

B.Sc. in Computer Engineering Study Plan

University Compulsory Courses 16 C.H

Page (64)

University Elective Courses 9 C.H

Pages (64 & 65)

Faculty Compulsory Courses 27 C.H

| Line No. | Code | Course | |
|----------|---------|--|---|
| 901010 | MATH101 | CALCULUS(1) | 3 |
| 901020 | MATH102 | CALCULUS (2) | 3 |
| 1712310 | CPE231 | DIGITAL LOGIC DESIGN | 3 |
| 1731011 | CS101 | INTRODUCTION TO PROGRAMMING | 3 |
| 1731020 | CS102 | PROGRAMMING LAB | 1 |
| 1731121 | CS112 | INTRODUCTION TO OBJECT-ORIENTED PROGRAMMING | 3 |
| 1732111 | CS211 | DATA STRUCTURES AND ALGORITHMS | 3 |
| 1742000 | CIIs200 | PROFESSIONAL AND ETHICAL ISSUES IN COMPUTING | 1 |
| 1742010 | CIIs201 | INTRODUCTION TO WEB DESIGN | 1 |
| 1742011 | CIIs201 | INTRODUCTION TO WEB DESIGN (LAB) | 0 |
| 1742280 | CIIs228 | FUNDAMENTALS OF DATABASE SYSTEMS | 3 |
| 1762300 | SE230 | FUNDAMENTALS OF SOFTWARE ENGINEERING | 3 |

Department Compulsory Courses 93 C.H

| Line No. | Code | Course | |
|----------|----------|--|---|
| 242120 | EE212 | ELECTRICAL CIRCUITS (FOR NON MAJOR) | 3 |
| 242130 | EE213 | ELECTRICAL CIRCUITS LAB | 1 |
| 242401 | EE240 | INTRODUCTION TO LINEAR SYSTEMS | 3 |
| 242601 | EE260 | SIGNAL AND SYSTEM ANALYSIS | 3 |
| 243211 | EE321 | ELECTRONICS (1) (FOR NONE EE STUDENTS) | 3 |
| 243220 | EE322 | ELECTRONIC CIRCUITS LAB (2) | 1 |
| 244401 | EE440A | CONTROL SYSTEMS | 3 |
| 252150 | ME215 | ENGINEERING MECHANICS | 3 |
| 902010 | MATH201 | INTERMEDIATE ANALYSIS | 3 |
| 902030 | MATH203 | ORDINARY DIFFERENTIAL EQUATIONS | 3 |
| 902411 | MATH241A | DISCRETE MATHEMATICS | 3 |
| 911031 | CHEM103A | GENERAL CHEMISTRY | 3 |
| 921010 | PHY101 | GENERAL PHYSICS (1) | 3 |
| 921020 | PHY102 | GENERAL PHYSICS (2) | 3 |
| 1712330 | CPE233 | DIGITAL LOGIC DESIGN LAB | 1 |
| 1712520 | CPE252 | COMPUTER ORGANIZATION AND DESIGN | 3 |
| 1713112 | CPE311 | OBJECT-ORIENTED SOFTWARE ANALYSIS & DESIGN | 3 |
| 1713512 | CPE351 | MICROPROCESSOR SYSTEMS | 3 |
| 1713520 | CPE352 | COMPUTER ARCHITECTURE | 3 |
| 1713541 | CPE354 | MICROPROCESSOR SYSTEMS LAB | 1 |
| 1713900 | CPE390 | PRACTICAL TRAINING (1) | 2 |
| 1714200 | CPE420 | DIGITAL INTEGRATED CIRCUITS | 3 |
| 1714330 | CPE433 | ADVANCED DIGITAL SYSTEMS DESIGN | 3 |
| 1714521 | CPE452 | MICROPROCESSOR INTERFACING LAB | 2 |
| 1714700 | CPE470 | OPERATING SYSTEMS | 3 |

