Syllabus (Cource Description) of the Mechanical Design Engineering First Year – Department of Materials Science and Production

Mathematics (1) : (6 weekly hours : 4 Theoretical + 2 practical) – First Semester

Linear algebra : algwbraic polynomials , vector space , matrices , determinats , linear equation system, eigenvalues and eigenvectors, quadratic equation.

Mathematicla Analysis:

1-Introduction to Mathematicl analysis: numerical groups of real numbers , Dicart and polar coordination in the plane, numerical progressions , real subordinate for one variable, subordinate end and continuation , primary subordinate , Indefinite small and large.

2-Copplex number field : differential evaluation of real function of one variable : derivation and differentiation , essential theorems in differentiation , indefinite cases and removal methods , l`Hopital`s rule, functions behaviour analysis and plotting , rectangular , draw curves of Subordinate given according To Dicart , as well as by average and polarity.

3-Numeriacl series : positive bound series convergence tests, qualitative sequences , alternating sequences and Lebiter tests , absolute and conditional convergence .

4-Functional sequences and functional series : point convergence and normal convergence , power series , Taylor and Maclasurin power series .

Physics (1) : (6 weekly hours : 4 Theoretical 2 practical) – First Semester

Light : Principal concepts: light nature , Fermat`s concept , Huygens principle , light measurements.

Geometrical light : plane mirrors , spherical mirrors , spherical refractors, parallel plates, prisms, thin lenses .physical light: polarization ,semi-waves plates, quarter positive plates , young`s double-slits, interference in multipoint source equally distant. Diffraction: diffraction in rectangular slit or tiny wires, diffraction grids.

Fiber optics : working mechanism, types properties and application.

Heat and its properties : Introduction to temperatures, status equation, gases movement theory, matter cases and status variables, zero law in thermodynamics, first principles in thermodynamics , Heat transfer, heat properties, heat change impact on electronic elements application.

Practical Lab. Experiments.

Descriptive Geometry: 6 weekly hours: 4 Theoretical+ 2 Practical – First Semester

Introduction to projection methods, represent the point and straight in projection levels, representation of tabular on projections levels, different positions of one tabular, two tabular, straight , tabular and point and tabular and straight on projections level, special methods in H.W from changing projection levels and circles around the axis and the main straight and the trace line, represent multi – subordinate and positions with the straight and tabular on projection levels, spatial projection , metric , vertical and inclined.

Chemistry : 4 weekly hours : 2 Theortical+ 2 Practical – First Semester:

Theoretical :

Introduction: basic definitions and terms in chemistry : Gases : idealism : and reality : Chemical reaction speed : factors that impacts on reaction and reaction movement and levels ; Oxidization and taking back reaction in acid and alkaline atmosphere ; Metals corrosion and how to protect ; Water : solidity and how to eliminate; Chemical thermodynamics: first, second and third principles; Electrolytic solutions; Electrical chemistry : electrical chemistry fundamentals and electro – Chemical cells thermodynamics.

Practical (Lab):

Volumetric analysis : calibration of acid / base balanced reaction, oxidation / reduction reaction calibration , calibration using Edta solution , water analysis , water s hardness specifying and water PH tests , gases: molecular weight measure of a gas, Avocado constant evaluation , solution : extraction and evaluation of analytic distribution coefficient, chemical equilibrium , chemical equilibrium constant evaluation , chemical reaction activity, speed of chemical reaction, effects of heat on the speed of chemical reaction, thermodynamics: evaluation of thermal degree in acid / base balancing , energy evaluation for oxygenated water composing , metal corrosion : acid and base effects of metals (iron, copper and aluminum) , metal protection methods, experiment of metal galvanic dying.

Engineering Mechanics (Statics) : (6 weekly hours: 4 Thworetical + 2 Practical) – First Semester

Introduction to engineering mechanics , principles of engineering mechanics , solids equilibrium in the plane, friction, static graphs and how to calculate charts, spatial forces group, parallel forces centers and weight centers; general and comprehensive exercises.

Foreign Language (1) : (4 weekly hours : 4 Theoretical) – First Semester

English Language : Book : Life Lines

Specialized Workshops: (4 weekly hours : 4 Practical) – First Semester

Turnery and leveling workshop; plumber and modeling electric workshop, electrical wiring workshop, automotive workshop, plates and welding workshop.

Mathematics (2) : (6 weekly hours: 4 Theoretical + 2 Practical) – Second Semester Calculus:

Indefinite integral : primitive function , principles of integration methods , -1

2- definite integral and its application : definite integral as a function of the greater bound , derivative of definite integral , relationship between definite integral and indefinite integral , improper integrals , engineering and physical applications of definite integrals, numerical methods of definite integral evaluation .

3- Real functions of more than one variable : Limits and derivatives , partial derivatives, exact differential, Taylor`s expansion , Minima , Maxima and Lagrange method.

Differential Equations:

1-Ordinary differential equations of 1^{st} rank and 1^{st} degree : variable – separable equation , homogenous equations, linear equations , exact equation and integration coefficients, initial value problem , Cauchy`s problem solution using power series .

2- Ordinary linear differential equations of higher ranks and constant cefficients : differential operators, lagrang method , inverse differential operator and particular solution evaluation method and sequential approximation method for solving (n) rank differential equation.

Technical Drawing (1) (4 weekly hours : 2 Theoretical + 2 Practical) – Second Semester:

Engineering structures necessary for drawing and engineering materials – engineering bodies projection as per the international method of projection – engineering bodies parts and training on cut projections drawings and general exercises.

Engineering Mechanics (2) : (Kinematics) (4 weekly hours : 2 Theoretical + 2 Practical)- Second Semester:

Methods to give material point coordinates , material point movement , rotational movement of the solid body , even movement of the solid body and material point compound movement.

Arabic Language: (4 weekly hours : 4 Theoretical) – second Semester

Parsing , Syntax , orthography ,grammar ,morphology; Arabic dictionaries ; handwriting , and various cultural and literary topics.

Introduction to Comuter Science and Programming : (4 weekly hours : 2 Theoretical + 2 Practical) – Second Semester:

Computer from user point of view , computer system components , computer inputs , numbering system, curves representation , correct inputs and floating separating inputs , an overview on computer structure , surrounding units of the computer interaction, data transfer protocols , local computers network LA N , cities networks MAN , computer wide networks WAN , clusters , an overview on operation system , programming tools , windows system , office applications programs (Word , Excel , Power Point , Explorer , Front Page).

Foreign Language (2) : (4 weekly hours : 4 Theoretical) Second Semester:

English Language : Book : Life Lines.

National Culture : (2 weekly hours : 2 Theoretical) – Second Semester :

Discuss contemporary humanitarian , social, economical and political issues.

Head of Mechanical Design Engineering Department
Assistant Prof. Khaled Sharaf

Syllabus (Course Description) of the Mechanical Design Engineering – second Year- Department of Materials Science and Production

Mathematics (3) : (6 weekly hours : 4 Theoretical + 2 Practical) – First Semester

1-Analytic geometry in space: vector algebra , vector functions of one variable or more , coordinate systems in space, curvilinear coordinates .

2-Surface and curves in space : plane , straight line , second degree surfaces in space , geometric properties of space curve, geometric properties of space surface.

