1st Semester

MEHRAN UNIVERSITY OF ENGINEERING AND TECHNOLOGY, JAMSHORO

DEPARTMENT OF ELECTRONIC ENGINEERING

Title of Subject	:	**Functional English**	
Discipline	:	Electronic Engineering	
Course Code	:	ENG-111	
Semester	:	1st Semester	
Effective	:	19ES-Batch onwards	
Pre-requisites	:	English Language Proficiency of Intermediate	Co-requisite: Nil
Assessment	:	**20%** Sessional, **20%** Mid Semester and **60%** 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	**Write** varied contents including official letters, e-mails, and applications and summarize the texts using appropriate grammatical mechanisms and cohesive devices.	Cognitive	2	12
2	**Apply** skimming, scanning and detailed reading and listening strategies to understand gist of the text/conversation.	Cognitive	3	2
3	**Utilize** their skills using English language to express their point of view, show arguments and deliver a presentation in a real-life situation.	Cognitive	3	10

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, paragraph, short descriptive writing, precis and letter and application, Identify contextual clues with the help of cohesive devices.

- **Listening:**

  Collect gist and important points from a 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, Vocabulary, Conversion of words, Tenses and sentence structure.

Recommended Materials:

Dawn newspaper, Reader Digest, New Scientist and other interesting materials selected by teachers.

Recommended Books:

1. Practical English Grammar, A. J. Thomson and A. V. Martinet, Latest Edition.
2. English Study Skills, SarwarZakia, A Spelt Publication Karachi, Latest Edition.
3. Study Skills in English, R.R.Jordon, Collins. William Collins Sons & Co. Glasgow Great Britain, Latest Edition.
4. A New English Course (An Approach to GCSE English Language for Individual Study or Class Use), Jones Rhodri**,** Latest Edition.
5. Listening Comprehension and Note-Taking Course (Collins Study Skills In English), K.James at al**,** Latest Edition.
6. Selected Text from Dwan, Readers, Digest, New Scientist and other relevant material of teacher's Choice**,** Latest Edition.

Approval	Board of Studies	Res. No**.**	**42.2**	Dated:	**16.7.2019**
	Board of FEEC Engineering	Res. No.	**14.6**	Dated:	**23.7.2019**
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MEHRAN UNIVERSITY OF ENGINEERING AND TECHNOLOGY, JAMSHORO

DEPARTMENT OF ELECTRONIC ENGINEERING

Title of Subject	:	**Applied Calculus**	
Discipline	:	Electronic Engineering	
Course Code	:	MTH-108	
Semester	:	1st Semester	
Effective	:	19ES-Batch onwards	
Pre-requisites	:	Nil	Co-requisite: Nil
Assessment	:	**20%** Sessional, **20%** Mid Semester and	**60%** 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), (∞/∞), (ox∞), (∞-∞), 1∞, ∞0, 00.

- **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	:	**Introduction to Computing**	
Discipline	:	Electronic Engineering	
Course Code	:	CS-150	
Semester	:	1st Semester	
Effective	:	19 ES-Batch onwards	
Pre-requisites	:	Nil	Co-requisite: Nil
Assessment	:	**20%** Sessional, **20%** Mid Semester 60**%** End Semester **Practical: 40%** Sessional and **60%** 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	Board of Studies	Res. No.	**42.2**	Dated:	**16.7.2019**
	Board of FEEC Engineering	Res. No.	**14.6**	Dated:	**23.7.2019**
	Academic Council	Res. No.	**96.7**	Dated:	**29.10.2019**

MEHRAN UNIVERSITY OF ENGINEERING AND TECHNOLOGY, JAMSHORO

DEPARTMENT OF ELECTRONIC ENGINEERING

Title of Subject	:	**Applied Physics**	
Discipline	:	Electronic Engineering	
Course Code	:	EL-116	
Semester	:	1st Semester	
Effective	:	19ES-Batch onwards	
Pre-requisites	:	F.Sc. Physics	Co-requisite: Nil
Assessment	:	**20%** Sessional, **20%** Mid Semester and **60%** End Semester **Practical: 40%** Sessional and **60%** 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-njunction 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	Board of Studies	Res. No.	**42.2**	Dated:	**16.7.2019**
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MEHRAN UNIVERSITY OF ENGINEERING AND TECHNOLOGY, JAMSHORO

DEPARTMENT OF ELECTRONIC ENGINERING

Title of Subject	:	**Professional Ethics**	
Discipline	:	Electronic Engineering	
Course Code	:	SS- 125	
Semester	:	1st Semester	
Effective	:	19ES-Batch onwards	
Pre-requisites	:	H.Sc. Pre-Engineering	Co-requisite: Nil
Assessment	:	**20%** Sessional, **20%** Mid Semester and **60%** 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 Miffin Co, Latest Edition.
2. Ethics in Engineering, Mike W. Martin and Roland Steiniger, McGraw-Hill, Latest Edition.

Approval	Board of Studies	Res. No.	**42.2**	Dated:	**16.7.2019**
	Board of FEEC Engineering	Res. No.	**14.6**	Dated:	**23.7.2019**
	Academic Council	Res. No.	**96.7**	Dated:	**29.10.2019**

MEHRAN UNIVERSITY OF ENGINEERING AND TECHNOLOGY, JAMSHORO

DEPARTMENT OF ELECTRONIC ENGINEERING

Title of Subject	:	**Electronics Workshop**	
Discipline	:	Electronic Engineering	
Course Code	:	ES-102	
Semester	:	1st Semester	
Effective	:	20ES-Batch onwards	
Pre-requisites	:	Nil	Co-requisite: Nil
Assessment	:	**Practical: 40%** Sessional **60%** 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:

- **Resister:**

  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.

Approval	Board of Studies	Res. No.	**44.1**	Dated:	**14.9.2020**
	Board of FEEC Engineering	Res. No.	**16.17**	Dated:	**12.10.2020**
	Academic Council	Res. No.	**98.2**	Dated:	**22.10.2020**

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	:	2nd Semester	
Effective	:	19ES-Batch onwards	
Pre-requisites	:	Applied Calculus	Co-requisite: Nil
Assessment	:	**20%** Sessional, **20%** Mid Semester and 60**%** 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	**Perform** the basic operation of matrix algebra and solution of system of linear equations.	Cognitive	2	2
2	**Utilize** the concepts of two- and three-dimensional geometry.	Cognitive	3	2
3	**Apply** area and volume of bounded regions by using multiple. integrals.	Cognitive	3	3

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 R3.
  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.

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	Academic Council	Res. No.	**97.10**	Dated:	**4.6.2020**

MEHRAN UNIVERSITY OF ENGINEERING AND TECHNOLOGY, JAMSHORO

DEPARTMENT OF ELECTRONIC ENGINEERING

Title of Subject	:	**Computer Programming**	
Discipline	:	Electronic Engineering	
Course Code	:	CS-113	
Semester	:	2nd Semester	
Effective	:	19 ES-Batch onwards	
Pre-requisites	:	Introduction to Computing	Co-requisite: Nil
Assessment	:	**20%** Sessional, **20%** Mid Semester and 60**%** End Semester **Practical: 40%** Sessional and **60%** 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.

