

BACHELOR OF ENGINEERING HONOURS IN ELECTRONIC ENGINEERING

COURSE SYNOPSIS

The purpose of the following course synopsis is to indicate the essential direction and broad scope of the content for each course.

PART I

SMA 1116 ENGINEERING MATHEMATICS 1A

Calculus in one variable. Limits and continuity of functions. Differentiation. Leibniz's Rule. L'Hopitals Rule. Elementary functions including hyperbolic functions and their inverses. Integration – techniques including reduction formulae. Applications – arc-length, area, volumes, moments of inertia, centroids. Plane polar coordinates. Complex Numbers: Basic algebra. De Moivre's theorem. Complex exponentials. Linear Algebra: Vector algebra in 2 and 3 dimensions. Scalar and vector products. Equations of lines and planes.

TIE 1101 ENGINEERING DRAWING

Introduction: Plane geometry. First and third angle projection. Dimensioning. Pictorial views. Freehand sketching. Drawing of common objects; sectioning. Intersections, Developments. Conventioneing. Assembly Drawing. Exercises.

TCE 1103 PROFESSIONAL ENGINEERING SKILLS I

Study methods; Communication principles; Technical definitions, Descriptions and instructions; Tables and graphs; Letters. Memoranda and Curricula Vitae; Written reports; Word processing and computer jargon; Interview technique; Running a meeting; Reading, understanding and summarizing technical articles.

TEE 1102 ELECTRICAL ENGINEERING WORKSHOP

Safety regulations. Standard electrical and electronic symbols and circuit diagrams. Use of Electronic equipment: Oscilloscopes, Signal Generators, Multi-meters, Electronic Kits. Soldering/unsoldering techniques Basic Circuit Development and PCB fabrication. Breadboard and veroboard

TEE 1131 INTRODUCTION TO COMPUTER ENGINEERING AND PROGRAMMING

History of computers. Applications of computers. Hardware and software. Computer components: types of computer systems, system features, central processing unit, memory, the

mother board, the expansion bus, memory map. Storage devices. Operating systems: MSDOS, UNIX and Windows. Computer maintenance.

TEE 1143 ELECTRICAL ENGINEERING CIRCUIT ANALYSIS

General concepts of current, voltage and resistance. DC and ac circuits. Kirchoff's Laws. Loop and nodal analysis of circuits (dc and ac). Delta-Wye conversions (dc and ac). Network Theorems (dc and ac). Capacitance. Inductance. Transient analysis of capacitive and inductive networks (for dc sources). Magnetism and introduction to magnetic circuits. Steady state response of capacitors and inductors to ac. AC power. Introduction to three phase ac systems.

TEE 1154 PHYSICS FOR ELECTRONIC ENGINEERS

Atomic arrangements, unit cell, crystal systems. Intrinsic and Extrinsic semiconductors. Contact phenomenon: P-N junction.

Applied mechanics. Statics: scalar and vector quantities, equilibrium, solution of pin jointed frames, stress and strain, pure bending theory, and pure torsion theory. Dynamics: kinematics, types and equations of motion, work done by a constant and a varying force, circular motion, rotational work, power and energy.

SMA 1216ENGINEERING MATHEMATICS 1B

Functions of Several variables: Partial derivatives, chain rules. Applications. Linear Algebra: Matrices – basic operations, rank, inverses. Systems of linear equations. Determinants. Eigen values and Eigen vectors. Linear independence. Ordinary Differential Equations. First order differential equations. Integrating factors. Linear second order equations with constant coefficients. Variation of Parameters. Systems of equations. Applications of differential equations.

CTL 1101CONFLICT TRANSFORMATION AND LEADERSHIP

TEE 1213 ELECTRONIC ENGINEERING DEVICES AND CIRCUITS

Rectifying and Zener diodes: structure, operation, characteristics and parameters. Diode applications: rectifiers and power supplies; clippers and clamps. Schottky diode. Transistors. Bipolar Junction Transistors (BJTs): structure, terminals and operation; BJT configurations, static characteristics and parameters; biasing methods; d.c. circuit analysis and design. Darlington pair. BJT packages and data sheet. Field Effect Transistors (FETs): types, structure, terminals and operation. Configurations and static characteristics; d.c. circuit analysis. Power devices and heat sinks. Opto-electronic and photo-electronic devices: Light-Emitting Diodes (LEDs), infra-red diodes, 7-segment displays, Liquid Crystal Displays (LCDs), photodiode and phototransistor. Applications. Thermistors: structure, types, operation and applications.

TEE 1232 CAD FOR ELECTRONIC ENGINEERS

Graphical techniques for drawing circuit diagrams, logic circuits, flowcharts. Concepts of engineering drawings. Presentation of graphs. Design of artwork for printed circuit boards. Use of pictures and cartoons. Use of CIRCUIT MAKER PRO program for graphical design.