3-Multivariable integrals: double integral and its application , triple integral and its applications, surface integral and its applications, line integral and its applications, improper multivariable integrals.

4-Vector analysis : scalar field and vector field , vector derivatives of first and second order , gradient , divergence , curl , potential vector field .

5-Vector calculus : ordinary vector integrals , linear vector integrals , work and circulation , vector integral on closed surface , vector function flux , volume integral of vector functions , gauss` s theorem , stokes theorem , green theorem .

6-Probabilities and statistics : probabilities definition , conditional Probabilities , independent Events, mathematical expectation , dispersion and standard deviation – probable distribution and methods of Probabilities Calculation in evaluating measurement results – methods to find correlation factor among Different events.

Engineering Mechanics (Dynamic) : (6 weekly hours : 4 Theoretical + 2 Practical) – First Semester

Free motion of material point : the fundamental relationship of material point Kinematics – the differential equation of free point mobility , General theories of maretial point movement : introduction – Momentum amount of motion of material point –kinetic energy of a material point power - kinetic energy of a material point - kinetic Momentum of a material point - Motion under the influence a central force . Restricted motion of a material point : the fundamental relationship of a restricted material point kinematics – the differential equation of restricted point kinematics pendulum simple – Mechanical equilibrium – D` Alembert principle – relative motion of material point . Amount of motion and motion momentum of a material : external forces – internal forces – differential theories of motion – motion of center mass group –the principle of linear momentum change – momentum

conservation and centere of mass motion – momentum motion. the application of general theories on rigid body motion : translational motion – central rotational motion – plane motion – the motion of rigid body groups – D Alembert principle.

Engineering Drawing (2): (4 weekly hours : 2 Theoretical + 2 + Practical) – First Semester :

Elements of the machines used for engineering , elements fastening from screws , nuts and washers , other fastening elements ; such as welding and rivets , dismantled fastening elements and machines drawings and exercises.

Programming (1) : (4 weekly hours : 2 Theoreticsl + 2 Practical) – First Semester

General view on C++ programming language , C++ program structure , variables and constants , arithmetic and logical expressions , programming expressions and statements , comments , control techniques (switch – if / else – if) .repetition instructions (for loop , while loop , do / while loop) , subordinates , subordinate definition, subordinate description , conductors passage, mathematical subordinates , subordinates excessive loading , subordinates structures , matrixes , define and declare Matrixes , transfer matrix to subordinate , multi – dimensions matrix, curving sentence , declaring the curving sentence , bar as a matrix of curves , sentences processing subordinates .

Lab: Computer – Aided Exercises .

Civil Engineering : (2 weekly hours : 2 T heoretical) – First Semester

Introduction into civil engineering , assessment of influential actions on structures , classifying structures , reinforced concrete structures, types of concrete used of concrete structures , steel reinforcement bars , natural and mechanical basic characteristics of the concrete , reinforcement and reinforced concrete bars , structural parts exposed to bending , structural parts exposed to pressure, reinforced concrete foundations, characteristics of certain construction materials , soil.

Foreign Language (3) : (4 weekly hours : 4 Theortical) – First Semester

English Language : Book : Oxford English for Mechanical and Electrical Engineering : Iron and Steel , Heat Treatment of Steel , Lubrication of Bearings , Welding , Steam boilers, Steam Locomotives , Condensation and Condensers , Centrifugal Centrifugal Governors , Impulse Turbines , The Petrol Engine , The Carburetion System , The Jet Engine , The Turbo – prop Engine , Aero Foils.

Mathematics (4) : (6 weekly hours : 4 Theoretical + 2 practical) – Second Semester:

Complex analysis : 1- complex variables and comlex functions : complex point sets and complex number representation , limit , derivative and continuity of a complex functions, analytic function ,singular points, elementary complex functions , complex integrals , Cauchy` s integral theorem and formulas

Complex series :Taylor` s expansion ,Laurent expansion ,classification of singularities -2

3-Residues theorem : evaluation of complex integral using residues theorem , evaluation of real – definite integrals using residues theorem.

4-Mappings and its representation : complex mapping and function , analytic function representation , conformal mapping , general conformal mappings.

5-Fourier series and integral : trigonometric series , complex form of Fourier series , harmonic analysis , Fourier integral , generalized Fourier series . Special functions : Gamma function , Beta function, error function , Freshen function , sine and cosin integrals , Bessel functions of first and second sort , legendres polynomials . Laplace transform and its applications: Laplace transform , inversion of Laplace transform, Laplace transform of some special functions , Laplace transform applications , relationship between Fourier integral and Laplace transform , Z transform .

Partial differential equations : partial differenetial equations with direct integral ability, partial differential equation of the first order, partial differential equations of high orders with two independent variables and constant coefficients , vibrating string wave equation , two – dimensional heat transfer equation , circular membrane and Bessel equation.

Mechanics of materials (1) : (6 weekly : 4 theoretical + 2 practical)- Second Semester:

Theoritical section : Introduction to the strength of materials , tensile and pressure , static advantages of profiles , twisting , bending, changes in the status of loading ; Castiliano theorem , Moore integrals , Farchagn theorem

Laboratory : Tensile testing , bars bending, vertical and horizontal shifting experiment (Castiliano) , bending device of curved bars.

Thermodynamics (1) : (4 weekly hours: 2 Theoretical + 2 Practical) – Second Semester:

1-Main concepts and definitions : Internationa system of units (SI) – basic thermodynamic parameters of state – the thermodynamic system – thermodynamic process – heat and work – Laws of stats for ideal gases – Boyl – Mariof s law – gay – Lussac` s law – equation of state of ideal gases. Specific heat chapter

2- The first law of thermodynamics : internal energy – work and heat in a process – reversible and irreversible processes .

The first law of thermodynamics for inclosing systems – mathematical statement of the first law of thermodynamics – enthalpy – the enthalpy of ideal gases.

3-Main thermodynamics processes in ideal gases: the isochoric process – the isochoric process –the isothermal process – the adiabatic process – poly tropic processes.

4- The second law of thermodynamics : the fundamentals of the second law thermodynamics – cycles thermodynamics processes – thermal efficiency and refrigerating factor of cycles – mathematical statement of second law of thermodynamics – cycle of Carnot – diagram (t –s) – entropy .

5-Cycles of thermal machines : the diesel stations – cycle of gas – turbine plants – cycle of steam power plants – multi stages compressors , exercises.

Programming (2) : (4 weekly hours : 2 Theoretical + 2 Practical) – second Semester:

Programing Language C++: pointers, pointers factors , pointers matrixes , relation between matrixes and pointers , subordinates pointers ,sentences and input evacuation , definition of structure , definition of line , structures , structures virtual transactions , destructive items advanced issues in lines , fixed objectives , fixed subordinate , friendly subordinates and matrixes , fixed items in lines , factors excessive loading , genetics , genetics types , multi – genetics , virtual subordinates , matrixes , Input and output flows , files processing , files flows , files processes . Lab : Computer – Aided Exercises.