Approval	Board of Studies	Res. No.	**42.2**	Dated:	**16.7.2019**
	Board of FEEC Engineering	Res. No.	**14.6**	Dated:	**23.7.2019**
	Academic Council	Res. No.	**97.10**	Dated:	**4.6.2020**

- **MEHRAN UNIVERSITY OF ENGINEERING AND TECHNOLOGY, JAMSHORO**

DEPARTMENT OF ELECTRONIC ENGINEERING

Title of Subject	:	**Basic Electronics**	
Discipline	:	Electronic Engineering	
Course Code	:	ES-112	
Semester	:	2nd Semester	
Effective	:	19ES-Batch onwards	
Pre-requisites	:	Nil	Co-requisite: Nil
Assessment	:	**20%** Sessional, **20%** Mid Semester and **60%** End Semester **Practical: 40%** Sessional and **60%** 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, pr actical 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.

Approval	Board of Studies	Res. No.	**43.2**	Dated:	**06.07.2020**
	Board of FEEC Engineering	Res. No.	**16.17**	Dated:	**12.10.2020**
	Academic Council	Res. No.	**98.2**	Dated:	**22.10.2020**

MEHRAN UNIVERSITY OF ENGINEERING AND TECHNOLOGY, JAMSHORO

DEPARTMENT OF ELECTRONIC ENGINEERING

Title of Subject	:	**Electrical Circuits**	
Discipline	:	Electronic Engineering	
Course Code	:	EL-107	
Semester	:	2nd Semester	
Effective	:	19ES-Batch onwards	
Pre-requisites	:	Applied Physics	Co-requisite: Nil
Assessment	:	**20%** Sessional, **20%** Mid Semester and **60%** End Semester **Practical: 40%** Sessional and **60%** 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, Crammer'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 Higganbotham, McGraw-Hill, Latest Edition.

Approval	Board of Studies	Res. No.	**42.2**	Dated:	**16.7.2019**
	Board of FEEC Engineering	Res. No.	**14.6**	Dated:	**23.7.2019**
	Academic Council	Res. No.	**97.10**	Dated:	**4.6.2020**

MEHRAN UNIVERSITY OF ENGINEERING AND TECHNOLOGY, JAMSHORO

DEPARTMENT OF ELECTRONIC ENGINEERING

Title of Subject	:	**Pakistan Studies**	
Discipline	:	Electronic Engineering	
Semester	:	2nd Semester	
Course Code	:	PS-106	
Effective	:	19ES-Batch onwards	
Pre-requisites	:	F.Sc. Pakistan Studies	Co-requisite: Nil
Assessment	:	**20%** Sessional, **20%** Mid Semester and	**60%** 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	**Explore** the Constitutional, Political and Diplomatic History of Pakistan	Cognitive	2	12
3	**Analyze** the Geo-strategic importance of Pakistan and contemporary challenges to Pakistan	Cognitive	4	7

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	Res. No.	**42.2**	Dated:	**16.7.2019**
	Board of FEEC Engineering	Res. No.	**14.6**	Dated:	**23.7.2019**
	Academic Council	Res. No.	**97.10**	Dated:	**4.6.2020**

MEHRAN UNIVERSITY OF ENGINEERING AND TECHNOLOGY, JAMSHORO

DEPARTMENT OF ELECTRONIC ENGINEERIN

Title of Subject	:	**Islamic Studies**	
Discipline	:	Electronic Engineering	
Course Code	:	SS-111	
Semester	:	2nd Semester	
Effective	:	19ES-Batch onwards	
Pre-requisites	:	Nil	Co-requisite: Nil
Assessment	:	**20%** Sessional, **20%** Mid Semester and	**60%** 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	Effectively maintain his/her identity in a multicultural world	Affective	2	6
2	Find solutions to his/her problems from own cultural practices, rather than be influenced by external ideologies.	Cognitive	3	8
3	Know why Muslims fail to equip themselves with essential survival tools needed in the world today.	Cognitive	2	12

Contents:

- **Quran and Uloom ul Quran:**

  Surah Al-Hujurat., Surah Al-Furqan (These both surahs cover all topics related to ethical values of Islamic society including Taqwa, 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 Angles, 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 KalimaShahadah, 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.

Books Recommended:

1. The universal religion:, A.A Umrani, Islam,Naseem book dept, Latest Edition.
2. Sirate-e-Mustaqeem,A.Q. Natiq, Urdu bazzar Karachi, Latest Edition.
3. Islam aurHamariZindagi,S.M. Saeed, Naseem Book Dept, Latest Edition.

Approval	Board of Studies	Res. No.	**42.2**	Dated:	**16.7.2019**
	Board of FEEC Engineering	Res. No.	**14.6**	Dated:	**23.7.2019**
	Academic Council	Res. No.	**97.10**	Dated:	**4.6.2020**

MEHRAN UNIVERSITY OF ENGINEERING AND TECHNOLOGY, JAMSHORO

DEPARTMENT OF ELECTRONIC ENGINEERING

Title of Subject	:	**Ethics**	
Discipline	:	Electronic Engineering	
Course Code	:	SS-104	
Semester	:	2nd Semester	
Effective	:	19ES-Batch onwards	
Pre-requisites	:	Nil	Co-requisite : Nil
Assessment	:	**20%** Sessional, **20%** Mid Semester and	**60%** 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** the basics of stable and healthy civilized atmosphere.	Cognitive	2	6
2	Develop uniformity of moral beliefs and behaviour.	Affective	3	8
3	Establish respectable attitude for different religions.	Affective	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	Res. No.	**42.2**	Dated:	**16.7.2019**
	Board of FEEC Engineering	Res. No.	**14.6**	Dated:	**23.7.2019**
	Academic Council	Res. No.	**97.10**	Dated:	**4.6.2020**

3rd Semester

MEHRAN UNIVERSITY OF ENGINEERING AND TECHNOLOGY, JAMSHORO

DEPARTMENT OF ELECTRONIC ENGINEERIG

Title of Subject	:	**Differential Equations & Fourier Series**	
Discipline	:	Electronic Engineering	
Semester	:	3rd Semester	
Course Code	:	MTH-212	
Effective	:	18ES-Batch onwards	
Pre-requisites	:	Applied Calculus, Linear Algebra & Analytical Geometry Co-requisite: Nil	
Assessment	:	**20%** Sessional, **20%** Mid Semester and **60%** 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 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, .Danial 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 FEEC Engineering	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	:	3rd Semester	
Course Code	:	ES-203	
Effective	:	19ES-Batch onwards	
Pre-requisites	:	Basic Electronics	Co-requisite: Nil
Assessment	:	**20%** Sessional, **20%** Mid Semester and 60**%** End Semester **Practical: 40%** Sessional and **60%** 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	Board of Studies	Res. No.	**44.1**	Dated:	**14.9.2020**
	Board of FEEC Engineering	Res. No.	**16.17**	Dated:	**12.10.2020**
	Academic Council	Res. No.	**98.2**	Dated:	**22.10.2020**

