SYRIAN ARAB REPUBLIC
Ministry of Higher Education
Tishreen University
Faculty of Mechanical and Electrical Engineering

الجمهورية العربية السورية
وزارة التعليم العالي
جامعة تشرين
كلية الهندسة الميكانيكية والكهربائية

Course Syllabus in the chair of Design and Manufacturing Engineering:

First Year - First Semester

Mathematics/1/: 2h theoretical, 2h practical

1. Sets, loops, fields.
2. Matrices and determinators.
3. Solving systems of linear equations.
4. Linear application space.
5. Real number field.
6. Real functions of real variable, function continuity.
7. Differential calculation of real function with 1 variable.
8. Study of function transformations and plotting graphs.
9. General quadratic equation in the plane.
10. Famous curves (intermediate, polar and hyperbolic functions)

Physics/1/: 2h theoretical, 2h practical

1. Heat basic concepts.
2. Ideal gases and kinetic theory of gases.
3. Equivalence of heat and work.
4. First and second thermodynamic principles.
5. Real gases and fumes.
6. Basic laws of geometrical optics.
7. Light refraction through parallel glass faces and prism.
8. Refraction and reflection on spheres and shadow formation.
9. Light interference, diffraction, and polarization.

Industrial chemistry: 2h theoretical, 2h practical

1. The modern atomic theory.
2. Mol, equivalent weights and solution concentration.
3. Oxidation and redox.
4. Mendeleev table and its development.
5. The concept of chemical bonds.
6. Interactions between molecules.
7. Liquid properties (water and its properties).
8. High polymers and crystals.
9. Chemical and electrical solutions.
10. Interaction velocity and chemical balance.

Descriptive geometry: 2 h theoretical, 2 h practical

1. Graphical projection basics – introduction to orthogonal projection.
2. Lines and planes projection.
3. Basic concepts of points and lines.
4. Descriptive geometry methods.
5. Instrumentation concepts.
6. Polyhedrons.
7. Curves, circles, and spheres.
8. Conical and cylinder surfaces.
9. Axonometric projection and inclined axonometric projection.

Geometric mechanics: 4h theoretical, 2h practical

1. Basics of geometric mechanics.
2. Basic vectors in mechanics.
3. Basics of statics.
4. Force composition and decomposition.
5. Mechanical twin theory.
6. 2D and 3D forces sum.
7. Structural facilities.
8. Friction.
9. Force systems in space.
10. Centres of gravity.

Foreign language: English/1/: 4h theoretical

Culture: 2h theoretical

First Year - Second Semester

Mathematics/2/: 4 hours theoretical, 2 hours practical

1. Introduction to real and complex numbers.
2. Sequences and numerical series.
3. Sequence and series of a function.
4. Differential calculation of 1-variable real functions.
5. Definite and indefinite integrals and their applications.
6. Multi-variable functions.

Physics/2/: 2 hours theoretical, 2 hours practical

1. Physical values and measurement units.
2. Field and voltage generated by a continuous distribution of charges (continuous and bulk distribution)
3. Movement of charged objects in electrical and magnetic fields.
4. Insulators.
5. Electric current.
6. Electric current study methods.
7. Magnetism.
8. Induced currents.
9. Sound: vibrating movement, wave movement, features.
10. Quantum theory in radiation.
11. Laser: properties of laser light, active medium.

Workshops: 4 hours practical

1. Definition of manufacturing engineering.
2. Manufacturing methods: formation, sintering, pressing, extrusion, blacksmith.
3. Welding methods.
4. Operation, turning, drilling, planing, milling, bulding, grinding.
5. Cast iron manufacturing, manufacturing non-iron metals.
6. Casting steele, non-iron metals casts, casting sand, testing and its methods, types of methods of casting.

Geometric Drawing/1/: 2 hours theoretical, 2 hours practical

1. Geometric drawing tools.
2. Geometric lines and rules of writing.
3. Geometric structure.
4. Dimensions and geometric terms.
5. Representation of objects on the plane.
6. Steel structures.
7. Wooden works.
8. Standard products.

Introduction to computers: 2 hours theoretical, 2 hours practical

1. Basics of computer science.
2. Information system and historical development of computers.
3. Basic components of a digital computer.
4. Numerical systems and data representation.
5. Logical design of electronic computers.
6. Computer networks.
7. Programming principles, introduction to programming using C++.
8. Practical section – introduction to Windows – Word, Excel, and PowerPoint.

