

1st Semester

Title of Subject:	Functional English		
Code :	ENG101		
Discipline :	1 st Semester		
Effective :	21 - Batch and onwards		
Assessment :	20% Sessional, 30% Mid Semester and 50% End Semester		
	Practical: 50% Sessional and 50% End Semester		
Credit Hours :	03 + 00	Marks :	100 + 00
Minimum Contact Hours:	48 + 00		

Course learning outcomes:

After completion of the “Functional English” course, each student will be able to:

CLO No.	Description	Taxonomy Level	Linking to PLOs
CLO-1	write varied contents including official letters, e-mails, and applications and summarize the texts using appropriate grammatical mechanisms and cohesive devices.	C6	PLO-10
CLO-2	apply skimming, scanning and detailed reading and listening strategies to understand gist of the text/conversation.	C3	PLO-2
CLO-3	debate and reflect their point of view, show arguments, and deliver presentations in real life situations.	C5	PLO-12

Contents:

Reading:

Interactive Reading, Apply the skills of surveying, skimming, scanning and detailed reading and identify topic sentence.

Writing:

Audience related writing, composition of sentences, paragraphs, short descriptive writing, précis and letter and application, identify contextual clues with the help of cohesive devices.

Listening:

Collect gist and important points from listening text or any other oral source viz. lecture, speech or conversation.

Speaking:

Taking part in different real-life situations, answer question, argue and explain one's point of view, ask for information, turn taking techniques and presentation skills.

Grammar:

Mechanics of English language, punctuation, conservation words, tenses and sentence structure.

Vocabulary: Matching vocabulary items with their corresponding definitions, identification odds items out of a list of vocabulary items, classification of vocabulary items in lexical sets.

Recommended Books

1. Selected text from Dawn, Readers Digest, New Scientist and other relevant material of teacher's choice.
2. Thomson A. J. and Mrtenet A. V. "A Practical English Grammar", 3rdEdn., OUP, latest edition.
3. SarwarZakia, "English Study Skills", A Spelt Publication Karachi 1991.
4. R. R. Jordon, "Collins Study Skills in English", William Collins Sons and Co. GlasgowGreat Britain 1980.
5. Jones Rhodri, "A New English Course (An Approach to GCSE English Language for Individual Study or Class Use), 1986.
6. K James et al, "Listening Comprehension and Note-Taking Cours" in Collins Study Skills in English, 1986.

7. S. Jannifer, “Grammar in Practice 1 and 2”, OUP, latest edition.
8. S. Michael, “Basic English Usage”, OUP, latest edition.
9. S. Michael, “Practical English Usage”, OUP, latest edition.

Approval:

Board of Studies, ELDC

Res. No.1

Dated: **21.11.2019.**

Board of Faculty (FoST&H) (1st/2017)

Dated: **19.7.2021.**

Academic Council

Dated: **24.08.2021.**

MEHRAN UNIVERSITY OF ENGINEERING AND TECHNOLOGY, JAMSHORO

DEPARTMENT OF ELECTRONIC ENGINEERING

Title of Subject	:	Applied Calculus	
Discipline	:	Electronic Engineering	
Course Code	:	MTH-108	
Semester	:	1 st Semester	
Effective	:	17ES-Batch onwards	
Pre-requisites	:	Nil	Co-requisite: Nil
Assessment	:	20% Sessional, 30% Mid Semester and 50% End Semester Practical: 50% Sessional and 50% End Semester	
Marks	:	Theory: 100	Practical: 00
Credit Hours	:	3	0
Minimum Contact Hours	:	48	0

Course Learning Outcomes:

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

CLO	Description	Bloom's Taxonomy		PLO
		Domain	Level	
1	Determine the functions and their derivatives	Cognitive	2	1
2	Compute the Integral calculus with applications	Cognitive	2	1
3	Apply the vector calculus in the field of engineering	Cognitive	3	1

Contents:

Introduction to functions:

Mathematical and physical meaning, graphs and types of function.

Introduction to limits:

Theorems of limits and their applications to functions. Right hand and left-hand limits. Continuous and discontinuous functions and their applications.

Derivatives:

Introduction to derivatives. Geometrical and physical meaning of derivatives. Partial derivatives and their geometric significance. Application problems (rate of change, marginal analysis).

Higher Derivatives:

Leibnitz theorem, Rolle's theorem, Mean value theorem. Taylors and Maclurin's series. Evaluation of limits using L' Hospital's rule: Indeterminate forms $(0/0)$, (∞/∞) , $(0 \times \infty)$, $(\infty - \infty)$, 1^∞ , ∞^0 , 0^0 .

Application of Derivatives:

Asymptotes, curvature and radius of curvature, differentials with application.

Application of partial Derivatives:

Euler's theorem, total differentials; maxima and minima of function of two variables.

Integral Calculus:

Methods of integration by substitution and by parts. Integration of rational and irrational algebraic functions. Definite integrals, improper integrals. Gamma and Beta functions; reduction formulae.

Application of Integral Calculus:

Cost function from marginal cost, rocket flights; area under curve.

Vector Calculus:

Vector differentiation and vector integration with their physical interpretation and applications. ∇ operator, gradient, divergence and curl with their application.

Recommended Books:

1. Brief Calculus and Its Applications, Benice, D.D, Latest Edition.
2. Applied Calculus, Raymond, A.B., Latest Edition.
3. Calculus and Analytical Geometry, Yusuf, S.M., Ilmi Kitab Khana, Lahore, Latest Edition.

Approval	Board of Studies: 01/2018	Res. No. 01	Dated: 26-03-2018
	Board of FOST&H	Res. No. 3.1	Dated: 11-04-2018
	Academic Council	Res. No. 17(ii)	Dated: 23-04-2018

MEHRAN UNIVERSITY OF ENGINEERING AND TECHNOLOGY, JAMSHORO

DEPARTMENT OF ELECTRONIC ENGINEERING

Title of Subject	:	Applied Physics	
Discipline	:	Electronic Engineering	
Course Code	:	EL-116	
Semester	:	1 st Semester	
Effective	:	19ES-Batch onwards	
Pre-requisites	:	Nil	Co-requisite: Nil
Assessment	:	20% Sessional, 30% Mid Semester and 50% End Semester Practical: 50% Sessional and 50% End Semester	
Marks	:	Theory: 100	Practical: 50
Credit Hours	:	3	1
Minimum Contact Hours	:	48	48

Course Learning Outcomes:

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

CLO	Description	Bloom's Taxonomy		PLO
		Domain	Level	
1	Define the basic concepts and fundamental laws of electrostatic and magnetism.	Cognitive	1	1
2	Explain the comprehensive knowledge of semiconductor physics, optics and lasers	Cognitive	2	1
3	Apply the fundamental knowledge of modern physics for solving application-oriented problems	Cognitive	3	2, 3
4	Reproduce and experimentally validate the basic laws of physics	Psychomotor	3	5

Contents:

Electrostatics

Coulomb's law, electric field and potential, capacitance, dielectrics.

Electrodynamics

Magnetic field and force, sources of magnetic field, electromagnetic induction, inductance.

Solid-state physics

Crystal lattices, unit cells, energy bands, allowed and forbidden states, conductors, semiconductors, insulators.

Semiconductors

Composition, purity, n- and p-type materials, carrier properties and distribution.

Carrier action

Diffusion, drift, generation, recombination. Conductivity, mobility, p-n junction diode, diode curve, forward-biased diode, reverse-biased diode, bipolar junction transistor and its biasing, MOSFET and its biasing, Hall effect.

Optics

Optical absorption, photoluminescence, photoconductivity, photoelectric effect, lasers, superconductivity. Heat and Thermodynamics in relation to cooling of electronics.

Recommended Books:

1. Fundamentals of Physics, David Halliday, Robert Resnick, and Jearl Walker, John Wiley & Sons, Latest Edition.
2. Schaum's Outline of Applied Physics, Arthur Beiser, McGraw-Hill, Latest Edition.
3. Electrical Technology, Huges. E., Longman, Latest Edition.
4. Electrical Technology, B.L. Thraja, Latest Edition.

Approval	Industrial Advisory Board (ES)	Res. No.	8.3	Dated:	22.8.2022
	Board of Studies (ES)	Res. No.	47.2	Dated:	28.11.2022
	Board of FEEC Engineering	Res. No.	20.5	Dated:	22.02.2023
	Academic Council	Res. No.	106.7(iii)	Dated:	14.10.2023

MEHRAN UNIVERSITY OF ENGINEERING AND TECHNOLOGY, JAMSHORO

DEPARTMENT OF ELECTRONIC ENGINEERING

Title of Subject	:	Electrical Circuits	
Discipline	:	Electronic Engineering	
Course Code	:	EL-120	
Semester	:	1 st Semester	
Effective	:	19ES-Batch onwards	
Pre-requisites	:	Nil	Co-requisite: Applied Physics
Assessment	:	20% Sessional, 30% Mid Semester and 50% End Semester Practical: 50% Sessional and 50% End Semester	
Marks	:	Theory: 100	Practical: 50
Credit Hours	:	3	1
Minimum Contact Hours	:	48	48

Course Learning Outcomes:

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

CLO	Description	Bloom's Taxonomy		PLO
		Domain	Level	
1	Describe AC/DC based electrical circuits as well as the related theorems to help solve and draw the equivalent circuits.	Cognitive	1	1
2	Explain steady state and transient analysis of circuits along with different forms of sinusoidal/exponential excitations and their responses.	Cognitive	2	1
3	Reproduce basic circuits in laboratory to validate the laws and theories of circuit analysis.	Psychomotor	3	5

Contents:

Introduction:

Basic two terminal circuit elements, Linear time-invariant resistor, Ohm's law, capacitor, inductor, energy concepts in two terminal elements, energy dissipated in a resistor, energy stored in a capacitor and inductor, Ideal independent voltage and current sources, ideal transformer, dependent and current sources.

Kirchoff's Laws:

Definitions of Branch, Loop, Node. Statements of Kirchoff's voltage and current laws. Linearly independent (KCL and KVL) equations. Elementary network topology, Nodal and Loop analysis by systematic application of KVL and KCL. Series and parallel connections of two terminal circuit elements.

Elementary Transient Analysis:

Differential and integral forms of circuit equations, initial voltage on a capacitor, initial current in an inductor, first-order circuits, solution of single first order differential equations, Homogeneous, particular and total solutions, exponential responses, second-order circuits.

Exponential Excitation and Transformed Network:

Representation of excitations by exponential functions, single element responses, forced response with exponential excitation, introduction to the transformed network, driving point impedance and admittance.

Network Theorems:

Linear and non-linear networks, Superposition theorem, Reciprocity theorem, Maximum power transfer theorem. Equivalent networks, Thevenin's theorem, Thevenin's equivalent network, Norton's theorem, Norton's equivalent networks, T-equivalent networks.

Transfer Function:

Transfer function on the basis of six sets of parameters, Cramer's rule applied to electrical circuits.

Formation of Numerical Transient Equations:

Formation of steady-state KVL and KCL equations of multi-loop networks, conversion of steady-state equations into transient equations. Re-writing of transient equations into integratable form by computer.

Recommended Books:

1. Basic Circuit Theory, Desoor and K., McGraw-Hill, Latest Edition.
2. Basic Electrical Engineering, Fitzgerald G. and Higginbotham, McGraw-Hill, Latest Edition.

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	Board of Studies (ES)	Res. No.	47.2	Dated:	28.11.2022
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	Academic Council	Res. No.	106.7(iii)	Dated:	14.10.2023

MEHRAN UNIVERSITY OF ENGINEERING AND TECHNOLOGY, JAMSHORO

DEPARTMENT OF ELECTRONIC ENGINEERING

Title of Subject	:	Electronics Workshop	
Discipline	:	Electronic Engineering	
Course Code	:	ES-102	
Semester	:	1 st Semester	
Effective	:	20ES-Batch onwards	
Pre-requisites	:	Nil	Co-requisite: Nil
Assessment	:	20% Sessional, 30% Mid Semester and 50% End Semester Practical: 50% Sessional and 50% End Semester	
Marks	:	Theory: 00	Practical: 50
Credit Hours	:	0	1
Minimum Contact Hours	:	0	48

Course Learning Outcomes:

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

CLO	Description	Bloom's Taxonomy		PLO
		Domain	Level	
1	Distinguish various discrete electronic components, describe their use in circuits and detect any trouble in simple electronic circuits.	Psychomotor	1	1
2	Demonstrate the ability to learn working mechanism and get some hands-on experience of basic electronic equipment.	Psychomotor	2	5
3	Reproduce basic electronic circuits on prototype boards using discrete electronic components	Psychomotor	3	5
4.	Participate in lab activities individually and in group also.	Affective	2	9

Contents:

Operation of Electronic Equipment:

Operation of voltmeters, ohmmeters, ammeters, power supplies, operation of function generators and oscilloscope. Measuring Parametric Values of Discrete Passive Components:

Resistor:

Colour Coding (practical example), variable resistor (practical example), wattage of resistor (practical example), measuring values with multimeter, drawing symbols.

Capacitor:

Reading value of mica, electrolyte & paper capacitors, capacitance measurement, drawing symbols.

Inductor:

Inductance measurement of an Inductor, drawing of symbols.

Diode:

Data sheet reading, analyzing diode characteristics on a curve tracer, finding a defective diode among a batch of non-defective diode, various kinds of diode and their uses, drawing symbols.

Transistor:

Data sheet reading, determining type (N&P) of an unknown bipolar transistor, labelling leads of an unknown transistor, analyzing transistor characteristics on a curve tracer, finding a defective transistor among a batch of non-defective transistors, various kinds of transistors and their uses, drawing of symbols.

PCB (Printed Circuit Board):

Assembling a simple circuit on a Bread Board, assembling and soldering components on a PCB (Kit Assembling).

Mini Project

On a PCB, on a bread board.

Recommended Books:

1. The First Practical Book on Electronic Workshop, Dr. B.S. Chowdhry & Ahsan A. Ursani, published by Mehran Infotech Consultants, Hyderabad, Latest Edition.
2. Laboratory Manual for Art of Electronics, Paul Horowitz & Ian Robinson, Cambridge University Press, Latest Edition.
3. Make Electronics, Learning through discovery, Charles Platt, Latest Edition.
4. Electronics for Dummies, Cathleen Shamieh, Gordon McComb, Latest Edition.

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MEHRAN UNIVERSITY OF ENGINEERING AND TECHNOLOGY, JAMSHORO

DEPARTMENT OF ELECTRONIC ENGINEERING

Title of Subject	: Introduction to Computing	
Discipline	: Electronic Engineering	
Course Code	: CS-150	
Semester	: 1 st Semester	
Effective	: 19 ES-Batch onwards	
Pre-requisites	: Nil	Co-requisite: Nil
Assessment	: 20% Sessional, 30% Mid Semester and 50% End Semester Practical: 50% Sessional and 50% End Semester	
Marks	: Theory:50	Practical: 50
Credit Hours	: 2	1
Minimum Contact Hours	: 32	48

Course Learning Outcomes:

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

CLO	Description	Bloom's Taxonomy		PLO
		Domain	level	
1	To become familiar with basic computer organization and functions of various computer hardware and software components.	Cognitive	1	1
2	Understand modern computer security risks, digital privacy and basic of computer networks	Cognitive	2	1, 8
3	Utilize hardware components, operating systems and Office Automation tools	Psychomotor	3	5

Contents

Introduction to computers

Computer defined, Application areas of computer, Generations of computers, Information/Data Processing Cycle, Classification on the basis of: Mechanism, Size, and Purpose.

Number Systems Input Output Devices:

Overview of Binary, Octal, Decimal and Hexadecimal number systems, Number system conversions. Input and Output devices: Keyboard, pointing devices (Mouse, Trackball, Trackpad, Joystick, Game controllers), Scanner, Barcode Reader, Finger Print Reader, Microphone, Digital Camera, Monitors: Cathode Ray Tube (CRT) and Flat Panel Displays (FPD), Printers, Projectors, Speakers and Plotters.

Computer Memory

Random Access memory (RAM), Read Only Memory (ROM), Flash Memory, Types of RAM: DRAM and SRAM, Types of ROM: PROM, EPROM and EEPROM, Hierarchy of memory devices: Ternary, Secondary, Primary, Cache, Registers, Units of memory measurement: Bit, Byte, KB, MB, GB, TB. PB, EB, ZB, YB.

Central Processing Unit (CPU)

Basic CPU organization, Arithmetic and Logic Unit (ALU), Memory Unit (MU), Control Unit (CU), Registers, Math Co-Processor, Arithmetic and Logic Operations.

Storage Devices

Introduction to storage devices, Magnetic storage devices: HDD, FDD, Tape Drives, Optical storage devices: CD, DVD, HD-DVD, BRD, Solid state storage devices: SSD, USB, Flash cards.

