دليل

كلية الهندسة

2020

قسم هندسة الطيران
Department of Aeronautical Engineering

Humanities courses   العلوم الإنسانية

Course No.	Course name	Pre request المتطلبات	Credits الوحدات	اسم المقرر	رقم المقرر
GH141	English I	Nil	3	اللغة الإنجليزية 1	ع إ 141
GH142	English II	GH141	3	اللغة الإنجليزية 2	ع إ 142
GH150	Arabic I	Nil	2	اللغة العربية 1	ع إ 150
GH151	Arabic II	GH150	1	اللغة العربية 2	ع إ 151
GH152	Technical Writing in Arabic	GH151	1	كتابا التقارير الفنية	ع إ 152
	Total Credits		10	إجمالي عدد الوحدات	

General Science Courses   العلوم الاساسية العامة

Course No.	Course name	Pre request المتطلبات	Credits الوحدات	اسم المقرر	رقم المقرر
GS101	Mathematics I	Nil	3	الرياضيات 1	ع ع 101
GS102	Mathematics II	GS101	4	الرياضيات 2	ع ع 102
GS111	Physics I	Nil	3	الفيزياء 1	ع ع 111
GS112	Physics II	GS111	3	الفيزياء 2	ع ع 112
GS112L	Physics Lab	GS111	1	فيزياء معمل	ع ع 112 م
GS115	Chemistry	Nil	3	الكيمياء العامة	ع ع 115
GS115L	Chemistry Lab	Nil	1	الكيمياء معمل	ع ع 115 م
GS200	Computer Programming	Nil	3	برمجة حاسوب	ع ع 200
GS203	Mathematics III	GS102	3	الرياضيات 3	ع ع 203
GS204	Mathematics IV	GS102	3	الرياضيات 4	ع ع 204
GS206	Probability & Statistics	Nil	3	الإحصاء والاحتمالات	ع ع 206
	Total Credits		30	إجمالي عدد الوحدات	

General Engineering Courses   العلوم الهندسية العامة

Course No.	Course name	Pre request المتطلبات	Credits الوحدات	اسم المقرر	رقم المقرر
GE121	Engineering Mechanics I	Nil	3	ميكانيكا هندسية 1	هـ ع 121
GE125	Engineering Graphics	Nil	2	الهندسة الوصفية	هـ ع 125
GE127	Engineering Drawing	Nil	2	الرسم الهندسي	هـ ع 127
GE129	Workshop Technology	Nil	2	تقنية الورش	هـ ع 129
GE129 L	Workshop Technology Lab	Nil	1	معمل تقنية الورش	هـ ع 129 م
GE133	Properties of Materials	GS101 GS111 GS115	3	خواص المواد	هـ ع 133
GE222	Engineering Mechanics II	GE121	3	ميكانيكا هندسية 2	هـ ع 222
EE280	Electrical Eng. Fundamentals	GS102 GS112	3	أساسيات الهندسة الكهربية	هـ كه 280
	Total Credits		19	إجمالي عدد الوحدات	

ثانيا :- قائمة مسميات المقررات الدراسية الملزمة لجميع طلبة القسم   List of departmental . 2nd

Course No.	Course name	Pre request المتطلبات	Credits الوحدات	اسم المقرر	رقم المقرر
AE200	Intro. to Aeronautics	GS101/GS111	3	مقدمة الى هندسة الطيران	هـ طي 200
ME201	Mechanical Drawing	GE127	2	الرسم الميكانيكي	هـ مك 201
ME206	Metallurgy	GE133	3	علم المعادن	هـ مك 206
AE210	Thermodynamics I	GS102/GS111	3	ديناميكا حرارية 1	هـ طي 210
AE213	Stress Analysis	GE121/GE133	3	تحليل الاجهادات	هـ طي 213
ME215	Production Engineering	GE129/ME206	3	هندسة إنتاج	هـ مك 215
AE300	Heat Transfer	AE210	3	انتقال الحرارة	هـ طي 300
AE301	Fluid Mechanics	GS111/AE200	3	ميكانيكا موائع	هـ طي 301
AE302	Aerodynamics I	AE301	3	الديناميكا الهوائية 1	هـ طي 302
AE305	Aircraft Propulsion I	AE312	3	محركات طائرات	هـ طي 305

