B.Sc. in Aeronautical Engineering

Study Plan

- **University Compulsory Courses** — **16 C.H**
  Page (64)

- **University Elective Courses** — **9 C.H**
  Pages (64 & 65)

- **Faculty Compulsory Courses** — **32 C.H**

Line No.	Code	Course	
224000	CHE400CH	PROFESSIONAL ETHICS FOR ENGINEERS	1
242020	EE202EE	COMMUNICATION SKILLS FOR ENGINEERS	2
901010	MATH101	CALCULUS(I)	3
901020	MATH102	CALCULUS (2)	3
902010	MATH201	INTERMEDIATE ANALYSIS	3
902030	MATH203	ORDINARY DIFFERENTIAL EQUATIONS	3
911010	CHEM101	GENERAL CHEMISTRY(I)	3
911020	CHEM102	GENERAL CHEMISTRY (2)	3
911072	CHEM107B	GENERAL CHEMISTRY LAB	1
921010	PHY101	GENERAL PHYSICS (1)	3
921020	PHY102	GENERAL PHYSICS (2)	3
921072	PHY107B	GENERAL PHYSICS (LAB)	1
1731150	CS115	C++ PROGRAMMING LANGUAGES	3

- **Department Compulsory Courses** — **93 C.H**

Line No.	Code	Course	
223400	CHE340	THERMODYNAMICS	3
232011	CE201A	STATICS	3
243032	EE303B	PRINCIBLES OF ELECTRICAL ENGINEERING (NON EE-STUDENTS)	3
243051	EE305	NUMERICAL METHODS FOR ENGINEERS	3
251010	ME101	ENGINEERING WORKSHOPS	2
251011	ME101A	ENGINEERING WORKSHOP (LAB)	0
252122	ME212B	DYNAMICS	3
252143	ME214C	STRENGTH OF MATERIALS	3
253053	ME305C	APPLIED MATH FOR ENGINEERS	3
253110	ME311	MECHANICS OF MACHINES	3
253123	ME312C	MECHANICS OF MATERIALS	1
253433	ME343C	FLUID MECHANICS	3
254453	ME445C	THERMALOFLUIDS LAB	1
254633	ME463C	MECHANICAL VIBRATIONS	3
254711	ME471A	INTRUMENTAION	3
254723	ME472C	INTURUMENTATION AND DYNAMIC SYSTEMS	1
293410	IE341	ENGINEERING ECONOMY	2
712030	AE203	COMPUTER AIDED DRAWING (CAD)	2
713300	AE330	MACHINE ELEMENTS DESIGN	3
713310	AE331	AIRCRAFT STRUCTURAL MATERIALS	3
713420	AE342	GAS DYNAMICS	3
713440	AE344	AERODYNAMICS (1)	3
714220	AE422	PROPULSION	3
714330	AE433	AIRCRAFT STRUCTURE (1)	3
714480	AE448	AERONAUTICS LAB (1)	1
714510	AE451	HEAT TRANSFER	3
714650	AE465	AUTOMATIC CONTROL	3
714660	AE466	AIRCRAFT STABILITY &CONTROL	3
714820	AE482	AIRCRAFT PERFORMANCE	3
714840	AE484	AIRCRAFT MAINTENANCE SYSTEMS	3
714900	AE490	GRADUATION PROJECT (1)	1
715350	AE535	AIRCRAFT DESIGN	3
715450	AE545	COMPUTATIONAL FLUID DYNAMICS	3
715490	AE549	AERONAUTICS LAB (2)	1
715910	AE591	GRADUATION PROJECT (2)	3
715920	AE592	ENGINEERING TRAINING	6