Manufacturing Methods (1) : (4 weekly hours : 2 Theoretical + Partical) – Second Semester:

Measuring devices , operating machines , cutting tools items , principles of operating materials by removing chips – operating process by turnery operating process by milling – operating process by perforation operating process by grinding – automated operation process – Micro operating process – machines regular and preventive maintenance and services – Principles of industrial security.

Material Sciencs and their Properties : (4 weekly hours : 2 Theoretical + 2+ Practical) – Second Semester:

Classification of metals and their solid structure, real structure of crystals and defects of crystal structures – methods of identifying the internal structure of the metals and their quality control . Metal crystallization and their growth – structure of metal alloys – the mechanical properties and tests of metals and metal alloys – the dynamic tests – types of metal alloys (Alumunium – copper – magnesium – nickel – titanium – zinc – lead – tin – hardly fusible metals .

Questions and Exercises . Laboratory classes and exercises.

Foreign Language (4) : (4 weekly hours : 4 Theortical) -Second Semester:

English Language : Book : **Oxford English for Mechanical and Electrical Engineering** :

Engineering Materials , Vectors , Force , Friction , Levers , Stress and Strain , Ideal and Practical Machines , the four stroke petrol engine.

Head of Mechanical Design Engineering Department
Assistant Prof. Khaled Sharaf

Syllabus (course Descripition) of the Mechanical Design Engineering Third Year- Department of Materials Science and Production

Metal Science and their Alloy: (4 weekly hours: 2 Theoretical + 2 Practical) – First Semester:

Iron and its alloy- Aluminum and its alloy- Copper and its alloy –Magnesium and its alloy- Nickel and its alloy- Zinc, Lead and Tin- Precious metals- Metals that are hard to melt- Extinction in metals- Corrosion and wear in metals- Optimal choice of metals.

Mechanics of Materials (2): (4 weekly hours: 2 Theoretical+ 2 Practical) – First Semester:

Theoretical Section:

Statically indecisive issues- theorem of three moments (continuous beams)- the theory of stress state of solids- stress state on solids- strain state on solids- theory of stiffness- cylinders of thin and thick wall- stability- longitudinal horizontal curvature- fatigue- impact strength.

Laboratory:

Testing the continuous beams- testing the cylinders of thin and thick walls- testing stability- testing the curvature of continuous beams- comparison between the practical application and the theoretical side of the stiffness theories.

Manufacturing Methods (2): (4 Weekly hours: 2 Theoretical+ 2 Practical) – First Semester

1- Advantages and disadvantages of casting: Definition of casting- manufacturing casting- advantages of casting- disadvantages of casting- types of casting- basic steps for sand casting.

2- Casting sands: the form and size of sand grains used in casting- materials composing- casting sands- general properties of casting sands- materials added to mold and core sand- insulation materials and and materials for painting the mold- pastes for fixing the core- selecting sand- core sands- (NA SiCE) the method of CO_2.

3-Manufactoring Models: the model and core box- types of models- differentiating different parts of models- tolerance in the model's dimensions- the function of model.

4-the core and core box: the importance of the function of the core- materials for manufacturing the cores- core boxes.

5-formation of manual sand molds: basic factors that must be taken into account when smelting and filtering liquid metal- types of manual sand molds- forming a mold as a model consisting of three parts- forming a mold on the foundry ground using the model- forming a model on the foundry ground using single model- methods of fixing a core within the mold cavity.

6-Forming molds and sand molds automatically: the goals and features of automatically forming sand molds- classification of the tools of automatically classifying sand molds and its work mechanism- making cores automatically- drying molds and cores- drying ovens for molds and cores.

7-Molding system: the function and types of molding systems- parts of molding system- designing a molding system- balancing thrusting powers when molding fused metal.

8-Molding in thermal permanent molds: materials used for manufacturing thermal permanent molds- the use of thermal permanent molds.

9-Molding in metallic permanent molds: steps and features of molding in metallic permanent molds- types of metallic permanent molds.

10-Molding with centrifugation: molding with centrifugation in a mold with vertical rotation axis- molding with centrifugation in a mold with horizontal rotation axis.

11-Continuous casting: molding pipes and pillars in the continuous method- molding boards in the continuous method.

12-Precision casting using Lost-wax models and the steps of their production.

13-Precision casting using shell mold: the elements of shell molds mixture- steps for making shell molds- advantages and disadvantages of casting using shell molds.

14-Detecting defects in castings: visual and sound testing with a hammer shock- hydrostatic pressure test- inspection with magnetic micros- radiographic testing- testing with ultrasonic waves.

Laboratory: laboratorial exercises and lessons.

Fundamentals of Electrical Engineering: (4 weekly hours: 2 theoretical + 2 practical) – First Semester:

Electrical current: principles, definitions and basic concepts, atomic structure of bodies, electrical charge, electrical current, electrical current circuit, electrical quantity difference, field quantities, concept of field, static electricity and static electrical field, princible of accumulation in the static electrical field, static electrical provocation, static electrical, field flow, static electrical quantity, saved capability in the static electrical field, electrical capacities theories and electrical condensers, connecting electrical condensers, multi- layers electrical condensers, applications.

Moving electricity- continued current: general rules and information, electrical moving power sources and electrical current distribution, continued current strength and density, principles, relations and general theories for the continued current, electrical resistance, measure electrical resistances, resistances collection theories, equivalent resistance.

Electrical magnetism: definition of the magnetic field, magnetic impacts of the electrical current, Bio Safar- laplas law, magnetic fields calculation, magnetic polarization, integrated current law, magnetic field calculation as per the integrated current law, principles used in the magnetic circuits, magnetic circuit, theories used in the magnetic circuits, magnetic circuits calculation, similarity between the magnetic circuits and electrical circuits, electromagnetic provocation, principle of alternative current generation, self- provocation, exchanged provocation, equal spools theories within the electromagnetic circuits,

instable status within the provocation circuits, saved capability in the provocation circuit, volumetric density of the capacity saved within the provocation circuit, electromagnetic capacity.

Alternative one- phase current: definition of the alternative current, generate alternative currents, currents and tensions, average value of the current and tension, effective value of the current and tension radiological representation of alternative tension, all currents and tensions, single- phase alternative current circuits, alternative current capacity, multi- elements alternative current circuits linked by sequence, use compound numbers with alternative current circuits, collect resistances, sub- circuits, use radiological drawings to calculate currents and tensions within the electrical current, diagrams solutions for single- phase alternative current circuits, capacities forms, generate continued current circuits calculation methods on alternative current circuits.

Electrical ringing within single- phase alternative current circuits: ringing circuit, ringing status within sequential circuits, ringing status within sub- circuits.

Improve capacity factor: pure Ohm resistance load, complex resistance load consists of real compound and provocative artificial compound, complex resistance load consists of real compound and capacity artificial compound, improve capacity factor by removing the artificial capacity completely, improve the capacity factor by partial removal of the Artificial capacity (reactive).

Triple- phase alternative current circuits: generate Triple- phase electrical moving forces, balanced and triple- phase tensions, currents and capacities, triple- phase systems connection methods, use complex, Numbers in triple- phase systems, capacity in triple- phase systems, un balanced in triple- phase systems.

