Mechatronics and Robotics Engineering

Graduation Requirements

In the Mechatronics and Robotics Engineering Department, Students must complete a minimum of 177 credits satisfactorily. These include 14 credits required by the university, 34 credits required by the college of engineering and 129 credits required by the Department of Mechatronics and Robotics Engineering.

INTRODUCTION

Mechatronics is rapidly emerging field that combines mechanical, electrical, and computer engineering. Mechatronic system uses the abilities of computer or microprocessor based automatic control to enhance the operation of mechanical systems. Mechatronics is often associated with robotic systems and applications ranging from automobiles to electric toothbrushes. As more and more industries are expanding their implementations of mechatronic systems, there is an increasing demand for engineers with multidisciplinary experience to design, work and analyze these types of systems.

EDUCATIONAL OBJECTIVES

After a successful completion of the Mechatronics Engineering program the graduates should be able to:

1. Apply and efficiently use knowledge and skills in the field of mechanical, electrical, electronic and IT to solve mechatronics engineering problems.

2. Cooperatively participate in teams for designing, manufacturing and integrating the components of different natures to build, test and operate mechatronic products.

3. Troubleshoot and propose the necessary solutions to solve the problems of any operating mechatronics system.

4. Analyze the whole lifecycle of a product and propose the necessary procedures and measures to reach enhanced performance and quality, improved cost-to-benefit ratio and better dependability.

5. Plan and implement a small-scale project either individually or in teamwork especially in the production of new mechatronic product or to develop an old product (This point includes marketing, design, manufacturing, and after purchase services).

6. Communicate effectively with individuals, groups and large-scale enterprises through the efficient use of languages, reporting, and advanced communication means.

7. Recognize of the environmental issues and local and international regulations and supervise depollution programs adopted by the industrial plants.

8. Recognize the contemporary engineering issues and ethical responsibilities.

9. Engage in self- and life-long learning.

10. Participate in the identification and solution of problems facing the society and consider the impacts of engineering solutions on it.

11. Participate in research and development (R&D) programs in mechatronics engineering institutions and industry.

MECHATRONICS & ROBOTICS ENGINEERING DEPARTMENT COURSES

1. COMPULSORY COURSES (120 CREDITS):

Course Code	Course Title	Credit Hours	Prerequisite
BS101	Mathematics 3	3	BS001
BS102	Mathematics 4	3	BS101
BS104M	Numerical Analysis (ME)	3	BS002
BS105M	Computer Applications in Engineering (ME)	2	9 CR.HR
EE101	Electronic Engineering I	3	BS004
EE102	Electronic Engineering II	3	EE101
EE103	Basics of Electrical Circuit I	3	BS004
EE104	Basics of Electrical Circuit II	3	EE103
EE108	Logic Circuit	2	9 CR.HR
EE203	Electronic Engineering III	3	EE102
EE209	Engineering Measurements	3	EE104
EE211	Automatic Control Systems	3	BS101
EE212	Motion Control and Servos	3	EE211
EE217	Power Electronic and Drive Systems	3	EE222
EE220	Sensor Technology and Applications	3	EE209
EE222	Electric Machinery	3	EE104
EE314	Embedded Systems	3	110 CR.HR
EE412	Digital Signal Processing (ME)	3	BS101
EE415	Programmable Logic Control (PLC)	3	EE209
ME101	Thermodynamics	3	BS003
ME102	Fluid Mechanics	3	BS003
ME103	Production Engineering	2	ME002
ME104	Engineering Materials	2	9 CR.HR
ME105	Mechanical Engineering Drawing	2	BS006,BS010
ME201	Stress Analysis	3	BS007
ME202	Machine Design I	3	ME201
ME203	Pollution Control	2	18 CRHR
ME204	Hydraulic & Pneumatic Components and Systems	3	ME102
ME301	Quality Control and Metrology	3	ME103,EE209
ME302	Computer Controlled Experimentation	2	EE209, EE211
ME303	Heat Transfer	3	ME101,ME102
ME304	Mechanical Vibrations	3	BS008
ME305	Machine Design II	3	ME202
ME307	Theory of Machines	3	BS008
ME401	Computer Aided Design	3	ME305
ME402	Mechanical Systems Laboratory	3	130 CR.HR
ME403	Design of Mechatronic Systems	3	EE314,ME202
ME404	Robotics	3	120 CR.HR
ME405	Modeling and Simulation	3	130 CR.HR
ME407	Computer Aided Manufacturing	2	ME103,ME105
ME490	Senior Seminar	2	110 CR.HR
ME499 I	Graduation Project I	3	126 CR.HR
ME499 II	Graduation Project II	3	ME499 I

2. Elective Courses (9 Credits)

Prerequisite: senior standing
Students at the senior standing must complete 9 credits from the following electives:

Course Code	Course Title	Credit Hours	Prerequisite
ME340	Fundamentals of Combustion Technology	3	120 CR.HR
ME341	Maintenance	3	110 CR. HR
ME440	Power Stations	3	110 CR. HR
ME441	Turbo Machinery	3	ME101, ME102
ME442	Renewable Energy	3	ME101
ME443	Fluid Machinery	3	ME102
ME444	Industrial Management	3	110 CR. HR
ME445	SCADA	3	120 CR. HR.
ME446	Robots and Material Handling	3	ME305
ME447	Hydraulic and Pneumatic Control	3	120 CR. HR
ME448	Artificial Intelligence	3	120 CR. HR
ME450	Automotive Computer Controlled systems	3	110 CR. HR
ME451	Reverse Engineering	3	110 CR. HR.
ME452	Biomechatronics	3	ME403
ME453	Introduction to MEMS	3	110 CR. HR.
EE454	Introduction to Nanoelectronics	3	EE203
ME455	Image Processing and Computer Vision	3	EE412
ME456	Introduction to Field and Service Robotics	3	110 CR. HR.

3. Comparison of the program curricula with the NARS and Requirements of the Engineering Sector Committee

	Subject Area							Total Credit Hours
	Hum. & Soc. Sc.	Math. & B. Sc.	B. Eng. Sc.	App. Eng. & Des.	Comp. App. & ICT	Proj. & Practice	Discretionary	
Total Credit Hours	**18**	**37**	**40**	**37**	**16**	**17**	**12**	**177**
Percentage	**10.2%**	**20.9%**	**22.6%**	**20.9%**	**9%**	**9.6%**	**6.8%**	**100**
NARS Engineering Requirements	**9-12 %**	**20-26 %**	**20-23 %**	**20-22 %**	**9-11 %**	**8-10 %**	**6-8 %**	

MECHATRONICS & ROBOTICS ENGINEERING PROGRAM
FRESHMAN

- **Semester 3**

Course Code	Course Title	Credit Hours	LT	TU	LB	Contact Hours
BS101	Mathematics 3	3	2	2	-	4
EE101	Electronic Engineering I	3	2	2	1	5
EE103	Basics of Electrical Circuits I	3	2	2	1	5
HM101	Technical Writing	2	2	-	-	2
ME101	Thermodynamics	3	2	2	1	5
ME103	Production Engineering	2	2	1	-	3
ME105	Mechanical Engineering Drawing	2	1	-	3	4
Total		**18**	**13**	**9**	**6**	**28**