MEHRAN UNIVERSITY OF ENGINEERING AND TECHNOLOGY, JAMSHORO

DEPARTMENT OF ELECTRONIC ENGINEERING

Title of Subject	:	**Digital Electronics**	
Disciplines	:	Electronic Engineering	
Semester		3rd Semester	
Course Code	:	ES-225	
Effective	:	18ES-Batch onwards	
Pre-requisites	:	Nil	Co-requisite: Nil
Assessment	:	**20%** Sessional **20%** Midterm and **60%** Written Final Examination Practical **40%** Sessional **60%** Final Examination	
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, Introduction to Semiconductor Memory and Programmable Logic Devices:

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.
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Approval	Board of Studies	Res. No.	**42.2**	Dated:	**16.7.2019**
	Board of FEEC Engineering	Res. No.	**14.6**	Dated:	**23.7.2019**
	Academic Council	Res. No.	**96.7**	Dated:	**29.10.2019**

MEHRAN UNIVERSITY OF ENGINEERING AND TECHNOLOGY, JAMSHORO

DEPARTMENT OF ELECTRONIC ENGINEERING

Title of Subject	:	**Measurements & Instrumentation**	
Discipline	:	B.E Electronic Engineering	
Semester	:	3rd Semester	
Course Code	:	ES-223	
Effective	:	19ES-Batch onwards	
Pre-requisites	:	Nil	Co-requisite: Nil
Assessment	:	**20%** Sessional, **20%** Mid Semester and **60%** End Semester **Practical: 40%** Sessional and **60%** 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
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

- **Measurement System:**

  Principles of general measurement system, passive transducers: capacitive, inductive and resistive.

- **Measuring Instruments:**

  Instruments for measurement of electrical and non-electrical quantities including voltmeters, ammeters, function generators, oscilloscopes; Control and damping, moving coil, moving iron, electrodynamics 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, Wheatstone bridge, 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**

  Systems for signal processing and signal transmission; modern instrumentation techniques; static and dynamic responses of instrumentation and signal conditioning; data acquisition systems;

- **Analog to Digital and Digital to Analog Conversion**

  Principles of operation, construction and working of different analog and digital converters;

- **Data Acquisition System**

  Data acquisition software, and virtual Instruments; intelligent instrumentation systems, NI LabVIEW, SCADA, and other distributed control systems.

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.
- ,By A.K.Sawhney, Electrical Instrumentation and Measurement techniques, Latest Edition.

Approval	Board of Studies	Res. No.	**44.1**	Dated:	**14.9.2020**
	Board of FEEC Engineering	Res. No.	**16.17**	Dated:	**12.10.2020**
	Academic Council	Res. No.	**98.2**	Dated:	**22.10.2020**

MEHRAN UNIVERSITY OF ENGINEERING AND TECHNOLOGY, JAMSHORO

DEPARTMENT OF ELECTRONIC ENGINEERING

Title of Subject	:	**Engineering Management**	
Discipline	:	Electronic Engineering	
Semester	:	3rd Semester	
Course Code	:	INM-101	
Effective	:	18ES-Batch onwards	
Pre-requisites	:	Nil	Co-requisite: Nil
Assessment	:	**20%** Sessional, **20%** Mid Semester and	**60%** 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, AvrahamShtub, 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	Board of Studies	Res. No.	**42.2**	Dated:	**16.7.2019**
	Board of FEEC Engineering	Res. No.	**14.6**	Dated:	**23.7.2019**
	Academic Council	Res. No.	**96.7**	Dated:	**29.10.2019**

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	:	3rd Semester	
Effective	:	18ES-Batch onwards	
Pre-requisites	:	Introduction to Computing, Computer Programming Co-requisite: Nil	
Assessment	:	**20%** Sessional, **20%** Mid Semester and **60%** 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.

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	Board of FEEC Engineering	Res. No.	**14.6**	Dated:	**23.7.2019**
	Academic Council	Res. No.	**96.7**	Dated:	**29.10.2019**

MEHRAN UNIVERSITY OF ENGINEERING AND TECHNOLOGY, JAMSHORO

DEPARTMENT OF BASIC SCIENCES AND RELATED STUDIES

Title of Subject	:	**Complex Variables & Transforms**	
Discipline	:	Electronic Engineering	
Semester		4th Semester	
Course Code	:	MTH-213	
Effective	:	18ES-Batch onwards	
Pre-requisites	:	Applied Calculus, Linear Algebra & Analytical Geometry Co-requisite: Nil	
Assessment	:	**20%** Sessional, **20%** Mid Semester and **60%** 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	3	1
3	**Analyse** Fourier transforms for the solution of differential equations	Cognitive	4	2

Contents:

- **Complex Numbers System and Complex Variable Theory:**

  Introduction to complex number systems. De Moiver'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 functionsand 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	Res. No**.**	**42.2**	Dated:	**16.7.2019**
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	Academic Council	Res. No.	**97.10**	Dated:	**4.6.2020**

4th Semester

MEHRAN UNIVERSITY OF ENGINEERING AND TECHNOLOGY, JAMSHORO

DEPARTMENT OF ELECTRONIC ENGINEERING

Title of Subject	:	**Electrical Machines**	
Discipline	:	Electronic Engineering	
Semester		4th Semester	
Course Code	:	EL-202	
Effective	:	18ES-Batch onwards	
Pre-requisites	:	Applied Physics	Co-requisite: Nil
Assessment	:	**20%** Sessional, **20%** Mid Semester and **60%** End Semester **Practical: 40%** Sessional and **60%** 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.

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	Board of FEEC Engineering	Res. No.	**14.6**	Dated:	**23.7.2019**
	Academic Council	Res. No.	**97.10**	Dated:	**4.6.2020**

MEHRAN UNIVERSITY OF ENGINEERING AND TECHNOLOGY, JAMSHORO

DEPARTMENT OF ELECTRONIC ENGINEERING

Title of Subject	:	**Communication Skills**	
Discipline	:	Electronic Engineering	
Course Code	:	ENG-204	
Semester	:	4th Semester	
Effective	:	18ES-Batch onwards	
Pre-requisites	:	Nil	Co-requisite: Nil
Assessment	:	**20%** Sessional, **20%** Mid Semester and	**60%** 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	Draft varied texts including formal letters, CV, cover letter for jobs, and Technical Reports using mechanisms of academic writing integrated with paraphrasing and summarizing techniques.	Cognitive	3	10
2	Understand, interpret and infer the texts critically and apply the knowledge in real life situations by participating in public speaking acts and group discussions.	Cognitive	2	9

Contents:

- **Introduction to Communication to Skills:**
  a. Communication Principles.
  b. The process of communication.
  c. Importance of good communication skills in business environment

A. Communication in business organizations
  i. Internal-operational
  ii. External-operational
  iii. Personal
  iv. Challenge of communication in the global market.

