University OF MOSUL

First Cycle – Bachelor's Degree (B.Sc.) – ***Electrical Engineering*** *(**Electronic and Communication / Power and Machines**)*

بكالوريوس - هندسة الكهربائية / الالكترونيك والاتصالات / القدرة والمكائن

Table of Contents

1. Overview

This catalogue is about the courses (modules) given by Two programs of Electrical Engineering (Electronic and Communication / Power and Machines) to gain the Bachelor of Science degree. each program delivers (**54**) Modules with (**6000**) total student workload hours and **240** total ECTS. The module delivery is based on the Bologna Process.

نظره عامه

يتناول هذا الدليل المواد الدراسية التي يقدمها برنامج هندسة الكهربائية بفرعيه (الالكترونيك والاتصالات) والـ (القدرة والمكائن) للحصول على درجة بكالوريوس العلوم. يقدم كل برنامج (**54**) مادة دراسية مع (**6000**) إجمالي ساعات حمل الطالب والـ **240** إجمالي وحدات أوروبية. يعتمد تقديم المواد الدراسية على عملية بولونيا.

2. Undergraduate Courses 2023-2024 (Electronic & Communication)

Module 1

Code	Course/Module Title	ECTS	Semester
EE101	Basics of Electrical Engineering I	8	One
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/sem)**
3	3	93	107
Description			
Basic Concept & Units: Electricity & atomic structure of substance, current and current density, current flow, electric circuit, E.M.F. & potential difference, international system of unit, abbreviation for multiples & sub-multiples, quantities derived from SI units, units of force-energy-torque and power, relation between energy and heat, electric units, efficiency & percentage efficiency, electromechanical equivalent of element. Analysis of D.C Circuit: Ohm's law, resistivity & conductivity, temperature affect, internal resistance of a source, open circuit & short circuit, equivalent resistance: Series-parallel, delat and star, grouping of E.M.F. sources, power calculation in D.C circuit, introduction to network theorems, types of source: independent and dependent voltage and current sources and their transformation, Kirchhoff's laws: KVL-KCL, Maxwell's circulating currents (mesh analysis), nodal analysis, superposition theorem, thevenin's theorem, Norton s theorem, maximum power transfer theorem, millman theorem, substitution theorem, reciprocity theorem.			

Module 2

Code	Course/Module Title	ECTS	Semester
EE102	Mathematics I	6	One
Class (hr./w)	**Lect. /Lab. /Prac. /Tutor.**	**SSWL (hr./sem)**	**USWL (hr./w)**
3	1	63	87
Description			
Matrices: Basic Definitions, Addition, Subtraction and Multiplication, Determinants, The Inverse of a 3 x 3 Matrix, Cramers Rule, Solve equations by Matrices: Gaussian Elimination. the method of finding the inverse of a square matrix, solution of simultaneous linear equations by matrix method. Coordinates and Graphs in the Plane: Directions and Quadrants, Distance between Points, Graphs of Equations, Intercepts and More about Graphing, Slope and Equations for Lines: Slope of Non-vertical Lines, Lines that are Parallel or Perpendicular, Point – Slope Equations, Slope – Intercept Equations, Functions and their Graphs, Domains and Ranges are Often Intervals, Even Functions and Odd Functions, Functions Defined in Pieces, Shifts, Circles, and Parabolas: How to Shift a Graph, Equations for Circles in the Plane, Equations for Parabolas, A Review of Trigonometric Functions: Radian Measure, The Six Basic Trigonometric Functions, Calculating Sines and Cosines, Graphs of Trigonometric Functions, Limits and Continuity: Limits, Examples of Limits, The Sandwich Theorem and $(\boldsymbol{\sin\theta})/\boldsymbol{\theta}$, Limits Involving Infinity, Continuous Functions. Derivatives: Slopes, Tangent Lines, and Derivatives, Defining Slopes and Tangent Lines, The Derivative of a function, The Slope of Lines, Differentiation Rules: Integer Powers, Multiples, Sums, and Differences, Second and Higher Order Derivatives, Negative Integer Powers of x, Velocity, Speed, and Other Rate of Change: Velocity, Speed, Acceleration, Derivatives of Trigonometric Functions: The Derivative of the Sine, The Derivative of the Cosine, The Derivative of the Other Basic Functions, The Chain Rule: Integer Powers of Differentiable Functions, Derivative Formulas that Include the Chain Rule, Implicit Differentiation and Fractional Powers: Lenses, Tangents, and Normal Lines, Using Implicit Differentiation to Find Derivatives of Higher Order, Fractional Powers of Differentiable Functions, Linear Approximations and Differentials.			

Module 3

Code	Course/Module Title	ECTS	Semester
EE103	Engineering drawing	4	One
Class (hr./w)	**Lect. /Lab. /Prac. /Tutor.**	**SSWL (hr./sem)**	**USWL (hr./w)**
2	2	63	37
Description			
Engineering Instruments, Lettering, Types of Lines, Orthographic Projection I, Graphic Geometry, Dimensions. Orthographic Projection II, Isometric Drawing. Computer Drawing: Introduction to Auto CAD, Dimension Units Commands, Drawing Commands, Drawing Files, T- Text Commands.			

Module 4

Code	Course/Module Title	ECTS	Semester
EE104	Physics	4	One
Class (hr./w)	**Lect. /Lab. /Prac. /Tutor.**	**SSWL (hr./sem)**	**USWL (hr./w)**

2	--	33	67
Description			
Introduction to physics; measuring things, quantitities, units systems, dimensional analysis, victor and scalar quantities, victor properties, resultant dding and subtracting victor quantities.Motion in one and two dimensions, position and displacement, velocity, acceleration. Force and motion; Newten's first law, force, mass, Newten's second law, gravitional force, weight,normal force, and tension force.Newton's third law, applying Newton's laws, Force and motion, friction, uniform circular motion. Work; Kinetic and Potential Energy; The work-kinetic energy theorem; Conservation of total mechanical energy,Spring forces and Hooke's law; Power and Effeciency.Linear momentum; Momentum and kinetic energy; Rate of change of linear momentum and Newton's laws; Law of conservation of linear momentum; Impulse; and Simple Harmonic Motion.Universal gravitation; Newton's law of universal gravitation; Free-fall acceleration and the gravitational force; and Solve problems using Newton's law of universal gravitation and calculate the gravitation for different locations. Fluid mechanics; Pressure and density of fluid at different depth; Hydrostatic pressure; Pascal's principle and the operation of a hydraulic lift; Buoyant forces and Archimedes's principle; the equation of continuity for fluids; and the Bernoulli's equation. Heat Transfer (Conduction, Convection, and Radiation). Basic of Architectural Physics; and Solar Radiation. Sound; Noise; Sound Intensity. Sound Insulation; and Thermal Behaviour of Materials. Current and Voltage; electrical circuit; and Ohm's Law. Power and Energy; and Parallel and Series Networks.			

Module 5

Code	**Course/Module Title**	**ECTS**	**Semester**
EE105	Mechanics Engineering	3	One
Class (hr./w)	**Lect. /Lab. /Prac. /Tutor.**	**SSWL (hr./sem)**	**USWL (hr./w)**
2	0	33	42
Description			
Static: Force system, Units system, Forces + Components, Resultant, Moment and Couples, Equilibrium, Centroid, Moment of Inertia, Friction. Dynamics: Rectilinear motion, Curvilinear motion, Projectile, Circular motion, Acceleration Components (Rectangular Comp., Normal Tangential Comp.), Kinetic - 2nd Law of Newton. Thermodynamics: Properties of Substance, Pressure and Temperature, Work and Energy, Ideal Gas, First Law of Thermodynamics, 2nd Law of Thermodynamics. Hook's law.			

Module 6

Code	**Course/Module Title**	**ECTS**	**Semester**
UOM103	Computer	6	One
Class (hr./w)	**Lect. /Lab. /Prac. /Tutor.**	**SSWL (hr./sem)**	**USWL (hr./w)**
2	2	63	12
Description			
Introduction to Algorithms, Types of Algorithms, Algorithms Analyzing & Designing, Algorithms Writing Methods, Flowcharts, Introduction to Computers: Software & Hardware, Operating Systems: Windows, Android, IOS, Applications: Introduction to MS – Word, Applications: Introduction to MS – Excel, Applications: Introduction to MS – PowerPoint, Reviews			

Module 7

Code	Course/Module Title	ECTS	Semester
UOM101	Arabic Language	2	One
Class (hr./w)	**Lect. /Lab. /Prac. /Tutor.**	**SSWL (hr./sem)**	**USWL (hr./w)**
2	--	33	17
Description			

Module 8

Code	Course/Module Title	ECTS	Semester
EE108	Basics of Electrical Engineering II	8	Two
Class (hr./w)	**Lect. /Lab. /Prac. /Tutor.**	**SSWL (hr./sem)**	**USWL (hr./w)**
3	3	93	107
Description			
Alternating quantities, generating of single phase voltage, waveforms instantaneous value and real, RMS and Average values, analysis of A.C Circuit: Ohm's law, impedance & admittance, conductance and suscpetance, internal impedance of a source, open circuit & short circuit, equivalent impedance: Series-parallel, delta and star, power calculation in A.C circuit, introduction to network theorems, types of source: independent and dependent voltage and current sources and their transformation, Kirchhoff's laws: KVL-KCL, Maxwell's circulating currents (mesh analysis), nodal analysis, superposition theorem, the venin's theorem, Norton s theorem, maximum power transfer theorem, resonant circuits.			

Module 9

Code	Course/Module Title	ECTS	Semester
EE109	Mathematics II	6	Two
Class (hr./w)	**Lect. /Lab. /Prac. /Tutor.**	**SSWL (hr./sem)**	**USWL (hr./w)**
3	1	63	87
Description			
Polar coordinates system: Polar coordinates system and the graphs of polar equations, plane area in polar coordinates, arc length of curves in polar coordinates. Brief Review: about differentiation and integration law, Applications of definite integral: Area between curves. Volume of solid revolution. Arc length of a plane curve. Surface area of arc length revolution. Methods of integration: Trigonometric substitutions. Partial fractions. Integration by parts. Further substitutions. First order differential equations: variable separable differential equations. Homogeneous differential equations. Linear differential equations. Exact differential equations. Numerical integration: Simpson's approximation methods. Limit: L'Hopital			

method and its applications.

Module 10

Code	Course/Module Title	ECTS	Semester
EE110	Computer programming	6	Two
Class (hr./w)	**Lect. /Lab. /Prac. /Tutor.**	**SSWL (hr./sem)**	**USWL (hr./w)**
2	2	63	87
Description			
Introduction to MATLAB. Types of variables, numbers. Expressions, operation and function. Matrix and its applications. Solving set of linear equations. Solving of Electrical circuit. Control flow in MATLAB program. Curve fitting, interpolation. Function and its application (pulse & ramp functions). Numerical application (numeric differentiation and numerical integration. Engineering graphics (two dimension and three dimensions) such as vector diagram mesh, bar plots). Solving equation by symbols. Solving of transient response in electrical circuit. Fourier series and Fourier transform. Solving of ordinary differential equation. Capacitor smoothing circuit analysis. Three phase analysis.			

Module 11

Code	Course/Module Title	ECTS	Semester
EE111	Digital Techniques	3	Two
Class (hr./w)	**Lect. /Lab. /Prac. /Tutor.**	**SSWL (hr./sem)**	**USWL (hr./w)**
2	1	48	27
Description			
Introduction to Digital Technique, Basic Definitions, System of Numbers, General number formula: Binary, octal, decimal & hexadecimal numbers, Numbers Base Conversion (Arithmetic operation in different numbers complements, binary codes, BCD, Ex-3, gray codes), Boolean algebra: (Basic definitions, basic theorem & properties, Boolean functions), Canonical & Standard Forms Digital Logic Gates, Karnaugh Maps (AND & OR implementation, don't care condition), Adders Arithmetic Operation (Sub tractors, half & full adders & Subtractors, binary parallel adders), Code Conversion (Even and odd party logic, decoders, encoders comparator, multiplexers & de-multiplexers), Sequential Logic (Flip Flops (RS, T, D, JK…) Master slave FF, Counters, Shift registers).			