System Unit, Ports, Connectors and Expansion Slots

System Unit, Power Supply Unit (PSU), PSU connectors: Molex, Mini-Molex, P4, SATA, AUX, ATX, PCIE, Motherboard, Microprocessor Sockets and Slots: LGA, PGA and SECC, 4-pin IDE, 40-pin IDE, SATA, CMOS, Heat sink and Fan, Chipsets: North bridge and South bridge, Ports and connectors, PS/2, Serial (COM), Parallel (LPT), USB, DIN5, Firewire, HDMI, RJ-11, RJ-45, VGA, S-Video, DVI, S/PDIF, Audio ports, Expansion Slots: RAM, ISA, PCI, PCI-X, PCI Express, AGP.

BIOS and POST Operation

BIOS Overview, POST Operation Overview, Booting, Cold Boot, Warm Boot, Boot Sequence, Configuring BIOS, POST Error Messages, POST Error Beep Codes, BIOS Shadowing.

Computer Software

Program, Software, Types of software: System and Application, System software: System Management Programs, System Support Programs, System Development Programs, Applications software: General-Purpose Application Programs, Application-Specific Programs, Operating System, Utilities, Device Drivers, Language Translators, Office Automation .

Operating System

Operating System (OS) Overview, Basic functions of OS, Types of OS: Single-User Single-Tasking, Single-User Multi-Tasking, Multi-User Multi-Tasking, Real Time, Graphical User Interface (GUI) OS, Command Line Interface (CLI) OS.

Computer Networking

Network, Internet, Intranet, Extranet, Network Types: LAN, MAN, WAN, PAN, WLAN, Peer-to-Peer (P2P), Home network, Network Topologies: Bus, Ring, Star, Mesh, Tree, Hybrid, Client, Server, IP Address.

Computer Privacy, Security and Ethics

Computer security risks, Malicious Software: Virus, Worm, Spyware, Trojan Horse, Adware, Keylogger, Screen logger, Botnets, Denial of Service Attacks, Back Doors, Spoofing, Phishing, Antiviruses, Firewalls, Spam, Ethics, Copyright and Digital Rights Management (DRM), Plagiarism.

Note: Practical work is based on the above theoretical course

Recommended Books

1. Introduction to Computers, Latest Edition, Peter Norton, McGraw Hill, Latest Edition.
2. Computing Essentials 2012 Complete Edition, Timothy J. O'Leary and Linda I. O'Leary, Latest Edition.
3. Discovering Computers: Fundamentals, 4th Edition, Shelly Cashman Series, Latest Edition.
4. PC Hardware: A Beginner's Guide, Latest Edition, Ron Glister, Latest Edition.
5. Upgrading and repairing PCs, 20th Edition, Scott Mueller, Latest Edition.

Approval	Industrial Advisory Board (ES)	Res. No.	8.3	Dated:	22.8.2022
	Board of Studies (ES)	Res. No.	47.2	Dated:	28.11.2022
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	Academic Council	Res. No.	106.7(iii)	Dated:	14.10.2023

2nd Semester

MEHRAN UNIVERSITY OF ENGINEERING AND TECHNOLOGY, JAMSHORO

DEPARTMENT OF ELECTRONIC ENGINEERING

Title of Subject	:	Linear Algebra & Analytical Geometry	
Discipline	:	Electronic Engineering	
Course Code	:	MTH-112	
Semester	:	2 nd Semester	
Effective	:	17ES-Batch onwards	
Pre-requisites	:	Applied Calculus	Co-requisite: Nil
Assessment	:	20% Sessional, 30% Mid Semester and 50% End Semester Practical: 50% Sessional and 50% End Semester	
Marks	:	Theory: 100	Practical: 00
Credit Hours	:	3	0
Minimum Contact Hours	:	48	0

Course Learning Outcomes:

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

CLO	Description	Bloom's Taxonomy		PLO
		Domain	Level	
1	Determine the basic operation of matrix algebra and solution of system of linear equations.	Cognitive	2	1
2	Apply the concepts of two and three dimensional geometry	Cognitive	3	1
3	Determine area and volume of bounded regions by using multiple integrals	Cognitive	2	1

Contents:

Introductions to matrices and elementary row operations.

Brief introduction of matrices. Types of matrices. Introduction to elementary row operations. Echelon and reduced echelon forms. Rank of a matrix. Inverse of a matrix using elementary row operations.

System of linear equations.

System of non-homogeneous and homogeneous linear equations. Gaussian elimination method, Gauss Jordan method. Consistence criterion for solution of homogeneous and non-homogeneous system of linear equations. Application of system of linear equations.

Determinants

Introduction to determinants. Properties of determinants of order n. Rank of a matrix by using determinants.

Analytic geometry of 3-dimensions.

Introduction; Coordinates in R^3 .

Line: Coordination of a point dividing a line segment in a given ratio. Straight line, in R^3 . Vector form of a straight line, parametric equations of a straight line, equation of a straight line in symmetric form, direction ratios and direction cosines, angle between two straight lines; distance of a point from a line.

Plane:

Equation of a plane, angle between two planes, intersection of two planes, a plane and a straight line; skew lines. Cylindrical and spherical coordinates.

Sphere:

General equation of sphere. Latitude and longitude directions; direction of Qibla.

Multiple Integrals.

Evaluation of double and triple integrals in Cartesian and polar coordinates.

Recommended Books:

1. Brief Calculus and its Applications, Doniel D. Benice, Latest Edition.
2. Calculus and Analytical Geometry, Dr. S.M. Yousuf, Latest Edition.
3. Mathematical Methods, Dr. S.M. Yousuf, Latest Edition.

Approval	Board of Studies (ES)	Res. No.	01	Dated:	26.03.2018
	Board of FOST&H	Res. No.	3.1	Dated:	11.04.2018
	Academic Council	Res. No.	17(ii)	Dated:	23.04.2018

MEHRAN UNIVERSITY OF ENGINEERING AND TECHNOLOGY, JAMSHORO

DEPARTMENT OF ELECTRONIC ENGINEERING

Title of Subject	: Computer Programming	
Discipline	: Electronic Engineering	
Course Code	: CS-113	
Semester	: 2 nd Semester	
Effective	: 19 ES-Batch onwards	
Pre-requisites	: Introduction to Computing	Co-requisite: Nil
Assessment	: 20% Sessional, 30% Mid Semester and 50% End Semester Practical: 50% Sessional and 50% End Semester	
Marks	: Theory :50	Practical: 50
Credit Hours	: 2	1
Minimum Contact Hours	: 32	48

Course Learning Outcomes

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

CLO	Description	Bloom's Taxonomy		PLO
		Domain	Level	
1	Summarize basic computational problem solving skills.	Cognitive	2	1,2
2	Illustrate effective solutions to computing problems.	Cognitive	3	3
3	Reproduce and debug simple computer programs.	Psychomotor	3	5

Contents

Problem solving skills.

Problem solving, six steps towards problem solution, Basic problem-solving concepts: Data types, Data literals, Variables, Constants, Rules for naming variable, constant, Operators; Problem analysis tools: IPO (Input, Process, Output) chart, Program design tools: Algorithm, Flow Chart.

Basics of programming

Compilation process, Basic C++ program structure, the main procedure, return type and return statement, Outputting data with Cout statement, Preprocessor directives, header file and namespace, Comments, Whitespaces, Manipulators (endl), Escape sequences, Variables, Variable declaration, Variable initialization, Data Types and Identifiers, Literals, Constants, Operators in C++ (Arithmetic, Relational, Logical, Short circuit, Arithmetic assignment, Increment and Decrement), Expressions and <cmath>; header file, Inputting with Cin statement.

Conditional control structures

One-Way Selection, Two-Way Selection, Multi-Way Selection, Choice-Way Selection, If Statement, If-Else Statement, If-Else- If Statement, Switch Statement.

Iterative control structures

Counter-Controlled Repetition, Sentinel-Controlled Repetition, For Loop, While Loop, Do-While Loop, Break Statement, Continue Statement, Nested Loops.

Arrays and structures

Introduction to arrays, Declaring and initializing arrays, Array indices and accessing array elements, Searching arrays with linear search, Sorting arrays with bubble sort, Multidimensional arrays, Introduction to structures, Creating structures, Structure variables, Accessing structure members, Structure of structures.

Functions and strings

Introduction to functions, Function declaration, Function definition, Function calling, Return type of functions, Arguments and parameters, Function overloading, Passing arguments by value, Passing arguments by reference, Introductions to strings, Types of strings in C++, Character string / null character terminated strings, Character string functions, String objects, String object functions.

Practical will be based of theory using Code: Blocks, DevC++

Recommended Books:

1. Problem Solving And Programming Concepts, Ninth Edition, Maureen Sprankle and Jim Hubbard, Latest Edition.
2. C++ How To Program, Eighth Edition, Paul Deitel and Harvey Deitel, Latest Edition.
3. C++ Programming: From Problem Analysis To Program Design, Fifth Edition, D.S. Malik, Latest Edition.
4. MATLAB: An Introduction with Applications 5th Edition, Amos Gilat, Latest Edition.

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MEHRAN UNIVERSITY OF ENGINEERING AND TECHNOLOGY, JAMSHORO
DEPARTMENT OF ELECTRONIC ENGINEERING

Title of Subject	:	Basic Electronics	
Discipline	:	Electronic Engineering	
Course Code	:	ES-112	
Semester	:	2 nd Semester	
Effective	:	19ES-Batch onwards	
Pre-requisites	:	Nil	Co-requisite: Nil
Assessment	:	20% Sessional, 30% Mid Semester and 50% End Semester Practical: 50% Sessional and 50% End Semester	
Marks	:	Theory: 100	Practical: 50
Credit Hours	:	3	1
Minimum Contact Hours	:	48	48

Course Learning Outcomes:

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

CLO	Description	Bloom's Taxonomy		PLO
		Domain	Level	
1	Explain the basics, working and characteristics of Semiconductor material and diodes.	Cognitive	2	1
2	Analyze the working and behaviour of transistors and their types and be able to understand different transistor applications	Cognitive	4	2
3	Reproduce basic electronic circuits on board using discrete components i.e. resistors, diodes and transistors, and develop project using discrete components and/or circuit simulation platform.	Psychomotor	3	5
4	Contribute and respond actively during lab work.	Affective	2	9

Contents:

Introduction to electronics: diodes:

pn junction diode, forward and reverse characteristics of a diode, ideal diode, practical diode, equivalent circuit of a diode, current equation of a diode, diode as a switch.

Types of diodes:

Schottky diode, zener diode, tunnel diode, varactor diode, LED, laser diode.

Applications of diode:

Half-and full-wave rectifiers, clipper and clamper circuits, voltage multipliers.

Bipolar junction transistor:

Operation, *npn* and *pnp* transistors, unbiased transistors, DC biasing of a transistor, static characteristics, DC circuit analysis, load line, operating point and bias stabilization, Transistor as an amplifier.

Transistor biasing configurations:

Common emitter, common base, common collector. Field-effect transistor.

FET biasing techniques:

Common drain, common source and common gate, fixed bias and self-bias configurations, voltage divider biasing, universal JFET bias curve, darlington pair.

MOSFET

Introduction, Enhancement mode, depletion mode MOSFET

Recommended Books:

1. Electronic Devices and Circuit Theory, Robert Boylestad and Louis Nashelsky, Prentice Hall, Latest Edition.
2. Introductory Basic Electronics: Electron Flow Version, Robert Paynter, Prentice Hall, Latest Edition.
3. Principles of Electronic, V.K Mehta, Latest Edition.
4. The Art of Electronics, Paul Horowitz and Winfield Hill, Latest Edition.

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	Board of FEEC Engineering	Res. No.	20.5	Dated:	22.02.2023
	Academic Council	Res. No.	106.7(iii)	Dated:	14.10.2023

MEHRAN UNIVERSITY OF ENGINEERING AND TECHNOLOGY, JAMSHORO

DEPARTMENT OF ELECTRONIC ENGINEERING

Title of Subject	:	Professional Ethics	
Discipline	:	Electronic Engineering	
Course Code	:	SS- 125	
Semester	:	1 st Semester	
Effective	:	19ES-Batch onwards	
Pre-requisites	:		Co-requisite: Nil
Assessment	:	20% Sessional, 30% Mid Semester and 50% End Semester	
		Practical: 50% Sessional and 50% End Semester	
Marks	:	Theory: 50	Practical: 00
Credit Hours	:	2	0
Minimum Contact Hours	:	32	0

Course Learning Outcomes:

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

CLO	Description	Bloom's Taxonomy		PLOs
		Domain	Level	
1	Describe why legal and professional definitions of ethics exist; Identify the benefits that are expected to arise for engineers from acting ethically as well as specific consequences of acting unethically in the society	Cognitive	1	6, 8
2	Demonstrate the use of Ethical decision- making framework.	Affective	3	8
3	Present an engineering catastrophe caused by not conforming to the code of ethics, report the flaws and give recommendations.	Affective	2	8

Contents:

- **An Overview of Professional Ethics:**
Professional ethics defined, Social responsibility and business ethics, the development of business/ professional ethics, framework for studying business ethics.
- **Ethical issues in Business:**
Foundation of ethical conflict, classifications of ethical issues, ethical issues related to participants and functional areas of business, recognizing an ethical issue.
- **Social Responsibility:**
The economic dimension, the legal dimension, the ethical dimension and the philanthropic dimension.
- **Ethical Decision-Making Framework:**
Ethical issue intensity, individual factors: Stages of cognitive moral development, corporate culture, significant others, opportunity, business ethics evaluations and intensions, using the ethical decision-making framework to improve ethical decisions.
- **How the Organization Influences Ethical Decision-Making:**
Organizational structure and business ethics, the role of corporate culture in ethical decision-making, group dimension of organization structure and culture, implications of organizational relationship for ethical decision.
- **Development of an Effective Ethics Program:**

An effective ethical compliance, program and codes of ethics and compliance standards, manager's responsibility, delegation of authority, effective communication of ethical standards, establishing a system to monitor, audit and enforce ethical standards.

Recommended Books:

1. Business Ethics: Ethical Decision Making and Cases, C. Ferrell, John Fraedrich and Linda Ferrell,” Houghton Mifflin Co, Latest Edition.
2. Ethics in Engineering, Mike W. Martin and Roland Steiniger, McGraw-Hill, Latest Edition.

Approval	Industrial Advisory Board (ES)	Res. No.	8.3	Dated:	22.8.2022
	Board of Studies (ES)	Res. No.	47.2	Dated:	28.11.2022
	Board of FEEC Engineering	Res. No.	20.5	Dated:	22.02.2023
	Academic Council	Res. No.	106.7(iii)	Dated:	14.10.2023

MEHRAN UNIVERSITY OF ENGINEERING AND TECHNOLOGY, JAMSHORO

DEPARTMENT OF ELECTRONIC ENGINEERING

Title of Subject	:	Pakistan Studies	
Discipline	:	Electronic Engineering	
Semester	:	2 nd Semester	
Course Code	:	PS-106	
Effective	:	17ES-Batch onwards	
Pre-requisites	:		Co-requisite: Nil
Assessment	:	20% Sessional, 30% Mid Semester and 50% End Semester Practical: 50% Sessional and 50% End Semester	
Marks	:	Theory: 50	Practical: 00
Credit Hours	:	2	0
Minimum Contact Hours	:	32	0

Course Learning Outcomes:

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

CLO	Description	Bloom's Taxonomy		PLO
		Domain	Level	
1	Trace the Muslim Nationalism in South Asia and the creation of Pakistan	Cognitive	2	6
2	Discuss the Constitutional and Political history of Pakistan and to analyse contemporary challenges to Pakistan	Cognitive	2	6

Contents:

- **The Historical Background of Pakistan**
 - Evolution and growth of Muslim society in Subcontinent
 - Muslim Revivalist and Reformist Movements
 - The Factors that shaped the Muslim Nationalism in the Subcontinent
 - The Factors that led birth to Pakistan
 - Ideology of Pakistan with special reference to Allama Muhammad Iqbal and Quaid-e-Azam Muhammad Ali Jinnah
 - Role of Sindh in Making of Pakistan
- **History of Internal and External Affairs of Pakistan:**
 - The Constitutional and Political Developments in Pakistan (1947-1973)
 - The Constitution of 1973; Salient Features and Amendments
 - Political Development in Pakistan (1973 to date)
 - Determinants of Foreign Policy of Pakistan
 - Pakistan's Relations with Big Powers
- **Contemporary Pakistan (Issues and Challenges):**
 - Geo-Strategic Significance of Pakistan
 - Economic Potential and its Utilization
 - Challenges to National Security of Pakistan
 - Internal Political, Economic and Legal Problems
 - Futuristic Outlook of Pakistan.