- **Study Skills:**
  a. Brain storming
  b. Time-Management
  c. Effective reading strategies
  d. Note-taking
  e. Organization
  f. Summarizing

- **Components of Communication:**
  a. Context
  b. Sender-Encoder
  c. Message
  d. Medium
  e. Receiver-decoder

f. Feedback

- **Non-Verbal Communication:**

a. Appearance and dress codes
b. Body language
c. Silence, time and space
d. Importance of listening in communication

- **Function English:**

A. Defining factors in everyday communication:
   i. In business organization
   ii. In social exchanges

B. Role-play/Speaking activities

- **Public Speaking:**

a. Difference between speaking and writing.
b. Reading texts of good public speeches and analysis of their components.
c. Listening to fomous public speeches.
d. D. Exercises in public speaking

- **Formal Presentations:**

A. Difference between informal and formal presentations
B. Modes of formal presentations
   i. Extemporaneous
   ii. Prepared
   iii. Reading out from a written text
   iv. Combination of the above mentioned
C. Purpose of oral presentations
   i. Entertain
   ii. Persuade
   iii. Inform
   iv. Sell
D. Mechanics of presentations
   i. Organization
   ii. Preparation (including AVAs)
   iii. Rehearse
   iv. Present
E. Teacher shall model presentation both, with and without AVAs

- **Formal Presentations:**

Student presentations.

- **Correctness of Written Communication:**
- **Punctuation**

A. Grammar: Some basic principles
B. Error correcting Exercises

- **Written Communication:**
- **Systematic approach to effective written communication.**

i. Language
ii. Style
iii. Tone
iv. Organization

A. Practice of written communication for a variety of situations.

Recommended Books:

1. Ultimate Cover Letter, Martin Yalke,

2. Effective Business Communication, Herbert W. Hidebranot, Latest Edition.
3. The Ultimate Job Search Letters, Martine Yate, Latest Edition.
4. Career Road Map Guide for Engineers, Engr. Junaid Shaikh, Latest Edition.

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MEHRAN UNIVERSITY OF ENGINEERING AND TECHNOLOGY, JAMSHORO

DEPARTMENT OF ELECTRONIC ENGINEERING

Title of Subject	:	**Electromagnetic Fields**	
Discipline	:	Electronic Engineering	
Semester	:	4th Semester	
Course Code	:	ES-243	
Effective	:	18ES-Batch onwards	
Pre-requisites	:	Linear Algebra & Analytical Geometry, Applied Physics Co-requisite: Nil	
Assessment	:	**20%** Sessional, **20%** Mid Semester and **60%** End Semester	
Marks	:	Theory: 100	Practical: 50
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	**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 in different situations.	Cognitive	3	3
3	**Analyze** magneto-statics theoretically and discuss the application of electric and magnetic laws for Maxwell equations and Wave equation and Antennas.	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, Guass' 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.

- **Uniform Plane Wave Propagation:**

  Uniform plane wave propagation, uniform plane waves, the wave equations for conducting medium & sinusoidal time variations, phase and group velocity, conductors & dielectrics, Poynting's theorem & flow of power.

- **Ground Wave Propagation:**

  Plane earth reflection, space & surface waves, spherical earth propagation, tropospheric waves.

- **Ionospheric Waves:**

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

- **Antennas:**

  Introduction, network theorems, directional properties of dipole antennas, two-element array, horizontal patterns in broadcast arrays, linear arrays, multiplication patterns, binomial array, antenna gain and effective area. antenna terminal impedance, transmission loss between antennas resistance & reciprocity theorem

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 Kraver, K.R., McGraw-Hill, Latest Edition.

Approval	Board of Studies	Res. No.	**44.2**	Dated:	**06.07.2020**
	Board of FEEC Engineering	Res. No.	**16.7**	Dated:	**14.09.2020**
	Academic Council	Res. No.	**98.2**	Dated:	**22.10.2020**

MEHRAN UNIVERSITY OF ENGINEERING AND TECHNOLOGY, JAMSHORO

DEPARTMENT OF ELECTRONIC ENGINEERING

Title of Subject	:	**Integrated Electronics**	
Discipline	:	Electronic Engineering	
Semester	:	4th Semester	
Course Code	:	ES-253	
Effective	:	18ES-Batch onwards	
Pre-requisites	:	Electronic Circuit Design	Co-requisite: Nil
Assessment	:	**20%** Sessional, **20%** Mid Semester and 60**%** End Semester **Practical: 40%** Sessional and **60%** 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 fabrication process, internal biasing circuits of ICs i.e. current mirrors and current sources and describe various logic families	Cognitive	2	1
2	**Apply and interpret** operational amplifiers, pulse & switched circuits and IC timers in different applications on the basis of understanding its different configurations.	Cognitive	3	3
3	**Analyze** the operations of differentiators, integrators, comparators, A/D & D/A converter 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.	**Organize** the lab data to emphasize experimental objectives, procedures, observations etc.	Affective	4	10

Contents:

- **IC Fabrication:**

  Introduction to the fabrication of digital microelectronic pMOS, nMOS, CMOS, and BiCMOS circuits, epitaxy, ion implantation and oxidation, Basics of VLSI Design, Presentation of concepts and techniques used in the fabrication of VLSI circuits, integrated circuit fabrication, integrated circuit layout, NMOS and CMOS logic design, design issues.

- **Logic Families:**

  Saturating and non-saturating logic families (DTL, TTL, ECL, I2L, CMOS), noise margin, fan-out, propagation delay.

- **Transistor sources and amplifiers:**

Analog and digital circuit interface with applications, differential amplifiers, DC and AC analysis of differential amplifier, design of simple differential amplifier, level translator, current sources (simple current mirror, Widler and Wilson current source), output stage design

- **Switching Circuit Design and applications:**

  Detailed design of pulse and switching circuits, monostable, astable and bistable circuits, emitter-coupled flip-flop, detailed study of timer ICs and their applications,

- **Operational Amplifier:**

  Use of op-amp as a circuit element, offset and offset compensation, op-amp with negative feedback, frequency response of an op-amp, DC and AC analysis of op-amp ICs, amplifier, linear and non-linear applications, A/D and D/A converter , Schmitt trigger.

Recommended Books:

1. Basic Electronics Devices, Circuits and Systems, M. Cirovic, Prentice Hall, Latest Edition.
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.

