Department of Electronic Engineering
Faculty of Engineering and Technology
University of Sindh Jamshoro

BOOKLET - BATCH 2K23

Department of Electronic Engineering
Faculty of Engineering and Technology
University of Sindh Jamshoro

Annex D - Batch 2K23 Programme Credit Hours: 136													
Semester	**Subject**	**PLO-1**	**PLO-2**	**PLO-3**	**PLO-4**	**PLO-5**	**PLO-6**	**PLO-7**	**PLO-8**	**PLO-9**	**PLO-10**	**PLO-11**	**PLO-12**
Semester 1	Functional English										1:C3 2:C2		3:A2
	Linear Circuit Analysis	1:C2			2:C3								
	Linear Circuit Analysis (Lab)									1:P3			
	Computer Fundamentals and Programming	1:C1		2:C3									
	Computer Fundamentals and Programming (Lab)					1:P3							
	Applied Physics	1:C2	2:C3										
	Applied Physics (Lab)									1:P3			
	Calculus and Analytical Geometry	1:C1	2:C2										
	Electronics Workbench	1:P1				2:P2 3:P3							
Semester 2	Communication Skills										1:C2 2:C3		
	Electronic Devices and Circuits	1:C2			2:C3								
	Electronic Devices and Circuits (Lab)									1:P3			
	Linear Algebra	1:C2	2:C3										
	Object Oriented Programming	1:C2		2:C3									
	Object Oriented Programming (Lab)					1:P4							
	Pakistan Studies						2:C3	1:C1					
	Solid State Electronics	1:C2	2:C3										
Semester 3	Computer-Aided Engineering Design					2:P4						1:P2	
	Differential Equations	1:C1	2:C2 3:C3										
	Digital Logic Design	1:C2	2:C3	3:C3									
	Digital Logic Design (Lab)				1:P4								
	Electronic Circuit Design	1:C2	2:C4	3:C3									
	Electronic Circuit Design (Lab)					1:P3							
	Instrumentation and Measurements	1:C2 2:C3		3:C3									
	Instrumentation and Measurements (Lab)					1:P3							
Semester 4	Complex Variables and Transforms	1:C1 2:C2	3:C3										
	Electrical Network Analysis	1:C2	2:C3										
	Electrical Network Analysis (Lab)									1:P2			
	Integrated Electronics	1:C2	2:C4	3:C3									
	Integrated Electronics (Lab)					1:P3							
	Islamic Studies						1:C2		2:C2				
	Microprocessors and Microcontrollers		1:C2	2:C3									
	Microprocessors and Microcontrollers (Lab)					1:P3							

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Semester 5	Electrical Machines	1:C2	2:C3		3:C2								
	Electrical Machines (Lab)					1:P3							
	Electromagnetic Field Theory	1:C2	2:C4	3:C4									
	Organizational Behaviour								3:C3		1:C1	2:C2	4:C2 5:C2
	Probability and Random Variables	1:C2	2:C3										
	Signals and Systems	1:C2	2:C3	3:C6									
	Signals and Systems (Lab)					1:P3							
Semester 6	Analog and Digital Communications		1:C4	2:C5									
	Analog and Digital Communications (Lab)								1:P3				
	Control Systems	1:C2	2:C4					3:C6	4:C5				
	Control Systems (Lab)	1:P4	2:P5								3:P6		
	Digital Signal Processing	1:C2	2:C3	3:C5									
	Digital Signal Processing (Lab)					1:P3							
	Professional Practice							1:C1	2:A4				3:A3
	Technical Report Writing and Presentation Skills										2:C3		1:C2
Semester 7	Engineering Economics							1:C3				2:C4 3:C2	
	Image Processing and Computer Vision	1:C2		2:C4			3:C3						
	Introduction to Robotics	1:C2 4:C3	2:C3 3:C3										
	Introduction to Robotics (Lab)									1:P3			
	Power Electronics	1:C2	2:C4	3:C6	4:C5								
	Power Electronics (Lab)	1:P4	2:P5	3:P6									
	FYP-I (EE-418)	1:C2	2:C4	4:P7	3:C6	3:C6		7:A4	5:A5	5:A5	5:A5	5:A5	
Semester 8	Entrepreneurship						3:A3	2:A4				1:C5	
	FPGA-Based System Design		3:C3	1:C2 2:C5									
	FPGA-Based System Design (Lab)									1:P3			
	Industrial Electronics	1:C6	2:C4		4:C5			3:C6					
	Industrial Electronics (Lab)	1:P4	2:P5	3:P6									
	FYP-II (EE-418)		2:C4	4:P7	3:C6	3:C6			5:A5	5:A5	5:A5	5:A5	6:C6
Total CLO-PLO Mappings		**33**	**29**	**19**	**8**	**14**	**4**	**7**	**7**	**8**	**9**	**7**	**6**

First Year - First Semester

Subject Name	:	**Applied Physics**
Credit Hours	:	3+1=4
Course Code	:	Theory (BH-114), Practical (BH-115)
Effective	:	2K23-BE(EE)
Pre-Requisites	:	Nil
Weeks/Lectures/Labs	:	16/48/15
Marks	:	Theory (100), Practical (100)
Instructor Name	:	Dr. Azhar Ali Ayaz Pirzado

DESCRIPTION

An Applied Physics course covers fundamental topics such as vectors, mechanics, electrostatics, and magnetism, providing a strong foundation in classical physics. It then delves into specialized areas like semiconductor physics, exploring the behavior of materials crucial to modern electronics. Additionally, students study waves, oscillations, optics, and lasers, exploring the principles behind light and its applications. The course may conclude with an overview of modern physics, offering insights into cutting-edge research and technologies.

COURSE LEARNING OUTCOMES

Upon successful completion of the course, the student will be able to:

	CLO	Description	Domain	Taxonomy level	PLO	Marks
Theory	1	**Explain** the fundamental concepts of electrostatics, electromagnetism, PN junction operation, forward biasing, and light-matter interaction.	Cognitive	C2	1	56
	2	**Solve** engineering problems involving electrostatics, electromagnetism, waves, and semiconductor principles.	Cognitive	C3	2	44

LABORATORY LEARNING OUTCOMES

Upon successful completion of the lab experiments, the student will be able to:

	CLO	Description	Domain	Taxonomy level	PLO	Marks
Practical	1	**Construct** and test basic circuits on breadboards and trainer kits under instructor guidance.	Psychomotor	P3	9	100

COURSE OUTLINE (THEORY)

Vectors (review of vectors, ordinary differentiation of vectors, gradient of scalar field, divergence and curl of vector field, line and surface integrals with applications), Mechanics (Newton's laws and their

applications, simple accelerometer, banked curve and rotor, frictional forces and coefficient of friction, work-energy theorem, conservation of energy, angular momentum, centre of mass of two-particles and many-particle systems, rotational inertia of solid bodies), Electrostatics and Magnetism (electric field due to discrete and continuous charge distribution, electrostatic potential, Gauss's law applications, Lorentz force, Hall effect, Ampere's law, magnetic field due to circular current loop and solenoid, magnetic dipole, atomic and nuclear magnetism, magnetization, magnetic materials), Semiconductor Physics (energy levels in semiconductors, hole concept, intrinsic and extrinsic regions, law of mass action, P-N junction, transistors), Waves and Oscillations (simple harmonic motion, damped and forced oscillations, resonance, types of waves, superposition principle, wave speed on stretched string, wave equation, energy and power of waves), Optics and Lasers (Huygens' principle, two-slit interference, single-slit diffraction, resolving power of optical instruments, principles of laser action, types of lasers, applications of lasers), Modern Physics (Planck's black body radiation, photoelectric effect, Compton effect, de Broglie hypothesis, electron microscope, atomic structure, X-rays, Moseley's law, atomic nucleus and its properties, radioactivity)

COURSE OUTLINE (PRACTICAL)

Introduction to safety and measuring instruments, verification of ohm's law, Basic understanding of passive components such as capacitors, inductor, transformers, color coding of resistor, resistor in series and parallel capacitor combination, charging and discharging of capacitor, LED characteristics, faraday law of electromagnetic induction, Diode characteristics, overview of Multisim simulation

RECOMMENDED TEXT AND REFERENCE BOOKS

[1] D. Halliday, R. Resnick, and J. Walker, Fundamentals of Physics. Hoboken, NJ, USA: John Wiley & Sons, 2005.

[2] A. Beiser, Schaum's Outline of Applied Physics. New York, NY, USA: McGraw-Hill, 2004.

Subject Name	: **Calculus and Analytical Geometry**
Credit Hours	: 3+0=3
Course Code	: Theory (BH-116)
Effective	: 2K23-BE(EE)
Pre-Requisites	: Nil
Weeks/Lectures/Labs	: 16/48/0
Marks	: Theory (100)
Instructor Name	: Engr. Abdul Manan Memon

DESCRIPTION

Calculus and Analytical Geometry equip students with the mathematical techniques needed for engineering analysis. The course covers differential and integral calculus, multivariable functions, sequences and series, and the study of curves and surfaces using algebraic and geometric methods, fostering analytical thinking and problem-solving skills applicable in engineering and applied science.

COURSE LEARNING OUTCOMES

Upon successful completion of the course, the student will be able to:

	CLO	Description	Domain	Taxonomy level	PLO	Marks
Theory	1	**Define** the key Concepts of single-variable calculus, differential Calculus, Integral Multivariable calculus and analytical geometry	Cognitive	C1	1	20
	2	**Explain** the fundamentals of functions, limits, continuity, derivatives, integration, and partial differentiation, and their relevance to engineering problems and coordinate systems.	Cognitive	C2	2	80

COURSE OUTLINE (THEORY)

Analytical Geometry (review of vectors, scalars and vector products, three-dimensional coordinate system, equation of straight line and plane), Functions, Limit and Continuity (review of functions and graphs, limits and continuity, techniques of finding limits, discontinuity, limits of sine, cosine and exponential functions), Differentiation (introduction to derivatives, examples of derivatives, derivative as rate of change, derivative rules, implicit differentiation, higher order derivatives, Leibnitz theorem), Applications of Derivatives (monotonic functions, optimization problems, relative and absolute extrema, first and second derivative tests, point of inflection, concavity, curvature, indeterminate forms, L'Hospital's rule, differentials), Integration (integrals and properties, techniques of integration, integration

by parts, definite integrals, integration of trigonometric, exponential and inverse functions, partial fractions, reduction rules), Applications of Integration (area under the curve, area between curves, solids of revolution, volume by disk, washer, cylindrical shell and cross-section methods, center of pressure, depth of center of pressure, center of mass, arc length), Improper Integrals (improper integrals, singularities, convergence of improper integrals), Infinite Sequence and Series (sequence and infinite series, convergence and divergence, positive term series, integral test, comparison test, limit comparison test, ratio and root tests, alternating series, absolute and conditional convergence), Power and Taylor Series (power series, Maclaurin and Taylor series, applications)

RECOMMENDED TEXT AND REFERENCE BOOKS

[1] G. B. Thomas, Jr., J. R. Hass, C. E. Heil, and M. D. Weir, Thomas' Calculus. Boston, MA, USA: Pearson/Addison-Wesley, 2025.

[2] G. F. Simmons, Calculus with Analytic Geometry. New York, NY, USA: McGraw-Hill, 1996.

[3] G. B. Folland, Advanced Calculus. Upper Saddle River, NJ, USA: Prentice Hall, 2002.

[4] M. J. Strauss, G. L. Bradley, and K. J. Smith, Calculus. Boston, MA, USA: Pearson/Prentice Hall, 2014.

Subject Name	:	**Computer Fundamentals and Programming**
Credit Hours	:	2+1=3
Course Code	:	Theory (CS-112), Practical (CS-113)
Effective	:	2K23-BE(EE)
Pre-Requisites	:	Nil
Weeks/Lectures/Labs	:	16/32/15
Marks	:	Theory (100), Practical (100)
Instructor Name	:	Engr. Noor ul Ain

DESCRIPTION

This course provides an introduction to computer systems and programming fundamentals, focusing on problem-solving, algorithm development, and structured programming using a high-level language. It develops logical and computational skills required for engineering applications.

COURSE LEARNING OUTCOMES

Upon successful completion of the course, the student will be able to:

	CLO	Description	Domain	Taxonomy level	PLO	Marks
Theory	1	**Define** the components of a computer system and core programming concepts.	Cognitive	C1	1	40
	2	**Apply** programming concepts such as loops, arrays, functions, and structures to solve problems.	Cognitive	C3	3	60

LABORATORY LEARNING OUTCOMES

Upon successful completion of the lab experiments, the student will be able to:

	CLO	Description	Domain	Taxonomy level	PLO	Marks
Practical	**1**	**Develop**, execute, and debug basic programs under guidance using appropriate programming tools.	Psychomotor	P3	5	100

COURSE OUTLINE (THEORY)

Introduction to Computers (history and evolution of computers, classification of computers, applications of computers in modern society), Computer System Organization (basic

components of a computer system, central processing unit (CPU), memory hierarchy: primary and secondary memory, peripheral devices: input/output devices), Storage Systems and Data Organization (storage media and storage devices, physical and logical storage, data organization, file storage concepts), Software Concepts (programs and software, types of software: system software, application software, operating systems and their functions), Programming Languages and Translators (programming languages: low-level and high-level, compilation and interpretation, language translators), Problem Solving and Program Design (problem specification, algorithms, flowcharts, pseudo code), Programming Fundamentals (basic programming techniques, data types and declarations, variables and constants, header files and linkage, arrays), Input / Output and Program Structure (input and output operations, program termination, remarks/comments in programs), Control Structures (control structures in programming, branching and conditional structures, repetition and loops), Library Functions (basic library functions, use of predefined functions), Social and Professional Impact of Computing (social impact of the computer age, role of computers in offices, industry, education**)**

COURSE OUTLINE (PRACTICAL)

Computation of number system, implementation of Boolean functions, basic machines organization including motherboard, memory, I/O cards, networking devices, use of flow charts, introduction to office tools, overview of different browsers including open-source browsers, introduction to various operating systems, coding, executing and debugging simple programs, implementation of simple control structures, implementation of simple functions, implementation of different function styles.

RECOMMENDED TEXT AND REFERENCE BOOKS

[1] H. M. Deitel and P. J. Deitel, C How to Program, Upper Saddle River, NJ, USA: Pearson/Prentice Hall, 2020.

[2] R. Lafore, Object-Oriented Programming in C++, Upper Saddle River, NJ, USA: Prentice Hall, 2002.

[3] W. Stallings, Computer Organization and Architecture: Designing for Performance, Boston, MA, USA: Pearson/Prentice Hall, latest ed.

[4] I. Horton, Beginning ANSI C++: The Complete Language, Berkeley, CA, USA: Apress, latest ed.

[5] R. Thareja, Computer Fundamentals & Programming in C, Oxford, UK: Oxford University Press, 2012.

Subject Name	:	**Electronics Workbench**
Credit Hours	:	0+1=1
Course Code	:	Practical (EE-119)
Effective	:	2K23-BE(EE)
Pre-Requisites	:	Nil
Weeks/Lectures/Labs	:	16/0/15
Marks	:	Practical (100)
Instructor Name	:	Engr. Aunsa Shah

DESCRIPTION

This practical course develops essential electronics workshop skills, including safe use of tools and measuring instruments, electrical wiring, power-backup systems, soldering, printed-circuit-board preparation, component handling, circuit assembly, testing, and troubleshooting.