Industrial Electronics: (4 weekly hours: 2 Theoretical+ 2 Practical) –First Semester

Semi- connectors elements, (p-n) binary, Zenar binary, connection transistor with dual polarity (BJT), faucial transistors (FET), multi- layers (Thirstor, dianstor, triac, diac, silicon driven breaker SCS, dual processes, thirstor).

Amplifiers: amplifier concept, amplifiers connection, dB concept, amplifiers classification, joint formula stress , procedures within transistor amplifier circuit design, transactions amplifier.

Electro- light elements and its applications: semi- connectors elements with Electro- light properties of different types, light multiples, applications by using electro- light elements within different circuits.

Contact elements, probes and its applications: electro- resistance probes and measure resistance by using Watisten Bridge, capacity probes (electro- capacity probes), provocative probes, digital placement probe, electro- light probe, hall influence. Polian algebra & Logical gates: dual system, principle of engineering logic, and Gate, NOT gate or inverter, OR gate , NOR gate, NAND gate logical programmable control: controls and its uses, PLC principles,

Control by using PLC.

Continued electrical feeding circuits: alignment circuits, stress multiples, Thiastor exchangers. Electrical heating by high frequency currents: heat metals by electrical provocation. Heat insulating materials by high frequency currents. Measurement and electrical measurement devices: measurement process stages and its duties, digital measurement system, adjust measurement circuit resistance, international measurement unites, measurement accuracy. Measurement error types and its sources, measurement Devices.

Thermodynamic (2): (4 weekly hours: 2 theoretical+ 2 practical)- First Semester

1-water steam: key concepts- charts of water steam- real gases- the process of generating steam and representing it by the coordinates of (P-V) – basic parameters – the temperature for fluid evaporation and dryness fraction – saturated wet gas- superheated steam- calculating parameters of water steam using tables-(T-S, I-S) chart for water steam –steam tables – basic thermodynamic process of water steam – exercises.

2-Moist air: key definitions- the content of humidity – density of moist air - ID charts of moist air- psyometric chart- exercises.

3-Gas turbine: information and key concepts- the cycle of gas turbine with giving temperature of Const =V, Const= P, exercises.

4-Cycles of steam turbines: the work mechanism of steam machines- Carnot cycle of water steam- Rankine cycle- exercises.

5-Cycle chillers: general information chillers – air and vapor comp chillers – the actual cycle of steam chillers (in the area saturated wet vapor) – the actual cycle of steam chillers with pulling saturated dry vapor – problems and exercises. **Laboratory:** laboratorial exercises and lessons.

Fluid Mechanics (1): (4 weekly hours: 2 Theoretical+ 2 Practical)- First Semester

1-Physical and mechanical properties of fluids: classification of fluids density- specific volume- specific weight- compressibility and flexibility- thermal expansion of fluids- surface tension and capillary action- viscosity- evaporation pressure- problems and exercises.

2-Equilibrium of non- compressible fluids: the concept of pressure (hydrostatic stress state)- distribution of pressure in homogeneous fluid (basic hydrostatic equation)- distribution of pressure in heterogeneous fluid (stable equilibrium)- the principle of communicating vessels- the principle of pressure measurement- manometers and parameters- calculating pressure forces on the walls of plane vessels- hydrostatic lift force (Archimedes' principle)- Pascal law (hydraulic compressor)- problems and exercises.

3-Fluid hydraulics: basic concepts of fluid hydraulics (flow field and speed field)- Lagrange's Method- Euler's Method (space method)- classification of fluids hydraulics (flow): stable- unstable flow- one dimension, two dimensions, three dimensions flow- laminar and turbulent flow- under-sonic, sonic and ultrasonic flow general continuation equation and physical conclusions.

4-Fluid dynamics: Euler's one dimensional dynamic equation- different forms of Bernoulli equation- applications on Bernoulli equation- problems and exercises.

Electrical Command and Control: (4 weekly hours: 2 Theoretical+ 2 Practical)- Second Semester:

Electrical engines characteristics, mechanical characteristics of industrial machines, mechanical characteristics of electrical engines, mechanical portion calculation of the command system. Continued current machines functions, parts principle of continued current operation.

Design of Machines Elements (1): (4 weekly hours: 2 Theoretical+ 2 Practical)- Second Semester:

General consideration in machines design, simple and compound tension, metals and its types, bots connectors, welding connectors, wedges and its different types, connection screws and bolts, capacity transfer screws, movement columns, fixtures devices with its types, fasteners and its types, brakes and types, springs and its types.

Theory of Machines: (4 weekly hours: 2 Theoretical+ 2 Practical)- Second Semester:

Basic definitions, describe auto famous installations, study auto installation movement by diagrams method of relativity movement equations , relative movement by two points with single- connection, relative movement between two compatible points from moving connectors, relative movement at contact point with full rolling, apply instant center concept to define speeds, study auto- installations moving, apply on regular structure, rotation power diagram, applications of amended wheel, study cam installation by establishing side cam diagram, study cam structure with certain sides, gears, establishing auto- installations.

Fluids Mechanics (2): (4 weekly hours: 2 Theoretical+ 2 Practical)- Second Semester:

Centrifugal pump machines: Euler's kinetic equation- the actual pressure and theoretical pressure generated by the centrifugal pump machine- volute diffuser- efficiency (total- volumetric- hydraulic mechanic)- distinctive actual curves of vane pumps- distinctive actual curve of pump- distinctive curve of actual capacity- types of distinctive curves of vane pumps- complete and incomplete distinctive curves- parallel and sequence connection of pumps- distinctive curve of the network and its graphic representation- factors affecting the distinctive curve of the network and the operation point- parallel and sequence connection of pipes- cavitation height for suction- types of pressure measurement devices.

Flow of compressible fluids (gases): thermodynamic basic equations of complete gases- first thermodynamic law- second thermodynamic law- single dimension and stable basic equations of flow- waves and their propagation in fluids- Mach number- Mach cone- the effect of flow section on the properties of the current.

Isentropic flow in nozzles: converging nozzles- Converging- Diverging nozzles- shock waves. Problems and exercises.

Laboratory: laboratorial exercises and lessons.

Metrology: (4 weekly hours: 2 Theoretical+ 2 Practical)- Second Semester:

Metrology- Basic of measurement- Disparities and dualities- Structure of geometric surfaces- Accuracy of operation- Errors of measurement devices- Measurement tools- Visual devices and measurement processing- Questions and exercises- Laboratory: Laboratory exercises and lesions using accurate measurement devices.

Manufacturing methods (3): (4 weekly hours: 2 Theoretical+ 2 Practical)- Second Semester:

Physical basics of metal welding- Classification of welding types- Cold welding and friction welding- Electrical short- circuit welding- Modem methods of pressure welding- Welding and cutting using gas- electrical arc welding- Classification of electrical arc welding styles- Calculating welding systems and the dimensions of the welding stitch when welding with the manual electrical arc and automatic arc- Electroslag welding- Welding in a surrounding of protective gases- Plasma welding- Electronic rays welding- Laser rays welding- Atomic hydrogen welding.

Steel welding- Cast iron welding- Colored metals welding- Underwater welding and cutting- Features of welded facilities- Types of welded connectors- Designing welded connectors- Properties of steel crusty structures- Stress and agitation resulting from welding- The work load required for producing welded structure pieces- Welding electrodes.