- **Semester 4**

Course Code	Course Title	Credit Hours	LT	TU	LB	Contact Hours
BS102	Mathematics 4	3	2	2	-	4
EE102	Electronic Engineering II	3	2	2	1	5
EN101	Technical Training I	-	-	-	-	-
HM102	Scientific Thinking	2	2	-	-	2
ME102	Fluid Mechanics	3	2	2	1	5
ME104	Engineering Materials	2	2	1	-	3
EE104	Basics of Electrical Circuits II	3	2	2	1	5
EE108	Logic Circuit	2	2	1	1	4
Total		**18**	**14**	**10**	**6**	**28**

MECHATRONICS & ROBOTICS ENGINEERING PROGRAM
SOPHOMORE

- **Semester 5**

Course Code	Course Title	Credit Hours	LT	TU	LB	Contact Hours
EE222	Electric Machinery	3	2	1	2	5
BS104 M	Numerical Analysis (ME)	3	2	2	-	4
EE203	Electronic Engineering III	3	2	2	1	5
EE209	Engineering Measurements	3	2	2	1	5
ME201	Stress Analysis	3	2	2	1	5
ME303	Heat Transfer	3	2	2	1	5
Total		**18**	**12**	**11**	**6**	**29**

- **Semester 6**

Course Code	Course Title	Credit Hours	LT	TU	LB	Contact Hours
ME202	Machine Design I	3	2	2	-	4
BS108	Probability and Statistics in Engineering	2	2	1	-	3
ME203	Pollution Control	2	2	-	-	2
EE220	Sensor Technology and Applications	3	2	1	1	4
EE217	Power Electronic and Drive Systems	3	2	1	2	5
EN201	Technical Training II	-	-	-	-	-
ME204	Hydraulic and Pneumatic Components and Systems	3	2	1	2	5
BS105 M	Computer Application in Engineering (ME)	2	1	-	2	3
Total		**18**	**13**	**6**	**7**	**26**

MECHATRONICS & ROBOTICS ENGINEERING PROGRAM
JUNIOR

- **Semester 7**

Course Code	Course Title	Credit Hours	LT	TU	LB	Contact Hours
EE211	Automatic Control Systems	3	2	2	1	5
HM	Elective	2	2	-	-	2
ME301	Quality Control and Metrology	3	2	1	2	5
ME305	Machine Design II	3	2	2	-	4
ME307	Theory of Machines	3	2	2	-	4
HM202	Engineering Economics and Management	2	2	1	-	3
Total		**16**	**12**	**8**	**3**	**23**

- **Semester 8**

Course Code	Course Title	Credit Hours	LT	TU	LB	Contact Hours
EE212	Motion Control and Servos	3	2	2	1	5
EE314	Embedded Systems	3	2	2	1	5
ME	Elective	3	2	2	-	4
EN301	Technical Training III	-	-	-	-	-
HM	Elective	2	2	-	-	2
ME304	Mechanical Vibrations	3	2	2	-	4
ME407	Computer Aided Manufacturing	2	1	2	2	5
ME490	Senior Seminar	2	1	2	-	3
Total		**18**	**12**	**12**	**4**	**28**

MECHATRONICS & ROBOTICS ENGINEERING PROGRAM
SENIOR

- **Semester 9**

Course Code	Course Title	Credit Hours	LT	TU	LB	Contact Hours
ME302	Computer Controlled Experimentation	2	1	-	3	4
EE415	Programmable Logic Controller	3	2	1	1	4
ME403	Design of Mechatronic Systems	3	2	2	1	5
ME401	Computer Aided Design	3	2	-	3	5
ME404	Robotics	3	1	2	2	5
ME499	Graduation Project I	3	2	1	2	5
Total		**17**	**10**	**6**	**12**	**28**

- **Semester 10**

Course Code	Course Title	Credit Hours	LT	TU	LB	Contact Hours
EE412	Digital Signal Processing (ME)	3	2	2	-	4
ME405	Modeling and Simulation	3	2	1	2	5
ME	Elective	3	2	2	-	4
ME402	Mechanical Systems Laboratory	3	1	-	4	5
ME	Elective	3	2	2	-	4
ME499 II	Graduation Project II	3	2	1	2	5
Total		**18**	**11**	**8**	**8**	**27**

MECHATRONICS & ROBOTICS ENGINEERING PROGRAM

Code	Course Title	CR	LT	TU	LB	CT	Code	Course Title	CR	LT	TU	LB	CT
Preparatory	**Semester 1**							**Semester 2**					
BS001	Mathematics 1	3	2	2	-	4	BS002	Mathematics 2	3	2	2	-	4
BS003	Physics 1	3	2	1	1	4	BS004	Physics 2	3	2	1	1	4
BS007	Engineering Mechanics 1	3	2	2	-	4	BS006	Computer Aided Drawing	1	-	-	2	2
BS009	Engineering Drawing 1	2	1	2	-	3	BS008	Engineering Mechanics 2	3	2	2	-	4
HM001	Russian Language 1	1	-	2	-	2	BS010	Engineering Drawing 2	2	1	2	-	3
HM003	English Language 1	1	-	2	-	2	HM002	Russian Language 2	2	1	2	-	3
BS005	Chemistry	3	2	1	1	4	HM004	English Language 2	2	1	2	-	3
HM005	Introduction to Engineering	2	2	-	-	2	ME002	Production Technology	2	1	1	1	3
Total		**18**	**11**	**12**	**2**	**25**	**Total**		**18**	**10**	**12**	**4**	**26**
Freshman	**Semester 3**							**Semester 4**					
BS101	Mathematics 3	3	2	2	-	4	BS102	Mathematics 4	3	2	2	-	4
EE101	Electronic Engineering I	3	2	2	1	5	EE102	Electronic Engineering II	3	2	2	1	5
EE103	Basics of Electrical Circuits I	3	2	2	1	5	EN101	Technical Training I	-	-	-	-	-
HM101	Technical Writing	2	2	-	-	2	HM102	Scientific Thinking	2	2	-	-	2
ME101	Thermodynamics	3	2	2	1	5	ME102	Fluid Mechanics	3	2	2	1	5
ME103	Production Engineering	2	2	1	-	3	ME104	Engineering Materials	2	2	1	-	3
ME105	Mechanical Engineering Drawing	2	1	-	3	4	EE104	Basics of Electrical Circuits II	3	2	2	1	5
							EE108	Logic Circuit	2	2	1	1	4
Total		**18**	**13**	**9**	**6**	**28**	**Total**		**18**	**14**	**9**	**5**	**28**
Sophomore	**Semester 5**							**Semester 6**					
EE222	Electric Machinery	3	2	1	2	5	ME202	Machine Design I	3	2	2	-	4
BS104 M	Numerical Analysis (ME)	3	2	2	-	4	BS108	Probability and Statistics in Engineering	2	2	1	-	3
EE203	Electronic Engineering III	3	2	2	1	5	ME203	Pollution Control	2	2	-	-	2
EE209	Engineering Measurements	3	2	2	1	5	EE220	Sensor Technology and Applications	3	2	1	1	4
ME201	Stress Analysis	3	2	2	1	5	EE217	Power Electronic and Drive Systems	3	2	1	2	5
ME303	Heat Transfer	3	2	2	1	5	EN201	Technical Training II	-	-	-	-	-
							ME204	Hydraulic and Pneumatic Components and Systems	3	2	1	2	5
							BS105 M	Computer Application in Engineering (ME)	2	1	-	2	3
Total		**18**	**12**	**11**	**6**	**29**	**Total**		**18**	**13**	**6**	**7**	**26**
Junior	**Semester 7**							**Semester 8**					
EE211	Automatic Control Systems	3	2	2	1	5	EE212	Motion Control and Servos	3	2	2	1	5
HM	Elective	2	2	-	-	2	EE314	Embedded Systems	3	2	2	1	5
ME301	Quality Control and Metrology	3	2	1	2	5	ME	Elective	3	2	2	-	4
ME305	Machine Design II	3	2	2	-	4	EN301	Technical Training III	-	-	-	-	-
ME307	Theory of Machines	3	2	2	-	4	HM	Elective	2	2	-	-	2
HM202	Engineering Economics and Management	2	2	1	-	3	ME304	Mechanical Vibrations	3	2	2	-	4
							ME407	Computer Aided Manufacturing	2	1	2	2	5
							ME490	Senior Seminar	2	1	2	-	3
Total		**16**	**12**	**8**	**3**	**23**	**Total**		**18**	**12**	**12**	**4**	**28**
Senior	**Semester 9**							**Semester 10**					
ME302	Computer Controlled Experimentation	2	1	-	3	4	EE412	Digital Signal Processing (ME)	3	2	2	-	4
EE415	Programmable Logic Controller	3	2	1	1	4	ME405	Modeling and Simulation	3	2	1	2	5
ME403	Design of Mechatronic Systems	3	2	2	1	5	ME	Elective	3	2	2	-	4
ME401	Computer Aided Design	3	2	-	3	5	ME	Elective	3	2	2	-	4
ME404	Robotics	3	1	2	2	5	ME402	Mechanical Systems Laboratory	3	1	-	4	5
ME499I	Graduation Project I	3	2	1	2	5	ME499II	Graduation Project II	3	2	1	2	5
Total		**17**	**10**	**6**	**12**	**28**	**Total**		**18**	**11**	**8**	**8**	**27**

