

SCHEME OF STUDIES – BACHELOR OF ENGINEERING (COMPUTER SYSTEMS)

First Year

Spring Semester				Fall Semester					
Course Code	Course Title	Credit Hrs			Course Code	Course Title	Credit Hrs		
		Th	Pr	Total			Th	Pr	Total
CS-108	Fundamentals of Computer Engineering	2	1	3	CS-111	Object Oriented Programming	2	1	3
CS-109	Computer Programming	2	1	3	EL-102	Basic Electronics	3	1	4
EE-120	Basic Electrical Engineering	3	1	4	PH-122	Applied Physics	3	1	4
MT-114	Calculus	3	0	3	ME-107	Basic Mechanical Engineering	3	1	4
HS-114	Functional English	3	0	3	CS-211	Discrete Structures	3	0	3
HS-105	Pakistan Studies OR	2	0	2					
HS-127	Pakistan Studies (For Foreigners)								

Second Year

Spring Semester				Fall Semester					
Course Code	Course Title	Credit Hrs			Course Code	Course Title	Credit Hrs		
		Th	Pr	Total			Th	Pr	Total
CS-216	Data Structures & Algorithms	3	0	3	CS-212	Computer Organization & Design	3	1	4
CS-214	Digital Logic Design	3	1	4	CS-215	Signals and Systems	2	1	3
EE-217	Circuit Theory	2	0	2	EL-303	Digital Integrated Circuits	3	1	4
MT-222	Linear Algebra & Ordinary Differential Equations	3	0	3	MT-224	Complex Variables & Fourier Analysis	3	0	3
HS-214	Academic Writing	3	0	3	CS-306	Database Management Systems	3	1	4
HS-205	Islamic Studies OR	2	0	2					
HS-209	Ethical Behaviour								

Third Year

Spring Semester				Fall Semester					
Course Code	Course Title	Credit Hrs			Course Code	Course Title	Credit Hrs		
		Th	Pr	Total			Th	Pr	Total
CS-301	Microprocessor Based System Design	3	1	4	CS-322	Computer Architecture	3	0	3
CS-302	Software Engineering	3	1	4	CS-318	Computer Communication Networks	3	1	4
CS-352	Digital Communication Systems	3	1	4	CS-317	Operating Systems	3	1	4
MT-335	Probability & Statistics	3	0	3	HS-304	Business Communication & Ethics	3	0	3
EF-303	Applied Economics for Engineers	3	0	3	CS-319	VLSI Design	3	1	4

Final Year

Spring Semester				Fall Semester					
Course Code	Course Title	Credit Hrs			Course Code	Course Title	Credit Hrs		
		Th	Pr	Total			Th	Pr	Total
CS-428	Parallel & Distributed Computing	3	1	4	MG-482	Organizational Behaviour	3	0	3
MT-442	Numerical Methods	3	0	3	CS-4##	Elective Course Entrepreneurship for Computer Engineers	2	1	3
CS-412	Artificial Intelligence	3	1	4	CS-425	Computer Systems Modelling	3	0	3
CS-419	Digital Signal Processing	3	1	4	CS-417	Computer Engineering Project	0	6	6
CS-406	* Computer Engineering Project	-	-	-					

* Duration one academic year: Requires literature survey and preliminary work during this Semester

Elective Course	
CS-413	Internet Computing
CS-422	Introduction to Embedded Systems
CS-426	Computer Systems Security
CS-427	Robotics and Kinematics

First Year

Spring Semester

CS-108 Fundamentals of Computer Engineering (2+1)

Number Systems; Digital Logic Gates, Classification of Computer Systems; Structure and Organization of Computers and Computer Systems; Computer Peripherals; Classification of Software Systems; Introduction to Software Development Process; Levels of Programming Languages; Data Communication and Computer Networking Fundamentals; Introduction to Databases and Information Systems

CS-109 Computer Programming (2+1)

Basic Data types; Variables & Constants; Operators & Expressions; Input/ processing/output; Decision Making Control Structures; Loop Structure and their Implementations; Function and their Types; Arrays and Strings; Pointers and their Application; Structures and Union; Files and their Control; Hardware Interfacing Techniques;

EE-120 Basic Electrical Engineering (3+1)

Fundamentals of Electric Circuits - Charge, Current, Voltage and Power, Voltage and Current Sources, Ohm's Law; Voltage and Current Laws - Nodes, Paths, Loops and Branches, Kirchhoff's Current Law, Kirchhoff's voltage Law, the Single-Loop Circuits, the Single Node-Pair Circuit, Series and Parallel Connected Independent Sources, Resistors in Series and Parallel, Voltage and Current Division.

