Course Description of
Mechatronics Engineering (EME)
B. SC. Program.

(EME) First Year

First Term:

MAT 121 Mathematics III. 3Cr. 4-2-0 Hrs/wk

PHY 121 Modern Physics. 3Cr. 4-1-1 Hrs/wk.

ECE 131 Electric Circuits I. 4Cr. 4-1-2 Hrs/wk.

ECE 133 Measuring Instruments and Electronic Transducers. 3Cr. 3-0-1 Hrs/wk.
Introduction to measurements and measuring instruments and systems. Bridges. Cathode ray oscilloscope and applications. Introduction to data acquisition systems. Electronic transducers for measuring temperature, force, displacement, sound, light, and ionic potential.

CE 101 Structured Programming and Data Structures. 4Cr. 4-1-1 Hrs/wk.

GNS 101 Technical Report Writing. 1Cr. 1-0-0 Hrs/wk.
Technical terms and abbreviations. Translation. Formats and methods of writing: reports, bids, CV, correspondence. etc.
**Second Term:**

**MAT 132 Mathematics IV. 3Cr. 4-2-0 Hrs/wk**

**ECE 132 Electric Circuits II. 4Cr. 4-1-1 Hrs/wk.**

**ECE 142 Basic Electronics. 4Cr. 4-1-2 Hrs/wk.**
Fundamental physics of semiconductor devices. Various circuit models of diodes, bipolar junction and field effect transistors. Basic amplifier design. DC biasing and small signal analysis.

**EME 132 Electric Energy Sources and Applications. 2Cr. 2-0-1 Hrs/wk.**
Conventional and unconventional energy sources. Electric energy storage systems (e.g. batteries). Solar energy and applications. Wind energy and applications. Transmission of electric energy. Electric energy utilization. Lighting systems. Lamps, characteristics and applications.

**CE 112 Fundamentals of Logic Design. 4Cr. 4-1-2 Hrs/wk.**

**GNS 102 Word Processing. 1Cr. 0-0-1 Hrs/wk.**
Use of a software for word processing. Writing of texts and mathematical equations. Graphic representation. Tables.
First Term:

MAT 241 Special Functions and Integral Transforms. 3Cr. 4-20 Hrs/wk.

EME 231 Electromechanical Energy Conversion I. 3Cr. 3-1-1 Hrs/wk.
Electromagnetic forces and torque, magnetic circuits and transformers, DC machines, three-phase AC synchronous and induction machines.

ECE 243 Digital Electronics. 3Cr. 3-1-1 Hrs/wk.
Logic gate families, memory devices, PLA, buffers, three state devices. A/D and D/A converters.

ECE 241 Electronic Circuits. 4Cr. 4-2-2 Hrs/wk.

ECE 261 Electromagnetic Fields and waves I. 4Cr. 4-1-0 Hrs/wk.

EN211 Engineering Problems of the Environment I. 1Cr. 1-0-0 Hrs/wk.
An introduction to the engineering design of measures to limit impacts on the environment. Global and local cycles in the hydrosphere, atmosphere, and biosphere, energy and materials balance in environmental problems, source control of pollutants. The process of establishing environmental goals is discussed.
Second Term:

MAT 252 Introduction to probability and statistics. 3Cr. 3-2-0 Hrs/wk.

EME 232 Electric power Engineering. 4Cr. 4-2-0 Hrs/wk.

EME 262 Engineering Materials. 3Cr. 4-1-1 Hrs/wk.
Bonding in solids, crystal systems; classification of metals, semiconductors, and insulators; defects in crystals, defect analysis in engineering materials, relationship to physical and mechanical properties, measurement of mechanical and physical properties, materials characterization.

CE 212 Digital System Design. 4Cr. 4-2-2 Hrs/wk.
Multifunction minimization of combinational circuits, formal and informal methods. MSI and LSI logic design. Synchronous sequential circuits. Control unit. Asynchronous sequential circuits.

CIE 202 Civil Engineering. 3Cr. 3-1-0 Hrs/wk.
Analysis of statically determinate beams, rigid frames and trusses. Design and analysis of metallic and nonmetallic structures, including reinforced concrete.

EN 212 Engineering Problems of the Environment II. 1 Cr. 1-0-0 Hrs/wk.
Continuation of EN 211.
First Term:

**MAT 361 Numerical Methods. 3Cr. 3-1-1 Hrs/wk.**

**EME 331 Electromechanical Energy Conversion II. 4Cr. 4-1-2 Hrs/wk.**

**EME 311 Thermodynamics. 3Cr. 3-1-1Hrs/wk.**
Definitions, microscopic and macroscopic points of view. Properties of pure substances and equations of state. Work and heat. The first and second law of thermodynamics and their applications, reversibility and irreversibility, the thermodynamic temperature scale, entropy, availability, second law analysis, power and refrigeration cycles and their engineering applications.

**ECE 357 Communication Theory and Systems. 3Cr. 4-1-1 Hrs/wk.**
Spectral analysis. Linear modulation techniques: AM, DSB, SSB, VSB. Exponential modulation techniques: FM, PM. Analog pulse modulation: PAM,PPM, PWM, PCM, delta modulation. Digital modulation techniques: ASK, PSK, FSK. Examples of communication systems.

