A Practical Approach using TMS320C6713 DSP Processor, Penerbit UTeM, 2007. 2. Mitra, Digital Signal Processing – A Computer Based Approach, 3rd Edition, McGraw-Hill, 2006. 3. Oppenheim, Schafer, Discrete-time Signal Processing, Prentice-Hall, 1999. Proakis, Manolikas, Digital Signal Processing: Principles, Algorithms, and Applications, 4th Edition, Prentice-Hall, 2007.

COURSE NAME	**USER INTERFACE DESIGN AND PROGRAMMING**
COUSE CODE	BENC 4153
CREDIT HOUR	3
PREREQUISITE	None
COURSE SYNOPSIS	Topics covered: User interface design, introduction to Java, object oriented programming, exception handling, files and streams input/output, graphical user interface and computer interface
LEARNING OUTCOMES	At the end of this course, students should be able to: 1 Describe fundamental concept of user interface design principles. PO1 C1 2 Apply control structures, procedures, event handler and exceptions in programs development. PO3 C4 3 Design and develop program code for user interface applications. PO4 C5 4 Develop user interface application incorporating the concept of sustainability of design and development. PO5 C5 5 Discuss and present technical report effectively. PO7 A2
REFERENCES	1. G. Booch, J. Rumbaugh, I. Jacobson, *The Unified Modeling Language User Guide*, 2nd Edition, Addison Wesley, 2005. 2. Ben Shneiderman, Catherine Plaisant, Maxine Cohen, and Steven Jacobs, *Designing the User Interface: Strategies for Effective Human-Computer Interaction (5th Edition)* Addison-Wesley, 2009. 3. Sharp, Rogers, Preece, *Interaction Design: Beyond Human-Computer Interaction*, John Wiley & Sons, Ltd 2007. 4. Ian F. Darwin, *Java Cookbook*, 2nd Edition, O'Reilly Media, 2004. 5. H.M. Deitel, P.J. Deitel, *Java How To Program*, 4th Edition, Prentice Hall, 2001.

COURSE NAME	**Embedded Software Design**
COURSE CODE	BENC 4163
CREDIT HOUR	3
PRE-REQUISITE	None
COURSE SYNOPSIS	The uses of embedded systems in different applications make the development of embedded software different from desktop software applications. The user requirements, system architecture, operating system, and software development toolset varied from application to application. With the increasing complexity of the application, formal approaches in designing and developing of embedded software are needed. The aim of this course is to provide a hands-on practical software development experience of an embedded system, from modeling the user requirements with Unified Modeling Language (UML), using software engineering approach, to the delivering of the final embedded system.
LEARNING OUTCOMES	At the end of the course, the students are able to: 1 illustrate the lifecycle of software development method. PO1 C2 2 formulate the user requirement with UML diagrams. PO3 C5 3 select the suitable embedded system architecture, *e.g.* system form factor, processors, hardware and necessary peripheral interfaces, based on the sustainability and system requirement. PO5 C6 4 built an embedded software in host and target system with embedded software development toolset. PO4 C5 5 perform assignment, in group, to develop the embedded system, project scheduling by using various sources. PO7, PO10, A2
REFERENCES	1. IEEE Standards Association, "IEEE Std 12207-2008 Systems and software engineering – Software life cycle processes", 2008. 2. CMMI Product Team, "CMMI for Development, Version 1.2", August 2008. 3. A.S. Koch, "Agile software development: Evaluating the Methods for Your Organization", Artech house, 2005. 4. P.A. Laplante, "Real-Time Systems Design and Analysis", Wiley Interscience, 2004. 5. L.A. Maciaszek, "Requirements analysis and system design: Developing Information Systems with UML", Addison-Wesley, 2001. 6. C. Larman and P. Kruchten, "Applying UML and patterns", Prentice Hall PTR, 2002. 7. A.S. Berger, "Embedded Systems Design: An Introduction to Processes, Tools, & Techniques", CMPBooks, 2002. 8. Dreamtech Software Team, "Programming for Embedded Systems: Cracking the Code", Wiley, 2002. 9. J.K. Peckol, "Embedded systems: A contemporary Design Tool", Wiley Publishing, 2007.

