Ministry of Science Research and Technology

DANESHPAJOOHAN PISHRO
Higher Education Institute

2018

# Computer Engineering –B.S.

DANESHPAJOOHAN PISHRO HIGHER EDUCATION INSTITUTE

- COURSE CHART
- SYLLABUS
- SEMESTER CHART

# Computer Engineering Undergraduate Course Chart

## General Courses

| Course Code | Course Title | Credits | Theoretical | Practical | Pre-requisite | Simultaneous |
|---|---|---|---|---|---|---|
| 61-11-004 | Islamic Thoughts-I | 2 | 2 | 0 | ----- | ----- |
| 61-11-011 | Islamic Thoughts-II | 2 | 2 | 0 | Islamic Thoughts-I | ----- |
| 61-11-003 | Rite of Life (Applied Ethics) | 2 | 2 | 0 | ----- | ----- |
| 61-11-012 | Islamic Revolution of Iran | 2 | 2 | 0 | ----- | ----- |
| 61-11-014 | Analytical History of Islam | 2 | 2 | 0 | ----- | ----- |
| 61-15-001 | Persian Language | 3 | 3 | 0 | ----- | ----- |
| 61-15-002 | English Language | 3 | 3 | 0 | ----- | ----- |
| 61-15-005 | Physical Education | 1 | 0.5 | 0.5 | ----- | ----- |
| 61-15-011 | Exercise-I | 1 | 0 | 1 | Physical Education | ----- |
| 61-15-007 | Family and Population Knowledge | 2 | 2 | 0 | ----- | ----- |
| 61-11-008 | Introduction to Constitution | 2 | 2 | 0 | ----- | ----- |
| 61-11-013 | The Holy Quran Exegesis | 2 | 2 | 0 | ----- | ----- |
| **Total Credits** | | 22 | Note: Only one course between 'Islamic Revolution of Iran' and 'Introduction to Constitution' shall be taken. | | | |

## Science Courses

| Course Code | Course Title | Credits | Theoretical | Practical | Pre-requisite | Simultaneous |
|---|---|---|---|---|---|---|
| 51-11-019 | Mathematics-I | 3 | 3 | 0 | ----- | ----- |
| 51-11-021 | Mathematics-II | 3 | 3 | 0 | Mathematics-I | ----- |
| 51-11-022 | Differential Equations | 3 | 3 | 0 | Mathematics-I | ----- |
| 15-71-001 | Computer Workshop | 1 | 0 | 1 | | ----- |
| 51-22-030 | Physics-I | 3 | 3 | 0 | ----- | ----- |
| 51-22-031 | Physics-II | 3 | 3 | 0 | Mathematics-I | ----- |
| 51-22-033 | Physics-II Lab | 1 | 0 | 1 | Physics-II | ----- |
| 51-11-034 | Engineering Probability & Statistics | 3 | 3 | 0 | Mathematics-II | ----- |
| **Total Credits** | | 20 | | | | |