Recommended Books:

1. Pakistan's Foreign Policy 1947–2016 A Concise History (4th ed.), Abdul Sattar, (2017), , Karachi: Oxford University Press, Latest Edition.
2. The Future of Pakistan Cohen Stephen, Washington: Brookings Institute Press, Latest Edition.
3. Front line Pakistan: The Struggle with Militant Islam, Hussian, Zahid, New York: I.B.Tauris, Latest Edition.
4. The Struggle for Pakistan: A Muslim Homeland and Global Politics, Jalal, Ayesha, (2014), The Belknap Press of Harvard University Press, Latest Edition.
5. A Concise History of Pakistan, Kazimi, M. R., (2008), Karachi: Oxford University Press, Latest Edition.
6. Constitutional and Political History of Pakistan (3rd ed.), Khan, Hamid, (2017), Karachi: Oxford University Press, Latest Edition.
7. A History of Pakistan, Long, Roger D., (2015), Karachi: Oxford University Press, Latest Edition.
8. Islam, Ethnicity, and Power Politics: Constructing Pakistan's National Identity, Rais, RasulBakhsh, (2017), Karachi: Oxford University Press, Latest Edition.
9. Deadly Embrace: Pakistan, America, and the Future of Global Jihad, Riedel, Bruce, (2011), Washington: Brookings Institute Press, Latest Edition.
10. Pakistan: The Formative Phase, Sayeed, K. B., (1960), Karachi: Oxford University Press, Latest Edition.
11. Pakistan: A New History, Talbot, Ian, (2014), Karachi: Oxford University Press, Latest Edition.
12. Jinnah of Pakistan, Wolpert, Stanley, (1997), Karachi: Oxford University Press, Latest Edition.

Approval	Board of Studies 01/2018	Res. No. 01	Dated: 26.03.2018
	Board of FOST&H	Res. No. 3.1	Dated: 11.04.2018
	Academic Council	Res. No. 17(ii)	Dated: 23.04.2018

MEHRAN UNIVERSITY OF ENGINEERING AND TECHNOLOGY, JAMSHORO

DEPARTMENT OF ELECTRONIC ENGINEERING

Title of Subject	:	Islamic Studies	
Discipline	:	Electronic Engineering	
Course Code	:	IS-111	
Semester	:	2 nd Semester	
Effective	:	17ES-Batch onwards	
Pre-requisites	:	Nil	Co-requisite: Nil
Assessment	:	20% Sessional, 30% Mid Semester and 50% End Semester Practical: 50% Sessional and 50% End Semester	
Marks	:	Theory: 50	Practical: 00
Credit Hours	:	2	0
Minimum Contact Hours	:	32	0

Course Learning Outcomes:

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

CLO	Description	Bloom's Taxonomy		PLO
		Domain	Level	
1	Explain scope and significance of basic beliefs & pillars of Islam, their effects on different aspects of individual life and society	Cognitive	2	8
2	Enhance understanding of Quran, Hadith and life of Holy Prophet Muhammad (ﷺ) as the source of inspiration and guidance.	Cognitive	2	6

Contents:

Quran and Uloomul Quran: Surah Al-Hujurat., Surah Al-Furqan (These both surahs cover all topics related to ethical values of Islamic society including Taqwa, Simplicity, Lawful earning, Social Justice, Rights of Parents, elders, neighbors, Fear of Allah and Truthfulness), Excellence of Holy Quran (Aijazul Quran), History of collection and compilation of Holy Quran. **Basic Beliefs of Islam:** Tauheed, its importance, effects on the life of believer, shirk and its types, Existence of Angels, Holy Scriptures, Prophethood, its need and necessities, characteristics and Finality of Prophethood, Concept on life hereafter. **Life history of Holy Prophet Muhammad (ﷺ):** Life history at Makkah (Before Prophethood), Life history at Makkah (after Prophethood), Life history at Madina {including Brotherhood, Charter of Madina, Victory of Makkah and Last Sermon of Holy Prophet Muhammad (ﷺ)}, Importance of Hadith and Sunnah, Ten selected Ahadiths (Covering topics related to Proper usage of time, Hospitality, quality of shyness, love and affection to humanity, facilitate to others and tolerance etc). **Fundamentals of Islam:** Testifying Kalima Shahadah, Prayer, its importance, pre-conditions, obligations and effects, Zakat, its aims & objectives, Requirements, Legal recipients, Nisab and benefits, Fasting, its philosophy, requirements and benefits, Pilgrimage, requirements, types, obligations, procedure and benefits, Jihad and its types. **Islam and Science:** Quran and Science, Importance of science and technology in Islam, Historical contribution of Islam and Muslims in the development of science, Verses of Holy Quran those cover different fields of science e.g. social, management and natural science.

Text books:

1. A.A. Umrani, **Islam: The universal Religion**, Naseem book depo, latest edition.
2. A.Q. Natiq, **Sirat-e-Mustaqeem**, Urdu bazaar Karachi, latest edition.

Reference books:

1. S.M. Saeed, **Islam aur Hamari Zindagi**, Naseem book depo, latest edition.
2. M. Shabudden, **Quran Science and Muslims**, Al Maktabah Al Ashrafiya, Lahore, latest edition.

Approval	Board of Studies 01/2018	Res. No. 01	Dated: 26.03.2018
	Board of FOST&H	Res. No. 3.1	Dated: 11.04.2018
	Academic Council	Res. No. 17(ii)	Dated: 23.04.2018

MEHRAN UNIVERSITY OF ENGINEERING AND TECHNOLOGY, JAMSHORO

DEPARTMENT OF ELECTRONIC ENGINEERING

Title of Subject	:	Ethics	
Discipline	:	Electronic Engineering	
Course Code	:	SS-104	
Semester	:	2 nd Semester	
Effective	:	17ES-Batch onwards	
Pre-requisites	:	Nil	Co-requisite : Nil
Assessment	:	20% Sessional, 30% Mid Semester and 50% End Semester Practical: 50% Sessional and 50% End Semester	
Marks	:	Theory: 50	Practical: 00
Credit Hours	:	2	0
Minimum Contact Hours	:	32	0

Course Learning Outcomes:

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

CLO	Description	Bloom's Taxonomy		PLO
		Domain	Level	
1	Create stable and healthy civilized society.	Cognitive	2	6
2	Develop uniformity of moral beliefs and behaviour.	Cognitive	2	8

Contents:

- **Ethics:**

Definition of Ethics, Position of ethics in different religions.

- **Islam:**

Introduction, Role of Beliefs and Arakans in character building, Rights of Non-Muslim, Ill effects of corruption and respect of law.

- **Hinduism:**

Introduction, Role of doctrines in character building, Religious books, Concept of Re-Birth and its influence in social life, Celebration days and their social effects, Comparative study of cast systems in the contemporary atmosphere.

- **Buddhism:**

Introduction, Doctrines, Eight Nobel Paths of Buddha and its benefits, Critical study on concept of Renunciation of material & worldly life.

- **Christianity:**

Introduction, Doctrines, Religious books, Celebration days.

- **Judaism:**

Introduction, Doctrines, Religious books, Ten Commandments of Moses and its importance in social life.

- **Moral values of different religions:**

Patience, Modesty, Moderation, Tawakal, Taqwa, Lawful earning, Sincerity, Positivity, Forgiveness and Softening.

- **Bad morals:**

lying, pride, selfishness, Fame, Greed, Extravagantness, Bribe, Social injustice, Religious biasness and Discrimination on the basis of race, color and faith

Books Recommended:

1. Comparative Study of Religions, Dr. A Rasheed, Tahir sons Karachi, Latest Edition.
2. Mazahib-e-Aalamkinazar main, Aadil Faraz, Ikhlaqiyat, ApnaIdaraLahor, Latest Edition.
3. Mazahib Aalam joTaqabili, Jaezo, M HashimChannaNaseem Book depot, Latest Edition.

Approval	Board of Studies 01/2018	Res. No.	01	Dated:	26.03.2018
	Board of FOST&H	Res. No.	3.1	Dated:	11.04.2018
	Academic Council	Res. No.	17(ii)	Dated:	23.04.2018

3rd Semester

MEHRAN UNIVERSITY OF ENGINEERING AND TECHNOLOGY, JAMSHORO

DEPARTMENT OF ELECTRONIC ENGINEERING

Title of Subject	:	Differential Equations & Fourier Series
Discipline	:	Electronic Engineering
Semester	:	3 rd Semester
Course Code	:	MTH-212
Effective	:	17ES-Batch onwards
Pre-requisites	:	Applied Calculus, Linear Algebra & Analytical Geometry Co-requisite: Nil
Assessment	:	20% Sessional, 30% Mid Semester and 50% End Semester Practical: 50% Sessional and 50% End Semester
	:	Theory: 100 Practical: 00
Credit Hours	:	3 0
Minimum Contact Hours	:	48 0

Course Learning Outcomes:

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

CLO	Description	Bloom's Taxonomy		PLO
		Domain	Level	
1	Determine The formation and the solution methods of first order linear and non-linear differential equation	Cognitive	2	1
2	Compute higher order linear and partial differential equations	Cognitive	2	1
3	Apply Fourier series of various functions	Cognitive	2	1

Contents:

- **First order linear and non-linear differential equations**
Introduction, formation and solution of first order, first degree Differential Equations.
- **Higher order linear differential equations**
Homogeneous linear equations of order n with constants coefficients, solutions of higher order differential equations according to the roots of auxiliary equation. Non-Homogeneous linear equations. Cauchy Euler equation. Method of variations of parameters. Applications of higher order linear differential equations.
- **Introduction to Partial Differential Equations**
Solution of Laplace equation, wave equation and equation, by variable separable method heat (simple case).
- **Fourier Series**
Fourier coefficients. Convergence of Fourier series. Fourier series of odd and even functions.

Recommended Books:

1. Differential Equations, .Daniel Murray, Latest Edition.
2. Advanced Engineering Mathematics, .H.K. Dass, Latest Edition.
3. Advanced Engineering Mathematics, Dr. B.S. Grawall, Latest Edition.
4. Mathematical Methods, Dr. S.M. Yusuf, Latest Edition.
5. Differential Equations and Fourier Series, M.U. Shaikh, Latest Edition.
6. Ordinary Differential Equations with Numerical Techniques, John L. Iwaarden, Latest Edition.

Approval	Board of Studies 01/2018	Res. No.	01	Dated:	26.03.2018
	Board of FOST&H	Res. No.	3.1	Dated:	11.04.2018
	Academic Council	Res. No.	17(ii)	Dated:	23.04.2018

MEHRAN UNIVERSITY OF ENGINEERING AND TECHNOLOGY, JAMSHORO

DEPARTMENT OF ELECTRONIC ENGINEERING

Title of Subject	:	Electronic Circuit Design	
Discipline	:	Electronic Engineering	
Semester	:	3 rd Semester	
Course Code	:	ES-203	
Effective	:	19ES-Batch onwards	
Pre-requisites	:	Basic Electronics	Co-requisite: Nil
Assessment	:	20% Sessional, 30% Mid Semester and 50% End Semester Practical: 50% Sessional and 50% End Semester	
Marks	:	Theory: 100	Practical: 50
Credit Hours	:	3	1
Minimum Contact Hours	:	48	48

Course Learning Outcomes:

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

CLO	Description	Bloom's Taxonomy		PLO
		Domain	Level	
1	Explain the basic concepts of amplifiers and its behavioural analysis with the help of hybrid parameters, AC & DC load lines	Cognitive	2	1
2	Infer the frequency characteristics and stability analysis of different electronic devices including filters, amplifiers and oscillators	Cognitive	4	2
3	Apply operational amplifiers, active filters, oscillators and data converters to construct various small-scale electronic circuits	Cognitive	3	3
4	Reproduce electrical parameters and frequency response of different discrete electronic circuit designs & signal generators.	Psychomotor	3	5
5	Contribute and respond actively during lab work.	Affective	2	9

Contents:

- **Amplifier Fundamentals:**
Gain calculation – system analysis, single stage BJT and FET amplifier, frequency response.
- **Practical Amplifier Considerations:**
Input and output impedance, real and apparent gain, amplifier loading, impedance matching of amplifiers.
- **Power Amplifiers:**
Classes of power amplifiers, series-fed class A amplifiers, Power efficiency and dissipation, harmonic distortion, single-ended class A amplifiers, transformer-coupled push-pull amplifiers, other push-pull amplifiers, complementary symmetry amplifiers.
- **Tuned Amplifiers:**
Single tuned amplifiers, coupling of tuned amplifiers, double tuned amplifiers, stagger tuned amplifiers.
- **Feedback Amplifiers:**
General feedback concepts, voltage feedback amplifiers, current feedback amplifiers, effect of feedback on frequency response, series and shunt feedback amplifiers, effect of feedback on non-linear distortion and noise.

- **The Transistor Amplifier at High Frequency:**

Design and analysis of high frequency amplifiers using S-plane technique, step response of high frequency amplifiers.

- **Multi-Stage Transistor Amplifier:**

The multi-stage amplifier at mid-frequencies, approximation for low and high frequencies, the design of a broadband amplifier.

- **Oscillators:**

Hartley oscillators, Colpits oscillators, RC phase shift oscillators, Wein-Bridge oscillators, crystal oscillators based on BJTs and FETs.

Recommended Books:

1. Basic Electronic Devices, Circuits and Systems, Cirovic, M.M., Prentice-Hall, Latest Edition.
2. Electronic Circuit Analysis and Design, Hayt and Neudeck, Houghton Mifflin Co., Boston, Latest Edition.
3. Electronic Principles, Cambell, G., and Searle, Latest Edition.

Approval	Industrial Advisory Board (ES)	Res. No.	8.3	Dated:	22.8.2022
	Board of Studies (ES)	Res. No.	47.2	Dated:	28.11.2022
	Board of FEEC Engineering	Res. No.	20.5	Dated:	22.02.2023
	Academic Council	Res. No.	106.7(iii)	Dated:	14.10.2023

MEHRAN UNIVERSITY OF ENGINEERING AND TECHNOLOGY, JAMSHORO

DEPARTMENT OF ELECTRONIC ENGINEERING

Title of Subject	:	Digital Electronics	
Disciplines	:	Electronic Engineering	
Semester	:	3 rd Semester	
Course Code	:	ES-226	
Effective	:	22ES-Batch onwards	
Pre-requisites	:	Nil	Co-requisite: Nil
Assessment	:	20% Sessional, 30% Mid Semester and 50% End Semester Practical: 50% Sessional and 50% End Semester	
Marks	:	Theory: 100	Practical: 50
Credit Hours	:	3	1
Minimum Contact Hours	:	48	48

Course Learning Outcomes:

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

CLO	Description	Bloom's Taxonomy		PLO
		Domain	Level	
1	Explain fundamentals and underlying principles of digital design.	Cognitive	2	1
2	Understand Boolean theorems, SOP, POS and their minimization techniques and Analyze various types of Gates and their applications to digital circuits.	Cognitive	4	2
3	Design Combinational and Sequential logic Circuits using basic gates as well as MSI devices.	Cognitive	5	3
4	Develop digital systems using the standard integrated circuits and explain how various digital functions can operate together as a total system to perform a specified task.	Psychomotor	4	5
5.	Organize the lab data to emphasize experimental, objectives, procedures, observations etc.	Affective	4	10

Contents:

Introductory Digital Concepts:

Digital and analog quantities, digital and analog systems, binary digits, logic levels and digital wave forms, representing binary quantities, digital integrated circuits, Logic families and their characteristics, TTL Integrated circuits, CMOS integrated circuits, IC packages, integrated circuit complexity classifications. Nonprogrammable, programmable, and Hardware Programmable ICs.

Number Systems, Operations and Codes:

Introduction to number systems, conversions, binary arithmetic, 1s and 2s complements of binary numbers, signed numbers, arithmetic operations with signed numbers, BCD code, gray code, binary to gray and gray to binary number conversion, alphanumeric codes, parity in codes.

Boolean Algebra and Logic Simplification:

Boolean constants and variables, truth tables, introduction to Boolean operations, Boolean theorems, DeMorgan's theorems. Introduction to digital logic gates, implementing Boolean expressions with logic gates, Simplification using Boolean algebra, Standard forms of Boolean expressions, Boolean expressions and truth

tables, Introduction to Karnaugh map, reducing an expression using Karnaugh map, Karnaugh map SOP minimization, Karnaugh map POS minimization.

Combinational Logic:

Basic combinational logic circuits, Implementation of combinational logic, the universal property of NAND and NOR gates, combinational logic using NAND and NOR gates, Adders, Multiplexers, DeMultiplexers, Decoders, Encoders, Comparators.