LABORATORY LEARNING OUTCOMES

Upon successful completion of the lab experiments, the student will be able to

	CLO	Description	Domain	Taxonomy level	PLO	Marks
Practical	1	**Follow** instructions to identify basic electronic components and their use in simple circuits.	Psychomotor	P1	1	25
	2	**Perform** basic operations on electronic equipment using standard procedures.	Psychomotor	P2	5	59
	3	**Construct** and test basic electronic circuits on prototype boards using discrete components under guidance.	Psychomotor	P3	5	16

COURSE OUTLINE (PRACTICAL)

Introduction to Workshop Facilities (introduction to technical facilities in a workshop, mechanical and electrical equipment), Electrical Safety (concepts in electrical safety, safety regulations, earthing concepts, electric shocks and treatment), Electrical Tools and Materials (use of tools used by electricians, wiring regulations, types of cables, electrical accessories including switches, plugs, circuit breakers and fuses), Power Backup Systems (UPS/invertors, battery charging), Wiring Systems (industrial wiring, domestic wiring, auto wiring, symbols for electrical wiring schematics, wiring schemes of two-way, three-way and ringing circuits), Soldering and PCB Work (electric soldering/de-soldering design, transferring a circuit to PCB, etching, drilling, soldering components on PCB).

RECOMMENDED TEXT AND REFERENCE BOOKS

[1] W. A. J. Chapman, Workshop Technology, Elsevier Butterworth-Heinemann, ISBN-13: 978-0713132724, latest ed.

[2] H. S. K. Choudhury, Elements of Workshop Technology, Media Promoters, ISBN-13: 978-8185099149, latest ed.

[3] R. P. Sing, Electrical Workshop: A Textbook, International Publishing House, ISBN-13: 978-8189866716, latest ed

Subject Name	:	**Functional English**
Credit Hours	:	3+0=3
Course Code	:	Theory (BH-100)
Effective	:	2K23-BE(EE)
Pre-Requisites	:	Nil
Weeks/Lectures/Labs	:	16/48/0
Marks	:	Theory (100)
Instructor Name	:	Ms. Perah Chandio

DESCRIPTION

This course is designed to equip students with essential language skills for effective communication in diverse real-world scenarios. It focuses on developing proficiency in English language usage: word choices, grammar and sentence structure. In addition, the course will enable students to grasp nuanced messages and tailor their communication effectively through application of comprehension and analytical skills in listening and reading. Moreover, the course encompasses a range of practical communication aspects including professional writing, public speaking and everyday conversation, ensuring that students are equipped for both academic and professional spheres. An integral part of the course is fostering a deeper understanding of the impact of language on diverse audiences. Students will learn to communicate inclusively and display a strong commitment to cultural awareness in their language use. Additionally, the course will enable them to navigate the globalized world with ease and efficacy, making a positive impact in their functional interactions.

COURSE LEARNING OUTCOMES:

Upon successful completion of the course, the student will be able to:

	CLO	Description	Domain	Taxonomy level	PLO	Marks
Theory	1	**Apply** English grammar and vocabulary in written communication and comprehension exercises.	Cognitive	C3	10	56
	2	**Explain** vocabulary and identify common errors made by learners of English as a second language.	Cognitive	C2	10	20
	3	**Participate** in English-speaking activities and demonstrate willingness to improve pronunciation and fluency.	Affective	A2	12	24

COURSE OUTLINE (THEORY)

Foundations of Functional English (vocabulary building: contextual usage, synonyms and antonyms, idiomatic expressions; communicative grammar: subject–verb agreement, verb tenses, fragments and run-ons, modifiers, articles, word classes; word formation: affixation,

compounding, clipping, back formation; sentence structure: simple sentences, compound sentences, complex sentences, compound-complex sentences), Sound Production and Pronunciation, Comprehension and Analysis (understanding purpose, audience, and context; contextual interpretation: tones, biases, stereotypes, assumptions, inferences; reading strategies: skimming, scanning, SQ4R, critical reading; active listening: overcoming listening barriers, focused listening)

RECOMMENDED TEXT AND REFERENCE BOOKS

[1] A. J. Thomson and A. V. Martinet, Practical English Grammar: Exercises, Oxford University Press, 1997, ISBN 0194313492.

[2] A. J. Thomson and A. V. Martinet, Practical English Grammar: Exercises, Oxford University Press, 1997, ISBN 0194313506.

[3] M.-C. Boutin, S. Brinand, and F. Grellet, Writing: Intermediate, Oxford Supplementary Skills, Fourth Impression, 1993, ISBN 0-19-435405-7, pages 20–27 and 35–41.

[4] B. Tomlinson and R. Ellis, Reading: Upper Intermediate, Oxford Supplementary Skills, Third Impression, 1992, ISBN 0-19-453402.

Subject Name	:	**Linear Circuit Analysis**
Credit Hours	:	3+1=4
Course Code	:	Theory (EE-110), Practical (EE-111)
Effective	:	2K23-BE(EE)
Pre-Requisites	:	Nil
Weeks/Lectures/Labs	:	16/48/15
Marks	:	Theory (100) Practical (100)
Instructor Name	:	Engr. Dr. Mudassir Ahmed Memon

DESCRIPTION

The Linear Circuit Analysis course provides undergraduate students with a foundation in basic linear electrical circuits using passive elements. It introduces essential circuit concepts including charge, current, voltage, current and voltage sources, and key circuit laws such as Ohm's law and Kirchhoff's laws. Students learn analytical techniques including nodal and mesh analysis, superposition, source transformations, and fundamental network theorems such as Thevenin's, Norton's and Maximum Power Transfer. The course also covers energy storage elements and transient/steady-state behavior of first-order circuits

COURSE LEARNING OUTCOMES

Upon successful completion of the course, the student will be able to:

	CLO	Description	Domain	Taxonomy level	PLO	Marks
Theory	1	**Explain** fundamental electrical quantities, laws, theorems, and methods used to analyze electric circuits.	Cognitive	C2	1	40
	2	**Apply** circuit-reduction, mesh, nodal, and network-theorem techniques to analyze static and transient circuits.	Cognitive	C3	4	60

LABORATORY LEARNING OUTCOMES

Upon successful completion of the lab experiments, the student will be able to:

	CLO	Description	Domain	Taxonomy level	PLO	Marks
Practical	**1**	**Perform** laboratory experiment under guidance to interpret experimental data and verify its conformity with theoretical analysis of linear electrical circuits.	Psychomotor	P3	9	100

COURSE OUTLINE (THEORY)

Electrical Elements and Circuits (resistance, inductance, capacitance, basic laws: Ohm's Law and Kirchhoff's Laws), Phasor Quantities (representation of phasors using j notation, addition, subtraction, multiplication, complex expressions for voltage, complex expressions for current, complex expressions for power, complex expressions for impedance), Series and Parallel Circuits (RL series circuits, series circuits, parallel circuits, resonance in series circuits, resonance in parallel circuits), DC Network Theorems (mesh/loop analysis, nodal analysis with DC sources, source conversions, superposition, Thevenin's Theorem, Norton's Theorem, Reciprocity Theorem, Maximum Power Transfer Theorem).

COURSE OUTLINE (PRACTICAL)

Study of DC series circuits, parallel circuits, Kirchhoff's current and voltage laws, current divider theorem, voltage divider theorem, network theorems, simple RLC circuits, and simulation of basic electrical circuits using PSPICE. Lab activity will be followed by semester project.

RECOMMENDED TEXT AND REFERENCE BOOKS

[1] W. Hayt, J. Kemmerly, and S. Durbin, Engineering Circuit Analysis, McGraw-Hill Science/Engineering/Math, 2011, ISBN: 0073529575.

[2] J. D. Irwin and R. M. Nelms, Basic Engineering Circuit Analysis, Wiley, 2010, ISBN: 0470633220.

[3] R. L. Boylestad, Introductory Circuit Analysis, Prentice Hall, 2010, ISBN: 0137146663.

[4] M. H. Rashid, Introduction to PSpice Using OrCAD for Circuits and Electronics, Prentice Hall, 2004, ISBN: 0131019880.

[5] A. H. Robbins and W. Miller, Circuit Analysis: Theory and Practice, Cengage Learning, 2012, ISBN: 978-1133281085.

First Year - Second Semester

Subject Name	:	**Communication Skills**
Credit Hours	:	3+0=3
Course Code	:	Theory (BH-101)
Effective	:	2K23-BE(EE)
Pre-Requisites	:	Nil
Weeks/Lectures/Labs	:	16/48/0
Marks	:	Theory (100)
Instructor Name	:	Ms. Asmat Fatima Izat

DESCRIPTION

This course develops students' professional and academic communication skills, including oral presentations, report and essay writing, CV preparation, and research writing. Emphasis is placed on effective verbal and written communication, study skills, and vocabulary development for professional and academic contexts.

COURSE LEARNING OUTCOMES

Upon successful completion of the course, the student will be able to:

	CLO	Description	Domain	Taxonomy level	PLO	Marks
Theory	1	**Explain** semantic and pragmatic principles used in professional written and oral communication.	Cognitive	C2	10	50
	2	**Apply** appropriate English-language skills to prepare professional documents and deliver clear oral presentations.	Cognitive	C3	10	50

COURSE OUTLINE (THEORY)

The 7 Cs of Communication (introduction to the 7 Cs of effective communication: clarity, conciseness, completeness, correctness, concreteness, courtesy, consideration; importance of the 7 Cs in professional communication; application of the 7 Cs in managerial communication, marketing communication, routine official and workplace communication, oral presentations, report writing, curriculum vitae (CV) and job applications), Study Skills (reading techniques and strategies: skimming and scanning, intensive and extensive reading; speed reading; academic comprehension skills; summary writing techniques; precis writing: rules, techniques, and practice; critical reading and comprehension development), Academic Writing and Communication Skills (formal and informal letter writing; memo writing and internal communication; minutes of meetings: format, language, and recording techniques; effective use of library resources, academic databases, internet and digital sources for research and learning; avoiding plagiarism and ethical use of information), Presentation Skills (fundamentals of effective presentations; personality development for professional communication; emphasis on content organization, style, and delivery; pronunciation, fluency, and confidence; verbal and non-verbal aspects of presentation; audience analysis and

engagement techniques; use of IT-based tools for presentations: multimedia slides, visual aids, online and digital presentation platforms), Professional Development Applications (preparing effective CVs and cover letters; job application writing; interview communication skills; professional ethics and workplace etiquette; team communication and collaboration).

RECOMMENDED TEXT AND REFERENCE BOOKS

[1] A. J. Thomson and A. V. Martinet, Practical English Grammar: Exercises, Oxford University Press, 1986, ISBN 0-19-431350-6.

[2] M.-C. Boutin, S. Brinand, and F. Grellet, Writing: Intermediate, Oxford Supplementary Skills, Fourth Impression, 1993, ISBN 0-19-435405-7, pages 45–53 (note taking).

[3] R. Nolasco, Writing: Upper-Intermediate, Oxford Supplementary Skills, 1992, ISBN 0-19-435406-5 (particularly good for writing memos, introduction to presentations, descriptive and argumentative writing).

[4] B. Tomlinson and R. Ellis, Reading: Advanced, Oxford Supplementary Skills, Third Impression, 1991, ISBN 0-19-453403-0.

[5] J. Langan, Reading and Study Skills, latest ed.

[6] R. York, Study Skills, latest ed.

Subject Name	:	**Electronic Devices and Circuits**
Credit Hours	:	3+1=4
Course Code		Theory (EE-122), Practical (EE-123)
Effective	:	2K23-BE(EE)
Pre-Requisites	:	Nil
Weeks/Lectures/Labs	:	16/48/15
Marks	:	Theory (100), Practical (100)
Instructor Name	:	Engr. Dr. Mudassir Ahmed Memon

DESCRIPTION

This course introduces the fundamentals of electronic devices and circuits, including diodes, transistors, FETs, and CMOS devices. Students will learn device characteristics, biasing, circuit analysis, and practical applications such as rectifiers, amplifiers, and basic analog signal processing.

COURSE LEARNING OUTCOMES

Upon successful completion of the course, the student will be able to:

	CLO	Description	Domain	Taxonomy level	PLO	Marks
Theory	1	**Explain** the basic construction, operation and characteristics of semiconductor devices such as diode transistor and other commonly used electronic component.	Cognitive	C2	1	40
	2	**Apply** the acquired knowledge to illustrate the DC and AC response of semiconductor devices-based small-scale electronics circuits.	Cognitive	C3	4	60

LABORATORY LEARNING OUTCOMES:

Upon successful completion of the lab experiments, the student will be able to:

	CLO	Description	Domain	Taxonomy level	PLO	Marks
Practical	**1**	**Assemble** and operate semiconductor-device circuits under guidance, measure and record key quantities, and confirm the expected theoretical behavior.	Psychomotor	P3	9	100

COURSE OUTLINE (THEORY)

Introduction to Electronics (overview of electronic devices and circuits, active and passive components, semiconductor materials and basic concepts, intrinsic and extrinsic semiconductors, energy band theory), Diodes (PN Junction Diode: formation and working principle of PN junction, forward and inverse bias characteristics, ideal vs practical diode, equivalent circuit models, current equation of a diode, diode as a switch; Types of Diodes: Zener diode, LED, photodiode, Schottky diode, varactor diode, tunnel diode; Applications of Diodes: half-wave rectifier, full-wave rectifier (center-tapped & bridge), ripple factor and efficiency, clipper circuits, clamper circuits, voltage multipliers: doubler, Tripler), Bipolar Junction Transistor (BJT) (Fundamentals: construction and operation of BJT, NPN and PNP transistors, unbiased transistor behavior; DC Analysis and Biasing: DC biasing methods, static characteristics (input & output), DC circuit analysis, load line analysis, operating point (Q-point), bias stabilization techniques; Transistor as an Amplifier: basic amplification principle, small signal operation, amplifier characteristics; Transistor Configurations: common emitter (CE), common base (CB), common collector (CC)), Field Effect Transistor (FET) (Introduction: construction and working principle, JFET and MOSFET basics, comparison of BJT and FET; FET Biasing Techniques: fixed bias, self-bias configuration, voltage divider biasing; FET Configurations: common source, common drain, common gate; Universal JFET Bias Curve: transfer characteristics, Shockley equation), Special Transistor Configurations (Darlington pair, advantages and applications), Introduction to CMOS (basic CMOS structure, MOS inverter, advantages of CMOS technology, applications in digital electronics).

COURSE OUTLINE (PRACTICAL)

The emphasis is first on understanding the characteristics of basic circuits that use resistors, capacitors, diodes, bipolar junction transistors and field-effect transistors. The students then use this understanding to design and construct more complex circuits such as rectifiers, amplifiers and power supplies.

RECOMMENDED TEXT AND REFERENCE BOOKS

[1] A. S. Sedra and K. C. Smith, Microelectronic Circuits, Oxford University Press, 2014, ISBN: 0199339139.

[2] B. Razavi, Fundamentals of Microelectronics, Wiley, 2013, ISBN: 1118166323.

[3] R. L. Boylestad and L. Nashelsky, Electronic Devices and Circuit Theory, Prentice Hall, 2012, ISBN: 0132622262.

[4] T. L. Floyd, Electronic Devices (Conventional Current Version), Prentice Hall, 2011, ISBN: 0132549867.

Subject Name	: **Linear Algebra**
Credit Hours	: 3+0=3
Course Code	: Theory (BH-126)
Effective	: 2K23-BE(EE)
Pre-Requisites	: Nil
Weeks/Lectures/Labs	: 16/48/0
Marks	: Theory (100)
Instructor Name	: Engr. Umair Abro

DESCRIPTION

This course covers the fundamentals of linear algebra, including matrices, determinants, vector spaces, linear transformations, eigenvalues and eigenvectors, and their applications in solving systems of linear equations and engineering problems.