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|---------|--------|-----------------------------------|---|
| 1714712 | CPE471 | UNIX SYSTEM PROGRAMMING | 3 |
| 1714800 | CPE480 | ARTIFICIAL INTELLIGENCE | 3 |
| 1714900 | CPE490 | PRACTICAL TRAINING (2) | 2 |
| 1715910 | CPE591 | GRADUATION PROJECT(1) | 1 |
| 1715920 | CPE592 | GRADUATION PROJECT(2) | 3 |
| 1752010 | NES201 | COMMUNICATION SKILLS | 3 |
| 1753010 | NES301 | PROBABILITY AND QUEUEING THEORY | 3 |
| 1753110 | NES311 | DATA COMMUNICATION | 3 |
| 1753120 | NES312 | FUNDAMENTALS OF COMPUTER NETWORKS | 3 |
| 1754130 | NES413 | COMPUTER NETWORKS LABORATORY | 1 |
| 1764400 | SE440 | PROJECT MANAGEMENT | 3 |

Department Elective Courses 15 C.H

| Line No. | Code | Course | |
|----------|---------|---|---|
| 1715100 | CPE510 | INTRODUCTION TO PARALLEL ALGORITHMS AND PROGRAMMING | 3 |
| 1715230 | CPE523 | VLSI SYSTEM DESIGN | 3 |
| 1715470 | CPE547 | RELIABILITY AND AVAILABILITY | 3 |
| 1715510 | CPE551 | ADVANCED COMPUTER ARCHITECTURE | 3 |
| 1715540 | CPE554 | EMBEDDED SYSTEMS | 3 |
| 1715590 | CPE559 | COMPUTER SYSTEMS PROJECT | 3 |
| 1715600 | CPE560 | DISTRIBUTED SYSTEMS AND MIDDLEWARE | 3 |
| 1715720 | CPE572 | REAL TIME SYSTEMS | 3 |
| 1715790 | CPE579 | SOFTWARE DESIGN AND DEVELOPMENT PROJECT | 3 |
| 1715811 | CPE581 | COMPUTER VISION | 3 |
| 1715831 | CPE583 | ROBOTICS | 3 |
| 1715840 | CPE584 | INTRODUCTION TO NEURAL AND FUZZY COMPUTING | 3 |
| 1715850 | CPE585 | INTRODUCTION TO BIOINFORMATICS | 3 |
| 1715930 | CPE593 | SPECIAL TOPICS IN COMPUTER ENGINEERING 1 | 1 |
| 1715940 | CPE594 | SPECIAL TOPICS IN COMPUTER ENGINEERING (2) | 2 |
| 1715950 | CPE595 | SPECIAL TOPICS IN COMPUTER ENGINEERING (3) | 3 |
| 1734720 | CS472 | COMPILER DESIGN | 3 |
| 1734800 | CS480 | COMPUTER GRAPHICS | 3 |
| 1743400 | CIIs340 | WEB APPLICATION DEVELOPMENT | 3 |
| 1744290 | CIIs429 | DATA MINING | 3 |
| 1754110 | NES411 | NETWORK PROGRAMMING | 3 |
| 1754150 | NES415 | NETWORKING PROTOCOLS | 3 |
| 1754400 | NES440 | WIRELESS NETWORKS | 3 |
| 1754520 | NES452 | CRYPTOGRAPHY AND NETWORK SECURITY | 3 |
| 1763100 | SE310 | VISUAL PROGRAMMING | 3 |
| 1763200 | SE320 | SYSTEM ANALYSIS AND DESIGN | 3 |
| 1764110 | SE411 | COMPONENT-BASED SOFTWARE DEVELOPMENT | 3 |

TOTAL

160 C.H

*** For prerequisite & equivalent courses see the Courses' Description.**

B.Sc. in Computer Engineering

Courses' Description

CPE 231 Digital Logic Design (3C, 3H, 0L)

Binary systems; Boolean algebra and logic gates; simplification of Boolean functions; combinational logic; design of combinational logic with MSI, LSI, programmable logic devices, and hierarchical logic design; sequential logic; registers, counters, and memory units; computer-aided design and logic simulation.
Prerequisite: CS 112

CPE 233 Digital Logic Design Lab (1C, 0H, 3L)

Experiments in digital logic design using TTL and MOS integrated circuits, MSI and LSI registers and ALUs, and PLDs; Choice of projects: various sequential machines, D/A converters and CRT displays, integrators, arithmetic processors, stored-program processors and game-playing machines. *Prerequisite: CPE 252 or concurrent*

