### B.Sc. in Mechanical Engineering Mechatronics

#### Study Plan

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| THERMODYNAMICS | 223400 CHE340 |
| STATICS | 232011 CE201A |
| PRINCIPLES OF ELECTRICAL ENGINEERING | 243031 EE303 |
| ELECTRIC DRIVE | 243042 EE304 |
| NUMERICAL METHODS FOR ENGINEERS | 243051 EE305 |
| ELECTRICAL ENGINEERING LAB | 243063 EE306C |
| ENGINEERING WORKSHOPS | 251010 ME101 |
| ENGINEERING WORKSHOP (LAB) | 251011 ME101A |
| ENGINEERING DRAWING B | 252013 ME201B |
| MECHANICAL DRAWING | 252023 ME202C |
| DYNAMICS | 252122 ME212B |
| STRENGTH OF MATERIALS | 252143 ME214C |
| APPLIED MATH FOR ENGINEERS | 253053 ME305C |
| MECHANICS OF MACHINES | 253110 ME311 |
| STRENGTH OF MATERIALS LAB | 253230 ME323 |
| MACHINE DESIGN (1) | 253323 ME3321 |
| MACHINE DESIGN (2) | 253433 ME3433 |
| MACHINE DESIGN (3) | 253442 ME3442 |
| THERMALFLUIDS LAB | 254453 ME445C |
| HEAT TRANSFER (1) | 254511 ME451A |
| AUTOMATIC CONTROL (1) | 254623 ME462C |
| MECHANICAL VIBRATIONS | 254633 ME463C |
| INTRUMENTATION | 254711 ME471A |

| **Faculty Compulsory Courses** | 32 C.H |
| Course | **No.** |
| INTRUMENTATION AND DYNAMIC SYSTEMS | 254723 ME472C |
| AUTOMATIC CONTROL 1 | 254920 ME492 |
| GRADUATION PROJECT (1) | 255911 ME591A |
| GRADUATION PROJECT | 255921 ME592A |
| PROJECTS IN MECHANICAL DESIGN | 255933 ME593C |
| ENGINEERING ECONOMY | 293410 IE341 |
| ENGINEERING MATERIALS | 293610 IE361 |
| MANUFACTURING PROCESSES (1) | 293640 IE364 |

<p>| <strong>Department Compulsory Courses</strong> | 75 C.H |
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| THERMODYNAMICS | 223400 CHE340 |
| ELECTRICAL ENGINEERING LAB | 243063 EE306C |
| ENGINEERING WORKSHOPS | 251010 ME101 |
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| MACHINE DESIGN (2) | 253433 ME3433 |
| MACHINE DESIGN (3) | 253442 ME3442 |
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| HEAT TRANSFER (1) | 254511 ME451A |
| AUTOMATIC CONTROL (1) | 254623 ME462C |
| MECHANICAL VIBRATIONS | 254633 ME463C |
| INTRUMENTATION | 254711 ME471A |
| FUNDAMENTALS OF ELECTRONICS | 243213 EE321C |
| MICROCONTROLLERS | 254253 ME425C |
| MECHATRONICS LAB 1 | 254463 ME446C |
| AUTOMATIC CONTROL 1 | 254643 ME464C |
| MECHATRONICS SYSTEMS | 255433 ME543C |
| DIGITAL LOGIC DESIGN AND COMPUTER ARCHITECTURE (NON-CIE STUDENTS) | 1712540 CPE254 |
| DIGITAL LOGIC DESIGN LAB | 1712550 CPE255 |
| INTRODUCTION TO INTELLIGENT SYSTEMS | 255459 ME549I |
| SPECIAL TOPICS IN THERMAL POWER | 255994 ME594G |
| SPECIAL TOPICS IN MECHATRONICS | 255996 ME596A |
| THERMODYNAMICS (2) | 253421 ME342A |
| PRODUCTION PROCESSES | 254610 ME461 |
| INTRODUCTION TO MICRO-ELECTRO-MECHANICAL SYSTEMS | 255003 ME500C |
| INFORMATION TECHNOLOGY FOR MECHATRONICS | 255023 ME502C |
| FRACTAL ANALYSIS OF PHYSICAL SYSTEM | 256009 ME506C |
| FINITE ELEMENTS ANALYSIS | 255073 ME507C |
| INTRODUCTION TO AERONAUTICS ENGINEERING (NON AERONAUTICS) | 255083 ME508C |
| INTRODUCTION TO MECHATRONICS (NON-MECHATRONICS) | 255131 ME513A |
| AIR POLLUTION | 255140 ME514 |
| MECHANICS OF MATERIAL (2) | 255190 ME519 |</p>
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**TOTAL** 159 C.H