## Computer Engineering Courses

| Course Code | Course Title | Credits | Theoretical | Practical | Pre-requisite | Simultaneous |
|---|---|---|---|---|---|---|
| 1571002 | Programming Foundations | 3 | 3 | 0 | ----- | ----- |
| 1571003 | Electronic Circuit | 3 | 3 | 0 | Differential Equations | ----- |
| 1571004 | Discrete Mathematics | 3 | 3 | 0 | ----- | Mathematics-I, Programming Foundations |
| 1571005 | Advanced Programming | 3 | 3 | 0 | Programming Foundations | ----- |
| 1571006 | Data Structure | 3 | 3 | 0 | Programming Foundations, Discrete Mathematics | ----- |
| 1571007 | Logical Circuit | 3 | 3 | 0 | ----- | Discrete Mathematics |
| 1571008 | Formal Languages & Automata | 3 | 3 | 0 | Data Structure | ----- |
| 1571009 | English For Computer Eng. | 2 | 2 | 0 | English Language | ----- |
| 1571010 | Research & Presentation Methods | 2 | 2 | 0 | English For Computer Eng. | ----- |
| 1372020 | Engineering Mathematics | 3 | 3 | 0 | Differential Equations, Mathematics-II | ----- |
| 1571011 | Computer Architecture | 3 | 3 | 0 | Logical Circuit | ----- |
| 1571012 | Operating Systems | 3 | 3 | 0 | Data Structure, Computer Architecture | ----- |
| 1571013 | Algorithms Design | 3 | 3 | 0 | Data Structure | ----- |
| 1571014 | Computer Design of Digital Systems | 3 | 3 | 0 | Computer Architecture | ----- |
| 1571015 | Signals & Systems | 3 | 3 | 0 | Engineering Mathematics | ----- |
| 1571016 | Microprocessor & Assembly Language | 3 | 3 | 0 | Computer Architecture | ----- |
| 1571017 | Computer Networks | 3 | 3 | 0 | Operating Systems | ----- |
| 1571018 | Artificial Intelligence & Expert Systems | 3 | 3 | 0 | Data Structure | ----- |
| 1571019 | Compiler Design Foundations | 3 | 3 | 0 | Data Structure | ----- |
| 1571020 | Operating Systems Lab | 1 | 0 | 1 | ----- | Operating Systems |
| 1571021 | Logical Circuit & Computer Architecture Lab | 1 | 0 | 1 | Logical Circuit | Computer Architecture |
| 1571022 | Microprocessor Lab | 1 | 0 | 1 | Microprocessor & Assembly Language | ----- |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1571023 | Computer Networks Lab | 1 | 0 | 1 | ----- | Computer Networks |
| 1571030 | Systems Analysis & Design | 3 | 3 | 0 | Advanced Programming | ----- |
| 1571031 | Data Base | 3 | 3 | 0 | Systems Analysis & Design | ----- |
| 1571032 | Information and Communication Technology (ICT) | 3 | 3 | 0 | ----- | ----- |
| 1571033 | Strategic Management in IT | 3 | 3 | 0 | ----- | ----- |
| 1571034 | Project Management in IT | 3 | 3 | 0 | ----- | ----- |
| 1571035 | Enterprise Application Integration | 3 | 3 | 0 | Systems Analysis & Design, Computer Networks | ----- |
| 1571036 | Security Engineering | 3 | 3 | 0 | Computer Networks | ----- |
| 1671014 | Engineering Economics | 3 | 3 | 0 | ----- | ----- |
| 1571037 | Electronic Commerce | 3 | 3 | 0 | Computer Networks, Engineering Economics | ----- |
| 1571038 | Final Project | 3 | 0 | 3 | (after passing 100 credits) | ----- |
| 1571039 | Internship | 1 | 0 | 1 | (after passing 80 credits) | ----- |
| **Total Credits** | | 90 | | | | |

**Elective Courses (not complete)**

| Course Code | Course Title | Credits | Theoretical | Practical | Pre-requisite | Simultaneous |
|---|---|---|---|---|---|---|
| 1571045 | Object-oriented Design of Systems | 3 | 3 | 0 | (based on the department's decision) | ----- |
| 1571046 | Specific Issues-I | 3 | 3 | 0 | (based on the department's decision) | ----- |
| 1571047 | Specific Issues-II | 3 | 3 | 0 | Advanced Programming | ----- |
| **Total Credits** | | 9 | Note: Students have to take 8 to 9 credits from the elective courses. | | | |

| | |
|---|---|
| **Total Credits (All Courses)** | 141 |

# Computer Engineering Syllabus

## Mathematics-I

| Course Code | Course Title | Credits | Theoretical | Practical | Pre-requisite | Simultaneous |
|---|---|---|---|---|---|---|
| 51-11-019 | Mathematics-I | 3 | 3 | 0 | ----- | ----- |

Consisted principally of one-variable Calculus, Functions, Derivative, Integrals, Integration Methods, Complex Numbers and Infinite Series.

## Mathematics-II

| Course Code | Course Title | Credits | Theoretical | Practical | Pre-requisite | Simultaneous |
|---|---|---|---|---|---|---|
| 51-11-021 | Mathematics-II | 3 | 3 | 0 | Mathematics-I | ----- |

The main goal of this course is to teach the students some topics in introductory linear algebra including matrix algebra and linear transformations and multivariable calculus including multivariable functions, partial derivatives, velocity and acceleration, tangent plane and normal gradient line, multi-integral cylindrical and spherical coordinates, vector field and line integrals, surface integral, Green's theorem, Divergence and Stoke's theorem.

