# NEHRU INSTITUTE OF ENGINEERING AND TECHNOLOGY

**T. M. Palayam, Coimbatore-641 105**
**(Approved by AICTE, New Delhi and Affiliated to Anna University, Chennai)**
**Accredited by NAAC, Recognized by UGC with Section 2(f) and 12(B)**
**NBA Accredited Departments: AERO, MECH, CSE**

| AE8501 | FLIGHT DYNAMICS | L T P C |
|---|---|---|
| | | 3 2 0 4 |

## OBJECTIVE:

To study the performance of airplanes under various operating conditions and the static and dynamic response of aircraft for both voluntary and involuntary changes in flight conditions

### UNIT I CRUISING FLIGHT PERFORMANCE 9+6

Forces and moments acting on a flight vehicle - Equation of motion of a rigid flight vehicle - Different types of drag –estimation of parasite drag co-efficient by proper area method- Drag polar of vehicles from low speed to high speeds - Variation of thrust, power with velocity and altitudes for air breathing engines. Performance of airplane in level flight - Power available and power required curves. Maximum speed in level flight - Conditions for minimum drag and power required

### UNIT II MANOEUVERING FLIGHT PERFORMANCE 9+6

Range and endurance - Climbing and gliding flight (Maximum rate of climb and steepest angle of climb, minimum rate of sink and shallowest angle of glide) – Takeoff and landing - Turning performance (Turning rate turn radius). Bank angle and load factor – limitations on turn - V-n diagram and load factor.

### UNIT III STATIC LONGITUDINAL STABILITY 9+6

Degree of freedom of rigid bodies in space - Static and dynamic stability - Purpose of controls in airplanes -Inherently stable and marginal stable airplanes – Static, Longitudinal stability - Stick fixed stability - Basic equilibrium equation - Stability criterion - Effects of fuselage and nacelle - Influence of CG location - Power effects - Stick fixed neutral point - Stick free stability-Hinge moment coefficient - Stick free neutral points-Symmetric maneuvers - Stick force gradients - Stick force per 'g' - Aerodynamic balancing.

### UNIT IV LATERAL AND DIRECTIONAL STABILITY 9+6

Dihedral effect - Lateral control - Coupling between rolling and yawing moments - Adverse yaw effects - Aileron reversal - Static directional stability - Weather cocking effect - Rudder requirements - One engine inoperative condition - Rudder lock.

### UNIT V DYNAMIC STABILITY 9+6

Introduction to dynamic longitudinal stability: - Modes of stability, effect of freeing the stick - Brief description of lateral and directional. dynamic stability - Spiral, divergence, Dutch roll, auto rotation and spin.

**TOTAL : 75 PERIODS**

## OUTCOMES:

- Know about the forces and moments that are acting on an aircraft, the different types of drag, drag polar, ISA, variation of thrust, power, SFC with velocity and altitude.
- Have understanding about performance in level flight, minimum drag and power required, climbing, gliding and turning flight, v-n diagram and load factor.
- Knowledge about degrees of stability, stick fixed and stick free stability, stability criteria, effect of fuselage and CG location, stick forces, aerodynamic balancing.
- Understanding about lateral control, rolling and yawing moments, static directional stability, rudder and aileron control requirements and rudder lock.
- Understanding about dynamic longitudinal stability, stability derivatives, modes and stability criterion, lateral and directional dynamic stability.

**TEXT BOOKS:**

1. Mc Cornick. W., "Aerodynamics, Aeronautics and Flight Mechanics", John Wiley, NY, 1979.
2. Nelson, R.C. "Flight Stability and Automatic Control", McGraw-Hill Book Co., 2004.
3. Perkins, C.D., and Hage, R.E., "Airplane Performance stability and Control", John Wiley & Son:, Inc, NY, 1988.

**REFERENCES :**

1. Babister, A.W., "Aircraft Dynamic Stability and Response", Pergamon Press, Oxford, 1980.
2. Dommasch, D.O., Sherby, S.S., and Connolly, T.F., "Aeroplane Aero dynamics", Third Edition, Issac Pitman, London, 1981.
3. Etkin, B., "Dynamics of Flight Stability and Control", Edn. 2, John Wiley, NY, 1982.
4. Mc Cornick B. W, "Aerodynamics, Aeronautics and Flight Mechanics", John Wiley, NY, 1995.