Sequential Logic:

Fundamentals of Sequential logic circuits, Latches, Flip-Flops and their applications; Counters, Shift Registers and their applications; Finite State Machines.

Recommended Books:

1. Digital Fundamentals, Thomas L. Floyd & R.P Jain, Latest Edition.
2. Digital Systems Principles and Applications, Ronald J. Tocci, Neal S. Widmer, Latest Edition.
3. Digital Electronics Practical Approach, William Kleitz, Latest Edition.
4. Logic and Computer Design Fundamentals, Morris Mano and Charles R. Kime, Prentice Hall, Latest Edition.

Approval	Industrial Advisory Board (ES)	Res. No.	8.3	Dated:	22.8.2022
	Board of Studies (ES)	Res. No.	47.2	Dated:	28.11.2022
	Board of FEEC Engineering	Res. No.	20.5	Dated:	22.02.2023
	Academic Council	Res. No.	106.7(iii)	Dated:	14.10.2023

MEHRAN UNIVERSITY OF ENGINEERING AND TECHNOLOGY, JAMSHORO**DEPARTMENT OF ELECTRONIC ENGINEERING**

Title of Subject	:	Measurements & Instrumentation
Discipline	:	B.E Electronic Engineering
Semester	:	3 rd Semester
Course Code	:	ES-227
Effective	:	22ES-Batch onwards
Pre-requisites	:	Nil
Assessment	:	20% Sessional, 30% Mid Semester and 50% End Semester Practical: 50% Sessional and 50% End Semester
Marks	:	Theory: 100 Practical: 50
Credit Hours	:	3 1
Minimum Contact Hours	:	48 48

Course Learning Outcomes:

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

CLO	Description	Bloom's Taxonomy		PLO
		Domain	Level	
1	Explain the fundamentals of instrumentation and measurement systems and working principles of sensors and transducers	Cognitive	2	1
2	Apply signal conditioning principles in practical scenarios to develop complete instrumentation and measurement systems with a given certain specifications.	Cognitive	3	3
3	Develop virtual instrumentation system with NI labView	Cognitive	3	3
4	Reproduce a complete instrumentation and measurement system data acquisition, display, archiving and retrieval.	Psychomotor	3	5
5	Participate and contribute towards the achievement of given experiment.	Affective	2	9

Contents**Measuring Instruments:**

Principles of general measurement system, Performance characteristics of Instruments, Instruments for measurement of electrical and non-electrical quantities including voltmeters, ammeters, function generators, oscilloscopes; Control and damping, moving coil, moving iron, electro-dynamics and rectifier ammeters and voltmeters, induction instruments, watt meters and energy meters, multimeter, indicating and recording instruments, shunts and multipliers, extension of instrument range calibration, frequency and power factor meters, maximum demand indicator, DC voltmeters, AC voltmeters (average, peak and rms), cathode ray oscilloscope (general purpose, dual trace, storage).

Transducer and Sensors

Selecting a Transducer, Transducer, Sensor, and Actuator, Types of Sensors, Displacement Measurements, Resistive sensors – potentiometers, resistive sensors – strain gauge, inductive sensors, LVDT, capacitive sensors, piezoelectric sensors, modes of piezoelectric sensors, transfer function of Piezoelectric Sensors, Temperature Measurement, Thermocouple, Thermocouple Laws, Thermoelectric Sensitivity, Thermistors, Circuits connection of Thermistors, Thermistors Resistance, Voltage-versus-current characteristics, Radiation Thermometer Systems, Fibre-Optic temperature sensors, optical measurement, Photoemissive Sensors, Photoconductive Cells, Photo junction Sensors, Photovoltaic Sensors; digital transducers i.e., Event counter and coding; performance and uncertainty analysis of digital transducers

Signal Conditioning Circuits

Analog Signal Conditioning: Wheat Stone Bridge, Filters, Operational Amplifier and Instrumentation Amplifier.

Digital Signal Conditioning: Analog to digital converter, Digital to analog converter.

Data Acquisition System

Data acquisition software, and virtual Instruments; intelligent instrumentation systems, NI LabVIEW.

Recommended Books:

- Modern Electronic Instrumentation and Measurements Techniques by A.D.Helfrick, W.D. Cooper, Latest Edition.
- Klaas B. Klaassen and Steve Gee, “Electronic Measurement and Instrumentation,” Cambridge University Press, Latest Edition.
- H Kevin, JamesH, “PC Interfacing and Data Acquisition: Techniques for Measurement, Instrumentation and Control,” Newnes, Latest Edition.
- Alan S. Morris, Reza Langari, “Measurement and Instrumentation, Theory and Application”, Elsevier, Latest Edition.
- ,ByA.K.Sawhney, Electrical Instrumentation and Measurement techniques, Latest Edition.

Approval	Industrial Advisory Board (ES)	Res. No.	8.3	Dated:	22.8.2022
	Board of Studies (ES)	Res. No.	47.2	Dated:	28.11.2022
	Board of FEEC Engineering	Res. No.	20.5	Dated:	22.02.2023
	Academic Council	Res. No.	106.7(iii)	Dated:	14.10.2023

MEHRAN UNIVERSITY OF ENGINEERING AND TECHNOLOGY, JAMSHORO
DEPARTMENT OF ELECTRONIC ENGINEERING

Title of Subject: Communication Skills (Th)
Code : ENG-201
Discipline : 3rd Semester
Effective : 21 Batch and onwards
Pre-requisite : Functional English Co-requisite: Nil
Assessment : 20% Sessional, 30% Mid Semester and 50% End Semester
Practical: 50% Sessional and 50% End Semester
Credit Hours : 02 + 00 Marks : 50 + 00
Minimum Contact Hours: 32 + 00

Course Learning Outcomes:

After completing the "Communication Skills" course, each student will be able to:

CLO No.	Description	Taxonomy Level	Linking to PLOs
CLO-1	write various formal and in-formal writing genres.	C6	PLO-10
CLO-2	use integrated skills to communicate effectively in professional settings and beyond.	C3	PLO-9

Contents:

Introduction to communication: Explanation, concept, kinds, process and use of communications. Effective communication, SEF model and characteristics of communications, barriers to communications.

Principles of Communication: Introduction to seven C's, role of seven C's, use of seven C's in daily and business communication.

Writing Skills: Introduction to effective writing, purpose of writing, stages of writing, reader's analysis, organization/gathering of writing material, writing techniques, approaches to written communication, writing formats (paragraphs, headings, subheadings, numbering etc).

Report Writing: Introduction and significance of report writing, internal office communication, effective business letter writing, organizing business messages, managing, and organizing long business reports, feasibility report and incident report, writing a business proposal, business requests, writing job application, resume/CV writing.

Handling Business Meetings: Agenda writing, minutes of the meeting, recording and presenting minutes of the meeting, successful written and oral presentation: presentation techniques including collecting and managing material, making and using audio visual aids, handling questions and audiences, attention getting techniques, personal management in presentation, persuasive communication.

Presentation Skills: Formal Presentation Skills (3 P's of Presentation) Public Speaking (Do's and Don'ts, Target audience, Required message, selection of medium and topic)

Recommended Books:

1. Cosmo F. Ferrara, "Writing on the Job", latest edition.
2. Murphy, "Effective Communication", latest edition.

Approval:

Board of Studies, ELDC
Board of Faculty (FoST&H)
Academic Council

Res. No.1

Dated: 21.11.2019
Dated: 19.7.2021
Dated: 24.08.2021

MEHRAN UNIVERSITY OF ENGINEERING AND TECHNOLOGY, JAMSHORO

DEPARTMENT OF ELECTRONIC ENGINEERING

Title of Subject	: Computer Aided Engineering Design	
Discipline	: Electronic Engineering	
Course Code	: CS-215	
Semester	: 3 rd Semester	
Effective	: 18ES-Batch onwards	
Pre-requisites	: Introduction to Computing, Computer Programming Co-requisite: Nil	
Assessment	: 20% Sessional, 30% Mid Semester and 50% End Semester	
	Practical: 50% Sessional and 50% End Semester	
Marks	: Theory: 00	Practical: 50
Credit Hours	: 0	1
Minimum Contact Hours	: 0	48

Course Learning Outcomes:

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

CLO	Description	Bloom's Taxonomy		PLO
		Domain	Level	
1	Explain the essential skills on how to use Computer Aided Design software.	Psychomotor	2	1
2	Reproduce the objects in 2-dimentional and 3-dimensional space.	Psychomotor	3	5

Contents

Introduction to computer-aided design tools such as AutoCAD, OrCAD and PCAD; computer-aided drafting principles and practices; engineering drawing fundamentals using AutoCAD; designing shapes in 2 dimensional and 3 dimensional space, drawing of electrical machinery and layouts of electronic assemblies, design and layout of circuit boards using software (PCAD or OrCAD).

Software Tools

AutoCAD, OrCAD, PCAD, Microsoft Visio.

Recommended Books:

1. Tutorial Guide to AutoCAD, Shawna Lockhart, Prentice Hall, Latest Edition.
2. Introduction to PSpice Using OrCAD for Circuits and Electronics, Muhammad H. Rashid, Prentice Hall, Latest Edition.
3. MATLAB: An Introduction with Applications, 5th Edition, Amos Gilat, Latest Edition.

Approval	Industrial Advisory Board (ES)	Res. No.	8.3	Dated:	22.8.2022
	Board of Studies (ES)	Res. No.	47.2	Dated:	28.11.2022
	Board of FEEC Engineering	Res. No.	20.5	Dated:	22.02.2023
	Academic Council	Res. No.	106.7(iii)	Dated:	...

4th Semester

MEHRAN UNIVERSITY OF ENGINEERING AND TECHNOLOGY, JAMSHORO

DEPARTMENT OF BASIC SCIENCES AND RELATED STUDIES

Title of Subject	:	Complex Variables & Transforms	
Discipline	:	Electronic Engineering	
Semester	:	4 th Semester	
Course Code	:	MTH-213	
Effective	:	17ES-Batch onwards	
Pre-requisites	:	Applied Calculus, Linear Algebra & Analytical Geometry Co-requisite: Nil	
Assessment	:	20% Sessional, 30% Mid Semester and 50% End Semester Practical: 50% Sessional and 50% End Semester	
Marks	:	Theory: 100	Practical: 00
Credit Hours	:	3	0
Minimum Contact Hours	:	48	0

Course Learning Outcomes:

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

CLO	Description	Bloom's Taxonomy		PLO
		Domain	Level	
1	Understand complex number and complex variables. Complex differentiation and integration	Cognitive	2	1
2	Apply Transformations, Laplace and Fourier and their geometrical and physical applications	Cognitive	2	1
3	Analyse Fourier transforms for the solution of differential equations	Cognitive	3	1

Contents:

- **Complex Numbers System and Complex Variable Theory:**
Introduction to complex number systems. De Moivre's theorem and its applications. Complex functions, Cauchy-Riemann equations (in Cartesian and polar coordinates). Complex integration, singularities, poles, residues and contour integration and applications.
- **Laplace Transforms**
Laplace and inverse Laplace transform of elementary functions and their properties. Applications of Laplace transformation in various fields of engineering.
- **Fourier transform**
Fourier transform and inverse Fourier transforms. Solution of differential equations using Fourier Transform.

Recommended Books:

1. Advanced Engineering Mathematics, H.K. Dass, Latest Edition.
2. Advanced Engineering Mathematics, Dr. B.S Grawall, Latest Edition.
3. Advanced Engineering Mathematics, Erwin Crayzig, Latest Edition.
4. Theory and Problems of Laplace Transforms, McGraw Hill.M.R. Speigal, Schaum's Outlines Series, Latest Edition.
5. Theory and Problems of Complex Variables, McGraw Hill. M.R. Speigal, Schaum's Outlines Series, Latest Edition.

Approval	Board of Studies 01/2018	Res. No.	01	Dated:	26.03.2018
	Board of FOST&H	Res. No.	3.1	Dated:	11.04.2018
	Academic Council	Res. No.	17(ii)	Dated:	23.04.2018

MEHRAN UNIVERSITY OF ENGINEERING AND TECHNOLOGY, JAMSHORO

DEPARTMENT OF ELECTRONIC ENGINEERING

Title of Subject	:	Electrical Machines	
Discipline	:	Electronic Engineering	
Semester	:	4 th Semester	
Course Code	:	EL-202	
Effective	:	18ES-Batch onwards	
Pre-requisites	:	Applied Physics	Co-requisite: Nil
Assessment	:	20% Sessional, 30% Mid Semester and 50% End Semester Practical: 50% Sessional and 50% End Semester	
Marks	:	Theory: 50	Practical: 50
Credit Hours	:	2	1
Minimum Contact Hours	:	32	48

Course Learning Outcomes:

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

CLO	Description	Bloom's Taxonomy		PLO
		Domain	Level	
1	Explain the working, construction, connections, and fundamentals of electrical machines.	Cognitive	2	1
2	Analyze the performance and characteristics of electrical machines.	Cognitive	4	2
3	Demonstrate the experiments and analyze the data of various electrical machines.	Psychomotor	4	5

Contents:

- **Transformer:**

Ideal and practical single-phase transformer, derivation of equivalent circuit, determination of transformer parameters, voltage regulation, efficiency, variable frequency operation, 3-phase transformer connection, auto transformer and current transformer.

- **DC Machine:**

General construction, motor/generator action, armature winding, magnetic circuit, armature reaction, commutation, EMF and torque equation, performance characteristics of shunt motor, speed control and starter, losses and efficiency, descriptive comparison of shunt, series and compounded motor.

- **Induction Motor:**

Production of rotating magnetic fields, principles of induction motor, induction motor as a generalized transformer, derivation of equivalent circuit, power balance equation, torque, output power, circuit parameters. starting, terminal characteristics of fractional horse-power motors and servo motors.

- **Synchronous Generator and Motor:**

General construction, relation between speed, number of poles and frequency waveform, armature winding. EMF equation, losses and efficiency, armature reaction, vector diagram of alternator, regulation, synchronous motor: torque, excitation, starting and power factor improvement, stepper motor.

Recommended Books:

1. Electrical Machines and their Applications, Hindmarsh, J, Latest Edition
2. Electrical Technology, Hughes, E, Latest Edition.

Approval	Industrial Advisory Board (ES)	Res. No.	8.3	Dated:	22.8.2022
	Board of Studies (ES)	Res. No.	47.2	Dated:	28.11.2022
	Board of FEEC Engineering	Res. No.	20.5	Dated:	22.02.2023
	Academic Council	Res. No.	106.7(iii)	Dated:	14.10.2023

MEHRAN UNIVERSITY OF ENGINEERING AND TECHNOLOGY, JAMSHORO

DEPARTMENT OF ELECTRONIC ENGINEERING

Title of Subject	:	Probability and Random Signals	
Discipline	:	Electronic Engineering	
Course Code	:	ES-232	
Semester	:	4 th Semester	
Effective	:	22ES-Batch onwards	
Pre-requisites	:	Nil	Co-requisite: Nil
Assessment	:	20% Sessional, 30% Mid Semester and 50% End Semester	
		Practical: 50% Sessional and 50% End Semester	
Marks	:	Theory: 50	Practical: 00
Credit Hours	:	2	0
Minimum Contact Hours	:	32	0

Course Learning Outcomes:

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

CLO	Description	Bloom's Taxonomy		PLO
		Domain	Level	
1	Explain basic probability concepts and their use in different problems	Cognitive	2	1
2	Apply basic statistical techniques such as regression, curve fitting to engineering data	Cognitive	3	2
3	Analyze different types of random variables to solve problems in science and engineering	Cognitive	4	3

Contents:

- Probability concepts, Basic concepts of probability,
- Conditional probability, independent events, Baye's formula.

Random Variables and Probability Distribution

Discrete and continuous random variables, Probability Distributions and density functions, Binomial, Poisson, hyper geometric, normal, uniform and exponential

Statistics

Mean, variance, standard deviations, moments and moment generating functions, linear regression and curve fitting, limits theorems

Recommended Books:

1. Introduction to Probability and Statistics: Principles and Applications for Engineering and the Computing Sciences Susan Milton and Jesse C Arnold, McGraw-Hill, Latest Edition.
2. Statistics for Engineers and the Sciences, William Mendenhall and Terry Sincich, Prentice Hall, Latest Edition.