## Differential Equations

| Course Code | Course Title | Credits | Theoretical | Practical | Pre-requisite | Simultaneous |
|---|---|---|---|---|---|---|
| 51-11-022 | Differential Equations | 3 | 3 | 0 | Mathematics-I | ----- |

Introduction to Differential Equations; First Order Differential Equations; Second Order Linear Equations; Higher Order Linear Equations; Series Solutions of Second Order Linear Equations; The Laplace Transform.

## Computer Workshop

| Course Code | Course Title | Credits | Theoretical | Practical | Pre-requisite | Simultaneous |
|---|---|---|---|---|---|---|
| 15-71-001 | Computer Workshop | 1 | 0 | 1 | | ----- |

The main goal of this course is to improve students' skills of programming. Students will practically apply their previous theoretical knowledge.

## Physics-I

| Course Code | Course Title | Credits | Theoretical | Practical | Pre-requisite | Simultaneous |
|---|---|---|---|---|---|---|
| 51-22-030 | Physics-I | 3 | 3 | 0 | ----- | ----- |

To provide tools by which students can learn how to effectively read scientific material, identify fundamental concepts, reason through scientific questions, and solve quantitative problems. Physics-I is the first course of this set. This course covers the fundamental concepts in Classical Mechanics and Thermodynamics.

## Physics-II

| Course Code | Course Title | Credits | Theoretical | Practical | Pre-requisite | Simultaneous |
|---|---|---|---|---|---|---|
| 51-22-031 | Physics-II | 3 | 3 | 0 | Mathematics-I | ----- |

The main goal of fundamental courses in physics is to provide tools by which students can learn how to effectively read scientific material, identify fundamental concepts, reason through scientific questions, and solve quantitative problems. Physics-II is the second course of this set. This course covers the fundamental concepts in Electromagnetism and includes:

Electric Charge and Electric Field; Gauss's Law; Electric Potential; Capacitance and Dielectrics; Current, Resistance, and Electromotive Force; Direct-Current Circuits; Magnetic Field and Magnetic Forces; Sources of Magnetic Field; Electromagnetic Induction; Inductance; Alternating Current; Electromagnetic Waves.

## Physics Lab-II

| Course Code | Course Title | Credits | Theoretical | Practical | Pre-requisite | Simultaneous |
|---|---|---|---|---|---|---|
| 51-22-033 | Physics-II Lab | 1 | 0 | 1 | Physics-II | ----- |

Examination of thermal resistance of various materials; Examination of Gauss's Law; Magnetic force testing; Electrical currents testing.

## Engineering Probability & Statistics

| Course Code | Course Title | Credits | Theoretical | Practical | Pre-requisite | Simultaneous |
|---|---|---|---|---|---|---|
| 51-11-034 | Engineering Probability & Statistics | 3 | 3 | 0 | Mathematics-II | ----- |

This course provides elementary probabilistic and statistical concepts as well as the methods to apply them to the engineering problems. Topics covered in this course:

Probability; Discrete Random variables, Probability Mass Function, Probability Distribution Function, Expectation and Variance; Especial Discrete Distributions; Continuous Random Variables, Probability Density Function, Probability Distribution Function, Expectation and Variance, Functions of a Random Variable; Especial Continuous Distributions; Joint Probability Distributions; Sampling Distributions, Distributions of the Sample Mean and Sample Variance; Point Estimation; Interval Estimation; Tests of Hypotheses based on a Single Sample; Tests of Hypotheses based on Two Samples; Determination of Sample Size in Confidence Intervals and Testing Hypotheses; Nonparametric Tests; Regression.