Foreign language: English/2/: 4 hours theoretical

Arabic language: 4 hours theoretical

Second Year - First Semester

Mathematics/3/: 2h theoretical, 2h practical

1. Basic Concepts in Differential Equations.
2. First-order differential equations, both solvable and unsolved, for the derivative.
3. Differential Equations of Higher Orders (decreasing system order).
4. Differential linear Equations of Higher Orders.
5. Differential linear Equations with transformative parameters.
6. Normal Differential Equations systems.
7. Multi-variable functions.
8. Plane and lines in space.
9. Curve and surface in space.
10. Multiple integrals and their applications.

Geometric mechanic /2/: 2h theoretical, 2h practical

1. Linear motion of a point.
2. Point motion equation.
3. Basic motions of a rigid body.
4. Compound motion of a point.
5. The planar motion of a rigid body
6. Motion of a rigid body around a fixed point
7. point Compound motion in the general state
8. Compound motion of a rigid body
9. Motion of physical point
10. Momentum and kinetic torque of a physical system and collision theory
11. Kinetic energy and potential energy
12. Relative motion of a physical point
13. Hypothetical Transition Principle Dalembert Principle
14. moment of inertia
15. rigid body motion

Geometric drawing /2/: 2 hours theoretical, 2 hours practical

1. Dimensions and engineering terminology (fine workmanship, surface finish quality, formation marks)
2. objects representation in the plane and auxiliary projections
3. Metal structures (welded joints)
4. temporary fixings
5. Executive drawing and representative drawing
6. Intersections and solitaries of surfaces
7. Gears and gear set

Programming /1/: 2h theoretical, 2h practical

1. Problem solving algorithms
2. Programming using Visual Basic 6.0/
3. Identifying the commands of VB software.
4. Dialog boxes.
5. List creation.
6. Matrices.

Thermodynamic: 4 hours theoretical, 2 hours practical

1. Applied thermodynamics concept, equation of state, forms of energy and its transformations
2. Energy conservation law and its applications
3. Closed and open thermodynamic cycles
4. The second law of thermodynamics and its applications
5. The differential equation for the thermodynamic state
6. thermodynamic balance
7. Properties of ideal gases and their thermodynamic processes
8. Properties of real gases and vapours
9. Water vapor
10. Humid air
11. internal combustion engine cycles
12. Steam turbine cycles and gas turbine cycles
13. air compressors
14. cooling and heat pump circuits

Electrical engineering basics: 2h theoretical, 2h practical

1. Fundamentals of electric technology.
2. Basic magnetic values and fundamental circuit laws.
3. Single-phase alternating current circuits.
4. DC circuit solution.
5. three-phase alternating current.
6. Magnetic circuit solution.
7. Transients in electric current.
8. Electric, magnetic and electromagnetic fields

Foreign language: English/3/: 4h theoretical

Second Year - Second Semester

Mathematics/4/: 2 hours theoretical, 2 hours practical

1. Algebra of complex numbers
2. Complex variables and functions
3. Integration of complex functions and Cauchy's theorem
4. Infinite sequences and series
5. Residue theory and real integrals
6. Infinite multiplications
7. Scalar field and radial field
8. Vectors and operations on them
9. Vector functions and their integrals
10. Gauss theorem and Stokes theorem

Heat transfer: 2 hours theoretical, 2 hours practical

1. The different ways of heat transfer
2. heat conduction
3. convection
4. Heat transfer by radiation
5. thermal effect
6. heat exchange.

Strength of Materials /1/: 4 hours theoretical, 2 hours practical

1. Basic principles (assumptions used in the resistance of materials)
2. strain and pressure
3. stress state theory
4. Geometrical characteristics of planar cross sections and their static moments
5. Torsion
6. bending
7. Displacements in bars when bending

Manufacturing methods /1/: 2 hours theoretical, 2 hours practical

1. An overview of metal formation methods
2. Mechanical drawings
3. Measurement devices and tools, production quality
4. engineering materials
5. Physical basics of cutting process, cutting tools
6. Machining
7. Materials used to manufacture tool bits.
8. Lathes and various operations on them
9. Drilling process, drilling machines, workpieces on drilling machines
10. Skimmers, flat surface skimming operations
11. Formation, its machines, surface work them
12. Surface Milling, Milling Machines
13. Surface grinding operations
14. CNC manufacturing methods
15. Movement axes and zero points in programmed operating machines
16. CNC software installation
17. Basic Commands in Programmed Operating Machines

Programming/2/: 2 hours theoretical, 2 hours practical

1. Introduction to MATLAB.
2. Matrices.
3. Operation on matrices.
4. Polynomials and equations in MATLAB.
5. Common drawing commands.
6. 2D drawing.
7. 3D drawing.
8. Conditional statements.