TEE 1231 SOFTWARE ENGINEERING

Software development life cycle. Requirements, specification, design implementation and testing, coding, maintenance. Function-oriented design methodologies. Documentation. Implementation strategies. Debugging, anti-bugging. Introduction to specifications, verification and validation. Elementary proof of correctness. Code and design reading. Structured walkthroughs. Testing strategies. Software reliability issues. Configuration Management. CASE tools. Programming languages. Compilers. The DotNet framework. Programming in C.

TEE 1202 ELECTRONIC ENGINEERING WORKSHOP

Measuring current-voltage characteristics for rectifying, Zener, light-emitting diode opto-electronic devices and thermistors. Diode rectifiers, clippers and clamps. Bipolar Junction Transistor (BJT) static characteristics in Common-Emitter, Common-Base and Common-Collector configuration. DC biasing methods. Darlington pair.

TEE 1214 DIGITAL ELECTRONICS

Numerical systems: Binary, Octal, Hexadecimal. System conversions. Mathematical operations in straight and BCD code. Logic gates. Truth tables, Boolean algebra theorems and K-maps. Minimization of logic expressions. Combinational logic applications and design: arithmetic circuits, encoders and decoders, code converters, multiplexers and de-multiplexers. Flip-Flops.

PART II

SMA 2116 ENGINEERING MATHEMATICS II

Multiple Integrals. Iterated integrals, change of order. Change of variable. Polar, cylindrical and spherical coordinates. Applications in three dimensions. Vector Calculus. Scalar and vector fields. Directional derivatives. Gradient, divergence and curl. Line and surface integrals. Theorems of Green, Gauss and Stokes. Fourier Analysis. Fourier Series. Half range series. Fourier integrals and transformations.

TEE 2142 ELECTRICAL MACHINES

Fields and magnetic circuits. Energy conversion phenomena. Three-phase theory. Transformers: principles, operation and construction. Special transformers. Principles, classification, characteristics and construction of synchronous, induction and dc machines. Single phase induction motors. Steady-state transient behaviour of machines.

TEE 2104 LABORATORY

This consists of number of experiments carried out in the laboratories to support the lecture materials of the semester.

TEE 2106 DESIGN AND PROJECT

Design of a circuit/system related to the current theoretical subjects. Literature review on a given topic, design, computer simulating and practical test. Writing a technical report.

TEE 2151 NETWORK THEORY

DC circuits analysis. First order circuits: The source free RC and RL circuits, step response of RC and RL circuits. Second order circuits: The source free series and parallel RLC circuits, step response of a series and parallel RLC circuit.

AC circuits analysis: Kirchoff's law in the frequency domain. Sinusoidal steady analysis. Frequency response. Series and parallel resonance. Filters. Transfer functions.

Advanced circuit analysis: Applications of Laplace Transform, Fourier series and Fourier Transform to circuit analysis.

Two-port networks: Impedance parameters, admittance parameters, hybrid parameters, transmission parameters, relationship between parameters, interconnection of networks.

TEE 2113 DIGITAL DEVICES AND SYSTEMS

Flip-Flops review. Master-slave Flip-Flops. Shift registers. Counters: asynchronous, with mod numbers $< 2^N$, synchronous, down counters, up/down counters, integrated circuits counters. Registers. Memory devices: magnetic memories, semiconductor memories: ROM, static and dynamic RAM. Applications.

TEE 2115 ANALOGUE ELECTRONICS I

Bipolar Junction Transistor (BJT) h-parameters and equivalent circuits. Single stage small-signal amplifiers analysis: Common Emitter (CE), Common Base (CB), Common Collector (CC). Multistage amplifiers. Coupling methods, frequency response, analysis and design. Differential amplifier, Darlington pair. Negative feedback amplifiers. Large signal amplifiers: class A, class B and class C. Circuits analysis and design.

TEE 2141 ELECTRICAL MEASUREMENTS

Basic electrical measuring devices, ammeters, voltmeters. Measurement of non-electrical parameters. Transducers and their operating principles. Signal conditioning. Oscilloscopes as measurement instruments. Recording measurement devices. Electronic measuring instruments, digital voltmeters, multimeters. Measurement of AC power.

SMA 2217 ENGINEERING MATHEMATICS III

Laplace Transforms. Definitions. Basic ideas. Applications to ordinary differential equations. Statistics. An introduction to Applied Statistics. Introduction to probability and distribution theory. Descriptive statistics/initial data exploration. Summary statistics, graphical presentation data. Point estimation/test of hypothesis. Interval Estimation. Analysis of Variance. Regression analysis.