Module 12

Code	Course/Module Title	ECTS	Semester
EE112	Electronics Physics	3	Two

Class (hr./w)	Lect. /Lab. /Prac. /Tutor.	SSWL (hr./sem)	USWL (hr./w)
2	1	48	27

Description
Energy Level and Atomic Structure: The atom, models, wave nature of light, dual nature of matter, energy-band theory of metals, insulators and semiconductors, crystal structure, ionic, covalent and metallic bonding, energy band of crystals, Internal structure of materials cell, packing miller indices, crystal planes and directions. Electrical Conduction in Metals: Mobility and conductivity, energy distribution of electrons, Fermi levels, work function, electronic emission. Semiconductors: Semiconductors materials (Si, Ge and compound semiconductors), extrinsic semiconductors, Fermi-level in semiconductor, diffusion and carrier life time, Hall effect. Semiconductor p-n Junction: p-n junction in equilibrium, current-voltage characteristics, charge-control description of a diode, Transition and diffusion capacitance's, diode switching times, diode models, small-signal model and load line concept, and introduction to Hetero-junctions and double Hetero-junctions. Diode Circuit Applications: Rectifiers, Zener diodes voltage regulators, clipping circuits, clamping circuits and wave form generation. Other Types of Semiconductor Diodes: Varactor diode, tunnel diode, photodiode and photovoltaic (solar) cell, Light emitting diode, metal electronic. Transistors Principle of Operation and type, Transistor biasing circuits, Application Circuit.

Module 13

Code	Course/Module Title	ECTS	Semester
UOM104	Democracy and Human Rights	2	One
Class (hr./w)	**Lect. /Lab. /Prac. /Tutor.**	**SSWL (hr./sem)**	**USWL (hr./w)**
2	0	33	17

Description
Definition and sources of democracy and human rights (international, regional, national, religious). Characteristics of democracy and human rights: universality, indivisibility, interdependence, inalienability. Emergence and evolution of human rights: historical development, key milestones, influential movements. Types of human rights: civil and political, economic and social, environmental, cultural, and developmental. Guarantees to prevent human rights violations: legal, institutional, societal safeguards, Islamic guarantees, national and international levels. Concept of democracy: principles, values, forms of governance (direct, semi-direct, indirect). Islamic stance on democracy: compatibility, strengths, weaknesses. Critique of the democratic system: analysis of strengths and weaknesses. Administrative corruption: definition, types, societal impact. Methods to combat administrative corruption.

Module 14

Code	Course/Module Title	ECTS	Semester
UOM102	English language	2	Two

Class (hr./w)	Lect. /Lab. /Prac. /Tutor.	SSWL (hr./sem)	USWL (hr./w)
2	0	33	17
Description			
Pronunciation, reading and writing. General knowledge of fundamental grammatical structures and functions (e.g. sentence types, tenses, voice, parts of speech, word order. Acquiring fundamental vocabulary to fulfill the above-mentioned functions in roles, topics and discussions.			

Module 15

Code	Course/Module Title	ECTS	Semester
EEEC201	Electrical Circuits Analysis I	6	Three
Class (hr./w)	**Lect. /Lab. /Prac. /Tutor.**	**SSWL (hr./sem)**	**USWL (hr./w)**
4	2	93	57
Description			
Transient Circuits: The Transient Circuits: RC, RL, RLC circuit in series and parallel and their complete response in time and Frequency. Poly-phase Circuits: Poly-phase Circuits: Single-phase and three phase wire system, 3-Phase balance and unbalance system, star and delta connections. Power in 3-phase circuits. Magnetic coupling circuit: Magnetic coupling circuit: Coefficient of coupling, Linear and ideal transformers.			

Module 16

Code	Course/Module Title	ECTS	Semester
EEEC202	Engineering Mathematics I	5	Three
Class (hr./w)	**Lect. /Lab. /Prac. /Tutor.**	**SSWL (hr./sem)**	**USWL (hr./w)**
4	1	78	47
Description			
Vectors: Vectors component and Units, Space coordinate and Space Vector, Scalar Product and Vector Product, Units and plane equation, equations of lines and planes, Product of Three Vectors, Applications. Vector Functions and Their Derivatives Gradient of Scalar Reid; Divergence of Vector Field; Curl of Vector Field; Directional Derivatives; Gradient, Divergence and Curl in Curvilinear Coordinates. Differential Equations: Introduction to Differential Equations, 1st and 2nd order linear differential equations with constant coefficients, solution via the auxiliary equation, nonhomogeneous equations, application to electrical systems. Coupled 1st order linear differential equations; transformation of higher order linear differential equations on to coupled differential equations. Homogenous differential of higher order. Fourier series: The need for Fourier series, Periodic functions, Fourier Series-Euler formulas. Even and odd functions, Half-Range expansions, Application in Electrical Eng.			

Module 17

Code	Course/Module Title	ECTS	Semester
EEEC203	Electronics Principles	5	Three
Class (hr./w)	**Lect. /Lab. /Prac. /Tutor.**	**SSWL (hr./sem)**	**USWL (hr./w)**
3	1	63	62
Description			
Transistor Construction. Transistor Symbols. Transistor Operation. Transistor Connections: Common Base CB Connection, Common Emitter CE Connection. Transistor Curves, Cutoff and Saturation. Transistor as a switch. Common Collector Connection Transistor Load Line Analysis Operating Point Transistor Parameters and Rating Amplification. Practical Circuit of Transistor Amplifier, D.C. and A.C. Equivalent Circuits. Transistor ac Equivalent Circuits h-parameters, Hybrid Equivalent Circuit. The Linear Amplifier The a.c. Load Line A.C. Analysis Using re Model for Transistor Common – Emitter Fixed – Bias Configuration Common – Emitter Emitter – Bias Configuration Common – Emitter Collector Feedback Configuration Common – Emitter Voltage Divider Configuration The Common – Collector Amplifier the Common – Base Amplifier Multistage Transistor Amplifiers.			

Module 18

Code	Course/Module Title	ECTS	Semester
EEEC204	Communication Principles	5	Three
Class (hr./w)	**Lect. /Lab. /Prac. /Tutor.**	**SSWL (hr./sem)**	**USWL (hr./w)**
3	1	63	62
Description			
Transmission Lines basics: Reflection in transmission line, Space-Time diagram (zig-zag), Discharge of transmission line. Transmission line equation, Propagation constant, Transmission line distortion, A.C. Steady state transmission line, Standing wave in transmission line. Transmission Lines analysis: Graphical solution of lossless transmission line using Crack diagram. Graphical solution of lossless transmission line using Smith chart. Graphical solution of lossy transmission line using Smith chart. Transmission line matching using Quarter Wave Transformer ($\lambda/4$). Transmission line matching using single stub. Signals and Systems: Signal classifications. Fourier series. Fourier Transform. Signals and linear systems. Power spectral density and Correlation.			

Module 19

Code	Course/Module Title	ECTS	Semester
EEEC205	Electromagnetic Fields	4	Three
Class (hr./w)	**Lect. /Lab. /Prac. /Tutor.**	**SSWL (hr./sem)**	**USWL (hr./w)**
2	1	48	52
Description			
coordinate systems: rectangular coordinate system, cylindrical coordinate system, spherical coordinate system. vector analysis: scalars and vectors, vector algebra, vector components and unit vectors, vector addition and subtraction, vector multiplication. coulomb's law and electric force: the experimental law of coulomb. electric field intensity: electric field of a point charge, electric field of n point charges. electric fields due to continuous charge distributions: electric field of a line charge. electric fields due to continuous charge distributions: electric field of a sheet of charge. electric fields due to continuous charge distributions: electric field of a volume of charge. electric flux density and gauss's law: gauss's law application on a point charge, gauss's law application on a line charge. electric flux density and gauss's law: gauss's law application on a surface charge. electric flux density and gauss's law: gauss's law application on a volume charge. work, potential & potential difference: work done in moving a point charge. work, potential & potential difference: potential & potential difference. conductors, dielectrics, and capacitance: electric fields in material space. conductors, dielectrics, and capacitance: dielectric – dielectric boundary conditions, conductor – dielectric boundary conditions, conductor – free space boundary conditions. conductors, dielectrics, and capacitance: capacitance and capacitors.			

Module 20

Code	Course/Module Title	ECTS	Semester
EEEC206	Electrical Engineering Lab. I	3	Three
Class (hr./w)	**Lect. /Lab. /Prac. /Tutor.**	**SSWL (hr./sem)**	**USWL (hr./w)**
0	2	33	42
Description			
Circuit Components and values: DC circuits, Current and voltage definitions, Passive sign convention and circuit elements, Resistive networks, real and ideal elements, voltage and current sources. Circuit reduction: combining sources, Combining resistive elements in series and parallel, delta and star transformation. Circuit Theory: Kirchhoff's laws and Ohm's law. Introduction to mesh and nodal analysis, Introduction to Thevenin and Norton theory, maximum power transfer, introduction to superposition theory.			

Module 21

Code	Course/Module Title	ECTS	Semester
EEEC207	The crimes of the Baath regime in Iraq	2	Three

Class (hr./w)	Lect. /Lab. /Prac. /Tutor.	SSWL (hr./sem)	USWL (hr./w)
2	--	33	17
Description			

Module 22

Code	Course/Module Title	ECTS	Semester
EEPM208	Electrical Circuits Analysis II	6	Four
Class (hr./w)	**Lect. /Lab. /Prac. /Tutor.**	**SSWL (hr./sem)**	**USWL (hr./w)**
4	2	93	57
Description			
Two-Port Networks: Two-Port Networks: One-pot networks, y-z-h-g and ABCD parameters. Frequency Response: Complex Frequency and Circuit Analysis in the s-Domain. Frequency Response. Filters: Constant k-filters, Low pass and high pass modern filter design, Butterworth and filters, Network transformations, and all pass filter, Active filter. Fourier circuit analysis.			

Module 23

Code	Course/Module Title	ECTS	Semester
EEEC209	Engineering Mathematics II	5	Four
Class (hr./w)	**Lect. /Lab. /Prac. /Tutor.**	**SSWL (hr./sem)**	**USWL (hr./w)**
4	1	78	47
Description			
Eigenvalues and eigenvectors; diagonalization. Sequence and series, sequence convergence, series geometric series, nth partial sum, test of convergence, Laplace Transforms: Introduction to transforms and operators, Laplace transforms of basic functions; unit step function, transforms of 1st and 2nd derivatives, Application to electric circuits; Transforms of piecewise continuous functions. Inverse Laplace transforms, derivation using partial fractions. Direct (s-domain) analysis of electrical circuits, Interpretation of s-domain functions Initial & final value theorems. Fourier transform for different functions (unit step function, unit impulse function, singularity function, applications in electrical engineering. Fourier transform for different functions (unit step function, unit impulse function, singularity function, applications in electrical engineering.			

Module 24

Code	Course/Module Title	ECTS	Semester
EEEC210	Electronic Circuits	5	Four
Class (hr./w)	**Lect. /Lab. /Prac. /Tutor.**	**SSWL (hr./sem)**	**USWL (hr./w)**
3	1	63	62
Description			
Types of Field Effect Transistors Junction Field Effect Transistor JFET Basic Structure, Basic Operation, JFET Symbols. Difference Between JFET and Bipolar Transistor, Relation Among JFET Parameters, Variation of Trans conductance gm of JFET Biasing: JFET Biasing by Bias Battery, Self – Bias for JFET, JFET with Voltage – Divider Bias JFET Connections: Common Source Connection, Common Gate Connection, Common Drain Connection. Practical JFET Amplifier, D.C. And A.C. Equivalent Circuits of JFET. D.C. Load Line Analysis JFET Small – Signal Model JFET A.C. Equivalent Circuit Fixed – Bias Configuration Self – Bias Configuration Voltage – Divider Configuration Common – Gate Configuration Source – Follower (Common – Drain) Configuration JFET Applications Metal Oxide Semiconductor FET (MOSFET) Types of MOSFET D – MOSFET, Circuit Operation of D – MOSFET, Depletion Mode, Enhancement Mode D – MOSFET Transfer Characteristic D – MOSFET Biasing D – MOSFET Small – Signal Model E – MOSFET , Operation , Schematic Symbols, Equation for Trans conductance Curve. E – MOSFET Biasing Circuits E – MOSFET Small – Signal Model, E – MOSFET Drain – Feedback Configuration, E – MOSFET Voltage – Divider Configuration E – MOSFET Versus D – MOSFET Tuned Amplifiers, Single – Tuned Amplifiers, Double – Tuned Amplifiers Introduction to Four – Layer Devices Description and Operation of Silicon Controlled Rectifier, Diac, Thyristor, GTO and Triac. High Frequency Equivalent Circuit, Low – Frequency Equivalent Circuit			

Module 25

Code	Course/Module Title	ECTS	Semester
EEEC211	Analoge Communication	5	Four
Class (hr./w)	**Lect. /Lab. /Prac. /Tutor.**	**SSWL (hr./sem)**	**USWL (hr./w)**
3	1	63	62
Description			
Modulation/Demodulation of AM-DSB, AM-DSB/SC, AM-SSB/SC, and AM-VSB frequency spectrum, average power, FDM. Frequency Modulation: Phase modulation, Frequency modulation, Single tone frequency modulation, Modulation/Demodulation of Narrow Band FM, frequency spectrum, average power, Modulation/Demodulation of Wide Band FM, frequency spectrum, average power. Noise: Definition of Noise, Statistical Description of Signals, Noise in Linear Systems, Naturally Occurring Noise, and Representation of Band limited Noise. Signal to Noise Ratios in AM and FM Reception.			