MECHATRONICS & ROBOTICS ENGINEERING
COURSE DESCRIPTION

1. MATHEMATICS 3

Code	Credit Hours	LT	TU	LB	Prerequisites
BS101	3	2	2	-	BS001

Ordinary different equations of the first order separable homogenous, exact and linear – Bernoulli - higher order linear equations - operator D - Initial value problem - vibrations: Transient and steady state solutions - Resonance - Laplace transform - Basic properties - Shift theorems - Dirac delta - Sign-functions - Solving differential equations by using Laplace Fourier series - Expansion for a general period - Sine and cosine half range expansions - Fourier complex exponential series - Fourier Integral - Fourier Transformations.

2. MATHEMATICS 4

Code	Credit Hours	LT	TU	LB	Prerequisites
BS102	3	2	2	-	BS101

Vector Fields, Divergence theorem, stokes theorem, Green's theorem, Independence of path. Functions of a complex variable, Cauchy-Riemann Equations, canton integrals, Cauchy theorem, Cauchy integral formulas, and Residue theorem.

3. NUMERICAL ANALYSIS (ME)

Code	Credit Hours	LT	TU	LB	Prerequisites
BS104 M	3	2	2	-	BS002

Errors – Numerical solution of nonlinear equations – Numerical solution of linear systems – Numerical differentiation and integration – Numerical solution of differential equations – Computer programming for numerical solutions.

4. COMPUTER APPLICATION IN ENGINEERING (ME)

Code	Credit Hours	LT	TU	LB	Prerequisites
BS105 M	2	1	-	2	-

Introduction: Generation and classification of computers, Basic organization of a computer. Programming basics: Introduction to 'C' programming – Fundamentals – Structure of a 'C' program – Compilation and linking processes – Constants, Variables – Data types – Looping statements – Solving simple scientific and statistical problems. Arrays and strings: Arrays – initialization – Declaration – One dimensional and two dimensional arrays.

5. ELECTRONIC ENGINEERING I

Code	Credit Hours	LT	TU	LB	Prerequisites
EE101	3	2	2	1	**BS004**

Introduction - Structure of atom, Conductors, Insulators and Semiconductor. Conductivity and number of charge carries. Band energy level and energy gap. Intrinsic semiconductors and doping. P and N type PN junction. Diode characteristics. Application of diode (different types of rectifiers, diode clipper, diode clamp, diode in logic circuits, voltage doubler). Two terminal devices (zener, tunnel, varicap, photo, light emitting diodes, varistors, thermistors , liquid crystal display, photo cells). Bipolar transistor (common base ,common emitter and common collector). Biasing and stabilization.

- Experiments on diode and transistor.

6. Electronics Engineering II

Code	Credit Hours	LT	TU	LB	Prerequisites
EE102	3	2	2	1	EE101

Transistors: circuit modeling, frequency response of transistors, transistor in multi-stage amplifiers. Field Effect Transistor (FET). Transistors in feedback amplifiers: modeling, analysis and characteristics, the amplifier response and stability. Operational amplifiers: analysis and characteristics, applications (active filters, logarithmic and exponential, converters, etc.). Technological basics of integrated circuits. Introduction to analog microcircuits. Introduction to digital microcircuits. Optic-electronic devices. Application with mini project.

- Experiments on FET and Op-Amp.

7. Basics of Electrical Circuits I

Code	Credit Hours	LT	TU	LB	Prerequisites
EE103	3	2	2	1	BS004

Element of electric circuit, sources in electric circuits (voltage sources, current sources, dependant & independent sources).

- D.C circuits, circuit theories (Kirchhoff's laws), Thevenin's theorem, Norton, Mesh and loop analysis. Max power transfer theorem) compensation theorem, super position theorem.
- A.C circuits, inductance, capacitance vector diagram power in A.C circuits. Single phase and three phase supply.

-Experiments for verify circuit theories.

8. Basics of Electrical Circuits II

Code	Credit Hours	LT	TU	LB	Prerequisites
EE104	3	2	2	1	EE103

Quadruple theory and circuits with distributed parameters theory. Inductances, and capacitors, first order circuits, second order circuits, Sinusoids and phasors, Three Phase circuits, magnetically coupled. Application with mini project.

-Experiments on AC circuits

9. Logic Circuit

Code	Credit Hours	LT	TU	LB	Prerequisites
EE108	2	2	1	1	**9 CR.HR**

Number systems: binary, octal, and hexadecimal. Binary mathematics: Gray code, BCD. Logic gates (OR, AND, NOT, NOR, XOR, NAND, and Truth table). Sequential Circuits, Flip Flop, Counters, Registers, Combinational Circuits, Address, Subtractions, Multipliers, Dividers, Multiplexers, Decoders, Encoders, Programming Language (VHDL).

10. Electronic Engineering III

Code	Credit Hours	LT	TU	LB	Prerequisites
EE203	3	2	2	1	EE102

-Negative feedback in amplifiers. Series and shunt feedback, current and voltage feedback. Effect of feedback on Z_i, Z_o, and voltage amplification.
-Frequency response of RC amplifiers. Cascade amplifiers, low and high frequency response and bandwidth. Miller effect. Plotting of frequency.