Basic Nodal and Mesh Analysis - Multi-Nodal Analysis, the Super node, Mesh Analysis, the Super mesh
Circuit Analysis Techniques - Linearity and Superposition, Source Transformations, Thevenin and Norton Equivalent Circuits,

Maximum Power Transfer, Delta- Wye Conversion

Capacitors and Inductors - Capacitor, Inductor, Inductance and Capacitance Combination

Basic RL and RC Circuits - The Source-Free RL Circuit, Properties of the Exponential Response, the Source-Free RC Circuit, the Unit-Step Function, Driven RL Circuits, Natural and Forced Response, Driven RL Circuits

The RLC Circuit - The Source-Free Parallel Circuit, the over damped Parallel RLC Circuit, Critical Damping, the under damped Parallel RLC Circuit, the Source- Free Series RLC Circuit, the Complete Response of the RLC Circuit, the Lossless LC Circuit

MT-114 Calculus (3+0)

Set and Functions: Define rational, irrational and real numbers; rounding off a numerical value to specified value to specified number of decimal places or significant figures; solving quadratic, and rational inequalities in involving modulus with graphical representation; Definition of set, set operations, Venn diagrams, DeMorgan's laws, Cartesian product, Relation, Function and their types (Absolute value, greatest integer and combining

functions). Graph of some well-known functions. Limit of functions and continuous and discontinuous functions with graphical representation.

Differential Calculus: Differentiation and Successive differentiation and its application: Leibnitz theorem. Taylor and Maclaurin theorems with remainders in Cauchy and Lagrange form, power series. Taylor and Maclaurin series, L Hopitals rule, extreme values of a function of one variable using first and second derivative test, asymptotes of a function, curvature and radius of curvature of a curve, partial differentiation, exact differential and its application in computing errors, extreme values of a function of two variables with and without constraints, solution of non-linear equation using Newton Raphson's method.

Integral Calculus: Indefinite integrals and their computational techniques, reduction formulae, definite integrals and their convergence. Beta and Gamma functions and their identities, applications of integration. Centre of pressure and depth of centre of pressure.

Sequence & Series: Sequence, Infinite Series, Application of convergence tests such as comparison, Root, Ratio, Raabe's and Gauss tests on the behaviour of series.

Complex Number: Argand diagram, De Moivre formula, root of polynomial equations, curve and regions in the complex plane, standard functions and their inverses (exponential, circular and Hyperbolic functions).

HS-114 Functional English

(3+0)

Listening: Types of Listening (content, critical, selective, active, reflective, empathic etc.), Problems in listening and coping strategies, Listening skills and sub skills, Practice in Listening

Vocabulary Development: Words easily confused, compound words, prefixes and suffixes, Forming adjectives, descriptive adjectives (personalities), Using synonyms and Antonyms, homophones, Use of idioms in current language, Exposure and practice to develop everyday vocabulary for formal and informal situations

Reading: Skimming, scanning, predicting, and anticipating, Guessing meanings of unfamiliar words from the context, Reading strategies, Reading practice through variety of reading texts and comprehension exercises, Beyond reading (speaking and writing outputs)

Writing: Making notes, Social formal letters (elements, style, formatting, organization and structure, types e.g. requests, invitation, thank you, condolence etc), Short reports (structure, format, and types i.e. informational, event and analytical)

Grammar: Tenses, Frequency, time and quantity expressions, Punctuation, Conditional Sentences, Active and passive, Semantic markers, Phrasal Verbs

Speaking: Giving a presentation, Discussion, Beginning a discussion, Entering a discussion (at a subsequent stage), Interrupting a discussion without giving offence, Changing your stance / point of view in the course of a discussion, Summing up a discussion, Role play/dialogue (e.g. interviewing: with respect to social interaction)

HS-105 Pakistan Studies

(2+0)