* For prerequisite & equivalent courses see the Courses’ Description.
# B.Sc. in Mechanical Engineering

## Thermal Power

### Study Plan

#### University Compulsory Courses

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#### Specialization Elective Courses

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<td>ME596G SPECIAL TOPICS IN MECHATRONICS</td>
<td>1</td>
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<td>255963</td>
<td>ME596B SPECIAL TOPICS IN MECHATRONICS</td>
<td>2</td>
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<tr>
<td>295553</td>
<td>IE555C SAFETY ENGINEERING AND MANAGEMENT</td>
<td>3</td>
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<tr>
<td>295570</td>
<td>IE557 INTRODUCTION TO PROJECT MANAGEMENT</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>295740</td>
<td>IE574 RELIABILITY AND MAINTENANCE MANAGEMENT</td>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>

**TOTAL** 159 C.H

*For prerequisite & equivalent courses see the Courses’ Description.*
## Courses’ Description

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
<th>Prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>ME 101</td>
<td>Engineering Workshops</td>
<td>2C.H</td>
<td>Pre: none</td>
</tr>
<tr>
<td>ME 201</td>
<td>Engineering Drawing B</td>
<td>2C.H</td>
<td>Pre: none</td>
</tr>
<tr>
<td>ME 202</td>
<td>Mechanical Drawing</td>
<td>2C.H</td>
<td>Pre: ME 201</td>
</tr>
<tr>
<td>ME 211</td>
<td>Fundamentals of Automobile Engineering (for non ME students)</td>
<td>3C.H</td>
<td>Pre: CE 201</td>
</tr>
<tr>
<td>ME 212</td>
<td>Dynamics</td>
<td>3C.H</td>
<td>Pre: ME 201</td>
</tr>
<tr>
<td>ME 214</td>
<td>Strength of Materials</td>
<td>3C.H</td>
<td>Pre: CE 201</td>
</tr>
<tr>
<td>ME 215</td>
<td>Engineering Mechanics (for none ME students)</td>
<td>3C.H</td>
<td>Pre: Phys 101, Math 201</td>
</tr>
<tr>
<td>ME 305</td>
<td>Applied Mathematics for Engineers</td>
<td>3C.H</td>
<td>Pre: Math 201, Math 203</td>
</tr>
<tr>
<td>ME 311</td>
<td>Mechanics of Machinery</td>
<td>3C.H</td>
<td>Pre: ME 212, ME 212</td>
</tr>
<tr>
<td>ME 312</td>
<td>Mechanics of Materials Lab.</td>
<td>1C.H</td>
<td>Pre: ME 214, IE361</td>
</tr>
<tr>
<td>ME 322</td>
<td>Engineering Thermodynamics</td>
<td>3C.H</td>
<td>Pre: ChE 340</td>
</tr>
<tr>
<td>ME 332</td>
<td>Machine Design I</td>
<td>3C.H</td>
<td>Pre: ME 214, ME 202</td>
</tr>
<tr>
<td>ME 343</td>
<td>Fluid Mechanics</td>
<td>3C.H</td>
<td>Pre: CS 115, CPE 255</td>
</tr>
<tr>
<td>ME 414</td>
<td>Aircraft Structures I</td>
<td>3C.H</td>
<td>Pre: ME 214</td>
</tr>
<tr>
<td>ME 425</td>
<td>Microcontrollers Applications</td>
<td>3C.H</td>
<td>Pre: ME 212, ME 212</td>
</tr>
<tr>
<td>ME 433</td>
<td>Machine Design II</td>
<td>3C.H</td>
<td>Pre: ME 332</td>
</tr>
<tr>
<td>ME 443</td>
<td>Aerodynamics I</td>
<td>3C.H</td>
<td>Pre: ME 343</td>
</tr>
<tr>
<td>ME 444</td>
<td>Fluid Mechanics for Mechanical Engineers</td>
<td>3 C.H</td>
<td>Pre: ME 343</td>
</tr>
</tbody>
</table>

### B.Sc. in Mechanical Engineering

- **ME 201 Engineering Drawing B**
  - 2C.H
  - Instruments and their use, graphical geometry, lettering, orthographic and isometric drawing and sketching, sectional views. Introduction to descriptive geometry. Surface intersections and developments. Computer graphics. Pre: CIS 100