Melting fluxes- Defects of welding connectors- Professional safety in welding operations- Welding coding- Monitoring and testing welding quality- Stages of executing productive projects- Issues and exercises- Laboratory: Laboratory exercises and lessons.

Head of Mechanical Design Engineering Departement

Assistant Prof. Khaled Sharaf

Syllabus (Course Description) of the Mechanical Design Engineering Fourth Year- Departement of Materials Science and Production

Hydraulic Control Systems & Components: (4 weekly hours: 2 Theoretical+ 2 Practical)- First Semester:

- Hydraulic elements (Valves- Sensors- Hydraulic engines- and all related elements of hydraulic system for operating machines)- detailed study of various models of hydraulic and automatic operating machines.

Design of Machines Elements (2): (6 weekly hours: 4 Theoretical+ 2 Practical)- First Semester:

- Study of modified gears design- Study of spiral gears design- Study of conical gears design- Study of vermicular gear design- Study of Simplified belts design- Study of the V-Belts design- Study of toothed belts design- Study of chains design- Study of sliding bearings design- Study of rolling bearings design- comprehensive problems and exercises.

Machines Dynamics and Vibrations: (6 weekly hours: 4 Theoretical+ 2 Practical)- First Semester:

- **Machines Dynamics:** Equations of motion for mechanical combinations- Lagrangian equation- Betennaurs' analytical and planning method for stable motion- Machines irregular motion- Finding the acceleration of the main connector- Mechanical combinations- Balancing rotary masses- Balancing rotary masses in one plane- Static and dynamical balance of rotary masses- Balancing forces of inertia- Round balancing the first level forces of inertia- Balance of mechanical combinations of a multi- cylinders engine- problems and exercises.
- **Mechanical Vibrations:** Dynamical model of sets- Equivalent rigidity- Vibrations of sets with the same degree of movement- Non- quenchable free vibrations of liner sets with the same degree of movement – Free vibrations with collusion in a set- The effect of temporally static forces- the effect of periodical non-consensual force- Coercive vibrations of liner sets eith the same degree of movement with a consensus- The effect of a dynamic frequency force- The critical speed of perpendiculars- Isolating vibrations- problems and exercises.
- **Laboratory:** Laboratory exercises and experiment: Sliding chain experiment- Cams experiment- Cylindrical gears experiment- Belts testing instrument- Flywheel's moment of inertia experiment- Hartnell's regulator v- Balancing the rotary set experiment- Fast return machine mechanism experiment.

Finite Elements Methods and Their Applications: (4 weekly hours: 2 Theoretical+ 2 Practical)- First Semester:

- **Chapter one:** Classification of mechanical problems- The concept of finite elements method- Advantages of finite elements method- Mechanism of rigid bodies and constructions- Rigid three dimensions body equations- Rigid two dimensions body equations- Rods equations- permissible equations- Sheets equations- RinserMandallen's theory of sheets.

- **Chapter two:** Hamilton's principle- Properties of function shape- Rods finite elements method- Making shape functions- Element Matrixes in positional coordinating system- Element Matrixes of total coordinates- Properties of finite elements method (Cloning Property- Convergence Property- Rate of convergence)- Higher ranked one dimension elements.
- **Chapter Three:** Modeling technics with the method of finite elements- Time of processing unite (CPU)- Modeling geometry shape- Use of symmetry- Modeling copying distances- Modeling supporters- Modeling connectors.
- **Problems and Exercises.**
- **Laboratory:** Laboratory exercises computer assist (ABAQUS Application).

Forming and It's Machines: (4 weekly hours: 2 Theoretical+ 2 Practical)- First Semester:

- **Introduction To Forming Processes:** Geometry Shape- Micro structure- Production processes by forming- Isolators and smelting resistance- Production of formative metal alloys- Classification of forming processes- Closed shearing process- Modeling forming process- Stress and agitation- Koncisdar's Structural method.
- **Chapter One:** Analyzing metal forming processes- Perfect and virtual curve of stress and agitation- Yielding in the case of composite stresses- Shear stress theory- Von Maes' theory- Levy mises' theory- Brand Raes' theory- Classification of metal forming processes- Cold forming- cold forming metals- Hot forming- Semi- hot forming- Limit of Yielding- Ductility- Analyzing methods of production processes.
- **Chapter two:** Shear templates- Press forming processes- flexible rebounding- Arranging index perpendiculars- Pistons selecting- Composite templates- Sequential templates-the principle of metal shearing in templates process- Purity- Shearing forces- Labor of shearing- The method of decreasing the shearing forces- Types of shearing templates- Saraued planning- Extractors- Colliders- Ore directory- Parts of Expulsion- Template unit- Perforation templates- Index fingers- Drawing templates- Drawing rate- Curvature of a negative drawn edge (rd)- Curvature of a positive drawn edge (rp)- Purity of Drawing- Speed of drawing- Ore dimensions calculation- Number of drawing process- Force of drawing- Ore holder pressure- Templates of redrawing- Drawn ejection by redrawing templates- Binary effect templates of redrawing- Molded drawing templates- Bending templates- Edge bending- Bending radius- Flexible rebounding- Force of bending- Force of concavity- Design considerations of sequential templates- Examples and exercises.
- **Chapter Three:** Designing metalworking templates- metalworking instruments- Types of pistons- Types of metalworking instruments- Designing metalworking formed parts- Preliminary metalworking processes- Template fixing- Template Maintenance- Examples and exercises.
- **Chapter Four:** Rolling- Analyzing rolling process- Maximum reduction- Load of rolling- Rolling torque and capability- Rolling capability- Rolling Mixtures- Examples and exercises.
- **Chapter five :** forming with extrusion processes – direct extrusion – indirect and reversed extrusion – Analyzing the extrusion process – extrusion pressure changes- examples and exercises.

- **Chapter six :** Drawn forming process for pipes and wires – Analyzing wires and bars drawing process – pipes drawing- analyzing pipes drawing process – pressure of the drawing instrument – examples and exercises.
- **Chapter seven :** high rates forming – Explosion formation – confined sets- non confined sets – explosion welding – Electrical hydraulic forming - Electrical magnetic forming – Ultrasound formation- problems and exercises.
- **Forming template design project.**

<u>Thermal and hydraulic Machines</u>: (<u>4 weekly hours: 2 Theoretical+ 2 Practical)- First Semester</u>

- Thermal machines :