Approval	Industrial Advisory Board (ES)	Res. No.	8.3	Dated:	22.8.2022
	Board of Studies (ES)	Res. No.	47.2	Dated:	28.11.2022
	Board of FEEC Engineering	Res. No.	20.5	Dated:	22.02.2023
	Academic Council	Res. No.	106.7(iii)	Dated:	14.10.2023

MEHRAN UNIVERSITY OF ENGINEERING AND TECHNOLOGY, JAMSHORO

DEPARTMENT OF ELECTRONIC ENGINEERING

Title of Subject	:	Electromagnetic Field Theory
Discipline	:	Electronic Engineering
Semester	:	4 th Semester
Course Code	:	ES-244
Effective	:	22ES-Batch onwards
Pre-requisites	:	Linear Algebra & Analytical Geometry, Applied Physics Co-requisite: Nil
Assessment	:	20% Sessional, 30% Mid Semester and 50% End Semester Practical: 50% Sessional and 50% End Semester
Marks	:	Theory: 50 Practical: 0
Credit Hours	:	2 0
Minimum Contact Hours	:	32 0

Course Learning Outcomes:

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

CLO	Description	Bloom's Taxonomy		PLO
		Domain	Level	
1	Describe the vector algebra and calculus, orthonormal and non-orthonormal coordinate systems, introduces the concepts of gradients, divergence and curl operations.	Cognitive	1	1
2	Apply the theory of electrostatics and magnetic field on different case studies	Cognitive	3	3
3	Analyze the application of electric and magnetic laws for Maxwell equations and Wave equation along with the propagation of EM wave.	Cognitive	4	2

Contents:

Introduction

Review coordinate system, gradient divergence and curl of a vector.

The Steady Electric Fields:

Coulomb's law, electric field intensity, field intensity due to a point charge, line charge, sheet of charge and continuous volume charge density, electric flux, and flux density, Gauss' law and its applications, divergence theorem, Poisson's and Laplace's equations.

The Steady Magnetic Fields:

Magnetic flux and flux density, Bio-Savart law, Ampere's law, Stokes theorem.

Time varying fields and Maxwell's equations:

Faraday's law, continuity equation, inconsistency of Ampere's law, displacement current, modified Ampere's law, Maxwell's equations in point and integral form.

Wave Propagation:

The wave equations for conducting medium & sinusoidal time variations, phase and group velocity

Ionospheric Waves:

Introduction to ionosphere; wave propagation in the ionosphere, reflection & refraction by the ionosphere.
Regular & irregular variations of the ionosphere, attenuation factor.

Recommended Books:

1. Electromagnetic Fields and Radiating Systems, Jordan, E.C, Prentice-Hall, Latest Edition.
2. Engineering Electromagnetic, Hayt, W.H., McGraw-Hill, Latest Edition.
3. Electromagnetics, Kraus, J.D., and Kravert, K.R., McGraw-Hill, Latest Edition.

Approval	Industrial Advisory Board (ES)	Res. No.	8.3	Dated:	22.8.2022
	Board of Studies (ES)	Res. No.	47.2	Dated:	28.11.2022
	Board of FEEC Engineering	Res. No.	20.5	Dated:	22.02.2023
	Academic Council	Res. No.	106.7(iii)	Dated:	14.10.2023

MEHRAN UNIVERSITY OF ENGINEERING AND TECHNOLOGY, JAMSHORO
DEPARTMENT OF ELECTRONIC ENGINEERING

Title of Subject	:	Integrated Electronics	
Discipline	:	Electronic Engineering	
Semester	:	4 th Semester	
Course Code	:	ES-257	
Effective	:	22ES-Batch onwards	
Pre-requisites	:	Electronic Circuit Design	Co-requisite: Nil
Assessment	:	20% Sessional, 30% Mid Semester and 50% End Semester Practical: 50% Sessional and 50% End Semester	
Marks	:	Theory: 100	Practical: 50
Credit Hours	:	3	1
Minimum Contact Hours	:	48	48

Course Learning Outcomes:

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

CLO	Description	Bloom's Taxonomy		PLO
		Domain	Level	
1	Explain the integrated circuits fabrication process, and delineate the logic for CMOS and other logic families	Cognitive	2	1
2	Apply and interpret operational amplifiers, Current Mirrors using BJT,&IC timers in different applications on the basis of understanding its different configurations.	Cognitive	3	3
3	Analyze the operations of differentiators, integrators, comparators, Schmitt trigger with the help of operational amplifier with given specifications.	Cognitive	4	2
4	Reproduce the characteristics of different digital logic families and build semester project on designing and simulation of interface and switching circuits	Psychomotor	3	5
5	Demonstrate the ability to design and communicate the assigned tasks (practically/ report writing) in groups.	Affective	4	9

Contents:

IC Fabrication:

Introduction to the fabrication of digital microelectronic pMOS, nMOS, CMOS, and BiCMOS circuits, wafer preparation and front end steps required in formation of silicon wafer, like epitaxy, Lithography, ion implantation, etching and oxidation, Basics of VLSI Design, Presentation of concepts and techniques used in the fabrication of VLSI circuits, integrated circuit fabrication, NMOS and CMOS logic design, design issues, ASICs.

Logic Families:

Saturating and non-saturating logic families (DTL, TTL, ECL, I²L), noise margin, noise immunity, fan-in, fan-out, propagation delay, Static & dynamic power dissipation CMOS logic gate circuits, static and dynamic CMOS circuits, basic structure CMOS realization of logic gates.

Transistor sources and amplifiers:

Current Mirrors using BJT, Simple current Mirror, Base current compensated current Mirror, Wilson and Improved Wilson Current Mirrors, Differential amplifiers, DC and AC analysis of differential amplifier, design of simple differential amplifier, level translator.

Switching Circuit Design and applications:

Detailed design of pulse and switching circuits, monostable, astable and bistable circuits, detailed internal structure of timer IC and applications,

Operational Amplifier:

Use of op-amp as a circuit element, practical and ideal op-amp characteristics, detailed internal structure of 741 IC, offset and offset compensation, op-amp with negative feedback, frequency response of an op-amp, linear and non-linear applications, differentiator, integrator, comparator, Zero/negative zero crossing detector, Schmitt trigger circuits design.

Recommended Books:

1. "Fundamentals of Microelectronics", Behzad Razavi, 2nd Edition, Wiley.
2. Microelectronic Circuits, Adel S. Sedra and Kenneth C. Smith, Oxford University Press, Latest Edition.
3. Basic Operational Amplifiers and Linear Integrated Circuits, Thomas L. Floyd and David M. Buchla, Prentice Hall, Latest Edition.
4. Microelectronic Circuit Design, Richard C. Jaeger and Travis N. Blalock, McGraw Hill Higher Education, Latest Edition.
5. Integrated Circuit Fabrication" By Kumar Shubham, Ankaj Gupta Year 2021

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	Board of Studies (ES)	Res. No. 47.2	Dated: 28.11.2022
	Board of FEEC Engineering	Res. No. 20.5	Dated: 22.02.2023
	Academic Council	Res. No. 106.7(iii)	Dated: 14.10.2023

MEHRAN UNIVERSITY OF ENGINEERING AND TECHNOLOGY, JAMSHORO
DEPARTMENT OF ELECTRONIC ENGINEERING

Title of Subject	:	Introduction to Embedded Systems
Discipline	:	B.E Electronic Engineering
Course Code	:	ES-250
Semester	:	4 th Semester
Effective	:	22ES-Batch onwards
Pre-requisites	:	Digital Electronics
Assessment	:	Co-requisite: Nil 20% Sessional, 30% Mid Semester and 50% End Semester Practical: 50% Sessional and 50% End Semester
Marks	:	Theory: 100
Credit Hours	:	3
Minimum Contact Hours	:	48

Course Learning Outcomes:

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

CLO	Description	Bloom's Taxonomy		PLO
		Domain	Level	
1	Understand Microprocessor & Microcontroller architecture, its internal registers, addressing modes and instruction set	Cognitive	2	1
2	Illustrate and analyses Semiconductor memories, interfacing, internal blocks, peripherals, ADC, interrupts, timers, serial protocols (RS232, SPI, I2C), etc to program both in Assembly language and High-level language. (C/ Python)	Cognitive	4	2
3	Choose an appropriate solution for a particular situation or specific needs to design a small microcontroller-based system prototype.	Cognitive	5	3
4	Perform experiments in the laboratory using development kits, ICs, and simulation software and build lab projects in a team.	Psychomotor	3	5
5	Collaborate by working in groups on laboratory experiments and project to demonstrate teamwork skills and ability.	Affective	2	9

Contents:

Microprocessors fundamentals, instruction set architecture (ISA), Semiconductor Memories, Embedded Systems concept, scope, processing cores, and applications. Microcontrollers (PIC/AVR/ Arduino/ Raspberry Pi) Basic Core Architecture, Addressing modes and Pin Configuration microcontroller instruction set and Applications, Branch Call and Time Delay Loop, IO Port Programming, Arithmetic, Logic Instructions, Masking Techniques and Programs, Handling of Timers, Counter, ADC, Interrupts, Programming in Assembly and High level programming language (C/ Python), Communication protocols (like RS232, SPI, I2C).

Recommended Books:

1. Microprocessor and Interfacing, Douglas V. Hall, Tata McGraw-Hill, Latest Edition.
2. Schaum's outline of theory and problems of microprocessor fundamentals (Schaum's outline series) By Roger L. Tokheim, Latest Edition.
3. The AVR Microcontroller and Embedded System using Assembly and C, Muhammad Ali Mazidi, Sarmad Naimi, Sepehr Naimi, Prentice Hall, Latest Edition.

4. The AVRMicrocontroller and Embedded Systems Using Assembly and C: Using Arduino Uno and Atmel, Latest Edition. Studio, Based on ATmega328 and Arduino Boards, Muhammad Ali Mazidi, Sarmad Naimi, Sepehr Naimi, Latest Edition.

Approval	Industrial Advisory Board (ES)	Res. No.	8.3	Dated:	22.8.2022
	Board of Studies (ES)	Res. No.	47.2	Dated:	28.11.2022
	Board of FEEC Engineering	Res. No.	20.5	Dated:	22.02.2023
	Academic Council	Res. No.	106.7(iii)	Dated:	14.10.2023

5th Semester

Title of Subject: Technical & Scientific Writing
Code : ENG-301
Discipline : 5th Semester
Effective : 21 Batch and onwards
Assessment : 20% Sessional, 30% Mid Semester and 50% End Semester
Practical: 50% Sessional and 50% End Semester

Credit Hours : 02 + 00

Marks : 50 + 00

Minimum Contact Hours: 32 + 00

Course Learning Outcomes:

After completing the 'Technical and Scientific Writing' course, each student will be able to:

CLO No.	Description	Taxonomy Level	Linking to PLOs
CLO-1	Analyse the content and structure of various technical and academic research documents e.g., dissertations, research papers or articles, proceeding papers and research review papers.	C-4	PLO-10
CLO-2	Create various writing genres such as: research reports, research articles, research proposals, and dissertation, proceeding papers and research review papers.	C-6	PLO-10

Contents:

Module 1: Basics of Technical Writing

- Introduction to Technical writing and communication,
- Rationale/Characteristics/Features of Technical Writing compared to other forms of writing.
- Types of technical documents

Module 2: Introduction to Writing Process

- Technical Writing Process: Pre-writing, Writing & Revising (Demonstration & Illustration)
- Context & technical writing
- Implicit vs Explicit features of writing/ Text
- Legal & Ethical communication in technical writing

Module 3: Writing a Technical Document

- Researching, organizing, and composing the content
- Revising, proofreading, and evaluating
- Elements of a technical document

Module 4: Research Writing-I

- Academic & Scientific Language: Word to Sentence & Sentences to Paragraph
- Research writing format, citation & referencing
- Annotation, paraphrasing, quotation, and Summarization

Module 5: Research Writing-II

- Abstract Writing
- Research Proposal Writing
 - Research Paper Writing
 - Research Review Paper Writing

Module 6: Organizational Technical Correspondence

Formal Technical Report Writing, Internship report, Project report writing

Recommended Books & Readings:

1. Perelman, L. C., J. Paradis, and E. Barrett. *Mayfield Handbook of Technical and Scientific Writing*, Mountain View, Mayfield, 1997
2. Sharma, S. D. *A Text Book of Scientific and Technical Communication Writing for Engineers and Professionals*. Sarup & Sons, 2007.
3. Glasman, Hilary. *Science research writing: For non-native speakers of English*. Imperial College Press: London, UK, 2010.
4. Van Aken, David C., and William F. Hosford. *Reporting Results*. Cambridge University Press, 2008.
5. Alred, Gerald J., Charles T. Brusaw, and Walter E. Oliu. *Handbook of technical writing*. Macmillan, 2009.

Approval:

Board of Studies, ELDC
Board of Faculty (FoST&H)
Academic Council

Res. No.1

Dated: 21.11.2019
Dated: 19.7.2021
Dated: 24.08.2021

EHRAN UNIVERSITY OF ENGINEERING AND TECHNOLOGY, JAMSHORO
DEPARTMENT OF ELECTRONIC ENGINEERING

Title of Subject	:	Signals & Systems	
Discipline	:	Electronic Engineering	
Course Code	:	ES-398	
Semester	:	5 th Semester	
Effective	:	22ES-Batch onwards	
Pre-requisites	:	Electrical Circuits, Complex Variables & Transforms	
Assessment	:	20% Sessional, 30% Mid Semester and 50% End Semester	
		Practical: 50% Sessional and 50% End Semester	
Marks	:	Theory: 100	Practical: 50
Credit Hours	:	2	1
Minimum Contact Hours	:	32	48

Course Learning Outcomes:

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

CLO	Description	Bloom's Taxonomy		PLO
		Domain	Level	
1	Explain continuous & discrete time signals and systems mathematical operations on signals and analogue to digital conversion of signals.	Cognitive	C2	1
2	Apply time domain and frequency domain representation and transformation techniques	Cognitive	C3	2
3	Analyse performance of the continuous time filters	Cognitive	C4	4
4	Reproduce logical codes for simulation of different signals and their transforms using modern platforms and software tools and their applications in solution of real-world problems.	Psychomotor	3	5
5	Organize the experimental data in the form of professional lab reports and present it on multimedia.	Affective	4	10

Contents:

- **Introduction**
Classification of signals, basic operations on signals, system characteristics.
- **Time Domain Analysis**
Sinusoidal and complex exponential signals, singularity function signals, signal energy and signal power, orthogonal signals, continuous time convolution, evaluation and properties, auto-correlation function.
- **Frequency Domain Representation and Analysis**
Spectra and bandwidths of signals, Fourier series representation of signals, Fourier transform, energy density spectrum, power density spectrum, system frequency response
- **Continuous-time filters**
Ideal filters, approximation of ideal filters, Butter worth and Chebyshev filter design.
- **Sampled Continuous – Time signals**
Ideal sampling, Sampling theorem, practical sampling effects.

Recommended Books:

1. Signals and Linear System Analysis, G.E. Carlson, John Wiley & Sons, Inc, Latest Edition.
2. Signals and Systems, S. Haykin, and B.V. Veen, John Wiley & Sons, Inc, Latest Edition.
3. Signals and Systems, Oppenheim and Willsky, Prentice Hall, Latest Edition.

Approval	Industrial Advisory Board (ES)	Res. No.	8.3	Dated:	22.8.2022
	Board of Studies (ES)	Res. No.	47.2	Dated:	28.11.2022
	Board of FEEC Engineering	Res. No.	20.5	Dated:	22.02.2023
	Academic Council	Res. No.	106.7(iii)	Dated:	14.10.2023

MEHRAN UNIVERSITY OF ENGINEERING AND TECHNOLOGY, JAMSHORO

DEPARTMENT OF ELECTRONIC ENGINEERING

Title of Subject	:	Power Electronics	
Discipline	:	Electronic Engineering	
Course Code	:	ES-319	
Semester	:	5 th Semester	
Effective	:	17ES-Batch onwards	
Pre-requisites	:	Basic Electronics	Co-requisite: Nil
Assessment	:	20% Sessional, 30% Mid Semester and 50% End Semester Practical: 50% Sessional and 50% End Semester	
Marks	:	Theory: 100	Practical: 50
Credit Hours	:	3	1
Minimum Contact Hours	:	48	48

Course Learning Outcomes:

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

CLO	Description	Bloom's Taxonomy		PLO
		Domain	Level	
1	Explain power electronics system and solid-state power semiconductor devices, their construction, thyristor, its types, operational modes, trigger and commutation methods	Cognitive	2	1
2	Apply solid-state power semiconductor devices and thyristors for switching and protection circuits and applications	Cognitive	3	3
3	Analyse power electronic converter topologies. and configurations.	Cognitive	4	4
4	Measure the simulated results to investigate the V-I characteristics of power semi-conductor devices, uncontrolled, semi-controlled and fully controlled rectifiers, single-phase and three-phase inverters, buck-boost Converter, cycloconverter & Switch mode power supplies.	Psychomotor	4	5
5.	Participate in lab activities individually as well as in group.	Affective	2	9

Course Outline:

- **Introduction**

Power electronics system, its interdisciplinary nature, classification of power semiconductor devices, static and dynamic application of power electronics.