**CE 311 Introduction to Microprocessors. 4Cr. 4-1-1Hrs/wk.**

**EM 311 Operations Research and Industrial Planning. 1Cr. 1-0-0 Hrs/wk.**
Theory and computation of optimal selection of decisions under certainty. Linear programming. Introduction to the design, scheduling, and control of production of production systems.
**Second Term:**

**EME 312 Fluid Mechanics. 4Cr. 4-1-1Hrs/wk.**

**EME 314 Heat Transfer. 3Cr. 3-1-1Hrs/wk.**

**EME 342 Power Electronics. 4Cr. 4-1-2Hrs/wk.**
Power devices, rectifier circuits, inverter circuits, uninterruptible power supplies, motor speed control. Programmable logic controllers.

**CE 312 Microprocessor Interfacing. 3Cr. 4-1-1 Hrs/wk.**
Microprocessor architecture. Architecture and design of microprocessor based systems. Principles of hardware and software interfacing. I/O techniques: polling, interrupt, DMA, daisy-chaining. Applications: interfacing to instruments, data acquisition systems. Other examples selected from several disciplines.

**EM 322 Introduction to Marketing 1Cr. 1-0-0hrs/wk.**
Study of the nature and scope of marketing. Market segmentation and marketing mix. Marketing research and marketing information systems.

*Elective (1)*

**ECE 344 Integrated Circuits. 3Cr. 3-1-1-Hrs/wk.**
Introduction to integrated circuits technology. Analogue integrated circuits: difference amplifier, practical considerations of operational amplifiers, linear and nonlinear applications of operational amplifiers, comparators, analog switches, the 555 timer, phase locked loops. Digital integrated circuits: large signal models for bipolar and MOS transistors, bipolar and MOS inverters and gates, propagation delay and noise margins, latches and flip. Flops, memories, A/D and D/A converters.

*Or*

**EME 302 Engineering vibrations. 3Cr. 3-1-1Hrs/wk.**
Linear single-degree-of-freedom systems, transient and steady forced vibration. Linear undamped multi-degree-of-freedom systems.
First Term:

**EME 401 Mechanics of Machines. 4Cr. 4-2-0Hrs/wk.**

**EME 451 Computer Control of Manufacturing systems. 3Cr. 4-1-1Hrs/wk.**
Basic elements of numerical control of metal processing systems, programming languages for point to point and contouring machines, interaction between geometry and machine-ability decisions. Computerized numerical control, adaptive control, industrial robots, flexible manufacturing systems. Examples of machinery processes such as laser beam machinery, electric discharge machining, plasma arc machining, etc., will be discussed.

**ECE 481 Control System Theory and Design. 3Cr. 3-1-1Hrs/wk.**

**EM 431 Engineering Economy. 2Cr. 2-0-0Hrs/wk.**
Economic decision process in the design and implementation of real engineering projects. Topics covered are: investment choice, general accounting principles including balance sheets and income statements; equivalence; interest and financial mathematics; present and annual worth, the benefit/cost ratio, and the internal rate of return; multiple alternatives; income tax effects on depreciation; inflation, loans, risk analysis and the cost of capital; and retirement and placement analysis.

**EME 491 Project I. 3Cr. 2-0-4Hrs./wk.**
Supervised projects in small groups of students aimed at providing practical experience in some aspects of car electronic system, microprocessor controlled mechanical and electrical systems, computer aided manufacturing, robotics. This is accomplished through lectures, discussions, field visits, and individual design.

**Elective(2)**

**CE 411 Application of Real Time Computer Systems. 3Cr. 3-1-1Hrs./wk.**
Principles of application of real time computer systems to engineering problems. Topics include: computer characteristics needed for real time use, mini/micro computer operating systems, man-computer communication, basic digital logic design, analog signal processing and conversion, and inter-computer communication. Topics investigated via laboratory using a microprocessor system.

*Or*

**EME 403 Dynamic System Analysis. 3Cr. 3-1-1Hrs/wk.**
Modeling and analysis of mechanical, electrical, electromechanical, thermal, and hydraulic systems. Simulation diagrams. Stability analysis.
**Second Term:**

**EME 412 Refrigeration and Air Conditioning. 3Cr. 4-1-1Hrs/wk.**

**EME 454 Introduction to Robotics. 4Cr. 4-1-1Hrs./wk.**
Introduction to the theory and practice of robots. Coverage will be predominantly of stationary robots in industrial settings. Industrial applications, coordinate systems, spatial transformation. Kinematics, dynamics, position and force control, system organization and architecture, robot teaching systems.

**EME 422 Automotive Engineering. 3Cr. 4-0-1Hrs./wk.**

**EM 442 Engineering Management. 2Cr. 2-0-0Hrs/wk.**
Basic management models used to optimize operation systems. Discrete and continuous-time markov chains and their application in modeling queues, inventories and production process behavior.

**EME 492 Project II. 3Cr. 2-0-4Hrs/wk.**
Continuation of EME 491.

*Elective (3)*

**EME 452 Design of Microprocessor-Based Mechanical System. 3Cr. 3-1-1Hrs/wk.**
This course provides preparation for the conceptual design and prototyping of mechanical systems that use microprocessors to control machine activities, acquire and analyze data, and interact with operators. The architecture of microprocessors is related to problems in mechanical systems through study of systems, including electromechanical components, thermal components, and a variety of instruments. Laboratory exercises lead through studies of different levels of software, including machine.

*Or*

**ECE 482 Digital Control. 3Cr. 3-1-1Hrs./wk.**