Materials science: 2 hours theoretical, 2 hours practica

1. Engineering materials – characteristics and testing.
2. Testing equipment.
3. Behaviour of engineering materials under static tension, static pressure, static bending, static shear
4. Behaviour of engineering materials under fatigue stresses
5. Metal hardness and its testing
6. Properties and use of ferroalloys

Foreign language: English/4/: 4 hours theoretical

Third Year - First Semester

Strength of Materials /2/: 4 hours theoretical, 2 hours practical

1. Composite turning
2. Methods for calculating displacement using Moore's integral, Castigliano's theorem, and Virthagen's theorem
3. Using methods for calculating transitions in solving statically indeterminate for simple straight gables.
4. Solving statically indeterminate groups (Power Method - Clapyron Equation)
5. lamentation
6. Impact stresses (longitudinal impact and transverse impact)

Manufacturing methods /2/: 2 hours theoretical, 2 hours practical

1. Introduction to the concept of welding and its classification
2. Resistance welding (spot welding, thread welding, projection welding, flash welding, friction welding, ultrasonic welding)
3. Electric arc welding and gas welding
4. Casting concept and casting in sand molds
5. Design study of a sand mold and methods of preparation
6. Main - subsidiary pouring channels
7. Rising Channels

Fluid dynamics: 2 hours theoretical, 2 hours practical

1. Characteristics of fluids.
2. Hydrostatic force on surfaces
3. Buoyancy.
4. Linear and rotational movement of fluids
5. Fundamentals of movement in fluids
6. hydrodynamic network

Mechanical measurements: 2 hours theoretical, 2 hours practical

1. Dimension measurements basics
2. Tolerance and Interference system
3. Basic components of measuring tools and devices
4. Measurement systems and measurement errors
5. Dimension series.
6. Shape and placement errors
7. Surface roughness
8. Gear Engagement Errors
9. Practical section - Practical experiments in lab

Power plants: 2 hours theoretical, 2 hours practical

1. Energy, types of electrical stations, circuits of steam power stations
2. Energy indicators of capacitor power stations
3. Energy indicators for thermoelectric power stations
4. Initial parameters and repeated heating of steam
5. Regenerative heating of feed water

Metallurgy and alloys : 4 hours theoretical, 2 hours practical

1. Material structure
2. The solid structure of metals and their formation
3. Metal alloy theory
4. Defects of crystal structures and their impact on the mechanical properties of metals
5. Identification of the internal structure of minerals
6. Major physical properties of metals and metal alloys and their tests
7. Balance diagram for iron and carbon alloys
8. Theoretical basics of heat treatment of iron and coal alloys
9. Core processors in thermal processors
10. Steel alloys and metal alloys.

Foreign language: English/5/: 4 hours theoretical

Third Year- Second Semester

Operations Research and Modeling: Theoretical 2h - Practical 2h

1. introduction.
2. Linear Programming: (Graphical Methods - Algebraic Methods)
3. The general form of a linear programming model.
4. Transfer algorithm.
5. Allocation problems.
6. The use of networks in project planning.

Combustion engines: theoretical 2h - practical 2h

1. Internal combustion engines.
2. Thermal units of internal combustion engines.
3. Fuel and combustion process.
4. Engine work indicators.
5. The main parts of the engine.
6. Forced air charging system in the engines.
7. The feeding system in the gasoline and gas engine, and in the diesel engine.
8. The ignition system in the gasoline engine.
9. Cooling system.
10. Pistonless heat engine system.
11. Thermal stations.
12. Modern steam generator.
13. Steam and gas turbines.
14. Free piston generator.
15. Electrical stations.

Manufacturing Methods/3/: Theoretical 2h - Practical 2h

1. basic principles of metal formation.
2. Metal plates cutting.
3. Bending and forming of metal plates.
4. Metal plates deep drawing.
5. Rolling mill.
6. drawing of wires and pipes.
7. modern methods of forming minerals.
8. Metal extrusion.

Machine Design/1/: Theoretical 2h - Practical 2h

1. General basic design rules.
2. the deflections of the external surfaces.
3. Resistance and allowable stress.
4. Columns and axes.
5. Base metal fusion welding joints.
6. Pressure welding joints.
7. Non-fused weld joints.
8. Adhesive connections.
9. Rivet connections.
10. Transmission bolts.
11. Springs.