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ME307	Mechanics of Machines	GE222	3	ميكاتيكا آلات	هـ مك 307
AE310	Flight Mechanics I	AE302	3	ميكانيكا الطيران 1	هـ طي 310
AE312	Thermodynamics II	AE210	3	ديناميكا حرارية 2	هـ طي 312
AE325	Numerical Analysis	GS200/GS204	3	التحليل العددي	هـ طي 325
AE380	Applied Electronics	EE280	3	تطبيقات إلكترونية	هـ طي 380
AE402	Aerodynamics II	AE302	3	الديناميكا الهوائية 2	هـ طي 402
AE406	Aircraft Propulsion II	AE305	3	محركات طائرات 2	هـ طي 406
AE409	Mechanical Vibrations	GE222/GS204	3	اهتزازات ميكانيكية	هـ طي 409
AE411	Flight Mechanics II	AE310/AE409	3	ميكانيكا الطيران 2	هـ طي 411
AE412	Aircraft Structure I	AE213	3	إنشاء هياكل الطائرات 1	هـ طي 412
AE413	Aircraft Structure II	AE412	3	إنشاء هياكل الطائرات 2	هـ طي 413
AE418	Boundary Layer Theory	AE402	3	نظرية الطبقة المتاخمة	هـ طي 418
AE430	Wind Tunnel Techniques	GH152/AE418	2	أساليب القياس في الانفاق الهوائية	هـ طي 430
AE450	Automatic Control	AE409	3	التحكم الالي	هـ طي 450
AE461	Aircraft Component Design	ME201/AE412	3	تصميم أجزاء الطائرت	هـ طي 461
AE465	Aircraft Design	AE305/AE310	3	تصميم الطائرات	هـ طي 465
AE599	B. Sc. Project	Pass 130 Units	4	المشروع	هـ طي 599
Total Credits			80	إجمالي عدد الوحدات	

ثالثا :- قوائم مسميات المقررات الدراسية الاختيارية   3rd List of the Elective courses

The student has to select 6 courses From the List below which about 12 Credits

Course No.	Course name	Pre request المتطلبات	Credits الوحدات	اسم المقرر	رقم المقرر
AE555AL	Air Law-Aviation Legislation	3rd Level courses	2	قانون الجو في الطيران	هـ طي 555
AE555HF	Human Factors in aviation	3rd Level courses	2	العامل البشري في الطيران	هـ طي 555
AE555AM	Intro. to Aircraft Maintenance	3rd Level courses , AE555HF, AE555SY, AE555AL	2	مقدمة في صيانة الطائرات	هـ طي 555
AE555SY	Introduction to Aircraft Systems	3rd Level courses	2	مقدمة في انظمة الطائرات	هـ طي 555
AE555AI	Aircraft Accident Investigation and Safety Assessment.	3rd Level courses	2	التحقيق في حوادث الطيران	هـ طي 555
AE555AT	Air Transport Management	3rd Level courses	2	إدارة النقل الجوي	هـ طي 555
AE555CM	Composite Materials	3rd Level courses	2	المواد المركبة	هـ طي 555
AE555ADS	Aircraft Detail Stressing	3rd Level courses	2	تحليل الاجهادات على الطائرات	هـ طي 555
AE555SSM	Structural Modelling and Simulation	3rd Level courses /AE412	2	نمذجة الهيكل والمحاكاة	هـ طي 555
AE555EPM	Engineering and Project Management	3rd Level courses	2	ادارة المشاريع الهندسية	هـ طي 555
AED555INS	Introduction to Navigation Systems	3rd Level courses	2	مقدمة في انظمة الملاحة	هـ طي 555
AE555IGS	Introduction to Guidance System	3rd Level courses /AE450	2	مقدمة في انظمة التوجية	هـ طي 555
AE555LA	Aircraft Loading	3rd Level courses /AE411	2	تحميل الطائرة	هـ طي 555
AE555SMS	System Modelling and Simulation	3rd Level courses /AE450	2	نمذجة النظم والمحاكاة	هـ طي 555
AE555AP	Autopilot	3rd Level courses /AE411/AE450	2	الطيار الالي	هـ طي 555
AE555HA	Helicopter Aerodynamics	3rd Level courses	2	ديناميكا الهوائية للطائرات العموديه	هـ طي 555
AE555MCP	Microcontroller Programming	3rd Level courses /AE380/AE450	2	برمجة المتحكم الدقيق	هـ طي 555

AE555WEE	Wind Energy Assessment	3rd Level courses	2	تقييم طاقة الرياح	هـ طي 555
AE555LPM	3-D Linear Panel Method	3rd Level courses	2	طريقة الالواح الخطية ثلاثية الابعاد	هـ طي 555
AE555DC	Digital Control	3rd Level courses /AE450	2	التحكم الرقمي	هـ طي 555
AE555GTC	Gas Turbine Engine Combustors	3rd Level courses	2	غرف إحتراق التوربينات الغازية	هـ طي 555
AE555SM	Space Mechanics	3rd Level courses	2	ميكانيكا الفضاء	هـ طي 555

الجدول التالي يبين تفاصيل متطلبات عدد الوحدات التخرج للطالب بقسم هندسة الطيران :