An Outline of Emergence of Pakistan - A Brief Historical Survey of Muslim Community in the Sub-Continent; War of Independence (1857 and Aftermath); Sir Syed Ahmed Khan; Development of Two Nation Theory; Formation of Muslim League; Luckhnow Pact; Khilafat and Non-Cooperation Movement; Political Events from 1924 to 1937; Pakistan Resolution Struggle for Pakistan from 1940 to 1947; Emergence of Pakistan. Land of Pakistan - Geophysical Conditions; Territorial Situation and its Importance; Natural Resources - Mineral and Water. Constitutional Process - Early Efforts to Make Constitution - Problems and Issues; Constitution of 1956

and its Abrogation; The Constitution of 1962 and its Annulment; Constitutional and Political Crisis of 1971; The Constitution of 1973; Recent Constitutional Developments. Post-Independence Developments - Education in Pakistan; Planning and Development in the Field of Education; Development of Science and Technology with Special Reference to Engineering and Architecture; Brief Survey of Pakistan Economy; Industrial and Agricultural Development; Development of Science and Technology Sectors in Culture; Development of Arts; Philosophy and Literature; Internal and External Trade; Economic Planning and Prospects. Cultural Development in Pakistan - Definition; Contents and Contributing Factors in Culture. Foreign Policy - Relations with Neighbours; Super Powers and Muslim World.

HS-127 Pakistan Studies (for Foreigners) (2+0)

Land of Pakistan - Land and People - Strategic Importance; Important Beautiful Sights; National Resources. A Brief Historical Background - A Brief Historical Survey of Muslim Community in the Sub Continent British Rule and its Impacts; Indian Reaction Two Nation Theory; Origin and Development Factors Leading Towards the Demand of a Separate Muslim State Creation of Pakistan. Government and Politics in Pakistan - Constitution of Pakistan; A Brief Outline. Government Structure Federal and Provisional - Local Government Institutions Political History; A Brief Account. Language and Culture - Origins of Urdu Language Influence of Arabic and Persian on Urdu Language and Literature; A Short History of Urdu Literature.

Fall Semester

CS-111 Object Oriented Programming (2+1)

Difference between Conventional and Object Oriented Programming; Data Abstraction; Objects, Classes and Methods; Inline and Friend Function; Inheritance; Polymorphism; Handling Message; Aggregation; Exception Handling

CS-211 Discrete Structures (3+0)

History and Overview - Contributors to the subject, purpose and role of discrete structures in computer engineering, contrasts between discrete-time models and continuous-time models. Functions, Relations and Sets - one-to-one, onto, inverses, composition functions; Reflexivity, symmetry, transitivity, equivalence relations; Discrete versus continuous functions and relations; Venn diagrams, complements, Cartesian products, power sets; Cardinality and countability; Application of functions in coding theory. Applications of set theory in grammar and languages. Basic Logic - Propositional logic, logical connectives, truth tables, conjunctive and disjunctive normal forms, predicate logic, universal and existential quantification, Boolean algebra, application of logic to computer engineering. Proof Techniques - Notions of implication, converse, inverse, negation and contradiction; structures of formal proofs; Direct Proofs; Proof by counterexample, contraposition and contradiction; Mathematical induction and strong induction. Introduction to Group Theory - groups and semi-groups. Basics of counting - Permutations and combinations; Discrete probability; Counting arguments rule of products; rules of sums; The pigeonhole principle; Generating functions; recurrence relation; Applications to algorithm analysis. Graphs and Tree - Basics of trees and graphs; Directed and Undirected graphs; Spanning Trees

Modern Physics: Planck's explanations of Black Body Radiation Photoelectric Effect, Compton Effect, Bohr's Theory of Hydrogen Atom, Atomic Spectra, Reduced Mass, De-Broglie Hypothesis, Electron Microscope, Atomic Nucleus and Properties of Nucleus, Radioactive Decay and Radioactive Dating, Radiation Detection Instruments, Nuclear Reactions and Nuclear Reactor.

