Enrolment No./Seat No_____

# GUJARAT TECHNOLOGICAL UNIVERSITY

**BE- SEMESTER–V (NEW) EXAMINATION – WINTER 2024**

**Subject Code:3150101 Date:28-11-2024**

**Subject Name:Flight Mechanics**

**Time:10:30 AM TO 01:00 PM Total Marks:70**

**Instructions:**

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Simple and non-programmable scientific calculators are allowed.**

| | | | MARKS |
|---|---|---|---|
| **Q.1** | **(a)** | Define: Pressure altitude, Temperature altitude and Density altitude | **03** |
| | **(b)** | Explain Hydrostatic Equation in detail. | **04** |
| | **(c)** | What is the International standard atmosphere? Explain the variation of temperature with altitude in standard model of atmosphere. | **07** |
| **Q.2** | **(a)** | Differentiate between Thrust and Power. | **03** |
| | **(b)** | Discuss factors affecting Range and Endurance of a fixed wing aircraft. | **04** |
| | **(c)** | Define and derive relation between geopotential and geometric altitudes. | **07** |
| | | **OR** | |
| | **(c)** | Consider the differential pressure measured by the aircraft cruising at 30 m/s is 409.05 Pa. Find corresponding altitude of Flight? Temperature at sea level consider 288.16 K. density is 1.225 kg/m$^3$ and constant a=-0.0065, R=287 and g=9.81 | **07** |
| **Q.3** | **(a)** | Define Energy height (specific energy) with equation. | **03** |
| | **(b)** | The maximum lift-to-drag ratio for the Aircraft is 13.6. Calculate the minimum glide angle and the maximum range measured along the ground covered by the Aircraft in a power-off glide that starts at an altitude of 10,000 ft. | **04** |
| | **(c)** | Derive equations of motion for an airplane in steady level flight. | **07** |
| | | **OR** | |
| **Q.3** | **(a)** | Explain methods to improve stability of aircraft. | **03** |
| | **(b)** | Explain Climb flight and gliding flight in neat sketch. | **04** |
| | **(c)** | Consider an airplane having the following characteristics: wing area = 47 m$^2$, aspect ratio = 6.5, Oswald efficiency factor = 0.87, weight = 103,047N, and zero-lift drag coefficient = 0.032. Find the following<br>(a) Calculate the power-required at sea level with velocity of aircraft 100 m/s. At sea level density is 1.225 kg/m$^3$<br>(b) Calculate power-required at 5-km altitude with same velocity with density 0.7364 kg/m$^3$ | **07** |
| **Q.4** | **(a)** | Define Absolute and Service Ceilings | **03** |
| | **(b)** | Explain V-N Diagram with a neat sketch. | **04** |
| | **(c)** | Develop an expression to determine the range and endurance for propeller driven airplanes. | **07** |
| | | **OR** | |
| **Q.4** | **(a)** | Define Positive stability, Negative Stability and Neutral Stability. | **03** |
| | **(b)** | What is Neutral point? Explain in detail. | **04** |

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| | **(c)** | State and explain the criteria for an airplane's longitudinal static stability. Justify role of Horizontal stabilizer. | **07** |
| **Q.5** | **(a)** | What is Static Margin? Explain. | **03** |
| | **(b)** | Differentiate between stick free and stick fixed stability. | **04** |
| | **(c)** | What do you mean by Elevator effectiveness? Explain in detail. | **07** |

**OR**

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| **Q.5** | **(a)** | Shortly explain Stick Force Gradient? | **03** |
| | **(b)** | Explain Aircraft pull-up and pull down maneuver. | **04** |
| | **(c)** | Discuss factors affecting directional stability of a fixed wing aircraft. | **07** |

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