Approval	Board of Studies	Res. No.	**43.2**	Dated:	**06.07.2020**
	Board of FEEC Engineering	Res. No.	**16.17**	Dated:	**12.10.2020**
	Academic Council	Res. No.	**98.2**	Dated:	**22.10.2020**

5th Semester

MEHRAN UNIVERSITY OF ENGINEERING AND TECHNOLOGY, JAMSHORO

DEPARTMENT OF ELECTRONIC ENGINEERING

Title of Subject	:	**Signals & Systems**	
Discipline	:	Electronic Engineering	
Course Code	:	ES-304	
Semester	:	5th Semester	
Effective	:	18ES-Batch onwards	
Pre-requisites	:	Electrical Circuits, Complex Variables & Transforms	
Assessment	:	**20%** Sessional, **20%** Mid Semester and **60%** End Semester **Practical: 40%** Sessional and **60%** 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** continuous & discrete time signals and systems mathematical operations on signals and analogue to digital conversion of signals.	Cognitive	2	1
2	**Apply** time domain and frequency domain representation and transformation techniques on the continuous & discrete time signals & systems.	Cognitive	3	2
3	**Analyse** continuous and discrete time systems including analogue filters using Laplace transform and Z transform.	Cognitive	4	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, signal representation and models, system characteristics.

- **Time Domain Analysis**

  Sinusoidal and complex exponential signals, singularity function signals, signal energy and signal power, orthogonal signals, signal representation by Generalized Fourier Series, continuous and discrete-time convolution evaluation and properties.

- **Frequency Domain Representation and Analysis**

  Spectra and bandwidths of signals, Fourier series representation of signals, Fourier transform, energy density spectrum, power density spectrum, auto-correlation function, system frequency response, phase delay and group delay.

- **Continuous-time filters**

Distortion-less transmission, ideal filters, approximation of ideal filters, Butter worth and Chebyshev filter design.

- **Sampled Continuous – Time signals**

  Ideal sampling, Sampling theorem, practical sampling effects.

- **Frequency Domain representation of Discrete-time signals**

  Z-transform, Inverse Z-transform, Z-transform solution of difference equations, stability of linear discrete-time systems.

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	Board of Studies	Res. No.	**44.1**	Dated:	**14.9.2020**
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MEHRAN UNIVERSITY OF ENGINEERING AND TECHNOLOGY, JAMSHORO

DEPARTMENT OF ELECTRONIC ENGINEERING

Title of Subject	:	**Sociology for Engineers**	
Discipline	:	Electronic Engineering	
Course Code	:	SS-338	
Semester	:	5th Semester	
Effective	:	17ES-Batch onwards	
Pre-requisites	:	Nil	Co-requisites: Nil
Assessment	:	**20%** Sessional, **20%** Mid Semester and **60%** End Semester **Practical: 40%** Sessional and **60%** 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.

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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-314	
Semester	:	5th Semester	
Effective	:	18ES-Batch onwards	
Pre-requisites	:	Digital Electronics	Co-requisite: Nil
Assessment	:	**20%** Sessional, **20%** Mid Semester and **60%** End Semester **Practical: 40%** Sessional and **60%** 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** AVR based microcontroller architecture, its internal registers, addressing modes and instruction set	Cognitive	2	1
2	**Illustrate** and **analyze** microcontroller memories, internal blocks, peripherals, ADC, interrupts, timers, serial protocols (RS232, SPI, I2C) etc to program both in C and Assembly language.	Cognitive	4	2
3	**Design** and develop an appropriate solution for a particular situation or specific application using small microcontroller based system prototype.	Cognitive	5	3
4	**Perform** experiments in laboratory using development kits, ICs and simulation software.	Psychomotor	3	5
5.	**Participate** and contribute towards the achievement of given experiment.	Affective	2	9

Contents:

- **Introduction to AVR microcontrollers and Assembly language programming, Application, Basic Core Architecture, Addressing modes and Pin Configuration microcontroller instruction set.**
- **Branch Call and Time Delay Loop**
- **AVR IO Port Programming**
- **Arithmetic, Logic Instructions, Masking Techniques and Programs**
- **Programming in Assembly and C, Handling of Timers, Counter, ADC, Interrupts**
- **Introduction to 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.

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MEHRAN UNIVERSITY OF ENGINEERING AND TECHNOLOGY, JAMSHORO

DEPARTMENT OF ELECTRONIC ENGINEERING

Title of Subject	:	**Power Electronics**	
Discipline	:	Electronic Engineering	
Course Code	:	ES-319	
Semester	:	5th Semester	
Effective	:	17ES-Batch onwards	
Pre-requisites	:	Basic Electronics	Co-requisite: Nil
Assessment	:	**20%** Sessional, **20%** Mid Semester and **60%** End Semester **Practical: 40%** Sessional and **60%** 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	Board of Studies	Res. No.	**44.1**	Dated:	**14.9.2020**
	Board of FEEC Engineering	Res. No.	**16.17**	Dated:	**12.10.2020**
	Academic Council	Res. No.	**98.2**	Dated:	**22.10.2020**

MEHRAN UNIVERSITY OF ENGINEERING AND TECHNOLOGY, JAMSHORO

DEPARTMENT OF ELECTRONIC ENGINEERING

Title of Subject	:	**Numerical Methods**	
Discipline	:	Electronic Engineering	
Course Code	:	MTH-310	
Semester	:	5th Semester	
Effective	:	18ES-Batch onwards	
Pre-requisites	:	Intermediate Mathematics	Co-requisites: Nil
Assessment	:	**20%** Sessional, **20%** Mid Semester and **60%** End Semester	
		Practical: 40% Sessional and **60%** 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 compute iterative methods for the solution of simultaneous linear algebraic equations.	Cognitive	2	1,5
2	**Estimate** interpolation and extrapolation and determine Numerical differentiation and integration.	Cognitive	2	1,5
3	**Compute** numerical solution of ordinary differential equations	Cognitive	2	1,5

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 methds: Jaccobi's method, Guass-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; Miline'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	Res. No.	**42.2**	Dated:	**16.7.2019**
	Board of FEEC Engineering	Res. No.	**14.6**	Dated:	**23.7.2019**
	Academic Council	Res. No.	**96.7**	Dated:	**29.10.2019**

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	:	6th Semester	
Effective	:	17ES-Batch onwards	
Pre-requisites	:	Electronic Circuit Design, Signals & Systems Co-requisites: Nil	
Assessment	:	**20%** Sessional, **20%** Mid Semester and **60%** End Semester **Practical: 40%** Sessional and **60%** 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	Board of Studies	Res. No.	**43.2**	Dated:	**06.07.2020**
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	Academic Council	Res. No.	**98.2**	Dated:	**22.10.2020**

