Annex A

The Mapping of Courses to Knowledge Profiles

Knowledge Profiles	Knowledge Area	Sub-Area	Course Title	CLOS
WK7	Humanities	English	Functional English	1. Classify different grammatical concepts and interpret complex English language text. (C2) 2. Follow the rules and regulations of grammar and develop communicative skills. (A2)
			Communication Skills	1. Define and comprehend complex English language texts. (C1) 2. Discuss different topics by acquiring four skills specifically Reading, Writing, Listening& speaking). (C2) 3. Conform the importance of communication and presentation skills for becoming an affective engineer. (A2)
			Technical Report Writing and Presentation Skills	1. Explain the basics of Report Writing, resumes and writing styles. (C2) 2. Justify an effective technical report by following the rules and regulations of formal writing prescribed. (A5)
		Culture	Islamic Studies /Ethics	1. To explain the basic concept of Islamic culture, Social System of Islam, Professional Ethics and Morality and translate Selected Verses of Surah Al-Inam, Surah Al-Hujrat, Surah Al-Ihzab, Surah Al-Hashar, Surah Al-Saf, Surah al-Furqan, Surah Al-Mumanoon, Surah Al-Baqara. (C2) 2. To demonstrate the concept of Islam and Science, Islam – Religion of Peace and Harmony. (C2)

			Pakistan Studies	1. To explore colonial and postcolonial history of Pakistan (C2) 2. To impart knowledge of foreign policy of Pakistan and current affairs (C1)
		Social Sciences & Ethics	Professional Ethics	1. IDENTIY the content of religious, national, or international law dealing with engineering ethics. 2. APPLY the knowledge of ethics in their personal and professional life 3. GAIN the ability to enhance key factors of interpersonal relations
	Management Sciences	Professional Practice	Entrepreneurship and Business Management	1. Develop a business plan with an appropriate business model. (C5) 2. Demonstrate the ability to provide a self-analysis in the context of an entrepreneurial career. (A4) 3. Demonstrate the ability to find an attractive market that can be reached economically. (A3)
			Engineering Economics and Management	1. APPLY the appropriate engineering economics analysis method(s) for problem solving i.e. present worth, annual worth/cost, rate of return, payback, break-even, benefit-cost ratio, cost minimization, profit maximization. (C3) 2. Evaluate the cost effectiveness of individual projects using the methods learnt, draw inferences for investment decisions, and compare the life cycle cost of multiple projects. (C4) 3. COMPUTE the depreciation of an asset using standard depreciation techniques to assess its impact on present or future value. (C2)
WK2	Natural Sciences	Math	Calculus & Analytical Geometry	1. Define the basic concept of complex number; function and derivatives. (C1) 2. Make use of the Analytical Geometry and Integral Calculus in multiple

					dimensions to solve different engineering problems. (C3)
				Differential Equations	1. Define the basic concept of ordinary differential equations and partial differential equations. (C1) 2. Solve the first, second and higher order differential equations and integral transforms by using various methods. (C3)
				Numerical Analysis	1. Find the concept of various method for interpolation, polynomial approximation. (C1) 2. Apply the various method to solve the linear, nonlinear equation and numerical solution of ordinary differential equations. Also perform evaluation of numerical differentiation and integration by applying different methods. (C3) 3. Lab CLO Analyze different numerical methods related to linear and non-linear algebraic equations by using MatLab simulation tool. (C4)
				Linear Algebra	1. Define the basic concept of matrix algebra, the vector space , linear transforms and Eigenvalues and Eigen Vectors. (C1) 2. Solve the system of linear equation and solution of linear programming. (C3)
				Multivariate Calculus	1. Find partial derivatives, geometry of space and vector in three space. (C1) 2. Solve Vector – Valued functions and motion in space , Integration in vector field and multiple integrals to resolve various problems related to engineering. (C3)
WK1			Physics	Electricity & Magnetism	1. Define electricity & magnetism and its role in different fields of engineering and Sciences. (C1) 2. Explain the nature of electricity and the related fundamental quantities i.e.

