The Undergraduate Curriculum of the Department

The annual system of study is followed in the department. The following is the curriculum of the department for the five years of study.

1st Year					
Code No.	**Title**	**Credit Hours)Units)**	**Contact Hours**		
			Th.	**Tut.**	**Lab.**
AE101	**Mathematics/I**	**4**	**3**	**1**	
AE102	**Engineering Mechanics**	**8**	**2**	**1**	
AE103	**Fundamental of Engineering Drawing**	**5**	**1**		**3**
AE104	**Production Engineering/I**	**5**	**1**	**1**	**2**
AE105	**Programming/ I**	**4**	**2**		**1**
AE106	**Physics and Chemistry**	**4**	**2**		**1**
AE107	**Computer Basics/I**	**2**	**2**		**1**
AE108	**Arabic Language**	**2**	**2**		
AE109	**English Language/I**	**2**	**2**		
AE110	**Human Rights and Democracy**	**2**	**2**		
Total		**38**	**19**	**3**	**8**
Total No. Weekly Hours			**30**		

2nd Year					
Code No.	Title	Credit Hours (Units)	Contact Hours		
			Th.	Tut.	Lab.
AE201	Mathematics/II	4	2	1	
AE202	Fluid Mechanics/I	4	2	1	
AE203	Thermodynamics	4	2		
AE204	Mechanics of Materials	6	3		1
AE205	Introduction to Aeronautical Science	4	2		
AE206	Engineering of Metallurgy	4	2	1	
AE207	Mechanical Drawing	3	1		2
AE208	Programming / II	3	1	1	
AE209	English Languages / II	2	2	1	
AE210	Aeronautical Engineering Labs. /I	2			
Total		36	17	5	3
Total No. Weekly Hours			25		

3rd Year					
Code No.	Title	Credit Hours (Units)	Contact Hours		
			Th.	Tut.	Lab.
AE301	Engineering and Numerical Analysis	6	3	1	1
AE302	Heat Transfer	4	2	1	
AE303	Gas Dynamics	4	2	1	
AE304	Aircraft Structures/I	4	2	1	1
AE305	Mechanics of Machines and Vibrations	4	2	1	
AE306	Manufacturing Processes	4	2		
AE307	Avionics	4	2	1	
AE308	Elective1	4	2	1	
AE309	Aeronautical Engineering Labs./II	2			4
Total		36	17	7	6
Total No. Weekly Hours			30		

Elective1

Flight Dynamics
Solar Energy
Thermal Insulation
Boundary Layer Theory
Combustion Engineering
Theory of Elasticity
Theory of Propellers
Biology for Engineers

4th Year					
Code No.	**Title**	**Credit Hours (Units)**	**Contact Hours**		
			Th.	**Tut.**	**Lab.**
AE401	**Design of Machine Elements**	**4**	**2**	**1**	**1**
AE402	**Control and Measurements**	**4**	**2**	**1**	
AE403	**Air Conditioning and Refrigeration**	**4**	**2**	**1**	
AE404	**Aerodynamics**	**6**	**3**	**1**	
AE405	**Jet Propulsion**	**6**	**3**	**1**	
AE406	**Aircraft Structures / II**	**2**	**1**	**1**	
AE407	**Aircraft Stability and Performance**	**2**	**2**	**1**	
AE408	**Elective2**	**4**	**2**	**1**	
AE409	**Aeronautical Engineering Labs./III**	**2**			**4**
Total		**34**	**17**	**8**	**5**
Total No. Weekly Hours			**30**		

Elective2
Aircraft Dynamic Response
Experimental Stress Analysis
Cryogenics
Helicopter Dynamics
Finite Element Analysis FEM
Robotics

