COURSE DESCRIPTION

Course Name	Circuit Theory I
Course Code	EEE105
Credit Unit	3
Course Objective	Learn the main components of electrical circuits and methods of electrical circuit analysis of DC and AC systems.
Course Synopsis	This course is teaching the fundamental of electric circuit and its analysis for DC and AC systems which comprises of topics such as Circuit Variables and Elements, Resistive Circuits, Techniques of Circuit Analysis, Inductance and Capacitance, First-Order Response of RL and RC Circuits, Sinusoidal Steady-State Analysis, AC Power Analysis and Three Phase Circuit.

Course Learning Outcomes:

1	Be able to apply the basic laws, methods and circuit theorems in DC circuit analysis.
2	Be able to analyze the basic laws, methods and circuit theorems in DC circuit analysis.
3	Be able to apply the basic laws, methods and circuit theorems in AC circuit analysis.
4	Be able to analyze the basic laws, methods and circuit theorems in AC circuit analysis.

Course Syllabus:

Topic	**Details**
Variables and Circuit Elements	Review circuit analysis, SI units, voltage and current, power, energy, top elements of the circuit (passive and active) source of voltage and current, Ohm's law, Kirchhoff's law, circuit model, circuit with `dependent source '.
Resistance Circuit	Series / parallel resistors, voltage divider circuits, current divider circuits, voltage and current measurements, Wheatstone bridges, delta-wye circuits (Pi-Tee).
Circuit Analysis Method	Introduction of node-voltage methods, node-voltage methods containing `dependent sources 'and special cases, introduction of mesh-current methods, mesh-current methods containing` dependent sources' and

	special cases, source embodiment, Thevenin and Norton equivalent circuits, maximum power transfer and superposition.
Inductance and Capacity	Inductors, voltage, current, power and energy relationships, capacitors, voltage, current, power and energy relationships, series-parallel combination of inductors and capacitors.
First-Order Reception of RL and RC Circuits	Original response of RL and RC circuits, step response (double force) of RL and RC circuits, general solution of original response and step.
Concept of Sines and Phasors	Sine stem, sine response, phasor concept and phasor design drawings, passive elements of the circuit in the frequency domain (V-I relations for R, L, C), impedance and reactance, Kirchhoff's law in the frequency domain.
Steady State Sinus Analysis	Circuit analysis techniques in frequency domain using node-voltage method, node-voltage method containing `dependent sources 'and special cases, mesh-current method, mesh-current method containing` dependent sources' and special cases, source embodiment, equivalent circuit Therenin and Norton, maximum power transfer and superposition.
Calculation of Sinus Power	Steady state of current power, active and reactive power, calculation of power and value of RMS, complex power, triangular power, maximum power transfer and impedance
Power System Circuits	1-phase and 3-phase systems (Y and Δ), balanced 3-phase voltage source, Y-Y and Y-Δ circuit analysis, balanced power calculation in 3-phase circuit, average power calculation in three-phase circuit

Endorsed by:

ASSOCIATE PROFESSOR Ir. Dr. ROSMIWATI MOHD MOKHTAR
Deputy Dean
(Academic, Career and International)
School of Electrical and Electronic Engineering
Engineering Campus
Universiti Sains Malaysia

COURSE DESCRIPTION

Course Name	COMPUTER PROGRAMMING FOR ENGINEERS
Course Code	EEE123
Credit Unit	3
Course Objective	The course aims to provide basic knowledge of the C++ programming language to prepare students in using programming tools to solve engineering problems.
Course Synopsis	This course is fundamental not only to computer-related subjects but also to other subjects that require complex calculations and computer simulations. It exposes students to step-by-step procedures, programming terminologies and program commands that are required in solving engineering problems based on computer program using C++ programming language.

Course Learning Outcomes:

1	Able to understand and apply fundamental C++ syntax with correct implementation
2	Able to apply different programming way in solving an engineering problem
3	Able to write a complete, executable C++ program with correct input and output for engineering problem solution
4	Able to apply or suggest advance C++ syntaxes/functions that beyond coverage of the lecture
5	

Course Syllabus:

Topic	**Details**
Introduction	Computer organization and computer programming language.
Starting the program	Description of usage and how to declare headers and constants. Introducing the types of variables
Declaration	Rules and method to declare and assign initial values to variables and constants.
Output and Input	Introduce instructions to display the output on the screen and how to use it. Introduce instructions for reading input from the keyboard and how to use it.
Arithmetic operations	Arithmetic expression, arithmetic operator, logic and bit-wise operations

Algorithms	Flow charts and pseudocode
Branch instructions	Introduce branch instructions, control streams and conditional branch instructions
Repetition / Loop	Control flow and repetition loop instructions
Functions	Introduce two types of functions, namely functions without variable forwarding and functions with variable forwarding, three components involved in writing both types of functions; function call instructions and function declarations, as well as how to write functions
Array	One-dimensional arrays for different types of variables including string characters
Structure	How to declare and use structures.
Pointer	How to declare an indicator and how to remove it
Files	Management of input and output files

Endorsed By:

ASSOCIATE PROFESSOR Ir. Dr. ROSMIWATI MOHD MOKHTAR
Deputy Dean
(Academic, Career and International)
School of Electrical and Electronic Engineering
Engineering Campus
Universiti Sains Malaysia

COURSE DESCRIPTION

Course Name	Basic Circuit Lab
Course Code	EEE125
Credit Unit	3
Course Objective	Students are able to interpret the practical implementation of circuits and the theory of electronic devices that have been taught in previous subjects. The circuits that students need to learn are basic circuits that commonly form electronic components. Students will also learn the practical skills needed to design and solve electronic circuits.
Course Synopsis	This course comprises of 15 experiments that will be conducted by the students. The experiments are on multimeter applications, the measurement of voltage, current and resistance in a dc circuit, oscilloscope and function generator, transformer, capacitor, inductor and power

Course Learning Outcomes:

1	Be able to evaluate the accuracy and reliability of measurements taken using basic lab equipment, and assess the effectiveness of proposed solutions in addressing circuit issues.
2	Be able to evaluate various electronic circuits with correct techniques.
3	Be able to explain properties of passive and active components using basic electronic circuits.
4	To train teamwork and communication skills in solving electronic circuit based projects.
5	To train enterpreneurship skills via electronic circuit based projects.

Course Syllabus:

Topic	**Details**
Multimeter breadboard and Power supply	To be able to demonstrate preliminary standard operating procedure in general electronic engineering design experiments
Resistors and ohms law.	To acquire important basic electronic concepts via implementation of resistors
Oscilloscope and Waveform Generator	To familiarize and identify important pre-laboratory preparation in using an oscilloscope and waveform generator.

