# Course Description

**110402221 Thermodynamics (1) 3CH (3,0) Prerequisites: 110103107 + 110102101**

Thermodynamics properties; states, processes and cycles; closed and open systems; work and heat, ideal and real gases; conservation of mass; 1st and 2nd laws of thermodynamics; entropy; exergy.

**110402212 Strength of Materials: (3,0,3), Prereq. ( 110401211)**

Types of loads, structures and supports, axial stress and strain, normal and bending moment diagrams, torsion, bending of beams, compound stresses, combined stresses, shearing stress and strain, Mohr's circle of stress and strain, thin walled pressure vessels, deflection of simple beams, buckling of columns.

**110402222 Thermodynamics (2) 3CH (3,0) Prerequisite: 110402221**

Review of basic laws and principles, vapor, air power and refrigeration cycles, mixtures of gas and vapor, psychrometry, combustion, enthalpy of formation, heat of reaction, compressible flow, velocity of sound Mach number, normal shock waves, nozzle and diffuser flows.

**110402231 Dynamics 3CH (3,0) Prerequisite: 110401211**

Kinematics of particles, rectilinear and curvilinear motion in various coordinate systems, kinetics of particles, Newton's laws, central force motion, work-energy equation, principle of impulse and momentum, impact, conservation of energy and momentum, kinematics of rigid bodies, relative velocity and acceleration, instantaneous center, plane kinetics of rigid.

**110402302 Engineering Measurements 3CH (3,0) Prerequisites: 110102102 + 110403242**

Introduction to measurement systems and experimental methods, basic concepts, calibration, dynamic response, analysis of experimental data, basic electrical measurements and sensing devices, displacement and area measurements, pressure measurement, flow measurement, temperature measurement, force, torque and strain measurements.

**110402303 Numerical Analysis 3CH (3,0) Prerequisites: 110101203 + 110108112**

Introduction to numerical methods, Solving non-linear equations, Solving linear and non-linear systems of equations, Interpolation and curve fitting, Numerical differentiation, Numerical integration, Numerical solution of ordinary differential equations, Initial and Boundary value problems.

**110402310 Fluid Mechanics (1) 3CH (3,0) Prerequisite: 110101203**

Flow classification, fluid properties, viscosity, vapor pressure, fluid statics, pressure measurements, buoyancy, fluids in motion, continuity equation, pressure gradient in fluid flow, Bernolli's, momentum and energy equations, dimensional analysis and similitude, and flow in conduits.

**110402313 Fluid Mechanics Lab 1CH (0,3) Prerequisite: 110402310**

Experimental methods and measurements: fluid properties, orifice and jet flow, Bernoulli's theorem-flow through a venture tube, impact of water jet, losses in pipes

and fittings, comparative fluid measurements, hydrostatic pressure, flow visualizations and turbulent pipe flow, performance of pumps.

**110402324 Heat Transfer (1) 3CH (3,0) Prerequisites: 110406260 + 110402221 + 110402310**

Introduction to heat transfer mechanisms, heat conduction equation, steady heat conduction including the thermal resistance networks, transient heat conduction, lumped systems, fundamental of convection and thermal boundary layers, external and internal forced convection, natural convection, boiling and condensation, thermal radiation, and heat exchangers.

**110402325 Thermal Science Lab (1) 1CH (0,3) Prerequisite: 110402222**

Marcet Boiler, Gas Calorific Value, Nozzle Test, Refrigeration Cycle., Stiring Cycle, 6-two-stage compressor, Thermal Resistance Of multilayer materials, Double-pipe concentric tube heat exchanger, Cross-flow heat exchanger, combined convection and Radiation, forced convection and radiation.

**110402330 Strength of Materials Lab 1CH (0,3) Prerequisite: 110402212**

Measuring and/or determination of some material properties such as stress (yield, ultimate & fracture) and strain, torsion, impact, fatigue, bending, creep, hardness and tensile tests.