Flexible Manufacturing Systems
Industrial Safety

5th Year					
Code No.	**Title**	**Credit Hours (Units)**	**Contact Hours**		
			Th.	**Tut.**	**Lab.**
AE501	**Aircraft Design**	**4**	**2**	**1**	**1**
AE502	**Wind Tunnels**	**4**	**2**	**1**	
AE503	**Aircrafts Systems**	**4**	**2**	**1**	
AE504	**Industrial Engineering**	**4**	**3**	**1**	
AE505	**Engineering Materials**	**4**	**3**		
AE506	**Engineering Project**	**5**	**2**		**3**
AE507	**Elective3**	**4**	**2**	**1**	
AE508	**Elective3**	**4**	**2**	**1**	
AE509	**Aeronautical Engineering Labs./VII**	**2**			**4**
Total		**35**	**18**	**6**	**8**
Total No. Weekly Hours			**32**		

Elective3
International Air Laws
Rockets and Projectiles
Plates and Shells
Airports Management
Fatigue and Fracture Mechanics
Control Towers
Computer Aided Design CAD
Satellites Aerodynamics
Airplanes Assembly
Computational Fluid Dynamics CFD
Wind Energy
Engineering Ethics

The Syllabus of the Proposed Curriculum

The following is a list of the syllabus of the subjects in the proposed curriculum.

1st Year Program

AE101: Mathematics / I:

Functions and Limits, Continuity, Logarithmic and Trigonometric Functions, Conic Sections. Differentiations and Its Applications, Integration and Its Applications, Methods of Integration, Matrices and Determinants, Introduction to Vectors, Complex Numbers.

AE102: Engineering Mechanics:

Statics: Introduction and Fundamental Concepts, Force Vectors Analysis, Equilibrium of Particles, Force Systems Resultant, Moments and Couples, Equilibrium of Rigid Bodies, Analysis of Trusses and Structures, Friction, Center of Gravity and Centroids, Moment of Inertia. Dynamics: Introduction to Dynamics, Absolute Motion, Relative Motion, Kinematics of Particles, Kinetics of Particles, Kinematics of Rigid Bodies, Kinetics of Rigid Bodies, Newton's 2nd Law, Work and Energy, Impulse and Momentum.

AE103: Engineering Drawing and Descriptive Geometry:

Engineering Drawing: Introduction, Engineering Instruments (Their Types and Uses), Lines and Their Types, Geometrical Operations, Writing of Letters and Numbers, Reading of Dimensions, Views (Types and Theories of Projection), Intersection and Its Theories, Dimensions and Notes, Isometric and Inclined Views, Concluding The Missed View, Engineering Drawing by Computer. Descriptive Geometry: Point Representation, Straight Line Representation, Couple of Straight Lines Representation, Finding The True Length of the Straight Line, Plane Representation, Plane Rotation, Auxiliary Planes, Cases of Parallelism and Intersection and Orthogonality, Sections of Geometrical Shapes, Deployment, Intersection of Geometrical Shapes and Their Deployment.

AE104: Principles of Production Engineering:

Production Of Metals, Rows Of Iron, Production Of Raw And Cast Iron, Production Of Ingots, Production Of Non-Ferrous Metals (Aluminum , Copper , Lead), Physical Properties Of Metals, Mechanical Properties Of Metals, Mechanism Of Metals Solidification, Defects Of Ingots, The Measurement And Marking-Out, Hand Tools, Metals Machining, Casting, Hot And Cold Working, Plastics, Glass And Ceramics, Metals Joining, Industrial Safety, Practical Training Hours In The Mechanical Workshop And Measuring Instruments Laboratory (Turning, Forging, Fitting, Carpentry, Measuring Instruments).

AE105: Programming / I:

Definitions Of Computer And Its Various Units And Terminals, Windows Operation System, Introduction To Programming By QBASIC Language, Algorithms And Flow Charts, Methods Of Data Input And Output, Results Output, Arithmetic Sentences, Symbols Of Arithmetic Operations, Rules Of Algebraic Expressions Writing And Priority Rules, Mathematical Library Functions, Control Statements, DO Loops In Their Various Forms, 1-D And 2-D Arrays, Results Output In Tables Form, User Functions (Single Row Sub- Functions), Computer Applications In The Above Subjects.

AE106: Physics and Chemistry:

According to the central curriculum of the college.