- **ME 211 Fundamentals of Automobile Engineering (for non ME students)**
  - 3C.H

- **ME 212 Dynamics**
  - 3C.H
  - Dynamics of particles, two- and three-dimensional dynamics of rigid bodies, moment of inertia, work and energy, impulse and momentum for rigid bodies. Pre: ME 201

- **ME 214 Strength of Materials**
  - 3C.H
  - Concepts of stress and strain. Stresses and displacements of axially loaded members. The state of stress and strain; Normal, bending, shear, and torsion stresses. Mechanical properties of materials, combined stresses, composite sections. Deflections: integration Method, Moment area method, Buckling of columns. Pre: CE 201

- **ME 215 Engineering Mechanics (for none ME students)**
  - 3C.H

- **ME 305 Applied Mathematics for Engineers**
  - 3C.H

- **ME 311 Mechanics of Machinery**
  - 3C.H

- **ME 312 Mechanics of Materials Lab.**
  - 1C.H
  - Strength of material experiments including: hardness, Tensile, compression, impact. Torsion. Creep. Buckling and fatigue tests. Experiments on thin pressure vessels, non-destructive testing, heat treatment, and casting. Pre: ME 214, IE361

- **ME 322 Engineering Thermodynamics**
  - 3C.H

- **ME 332 Machine Design I**
  - 3C.H

- **ME 343 Fluid Mechanics**
  - 3C.H

- **ME 414 Aircraft Structures I**
  - 3C.H

- **ME 425 Microcontrollers Applications**
  - 3C.H
  - Introduction to microcontroller-based systems for embedded control applications. Topics include microcontroller programming interfacing, and interrupt handling, application of microcontrollers in process control, automation, instrumentation, and communication. Pre: CS 115, CPE 255

- **ME 433 Machine Design II**
  - 3C.H
  - Design of screws, fasteners and connections. Welded joints, mechanical springs, spur gears, shafts, belts, chains and rolling bearings. Lubrication and journal bearings. Pre: ME 332

- **ME 443 Aerodynamics I**
  - 3C.H

- **ME 444 Fluid Mechanics for Mechanical Engineers**
  - 3 C.H
ME 445 Thermofluid Lab. 1C.H
Experiments on thermo-fluid systems including: pipe flows, flow meters, hydrostatic forces, pump performance, jet forces, thermal conductivity, heat transfer coefficients, heat exchanger performance, air-conditioning processes, refrigeration cycles, boiling and condensation, and steam devices. Pre/Co.: ME 451

ME 446 Mechatronics Lab I 1C.H
Microcontroller programming interfacing and applications on classical control concepts and mechatronics system design. Pre: ME 425, ME 462

ME 451 Heat Transfer I 3C.H

ME 452 Heat Transfer II 3C.H

ME 462 Automatic Control I 3C.H

ME 463 Mechanical Vibrations 3C.H

ME 464 Automatic Control II 3C.H
Introduction to signals and systems continuous and discrete –time signals difference equations, z-transform; sampled-data systems; sample and hold, discrete models including state-space; discrete equivalents of continuous-time systems; stability analysis; controllability and observability of sampled-data systems; design specifications; controller design using transform techniques, design using state-space methods; generalized sample-data hold functions; and introduction to optimal control. Pre: ME 462

ME 471 Instrumentation 3C.H
Analysis of experimental data. statistics; mean and variance, Basic electronic measurement and sensing devices, Displacement, area, force, torque, pressure, strain, flow, temperature, and thermal and transport properties measurements. Data acquisition and processing. Pre: ME 343, EE 303

ME 472 Instrumentation & Dynamic Systems Lab. 1C.H

ME 492 Engineering Training 3C.H
Eight weeks of practical training in an institution (university, company, ...etc) that is accredited by the mechanical engineering department and faculty of engineering at JUST for training purposes in the field of mechanical engineering. Pre: Completion of 117 credit hours

ME 500 Introduction to Micro-Electro-Mechanical-Systems (MEMS) 3C.H
Overview of MEMS and Microsystems; history and industry perspective. Scaling laws in miniaturization. Working principles of Microsystems, microsensors and microactuators. Microsystems design, modeling and fabrication processes. Studies on several classes of devices including mechanical MEMS, Bio-MEMS, microfluidics, RF MEMS, microrobots. Pre: ME 343, IE 361, ME 451