Module 26

Code	Course/Module Title	ECTS	Semester
EEEC212	Electrical measurements	4	Four

Class (hr./w)	Lect. /Lab. /Prac. /Tutor.	SSWL (hr./sem)	USWL (hr./w)
2	1	48	52
Description			
Electrical Measurement Principle: Basics, instruments classifications, linearity, Errors. Electromechanical instruments Principal work, Torques types, PMMC, multi-range voltmeters, ammeters, ohmmeters, rectifier type voltmeter. Oscilloscope and bridges. Oscilloscopes and their applications, DC and AC bridges. Transducers, types applications.			

Module 27

Code	Course/Module Title	ECTS	Semester
EEEC213	Electrical Engineering Lab. II	3	Four
Class (hr./w)	**Lect. /Lab. /Prac. /Tutor.**	**SSWL (hr./sem)**	**USWL (hr./w)**
0	2	33	42
Description			
Circuit Components and values: DC circuits, Current and voltage definitions, Passive sign convention and circuit elements, Resistive networks, real and ideal elements, voltage and current sources. Circuit reduction: combining sources, Combining resistive elements in series and parallel, delta and star transformation. Circuit Theory: Kirchhoff's laws and Ohm's law. Introduction to mesh and nodal analysis, Introduction to Thevenin and Norton theory, maximum power transfer, introduction to superposition theory.			

Module 28

Code	Course/Module Title	ECTS	Semester
EEEC214	English Language	2	Four
Class (hr./w)	**Lect. /Lab. /Prac. /Tutor.**	**SSWL (hr./sem)**	**USWL (hr./w)**
2	0	33	17
Description			
Classification of Essays: I independent essays based on personal thoughts. Dependent essays based on data, figures, diagrams. Integrated essays. Structure of academic essays: Analyzing academic essays according to the standard structure of academic essays. Idea Maps: Filling the idea maps from the major information extracted while reading an essay. Responding to an essay question: Building an outline using personal ideas in response to an essay question. Writing Paragraphs: Writing thesis statement. The Introduction Paragraph, The Body Paragraphs. Essay Conclusion: Writing the conclusion paragraph considering the main ideas stated in the introduction and body paragraphs, Transition words and connection phrases: Dependent essays: Introduction to essays based on figures, tables, diagrams, and processes.			

Module 29

Code	Course/Module Title	ECTS	Semester

EEEC301	Engineering Analysis I	4	Five
Class (hr./w)	**Lect. /Lab. /Prac. /Tutor.**	**SSWL (hr./sem)**	**USWL (hr./w)**
3	1	63	37
Description			
The concepts of z transform and to solve the difference equations. he basic principles of function of complex variables. Discrete time system analysis Z-transforms Inverse Z-transform Difference equations. Series solution of differential equation. Power series Frobenious method Bessel differential equation Solutions of Bessel's Equation Applications of Bessel's Equation, functions of complex variables, ; Analytic functions integrations.			

Module 30

Code	**Course/Module Title**	**ECTS**	**Semester**
EEEC302	Electronics I	6	Five
Class (hr./w)	**Lect. /Lab. /Prac. /Tutor.**	**SSWL (hr./sem)**	**USWL (hr./w)**
3	1	63	87
Description			
Frequency Response of the Amplifiers: Frequency Response of single stage and Multistage Amplifiers used as a BJT transistors and FET. Differential Amplifier, and Differential Amplifier Applications. Operational amplifiers and its types: Operational amplifiers and its types, Operation amplifier internal circuits, Inverting amplifiers non-inverting amplifiers, Differentiator and integrator circuits. A/D and D/A convertor circuit and active filter design: A/D convertor and D/A convertor. Logarithmic amplifier. Analog computer circuit. Passive filter design. Active filter design and its applications.			

Module 31

Code	**Course/Module Title**	**ECTS**	**Semester**
EEEC303	Microprocessors	6	Five
Class (hr./w)	**Lect. /Lab. /Prac. /Tutor.**	**SSWL (hr./sem)**	**USWL (hr./w)**
3	1	63	87
Description			
Microprocessor: Central Processing Unit, memory and input/output interfacing. Memory Classification Volatile and non-volatile memory, Primary and secondary memory, Static and Dynamic memory, Logical, Virtual and Physical memory. Architecture of INTEL 8086: (Bus Interface Unit, Execution unit), register organization, memory addressing, memory segmentation, Operating Modes. 8086 microprocessor instructions Set: Instruction Set of 8086: Addressing Modes: Instruction format: Discussion on instruction Set: Groups: data transfer, arithmetic, logic string, branch control transfer, processor control. Interrupts: Hardware and software interrupts, responses, and types.			

Module 32

Code	Course/Module Title	ECTS	Semester
EEEC304	Digital Communication	6	Five
Class (hr./w)	**Lect. /Lab. /Prac. /Tutor.**	**SSWL (hr./sem)**	**USWL (hr./w)**
3	1	63	87
Description			
Probability, Random Processes, and Information. Theory Probability theory, Random variables, CDF, PDF, Random process, Correlation, Information, Capacity. Sampling Theory and Digital Modulations. Sampling theory, PAM, PCM, DM, Matched filter, ASK, FSK, PSK, and QAM.			

Module 33

Code	Course/Module Title	ECTS	Semester
EEEC305	Digital Electronics	4	Five
Class (hr./w)	**Lect. /Lab. /Prac. /Tutor.**	**SSWL (hr./sem)**	**USWL (hr./w)**
3	1	63	37
Description			
Flip-flops - SR, JK, T, D, Master/Slave FF, Triggering of FF, Analysis of clocked sequential circuits and their design, , Synchronous and asynchronous sequential circuits state assignment, State minimization Circuit implementation, Registers-Shift registers, Ripple counters, Synchronous counters, Timing signal, RAM, Semiconductor memories, Fundamental Mode Sequential Circuits, Memory decoding.			

Module 34

Code	Course/Module Title	ECTS	Semester
EEEC306	Electronics and Communications Lab. I	4	Five
Class (hr./w)	**Lect. /Lab. /Prac. /Tutor.**	**SSWL (hr./sem)**	**USWL (hr./w)**
0	4	63	37
Description			
Circuit Components and values: Operational amplifier, Operational amplifier application, Active Filter, Frequency Modulation Single Phase Transformer Open and Short Circuit Tests and Three Phase Power Measurements and No-load test of D.C. shunt generator. Circuit reduction: Class A Power Amplifier and Phase Splitter, Push-Pull & Complementary Power Amplifiers (Class AB power amplifier), Transmission line characteristics (Coaxial Cable), Three Phase Power Measurements, Speed and Direction Control of D.C shunt Motor using voltage control method and Encoder& Decoder.			

Module 35

Code	Course/Module Title	ECTS	Semester
EEEC307	Engineering Analysis II	4	Six
Class (hr./w)	**Lect. /Lab. /Prac. /Tutor.**	**SSWL (hr./sem)**	**USWL (hr./w)**
3	1	63	37
Description			
Solving the 2nd order differential equation and Bessel differential equations by series solutions. The principals of the wave equation for one and two dimensions. To introduce the fundamentals of numerical methods used for the solution of engineering problems and to improve the computer skills of the students. Partial Differential Equations. One dimensional wave equation Separation of variables, Vibrating string, two-dimensional wave equation, transmission line, Introduction to Complex Variables Complex number system and its operations, Limits and sequences Continuous functions and their properties, Derivatives complex integration and Cauchy integral theorems. Concepts and role for the numerical method in engineering, Numerical Solution of Nonlinear Algebraic Equations, Open Methods, Numerical Solution of linear algebraic equations, Curve Fitting.			

Module 36

Code	Course/Module Title	ECTS	Semester
EEEC308	Electronics II	6	Six
Class (hr./w)	**Lect. /Lab. /Prac. /Tutor.**	**SSWL (hr./sem)**	**USWL (hr./w)**
3	1	63	87
Description			
Classes of the Operational amplifiers: Power Amplifier Class (A), Power Amplifier Class (B, AB), Power Amplifier Class (C). Power Amplifier Class (D). Amplifiers Circuit and timer integrated circuit: Negative and Positive Amplifier Circuit. Oscillator (Radio Frequency) and its types. Timer integrated circuit design IC555. Integrated circuit design and power supply: The voltage controlled oscillators VCO IC566. The phase locked loop PLL IC655. Frequency Synthesizer. Power Supply Circuit. Types of Voltage Regulator Power Supply Circuit.			

Module 37

Code	Course/Module Title	ECTS	Semester
EEEC309	Antennas and Wave Propagation	6	Six
Class (hr./w)	**Lect. /Lab. /Prac. /Tutor.**	**SSWL (hr./sem)**	**USWL (hr./w)**
3	1	63	87
Description			
Fundamental Parameters of Antennas (radiation pattern lobes, field region, radiation intensity, directivity, gain, half power beamwidth, bandwidth, input impedance, efficiency, and Friis transmission equation). Linear Wire Antennas (infinitesimal dipole). Linear Wire Antennas (finite length dipole). Array Theory (two element array, broadside array, end-fire array). N-Element Linear Array-Uniform Amplitude and Spacing. N-Element Linear Array -Phased Array. Non-Uniform Array (Binomial array). Broadband Dipoles (biconical antenna, cylindrical dipole antenna). Broadband Dipoles (dish antenna). Microstrip Antenna (characteristics and design). Plane Wave (normal incidence and oblique incidence). Radio Wave Propagation (propagation of radio waves at different frequencies). Radio Wave Propagation (ground wave propagation). Radio Wave Propagation (sky wave propagation). Radio Wave Propagation (space wave propagation).			

Module 38

Code	Course/Module Title	ECTS	Semester
EEEC310	Control Systems	6	Six
Class (hr./w)	**Lect. /Lab. /Prac. /Tutor.**	**SSWL (hr./sem)**	**USWL (hr./w)**
3	1	63	87
Description			
Introduction to control system, Basic Components of a Control System, Open loop and closed loop control system , Block diagram and block diagram reduction, Signal flow graph; Masson gain formula, transfer function, Mathematical model, State space representation of control system, State Space representation: State equation, output equation, state transition Matrix, state transition equation, Characteristic Equations , state diagram, Controllability Canonical Form (CCF), Observability Canonical Form (OCF), Diagonal Canonical Form (DCF) , Jordan Canonical Form (JCF), controllability, observability of control system, Time domain analysis of control system, Stability of control system, Rowth Hurwitz criterion.			

Module 39

Code	Course/Module Title	ECTS	Semester
EEEC311	Programmable controllers	2	Six
Class (hr./w)	**Lect. /Lab. /Prac. /Tutor.**	**SSWL (hr./sem)**	**USWL (hr./w)**
2	--	33	17
Description			
Introduction to PLCs,PLC basics, PLC Addressing and Basic Instructions, Basic Ladder Logic Programming, Programming word level logic instructions, Relation of digital gate logic to contact/coil logic, Relay logic, Relay Sequencers, PLC Timer Functions, ladder diagram elements. Instructions: Relay type instructions, Instruction addressing, Branch Instructions, Internal Relay Instructions, Programming. Data Handling and Program Control Flow Instructions, Shift and Sequencer Instructions, PLC I/O Module Types and PLC Trainer Configuration.			