AE107: Computer Basics/I:

Introduction to computers and historical review, Computer Components and Hardware, operating systems review and windows evolution, Introduction to windows XP, Microsoft® Office (word, Excel, PowerPoint), Introduction to programming Languages, Basic Language (Constants and Variables, Library Functions, Input, and Output Statements, Conditional and Unconditional Branches, Loops, Arrays and Matrices, Subroutines, and Applications). (The course includes laboratory Works).

AE108: Arabic Language:

According to the central curriculum of the college.

AE109: English Language/I:

Grammars, Pronunciation, Selected Paragraphs in Aeronautical Engineering.

AE110: Human Rights and Democracy:

According to the central curriculum of the college.

2nd Year Program

AE201: Mathematics / II:

Review of Integral Methods, Partial Differentiation, Planes, Double Integral, Complex Functions, Polar Coordinates, Vectors, Directional Differentiation, Line and Surface Integrals, Cramer 's Theory, Divergence Theory of Gauss, Infinite Series and Sequences, Ordinary Differential Equations.

AE202: Fluid Mechanics / I:

Introduction To Fluids Science, General Concepts And Definitions, Fluid Statics, Pressure Distribution, Hydrostatic Forces On Submerged Surfaces And Bodies, Stability Of Submerged And Floating Bodies, Accelerated Fluids, Fluid Flow Concepts (Continuity, Energy And Momentum Equations And Their Applications), Dimensional Analysis And Similitude, Viscous Fluid Flow (Laminar Flow Between Two Plates And Through Circular Tubes, Boundary Layer, Pipe Flow And Frictional Losses And Moody Diagram, Minor Losses), Flow Measurements, Networks of Pipes And Pumps.

AE203: Thermodynamics:

Introduction, Definitions, Heat, Work, Power, Internal Energy, Enthalpy, Zeroth Law Of Thermodynamic, Temperature And Its Measurements, 1st Law Of Thermodynamic, Boyle 's Law, Charles 's Law, Perfect Gas Law, Closed Systems Processes, Open Systems Processes, Energy Equation For Steady Flow And Its Applications, Reversible And Irreversible Processes, Heat Engine And Reversible Heat Engine, 2nd Law Of Thermodynamic, Carnot Cycle And Reversed Carnot Cycle, Entropy, Clauses Inequality, Gases Mixtures, Cycles.

AE204: Mechanics of Materials:

Mechanics of materials: simple and normal Stress, Shear Stress, Bearing Stress, Thin Cylinder, Simple Strain, Hook's Law, Axial Deformations, Statically Indeterminate Parts, Thermal Stresses, Torsion, Flanged Circular Coupling, Springs, Shear and Moments in Beams, Shear

and Moments Diagrams, Stresses in Beams. Mechanics of Machines: Velocity and Acceleration and Forces Diagrams in Mechanisms, Friction Applications (Brakes and Clutches, Belts, Ropes and Chains), Turning Moment Diagram, Flywheel, Cams, Hook's Joint,

AE205: Introduction to Aeronautical Science:

Introduction to Aerodynamics: Gift and Lift Generation, Lift Wings, Airfoils Theories, Types of Wings. Boundary Layer On Wings, Boundary Layer Control, Drag, Theories of Drag and Preliminary Calculations of Drag and Lift, Introduction to Aircraft Stability, Take – Off and Landing, Aircrafts Performance.

Gas Dynamics: General Principles of Compressible Fluid Flow, One-Dimensional Isentropic Varying Area Flow, Normal and Oblique Shocks, Nozzles, Diffusers, Jet Propulsion, Constant Area Flow (Fanno Line and Rayleigh Line Flows).

AE206: Engineering of Metallurgy:

Introduction to metallic and Non-Metallic Materials, Crystal and Micro-Structure of Metals and Alloys, Crystallization and Solidification Process and Cooling Curves, Thermal Equilibrium Diagrams, Thermal Equilibrium Diagrams of Iron and Carbon, Relation Between Micro-Structure and Mechanical Properties, Basic Heat Treatments for Iron and Alloys, Light Metals, Copper and Zinc and Their Alloys, Hardening.