MT-222 Linear Algebra & Ordinary Differential Equations (3+0)

Linear Algebra: Linearity and linear dependence of vectors, basis, dimension of a vector space, field matrix and type of matrices (singular, non-singular, symmetric, non-symmetric, upper, lower, diagonal), Rank of a matrix using row operations and special method, echelon and reduced echelon forms of a matrix, determination of consistency of a system of linear equation using rank, matrix of linear transformations, Eigen value and Eigen vectors of a matrix, Diagonalization, Applications of linear algebra (Scaling, translation, rotation and projection) with graphical representation.

Introduction to Ordinary Differential Equations (ODE): The Concepts & Terminologies: Order and Degree; Linearity & Non-linearity; A Brief Classification of ODEs; Formulation of ODEs: Concrete Examples; Solutions: General & Particular: Concrete Examples & Applications: Initial Value Problems (IYP) and Boundary Value problems (BVP): A Brief Introduction to Issues related to Existence & Uniqueness of Solutions.

The First Order ODEs: Linear and Non-Linear: Variable Separable Cases & Applications: Growth & Decay Problems, Newton's Law of Cooling, Torricelli's Law, Simple Kinematical Dynamical Applications; Exact and No-Exact ODEs: Solution Procedures and Integrating Factors; the Standard Linear Differential Equation of First Order: Solution Procedures and Applications to RL-Circuits and RC-Circuits, Bernoulli's Equations & Logistical Growth Models. Direction Fields and Euler's and Picard's Iterative Schemes for the 1st Order ODEs, The Linear Second Order ODEs: Homogeneous and Non-Homogeneous Cases, Linear Second Order Homogeneous ODE with Constant Coefficients: Solution Procedures and the Principle of Linear Superposition and Applications, Mechanical Systems & Electrical Systems, Undamped and Damped Harmonic Oscillators: Linear Second Order Non-Homogeneous ODEs with Constant Coefficients: Solution Procedures and the Principle of General Linear Superposition: Complementary Functions & Particular Solutions, the method of Undetermined Coefficients & Variation of Parameters, Applications: Spring-Mass Systems, Damped & Undamped Harmonic Oscillators with Forcing Terms and their ODEs and Solutions; RCL-Circuits and their ODEs and Solutions; The Physics and Mathematics of the Phenomenon of Resonance in Mechanical & Electrical Systems; Cauchy-Euler ODEs and their Solution Procedures.

Partial Differential Equation: Formation of partial differential equations, Solutions of first order linear and special types of second and higher order differential equations, Homogeneous partial differential equations of order one, Lagrange's multiplier.

Advance Calculus & Vector Calculus: Double & triple integral with application (Area, centroid, moment of inertia) vector differentiation & vector integral with applications, Green & Stokes theorem with applications.

HS-214 Academic Writing (3+0)

Writing Process: Identifying topic area, narrowing topic, planning, brainstorming, mind mapping, outlining, writing first draft, reviewing, revising, proofreading, writing final draft

Reading & Writing: Analysing different texts: identifying point of views, claims, assumptions, differentiate facts from opinions, Practicing Academic Language: differentiate using language of opinion and fact; synthesize information, developing critical write up with relevant factual information, personal views, academic evidence, examples, cause and effect etc.; presenting and describing visuals (tables & graphs)

MT-224 Complex Variable & Fourier Analysis**(3+0)**

Infinite Series: Application of convergence tests such as comparison, Root, Ratio, Raabe's and Gauss tests on the behaviour of series.

Complex Variable: Limit, continuity, zeros and poles of a complex function. Cauchy-Reimann equations, conformal transformation, contour integration.

Laplace Integral & Transformation: Definition, Laplace transforms of some elementary functions, first translation or shifting theorem, second translation or shifting theorem, change of scale property, Laplace transform of the n th order derivative, initial and final value theorem Laplace transform of integrals, Laplace transform of functions $t^n F(t)$ and $F(t)/t$, Laplace transform of periodic function, evaluation of integrals, definition of inverse Laplace transform and inverse transforms, convolution theorem, solutions of ordinary differential and partial differential equations using Laplace transform (I.V.P's & B.V.P's), Z and Inverse Z – transformations, properties of Z - transformation and applications

Fourier series: Introduction to Fourier series. Euler Fourier formulae, even and odd functions, application of Fourier series, Fourier transform and fast Fourier transform and properties with applications.