COURSE INCHARGE IQAC (Dept) HOD

**NEHRU INSTITUTE OF ENGINEERING AND TECHNOLOGY**

Hello | 
**2021 February 16 , Tuesday , 06:19 PM** iCampuz

Home Search Students Batches Subjects Syllabus Time Table

Attendance Exams LMS

**Set Syllabus** **Syllabus Coverage View**

**College** Nehru Institute of Engineering and Techn
**Course** BE Aeronautical Engineering
**Batch** 2018-19
**Class** B
**View** Normal Subjects
**Subject** AE8501-Flight Dynamics
View

**College** Nehru Institute of Engineering and Technology **Course** BE Aeronautical Engineering **Year** 2018 **Class** B **Subject** AE8501 - Flight Dynamics

| Unit | Topic to be covered | No of Hours required | Scheduled Completion Date | Reference Book/weblink/eContent | Topic completed on (Date) | Methodology used | Expected Outcomes |
|---|---|---|---|---|---|---|---|
| 1 | Basics of Aerodynamics | 1 | 2020-06-11 | Mc Cornick. W., "Aerodynamics, Aeronautics and Flight Mechanics", John Wiley, NY, 1979. Perkins, C.D., and Hage, R.E., "Airplane Performance stability and Control", John Wiley & Son:, Inc, NY, 1988. | 2020-06-11 14:00:00 | Online Class | •Calculate the forces and moments that are acting on an aircraft and variation of thrust, power, SFC with velocity and altitude. |
| | Forces and moments acting on a flight vehicle | 1 | 2020-06-13 | | 2020-06-13 14:00:00 | Online Class | |
| | Equation of motion of a rigid flight vehicle | 1 | 2020-06-16 | | 2020-06-16 14:00:00 | Online Class | |
| | Different types of drag, estimation of parasite drag co-efficient by proper area method | 1 | 2020-06-18 | | 2020-06-18 14:00:00 | Online Class | |
| | Drag polar of vehicles from low speed to high speeds | 1 | 2020-06-20 | | 2020-06-20 14:00:00 | Online Class | |
| | Variation of thrust, power with velocity and altitudes for air breathing engines | 1 | 2020-06-23 | | 2020-06-23 14:00:00 | Online Class | |
| | Performance of airplane in level flight, Power available and power required curves | 1 | 2020-06-25 | | 2020-06-25 12:00:00 | Online Class | |
| | Thrust available and Thrust required curves | 1 | 2020-06-27 | | 2020-06-27 12:00:00 | Online Class | |
| | Maximum speed in level flight | 1 | 2020-06-30 | | 2020-06-29 12:00:00 | Online Class | |
| | Conditions for minimum drag and power required | 1 | 2020-07-02 | | 2020-07-01 12:00:00 | Online Class | |
| | Problems - Drag Polar | 1 | 2020-07-04 | | 2020-11-17 12:00:00 | Online Class | |
| | Problems - Maximum speed in level flight | 1 | 2020-07-07 | | 2020-11-16 12:00:00 | Online Class | |
| | Problems - Power Required and Thrust Required | 1 | 2020-07-09 | | 2020-11-06 12:00:00 | Online Class | |
| | Problems - Power available, Power required, Thrust available and Thrust Required | 1 | 2020-07-11 | | 2020-11-04 11:00:00 | Online Class | |