## Programming Foundations

| Course Code | Course Title | Credits | Theoretical | Practical | Pre-requisite | Simultaneous |
|---|---|---|---|---|---|---|
| 1571002 | Programming Foundations | 3 | 3 | 0 | ----- | ----- |

The main goal of this course is to learn the methods to solve computational problems using a computer; which will be fulfilled within these three sub-goals: 1-Recognizing the computer as calculating machine; 2-Learning the algorithmic mindset to solve problems; 3-The ability to describe algorithms using a programming language (such as C)

## Electronic Circuit

| Course Code | Course Title | Credits | Theoretical | Practical | Pre-requisite | Simultaneous |
|---|---|---|---|---|---|---|
| 1571003 | Electronic Circuit | 3 | 3 | 0 | Differential Equations | ----- |

- Lumped circuits and Kirchhoff's laws
- Circuit components and their characteristics
- Simple RLC circuits
- Thevenin's and Norton's equivalent circuits
- Nodal and mesh analysis of networks
- Thevenin's, Norton's, Superposition and maximum power transfer theorems applied to simple circuits
- RC, RL and RLC circuits and their response to step, impulse and zero excitations
- Zero state, sinusoidal steady-state analysis
- Resonance
- Single and three phase circuits
- Power in three phase systems

## Discrete Mathematics

| Course Code | Course Title | Credits | Theoretical | Practical | Pre-requisite | Simultaneous |
|---|---|---|---|---|---|---|
| 1571004 | Discrete Mathematics | 3 | 3 | 0 | ----- | Mathematics-I, Programming Foundations |

Propositional & predicate logic, valid arguments, methods of proof; Elementary set theory. Elementary graph theory; Relations & functions; Induction & recursive definitions; Counting methods (pigeonhole, inclusion/exclusion); Introductory probability; Binary operations, groups, fields; Applications of finite fields; Elementary number theory.

## Advanced Programming

| Course Code | Course Title | Credits | Theoretical | Practical | Pre-requisite | Simultaneous |
|---|---|---|---|---|---|---|
| 1571005 | Advanced Programming | 3 | 3 | 0 | Programming Foundations | ----- |

Introduction to large-scale programming and the attributes of high quality software; Top-down design method, Real world modeling based on object-oriented designing; Creating models using UML language; Object-oriented programming; Program diagnosis; Standard data structures; Concepts and techniques of Advanced Programming.

## Data Structure

| Course Code | Course Title | Credits | Theoretical | Practical | Pre-requisite | Simultaneous |
|---|---|---|---|---|---|---|
| 1571006 | Data Structure | 3 | 3 | 0 | Programming Foundations, Discrete Mathematics | ----- |

An introduction to data structures and their impact on programming – selection of optimum data structure and memory management. Topics covered in this course:

Arrays, Vectors, matrices and their application, sparse matrices- heap and stack- queue- lists- linked lists (linear, cyclic, doubly and multiply linked lists)- introduction to trees- binary trees (decision making trees, gaming trees, search trees and …)- graphs (representation, sweeping and applications)- Spanning tress, Dynamic memory allocation methods, searching, sorting and merging algorithms.

## Logical Circuit

| Course Code | Course Title | Credits | Theoretical | Practical | Pre-requisite | Simultaneous |
|---|---|---|---|---|---|---|
| 1571007 | Logical Circuit | 3 | 3 | 0 | ----- | Discrete Mathematics |

- Number systems
- Boolean algebra and related rules
- Logic gates (such as RTL, DTL, MDTL, TTL) and related algebra
- Combinatorial circuits (such as comparators, coders, code converters, combiners)
- Sequential circuits (such as flip-flops, shift registers, counters, synchronous and asynchronous logic circuits)
- Study of various types of codes

## Formal Languages & Automata

| Course Code | Course Title | Credits | Theoretical | Practical | Pre-requisite | Simultaneous |
|---|---|---|---|---|---|---|
| 1571008 | Formal Languages & Automata | 3 | 3 | 0 | Data Structure | ----- |

Introduction to inductive definitions using rules and proof by rule induction; Abstract syntax trees; Regular expressions and their algebra; Finite automata and regular languages: Kleene's theorem and the Pumping Lemma.

## English for Computer Students

| Course Code | Course Title | Credits | Theoretical | Practical | Pre-requisite | Simultaneous |
|---|---|---|---|---|---|---|
| 1571009 | English For Computer Eng. | 2 | 2 | 0 | English Language | ----- |

Introduction to technical words and expressions within the field of Computer Engineering.