-Power amplifiers. Class A, class B, class AB. Efficiency of different types. Transformer coupled amplifier. Push –Pull circuits, complementary- symmetry circuit. Heat loss and cooling of power amplifiers. Distorsion in power amplifier.
-Oscillators theory of feedback. RL oscillator, RC oscillators, Wien Bridge oscillator. Double T oscillator, Cristal oscillators. Application with mini project.

11. Engineering Measurements

Code	Credit Hours	LT	TU	LB	Prerequisites
EE209	3	2	2	1	EE104

What is measurement, Units and dimensions, Measuring system components, DC Bridge as signal conditioning circuit. Transducers, advantages of using transducers, characteristics of transducers (sensitivity, accuracy, precession, resolution, response time, linearity, declivity,…). Measurement of temperature (thermocouples, RTD, thermistors, diode temperature detector, etc.), strain gauges (one-, two-, four-element bridge), sound transducers (different types of microphones), lux meter. Flow transducers, liquid level transducers, humidity transducers, speed transducers, Pressure transducers, Proximity transducers. Measurement by feedback methods, anemometer, flow measurement, high frequency current measurement, high voltage measurement.
-Operational amplifier as signal conditioning circuit. Application on displacement transducers. Applications (time measurements, frequency, two frequency comparison, and clock mode).

-Experimental Part: Measuring electrical and mechanical values, Calibrating some measuring devices. Oscilloscope parts, modes of operation, probes, applications, digital oscilloscope. Application with mini-project.

12. Automatic Control Systems

Code	Credit Hours	LT	TU	LB	Prerequisites
EE211	3	2	2	1	BS101

Introduction to feedback system, mathematical modeling of physical systems, Laplace transform, transfer function. Time domain response, roots of the characteristic equation. Closed-loop control system, block diagram reduction technique and signal flow graphs, principle of superposition. Controllers of closed-loop systems (P, PI, PD, and PID).

- Experimental Part: Open and closed loop system, Servo-mechanism principles. The effect of proportional, integral, and derivative controllers.

13. Motion Control and Servos

Code	Credit Hours	LT	TU	LB	Prerequisites
EE212	3	2	2	1	EE211

Motion control systems, speed control systems, DC servo system (field control), DC servo system (Armature Control), and AC control servo system. Application on servo systems (In robots control- in aircraft control- in cutting machines- flow control- thermal system control).

- Experimental Part: Two motion control system trainer, stepper motor trainer, DC/AC servo system trainer. Application with mini-project.

14. Power Electronics and Drive System

Code	Credit Hours	LT	TU	LB	Prerequisites
EE217	3	2	1	2	EE222

Solid state power components: DIODES (rectification circuits, factors, half, full wave center tapped, bridge), rating, diode with inductive load, fly-wheel diode, power transistor (BJT, MOSFET, IGBT, comparison), SCR (controlled rectifier circuits), GTO, SCS, TRIAC, DIAC, triggering circuits(R, RC trigger, UJT, BUT), Application (SSR, light dimmer, timer, flasher,…), electronic drive (DC, 3-phase induction motors), VFD.

15. Sensor Technology and Applications

Code	Credit Hours	LT	TU	LB	Prerequisites
EE220	3	2	1	1	EE209

Introduction to the need of sensors and transducers - Sensors and transducers in industry: thermal sensors and transducers, optical sensors and transducers, magnetic sensors and transducers, electromechanical sensors and transducers. Applications of sensors and transducers in industry, hot wire, bi-elastic sensors, radiation, and gas exhaust components and level sensors.

16. Electric Machinery

Code	Credit Hours	LT	TU	LB	Prerequisites
EE222	3	2	1	2	EE104

Introduction to electrical machines: single phase transformers, pulse transformers, D.C. motors (main features, types and control), stepper motors and permanent magnet motors (main features, types and control), introduction to single phase, two phase and three phase induction motors, shaded pole motors.

17. Embedded Systems

Code	Credit Hours	LT	TU	LB	Prerequisites
EE314	3	2	2	1	110 CR.HR

Embedded systems characteristics. Microprocessors versus microcontrollers. Microcontroller characteristics. General Purpose microcontrollers. Examples of microcontroller architectures. Interrupts, counter/timers, input/output ports. Microcontroller programming. Instruction set. Program development and use of assemblers. Memory maps and addressing modes. Digital to analogue an analogue to digital conversion in microcontrollers. Data acquisition and distribution. Serial and parallel communications. Real time system and its constraints. Interfacing to external devices. Power consumption consideration. Applications.

- Experimental Part: Introduction to embedded systems design tools and hardware programmers. Experiments using both simulation and practical implementation of the basic building blocks of microcontroller including timers, counters, PWM generation, I/O techniques and requirements, A/D conversion, serial communications. Experiments to explore the system design process using hardware-software design process. Design project.

18. Digital Signal Processing (ME)

Code	Credit Hours	LT	TU	LB	Prerequisites
EE412	3	2	2	-	**BS101**

Periodic signals and design of discrete time signals and systems, Fourier analysis– Fast Fourier transforms - Z transforms and discrete Fourier transform - Integrated functions – Fault analysis – Data collection and correlation- Hilbert transforms, parametric signal modeling and power spectrum estimation. Introduction to image processing.

19. Programmable Logic Controller (PLC)

Code	Credit Hours	LT	TU	LB	Prerequisites
EE415	3	2	1	1	EE 209

Architecture of the PLC system, handheld programmer unit-Ladder instructions for logic gates-Ladder instructions for timers and counters-Design procedures for logic microcontroller and implementation by ladder (Block Logic, Process sequence bits, Using transition logic, Using function logic and outputs, State machine based design)
Sequencer unit implementation by ladder, also register diagnostic by ladder instruction. Practical examples from real time.

20. Thermodynamics

Code	Credit Hours	LT	TU	LB	Prerequisites
ME101	3	2	2	1	BS003

Introduction and basic concepts of Thermodynamics. Energy, Energy transfer and general energy analysis. Properties of pure substances. Energy analysis of closed systems. Mass and energy analysis of control volumes. The second law of thermodynamics. Entropy.
Experimental Part: Application of the first law of thermodynamics for the cases of air conditioner, heat pump, refrigeration unit, pump, gasoline and diesel engine.

21. Fluid Mechanics

Code	Credit Hours	LT	TU	LB	Prerequisites
ME102	3	2	2	1	ME101

Introduction – Fluid properties – Fluid statics – Fundamentals of fluid motion – Fluid kinematics – Bernoulli's equation – Principal equations for mass continuity, energy conservation and momentum – Applications – Dimensional analysis and similarity – Laminar and turbulent flows – Reynolds number – Laminar flow cases – Steady flow in pipelines – Friction coefficient and losses – Minor losses – Methods of nets connection.

-Experiments cover hydrostatic, energy equipment, impact of a jet and minor and major losses

22. Production Engineering

Code	Credit Hours	LT	TU	LB	Prerequisites
ME103	2	2	1	-	ME002

Theory of metal cutting – different cutting theories – cutting temperature and methods of temperature measuring – tool life & tool wear and factors affecting tool life – measurement of tool life – surface roughness – measurement of machined surface – economics of metal cutting – machine tools – turning – drilling – milling –shaping.