- **Power Diode**

Construction, Manufacturing process, reverse recovery time, switching, types of power diode , power diode circuits: series/ parallel connection of power diode, snubber circuit, Power diode with RC, RL circuits, freewheeling diode, Uncontrolled rectifier: single phase and three phase.

- **Power Transistor**

Construction, manufacturing process and switching of Power BJT, Power MOSFET and Insulated gate bipolar transistors (IGBT).

- **Thyristor**

Two transistor model of Thyristor, Operating modes of SCR, Triggering and Commutation methods of SCR, Switching Application of SCR.

- **Types of thyristor**

DIAC, TRIAC, GTO, UJT and their applications.

- **Converter Topologies and Configurations**

Controlled Rectifier: Single phase semi-controlled rectifiers, Single phase fully controlled rectifiers, Three-phase semi controlled rectifiers, Three-phase fully controlled rectifiers.

Inverters: Single phase and three phase Inverters

AC Converters: Single-phase-to-single-phase cycloconverters, Matrix converters, AC voltage regulators.

DC-DC converters: Buck converter, Boost converter, Buck-boost converters, Isolated converters, Forward converters, Fly back converters.

Recommended Books:

1. Power Electronics, Cyril W. Lander, McGraw-Hill UK, Latest Edition.
2. Power Electronics: Circuits, Devices and Applications, Muhammad H. Rashid, Prentice Hall, Latest Edition.
3. Power Electronics: Converters, Applications and Design, Ned Mohan, William P. Robbins and Tore M. Undeland, Media Enhanced, John Wiley & Sons, Latest Edition.

Approval	Industrial Advisory Board (ES)	Res. No.	8.3	Dated:	22.8.2022
	Board of Studies (ES)	Res. No.	47.2	Dated:	28.11.2022
	Board of FEEC Engineering	Res. No.	20.5	Dated:	22.02.2023
	Academic Council	Res. No.	106.7(iii)	Dated:	14.10.2023

MEHRAN UNIVERSITY OF ENGINEERING AND TECHNOLOGY, JAMSHORO

DEPARTMENT OF ELECTRONIC ENGINEERING

Title of Subject	:	Numerical Methods	
Discipline	:	Electronic Engineering	
Course Code	:	MTH-310	
Semester	:	5 th Semester	
Effective	:	F-16ES-Batch onwards	
Pre-requisites	:	Nil	Co-requisites: Nil
Assessment	:	20% Sessional, 30% Mid Semester and 50% End Semester Practical: 50% Sessional and 50% End Semester	
Marks	:	Theory: 100	Practical: 50
Credit Hours	:	3	1
Minimum Contact Hours	:	48	48

COURSE LEARNING OUTCOMES:

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

CLO	Description	Bloom's Taxonomy		PLO
		Domain	Level	
1	Locate the root of a non-linear equations $f(x)=0$ and determine iterative methods for the solution of simultaneous linear algebraic equations.	Cognitive	2	1
2	Apply interpolation and extrapolation techniques and determine Numerical differentiation and integration.	Cognitive	2	1
3	Compute numerical solution of ordinary differential equations	Cognitive	2	1
4	Perform computations of defined numerical schemes by using C++ Programming	Psychomotor	4	5

Contents:

- **Error analysis:**
Introduction, floating points, errors, types of errors.
- **Solution of non-linear equation:**
Bisection method, Regula-Falsi method, Newton-Raphson method, Fixed-Point iterative method.
- **Solution of linear algebraic equation**
: Iterative methods: Jacobi's method, Gauss-Seidal method.
- **Eigen values and Eigen vectors: Power method.**
- **Interpolation and extrapolation:**
Differences: Forward, backward, central, operators and their relations. Newton's forward interpolation formula. Newton's backward interpolation formula, Newton's divided difference formula, Lagrange's interpolation formula. Stirling's formula.
- **Numerical Differentiation:**
Newton's forward and backward differentiation formulae.
- **Numerical Quadrature:**
Trapezoidal rule, Simpson's one-third rule, Simpson's three-eighth rule, Weddle's rule, Gaussian quadrature.
- **Numerical solution of ordinary differential equations:**

Taylor series method, Euler's and its modified methods, Runge-Kutta methods, Predictor Corrector Methods; Milne's method, Adam-Bashforth method.

Recommended Books:

1. Numerical Methods for Engineers, Canal and Chapra, Latest Edition.
2. Applied Numerical Analysis, Curits F. Gerald, Latest Edition.
3. Advanced Engineering Mathematics", Evvien Cryzigg, Latest Edition.
4. Applied Numerical Methods for The Solution of Partial Differential Equations Chung Yau Lam, Latest Edition.
5. A First Course in Numerical Analysis, Dr Saeed Akhtar Bhatti, Latest Edition.

Approval	Board of Studies 01/2018	Res. No.	01	Dated:	26.03.2018
	Board of FOST&H	Res. No.	3.1	Dated:	11.04.2018
	Academic Council	Res. No.	17(ii)	Dated:	23.04.2018

MEHRAN UNIVERSITY OF ENGINEERING AND TECHNOLOGY, JAMSHORO

DEPARTMENT OF ELECTRONIC ENGINEERING

Title of Subject	:	Entrepreneurship
Discipline	:	Electronic Engineering
Course Code	:	SS-315
Semester	:	5 th Semester
Effective	:	F16ES-Batch onwards
Pre-requisites	:	Nil Co-requisites: Nil
Assessment	:	20% Sessional, 30% Mid Semester and 50% End Semester Practical: 50% Sessional and 50% End Semester
Marks	:	Theory: 100 Practical: 00
Credit Hours	:	3 0
Minimum Contact Hours	:	48 0

Course Learning Outcomes:

CLO	Description	Bloom's Taxonomy		PLO
		Domain	Level	
1	Understand the whole Entrepreneurial Process	Cognitive	C2	6
2	Understand the key processes necessary to bring new products and services to market and key challenges faced by the entrepreneur at different stages.	Cognitive	C2	7
3	Design the business plan for a new venture with the goal of bringing new products and services in the market	Cognitive	C6	8

Contents:

- Introduction to Entrepreneurship, Nature and Importance of Entrepreneurship,
- types of entrepreneurs.
- Recognizing Opportunities and Generating Ideas, finding gaps, process of generating creative ideas, protecting ideas from being lost and stolen.
- Feasibility Analysis, Industry and Competitor Analysis, Writing a Business Plan.
- Process of financial management, building a New-Venture Team, Getting
- Funding or Financing, Local Venture Capitalist or Business Angel.
- The Importance of Intellectual Property, E-business strategy.
- Business Model Canvas.

Recommended Books:

- Entrepreneurship: Successfully Launching New Ventures, 4th Edition. Bruce R. Barringer,
- Oklahoma State University R. Duane Ireland, Texas A&M University © (2012) |Pearson
- Innovation and Entrepreneurship, (2014) by Peter F. Drucker Harper Collins publishers UK “Patterns of Entrepreneurship”, (2009) by Jack M Kaplan
- Naqi, Dr. S. M, (2007), Entrepreneurship – A Recipe for Economic Development: Lahore, Naqi Hyder & Associates.
- Kuratko Donald F and Hodgetts (2001) Richard M, Entrepreneurship- A Contemporary, Approach, New York, South-Western, Thomas Learning.

Approval	Board of Studies, MUISTD	Res. No.	8.3	Dated:	28.12.2021
	Board of Faculty	Res. No.	1.9	Dated:	25.07.2022
	Academic Council	Res. No.	106.7(iii)	Dated:	14.10.2023

6th Semester

MEHRAN UNIVERSITY OF ENGINEERING AND TECHNOLOGY, JAMSHORO DEPARTMENT OF ELECTRONIC ENGINEERING

Title of Subject	:	Communication Systems
Discipline	:	Electronic Engineering Course
Code	:	ES-385
Semester	:	6 th Semester
Effective	:	22ES-Batch onwards
Pre-requisites	:	Electronic Circuit Design, Co-requisites: Signals & Systems
Assessment	:	20% Sessional, 30% Mid Semester and 50% End Semester Practical: 50% Sessional and 50% End Semester
Marks	:	Theory: 100 Practical: 50
Credit Hours	:	3 1
Minimum Contact Hours	:	48 48

Course Learning Outcomes:

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

CLO	Description	Bloom's Taxonomy		PLO
		Domain	Level	
1	Explain the building blocks of communication, transmission media, principles of analogue, digital and pulse modulation/demodulation techniques and concepts of modern communication systems including cellular and satellite communication.	Cognitive	2	1
2	Analyse the performance of different communication systems and modulation techniques in the presence of noise.	Cognitive	4	4
4	Reproduce different communication systems to investigate the output of different modulation/demodulation schemes.	Psychomotor	3	5
5.	Organize the lab data to emphasize experimental objectives, procedures, observations etc.	Affective	4	10

Contents:

- **Introduction**
Basic Blocks of Communication System, Electromagnetic Spectrum, Transmission Media, Wire and Wireless Communication.
- **Amplitude Modulation**
Baseband and carrier communications, Double Sideband (DSB), Single Sideband (SSB), Vestigial Sideband (VSB), Superhetrodyne AM Receiver, Carrier Acquisition, Television
- **Angle Modulation**
Instantaneous frequency, Bandwidth of FM/PM, Generation of FM/PM, Demodulation of FM/PM.

- **Noise**
Mathematical representation, Signal to Noise Ratio, Noise in AM, FM, and PM systems
- **Pulse Modulation**
Sampling and Quantization, Pulse Amplitude Modulation, Pulse Position and Pulse Width Modulation, Quantization Noise, Signal to Quantization Noise Ratio, Pulse code Modulation, Delta Modulation, Frequency Shift Keying, Phase Shift Keying, Information theory, Error detection and correction, Multiplexing techniques
- **Modern Communication Systems**
Cellular communication and their generation (1G to 5G), Satellite communication and their applications

Recommended Books:

1. Modern Digital and Analog Communication Systems, B. P. Lathi, Oxford University Press, Latest Edition.
2. Digital and Analog Communication Systems, Leon W. Couch, Prentice Hall, Latest Edition.
3. Communication Systems Engineering, John G. Proakis and Masoud Salehi, Prentice Hall, Latest Edition.

Approval	Industrial Advisory Board (ES)	Res. No.	8.3	Dated:	22.8.2022
	Board of Studies (ES)	Res. No.	47.2	Dated:	28.11.2022
	Board of FEEC Engineering	Res. No.	20.5	Dated:	22.02.2023
	Academic Council	Res. No.	106.7(iii)	Dated:	14.10.2023

MEHRAN UNIVERSITY OF ENGINEERING AND TECHNOLOGY, JAMSHORO
DEPARTMENT OF ELECTRONIC ENGINEERING

Title of Subject	:	Control Systems
Discipline	:	Electronic Engineering
Course Code	:	ES-353
Semester	:	6 th Semester
Effective	:	17ES-Batch onwards
Pre-requisites	:	Complex Variables & Transforms, Signals & Systems Co-requisites: Nil
Assessment	:	20% Sessional, 30% Mid Semester and 50% End Semester Practical: 50% Sessional and 50% End Semester
Marks	:	Theory: 100 Practical: 50
Credit Hours	:	3 1
Minimum Contact Hours	:	48 48

Course Learning Outcomes:

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

CLO	Description	Bloom's Taxonomy		PLO
		Domain	Level	
1	Explain the mathematical modelling of electrical, mechanical and electromechanical systems using differential equations, transfer functions, block diagrams and state variables.	Cognitive	2	1
2	Analyze the stability of control systems using Routh's Criteria, root locus, bode plots and state space.	Cognitive	4	2
3	Design feedback controllers using root locus, bode plots and state space techniques to achieve desired transient response and acceptable steady-state errors.	Cognitive	5	3
4	Constructs programs in simulation tool for analysis and design of control systems	Psychomotor	4	5
5	Complete effectively control system design details through a technical report and oral presentations	Affective	4	10

Contents:

- **Introduction to control systems**
Open-loop and closed-loop systems,
- **System Modelling**
Input-Output Model, Mathematical modelling of electrical systems, Mathematical modelling of mechanical systems, Mathematical Modelling of electro-mechanical systems
- **Time Domain Analysis**
Review of Laplace Transform, differential equations, transfer functions, time domain response of first order systems, time domain response of 2nd order systems, step response analysis and performance specification, steady state errors
- **Frequency domain analysis**
Frequency domain response of first order systems, The Bode diagram, Nichols chart
- **Closed Loop Control Systems**

Closed loop transfer function, Block diagram reduction, Signal flow graph, Controllers for close loop system, P, PI, PID controller, Z-N Method for tuning PID controller, case study examples

- **Classical design in time domain**

Stability of dynamic systems, Routh Hurwitz stability criterion in time domain, Root locus analysis, Compensator design in time domain

- **Classical design in frequency domain**

Nyquist stability criterion in frequency domain, Phase lead compensator, Phase lag compensator

- **State space methods for control systems design**

State space method, state vector differential equations, State equations from transfer functions

Recommended Books:

1. Modern Control Engineering”, K. Ogata, Prentice Hall, Latest Edition.
2. Automatic Control Systems, B.C. Kuo, Latest Edition.
3. Modern Control Systems, Richard C.Dorf, Latest Edition

Approval	Industrial Advisory Board (ES)	Res. No.	8.3	Dated:	22.8.2022
	Board of Studies (ES)	Res. No.	47.2	Dated:	28.11.2022
	Board of FEEC Engineering	Res. No.	20.5	Dated:	22.02.2023
	Academic Council	Res. No.	106.7(iii)	Dated:	14.10.2023

MEHRAN UNIVERSITY OF ENGINEERING AND TECHNOLOGY, JAMSHORO

DEPARTMENT OF ELECTRONIC ENGINEERING

Title of Subject	:	Digital Signal Processing	
Discipline	:	Electronic Engineering	
Course Code	:	ES-392	
Semester	:	6 th Semester	
Effective	:	22ES-Batch onwards	
Pre-requisites	:	Signals & Systems	Co-requisites: Nil
Assessment	:	20% Sessional, 30% Mid Semester and 50% End Semester Practical: 50% Sessional and 50% End Semester	
Marks	:	Theory: 100	Practical: 50
Credit Hours	:	3	1
Minimum Contact Hours	:	48	48

Course Learning Outcomes:

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

CLO	Description	Bloom's Taxonomy		PLO
		Domain	Level	
1	Explain the principles of discrete-time signal analysis to perform various signal operations	Cognitive	2	1
2	Apply the principles of Fourier Transform to solve and investigate the frequency characteristics of discrete-time signals and systems	Cognitive	3	2
3	Create appropriate digital filter design to meet specific magnitude and phase requirements	Cognitive	5	3
4	Reproduce design problems related to discrete signal and systems, frequency selective processing and design FIR/IIR filters in computer using simulation tool. Implement the semester project on the design/development of digital filters	Psychomotor	3	5
5.	Organize the experimental data in the form of professional lab reports and present it on multimedia.	Affective	4	10

Contents:

- **Introduction**
Review of Signals & Systems. Introduction to Digital Signal Processing, Real-world typical DSP applications,
- **Digital Signals and Systems**
Analog to Digital Conversion (Sampling, Quantization, and digitization), Digital Signals, Discrete LTI systems, Difference Equations, discrete convolution, Impulse response and Response of discrete time LTI system to any arbitrary input, Autocorrelation
- **Discrete Fourier Transform and Signal Spectrum**

Discrete Fourier Series, Discrete Fourier Transform (DFT), Discrete Time Fourier Transform (DTFT), Fast Fourier Transform (FFT), frequency response of discrete time and its analysis. Energy density spectrum and power density spectrum for discrete time signals.

- **Z-Transform and Inverse Z Transform**

Z-transform, Inverse Z-transform, Z-transform solution of difference equations, stability of linear discrete-time systems. Difference equation and transfer function, Z-plane pole-zero plot.

