Assistant Professor

Aerospace Engineering

(Syllabus)

FM: 100, PM: 40

Section A

1. Fundamentals of Aerospace Engineering

1.1) History of aeronautics
1.2) The standard atmosphere
1.3) Airfoils, wings and aerodynamic shapes
1.4) Analytical design methods in aeronautics
1.5) Basic experimental and numerical techniques in aeronautics
1.6) Familiarity with past and present aircrafts and spacecrafts

2. Aerodynamics

2.1) Fundamental principles and equations
2.2) Inviscid, Incompressible flows
2.3) Incompressible flow over airfoils and wings
2.4) Compressible aerodynamics
2.5) Viscous flows and boundary layer
2.6) Hypersonic aerothermodynamics
2.7) Chemically reacting flows

3. Small satellite development and operation

3.1) CubeSats and small satellites
3.2) Mission system
3.3) Communication system
3.4) Sensor and actuator system
3.5) Command & data handling system.
3.6) Power system
3.7) Ground testing and field experiment.
3.8) Satellite assembly, integration, and testing
3.9) Opensource satellite datasets

4. Instrumentation, Fault monitoring and diagnosis

4.1) Sensors and transducers
4.2) Calibration of sensors and instruments
4.3) Noise measurement and filtering
4.4) Digital signal processing
4.5) Strain gauge and load cells

4.6) Data Acquisition systems and its operation
4.7) Microcontrollers
4.8) Aircraft fault detection & diagnosis
4.9) Condition monitoring principles
4.10) Vibration and noise based NDT
4.11) Eddy current testing
4.12) Ultrasonic testing
4.13) Visual inspection techniques
4.14) Failure trend analysis

5. Aircraft Materials and Manufacturing

5.1) Aerospace materials: state-of-the-art
5.2) Materials and material requirement for aerospace structures and engine
5.3) Aluminum, titanium, Iron, and their alloys
5.4) Testing of aerospace materials
5.5) Machining and processing of aerospace materials
5.6) Super alloys for aircraft engine
5.7) Fiber-polymer composite materials for aerospace structures and engine
5.8) Wood, glass fiber, carbon fiber in small aircraft construction
5.9) Material selection for piloted and unmanned aircraft

6. Aircraft Systems and Avionics

6.1) Avionics technology
6.2) Sensors in aircraft
6.3) Display and man-machine-interaction
6.4) Aircraft communication system
6.5) Navigation system and radio wave propagation
6.6) Flight control system
6.7) Instrument landing system
6.8) Engine and utility system
6.9) Aerodrome and air traffic control
6.10) Aeronautical Information Publication: GEN, ENR, and AD

7. Aerospace Propulsion

7.1) Introduction to turbomachine and jet engine
7.2) Types of aircraft engine and their operational characteristics
7.3) Compressor and turbined
7.4) Combustion Chamber and afterburner
7.5) Intake, diffuser, and nozzle
7.6) Losses in turbomachine
7.7) Advanced Propulsion System
7.8) Combustion theory

8. Flight Dynamics and Control

8.1) Flight performance
8.2) Static and dynamic stability
8.3) Kinematics and dynamics of aircraft motion
8.4) Flight testing and evaluation in simulator
8.5) Automatic control theory: Classical and modern approach

9. Unmanned Aerial Systems

9.1) Unmanned Aerial Systems state-of-the-art
9.2) Fixed wing and rotorcraft
9.3) UAS design methodology
9.4) UAS design and simulation tools
9.5) Dynamics of fixed wing UAS and rotorcraft
9.6) UAS controller and its operation
9.7) UAS propulsion system selection
9.8) UAS manufacturing techniques
9.9) UAS testing and evaluation
9.10) UAS navigation equipment and its operation
9.11) Autonomy level of unmanned systems
9.12) UAS operation and regulation

10. Aircraft Maintenance Engineering, Human Factors and Aviation Practices

10.1) Nepali aviation industry and regulator
10.2) Aircraft maintenance programme
10.3) Aviation industry certification requirements
10.4) Documentation for maintenance
10.5) Requirement for maintenance program
10.6) Line and base maintenance
10.7) NCAR part 145 and 66
10.8) Human reliability, error, and human factors in aviation
10.9) Methods for performing human reliability and error analysis
10.10) Types of human error and human error analysis
10.11) Human factor in aviation maintenance

11. Aircraft Design

11.1) Overview of aircraft design process
11.2) Conceptual sketch
11.3) Weight estimation and Preliminary design calculation
11.4) Thrust-to-weight ratio and wing loading
11.5) Initial sizing and selection tradeoffs
11.6) Configuration, layout, and lofting
11.7) Propulsion system integration
11.8) Landing gear and subsystem

11.9) Stability Analysis
11.10) Flying and handling quality assessment
11.11) Flight performance evaluation

12. Aerospace Structures

12.1) Types of aircraft structure and structural layout of aircraft
12.2) Loads acting on an aircraft
12.3) Allowable stress, margin of safety, failsafe, safe life concept in structural design
12.4) Gust, load factor and gust envelope
12.5) Wing structural components
12.6) Fuselage structural components
12.7) Landing gear structural components
12.8) Bending, shear and torsional analysis of thin-walled structure
12.9) Instability in thin-walled structures
12.10) Buckling of column and skin
12.11) Crippling in stiffened structure

Section B:

1. **Teaching Aptitude:**
   1.1 Objective and perspectives
   1.2 Required qualities for teaching in higher education: Individual, social and occupational/professional
   1.3 Teaching methods
   1.4 Student evaluation and assessment
2. **Research Aptitude, publication ethics and Data Interpretation**
   2.1. Meaning of research
   2.2. Objectives, types and methods
   2.3. Research & publication ethics
   2.4. Data sources, access to data, availability of data and presentation
   2.5. Research based article and quality of journal
   2.6. Dissertation/thesis framework
3. **Tribhuvan University:**
   3.1. Higher Education Policy 2076
   3.2. Tribhuvan University Acts, Laws and Bylaws

Written Exam Questions [Full Marks: 100, 3Hrs]

Section-A

Chapters	1	2	3	4	5	6	7	8	9	10	11	12	Total Marks
MCQ (1 marks each)	2	2	2	2	2	2	2	2	2	1	1	-	20
Short [5 marks each]	-	1	-	-	1	1	1	1	-	-	-	1	30
Long [10 marks each]	-	-	-	-	-	-	-	-	1	1	1	-	30

Section-B

Chapters	1	2	3	Total Marks
MCQ (1 marks each)	1	2	2	5
Short [5 marks each]	1	1	1	15