الإجمالي	العلوم التخصصية الاختيارية		المقررات التخصصية الملزمة لجميع طلبة القسم		العلوم الهندسية العامة		العلوم الاساسية العامة		العلوم الإنسانية		الشعبة	القسم
	النسبة المئوية من اجمالي عدد الوحدات الكلية	عدد الوحدات	النسبة المئوية من اجمالي عدد الوحدات الكلية	عدد الوحدات	النسبة المئوية من اجمالي عدد الوحدات الكلية	عدد الوحدات	النسبة المئوية من اجمالي عدد الوحدات الكلية	عدد الوحدات	النسبة المئوية من اجمالي عدد الوحدات الكلية	عدد الوحدات		
151	7.9%	12	53.0%	80	12.6%	19	19.9%	30	6.6%	10	القسم شعبة واحدة	هندسة الطيران

المحتوى العلمي للمقررات الدراسيةالملزمة لجميع طلبة القسم

AE200	Introduction to Aeronautics	3 Credits

Pre-requisite: GS101-GS111

Aerodynamics: The atmosphere, Airplane types and components, Generation of aerodynamic forces and moments; Axis systems, Airfoil and wing geometry, General aerodynamic characteristics of airfoils and wings, Viscous effects. Flight mechanics: General meaning of aircraft performance, Elements of aircraft performance, Power effects, Operating limitations, General meaning of equilibrium, General meaning of stability, Requirements to achieve equilibrium effect of C.G. position. Propulsion: Aircraft engine components, Aircraft engine types, Jet fuels, Comparison between jet and piston engines. Structures: Familiarization with the main components of the airplane, and terminology, control surfaces, basic flight instruments, structural configuration, basic materials and manufacturing processes.

AE210	Thermodynamics I	3 Credits

Pre-requisite: GS102-GS111

Introduction, definitions, units, equation of state for ideal gases, properties of pure substances, the first law of thermodynamics, reversible and irreversible process, the second law of thermodynamics, Carnot cycle, entropy, reversible steady flow process, power and refrigeration cycles.

AE213	Stress Analysis	3 Credits

Pre-requisite: GE133-GE121

Introduction to stress and strain, Mechanical properties of materials, Transformation of plane stress and strain, Principles of plane stresses and plane strains, Stress strain relation, Elastic materials, Hooke's law, Normal and shear stresses, Mohr's circle, Shear force and moment diagrams in beams, Bending, Shear, Torsion and Combined stresses. Thin walled pressure vessels. Deflections of beams using Castigliano's theorem. Introduction to indeterminate beams.

AE300	Heat Transfer	3 Credits

Pre-requisite: AE210

Heat and temperature, modes of heat transfer, combined mechanisms, general equation of heat transfer, overall coefficients, mean temperature difference, electrical analogy. Conduction, Fourier's Poisson's and Laplace's equations for coduction, steady state one dimensional conduction simple and composite slabs and in cylinders, shape factors, extended surfaces, Newtonian heating and cooling. Convention, natural forced convention, Nusselt, Prandtl, Rynolds and Grashoff numbers, natural convention equation, forced convention flow inside tube, laminar and turbulent flow equation,. Radiation, absorption, reflection and transmission, black and gray bodies, Kirchhoff's law, Stefan-Boltzman's laws, radiation intensity, and total emissive power, radiation between black and gray bodies, combined radiation with convection and conduction.

AE301	Fluid Mechanics	3 Credits

Pre-requisite: GS111-AE200

Introduction, scope of fluid mechanics, basic equations, methods of analysis, dimensions and units, velocity field, stress field, viscosity, the basic

equation of fluid, statics. The standard atmosphere, pressure variation in a static fluid, incompressible liquids, hydrostatic. Force on submerged surfaces, buoyancy and basic equation in integral formula. Conservation of mass, newton 'second law principle. Introduction to differential analysis of fluid motion, conservation of mass, stream function for two-dimensional incompressible flow, motion of a fluid particle (Kinematics). Fluid translation, acceleration of a fluid particle in a velocity field, fluid rotation, fluid deformation, momentum equation, forces acting on a fluid particle. Differential momentum equation, Newtonian Fluid: Navier_Stokes equations. Bernoulli equation, static, stagnation, and dynamic pressures, Bernoulli equation applied to irrotational flow, velocity potential, stream function and velocity potential for two-dimensional, irrational, incompressible flow, Laplace's Equation, Buckingham Pi theorem, determining the Π Groups, flow similarity and model studies, incomplete similarity, scaling with multiple dependent parameters.

AE302	Aerodynamic I	3 Credits

Pre-requisite: AE301

Review of flow around circular cylinder, Circulation, Flow around circular cylinder with circulation, Kutta-Jaoukowski theory /lift, Thin airfoil theory, Lifting line and lifting surface theories, Panel methods, Aerodynamic interference, Sweep back; delta wing, High lift devices, Twist; additional lift, High alpha effects.

AE305	Aircraft Propulsion I	3 Credits

Pre-requisite: AE312

Introduction to air breathing propulsion systems, thermodynamic fundamentals, momentum , thermodynamic cycles of gas turbine engines and their performances, the turbojet engine components and functions, engine non-rotating component aerodynamics and performance, starting problems.