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|---|---|---|---|---|---|---|---|
| | Problems - Conditions for minimum drag and power required | 1 | 2020-07-14 | | 2020-10-30 12:00:00 | Online Class | |
| | **Total** | **15** | | | | | |
| **2** | Range | 1 | 2020-07-16 | Mc Cornick. W., "Aerodynamics, Aeronautics and Flight Mechanics", John Wiley, NY, 1979. Nelson, R.C. "Flight Stability and Automatic Control", McGraw-Hill Book Co., 2004. Mc Cornick. W., "Aerodynamics, Aeronautics and Flight Mechanics", John Wiley, NY, 1979. Perkins, C.D., and Hage, R.E., "Airplane Performance stability and Control", John Wiley & Son:, Inc, NY, 1988. | 2020-07-03 12:00:00 | Online Class | •Calculate the performance of an airplane for non-accelerating flight conditions |
| | Endurance | 1 | 2020-07-18 | | 2020-07-06 12:00:00 | Online Class | |
| | Gliding flight - minimum rate of sink and shallowest angle of glide | 1 | 2020-07-21 | | 2020-07-08 12:00:00 | Online Class | |
| | Climbing flight - Maximum rate of climb | 1 | 2020-07-23 | | 2020-07-13 12:00:00 | Online Class | |
| | Climbing flight - steepest angle of climb | 1 | 2020-07-25 | | 2020-07-15 12:00:00 | Online Class | |
| | Takeoff Performance | 1 | 2020-07-28 | | 2020-07-17 12:00:00 | Online Class | |
| | Landing Performance | 1 | 2020-07-30 | | 2020-07-20 12:00:00 | Online Class | |
| | Turning performance | 1 | 2020-08-01 | | 2020-07-22 12:00:00 | Online Class | |
| | Bank angle and load factor and limitations on turn | 1 | 2020-08-04 | | 2020-07-24 12:00:00 | Online Class | |
| | V-n diagram and load factor | 1 | 2020-08-06 | | 2020-07-27 12:00:00 | Online Class | |
| | Problems - Range and Endurance | 1 | 2020-08-08 | | 2020-10-21 12:00:00 | Online Class | |
| | Problems - Gliding flight | 1 | 2020-08-11 | | 2020-10-16 12:00:00 | Online Class | |
| | Problems - Climbing flight | 1 | 2020-08-13 | | 2020-10-23 12:00:00 | Online Class | |
| | Problems - Takeoff Performance | 1 | 2020-08-15 | | 2020-10-28 12:00:00 | Online Class | |
| | Problems - Landing Performance | 1 | 2020-08-18 | | 2020-10-29 12:00:00 | Online Class | |
| | Problems - Turning performance | 1 | 2020-08-20 | | 2020-07-29 12:00:00 | Online Class | |
| | **Total** | **16** | | | | | |
| **3** | Degree of freedom of rigid bodies in space - Static and dynamic stability - Purpose of controls in airplanes, Inherently stable and marginal stable airplanes | 1 | 2020-08-22 | Mc Cornick. W., "Aerodynamics, Aeronautics and Flight Mechanics", John Wiley, NY, 1979. Nelson, R.C. "Flight Stability and Automatic Control", McGraw-Hill Book Co., 2004. Perkins, C.D., and Hage, R.E., "Airplane Performance stability and Control", John Wiley & Son:, Inc, NY, 1988. | 2020-07-31 12:00:00 | Online Class | •Estimate Longitudinal static stability and trim requirements for an aircraft |
| | Static Longitudinal stability | 1 | 2020-08-25 | | 2020-08-03 12:00:00 | Online Class | |
| | Stick fixed stability | 1 | 2020-08-27 | | 2020-08-05 12:00:00 | Online Class | |