	To calculate, obtain, and measure the time varying signals, amplitude and duration (period) of various voltage signals. To distinguish characteristics of different time domain signals.
Oscilloscope and Voltage Measurement	To experiment with variety of DC measuring technique and effects from apparatus' internal resistance
Oscilloscope XY mode, Function Gen, Lissajous Polar	• To generate and measure different signal characteristics • To measure phase angle using automated time difference measurement and Lissajous Polar.
Transformer.	To recognize the common specification for single phase transformer • To investigate the voltage and phase relationship between primary winding and secondary winding
Basic circuit, Delta Y Transformation, Current sensor and power measurement	• To verify experimentally the principle of Delta-Wye and Wye-Delta transformation. • To prove that the Delta network can be transformed into its equivalent Wye and vice versa. • To build a current sensor circuit and measure DC power.
Capacitor and Inductor.	To identify different value of passive components and measure different circuit combination
DC Circuit, Voltage and Current Dividers	Two fundamental elements of circuit theory are Kirchhoff's voltage and current laws. These laws are so important to the development of circuit theory that it seems reasonable to test them in the laboratory. This lab exercise is to test Kirchhoff's laws by comparing measurements on several resistive circuits with the predictions of these laws. The circuits are similar but contain resistors with substantially different values. In this lab, you have to determine the extent to which you can verify KVL and KCL in simple resistive circuits. You also have to reinforce the notion of voltage and current polarity. You will need

	to think about polarity when you write KVLs and KCLs, and also when you perform the measurements
DC Circuit Mesh and Nodal Analysis	Generate the Mesh equations by summing voltages around each mesh (using KVL). Voltages are to be considered positive unless a voltage source exists in the mesh (then you use the polarity of the voltage to determine the sign). Where two meshes have a common branch, a net current (one mesh current minus the other) must be used to express voltage in that branch. Generate the Nodal equations by summing currents at each non-reference node (using KCL). Currents are to be considered leaving the node unless a current source exists in the branch (then you use the direction of the arrow for determining the sign).
DC Circuit: Thevenin, Norton and Maximum Power Transfer	Thevenin Theorem and Norton Theorem are two ways to simplify the two-terminal circuit. Complex circuits can be replaced by simple Thevenin equivalent or Norton equivalent. Maximum power transfer condition can also be tested experimentally. This lab exercise is to verify Thevenin Theorem, Norton Theorem and maximum power transfer condition by comparing the calculated values with the measured values.
DC Circuit, Linearity and Superposition Theorem	Linearity and Superposition Theorems are two approaches to analyse and design the DC circuit. These two theorems provide insight into the behaviour and properties of electrical circuits. This lab exercise is to learn the concept and verify Linearity and Superposition Theorem by comparing the calculated values with the measured values.
Diode and AC Measurement	To determine and analyze important concepts for diode and series configuration in any network

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ASSOCIATE PROFESSOR Ir. Dr. ROSMIWATI MOHD MOKHTAR
Deputy Dean
(Academic, Career and International)
School of Electrical and Electronic Engineering
Engineering Campus
Universiti Sains Malaysia

COURSE DESCRIPTION

Course Name	Digital Electronic I
Course Code	EEE130
Credit Unit	3
Course Objective	To learn the basics of digital electronic circuits.
Course Synopsis	This course covers digital electronic systems, major logic devices, and combination and sequential logic circuits.

Course Learning Outcomes:

1	To apply the knowledge of engineering fundamentals to solve complex engineering problems on combinational digital logic circuits.
2	To analyze complex engineering problems on combinational digital logic circuits using first principles of engineering.
3	To apply the knowledge of engineering fundamentals to solve complex engineering problems on sequential digital logic circuits.
4	To analyze complex engineering problems on sequential digital logic circuits using first principles of engineering.

Course Syllabus:

Topic	**Details**
Introduction	Introduction to basic concepts, number systems, operations and codes.
Logic Gates and Boolean Algebra	Basic logic gates, Boolean algebra laws and rules, DeMorgan's theorem, simplification of logical expressions, and the K-map method.
Combinational Circuit Design	Design and implementation of combinational logic circuits, logical functions such as adders, subtractors, comparators, decoders, encoders, multiplexers, and demultiplexers.
Bistable Memory Devices	Bistable memory circuits, latches, flip-flops, timing diagram features and applications.
Sequential Circuit Design	Synchronous and asynchronous counters, Moore and Mealy models for synchronous machines, state transition diagrams, counters, shift registers, and applications.

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ASSOCIATE PROFESSOR Ir. Dr. ROSMIWATI MOHD MOKHTAR
Deputy Dean
(Academic, Career and International)
School of Electrical and Electronic Engineering
Engineering Campus
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COURSE DESCRIPTION

Course Name	SEMICONDUCTOR DEVICES
Course Code	EEE131
Credit Unit	3
Course Objective	(i) Provide knowledge of how current flows through a p-n junction and relate this phenomenon to the characteristics and operation of diodes, BJTs and FETs. (ii) Provide knowledge about the function and application of diodes in electronic circuits, as well as the DC bias of BJTs and FETs.
Course Synopsis	This course provides basic concepts necessary to understand the fundamentals of semiconductor devices. It covers knowledge on semiconductor materials and physics, and provide insights on the operation of semiconductor devices such as P-N junction diodes, Bipolar Junction Transistors (BJTs) and Field-Effect Transistors (FETs).

Course Learning Outcomes:

1	Able to apply knowledge and understandings related to semiconductor physics and P-N junction into its application in semiconductor device and material analysis.
2	Able to analyse diode characteristics and its application in electronic circuits.
3	Able to apply knowledge and understandings related to BJT and FET characteristics and their corresponding DC-biasing.
4	Able to analyse BJT and FET characteristics as well as their corresponding DC-biasing in electronic circuit application.
5	

Course Syllabus:

Topic
Semiconductor physics of extrinsic p and n materials
p-n junction characteristics
Diode characteristics and diode application in electronic circuits
Special function diode’s characteristics
BJT characteristics and DC biasing
JFET characteristics and DC biasing
E-MOSFET characteristics and DC biasing

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ASSOCIATE PROFESSOR Ir. Dr. ROSMIWATI MOHD MOKHTAR
Deputy Dean
(Academic, Career and International)
School of Electrical and Electronic Engineering
Engineering Campus
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COURSE DESCRIPTION

Course Name	Circuit Theory II
Course Code	EEE208
Credit Unit	3
Course Objective	To learn electrical circuit analysis techniques for mutual induction circuits, frequency response for alternating current circuits, Laplace transform, Fourier series and Fourier transform, and two-port network.
Course Synopsis	This course covers techniques for analyzing electrical circuits, including the topics of mutual inductance, frequency response for AC circuits, Laplace transform, Fourier series and Fourier transforms, and two port circuits.

Course Learning Outcomes:

1	To apply principles of mathematics and engineering sciences on complex circuit problems involving magnetically coupled circuits, circuit frequency responses and Laplace transform theory.
2	To assess investigation on complex engineering problems involving magnetically coupled circuits, circuit frequency responses and Laplace transform theory.
3	To apply principles of mathematics and engineering sciences on complex circuit problems utilizing Fourier series, Fourier transform and two-port circuit theory.
4	To assess investigation on complex engineering problems utilizing Fourier series, Fourier transform and two-port circuit theory.

Course Syllabus:

Topic	**Details**
Mutual Inductance	Introduction to self-inductance, the concept of mutual inductance, dot convention, energy storage, ideal and linear transformers, equivalent circuits for magnetically coupled coils, ideal transformer equivalent circuits.
Introduction to The Laplace Transform	Definition of the Laplace transform, function and inverse transforms, properties of the Laplace transform.
Laplace Transform in Circuit Analysis	Circuit elements in s-domain, circuit analysis in s-domain, transfer functions, transfer functions in partial fraction expansion, the convolution integral.
Frequency Response for Alternating Current Circuits	Frequency response (magnitude and phase plots, passband, stopband), cutoff frequency, typical filters, RL and RC low-pass filters, RL and RC high-pass filters, bandpass RLC filters

	(resonance frequency, bandwidth, Q factor), bandstop RLC filters (resonance frequency, bandwidth, Q factor), frequency response using Bode diagram (complex poles and zeroes).
Fourier Series	Introduction to Fourier series, Fourier coefficients, symmetric effects on Fourier coefficients, Fourier series analysis for first order circuits (RL and RC), average power calculation with periodic functions, rms value for periodic functions, phase spectrum and amplitude.
Fourier Transform	Fourier transform derivation, relationship between Laplace and Fourier transforms, circuit analysis using Fourier transform, Parseval Theorem, and energy calculation using spectrum magnitude.
Two-Port Circuit	Terminal equations, two-port parameters (eg. Z, Y, h), relationship between two-port parameters, two-port circuit analysis with load (eg. Zin, I2, VTh, ZTh), relationship between two-port circuits (cascade, series, parallel, series-parallel, parallel-series).