## Research & Presentation Methods

| Course Code | Course Title | Credits | Theoretical | Practical | Pre-requisite | Simultaneous |
|---|---|---|---|---|---|---|
| 1571010 | Research & Presentation Methods | 2 | 2 | 0 | English For Computer Eng. | ----- |

Introduction to research methods; Use of secondary sources; Critique; Round-table research discussion; Academic writing; Writing research proposals

## Engineering Mathematics

| Course Code | Course Title | Credits | Theoretical | Practical | Pre-requisite | Simultaneous |
|---|---|---|---|---|---|---|
| 1372020 | Engineering Mathematics | 3 | 3 | 0 | Differential Equations, Mathematics-II | ----- |

Engineering mathematics is a branch of applied mathematics that concerns itself with mathematical methods and techniques that are typically used in engineering and industry. Topics covered in this course:

Fourier series, Integrals and The Fourier Transform; Partial Differential Equations; Complex Analysis; Calculus of Variations.

## Computer Architecture

| Course Code | Course Title | Credits | Theoretical | Practical | Pre-requisite | Simultaneous |
|---|---|---|---|---|---|---|
| 1571011 | Computer Architecture | 3 | 3 | 0 | Logical Circuit | ----- |

Review of basic computer architecture designs; Fundamentals of computer design and performance; Cost issues; Instruction set design principles; Memory hierarchies: registers, caches, and virtual memories; Basic processor implementation issues; High performance computing issues such as pipelining, superscalar, and vector processing; Input/output subsystem designs.

## Operating System

| Course Code | Course Title | Credits | Theoretical | Practical | Pre-requisite | Simultaneous |
|---|---|---|---|---|---|---|
| 1571012 | Operating Systems | 3 | 3 | 0 | Data Structure, Computer Architecture | ----- |

The overall aim of this course is to provide a general understanding of the structure and key functions of the operating system. Case studies will be used to illustrate and reinforce fundamental concepts.

## Algorithms Design

| Course Code | Course Title | Credits | Theoretical | Practical | Pre-requisite | Simultaneous |
|---|---|---|---|---|---|---|
| 1571013 | Algorithms Design | 3 | 3 | 0 | Data Structure | ----- |

Basics of algorithm analysis; Elementary graph algorithms; Greedy algorithms; Divide-and-conquer algorithms; Dynamic programming; Network flows; NP and computational intractability.

## Computer Design of Digital Systems

| Course Code | Course Title | Credits | Theoretical | Practical | Pre-requisite | Simultaneous |
|---|---|---|---|---|---|---|
| 1571014 | Computer Design of Digital Systems | 3 | 3 | 0 | Computer Architecture | ----- |

To understand basic digital logic circuit design, optimization and concepts; To become comfortable using Computer-Aided Design (CAD) tools in design; To gain hands-on experience with the design and debug of digital systems, using programmable logic.

## Signals and Systems

| Course Code | Course Title | Credits | Theoretical | Practical | Pre-requisite | Simultaneous |
|---|---|---|---|---|---|---|
| 1571015 | Signals & Systems | 3 | 3 | 0 | Engineering Mathematics | ----- |

Discrete sequences and systems, their types and properties. Linear time-invariant systems, convolution.

## Microprocessor & Assembly Language

| Course Code | Course Title | Credits | Theoretical | Practical | Pre-requisite | Simultaneous |
|---|---|---|---|---|---|---|
| 1571016 | Microprocessor & Assembly Language | 3 | 3 | 0 | Computer Architecture | ----- |

- Control units
- Address and data buses
- Memories (ROM, RAM, EPROM, ...)
- Assembly language
- Analysis of a processing unit
- Methods of connection of interface units (I/O) to microcomputers (such as polling, interrupt)
- Priority and its execution (interrupt, daisychain such as interrupt- nonmaskable vector)
- Data transmission from processor to I/O and reverse direction in parallel and series schemes through interface IC's (such as PIO and STO in Z-80)
- Direct link of I/O with memory such as 8-bit microprocessors such as 6800, 8080, 8085 and Z-80 and their comparison
- Study of 16-bit microprocessors such as Z-8000, MC6800, 8086 and their comparison with 80bit microprocessors

## Computer Networks

| Course Code | Course Title | Credits | Theoretical | Practical | Pre-requisite | Simultaneous |
|---|---|---|---|---|---|---|
| 1571017 | Computer Networks | 3 | 3 | 0 | Operating Systems | ----- |

The aim of this course is to introduce key concepts and principles of computer networks. The course will use a Top-down approach to study the Internet and its protocol stack. Instances of architecture, protocol, application-examples will include email, web and media-streaming. We will cover communications services (e.g., TCP/IP) required to support such network applications. The implementation and deployment of communications services in practical networks: including wired and wireless LAN environments, will be followed by a discussion of issues of network-management. Throughout the course, the Internet's architecture and protocols will be used as the primary examples to illustrate the fundamental principles of computer networking.