23. Engineering Materials

Code	Credit Hours	LT	TU	LB	Prerequisites
ME104	2	2	1	-	**9 CR.HR**

Elements of atomic structure and bonding – Crystal structure – Solidification –Phase diagrams – Alloy Properties – Classification use and selection of common alloys – TTT diagrams – Heat treatment – Polymeric materials.

24. Mechanical Engineering Drawing

Code	Credit Hours	LT	TU	LB	Prerequisites
ME105	2	1	-	3	BS006,BS010

Working drawing, Surface finish symbols, Fits and tolerances, Standard tables. Material codes, Threads (types, specs), Joints, Bolts and Nuts. Springs (types, specs), Keys, Rivets, Welds, Gears. Mechanical drawing with computer graphic.

25. Stress Analysis

Code	Credit Hours	LT	TU	LB	Prerequisites
ME201	3	2	2	1	BS007

Equilibrium of simple mechanical elements - Normal and shear forces - Bending and torsion moments - Stresses in loaded elastic bars: Axial, bending, torsion – Strains – Rigidity - Strain energy. Stresses in combined loading: Eccentric loads, inclined bending and torsion. Two dimensional stresses: Principal stresses, Mohr circle, theory of failure Applications: Thin and thick cylinders, springs, Frames, Finite elements.
-Experimental part: Strain measurements, Wheatstone bridge, principal strains, strains in thin and thick cylinders, stress concentration factor, elastic failure, and deflections of beams.

26. Machine Design I

Code	Credit Hours	LT	TU	LB	Prerequisites
ME202	3	2	2	-	ME201

Material properties and selection - Type of joints: bolts, keys, couplings, rivets, welded joints - Design of power transmission elements: friction disks, brakes, clutches, belting, power shafts, axles, bearing mounting– Application with mini-project.

27. Pollution Control

Code	Credit Hours	LT	TU	LB	Prerequisites
ME203	2	2	-	-	**18 CRHR**

Introduction to pollution and its effect on human health – Sources of pollution - Clean air requirements – Pollution formation (NOx, CO, CO2, HC, and particulates….etc) – Exhaust gas treatment – Acoustic pollutions – Vibration – New fuels and pollution – Legislation-industrial plants, rivers, channels and soil.

28. Hydraulic & Pneumatic Components and Systems

Code	Credit Hours	LT	TU	LB	Prerequisites
ME204	3	2	1	2	ME102

Introduction to fluid power, physical properties of hydraulic fluids, energy and power in hydraulic systems, frictional losses in hydraulic pipelines, hydraulic pumps (types, performance, selection), hydraulic cylinders and motors (types, performance, selection, hydrostatics transmission), hydraulic valves (directional control values, pressure, flow), primary function and operation of the various types of valves. Basic types of hydraulic circuits (performance, ANSI graphical representations), conductor and fittings.

Pneumatics: Components (Compressors, fluid conditioners, valves, actuators), operation and analysis of basic pneumatic circuits.
-Experimentation on: Function of various hydraulic and pneumatic, components testing, simple hydraulic and pneumatic circuits, homework assignments.

29. Quality Control and Metrology

Code	Credit Hours	LT	TU	LB	Prerequisites
ME301	2	1	0	2	ME103,EE209

Concepts of quality control- Different quality costs and optimum quality level. Methods of quality control. Quality control charts.

Basic concepts measurements, Linear and angular measurements, Form measurements (Screw thread and gears, Radius measurement, Surface finish measurement, Flatness and roundness measurements.

-Experimentation on: Straightness measurements, Taper angle, Screw thread, Angles.

30. Computer Controlled Experimentation

Code	Credit Hours	LT	TU	LB	Prerequisites
ME302	2	1	-	3	EE209,EE211

State of the art techniques involving use of digital & analog computers to monitor & control physical process (mechanical, electrical, thermal, and fluid systems). Programming techniques for digital minicomputers in real-time online applications & fundamental topics in signal conditioning & data reduction.

31. Heat Transfer

Code	Credit Hours	LT	TU	LB	Prerequisites
ME303	3	2	2	1	ME101,ME102

Introduction to different heat transfer mechanisms (conduction, convection, and radiation). One dimensional steady and transient heat conduction, thermal resistance, extended surfaces, two dimensional steady heat conduction, shape factor, forced and free convection heat transfer, basic concepts of boiling and condensation, heat transfer in electronic systems, heat exchangers.
Experimental Part: experiments show the different modes of heat transfer (conduction, convection, boiling), industrial heat exchanges performance.

32. Mechanical Vibrations

Code	Credit Hours	LT	TU	LB	Prerequisites
ME304	3	2	2	-	BS008

Principles of vibrational motion - Elements of vibration system - Single degree of freedom - Effect of damping on free vibrations - Forced vibrations and applications - Shaft stability - Isolation - Measurement devices - Two degree of freedom systems - Dampers - Multi degree of freedom systems and solution methods - Computer applications

33. Machine Design II

Code	Credit Hours	LT	TU	LB	Prerequisites
ME305	3	2	2	-	ME202

Design of power screws – Springs - Design of gears; spur, helical, bevel and worm gears – Selection and design of belt and chain drives – Rolling element bearings – Service life – Load capacity – Selection and maintenance.

34. Theory of Machines

Code	Credit Hours	LT	TU	LB	Prerequisites
ME307	3	2	2	-	BS008

Definitions and description of basic types of mechanisms – Motion and inertia – Velocity and acceleration – Mechanisms with lower pairs – Valve diagrams and valve gears – Friction – Brakes and Dynamometers – Cams – Toothed gears and gear trains – Turning moments and flywheels – Governors – Balancing – Computer applications – Mini project for students.

35. Fundamentals of Combustion Technology

Code	Credit Hours	LT	TU	LB	Prerequisites
ME340	3	2	2	1	120 CR.HR

Introduction – Air standard cycles. Fuel-Air cycles. Actual cycles. Combustion in Spark Ignition (S.I.) engines. Combustion in Compression Ignition (C.I.) engine. Conventional and alternative fuels. Carburetors and petrol injection. Fuel injection systems for C.I. engines. ignition systems for S.I. engine. Lubrication and cooling system. Air pollution from internal combustion engines and its control.

-Experimental Part: Testing of spark ignition engine. Engine performance at full throttling opening (Power, thermal, efficiency, specific fuel consumption, and A/F ratio).

36. Maintenance

Code	Credit Hours	LT	TU	LB	Prerequisites
ME341	3	2	2	-	110 CR.HR

Maintenance strategies break down maintenance, programmable preventive maintenance, cleaning, lubrication, greasing, oil viscosity measurement, spear parts store and regulations, fault diagnosis, flow diagram of action, acceptance tests.

37. Computer Aided Design

Code	Credit Hours	LT	TU	LB	Prerequisites
ME401	3	2	-	3	ME305

CAD software and commands- Three dimensional modeling- Advanced CAD software commands and libraries- Practical exercises related to the department, including parametric modeling and editing, practical exercises include modeling of parts and assemblies as well as insertion of standard parts such as bolts, nuts, washers, bearings….etc- stress analysis simulation.

38. Mechanical Systems Laboratory

Code	Credit Hours	LT	TU	LB	Prerequisites
ME402	3	1	-	4	130CR.HR

The laboratory has the basic following systems: refrigeration and air conditioning – fluid flow - turbo machinery - internal combustion engine - continuous combustion – heat exchanger- solar collectors, pumps. The students conduct experiments on condition monitoring and performance test using sensors and line data acquisition system.