**110402381 Thermofluids 3CH (3,0) Prerequisite: 110102101**

Basic concepts of thermodynamics, properties of pure substances, 1st and 2nd laws of thermodynamics, basic principles of fluid mechanics including fluid static and in motion, mass, momentum and energy conservation laws, external and internal flow in pipes, basic principles of heat transfer including modes of heat transfer, steady heat transfer, and heat exchangers.

**110402382 Thermofluids Lab 1CH (0,3) Prerequisite: 110402381**

Measurement of specific heat ratio, bomb calorimeter, heat pump, Marcet boiler, conversion of work to heat, flow through a nozzle, impact of water jet and pump characteristics.

**110402384 Mechanical Design 3CH (3,0) Prerequisite: 110402212**

Evaluation and considerations of design process, load and stress analysis, deflection and stiffness, static strength and theories of failure, fatigue theories of failure, shafts, design of fasteners and connections, riveted joints, bolts and screws, force-deflection diagrams of bolted connections, welded joints, Mechanical springs, bearings, Lubrication and journal bearings , gears and geometry.

**110402385 Process Control Systems 3CH (2,3) Prerequisite: 110101203**

Different types of control systems: open- and closed-loop, review of complex variables and Laplace transform, poles and element transfer function and block diagram, modeling of physical systems, signal flow and block diagrams, introduction to state-space representation, sensitivity of open and closed-loops control systems, stability criterion and analysis.

**110402426 Thermal Science Lab(2) 1CH (0,3) Prerequisites: 110402324 + 110402325**

Flash point, stroke S.I engine, stroke diesel engine, Emission analysis of, S.I engine, Psychometric process, Air Conditioning reversed cycle, Center heating system, Weather station, Solar collector efficiency, Film and drop wise condensation, Boiling heat transfer.

**110402433 Mechanical Vibrations 3CH (3,0) Prerequisites: 110406260 + 110402231**

Linear Spring-mass-damper modeling, Single and Multi-Degree Degree of Freedom systems, Newton's Methods, Energy and Lagrange methods, Hysteretic Damping, Coulomb Friction Damping, Free and Forced Response, Harmonic, Periodic and Arbitrary Forced Excitation Response, Modal analysis and Mode summation techniques, Basic Principles of Vibrations Measurements, Design of Vibration Isolators, Continuous systems.

**110402434 Control Systems 3CH (3,0) Prerequisite: 110402433**

Modeling of dynamical systems, linearization, introduction to state-space representation, transfer functions, block diagrams, stability, Routh-Hurwitz criterion, time domain response, root locus, feedback compensator design, Bode diagrams, Nyquist criterion, lead-, lag, and lead-lag compensation.

**110402440 Theory of Machines 3CH (3,0) Prerequisites: 110406260 + 110402231**

Mechanisms and applications, mobility and linkages, cams, spur gears, helical and bevel gears, worm gears and Gear trains.

**110402445 Mechanical Drawing 1CH (0,3) Prerequisite: 110400202**

Computer-aided solid modeling concepts, Modeling 3D geometries using solid modeling techniques, Combination of solid modeling techniques to create complex parts, Assembly of 3D parts to form a machine or complete mechanical system, Generating multi-view engineering drawings for 3D parts or assemblies.

**0402446 Machine Design (1) 3CH (3,0) Prerequisite: 110402330**

Evaluation and considerations of design process, static strength and theories of failure, fatigue strength, fatigue theories of failure, design of fasteners and connections, riveted joints, bolts and screws, force-deflection diagrams of bolted connections, welded joints.

**110402447 Machine Design (2) 3CH (3,0) Prerequisites: 110402440 + 110402445 + 110402446**

Mechanical springs: helical, leaf and torsion springs shafts, rolling element bearings. Lubrication and journal bearings, clutches, coupling and brakes, gears and geometry, gear trains force and stress, multi-speed gear boxes design and analysis, couplings, clutches, brakes and fly wheels, cams, belts and chains, and term project.