ME 501 Water Desalination 3C.H

ME 502 Information Technology for Mechatronics 3C.H
Computer vision operating systems, computer networking internet programming and application: tele-monitoring. Pre: ME 425

ME 503 Modeling, Simulation and Analysis Of Physical Systems 3C.H

ME 504 Composite Materials 3C.H

ME 505 Finite Elements Analysis 3C.H
Basic concepts of the finite element method. Spring, bar, beam and triangular elements. Plane stress and plane strain models. Axisymmetric elements. 3D stress analysis. Applications to heat transfer, fluid mechanics, vibrations and thermal stresses. Pre: EE 305

ME 506 Introduction to Aeronautics Engineering (non Aeronautics Students) 3C.H
Basic concepts in fluid mechanics and aerodynamics. Stability and controllability of flight vehicles. Lift and drag forces. Aircraft propulsive systems. Performance characteristics of typical aircraft. Pre: 5th Year Standing

ME 507 Introduction to Mechatronics 3C.H (non Mechatronics Students)
Introduces technologies involved in mechatronics (Intelligent Electro Mechanical Systems) and techniques necessary to apply this technology to mechatronics system design. Topics: electronics, A/D, D/A converters, op-amps, filters, power devices, software program
design, hardware and DC motors and stepper motors, solenoids, and sensing. Pre: ME 471

ME 508  Air Pollution  3C.H
Air pollution sources and effects. Air pollution meteorology; measurements and monitoring. Control of Air pollution. Air pollution standards and regulations. Pre: ME 322

ME 514  Mechanics of Materials II  3C.H

ME 516  Aeroelasticity  3C.H

ME 517  Flight Dynamics and Stability I  3C.H

ME 518  Aircraft Structures II  3C.H
Energy principles, matrix analysis of structures, introduction to finite element methods. Application to aircraft structural elements. Introduction to composite material in aircrafts and introduction to classical laminated plate theory. Elementary aerelasticity. Pre: ME 414

ME 519  Flight Dynamics and Stability II  3C.H
Review of six degree of freedom vehicle model. Integration of the aerodynamics and propulsive inputs. Nonlinear analysis and computer simulation. Introduction to three dimensional motion under central fields. Solution to orbital motion. Helicopter flight dynamics. Pre: ME 517

ME 524  Fuel and Combustion  3C.H

ME 525  Propulsion  3C.H
An integrated approach to the application of engineering principles to propulsion systems. Topics include: piston props, turboprops, turbobjets, turbofans, turbo shaft, ramjets, scramjets and rocket engines, beside intakes, compressors, fans, combustors, turbines and propelling nozzles. Pre: ME 443

ME 526  Real Time Systems  3C.H
Sample rate selection, pre-filtering, quantization effects and computational delay; scheduling theory and priority assignment to control processes, timing of control loops, effects of missed deadlines; time based characteristics of sensors and devices, embedded processors, processor/device interface, real time operating systems, real time programming of mechatronics systems. Pre: ME 425, ME 462

ME 527  Internal Combustion Engines  3C.H
Internal combustion engines: Cycles, performance, fuel metering, ignition system, and Supercharging. Lab demonstrations. Pre: ME 322

ME 528  Thermal Power Plants  3C.H

ME 529  Industrial Heat Exchangers  3C.H

ME 532A  Aircraft Design  3C.H
Preliminary design of a modern airplane to satisfy a given set of requirements. Estimation of size, selection of configuration, weight and balance, and performance of airplane. Satisfaction of stability, control, and handling quality requirements. Pre: ME 443, ME 542

ME 533A  Design of Thermal Systems  3C.H
Modeling of thermal systems. Basic optimization techniques such as Lagrange multipliers, dynamic programming, geometric programming, linear programming and calculus of variation. Case studies. Pre: EE 305, ME 452

ME 541  Aerodynamics II  3C.H

ME 542  Aeronautic Lab.  1C.H
Basic measurements of aerodynamic forces and pressure distribution using low speed wind tunnel. Supersonic flow, flight demonstration, tunnel experiments. Aerospace propulsion (gasturbines), ramjets, etc.). Basic aircraft sensors. Pre/Co.: ME 443

ME 543  Mechatronics Systems Integration  3C.H

ME 544  Turbomachinery  3C.H
Types of turbomachinery, energy transfer between fluid and rotor. Axial machines and centrifugal machines. Pumps, compressors, and turbines. Gas-turbine power plant and applications. Pre: ME 322, ME 444