MEHRAN UNIVERSITY OF ENGINEERING AND TECHNOLOGY, JAMSHORO

DEPARTMENT OF ELECTRONIC ENGINEERING

Title of Subject	:	**Control Systems**	
Discipline	:	Electronic Engineering	
Course Code	:	ES-353	
Semester	:	6th Semester	
Effective	:	17ES-Batch onwards	
Pre-requisites	:	Complex Variables & Transforms, Signals & Systems Co-requisites: Nil	
Assessment	:	**20%** Sessional, **20%** Mid Semester and 60**%** End Semester **Practical: 40%** Sessional and **60%** 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

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MEHRAN UNIVERSITY OF ENGINEERING AND TECHNOLOGY, JAMSHORO

DEPARTMENT OF ELECTRONIC ENGINEERING

Title of Subject	:	**Probability and Random Signals**	
Discipline	:	Electronic Engineering	
Course Code	:	ES-324	
Semester	:	6th Semester	
Effective	:	17ES-Batch onwards	
Pre-requisites	:	Nil	Co-requisite: Nil
Assessment	:	**20%** Sessional, **20%** Mid Semester and	**60%** 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	**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:

- **Set Theory**
- **Basic set definitions, types of sets, set operations, Vann diagram, set properties.**
- **Basic concepts of probability**

  Conditional probability, independent events, Baye's formula, discrete and continuous random variables, distributions and density functions,
- **Probability Distributions**

  Binomial, Poisson, hyper geometric, normal, uniform and exponential
- **Statistics**

  Mean, variance, standard deviations, moments and moment generating functions,
- **Regression and Curve Fitting**

  Linear regression and curve fitting, limits theorems
- **Stochastic processes**

  First and second order characteristics, applications.

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	Board of Studies	Res. No.	**43.2**	Dated:	**06.07.2020**
	Board of FEEC Engineering	Res. No.	**16.17**	Dated:	**12.10.2020**
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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	:	6th Semester	
Effective	:	17ES-Batch onwards	
Pre-requisites	:	Digital Electronics	Co-requisites: Nil
Assessment	:	**20%** Sessional, **20%** Mid Semester and **60%** End Semester **Practical: 40%** Sessional and **60%** 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 Biousl, 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	Board of studies	Res.No.	43.2	Dated:	06.07.2020
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MEHRAN UNIVERSITY OF ENGINEERING & TECHNOLOGY, JAMSHORO

DEPARTMENT OF ELECTRONIC ENGINEERING

Title of Subject	:	**Optoelectronics**	
Discipline	:	Electronic Engineering	
Course Code	:	ES-397	
Semester	:	6th Semester	
Effective	:	17ES-Batch onwards	
Pre-Requisites	:	Applied Physics	Co-requisites: Nil
Assessment	:	**20%** Sessional, **20%** Mid Semester and	**60%** 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, energy harvesting, optical sensing and measurement.	Cognitive	3	2
4	**Reproduce** different optical setups to investigate the characteristics of optoelectronic devices.	Psychomotor	3	5
5	**Work** individually or in group for designing of optics based project	Affective	3	9

Contents:

- **Geometric and Wave Optics**

  Snell's Law, Numerical Aperture, Total internal reflection, Fresnel equations, dispersion, pulse broadening and distortion. interferometry, diffraction and polarization of light

- **Optical Waveguides, Resonators and Cavities**

  Resonant cavities. dielectric slab optical waveguide, optical fibre waveguide. Laser principles, population inversion and threshold conditions, laser modes.

- **Light emitting diodes and laser and Optical Sensors**

  Operating characteristics and typical structures, Types of laser diodes (monomode/tunable) such as DBR and DFB. Light Detectors: Principles of photo-detection, types of semiconductor photodiodes.

- **Optical Communication and Optical Noise**

Analog / Digital Modulation and corresponding opto-electronic circuits. Noise: Thermal and Shot noise, and signal to noise ratio in electro-optical systems. Optoelectronics in energy and telecommunications such as photo-voltaic devices and wavelength division multiplexing.

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.

Approval	Board of studies	Res.No.	43.2	Dated:	06.07.2020
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7th Semester

MEHRAN UNIVERSITY OF ENGINEERING AND TECHNOLOGY, JAMSHORO

DEPARTMENT OF ELECTRONIC ENGINEERING

Title of Subject	:	**Computer Communication & Networking**	
Discipline	:	Electronic Engineering	
Course Code	:	TL-416	
Semester	:	7th Semester	
Effective	:	F16ES-Batch onwards	
Pre-requisites	:	Communication Systems	Co-requisites: Nil
Assessment	:	**20%** Sessional, **20%** Mid Semester and **60%** End Semester **Practical: 40%** Sessional and **60%** 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, Uyless 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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MEHRAN UNIVERSITY OF ENGINEERING AND TECHNOLOGY, JAMSHORO

DEPARTMENT OF ELECTRONIC ENGINEERING

Title of Subject	:	**Digital Control Systems**	
Discipline	:	Electronic Engineering	
Course Code	:	ES-413	
Semester	:	7th Semester	
Effective	:	17ES-Batch onwards	
Pre-requisites	:	Control Systems	Co-requisites: Nil
Assessment	:	**20%** Sessional, **20%** Mid Semester and **60%** End Semester **Practical: 40%** Sessional and **60%** 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** basic concepts of digital control systems	Cognitive	2	1
2	**Analyse** 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 controllers using root locus method to achieve the desire 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, Sampled data systems**
- **Difference Equation, discrete transfer functions**
- **Z transform analysis**
- **Sample/Hold unit with zero-order hold, Ideal sampler**
- **Sate variables, solution to state equations**
- **Data reconstruction, A-D and D/A conversion**
- **State space and input/output representation**
- **Review of continues stare variables**
- **Discrete state equations**
- **Close loop systems**
- **Modelling S&Z planes**
- **Discrete time representation of continuous time systems**

- **Stability: Bilinear transformation, Jury stability test.**
- **Time response: Steady stare accuracy**
- **Frequent Response, Bode diagram, Nyquist Criterion**
- **Root Locus Analysis**
- **Design methods of digital controllers**
- **PID controller design by root locus**
- **Digital filtering of systems**

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. Santina H, 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.

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MEHRAN UNIVERSITY OF ENGINEERING AND TECHNOLOGY, JAMSHORO

DEPARTMENT OF ELECTRONIC ENGINEERING

Title of Subject	:	**Embedded Systems Design**	
Discipline	:	Electronic Engineering	
Course Code	:	ES-423	
Semester	:	7th Semester	
Effective	:	17ES-Batch onwards	
Pre-requisites	:	Introduction to Embedded Systems	Co-requisites: Nil
Assessment	:	**20%** Sessional, **20%** Mid Semester and **60%** End Semester **Practical: 40%** Sessional and **60%** 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** ARM processor architecture and programming concepts in C/Assembly for embedded systems development	Cognitive	2	1
2	**Apply** different programming techniques to develop embedded system applications	Cognitive	3	3
3	**Develop** solution for inter-process communication, process synchronization in embedded software through semaphores and conditional variables	Cognitive	5	4
4	**Use** commercial API and tools to accelerate the development cycle of Arm-based embedded systems and **Build** an Arm-based embedded system project and program to satisfy given user specifications	Psychomotor	3	5
5.	**Organize** the lab data to emphasize experimental objectives, procedures, observations etc.	Affective	4	10

Contents:

- **Introduction to Embedded Systems**
- **The Arm Cortex-M0+ Processor Architecture**
- **Introduction to Cortex-M0+ Programming**
- **Digital Input and Output**
- **Interrupts and Low Power Features**
- **Introduction to the Mbed Platform, Arm-based Software Libraries, CMSIS and the Mbed SDK**
- **Analog Input and Output**
- **Timer and Pulse-Width Modulation**
- **Serial Communication**

Recommended Books:

1. Embedded Systems Fundamentals with Arm Cortex-M based Microcontrollers: A Practical Approach by by Dr Alexander G. Dean, Latest Edition.
2. Atmel Arm Programming for Embedded Systems: (Mazidi & Naimi ARM Series) by Muhammad Ali Mazidi, Shujen Chen, et al, Latest Edition.

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	Board of FEEC Engineering	Res. No.	**16.17**	Dated:	**12.10.2020**
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MEHRAN UNIVERSITY OF ENGINEERING AND TECHNOLOGY, JAMSHORO

DEPARTMENT OF ELECTRONIC ENGINEERING

Title of Subject	:	**Technical Report Writing & Presentation Skills**	
Discipline	:	Electronic Engineering	
Course Code	:	ENG-402	
Semester	:	7th Semester	
Effective	:	16ES-Batch onwards	
Pre-requisites	:	Functional English	Co-requisites: Nil
Assessment	:	**20%** Sessional, **20%** Mid Semester and **60%** 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	**Develop** the content and structure of various technical and academic research documents e.g., dissertations, research papers or articles, proceeding papers and research review papers.	Cognitive	2	1, 12
2	**Distinguish** between formal and informal reports and use different type of reports, such as; progress reports, research report, recommendation report, evaluation report and feasibility report, internship reports). Besides, Format proposals, elements and types of different proposals along with technical manuals and SOPs.	Cognitive	3	10

Contents:

- **Presentation Skills:**

- **Essay Writing:**

  Descriptive, narrative, discursive, argumentative.

- **Academic Writing:**

  How to write a proposal for research paper/term paper, how to write a research paper/term paper (emphasis on style, content, language, form, clarity, consistency).

- **Technical Report Writing:**

  How to write a technical report.

- **Progress Report Writing:**

  How to write a progress report.

Recommended Books:

1. Writing Advanced, Ron White, Oxford Supplementary Skill, Latest Edition.
2. College Writing Skills, John Langan, Mc-Graw-Hill, Latest Edition.
3. Patterns of College Writing, Laurie G. Kriszner and Stephen R. Mandell, St.Martin's Press, Latest Edition.

4. The Mercury Reader, Janice Neulib, Kathleen Shine Cain, Stephen Ruffus and Maurice Scharton, A Custom Publication, NortherILLinois University, Latest Edition.

Approval	Board of Studies	Res. No.	**42.2**	Dated:	**16.7.2019**
	Board of FEEC Engineering	Res. No.	**14.6**	Dated:	**23.7.2019**
	Academic Council	Res. No.	**96.7**	Dated:	**29.10.2019**

8th Semester

MEHRAN UNIVERSITY OF ENGINEERING AND TECHNOLOGY, JAMSHORO

DEPARTMENT OF ELECTRONIC ENGINEERING

Title of Subject	:	**Entrepreneurship**	
Discipline	:	Electronic Engineering	
Course Code	:	SS-411	
Semester	:	8th Semester	
Effective	:	F16ES-Batch onwards	
Pre-requisites	:	Nil Co-requisites: Nil	
Assessment	:	**20%** Sessional, **20%** Mid Semester and **60%** 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	**Develop** a business plan with an appropriate business model	Cognitive	5	11
2	**Demonstrate** the ability to provide a self-analysis in the context of an entrepreneurial career	Affective	4	9
3	**Demonstrate** the ability to find an attractive market that can be reached economically	Affective	3	6

Contents

- **Venture Opportunity, Concept, and Strategy**

  Introduction
  Business Model
  Strategies

- **Venture Formation and Planning**

  Risk and Return
  The Business Plan
  Types of Ventures
  Legal Formation and Intellectual Property

- **Financing**

  The financial plan
  Sources of Capital

- **Detailed Functional Planning**

  Marketing and Sales Plan
  Acquiring and Organizing Resources
  Management of Operations

Recommended Books:

1. Technology Ventures: From Idea to Enterprise by Thomas Byers, Richard Dorf, Andrew Nelson, 4th Edition, McGrawHill, Latest Edition.
2. The Startup Owner's Manual: The Step-By-Step Guide for Building a Great Company by Steve Blank, Bob Dorf, K & S Ranch, Latest Edition.
3. The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses by Eric Ries, Penguin Book, Latest Edition.

Approval	Board of Studies	Res. No.	**42.2**	Dated:	**16.7.2019**
	Board of FEEC Engineering	Res. No.	**14.6**	Dated:	**23.7.2019**
	Academic Council	Res. No.	**97.10**	Dated:	**4.6.2020**

MEHRAN UNIVERSITY OF ENGINEERING AND TECHNOLOGY, JAMSHORO

DEPARTMENT OF ELECTRONIC ENGINEERING

Title of Subject	:	**Digital Signal Processing**	
Discipline	:	Electronic Engineering	
Course Code	:	ES-433	
Semester	:	8th Semester	
Effective	:	F16ES-Batch onwards	
Pre-requisites	:	Signals & Systems	Co-requisites: Nil
Assessment	:	**20%** Sessional, **20%** Mid Semester and 60**%** End Semester **Practical: 40%** Sessional and **60%** 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**

  Introduction to Digital Signal Processing, Real-world typical DSP applications, Review of Signals & Systems.
- **Digital Signals and Systems**

  Digital Signals, Discrete LTI systems, Difference Equations and Impulse Response, Digital Convolution
- **Discrete Fourier Transform and Signal Spectrum**

  Discrete Fourier Series, Discrete Fourier Transform, Discrete Time Fourier Transform (DTFT), Fast Fourier Transform

- **Z-Transform and Inverse Z Transform Introduction to Digital Filters and Filter Realization**

  Difference equation and digital filtering
  Difference equation and transfer function
  Z-plane pole-zero plot and stability
  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 Chebyshav
  Pole-Zero placement method
  Various Design Applications

- **Hardwar and Software for Digital Signal Processing**

Recommended Books:

1. Digital Signal Processing Fundamentals and Applications, Li Tan, Elsevier, Latest Edition.
2. Digital Signal Processing Proakis J.G. and Manolakis D.G., Macmillan Publishing Company, Latest Edition.
3. Digital Signal Processing Oppenhiem A.V., Prentice Hall, Latest Edition.
4. Fundamentals of Digital Signal Processing, Joyce van de vegte, Prentice Hall, Latest Edition.