**110402448 Dynamics of machinery 2CH (2,0) Prerequisite: 110402440**

Velocity analysis of mechanisms, Acceleration analysis of machinery, Static forc analysis, dynamic force analysis, balancing of rotors and reciprocating engines, synthesis of mechanisms. Term project.

**110402450 Mechanical and Electrical Systems for Architectural Students 2CH (2,0) Prerequisite: 110497431***

Basic mechanical, electrical and electromechanical design principles in buildings, such as heating and cooling systems, insulation, thermal loss calculations, and light and electrical load distribution. Acquisition and analysis of mechanical sings, symbols, and plans. Electrical and mechanical field work along with architectural works.

**110402531 Finite Elements Method for Engineering Design 3CH (3,0) Prerequisites: 110406260 + 110402303 + 110402447**

Introduction to approximate solution methods for problems in elasticity; the RITZ method; interpolation; weighted residual methods; applications of the finite element method; isoparametric finite elements; displacement-based bending elements in solid and structural mechanics; programming the finite element method; advanced topics in finite element analysis.

**110402513 Turbomachinery 3CH (3,0) Prerequisites: 110402222 + 110402310**

Classification of turbomachines, dimensional analysis and similarity laws, pressure and temperature isentropic relations for compressible flow, total pressure and temperature relations, energy transfer between rotating rotors and fluid flow, degree of reaction, construction of velocity diagrams, analyses of axial and radial flow compressors and turbines, free vortex design, estimation of stage and design point performance.

**110402514 Fluid Mechanics (2) 3CH (3,0) Prerequisite: 110402310**

Review of conservation equations. Compressible flow: Isentropic flow. Normal shock waves. Oblique shock waves. Prandtl Meyer-expansion. Adiabatic frictional flow in a constant-area duct. Compressible Flow with heat friction. Applications of compressible flow to nozzles and airfoils.

**110402527 Heat Transfer (2) 3CH (3,0) Prerequisite: 110402324**

Two-Dimensional Steady State Conduction, finite difference solutions, Numerical solutions of multi-dimensional transient conduction problems, convection boundary layer equations and analogies, boiling and condensation, radiation properties and processes, radiation exchange between surfaces, software applications, term paper.

**110402535 Vibration and control Lab 1CH (0,3) Prerequisite: 110402434**

Free vibration of simple mass-spring system., Free damped response of simple mass-spring-system. Static and dynamic balancing. Harmonically excited rotational system. Frequency response of the harmonically excited rotational system. Frequency response base excitation. Introduction to Control. Spring- Mass-damper system simulation, PID Controllers. Modeling of a fluid system. Fluid level control. Electromagnetic Levitation.

**110402536 Composite Materials 3CH (3,0) Prerequisite: 110402212**

Classification and characterization of composite materials, basic terminology of laminated fiber reinforced composite material, manufacturing methods, testing for mechanical properties, non-destructive inspection, macro-behavior of lamina, stress-strain relations for anisotropic material, orthotropic materials, invariant properties and strength of orthotropic lamina , biaxial strength theories for orthotropic lamina,

micro behavior of lamina, mechanics of material and elasticity approaches to stiffness, mechanics of material approach to strength.

**110402538 Introduction to Non-Destructive Testing Techniques 3CH (2,1) Prerequisite: 110400101**

General introduction about Non-destructive Testing (NDT) applications, methods and certification schemes. Four of the most widely used NDT methods (PT, MT, UT & RT) will be covered thoroughly in this course. The course contents, layout and organization are consistent with the American Society of Nondestructive Testing (ASNT) certification standard ASNT-CP-189.

**110402542 Electromechanical Systems 3CH (3,0) Prerequisites: 110402440 + 110406229**

A study of devices and components that translate electrical energy into mechanical motion. Interfacing of mechanical and electrical systems and mechatronics. Basic introduction to sensors, actuators and computer interfacing and control. Transducers and measurement devices, actuators, A/D and D/A conversion, signal conditioning and filtering. DC and AC motors, servo motors, stepping motors, solenoids, relays, and timers. Applications of sensors and actuators in mechanical systems.