Materials; Techniques Designs, etc.; A Basic Investment Philosophy; Alternatives Having Identical Lives; Alternatives Having Different Lives. Value Analysis - Important Cost Concepts; Cost-Benefit Analysis Feasibility Studies; Value Analysis in Designing and Purchasing. Linear Programming - Mathematical Statement of Linear Programming Problems; Graphic Solution; Simplex Procedure; Duality Problem, Depreciation and Valuation - Types of Depreciation Economic Life; Profit and Interest Returns to Capital; Productivity of Capital; Discrete Continuous Compounding; Discounting Sinking Fund Problems. Capital Financing and Budgeting - Types of Ownership; Types of Stock; Partnership and Joint Stock Companies; Banking and Specialized Credit Institution. Theory of Production - Factors of Production; Laws of Returns; Break-Even Charts and Relationships, Industrial Relationship - Labour Problems; Labour Organizations Prevention and Settlement of Disputes.

MT-335 Probability and Statistics**(3+0)**

Introduction to Statistics: Introduction, Types of Data & Variables, Presentation of Data, Object, Classifications, Tabulation, Frequency Distribution and their types, Graphical Representation, Simple, Multiple and Component bar diagrams, Pie-chart, Histogram, Frequency polygon and Frequency curves.

Measures of Central Tendency and Dispersion: Statistical Averages, Median, Mode, Quartiles, Range, Moments, Skewness & Kurtosis, Quartile Deviation, Mean Deviation, Standard Deviation, Variance & its coefficient.

Probability: Basic concepts, Permutation & Combination, Definitions of Probability, Laws of Probability, Conditional Probability, Bayes' Rule.

Random Variables and Random Processes: Introduction, Discrete & Continuous Random Variables, Random Sequences and Transformations, Probability Distribution, Probability Density Function, Distribution Function, Mathematical Expectations, Moment Generating Function(M.G.F), Introduction to Random Processes and Time Series, Statistical Averages of Random Processes, Stationary, Auto-Correlation of Wide Sense Stationary Random Processes, Time Averaging, Ergodicity, Markov Chain and Queuing Theory.

Probability Distributions: Introduction, Discrete Probability Distributions, Binomial, Poisson, Hypergeometric & Negative Binomial Distributions, Continuous Probability Distribution, Uniform, Exponential & Normal Distributions.

Sampling and Sampling Distributions: Introduction, Population, Parameter & Statistic, Objects of Sampling, Sampling Distribution of Mean, Standard Errors, Sampling & Non-Sampling Errors, Random Sampling with & without Replacement, Sequential Sampling, Central Limit Theorem.

Statistical Inference and Testing of Hypothesis: Introduction, Estimation, Types of Estimation, Confidence Interval, Tests of Hypothesis, Chi-Square Distribution/Test, One and Two Tails Test.

Simple Regression & Correlation: Introduction, Scatter Diagrams, Correlation & its Coefficient, Regression Lines, Rank Correlation & its Coefficient, Probable Error (P.E).

HS-304 Business Communication & Ethics**(3+0)**

Communication Skills - Definition and Conditions; Modes: Verbal, Non-Verbal, Vocal, Non- Vocal, Sender, Receiver, Encoding, Decoding, Noise, Context, Emotional Maturity, Relationships, etc; Language, Perception; Non-Verbal, Body Language, Physical Appearance, Cultural Differences, etc; Personal and Interpersonal Skills/Perceptions; Communication Dilemmas and Problems; Public Speaking: Speaking Situation, Persuasion; Making Presentations; Interviews. Business Writing - Formal/Business Letters, Emails: Job Application and Resume/CV, Enquiries, Complaints/Adjustments, Orders, Quotations, Banking, etc; Memos: Layout, Language, Style; Meeting Management: Notice, Agenda, Conducting/Participating, Writing Minutes; Contracts and Agreements (Basic Theoretical Knowledge and Comprehension); Research/Scientific Reports: Types, Structure, Layout/Presentation, Writing Process, etc; Tenders (Basic Theoretical Knowledge and Comprehension). Engineering/Business Ethics - Need and Objective of Code of Ethics and its Importance; Types of Ethics, Involvement and Impact in Daily Life, Problems/ Conflicts/ Dilemmas in Application (Case Studies); Sexual Harassment/ Discrimination in the Workplace: Why it Occurs, Myths Regarding Sexual Harassment, How to Deal With it, Gender Equality, Respect, etc. Codes of Conduct - Pakistan Engineering Council; Code for Gender Justice; Brief Study of Other Codes of Conduct

CS-422 Introduction to Embedded Systems (2+1)

Introduction to Embedded Systems, Custom Single-Purpose Processors, General-Purpose Processors, The Embedded Environment, Programming of Embedded Systems, Simulators, Emulators, and Debuggers, Code Optimization for Size and Speed, Timers and Interrupts, Interfacing, Introduction to Low-Power Computing, Operating Systems for Embedded Systems.