- **Specialization Elective Courses** — **9 C.H**

Line No.	Code	Course	
714680	AE468	ROTARY WING AIRCRAFTS	3
714740	AE474	AIRCRAFT SENSORS AND ACTUATORS	3
715060	AE506	MICRO ELECTRO MECHANICAL SYSTEMS (MEMS)	3
715070	AE507	FINITE ELEMENTS METHODS IN AEROSPACE STRUCTURES	3
715340	AE534	AIRCRAFT STRUCTURES (2)	3
715360	AE536	AEROELASTICITY	3
715370	AE537	COMPOSITE MATERIALS	3
715390	AE539	FRACTURE MECHANICS	3
715460	AE546	AERODYNAMICS (2)	3
715470	AE547	BOUNDARY LAYER THEORY	3
715760	AE576	AIRCRAFT NAVIGATION	3
715930	AE593	SPECIAL TOPICS IN AERONAUTICS (A)	3
715931	AE593	SPECIAL TOPICS IN AERONAUTICS (B)	2
715932	AE593	SPECIAL TOPICS IN AERONAUTICS (C)	1

TOTAL — **159 C.H**

**** For prerequisite & equivalent courses see the Courses' Description.***

B.Sc. in Aeronautical Engineering

Courses' Description

AE 203 Computer Aided Drawing 2C.H
Study of parametric solid modeling as a design/drawing tool using software such as ProEngineer. Topics include creation of three-dimensional solid models, assemblies, and renderings, as well as generation of two-dimensional technical drawings from three-dimensional models**.** *Pre: CIS 100*

AE 330 Machine Elements Design 3.CH
The analysis of design of machine elements including fatigue-failure analysis of shafts, springs, screws, brakes, clutches, chains, belts, welds & rivets, lubrication of journals, ball & roller bearings, and spur, helical, bevel and worm gears. *Pre: ME 214*

AE 331 Aircraft Structural Materials 3.CH
Imperfections in solids; Requirements from aerospace structural materials; Design philosophy (safe-life and damage-tolerant design); Aerospace applications of fracture mechanics; Airframe fatigue; Creep; Oxidation; Composite materials; Computer applications.
Pre: ME 101, ME 214

AE 342 Gas Dynamics 3.CH
One-dimensional gas dynamics; normal and oblique shock waves; Prandtl-Meyer flows; Rayleigh and Fanno-line flow; method of characteristics. *Pre: ME 343*

AE 344 Aerodynamics I 3.CH
Basics of aerodynamics: the concept of lift and drag, stream function and potential velocity function. Incompressible-inviscid flow theory: flow about bodies, superposition of flows, source panel method, kutts-Joukwski theorem. Aerodynamic characteristics of airfoils: airfoil geometry parameters, vortex panel method, kutta condition, thin-airfoil theory, high-lift airfoil section. Wings of finite span: lifting-line theory, trailing vortices and downwash, vortex-induced drag, vortex-lattice method. Effects of boundary layer interaction. *Pre: ME 343*

AE 422 Propulsion 3.CH
An integrated approach to the application of engineering principles to propulsion systems. Topics include: piston props, turboprops, turbojets, turbofans, turbo shaft, ramjets, scramjets and rocket engines, beside intakes, compressors, fans, combustors, turbines and propelling nozzles. *Pre: AE 344*

AE 433 Aircraft Structure I 3.CH
Basics of elasticity. Bending, buckling, and Vibration of Euler-Bernoulli beam. Aerodynamic loads. Functions of structural components. Fabrication of structural components. Principles of stressed skin construction; bending, shear, and torsion of open and closed thin-walled, single and multi-cell, cross-section beams, including shear center and structural idealization.
Pre: ME 214

AE 448 Aeronautics Lab. I 1C.H
Basic measurements of aerodynamic forces and pressure distribution using low speed wind tunnel. Supersonic flow, flight demonstration, tunnel experiments. Aerospace propulsion (gasturbines), ramjets, etc.). Basic aircraft sensors. *Pre: AE 344*

AE 451 Heat Transfer 3.CH
Principles of Heat Transfer. Steady state and transient conduction in different coordinates. Extended surfaces. Convective heat transfer. Analysis and empirical relations for forced and natural convection. Radiation heat transfer, radiation exchange between black and gray surfaces. Heat Exchangers. Thermal Stresses.
Pre: ME 305, ME 343

AE 465 Automatic Control 3C.H
Study of continuous-time systems, classical and modern system design methods, transfer function models, state space, dynamics of linear systems, and frequency domain analysis and design techniques. Introduction of controllability and observability, and full-state pole placement controller design. *Pre/Co. : ME 463*