COURSE LEARNING OUTCOMES:

Upon successful completion of the course, the student will be able to:

	CLO	Description	Domain	Taxonomy level	PLO	Marks
Theory	1	**Interpret** the existence and uniqueness of solutions geometrically.	Cognitive	C2	1	45
	2	**Apply** algebraic and geometric representations of vectors and their operations in engineering problems.	Cognitive	C3	2	55

COURSE OUTLINE (THEORY)

Systems of Linear Equations (algebra of matrices, types of matrices, matrix operations, inverse of a matrix, Gaussian elimination, Gauss–Jordan method, homogeneous and non-homogeneous systems, rank of a matrix, pivoting strategies), Determinants (definition of determinant, properties of determinants, cofactor expansion, determinants and invertibility, applications of determinants, determinants from a computational point of view), Vector Spaces (vectors in the plane and three dimensions, vector spaces, subspaces, span, linear independence, basis,

dimension, coordinates, change of basis, isomorphism), Eigenvalues and Eigenvectors (characteristic equation, eigenvalues, eigenvectors, diagonalization, Hermitian matrices, eigenvalue problems, applications of eigenvalues), Orthogonality and Least Squares (inner product spaces, orthogonal vectors, orthogonal transformations, orthogonal matrices, least square problems, applications in engineering), Advanced Matrix Concepts (singular value decomposition, quadratic forms, positive definite matrices, non-negative matrices, matrix norms, condition numbers), Numerical Linear Algebra (floating-point numbers, numerical stability, error analysis in linear systems, computational considerations in matrix operations), Systems of Linear Differential Equations (matrix formulation of differential systems, solution using eigenvalue methods, diagonalization approach, applications in engineering systems)

RECOMMENDED TEXT AND REFERENCE BOOKS

[1] B. Kolman and D. Hill, Elementary Linear Algebra, Prentice Hall, 2007, ISBN: 0132296543.

[2] K. Hardy, Linear Algebra for Engineers and Scientists Using Matlab, Prentice Hall, 1st Edition, 2005, ISBN: 0139067280.

[3] S. Goode, Differential Equations and Linear Algebra, Prentice Hall, 2007, ISBN: 0130457949.

[4] G. Strang, Introduction to Linear Algebra, Wellesley-Cambridge Press, 2009, ISBN: 978-0980232714.

Subject Name	:	**Object Oriented Programming**
Credit Hours	:	3+1=4
Course Code	:	Theory (CS-124), Practical (CS-125)
Effective	:	2K23-BE(EE)
Pre-Requisites	:	Nil
Weeks/Lectures/Labs	:	16/48/15
Marks	:	Theory (100), Practical (100)
Instructor Name	:	Engr. Noor ul Ain Patoli

DESCRIPTION

This course introduces the principles of object-oriented programming, including classes, objects, inheritance, polymorphism, encapsulation, and abstraction. Students will learn to design, implement, and debug modular and reusable software using object-oriented concepts and programming languages.

COURSE LEARNING OUTCOMES

Upon successful completion of the course, the student will be able to:

	CLO	Description	Domain	Taxonomy level	PLO	Marks
Theory	1	**Explain** the principles and features of object-oriented programming, including classes, objects, encapsulation, inheritance, polymorphism, and abstraction.	Cognitive	C2	1	55
	2	**Apply** object-oriented concepts to develop, test, and debug modular and reusable programs.	Cognitive	C3	3	45

LABORATORY LEARNING OUTCOMES

Upon successful completion of the lab experiments, the student will be able to:

	CLO	Description	Domain	Taxonomy level	PLO	Marks
Practical	**1**	**Construct** and test object-oriented programs using classes, inheritance, polymorphism, templates, exception handling, and file operations.	Psychomotor	P4	5	100

COURSE OUTLINE (THEORY)

Introduction to Object-Oriented Programming (procedural and object-oriented paradigms; classes and objects; data abstraction and encapsulation), Class Design (data members, member functions, access specifiers, constructors, destructors, copy constructors, static members, const objects and functions), Inheritance (single, multiple, multilevel, hierarchical and hybrid inheritance; protected members; constructor and destructor order), Polymorphism (function overloading, operator overloading, overriding, virtual functions, pure virtual functions and abstract classes), Templates and Exception Handling (function templates, class templates, exception handling), File Handling and Standard Library (file streams, object persistence, standard library concepts), Software Design and Testing (modular design, code reuse, debugging and testing of object-oriented programs).

COURSE OUTLINE (PRACTICAL)

Implementation of classes and objects; constructors and destructors; encapsulation and access control; function and operator overloading; inheritance; virtual functions and runtime polymorphism; abstract classes; templates; exception handling; file handling; and development, testing, and demonstration of a small object-oriented application.

RECOMMENDED TEXT AND REFERENCE BOOKS

[1] P. Deitel and H. Deitel, C++ How to Program, Pearson, latest ed.

[2] R. Lafore, Object-Oriented Programming in C++, Prentice Hall, ISBN: 0672323087, latest ed.

Subject Name	: **Pakistan Studies**
Credit Hours	: 2+0=2
Course Code	: Theory (PS-103)
Effective	: 2K23-BE(EE)
Pre-Requisites	: Nil
Weeks/Lectures/Labs	: 16/32/0
Marks	: Theory (100)
Instructor Name	: Mr. Bisharat lajwani

DESCRIPTION

This course provides an overview of Pakistan's history, ideology, geography, political development, economy, society, and contemporary issues. It emphasizes the understanding of national identity, constitutional development, governance, and the role of Pakistan in regional and global contexts

COURSE LEARNING OUTCOMES

Upon successful completion of the course, the student will be able to:

	CLO	Description	Domain	Taxonomy level	PLO	Marks
Theory	1	**Recall** key events, constitutional developments, geography, and contemporary challenges of Pakistan.	Cognitive	C1	7	40
	2	**Apply** knowledge of political systems to compare different regimes in Pakistan.	Cognitive	C3	6	60

COURSE OUTLINE (THEORY)

Historical Perspective (ideological rationale with special reference to Sir Syed Ahmed Khan, Allama Muhammad Iqbal and Quaid-e-Azam Muhammad Ali Jinnah, factors leading to Muslim separatism, people and land, Indus Civilization, Muslim advent in the subcontinent, location of Pakistan, geo-physical features of Pakistan), Government and Politics in Pakistan (political and constitutional phases: 1947–58, 1958–71, 1971–77, 1977–88, 1988–99, political and constitutional developments from 1999 onward), Contemporary Pakistan (economic institutions and issues, society and social structure, ethnicity and regional diversity, foreign policy of Pakistan and its challenges, futuristic outlook of Pakistan)

RECOMMENDED TEXT AND REFERENCE BOOKS

[1] S. J. Burki, State & Society in Pakistan, The Macmillan Press Ltd, 1980.

[2] S. A. Zaidi, Issues in Pakistan's Economy, Karachi, Pakistan: Oxford University Press, latest ed.

[3] S. M. Burke and L. Ziring, Pakistan's Foreign Policy: An Historical Analysis, Karachi, Pakistan: Oxford University Press, latest ed.

[4] S. Mehmood, Pakistan: Political Roots & Development, Lahore, Pakistan, 1994.

[5] W. Wilcox, The Emergence of Bangladesh, Washington, DC, USA: American Enterprise Institute of Public Policy Research, 1972.

[6] S. Mehmood, Pakistan Kayyun Toota, Lahore, Pakistan: Idara-e-Saqafat-e-Islamia, latest ed.

[7] T. Amin, Ethno-National Movement in Pakistan, Islamabad, Pakistan: Institute of Policy Studies, latest ed.

[8] L. Ziring, Enigma of Political Development, Kent, England: Wm. Dawson & Sons Ltd, 1980.

[9] A. Zahid, History & Culture of Sindh, Karachi, Pakistan: Royal Book Company, 1980.

[10] M. R. Afzal, Political Parties in Pakistan, Vol. I, II & III, Islamabad, Pakistan: National Institute of Historical and Cultural Research, 1998.

[11] K. B. Sayeed, The Political System of Pakistan, Boston, MA, USA: Houghton Mifflin, 1967.

[12] K. K. Aziz, Party Politics in Pakistan, Islamabad, Pakistan: National Commission on Historical and Cultural Research, 1976.

[13] M. Waseem, Pakistan under Martial Law, Lahore, Pakistan: Vanguard, 1987.

[14] N. ul Haq, Making of Pakistan: The Military Perspective, Islamabad, Pakistan: National Commission on Historical and Cultural Research, 1993.

Subject Name	:	**Solid State Electronics**
Credit Hours	:	3+0=3
Course Code	:	Theory (EE-120)
Effective	:	2K23-BE(EE)
Pre-Requisites	:	Nil
Weeks/Lectures/Labs	:	16/48/0
Marks	:	Theory (100)
Instructor Name	:	Engr. Dr. Azhar Ali Ayaz Pirzado

DESCRIPTION

This course covers the principles and applications of solid-state electronic devices, including semiconductors, diodes, transistors, FETs, and optoelectronic devices. Students will study device characteristics, operational principles, and their use in analog and digital circuits.

COURSE LEARNING OUTCOMES

Upon successful completion of the course, the student will be able to:

	CLO	Description	Domain	Taxonomy level	PLO	Marks
Theory	1	**Explain** solid-state physics, quantum-mechanical concepts, semiconductor materials, and electronic devices.	Cognitive	C2	1	50
	2	**Apply** semiconductor concepts to solve problems involving crystal lattices, diodes, and BJTs.	Cognitive	C3	2	50

COURSE OUTLINE (THEORY)

Semiconductor Fundamentals (introduction to semiconductor materials, basic crystal structure of semiconductors, intrinsic and extrinsic semiconductors, energy band theory, carrier concentration, electrical properties of semiconductors), Carrier Transport Mechanisms (drift current, diffusion current, mobility, conductivity, continuity equation, carrier generation and recombination, transport equations), PN Junction and Contacts (formation of pn junction, built-in potential, depletion region, current-voltage characteristics of pn junction, breakdown mechanisms, metal-semiconductor contacts, ohmic and Schottky contacts), Field Effect Transistors (junction field-effect transistor (JFET), mathematical models of JFET, metal oxide semiconductor field-effect transistor (MOSFET), MOS structure and operation, current-voltage characteristics of MOSFET), Bipolar Junction Transistors (structure and operation of bipolar transistors, current components in BJT, Ebers-Moll model, small-signal models, transistor characteristics), Microelectronics (introduction to microelectronics, integrated circuit fabrication overview, scaling of devices, basic concepts of CMOS technology, applications in modern electronic systems)

RECOMMENDED TEXT AND REFERENCE BOOKS

[1] B. Streetman and S. Banerjee, Solid State Electronic Devices, Prentice Hall, ASIN: B00LT83RSE, latest ed.

[2] D. A. Neamen, Semiconductor Physics and Devices: Basic Principles, McGraw-Hill, ISBN: 0073529583, latest ed.

Second Year - Third Semester

Subject Name	:	**Computer-Aided Engineering Design**
Credit Hours	:	0+1=1
Course Code	:	Practical (CS-219)
Effective	:	2K23-BE(EE)
Pre-Requisites	:	Nil
Weeks/Lectures/Labs		16/0/15
Marks	:	Practical (100)
Instructor Name	:	Engr. Abdul Manan Memon

DESCRIPTION

This course introduces the principles and techniques of engineering drawing using computer-aided design (CAD) software. Students learn to create accurate 2D and 3D drawings, orthographic projections, sectional views, assemblies, and engineering documentation for design and manufacturing applications.

LABORATORY LEARNING OUTCOMES

Upon successful completion of the lab experiments, the student will be able to:

	CLO	Description	Domain	Taxonomy level	PLO	Marks
Practical	1	**Operate** computer-aided engineering drawing tools to plan, document, and manage engineering drawings.	Psychomotor	P2	11	45
	2	**Produce** accurate two-dimensional and three-dimensional engineering drawings using CAD software.	Psychomotor	P4	5	55

COURSE OUTLINE (PRACTICAL)

Introduction to computer-aided design tools such as AutoCAD, OrCAD and PCAD; computer-aided drafting principles and practices; engineering drawing fundamentals using AutoCAD; drawing of electrical machinery and layouts of electronic assemblies; design and layout of circuit boards using software (PCAD or OrCAD).

RECOMMENDED TEXT AND REFERENCE BOOKS

[1] S. Lockhart, Tutorial Guide to AutoCAD, Prentice Hall, latest ed.

[2] A. C. Parkinson, "First Year Engineering Drawing".

[3] N.D. Bhatt, Engineering Drawing.

Subject Name	:	**Differential Equations**
Credit Hours	:	3+0=3
Course Code	:	Theory (BH-216)
Effective	:	2K23-BE(EE)
Pre-Requisites	:	Nil
Weeks/Lectures/Labs	:	16/48/0
Marks	:	Theory (100)
Instructor Name	:	Mr. Waseem Javaid Soomro

DESCRIPTION

This course covers the formulation, solution, and applications of ordinary and partial differential equations. Topics include first- and second-order differential equations, series solutions, Laplace and Fourier transforms, and modelling of engineering and physical systems.

COURSE LEARNING OUTCOMES

Upon successful completion of the course, the student will be able to:

	CLO	Description	Domain	Taxonomy level	PLO	Marks
Theory	1	**Define** basic mathematical concepts related to differential equations.	Cognitive	C1	1	30
	2	**Explain** analytical methods used to solve ordinary and partial differential equations.	Cognitive	C2	2	30
	3	**Apply** differential-equation methods to solve engineering problems.	Cognitive	C3	2	40

COURSE OUTLINE (THEORY)

Ordinary Differential Equations (ODEs) (formulation of differential equations, order and degree of a differential equation, linearity of differential equations, complementary and particular solutions, initial-value problems, boundary-value problems, solution of first-order linear differential equations, Bernoulli's differential equation, solution of second-order ordinary differential equations), Partial Differential Equations (PDEs) (origin and formulation of partial differential equations, solutions of first-order partial differential equations, solutions of second-order partial differential equations, higher-order partial differential equations, homogeneous partial differential equations of order one, Lagrange's method of solution), Linear PDEs in Engineering Applications (second-order linear partial differential equations, wave equation, heat equation, applications in engineering and physical sciences, solution using Fourier series), Series Solutions of Differential Equations (review of power series, series solutions near ordinary points, Legendre equation, types of singular points, Euler's equation, series solutions near regular singular points, general case of series solutions near regular singular points, Bessel's equation, Bessel functions)

RECOMMENDED TEXT AND REFERENCE BOOKS

[1] E. Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, 2011, ISBN: 0470458364.

[2] J. Polking, A. Boggess, and D. Arnold, Differential Equations, Prentice Hall, 2006, ISBN: 0131437380.

[3] S. Goode, Differential Equations and Linear Algebra, Prentice Hall, ISBN: 0130457949, latest ed.

Subject Name	:	**Digital Logic Design**
Credit Hours	:	3+1=4
Course Code	:	Theory (EE-214), Practical (EE-215)
Effective	:	2K23-BE(EE)
Pre-Requisites	:	Nil
Weeks/Lectures/Labs	:	16/48/15
Marks	:	Theory (100), Practical (100)
Instructor Name	:	Dr. Raza Hussain Shah

DESCRIPTION

This course introduces the principles of digital logic design, including number systems, Boolean algebra, logic gates, combinational and sequential circuits, state machines, memory elements, and basic programmable logic devices. Students will develop skills for designing and analyzing digital systems.