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ASSOCIATE PROFESSOR Ir. Dr. ROSMIWATI MOHD MOKHTAR
Deputy Dean
(Academic, Career and International)
School of Electrical and Electronic Engineering
Engineering Campus
Universiti Sains Malaysia

COURSE DESCRIPTION

Course Name	MICROPROCESSOR I
Course Code	EEE226
Credit Unit	3
Course Objective	• To study the architecture of microprocessor and microcontroller systems. • To study interfacing devices with microprocessors and microcontrollers.
Course Synopsis	Introducing fundamental architecture and programming of microprocessor and microcontroller. That understanding can be used to build a simple application using the microprocessor and microcontroller.

Course Learning Outcomes:

1	To explain about architecture of microprocessor and microcontroller.
2	To perform the programming of the microprocessor and microcontroller using assembly language.
3	To build the interfacing of the I/O devices to microprocessor/microcontroller using Embedded Software Tool.
4	To develop a microprocessor/microcontroller based system in solving the engineering problems by applying the knowledge of programming and interfacing between microprocessor/microcontroller and external devices.
5	

Course Syllabus:

Topic	**Details**
Introduction	Basic of microprocessor and microcontroller, type of microprocessor, I/O subsystem, memory subsystem and programming.
Internal Architecture of microprocessor and microcontroller	CPU structure, data bus, address bus and control bus, register, interrupt, stack, special function register, I/O and memory addressing, addressing mode, timer and instruction set.
Programming of microprocessor and microcontroller	Assembly language, assembler, programming format, instruction set, data transfer, arithmetic, branch, bit manipulation and arithmetic operation

Operational of I/O	Programming to control I/O, Interrupt, Interrupt priority, digital input and observation, digital input using switch and keypad.
Analog Data for Input and output	Analog to digital conversion and vice versa, sampling theory, sample and hold, signal adaptation, analog to digital converter, digital to analog converter.
Basic System of Microprocessor and Microcontroller	Decoding of memory address and I/O interfacing, memory interfacing, RAM and ROM, basic system software and basic system design.

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ASSOCIATE PROFESSOR Ir. Dr. ROSMIWATI MOHD MOKHTAR
Deputy Dean
(Academic, Career and International)
School of Electrical and Electronic Engineering
Engineering Campus
Universiti Sains Malaysia

COURSE DESCRIPTION: EEE 228 (SIGNAL AND SYSTEM)

Course Name	SIGNAL AND SYSTEM
Course Code	EEE 228
Credit Unit	3
Course Objective	1. To provide a common background for subsequent courses in control, communication, electronic circuits, filter design and digital signal processing. 2. To introduce fundamental concepts, system and signal analysis. 3. To introduce transformations of signals in between different domains.
Course Synopsis	This course introduces the concepts of signal representations (continuous and discrete signals), elementary signals and transformations of the independent variable (time-reversal, time-shift, time-scaling). It also covers the signals analysis in frequency and time domains. It provides knowledge on continuous time systems to model linear time invariant continuous (LTIC) system, analyze and interpret the system properties. The course elaborates on Fourier series representation of periodic signals and properties, Fourier transform of signals, systems properties and Z-transforms.

Course Learning Outcomes:

1	To apply the knowledge on signal representations, elementary signals and transformations of signal.
2	To analyze the continuous time systems, linear time-invariant system and system properties.
3	To apply the Fourier representation properties and Z- transform properties to solve problems.

Course Syllabus:

Topic	Details
Introduction to Signal	- Signal classification - Signal models - Basic signal operations - Signal representations
Continuous-Time (CT) Signal & System	Signal Transformation - Time-based operation (independent variable) - Amplitude-based operation (dependent variable) Signal Characteristics - Periodic and aperiodic - Even and odd functions Basic Functions of Signal - Singularity functions: unit step, unit ramp, unit impulse Properties of CT Systems - System classification: memory, causality, invertibility, time-invariant, linearity
Discrete Time (DT) Signal & System	Signal Transformation - Time-based operation (independent variable) - Amplitude-based operation (dependent variable) Basic Functions of Signal - Singularity functions: unit step, unit ramp Signal Characteristics - Even and odd functions Properties of DT Systems - System classification: memory, causality, invertibility, time-invariant, linearity
Continuous-Time Linear Time Invariant Systems	–Introduction to LTI systems –Main properties of LTI systems –Convolution integrals and its properties in continuous-time LTI systems –Graphical convolution analysis
Discrete-Time Linear Time Invariant Systems	–Convolution sum and its properties in discrete -time LTI systems –Graphical convolution analysis
Fourier Series	–Introduction to Fourier series –Signal Expressions, time domain and Frequency domain signals –Phase representation –Fourier series symmetrical properties –Trigonometric Fourier series analysis –Complex exponential Fourier series analysis

Fourier Transform	Introduction Definition of Fourier Transform Fourier Transform Properties Application of Fourier Transform -Solution to Differential Equation -Modulation -Signal Transmission -Sampling
Fourier Analysis of Discrete Time Signals	Discrete Time Fourier Series (DTFS) Discrete-time Fourier Transform (DTFT) Discrete Fourier Transform (DFT)
Discrete Time Signals Using Z – Transform	Introduction Definition of Z-transform Region of Convergence Inverse Z-transform Solution of Difference Equation Using Z-transform Transfer Function Application of Z Transform

Endorsed by:

ASSOCIATE PROFESSOR Ir. Dr. ROSMIWATI MOHD MOKHTAR
Deputy Dean
(Academic, Career and International)
School of Electrical and Electronic Engineering
Engineering Campus
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COURSE DESCRIPTION

Course Name	Digital Electronic Laboratory
Course Code	EEE231
Credit Unit	3
Course Objective	To conduct experiments on digital circuits
Course Synopsis	The course (lab) is divided into 2 modules which are based on the course EEE130 – Digital Electronic I. The first module concentrates on the basic of digital electronics which includes Logic Gate ICs and troubleshooting, Counters, Multiplexers, Flip-Flop, Triggers, Registers and Combinational Logic. The outcome of the first module is to enable students to understand and design simple and basic digital circuits. The knowledge will then be used in the second module where students will be given the tasks on designing more complex combinational and sequential circuits.

Course Learning Outcomes:

1	Able to recognize the functionality of digital components by using the basic tools
2	Able to analyze the problem of digital circuit with difference difficulty
3	Able to produce design output by developing digital circuit with difference difficulty and the relevance observation
4	Able to recognize the usage requirements of digital component in developing suitable digital circuit
5	

Course Syllabus:

Topic
MODULE 1 - INTRODUCTION TO LOGIC GET
MODULE 1 - LATCH AND FLIP-FLOP
MODULE 1 - SYNCHRONOUS COUNTER AND RIPPLE COUNTER, AND COUNTER DEVICE SYSTEM
MODULE 1 - SHIFT REGISTER
MODULE 1- SCHMITT TRIGGER AND MULTIVIBRATOR CIRCUIT
MODULE 1 - MULTIPLEXERS, COMPARATOR AND CODE CONVERTER
MODULE II- COMBINATIONAL SYSTEM DESIGN
MODULE II - SEQUENTIAL SYSTEM DESIGN
MINI PROJECT

Endorsed By:

ASSOCIATE PROFESSOR Ir. Dr. ROSMIWATI MOHD MOKHTAR
Deputy Dean
(Academic, Career and International)
School of Electrical and Electronic Engineering
Engineering Campus
Universiti Sains Malaysia

COURSE DESCRIPTION

Course Name	Complex Analysis For Engineers
Course Code	EEE 236
Credit Unit	3
Course Objective	Provides understanding and skills for the calculus of complex functions for complex variables. Topics include differentiating functions and obtaining line integrals in the complex plane and understanding several formulas and theorems such as the Cauchy-Riemann Formula and Cauchy's Theorem as well as Taylor and Laurent series expansions and the Balance Theorem. Next, use complex function theory to solve related engineering problems.
Course Synopsis	This course reviews the topics on complex number, complex function, analytic function, complex differentiation and integration, series expansion and Residue Theorem, as well as complex conformal mapping.