39. Design of Mechatronic Systems

Code	Credit Hours	LT	TU	LB	Prerequisites
ME403	3	2	2	1	ME202,EE314

The objective of this course is to allow the students to understand the synergy between mechanical design, computer control and electronic components in arriving at a mechatronics system. Students will be provided with the needed knowledge and understanding of issues related to integrating mechanical, electronic and software components towards building mechatronic devices. Subjects such as actuators, sensors, electronics and hardware components for mechatronics systems as well as methods of deploying control programs will be discussed. The course is project and design oriented and the focus is placed on learning to work with real hardware.

40. Robotics

Code	Credit Hours	LT	TU	LB	Prerequisites
ME404	3	1	2	2	120 CR.HR

Introduction and an overview of robot types and their applications, robotic terminologies, kinematic configuration, kinematic analysis, forward and inverse dynamical analysis. Lagrange formulation, Newton-Euler Method. Path planning and motion programming. Robot arm joint control. Overview of robot programming. Introduction to vision systems.

41. Modeling and Simulation

Code	Credit Hours	LT	TU	LB	Prerequisites
ME405	3	2	1	2	130 CR.HR

Mathematical modeling of complex systems (Mechanical, Electrical, Fluids, Thermal)- Modeling of integrated systems using block diagram and transfer function- State space theory- State space models for dynamic system (From system's D.E, from system's block diagram, from system's transfer function).

Computer simulation block diagram from state space model- Numerical integration methods- Computer simulation programs- Application using MATLAB and Simulink packages.

42. COMPUTER AIDED MANUFACTURING

Code	Credit Hours	LT	TU	LB	Prerequisites
ME407	2	1	2	2	ME103,ME105

Introduction to CAM – NC (Numerical Control) systems – NC part programming – Repeatable machinery sequence – APT (Automatically Programmed Tools) programming – Applications, Modeling and analysis of process control, manufacturing support systems.

43. POWER STATIONS

Code	Credit Hours	LT	TU	LB	Prerequisites
ME440	3	2	2	-	110 CR. HR

Classification of power stations – Analysis of load, storage and economy in power stations – Daily load – Annual load – Performance parameters – Turbines selection – Steam power stations: Cycles and components – Evaporators – Reheat and super heaters – Economizers – Air pre-heaters – Condensers – Pumps, connections and pipe lines – Boilers: its operations – Boiler performance and heat balance – Control devices – New trends for steam generation - Binary power station- Gas power station - Combined power station - nuclear power station - Operation and control of power station - Environmental aspects of power generation.

44. TURBO-MACHINERY

Code	Credit Hours	LT	TU	LB	Prerequisites
ME441	3	2	2	-	ME101, ME102

Basic thermodynamics and fluid mechanics for turbines – Classifications of turbo machinery – Euler's equation – Losses – Efficiencies – dimensional analysis and similarity – One dimensional flow – Two dimensional flow – Axial, radial and mixed turbines – Axial, radial and mixed compressors and pumps – Performance curves -Effect of viscosity, compressibility, and cavitation's – Three dimensional flow steady and unsteady flow – fans and blowers- water turbines.

45. RENEWABLE ENERGY

Code	Credit Hours	LT	TU	LB	Prerequisites
ME442	3	2	2	-	ME101

Modern society relies on stable, readily available energy supplies. Renewable energy is an increasingly important component of the new energy mix. The course covers energy conversion, utilization and storage for renewable technologies such as wind, solar, biomass, fuel cells and hybrid systems. Thermodynamics concepts (including the first and second law) will form the basis for modeling the renewable energy systems.
The course also touches upon the environmental consequences of energy conversion and how renewable energy can reduce air pollution and global climate change. Transport Phenomena is recommended as a co-requisite, but not required.

46. Fluid Machinery

Code	Credit Hours	LT	TU	LB	Prerequisites
ME443	3	2	2	-	ME102

Energy transfer considerations. Theory and design of pumps, turbines and compressors performance characteristics. Non-classical pumps (sewage pumps, concrete pumps, …). Selection criteria, operation and system. Hydrostatic power transmission.

47. Industrial Management

Code	Credit Hours	LT	TU	LB	Prerequisites
ME444	3	2	2	-	110 CR. HR

Factory planning, material flow, plant planning, material handling equipment, quality control, costing, cost analysis, direct and indirect costs, machine hour rate, depreciation, industrial safety.

48. SCADA

Code	Credit Hours	LT	TU	LB	Prerequisites
ME445	3	2	-	3	120 CR. HR.

Introduction to the supervisory control and data acquisition (SCADA) system: the concept, levels of control in industry, PLC's or PC's in a network control system – The architecture of large controllers: plant controllers, area controllers, cell controllers, etc. – Supervision and data acquisition: network communications, protocols, architecture, realization and applications.

49. Robots and Materials Handling

Code	Credit Hours	LT	TU	LB	Prerequisites
ME446	3	2	2	-	ME305

Introduction to industrial automation. Manufacturing operations, material handling and identification technologies (Material handling, material transport systems, and automatic data capture). Manufacturing, flexible manufacturing systems including: single station manufacturing cells, group technology and cellular manufacturing, flexible manufacturing systems, manual assembly lines, transfer lines and similar automated manufacturing systems, and automated assembly systems.

50. Hydraulic and Pneumatic Control

Code	Credit Hours	LT	TU	LB	Prerequisites
ME447	3	2	-	3	120 CR. HR

Basic electrical controls for fluid power (manually actuated switches, limit switches, pressure switches, solenoids, relays, timers and temperature switches). Electrical ladder diagram and fluid power circuits. Moving-part logic control of fluid power circuits. Components of an electrohydraulic servo system, PLC, Automation studio computer software for simulation, analysis and animation of fluid power circuits.

-Experimentation on: Testing of hydraulic, electrohydraulic, pneumatic, electro-pneumatic circuit, using automation studio software for design and analysis of circuits.

51. Artificial Intelligence

Code	Credit Hours	LT	TU	LB	Prerequisites
ME448	3	2	-	3	120 CR. HR

Introduction to AI including definitions, Knowledge based systems: knowledge acquisition and representation, construction, operation, forward and backward chaining.
Neural nets: overview of network architectures and learning schemes, perception learning, multi-layer perception and back-propagation, implementation.
Genetic algorithms: optimization and conventional techniques, data coding, reproduction, cross-over, mutation and evolution techniques.
Case studies will illustrate the application and performance of AI methods in engineering, e.g. modeling of systems and signals; pattern recognition; image processing.

52. Automotive Computer Controlled systems

Code	Credit Hours	LT	TU	LB	Prerequisites
ME450	3	2	-	2	110 CR. HR

Introduction to internal combustion engine, basic cycles of internal combustion engines, ignition systems (the constant energy ignition system, digital (programmed) ignition system, distributorless ignition system, optoelectronic sensing for the ignition system, knock sensing, adaptive ignition). Computer controlled petrol fuelling systems, (single-point injection, multi-point injection), computer controlled diesel fuelling systems (common rail system), engine management systems (EMS) exhaust gas recirculation, computer control of evaporative emissions.

53. Reverse Engineering

Code	Credit Hours	LT	TU	LB	Prerequisites
ME451	3	2	-	2	110 CR. HR.