TEE 2212 ELECTRONIC DRIVES

Power electronic devices: characteristics, drive requirements and device protection. Converters: DC-DC, DC-AC, AC-AC, AC-DC, and control techniques. Power and distortion factor. Special transformers. Application of AC and DC motors. Special motors. Motor control: variable speed drives, regenerative braking, slip energy recovery, four- quadrant operation. Selection and sizing of motor-drive systems. Transducers for power electronics applications.

TEE2204 LABORATORY

This consists of number of experiments carried out in the laboratories to support the lecture materials of the semester.

TEE 2255 THE PROFESSIONAL ENGINEER

Research techniques, project proposals, technical report writing and bibliography. General research survey on technological developments. Brief history of engineering. Engineering boards, ethics.

TEE 2206 DESIGN AND PROJECT

Design of a circuit/system related to the current theoretical subjects. Literature review on a given topic, design, computer simulating and practical test. Writing a technical report.

TEE 2233 OBJECT ORIENTED PROGRAMMING

Process-oriented software development: functions, pointers and arrays. Process-oriented analysis, design and implementation, and testing using C++. Data-oriented software development: structures, dynamic memory allocation, file handling, and relational database. Object-oriented software development: encapsulation, polymorphism and inheritance. Object-oriented analysis, design and implementation using C++ classes and objects. Structures.

TEE 2256 ELECTROMAGNETIC THEORY

Maxwell's equations. Laplace and Poisson equations and their solution. Boundary conditions. Plane waves in a perfect dielectric; propagation in imperfect dielectric. Propagation in imperfect conductors, skin effect. Generalized wave equation, field distributions in rectangular waveguide. Radiation field, dipoles, radiation resistance, impedance, mutual impedance, linear arrays.

TEE 2215 ANALOGUE ELECTRONICS II

FETs circuits. Optoelectronic devices and thermistor circuits. Positive feedback. Oscillators and Multivibrators. Sine-wave oscillators- Wien-bridge and R-C-shift types. Astable, Mono-stable and Bi-stable multivibrators. RF and crystal oscillators. Voltage regulators. Linear ICs basic building blocks.

PART III

SMA 3116 ENGINEERING MATHEMATICS IV

Differential Equations. Power series solutions. Singular points. Frobenius method. Special functions and their properties. Legendre polynomials, Bessel functions. Partial Differential Equations. Solution of the partial differential equations. Method of separation of variables. Numerical Methods. Errors, absolute and relative. The solution of nonlinear equations. The solution of linear systems. Interpolation and polynomial approximation. Curve fitting. Numerical differentiation and integration. Approximate solution of differential equations.

TEE 3151 DIGITAL SIGNAL PROCESSING

Analysis of continuous and discrete signals and systems. Fourier series and transforms. Laplace transforms, Z transforms, transfer functions, analysis of stability, probabilistic convolution, impulse response and transfer functions.

TEE 3104 LABORATORY

This consists of number of experiments carried out in the laboratories to support the lecture materials of the semester

TEE 3113 LINEAR INTEGRATED CIRCUITS

Operational amplifier circuits: comparators, inverting and non-inverting amplifiers, mathematical operations, oscillators and multivibrators, active filters. Voltage regulators. Timer ICs and their applications. Instrumentation amplifiers. Analogue-to-Digital converters and Digital-to-Analog converters.

TEE 3122 COMMUNICATION ENGINEERING I

Introduction to communication systems. Telecommunication signals. Analogue cellular systems. Amplitude modulation. Angle modulation. Multiplexing methods. Noise in communication systems.

TEE 3133 SOFTWARE ENGINEERING APPLICATIONS

Databases. Data-oriented software development and implementation using SQL. Web development. Java programming.

TEE 3106 DESIGN AND PROJECT

Design of a circuit/system related to the current theoretical subjects. Literature review on a given topic, design, computer simulating and practical test. Writing a technical report.

TEE 3112 MICROPROCESSORS

Basic concepts of microprocessors. Architecture and Operation. Instruction sets and assembly language programming. Subroutine, interrupts, I/O. Applications of microprocessors.

TEE3241 CONTROL ENGINEERING

Examples of controlled processes, objectives and terminology, open and closed-loop controllers. Modeling by transfer functions; Simple servomechanisms; derivation of transfer functions from specifications. Time and frequency–response specifications. Direct analysis and design; stability, Routh criterion. The ITAE and other performance criteria. Examples of servo design. Frequency-response analysis and design. Root-locus methods; system analysis and design.

TEE 3232 EMBEDDED COMPUTER SYSTEMS

Applications of embedded systems. Microcontrollers: memory maps, programming languages, I/O, timers, interrupts, hardware interfacing. Picocontrollers: memory maps, SFRs, stacks, programming languages, oscillator types, configuration fuses, watchdog timers, code protection.

