Syllabus for the Post of Assistant Professor

(*Aerospace Engineering)*

S.N.	Paper	Question Format	Full Marks	Number of Questions	Exam Time
1.	**Paper I**	Aptitude + Core Course (Objective)	50 + 50	100	100 minutes
2.	**Paper II**	Core Course, Research, and Teaching-Learning (Subjective)	100	10	3hrs
Total Written Exam Full Marks:			**200**		

Paper I: Aptitude Test (Objective) Marks: 1 × 50 = 50

S.N.	Area of Questions Aptitude Test	Number Questions	Details
1.	Teaching and Communication Aptitude	15	Objectives and Perspectives, Essential Qualities for Higher Education, Teaching Rolls: Individual, Social, and Professional, Teaching Methods, Student Evaluation and Assessment
2.	Research Aptitude, Publication Ethics, and Data Interpretation	15	Definition and Importance of Research, Objectives, Types, and Methods of Research, Research and Publication Ethics, Data Sources, Accessibility, Availability, and Presentation. Research-Based Articles, Journal Quality, Dissertation/Thesis Framework
3.	Information and communication Technology	10	Benefits and Risk, Use of ICT in teaching-Learning and research, Virtual Learning Platforms, Digital Education Resources, Tools and Applications
4.	Higher Education System, Tribhuvan University	10	Higher Education Policy 2076, Tribhuvan University Acts, Laws, and Bylaws

Assistant Professor

(Aerospace Engineering)

(Detail Syllabus)

Paper I: Core Course (Objective) Marks: 1 × 50 = 50

Unit	Area of Questions	Number Questions
1.	Fundamentals of Aerospace Engineering	5
2.	Aerodynamics	5
3.	Small satellite development and operation	2
4.	Instrumentation, Fault monitoring and diagnosis	5
5.	Aircraft Materials and Manufacturing	4
6.	Aircraft Systems and Avionics	5
7.	Aerospace Propulsion	5
8.	Flight Dynamics and Control	5
9.	Unmanned Aerial Systems	4
10.	Aircraft Maintenance Engineering, Human Factors and Aviation Practices	4
11.	Aircraft Design	4
12.	Aerospace Structures	2

Paper II: **Core Course** **Marks: $10 \times 10 = 100$**

Subjective Knowledge, Research, and Teaching-Learning Questions

S.N.	Area of Questions	Number of Questions
1.	Fundamentals of Aerospace Engineering	1
2.	Aerodynamics	
3.	Small satellite development and operation	1
4.	Instrumentation, Fault monitoring and diagnosis	
5.	Aircraft Materials and Manufacturing	
6.	Aircraft Systems and Avionics	1
7.	Aerospace Propulsion	1
8.	Flight Dynamics and Control	1
9.	Unmanned Aerial Systems	1
10.	Aircraft Maintenance Engineering, Human Factors and Aviation Practices	
11.	Aircraft Design	1
12.	Aerospace Structures	1
13.	Research Methodology, Applications; Problem - Solving	1
14.	Teaching Learning and Student Evaluation; Syllabus Structure (Bachelors and Masters, TU)	1

Syllabus

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