**110402549 Computer Aided Design 2CH (2,0) Prerequisite: 110402446**

Fundamentals of engineering design idea implementation and manipulation, introduction to concepts of wireframe, surface and solid modeling, geometric transformations of entities, data fitting techniques (splines, Bezier and B-splines), utilization of CAD packages for visualization and optimization and the simulation of mechanical problems.

**110402551 HVAC (Heating, Ventilation and Air-Conditioning) 2CH (2,0) Prerequisite: 110402324**

Review of psychrometry, thermal comfort, air conditioning processes, inside and outside design conditions, heating load calculations, infiltration, cooling load calculations, solar gain, heating systems, design, layout, hot water, steam, hot air systems, under floor heating.

**110402552 Building Services 3CH (3,0) Prerequisite: 110402310**

Basic definitions, plumbing materials, pluming fixtures, traps, clean-outs, interceptors and valves, indirect waste piping and special wastes, sizing of hot and cold water supply and drainage systems, vents fire fighting networks, drinking water quality.

**110402553 Refrigeration Systems 3CH (3,0) Prerequisite: 110402222**

Basic definitions and concepts, review of vapor compression and absorption cycles, compressors, condensers, expansion devices, evaporators, refrigerants, cooling towers and other components of refrigeration systems.

**110402554 Design of Thermal Systems 3CH (3,0) Prerequisite: 110402222**

Designing of a workable thermal system, modeling of thermal equipment, system simulation and optimization, thermodynamic properties and steady-state simulation of large systems.

**110402561 Internal Combustion Engines 2CH (2,0) Prerequisite: 110402222**

Engine classifications and terminology. Analysis of engine performance parameters and the main engine cycles including: Otto, Diesel, Dual and two-stroke cycles.

Common fuels used in IC engines, combustion reactions and the associated thermochemical calculations. Engine emissions and their control technologies and strategies. Air and fuel induction methods and technologies and the combustion phenomena. Friction losses and different engine lubricants.

**110402562 Energy Conservation 3CH (3,0) Prerequisite: 110402222**

Basic principles, terminology and concepts of conservation, energy auditing, energy conservation in boilers, furnaces & dryers, energy storage and waste heat recovery, co-generation and combined heat and power systems.

**110402564 Renewable Energy 3CH (3,0) Prerequisite: 110402324**

A comprehensive overview of renewable energy sources and applications, including solar thermal applications, photovoltaic system, geothermal, wind, wave, tilde, fuel-cell, and biomass.

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**110402571 Special Topics in Mechanical Engineering 3CH (3,0) Dept. consent**

Special up-to-date topic in one of the mechanical engineering streams, energy, or building services, or machine design and applied mechanics.

**110402572 Graduation Project 1 1CH (0,3) Prerequisite:**

**The student must pass at least (120) credit hours from the curriculum which must include 110402222, 110402310, and 110402446.**

Planning, design, construction and/or management of a mechanical engineering project. Writing a technical report. Preparation of technical engineering drawings.

**110402573 Graduation Project 2 2CH (0,6) Prerequisite: 110402572**

Completion of Graduation Project 1.

**110402599 Practical Training 0 CH (0) Prerequisites (The student should pass (112) credit hours from the curriculum).**

Getting a bachelor's degree in Mechanical Engineering requires practical training for a period of eight (8) weeks in any private or public organizations inside or outside Jordan that work in the area of Mechanical Engineering and had been approved by the department of Mechanical Engineering and the Faculty of Engineering.

**110108114 Automobile Essentials 3CH (3,0) Prerequisites: -**

Introduction, engine systems (Ignition, fuel, lubrication, cooling),Car systems (Power terrain, brakes, steering, suspension, air-conditioning and heating)و Exhaust and emission, wheels and tires, Common malfunctions and remedies, Automobile up-to-date technologies