ME 545  Mechatronics Lab II  1C.H
This Lab. will introduce the students to the concept of low cost automation using electro-pneumatic, electro-hydraulic systems, sensors, actuators and PLCs to automate industrial processes, Data acquisition, and intelligent control. Co: ME 543

ME 546  Aircraft Sensors & Actuators  3C.H
Study of control systems components and mathematical models. Amplifiers, DC servomotors, reaction mass actuators. Accelerometers, potentiometers, shaft
encoders and resolvers, proximity sensors, force transducers, piezoceramic materials, gyroscopes, air-data systems, heading sensors, GPS receivers.  
Pre: ME 471

ME 547 Robotics 3.C.H  
Overview of the field of robotics and their applications; Types, locomotion, kinematics, dynamics, planning, control and design of manipulators and mobile (wheelled) robots; Robotics perception (sensors) and actuators; Multi-robots systems. Pre: ME 462

ME 548 Autotronics 3.C.H  
Fundamentals of engine and vehicle systems, Review of Electrics and Electronics, control and instrumentation, sensors and actuators, electronic engine control, vehicle motion control. Pre: ME 462, ME 471

ME 549 Introduction to Intelligent Systems 3.C.H  
Classical logic and Fuzzy logic, fuzzy sets and fuzzy systems, fuzzy operations and inference, fuzzy control and applications, Introduction to Neural networks and Adaptive Neuro Fuzzy Inference System. Pre: ME 462

ME 551A Sustainable Energy Conversion 3.C.H  
Sustainable energy resources: Solar, wind, geothermal, ocean, biogas, and hydropower. Oilshale. Energy storage. Introduction to direct energy conversion. Pre: ME 322

ME 561 Fluid Power Control 3.C.H  
Fundamentals of fluid power (hydraulic and pneumatic) and its components. Pipes, compressors, pumps, motors and control. In addition, complex components, such as servo actuators and electro-hydraulic servo valves will be discussed functions and terminology. Basic circuit design, symbols, and schematic diagrams. Pre: ME 462, ME 343

ME 562 Acoustics 3.C.H  

ME 563 Aircraft Performance 2.C.H  

ME 581A Heating, Ventilation, and Air Conditioning 3.C.H  
Air-conditioning processes; psychrometric and humid air calculations. Air quality and comfort conditions, Heating- and cooling-load calculations. Air handling units and air distribution systems. Pre: 5th year standing

ME 582A Refrigeration 3.C.H  

ME 591 Graduation Project I 1.C.H  
Documents the application of previous learning, experience and knowledge to the problem at hand, and evaluates the results. Pre: Completion of 114 C.H

ME 592 Graduation Project II 3.C.H  
Students perform the experimental and practical phases associated with solving the mechanical engineering problem addressed in Graduation Capstone Project I. Students produce a full technical report that documents the research, design, results, analysis, and recommendations of the study, followed by a final presentation and defense. Pre: ME 591

ME 593 Projects in Mechanical Design 2.C.H  

ME 594A Special Topics in Thermal Power 3 C.H  
Pre Department approval

ME 594B Special Topics in Thermal Power 2 C.H  
Pre Department approval

ME 594C Special Topics in Thermal Power 1 C.H  
Pre Department approval

ME 595A Special Topics in Aeronautics 3 C.H  
Pre Department approval

ME 595B Special Topics in Aeronautics 2 C.H  
Pre Department approval

ME 595C Special Topics in Aeronautics 1 C.H  
Pre Department approval

ME 596A Special Topics in Mechatronics 3 C.H  
Pre Department approval

ME 596B Special Topics in Mechatronics 2 C.H  
Pre Department approval

ME 596C Special Topics in Mechatronics 1 C.H  
Pre Department approval

ME 593 Projects in Mechanical Design 2.C.H  

ME 594A Special Topics in Thermal Power 3 C.H  
Pre Department approval

ME 594B Special Topics in Thermal Power 2 C.H  
Pre Department approval

ME 594C Special Topics in Thermal Power 1 C.H  
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ME 595A Special Topics in Aeronautics 3 C.H  
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ME 596A Special Topics in Mechatronics 3 C.H  
Pre Department approval

ME 596B Special Topics in Mechatronics 2 C.H  
Pre Department approval

ME 596C Special Topics in Mechatronics 1 C.H  
Pre Department approval