AE207: Mechanical Drawing:

General Review, Auxiliary Views, Bolts and Nuts, Welding and Its Use in Assembly, Springs, Keys and Their Types, Gears, Cams, Mechanical Assembly, Mechanical Dis-Assembly, Tolerances and Fits.

AE208: Programming / II:

Introduction to programming by FORTRAN language, Methods of Data Input and Results Printing, Arithmetic Sentences, Symbols of Arithmetic Operations, Rules of Algebraic Expressions Writing and Priority Rules, Mathematical Library Functions, Control Statements, DO Loops in Their Various Forms, 1-D and Multi-Dimensional Arrays, User Functions and Subroutines, Files, Operation and Use of AUTOCAD Software, Computer Applications in The Above Subjects. Computer Interfacing: Introduction to Digital Electronics, Standard Interfaces, Bus Interface, Sensors, Actuators and Solenoids, Motors, Experimental Interface Projects

AE209: English Languages / II:

Advance Grammars, Pronunciation, Selected Paragraphs in Aeronautical Engineering.

AE210: Aeronautical Engineering Laboratories / I:

Various Laboratory Experiments in The (Fluids, Thermodynamics, Metallurgy, Strength of Material, Theory of Machines) Laboratories.

3rd Year Program

AE301: Engineering and Numerical Analysis:

Engineering Analysis: The Special Functions, Laplace Transformation, Convolution and Inverse Convolution Theorem, Applications in Ordinary Differential Equations, Fourier Series, Complex Fourier Series, Partial Differential Equations. Numerical Analysis: Numerical Methods, Finite Differences, Numerical Differentiation and Integration, Numerical Solution of

Partial Differential Equations, Numerical Double Integration, Trapezoidal Method, Simpson Method, Applications On Computer in The Subjects of Numerical Analysis by Using MATHCAD and MATHLAB Software.

AE302: Heat Transfer:

General Concepts and Definitions, Modes of Heat Transfer, Conduction Heat Transfer, Extended Surfaces (Fins), Two-Dimensional Problems, Unsteady Conduction Heat Transfer, Heisler Charts, Forced Convection Heat Transfer, Thermal Boundary Layer, Heat Transfer in Pipes for Laminar and Turbulent Flow, Natural Convection Heat Transfer, Heat Exchangers, Radiation Heat Transfer: General Principles, Configuration (Shape) Factor, Radiation Applications.

AE303: Gas dynamics:

Gas Dynamics: General Principles of Compressible Fluid Flow, One-Dimensional Isentropic Varying Area Flow, Normal and Oblique Shocks, Nozzles, Diffusers, Jet Propulsion, Constant Area Flow (Fanno Line and Rayleigh Line Flows).

ME304: Aircrafts Structure/I:

Bending and Deflection of Statically Determinate and Indeterminate Beams, Structural Instability, Pressure Vessels, Rotating Discs, Yield Theories, Torsion of Non-Circular Thin Tubes and Narrow Sections, Energy Methods for Structural Analysis, Bending and Buckling of Thin Shells, Thin Plates Structure, Ribs, Analysis of Wings and Fuselage Resistance, Introduction to Arrays Method for Structural Analysis, Introduction to Aero-elasticity.

AE305: Mechanics of Machines and Vibrations:

Mechanics of Machines: Gears, Gear Trains, Gyroscopic Moment, Governor, Balancing of Rotating Masses, Balancing of Reciprocating Masses. Vibrations: General Principles, Oscillatory Motion, Free Vibrations, Damped Vibrations, Forced Vibrations, Harmonic Vibration, Whirling Speed of Rotating Shafts, One- And Two- And Multi- Degrees of Freedom Systems.