CPE 234 Digital Logic Design and Computer Architecture (3C, 3H, 0L)

Boolean algebra; combinational logic; synthesis methods of sequential circuits; fundamentals of processor design; PLDs, memory, and I/O. *Prerequisite: CIS 100. (Non CPE-Students)*

CPE 235 Digital Logic Design Lab (1C, 0H, 3L)

Experiments in digital logic and computer design and implementation using TTL integrated circuits including SSI, MSI, and LSI ALUs; design and implementation of arithmetic and logic units and various sequential machines. *Prerequisite: CPE 234 or CPE 252. (Non CPE-Students)*

CPE 252 Computer Organization and Design (3C, 3H, 0L)

Basic computer organization; memory systems including caches, computer arithmetic, processors, controllers, input/output, buses, DMA; data formats; addressing modes; instruction sets and microcode; design of a simple computer. *Prerequisite: CPE 231*

CPE 311 Object-Oriented Software Analysis and Design (3C, 3H, 0L)

Software development processes, the Unified Modeling Language (UML), and object-oriented concepts such as data and program abstraction, decomposition of large systems into reusable objects, and inheritance encapsulation and polymorphism. Programming projects will be implemented in an object-oriented language such as JAVA and C#. *Prerequisite: SE 230*

CPE 351 Microprocessor Systems (3C, 3H, 0L)

Microprocessor and microcontroller organization; assembly language and programming techniques, bus and memory organization, DMA, timing issues, interrupts, peripheral devices, serial and parallel communication, timing analysis; and interfacing to analog and digital systems. *Prerequisite: CPE 252*

CPE 352 Computer Architecture (3C, 3H, 0L)

Prerequisite: CPE 252
Processor design, RISC and CISC; floating-point unit; memory management; caches; I/O systems; DMA; CPU utilization and performance measured.

CPE 353 Microprocessor Systems (3C, 3H, 0L)

Microprocessor organization and assembly language; parallel and serial interfaces and bus architecture; memory organization and software for real time control design applications. *Prerequisite: CPE 234 or CPE 252 (Non CPE-Students)*

CPE 354 Microprocessor Systems Lab (1C, 0H, 3L)

Design, build, program, debug, document, and demonstrate a microprocessor-based system comprising CPU, RAM, EPROM, Programmable parallel interface, serial interface, and timer. *Prerequisite: CPE 233, CPE 351 or Concurrent*

CPE 420 Digital Integrated Circuits (3C, 3H, 0L)

Analysis and design of CMOS digital integrated circuits, CMOS logic circuits, layout, and fabrication, MOS transistor theory, modeling MOS devices using equations and SPICE, voltage transfer characteristics, noise margins delay estimation, logical effort, electrical effort, CMOS logic circuits families: static CMOS logic, pseudo-nMOS logic, dynamic/domino logic, pass transistor logic. Latches and flip-flops, buffers and I/O circuits. semiconductor memories: DRAM, SRAM, ROM, introducing VLSI concepts. A set of laboratory experiments will provide hands-on experience.
Prerequisite: EE 321 + CPE 231

CPE 433 Advanced Digital Systems Design (3C, 3H, 0L)

Advanced topics in combinational logic design: use of CAD, timing characteristics, system decomposition, arithmetic modules, PLD design, ALU design, and use of standard combinational modules. Introduction to HDL and its use in combinational logic design. FPGA. Advanced topics in sequential system design: using standard sequential modules, timing characteristics, effect of state code, modularization, design of complex sequential systems. Using HDL to describe sequential systems. Strategies and methods used in digital system design, Real-world digital design projects, Design for testability.
Prerequisite: CPE 420 and CPE 352

CPE 452 Microprocessor Interfacing Lab (2C, 1H, 3L)

Design and implementation of several interfacing tasks; interfacing with simple I/O devices using latches, buffers, and parallel adapters; parallel and serial interfacing to printers, scanners, and CRTs. Timer programming (wave generation, frequency meters, and real time clocks); A/D and D/A converters and data acquisition; host-to-host communication through parallel and serial links and Modems; interfacing sound chips and control circuits.
Prerequisite: CPE 354

CPE 470 Operating Systems (3C, 3H, 0L)

Theories and implementation of modern operating systems including operating system interface (system calls), process and thread management, CPU and disk scheduling, synchronization, deadlock, memory management and virtual memory, file system, device management and I/O handling. *Prerequisite: CPE 352*

CPE 471 UNIX System Programming (3C, 3H, 0L)

Introduction to the UNIX operating system and environment including the file system, editors, shell variables and programming, common Unix commands, system calls, make file usage, Process (threads) control and synchronization, Concurrency, interrupts and signals, Internetwork-Process Communication (IPC), IPC user interfaces including: pipes, shared memory, message queues, semaphores, sockets, system V Transport Layer Interface (TLI), and Remote Procedure Calls (RPC), and scripting languages. *Prerequisite: CPE 470*

CPE 480 Artificial Intelligence Systems (3C, 3H, 0L)

Introduces representations, techniques, and architectures used to build applied systems and to account for intelligence from a computational point of view. Applications of rule chaining, heuristic search, constraint propagation, constrained search, inheritance, and other

problem-solving paradigms. Applications of identification trees, neural nets, genetic algorithms, and other learning paradigms. Speculations on the contributions of human vision and language systems to human intelligence.

Prerequisite: CPE 311, NES 301

CPE 390 Practical Training I (2C)

Eight weeks practical training in an institution that deals with information technology. Only institutions listed in the department are accepted. However, students who prefer to conduct the training in regional or international institutions are required to submit papers for acceptance, before they even start. At the end, students must submit a professional report that details the eight weeks activities. *Prerequisite: Completion of 90 CHs*

CPE 490 Practical Training II (2C)

Eight weeks practical training in an institution that deals with information technology. Only institutions listed in the department are accepted. However, students who prefer to conduct the training in regional or international institutions are required to submit papers for acceptance, before they even start. At the end, students must submit a professional report that details the eight weeks activities. *Prerequisite: Completion of 110 CHs + CPE 390 or concurrent*

CPE 510 Introduction to Parallel Algorithms and Programming (3C, 3H, 0L)

Models of parallel computation, performance measures, basic parallel constructs and communication primitives, parallel programming using MPI, parallel algorithms for selected problems including sorting, matrix, tree and graph problems, fast Fourier transforms.

Prerequisite: CPE 470

CPE 523 VLSI System Design (3C, 3H, 0L)

Review of CMOS logic design and fabrication, review of RTL description and HDL synthesis, design and analysis of sequential circuits, data path and functional units, memory array subsystems, I/O and clocking, layout design. Students will learn design methodologies and tools to be used in the implementation of the course experimental tasks. *Prerequisite: CPE 433*

CPE 547 Reliability and Availability (3C, 3H, 0L)

Design concepts and data analysis used in quantifying availability and reliability as measures of operational readiness and system effectiveness; basic reliability concepts, reliability models; hardware/software reliability modeling; modeling of large and complex systems; maintainability modeling; availability modeling; safety modeling; effectiveness modeling; support analyses; design of fault - tolerant systems. *Prerequisite: CPE 351, CPE 470*

CPE 551 Advanced Computer Architecture (3C, 3H, 0L)

This course will be a completely case-study based course. Topics include: the design principles and operation of state of the art architectures, qualitative and quantitative evaluation of computer systems, architectures based on Instruction-level parallelism (ILP) and task-level parallelism, basics of ISA design, pipelining, VLIW architectures, super pipelined, superscalar, SIMD and MIMD architectures, out-of-order and speculative execution, branch prediction, data prediction, advanced memory hierarchies, multi-threading, exploiting task-level and instruction-level parallelism; input and output; network communication architecture. Starting with the basic architecture concepts and ending up with studying several case studies based on the latest commercial

processors, embedded processors and academic processors. *Prerequisite: CPE 352*

CPE 554 Embedded Systems (3C, 3H, 0L)

Definition, structure and properties of embedded systems, real-time programming: interrupts, latency, context, re-entrancy, thread and process models, microcontroller and DSP hardware structures, I/O systems, timing and event management, issues and concepts of hard and soft real-time systems, real-techniques for development, debugging and verification, limited resource environments, network embedded systems. *Prerequisite: CPE 470 and CPE 452*

CPE 559 Computer Systems Project (3C, 3H, 0L)

Review of the important concepts in computer architecture, hardware implementation, operating systems, microprocessor, network architecture that are needed to carry out the tasks of the course project. Design of Instruction set architecture, design of data path and control, introduction to the design of special purpose architectures and embedded systems, simulation and performance analysis of a chosen case study, implementation and testing of the case study using hardware description language, hardware implementation and verification of the case study using CAD tools. The course may also include some operating system modules and/or network architecture components.

Prerequisite: CPE 402 and CPE 470

CPE 560 Distributed Systems and Middleware (3C, 3H, 0L)

Fundamentals of distributed computing, software agents, naming services, distributed transactions, security management, distributed object-based systems, web-based systems, middleware-based application design and development, case studies of middleware and internet applications. *Prerequisite: CPE 470*

CPE 572 Real Time Systems (3C, 3H, 0L)

Fundamental concepts in real-time systems. Real time task scheduling paradigms. Resource management in uniprocessor, multiprocessor, and distributed real-time systems. Fault-tolerance, resource reclaiming, and overload handling. Real-time channel, packet scheduling, and real-time LAN protocols. Case study of real-time operating systems. *Prerequisite: CPE 470, CPE 452*

CPE 579 Software Design and Development Project (3C, 3H, 0L)

This course will expose students to the methods of developing large software systems in an industrial environment. Working in teams, students will design, implement, test, and document a complete software system in a specialized application domain. The work will include oral presentations and written reports.

Prerequisite: CPE 402

CPE 581 Computer Vision (3C, 3H, 0L)

Image perception; image sampling and quantization; image transforms; image representation, enhancement, filtering, restoration, and segmentation; image analysis and computer vision; image reconstruction from projections; image compression; edge detection; region extraction and representation; pattern recognition; fundamental issues and techniques of computer vision. A set of laboratory experiments will provide hands-on experience in related topics. *Prerequisite: CPE 480*

CPE 583 Robotics (3C, 3H, 0L)

Basic concepts underlying the design and application of computer-controlled manipulators; manipulator geometry; work volume; sensors; feedback control of manipulator linkages; kinematics; trajectory planning; programming; robot system architecture; design and application. *Prerequisite: CPE 452*

CPE 584 Introduction to Neural and fuzzy computing (3C, 3H, 0L)

Basic of fuzzy sets; fuzzy relations; fuzzy measures; fuzzy logic and approximate reasoning; applications of fuzzy systems in pattern recognition, control, and signal processing; overview of neuro-engineering technology; basic neural network architectures; feed forward and feedback networks; supervised and unsupervised learning; learning by punish/reward; temporal modeling; applications of neural networks in pattern recognition, control, and signal processing. *Prerequisite: CPE 311, NES 311*

CPE 585 Introduction to Bioinformatics (3C, 3H, 0L)

Broad overview of bioinformatics with a significant problem-solving component, including fundamental biological, mathematical and algorithmic models underlying bioinformatics; sequence analysis, database search, gene prediction, molecular structure comparison and prediction, phylogenetic trees, high throughput biology, massive datasets; applications in molecular biology and genetics; use and extension of common bioinformatics tools. *Prerequisite: CPE 480*

CPE 591 Graduation Project I (1C)

Prerequisite: Completion of 120 CHs

The student should get familiar with the theoretical and practical aspects associated with the subject matter of the project.

CPE 592 Graduation Project II (3C)

The student implements, tests and presents the project proposed in graduation Project I course. *Prerequisite: CPE 591. (Computer Option).*

CPE 593 Special Topics in Computer Engineering I (1C, 1H, 0L)

Selected state-of-the-art topics in computer and information technology. *Prerequisite: Department approval*

CPE 594 Special Topics in Computer Engineering II (2C, 2H, 0L)

Selected state-of-the-art topics in computer and information technology. *Prerequisite: Department approval*

CPE 595 Special Topics in Computer Engineering III (3C, 3H, 0L)

Selected state-of-the-art topics in computer and information technology. *Prerequisite: Department approval*