Methods of determining part characteristics, Reverse engineering methodology, Technical data development, Product design and materials selection, Heat treatment, (Drawing, fits & tolerance, geometric tolerance), Manufacturing planning, Economic aspects of materials and process selection, Case studies.

54. Biomechatronics

Code	Credit Hours	LT	TU	LB	Prerequisites
ME452	3	2	2	-	ME403

This course mainly introduces the history, background, fundamentals, current situation, active topics and future trend in the field of biomechtronics. Topics consist of medical device design, rehabilitation engineering, artificial tissue and organs, implantable neural prosthesis, orthopedic implants and implanted devices, biology-machine interface, minimally invasive surgical instruments, surgical robot, introduces its basic principle, key technology and its development and application.

55. Introduction to MEMS

Code	Credit Hours	LT	TU	LB	Prerequisites
ME453	3	2	-	2	110 CR. HR.

The goal of this course is to introduce students to MEMS devices, microsystems and their applications. The course will start with an introduction on the mechanical and electrical properties of materials commonly used in MEMS. The micro-fabrication processes, including bulk and surface micromachining processes for realization of these micro/nano transducers will be discussed, along with integration of MEMS with CMOS electronics. Some representative sensors and actuators, including capacitive & piezoelectric pressure sensors, mechanical resonators and filters, minimally invasive implantable medical devices, and biomedical lab-on-a-chip will be used to illustrate the capabilities & advantages of these miniaturized devices.

56. Introduction to Nanoelectronics

Code	Credit Hours	LT	TU	LB	Prerequisites
EE454	3	2	2	-	EE203

The major goals and objectives are to provide graduate students with knowledge and understanding of physical background and applications of nanoelectronics. The course will cover electrical and optical properties of materials and nanostructures, fabrication of nanostructures, nanoelectronic devices including resonant-tunneling devices, transistors, and single-electron transfer devices, as well as applications of nanotechnologies in molecular biology and medicine.

57. Image Processing and Computer Vision

Code	Credit Hours	LT	TU	LB	Prerequisites
ME455	3	2	-	2	EE412

Image sampling and quantization, color, point operations, segmentation, morphological image processing, linear image filtering and correlation, image transforms, eigen-images, multi-resolution image processing, noise reduction and restoration, feature extraction and recognition tasks, image registration. Emphasis is on the general principles of image processing. Students learn to apply material by implementing and investigating image processing algorithms in MATLAB and optionally on Android mobile devices. Term project.

58. Introduction to Field and Service Robotics

Code	Credit Hours	LT	TU	LB	Prerequisites
ME456	3	2	-	2	110 CR. HR.

Field and service robots: Classification, applications, sensing and perception, social and ethical implications of robotics. Autonomous Mobile robots: Kinematics, locomotion, perception, motion planning and control, localization and mapping; Intelligent unmanned vehicles. Underwater robots: Kinematics and dynamics, modeling and simulation, navigation, guidance and control. Aerial robots: Basics of aerial robots, sensors and actuators, modeling and control of small Unmanned Aerial vehicles, guidance and navigation of small range aerial robots, Autonomous indoor flight control. Medical Robots: Tele-operated surgical robots, haptics for tele-operation, design and control.

59. Senior Seminar

Code	Credit Hours	LT	TU	LB	Prerequisites
ME490	2	1	2	-	110 CR. HR

Selected topics of interest to the faculty will be used to introduce students to engineering science.

60. Graduation Project I

Code	Credit Hours	LT	TU	LB	Prerequisites
ME499 I	3	2	1	2	126 CR. HR

The student introduces a complete study and constructs the basic designs and calculations for the project determined through his department applying the basics of sciences that he studied- The projects include mechanical design, electronics, control and programming – The student presents a report containing the rules and calculations that he made in his project.

61. Graduation Project II

Code	Credit Hours	LT	TU	LB	Prerequisites
ME499 II	3	2	1	2	ME499 I

The student complete study of the projects and constructs the determined designs including mechanical design, electronics, control and programming – The student presents a report containing the rules and calculations that he made in his project.

APPENDIX
MECHATRONICS & ROBOTICS ENGINEERING PROGRAM
COURSE GRADING

Code	Course Title	CW	MT	LB	WR	Total	Code	Course Title	CW	MT	LB	WR	Total
Preparatory	**Semester 1**							**Semester 2**					
BS001	Mathematics 1	30	20	-	50	100	BS002	Mathematics 2	30	20	-	50	100
BS003	Physics 1	25	20	5	50	100	BS004	Physics 2	25	20	5	50	100
BS007	Engineering Mechanics 1	30	20	-	50	100	BS006	Computer Aided Drawing	-	20	30	50	100
BS009	Engineering Drawing 1	40	20	-	40	100	BS008	Engineering Mechanics 2	30	20	-	50	100
HM001	Russian Language 1	30	20	-	50	100	BS010	Engineering Drawing 2	40	20	-	40	100
HM003	English Language 1	30	20	-	50	100	HM002	Russian Language 2	30	20	-	50	100
BS005	Chemistry	20	20	20	40	100	HM004	English Language 2	30	20	-	50	100
HM005	Introduction to Engineering	30	20	-	50	100	ME002	Production Technology	20	20	20	40	100
Freshman	**Semester 3**							**Semester 4**					
BS101	Mathematics 3	30	20	-	50	100	BS102	Mathematics 4	30	20	-	50	100
EE101	Electronic Engineering I	25	20	5	50	100	EE102	Electronic Engineering II	25	20	5	50	100
EE103	Basics of Electrical Circuits I	25	20	5	50	100	EN101	Technical Training I	-	-	-	-	-
HM101	Technical Writing	30	20	-	50	100	HM102	Scientific Thinking	30	20	-	50	100
ME101	Thermodynamics	25	20	5	50	100	ME102	Fluid Mechanics	25	20	5	50	100
ME103	Production Engineering	30	20	-	50	100	ME104	Engineering Materials	30	20	-	50	100
ME105	Mechanical Engineering Drawing	-	20	30	50	100	EE104	Basics of Electrical Circuits II	25	20	5	50	100
							EE108	Logic Circuit	25	20	5	50	100
Sophomore	**Semester 5**							**Semester 6**					
EE222	Electric Machinery	25	20	5	50	100	ME202	Machine Design I	30	20	-	50	100
BS104 M	Numerical Analysis (ME)	30	20	-	50	100	BS108	Probability and Statistics in Engineering	30	20	-	50	100
EE203	Electronic Engineering III	25	20	5	50	100	ME203	Pollution Control	30	20	-	50	100
EE209	Engineering Measurements	25	20	5	50	100	EE220	Sensor Technology and Applications	30	20	-	50	100
ME201	Stress Analysis	25	20	5	50	100	EE217	Power Electronic and Drive Systems	25	20	5	50	100
ME303	Heat Transfer	25	20	5	50	100	EN201	Technical Training II	-	-	-	-	-
							ME204	Hydraulic and Pneumatic Components and Systems	20	20	10	50	100
							BS105 M	Computer Application in Engineering (ME)	30	20	-	50	100
Junior	**Semester 7**							**Semester 8**					
EE211	Automatic Control Systems	25	20	5	50	100	EE212	Motion Control and Servos	25	20	5	50	100
HM	Elective	30	20	-	50	100	EE314	Embedded Systems	25	20	5	50	100
ME301	Quality Control and Metrology	20	20	10	50	100	ME	Elective	30[1]	20[1]	-[1]	50	100
ME305	Machine Design II	30	20	-	50	100	EN301	Technical Training III	-	-	-	-	-
ME307	Theory of Machines	30	20	-	50	100	HM	Elective	30	20	-	50	100
HM202	Engineering Economics and Management	30	20	-	50	100	ME304	Mechanical Vibrations	30	20	-	50	100
							ME407	Computer Aided Manufacturing	20	20	10	50	100
							ME490	Senior Seminar	50	20	-	30	100
Senior	**Semester 9**							**Semester 10**					
ME302	Computer Controlled Experimentation	15	20	15	50	100	EE412	Digital Signal Processing (ME)	30	20	-	50	100
EE415	Programmable Logic Controller	25	20	5	50	100	ME405	Modeling and Simulation	20	20	10	50	100
ME403	Design of Mechatronic Systems	25	20	5	50	100	ME	Elective	30[1]	20[1]	[1]	50	100
ME401	Computer Aided Design	15	20	15	50	100	ME	Elective	30[1]	20[1]	[1]	50	100
ME404	Robotics	20	20	10	50	100	ME402	Mechanical Systems Laboratory	20	20	20	40	100
ME499I	Graduation Project I	30	20[2]	-	50	100	ME499II	Graduation Project II	30	20[2]	-	50	100