Course Learning Outcomes:

1	Able to simplify the basics concept of complex variables and complex functions.
2	Able to solve the problems related to complex variables and complex functions.
3	Able to determine the formula and theorem in solving the problem in complex variables and complex functions.

Course Syllabus:

Topic	**Details**
Complex numbers and plane.	Introduction, Complex numbers and complex planes; Roots and powers.
Complex functions	Elementary function: Exponential and logarithmic functions; Complex power.
Complex differentiation	Complex Differentiation, Cauchy-Riemann's equations; Harmonic functions.

Complex integration	Complex integration, Line integration in complex planes; Cauchy's integration theorem; Cauchy's integration formula

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ASSOCIATE PROFESSOR Ir. Dr. ROSMIWATI MOHD MOKHTAR
Deputy Dean
(Academic, Career and International)
School of Electrical and Electronic Engineering
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Universiti Sains Malaysia

COURSE DESCRIPTION

Course Name	Analog Electronics Laboratory
Course Code	EEE243
Credit Unit	3
Course Objective	To conduct practical experiments on analog electronic circuits.
Course Synopsis	This course comprises of 14 experiments that will be conducted by the students. The experiments are on Diode, BJT, FET, Op-amp, Power Amplifier, filters and rectifiers as well as their applications.

Course Learning Outcomes:

1	
2	
3	
4	
5	

Course Syllabus:

Topic
Rectifier Circuits
Bipolar Junction Transistor - Part 1
Bipolar Junction Transistor - Part 2
Junction Field Effect Transistor (JFET)
Frequency Response
Operational Amplifier (OP-AMP) - Part 1
Operational Amplifier (OP-AMP) - Part 2
555 Timer Applications Circuits
Monostable Timer, Voltage Regulator and Relay Application Circuits
Simulation Passive Filter Circuits
Passive Filter Circuits
OP-AMP Application Circuits
Power Amplifier Circuits
Oscillator Circuits

Endorsed By:

ASSOCIATE PROFESSOR Ir. Dr. ROSMIWATI MOHD MOKHTAR
Deputy Dean
(Academic, Career and International)
School of Electrical and Electronic Engineering
Engineering Campus
Universiti Sains Malaysia

COURSE DESCRIPTION

Course Name	Analog Electronic I
Course Code	EEE244
Credit Unit	4
Course Objective	To learn electronic amplifier circuits
Course Synopsis	This course emphasizes on the analysis of single and multi-stage amplifiers.

Course Learning Outcomes:

1	Be able to identify the use of diodes and transistors as well as their small signal models in electronic circuits.
2	Be able to explain the applications of amplifiers in electronic circuits that benefit society.

Course Syllabus:

Topic	**Details**
DIODE CIRCUITS	• Diode Circuit Analysis • Multiple-Diode Circuits • Half-Wave Rectifier Circuits & Full-Wave Rectifier Circuits • Rectifier Comparison and Design Tradeoffs • Clipping or Limiting Diode Circuit • Clamping Diode Circuit
FIELD-EFFECT TRANSISTOR CIRCUITS	• The NMOS Transistor & PMOS Transistors • MOSFET Circuit Symbols • Biasing the NMOS Field-Effect Transistor • Biasing the PMOS Field-Effect Transistor • The Junction Field-Effect Transistor (JFET) • Biasing the JFET and Depletion-Mode MOSFET
BIPOLAR JUNCTION TRANSISTOR CIRCUITS	• The Transport Model for the npn Transistor • The pnp Transistor • Equivalent Circuit Representations for the Transport Models • The i-v Characteristics of the Bipolar Transistor • The Operating Regions of the Bipolar Transistor • Transport Model Simplifications

	• Practical Bias Circuits for the BJT
ANALOG SYSTEMS AND IDEAL OPERATIONAL AMPLIFIERS	• An Example of an Analog Electronic System Amplification • Two-Port Models for Amplifiers • Mismatched Source and Load Resistances • Introduction to Operational Amplifiers • Distortion in Amplifiers • Differential Amplifier Model • Ideal Differential and Operational Amplifiers • Analysis of Circuits Containing Idea lOperational Amplifiers • Frequency Dependent Feedback
NONIDEAL OPERATIONAL AMPLIFIERS AND FEEDBACK AMPLIFIER STABILITY	• Classic Feedback Systems • Analysis of Circuits Containing Nonideal Operational Amplifiers • Series and Shunt Feedback Circuits • Series-Shunt Feedback—Voltage Amplifiers • Shunt-Shunt Feedback—Transresistance Amplifiers • Series-Series Feedback—Transconductance Amplifiers • Shunt-Series Feedback—Current Amplifiers • DC Error Sources and Output Range Limitations • Common-Mode Rejection and Input Resistance • Frequency Response and Bandwidth of Operational Amplifiers • Stability of Feedback Amplifiers
OPERATIONAL AMPLIFIER APPLICATIONS	• Cascaded Amplifiers • Active Filters
SMALL-SIGNAL MODELING AND LINEAR AMPLIFICATION	• The Transistor as an Amplifier • Coupling and Bypass Capacitors • Circuit Analysis Using dc and ac Equivalent Circuits • Introduction to Small-Signal Modeling • Small-Signal Models for Bipolar Junction Transistors • The Common-Emitter (C-E) Amplifier • Important Limits and Model Simplifications • Small-Signal Models for Field-Effect Transistors • Summary and Comparison of the Small-Signal Models of the BJT and FET

	• The Common-Source Amplifier • Common-Emitter and Common-Source Amplifier Summary • Amplifier Power and Signal Range
SINGLE-TRANSISTOR AMPLIFIERS	• Amplifier Classification • Inverting Amplifiers—Common-Emitter and Common-Source Circuits • Follower Circuits—Common-Collector and Common-Drain Amplifiers • Noninverting Amplifiers—Common-Base and Common-Gate Circuits • Amplifier Prototype Review and Comparison • Coupling and Bypass Capacitor Design • Multistage ac-Coupled Amplifier

Endorsed by:

ASSOCIATE PROFESSOR Ir. Dr. ROSMIWATI MOHD MOKHTAR
Deputy Dean
(Academic, Career and International)
School of Electrical and Electronic Engineering
Engineering Campus
Universiti Sains Malaysia

COURSE DESCRIPTION

Course Name	Analog Electronic II
Course Code	EEE270
Credit Unit	3
Course Objective	To learn methods of analysis and design of analog electronic amplifier circuits.
Course Synopsis	This course emphasizes on the analysis and design of amplifiers and its frequency response.

Course Learning Outcomes:

1	Be able to analyze the design of an amplifier circuit and its frequency response.
2	Be able to investigate the design of an amplifier circuit and its frequency response.
3	Be able to use modern tools in the design of amplifier circuits and their frequency response.