COURSE NAME	**MULTIMEDIA APPLICATION & TECHNOLOGY**
COURSE CODE	BENC 4173
CREDIT HOURS	3
PREREQUISITE	None
COURSE SYNOPSIS	This subject prepares the students with the basic concept of multimedia, technology and the importance of multimedia application. It covers the introduction to multimedia technology, multimedia graphic implementation, 2D/3D graphics and animation, video, audio, authoring, multimedia integration and application development.
LEARNING OUTCOMES	At the end of this course, students should be able to: 1 define several media editing software in order to understand how to create original multimedia content. [PO1 C1] 2 analyze problem solving skills by identifying several different environments in which multimedia might be used and several different aspects of multimedia that benefit other forms of information presentation. [PO3 C4] 3 design and develop the multimedia application using multimedia authoring tools. [PO4 C5] 4 describe the fundamental concept of multimedia systems into other subjects (e.g. Software Engineering, Internet Technology, PSM etc). [PO10 C1] 5 work effectively as individual or in group to complete tasks and assignment. [PO8 A3] 6 compare static multimedia application design with dynamic multimedia application design with some examples. [PO5 C6]
REFERENCES	1. Todd Perkins. Adobe Flash CS3 Profesional Hans-on Training, 2008. 2. Tay Vaughan, Multimedia: Making It Work 7th Edition, McGraw-Hill Osborne Media, 2006. 3. Mark Drew and Ze-Nian Li, Fundamentals of Multimedia 4th Edition, Prentice Hall, 2004. 4. Nigel Chapman, Digital Multimedia, John Wiley and Sons, 2004. 5. Ken Abernethy and Tom Allen, Exploring the Digital Domain: An Introduction to Computing with Multimedia and Networking, Pws Pub Co, 1999

COURSE NAME	**DIGITAL IC DESIGN**
COUSE CODE	BENM 4123
CREDIT HOUR	3
PREREQUISITE	None
COURSE SYNOPSIS	This course aims to introduce students to the basics of logic design, hardware description languages (HDL) and logic synthesis tools, and help them develop technical skills to design, simulate, analyze and verify complex digital circuits.
LEARNING OUTCOMES	At the end of this course, students should be able to: 1 describe the role of hardware description language (HDL) in design flows for FPGA and ASIC with a historical development of the Verilog HDL. — PO1 C2 2 develop program codes for structural and behavioral modeling of combinational and sequential logic using Verilog HDL in any problem identification, formulation and solution. — PO3 C5 3 design a controller for a data path relating to a simple RISC CPU and synthesize simple models of computer processor, RAM and ROM. — PO4 C5 5 develop a program codes for synthesis-friendly combinational and sequential logic incorporating the concept of sustainability of design and development. — PO5 C5 6 complete tasks and assignment effectively as instructed with the use of modern technology through research and case studies — PO10 A4
RUJUKAN	1.Michael D. Ciletti, Advanced Digital Design with the Verilog HDL, Prentice Hall, 2003 2.J. Rabaey, A. Chandrakasan, and B. Nikolic, Digital Integrated Circuits: A Design Perspective, 2nd Ed., Prentice Hall, 2003. 3.Stephen Brown and Zconko Vranesic, Fundamentals of Digital Logic with VHDL Design, 2nd Ed., McGraw-Hall, 2005. 4.M. Rafiquzzaman, Fundamentals of Digital Logic and Microcomputer Design, 5th Ed., Wiley-Hill, 2005. 5.M. Morris Mano, Digital Design, 3rd Ed., Prentice-Hall, 2002. 6.John F. Wakerly, Digital Design Principles and Practices, 3rd Ed., Prentice-Hall, 2001