[1] Depends on course nature
[2] Project report

MECHATRONICS & ROBOTICS ENGINEERING PROGRAM
EXAM TIME

Code	Course Title	CR	LT	TU	LB	CT	Exam Time	Code	Course Title	CR	LT	TU	LB	CT	Exam Tim
Preparatory	**Semester 1**								**Semester 2**						
BS001	Mathematics 1	3	2	2	-	4	2	BS002	Mathematics 2	3	2	2	-	4	2
BS003	Physics 1	3	2	1	1	4	2	BS004	Physics 2	3	2	1	1	4	2
BS007	Engineering Mechanics 1	3	2	2	-	4	2	BS006	Computer Aided Drawing	1	-	-	2	2	2
BS009	Engineering Drawing 1	2	1	2	-	3	2.5	BS008	Engineering Mechanics 2	3	2	2	-	4	2
HM001	Russian Language 1	1	-	2	-	2	2	BS010	Engineering Drawing 2	2	1	2	-	3	2.5
HM003	English Language 1	1	-	2	-	2	2	HM002	Russian Language 2	2	1	2	-	3	2
BS005	Chemistry	3	2	1	1	4	2	HM004	English Language 2	2	1	2	-	3	2
HM005	Introduction to Engineering	2	2	-	-	2	2	ME002	Production Technology	2	1	1	1	3	2
Total		**18**	**11**	**12**	**2**	**25**		**Total**		**18**	**10**	**12**	**4**	**26**	
Freshman	**Semester 3**								**Semester 4**						
BS101	Mathematics 3	3	2	2	-	4	2	BS102	Mathematics 4	3	2	2	-	4	2
EE101	Electronic Engineering I	3	2	2	1	5	2	EE102	Electronic Engineering II	3	2	2	1	5	2
EE103	Basics of Electrical Circuits I	3	2	2	1	5	2	EN101	Technical Training I	-	-	-	-	-	-
HM101	Technical Writing	2	2	-	-	2	2	HM102	Scientific Thinking	2	2	-	-	2	2
ME101	Thermodynamics	3	2	2	1	5	2	ME102	Fluid Mechanics	3	2	2	1	5	2
ME103	Production Engineering	2	2	1	-	3	2	ME104	Engineering Materials	2	2	1	-	3	2
ME105	Mechanical Engineering Drawing	2	1	-	3	4	2.5	EE104	Basics of Electrical Circuits II	3	2	2	1	5	2
								EE108	Logic Circuit	2	2	1	1	4	2
Total		**18**	**13**	**9**	**6**	**28**		**Total**		**18**	**14**	**9**	**5**	**28**	
Sophomore	**Semester 5**								**Semester 6**						
EE222	Electric Machinery	3	2	1	2	5	2	ME202	Machine Design I	3	2	2	-	4	2
BS104 M	Numerical Analysis (ME)	3	2	2	-	4	2	BS108	Probability and Statistics in Engineering	2	2	1	-	3	2
EE203	Electronic Engineering III	3	2	2	1	5	2	ME203	Pollution Control	2	2	-	-	2	2
EE209	Engineering Measurements	3	2	2	1	5	2	EE220	Sensor Technology and Applications	3	2	1	1	4	2
ME201	Stress Analysis	3	2	2	1	5	2	EE217	Power Electronic and Drive Systems	3	2	1	2	5	2
ME303	Heat Transfer	3	2	2	1	5	2	EN201	Technical Training II	-	-	-	-	-	-
								ME204	Hydraulic and Pneumatic Components and Systems	3	2	1	2	5	2
								BS105 M	Computer Application in Engineering (ME)	2	1	-	2	3	2
Total		**18**	**12**	**11**	**6**	**29**		**Total**		**18**	**13**	**6**	**7**	**26**	
Junior	**Semester 7**								**Semester 8**						
EE211	Automatic Control Systems	3	2	2	1	5	2	EE212	Motion Control and Servos	3	2	2	1	5	2
HM	Elective	2	2	-	-	2	2	EE314	Embedded Systems	3	2	2	1	5	2
ME301	Quality Control and Metrology	3	2	1	2	5	2	ME	Elective	3	2	2	-	4	2
ME305	Machine Design II	3	2	2	-	4	2	EN301	Technical Training III	-	-	-	-	-	-
ME307	Theory of Machines	3	2	2	-	4	2	HM	Elective	2	2	-	-	2	2
HM202	Engineering Economics and Management	2	2	1	-	3	2	ME304	Mechanical Vibrations	3	2	2	-	4	2
								ME407	Computer Aided Manufacturing	2	1	2	2	5	2
								ME490	Senior Seminar	2	1	2	-	3	2
Total		**16**	**12**	**8**	**3**	**23**		**Total**		**18**	**12**	**12**	**4**	**28**	
Senior	**Semester 9**								**Semester 10**						
ME302	Computer Controlled Experimentation	2	1	-	3	4	2	EE412	Digital Signal Processing (ME)	3	2	2	-	4	2
EE415	Programmable Logic Controller	3	2	1	1	4	2	ME405	Modeling and Simulation	3	2	1	2	5	2
ME403	Design of Mechatronic Systems	3	2	2	1	5	2	ME	Elective	3	2	2	-	4	2
ME401	Computer Aided Design	3	2	-	3	5	2	ME	Elective	3	2	2	-	4	2
ME404	Robotics	3	1	2	2	5	2	ME402	Mechanical Systems Laboratory	3	1	-	4	5	2
ME499I	Graduation Project I	3	2	1	2	5	2	ME499II	Graduation Project II	3	2	1	2	5	2
Total		**17**	**10**	**6**	**12**	**28**		**Total**		**18**	**11**	**8**	**8**	**27**	

Mechatronics Engineering

Egyptian Russian University

Mechatronics and Robotics Courses Flow Chart 2018