AE310	Flight Mechanics I	3 Credits

Pre-requisite: AE302

Part 1: Flight vehicle aerodynamic forces and moments, Analysis of subsonic drag components, Changes of total drag with aircraft speed, Atmospheric flight (International Standard Atmosphere), Calculations of the variation of various air physical properties with altitude within the Stratosphere.

Part 2: Engine performance (Piston engine-Jest engine), Power available and power required for piston-engine and jet engine aircraft, Flight Envelope, Excess Power, Absolute and Service Ceiling.

Part 3: Aircraft performance in level flight, clime flight, cruise flight, takeoff and landing, Maneuvering and turning flight, maneuvering boundaries, V-n diagram, Flight boundaries.

Part 4: Range and Endurance (Breguet Equations), Speeds of maximum range and maximum Endurance, Effect of wind on Range and endurance.

AE312	Theromodynamics II	3 Credits

Pre-requisite: AE210

Thermodynamic relations o single component systems, deviations from ideal gas behavior, generalized charts. Mixtures and solutions: properties of component in mixture, ideal gas mixtures, stecheometry. Chemically reactive systems: stoichiometry, energy and free energy of reaction , generalized availability, equilibrium, Gibbs equation for simple chemical systems, the chemical potential, phase equilibrium, chemical reaction equilibrium. Introduction to irreversible thermodynamics: rate equation, coupling phenomena , application to thermoelasticity. Introduction to statistical thermodynamics: Information theory approach.

AE325	Numerical Analysys	3 Credits

Pre-requisite: GS200-GS204

Errors, sources and reduction, software tools, Taylor approximation/Euler, Newton-Raphson method-root, Bisection/Secant, The Jacobian, Numerical integration-Trapezoidal, Numerical integration-Simpson rule, Numerical integration 8/3 Simpson rule , Solution of differential equations, Linear system of equations: Gaussian/Cramer, Linear system of equations: Causs Seidel, Least Squares: curve fitting, case study: Runge Kutta 4th order/Predator & Prey Simulation.

AE380	Applied Electronics	3 Credits

Pre-requisite: EE280

AC Circuit Review: Phasors, Angular Velocity, Phase Relations, Average And RMS Values, Power In Electric Circuits, Transformers. RLC Frequency Response: Resonance–Filters. Semiconductors Diodes And Transistors: PN Junction, Diode Characteristics, Diode Equivalent Circuit, Load Line, Examples, Rectification, Zener Diode. Bipolar Junction Transistors (BJT): Construction And

Notations Working Principles, Common Transistor Configuration, Load Line Analysis, Biasing. Field Effect Transistor FET. Amplifiers: Differential Amplifiers, Feedback Amplifiers, Operation Amplifiers (O Amps). Digital Electronics: Number Systems, Boolean Algebra, Logic Gates, Flip Flops, Shift Registers, Digital Counters, Digital Memories, Microcomputers And Microprocessors. Communication Systems: Modulation, AM, FM, PM, Power in AM, Single Side Band (SSB), Double Side Band (DSB). Aircraft Electrical Systems: Auxiliary Power Unit (APU), Ground Power Supply, Emergency Power Supply. Transducers: Resistive Transducers, LVDDT, Strain Gauge, Thermocouples, Thermistors, Photoelectric Transducers.

AE402	Aerodynamic II	3 Credits

Pre-requisite: AE302

Dynamics of Inviscid Compressible Flow: Second low of thermodynamics: specific heat, speed of sound. Adiabatic and isentropic flows. Nozzle operation process (converging nozzle and converging diverging nozzle). Normal shock waves, oblique shock waves, Prandtl-Meyer function, Shock and expansion waves. Compressible Subsonic and Transonic flows: Thin wing at small angle of attack (linearized subsonic flow), Transonic flow about wings. Two-Dimensional Subsonic flow Around Thin Airfoil: Linear theory, Buseman theory, Shock-expansion method. Supersonic Flow over Bodies and wings: Linearized equations. Solution method: conical flow, Singularity distribution, Aerodynamic interference. Computational Aerodynamics (introductory material), Hyper Sonic Flow (introductory material).

AE406	Aircraft Propulsion II	3 Credits

Pre-requisite: AE305

Engine rotating components aerodynamics and performance, engine components matching, propellers and performance.

AE409	Mechanical Vibrartion	3 Credits

Pre-requisite: GS204-GE222

Oscillatory Motion: Harmonic Motion. Free Vibration: Equation of Motion – Natural frequency (Newton's Law), Energy Method, Equivalent Spring (springs in series and in parallel), Mass or Inertia Elements, Equivalent Mass of a system, Damped free vibration, Logarithmic Decrement, Un-damped forced Vibration, Beating phenomenon, Damped forced system. Forced Harmonic Vibration: Rotating unbalance, Support Motion, Transmissibility and Vibration

Isolation. Two Degree of freedom: normal mode vibration, Coordinate coupling, forced harmonic motion, Mode shape of vibration system. Properties of vibrating systems: Flexibility and stiffness Matrices, Eigen-values and Eigen-vectors, Equations Based on flexibility formulation, Equations Based on stiffness formulation, Orthogonal properties of the eigenvectors, Repeated roots. Lagrange's Equation: Kinetic, potential energy, generalized coordinates, Lagrange's equations. Approximate numerical methods: Matrix iteration, Calculation of Higher Modes.

AE411	Flight Mechanics II	3 Credits

Pre-requisite: AE310-AE409

General meaning of equilibrium and stability. Static stability equilibrium and trim. General meaning of dynamic stability. Static stability theory and static pitching moment on Aircraft. Requirement of A/C static stability, stick-fixed neutral point, static margin and effect of center of mass position. Longitudinal control requirements, some longitudinal maneuvers. Lateral-directional stability and control aspects, some lateral maneuvers.
Derivation of rigid body equations of motion, body frame and inertial frame. The full non-linear equations of aircraft motion.
Linearization of the equations of motion, stability derivatives, NACA non-dimensional system, non-dimensional Linearized equations of motion. Stability derivatives, evaluation of stability derivatives for low speed flight.
Solution of the characteristic equation; longitudinal motion of aircraft; characteristics of short period and phugiod modes. Lateral motion of aircraft; Spiral, roll-convergence, and Dutch-roll modes. Introduction to flying qualities and handling.

AE412	Aircraft Structure I	3 Credits

Pre-requisite: AE213

Material used in aircraft skin structures, loads applied on A/C structural components; factors of safety, inertia loads, maneuvers loads, gust loads, V-n diagrams. Open and closed thin walled cross sections; bending, shear, and torsion. Strain and displacement. Boom analysis, Multi-cell cross sections; bending, shear, and torsion. Shear variations, Effect of taper, deflection, Structural Constraint. Applications of stress analysis on A/C components; Fuselages, Wings. Cut-outs.

AE413	Aircraft Structure II	3 Credits

Pre-requisite: AE412

      Energy Methods: strain and complementary energy, total potential energy, application to deflection problems, application to statically indeterminate structures, unit load method. Bending of thin plates: pure bending, bending and twisting of plates, distributed loading, combined bending and in-plane loading, small initial curvature, energy for thin plate analysis. Structural instability: Euler buckling of columns, Inelastic buckling, Effects of imperfections, Buckling of columns and thin plates, Inelastic buckling of plates, Local instability.

AE418	Boundary Layer Theory	3 Credits

Pre-requisite: AE402

      Effect of viscosity on flow around objects: Inviscid and viscid patterns and pressure distribution on circular cylinder, Drag paradoy. Navier-Stoke's equations for compressible viscous flow: Derivation of the equations, Some exact solution of incompressible flow form of Navier-Stoke's equations, Emergence of boundary layer concept. Velocity boundary layer equations in incompressible flow-laminar case: Deducing the equations, Flat plate solution (Blasius solution), Boundary layer with pressure gradient, Boundary layer separation, Integral methods. Transition to turbulent boundary layer: Stability of laminar boundary layer, Transition. Two-Dimensional incompressible turbulent velocity boundary layer: Reynold's shear stress, Approximate solutions, Structure of turbulent boundary layer. Thermal boundary layer: Energy equation, Thermal boundary layer on flat plate.

AE430	Wind Tunnel Techniques	2 Credits

Pre-requisite: GH152-AE418

      1. Wind tunnels: Classification of wind tunnels, Subsonic wind tunnels components: Open circuit, Closed circuit. Supersonic wind tunnel components: Blow down in draft, Continuos. 2. Pressure measurement, Absolute pressure, Gauge pressure: Fluid manometers, Pressure transducers. 3. Velocity measurement: Pitot-static tube, Hot-wire anemometer, LASER Doppler Anemometer. 4. Aerodynamic balances, 5. Flow Visualization: Smoke, Dye, Oil, Tufts, Schlieren. 6. Temperature measurement. 7. error source in wind tunnel measurements, test procedures.

AE450	Automatic Control	3 Credits

Pre-requisite: AE409

Introduction to control systems, history of automatic control, mechanical examples of modern control systems; mathematical models of system, differential equations of physical system, linear approximations of physical systems, main rules of Laplace transformation, the transfer function of linear system, block diagram models, signal flow graph models, simulation of control system (particular emphasis given to mechanical and industrial examples). Feedback control system characteristics; open and closed loop control system, sensitivity of control system to parameter variations, control of the transient response of control system, steady state error, the cost of feedback. Performance of feedback control systems; time domain performance specifications, the s-plane root location and the transient response, performance indices, simplification of linear system, mechanical and industrial examples. Stability of linear feedback system: the concept of stability, the Routh-Hurwitz stability criterion, the relative stability of feedback control systems, determination of root location in the s-plane, practical applications in mechanical and industrial examples.

AE461	Aircraft Component Design	3 Credits

Pre-requisite: ME201-AE412

Introduction: Theory of elasticity fundamentals, stress analysis equations review. Cross sections properties. Materials for aircraft. Design of basic structural elements: Shear force and bending moment diagrams, factors of safety, allowed design stresses, rivets, circular of open and closed. Flight envelope: Design load, limit load, ultimate load, n-v diagram, maneuvering envelop, gust envelop, flight envelop. Wing stress analysis: Shear force and bending moment diagram. Fuselage stress analysis: Determination of shear forces and moment diagrams, design of fuselage: Procedure, sizing of cross section of fuselage. Design of mono-spar wings: Shear force and bending moment diagram for tapered spar, sizing of spar cross section. Design for two spar wings: Procedure, sizing, wing rib design. Landing gear design: Types of landing gears, loads on landing gears, impact energy, tyre selection, shock absorber sizing, plunger design, strut design.

AE465	Aircraft Conceptual Design	3 Credits

Pre-requisite: AE305-AE310

Introduction, A/C design organization, A/C configurations, A/C weight calculation, mission fuel weight, sizing to stall speed requirements, sizing to take off distance requirements, sizing to landing requirements, drag polar

estimation at low speed, sizing to FAR23 and FAR25 climb requirements, sizing time to climb, ceiling and maneuvering requirements, sizing to cruise speed requirements, matching diagram, wing design considerations, fuselage design (overall configuration), landing gear design and integration, weight and balance analysis, drag estimation, stability and control analysis, overall configuration design.

المحتوى العلمي للمقررات الدراسية الاختيارية بقسم هندسة الطيران

AE555AL	Air Law Aviation Legislation	2 Credits

Pre-requisite: 3rd Level Courses

General Introduction about Aviation Industry and Air Law Organizations and Conventions/Agreements and Aviation Organizations. Roles of the member of States Libyan Civil Aviation Authority. Modules required for B1, B2, B3 and C certificates (General Introduction).

Radiotelephony Aircraft Nationalities and Registrations (Generals) Freedoms of Flight. Aircraft Lease. Aircraft Navigation Lights. Airport Main Areas. Airport Codes (ICAO-IATA). Aircraft Codes (ICAO- IATA). Aircraft Marshalling. Rights of Aircraft Overtaking on Ground (Taxiing) and in Air. Rights of Aircraft Approaching on Ground and in Air. General Introduction about Maintenance, Training, Design, Operations, Manufacturing, etc. Organizations.

National and International Requirements for Maintenance Program. National and International Requirements for Continuing Airworthiness.

Aircraft Certifications and Documents, commercial Air Transportation. Tripoli National Airport. Imitiga Airport. Libyan Civil Aviation Authorities Headquarter/Divisions/Facilities.

AE555HF	Human Factors in Aviation	2 Credits

Pre-requisite: 3rd Level Courses

Introduction to human factors in aviation. The effect of human factors on performance. The relationship between human factors, safety and efficiency. The role of human factors in system design, operations, management and safety. Models of human factors analysis(SHEL model, James Reason's human error theory and HFACS model). Models of human factors analysis (SHEL model, James Reason's human error theory and HFACS model). Human information processing. Communication and overcoming barriers to

effective communication. Applying human factors to Human Factors in Aviation Maintenance

AE555SY	Introduction to Aircraft Systems	2 Credits

Pre-requisite: 3rd **Level Courses**

General introduction, Air transport association (ATA).

Aircraft systems

Part 1: airframe systems: Airframe and structure construction, pneumatic, air conditioning and pressurization system, oxygen system, hydraulic system, flight control system, landing gears system, fuel system, ice and rain protection system, water and waste system, equipment and furnishing system, fire and smoke detection protection systems, fire extinguisher system, etc.

Part 2: Propulsion systems: Types of powerplant, ignition system, starting system, fuel system, oil system, auxiliary power system.

Part 3: electrical and avionics systems: Electrical power, auto-flight/auto-throttle, navigation system, communications systems, indicating/instrument, avionics, etc..

Practical work: Practical work plus use of manuals and tools for typical available(for example hydraulic system AIRBUS A-320).

AE555AM	Introduction to Aircraft Maintenance	2 Credits

Pre-requisite: 3rd **Level Courses-AE555HF-AE555SY-AE555AL**

General aspects, Safety Precautions and Fire Hazards. Inspection fundamentals, Airframe maintenance, Hardware, Materials, material processing and sheet metal forming, Ground handling, safety and support equipments. Hand tools and measuring devices. Maintenance practices, Maintenance types, Documents, Practical work: practical work plus use of manuals and tools for typical available aircraft (for example AIRBUS A-320).

AE555AI	Aircraft Accident Investigation and Safety	2 Credits

Pre-requisite: 3rd **Level Courses**

Introduction and fundamental of accident investigation. The management of safety. Safety risk management. Human Factors in safety investigations. Human Performance in safety investigations. Applied Aircraft

Accident Investigation. Airline internal safety investigation. Organization and planning of an investigation. Conduct of the investigation.