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|---|---|---|---|---|---|---|---|
| | Stick fixed stability | 1 | 2020-08-29 | | 2020-08-12 12:00:00 | Online Class | |
| | Stick Free stability | 1 | 2020-09-01 | | 2020-08-14 12:00:00 | Online Class | |
| | Stick Free stability | 1 | 2020-09-03 | | 2020-08-17 12:00:00 | Online Class | |
| | Power effects | 1 | 2020-09-05 | | 2020-08-19 12:00:00 | Online Class | |
| | Effects of fuselage and nacelle and Influence of CG location | 1 | 2020-09-08 | | 2020-08-21 12:00:00 | Online Class | |
| | Elevator angle per g and Stick force per | 1 | 2020-09-10 | | 2020-08-24 12:00:00 | Online Class | |
| | Aerodynamic balancing | 1 | 2020-09-12 | | 2020-08-26 12:00:00 | Online Class | |
| | Problems - Static Longitudinal stability | 1 | 2020-09-15 | | 2020-08-28 12:00:00 | Online Class | |
| | Problems - Stick Fixed Static Longitudinal stability | 1 | 2020-09-17 | | 2020-10-12 12:00:00 | Online Class | |
| | Problems - Stick FreeStatic Longitudinal stability | 1 | 2020-09-19 | | 2020-10-14 12:00:00 | Online Class | |
| | Problems - Power effects | 1 | 2020-09-22 | | 2020-10-15 12:00:00 | Online Class | |
| | Problems - Elevator angle to trim | 1 | 2020-09-24 | | 2020-10-19 12:00:00 | Online Class | |
| | **Total** | **15** | | | | | |
| 4 | Dihedral effect | 1 | 2020-09-25 | Mc Cornick. W., "Aerodynamics, Aeronautics and Flight Mechanics", John Wiley, NY, 1979. Nelson, R.C. "Flight Stability and Automatic Control", McGraw-Hill Book Co., 2004. Perkins, C.D., and Hage, R.E., "Airplane Performance stability and Control", John Wiley & Son:, Inc, NY, 1988. | 2020-09-02 12:00:00 | Online Class | •Compute lateral and directional stability requirements for an aircraft |
| | Lateral control | 1 | 2020-09-28 | | 2020-09-04 12:00:00 | Online Class | |
| | Coupling between rolling and yawing moments | 1 | 2020-09-30 | | 2020-09-07 12:00:00 | Online Class | |
| | Adverse yaw effect | 1 | 2020-10-02 | | 2020-09-09 12:00:00 | Online Class | |
| | Aileron Reversal & Static directional stability | 1 | 2020-10-05 | | 2020-09-11 12:00:00 | Online Class | |
| | Rudder requirements | 1 | 2020-10-07 | | 2020-09-14 12:00:00 | Online Class | |
| | One engine inoperative condition - Rudder lock. | 1 | 2020-10-09 | | 2020-09-15 12:00:00 | Online Class | |
| | Problems 1 | 1 | 2020-10-12 | | 2020-10-07 12:00:00 | Online Class | |
| | Problems 2 | 1 | 2020-10-14 | | 2020-10-09 12:00:00 | Online Class | |
| | Problems 3 | 1 | 2020-10-16 | | 2020-11-18 12:00:00 | Online Class | |

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|---|---|---|---|---|---|---|---|
| | Problems 4 | 1 | 2020-10-19 | | 2020-11-19 12:00:00 | Online Class | |
| | Problems 5 | 1 | 2020-10-21 | | 2020-11-20 12:00:00 | Online Class | |
| | Problems 6 | 1 | 2020-10-23 | | 2020-11-23 12:00:00 | Online Class | |
| | Problems 7 & 8 | 1 | 2020-10-26 | | 2020-11-30 12:00:00 | Online Class | |
| | Lateral-directional response of general aviation airplane (Navion) CBS | 1 | 2020-10-28 | | 2020-12-02 12:00:00 | Online Class | |
| | **Total** | **15** | | | | | |
| **5** | Introduction to dynamic longitudinal stability | 1 | 2020-10-30 | Mc Cornick. W., "Aerodynamics, Aeronautics and Flight Mechanics", John Wiley, NY, 1979. Nelson, R.C. "Flight Stability and Automatic Control", McGraw-Hill Book Co., 2004. Perkins, C.D., and Hage, R.E., "Airplane Performance stability and Control", John Wiley & Son:, Inc, NY, 1988. | 2020-09-16 12:00:00 | Online Class | • Calculate the dynamic longitudinal stability, lateral and directional dynamic stability |
| | Modes of stability | 1 | 2020-11-02 | | 2020-09-18 12:00:00 | Online Class | |
| | effect of freeing the stick | 1 | 2020-11-04 | | 2020-09-21 12:00:00 | Online Class | |
| | Brief description of lateral stability | 1 | 2020-11-06 | | 2020-09-22 12:00:00 | Online Class | |
| | Brief description of lateral stability | 1 | 2020-11-09 | | 2020-09-23 12:00:00 | Online Class | |
| | dynamic stability | 1 | 2020-11-11 | | 2020-09-25 11:00:00 | Online Class | |
| | Spiral | 1 | 2020-11-13 | | 2020-09-25 12:00:00 | Online Class | |
| | divergence | 1 | 2020-11-16 | | 2020-09-28 12:00:00 | Online Class | |
| | Dutch roll | 1 | 2020-11-18 | | 2020-09-30 12:00:00 | Online Class | |
| | auto rotation | 1 | 2020-11-20 | | 2020-10-05 12:00:00 | Online Class | |
| | spin | 1 | 2020-11-23 | | 2020-12-07 12:00:00 | Online Class | |
| | Tutorial | 1 | 2020-11-25 | | 2020-12-09 12:00:00 | Online Class | |
| | Tutorial | 1 | 2020-11-27 | | 2020-12-11 12:00:00 | Online Class | |
| | Tutorial | 1 | 2020-11-30 | | 2020-12-16 12:00:00 | Online Class | |
| | **Total** | **14** | | | | | |

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NBA Accredited Departments: AERO, MECH, CSE

## DEPARTMENT OF AERONAUTICAL ENGINEERING

Course Name: Flight Dynamics

| SNO | UNIT NO | TOPIC TITLE | CONTENT TYPE | LINK |
|---|---|---|---|---|
| 1 | I | CRUISING FLIGHT PERFORMANCE | PDF | https://drive.google.com/file/d/1XTZkxw1dlVmdORWoG8KFEXeACUcDb9LE/view?usp=sharing |
| 2 | I | MANOEUVERING FLIGHT PERFORMANCE | PDF | https://drive.google.com/file/d/1HcAHMcyLou3kNjjrjWZfXL1pbN-yzFFP/view?usp=sharing |
| 3 | I | STATIC LONGITUDINAL STABILITY | PDF | https://drive.google.com/file/d/11BO0ovW4T0HzwQO-EJa16CZD8Kstwi_l/view?usp=sharing |
| 4 | I | LATERAL AND DIRECTIONAL STABILITY | PDF | https://drive.google.com/file/d/1gF8oaSVSPrUo9RXoIQeQb99a-HaZoZ2G/view?usp=sharing |
| 5 | I | DYNAMIC STABILITY | PDF | https://drive.google.com/file/d/1TG9JdW8GqKGi_2pUPBSZcJ9m8uh-CnrO/view?usp=sharing |
| 6 | I | ESTIMATION OF PARASITE DRAG COEFFICIENT BY PROPER AREA METHOD | Power Point | https://drive.google.com/file/d/1B6ZwQcB4HdTs6DwsR9jcCbjpFBnLp6LV/view?usp=sharing |
| 7 | I | FORCES AND MOMENTS | Power Point | https://drive.google.com/file/d/1Y_GEf4WqJUTjrcHO41P61wWjjqnqkY_d/view?usp=sharing |
| 8 | I | POWER AVAILABLE AND POWERED REQUIRED CURVES | Power Point | https://drive.google.com/file/d/1FJVvKLzPCSOTeyFhoTQmXT0VkWAVunok/view?usp=sharing |
| 9 | I | STEADY LEVEL FLIGHT | Power Point | https://drive.google.com/file/d/1UczyD51KYar7_rk5HrlKflyRwn6tMfBg/view?usp=sharing |
| 10 | I | THRUST REQUIRED | Power Point | https://drive.google.com/file/d/1o0gKs4WO9AaZ2LX_ZipHN68sSss4YrTw/view?usp=sharing |
| 11 | I | TYPES OF DRAG FORCES | Power Point | https://drive.google.com/file/d/1CKD89pcSAKxzJ6yfCS21ZHw9OgV1N4at/view?usp=sharing |
| 12 | I | VARIATION OF PA AND TA WITH RESPECT TO VELOCITY AND ALTITUDE | Power Point | https://drive.google.com/file/d/1jR__xLwM43ol0zQwl4fjclT24aaKGZE-/view?usp=sharing |
| 13 | I | EQUATION OF MOTION FOR A RIGID FLIGHT VEHICLE | Power Point | https://drive.google.com/file/d/1fQjC1Q_11v8AOHc7FbzNyXG33Rj-DiPg/view?usp=sharing |
| 14 | I | FLIGHT DYNAMICS INTRODUCTION | Power Point | https://drive.google.com/file/d/1Xm66l-6q4jCuUViNECmELWfACQxVRvup/view?usp=sharing |
| 15 | II | SPECIAL PERFORMANCE | Power Point | https://drive.google.com/file/d/1MbLGM627UWFabVb-Nnel1GeyegGi5cDP/view?usp=sharing |
| 16 | II | GLIDING PERFORMANCE | Power Point | https://drive.google.com/file/d/1UNuNtxoPRnK2jL8wMFleVQWKoPGzCtJr/view?usp=sharing |
| 17 | II | LANDING PERFORMANCE | Power Point | https://drive.google.com/file/d/1UNuNtxoPRnK2jL8wMFleVQWKoPGzCtJr/view?usp=sharing |

## DEPARTMENT OF AERONAUTICAL ENGINEERING

| | | | | |
|---|---|---|---|---|
| 18 | II | CLIMBING PERFORMANCE | Power Point | https://drive.google.com/file/d/1pWbAVRJx6mqE7n7tYJOR88DHKYsD6XpL/view?usp=sharing |
| 19 | II | CLIMBING PERFORMANCE - MAXIMUM RATE OF CLIMB | Power Point | https://drive.google.com/file/d/1BpWi5832nHC8HPjSdwSKM506I8CqqITN/view?usp=sharing |
| 20 | II | CLIMBING PERFORMANCE - MAXIMUM CLIMB ANGLE | Power Point | https://drive.google.com/file/d/1GSmyMB-DZr1erED8TGfTE5uI9vraml6r/view?usp=sharing |
| 21 | II | TURNING PERFORMANCE | Power Point | https://drive.google.com/file/d/15PvRnRh6UJrwRi1Cf5K3W34UxcealtGW/view?usp=sharing |
| 22 | III | AIRCRAFT STABILITY - INTRODUCTION | Power Point | https://drive.google.com/file/d/1K3kWaLRLtTdKbw4ykNFVXWtQ5gTEfaBx/view?usp=sharing |
| 23 | III | PURPOSE OF CONTROLS | Power Point | https://drive.google.com/file/d/1t36jYFQU_tm9yZdBPwa1lpvi1l7y43pk/view?usp=sharing |
| 24 | III | WING CONTRIBUTION | Power Point | https://drive.google.com/file/d/1wP5vlq7RWdr_SOqte7JYf4Wkoylr2CgO/view?usp=sharing |
| 25 | III | WING AND HORIZONTAL TAIL CONTRIBUTION | Power Point | https://drive.google.com/file/d/195qgnNM717Bb-uRj8Q8c20m6SHx-0Jy9/view?usp=sharing |
| 26 | III | STICK FIXED CONDITION | Power Point | https://drive.google.com/file/d/1s53oX_7ZxCsyHJ9GxtoHtvzaJomxAxUh/view?usp=sharing |
| 27 | III | STICK FREE CONDITION | Power Point | https://drive.google.com/file/d/1o1We02k2IQ-y1zDbzO8pdOpDb97RWSKU/view?usp=sharing |
| 28 | III | EFFECTS OF ELEVATOR AND FUSELAGE | Power Point | https://drive.google.com/file/d/1cIdU1O3iZIqFO7dJq8eMtBw7yNISMZP3/view?usp=sharing |
| 29 | III | ELEVATOR CONTROL POWER AND ELEAVTOR ANGLE TO TRIM | Power Point | https://drive.google.com/file/d/1ZrMx7CigfV1mKKdtb1xQY3GMIQnPhHXm/view?usp=sharing |
| 30 | III | POWER EFFECTS | Power Point | https://drive.google.com/file/d/160b0E7aW0VfjI8eBNRHPm1BU07UReBAq/view?usp=sharing |
| 31 | IV | LATERAL STABILITY | Power Point | https://drive.google.com/file/d/141LopRonAy5f2pSrODUQU3G6HLxs2s6c/view?usp=sharing |
| 32 | V | DYNAMIC LONGITUDINAL STABILITY | Power Point | https://drive.google.com/file/d/1c3ingnMMgUDpAMIfJ0Mb8u60sOvalw8k/view?usp=sharing |
| 33 | I | FLIGHT DYNAMICS INTRODUCTION | Video | https://drive.google.com/file/d/1X-PSwVwUXbptuIRMEeelCuMD2H2bw_OS/view?usp=sharing |
| 34 | I | FORCES AND MOMENTS | Video | https://drive.google.com/file/d/1-9qskow0wdimTM7IL0Xd92fQBxwbrYSY/view?usp=sharing |
| 35 | I | TYPES OF DRAG FORCES | Video | https://drive.google.com/file/d/13Tr9XOHzXRjxVI921hXz0Z5_txITF_OE/view?usp=sharing |
| 36 | I | STEADY LEVEL FLIGHT | Video | https://drive.google.com/file/d/1orvKhICv2EY2r-LgokVuIr04OnDyRUq7/view?usp=sharing |
| 37 | I | VARIATION OF PA AND TA WITH RESPECT TO VELOCITY AND ALTITUDE | Video | https://drive.google.com/file/d/1cysh-xaosW7MPPURvCk25SMEDI7HcQx8/view?usp=sharing |