1- Introduction to piston internal combustion engines and the main components of the engine - classification of internal combustion engines-primary concepts and definitions-the main parts and the main tasks of the engine.
2- Theoretical and actual thermal cycles of internal combustion engines and fuel and combustion reactions- the main cycle – the double cycle – heat generating cycle under static size- heat generating cycle under static pressure- Actual thermal cycles of internal combustion engines compositing – the main specifications and properties of liquid fuel .
3- Distinguishing factors of the cycles of frequency internal combustion engines and thermal balancing of the engine – Graphical factors – Effective factors – Thermal balancing .
4- Pollutants ejected by gasoline and diesel engines and internationally allowed limits – Components of atmospheric air – Study of pollutants ejected by internal combustion engines causing environmental pollution – Mechanism of forming gaseous pollutants released by internal combustion engines and how they affect human health and environment – International limits of gaseous pollutants released by diesel engines – Some of the technical solutions by researchers in order to reduce pollutants released by engines – Global warming Phenomenon.
5- A brief of some of the modern electronic systems used in cars – Electronic control of fuel circuit of internal combustion engines – The System of road electronic control – Electronic control of valves movement (VTEC System).
6- Thermal turbines – Basic introduction to thermal turbine mechanism of action – Basic Concepts of thermal turbine action – Degree of reaction – Zeroth degree of reaction – Selecting the degree of reaction and how it affects the output – The output of thermal machines.
7- Steam turbine – Steam nozzles – nozzle output – Reheating factor – Metastability balance – Stage design – Designing a multi-stage turbine – Propulsive stage – Steam propulsive turbine – Compound pressure (RATEAU Turbine) – Compound speed (Cortis' Turbine) – Steam turbines with reactions – Gaseous turbine.
8- Flow in rotary puddles – Forces that affect the rotary puddles – Total capability - Qualitative labor and the total actual internal ouput – Mechanism of extensibility theory – The main equations of operating body movement – Calculating the speed of flow in the nozzle – Calculating exit cut – Flow equation through a rotary disk – Axial stage theory – One dimension Axial stage theory – Stage output.

9- Implementations of turbine thermal machines – Steam turbine power generating stations – Ships power generating stations – Nuclear power generating stations – Gaseous power generating stations – Simple opened cycles – Real opened cycle – Binary axial system – Closed cycles – Complex opened cycle (a cycle with Retrieval) – Stations with compound cycles (Steam - Gaseous)

- **Hydraulic Machines :**
  1- Water turbines – Main types of turbines – Pelton's wheel – Francis' turbine (Reaction turbine) – Axial flow turbines – Advantages of hydraulic – Analyzing the elements of water turbines – Main flow equations – Drawing pipes - Cavitation phenomenon.
  2- Hydraulic pumps – Liquids transporting –Pumps classification - Volumetric pumps – Specifications of volumetric and rotary pumps.
  3- Pumping system – Pumping systems classification – Parameters of pumping system and energetic system – Parameters of labor and specifications of volumetric and rotary pumps – Multiple pumping processes – Positive absorption compressor of the network.
  4- Compressors and fans – Classification of compression instruments – Main equations of flow machines – Basic thermodynamic equations of the process of compression in a multi-stages compressor.
  5- Diagonal flow compressors and fans – Diagonal flow compressors and fans theory – Axial compressors and fans theory – Piston compressors theory – Centrifugal Compressors and fans.
  6- Comprehensive problems and exercises.

Casting And its Machines (4 Weekly hours: 2 Theoretical + 2 Practical) -Second Semester :

- Basic fundamentals of Pouring – Pouring theories – Flow of fusible metals and cyclonic movement – Casting system –Mining the law of calculating the casting system – Mutual effects between the fusible metals and the template – Fusible metal pressure and thermal and physical and chemical effects on the template - Initial crystallization of metals – Crystals distributions – Alloys defects – Free and limited contraction–Gaps forming – Protecting alloys from gaps – Guided freezing of alloys – Negative guided freezing of alloys – Simple and complex freezing of alloys and methods of fixing – Fixing the thermal nodes – Alloys defects – Contraction – Stresses and stresses classification – Hot and cold fractures and distortions – Remained thermal stresses in alloys – Special methods of Pouring – Pouring sand – Template sand – Nucleuses sand.
- Laboratory : Laboratory exercises.

Conveying And Lifting Machines : (4 Weekly hours: 2 Theoretical + 2 Practical) -Second Semester :

- **Lifting Machines :**

  Cranes and cranes specifications – Fundamentals of calculating of lifting machines – Hanging equipment – Elements of lifting machines – Stopping and braking instruments – Source of movements of lifting machines – Problems and exercises

Transporting Machines :

Introduction –Autolines – sheets based transporters – Pots based transporters – Spiral Transporters – Pneumatic transporters – Problems and exercises.

- **Laboratory :**

Identifying transporting and lifting machines and mechanism of action.

Automatic Control And Automated Productivity (4 Weekly hours: 2 Theoretical + 2 Practical) - Second Semester :

- **Introduction To Control And Automatic Control :**

Introduction – Operating processes Automating – Technical process – Dividing the control system into partial simplified systems – Control and automatic control (control with an open loop or a close loop)

- **Sensors :**

Introduction – Elements of the converter – Signals as data bearer – Different types of signals –Signal converting and harmonizing – Sensors look for arriving objects – Sensors of pressure measurement (The hydrostatical and mechanical ways) – Force measurement sensors – Temperature measurement sensors – Changes in length or angles measurement sensors – Tanks level of filling measurement sensors.

- **Actuators :**

  Introduction -Phases movement generating (Liner movement) – Rotary movement generating (Electronic Actuators) – Great forces generating – Converting and transmitting signals.

- **Processing (Processors) :**

  Introduction – Related Data – Saving signal and logical storage – Time of processing – The application – From one simple digit processor into complex words processer – Practical examples.

- **Application :**

  Introduction – Motion and specified time of operation – Converting an application model into an application – Memory of application – Programming languages.

- **Automatic Control Systems :**

  Fundamentals and types of control systems – Cams control – Mechanical bumpers control – Stamp control – control using the Perforated panel – Single panel computer – Personal computer –

  Programmed logical control devices (PLC) – Numerical control device (NC) – Computer numerical control system (CNC).

- **Networks :**

  Introduction – How does it send data? – Decentralization systems – Structure of networks – Practical examples.

- **Handling technic :**

  Introduction – what is handling? – Practical examples –Divided liner handling tasks – Handling task (rotary dividing) .

- **Artificial Robots:**

  Introduction – Introduction to artificial robot – Motion systems – Actuators – Sensors – Processors – Application – Networks.

General Fundamentals Of Production Mechanization And Automation, Mechanization And Automation Properties, Mechanization And Automation Technical And Economic Advantages introduction – Efficiency of automatic machine theory.

- **Production Automation and Mechanization :**

Introduction – Development in order to reduce the main time - Development in order to reduce the Preparative time – Development in order to expand instruments technological Potential – Development in order to Automate cutting operation processes – Practical examples.

- **Automation of Products Observation Processes :**

Introduction – Setting external dimensions – Setting internal dimensions – Online measurement – Nohands one point measurement devices – Double points of contact measurement devices – Triple points of contact measurement devices – Offline measurement –Automatic setting of metal cutting machines – Magnetic effect Actuators.

- **Parts Handling Automation :**

Main properties and features – Channels – Warehouses – Glove model handling devices – Separators – Suppliers – Impetuses and ejectors – Positioners – Handlers (Automatic Arms) – Artificial Robots.

- **Factory inside transportation :**

Storage automation – Continues and Intermittent effects transportations – Automated storage systems .

- **Automatic Transportation Machines :**

Overview – Types of transportation machines– Operation process transportations – Transportation machine control – Contents of technologic process design – Transportation machine reliability.

- **Compiling Automation :**

Methods and ways of Automation – Steps of Automated compiling.

- **Laboratory :**

Laboratory of hydraulic control (Practical exercises)– Laboratory of air control (Practical exercises) – Laboratory of programmable logical control (PLC)(Practical exercises) – Laboratory of sensors technics (Practical exercises).