Machine theory: theoretical 4h - practical 2h

1. Parts of compositions and their functions.
2. Automated installation applications.
3. Fundamentals of composition analysis.
4. Elbow fittings and their calculations.
5. Dynamic study of automated structures.
6. Cam structures.
7. Toothed fittings.
8. Gear sets.
9. Brake fittings.

Industrial electronics: theoretical 2h - practical 2h

1. Electronic components.
2. The source of electrons.
3. Photoelectric release method.
4. Electric discharge in gases and gas valves.
5. The physical half of the carrier.
6. PV elements.
7. Measurement elements based on resistance change
8. Electrical capacitive elements.
9. Applications in changing electrical capacitance.
10. Charging and discharging capacitors.
11. Continuous electrical feeding.
12. Applications for electronic circuits.

Fourth Year - First Semester

Conveying machines: 2 hours theoretical, 2 hours practical

1. Classification of conveying machines
2. mobile ruler.
3. Plate conveyer.
4. Beam conveyer.
5. hung conveyor
6. factory conveyor.
7. helical conveyor
8. vibrating conveyor
9. pneumatic conveyor
10. Auxiliary equipment for transportation machinery

Machine Element Design /2/: 4 hours theoretical, 2 hours practical

1. introduction
2. conveyers.
3. Tracks and chains
4. Frictional transmission of motion.
5. Motion Transmission by gear
6. bearings
7. couplers
8. clutches
9. brakes
10. Restraints and interlocking devices.
11. Applications of gears and bearings in gearboxes

Machines dynamics and vibrations: 4 hours theoretical, 2 hours practical

1. Forces acting on machines
2. Non-sequential movement of machines
3. The balance of acting forces
4. Balance of inertia forces of the mechanical structure
5. System balance.
6. The concept of mechanical vibration
7. Mechanical attenuation.

Production plans: 2 hours theoretical, 2 hours practical

1. Basic concepts, identification of excess and residual layer for machining
2. Operational accuracy
3. The quality of the working surfaces
4. Calculation of cutting systems and technical parameters of the technological scheme
5. The basic principles for technological scheme correction.
6. Similar elements operation.
7. Aggregated works technology.

Forming and its machinery: 2 hours theoretical, 2 hours practical

1. Basic Laws of forming
2. Warming up in forming.
3. heating furnaces
4. Drawing - rolling - forging - extrusion
5. Sheet shaping, drilling and shearing

Computer aided design and manufacturing: 2 hours theoretical, 2 hours practical

1. Introduction to CAD/CAM.
2. Basic components of CAD/CAM.
3. CAD/CAM software.
4. CAD/CAM and microcomputers.
5. Mathematical models and representations of curves.
6. Mathematical models and representations of planes.
7. Mathematical models and representations for rigid bodies.
8. Drawing aids.
9. Working with drawings and editing.
10. Computer aided animation.

Foreign language: English/6/: 4 hours theoretical

Fourth Year - Second Semester

Casting and its machinery: 4 hours theoretical, 2 hours practical

1. Casting process and the interaction between the liquid metal and the mold.
2. Metal freezing basics.
3. Preventing the forming of gaps in metal castings.
4. Specific casting methods.
5. Casting sand.
6. sand mold machines.

Lifting machine: 2 hours theoretical, 2 hours practical

1. Overview of Lifting Machines
2. Basics of element calculation of lifting machines
3. Lifting mechanisms
4. Balance mechanisms
5. metal structures.

Operating machines: 4 hours theoretical, 2 hours practical

1. Classification of movements in operating machines
2. lathes
3. automatic machines
4. Drilling machines and boring machines
5. Milling machines
6. Planing machines
7. Grinding machines
8. Gear teeth cutting machines

Hydraulic machines and systems: 4 hours theoretical, 2 hours practical

1. Basic Elements of Hydraulic Transmissions
2. Turbines
3. Pumps
4. Hydraulic Powering and Forming Machines
5. Hydraulic control circuits

Thermal treatment: 2 hours theoretical, 2 hours practical

1. Balance diagram for iron and coal alloys
2. Theoretical fundamental of heat treatment of iron and coal alloys.
3. Heat treatment of iron and coal alloys
4. Steel alloys.
5. Metal alloys

Applied project: Practical (2 hours)

Fifth Year - First Semester

Maintenance of production facilities and industrial security: 2 hours theoretical, 2 hours practical

1. Importance and general concepts in industrial security and occupational health.
2. Factors affecting accidents and injuries at work.
3. Electricity and its risks.
4. Safe use of electrical energy.
5. Chemical safety.
6. Industrial fires.
7. Explosions in the workplace.
8. Structural security.
9. Occupational health.
10. Regulating industrial security affairs in the industrial establishment.