CS-426 Computer Systems Security (2+1)

Cryptographic foundations; Access Control Lists (ACLs); Operating System Security - Principles; Computer systems' structure and its impact on security; Principles and practices for secure system design; Security models: Properties, information flow, non-interference, separation of duties; Software vulnerabilities: Memory corruption (stack-smashing, heap overflows, integer overflows), Input validation errors, Race conditions; Web server and Browser vulnerabilities; Malware and Untrusted software: Viruses and worms, Rootkits, Botnets, Obfuscation and evasion; Defenses for software threats: Static analysis for vulnerability detection, Code transformation for runtime policy checking, Runtime policy enforcement and sandboxing, Isolation and information-flow control; Virtual machines; Network-layer threats: network probing, scanning, Defenses -intrusion detection, Side-channel attacks - covert channels, timing attacks, power analysis, emanations, remanence and reuse; Human and social engineering
- Digital rights management

CS-427 Robotics and Kinematics (2+1)

Introduction; Basics of Robotics and Linear algebra; Representing positions and rotations; Rotational transformations; Parameterizations of rotations; Homogeneous transformations; Kinematic chains and Denavit-Hartenberg (DH) convention; Forward kinematics; Inverse kinematics; Angular velocity and Jacobian Operator; Trajectory design; Configuration space; Motion planning -- potential field, roadmap; Control - PID control, Joint space control, Operational space control and Force control; Sensors and actuators; Mobile robot; Robot applications

MG-482 Introduction to Organizational Behaviour (3+0)

Foundations of Organizational Behaviour (OB): Management functions, roles, and skills; Effective versus successful managerial activities; replacing intuition with systematic study, Exploring OB challenges and opportunities facing globalization: Improving quality and productivity; improving people skills; managing work force diversity; responding to globalization; empowering people; stimulating innovation and change; coping with temporariness; handling declining employee loyalty; improving ethical behaviour.

Foundations of Individual Behaviour: Individuals & Organizations: Biographical traits and ability; and personality, Perceptions and individual decision making: Understanding perception and its significance, factors influencing perception; linking perception and individual decision making; optimizing decision making model; alternative decision making models; issues in decision making, Values, attitudes and job satisfaction: Importance, sources, types of values; sources and types of attitude; attitude and consistency; measuring job

satisfaction; determinants of job satisfaction; effect of job satisfaction on employee performance; ways employees can express dissatisfaction, Motivation- basic concepts and applications

Foundations of Group Behaviour: Group in OB: Defining and classifying groups; stages of group development, work group behaviour; dynamics of groups, Understanding work teams: Team versus group; types of teams, creating high performance teams; turning individuals into team players, Communication: communicating at interpersonal and organizational level, Leadership: basic approaches and contemporary issues, Conflict & negotiation: defining conflict; transition in conflict thought; conflict process; negotiation - strategies, process and issues.

Foundations of Organizational Structure: Organizational structure and design; work design; work stress, Organizational culture: definition; culture's functions, employees and organizational culture, Organization change and development: forces for change; managing planned change, resistance to change; approaches to managing organizational change.

CS-406 Computer Engineering Project

(0-6)

The final year students will be required to consult the Chairman of Computer Systems Engineering Department regarding the offering of various projects in the department. The student or group of students will be assigned the project by teacher concerned and will carry out the assignment as required and directed by the teacher. At the end of the academic session, they will submit the written report on work of their project to the chairman, preferably in the typed form. The students will be required to appear before a panel of examiners for oral examination.

By doing project the student will demonstrate the application of the knowledge gained during his/her stay in the university. He/she may also work on a project which may help him/her to learn more in some specific area related to Computer Engineering.