Module 40

Code	Course/Module Title	ECTS	Semester
EEEC312	Electronics and Communications Lab. II	4	Six
Class (hr./w)	**Lect. /Lab. /Prac. /Tutor.**	**SSWL (hr./sem)**	**USWL (hr./w)**
0	4	63	37
Description			
Circuit Components and values: Digital Counter, Amplitude Modulation and Demodulation, Analysis of FM, 8086 Study of Finite Length Dipole Antenna, PCM, Design of a timer using the IC-555, No load test of D.C. shunt generator, Digital –To- Analog Converters, Voltage regulators No load test of D.C. shunt generator and Speed and Direction Control of D.C shunt Motor using voltage control. Circuit reduction: Class A Power Amplifier and Phase Splitter, Push-Pull & Complementary Power Amplifiers (Class AB power amplifier), Transmission line characteristics (Coaxial Cable), Three Phase Power Measurements, Speed and Direction Control of D.C shunt Motor using voltage control method and Encoder& Decoder.			

Module 41

Code	Course/Module Title	ECTS	Semester
EEEC313	English language	2	Six
Class (hr./w)	**Lect. /Lab. /Prac. /Tutor.**	**SSWL (hr./sem)**	**USWL (hr./w)**
2	0	33	17
Description			
This course develops further knowledge of the grammar and of essential vocabulary in order to lead the students to an advanced level of proficiency. Emphasis is placed on developing listening, speaking, reading and writing skills through an integrated approach. It focuses on grammar and fundamental writing skills. By the end of the course, students are expected to: Understand the main ideas of a variety of written and spoken texts. Participate effectively in a short conversation using appropriate language. Produce a range of text types in the form of a logical and cohesive paragraph. Select appropriate vocabulary to talk about feelings, opinions and experiences. Recognize, understand and use a number of phrasal verbs and collocations. Use effective organizational strategies that include introductions, paragraphs, transitions, and conclusion.			

Module 42

Code	Course/Module Title	ECTS	Semester
EEEC401	Satellite Communications	6	Seven
Class (hr./w)	**Lect. /Lab. /Prac. /Tutor.**	**SSWL (hr./sem)**	**USWL (hr./w)**
3	1	63	87
Description			
Introduction to Satellite Communications, Evolution of Satellite Communication, Elevation Angle to Satellite, Azimuth Angle to Satellite, Applications of Satellites, Frequency allocation for satellite Type of Satellites (Based on Orbits): (GEO, LEO, MEO, HEO, Polar Orbit), Satellite Examples (INTELSAT, U.S DOMSATS), Direct Broadcast Satellite System DBS. Kepler's Laws (First and Second). Satellite Communications Segments, Radio Wave propagation. Ionospheric Effects, Rain Attenuation, Other Propagation Impairments, Angle of Elevation and propagation impairments, Propagation delay. Satellite Construction, Satellite Transponder, Tracking, Telemetry, Command, and Monitoring. Satellite Link Parameters, Equivalent Isotropic Radiated Power (EIRP), Transmission Losses. Bad weather loss, Noise Temperature. Uplink and down signal budget calculations, Microwave Interference. Satellite Access (FDMA, TDMA, CDMA, SDMA). International Standards (The T-carrier TDM/PCM telephony system), Compressor and expander (Compander). Centralized and Decentralized Control, SPADE system.			

Module 43

Code	Course/Module Title	ECTS	Semester
EEEC402	Digital Signal Processing	6	Seven

Class (hr./w)	Lect. /Lab. /Prac. /Tutor.	SSWL (hr./sem)	USWL (hr./w)
3	1	63	87
Description			
Introduction to the theory of digital signal processing (DSP). Introduction to discrete linear systems. Digital Signals and Systems: Classification of Systems, Linear System, Time-Invariant System, Causal System, Stability. Digital Convolution: Graphical Method, Table Lookup Method, Matrix by Vector Method, Linear Convolution and Circular Convolution, Deconvolution. Fourier transforms AND Z-transforms. Discrete-Time Fourier Transform and Linear Time Invariant Systems. The Z transform, Regions of convergence and Z-transform properties and Inverse Z-transform. The discrete Fourier transform and fast Fourier transform. The discrete Fourier transform. The fast Fourier transform. Digital filter design. Digital filter design (Finite impulse response (FIR) filters). Infinite impulse response (IIR) filters). Structures and properties of FIR and IIR filters and review.			

Module 44

Code	Course/Module Title	ECTS	Semester
EEEC403	Microelectronics I	6	Seven
Class (hr./w)	**Lect. /Lab. /Prac. /Tutor.**	**SSWL (hr./sem)**	**USWL (hr./w)**
3	1	63	87
Description			
Microwave devices: Energy and band theory, Diode, PN, IMPAD, gun diode, IGBT, Tyristor, Triac, DIAC, TTL,RTL, ECL, LED, MS. Digital circuit analyses: DTL , MOS, CMOS, DMOS, NMOS.			

Module 45

Code	Course/Module Title	ECTS	Semester
EEEC404	Computer Networks	6	Seven
Class (hr./w)	**Lect. /Lab. /Prac. /Tutor.**	**SSWL (hr./sem)**	**USWL (hr./w)**
3	1	63	87
Description			
OSI and TCP/IP models and their associated protocols to explain how data flows in a network. Wired LANs: Ethernet: Networks of networks and inter-networking. Forwarding and routing IP (local and ISP-based - interdomain). Router. Multicasting. Application layer: Examples of protocols and services at the application layer. SMTP (email), http (WWW), DNS, streaming video, gaming, P2P, VoIP.			

Module 46

Code	Course/Module Title	ECTS	Semester
EEEC405	Electronics and Communications Lab. III	4	Seven

Class (hr./w)	Lect. /Lab. /Prac. /Tutor.	SSWL (hr./sem)	USWL (hr./w)
0	4	63	37
Description			
PAM and PCM systems, sampling, quantization, and the encoding. PCM Transmission Bandwidth, PCM Signal-to-Quantization-Noise Ratio. Learn Arduino programing using C-language. Binary line coding, extract the differences between the NRZ and RZ. Digital carrier modulation On-Off Keying (OOK) and Amplitude Shift Keying (ASK). Network connection topologies. Data acquisition concept. System transfer function characteristics in MATLAB.			

Module 47

Code	Course/Module Title	ECTS	Semester
EEEC406	Graduation Project I	2	Seven
Class (hr./w)	**Lect. /Lab. /Prac. /Tutor.**	**SSWL (hr./sem)**	**USWL (hr./w)**
2	0	33	17
Description			
Project is a phrase that can refer to a variety of tasks, activities, or deliverables in different contexts. Generally, a project involves a set of planned activities with a defined objective or goal. A report is a document that presents information about a specific topic, usually including findings, analysis, and recommendations. Projects often require reports as part of the deliverables or outcomes.			

Module 48

Code	Course/Module Title	ECTS	Semester
EEEC407	Mobile Communications	6	Eight
Class (hr./w)	**Lect. /Lab. /Prac. /Tutor.**	**SSWL (hr./sem)**	**USWL (hr./w)**
4	2	93	57
Description			
Wireless Communication Systems. Types of Mobile Communication Systems. The Cellular Concept - System Design Fundamentals. Frequency Reuse. Channel Assignment Strategies. Handoff Strategies. Practical Handoff Considerations. Interference and System Capacity. Co-channel Interference, Adjacent Channel Interference. Power Control for Reducing Interference. Trunking and Grade of Service. Blocked Calls Cleared (Erlang B). Blocked Calls Delayed (Erlang C). Improving coverage and capacity in cellular systems. Cellular Systems. 1G: AMPS, ETACS, N-AMPS, USDC(D-AMPS). 2G: Global System for Mobile GSM. GSM System Architecture. Spread spectrum (frequency hopping direct sequence). Frequency Hopping Spread Spectrum (FH-SS). Direct Sequence Spread Spectrum (DS-SS).			

2G, Code Division Multiple Access (CDMA). Comparison of the IS-95, IS-54, and GSM systems. 4G: Long-Term Evolution (LTE). Large Scale Propagation Models. Practical Link Budget Design Using Path Loss Models. Outdoor Propagation Models. Okumura Model, Hata Model, Walfisch-Bestoni Model Indoor Propagation, Small Scale Fading and Multipath. Properties of Small-Scale Multipath Propagation. Doppler Shift, Shadowing, Multipath Propagation. Parameters of Mobile Multipath channels. Types of Small-Scale Fading, Rayleigh and Ricean Distributions, Plane wave: normal incidence. Plane wave: oblique incidence. Radio wave propagation. ground wave propagation. Radio wave propagation. troposphere wave propagation. Radio wave propagation. ionosphere wave propagation.

Module 49

Code	Course/Module Title	ECTS	Semester
EEEC408	Microelectronics II	6	Eight
Class (hr./w)	**Lect. /Lab. /Prac. /Tutor.**	**SSWL (hr./sem)**	**USWL (hr./w)**
4	1	78	72
Description			
Semiconductor Materials and Diodes + The Bipolar Junction Transistor. The Field-Effect Transistor. Basic FET Amplifiers. Integrated Circuit Biasing and Active Loads + Basic BJT Amplifiers.			

Module 50

Code	Course/Module Title	ECTS	Semester
EEEC409	Computer Network Security	6	Eight
Class (hr./w)	**Lect. /Lab. /Prac. /Tutor.**	**SSWL (hr./sem)**	**USWL (hr./w)**
4	1	78	72
Description			
This course provides students with basic knowledge in: Basic concepts of network security; History of encryption techniques; AES symmetric encryption technique; public-key encryption and RSA; Message Authentication and Hash Functions; Authentication Protocols; Cryptographic Systems: Secure Socket Layer (SSL), Virtual Private Network (VPN), and Kerberos; Access Control of Computer Resources; Computer Viruses, Malicious and Antivirus Software; Network Security Tools: Firewall, Intrusion Detection System (IDS) and Intrusion Prevision System (IPS); Web Security, Email Security and Password Management; and Security of Wireless Networks.			

Module 51

Code	Course/Module Title	ECTS	Semester
EEEC410	Microwave Devices	4	Eight
Class (hr./w)	**Lect. /Lab. /Prac. /Tutor.**	**SSWL (hr./sem)**	**USWL (hr./w)**

3	--	48	52
Description			
Maxwell's Equations (solution of Maxwell's equations for free space condition). Wave Equations. Rectangular Waveguides (transverse modes, TE mode, TM mode). Rectangular Waveguides (propagation constant, wave impedance, characteristic impedance, transmitted power, attenuation factor). Scattering Parameters (S-parameters, scattering matrix). Passive Microwave Components (wave guide sections, waveguide Tees). Passive Microwave Components (attenuators, directional coupler). Passive Microwave Components (isolators, circulators). Microwave Transistors and Tunnel Diodes (microwave tunnel diodes). Transferred Electron Devices (Gunn effect diodes). Microwave Linear Beam Tubes (two cavity klystron). Microwave Linear Beam Tubes (reflex klystron). Microwave Linear Beam Tubes (helix traveling wave tubes) Microwave Crossed Field Tubes (magnetrons). Microwave Strip Lines (microstrip lines).			

Module 52

Code	**Course/Module Title**	**ECTS**	**Semester**
EEEC411	Electronics and Communications Lab. IV	4	Eight
Class (hr./w)	**Lect. /Lab. /Prac. /Tutor.**	**SSWL (hr./sem)**	**USWL (hr./w)**
0	4	63	37
Description			
PAM and PCM systems, sampling, quantization, and the encoding. PCM Transmission Bandwidth, PCM Signal-to-Quantization-Noise Ratio. Learn Arduino programing using C-language. Understanding Control theory using MATLAB. Binary line coding, extract the differences between the NRZ and RZ. Digital carrier modulation On-Off Keying (OOK) and Amplitude Shift Keying (ASK). Network connection topologies. Data acquisition concept. System transfer function characteristics in MATLAB. Inter symbol interference.			

Module 53

Code	**Course/Module Title**	**ECTS**	**Semester**
EEEC412	Graduation Project II	2	Eight
Class (hr./w)	**Lect. /Lab. /Prac. /Tutor.**	**SSWL (hr./sem)**	**USWL (hr./w)**
2	0	33	17
Description			
Project is a phrase that can refer to a variety of tasks, activities, or deliverables in different contexts. Generally, a project involves a set of planned activities with a defined objective or goal. A report is a document that presents information about a specific topic, usually including findings, analysis, and recommendations. Projects often require reports as part of the deliverables or outcomes.			