				current, voltage, resistance power etc. (C2) 3. Describe the origin of magnetism, types and factors affecting magnetism. (C3) 4. Conduct experiments in laboratory in order to interpret experimental data and observe its conformance with analyzed results of circuits. (P2)
WK2/WK4/WK5/Wk6	Computing	Fundamentals	Introduction to Computing	1. Identify the components of a computer system, demonstrate basic proficiency in computer and commonly used computer applications. (C3) 2. Explain the fundamentals of operating systems, databases, computer networks and internet. (C2) 3. Ability to write, debug and execute programs in C language. (C3)
		Estimation	Programing Fundaments	1. Build logic of program, design an algorithm and make flow chart to represent the solution. (C3) 2. Design and implement the solution of problem using loops, array, functions, structures (C5) 3. Analyze different programs to compare the output and identify logical and syntax errors. C4)
		Design	Data Structure and Algorithms	1. Classify and analyze different categories of data structure and algorithms (C3). 2. Implement common searching and sorting algorithms (C3). 3. Perform analysis of various algorithms and determine their complexities. (C3)
			Microprocessor System	4. EXPLAIN fundamental concepts microprocessor, Control signal and Number system. 5. ANALYZE a system with Memory Mapped I/O versus I/O Mapped I/O 6. MAKE USE OF assembly programing language for

				microprocessor and microcontroller
				7. DEMONSTRATE the skills to program and interface microprocessor and microcontroller based embedded systems with sensors and actuators.
				8. (This CLO shall be assessed with Rubrics as Lab Work)

Knowledge Profile	Knowledge Area	Course Title	
WK3/Wk4	Engineering Foundation	Linear Circuit Analysis	1. To Discuss knowledge related to basic concepts, laws and theorems used for circuit analysis. (C2) 2. To solve the circuits using basic concepts, laws and theorems. (C3) 3. Conduct experiment interpret experimental data and observe its conformance with analyzed results of circuits. (P4)
		Engineering Drawing	1. ABILITY to draw basic drawing objects. (P3) 2. ABILITY to read basic engineering drawing. (C3) 3. APPLY engineering drawing skills using Auto CAD tool. (P2)
		Electrical Network Analysis	1. ANALYZE AC circuits in time domain and frequency domain. (C4) 2. ANALYZE balanced three phase systems (C4) 3. USE simple electric circuit models to examine the behaviour of complex networks. (C3) 4. CONSTRUCT circuits on breadboards and perform electrical measurements and analyze using modern engineering tools (P2)
		Workshop Practice	1. ACQUIRE the basic knowledge of Electric circuit, its components. Electrical Power System, process of Electrical power Generation, Transmission and Distribution. (C1) 2. EXPLAIN Electrification System, how to get Electric supply both single and three phase from the Transformer, its protection. (C2) 3. To Solve simple electric wiring circuits for electrification of buildings, selection of different components and bill calculation for buildings and houses. (C3) 4. To Demonstrate the use of measuring tools used in various shops in the workshop. (P4)
		Signals and Systems	1. APPLY the time domain and frequency domain representation and transformation techniques on the continuous-time signals/systems (C2) 2. ANALYZE and DESIGN continuous time systems using Laplace transforms. (C3)

			3. REPRODUCE logical codes for simulation of different signals and their transforms using modern platform and software tools. (C3)
		Electronic Devices and Circuits	1. DESCRIBE and EXPLAIN the basic construction, operation and characteristics of semiconductor devices. (C2) 2. APPLY the acquired knowledge to solve small scale circuits consisting of semiconductor devices. (C3) 3. ILLUSTRATE dc and ac response of small signal amplifier circuits using device models. (C3)
		Digital Logic Design	1. PERFORM gate level minimization using K-map and combinational logic by employing analysis and design procedure. (C3) 2. DERIVE equations from truth / state table in order to design synchronous sequential logic which includes latches, flip-flops and state reduction. (C3) 3. DESIGN a valid ALU using VERILOG language and Xilinx ISE platform. (C5)
		Probability Methods in Engineering	1. Understand basic probability and statistical concepts and their use in different problems. (C1) 2. Apply the various probability distributions and statistical inference. (C3) 3. Assess the Probability and rules of probability (C5)
		Electromagnetic Field Theory	1. Knowledge about the vector calculus and fundamental law of physics to understand the electric and magnetic fields. (C1) 2. Problem formulation and analysis of electromagnetic fields in the region surrounded by different static and moving charge configurations. (C4)
Wk4/Wk5	Major Based Core (Breadth)	Communication Systems	1. Define the fundamentals of communication systems and demonstrates description of signals. (C1/C2) 2. DESCRIBE the basic theory, compare advantages and disadvantages, identify and compute parameters, the performance metrics, and explain the working of the different types of analog transceiver designs using time and frequency domain analysis. (C3/C4) 3. APPLY principles of Analog to Digital conversion and design Quantizers under various constraints (C4) 4. Carry out experiments using MATLAB. (C5)
		Introduction to Embedded System	1. DESCRIBE AVR based microcontroller architecture, its internal registers, and instruction set. (C2) 2. PERFORM timer programming, serial port programming and interrupt programming both in C and assembly language. (C3)

			3. DESIGN and IMPLEMENT microcontroller-based project for input voltage-based speed control of a motor. (P5)
		Electrical Machines	1. To understand the fundamentals of electrical machines. (C1) 2. To evaluate the performance and characteristics of electrical machines (C3) 3. To analyze the equivalent parameters performance of electrical machines (C4) 4. PERFORM experiments in a laboratory enabling the students to gain insight into the functioning of transformer, ac and dc machines. (P2)
		AC Machines	5. To understand the fundamentals of electrical machines. (C1) 6. To evaluate the performance and characteristics of electrical machines. (C3) 7. To analyze the equivalent parameters performance of electrical machines. (C4) 8. To perform different test and evaluate the operation and characteristics of single phase, three-phase transformers, induction motors, and synchronous generators. (P5) 9.
		Linear Control Systems	1. DEVELOP a mathematical model using input/output Differential equations, Transfer Functions and State Space for Linear Time Invariant electrical and mechanical systems. (C3) 2. ANALYZE the stability of Linear Time Invariant complex engineering systems using Routh's Criteria, Root Locus, Bode plots and State Space analysis. (C3) 3. DESIGN a compensator to achieve desired closed loop response for a system using, Root Locus, Bode plots and State Space. (C5) 4. USE MATLAB and Simulink for modelling and simulation of complex engineering systems. (P2)
		Power System Analysis	1. Application of various iterative methods and algorithms for load flow analysis, Application of equal area criterion to a sudden increase in power input and to a short circuit fault. (C3) 2. Application of symmetrical faults on power system network, Development of sequence impedances and networks of different power system elements, Application of unsymmetrical faults on power system network. (C3)
		Power Dist. & Utilization	1. Knowledge about the basics of power distribution system. (C1) 2. Use of different techniques and tools for the analysis of distribution system. (C2) 3. To study and analyse different applications related to the utilization of electric power. (C4)
WK5/WK6	Major Based Core (Depth)	Electrical Power Transmission	1. TO DEVELOP the necessary theoretical knowledge for basic and advanced concepts in Electrical Power Transmission. (C1)

				2. TO ANALYZE and develop the electrical models for short, medium and long transmission lines. (C2) 3. Conduct experiments on different transmission models, analyze and measure data of different parameters and effects of Transmission lines. (P4)
			Power Electronics	1. Explain power electronics system and solid-state power semiconductor devices, their construction, thyristor, its types, operational modes, trigger and commutation methods. (C2) 2. Apply solid-state power semiconductor devices and thyristors for switching and protection circuits and applications. (C3) 3. Analyse power electronic converter topologies. and configurations. (C4) 4. Measure the simulated results to investigate the V-I characteristics of power semi-conductor devices, uncontrolled, semi-controlled and fully controlled rectifiers, single-phase and three-phase inverters, buck-boost Converter, cycloconverter & Switch mode power supplies. (P4)
			Instrumentation and Measurements	1. EXPLAIN the fundamentals of instrumentation and measurement systems (C2) 2. Illustrate the principle, construction, and working of various electromechanical and electronic instruments.C3) 3. Illustrate bridges, potentiometers, use of transducers to measure non-electrical quantities and signal analysis instruments. (C3) 4. Demonstrate use of various measuring instruments commonly used by the electrical engineers. (C3)
			Power System Protection	1. Acquire the basic knowledge of protection system attributes and understand the concepts of various protection schemes. (C2) 2. Solve and evaluate the protection schemes for a power system. (C3) 3. Design a protection scheme for a given problem. (C3)
			Power Generation Systems	1. Explain working operation of various power plants. (C2) 2. Analyse and compare various generation technologies with respect to their site selection, cost, efficiency. (C3) 3. Application of SCADA in power generation systems. (C3)

WK3	Inter-Disciplinary Engineering Breadth (Electives)	Basic Mechanical Engineering	1. Understand the basic concepts of statics and dynamics which include Moment and couples; Resultant of forces and couples; laws of equilibrium; Kinetics and Kinematics of particles in two dimensions and three dimensions. (C2) 2. Calculate the resultant force, resultant couple, moment about an axis of rotation, motion variables regarding rectilinear and curvilinear motion of particles in various coordinate systems. (C3)
WK8	Electrical Engineering Project	Senior Design Project-1	1. Through literature research, analyse and the given complicated engineering challenge into sub-problems. (C4) 2. Examine the viability of current solutions and make suggestions for improvements. (C4) 3. As a team member and/or team leader, manage interdisciplinary workgroup while working independently to interact with engineering and social circles. (A2) (C2)
		Senior Design Project-2	1. Specific to the projects that have been allocated to you. (C5) 2. Specific to the projects that have been allocated to you. (C6) 3. To avoid plagiarism, respect privacy, confidentiality, work ethics, and intellectual property rights. (A3), (C2) 4. In written and spoken communication, describe joint research work done with professional engineers, electrical engineers, lab engineers and technicians. (C5)