Course Syllabus:

Topic	**Details**
Differential Amplifiers	• Bipolar and MOS Differential Amplifiers • dc Analysis of the Bipolar Differential Amplifier • Transfer Characteristic for the Bipolar Differential Amplifier • ac Analysis of the Bipolar Differential Amplifier • Differential-Mode Gain and Input and Output Resistances • Common-Mode Gain and Input Resistance • Common-Mode Rejection Ratio (CMRR) • Analysis Using Differential- and Common-Mode Half-Circuits • Biasing with Electronic Current Sources • dc Analysis of the MOSFET Differential Amplifier • Differential-Mode Input Signals • Small-Signal Transfer Characteristic for the MOS Differential Amplifier • Common-Mode Input Signals • Model for Differential Pairs

Evolution to Basic Operational Amplifiers	• A Two-Stage Prototype for an Operational Amplifier • Improving the Op Amp Voltage Gain • Output Resistance Reduction • A CMOS Operational Amplifier Prototype
Output Stages	• The Source Follower—a Class-A Output Stage • Efficiency of Class-A Amplifiers • Class-B Push-Pull Output Stage • Class-AB Amplifiers 996 • Class-AB Output Stages for Operational Amplifiers • Short-Circuit Protection
Electronic Current Sources	• Single-Transistor Current Sources • Figure of Merit for Current Sources • Higher Output Resistance Sources • Current Source Design Examples
Amplifier Frequency Response	• Low-Frequency Response • Estimating ωL in the Absence of a Dominant Pole • High-Frequency Response • Estimating ωH in the Absence of a Dominant Pole
Low-Frequency Response	• Estimation of ωL for the Common-Emitter Amplifier • Estimation of ωL for the Common-Source Amplifier • Estimation of ωL for the Common-Base Amplifier • Estimation of ωL for the Common-Gate Amplifier • Estimate of ωL for the Common-Collector Amplifier • Estimate of ωL for the Common-Drain Amplifie
Transistor Models at High Frequencies	• Frequency-Dependent Hybrid-Pi Model for the Bipolar Transistor • Modeling Cπ and Cμ in SPICE • Unity-Gain Frequency fT • High-Frequency Model for the FET • Modeling CG S and CG D in SPICE • Channel Length Dependence of fT • Limitations of the High-Frequency Models

Base and Gate Resistances in the Small-Signal Models	• Effect of Base and Gate Resistances on Midband Amplifier
High-Frequency Common-Emitter and Common-Source Amplifier Analysis	• The Miller Effect • Common-Emitter and Common-Source Amplifier High-Frequency Response • Direct Analysis of the Common-Emitter Transfer Characteristic • Poles of the Common-Emitter Amplifier • Dominant Pole for the Common-Source Amplifier • Estimation of ωH Using the Open-Circuit Time-Constant Method • Common-Source Amplifier with Source Degeneration Resistance • Poles of the Common-Emitter with Emitter Degeneration Resistance
High-Frequency Common-Base and Common-Gate Amplifier Analysis	• Common-Base and Common-Gate Amplifier High-Frequency Response
High-Frequency Common-Collector and Common-Drain Amplifier Analysis	• Common-Collector and Common-Drain Amplifier High-Frequency Response
Single-Stage Amplifier High-Frequency Response Summary	• Amplifier gain-bandwidth limitation
Frequency Response of Multistage Amplifiers	• Differential Amplifier • The Common-Collector/Common Base Cascade • High-Frequency Response of the Cascode Amplifier • Cutoff Frequency for the Current Mirror • Three-Stage Amplifier Example
Review of Feedback Amplifier Stability	• Closed-Loop Response of the Uncompensated Amplifier • Phase Margin • Higher Order Effects • Response of the Compensated Amplifier Small-Signal Limitations
Single-Pole Operational Amplifier Compensation	• Three-Stage Op-Amp Analysis • Transmission Zeros in FET Op Amps • Bipolar Amplifier Compensation 1257 18.5.4 • Slew Rate of the Operational Amplifier Relationships between Slew Rate and Gain-Bandwidth Product

Endorsed By:

ASSOCIATE PROFESSOR Ir. Dr. ROSMIWATI MOHD MOKHTAR
Deputy Dean
(Academic, Career and International)
School of Electrical and Electronic Engineering
Engineering Campus
Universiti Sains Malaysia

COURSE DESCRIPTION

Course Name	Electromagnetic Theory
Course Code	EEE276
Credit Unit	3
Course Objective	In this course, students will learn theory and analysis of electromagnetic fields and apply th theory in transmission and system design
Course Synopsis	This course deals with the theory and analysis of transmission line and electromagnetic for electrostatics, magnetostatics and dynamic (time-varying). It also covers the properties of plane wave propagation and electromagnetics application in system design, including the concept of electromagnetic interference (EMI) and electromagnetic compatibility (EMC).

Course Learning Outcomes:

1	*To be able to explain the transmission line concept as a bridge between the circuit theory and electromagnet, thus able to analyse vectors in the form of magnitude and direction to carry out vector algebra and calculus*
2	To analyze Maxwell equations as electromagnetic theory main concept and relate it in electrostatic and magnetostatic applications
3	To assess the theory and application of electromagnetic in time varying (dynamic) during transmission for specific structure and medium including inside system design
4	To practice the concept and apply the electromagnet in waveguides, electromagnetic interference (EMI) and electromagnetic compatibility (EMC)

Course Syllabus:

Topic	**Details**
Introduction: Waves and Phasors	• Travelling Waves • The Electromagnetic Spectrum • Review of Complex Number • Review of Phasor *The basic principles of electromagnetics and waves, sinusoidal waves propagation in the lossless and lossy medium*

Transmission Line	*Equation of transmission line, wave propagation in transmission line, transmission line in lossless medium*
Vector Algebra	*The principle of vector algebra, orthogonal coordinate systems, transformation of coordinate systems, gradian for scalar, fraction and vector fields, Stoke theory and Laplacean operation*
Electrostatic	*Basics of Electrostatic Law, Coulombs Law, Gaussian Law, Electric Flux Density, Electricity Field Intensity and Capacity, Laplace and Poisson Equations, Electrostatic Boundary Conditions, Electrostatic Fields in Dielectric Materials, Resistance and Capacity*
Magnetostatic	*Biot-Savart Law, Ampere Law, Magnetic Flux Density, Magnetic Flux Intensity, Magnetic Efforts, Magnetostatic Boundary Conditions, Induction*
Time-varying electromagnetic theory (Dynamic)	*Faraday's law, static and dynamic magnetic fields, electromagnetic potential*
Plane waves propagation	*The basis properties of time-varying electromagnetic waves as well as the application of the Maxwell concept, propagation and polarization of plane waves*
Application of electromagnetics	*Basic principles, applications of electromagnetic in waveguides, interference (EMI) and electromagnetic compatibility (EMC)*

Endorsed By:

ASSOCIATE PROFESSOR Ir. Dr. ROSMIWATI MOHD MOKHTAR
Deputy Dean
(Academic, Career and International)
School of Electrical and Electronic Engineering
Engineering Campus
Universiti Sains Malaysia

COURSE DESCRIPTION

Course Name	Electrical Power Technology
Course Code	EEK241
Credit Unit	3
Course Objective	Student to understand the fundamental principle of electrical power technology, electrical power generation, transmission and distribution of electrical power energy, power electrical measurement instruments, application of electrical power and safety system
Course Synopsis	This course is offered for students to learn and understand basic principles of electrical power technology such as single-phase and three-phase ac network, electric power generation, power transmission and distribution, power measurements and instrumentation, protection systems, and alternatives energy sources.

Course Learning Outcomes:

1	Able to define the basic characteristic and electrical laws and magnet and the applications in electrical networks.
2	Able to analyze complex power and power factor for single and three phase.
3	Able to explain the technology used in electrical generation, transmission and distribution
4	Able to solve the problems related to power technology and the environment.