- **Introduction to Digital Filters, Filter Realization,**

- **Digital filter frequency response, Realization of digital filters – direct form-I, direct form-II, cascade and parallel and its applications**

Finite Impulse Response Digital Filters and its design

Introduction to FIR filters

Design of FIR by

Fourier Transform Method, Window Method, Frequency Design Sampling Method

Various Design Applications

- **Infinite Impulse Response Filter Design**

Introduction to IIR filter

Design of IIR filter by

Bilinear Method

Digital Butterworth and Chebyshev

Pole-Zero placement method

Various Design Applications

- **Adaptive filtering, Kalman filter, Adaptive noise cancellation**

Approval	Industrial Advisory Board (ES)	Res. No.	8.3	Dated:	22.8.2022
	Board of Studies (ES)	Res. No.	47.2	Dated:	28.11.2022
	Board of FEEC Engineering	Res. No.	20.5	Dated:	22.02.2023
	Academic Council	Res. No.	106.7(iii)	Dated:	14.10.2023

MEHRAN UNIVERSITY OF ENGINEERING AND TECHNOLOGY, JAMSHORO

DEPARTMENT OF ELECTRONIC ENGINEERING

Title of Subject	:	FPGA Based Digital Design	
Discipline	:	Electronic Engineering	
Course Code	:	ES-373	
Semester	:	6 th Semester	
Effective	:	17ES-Batch onwards	
Pre-requisites	:	Digital Electronics	Co-requisites: Nil
Assessment	:	20% Sessional, 30% Mid Semester and 50% End Semester Practical: 50% Sessional and 50% End Semester	
Marks	:	Theory: 100	Practical: 50
Credit Hours	:	3	1
Minimum Contact Hours	:	48	48

Course Learning Outcomes:

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

CLO	Description	Bloom's Taxonomy		PLO
		Domain	Level	
1	Interpret the role of programmable logic devices in the modern electronic system designs and describe various types of FPGA architectures	Cognitive	2	1
2	Apply the concepts and constructs of Hardware Description Language (VHDL) in order to experiment implementation of combinational and sequential digital systems in programmable devices.	Cognitive	3	2
3	Design Finite State Machines (FSM) in VHDL in order to execute a practical design project and Illustrate impact of various parameters related to Optimization.	Cognitive	5	4
4	Write VHDL code for different experiments on FPGA Trainers and Reproduce results using Software to observe and verify the digital designs on hardware; and analyze the area-performance characteristics.	Psychomotor	3	5
5.	Organize the lab data to emphasize experimental objectives, procedures, observations etc.	Affective	4	10

Contents:

- **Unit I- FPGA and its Architecture:**

Types of Programmable Logic Devices: PLA & PAL, FPGA Generic Architecture, Digital Design and FPGAs, FPGA Based System Design, FPGA Fabrics, SRAM-Based FPGAs, Permanently Programmed FPGAs, Chip I/O, Circuit Design of FPGA Fabric. FPGA Design Flow Based on VHDL, System Design Examples using Xilinx/Altera FPGAs.

- **Unit II- VHDL Coding Style:**

Basic VHDL Elements and Semantics, Industry standard EDA tools for logic description, simulation and synthesis.

- **Unit III VHDL Modelling of Combinational & Sequential Circuits:**

Behavioural, Data Flow and Structural Realization – Adders – Multipliers- Comparators - Flip Flops - Realization of Shift Register - Realization of a Counter- Synchronous and Asynchronous FIFO –Single port and Dual port RAM.

- **Unit IV Synchronous Sequential Circuit:**

Sequential Design Using FPGAs, Sequential Machine Design Process, Sequential Design Style: FSM Design, ASM Design. Finite State Machines (FSMs) for establishing Sequencing and Control: types and examples, Analysis and Synthesis, Optimization and principles using VHDL.

Recommended Books:

1. Introduction to Embedded System Design Using Field Programmable Gate Arrays, Rahul Dubey, Springer, Latest Edition.
2. Synthesis of Arithmetic Circuits: FPGA, ASIC, and Embedded Systems Jean-Pierre Deschamps, Gery Jean Antoine Biouls, Gustavo D. Sutter, 2005, John Wiley & Sons Inc, Latest Edition.
3. FPGA-Based System Design Wayne Wolf, Prentice Hall, Latest Edition.
4. Circuit Design and Simulation with VHDL, Volei A. Pedroni, MIT Press, Latest Edition.
5. Digital System Design Using VHDL, Charles H. Roth, Jr., Cengage Learning, Latest Edition.
6. VHDL For Engineers Kenneth L. Short, Prentice Hall, 2008, Latest Edition.

Approval	Industrial Advisory Board (ES)	Res. No.	8.3	Dated:	22.8.2022
	Board of Studies (ES)	Res. No.	47.2	Dated:	28.11.2022
	Board of FEEC Engineering	Res. No.	20.5	Dated:	22.02.2023
	Academic Council	Res. No.	106.7(iii)	Dated:	14.10.2023

MEHRAN UNIVERSITY OF ENGINEERING AND TECHNOLOGY, JAMSHORO

DEPARTMENT OF ELECTRONIC ENGINEERING

Title of Subject	:	Sociology for Engineers	
Discipline	:	Electronic Engineering	
Course Code	:	SS-336	
Semester	:	6 th Semester	
Effective	:	17ES-Batch onwards	
Pre-requisites	:	Nil	Co-requisites: Nil
Assessment	:	20% Sessional, 30% Mid Semester and 50% End Semester Practical: 50% Sessional and 50% End Semester	
Marks	:	Theory: 50	Practical: 00
Credit Hours	:	2	0
Minimum Contact Hours	:	32	00

Course Learning Outcomes:

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

CLO	Description	Bloom's Taxonomy		PLO
		Domain	Level	
1	Define the basic concepts and theoretical models of sociology. Distinguish between the major fields of contemporary sociology.	Cognitive	2	6
2	Analyze the basic social issues caused by unethical behaviour of engineers and determine the impact of unethical engineer's work on the society, environment and sustainable development.	Affective	4	6, 7
3	Discuss the social dilemmas involving engineers, formulate possible actions that can be taken in response to a social issue, and evaluate the probable consequences of those actions.	Affective	3	6

Contents:

- **Introduction and Fundamentals**
Introduction to Sociology, Nature, Scope, and Importance of Sociology
- **Methods of Sociological Research**
Culture, Society and Socialization, Groups, Organizations, Deviance and Crime
- **The Basis of Society**
Social Interaction Processes,
- **Major Perspectives in Sociology**
- **Social Stratification**
Factors of Social Stratification, Caste, Power, Prestige, and Authority
- **Macro-sociology and Social Change**
Politics and Government, Social Processes of Globalization
- **Engineers and Sociology**

Understanding Social Responsibilities of an Engineer, Engineers Bringing Social Change

- **Community Development Involving Engineers**

Meaning, Scope and Subject Matter of Community Development, Processes of Community Development, Role of Engineers in Community Development

- **Case Studies Regarding Sociology Concerning Engineers**

Recommended Books:

1. Sociology 16th edition, John J. Macionis, Pearson Education, Latest Edition.

Approval	Industrial Advisory Board (ES)	Res. No.	8.3	Dated:	22.8.2022
	Board of Studies (ES)	Res. No.	47.2	Dated:	28.11.2022
	Board of FEEC Engineering	Res. No.	20.5	Dated:	22.02.2023
	Academic Council	Res. No.	106.7(iii)	Dated:	14.10.2023

7th Semester

MEHRAN UNIVERSITY OF ENGINEERING AND TECHNOLOGY, JAMSHORO DEPARTMENT OF ELECTRONIC ENGINEERING

Title of Subject	:	Computer Communication and Networking
Discipline	:	Electronic Engineering
Course Code	:	TL-321
Semester	:	6 th Semester
Effective	:	22ES-Batch onwards
Pre-requisites	:	Communication Systems Co-requisites: Nil
Assessment	:	20% Sessional, 30% Mid Semester and 50% End Semester Practical: 50% Sessional and 50% End Semester
Marks	:	Theory: 100 Practical: 50
Credit Hours	:	3 1
Minimum Contact Hours	:	48 48

Course Learning Outcomes:

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

CLO	Description	Bloom's Taxonomy		PLO
		Domain	Level	
1	Explain the concepts of network models, layers, protocols, addressing schemes, switching, routing, circuits and channels.	Cognitive	2	1
2	Analyze the issues of network security, network, transport and application layer protocols	Cognitive	4	2
3	Construct realizable data networks involving routing, switching, and subnet masking on network simulation tools	Psychomotor	4	3, 5

Contents:

- Network Models and Topologies
- Network Layering Concepts and Protocols
- Internet Protocol (IP) and Associated Control Protocols. End-To-End Protocols, With TCP and UDP as Examples
- Addressing schemes at link layer, network layer and transport layer
- Transmission Media and characteristics
- Switching Techniques
- Channel Access Techniques
- MAC
- Routing Protocols and Multicast
- Overview of Application Layer Protocols (HTTP, FTP, SMTP etc.)
- Multimedia Protocols (RTP, RTSP, RTCP)
- Security Mechanisms and Services
- Concepts of Symmetric and Asymmetric Cryptography, Digital Signature
- Convergence of communication networks

Recommended Books:

1. Data & Computer Communication, William Stalling, Prentice Hall, Latest Edition.
2. Computer Networks, Uyles Black, Prentice Hall, Latest Edition.
3. Computer Networks, S. Tanenbaum, Prentice Hall, Latest Edition.
4. Computer Networks, Andrew Tanenbaum, Prentice Hall, Latest Edition.
5. Data Communications Networking, Behrouz A Forouzan, TFourth, McGraw-Hill, Latest Edition.
6. Computer Networking: A top down approach, James F. Kurose and K. W. Ross, Latest Edition.

Approval	Industrial Advisory Board (ES)	Res. No.	8.3	Dated:	22.8.2022
	Board of Studies (ES)	Res. No.	47.2	Dated:	28.11.2022
	Board of FEEC Engineering	Res. No.	20.5	Dated:	22.02.2023
	Academic Council	Res. No.	106.7(iii)	Dated:	14.10.2023

MEHRAN UNIVERSITY OF ENGINEERING AND TECHNOLOGY, JAMSHORO
DEPARTMENT OF ELECTRONIC ENGINEERING

Title of Subject	:	Digital Control Systems	
Discipline	:	Electronic Engineering	
Course Code	:	ES-414	
Semester	:	7 th Semester	
Effective	:	22ES-Batch onwards	
Pre-requisites	:	Control Systems	Co-requisites: Nil
Assessment	:	20% Sessional, 30% Mid Semester and 50% End Semester Practical: 50% Sessional and 50% End Semester	
Marks	:	Theory: 100	Practical: 50
Credit Hours	:	3	1
Minimum Contact Hours	:	48	48

Course Learning Outcomes:

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

CLO No.	Description	Bloom's Taxonomy		PLOs
		Domain	Level	
1	Explain basic concepts of digital control systems	Cognitive	2	1
2	Analyze various discrete time open-loop and close-loop systems and impact of various parameters related to stability of the digital systems	Cognitive	4	2
3	Design a digital controller using root locus method to achieve the desired response	Cognitive	5	3
4	Reproduce digital control system using simulation tools to analyze effects of various parameters	Psychomotor	3	5
5	Complete effectively control system design details through a technical report and oral presentations	Affective	4	10

Contents

Introduction to digital control systems

Discrete time systems, Difference Equations, discrete transfer functions, review of z transform and sampled data systems, inverse z- transform, A-D and D/A conversion, State variables, solution to state equations, Discrete state equations, State space and input/output representation.

System modeling

Discrete time representation of continuous time systems, Sample/Hold unit with zero-order hold, Ideal sampler, Starred Laplace Transform, Pulse transfer function of open loop and closed loop systems, Mapping between the s-plane and z-plane

Analysis of Sampled Data Systems

stability analysis of closed loop system in z- plane, stability analysis using bilinear transformation, jury stability, steady state accuracy, Bode diagram, Nyquist criteria.

Design of discrete time controllers

Emulating Continuous-Time Controller, Z-plane root locus, root-locus based digital control design, discrete PID control design.

Recommended Books:

1. Digital Control System Analysis and Design, Charles L. Phillips and H. Troy Nagle, Prentice Hall, Latest Edition.
2. Digital Control Systems, H Benjamin C. Kuo H, Oxford University Press, Latest Edition.
3. Digital Control System Design, H Mohammed S. SantinaH, Hallen R. Stubberud Hand H Gene H. Hostetter H, Oxford University Press, Latest Edition.
4. Discrete-Time Control Systems, Katsuhiko Ogata, Prentice Hall, Latest Edition.

Approval	Industrial Advisory Board (ES)	Res. No.	8.3	Dated:	22.8.2022
	Board of Studies (ES)	Res. No.	47.2	Dated:	28.11.2022
	Board of FEEC Engineering	Res. No.	20.5	Dated:	22.02.2023
	Academic Council	Res. No.	106.7(iii)	Dated:	14.10.2023

MEHRAN UNIVERSITY OF ENGINEERING AND TECHNOLOGY, JAMSHORO
DEPARTMENT OF ELECTRONIC ENGINEERING

Title of Subject	: Artificial Intelligence in Edge Computing	
Discipline	: Electronic Engineering	
Course Code	: CS-450	
Semester	: 7 th Semester	
Effective	: 22ES Batch & Onwards	
Pre-requisites	: Introduction to Embedded Systems	
	Co-requisites: Nil	
Knowledge Area	: Computing Elective	
Assessment	: Theory: 30% Sessional, 30% Mid Semester & 40% Final Examination	
	Practical: 30% lab rubrics, 20% open-ended lab. / mini-project, 50% final lab. Examination	
Sessional Activities	Tutorial/ Readings Test/Quizzes/ Assignment/ Project	
Marks	: Theory: 100	Practical: 50
Credit Hours	3	1
Contact Hours	3	3
Minimum Contact Hours	: 48	48

Course Learning Outcomes:

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

CLO	Description	Bloom's Taxonomy		PLO
		Domain	Level	
1	Explain fundamental principles and methodologies of AI, machine learning and deep learning.	Cognitive	2	1
2	Analyse the performance and effectiveness of AI models in terms of accuracy, efficiency, precision, recall, F1 scores, and resource utilization.	Cognitive	4	2
3	Design and develop data collection and preprocessing strategies tailored for edge devices, considering resource limitations	Cognitive	6	3
4	Perform experiments in laboratory using Python IDE, Google Colab, Development kits and Edge platforms.	Psychomotor	3	5
5	Apply advanced techniques, such as anomaly detection, image classification, object detection, and keyword spotting, to identify and address practical challenges in edge computing individually and in groups.	Affective	4	9

Course outline:

Part I: Introduction to Artificial Intelligence

- Introduction to Artificial Intelligence (AI)
- foundational concepts of intelligent agents
- problem-solving methodologies,
- contrasting uninformed search strategies with informed approaches

Part II: Machine Learning Basics

- Fundamentals of Machine Learning
- supervised, unsupervised, and reinforcement learning.
- regression and classification
- essential evaluation metrics.
- decision trees and ensemble methods like random forests.

Part III: Advanced Machine Learning Techniques

- support vector machines
- k-nearest neighbours
- probabilistic learning approach of Naive Bayes.
- model evaluation and selection
- clustering algorithms
- techniques for dimensionality reduction

Part IV: Neural Networks and Deep Learning

- Introduction to neural networks and deep learning
- basics of perceptrons and multilayer perceptrons
- training techniques involving forward and backpropagation.
- Introduction to deep neural network architectures
- convolutional neural networks (CNNs)

• Part V: AI Deployment and Optimization on Edge Devices

- Application of AI in various fields
- practical aspects of AI implementation
- overview of edge computing and edge devices
- deployment of models on edge devices.
- end-to-end machine learning workflow for edge devices.
- optimization techniques for resource-constrained edge devices
 - Model Compression (e.g. Pruning, Quantization, and Knowledge Distillation)
 - Lightweight Neural Networks (TinyML models like MobileNet, SqueezeNet etc.)
 - Energy-Efficient Inference
 - Memory Management
 - Latency Optimization
 - On-device Training (Efficient fine-tuning of models)
- practical challenges and solutions associated with deploying AI models on edge devices
- **Practical work:** The students will gain comprehensive hands-on experience with Python programming and data analysis using Pandas, and data visualization with Matplotlib and Seaborn. They will develop machine learning skills using Scikit-learn for classification and regression tasks, and learn techniques for improving classification performance. The course also covers MicroPython and Edge Device Programming, including the deployment of machine learning models on edge devices using platforms like Python IDE, Google Colab, Development kits, Edge Impulse and similar edge platforms, with applications in anomaly detection, image classification using CNNs, object detection, image segmentation, gesture recognition and audio classification with deep learning techniques.