AE306: Manufacturing Processes:

Manufacturing Processes: Machining Processes, Casting, Powder Metallurgy, Welding, Hot and Cold Working, Engineering Statistics (Statistical Methods, Specimens, Central Tendency, Scales of Variations, The Frequency Distribution, The Relationship Between the Specimens and The Population, Basics of Probability Theory, Probability Distribution, Tests of Significance). Engineering Materials: Various Mechanical Inspections, Various Engineering Materials and Their Manufacturing, Materials Used in Aircrafts, Light Metals, Thermal Metals, Plastics, Aluminum and Its Alloys, Copper and Its Alloys. Practical Training Hours in The Mechanical Workshop and Measuring Instruments Laboratory (Turning, Forging, Carpentry, Measuring Instruments).

AE307: Avionics:

General Principles of Electrical Machines, D.C. Machines (Generators, Motors), Transformers, A.C. Machines (Three - Phase and Single - Phase Induction Motor), Electrical Power

Transmission, Relays and Circuit Breakers, Amplifiers, Electrical Measurements Instruments, Laboratory Experiments in The Above Subjects.

AE308: Elective 1:

AE309: Aeronautical Engineering Laboratories / II:

Various Laboratory Experiments in The (Fluids, Heat Transfer, Strength of Material, Theory of Machines, Vibrations) Laboratories.

4th Year Program

AE401: Design of Machine Elements:

Introduction to Simple and Compound Stresses and Deformations and Their Applications, Failure Theories and Their Applications, Stresses Concentration in Machine Elements, Fatigue Stresses, Riveted Joints, Welded Joints, Bolted Joints, Couplings and Keys, Pressure Vessels, Power Screws, Rotating Shafts, Spar and Helical Gears, Chains Drives, Belts, Brakes and Clutches, Roller and Sliding Bearings, Springs, Problems in Design, Applications On Computer by Using ANSYS Software.

AE402: Control and Measurements:

Introduction to Control Systems, General Mathematical Review (Laplace Transformation, Partial Fraction Expansion, Differential Equations, Matrices), Mathematical Modeling of Mechanical and Fluids and Thermal Systems, Transient and Steady State Response, Root Locus Method, Introduction to Measurement, Measurements Sensors and Instruments, Temperature and Pressure Measurements, Force and Mass and Torque Measurements, Translational and Angular Motion Measurements.

AE403: Air - Conditioning and Refrigeration:

Air and Humidity Calculations, Physiological Reactions for Cooling and Heating, Thermal Calculations and Heating Systems, Air – Conditioning and Cooling Calculations, Classification of Air Ducts, Design of Air Ducts for Air Distribution Systems, Ventilation and Air Cleaning, Units of Cooling and Adsorption and Compression, Cold Storages and Low Temperature Cooling Requirements, Methods of Automatic Control. (For Aeronautical Students, Focusing Is Made On Aircrafts Air – Conditioning).

AE404: Aerodynamics:

Fluid Dynamics Fundamentals, Potential Flow Theory, Aerodynamics of Wings and Streamlined Surfaces, Viscous Flow Theory and Boundary Layer, Three – Dimensional Finite Wings in Incompressible Flow, Streamlined Surfaces in Two – Dimensional Flow, Compressible Flow Over Finite Three – Dimensional Wings, Numerical Methods in Aerodynamics.

AE405: Jet Engines:

Petrol Otto Engine as A Classical Engine, Jet Propulsion Theory, Fundamentals of Jet Engines, Analysis Of Engines Types, Turbojet Engine, Turbofan Engine With By – Pass, Engines Performance, Various Parts Of Jet Engine, Review Of Nozzles And Diffusers and Burners, Turbo Machineries, Single- and Multi-Stage Axial Compressor, Aerodynamics Of Cascades, Compressor Efficiency Performance And Off-Design Performance, Centrifugal Compressor, Gas Turbine, Types Of Blades And Their Radial Variation, Performance and Efficiency, Turbine and Compressor Matching.

AE406: Aircrafts Structure/II:

The components of aircraft structures are subjected to forces and deformed elastically during the life of service.