Course Syllabus:

Topic	**Details**
Physic electric previous literature	Basic quantities, voltage, current, resistor, capacitor, inductor, charge definition, power; types of circuit and element; Ohms Law, Kirchoff law, one loop circuit analysis, single node double loop, joined resistors and source
Electrical networks	AC and DC networks, characteristic of voltage and current, average value, rms or effect from electric values. Graphic and phasor for real power, complex power and stretching power. Single and three phase analyzing.
Electric Power Generation	Principle operation from generator, types of electric power plant, synchronize plant and

	basic components and their function, renewable technology
Usage system for electrical power	Transmission of electrical power energy, basic components for electrical power, types of electrical transmission, standard voltage, transmission network component, basic purpose for electric transmission, equivalent circuit from transmission. Direct current transmission, electrical power distribution system, types of distribution, circuit breaker, grounding, voltage regulator and low voltage distribution
Electrical loads	Types of load at electric system power, load resistor, load inductor, feedback load and motor load, electronic instruments load. Power factor and improved power factor
Electric Power Measurement Instruments	Types of power electrical measurement instruments, moving coil, hot wire, thermocouple electrodynamic, indicator, measurement instruments for direct and alternate current, ammeter, voltmeter, wattmeter, frequency meter. classifying and standardizing the measurement instruments, techniques of current, voltage and power measurement, power factor at single and three phase system. Magnetic measurement and digital measurement instrument.

Endorsed By:

ASSOCIATE PROFESSOR Ir. Dr. ROSMIWATI MOHD MOKHTAR
Deputy Dean
(Academic, Career and International)
School of Electrical and Electronic Engineering
Engineering Campus
Universiti Sains Malaysia

COURSE DESCRIPTION

Course Name	Electrical Machine
Course Code	EEK260
Credit Unit	3
Course Objective	Students to learn the basic theory, construction, and operation of power transformers, direct current motors, direct current generators, magnetic field concepts, three-phase synchronous generators, three-phase synchronous motors, three-phase and single-phase induction motors.
Course Synopsis	This course covers the topics of magnetic circuit fundamental, transformer, dc generator, dc motor, three-phase synchronous generator, three-phase synchronous motor, three-phase and single-phase induction motors.

Course Learning Outcomes:

1	Able to examine types, characteristics and operating principles of transformer, dc machine, and ac machine.
2	Able to analyse magnetic circuit, flux, induced voltage, speed, power and efficiency of electrical transformer and electrical machines.
3	Able to determine solutions for the problems related to the electrical transformer, dc machine and ac machines.

Course Syllabus:

Topic	Details
Magnetic circuits	Basics of magnetic circuit, magnetic field, magnetic flux, flux density, hysteresis and eddy current, magnetic core loss, equations for serial and parallel magnetic circuits.
Transfromers	Types of electrical power transformers, structure, characteristics and operating principles, power calculation and connection V-I, electrical circuit equations and model determination, open circuit and short circuit testing, voltage regulation, efficiency of transformer, measuring transformer, automatic transformer and three-phase transformer
Direct Current Generators	Direct current generation, operating principles and structures, armature windings and commutator action, self and separate excitations, characteristics of shunt,

	series and compound generators, voltage regulation, power loss and efficiency
Direct Current Motors	Direct current motor, its operating principles and structure, calculation of torque, power, loss and efficiency, characteristics of shunt, series and compound motors, starting, speed control, and industrial applications of dc motors
Three-phase Synchronous Generators and Motors	Synchronous motors and synchronous generators, introduction, operating principles, contruction and structure, three-phase windings, concept of rotating magnetic field, field current control, induced voltage, power, efficiency, power factor, active power, reactive power, power loss
Three-phase Induction Motors	Induction motor, introduction, construction and structure, operating principles, three-phase windings, types of induction motors, slip operation, torque-speed curve, circuit equation and diagram, determination of model parameters, speed control, starting, industrial applications of induction motors, single-phase induction motor, its operation, basic theory, circuit diagram

Endorsed By:

ASSOCIATE PROFESSOR Ir. Dr. ROSMIWATI MOHD MOKHTAR
Deputy Dean
(Academic, Career and International)
School of Electrical and Electronic Engineering
Engineering Campus
Universiti Sains Malaysia

COURSE DESCRIPTION

Course Name	Engineering Practice
Course Code	EEL102
Credit Unit	2
Course Objective	To expose students to the basic skills required by electrical and electronics graduates. In addition, students are taught how to use PSpice and ORCAD software to design and analyze electrical and electronic circuits. Students are also exposed to basic knowledge in domestic electrical wiring, PCB fabrication and welding basics.
Course Synopsis	This course is divided into 3 components. The components are on the skill/technique on how to use PSpice and OrCAD software in simulation/design the electrical and electronic circuitry and fabrication technique for PCB. Domestic wiring and basic welding process are exposed to equip students with fundamental engineering skill.

Course Learning Outcomes:

1	Able to describe basic operation of electrical circuit and design using Pspice/Orcad and techniques employed in PCB fabrication, as well as learning about safety theories and electrical hazard.
2	Able to perform basic operation of Pspice/Orcad and techniques employed in PCB fabrication
3	Able to work independently and in groups for the mini project using Pspice/Orcad and PCB fabrication.
4	Able to perform written and verbal communication through the mini project.
5	Able to describe and explain basic techniques employed in electrical wiring and mechanical engineering

Course Syllabus:

Topic	**Details**
Safety practices and electrical hazard	
Simulation design using Orcad Capture	
Schematic circuit design using Orcad Capture	
Layout artwork creation using Orcad Layout	
Printed circuit board fabrication	
Domestic wiring	
Basic mechanical engineering	

Endorsed By:

ASSOCIATE PROFESSOR Ir. Dr. ROSMIWATI MOHD MOKHTAR
Deputy Dean
(Academic, Career and International)
School of Electrical and Electronic Engineering
Engineering Campus
Universiti Sains Malaysia

COURSE DESCRIPTION

Course Name	Mechatronic engineering Practice
Course Code	EEM102
Credit Unit	2
Course Objective	Provide exposure to students the basic skills required by Mechatronics graduates. Students are taught how to use PSpice and OrCAD intelligence to design and analyze electrical and electronic circuits. Students are also exposed to basic knowledge in domestic electrical wiring, PCB fabrication and the basics of Mechanical Engineering.
Course Synopsis	This course is divided to two major components: Electrical/Electronic and Mechanical components. The components are on the skill and technique on how to use PSpice and OrCAD software in simulation and design the electrical and electronic circuitry, fabrication technique for Printed Circuit Board (PCB), basic electrical wiring and Mechanical Engineering practice such as welding, measurement, lathe and milling.

Course Learning Outcomes:

1	To learn operation of basic Pspice, OrCAD, Electrical Wiring, technique in PCB Fabrication and Mechanical Engineering.
2	To be able to learn communication skill in activities related to Pspice, OrCAD, Electrical Wiring, PCB Fabrication and Mechanical Engineering
3	
4	
5	

Course Syllabus:

Topic	**Details**
Safety and health theory in engineering practice	
Designing, editing and simulating basic electronic circuit using Pspice/OrCAD	
Drawing, editing and netlisting of electrical/electronic circuit	
Changing and exporting netlist from OrCAD capture to figure	
Printed circuit board fabrication	

Electrical wiring	
Welding	
Lathe	
Measurement	
Milling	

Endorsed By:

ASSOCIATE PROFESSOR Ir. Dr. ROSMIWATI MOHD MOKHTAR
Deputy Dean
(Academic, Career and International)
School of Electrical and Electronic Engineering
Engineering Campus
Universiti Sains Malaysia

COURSE DESCRIPTION

Course Name	ELECTRONIC DEVICES AND ANALOG CIRCUITS
Course Code	EEM103
Credit Unit	4
Course Objective	(i) To provide knowledge of how current flows through a p-n junction and relate this phenomenon to the characteristics and operation of diodes, BJTs and FETs. (ii) To provide knowledge about the function and application of diodes in electronic circuits, as well as the DC bias of BJTs and FETs. (iii) To study analog electronic amplifier circuits.
Course Synopsis	This course provides introduction on semiconductor material and p-n junction, diode and its application, operation and biasing techniques for Bipolar Junction Transistor (BJT) and Field Effect Transistor (FET) as well as introduces the analysis of single and multi-stage amplifiers.