Recommended Books:

1. “TinyML Cookbook: Combine machine learning with microcontrollers to solve real-world problems”, Latest Edition by Gian Marco Iodice , ISBN-10 : 1837637369, Packt Publishing, ISBN-13 : 978-1837637362
<https://a.co/d/btsjuUr>
2. “TinyML: Machine Learning with TensorFlow Lite on Arduino and Ultra-Low-Power Microcontrollers” Latest Edition by by Pete Warden, Daniel Situnayake, O'RELLIE Publisher. ISBN-10 1492052043, ISBN 13: 978-1492052043
3. “AI at the Edge: Solving Real-World Problems with Embedded Machine Learning” Latest Edition, by Daniel Situnayake & Jenny Plunkett, O'RELLIE Publisher, ISBN-10: 1098120205, ISBN-13:978-1098120207
4. O. Simeone, “A Brief Introduction to Machine Learning for Engineers”, Foundations and Trends in Signal Processing, 12(3-4), 200-431, latest edition
5. C. M. Bishop, Pattern Recognition and Machine Learning, Springer, latest edition.
6. R. S. Sutton and A. G. Barto, Reinforcement Learning: An Introduction, MIT Press, latest edition.
7. J. Watt, R. Borthani, and A. K. Katsaggelos, Machine Learning Refined: Foundation, Algorithms, and Applications, Cambridge University Press, latest edition.
8. David J.C. Mackay, “Information Theory, Inference and Learning Algorithms”, ISBN-10: 052164298, latest edition.
9. Christopher M. Bishop, “Pattern Recognition and Machine Learning”, Springer, latest edition.

Approval	Industrial Advisory Board	Res. No.	11.3	Dated:	24-05-24
	Board of Studies	Res. No.	48.2	Dated:	10-07-24
	Board of FEEC Engineering	Res. No.	22.3	Dated:	02-10-24
	Academic Council	Res. No.	108.5b-i	Dated:	31-10-24

MEHRAN UNIVERSITY OF ENGINEERING AND TECHNOLOGY, JAMSHORO

DEPARTMENT OF ELECTRONIC ENGINEERING

Title of Subject	:	Engineering Management	
Discipline	:	Electronic Engineering	
Semester	:	7 th Semester	
Course Code	:	INM-412	
Effective	:	22-Batch onwards	
Pre-requisites	:	Nil	Co-requisite: Nil
Assessment	:	20% Sessional, 30% Mid Semester and 50% End Semester	
		Practical: 50% Sessional and 50% End Semester	
Marks	:	Theory: 50	Practical: 00
Credit Hours	:	2	0
Minimum Contact Hours	:	32	0

Course Learning Outcomes:

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

CLO	Description	Bloom's Taxonomy		PLO
		Domain	Level	
1	Understand a sustainable lifestyle and why a sustainable society is important for the environment.	Affective	1	7
2	Explain competency in various project management knowledge areas, including Risk, Quality, Stakeholder, Time and Cost management.	Cognitive	2	11
3	Separate the complex tasks of time and cost estimation using project-scheduling techniques such as CPM/PERT and GERT.	Cognitive	4	11
4	Discuss various Knowledge areas of project management in order to prepare a project plan on a simulation level using modern tool e.g. MS Project.	Affective	2	5

Contents:

- **Introduction to Management:**

Principles of management, decision making; stress management, conflict management, crisis management, leadership, motivation, delegation of powers.

- **Project Management:**

Role of projects in organization's competitive strategy, standard methodologies for managing projects, project life cycle, design implementation interface, estimating, contractual risk allocation, scheduling, PBS and WBS, integration of scope, time, resource and cost dimensions of a project, evaluation of labor, material, equipment, and subcontract resources, scheduling techniques such as CPM/PERT and GERT, critical chain, solving real-world project schedules, cost budgeting, cost baseline, cash flow analysis, earned value analysis, cost control, proposal presentation, application of software for project management.

Recommended Books:

1. Project Management: Processes, Methodologies, and Economics, Avraham Shtub, Jonathan F. Bard and Shlomo Globerson, Prentice Hall, Latest Edition.
2. Human Resource Development Training & Development, Meggnison, Managing Learning Competence, Academic Council, Latest Edition.

Approval	Industrial Advisory Board (ES)	Res. No.	8.3	Dated:	22.8.2022
	Board of Studies (ES)	Res. No.	47.2	Dated:	28.11.2022
	Board of FEEC Engineering	Res. No.	20.5	Dated:	22.02.2023
	Academic Council	Res. No.	106.7(iii)	Dated:	14.10.2023

MEHRAN UNIVERSITY OF ENGINEERING AND TECHNOLOGY, JAMSHORO

DEPARTMENT OF ELECTRONIC ENGINEERING

Title of Subject	:	Optoelectronics	
Discipline	:	Electronic Engineering	
Course Code	:	ES- 441	
Semester	:	7 th Semester	
Effective	:	22ES-Batch onwards	
Pre-Requisites	:	Applied Physics	Co-requisites: Nil
Assessment	:	20% Sessional, 30% Mid Semester and 50% End Semester Practical: 50% Sessional and 50% End Semester	
Marks	:	Theory: 50	Practical: 50
Credit Hours	:	2	1
Minimum Contact Hours	:	32	48

Course Learning Outcomes:

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

CLO	Description	Bloom's Taxonomy		PLO
		Domain	Level	
1	Describe the basic concepts of optics, ray and wave nature of light, optical waveguides, resonators and cavities.	Cognitive	1	1
2	Explain the working principle of Laser, LEDs, optical sensors, and related optoelectronics devices.	Cognitive	2	1
3	Apply the optoelectronics concepts and interfacing techniques for optical communication, optical sensing and measurement.	Cognitive	3	2
4	Reproduce different optical setups to investigate the characteristics of optoelectronic devices.	Psychomotor	3	5
5	Work in group for designing of optics based project	Affective	3	9

Contents:

Nature and properties of light

Basic concepts: Introduction to photonics, properties of light, units of light, concept of light waves, electromagnetic spectrum.

Light sources and Laser safety

Non laser light sources, concept of laser safety, eye hazards, laser safety standards and safety classification, maximum permissible exposure,

Basic Geometrical optics

Laws of Refraction and reflection, Diffused and specular reflection, index of refraction, snells law, critical angle and TIR, Dispersion, diffraction, types of lenses

Basic Physical Optics

Light waves and physical optics, interference, Youngs double slit interference, Diffraction, Diffraction grating, Polarization, law of Malus, Brewster's angle,

Laser Fundamentals

Basic mechanism, emission absorption pumping, Population inversion, spontaneous and stimulated emission, 3-level and 4-level laser, Characteristics of laser, laser construction, methods of achieving population inversion, types of lasers,

Optical detectors

Types of optical detectors, detector characteristics, noise considerations, types of photo detectors, working of photodiodes, PN, PIN, APD

Optical waveguides and Fibers

Historical introduction, Optical fiber, Importance of cladding, Material of optical fiber, coherent bundle, Acceptance angle and numerical aperture, Attenuation in optical fibers, Pulse dispersion in optical fibers, Parabolic optical fibers, Plastic optical fibers, Fiber optic sensors, Mach zenderinterferometeric fiber sensor, Fiber optic gyroscope.

Fiber optic communication

Benefits of fiber optics, Transmission windows, Fiber optic loss calculation, Types of Fiber, Step-index, graded index, single mode, multi-mode, Modal and chromatic dispersion, material and waveguide dispersion, Dispersion power penalty, Bit error rate, zero and non-zero Dispersion shifted fiber, PMD, Power budget, Bandwidth and rise time, multiplexing TDM and WDM, EDFA, FBGs and MZM.

Recommended Books

1. Introduction to Optics, Frank L Pedrotti, Leno M Pedrotti, Leno S Pedrotti, Latest Edition.
2. Fibre Optics Communications, Harold Kolimbiris, Prentice Hall, Latest Edition.
3. Optical Fibre Communications: Principles and Practice, John M. Senior, Prentice Hall, Latest Edition..
4. Fibre Optics: Communications and other Applications, Henry Zanger, Cynthia Zanger, Maxwell MacMillan International, Latest Edition.

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	Board of Studies (ES)	Res. No.	47.2	Dated:	28.11.2022
	Board of FEEC Engineering	Res. No.	20.5	Dated:	22.02.2023
	Academic Council	Res. No.	106.7(iii)	Dated:	14.10.2023

8th Semester

MEHRAN UNIVERSITY OF ENGINEERING AND TECHNOLOGY, JAMSHORO

DEPARTMENT OF ELECTRONIC ENGINEERING

Title of Subject	:	Industrial Electronics
Disciplines	:	Electronic Engineering
Semester	:	8 th
Course Code	:	ES-451
Effective	:	22ES-Batch and onwards
Pre-requisites	:	Measurement and Instrumentation, Digital Electronics
Assessment	:	20% Sessional, 30% Mid Semester and 50% End Semester Practical: 50% Sessional and 50% End Semester
Marks	:	Theory: 100 Practical: 50
Credit Hours	:	3 1
Minimum Contact Hours	:	48 48

Course Learning Outcomes (CLOs):

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

CLO No.	Description	Bloom's Taxonomy		Linking to PLOs
		Domain	Level	
1	Understand the basics of industrial Process elements, Characteristics and Control loops.	Cognitive	2	1
2	Understand the basics, instruction set and Programming knowledge to develop the PLC based system model for industrial applications.	Cognitive	2	2
3	Apply Distributed Control System case studies in Industrial Processes and Applications	Cognitive	3	3
4	Develop the ladder logic diagrams and control panels to operate and control the industrial process and applications.	Psychomotor	3	5
5	Participate in lab activities as well in group	Affective	2	9

Course Contents:

Industrial Process Characteristics and Control:

Industrial process characteristics: set points, gain, dead time, response curve, process variables, manipulated variables; Input/output relationships of process modules: Tanks, Heat exchangers, Reactors; Process unit operations, Process dynamics, Process Control Loops: Level, Temperature, Pressure, and Flow.

PLC System and Programming Applications:

Life before PLCs, PLC System Elements and Architecture, PLC Control Panel, PLC Logics and Instruction Set, PLC Programming Language, Ladder logic based PLC programming and design configurations. Timers as an application of PLC, Timers instruction set and programming examples, Non-retentive and Retentive timers, ON and OFF delay timers, Counters as an application of PLC, Counter instructions and programming examples, Up- down Counters, Sequencers as an application of PLC, Sequencer instructions and programming examples, Time driven sequencers, Event driven sequencers, Sequencer -traffic light control, Sequencer- automatic washing machine, Sequential motor control, Comparator as an application of PLC, Comparator instructions and programming examples, Combinational and bit magnitude logic circuits examples.

Distributed Control System for Industrial Process:

Automation Process and Control Mechanism, Hybrid Control System, Digital Control System, Evolution of Distributed Control System, DCS System elements and Architecture, DCS Subsystem Network Elements, DCS Communication and Servers, Processing and Data accessing Methods in DCS, DCS workstations and process graphics, Case studies: DCS industrial process monitoring and control.

Recommended Books:

1. Dale R. Patrick, Stephen W. Fardo, "Industrial Process Control Systems", River Publishers, ISBN: 978-1439815762, latest edition
2. Garry Dunning, "Introduction to Programmable Logic Controller", Publisher: Thomson/ Delmar learning, ISBN: 978-1401884260, Latest edition.
3. Kelvin T. Erickson, "Programmable Logic Controllers: An Emphasis on Design and Application", Publisher: Dogwood Valley Press, ISBN: 9780976625902, Latest edition.
4. MoustafaElshafei" Modern Distributed Control Systems: A comprehensive coverage of DCS technologies and standards", Publisher: International Kindle, ISBN: 978-1535103855, Latest edition.

Approval	Industrial Advisory Board (ES)	Res. No.	8.3	Dated:	22.8.2022
	Board of Studies (ES)	Res. No.	47.2	Dated:	28.11.2022
	Board of FEEC Engineering	Res. No.	20.5	Dated:	22.02.2023
	Academic Council	Res. No.	106.7(iii)	Dated:	14.10.2023

MEHRAN UNIVERSITY OF ENGINEERING AND TECHNOLOGY, JAMSHORO

DEPARTMENT OF ELECTRONIC ENGINEERING

Title of Subject	:	Robotics and Mechatronics Systems Design	
Disciplines	:	Electronic Engineering	
Semester	:	8 th	
Course Code	:	ES-422	
Effective	:	22ES-Batch and onwards	
Pre-requisites	:	Control Systems, Introduction to Embedded System	
Assessment	:	20% Sessional, 30% Mid Semester and 50% End Semester Practical: 50% Sessional and 50% End Semester	
Marks	:	Theory: 100	Practical: 50
Credit Hours	:	3	1
Minimum Contact Hours	:	48	00

Course Objectives: This course will familiar the students to robotics concepts, robot kinematics and dynamics and will also focuses on the synergetic integration of the knowledge of mechanical engineering, electronics, and computer engineering to achieve diverse optimal designing features and functional applications as a Mechatronics system.

Course Learning Outcomes (CLOs):

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

CLO No.	Description	Taxonomy Level		Linking to PLOs
1	Develop a working knowledge of mathematical and designing aspects of robot manipulator for analysis and control.	Cognitive	3	3
2	Apply Mechatronics system as a multi-disciplinary technology using hardware and software components for integrated solutions.	Cognitive	3	4
3	Analyse Mechatronics system for product manufacturing using designing, interfacing and optimization techniques.	Cognitive	4	5
4	Understand and create own commands to operate and control robotics motion and position.	Psychomotor	3	5
5	Organize the experimental data in the form of professional lab reports and present it on multimedia.	Affective	4	10

Course Contents:

Robotics:

Types of joints and links, common robot configurations, types of joint drive systems, electric drives, hydraulic and pneumatic drives, robot grippers, industrial robot applications, robot programming

Mechatronics System Modeling:

Mechatronics system theory, Mechatronics system constituents and key elements, Mechatronic system as a multi-disciplinary technology, Mechatronics system applications and real-life examples, , Software designing approaches, Modeling and simulation of power steering of a vehicle, Software validation and verification approaches

Mechatronics System Manufacturing and Optimization:

Mechatronics system modeling for automatic camera, automatic washing machine, anti-lock braking system and adaptive cruise control system, V-model design approach for Mechatronics, Linear and non-linear optimization techniques, Agent based Mechatronic system optimization, Mechatronics system product classification, Design and manufacturing of a Mechatronics product, Mechatronics system integration: Case studies of complex models.

Recommended Books:

1. John J. Craig , “Introduction to Robotics: Mechanics and Control”, Publisher: Addison-Wesley, ISBN: 978-0201095289, Latest Edition

2. Lung-Wen Tsai, “Robot Analysis: The Mechanics of Serial and Parallel Manipulators”, Publisher: John Wiley & Sons, ISBN: 978-0-471-32593-2, Latest Edition.
3. Godfrey C. Onwubolu, “Mechatronics: Principles and Applications”, Publisher: Elsevier Butterworth-Heinemann, ISBN 0 7506 6379 0, Latest Edition
4. Devdas Shetty and Richard A. Kolk, “Mechatronics System Design”, Publisher: Cengage Learning, ISBN: 978-1439061985, Latest Edition.
5. Wolfram Stadler, “Analytical Robotics and Mechatronics”, Publisher: McGraw-Hill, Intl. Edition, ISBN: 978-0070606081 Latest Edition.

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	Board of Studies (ES)	Res. No.	47.2	Dated:	28.11.2022
	Board of FEEC Engineering	Res. No.	20.5	Dated:	22.02.2023
	Academic Council	Res. No.	106.7(iii)	Dated:	14.10.2023

DEPARTMENT OF ELECTRONIC ENGINEERING

Course Learning Outcomes:

CLO	Description	Bloom's Taxonomy		PLO
		Domain	Level	
1	Explain the concepts of network models, layers, protocols, addressing schemes, switching, routing, circuits and channels.	Cognitive	2	1
2	Analyze the issues of network security, network, transport and application layer protocols	Cognitive	4	2
3	Construct realizable data networks involving routing, switching, and subnet masking on network simulation tools	Psychomotor	4	3, 5

- Network Models and Topologies
- Network Layering Concepts and Protocols
- Internet Protocol (IP) and Associated Control Protocols. End-To-End Protocols, With TCP and UDP as Examples
- Addressing schemes at link layer, network layer and transport layer
- Transmission Media and characteristics
- Switching Techniques
- Channel Access Techniques
- MAC
- Routing Protocols and Multicast
- Overview of Application Layer Protocols (HTTP, FTP, SMTP etc.)
- Multimedia Protocols (RTP, RTSP, RTCP)
- Security Mechanisms and Services
- Concepts of Symmetric and Asymmetric Cryptography, Digital Signature
- Convergence of communication networks

Recommended Books:

1. Data & Computer Communication, William Stalling, Prentice Hall, Latest Edition.
2. Computer Networks, Uyles Black, Prentice Hall, Latest Edition.
3. Computer Networks, S. Tanenbaum, Prentice Hall, Latest Edition.
4. Computer Networks, Andrew Tanenbaum, Prentice Hall, Latest Edition.
5. Data Communications Networking, Behrouz A Forouzan, TFourth, McGraw-Hill, Latest Edition.
6. Computer Networking: A top down approach, James F. Kurose and K. W. Ross, Latest Edition.

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