This course covers the general information of aircraft structures and materials, and transfer of external aerodynamic loads into structural internal forces. The focus is to deliver the fundamental knowledge for stresses, deflection, and buckling analysis of these structural components under various static loading conditions including torsion, bending and shear. There are two main activities in this course. The first is lectures which emphasize the fundamentals of structural mechanics and analytical approaches for analysis of aircraft structures. The students will learn to derive the theory of linear elasticity and apply it to analyze the components subjected to typical aircraft loading conditions and design requirements. The second is tutorials which provide a set of lessons and exercises teaching the concepts and methodology in analysis of aircraft structures. The students will be able to learn and understand the procedure of aircraft structural analysis from following tutorial problem solving exercises with group discussions.

AE407: Aircraft Stability and Performance:

Aircraft Performance: Longitudinal and Lateral Static Stability, Effect of Movement of Center of Gravity, Unstable Aircrafts, Yawing and Rolling Stability, Longitudinal and Lateral Dynamic Stability, Dutch Rolling, Energy Method, Super Specific Energy Lines, Maneuverability, Climbing and Landing, Level Flight, Turning Performance, Stalling, Energy and Power. Systems: Types of Pumps, Performance and Selection of Pumps, Basics of Hydraulic Systems, Hydraulic System as an Operation and Control Device, Design of Hydraulic Systems, Aircraft Flight Control System, Air System, Fuel System, Cover of Cabin System, Air – Conditioning System, Ejection Seat System, Fire Protection System.

AE408: Elective 2:

AE409: Aeronautical Engineering Laboratories / IV:

Various Laboratory Experiments in The (Air – Conditioning, Control, Combustion, Power Plants, Aircraft structures) Laboratories.

5th Year Program

AE501: Aircraft Design:

This course is designed to provide students an understanding of procedure followed in conceptual design of an aircraft, meeting the user-specified design requirements and safety considerations specified by the aircraft certification agencies. The students will be exposed to types of aircraft and their features, requirements capture, configuration selection, initial sizing, determination of aerodynamic coefficients, constraint analysis, types of loads, V-n diagram, Range-Payload diagram, and Life Cycle Cost analysis. A special feature of this course will be a series of tutorials which will run all along the course to give the participants a practical feel of conceptual sizing and of an existing civil transport aircraft. COURSE LAYOUT: Introduction to Aircraft Design & Requirements Capture, Design Considerations in Airliners,

Cargo, and SST Design Considerations in GA and Military Aircraft, Aircraft Configuration Design, Aircraft Layout Choices Initial Sizing, Estimation of Lift Coefficient, Estimation of subsonic parasite drag coefficient, Constraint Analysis of Military Aircraft, Constraint Analysis of Transport Aircraft, Aircraft Loads and V-N Diagram, Cost Estimation in Aircraft Design

AE502: Wind Tunnels:

Course Objectives and background the overall course objective is to acquire theoretical and practical knowledge on how to perform and analyses wind tunnel tests related to Aeronautical engineering. The course consists of lectures and practical exercises. The lectures topics are: aerodynamic investigation of Aeronautical engineering in a wind tunnel such as fluid dynamics, principles of wind tunnels, scaling issues, test purpose and setups, model building and instrumentation, data sampling and signal analysis and overview over typical test types. The practical exercises in form of wind tunnel tests focus on preparation, performance, observation and measurements, data analysis and reporting. The wind tunnel tests will take place in the small Open-Circuit Wind Tunnel. Following topics for the exercises are under consideration: Measurement of turbulent flow (mean velocity profile, turbulence intensity and spectral density function). Measurement of base moments and forces on a scaled wing and airplane (load spectrum and scaling issues). Surface pressures on a building model (depending on the availability of high-speed pressure scanning system). Visualization of airflow around a body. The topics may change depending on the availability of measuring equipment and facilities. Details regarding content of lectures.

AE503: Aircraft Systems:

The Aerospace Engineering: Aircraft Systems and Avionics Course is a multidisciplinary course where you will study the engineering of the many systems onboard of Airplanes and Aircraft. Students will be able to fully understanding the main topics regarding Systems Engineering of Aircraft and Airplanes. The structure of the Course is the following: Introduction, Flight Instruments, Electrical System, Pneumatic System, Hydraulic System, Avionics, Cockpit We will discuss topics such as Flight Instruments on Civil Aircraft, the generators used to produce electricity on board, the Key differences between Pneumatic and Hydraulic Systems, the objective of the Course to understand why Aircraft require a specific set of systems in order to operate at normal conditions. Why the hydraulic system is essential to move the control surfaces on the aircraft and how it is linked to the Landing Gear. Cockpit main instruments and their relation to the conditions of flight.