Computer Aided Design /Manufacturing : (6Weekly hours :2Theoretical+4Practical)- second semester :

Types and properties of operating machines – components of programmed control systems used in programmed operating machines – Terms used in numeric control machines (CNC) – Manual programming and introduction to manufacturing with computer assist – Practical lessons of (Autodesk inventor – Surfcam) applications-practical lessons of automated lathing machine and automated Sorting machine (CNC)-problems and exercises.

Design project: (4weekly hours:4 practical)-second semester:

- A design project of a specific mechanical subject, studied by the student under the supervision of a

Professor/s, and been held by the department of mechanical design engineering. The final discussion of

The project is held in the present of a board composed of multiple professors, in order to judge and grade the project.

Heat Treatment: (4 weekly hours:2theoretical+2 practical)-second semester:

- **Concept and types of thermal processing:**

Concept and main elements of thermal processing-temperature and time -classifications of thermal

Processors-thermal processing and scheme of balance-main types of thermal processing of steel-

The four main transformation of steel.

- **Practical Implementations of thermal processing of steel -carbon:**

Selecting heating temperature-determining heating time (maintaining time)-The reaction between

The surface of the part and the storage material-cooling materials in quenching-steel ability of

Concretion -internal stress of steel after been thermally processed-methods of quenching –

Negative temperature quenching – defects that happen to steel when been quenched-Annealing and

Coordination.

- **Surface steel Quenching:**

Main fundamentals-Quenching with a high inductance current.

- **Steel thermal-chemical processing:**

thermal-chemical processing theory- steel carbonation (Solid carbonation, gaseous carbonation)-

steel nitridation- steel carbo-nitridation (Cyanidation)-spread mining.

- **Thermal processing of light Mixtures (Aluminum, Magnesium, Beryllium).**
- **Thermal processing of Copper Mixtures.**
- **Thermal processing of Titanium Mixtures.**
- **Laboratory practical Experiments.**
- **Problems and exercises.**

Head of Mechanical Design Engineering Department

Assistant Prof. Khaled Sharaf

Syllabus (Course Description) of the Mechanical Design Engineering Fifth Year Department of Materials Science

Metallic Aloys And their casting (4 Weekly hours: 2 Theoretical + 2 Practical) - First Semester:

Geometry Materials and Classification.

Study of Cooling Curves of Triple-Mixtures.

Study of Tests : Mechanical tests (Static, Dynamical)- Thermal tests (Thermal expansion, Thermal resistance, Material's specific temperature) - Some of the non-consuming tests methods (Testing with revealing liquids, Testing by visual examination, Testing with ultrasound waves, Testing with X waves and Gamma waves, Testing with ultrasound waves in air tunnel).

Ferrous Mixtures: Steel- Pouring iron.

Non ferrous Mixtures: Aluminum and it's alloys -Lead and it's alloys - Zinc and it's alloys-Tin and it's alloys-Heavy metals.

Problems and Exercises.

Laboratory: Spectrum analysis device of metal structure.

Composite Materials (4 Weekly hours: 2 Theoretical + 2 Practical)- First Semester:

Basic Fundamentals of Compound Materials: introduction-Definition of compound materials- Types of compound materials- Designing compound materials - Convection translation concept.

The Basic Material (Host) and Strengthening Material : Introduction -Strengthening Materials (Carbon ibers, Fiberglass, Organic fibers, Silicon Carbide fibers, Aluminum oxide and Aluminum silicate fibers) - Durability of strengthening material (Thermal stability-Pressure durability - Flexibility and fiber crash) -The Basic Material (Polymeric host material, Metal host material, Ceramic host material).

Correlation Surfaces Area or Interfaces : Mechanisms of correlation (Absorption and getting wet Internal spread and chemical reaction, Attraction with a static electric charge, Mechanical correlation Remaining stresses)-Experimental measurements of correlation durability (Single fiber drawing test - Single fiber inside and underneath pressure tests, Other tests) - Correlation durability control (correlation factors and environmental effects, Stiffness reduction paint, Chemical reaction on contact surfaces and spread obstruction paint, The area inside the interface phase).

Compound Materials Manufacturing : Introduction-Polymeric compound materials-Metal compound materials-Ceramic compound materials -Carbon\Carbon compound materials. ***Compound Materials Implementations.**

Problems and Exercises.

Laboratory: Laboratory exercises.

Surface Engineering (4 Weekly hours: 2 Theoretical + 2 Practical)- First Semester:

Corrosion Basics: Corrosion Definition - Importance of corrosion study - Electrochemical reactions of corrosian- Electrochemical corrosion cell - Lethargy - Faraday's experiment - Polarization - Types of polarization.

Thermal Dynamic and Corrosion Voltage : Free energy - Pole voltage - Standard pole voltage - Calculating cell voltage - Types of standard poles - The effect of solution condensation on the voltage of the pole - Burier's schemes.

Methods Of Modifying Corrosion Rates : Corrosion rates - Lost weight method - Electrachemical methods- Corrosion monitoring and observation.

Corrosion Shapes : General or regular corrosion - Galvanic corrosion-Pitting corrosion- Cavity corrosion - Intergranular corrosion-Stress corrosion-Erosion corrosion- Bacterial corrosion.

Corrosion Control : Cathodic protection -Anode protection-Corrosion inhibitors.

Electrical-Gaseous Spraying : By Plasma - By frequency By electric arc.

Filling Welding Methods : Under-Flex filling-Filling by the open arc - Filling by high frequency currents - Electrical filling with slag - Special methods for filling colored metalsand compound mixtures.

Surface Processing Using Laser : Thermal laser surface strengthen -Strengthen methods - Big areas strengthen by pulsing laser -Big areas strengthen by continues laser - Specifications of laser processed metals -Using laser in plasticizer processes.

Laboratory: Laboratory experiments.

Industrial Organizing And Projects (4 Weekly hours: 2 Theoretical + 2 Practical)- First Semester :

Planning the industrial installation buildings - Basics of organizing productive process -Basics of organizing the technologic and organizing preparation of production - Basics of work organization an industrial management-Salaries and wages- Human resources management Work contemplation - Network Planning and it's uses in management.

Maintenance : Periodic and technical maintenance systems and preventive maintenance of various equipments and machines and methods of organizing the maintenance processes in industrial institutes - The technical suit of machines and it's transformation during the investment period - The general scheme of maintenance and repairing processes- Various technical ways and methods for repairing the elements af the broken machines and getting them back on - General basics of planning the maintenance and repairing installations, departments, and workshops - General basics of investing production equipments and machines and commanding operating helm.

Problems and Exercises.

Plastics Engineering (4 Weekly hours: 2 Theoretical + 2 Practical) - First Semester:

Plastic engineering -Introduction (Importance and development of plastic materials)- Classification of Plastic materials -Chemical specification of plastic materials- Physical specifications of plastic materials - Mechanical specifications of plastic materials - Rheologic behavior of plastic materials - plastic materials tests- Main methods of manufacturing plastic materials -reinforced plastic-Additional materials- Plastic production and manufacturing machines -Used templates for manufacturing plastic templates - Making injection templates - The table of the general specifications of plastic materials.