Course Learning Outcomes:

1	Able to explain on the p-n junction characteristics, diode and its application in electronic circuits, as well as BJT and FET characteristics and DC biasing.
2	Able to analyse the p-n junction characteristics, diode and its application in electronic circuits, as well as BJT and FET characteristics and DC biasing.
3	Able to construct small signal models of the single-stage and multi-stage amplifiers.
4	Able to analyse small signal model of the single-stage and multi-stage amplifier.
5	

Course Syllabus:

Topic
Semiconductor physics of extrinsic p and n materials
p-n junction characteristics
Diode characteristics and diode application in electronic circuits
DC biasing of BJT and FET
Analog system and ideal operational amplifier.
Non-ideal operational amplifier
Operational amplifier application
Small signal model
Common emitter single-stage amplifier
Common emitter multi-stage amplifier

Endorsed By:

ASSOCIATE PROFESSOR Ir. Dr. ROSMIWATI MOHD MOKHTAR
Deputy Dean
(Academic, Career and International)
School of Electrical and Electronic Engineering
Engineering Campus
Universiti Sains Malaysia

COURSE DESCRIPTION

Course Name	Principles and Mechanics of Materials
Course Code	EEM201
Credit Unit	3
Course Objective	Menyediakan Pelajar kejuruteraan supaya mempunyai kebolehan menganalisa dan memahami prinsip dan masalah-masalah di dalam mekanik dan bahan kejuruteraan secara mudah dan logikal.
Course Synopsis	Kursus ini merangkumi konsep asas susunan atom, ciri bahan, ciri plastik dan kenyal serta gambrajah-fasa. Konsep rajah terikan dan momen serta hubungan dengan tegasan serta lenturan.

Course Learning Outcomes:

1	To be able to explain the structure of crystalline solids, the imperfections in solids and diffusion process
2	To be able to explain and application of mechanical properties in metals, dislocation and strengthening mechanism and failure in materials
3	Able to analyze the principle of stress in beam, deflection in beam, stress under torsion and structures using basic principle of equilibrium
4	Able to analyze the effect of load on structures through shear force diagrams, bending moment diagrams and deflection

Course Syllabus:

Topic	**Details**
Crystal structure, point, direction and plane of crystallography	• Introduction Atomic Structure and Interatomic Bonding. • The Structure of Crystalline Solids
Defects in solids	• Imperfections in Solids • Diffusion
Mechanical properties of metals	• Mechanical Properties of Metals
Dislocation and reinforcement mechanism, failure	• Dislocation and Plastic Deformation Failure Phase Diagram
Phase diagram	• Flexure Formula Allowable Moment
Shear force and bending moment	• Type of Beam and Loading • Shear Force and Bending Moment Shear Force and Bending Moment Diagram.

	• Relationship between Load, Shear & Moment
Types of stresses in beams	• Normal Stresses
Beam Design	• Shear Stress Formula • Design of Beam Strength
Bending for Beams	• Deflection of Beam • Torsion of Circular Shaft

Endorsed By:

ASSOCIATE PROFESSOR Ir. Dr. ROSMIWATI MOHD MOKHTAR
Deputy Dean
(Academic, Career and International)
School of Electrical and Electronic Engineering
Engineering Campus
Universiti Sains Malaysia

COURSE DESCRIPTION

Course Name	Fundamentals of Dynamics and Mechanism
Course Code	EEM222
Credit Unit	4
Course Objective	Memberi pendedahan kepada pelajar konsep asas dan prinsip bagi partikel dan dinamik suatu satah jasad tegar. Di samping itu, pelajar akan diperkenalkan dengan aplikasi mekanisma di dalam persekitaran kejuruteraan mekanik.
Course Synopsis	Pengenalan kepada dinamik, kinematik partikel, kinematik jasad tegar, pergerakan satah jasad tegar – daya dan pecutan, kaedah tenaga dan momentum, kinetik jasad tegar 3D, seimbangan bagi jisim berputar, sistem gear – gigi gear dan rangkaian gear, sistem engkol dan pengikut, mekanisma – rajah kinematik, keupayaan bergerak, kedudukan, halaju dan analisa pecutan.

Course Learning Outcomes:

1	To be able to explain the kinematic movement of a rigid body particle by using motion equations for the solution of kinematic problems & mechanisms.
2	To be able to apply the principles of work, energy, impulse and momentum in solving kinematic problems & mechanisms.
3	To be able to design solution for problems related to kinematics and mechanisms.

Course Syllabus:

Topic	**Details**
Kinematics of a particle:	• Rectilinear Kinematics, erratic & continuous motion • General curvilinear motion • Curvilinear erratic motion • Curvilinear motion: rectangular components
Kinematics of a particle:	• Motion of a projectile • Curvilinear motion: Normal and Tangent component • Curvilinear motion: Cylindrical component
Kinetics of a particle:	• Newton’s Second Law of motion • The equation of motion for a particles

	• Equation of motion: rectangular, normal and tangent, and cylindrical coordinate
Kinetics of a Particle: Work & Energy	• The work of a Force • Principle of a Work & Energy • Power & Efficiency • Conservation of forces
Kinetics of a Particle: Impulse and Momentum	• Principle of Linear Impulse and Momentum • Conservation of Linear Impulse and Momentum • Impact
Kinetics of a Particle: Impulse and Momentum	• Angular momentum • Relation between moment of a force and angular momentum • Principle of Angular Impulse & Momentum
Planer Kinematics of a Rigid Body	• Planar Rigid-Body motion • Translation • Rotation about a fixed-axis • Absolute & relative motion analysis.
Mechanism analysis: Position, velocity and acceleration	• Introduction to Mechanisms and Kinematics. • Vectors • Position and Displacement Analysis
Mechanism analysis: Power Analysis - Power Group	• Mechanism Design • Velocity Analysis • Acceleration Analysis
Gear: gear type and selection	• Kinematic Analysis and Selection • Kinematic Analysis and Selection
Cams mechanism: Analysis, design etc.	• Design and Kinematic Analysis

Endorsed By:

ASSOCIATE PROFESSOR Ir. Dr. ROSMIWATI MOHD MOKHTAR
Deputy Dean
(Academic, Career and International)
School of Electrical and Electronic Engineering
Engineering Campus
Universiti Sains Malaysia

COURSE DESCRIPTION

Course Name	Thermofluid
Course Code	EEM223
Credit Unit	3
Course Objective	To give introduction to the terminology and the principle of thermodynamic and fluid mechanic and the application.
Course Synopsis	This course is intended to encompass the knowledge of thermodynamics and fluid mechanics principles. The students will be given an introductory course of both principles such as laws in thermodynamics and static/dynamic in fluid mechanics. The knowledge of grounding principles will provide students with ability to understand how the concepts of thermodynamics theory can be used on human made machine.