AE504: Industrial Engineers:

Industrial Engineers design, develop, improve, and manage efficient systems. Industrial engineering at Illinois encompasses the analysis, development, improvement, and implementation of all integrated processes and their components, including materials, equipment, information, energy, people, money, and time. Industrial Engineers figure out how to do things better. Industrial Engineering fuses engineering, business, and communications, drawing upon computer science, math, production management, process control, and psychology. Industrial engineers have the technical training and understanding of people to make improvements in efficiency and quality in any setting. The bachelor of science in Industrial Engineering prepares students to work in a limitless variety of industries, including technology, health care, communications, manufacturing, and government—you will be equipped to make an impact in the career path of your choice. Many are misled by the term “Industrial Engineer.” “Industrial” does not mean just manufacturing—it encompasses telecommunications, computing, service industries, and human relations as well. While it has long been known that industrial engineers have the technical training to make improvements in

a manufacturing setting, now it is increasingly recognized that these same skills provide a systematic technique to evaluate and improve efficiency and quality in any setting. Industrial Engineers eliminate waste of time, money, materials, energy, and other commodities; strain on workers and the environment; and save companies money. More and more organizations are hiring industrial engineers and promoting them into management positions.

AE505: Engineering Materials:

This course will familiarize the student with the properties of metal, ceramic, polymer and composite engineering materials. Methods to protect materials and alter their properties will be investigated. Learning Outcomes: Upon completion of this course the student will be able to: a) select appropriate materials for various engineering applications; b) identify characteristic properties of engineering materials made of metals, ceramics and polymers, relate the material properties to their chemical make-up and structure and how these can be changed; c) choose appropriate means of protecting materials against corrosion; d) explain the effect of heat treatment in material property alteration. Course Content: 1. Atomic bonding and Crystal structure of engineering materials. 2. Chemical and Physical properties of engineering materials. 3. Mechanical Properties and Behaviors of Materials - Stress - Strain Relationships - Tensile Strength - Hardness- Impact Strength - Fatigue & Stress Rupture - Creep & Stress Rupture - Comparison of Material Properties 4. Ferrous Metals and their Properties -Iron - Carbon Equilibrium Diagram - Carbon Steel & AISI Numerical Identification Systems - Alloy Steel - Tool Steel - Stainless Steel 5. Changing Steel Properties by Heat Treatment - Strain Hardening - Recovery & Recrystallization - Solid State transformations (Equilibrium Diagrams) - Heat Treating Ferrous Alloys & Their Microstructures - Stress Relieving - Normalizing – Annealing - Through Hardening - Surface Hardening - Case Hardening – Tempering 6. Nonferrous Metals – Aluminum - Magnesium & Titanium - Copper and its Alloys - Low Melting Temperature Alloys 7. The Chemistry and prevention of corrosion 8. Polymers and their Properties - Effects of Heat, Light, Humidity, Electricity & Oxygen - Thermoplastics- Polyethylene, Polypropylene, Polystyrene -PVC, ABS, PTFE, Nylon, Polycarbonate - Thermosets - Phenolic, Polyesters, Epoxies, Silicone - Synthetic Rubbers - Reinforced Resins as Composites - Foamed Polymer Structures – Adhesives – Coatings 9. Glass and Ceramic Materials- Glass - Types, Forms & Properties –Refractory Ceramics - High Performance ceramics- Carbon Fiber– Reinforcement – Concrete Evaluation.

AE507: Engineering Project:

Independent Work for The Senior Students Under the Supervision of the Department Teachers, The Student Should Presents a Report About the Project at The End of the Year. For Aeronautical Students, The Selected Projects Are Related to Aeronautical Engineering.

AE508: Elective 3: