# Syllabus for the Position of Chief Technical Officer

**(***Aerospace Engineering***)**

| S.N. | Paper | Question Format | Full Marks | Number of Questions | Exam Time |
|---|---|---|---|---|---|
| 1. | **Paper I** | Aptitude Test + Core Course | 20 +30 | 50 | 50 minutes |
| 2. | **Paper II** | Core Course ( Theory + Practical ) | 80 + 20 | 8 | 3hrs |
| **Total Written Exam Full Marks:** | | | **150** | | |

## Chief Technical Officer

(*Aerospace Engineering*)

**(Detail Syllabus)**

**Paper I: Objective (Core Course + Aptitude Test) Marks: 1 × 50 = 50**

| Unit | Area of Questions | Number Questions |
|---|---|---|
| 1. | Fundamentals of Aerospace Engineering | 2 |
| 2. | Aerodynamics | 4 |
| 3. | Small Satellite Development and Operation | 4 |
| 4. | Instrumentation, Fault Monitoring and Diagnosis | 2 |
| 5. | Aircraft Materials and Manufacturing | 4 |
| 6. | Aircraft Systems and Avionics | 4 |
| 7. | Aerospace Propulsion | 4 |
| 8. | TU Laws 2049, TU Teacher and Officers Service laws ( 2050) (Section 5,6,9, and 10), TU Economic Management and Procurement laws ( 2050) (Section 12, 13 and 14) | 10 |
| 9. | Flight Dynamics and Control | 4 |
| 10. | Unmanned Aerial Systems | 4 |
| 11. | Aircraft Maintenance Engineering | 2 |
| 12. | Aircraft Design | 4 |
| 13. | Aerospace Structures | 2 |

**1. Fundamentals of Aerospace Engineering**

1.1 History of aeronautics

1.2 The standard atmosphere

1.3 Airfoils, wings, and aerodynamic shapes

**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 aerodynamics

**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

**4. Instrumentation, Fault monitoring and diagnosis**

4.1 Sensors and transducers

4.2 Calibration of sensors and instruments

4.3 Digital signal processing

4.4 Strain gauge

4.5 Eddy current testing

4.6 Ultrasonic testing

4.7 Visual inspection techniques

**5. Aircraft Materials and Manufacturing**

5.1 Materials and material requirement for aerospace structures and engine

5.2 Aluminum, titanium, Iron, and their alloys

5.3 Testing of aerospace materials

5.4 Machining and processing of aerospace materials

5.5 Fiber-polymer composite materials for aerospace structures and engine

5.6 Wood, glass fiber, carbon fiber in small aircraft construction

5.7 Material selection for piloted and unmanned aircraft

**6. Aircraft Systems and Avionics**

6.1 Sensors in aircraft

6.2 Display and man-machine-interaction

6.3 Aircraft communication system

6.4 Navigation system and radio wave propagation

6.5 Flight control system

6.6 Instrument landing system

6.7 Engine and utility system

6.8 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

**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

**9. Unmanned Aerial Systems**

9.1 UAS design methodology

9.2 UAS design and simulation tools

9.3 UAS Controller and its operation

9.4 UAS Propulsion system selection

9.5 UAS manufacturing techniques

9.6 Autonomy level of unmanned systems

9.7 UAS operation and regulation

**10. Aircraft Maintenance Engineering**

10.1 Aircraft maintenance programme

10.2 Aviation industry certification requirements

10.3 Documentation for maintenance

10.4 Requirement for maintenance program

10.5 Line and base maintenance

10.6 NCAR part 145 and 66

**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 Propulsion system integration

11.7 Landing gear and subsystem

11.8 Flying and handling quality assessment

11.9 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 Semi-monocoque structure

12.5 Bending, shear and torsional analysis of thin-walled structure

12.6 Buckling of column and skin

**Paper II:** **Core Course** **Marks: 10 × 8 = 80**

## Subjective Knowledge

| S.N. | Area of Questions | No of Questions |
|---|---|---|
| **1.** | Aerodynamics | **1** |
| **2.** | Aircraft Design | **1** |
| **3.** | Flight Dynamics and Control | **1** |
| **4.** | Unmanned Aerial Systems | **1** |
| **5.** | Aircraft Materials and Manufacturing<br>Aircraft Systems and Avionics | **1** |
| **6.** | Aerospace Propulsion | **1** |
| **7.** | Aerospace Structures | **1** |
| **8.** | TU Laws 2049, TU Teacher and Officers Service laws ( 2050) (Section 5,6,9, and 10), TU Economic Management and Procurement laws ( 2050) (Section 12, 13 and 14) | **1** |
| **Practical (20 Marks)** | | |

In subjective Knowledge questions, each 10 marks question may be subdivided into two subdivision a and b.

**द्रष्टव्य** :

१. लिखित परीक्षाको लागि ८० पूर्णाङ्कको एक पत्र हुनेछ ।

२. वस्तुगत बहुवैकल्पिक (Multiple Choice) प्रश्नको विकल्प छनौट गर्दा गलत विकल्प छानेमा ऋणात्मक मूल्याङ्कन (Negative Marking) गरिने छ । अर्थात् यसरी मूल्याङ्कन गर्दा प्रत्येक गलत उत्तरको लागि २० प्रतिशत अङ्ककट्टा गरिनेछ । बहुवैकल्पिक प्रश्नको २० प्रतिशत अङ्क प्राप्ताङ्कबाट घटाइने छ । (उदाहरणका लागि परीक्षार्थीले २० अङ्कको बहुवैकल्पिक प्रश्नमा १५ प्रश्नको सही उत्तर र ५ प्रश्नको गलत उत्तर दिएमा निजको प्राप्ताङ्क (०.२० × ५=१.००) अर्थात् १५–१= १४ अङ्क हुनेछ । तर उत्तर नदिएमा त्यस बापत अङ्क दिइने छैन र अङ्क कट्टा पनि गरिने छैन ।

३. विषयगत प्रश्नको हकमा एउटै प्रश्नका दुई वा दुई भन्दा बढी भाग (Two or more parts of a single question) वा एउटा प्रश्न अन्तर्गत दुई वा बढी टिप्पणीहरू (Short notes) सोध्न सकिने छ ।

४. प्रत्येक पत्रको उत्तीर्णाङ्क पूर्णाङ्कको ४० प्रतिशत हुनेछ ।

५ . भाषा विषयबाहेक अन्य विषयका लागि उत्तरको माध्यम अंग्रेजी वा नेपाली हुनेछ ।