AE555AT	Air Transport Management	2 Credits

Pre-requisite: 3rd **Level Courses**

Part one: An historic prospective, the organization and the regulation of air transport: international level, regional level and national level. Air transport infrastructure: Airports and aerodromes, navigation aids. Aviation activities: general aviation companies, maintenance and ground support, scheduled airlines, legend and LCCs, charter operations, cargo operations, and travel agents.

Part two: An introduction to the geography and air transport, An introduction to air transport and the economy, An introduction to air transport management: air safety, bilateral air services agreements and the economic management of the air space, the management of the infrastructure, finance and financing. Airline management: network and fleet planning, management tools, finance, finance and financing.

AE555CM	Composite Materials	2 Credits

Pre-requisite: 3rd **Level Courses**

Basic definitions concerning composites. Benefits from the use of composites especially in aerospace applications. Processes, manufacture and quality control. Anisotropic, orthotropic and isotropic material properties. Lamina constitutive equations. Parameter of mutual influence of the 1st and 2nd kind. Lamination theory; symmetric and non-symmetric laminates with emphasis on the coupling effects. Analysis of stresses and strains through the thicknesses of laminates. Comparison of experimental and theoretical laminate stiffnesses, strength of laminates. Inter laminar stresses. Design of laminates.

AE555ADS	Aircraft Detail Stressing	2 Credits

Pre-requisite: 3rd **Level Courses**

Data Sheets For Details Stressing. Aircraft Structures Strength Requirements Reserve Factors. Strength Requirement For Rivets, Lugs, Bolts. Stressing Requirement For Wing Spar Beams. Stressing Requirements For Ribs, Stringers. Buckling Strength Of [Web, Skin Panels]. Shear Strength Of Wing Box Structures. Fatigue Strength Of Structural Components.

AE555SSM	Structural Modeling and Simulation	2 Credits

Pre-requisite: 3rd Level Courses-AE412

      Review: aircraft structure components functions, applied loads and related stresses on aircraft structures. Introduction to modeling and simulation: Modeling concepts, simulation concepts. Introduction to available software (MSC/PATRAN and MSC/NASTRAN). Application to some of the aircraft structure components (open and close sections). Hands-on Practice.

AE555EPM	Engineering and Project Management	2 Credits

Pre-requisite: 3rd Level Courses

      Concepts of Engineering and Project Management. Development of main documents: CV – Business Plan – RFP – Proposals – Evaluation of Proposals – Feasibility Studies. Project Managements Tools and definitions – Methodologies - Pert – Gantt Charts – Allocation/Flattening of resources – Tasks – Monitoring – Control. Organization – Roles – delegation – Business intelligence and analytics. Business Development – SWOT – Master Plan. Selected topics – Problem solving – game theory - travelling salesman – decision making – negotiations – risk analysis.

Course is based on participation of students. A case study is encouraged to be considered for course, preferably related to Aero industry. Various software tools are used.

AE555INS	Introduction to Navigation Systems	2 Credits

Pre-requisite: 3rd Level Courses

      Aircraft avionics, Communications, Monitoring, Aircraft flight-control systems, Collision-avoidance systems, Black Boxes, Mission or tactical avionics, ESM/DAS, Sonar, Air navigation fundamentals, Radio navigational aids; direction finding(ADF), Non directional Beacon(NDB), Very High Omnidirectional Range(VOR), Distance Measuring Equipment (DME),

Instrument Landing System (ILS), Global positioning system (GPS), Inertial navigation systems (INS), Airborne surveillance systems: ACAS and TAWS, Flight Management System(FMS).

AE555IGS	Introduction to Guidance Systems	2 Credits

Pre-requisite: 3rd **Level Courses-AE450**

Fundamentals Of Guidance Systems, Categories Of Guidance Systems, Remote Control Guidance, Command to Line-Of-Sight (CLOS, Command off Line-Of-Sight (COLOS), Line- Of-Sight Beam Riding Guidance (LOSBR), Homing Guidance: Active homing. Semi-active Homing. Passive homing. Homing Guidance Laws: Pursuit. Constant bearing course. Proportional navigation. Modeling of guidance laws using MATLAB and SIMULINK.

AE555LA	Aircraft Loading	2 Credits

Pre-requisite: 3rd **Level Courses-AE411**

Aircraft structural loads, Airworthiness requirements, loads – sources, frequency, magnitude, load factors – proof & ultimate, Structure life – safe-life, fail-safe, damage tolerant, maneuver flight cases, normal load factor, N-V diagram, inertia loading, wing loading cases, Shear force & bending moment diagrams, wing span-wise aerodynamic loads, symmetric, asymmetric maneuver flight cases, fuselage loading case, shear force & bending moment diagrams, symmetric, asymmetric maneuver flight cases, engine loading case, landing gear loading case.