Module 54

Code	Course/Module Title	ECTS	Semester
EEEC413	English language	2	Eight
Class (hr./w)	**Lect. /Lab. /Prac. /Tutor.**	**SSWL (hr./sem)**	**USWL (hr./w)**
2	0	33	17
Description			
This is an under graduate level course on English Language at an upper-intermediate level. The course involves practicing the four language skills (reading, writing, listening, and speaking) as well as oral and written exams. We will read and discuss topics on various aspects of English Language such as: casual conversations, present simple, perfect, and continuous, narrative tense, being polite, future forms.			

3. Undergraduate Courses 2023-2024 (Power & Machine)

Module 1

Code	Course/Module Title	ECTS	Semester
EE101	Basics of Electrical Engineering I	8	One
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/sem)**
3	3	93	107
Description			
Basic Concept & Units: Electricity & atomic structure of substance, current and current density, current flow, electric circuit, E.M.F. & potential difference, international system of unit, abbreviation for multiples & sub-multiples, quantities derived from SI units, units of force-energy-torque and power, relation between energy and heat, electric units, efficiency & percentage efficiency, electromechanical equivalent of element. Analysis of D.C Circuit: Ohm's law, resistivity & conductivity, temperature affect, internal resistance of a source, open circuit & short circuit, equivalent resistance: Series-parallel, delat and star, grouping of E.M.F. sources, power calculation in D.C circuit, introduction to network theorems, types of source: independent and dependent voltage and current sources and their transformation, Kirchhoff's laws: KVL-KCL, Maxwell's circulating currents (mesh analysis), nodal analysis, superposition theorem, thevenin's theorem, Norton s theorem, maximum power transfer theorem, millman theorem, substitution theorem, reciprocity theorem.			

Module 2

Code	Course/Module Title	ECTS	Semester
EE102	Mathematics I	6	One
Class (hr./w)	**Lect. /Lab. /Prac. /Tutor.**	**SSWL (hr./sem)**	**USWL (hr./w)**
3	1	63	87
Description			

Matrices: Basic Definitions, Addition, Subtraction and Multiplication, Determinants, The Inverse of a 3 x 3 Matrix, Cramers Rule, Solve equations by Matrices: Gaussian Elimination. the method of finding the inverse of a square matrix, solution of simultaneous linear equations by matrix method. Coordinates and Graphs in the Plane: Directions and Quadrants, Distance between Points, Graphs of Equations, Intercepts and More about Graphing, Slope and Equations for Lines: Slope of Non-vertical Lines, Lines that are Parallel or Perpendicular, Point – Slope Equations, Slope – Intercept Equations, Functions and their Graphs, Domains and Ranges are Often Intervals, Even Functions and Odd Functions, Functions Defined in Pieces, Shifts, Circles, and Parabolas: How to Shift a Graph, Equations for Circles in the Plane, Equations for Parabolas, A Review of Trigonometric Functions: Radian Measure, The Six Basic Trigonometric Functions, Calculating Sines and Cosines, Graphs of Trigonometric Functions, Limits and Continuity: Limits, Examples of Limits, The Sandwich Theorem and $(\boldsymbol{\sin\theta})/\boldsymbol{\theta}$, Limits Involving Infinity, Continuous Functions. Derivatives: Slopes, Tangent Lines, and Derivatives, Defining Slopes and Tangent Lines, The Derivative of a function, The Slope of Lines, Differentiation Rules: Integer Powers, Multiples, Sums, and Differences, Second and Higher Order Derivatives, Negative Integer Powers of x, Velocity, Speed, and Other Rate of Change: Velocity, Speed, Acceleration, Derivatives of Trigonometric Functions: The Derivative of the Sine, The Derivative of the Cosine, The Derivative of the Other Basic Functions, The Chain Rule: Integer Powers of Differentiable Functions, Derivative Formulas that Include the Chain Rule, Implicit Differentiation and Fractional Powers: Lenses, Tangents, and Normal Lines, Using Implicit Differentiation to Find Derivatives of Higher Order, Fractional Powers of Differentiable Functions, Linear Approximations and Differentials.

Module 3

Code	**Course/Module Title**	**ECTS**	**Semester**
EE103	Engineering drawing	4	One
Class (hr./w)	**Lect. /Lab. /Prac. /Tutor.**	**SSWL (hr./sem)**	**USWL (hr./w)**
2	2	63	37
Description			
Engineering Instruments, Lettering, Types of Lines, Orthographic Projection I, Graphic Geometry, Dimensions. Orthographic Projection II, Isometric Drawing. Computer Drawing: Introduction to Auto CAD, Dimension Units Commands, Drawing Commands, Drawing Files, T- Text Commands.			

Module 4

Code	**Course/Module Title**	**ECTS**	**Semester**
EE104	Physics	4	One
Class (hr./w)	**Lect. /Lab. /Prac. /Tutor.**	**SSWL (hr./sem)**	**USWL (hr./w)**
2	--	33	67
Description			
Introduction to physics; measuring things, quantitities, units systems, dimensional analysis, victor and scalar quantities, victor properties, resultant dding and subtracting victor quantities.Motion in one and two dimensions, position and displacement, velocity, acceleration. Force and motion; Newten's first law, force, mass, Newten's second law, gravitional force, weight,normal force, and tension force.Newton's third law, applying Newton's laws, Force and motion, friction, uniform circular motion. Work; Kinetic and Potential Energy; The work-kinetic energy theorem; Conservation of total mechanical energy,Spring forces and Hooke's law; Power and Effeciency.Linear momentum; Momentum and kinetic energy; Rate			

of change of linear momentum and Newton's laws; Law of conservation of linear momentum; Impulse; and Simple Harmonic Motion.Universal gravitation; Newton's law of universal gravitation; Free-fall acceleration and the gravitational force; and Solve problems using Newton's law of universal gravitation and calculate the gravitation for different locations. Fluid mechanics; Pressure and density of fluid at different depth; Hydrostatic pressure; Pascal's principle and the operation of a hydraulic lift; Buoyant forces and Archimedes's principle; the equation of continuity for fluids; and the Bernoulli's equation. Heat Transfer (Conduction, Convection, and Radiation). Basic of Architectural Physics; and Solar Radiation. Sound; Noise; Sound Intensity. Sound Insulation; and Thermal Behaviour of Materials. Current and Voltage; electrical circuit; and Ohm's Law. Power and Energy; and Parallel and Series Networks.

Module 5

Code	Course/Module Title	ECTS	Semester
EE105	Mechanics Engineering	3	One
Class (hr./w)	**Lect. /Lab. /Prac. /Tutor.**	**SSWL (hr./sem)**	**USWL (hr./w)**
2	0	33	42
Description			
Static: Force system, Units system, Forces + Components, Resultant, Moment and Couples, Equilibrium, Centroid, Moment of Inertia, Friction. Dynamics: Rectilinear motion, Curvilinear motion, Projectile, Circular motion, Acceleration Components (Rectangular Comp., Normal Tangential Comp.), Kinetic - 2nd Law of Newton. Thermodynamics: Properties of Substance, Pressure and Temperature, Work and Energy, Ideal Gas, First Law of Thermodynamics, 2nd Law of Thermodynamics. Hook's law.			

Module 6

Code	Course/Module Title	ECTS	Semester
UOM103	Computer	3	One
Class (hr./w)	**Lect. /Lab. /Prac. /Tutor.**	**SSWL (hr./sem)**	**USWL (hr./w)**
2	2	63	12
Description			
Introduction to Algorithms, Types of Algorithms, Algorithms Analyzing & Designing, Algorithms Writing Methods, Flowcharts, Introduction to Computers: Software & Hardware, Operating Systems: Windows, Android, IOS, Applications: Introduction to MS – Word, Applications: Introduction to MS – Excel, Applications: Introduction to MS – PowerPoint, Reviews			

Module 7

Code	Course/Module Title	ECTS	Semester
UOM101	Arabic Language	2	One
Class (hr./w)	**Lect. /Lab. /Prac. /Tutor.**	**SSWL (hr./sem)**	**USWL (hr./w)**
2	--	33	17
Description			

Module 8

Code	Course/Module Title	ECTS	Semester
EE108	Basics of Electrical Engineering II	8	Two
Class (hr./w)	**Lect. /Lab. /Prac. /Tutor.**	**SSWL (hr./sem)**	**USWL (hr./w)**
3	3	93	107
Description			
Alternating quantities, generating of single phase voltage, waveforms instantaneous value and real, RMS and Average values, analysis of A.C Circuit: Ohm's law, impedance & admittance, conductance and suscpetance, internal impedance of a source, open circuit & short circuit, equivalent impedance: Series-parallel, delta and star, power calculation in A.C circuit, introduction to network theorems, types of source: independent and dependent voltage and current sources and their transformation, Kirchhoff's laws: KVL-KCL, Maxwell's circulating currents (mesh analysis), nodal analysis, superposition theorem, the venin's theorem, Norton s theorem, maximum power transfer theorem, resonant circuits.			

Module 9

Code	Course/Module Title	ECTS	Semester
EE109	Mathematics II	6	Two
Class (hr./w)	**Lect. /Lab. /Prac. /Tutor.**	**SSWL (hr./sem)**	**USWL (hr./w)**
3	1	63	87
Description			
Polar coordinates system: Polar coordinates system and the graphs of polar equations, plane area in polar coordinates, arc length of curves in polar coordinates. Brief Review: about differentiation and integration law, Applications of definite integral: Area between curves. Volume of solid revolution. Arc length of a plane curve. Surface area of arc length revolution. Methods of integration: Trigonometric substitutions. Partial fractions. Integration by parts. Further substitutions. First order differential equations: variable separable differential equations. Homogeneous differential equations. Linear differential equations. Exact differential equations. Numerical integration: Simpson's approximation methods. Limit: L'Hopital method and its applications.			

Module 10

Code	Course/Module Title	ECTS	Semester
EE110	Computer programming	6	Two
Class (hr./w)	**Lect. /Lab. /Prac. /Tutor.**	**SSWL (hr./sem)**	**USWL (hr./w)**
2	2	63	87
Description			
Introduction to MATLAB. Types of variables, numbers. Expressions, operation and function. Matrix and			

its applications. Solving set of linear equations. Solving of Electrical circuit. Control flow in MATLAB program. Curve fitting, interpolation. Function and its application (pulse & ramp functions). Numerical application (numeric differentiation and numerical integration. Engineering graphics (two dimension and three dimensions) such as vector diagram mesh, bar plots). Solving equation by symbols. Solving of transient response in electrical circuit. Fourier series and Fourier transform. Solving of ordinary differential equation. Capacitor smoothing circuit analysis. Three phase analysis.

Module 11

Code	Course/Module Title	ECTS	Semester
EE111	Digital Techniques	3	Two
Class (hr./w)	**Lect. /Lab. /Prac. /Tutor.**	**SSWL (hr./sem)**	**USWL (hr./w)**
2	1	48	27
Description			
Introduction to Digital Technique, Basic Definitions, System of Numbers, General number formula: Binary, octal, decimal & hexadecimal numbers, Numbers Base Conversion (Arithmetic operation in different numbers complements, binary codes, BCD, Ex-3, gray codes), Boolean algebra: (Basic definitions, basic theorem & properties, Boolean functions), Canonical & Standard Forms Digital Logic Gates, Karnaugh Maps (AND & OR implementation, don't care condition), Adders Arithmetic Operation (Sub tractors, half & full adders & Subtractors, binary parallel adders), Code Conversion (Even and odd party logic, decoders, encoders comparator, multiplexers & de-multiplexers), Sequential Logic (Flip Flops (RS, T, D, JK…) Master slave FF, Counters, Shift registers).			

Module 12

Code	Course/Module Title	ECTS	Semester
EE112	Electronics Physics	3	Two
Class (hr./w)	**Lect. /Lab. /Prac. /Tutor.**	**SSWL (hr./sem)**	**USWL (hr./w)**
2	1	48	27
Description			
Energy Level and Atomic Structure: The atom, models, wave nature of light, dual nature of matter, energy-band theory of metals, insulators and semiconductors, crystal structure, ionic, covalent and metallic bonding, energy band of crystals, Internal structure of materials cell, packing miller indices, crystal planes and directions. Electrical Conduction in Metals: Mobility and conductivity, energy distribution of electrons, Fermi levels, work function, electronic emission. Semiconductors: Semiconductor's materials (Si, Ge and compound semiconductors), extrinsic semiconductors, Fermi-level in semiconductor, diffusion and carrier life time, Hall effect. Semiconductor p-n Junction: p-n junction in equilibrium, current-voltage characteristics, charge-control description of a diode, Transition and diffusion capacitance's, diode switching times, diode models, small-signal model and load line concept, and introduction to Hetero-junctions and double Hetero-junctions. Diode Circuit Applications: Rectifiers, Zener diodes voltage regulators, clipping circuits, clamping circuits and wave form generation. Other Types of Semiconductor Diodes: Varactor diode, tunnel diode, photodiode and photovoltaic (solar) cell, Light emitting diode, metal electronic. Transistors Principle of Operation and type, Transistor biasing circuits, Application Circuit.			

Module 13

Code	Course/Module Title	ECTS	Semester
UOM104	Democracy and Human Rights	2	One
Class (hr./w)	**Lect. /Lab. /Prac. /Tutor.**	**SSWL (hr./sem)**	**USWL (hr./w)**
2	0	33	17
Description			
Definition and sources of democracy and human rights (international, regional, national, religious). Characteristics of democracy and human rights: universality, indivisibility, interdependence, inalienability. Emergence and evolution of human rights: historical development, key milestones, influential movements. Types of human rights: civil and political, economic and social, environmental, cultural, and developmental. Guarantees to prevent human rights violations: legal, institutional, societal safeguards, Islamic guarantees, national and international levels. Concept of democracy: principles, values, forms of governance (direct, semi-direct, indirect). Islamic stance on democracy: compatibility, strengths, weaknesses. Critique of the democratic system: analysis of strengths and weaknesses. Administrative corruption: definition, types, societal impact. Methods to combat administrative corruption.			

Module 14

Code	Course/Module Title	ECTS	Semester
UOM102	English language	2	Two
Class (hr./w)	**Lect. /Lab. /Prac. /Tutor.**	**SSWL (hr./sem)**	**USWL (hr./w)**
2	0	33	17
Description			
Pronunciation, reading and writing. General knowledge of fundamental grammatical structures and functions (e.g. sentence types, tenses, voice, parts of speech, word order. Acquiring fundamental vocabulary to fulfill the above-mentioned functions in roles, topics and discussions.			

Module 15

Code	Course/Module Title	ECTS	Semester
EEPM201	Electrical Circuits Analysis I	6	Three
Class (hr./w)	**Lect. /Lab. /Prac. /Tutor.**	**SSWL (hr./sem)**	**USWL (hr./w)**
4	2	93	57
Description			
Transient Circuits: The Transient Circuits: RC, RL, RLC circuit in series and parallel and their complete response in time and Frequency. Poly-phase Circuits: Poly-phase Circuits: Single-phase and three phase wire system, 3-Phase balance and unbalance system, star and delta connections. Power in 3-phase circuits. Magnetic coupling circuit: Magnetic coupling circuit: Coefficient of coupling, Linear and ideal transformers.			

Module 16

Code	Course/Module Title	ECTS	Semester
EEPM202	Engineering Mathematics I	5	Three
Class (hr./w)	**Lect. /Lab. /Prac. /Tutor.**	**SSWL (hr./sem)**	**USWL (hr./w)**
4	1	78	47
Description			
Vectors: Vectors component and Units, Space coordinate and Space Vector, Scalar Product and Vector Product, Units and plane equation, equations of lines and planes, Product of Three Vectors, Applications. Vector Functions and Their Derivatives Gradient of Scalar Reid; Divergence of Vector Field; Curl of Vector Field; Directional Derivatives; Gradient, Divergence and Curl in Curvilinear Coordinates. Differential Equations: Introduction to Differential Equations, 1st and 2nd order linear differential equations with constant coefficients, solution via the auxiliary equation, nonhomogeneous equations, application to electrical systems. Coupled 1st order linear differential equations; transformation of higher order linear differential equations on to coupled differential equations. Homogenous differential of higher order. Fourier series: The need for Fourier series, Periodic functions, Fourier Series-Euler formulas. Even and odd functions, Half-Range expansions, Application in Electrical Eng.			

Module 17

Code	Course/Module Title	ECTS	Semester
EEPM203	Electromagnetic Fields	5	Three
Class (hr./w)	**Lect. /Lab. /Prac. /Tutor.**	**SSWL (hr./sem)**	**USWL (hr./w)**
3	1	63	62
Description			
coordinate systems: rectangular coordinate system, cylindrical coordinate system, spherical coordinate system. vector analysis: scalars and vectors, vector algebra, vector components and unit vectors, vector addition and subtraction, vector multiplication. coulomb's law and electric force: the experimental law of coulomb. electric field intensity: electric field of a point charge, electric field of n point charges. electric fields due to continuous charge distributions: electric field of a line charge. electric fields due to continuous charge distributions: electric field of a sheet of charge. electric fields due to continuous charge distributions: electric field of a volume of charge. electric flux density and gauss's law: gauss's law application on a point charge, gauss's law application on a line charge. electric flux density and gauss's law: gauss's law application on a surface charge. electric flux density and gauss's law: gauss's law application on a volume charge. work, potential & potential difference: work done in moving a point charge. work, potential & potential difference: potential & potential difference. conductors, dielectrics, and capacitance: electric fields in material space. conductors, dielectrics, and capacitance: dielectric – dielectric boundary conditions, conductor – dielectric boundary conditions, conductor – free space boundary conditions. conductors, dielectrics, and capacitance: capacitance and capacitors.			

Module 18

Code	Course/Module Title	ECTS	Semester

EEPM204	Electrical Transformers	5	Three
Class (hr./w)	**Lect. /Lab. /Prac. /Tutor.**	**SSWL (hr./sem)**	**USWL (hr./w)**
3	1	63	62
Description			
Transformers working, principle of transformers. Transformer construction, E.M.F equation. Transformer on no load and on load. Transformer equivalent circuit. Open and short circuit test. Separation of core losses. Regulation of transformer. Losses and efficiency. All-Day efficiency. Auto transformer. Parallel operation. Three-phase transformer, connections. Open-Delta Scoot connection, cooling of transformers.			

Module 19

Code	Course/Module Title	ECTS	Semester
EEPM205	Electronics Principles	4	Three
Class (hr./w)	**Lect. /Lab. /Prac. /Tutor.**	**SSWL (hr./sem)**	**USWL (hr./w)**
2	1	48	52
Description			
Transistor Construction. Transistor Symbols. Transistor Operation. Transistor Connections: Common Base CB Connection, Common Emitter CE Connection. Transistor Curves, Cutoff and Saturation. Transistor as a switch. Common Collector Connection. Transistor Load Line Analysis. Operating Point. Transistor Parameters and Rating Amplification. Stabilization, Stability Factor Methods of Transistor Biasing. Practical Circuit of Transistor Amplifier, D.C. and A.C. Equivalent Circuits. Transistor ac Equivalent Circuits h-parameters, Hybrid Equivalent Circuit. r-parameters, r-parameters Equivalent Circuit. The Linear Amplifier The a.c. Load Line A.C. Analysis Using re Model for Transistor Common – Emitter Fixed – Bias Configuration Common – Emitter Emitter – Bias Configuration Common – Emitter Collector Feedback Configuration Common – Emitter Voltage Divider Configuration The Common – Collector Amplifier the Common – Base Amplifier Multistage Transistor Amplifiers.			

Module 20

Code	Course/Module Title	ECTS	Semester
EEPM206	Electrical Engineering Lab. I	3	Three

Class (hr./w)	Lect. /Lab. /Prac. /Tutor.	SSWL (hr./sem)	USWL (hr./w)
0	2	33	42
Description			
Circuit Components and values: DC circuits, Current and voltage definitions, Passive sign convention and circuit elements, Resistive networks, real and ideal elements, voltage and current sources. Circuit reduction: combining sources, Combining resistive elements in series and parallel, delta and star transformation. Circuit Theory: Kirchhoff's laws and Ohm's law. Introduction to mesh and nodal analysis, Introduction to Thevenin and Norton theory, maximum power transfer, introduction to superposition theory.			

Module 21

Code	Course/Module Title	ECTS	Semester
EEEC207	The crimes of the Baath regime in Iraq	2	Three
Class (hr./w)	**Lect. /Lab. /Prac. /Tutor.**	**SSWL (hr./sem)**	**USWL (hr./w)**
2	--	33	17
Description			

Module 22

Code	Course/Module Title	ECTS	Semester
EEPM208	Electrical Circuits Analysis II	6	Four
Class (hr./w)	**Lect. /Lab. /Prac. /Tutor.**	**SSWL (hr./sem)**	**USWL (hr./w)**
4	2	93	57
Description			
Two-Port Networks: Two-Port Networks: One-pot networks, y-z-h-g and ABCD parameters. Frequency Response: Complex Frequency and Circuit Analysis in the s-Domain. Frequency Response. Filters: Constant k-filters, Low pass and high pass modern filter design, Butterworth and filters, Network transformations, and all pass filter, Active filter. Fourier circuit analysis.			

Module 23

Code	Course/Module Title	ECTS	Semester
EEPM209	Engineering Mathematics II	5	Four
Class (hr./w)	**Lect. /Lab. /Prac. /Tutor.**	**SSWL (hr./sem)**	**USWL (hr./w)**
4	1	78	47
Description			

Eigenvalues and eigenvectors; diagonalization. Sequence and series, sequence convergence, series geometric series, nth partial sum, test of convergence, Laplace Transforms: Introduction to transforms and operators, Laplace transforms of basic functions; unit step function, transforms of 1st and 2nd derivatives, Application to electric circuits; Transforms of piecewise continuous functions. Inverse Laplace transforms, derivation using partial fractions. Direct (s-domain) analysis of electrical circuits, Interpretation of s-domain functions Initial & final value theorems. Fourier transform for different functions (unit step function, unit impulse function, singularity function, applications in electrical engineering. Fourier transform for different functions (unit step function, unit impulse function, singularity function, applications in electrical engineering.

Module 24

Code	Course/Module Title	ECTS	Semester
EEPM210	DC Machines	5	Four
Class (hr./w)	**Lect. /Lab. /Prac. /Tutor.**	**SSWL (hr./sem)**	**USWL (hr./w)**
3	1	63	62
Description			
Principles of Electro-Mechanical Energy Conversion. Classification of Electrical machines. D.C generator. General principle. Construction and working, E.M.F equation. Armature Winding Armature. Reaction and communication, types of generation. Losses in generator. The efficiency, generation characteristics. Parallel operation of D.C generator. D.C Motors principle. Voltage equation of motor, torque, types of motors. Motor characteristics, power stages, losses and efficiency. Speed control of D.C motors, breaking. Starters, testing of D.C Machines Permeant D.C Machines.			

Module 25

Code	Course/Module Title	ECTS	Semester
EEPM211	Distribution Systems	5	Four
Class (hr./w)	**Lect. /Lab. /Prac. /Tutor.**	**SSWL (hr./sem)**	**USWL (hr./w)**
3	1	63	62
Description			
Introduction, Classification of Distribution System, Methods of Connection, Comparison among Distribution Systems. Type of D.C Distributions: - D.C Distributor fed at One End-Concentrated Loading. - D.C Distributor fed at Both End- Concentrated Loading. - D.C Distributor fed at One End with Uniformly Distributed Load. - D.C Distributor fed at Both Ends with Uniformly Distributor Loaded Ring Distributor: Ring Distributor with Inter-Connector, Stepped Distributor, 3 wire D.C System Introduction. Classification of A. C. Distribution Systems. Methods of Connection. Single Phase Distribution Systems, Three Phase Distribution Systems. Types of A. C. Distribution Systems. A. C. Radial Systems: A. C. Distributor fed at one end. A. C. Distributor fed at both ends. A. C. Ring Systems Protection of Distribution Systems: Protection of Distribution Lines. Protection of Distribution Transformers.			

Module 26

Code	Course/Module Title	ECTS	Semester
EEPM212	Renewable Energy Sources	4	Four

Class (hr./w)	Lect. /Lab. /Prac. /Tutor.	SSWL (hr./sem)	USWL (hr./w)
2	1	48	52

Description
Traditional power plants, Introduction to Renewable Energy, Solar Energy and Physics of Energy Conversion in Solar Cell (Current and Voltage), Understanding basic terminologies of a PV cell (1-V Curve, Efficiency, FF), Wind Energy, Biogas Energy and Ocean Energy, Small hydro Power Plant, Geothermal Energy, Photovoltaic Energy Systems, Energy Storage devices, Integration of Renewable Energy Resources, Distributed Generation, Economics of Renewable Energy, Future Trends and Challenges.

Module 27

Code	Course/Module Title	ECTS	Semester
EEPM213	Electrical Engineering Lab. II	3	Four

Class (hr./w)	Lect. /Lab. /Prac. /Tutor.	SSWL (hr./sem)	USWL (hr./w)
0	2	33	42

Description
Circuit Components and values: DC circuits, Current and voltage definitions, Passive sign convention and circuit elements, Resistive networks, real and ideal elements, voltage and current sources.Circuit reduction: combining sources, Combining resistive elements in series and parallel, delta and star transformation. Circuit Theory: Kirchhoff's laws and Ohm's law. Introduction to mesh and nodal analysis, Introduction to thevenin and Norton theory, maximum power transfer, introduction to superposition theory.

Module 28

Code	Course/Module Title	ECTS	Semester
EEPM214	English language	2	Four

Class (hr./w)	Lect. /Lab. /Prac. /Tutor.	SSWL (hr./sem)	USWL (hr./w)
2	0	33	17

Description
Classification of Essays: I independent essays based on personal thoughts. Dependent essays based on data, figures, diagrams. Integrated essays. Structure of academic essays: Analyzing academic essays according to the standard structure of academic essays. Idea Maps: Filling the idea maps from the major information extracted while reading an essay. Responding to an essay question: Building an outline using personal ideas in response to an essay question. Writing Paragraphs: Writing thesis statement. The Introduction Paragraph, The Body Paragraphs. Essay Conclusion: Writing the conclusion paragraph considering the main ideas stated in the introduction and body paragraphs, Transition words and connection phrases: Dependent essays: Introduction to essays based on figures, tables, diagrams, and processes.

Module 29

Code	Course/Module Title	ECTS	Semester

EEPM301	Engineering Analysis I	4	Five
Class (hr./w)	**Lect. /Lab. /Prac. /Tutor.**	**SSWL (hr./sem)**	**USWL (hr./w)**
3	1	63	37
Description			
The concepts of z transform and to solve the difference equations. he basic principles of function of complex variables. Discrete time system analysis Z-transforms Inverse Z-transform Difference equations. Series solution of differential equation. Power series Frobenious method Bessel differential equation Solutions of Bessel's Equation Applications of Bessel's Equation, functions of complex variables, ; Analytic functions integrations.			

Module 30

Code	Course/Module Title	ECTS	Semester
EEPM302	Transmission Systems	6	Five
Class (hr./w)	**Lect. /Lab. /Prac. /Tutor.**	**SSWL (hr./sem)**	**USWL (hr./w)**
4	1	78	72
Description			
Lines (OHTL), Electrical Calculations of OHTL, Mechanical calculations of OHTL, Insulators of OHTL, Corona. Transmission Lines, Incident and reflected voltage, General Circuit Constant. Capacitance of EPC, Current Rating of Cables.			

Module 31

Code	Course/Module Title	ECTS	Semester
EEPM303	AC Machines	6	Five
Class (hr./w)	**Lect. /Lab. /Prac. /Tutor.**	**SSWL (hr./sem)**	**USWL (hr./w)**
4	1	78	72
Description			
Introduction to AC Machines and Rotating Magnetic Field. Concept of a rotating magnetic field. Induction Machines: Construction and working principles of induction machines, Induction machine equivalent circuit. Power and torque equations in induction motor. Torque-speed characteristics of induction machines. speed control methods of induction motor. Finding equivalent circuit parameters. Induction machine as a generator. Synchronous Machines: Construction and working principles of synchronous machines. Synchronous machine equivalent circuit. Phasor diagrams for synchronous machines. Power and torque equations in synchronous machines and Power Flow Diagrams. Variation of terminal voltage with load in synchronous generators. Synchronous Generators operating alone. Parallel Operation of Synchronous Generators and Conditions required for parallel operation of synchronous generators. Operation of synchronous generators in parallel with an infinite bus. Stability and Ratings of Synchronous Generators. Effect of governor set point changes and filed current changes on synchronous generator variables. Impact of load changes and filed current changes on synchronous motor performance. Synchronous machine "V" Curves.			

Module 32

Code	Course/Module Title	ECTS	Semester
EEPM304	Electrical Measurements	4	Five
Class (hr./w)	**Lect. /Lab. /Prac. /Tutor.**	**SSWL (hr./sem)**	**USWL (hr./w)**
3	1	63	37
Description			
Electrical Measurement Principle: Basics, instruments classifications, linearity, Errors. Electromechanical instruments Principal work, Torques types, PMMC, multi-range voltmeters, ammeters, ohmmeters, rectifier type voltmeter. Oscilloscope and bridges. Oscilloscopes and their applications, DC and AC bridges. Transducers, types applications.			

Module 33

Code	Course/Module Title	ECTS	Semester
EEPM305	Power Electronics I	6	Five
Class (hr./w)	**Lect. /Lab. /Prac. /Tutor.**	**SSWL (hr./sem)**	**USWL (hr./w)**
3	1	63	87
Description			
DC Choppers: First quadrant, second quadrant, first and second quadrants, first and fourth quadrants and four quadrants' choppers. Bridge Circuit switching function. non-isolated D.C power supply circuits: Buck, boost, buck-boost, and Cuk regulators. Transformer-Isolated DC supplies: Feedforward and flyback. Single-phase and three-phase inverters: square wave mode (half and full bridge circuits), quasi square wave operation and PWM of single-phase inverter. Three phase inverter and its switching variables. Pulse width modulation (PWM) strategies of three-phase inverter.			

Module 34

Code	Course/Module Title	ECTS	Semester
EEPM306	Power and Machines Lab. I	4	Five

Class (hr./w)	Lect. /Lab. /Prac. /Tutor.	SSWL (hr./sem)	USWL (hr./w)
0	4	63	37

Description
Power and machine: open and short circuit test for single-phase Transformer. Speed and direction control of D.C. shunt motor using voltage control method Three-phase Power measurement. Speed Control of D.C shunt Motor using field control method. Speed Control of DC Shunt Motor Using Armature Voltage Control Method. No load test of D.C. shunt generator. shunt generator load test. Single phase transformer load test. Power Electronics: Thyristor Controllable Rectification Circuit. Three phase full wave Rectifier. The triac light dimmer control circuit. DC-DC Converters. Electronics: The operation Amplifier. Decoder Encoder circuit. Integrating and differentiating circuit. Digital counter.

Module 35

Code	Course/Module Title	ECTS	Semester
EEPM307	Engineering Analysis II	4	Six
Class (hr./w)	**Lect. /Lab. /Prac. /Tutor.**	**SSWL (hr./sem)**	**USWL (hr./w)**
3	1	63	37

Description
Solving the 2nd order differential equation and Bessel differential equations by series solutions. The principals of the wave equation for one and two dimensions. To introduce the fundamentals of numerical methods used for the solution of engineering problems and to improve the computer skills of the students. Partial Differential Equations. One dimensional wave equation Separation of variables, Vibrating string, two-dimensional wave equation, transmission line, Introduction to Complex Variables Complex number system and its operations, Limits and sequences Continuous functions and their properties, Derivatives complex integration and Cauchy integral theorems. Concepts and role for the numerical method in engineering, Numerical Solution of Nonlinear Algebraic Equations, Open Methods, Numerical Solution of linear algebraic equations, Curve Fitting.

Module 36

Code	Course/Module Title	ECTS	Semester
EEPM308	Generation Systems	6	Six
Class (hr./w)	**Lect. /Lab. /Prac. /Tutor.**	**SSWL (hr./sem)**	**USWL (hr./w)**
3	1	63	87

Description
Generation Systems: Introduction and Definitions of Primary and secondary energy, commercial and noncommercial Energy, renewable and non-renewable energy, Definitions: Load factor, utilization factor, capacity factor, diversity factor, demand factor, availability. Energy Generation in Power Plants: Hydro power plants, Thermal Power Plants, Steam Power Plant, Gas Power Plant, Combined Cycle Gas Power Plant, Nuclear Power Plant, Diesel Power Plants. Renewable Energy Systems: Solar energy system, Solar Thermal Power Plants, Wing energy systems, Geothermal systems, Biomass systems, Fuel Cell.

Module 37

Code	Course/Module Title	ECTS	Semester
EEPM309	Electrical Machines Drives	6	Six
Class (hr./w)	**Lect. /Lab. /Prac. /Tutor.**	**SSWL (hr./sem)**	**USWL (hr./w)**
4	1	78	72
Description			
Introduction to Electrical Machine Drives: Overview of electrical machine drives and their importance in various industries. Introduction to fundamental concepts, theories, and principles of electrical machine drives. Introduction to mechanical loads and steady-state stability points in different operation quadrants. Types of Electrical Machines: Classification and characteristics of electrical machines, including DC, induction, and synchronous motors. Operating principles, construction, and key features of each type of electrical machine. Analysis of the operating characteristics, performance parameters, and limitations of electrical machines. Power Electronic Converters. Introduction to power electronic converters and their role in electrical machine drives. Control Strategies for Electrical Machine Drives. Performance Analysis of Electrical Machine Drives. Analysis and evaluation of the performance parameters of electrical machine drive systems. Discussion of cutting-edge research, innovations, and future directions in electrical machine drives.			

Module 38

Code	Course/Module Title	ECTS	Semester
EEPM310	Power Electronics II	6	Six
Class (hr./w)	**Lect. /Lab. /Prac. /Tutor.**	**SSWL (hr./sem)**	**USWL (hr./w)**
3	1	63	87
Description			
Introduction, definitions and tools: Power Electronics: definitions, approach and applications. Figures of Merits: Ripple factor, Total harmonic distortion, Form factor, Power factor (non-sinusoidal waveform), conversion efficiency. Semiconductor Switching Devices: combining sources, Combining resistive elements in series and parallel, delta and star transformation. Phase-controlled AC-DC converters: Kirchhoff's laws and Ohm's law. Introduction to mesh and nodal analysis, Introduction to Thevenin and Norton theory, maximum power transfer, introduction to superposition theory.			

Module 39

Code	Course/Module Title	ECTS	Semester
EEEC311	Programmable controllers	2	Six

Class (hr./w)	Lect. /Lab. /Prac. /Tutor.	SSWL (hr./sem)	USWL (hr./w)
2	--	33	17
Description			
Introduction to PLCs,PLC basics, PLC Addressing and Basic Instructions, Basic Ladder Logic Programming, Programming word level logic instructions, Relation of digital gate logic to contact/coil logic, Relay logic, Relay Sequencers, PLC Timer Functions, ladder diagram elements. Instructions: Relay type instructions, Instruction addressing, Branch Instructions, Internal Relay Instructions, Programming. Data Handling and Program Control Flow Instructions, Shift and Sequencer Instructions, PLC I/O Module Types and PLC Trainer Configuration.			

Module 40

Code	Course/Module Title	ECTS	Semester
EEPM312	Power and Machines Lab. II	4	Six
Class (hr./w)	**Lect. /Lab. /Prac. /Tutor.**	**SSWL (hr./sem)**	**USWL (hr./w)**
0	4	63	37
Description			
Power and machine: Determination of regulation of an alternator by Synchronous Impedance Method. Three-phase induction motor (No-load & Locked rotor test) parallel Operation of Two Single-phase Transformers. Load test of D.C. series generator Three-phase induction motor. (Directional control and star -delta starting) Three-phase Synchronous generator (Load test). Power Electronics: PWM signal generation to control a D.C. chopper using Arduino Motor drive. full Bridge Inverter Automatic Control of Motor Drive ACH555. Electronics: Design of a timer using the IC-555 Shift Registers. The concept of Analog to digital converter (ADC) using Arduino Introduction to PLC and Ladder Logic Programming.			

Module 41

Code	Course/Module Title	ECTS	Semester
EEPM313	English language	2	Six
Class (hr./w)	**Lect. /Lab. /Prac. /Tutor.**	**SSWL (hr./sem)**	**USWL (hr./w)**
2	0	33	17
Description			
This course develops further knowledge of the grammar and of essential vocabulary in order to lead the students to an advanced level of proficiency. Emphasis is placed on developing listening, speaking, reading and writing skills through an integrated approach. It focuses on grammar and fundamental writing skills. By the end of the course, students are expected to: Understand the main ideas of a variety of written and spoken texts. Participate effectively in a short conversation using appropriate language. Produce a range of text types in the form of a logical and cohesive paragraph. Select appropriate vocabulary to talk about feelings, opinions and experiences. Recognize, understand and use a number of phrasal verbs and collocations. Use effective organizational strategies that include introductions, paragraphs, transitions, and conclusion.			

Module 42

Code	Course/Module Title	ECTS	Semester
EEPM401	Control Systems I	6	Seven
Class (hr./w)	**Lect. /Lab. /Prac. /Tutor.**	**SSWL (hr./sem)**	**USWL (hr./w)**
3	1	63	87
Description			
Introduction to control system, Basic Components of a Control System, Open loop and closed loop control system , Block diagram and block diagram reduction, Signal flow graph; Masson gain formula, transfer function, Mathematical model, State space representation of control system, State Space representation: State equation, output equation, state transition Matrix, state transition equation, Characteristic Equations , state diagram, Controllability Canonical Form (CCF), Observability Canonical Form (OCF), Diagonal Canonical Form (DCF) , Jordan Canonical Form (JCF), controllability, observability of control system, Time domain analysis of control system, Stability of control system, Rowth Hurwitz criterion.			

Module 43

Code	Course/Module Title	ECTS	Semester
EEPM402	Power System Analysis	6	Seven
Class (hr./w)	**Lect. /Lab. /Prac. /Tutor.**	**SSWL (hr./sem)**	**USWL (hr./w)**
2	0	63	87
Description			
basic components of a power system, single line diagram, per unit analysis, generator, transformer, transmission line and load representation for different power system, Construction of Y-bus and Z-bus, Power-flow problem and equations. Gauss-Seidel method for solving power-flow equations, Newton-Raphson method for solving power-flow equations, balanced three-phase fault, short-circuit capacity, Bus impedance matrix, Fault analysis using bus impedance matrix, Symmetrical components and unbalanced faults (Review), Economical Operation of Power System neglecting generator limits and line losses. Economical Operation of Power System with generator limits and line losses. Introduction, Classification of Power System Stability. Dynamic Equation of Synchronous Machine, Stability Analysis Swing equation, Multi machine system, Machines swinging in unison or coherently. Power flow under steady state, Steady-state Stability, Transient Stability-Equal area criterion. Transient Stability Applications of sudden change in power input, Critical clearing angle and critical clearing time, Application of equal area criterion 1- Sudden loss of one parallel line 2- sudden short circuit on one of parallel lines a) Short circuit at one end of line b) Short circuit at the middle of a line.			

Module 44

Code	Course/Module Title	ECTS	Semester
EEPM403	High Voltage Engineering	6	Seven
Class (hr./w)	**Lect. /Lab. /Prac. /Tutor.**	**SSWL (hr./sem)**	**USWL (hr./w)**
4	2	93	57
Description			
Introduction to High Voltage Engineering: Basic concepts and terminology in high voltage engineering. Electrical Insulation Systems: Insulation testing techniques, breakdown voltage, measurement, dielectric spectroscopy, etc. Generation and Measurement of High Voltages: AC high voltage generation: transformers, resonant circuits, and voltage multipliers. DC high voltage generation: rectifiers, voltage multipliers, and voltage doubles. Impulse high voltage generation: Lightning and Switching impulse, multi stage impulse generator. High Voltage Equipment. Transformers: construction, design considerations, and insulation systems. Circuit breakers: types, principles of operation, and arc interruption techniques. Capacitors: types, applications, and dielectric breakdown considerations. Overvoltage Phenomena and Protection: Lightning surges, Switching surges, Insulation coordination. High Voltage Transmission and Distribution: High voltage transmission lines, Substations. High Voltage Testing and Diagnostics: Partial discharge (PD) testing, Dielectric response analysis. Safety and Environmental Aspects. Case Studies and Practical Applications.			

Module 45

Code	Course/Module Title	ECTS	Semester
EEPM404	Special Electrical Machines I	6	Seven
Class (hr./w)	**Lect. /Lab. /Prac. /Tutor.**	**SSWL (hr./sem)**	**USWL (hr./w)**
3	1	63	87
Description			
Starting Problems and distributed field: Introduction, Single phase induction motors (SPIM): Principal of operations, Types of SPIM, Motors with main winding only, Cross field theory, Rotating field theory (Double-field revolving theory), Transformer voltage, Rotational voltage, Torque speed characteristic, Fields in SPIM. Equivalent Circuit and Modeling Cases: Equivalent circuit, Power diagram, two phase induction motor, Symmetrical two-phase motor supplied from two-phase balance system, Symmetrical two-phase motor supplied from two phase unbalance system, Unsymmetrical two-phase motor supplied from two phase unbalance system. Special cases and starting Torque: Special cases, SPIM with main and auxiliary windings, Improvement of torque production in SPIM, starting torque, adding resistance with auxiliary winding, adding capacitor with auxiliary winding, and performance improvement.			

Module 46

Code	Course/Module Title	ECTS	Semester

EEPM405	Power and Machines Lab. III	4	Seven
Class (hr./w)	**Lect. /Lab. /Prac. /Tutor.**	**SSWL (hr./sem)**	**USWL (hr./w)**
0	4	63	37
Description			
Power and Machines lab consist of sum of laboratories can be listed below: - 1- Machines Laboratory. In this lab. student can perform sum of experiments that related with different types of machines. 2- Control Laboratory. Demonstrate his/her understanding of the basics of control system laboratory including: Basics of transfer function of any control system and represented in MATLAB software, realization, and implementation of control system in time domain and frequency domain response such step response, bode plot response, Nichols. PID controller. State space model represent for transfer function of control system. Implement some controller such state variable feedback design and root locus design for speed control of dc servo motor. Principle of Arduino microcontroller with many applications. 3- Transmission Line Laboratory. To study the behavior of transmission line under open and short circuit tests and show the Ferranti effect of Long Transmission Line model in order to calculate the transmission line parameters for PI representation also to understand the principles of compensation and voltage regulation along with load flow analysis and fault study. 4- Renewable Energy Laboratory. Recently, renewable energy has been more popular in the household and rerial locations application due to reduction of the conventional energy sources. This laboratory helps the student to understand, test and design different types of renewable energy such as photovoltaic energy system, wind energy system etc. 5- High Voltage Laboratory. The first course provides principal knowledge associated with high voltage engineering methods, techniques, and equipment. It is divided into two sections. The first section presents fundamentals of the failure mechanisms gaseous insulation at high voltages. It also discusses consequent design principles for high-voltage equipment; of the generation of high direct, alternating, and impulse voltages for testing high-voltage equipment.		

Module 47

Code	Course/Module Title	ECTS	Semester
EEPM406	Graduation Project I	2	Seven
Class (hr./w)	**Lect. /Lab. /Prac. /Tutor.**	**SSWL (hr./sem)**	**USWL (hr./w)**
2	0	33	17
Description			
Project is a phrase that can refer to a variety of tasks, activities, or deliverables in different contexts. Generally, a project involves a set of planned activities with a defined objective or goal. A report is a document that presents information about a specific topic, usually including findings, analysis, and recommendations. Projects often require reports as part of the deliverables or outcomes.			

Module 48

Code	Course/Module Title	ECTS	Semester
EEPM407	Control Systems II	6	Eight

Class (hr./w)	Lect. /Lab. /Prac. /Tutor.	SSWL (hr./sem)	USWL (hr./w)
4	1	78	72
Description			
Root locus PID Controller structure and design using root locus. Frequency response specifications. Nyquist stability, relative stability, gain margin, phase margin Nichol's chart, and implementing it in the design. Bode plot, Gain, Lead, lag, Lead lag, and PID compensator design.			

Module 49

Code	Course/Module Title	ECTS	Semester
EEPM408	Power System Protection	6	Eight
Class (hr./w)	**Lect. /Lab. /Prac. /Tutor.**	**SSWL (hr./sem)**	**USWL (hr./w)**
4	1	78	72
Description			
Introduction to power system protection, Fundamental of power system protection. Review on fault analysis, Fundamentals of electromechanical relays and digital protective relaying. Fuse, circuit breakers, and Instrument transformers, Overcurrent protection and coordination. Directional overcurrent protection, Differential protection. Protection of busbar, Transformer protection, Generator protection, Motors protection, Distance protection Summarization on course.			

Module 50

Code	Course/Module Title	ECTS	Semester
EEPM409	Special Electrical Machines II	6	Eight
Class (hr./w)	**Lect. /Lab. /Prac. /Tutor.**	**SSWL (hr./sem)**	**USWL (hr./w)**
4	1	78	72
Description			
Starting Problems and distributed field: Introduction about Special Electrical Machines, Single phase synchronous motors: Variable Reluctance type motors, Switched Reluctance motors, Hysteresis motor. *Equivalent Circuit and Modeling Cases:* Single phase AC series commutator motor. The Universal motor. The Repulsion motors. Stepper motors: Types, construction, characteristics, equivalent circuit, applications, advantages and disadvantages. Linear induction motors: Types and features and applications. *Special cases and starting Torque:* Three-phase ac commutator machines. Schrage motor. Permanent Magnet Synchronous Motor (PMSM). Pilot exciter synchronous generator, Generator excitation and voltage control systems.			

Module 51

Code	Course/Module Title	ECTS	Semester

EEPM410	Smart Grid	4	Eight
Class (hr./w)	**Lect. /Lab. /Prac. /Tutor.**	**SSWL (hr./sem)**	**USWL (hr./w)**
3	--	45	55
Description			

Module 52

Code	**Course/Module Title**	**ECTS**	**Semester**
EEPM411	Power and Machines Lab. IV	4	Eight
Class (hr./w)	**Lect. /Lab. /Prac. /Tutor.**	**SSWL (hr./sem)**	**USWL (hr./w)**
0	4	63	37
Description			
Power and Machines lab consist of sum of laboratories can be listed below: - **Machines Laboratory:** In this lab. student can perform sum of experiments that related with different types of machines. **Control Laboratory:** Demonstrate his/her understanding of the basics of control system laboratory including: Basics of transfer function of any control system and represented in MATLAB software, realization, and implementation of control system in time domain and frequency domain response such step response, bode plot response, Nichols. PID controller. State space model represent for transfer function of control system. Implement some controller such state variable feedback design and root locus design for speed control of dc servo motor. Principle of Arduino microcontroller with many applications. **High Voltage Laboratory:** The first course provides principal knowledge associated with high voltage engineering methods, techniques, and equipment. It is divided into two sections. The first section presents fundamentals of the failure mechanisms gaseous insulation at high voltages. It also discusses consequent design principles for high-voltage equipment; of the generation of high direct, alternating, and impulse voltages for testing high-voltage equipment. **AC Motor Drives:** To study the methods of controlling the three-phase induction motor, as well as the use of modern methods to start the induction motor and the use of modern methods of dynamic braking of the motor.			

Module 53

Code	**Course/Module Title**	**ECTS**	**Semester**
EEPM412	Graduation Project II	2	Eight
Class (hr./w)	**Lect. /Lab. /Prac. /Tutor.**	**SSWL (hr./sem)**	**USWL (hr./w)**
2	0	33	17
Description			
Project is a phrase that can refer to a variety of tasks, activities, or deliverables in different contexts. Generally, a project involves a set of planned activities with a defined objective or goal. A report is a document that presents information about a specific topic, usually including findings, analysis, and recommendations. Projects often require reports as part of the deliverables or outcomes.			

Module 54

Code	**Course/Module Title**	**ECTS**	**Semester**

EEPM413	English language	2	Eight
Class (hr./w)	**Lect. /Lab. /Prac. /Tutor.**	**SSWL (hr./sem)**	**USWL (hr./w)**
2	0	33	17
Description			
This is an under graduate level course on English Language at an upper-intermediate level. The course involves practicing the four language skills (reading, writing, listening, and speaking) as well as oral and written exams. We will read and discuss topics on various aspects of English Language such as: casual conversations, present simple, perfect, and continuous, narrative tense, being polite, future forms, expressions of quantity, exaggerations and understatement, relative clauses, make your point.			

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