COURSE LEARNING OUTCOMES

Upon successful completion of the course, the student will be able to:

	CLO	Description	Domain	Taxonomy level	PLO	Marks
Theory	1	**Explain** the fundamentals and underlying principles of digital design.	Cognitive	C2	1	10
	2	**Apply** number-system conversion and K-map minimization techniques to solve digital-logic problems.	Cognitive	C3	2	60
	3	**Use** truth tables and state equations to implement combinational and sequential logic circuits.	Cognitive	C3	3	30

LABORATORY LEARNING OUTCOMES

Upon successful completion of the lab experiments, the student will be able to:

	CLO	Description	Domain	Taxonomy level	PLO	Marks
Practical	1	**Construct** and test basic, combinational, and sequential digital-logic circuits to obtain the specified outputs.	Psychomotor	P4	4	100

COURSE OUTLINE (THEORY)

Introduction to Digital Design (basic concepts of digital systems, number systems, logic levels, logic gates, Boolean algebra, DeMorgan's theorems, simplification of Boolean functions), Combinational Logic Design (Karnaugh maps, tabulation techniques: Quine-McCluskey, design of combinational circuits, adders, subtractors, multiplexers, demultiplexers, encoders, decoders, comparators), Sequential Logic Design (sequential circuits, flip-flops: SR, JK, D, T, registers, shift registers, counters, synchronous and asynchronous circuits, state machines, memory elements, simple programmable logic devices (SPLDs)), Hardware Description Languages (HDL) (introduction to Verilog and VHDL, simulation of combinational and sequential circuits, synthesis and hardware implementation), Practical Implementation and Project Work (implementation of sequential circuits using Verilog/VHDL, implementation of logic circuits using SPLDs, project solving a real-life problem using digital design techniques, testing and verification of digital systems)

COURSE OUTLINE (PRACTICAL)

Basic logic gates; Verilog simulation and hardware implementation of combinational circuits such as MUX/DEMUX, encoder/decoder, arithmetic logic unit (ALU); Verilog simulation and hardware implementation of sequential circuits such as flip-flops, registers, shift registers, counters; implementation of logic circuits using SPLDs; project solving a real-life problem.

RECOMMENDED TEXT AND REFERENCE BOOKS

[1] M. M. Mano and C. Kime, Logic and Computer Design Fundamentals, Prentice Hall, ISBN: 013198926X, latest ed.

[2] T. L. Floyd, Digital Fundamentals, Prentice Hall, ISBN: 0132359235, latest ed.

[3] R. Tokheim, Digital Electronics: Principles and Applications, Student Text with MultiSIM CD-ROM, Career Education, 6th ed., 2002, ISBN: 0078309816.

[4] W. Kleitz, Digital Electronics: A Practical Approach with VHDL, Pearson, ISBN: 0132543036, latest ed.

Subject Name	:	**Electronic Circuit Design**
Credit Hours	:	3+1=4
Course Code	:	Theory (EE-210) Practical (EE-211)
Effective	:	2K23-BE(EE)
Pre-Requisites	:	Nil
Weeks/Lectures/Labs	:	16/48/15
Marks	:	Theory (100), Practical (100)
Instructor Name	:	Engr. Fozia Hajano

DESCRIPTION

This course covers the design, analysis, and implementation of electronic circuits using diodes, transistors, and FETs. Topics include amplifier design, biasing techniques, feedback, oscillators, and practical analog circuit applications.

COURSE LEARNING OUTCOMES

Upon successful completion of the course, the student will be able to:

	CLO	Description	Domain	Taxonomy level	PLO	Marks
Theory	1	**Explain** the basic concepts of amplifiers and its behavioral analysis with the help of hybrid parameters, AC & DC load lines	Cognitive	C2	1	30
	2	**Infer** the frequency characteristics and stability analysis of different electronic devices including filters, amplifiers, and oscillators	Cognitive	C4	2	52
	3	**Apply** operational-amplifier, active-filter, oscillator, and data-converter concepts to design small-scale electronic circuits.	Cognitive	C3	3	18

LABORATORY LEARNING OUTCOMES

Upon successful completion of the lab experiments, the student will be able to:

	CLO	Description	Domain	Taxonomy level	PLO	Marks
Practical	1	**Practice** electrical parameters under guidance and frequency response of different discrete electronic circuit designs & signal generators.	Psychomotor	P3	5	100

COURSE OUTLINE (THEORY)

Amplifier Analysis (transistor as an amplifier, hybrid model of a transistor, small-signal analysis, large-signal analysis, gain calculation of single-stage amplifier, cascading, multistage gain calculations), Classification of Amplifiers (based on biasing: Class A, Class B, Class AB, Class C, push-pull, complementary symmetry; based on coupling: RC-coupled, transformer-coupled, direct-coupled; based on frequency: audio-frequency, radio-frequency, tuned), Feedback in Amplifiers (feedback concept, feedback amplifiers, voltage feedback amplifier, current feedback amplifier, effect of feedback on gain and frequency response), Practical Amplifier Considerations (input and output impedance, amplifier loading, impedance matching, stability, distortion, bandwidth considerations), Oscillators (basic theory of oscillators, tank circuit, damped and undamped oscillations, phase-shift oscillator, Colpitts oscillator, Hartley oscillator, Wien bridge oscillator, Clapp oscillator, frequency determination).

COURSE OUTLINE (PRACTICAL)

Transistor curve tracer, introduction to PSPICE and AC voltage dividers, characterization and design of emitter and source followers, characterization and design of AC variable-gain amplifier, design of test circuits for BJTs and FETs, design of FET ring oscillators, design and characterization of emitter-coupled transistor pairs, tuned amplifier and oscillator, design of oscillators.

RECOMMENDED TEXT AND REFERENCE BOOKS

[1] A. S. Sedra and K. C. Smith, Microelectronic Circuits, Oxford University Press, ISBN: 0199339139, latest ed.

[2] B. Razavi, Fundamentals of Microelectronics, Wiley, ISBN: 1118166323, latest ed.

[3] R. L. Boylestad and L. Nashelsky, Electronic Devices and Circuit Theory, Prentice Hall, ISBN: 0132622262, latest ed.

[4] T. L. Floyd, Electronic Devices (Conventional Current Version), Prentice Hall, ISBN: 0132549867, latest ed.

Subject Name	:	**Instrumentation and Measurements**
Credit Hours	:	3+1=4
Course Code	:	Theory (EE-212), Practical (EE-213)
Effective	:	2K23-BE(EE)
Pre-Requisites	:	Nil
Weeks/Lectures/Labs	:	16/48/15
Marks	:	Theory (100), Practical (100)
Instructor Name	:	Engr. Dr. Aamir Hussain Memon

DESCRIPTION

This course introduces the principles and techniques of measurement and instrumentation. Topics include measurement of electrical and non-electrical quantities, transducers and sensors, signal conditioning, data acquisition systems, and modern instrumentation for industrial and scientific applications.

COURSE LEARNING OUTCOMES

Upon successful completion of the course, the student will be able to:

	CLO	Description	Domain	Taxonomy level	PLO	Marks
Theory	1	**Explain** the fundamentals and elementary concepts of measurement and instrumentation systems.	Cognitive	C2	1	35
	2	**Apply** measurement principles to select and use electrical and electronic instruments.	Cognitive	C3	1	35
	3	**Apply** signal-conditioning principles to transducers and sensors used in instrumentation systems.	Cognitive	C3	3	30

LABORATORY LEARNING OUTCOMES

Upon successful completion of the lab experiments, the student will be able to:

	CLO	Description	Domain	Taxonomy level	PLO	Marks
Practical	1	**Set up** and operate measurement and instrumentation systems under guidance, acquire data, and verify instrument performance.	Psychomotor	P3	5	100

COURSE OUTLINE (THEORY)

Fundamentals of Measurement (precision measurement terminologies: resolution, sensitivity, accuracy, uncertainty; engineering units and standards; principles of different measurement techniques), Measurement of Physical Quantities (instruments for measurement of electrical properties, pressure, temperature, position, velocity, flow rates: mass and volume, concentration; transducers and sensors for various applications), Instrumentation Systems and Signal Processing (systems for signal processing and signal transmission, static and dynamic responses of instrumentation, signal conditioning, modern instrumentation techniques, data acquisition systems, basic data manipulation using personal computers and graphs), Electrical Measuring Instruments (principles of operation, construction, and working of analog and digital meters, oscilloscopes, recording instruments, signal generators, power and energy meters, bridges for measurement of resistance, inductance, and capacitance, high-voltage measurements).

COURSE OUTLINE (PRACTICAL)

Design, construction, and analysis of measurement circuits, data acquisition circuits, instrumentation devices, and automatic testing; measurement of electrical parameters using different lab instruments; calibration of measurement instruments; use of data acquisition systems for presentation and interpretation of data; use of microcomputers to acquire and process data; use of simulation and instrumentation languages (LabVIEW).

RECOMMENDED TEXT AND REFERENCE BOOKS

[1] K. B. Klaassen and S. Gee, Electronic Measurement and Instrumentation, Cambridge University Press, ISBN: 0521477298, latest ed.

[2] K. James, PC Interfacing and Data Acquisition: Techniques for Measurement, Instrumentation and Control, ISBN: 0750646241, latest ed.

Second Year - Fourth Semester

Subject Name	:	**Complex Variables and Transforms**
Credit Hours	:	3+0=3
Course Code	:	Theory (BH-226)
Effective	:	2K23-BE(EE)
Pre-Requisites	:	Nil
Weeks/Lectures/Labs	:	16/48/0
Marks	:	Theory (100)
Instructor Name	:	Dr. Shahnawaz Shah

DESCRIPTION

This course introduces complex variable theory and integral transforms for engineering applications. Topics include analytic functions, Cauchy-Riemann equations, contour integration, singularities, residues, Laplace and Fourier transforms, and their use in solving differential equations and system analysis.

COURSE LEARNING OUTCOMES

Upon successful completion of the course, the student will be able to:

	CLO	Description	Domain	Taxonomy level	PLO	Marks
Theory	1	Define the complex number, complex functions, and fundamental theorems of complex-valued functions.	Cognitive	C1	1	30
	2	**Illustrate** the concept of the calculus for the complex-valued functions and the properties of various transforms	Cognitive	C2	1	30
	3	**Apply** the computational and conceptual principles of various transforms for solving problems in engineering and the sciences.	Cognitive	C3	2	40

COURSE OUTLINE (THEORY)

Complex Numbers and Functions (introduction to complex number systems, Argand's diagram, modulus and argument of a complex number, polar form, De Moivre's theorem and applications, complex functions, analytical functions, harmonic and conjugate harmonic functions, Cauchy-Riemann equations), Complex Integration (line integrals, Green's theorem, Cauchy's theorem, Cauchy's integral formula, singularities, poles, residues, contour integration, applications of residue theorem in engineering problems), Laplace Transform (definition, Laplace transforms of elementary functions, properties, periodic functions and their transforms, inverse Laplace transform and its properties, convolution theorem, inverse Laplace transform by integral and partial fraction methods, Heaviside expansion formula, solution of

ordinary differential equations, engineering applications), Series Solutions of Differential Equations (series solution of differential equations, validity of series solution, ordinary and singular points, Frobenius method, indicial equation, Bessel differential equation and solution of first kind, recurrence formulae, Legendre differential equation and solution, Rodrigues formula), Fourier Transform (definition, transforms of simple functions, magnitude and phase spectra, Fourier transform theorems, inverse Fourier transform, solution of differential equations, applications in signal processing and engineering).

RECOMMENDED TEXT AND REFERENCE BOOKS

[1] E. Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, ISBN: 0470458364, latest ed.

[2] M. Rahman, Complex Variables and Transform Calculus, Computational Mechanics Publications, ISBN: 1853124915, latest ed.

[3] F. Ladeinde, Applications of Complex Variables: Asymptotics and Integral Transforms, Walter de Gruyter, ISBN: 9783111351292, latest ed.

Subject Name	:	**Electrical Network Analysis**
Credit Hours	:	3+1=4
Course Code	:	Theory (EE-224), Practical (EE-225)
Effective	:	2K23-BE(EE)
Pre-Requisites	:	Nil
Weeks/Lectures/Labs	:	16/48/15
Marks	:	Theory (100), Practical (100)
Instructor Name	:	Mr. Waseem Javaid Soomro

DESCRIPTION

This course introduces the principles and techniques for analyzing electrical networks. Topics include network theorems, AC and DC circuit analysis, phasor techniques, transient and steady-state responses, resonance, and applications in electrical engineering systems.

COURSE LEARNING OUTCOMES

Upon successful completion of the course, the student will be able to:

	CLO	Description	Domain	Taxonomy level	PLO	Marks
Theory	1	**Explain** the effects of power transfer, power dissipation, and power factor in electrical networks.	Cognitive	C2	1	50
	2	**Apply** time-domain and s-domain circuit-analysis techniques to RLC networks and transient responses.	Cognitive	C3	2	50

LABORATORY LEARNING OUTCOMES:

Upon successful completion of the lab experiments, the student will be able to

	CLO	Description	Domain	Taxonomy level	PLO	Marks
Practical	1	**Establish** circuits on breadboards, perform electrical measurements, and analyze results using modern engineering tools.	Psychomotor	P2	9	100

COURSE OUTLINE (THEORY)

AC Circuits and Network Analysis (complete response of RLC circuit, resonance, lossless LC circuit, complex forcing functions, phase relationships for R, L, and C, impedance and admittance, sinusoidal steady-state response, quality factor, power factor and power factor improvement, complex frequency), Three-Phase Circuits (three-phase balanced and unbalanced circuits, three-phase source-load connections, power relationships), Magnetically Coupled Circuits (mutual inductance, energy considerations, ideal transformers), Frequency Response and Network Performance (variable frequency network performance, variable frequency response analysis, sinusoidal frequency analysis), Transform Methods in Circuit Analysis (analysis of circuits using Laplace transform and Bode plot, analysis of circuits using Fourier series), Resonant and Filter Circuits (resonant circuits, filter circuits), Two-Port Networks (general two-port networks, impedance parameters, admittance parameters, transmission parameters, hybrid parameters, interconnection of two-port networks).

COURSE OUTLINE (PRACTICAL)

Basic RL and RC circuits, RLC circuit, sinusoidal steady-state analysis, AC power circuit analysis, poly phase circuits, frequency-domain analysis and Bode plots, network analysis in the s-domain, mutual inductance and transformers, two-port networks, circuit analysis techniques using software packages such as PSPICE, Electronic Workbench, Multi-Sim, and Lab View.

RECOMMENDED TEXT AND REFERENCE BOOKS

[1] W. Hayt, J. Kemmerly, and S. Durbin, Engineering Circuit Analysis, McGraw-Hill Science/Engineering/Math, ISBN: 0073529575, latest ed.

[2] J. D. Irwin and R. M. Nelms, Basic Engineering Circuit Analysis, Wiley, ISBN: 0470633220, latest ed.

[3] R. L. Boylestad, Introductory Circuit Analysis, Prentice Hall, ISBN: 0137146663, latest ed.

[4] M. H. Rashid, Introduction to PSpice Using OrCAD for Circuits and Electronics, Prentice Hall, ISBN: 0131019880, latest ed.

Subject Name	:	**Integrated Electronics**
Credit Hours	:	3+1=4
Course Code	:	Theory (EE-222), Practical (EE-223)
Effective	:	2K23-BE(EE)
Pre-Requisites	:	Nil
Weeks/Lectures/Labs	:	16/48/15
Marks	:	Theory (100), Practical (100)
Instructor Name	:	Engr. Fozia Hajano

DESCRIPTION

This course covers the principles, design, and applications of integrated electronic circuits. Topics include operational amplifiers, analog and digital ICs, device characteristics, signal processing, and practical circuit design using integrated components.

COURSE LEARNING OUTCOMES

Upon successful completion of the course, the student will be able to:

	CLO	Description	Domain	Taxonomy level	PLO	Marks
Theory	1	**Explain** integrated-circuit fabrication, internal biasing circuits, current mirrors, current sources, and logic families.	Cognitive	C2	1	15
	2	**Analyze** operational-amplifier applications, including differentiators, integrators, comparators, summing circuits, and data converters.	Cognitive	C4	2	60
	3	**Apply** operational-amplifier configurations to design circuits for specified applications.	Cognitive	C3	3	25

LABORATORY LEARNING OUTCOMES

Upon successful completion of the lab experiments, the student will be able to:

	CLO	Description	Domain	Taxonomy level	PLO	Marks
Practical	1	**Perform** simulation, hardware implementation, testing, and measurement of integrated electronic circuits using operational amplifiers and timer ICs with appropriate laboratory and simulation tools under guidance, and construct a semester project based on integrated electronics.	Psychomotor	P3	5	100

COURSE OUTLINE (THEORY)

Pulse and Switching Circuits (design and analysis of pulse circuits, switching circuits and their characteristics, monostable, astable, and bistable multivibrators, emitter-coupled flip-flop, noise margin, fan-out, propagation delay, Schmitt trigger), Logic Families (saturating and non-saturating logic families: DTL, TTL, ECL, I^2L, CMOS), Timer ICs and Applications (detailed study of timer ICs, monostable and astable configurations, applications of timer circuits), Analog and Digital Circuit Interface (analog and digital interfacing techniques, mixed-signal applications), Fabrication of Digital Microelectronic Circuits (introduction to pMOS, nMOS, CMOS and BiCMOS circuits, epitaxy, ion implantation, oxidation), Differential Amplifiers (DC and AC analysis of differential amplifier, design of simple differential amplifier, level translator), Current Sources and Output Stage Design (simple current mirror, Wilder current source, Wilson current source, output stage design), Operational Amplifiers (op-amp as a circuit element, offset and offset compensation, op-amp with negative feedback, frequency response, DC and AC analysis of op-amp ICs), Amplifiers (linear and non-linear applications).