AE 466 Aircraft Stability and Control 3C.H
Introduction to stability and control of flight vehicles. Flight dynamic equations of unsteady motion. Inertial and aerodynamic coupling. Stability and control of longitudinal and lateral-directional motions. Dynamic stability and control. *Pre: AE 344, AE 465*

AE 468 Rotary Wing Aircrafts 3C.H
Fundamentals of aerodynamics and fluid flow concepts for developing rotary wing aircraft performance. Two-dimensional aerodynamic characteristics of airfoils and their application in helicopter design. Means for augmenting lift and the effects of various types of high lift devices on the aerodynamic characteristics. Aerodynamics of finite aspect ratio wings leading to the fundamentals of airplane performance calculation. Theory of helicopter hovering and vertical flight including autorotation and the aerodynamic behavior of the rotor and helicopter in forward flight. Introduction to airplane and helicopter stability.*Pre: AE 344*

AE 474 Aircraft Sensors & Actuators 3C.H
Study of control systems components and mathematical models. Amplifiers, DC servomotors, reaction mass actuators. Accelerometers, potentiometers, shaft encoders and resolvers, proximity sensors, force transducers, piezoceramic materials, gyroscopes, air-data systems, heading sensors, GPS receivers.
Pre: ME 471

AE 482 Aircraft Performance 3C.H
Aircraft performance in steady flight; Straight and level flight; Flight limitations; Drag; Power; Performance curves in terms of thrust and power; Gliding flight; Climbing flight; Range and endurance; Other methods of solution to performance problems; Aircraft performance in accelerated flight; Climbing flight; Take off; Landing; Turning flight; Introduction to helicopters; Helicopter performance; Thrust and torque theory; Rotor flow effects; Power required; Vertical climb.*Pre: AE 344*

AE 490 Graduation Project I 1 C.H
Provides students the opportunity to individually explore an aeronautical engineering problem or issue within their field of study and apply their education to solving the problem for the benefit of the local community and society as a whole. Students produce a short report that documents the application of previous learning, experience and knowledge to the problem at hand, and evaluates the results. *Pre: Completion of 114 credit hours*

AE 506 MicroElectroMechanical Systems MEMS 3CH
Fabrication and design fundamentals for Microelectromechanical Systems (MEMS): on-chip sensor and actuator systems having micron-scale dimensions. Basic principles covered include microstructure fabrication, mechanics of silicon and thin-film materials, electrostatic force, capacitive motion detection, fluidic damping, piezoelectricity, piezoresistivity, and thermal micromechanics. Applications covered include pressure

sensors, micromirror displays, accelerometers, and gas microsensors and microfluidic systems.
Pre: AE 331, AE 451

AE 507 Finite Elements Methods in Aerospace Structures 3C.H
Introduction to the advanced matrix methods in treating aerospace structures. Static analysis of wing, fuselage, and rocket structures. Stability and large displacement of ribs, stringers, and skins. Vibration of wing-fuselage combinations. Structural damping. Vibration of stretched or compressed wing panels. *Pre: ME 214, EE 305*

AE 534 Aircraft Structures II 3C.H
Energy principles, matrix analysis of structures, introduction to finite element methods. Application to aircraft structural elements. Introduction to composite material in aircrafts and introduction to classical laminated plate theory. Elementary aerolasticity.
Pre: AE 433

AE 535 Aircraft Design 3C.H
Preliminary design of a modern airplane to satisfy a given set of requirements. Estimation of size, selection of configuration, weight and balance, and performance of airplane. Satisfaction of stability, control, and handling quality requirements. *Pre: AE 466*

AE 536 Aeroelasticity 3C.H
Wing divergence control reversal. Lift effectiveness. Swept wing aero elasticity. Vibrations of structure unsteady aerodynamic forces and moment. Flutter of a single degree of freedom system. Methods of flutter analysis.*Pre: AE 433, AE 344*

AE 537 Composite Materials 3C.H
Introduction. Application of composite materials in aerospace industry.
Fiber reinforced composites. Stress, strain, and strength of composite laminate. Failure criterion. Environmental effect. Design of composite structure.
Pre: AE 331, AE 433

AE 539 Fracture Mechanics 3C.H
Investigation of linear elastic and elastic-plastic fracture mechanics. Topics include microstructural effects on fracture in metals, ceramics, polymers, thin films, biological materials and composites, toughening mechanisms, crack growth resistance and creep fracture. Also covered: interface fracture mechanics, fatigue damage and dislocation substructures in single crystals, stress- and strain-life approach to fatigue, fatigue crack growth models and mechanisms, variable amplitude fatigue, corrosion fatigue and case studies of fracture and fatigue in structural, bioimplant, and microelectronic components.*Pre: AE 433*

AE 545 Computational Fluid Dynamics 3 C.H
Introduction to computational fluid dynamics and heat transfer using the finite-volume method. Extensive code development. Application of a commercial CFD solver to a problem of interest.*Pre: ME 343, AE 451*

AE 546 Aerodynamics II 3 C.H
Dynamics of a compressible flow field, Prandtl-Meyer flow, Mach lines and characteristics, Linearized compressible subosonic flow: flow about a thin wing, swept wings at transonic speed Two-dimensional, supersonic flows over wings and airplane configuration: conical-flow method, singularity-distribution method . High-lift configurations: multielement airfoils, Drag reduction methods: laminar-flow control. Aerodynamics design tools. *Pre: AE 344*

AE 547 Boundary Layer Theory
Derivation of the boundary layer equations. Exact, approximate, and numerical solution techniques. Boundary layers in compressible flow. Separation. Unsteady boundary layers. Stability and transition. Turbulent boundary layers. Integral, differential, & numerical methods for solving problems associated with transfer of heat in a viscous fluid. *Pre: ME 343, AE 451*

AE 549 Aeronautics Lab. II 1C.H
Short period oscillation; The phugoid oscillation; Trim curves and neutral point determination; Bending of Aircraft Wing (Symmetric Wing; The Role of the Shear Center); Torsion of Airfoils (Two-cell Section; Effect of the Spar); Thin-walled Shear Beams (Three Stringer Beams; The Role of the Shear Center); Structural Dynamics (Vibration of Beam; Various Vibration Modes of a Cantilevered Plate); Whole-field Stress Analysis (Photoelasticity of Grooved Specimen; Effect of Notch Geometry).*Pre: AE 448*

AE 576 Aircraft Navigation 3C.H
Fundamentals of aircraft navigation systems. Techniques in celestial and inertial navigation. Global Positioning System (GPS) principles. Least squares estimation and Kalman filtering for optimal estimation of stochastic systems.*Pre: AE 466*

AE 583 Aircraft Maintenance Systems 3C.H
Introduction; Reliability theory; Life testing; Maintained systems; Integrated logistic support (ILS); Aircraft handling; Repair station requirements; Quality systems; Inventory control; Structural repair; Engine maintenance and overhaul; Maintenance of aircraft systems and instruments.*Pre: ME 305, AE 433*

AE 591 Graduation Project II 3C.H
Students perform the experimental and/or practical phases associated with solving the aeronautical engineering problem addressed in Graduation Capstone Project I. Students produce a full technical report that documents the research, design, results, analysis, and recommendations of the study, followed by a final presentation and defense.*Pre: AE 490*

AE 592 Engineering Training 6 C.H
One academic semester (16 weeks) of practical training in an institution (university, company, …etc) that is accredited by the aeronautical engineering department and faculty of engineering at JUST for training purposes in the field of aeronautical engineering. The training should be under the supervision of a staff member. Students have to submit a report about his achievements during training in addition to any other requirements assigned by the department. By the end of the training period, the student should be capable to apply for the Airframe and Power (A&P) certificate.
Pre: AE 591

AE 593A Special Topics in Aeronautics 3C.H
Pre: Department approval

AE 593B Special Topics in Aeronautics 2C.H
Pre: Department approval

AE 593C Special Topics in Aeronautics 1C.H
Pre: Department approval