Laboratory: Laboratory experiments.

Plastic Template Design Project.

Fracture Mechanics (4 Weekly hours: 2 Theoretical - 2 Practical) - First Semester :

Chapter one :

Introduction : Historical review of collapsing mehanism -Using the collapsing mechanism with designing - The effect of materials specifications on collapsing - Dimensional analysis of colapsing mechanism. **Liner collapsing mechanism** : Atomic description of hoar collapsing - Near gap stress concentration- Griffith's energy - Description of the stresses field at the cut's edge with the help of the stresses concentration parameter-The relationship between stresses concentration and Griffith's energy - Overlapping concept of Liner collapsing mechanism - Weighting functians - The relationship between stresses concentrotion parameter and the main behaviorism- Sudden spreading of the cracks - Materials durability - Unstable spreading - Anti collapsing curves R- Plasticity area in the depth of the crack- Cases of flat stresses or flat deformation-The pattern of the mixed collapse. **Review of the triple stress case** :General behavior of the hoar and wrought materials - Designing with the limit of flexibility - Most important standards of flexibility. **Problems and Exercises**.

Collapsing and fracturing Shapes : introduction-The case of Longitudinal curving -Flow case- Nicking case in the cross section-Design concepts- Fracturing in the result of cracks spreading -Samples testing (Containing furrows) on the collusion**. Stresses concentration** :Introduction-Graphical representations of the stresses orbit - Deformation-Main strasses and defarmations -The relationship between the stress and the deformation in the flexible obiects - the case of the triple-axial fiexible stress-Basics of toughness theory-Stresses functions- Primary evaluation of stresses concentration- Stress plasticity at the center of the stresses-Loads that causes complete yielding case-The case i over-stressing**. Prablems and Exercises**.

Powders Metallurgy (4 Weekly hours: 2 Theoretical + 2 Practical)- First Semester:

Making Metallic Powders :Mechanical methods for getting powders (Metals crushing-Molten tapping -The method of freezing the molten by cold current-The method of spraying the molten metals-The method of metal steam condensation). The Physical Chemical methods between crystals -The method of getting

powders in the gaseous phase (Carbonyl method). ***Properties OF Metallic Powders And Methods Of Monitoring** :

Physical properties (Shape, size and distribution of the granules -Qualitative surface and condensation Micro-Hardness) - Chemical properties - Technalogical properties (Qualitative weight and porosity, Compression, Green durability).

Forming And Merging:

Mixing and blending-The steps of preparing the mixtures for the merging process-Calculating the quantity of the charge- Cold merging (Single and double sided pressure- Hydrostatical pressure - Forming by rolling-Forming by extrusion -Forming by injection - Foirming by vibrations - pulsing forming) - Hot merging - Hot Aiso statical pressure - Theoretical concepts of merging process (Processes in the result of compressing-The relationship between the merged condensation and the compressor pressure-Side pressure and friction missing)- Oiling effect-Ejection pressure and flexible rebounding-Overcoming design limits - Designing the forming template - Durability and defects of the merged.

Sintering :

Sintering theory - Rigid phase sintering - Liquid phase sintering - The effect of the different parameters on the sintering process-Hot compression.

Properties Of The Compacted Powders After The Process Of Sintering And Methods Of Testing:

Mechanical tests (Pulling and pressing test - Curvature test - Hardness test - Collusion test) Tripology tests -Mechanical wearing test - Mechanical corrosion test - Oxidation test. ***Products of powders metallurgy** :

Porous materials - Frictional and anti-frictional materials - Installment materials - Compaund materials - Anti-fusion materials.

Examples of products of powders metallurgy Usage Implementations.

Laboratory : Laboratory Exercises.

<u>Materials Chosing And Testing (2 Theoretical + 2 Practical 4 Hours A Week) Second Semester:</u>

Introduction to Nondestructive Evaluation:

Introduction-Elements of Nondestructive test-History of nondestructive analysis - Selecting a useful method for nondestructive evaluation-Benefits of nondestructive examinations-Methods of nondestructive tests - Codes and standards - Quality insurance of the nondestructive tests Rehabilitation and authorization in nondestructive tests.

Materials Defects:

Introduction - Types of defects by position -Classification of the defects by origin - Metalworking derects-Casted objects defects-Defects caused by the final operating processes- Delects caused by usage-Visual

exarmination -Testing by influent liquids - testing by magnet particles - Testing with ultrasound waves- Testing by radiography -Testing by Hurricane streams-Over acting measurement by over acting sensors.

Problems and Exercises.

Laboratory : Laboratory exercises.

Physical Chemistry of Materials (4 Weekly hours: 2 Theoretical + 2 Practical)- First Semester: Thermodynamics (Thermal Dynamics) :

First law of thermodynamics : Enthalpy - Thermal chemistry (Hess' law, Kirchoff's equation), Second law of thermodynarnics and the direction of the chemical reaction : Entropy -Thermal energy - Chemical balance - The relationship between balancing constant and temperature - Phasic transformations - Third law of thermadynamics: Third law of thermadynamics - Absolute entropy method - Solutions and thermodynamic effectiveness (Thermodynamic, activity)-Local partial values -Mixing solutions - Absolute solutions - Thermodynamic effectiveness. Phase rule :Reasoningthe phase rule - Creating balancing binary schemes using thermal energy curves -The concept of balancing binary schemes. Exampies of chemical balances with each of metals, slags, and gases: Elements activity for some af the metal sets - Steel returning-The removal of Sulfur and Phosphorus out of steel. Electrical chemistry elements :Electrolytic solutions -Carry number - Galvanic element thermodynamics -Types of Galvanic electrodes and elements - Normal potentials table.

Statistical Thermodynamic:

The statistical concept of thermodynamics and statistical calculations : Boltzmann distribution law - using Boltzmann's law- Thermal capacity -Quantum theory of thermal capacity- Calculating thermodynamic functions - Calculating balances callections -Pusa's statistics -Einsteinand Fermi Dirac - Radiations (Photonic gas) - Energy of electronic gas -Gibbs' statistics - Statistical theory of solutions. Carry phenomenon of gases, liquids, and solids : Carry phenormenon of perfect gases - Spreading phenomenon of solids-Defects of solids - spreading effectiveness in solids -Liquid case Superficial phenomenon : Gases adsorption phenomenan - Isotherm phenomenon -Lingamor isotherm - Adsorption phenomenon at a disproportionate surface and calculating mutual effect between adsorption molecules - Multi-malecules adsorption phenomenon - Gases adsorption in different coloring layers - Adsorption phenomenon at liquid surface - Getting wet phenomenon.

Dynamics of Chemical Reactions:

Dynamics of homogeneous reactions and identical series: Dynamics equations-homogeneous reactions theory-series reactions. Dynamics of heterogeneous reactions : Mass external movement phenomenon - Mass internal movement phenomenon - Dynamics of electrodesprocesses - Catalysis phenomenon. Dynamics of processes that are related to forming new phases. Chemical reactions on the threshold of solids - Dynamics of the crystalation process- Dynamics of forming malignant precise.

Bachelor Degree Project (2 Theoretical +2 Practical =4 Hours A Week) First Semester + Second Semester.

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