TEE 3204 LABORATORY

This consists of number of experiments carried out in the laboratories to support the lecture materials of the semester

TEE 3222 COMMUNICATION ENGINEERING II

Introduction to digital communication systems. Digital modulation and demodulation. Digital transmission and multiplexing. Digital cellular systems.

TEE 3206 DESIGN AND PROJECT

Design of a circuit/system related to the current theoretical subjects. Literature review on a given topic, design, computer simulating and practical test. Writing a technical report.

TEE 3231 COMPUTER ARCHITECTURE AND OPERATING SYSTEMS

Evolution of computers hardware for Von Neumann machines. Operating systems for single tasking. Process scheduling for concurrent operation. Inter-process communication. Deadlock avoidance. Memory management. Virtual memory. Architectures for parallel processing. Computer networking.

TEE 3255 ENGINEERING MANAGEMENT

Based on “Management by Engineers” by D. Johnson through group discussion and talks by external speakers. Centred on industrial organizations; reviews and performance measures, planning and managing change, development and motivating groups, leaderships and communication; financial management; business environment; companies; basic accounts.

PART IV

TEE 4000 INDUSTRIAL ATTACHMENT

Familiarization with actual plan organization and operations, training in practical engineering work for graduate engineers, exposure to as many of the following as possible; industrial management, plant maintenance, design and development, service/field engineering; working with planning, manufacturing, production and marketing departments, industrial research.

PART V

TEE 5003 HONOURS PROJECT

Selection of a problem, research, planning of possible solutions, selection of an optimal solution, acquisition of components, testing, construction of a prototype, writing of the final report.

TEE 5122 COMMUNICATION SYSTEMS PERFORMANCE

The concept of noise characterization and receiver performance. Overview of contemporary communication systems link budget. Random processes and spectral analysis: linear systems; the Gaussian random process; error probabilities for binary signaling; performance of baseband binary systems detection of band-pass binary signals.

TEE 5142 MODERN CONTROL ENGINEERING

State Space Analysis: State-space methods of analysis and design. Observability and controllability. Pole placement for the optimization response. State observers and pole placement design with state observers. Multi-input, multi-output systems and cross-coupling problems. Digital Control: Digital time control systems. Modeling of Sampled Processes. Transient response. Steady state response. Stability. Design of Digital Controllers. Root Locus.

TEE 5155 PROJECT MANAGEMENT

Project proposal writing- types of proposals; Project definition, life cycle, and systems approach; Project scoping, work definition, and work breakdown structure (WBS); Project time estimation and scheduling using GANTT, PERT and CPM. Project costing, budgeting, and financial appraisal; Project control and management, using standard tools of cost and schedule variance analysis; project management use-case through practical, example projects; use of computers in project management, some software tools for PM e.g. MSProject; PM techniques e.g. PRINCE2.

TEE 5223 MOBILE COMMUNICATION SYSTEMS

Introduction to mobile communications. Global System for Mobile communications (GSM) General Packet Radio System (GPRS). The Universal Mobile Telecommunications System (UMTS). Long term Evolution (LTE). IEEE 802.16 and WIMAX.

TEE 5233 HIGH SPEED NETWORKS

A comprehensive view of high-speed LAN, MAN, and ATM technologies and standards. Evolution towards broadband integrated services digital network (B-ISDN).

TEE 5212 POWER ELECTRONICS APPLICATIONS

Review of power electronic devices: ratings, performance and applications. Switch mode DC-DC and DC-AC converters. Control techniques: square wave and PWM outputs. Implementation: hardware, software, implementation problems. Harmonics and interference: EMI reduction, regulation, regulations, filtering. Resonant-mode converters: zero-current and zero-voltage. Switch mode and interruptible power supplies. Static var. compensators, HVDC transmission. Special transformers for switched power applications. Variable speed drivers, control schemes and performance.

TEE 5222 RF AND MICROWAVE DEVICES AND CIRCUITS

Oscillators: Magnetrons, Gunn and Impatt diodes, Other group III-V semiconductor devices. Amplifiers: Bipolar Junction Transistors and GaAs. FET amplifiers, low noise broadband and power amplifier design. Mixers: the mixing process, noise and noise figure measurement, single ended, single balanced and double balanced mixers. Control Devices: P.I.N. diode modulators, switches and phase shifters.

TEE 5241 INDUSTRIAL CONTROL

Industrial control situations, process control; instrumentation, actuators, transducers and controllers; hybrid systems; time-domain analysis, state-space analysis, stability; computer control; system characterization, algorithm design, feedback control for digital systems, PLC applications.

TEE 5234 ADVANCED SOFTWARE ENGINEERING

Software Measurement & Testing; Software Design & Architecture, Computational Models: UML and MVC modeling, Access Control & Privacy Policies, Agents & Multi-Agent Systems, Data Structures and their Implementation in C++ or Java, Database Technology, Parallel & Distributed Systems, Software Engineering of Internet Applications