Course Learning Outcomes:

1	To be able to explain the basic definition of thermodynamics such as heat transfer and fluid variability.
2	To be able to analyse the problem of thermodynamics and the application in machine construction.
3	To be able to analyse the problem of model analysis, model prototype and Bernoulli principle

Course Syllabus:

Topic	**Details**
Introduction and overview	
Basic concept of thermodynamics:	• Systems and control volume, properties of a system, density, and specific gravity. • state of equilibrium, process and cycles, temperature. • Pressure
Energy, energy transfer, and general energy analysis	
The first law of thermodynamics	
Properties of pure substance:	• Phases, phase change • property diagram • property Table

Energy analysis of closed system:	• Moving boundary works. • energy balance for closed system • Specific heat, internal energy
Introduction and overview of fluid mechanics	
Classification of fluid flows	
Introduction to fluid statics	
Hydrostatic forces on submerged plane surfaces	
Hydrostatic forces on submerged curved surfaces	
Buoyancy and stability	
Introduction to Bernoulli and energy equations	
Mechanical energy and efficiency	
Applications of the Bernoulli equation	
Energy analysis of steady-flow systems	

Endorsed By:

ASSOCIATE PROFESSOR Ir. Dr. ROSMIWATI MOHD MOKHTAR
Deputy Dean
(Academic, Career and International)
School of Electrical and Electronic Engineering
Engineering Campus
Universiti Sains Malaysia

COURSE DESCRIPTION

Course Name	MECHATRONICS LABORATORY 1
Course Code	EEM242
Credit Unit	2
Course Objective	To understand the basics of analog and digital electronic circuits, the operation of these circuits theoretically and practically including problems on these circuits. Students will learn how to compare between theory and practical methods of implementation.
Course Synopsis	This course is divided into three parts, namely experiments related to digital electronics, experiments related to analog electronics and experiments using FPGA applications.

Course Learning Outcomes:

1	Able to analyse complex digital circuits using flip-flops, logic gates and FPGA as well as analog circuits using BJT, FET and OP-AMP
2	Able to construct complex digital, analogue and FPGA circuits using appropriate techniques, resources and modern engineering and IT tools.
3	Able to demonstrate professional ethics and norms of engineering practice through laboratory work related to complex digital, analog and FPGA circuits.
4	Able to demonstrate individual potential and teamwork through laboratory work related to complex digital, analog and FPGA circuits.
5	Able to demonstrate effective communication skills through presentations on laboratory work related to complex digital, analog and FPGA circuits.
6	Able to demonstrate engineering management skills through laboratory work related to complex digital, analog and FPGA circuits.

Course Syllabus:

Topic
IC logic gates
Flip-flops
Synchronous and ripple counters
Shift register
Schmitt trigger and its application
Comparator
Bipolar Junction Transistor (BJT)
Junction Field Effect Transistor (JFET)
Operational Amplifier (OPAMP)

Frequency response
Mini project using FPGA

Endorsed By:

ASSOCIATE PROFESSOR Ir. Dr. ROSMIWATI MOHD MOKHTAR
Deputy Dean
(Academic, Career and International)
School of Electrical and Electronic Engineering
Engineering Campus
Universiti Sains Malaysia

COURSE DESCRIPTION

Course Name	Mechatronic Design 1
Course Code	EEM253
Credit Unit	2
Course Objective	This course aims to expose students to the design of mechatronics systems. After attending this course, students can integrate design theory and develop practical mechatronic circuit experiments.
Course Synopsis	The purpose of this course is to give exposure to the students theory of mechatronic system design and experimental implementations. Student will design a mechatronic system using fundamental knowledge such as programmable logic controller, sensors and actuators, computer simulation of mechatronic systems, and computer-aided mechatronic design.

Course Learning Outcomes:

1	*Able to analyse the PLC programming, circuitry and hardware requirements of industrial automation system.*
2	*Able to design the PLC-based automation systems.*
3	*Able to develop an automation system using hardware and current state the art software*
4	
5	

Course Syllabus:

Topic	**Details**
Introduction to mechatronic system, programmable logic controller, hardware and software	
Programmable logic controller and control using ladder logic diagram	

Timer and Counter	
IEC 61131-3 programming	
Sensors and Human Machine Interface	
Basic principles of pneumatic and electropneumatic and symbols	
Electropneumatic :speed control, direction control and sequential control	
PLC-based application	

Endorsed By:

ASSOCIATE PROFESSOR Ir. Dr. ROSMIWATI MOHD MOKHTAR
Deputy Dean
(Academic, Career and International)
School of Electrical and Electronic Engineering
Engineering Campus
Universiti Sains Malaysia

COURSE DESCRIPTION

Course Name	ENGINEERING CALCULUS
Course Code	EUM 113
Credit Unit	3
Course Objective	Strengthening basic calculus knowledge and skills to prepare students to understand advanced mathematical concepts and then be able to be used in solving related engineering problems.
Course Synopsis	This course reviews the topics on calculus of one and multivariable. It also covers the topics of solutions of ordinary differential using analytical and numerical methods.

Course Learning Outcomes:

1	Able to simplify the basics concept of engineering calculus.
2	Able to solve the problems related to engineering calculus.
3	Able to determine the formula and theorem in the solution of engineering calculus.

Course Syllabus:

Topic	**Details**
Single variable Functions	Concept of Function: domain and range, limit and continuity, L'Hopital Rule. Differentiation: mean theorem concept, techniques of solutions and applications. Integration: Riemann sum concept, techniques of solutions and applications. Solution of Numerical Method, Newton Raphson, Simpson.
Multi variables Functions	Multivariable Function: introduction to multivariable function, limits and continuity, quadratic surfaces.

	Partial Differentiation: chain rule, derivatives differential and vector slope, maximum and minimum values, Lagrange multiplier. Multiple Integration: Double integration and its application, triple integration (rectangular) and its applications, change of variables in multiple integration.
First Order Ordinary Differential Equations	Separation of variables, Linear equation, Bernoulli equation, Exact and non-exact equation, Homogenous and non-homogenous equation, Engineering Applications.
Second Order Ordinary Differential Equations	Homogenous linear with constant coefficients, Non Homogenous linear with constant coefficients: method of undetermined coefficient, variation of parameter, Euler Cauchy equation, Laplace Transform, Numerical method (Euler), Engineering Applications

Endorsed By:

ASSOCIATE PROFESSOR Ir. Dr. ROSMIWATI MOHD MOKHTAR
Deputy Dean
(Academic, Career and International)
School of Electrical and Electronic Engineering
Engineering Campus
Universiti Sains Malaysia

COURSE DESCRIPTION

Course Name	ADVANCED ENGINEERING CALCULUS
Course Code	EUM 114
Credit Unit	3
Course Objective	Extend students' knowledge in calculus topics that include linear algebra, Fourier series, partial differentiation and vector calculus. And then able to be used in solving related engineering problems.
Course Synopsis	This course covers the topics on linear algebra, Fourier series, partial differential equations, and vector calculus. Numerical techniques for solving systems of linear equations and partial differential equations are also given.

Course Learning Outcomes:

1	Able to simplify the basics concept of advanced engineering calculus.
2	Able to solve the problems related to advanced engineering calculus.
3	Able to determine the formula and theorem in the solution of advanced engineering calculus.

Course Syllabus:

Topic	**Details**
Fourier Series	Fourier series expansion, periodic functions, Fourier coefficients, Dirichlet condition, functions of period 2π, even and odd functions, linearity property, convergence of the Fourier series. Function defined over a finite interval: Full-range and half- range cosine and sine series.
Partial Differential Equations	Solutions for 1st & 2nd order linear PDE, Linear PDE, PDE Wave equations, PDE Heat

	equations, Numerical solutions for heat equation.
Vector Calculus	Vector differentiation, Directional derivative, Grad, Divergence, Curl, Vector Integration: line, surface, volume. Green, Stokes & Gauss Theorems.
Linear Algebra	Concept of matrix, Solutions of linear systems using inverse matrix, Cramer's rule, Gauss elimination, LU (Doolittle, Crout), Eigen value and Eigen vector, Numerical method for solving linear equation: Gauss Seidel.

Endorsed By:

ASSOCIATE PROFESSOR Ir. Dr. ROSMIWATI MOHD MOKHTAR
Deputy Dean
(Academic, Career and International)
School of Electrical and Electronic Engineering
Engineering Campus
Universiti Sains Malaysia