AE555SMS	System Modeling and Simulation	2 Credits

Pre-requisite: 3rd **Level Courses-AE450**

Static and dynamic systems, linear and nonlinear systems, time invariant and time varying systems, continues systems, discrete systems, hybrid systems and digital logic systems, linearization methods, classification and properties of linear systems, the commonality behavior of systems, simulation and analysis of linear models, dynamical behavior and their correlations with physical parameters, frequency response and state space modelling approach, simulation of dynamic systems, systems concepts and representations, simulation block diagram, simulation run time control and

simulation case study. This course is supported by PC laboratory, using MATLAB/Simulink toolbox.

AE555AP	Autopilot	2 Credits

Pre-requisite: 3rd **Level Courses-AE411-AE450**

Longitudinal flight transfer functions, lateral flight transfer functions, flight modes, longitudinal flying and handling qualities, lateral directional flying and handling qualities, the displacement autopilot, stability augmentation, instrument landing, actuator dynamics, sensor dynamic, longitudinal flight control, gain scheduling technique, lateral control, automatic landing system, a terrain-following technique control system, aircraft role, pilot opinion rating control anticipation parameters.

AE555HA	Helicopter Aerodynamic	2 Credits

Pre-requisite: 3rd **Level Courses**

Basic aerodynamic review, helicopter in civil operations and its capability, helicopter components and their functions, difference between helicopter and conventional aircraft, helicopter rotors and rotor system dynamics, hovering flight, momentum theory for hovering flight: blade element theory for hovering flight, axial flight, forward flight: momentum theory for forward flight, blade element theory for forward flight, power required, introduction to stability.

AE555MCP	Microcontroller Programming	2 Credits

Pre-requisite: 3rd **Level Courses-AE380-AE450**

About Arduino and the microcontroller, Fittings, Start with Arduino, Use of sensors, communicating with the computer, the use of engines, Advance input and output devices, Arduino covers, The history of the evolution of Arduino, Applied Projects.

AE555WEE	Wind Energy Assessement	2 Credits

Pre-requisite: 3rd **Level Courses**

Introduction, wind energy generation, historical background, wind turbines, types of winf turbines, main components of wind turbines, wind assessment, solution of sites. Power of characteristics of wind collection of wind data, wind data analysis, wind speed variation with height, power and logarithmic function, Weibull distribution, mean wind speed, wind power density operational characteristics,, power performance availability annual energy output calculation project assessment, economic assessment. Planning authorization, environmental and social issues project engineering.

AE555LPM	3D Linear Panel Method	2 Credits

Pre-requisite: 3rd **Level Courses**

Flow Model: Choice of the flow model, Derivation of the governing equations of motion, Solution trends (general approach). Numerical Implementation: Surface discretization, Singularity distribution, Boundary conditions, Matrix calculation and solution procedure. Application to simplified geometry 3D wing (mini project).

AE555DC	Digital Control	2 Credits

Pre-requisite: 3rd **Level Courses-AE450**

The z-transform. The inverse z-transform. The relation between z and s transforms. Mapping the s-plane into the z-plane. Bilinear transformations. Discrete control system. A data hold element. Sampled data control systems. Stability of digital systems. Closed-Loop feedback Sampled-Data Systems. Discrete control use of digital computers in AFCS. Digital-to-analog conversion. Analog-to-digital conversion. Digital controller design. Aircraft landing system. Servomotor system.

AE555GTC	Gas Turbine Engine Combustors	2 Credits

Pre-requisite: 3rd **Level Courses**

Introduction: The combustion process, Typical combustor arrangements, Main components of acombustion chamber, Fuel preparation, Ignition, Combustor reliability, Air pollutionproblems, Combustion chamber performance requirements. Design objectives and constraints: Physical model establishment; Combustion chamber dimensions; The required airflowrate by each zone; Airflow rate distribution; Performance parameters, Gas exit temperature profile. Combustor design process basic considerations: Overall dimensions: volume and length; Liner airflow rate; Chamber sizing and reference parameters. Annular Type Combustor Design Procedure: Calculation

of Liner airflow rate; Determination of overall dimensions: Combustion chamber volume, Combustion chamber casing diameter; Calculation of reference parameters: flow reference velocity, dynamic head and Mach number, Chamber overall pressure loss; Combustor Main zones dimensioning, Estimation of the combustion efficiency.

AE555SM	Space Mechanics	2 Credits

Pre-requisite: 3rd **Level Courses**

Space Environment. Introduction to the laws of Kepler and Newton; universal gravitation and integrals of motion. Fundamental concepts associated with the twobody problem and conics; orbital elements. Orbital maneuvers: (a) orbit establishment; (b) single impulse adjustments; (c) multiple impulse transfers including Hohmann transfers, local gravity fields and flybys, Hoelker and Silber transfers, Lambert time-offlight theorem, three-dimensional transfers; (d) mission design issues. Orbital perturbations including Euler-Hill equations for two-close orbiters and some navigational issues. Ballistic Missile Trajectories.