COURSE OUTLINE (PRACTICAL)

Comparator analysis, inverting and non-inverting amplifiers, analog-to-digital and digital-to-analog converters, dual regulator, switched-capacitor voltage converter, op-amp DC characteristic measurement, op-amp speed, single-supply op-amp, function generator, phase locked-loop, frequency synthesizer.

RECOMMENDED TEXT AND REFERENCE BOOKS

[1] A. S. Sedra and K. C. Smith, Microelectronic Circuits, Oxford University Press, ISBN: 0199339139, latest ed.

[2] B. Razavi, Fundamentals of Microelectronics, Wiley, ISBN: 1118166323, latest ed.

[3] R. L. Boylestad and L. Nashelsky, Electronic Devices and Circuit Theory, Prentice Hall, ISBN: 0132622262, latest ed.

[4] T. L. Floyd and D. M. Buchla, Basic Operational Amplifiers and Linear Integrated Circuits, 2nd ed., Prentice Hall, 1999, ISBN: 0130829870.

[5] T. L. Floyd, Electronic Devices (Conventional Current Version), Prentice Hall, ISBN: 0132549867, latest ed.

Subject Name	:	**Islamic Studies**
Credit Hours	:	2+0=2
Course Code	:	Theory (IS-202)
Effective	:	2K23-BE(EE)
Pre-Requisites	:	Nil
Weeks/Lectures/Labs	:	16/32/0
Marks	:	Theory (100)
Instructor Name	:	Mr. Muzammil Ahmed Ansari

DESCRIPTION

This course introduces the fundamental concepts of Islam, including the study of the Holy Quran, Seerah of the Holy Prophet (S.A.W), Hadith, Islamic law and jurisprudence, Islamic culture and civilization, and the social, economic, and political teachings of Islam.

COURSE LEARNING OUTCOMES

Upon successful completion of the course, the student will be able to:

	CLO	Description	Domain	Taxonomy level	PLO	Marks
Theory	1	**Explain** fundamental concepts of the Quran, Hadith, Sunnah, and the life of the Holy Prophet (S.A.W.).	Cognitive	C2	6	60
	2	**Explain** Islamic ethics, law, culture, civilization, and contemporary social responsibilities.	Cognitive	C2	8	40

COURSE OUTLINE (THEORY)

Introduction to Quranic Studies (basic concepts of the Quran, history of the Holy Quran, Uloom-ul-Quran, study of selected texts: Surah Al-Baqara 284–286, Surah Al-Hujrat 1–18, Surah Al-Mumanoon 1–11, Surah Al-Furqan 63–77, Surah Al-Inam 162–164, Surah Al-Ihzab 6, 21, 40, 56–58, Surah Al-Hashar 18–20, Surah Al-Saf- 1, 14), Seerat of the Holy Prophet (S.A.W) (life before Prophethood, life in Makkah: important lessons, life in Madina: important events and lessons), Introduction to Sunnah and Hadith (basic concepts, history, kinds of Hadith, Uloom-ul-Hadith, legal position of Sunnah, selected study from Hadith texts), Introduction to Islamic Law & Jurisprudence (basic concepts, history and importance, sources, nature of differences, Islam and sectarianism), Islamic Culture & Civilization (basic concepts,

historical development, characteristics, contemporary issues), Islam & Science (basic concepts, contributions of Muslims in science, relationship between Quran and science), Islamic Economic System (basic concepts, means of distribution of wealth, Islamic concept of Riba, Islamic ways of trade and commerce), Political System of Islam (basic concepts, Islamic concept of sovereignty, basic institutions of government), Islamic History (period of Khilafat-e-Rashida, period of Umayyads, period of Abbasids), Social System of Islam (basic concepts, elements of family, ethical values of Islam).

RECOMMENDED TEXT AND REFERENCE BOOKS

[1] M. Hameed Ullah, Emergence of Islam, IRI, Islamabad, latest ed.

[2] M. Hameed Ullah, Muslim Conduct of State, latest ed.

[3] M. Hameed Ullah, Introduction to Islam, latest ed.

[4] H. H. Hassan, An Introduction to the Study of Islamic Law, Leaf Publication, Islamabad, Pakistan, latest ed.

[5] A. Hasan, Principles of Islamic Jurisprudence, Islamic Research Institute, International Islamic University, Islamabad, latest ed.

[6] M. Waliullah, Muslim Jurisprudence and the Quranic Law of Crimes, Islamic Book Service, latest ed.

[7] H. S. Bhatia, Studies in Islamic Law, Religion and Society, Deep & Deep Publications, New Delhi, latest ed.

[8] M. Zia-ul-Haq, Introduction to Al Sharia Al Islamia, Allama Iqbal Open University, Islamabad, latest ed.

Subject Name	:	**Ethics (Alternative to Islamic Studies)**
Credit Hours	:	2+0=2
Course Code	:	Theory (IS-202)
Effective	:	2K23-BE(EE)
Pre-Requisites	:	Nil
Weeks/Lectures/Labs	:	16/32/0
Marks	:	Theory (100)
Instructor Name	:	Mr. Muzammil Ahmed Ansari

DESCRIPTION

As an alternative to Islamic Studies for eligible non-Muslim students, this course introduces the fundamental concepts of ethics, including the study of moral philosophies, ethical principles, professional and social responsibilities, human values, cultural and civic understanding, and the social, economic, and ethical dimensions of human behavior and society.

COURSE LEARNING OUTCOMES

Upon successful completion of the course, the student will be able to:

	CLO	Description	Domain	Taxonomy level	PLO	Marks
Theory	1	**Explain** the fundamental concepts of ethics, moral values, and ethical theories.	Cognitive	C2	6	50
	2	**Apply** ethical principles and moral reasoning to personal, social, and professional issues.	Cognitive	C3	8	50

Introduction to Ethics (basic concepts of ethics, nature and scope of ethics, ethics and morality, ethics and values, importance of ethics in individual and social life), Historical Development of Ethical Thought (ancient ethical traditions, Greek ethics, medieval and modern ethical philosophies, contemporary ethical perspectives), Ethical Theories (utilitarianism, deontology, virtue ethics, egoism, intuitionism, rationalism, moral reasoning and decision making), Ethics and Religion (relationship between ethics and religion, ethical teachings of major world religions including Christianity, Hinduism, Buddhism, Judaism, Sikhism, Islam, and Zoroastrianism), Professional and Applied Ethics (professional ethics, business ethics, engineering ethics, teacher and student ethics, environmental ethics, media ethics, bioethics), Human Values and Society (justice, tolerance, honesty, integrity, responsibility, human rights, social harmony, peaceful coexistence), Ethics and Contemporary Issues (ethics in science and

technology, ethics in economics and politics, globalization and cultural diversity, ethics in social media and communication), Ethical Decision Making (critical thinking, ethical dilemmas, case studies, conflict resolution, moral accountability), Civic and Social Responsibilities (citizenship, community service, leadership, respect for diversity, social welfare and sustainable development).

RECOMMENDED TEXT AND REFERENCE BOOKS

[1] W. Lillie, An Introduction to Ethics. London, U.K.: Methuen & Co. Ltd.

[2] J. S. Mackenzie, A Manual of Ethics. London, U.K.: University Tutorial Press.

[3] M. W. Martin and R. Schinzinger, Ethics in Engineering, 4th ed. New York, NY, USA: McGraw-Hill.

[4] C. E. Harris, M. S. Pritchard, and M. J. Rabins, Engineering Ethics: Concepts and Cases, 4th ed. Boston, MA, USA: Wadsworth Cengage Learning.

[5] J. Rachels and S. Rachels, The Elements of Moral Philosophy, 9th ed. New York, NY, USA: McGraw-Hill Education.

Subject Name	:	**Microprocessors and Microcontrollers**
Credit Hours	:	3+1=4
Course Code	:	Theory (EE-220), Practical (EE-221)
Effective	:	2K23-BE(EE)
Pre-Requisites	:	Nil
Weeks/Lectures/Labs	:	16/48/15
Marks	:	Theory (100), Practical (100)
Instructor Name	:	Engr. Abdul Manan Memon

DESCRIPTION

This course introduces the fundamental concepts of microprocessors and microcontrollers, including architecture, instruction sets, programming, memory systems, and I/O interfacing. It covers ADC/DAC, interrupts, DMA, and interfacing techniques for developing microprocessor- and microcontroller-based systems. Practical sessions focus on programming, interfacing, and implementing embedded systems through hands-on experiments and projects

COURSE LEARNING OUTCOMES

Upon successful completion of the course, the student will be able to

	CLO	Description	Domain	Taxonomy level	PLO	Marks
Theory	1	**Explain** the fundamental concepts of microprocessor-based system design using appropriate architectural and timing diagrams.	Cognitive	C2	2	50
	2	**Apply** microcontroller-based system-design knowledge to interface input/output devices and memory integrated circuits.	Cognitive	C3	3	50

LABORATORY LEARNING OUTCOMES

Upon successful completion of the lab experiments, the student will be able to

	CLO	Description	Domain	Taxonomy level	PLO	Marks
Practical	1	**Construct** and verify microprocessor- and microcontroller-based interface circuits using training kits and simulation tools.	Psychomotor	P3	5	100

COURSE OUTLINE (THEORY)

Intel Family Microprocessors (introduction to Intel family microprocessors, instruction set architecture (ISA), assembly language programming, hardware model, read/write cycles, exception and interrupt processing, memory systems, I/O devices, direct memory access (DMA), interfacing to memory and I/O devices, analog-to-digital converters (ADC), digital-to-analog converters (DAC)), Microcontrollers (introduction to PIC and Atmel 8051 microcontrollers, microcontroller architecture, addressing modes, programming of microcontrollers).

COURSE OUTLINE (PRACTICAL)

Study of Intel microprocessor ISA using its training boards, implementation of interfacing techniques (using gates, decoders, and SPLDs) to memory system and different I/O devices, learning and implementation of interrupt-driven I/O, learning and implementation of simple microcontroller-based circuits, followed by a course project for demonstration of the practical skills developed.

RECOMMENDED TEXT AND REFERENCE BOOKS

[1] B. B. Brey, The Intel Microprocessors, Prentice Hall, ISBN: 0135026458, latest ed.

[2] D. V. Hall, Microprocessor and Interfacing, Tata McGraw-Hill, Revised, ISBN: 0070601674, latest ed.

[3] M. A. Mazidi and J. Gillispie-Mazidi, 80X86 IBM PC and Compatible Computers: Assembly Language, Design, and Interfacing, Prentice Hall, ISBN: 013061775X.

[4] M. A. Mazidi, J. Mazidi, and R. McKinlay, 8051 Microcontroller and Embedded Systems, Prentice Hall, ISBN: 013119402X, latest ed.

Third Year - Fifth Semester

Subject Name	:	**Electrical Machines**
Credit Hours	:	3+1=4
Course Code	:	Theory (EE-310), Practical (EE-311)
Effective	:	2K23-BE(EE)
Pre-Requisites	:	Nil
Weeks/Lectures/Labs	:	16/48/15
Marks	:	Theory (100), Practical (100)
Instructor Name	:	Engr. Dr. Aamir Hussain Memon

DESCRIPTION

This course covers the principles, construction, operation, and performance of electrical machines. Topics include transformers, DC machines, AC machines, induction motors, synchronous machines, and special machines, along with their characteristics, control, and industrial applications.

COURSE LEARNING OUTCOMES

Upon successful completion of the course, the student will be able to:

	CLO	Description	Domain	Taxonomy level	PLO	Marks
Theory	1	**Explain** electromechanical energy-conversion concepts and the construction and operation of AC and DC machines.	Cognitive	C2	1	35
	2	**Apply** machine characteristics and equivalent-circuit concepts to analyze AC and DC generators and motors.	Cognitive	C3	2	35
	3	**Explain** the construction, operating principles, and performance of transformers.	Cognitive	C2	4	30

LABORATORY LEARNING OUTCOMES

Upon successful completion of the lab experiments, the student will be able to:

	CLO	Description	Domain	Taxonomy level	PLO	Marks
Practical	1	**Perform** and analyze laboratory tests on transformers, AC and DC motors, and generators using standard procedures. under guidance of instructor	Psychomotor	P3	5	100

COURSE OUTLINE (THEORY)

Magnetic Circuits (magnetic circuits and calculations, single-phase circuits, polyphase circuits), Transformers (principle of operation, construction, types, EMF equation, transformation ratio, equivalent values, equivalent power circuit diagram, impedance matching, operation and phasor diagram with and without load, measurement of losses and efficiency, parallel operation, cooling methods, three-phase connections, instrumentation transformers), DC Machines (construction, types, armature reaction, no-load and on-load voltage characteristics of series and shunt generators, division of loads in parallel operation, torque-speed characteristics, measurement of losses and efficiency), AC Machines (AC machine armature winding, three-phase windings, magnetomotive force (MMF) of distributed windings, speed and direction of rotating magnetic field), Induction Motors (types, construction, principle of operation, induced EMF, relation between stator and rotor quantities, phasor diagram, equivalent circuit diagram, torque-slip-power relations), Synchronous and Special Machines (synchronous generators, brushless DC motors, switched-reluctance motors, stepper motors).

COURSE OUTLINE (PRACTICAL)

Characteristics of DC series and shunt motors, DC series and shunt generators, AC induction motor, synchronous generator, induction generator, universal motor, brushless DC motor and switched reluctance motor; transformer theory and testing.

RECOMMENDED TEXT AND REFERENCE BOOKS

[1] S. Umans, Fitzgerald & Kingsley's Electric Machinery, McGraw-Hill Science/Engineering/Math, ISBN: 0073380466, latest ed.

[2] S. Chapman, Electric Machinery Fundamentals, McGraw-Hill - Science/Engineering/Math, ISBN: 0073529540, latest ed.

[3] T. Wildi, Electrical Machines, Drives and Power Systems, Prentice Hall, 2005, ISBN: 0131776916.

Subject Name	:	**Electromagnetic Field Theory**
Credit Hours	:	3+0=3
Course Code	:	Theory (EE-314)
Effective	:	2K23-BE(EE)
Pre-Requisites	:	Nil
Weeks/Lectures/Labs	:	16/48/0
Marks	:	Theory (100)
Instructor Name	:	Dr. Shahnawaz Shah

DESCRIPTION

This course introduces the fundamental concepts of electromagnetic fields and waves. Topics include vector analysis, Coulomb's law, Gauss's law, electric and magnetic fields, Maxwell's equations, electromagnetic wave propagation, and applications in engineering systems.

COURSE LEARNING OUTCOMES

Upon successful completion of the course, the student will be able to:

	CLO	Description	Domain	Taxonomy level	PLO	Marks
Theory	1	**Explain** vector algebra and vector calculus in commonly used orthogonal coordinate systems.	Cognitive	C2	1	30
	2	**Analyze** electrostatic and magnetostatic fields produced by stationary and moving charges.	Cognitive	C4	2	30
	3	**Analyze** time-varying electromagnetic fields using Maxwell equations and appropriate boundary conditions.	Cognitive	C4	3	40

COURSE OUTLINE (THEORY)

Vector Analysis (vector algebra, vector calculus, gradient, divergence, curl, line, surface, and volume integrals, Gauss's and Stokes' theorems, applications in electromagnetics), Electrostatics (Coulomb's law, electric field intensity, Gauss's law, flux density, divergence, energy in electrostatic fields, electric potential, conductors, dielectrics, capacitance, Poisson's and Laplace's equations), Magnetostatics (steady-state magnetic fields, magnetic forces, magnetic materials, inductance, Ampere's law, Biot-Savart law), Time-Varying Fields (Faraday's law of induction, displacement current, Maxwell's equations in integral and differential forms, wave propagation concepts), Electromagnetic Waves (uniform plane waves, wave equations, propagation in free space and materials, basic characteristics: wavelength, phase velocity, polarization, Poynting vector).

RECOMMENDED TEXT AND REFERENCE BOOKS

[1] W. Hayt and J. A. Buck, Engineering Electromagnetics, McGraw-Hill, ISBN: 0073104639, latest ed.

[2] M. N. Sadiku, Elements of Electromagnetics, Oxford University Press, ISBN: 0195103688, latest ed.

[3] Z. B. Popović and B. D. Popović, Introductory Electromagnetics, Prentice Hall, latest ed.

[4] J. A. Kong, Electromagnetic Wave Theory, Wiley, ISBN: 0471828238, latest ed.

Subject Name	:	**Organizational Behavior**
Credit Hours	:	3+0=3
Course Code	:	Theory (BH-318)
Effective	:	2K23-BE(EE)
Pre-Requisites	:	Nil
Weeks/Lectures/Labs	:	16/48/0
Marks	:	Theory (100)
Instructor Name	:	Engr. Syed Safiullah Shah Syed

DESCRIPTION

This course explores the behavior of individuals and groups within organizations. Topics include motivation, leadership, communication, group dynamics, organizational culture, stress management, and strategies for improving productivity and workplace effectiveness.

COURSE LEARNING OUTCOMES

Upon successful completion of the course, the student will be able to:

	CLO	Description	Domain	Taxonomy level	PLO	Marks
Theory	1	**Define** organizational behavior and list its relevance to the workplace.	Cognitive	C1	10	14
	2	**Describe** the effects of workforce diversity on organizational performance.	Cognitive	C2	11	14
	3	**Apply** methods that encourage ethical behavior and good corporate practices.	Cognitive	C3	8	18
	4	**Explain** the importance of recognizing and valuing individual differences.	Cognitive	C2	12	30
	5	**Discuss** the effects of organizational culture on individuals and the workplace.	Cognitive	C2	12	24

COURSE OUTLINE (THEORY)

Introduction to Organizational Behaviour (organizational disciplines and topics, psychological perspective, social-psychological perspectives), Structure and Control in Organizations (organizational structure, bureaucracy, managerial work, contingency theory, organizational design), Individual and Work Learning (learning theories, learning and work), Stress (types of stress at work, occupational stress management), Individual Differences (personality and its factors, personality dimensions and social learning, intelligence), Motivation and Job Satisfaction (needs at work, theories of motivation and job satisfaction, correlates of job satisfaction), Group and Work (social interaction, dramaturgy and impression management, social skills), Group and Inter-Group Behaviour (group structure and norms, group processes,

Hawthorne studies), Leadership (leadership as an attribute, leadership styles), Patterns of Work (classical approach, Marx, Weber, critique of labor, Foucault and disciplinary power), Conflict and Consent in Work (labor process debate, workplace control and resistance, industrial conflict and industrial relations), Organizational Culture (organizational culture and strategic management, exploring and evaluating concept of culture).

RECOMMENDED TEXT AND REFERENCE BOOKS

[1] R. Finchan and R. Rhodes, Principles of Organizational Behaviour, 3rd ed., Oxford, latest ed.

[2] R. Noe, J. Hollenbeck, B. Gerhart, and P. Wright, Human Resource Management, McGraw-Hill, 2006.

[3] J. W. Newstrom, Organizational Behaviour, McGraw-Hill, latest ed.

[4] F. Luthans, Organizational Behaviour, McGraw-Hill Inc., latest ed.

[5] S. Robins, Organizational Behaviour, McGraw-Hill Inc., latest ed.

Subject Name	:	**Probability and Random Variables**
Credit Hours	:	3+0=3
Course Code	:	Theory (EE-316)
Effective	:	2K23-BE(EE)
Pre-Requisites	:	Nil
Weeks/Lectures/Labs	:	16/48/0
Marks	:	Theory (100)
Instructor Name	:	Engr. Fozia Hajano

DESCRIPTION

This course introduces the fundamentals of probability theory and random variables for engineering applications. Topics include probability concepts, conditional probability, discrete and continuous random variables, probability distributions, moments, linear regression, and stochastic processes.

COURSE LEARNING OUTCOMES

Upon successful completion of the course, the student will be able to:

	CLO	Description	Domain	Taxonomy level	PLO	Marks
Theory	1	**Explain** basic probability concepts and their application to engineering problems.	Cognitive	C2	1	50
	2	**Apply** basic statistical techniques such as regression, curve fitting to engineering data and different types of random variables to solve problems in science and engineering	Cognitive	C3	2	50

COURSE OUTLINE (THEORY)

Set Theory and Probability Fundamentals (set theory, basic concepts of probability, conditional probability, independent events, Bayes' theorem), Random Variables and Probability Distributions (discrete and continuous random variables, probability density functions, probability distributions: binomial, Poisson, hypergeometric, Gaussian, uniform, exponential), Statistical Measures (mean, variance, standard deviation, moments, moment generating functions), Regression and Curve Fitting (linear regression, curve fitting techniques, least-squares method), Limit Theorems (law of large numbers, central limit theorem, applications of limit theorems), Stochastic Processes (introduction, first-order and second-order characteristics, stationary and non-stationary processes, applications in engineering and science).

RECOMMENDED TEXT AND REFERENCE BOOKS

[1] S. Milton and J. C. Arnold, Introduction to Probability and Statistics: Principles and Applications for Engineering and the Computing Sciences, McGraw-Hill, ISBN: 007246836, latest ed.

[2] W. Mendenhall and T. Sincich, Statistics for Engineers and the Sciences, Prentice Hall, ISBN: 0131877062, latest ed.

[3] R. A. Johnson and P. K. Bhattacharyya, Statistics: Principles and Methods, 6th ed., Wiley, ISBN: 0470462248, latest ed.

[4] A. Papoulis and S. U. Pillai, Probability, Random Variables, and Stochastic Processes, 4th ed., McGraw-Hill, ISBN: 0071226611, latest ed.

[5] J. T. McClave, P. G. Sincich, Statistics, 12th ed., Pearson, ISBN: 0134743552, latest ed.

Subject Name	:	**Signals and Systems**
Credit Hours	:	3+1=4
Course Code	:	Theory (EE-312), Practical (EE-313)
Effective	:	2K23-BE(EE)
Pre-Requisites	:	Nil
Weeks/Lectures/Labs	:	16/48/15
Marks	:	Theory (100), Practical (100)
Instructor Name	:	Engr. Abdul Wahab Khokhar

DESCRIPTION

This course introduces the analysis and characterization of continuous- and discrete-time signals and systems. Topics include system classification, time- and frequency-domain analysis, Laplace and Fourier transforms, Z-transform, stability, and applications in engineering systems.

COURSE LEARNING OUTCOMES

Upon successful completion of the course, the student will be able to:

	CLO	Description	Domain	Taxonomy level	PLO	Marks
Theory	1	**Explain** the fundamental concepts and properties of continuous-time signals and systems and perform standard signal operations.	Cognitive	C2	1	55
	2	**Apply** time-domain, frequency-domain, and complex-frequency-domain methods to solve signal and system problems.	Cognitive	C3	2	35
	3	**Develop** continuous-time system and filter designs with appropriate properties.	Cognitive	C6	3	10

LABORATORY LEARNING OUTCOMES

Upon successful completion of the lab experiments, the student will be able to:

	CLO	Description	Domain	Taxonomy level	PLO	Marks
Practical	1	**Construct** and analyze signal-processing models in the time and frequency domains and implement filters using guided laboratory procedures.	Psychomotor	P3	5	100

COURSE OUTLINE (THEORY)

Introduction to Signals and Systems (introduction, classification of signals, classification of systems, complex number applications in signal analysis), Time-Domain Analysis of LTI Systems (linear time-invariant systems, convolution, system response, BIBO stability, properties of LTI systems), Laplace Transform and Applications (Laplace transform, inverse Laplace transform, properties, applications to LTI system analysis and differential equations), Fourier Analysis (continuous-time Fourier series, Fourier transform, properties, frequency-domain representation of signals, applications in signal processing), Z-Transform (Z-transform, inverse Z-transform, properties, applications in discrete-time signal and system analysis), Analog Filter Design (introduction, low-pass, high-pass, band-pass, band-stop filters, filter specifications, applications in communication and signal processing).

COURSE OUTLINE (PRACTICAL)

Developing and understanding signal systems and transforms using MATLAB.

RECOMMENDED TEXT AND REFERENCE BOOKS

[1] V. Oppenheim, A. S. Willsky, and S. H. Nawab, Signals and Systems, Prentice Hall, ISBN: 0138147574, latest ed.
[2] S. Haykin and B. Van Veen, Signals and Systems, Wiley, 2002, ISBN: 0471164747.
[3] L. Chaparro, Signals and Systems Using MATLAB, Academic Press, ISBN: 0123747163, latest ed.

Third Year - Sixth Semester

Subject Name	:	**Analog and Digital Communications**
Credit Hours	:	3+1=4
Course Code	:	Theory (EE-324), Practical (EE-325)
Effective	:	2K23-BE(EE)
Pre-Requisites	:	Nil
Weeks/Lectures/Labs	:	16/48/15
Marks	:	Theory (100), Practical (100)
Instructor Name	:	Engr. Mirza Altamash Baig

DESCRIPTION

This course introduces the principles and techniques of analog and digital communication systems. Topics include amplitude and angle modulation, pulse modulation, digital modulation schemes (ASK, FSK, PSK, QPSK, DPSK, MSK), sampling theory, transmission, detection, matched filters, and performance analysis in terms of bandwidth and bit error rate (BER).

COURSE LEARNING OUTCOMES

Upon successful completion of the course, the student will be able to:

	CLO	Description	Domain	Taxonomy level	PLO	Marks
Theory	1	**Analyze** analog and digital modulation and demodulation techniques and communication-system performance in the presence of noise.	Cognitive	C4	2	50
	2	**Evaluate** communication-system performance under bandwidth, noise, and implementation constraints.	Cognitive	C5	3	50

LABORATORY LEARNING OUTCOMES

Upon successful completion of the lab experiments, the student will be able to:

	CLO	Description	Domain	Taxonomy level	PLO	Marks
Practical	1	**Operate** analog and digital communication training systems under guidance while observing professional and ethical laboratory practices.	Psychomotor	P3	8	100

COURSE OUTLINE (THEORY)

Introduction to Communication Systems (introduction, basic concepts of analog and digital communication, system components, signal transmission and reception), Analog Modulation Techniques (amplitude modulation, frequency modulation, phase modulation, analysis of AM/FM/PM signals, advantages and applications), Pulse and Digital Modulation Techniques (pulse modulation, pulse code modulation, delta-sigma modulation, differential PCM, adaptive DPCM, transmission of digital signals), Sampling Theory (sampling theorem, Nyquist criterion, aliasing, reconstruction of signals), Digital Modulation Techniques (amplitude shift keying, binary phase shift keying, quadrature phase shift keying, differential phase shift keying, frequency shift keying, minimum shift keying, coherent and non-coherent detection), Performance Analysis (bit error rate, bandwidth considerations, matched filters, correlator, introduction to inter-symbol interference).

COURSE OUTLINE (PRACTICAL)

Study of different modulation techniques including amplitude modulation, frequency and pulse modulation, study of demodulation techniques; use of training modules/simulation tools (e. g MATLAB/ Simulink); a mini project.

RECOMMENDED TEXT AND REFERENCE BOOKS

[1] B. P. Lathi and Z. Ding, Modern Digital and Analog Communication Systems, Oxford University Press, ISBN: 0195331451, latest ed.

[2] W. Tomasi, Electronic Communication System: Fundamentals Through Advanced, Prentice Hall, ISBN: 0130494925, latest ed.

[3] S. Haykin and M. Moher, Communication Systems, Wiley, ISBN: 0471697907, latest ed.

[4] L. W. Couch, Digital and Analog Communication Systems, Prentice Hall, ISBN: 0132916383, latest ed.

Subject Name	:	**Control Systems**
Credit Hours	:	3+1=4
Course Code	:	Theory (EE-326), Practical (EE-327)
Effective	:	2K23-BE(EE)
Pre-Requisites	:	Nil
Weeks/Lectures/Labs	:	16/48/15
Marks	:	Theory (100), Practical (100)
Instructor Name	:	Mr. Ghulam Mustafa Shoro

DESCRIPTION

This course introduces the principles and analysis of control systems. Topics include open- and closed-loop systems, transfer functions, block diagrams, stability analysis, feedback control, root locus, frequency response methods, state-space representation, and controller design for engineering applications.

COURSE LEARNING OUTCOMES

Upon successful completion of the course, the student will be able to:

	CLO	Description	Domain	Taxonomy level	PLO	Marks
Theory	1	**Explain** the fundamental concepts of control systems and their engineering applications.	Cognitive	C2	1	10
	2	**Analyze** system behavior using time response and transient response techniques.	Cognitive	C4	2	30
	3	**Design** and simulate control systems to improve the energy efficiency and reduce environmental impact in industrial applications.	Cognitive	C6	7	30
	4	**Evaluate** control-system designs considering performance, intellectual-property, and ethical requirements.	Cognitive	C5	8	30

LABORATORY LEARNING OUTCOMES:

Upon successful completion of the lab experiments, the student will be able to:

	CLO	Description	Domain	Taxonomy level	PLO	Marks
Practical	1	**Configure** basic control-system experiments and observe system responses consistency with theoretical control-system behavior.	Psychomotor	P4	3	100

COURSE OUTLINE (THEORY)

Introduction to Control Systems (introduction, open-loop and closed-loop systems, transfer functions, block diagrams, signal flow graphs), System Modelling (modelling, formation of differential equations of electrical, mechanical, and other systems, derivation of transfer functions), Performance Analysis of Closed-Loop Systems (performance analysis, stability, Routh's stability criterion, feedback control systems, steady-state and transient response of first-order, second-order, and higher-order systems), Frequency-Domain Analysis (root locus, Bode plots, polar plots, Nyquist stability criterion, gain and phase margins, Nichols chart), State-Space Analysis (state-space concepts, formation and solution of state equations, eigenvalues and eigenvectors, transfer function matrices), Controller Design (controller design using frequency response methods, root locus methods, design specifications, compensator design, and system tuning).

COURSE OUTLINE (PRACTICAL)

Familiarization with MATLAB Control System toolbox and MATLAB/SIMULINK tool box; Modelling and simulation of armature-controlled and field-controlled DC motors, simulation of step response and impulse response with unity feedback using MATLAB; system analysis using root locus, bode plot, and Nyquist plot using MATLAB; PI, PD and PID controller design, analysis of servo system and higher order systems.

RECOMMENDED TEXT AND REFERENCE BOOKS

[1] K. Ogata, Modern Control Engineering, Prentice Hall, ISBN: 0136166738, latest ed.

[2] N. S. Nise, Control Systems Engineering, Wiley, ISBN: 9780470547564, latest ed.

[3] A. Anand Kumar, Control Systems, Prentice-Hall of India Pvt. Ltd, ISBN: 8120331974, latest ed.

Subject Name	:	**Digital Signal Processing**
Credit Hours	:	3+1=4
Course Code	:	Theory (EE-322), Practical (EE-323)
Effective	:	2K23-BE(EE)
Pre-Requisites	:	Nil
Weeks/Lectures/Labs	:	16/48/15
Marks	:	Theory (100), Practical (100)
Instructor Name	:	Engr. Dr. Beenish Ansari

DESCRIPTION

This course covers analysis and processing of discrete-time signals and systems, including z-transform, Fourier transforms, FFT, multirate systems, and digital filter design.

COURSE LEARNING OUTCOMES

Upon successful completion of the course, the student will be able to:

	CLO	Description	Domain	Taxonomy level	PLO	Marks
Theory	1	**Explain** the fundamental concepts and properties of discrete-time signals and systems and perform standard signal operations.	Cognitive	C2	1	30
	2	**Apply** time-domain, frequency-domain, and complex-frequency-domain methods to solve discrete-time signal and system problems.	Cognitive	C3	2	50
	3	**Develop** discrete-time systems and digital filters with appropriate properties and windowing methods.	Cognitive	C6	3	20

LABORATORY LEARNING OUTCOMES

Upon successful completion of the lab experiments, the student will be able to:

	CLO	Description	Domain	Taxonomy level	PLO	Marks
Practical	1	**Practice** the signals time and frequency domain and designing of filters with various windowing methods.	Psychomotor	P3	5	100

COURSE OUTLINE (THEORY)

Introduction to DSP (physical and mathematical significance of digital signal processing, theoretical, application, and implementation perspectives, review of discrete-time signals and systems), Discrete-Time Transforms (Z-transform, discrete-time Fourier transform, bandlimited sampling, applications in signal analysis), Multirate Systems (introduction, decimation, interpolation, practical applications), Discrete Fourier Transform (DFT as a practical spectral analysis tool, algorithms for efficient computation including FFT and Goertzel Algorithm), Frequency-Domain Analysis and System Implementation (frequency-domain analysis of discrete-time systems, system structures for implementation, practical considerations), Digital Filter Design (techniques for digital filter design, FIR and IIR filters, practical significance and applications).

COURSE OUTLINE (PRACTICAL)

Review of MATLAB and Complex Exponentials, Introduction to DSP KIT, Audio Processing using DSP Kit, A/D and D/A Conversion: Digital Images, DFT and Spectral Leakage, Sampling, Quantization and Aliasing Using DSK, DFT Properties and Block Convolution, Frequency Response, Bandpass and Nulling Filters, Frequency Response and Pole Zero Plots of FIR/IIR Filters, Delays and FIR Filtering (DSK), FIR Filter Design Using Windowing, IIR Filter Design using Analog Design Techniques

RECOMMENDED TEXT AND REFERENCE BOOKS

[1] A. V. Oppenheim and R. W. Schafer, Discrete-Time Signal Processing, Prentice Hall, ISBN: 0131988425, latest ed.

[2] R. G. Lyons, Understanding Digital Signal Processing, ISBN: 0137027419, latest ed.

[3] S.K. Mitra, Digital Signal Processing: A Computer Based Approach, McGraw-Hill, latest ed.

[4] J.G. Proakis and D. Manolakis, Digital Signal Processing: Principles, Algorithms and Applications, Prentice-Hall, latest ed.

[5] Li Tan, Digital Signal Processing Fundamentals and Applications, Academic Press, Elsevier, ISBN: 978-0-12-374090-8.

Subject Name	:	**Professional Practice**
Credit Hours	:	3+0=3
Course Code	:	Theory (BH-320)
Effective	:	2K23-BE(EE)
Pre-Requisites	:	Nil
Weeks/Lectures/Labs	:	16/48/0
Marks	:	Theory (100)
Instructor Name	:	Engr. Abdul Wahab Khokhar

DESCRIPTION

This course introduces students to professional ethics, responsibilities, and practices in engineering. Topics include moral reasoning, ethical standards, law and morality, equity, justice, workplace responsibilities, and contemporary issues facing professionals.

COURSE LEARNING OUTCOMES

Upon successful completion of the course, the student will be able to:

	CLO	Description	Domain	Taxonomy level	PLO	Marks
Theory	1	**Identify** legal and professional definitions of ethics, the benefits of ethical conduct, and the consequences of unethical conduct in society.	Cognitive	C1	7	30
	2	**Organize** appropriate responses to workplace ethical dilemmas and justify the likely consequences of each response.	Affective	A4	8	60
	3	**Demonstrate** commitment to professional codes of ethics by evaluating an engineering failure and recommending preventive actions.	Affective	A3	12	10

COURSE OUTLINE (THEORY)

Introduction to Ethics (contemporary ethical issues, professional ethics, moral reasoning, moral dilemmas, law and morality), Principles of Ethical Practice (equity, justice, fairness, ethical standards, codes of conduct, corporate and professional responsibilities), Moral Development (theories of moral development, ethical decision-making models, application of moral reasoning in professional life), Ethical Obligations (moral responsibilities and obligations in the workforce and society, ethical challenges in contemporary professional settings, case studies of ethical dilemmas).

RECOMMENDED TEXT AND REFERENCE BOOKS

[1] C. Ferrell, J. Fraedrich, and L. Ferrell, Business Ethics: Ethical Decision Making and Cases, Cengage Learning, ISBN: 1285423712, latest ed.

[2] M. W. Martin and R. Schinzinger, Ethics in Engineering, McGraw-Hill, ISBN: 0072831164, latest ed.

Subject Name	:	**Technical Report Writing and Presentation Skills**
Credit Hours	:	3+0=3
Course Code	:	Theory (BH-302)
Effective	:	2K23-BE(EE)
Pre-Requisites	:	Nil
Weeks/Lectures/Labs	:	16/48/0
Marks	:	Theory (100)
Instructor Name	:	Mr. Israr Ahmed Khoso

DESCRIPTION

This course develops students' abilities in technical writing and professional communication. Topics include essay writing, research and progress reports, proposals, presentations, and the use of visual aids and IT tools to effectively communicate technical information.

COURSE LEARNING OUTCOMES

Upon successful completion of the course, the student will be able to:

	CLO	Description	Domain	Taxonomy level	PLO	Marks
Theory	1	**Explain** the principles, structure, and ethical requirements of technical reports and professional presentations.	Cognitive	C2	12	40
	2	**Produce** clear technical reports and professional presentations using appropriate organization, language, and visual tools.	Cognitive	C3	10	60

COURSE OUTLINE (THEORY)

Presentation Skills (oral presentation techniques, use of visual aids, structuring presentations, audience engagement, clarity and style of delivery), Essay Writing (descriptive, narrative, discursive, and argumentative essays, techniques for developing content, coherence, and style), Academic Writing (writing research proposals and term papers with emphasis on style, content, language, form, clarity, and consistency, referencing and citation styles), Technical Report Writing (structure and format of technical reports, progress report writing, clarity and conciseness in technical communication, documentation of experiments and findings), Vocabulary Development (extensive reading for vocabulary building, use of academic and technical terminology in writing and presentations).

RECOMMENDED TEXT AND REFERENCE BOOKS

[1] R. White, Writing. Advanced, Oxford Supplementary Skills, 3rd Impression 1992, ISBN: 0 19 435407 3.

[2] J. Langan, College Writing Skills, McGraw-Hill Higher Education, latest ed.

[3] L. G. Kirszner and S. R. Mandell, Patterns of College Writing, St. Martin's Press, latest ed.

[4] Northern Illinois University, The Mercury Reader, Compiled by Janice Neulib, Kathleen Shine Cain, Stephen Ruffus, and Maurice Scharton, latest ed.

Fourth Year – Seventh Semester

Subject Name	:	**Engineering Economics**
Credit Hours	:	3+0=3
Course Code	:	Theory (MS-416)
Effective	:	2K22-BE(EE)
Pre-Requisites	:	Nil
Weeks/Lectures/Labs	:	16/48/0
Marks	:	Theory (100)
Instructor Name	:	Engr. Anusa Shah

DESCRIPTION

This course introduces the principles and applications of engineering economics. Topics include cost analysis, financial effectiveness, selection among alternatives, depreciation, valuation, capital budgeting, linear programming, production theory, and industrial economic decision-making.

COURSE LEARNING OUTCOMES

Upon successful completion of the course, the student will be able to:

	CLO	Description	Domain	Taxonomy level	PLO	Marks
Theory	1	**Apply** the appropriate engineering economics analysis method(s) for problem solving i.e. present worth, annual cost, rate of return, payback, break-even, benefit-cost ratio	Cognitive	C3	7	64
	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.	Cognitive	C4	11	16
	3	**Understand** the depreciation of an asset using standard depreciation techniques to assess its impact on present or future value	Cognitive	C2	11	20

COURSE OUTLINE (THEORY)

Fundamentals of Engineering Economics (financial effectiveness, non-monetary values, economic environment, consumer and producer goods, measures of economic worth, price, supply and demand relationships), Selection Between Alternatives (present worth analysis, selection among materials and designs, investment philosophy, alternatives with identical and different lives), Value Analysis (cost concepts, cost-benefit analysis, feasibility studies, value analysis in designing and purchasing), Linear Programming (mathematical statement, graphical solution, simplex procedure, duality problem), Depreciation and Valuation (types of

depreciation, economic life, profit and interest, returns to capital, discrete and continuous compounding, discounting, sinking fund problems), Capital Financing and Budgeting (types of ownership, stock, partnerships, joint-stock companies, banking and specialized credit institutions), Theory of Production (factors of production, laws of returns, break-even charts, production optimization), Industrial Relations (labor problems, labor organizations, prevention and settlement of disputes, industrial harmony, workplace regulations).

RECOMMENDED TEXT AND REFERECE BOOK

[1] L. T. Blank and A. J. Tarquin, Engineering Economy, McGraw-Hill Science/Engineering/Math, ISBN: 0073376302, latest ed.

[2] E. W. Sullivan, W. G. Wicks, and C. P. Koelling, Engineering Economy, Pearson, ISBN: 0132556603, latest ed.

[3] T. R. Chand, Engineering Economics and Financial Accounting, McGraw-Hill Education, latest ed.

[4] D. G. Newnan, T. G. Eschenbach, and J. P. Lavelle, Engineering Economic Analysis, Oxford University Press, ISBN: 0195339273, latest ed.

[5] J. A. White, Principles of Engineering Economic Analysis, Wiley, latest ed.

Subject Name	:	**Image Processing and Computer Vision**
Credit Hours	:	3+0=3
Course Code	:	Theory (EE-414)
Effective	:	2K22-BE(EE)
Pre-Requisites	:	Nil
Weeks/Lectures/Labs	:	16/48/0
Marks	:	Theory (100)
Instructor Name	:	Engr. Umair Ali Abro

DESCRIPTION

This course introduces the fundamentals and applications of digital image processing and computer vision. Topics include image acquisition, enhancement, restoration, segmentation, color processing, morphological operations, feature extraction, image compression, motion analysis, and practical computer vision techniques.

COURSE LEARNING OUTCOMES

Upon successful completion of the course, the student will be able to:

	CLO	Description	Domain	Taxonomy level	PLO	Marks
Theory	1	**Understand** the fundamental concepts and the mathematical tools used in digital image processing and computer vision.	Cognitive	C2	1	42
	2	**Analyze** and evaluate high-level concepts that use both image processing and computer vision for real-world applications.	Cognitive	C4	3	35
	3	**Apply** various algorithms for digital image processing and computer vision.	Cognitive	C3	6	23

COURSE OUTLINE (THEORY)

Digital Image Fundamentals (elements of visual perception, image sensing and acquisition, image sampling and quantization), Intensity Transformations and Spatial Filtering (histogram processing, fuzzy techniques, spatial filtering methods, image smoothing and sharpening), Frequency Domain Filtering (basics of frequency domain filtering, image smoothing and sharpening using frequency domain filters, selective filtering), Image Restoration and Reconstruction (noise models, periodic noise reduction, linear position-invariant degradations, inverse filtering, Wiener filtering, constrained least squares filtering, geometric mean filter, image reconstruction from projections), Color Image Processing (color fundamentals, color models, pseudo-color image processing, color transformations, smoothing and sharpening, image segmentation based on color, noise in color images), Image Compression and Watermarking (image compression models, digital image watermarking, principles of image

coding, applications), Morphological Image Processing (erosion and dilation, opening and closing, gray-scale morphology, applications in segmentation and feature extraction), Image Segmentation (point, line, and edge detection, thresholding, region-based segmentation, segmentation using morphological watersheds, use of motion in segmentation).

RECOMMENDED TEXT AND REFERENCE BOOKS

[1] C. Solomon and T. Breckon, Fundamentals of Digital Image Processing: A Practical Approach with Examples in MATLAB, Wiley, ISBN: 0470844736, latest ed.

[2] R. C. Gonzalez and R. E. Woods, Digital Image Processing, Prentice Hall, ISBN: 013168728X, latest ed.

[3] R. C. Gonzalez and R. E. Woods, Digital Image Processing using Matlab Latest Edition.

Subject Name	:	**Introduction to Robotics**
Credit Hours	:	3+1=4
Course Code	:	Theory (EE-412), Practical (EE-413)
Effective	:	2K22-BE(EE)
Pre-Requisites	:	Nil
Weeks/Lectures/Labs	:	16/48/15
Marks	:	Theory (100), Practical (100)
Instructor Name	:	Dr. Zain Anwer Memon

DESCRIPTION

This course introduces the fundamentals of robotics, including robot classification, components, kinematics, dynamics, sensors and actuators, trajectory planning, and robot programming. Students will learn both theoretical concepts and practical applications in automation.

COURSE LEARNING OUTCOMES

Upon successful completion of the course, the student will be able to:

	CLO	Description	Domain	Taxonomy level	PLO	Marks
Theory	1	**Explain** the necessary ingredients of robotic systems ranging from basic to the state of the art.	Cognitive	C2	1	25
	2	**Solve** the forward and inverse kinematics of robotic manipulators.	Cognitive	C3	2	30
	3	**Apply** navigation schemes to mobile robotic systems including ground and aerial robots	Cognitive	C3	2	25
	4	**Apply** sensing and actuation techniques in the development of robotic systems.	Cognitive	C3	1	20

LABORATORY LEARNING OUTCOMES

Upon successful completion of the lab experiments, the student will be able to:

	CLO	Description	Domain	Taxonomy level	PLO	Marks
Practical	1	**Reproduce** kinematic parameters and motion characteristics of different robotic joints and manipulators.	Psychomotor	P3	9	100

COURSE OUTLINE (THEORY)

Introduction to Robotics (fundamentals of robotics, classification of robots, advantages and disadvantages, components, degrees of freedom, joints, coordinates, reference frames, robot languages), Robot Kinematics (position analysis, forward and inverse kinematics, robots as mechanisms, matrix representation, homogeneous transformation matrices, Denavit-Hartenberg representation, inverse kinematic programming, degeneracy and dexterity), Dynamic Analysis and Forces (Lagrangian mechanics for robot dynamics, force analysis, torque computation, dynamic modelling of manipulators), Trajectory Planning (path vs. trajectory, joint-space vs. Cartesian-space descriptions, trajectory planning basics, joint-space trajectory planning, trajectory generation algorithms), Sensors and Actuators in Robotics (sensors, actuators, drive systems, feedback devices, integration with control systems).

COURSE OUTLINE (PRACTICAL)

Experiments to introduce the students to basic robotics and programming of programmable devices used in the robotics field.

RECOMMENDED TEXT AND REFERENCE BOOKS

[1] J. J. Craig, Introduction to Robotics: Mechanics and Control, Prentice Hall, ISBN: 0201643613, latest ed.

[2] S. B. Niku, Introduction to Robotics: Analysis, Control, Applications, Wiley, ISBN: 0470604468, latest ed.

[3] J. L. Fuller, Robotics: Introduction, Programming, and Projects, Prentice Hall, ISBN: 0130955434, latest ed.

Subject Name	:	**Power Electronics**
Credit Hours	:	3+1=4
Course Code	:	Theory (EE-410), Practical (EE-411)
Effective	:	2K22-BE(EE)
Pre-Requisites	:	Nil
Weeks/Lectures/Labs	:	16/48/15
Marks	:	Theory (100), Practical (100)
Instructor Name	:	Mr. Ghulam Mustafa Shoro

DESCRIPTION

This course introduces the principles and applications of power electronic devices and circuits. Topics include power semiconductors (diodes, SCRs, MOSFETs, IGBTs, TRIACs), rectifiers, DC-DC converters, inverters, AC controllers, switched-mode power supplies, and motor drives.

COURSE LEARNING OUTCOMES

Upon successful completion of the course, the student will be able to:

	CLO	Description	Domain	Taxonomy level	PLO	Marks
Theory	1	**Explain** the operating principles and characteristics of power semiconductor devices and circuits.	Cognitive	C2	1	10
	2	**Analyze** the operating principles and performance of controlled and uncontrolled rectifier circuits.	Cognitive	C4	2	30
	3	**Design** power electronic systems and circuits to meet specified requirements.	Cognitive	C6	3	30
	4	**Evaluate** the performance and efficiency of power electronic systems.	Cognitive	C5	4	30

LABORATORY LEARNING OUTCOMES

Upon successful completion of the lab experiments, the student will be able to:

	CLO	Description	Domain	Taxonomy level	PLO	Marks
Practical	1	**Reproduce** and analyze the operating characteristics of power electronic devices, converters and implement their control using simulation and hardware-based power electronics systems.	Psychomotor	P4	5	100

COURSE OUTLINE (THEORY)

Power Electronics (Introduction to power electronics, applications and significance, overview of power electronic systems, solid-state devices used in power electronics), Power Semiconductor Devices (Power diode, power BJT, power MOSFET, SCR, GTO, IGBT, TRIAC, DIAC, on-state and switching power losses, characteristics and applications of each device), Rectifiers (Semi-controlled, fully-controlled, and uncontrolled rectifiers; single-phase and three-phase rectifiers; six-pulse, twelve-pulse, and twenty-four-pulse rectifiers; performance analysis; applications), DC-DC Converters (Buck converter, Boost converter, Buck-Boost converter; operation, control, applications), Inverters (Single-phase and three-phase inverters; pulse-width-modulated (PWM) inverters; control techniques; applications in AC power systems), AC Controllers and Switched-Mode Power Supplies (AC voltage controllers; principles of operation; SMPS design and applications), Motor Drives (Fundamentals of AC and DC motor drives; integration with power electronic converters; industrial applications).

COURSE OUTLINE (PRACTICAL)

Design of converters; single-phase and three-phase uncontrolled, half-controlled and fully-controlled rectifiers; buck, boost and polarity inverting converters; flyback converter; PWM Inverters.

RECOMMENDED TEXT AND REFERENCE BOOKS

[1] R. W. Erickson and D. Maksimovic, Fundamentals of Power Electronics, Springer, ISBN: 0792372700, latest Edition.

[2] M. H. Rashid, Power Electronics: Circuits, Devices & Applications, Prentice Hall, ISBN: 0133125904, latest Edition.

[3] N. Mohan, W. P. Robbins, and T. M. Undeland, Power Electronics: Converters, Applications and Design, John Wiley & Sons, ISBN: 0471429082, latest Edition.

[4] D. Hart, Power Electronics, McGraw-Hill Science/Engineering/Math, ISBN: 0073380679, latest Edition.

Final Year Project-I

The combined CLOs, PLO mappings, assessment criteria, and marks distribution for Final Year Project-I and Final Year Project-II are provided in the consolidated FYP section.

Fourth Year - Eighth Semester

Subject Name	:	**Entrepreneurship**
Credit Hours	:	3+0=3
Course Code	:	Theory (MS-424)
Effective	:	2K22-BE(EE)
Pre-Requisites	:	Nil
Weeks/Lectures/Labs	:	16/48/0
Marks	:	Theory (100)
Instructor Name	:	Engr. Anusa Shah

DESCRIPTION

This course introduces the principles and practices of entrepreneurship, including opportunity recognition, business planning, innovation, small and medium enterprises (SMEs), entrepreneurial marketing, and the role of entrepreneurship in economic development.

COURSE LEARNING OUTCOMES

Upon successful completion of the course, the student will be able to:

	CLO	Description	Domain	Taxonomy level	PLO	Marks
Theory	1	**Evaluate** a business plan based on the suitability of its business model.	Cognitive	C5	11	40
	2	**Integrate** self-analysis with social, environmental, and economic considerations when planning an entrepreneurial career.	Affective	A4	7	44
	3	**Demonstrate** preference for an attractive market that can be reached economically.	Affective	A3	6	16

COURSE OUTLINE (THEORY)

Entrepreneurship (Introduction: Concept of entrepreneurship; economist and sociologist views; behavioral approach; entrepreneurship and management; The Practice of Entrepreneurship: Process of entrepreneurship; entrepreneurial management; entrepreneurial business; entrepreneurship in service institutions; the new venture; Entrepreneurship and Innovation: Innovation concepts; importance of innovation for entrepreneurship; sources of innovative opportunities; innovation process; risks involved; Developing Entrepreneur: Entrepreneurial profile; trait approach; factors influencing entrepreneurship; environment; socio-cultural factors; support systems; Entrepreneurship Organization: Teamwork; networking; motivation and compensation; value system; Entrepreneurship and SMEs: Defining SMEs; scope; entrepreneurial managers; financial and marketing problems; Entrepreneurial Marketing: Framework for developing marketing; marketing plan; marketing strategies; product quality and design; Entrepreneurship and Economic Development: Role of entrepreneur in economic

development; employment creation and training; ideas, knowledge and skill development; Japanese experience)

RECOMMENDED TEXT AND REFERENCE BOOKS

[1] P. Burns and J. D. Hurst, Small Business and Entrepreneurship, latest ed.

[2] P. N. Singh, Entrepreneurship for Economic Growth, latest ed.

[3] P. F. Drucker, Innovation and Entrepreneurship, latest ed.

[4] J. B. Miner, Entrepreneurial Success, latest ed.

Subject Name	:	**FPGA-Based System Design**
Credit Hours	:	3+1=4
Course Code	:	Theory (EE-422), Practical (EE-423)
Effective	:	2K22-BE(EE)
Pre-Requisites	:	Nil
Weeks/Lectures/Labs	:	16/48/15
Marks	:	Theory (100), Practical (100)
Instructor Name	:	Engr. Dr. Zain Anwer Memon

DESCRIPTION

This course introduces the design and implementation of digital systems using Field-Programmable Gate Arrays (FPGAs). Topics include FPGA architectures, combinational and sequential logic design, synthesis, physical design, finite state machines, and practical FPGA-based system applications.

COURSE LEARNING OUTCOMES

Upon successful completion of the course, the student will be able to:

	CLO	Description	Domain	Taxonomy level	PLO	Marks
Theory	1	**Explain** the fundamental concepts of digital system design.	Cognitive	C2	3	35
	2	**Evaluate** FPGA systems comprising logic blocks, LUTs, and memory resources.	Cognitive	C5	3	40
	3	**Implement** hardware components and systems using Hardware Description Language (HDL) and software tools.	Cognitive	C3	2	25

LABORATORY LEARNING OUTCOMES

Upon successful completion of the lab experiments, the student will be able to:

	CLO	Description	Domain	Taxonomy level	PLO	Marks
Practical	1	**Practice** the digital logic designs circuits under guidance in the laboratory with help of HDL in any FPGA base software.	Psychomotor	P3	9	100

COURSE OUTLINE (THEORY)

Introduction to Digital Design and FPGA (Introduction to digital design, FPGA-based system design, FPGA manufacturing process, transistor characteristics, CMOS logic gates, wires, registers and RAM, packages and pads), FPGA Architectures (FPGA architectures, SRAM-based FPGAs, permanently-programmed FPGAs, circuit design of FPGA fabrics, architecture of FPGA fabrics), Logic Design Using FPGAs (Logic design process, combinational network delay, power and energy optimization, arithmetic logic elements, logic implementation using FPGAs), Physical Design for FPGAs (Physical design – placement and routing for FPGAs, synthesis process, timing and optimization considerations), Sequential Design Using FPGAs (Sequential design using FPGAs, sequential machine design process, sequential design styles, finite state machine (FSM) design, algorithmic state machine (ASM) design), Practical Course Outline (Introduction to Verilog HDL, gate-level modelling, data flow modelling, behavioral modelling, design, simulation, synthesis and fitting of combinational circuits, design and implementation of an FSM and memory).

COURSE OUTLINE (PRACTICAL)

Introduction to Verilog HDL, gate-level modelling, data flow modelling, behavioral modelling, design, simulation, synthesis and fitting of combinational circuits, design and implementation of an FSM and memory.

RECOMMENDED TEXT AND REFERENCE BOOKS

[1] Steve Kilts, Advanced FPGA Design: Architecture, Implementation, and Optimization, Wiley-IEEE Press, ISBN: 0470054379, latest ed.

[2] Samir Palnitkar, Verilog HDL, Prentice Hall, ISBN: 0130449113, latest ed.

[3] Pong P. Chu, FPGA Prototyping by VHDL Examples: Xilinx Spartan-3, Wiley-Interscience, ISBN: 0470185317, latest ed.

[4] Michael D. Ciletti, Advanced Digital Design with the Verilog HDL, Prentice Hall, ISBN: 0136019285, latest ed.

Subject Name	:	**Industrial Electronics**
Credit Hours	:	3+1=4
Course Code	:	Theory (EE-420), Practical (EE-421)
Effective	:	2K22-BE(EE)
Pre-Requisites	:	Nil
Weeks/Lectures/Labs	:	16/48/15
Marks	:	Theory (100), Practical (100)
Instructor Name	:	Mr. Ghulam Mustafa Shoro

DESCRIPTION

This course covers the principles and applications of electronics in industrial automation and control. Topics include electric heating, welding, industrial drives, measurement of non-electrical quantities, digital measurement systems, process control techniques, PLC-based control, data acquisition, power distribution, SCADA, and distributed control systems.

COURSE LEARNING OUTCOMES

Upon successful completion of the course, the student will be able to:

	CLO	Description	Domain	Taxonomy level	PLO	Marks
Theory	1	**Design** the functional building blocks of an industrial heating system.	Cognitive	C6	1	10
	2	**Analyze** control mechanisms used in industrial drives.	Cognitive	C4	2	30
	3	**Design** industrial electronic systems and assess their effects on energy consumption and environmental sustainability.	Cognitive	C6	7	30
	4	**Evaluate** the integration of advanced industrial automation technologies.	Cognitive	C5	4	30

LABORATORY LEARNING OUTCOMES

Upon successful completion of the lab experiments, the student will be able to:

	CLO	Description	Domain	Taxonomy level	PLO	Marks
Practical	1	**Demonstrate** Proficiency in Laboratory Techniques and Equipment	Psychomotor	P4	1	30
	2	**Perform** the Experiments and Analyze Data	Psychomotor	P5	2	40
	3	**Adapt** Communication Effectively and write Laboratory Report	Psychomotor	P6	3	30

COURSE OUTLINE (THEORY)

Electric Heating and Welding (Principles and applications of electric heating; induction heating; dielectric heating; high-frequency welding; spot welding), Industrial Drives (AC drives; DC drives; stepper motor drives; servo drives and mechanisms; applications in industrial automation), Measurement of Non-Electrical Quantities (Force and pressure measuring transducers; linear variable differential transformer (LVDT); speed and position transducers; semiconductor, photoelectric, and temperature transducers; Hall effect transducers/sensors), Digital Industrial Measuring Systems (Digital measurement techniques; signal conditioning; data acquisition systems; interfacing with industrial sensors), Industrial Process Techniques and Control Methods (Industrial process techniques; process control methods; feedback and feedforward control; process modelling), Industrial Control Using PLCs (Programmable logic controllers (PLCs); PLC programming; industrial control applications; ladder logic and function block programming), Power Distribution in Industries (Power distribution systems; electrical supply for industrial loads; safety and efficiency considerations), SCADA and Distributed Control Systems (Supervisory Control and Data Acquisition (SCADA) systems; distributed control systems (DCS); monitoring and control of process industries; integration of sensors, actuators, and communication networks).

COURSE OUTLINE (PRACTICAL)

Experiments related to the principles of welding and PLCs; speed control of DC, AC, and servo motors.

RECOMMENDED TEXT AND REFERENCE BOOKS

[1] F. D. Petruzella, Programmable Logic Controllers, McGraw-Hill Science/Engineering/Math, latest ed., ISBN: 0073510882.

[2] T. L. M. Bartelt, Industrial Control Electronics, Cengage Learning, latest ed., ISBN: 1401862926.

[3] K. T. Erickson, Programmable Logic Controllers: An Emphasis on Design and Application, Dogwood Valley Press LLC, latest ed., ISBN: 097662592X.

Subject Name	:	**Final Year Project-I and II**
Credit Hours	:	6 (FYP-I and FYP-II combined)
Course Code	:	EE-418
Effective	:	2K23-BE(EE)
Assessment Period	:	Semester 7 and Semester 8
Semester 7 Status	:	FYP-I (To be continued)
Completion Semester	:	Semester 8 (FYP-II)
Marks	:	FYP-I (100), FYP-II (100), Total (200)

Final Year Project-I and II

CLO1	Cognitive Domain (C2)
	The student should identify the project domain and field of specialization.
CLO2	Cognitive Domain (C4)
	The student should analyze the literature and underline the research gap, accordingly.
CLO3	Cognitive Domain (C6)
	The student should propose the problem solution by creating a methodology based on the research gap found in the literature.
CLO4	Psychomotor Domain (P7)
	Students should build, implement, test, and analyze the working prototype that intends to achieve project aims and objectives.
CLO5	Affective Domain (A5)
	Display communication skills through the presentation, be able to demonstrate the project in exhibition, defend the project outcome as a team, and respond to the queries via an oral examination.
CLO6	Cognitive Domain (C6)
	Write and compile a report that interprets the working principle of the project free from plagiarism.
CLO7	Affective Domain (A4)
	Integrate societal, environmental, and application considerations into project decisions and outcomes.

Course	CLOs	PLOs												Learning Levels
		1	2	3	4	5	6	7	8	9	10	11	12	
FYP	1	✓												C2
	2		✓											C4
	3				✓	✓								C6
	4			✓										P7
	5								✓	✓	✓	✓		A5
	6												✓	C6
	7						✓	✓						A4

Course	PLO	CLO1	CLO2	CLO3	CLO4	CLO5	CLO6	CLO7
FYP	1	100%						
	2		100%					
	3				100%			
	4			50%				
	5			50%				
	6							50%
	7							50%
	8					25%		
	9					25%		
	10					25%		
	11					25%		
	12						100%	

Semester	Criteria	Marks Distribution	Marks Assigned by
7th Semester	Proposal Defense	25	Committee
	Progress Report	25	Supervisor
	Progressive Seminar	50	Committee
8th Semester	Project Demonstration and Evaluation	25	Committee
	Final Presentation	30	
	Thesis	20	
	Overall performance	25	Supervisor
Total		**200**	

Final Year Project I and II

	Marks	FYP-I	FYP-II
CLO1	10	10	0
CLO2	40	27	13
CLO3	50	25	25
CLO4	50	23	27
CLO5	20	5	15
CLO6	20	0	20
CLO7	10	10	0

	CLO 1 (10)	CLO 2 (40)	CLO 3 (50)	CLO 4 (50)	CLO 5 (20)	CLO 6 (20)	CLO7 (10)	Total
Proposal Defense	10	2	2		1		10	25
Progress Report		10	8	7				25
Progressive Seminar		15	15	16	4			50
Project Demonstration and Evaluation				18	7			25
Final Presentation		10	12		8			30
Thesis						20		20
Overall performance		3	13	9	0	0		25
Total								**200**