## Artificial Intelligence & Expert Systems

| Course Code | Course Title | Credits | Theoretical | Practical | Pre-requisite | Simultaneous |
|---|---|---|---|---|---|---|
| 1571018 | Artificial Intelligence & Expert Systems | 3 | 3 | 0 | Data Structure | ----- |

The aim of this course is to provide an introduction to some fundamental issues and algorithms in artificial intelligence (AI). The course approaches AI from an algorithmic, computer science-centric perspective; relatively little reference is made to the complementary perspectives developed within psychology, neuroscience or elsewhere. The course aims to

provide some fundamental tools and algorithms required to produce AI systems able to exhibit limited human-like abilities, particularly in the form of problem solving by search, game-playing, representing and reasoning with knowledge, planning, and learning.

## Compiler Design Foundations

| Course Code | Course Title | Credits | Theoretical | Practical | Pre-requisite | Simultaneous |
|---|---|---|---|---|---|---|
| 1571019 | Compiler Design Foundations | 3 | 3 | 0 | Data Structure | ----- |

Languages and Grammars: regular expressions, context-free grammars, BNF; Parsing: top-down and bottom-up techniques; Semantic Analysis: attribute grammars, translation schemes, type inference, symbol tables; Code Generation: run-time environment, intermediate code, register allocation, optimization; Programming Paradigms: issues in the compilation of imperative, functional, and object-oriented languages.

## Operating System Lab

| Course Code | Course Title | Credits | Theoretical | Practical | Pre-requisite | Simultaneous |
|---|---|---|---|---|---|---|
| 1571020 | Operating Systems Lab | 1 | 0 | 1 | ----- | Operating Systems |

Practical and experimental introduction to theoretical concepts discussed in the Operating System course. The first part of this course focuses on working with Linux operating system, and in the second part the focus will be on programming on this OS, and interactions with its core.

## Logical Circuit & Computer Architecture Lab

| Course Code | Course Title | Credits | Theoretical | Practical | Pre-requisite | Simultaneous |
|---|---|---|---|---|---|---|
| 1571021 | Logical Circuit & Computer Architecture Lab | 1 | 0 | 1 | Logical Circuit | Computer Architecture |

- Logic gates
- Familiarization with several logic circuits and determination of parameters of digital IC's
- Several combinatorial circuits (Decoder, Multiplexer, parity generators and checkers)
- Displays
- Study of types of flip-flops
- Asynchronous counters
- Shift registers

## Microprocessor Lab

| Course Code | Course Title | Credits | Theoretical | Practical | Pre-requisite | Simultaneous |
|---|---|---|---|---|---|---|
| 1571022 | Microprocessor Lab | 1 | 0 | 1 | Microprocessor & Assembly Language | ----- |

Practical introduction to microprocessors and microcontrollers, through a series of sessions leading to one final project at the end of the course.

## Computer Networks Lab.

| Course Code | Course Title | Credits | Theoretical | Practical | Pre-requisite | Simultaneous |
|---|---|---|---|---|---|---|
| 1571023 | Computer Networks Lab | 1 | 0 | 1 | ----- | Computer Networks |

The main goal of this course is to provide a true and practical understanding of Computer Networks. During this course the necessary tools and equipment for designing, performing and organizing computer networks will be introduced to students. Additionally, they will carry out experiments and tests based on theoretical topics, in order to obtain essential skills.

## Systems Analysis & Design

| Course Code | Course Title | Credits | Theoretical | Practical | Pre-requisite | Simultaneous |
|---|---|---|---|---|---|---|
| 1571030 | Systems Analysis & Design | 3 | 3 | 0 | Advanced Programming | ----- |

System Analysis Fundamentals; Information requirements analysis; The analysis process; The essentials of design; Software engineering and implementation.

## Data Base

| Course Code | Course Title | Credits | Theoretical | Practical | Pre-requisite | Simultaneous |
|---|---|---|---|---|---|---|
| 1571031 | Data Base | 3 | 3 | 0 | Systems Analysis & Design | ----- |

This course introduces basic concepts for database systems as seen from the perspective of application designers. That is, the focus is on the abstractions supported by database management systems and not on how those abstractions are implemented.

## Information and Communication Technology (ICT)

| Course Code | Course Title | Credits | Theoretical | Practical | Pre-requisite | Simultaneous |
|---|---|---|---|---|---|---|
| 1571032 | Information and Communication Technology (ICT) | 3 | 3 | 0 | ----- | ----- |

The aims of this course are to develop: knowledge of ICT including new and emerging technologies; Autonomous and discerning use of ICT; Skills to enhance work produced in a range of contexts; Skills to analyze, design, implement, test and evaluate ICT systems; Skills to consider the impact of current and new technologies on methods of working in the outside world and on social, economic, ethical and moral issues; ICT-based solutions to solve problems; The ability to recognize potential risks when using ICT, and use safe, secure and responsible practice.

## Strategic Management in IT

| Course Code | Course Title | Credits | Theoretical | Practical | Pre-requisite | Simultaneous |
|---|---|---|---|---|---|---|
| 1571033 | Strategic Management in IT | 3 | 3 | 0 | ----- | ----- |

Strategic management can be defined as the art and science of formulating, implementing, and evaluating cross-functional decisions that enable an organization to achieve its objectives. As this definition implies, strategic management focuses on integrating management, marketing, finance/accounting, production/operations, research and development, and computer information systems to achieve organizational success.

## Project Management in IT

| Course Code | Course Title | Credits | Theoretical | Practical | Pre-requisite | Simultaneous |
|---|---|---|---|---|---|---|
| 1571034 | Project Management in IT | 3 | 3 | 0 | ----- | ----- |

An understanding of robust project management techniques to include:

Defining measurable project objectives; Stakeholder identification and engagement; Project planning and scheduling; Budget management; Efficient resource allocation; Risk categorization and mitigation; Project evaluation.

## Enterprise Application Integration

| Course Code | Course Title | Credits | Theoretical | Practical | Pre-requisite | Simultaneous |
|---|---|---|---|---|---|---|
| 1571035 | Enterprise Application Integration | 3 | 3 | 0 | Systems Analysis & Design, Computer Networks | ----- |

Fundamental Problems in Large-Scale Application Integration; Service Oriented Architecture; Security in Large-Scale Enterprise Systems; Middleware; Integrating with Business Partners; Reliability and Fault-Tolerance.

## Security Engineering

| Course Code | Course Title | Credits | Theoretical | Practical | Pre-requisite | Simultaneous |
|---|---|---|---|---|---|---|
| 1571036 | Security Engineering | 3 | 3 | 0 | Computer Networks | ----- |

This course provides an overview of technical measures commonly used to enforce security policies, to protect networked and multi-user information systems against malicious user activity, mainly at the level of operating systems and network protocols. It also discusses common security concepts and pitfalls for application programmers and system architects, and strategies for exploiting and mitigating the resulting vulnerabilities.

## Engineering Economics

| Course Code | Course Title | Credits | Theoretical | Practical | Pre-requisite | Simultaneous |
|---|---|---|---|---|---|---|
| 1671014 | Engineering Economics | 3 | 3 | 0 | ----- | ----- |

The systematic evaluation of the economic benefits and costs of projects involving engineering design and analysis; Economic decision-making in an environment of limited resources and uncertainty; Present economy, the economy of multi-year projects, selection among competing alternatives, sensitivity of outcomes to input parameters, before- and after-tax analysis, replacement economy, inflation, and estimation of future events.

## Electronic Commerce

| Course Code | Course Title | Credits | Theoretical | Practical | Pre-requisite | Simultaneous |
|---|---|---|---|---|---|---|
| 1571037 | Electronic Commerce | 3 | 3 | 0 | Computer Networks, Engineering Economics | ----- |

Introduction to E-commerce; Technology Infrastructure for E-commerce; Business Concepts and Social Issues in E-commerce.