Approval	Board of Studies	Res. No.	**43.2**	Dated:	**06.07.2020**
	Board of FEEC Engineering	Res. No.	**16.17**	Dated:	**12.10.2020**
	Academic Council	Res. No.	**98.2**	Dated:	**22.10.2020**

MEHRAN UNIVERSITY OF ENGINEERING AND TECHNOLOGY, JAMSHORO

DEPARTMENT OF ELECTRONIC ENGINEERING

Title of Subject	:	Mechatronic Systems and Applications	
Disciplines	:	Electronic Engineering	
Semester	:	8th	
Course Code:	:	ES-451	
Effective	:	F16ES-Batch and onwards	
Pre-requisites	:	Digital Control Systems, Embedded System Design	
Assessment	:	Sessional Work: 20%	Written Examination: 80%
Marks	:	Theory: 100	Practical: 00
Credit Hours	:	3	0
Minimum Contact Hours	:	48	00

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	**Apply** Mechatronics system as a multi-disciplinary technology using electronic hardware and software components.	Cognitive	C3	3
2	**Analyse** Mechatronics system for product manufacturing using designing, interfacing and optimization techniques.	Cognitive	C4	4
3	**Design** Mechatronic process development techniques and system controllers for industrial automation applications.	Cognitive	C5	5

Course Contents:

Mechatronics system theory, Mechatronics system constituents and key elements, Mechatronic system as a multi-disciplinary technology, Mechatronics system applications and real-life examples, Device design and evolution process of SCARA robot, Software designing approaches, Modeling and simulation of power steering of a vehicle, Software validation and verification approaches, Assembly of hardware components: Case studies of automotive mechatronic subsystem and industrial robot gripper.

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.

Programmable Logic Controller as a Mechatronic System Application, Distributed Control System as a Mechatronic System Application, Supervisory Controller and Data Acquisition System as a Mechatronic System.

Recommended Books:

1. HGodfrey C. OnwuboluH, “Mechatronics: Principles and Applications”, Elsevier Butterworth-Heinemann.
2. HJohn BillingsleyH, “Essentials of Mechatronics”, John Wiley & Sons, Latest Edition.
3. HRolf IsermannH, “Mechatronic Systems: Fundamentals”, Springer, Latest Edition.
4. HDevdas ShettyHand HRichard KolkH, “Mechatronics System Design”, Thomson-Engineering, Latest Edition.
5. W. Bolton, “Mechatronics: Electronic Control Systems in Mechanical and Electrical Engineering”, Pearson Education, Latest Edition

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	Board of FEEC Engineering	Res. No. 16.17	Dated: 14.9.2020
	Academic Council	Res. No. 98.2	Dated: 22.10.2020

MEHRAN UNIVERSITY OF ENGINEERING AND TECHNOLOGY, JAMSHORO

DEPARTMENT OF ELECTRONIC ENGINEERING

Title of Subject	:	**Artificial Intelligence**	
Discipline	:	Electronic Engineering	
Course Code	:	CS-490	
Semester	:	8th Semester	
Pre-requisites	:	Computer Programming, Complex Variables & Transforms Co-requisites: Nil	
Effective	:	F16ES-Batch onwards	
Assessment	:	**20%** Sessional, **20%** Mid Semester and **60%** End Semester **Practical: 40%** Sessional and **60%** 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	**Explain** the process of realizing intelligent human behaviors in to a machine/computer program.	Cognitive	2	1
2	**Applying** and representing expert knowledge for expert systems.	Cognitive	3	1
3	**Distinguish** classical Artificial Intelligence techniques for computational problem solving.	Cognitive	4	2
4	**Construct** intelligent programs using MATLAB toolboxes and unconventional programming languages as PROLOG and LISP.	Psychomotor	4	3, 5

Course outline:

- **Introduction to Artificial Intelligence (AI)**

  History of AI, Basic elements of AI, Application areas of AI, Fields of AI, Turing Test, McCulloch Pits Model, Intelligence.

- **Expert System (ES):**

  Overview of ES, Benefits and Limitation of ES, Components of ES, Knowledge Representation, Chaining: Forward and Backward, Inference Engine, Knowledge Engineer, Domain Expert, Human vs. Artificial Expertise, Expert System Categories, Stage of Expert System Development.

- **Intelligent Agents:**

  Overview of Agents, Generic Agent, Software Agent, Structure of Intelligent Agent, PAGE Descriptors, Agent Environment, Properties of Environment, Basic Agent Types: Table Driven, Simple Reflex, Model Based, Goal Based, Utility Based.

- **Solving Problem by Searching:**

  Graph Theory, Single-Agent path finding problems, Two player games, constraint satisfaction problems, Problem space, State space, Problem instance, Tic-Tac-Toe game, 8-puzzle game, Water-Jug problem, 8 Queens problem, search strategies: Forward and Backward, Evaluating Search strategies.

- **Uninformed Search:**

  Breadth First Search, Depth First Search, Depth Limited Search, Depth First Iterative Deeping Search, Evaluating Search Algorithms, Uniform Cost Search, Repeated States.

- **Informed Search:**

  Heuristics, Heuristic search, Heuristic function, Best First Search, Greedy Best First Search, A* Search, Hill climbing, Simulated Annealing, Alpha-Beta pruning.

- **Knowledge Engineering:**

  DIKW pyramid, Knowledge based system, levels of knowledge, categories of knowledge, Knowledge representation, Main approaches of knowledge representation.

- **Knowledge Representation:**

  Rule based knowledge, case-based knowledge, Structures, Semantic networks, Frames, Scripts.

- **Proportional Logic:**

  Proportional Logic, Syntax of Proportional Logic, Identities, Tautology, Contradiction, Satisfiable, Inference.

- **Predicate Logic:**

  Predicate language, Syntax of predicate logic, Universal quantifier, Existential quantifier.

- **Fuzzy Logic:**

  Overview of fuzzy logic, Linguistic variables, Fuzzy logic vs Bi-Valued logic, Membership function, Fuzzy sets, Fuzzy set operations, Properties of Fuzzy sets, Fuzzy Cartesian product, Fuzzy composition.

- **Practical work is based on the above theoretical course using MATLAB, PROLOG and LISP.**

Recommended Books:

1. Artificial intelligence – A Modern Approach, Russell S.; Norvig P., Prentice Hall, Latest Edition.
2. Artificial Intelligence – Structures and Strategies for Complex Problem Solving, Luger G.F.;, Pearson Higher Education, Latest Edition.
3. An Introduction to Fuzzy Logic and Fuzzy Sets, James J. Buckley, Esfandiar Eslami, Springer, Latest Edition.

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