Cutting theory and cutting tools theoretical 2h - practical 2h:

1. Cutting materials and tools and their properties.
2. The geometry of the turning tool bit shape.
3. Elements of the cutting process in operation on lathes.
4. The physical basis of metal cutting.
5. Cutting resistors in the turning process.
6. The geometric shape of the tool bit.
7. Determination of cutting variables in lathing operations.
8. Single turning tool design.
9. Shaping tool bits.
10. Leveling and planing.
11. Metal drilling, feather design.
12. Expansion blades and their manufacture.
13. Milling, design of milling cutters.
14. Gear bits, gear bit design.
15. Cutting spirals, designing the number of pieces of spirals.
16. formation and metalwork
17. grinding.

Industrial economics and industrial project matching: Theoretical 2h - Practical 2h

1. The emergence of economic sciences.
2. Production methods.
3. Industry and national production structure.
4. Basic assets in industrial establishments.
5. Industrial planning.
6. Production cost and prices.
7. Labor productivity.
8. Project evaluation and criteria.
9. Marketing and technical studies of the projects.
10. Estimated costs of the project.
11. Financial studies.

Design of operating machines and production plans: theoretical 2h - practical 2h

1. Specific modern requirements for the design of operating machines.
2. Drive systems and machining.
3. The interlocutor and their intercourse.
4. Linear motion mechanics.
5. Non-graded driving mechanisms.
6. Rotational mechanics.
7. Characteristics of the machine body and bases.
8. Chutes and pistons.
9. Numerical control of NC machining.

Designing Evidence and Proofs: Theoretical 2h - Practical 2h

1. The concept of design.
2. Positioning schemes.
3. Stabilization rules - Leaning points - V-blocks.
4. Installation mechanisms.
5. Clamping devices with camber surfaces.
6. Simple and complex mechanisms.
7. Anatomical Mechanisms.
8. Mechanisms: with arms, cam, articulated, multiple fixing elements, working with hydraulic plastic.
9. Structures, partitioning devices and their parts.
10. Pneumatic, hydraulic, and magnetic fasteners.

Foreign Language: English /7/: Theoretical

Fifth Year - Second Semester

Industrial organization and project management: 2 hours theoretical, 2 hours practical

1. Production methods and techniques
2. Factory site selection principles
3. Quantitative indicators and methods for selecting the location of the industrial facility
4. Factory buildings
5. Production process elements
6. Production process and organization
7. Production structure of machinery production plant
8. Patterns of organization of production and work flow.
9. Basic of organizing technical, design and technological preparation for production
10. Factory preparation.
11. Analysis of work, costs, wages and salaries
12. Organizing industrial management, network planning.
13. Managing the Means of Production by Methods (Johnson , Algorithm, NEH, LPT, CDS, Jackson)

Industrial heating and ventilation: 4 hours theoretical, 2 hours practical

1. The importance of thermal transfer in heating
2. Heat loss in buildings
3. Equipment used for thermal transmission
4. Hot water heating
5. Steam heating.
6. Solar energy uses for heating and water heating
7. Air conditioning, calculation of air conditioning loads, equipment design, performance analysis, and control systems
8. Ventilation methods
9. Air conditioning

Automation control and Production automation: 4 hours theoretical, 2 hours practical

1. General concepts of mechanization and automation of production and their characteristics
2. Technical and economic requirements for mechanization and automation
3. Economic advantages of automation
4. Control automation means
5. automatic control systems
6. Automation of production machines
7. automatic transmission machines
8. assembly automation
9. Techniques used in automated control processes

Industrial robot: 2 hours theoretical, 2 hours practical

1. Introduction to robotics and industrial robotics
2. Math calculations used in Android
3. Transformations and change of coordinates
4. Kinetic chains and serial robots
5. Direct & inverse geometric model
6. Direct & inverse kinematic model
7. Direct & inverse dynamic Model
8. Robotic arms and their types
9. Sensors used in robots and their types

Plastic engineering: 4 hours theoretical, 2 hours practical

1. The importance of plastics
2. Polymer science
3. General mechanical, physical and chemical properties of plastic materials
4. The main methods of manufacturing plastic
5. Special methods for the manufacture and production of reinforced plastic
6. Plastics production and processing machinery
7. plastic molds

Graduation project: 2 hours theoretical, 2 hours practical

Chair of Design and Manufacturing Engineering

Dr. Ali Mohammad Hatra

Dean of Faculty of Mechanical and Electrical Engineering

Prof. Michael Yousef Barbahan