## Final Project

| Course Code | Course Title | Credits | Theoretical | Practical | Pre-requisite | Simultaneous |
|---|---|---|---|---|---|---|
| 1571038 | Final Project | 3 | 0 | 3 | (after passing 100 credits) | ----- |

Teaching students how to do researches, gather information, and categorize data and present results based on data.

## Internship

| Course Code | Course Title | Credits | Theoretical | Practical | Pre-requisite | Simultaneous |
|---|---|---|---|---|---|---|
| 1571039 | Internship | 1 | 0 | 1 | (after passing 80 credits) | ----- |

Practical introduction of studied courses through the university, in work environments.

| Total | Guide | | Course Title | | Computer Engineering-B.S.<br>Semester Chart | | | | | | | | | | | | Semester |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **CE** Computer Eng. | **G** General Course | | | | | | | | | | | | | | | |
| | **S** Science | **E** Elective Course | Credits | Course type according to the guide | | | | | | | | | | | | | |
| **18** | **English Language** | | **Persian Language** | | | | **Physics-I** | | **Discrete Mathematics** | | **Mathematics-I** | | **Programming Foundations** | | | | **1** |
| | 3 | G | 3 | G | | | 3 | S | 3 | CE | 3 | S | 3 | CE | | | |
| **17** | **One Lesson of Islamic Groups** | | **English For Computer Eng.** | | **Mathematics-II** | | **Physics-II** | | **Differential Equations** | | **Computer Workshop** | | **Advanced Programming** | | | | **2** |
| | 2 | G | 2 | CE | 3 | S | 3 | S | 3 | S | 1 | S | 3 | CE | | | |
| **18** | **Information and Communication Technology (ICT)** | | **One Lesson of Islamic Groups** | | **Logical Circuit** | | **Data Structure** | | **Engineering Probability & Statistics** | | **Physics Lab-II** | | **Engineering Mathematics** | | | | **3** |
| | 3 | CE | 2 | G | 3 | CE | 3 | CE | 3 | S | 1 | S | 3 | CE | | | |
| **17** | **Logical Circuit& Computer Architecture Lab** | | **One Lesson of Islamic Groups** | | **Computer Architecture** | | **Formal Languages & Automata** | | **Research & Presentation Methods** | | **Strategic Management in IT** | | **Algorithms Design** | | | | **4** |
| | 1 | CE | 2 | G | 3 | CE | 3 | CE | 2 | CE | 3 | CE | 3 | CE | | | |
| **20** | **Project Management in IT** | | **One Lesson of Islamic Groups** | | **Operating Systems** | | **Compiler Design Foundations** | | **Microprocessor & Assembly Language** | | **Electronic Circuit** | | **Systems Analysis & Design** | | | | **5** |
| | 3 | CE | 2 | G | 3 | CE | 3 | PE | 3 | CE | 3 | CE | 3 | CE | | | |
| **19** | **Signals & Systems** | | **Computer Networks Lab** | | **One Lesson of Islamic Groups** | | **Computer Networks** | | **Operating Systems Lab** | | **Computer Design of Digital Systems** | | **Engineering Economics** | | **Data Base** | | **6** |
| | 3 | CE | 1 | CE | 2 | G | 3 | CE | 1 | CE | 3 | CE | 3 | CE | 3 | CE | |
| **16** | **Elective Course** | | **Population & Family planning** | | **Enterprise Application Integration** | | **Electronic Commerce** | | **Security Engineering** | | **Physical Education** | | **Microprocessor Lab** | | | | **7** |
| | 3 | O | 2 | G | 3 | CE | 3 | CE | 3 | CE | 1 | S | 1 | CE | | | |
| **16** | **One Lesson of Islamic Groups** | | **Exercise-I** | | **Elective Course** | | **Artificial Intelligence & Expert Systems** | | **Elective Course** | | **Internship** | | **Final Project** | | | | **8** |
| | **2** | **S** | **1** | **G** | **3** | **CE** | **3** | **CE** | **3** | **CE** | **1** | **CE** | **3** | **CE** | | | |