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|---|---|---|---|---|
| 38 | I | THRUST REQUIRED AND POWER REQUIRED | Video | https://drive.google.com/file/d/123M22z9GzYOX8VqczQFIVfrCr4shOxbp/view?usp=sharing |
| 39 | I | EXAMPLE PROBLEMS - I | Video | https://drive.google.com/file/d/1KUGanw3fKTCHyLVFrBQJXf-Aw1K1K9mK/view?usp=sharing |
| 40 | I | EXAMPLE PROBLEMS - II | Video | https://drive.google.com/file/d/1nxRWtuybzXLMFVige_xfaMq01oiqtdq9/view?usp=sharing |
| 41 | I | EXAMPLE PROBLEMS - III | Video | https://drive.google.com/file/d/1pB7FaVKAv4zOkZEF-5pscuScKGMyQChQ/view?usp=sharing |
| 42 | I | EXAMPLE PROBLEMS - IV | Video | https://drive.google.com/file/d/1Qir0zVDqlc3VFAK4LaB1cZ6nQ0P7Q-IK/view?usp=sharing |
| 43 | II | BREGUET RANGE EQUATION | Video | https://drive.google.com/file/d/1sntVOb_YG-Vj9ayLtykmcWxMasu9_NP5/view?usp=sharing |
| 44 | II | CLIMBING PERFORMANCE | Video | https://drive.google.com/file/d/1ctMKcAnGavxbYY80LMV8zqj03PrMSU0U/view?usp=sharing |
| 45 | II | CLIMBING PERFORMANCE - MAXIMUM RATE OF CLIMB | Video | https://drive.google.com/file/d/1_OVisQzNPnZDInUlqOj-GsHrUbtHm5cs/view?usp=sharing |
| 46 | II | CLIMBING PERFORMANCE - MAXIMUM CLIMB ANGLE | Video | https://drive.google.com/file/d/1fY_4-2BPTOMMoAfFOqzVP-wh0v5WJfcz/view?usp=sharing |
| 47 | II | ENDURANCE | Video | https://drive.google.com/file/d/11SiHAuwfL2ZksMDsX23HrC_4Zl9618g1/view?usp=sharing |
| 48 | II | GLIDING PERFORMANCE | Video | https://drive.google.com/file/d/1WzLZYRez3-7J9JVRBflmv7bENonrxOwu/view?usp=sharing |
| 49 | II | LANDING PERFORMANCE | Video | https://drive.google.com/file/d/1mcmM40WldwrkxnywPTxDBcZcyI8Qz14l/view?usp=sharing |
| 50 | II | RANGE | Video | https://drive.google.com/file/d/1dDF-KI84I3m2eJpjW8Sm0-b2hWWB3cyi/view?usp=sharing |
| 51 | II | TURNING PERFORMANCE LEVEL TURN | Video | https://drive.google.com/file/d/1I_P3_Xs40ZVvM-rqVxR-Xq7hdjMqRGZ3/view?usp=sharing |
| 52 | II | TURNING PERFORMANCE MAXIMUM TURN RATE | Video | https://drive.google.com/file/d/1ULSmCJbG_V9LLsJ4NkcGESqEEHCPRjhl/view?usp=sharing |
| 53 | II | TURNING PERFORMANCE MINIMUM TURN RADIUS | Video | https://drive.google.com/file/d/1GsAy7nGcb3D_Ds6t30CZOHU_sUEhaH0K/view?usp=sharing |
| 54 | III | STATIC LONGITUDINAL STABILITY | Video | https://drive.google.com/file/d/1GvCGX0rsUhJVCCR6KdBaRsaciJhJZizG/view?usp=sharing |
| 55 | III | HORIZONTAL TAIL CONTRIBUTION | Video | https://drive.google.com/file/d/1FJTfuz8J5VFakBdJDXF-n7Yww7u_uns4/view?usp=sharing |
| 56 | III | WING AND HORIZONTAL TAIL CONTRIBUTION | Video | https://drive.google.com/file/d/1cCCtBR4v2aaKrsyFl4xbESOSP09TUmHG/view?usp=sharing |
| 57 | III | FUSELAGE CONTRIBUTION | Video | https://drive.google.com/file/d/1nymoS1wEMQy9wg7Tg5rqOYpdnkBqJIb1/view?usp=sharing |

| | | | | |
|---|---|---|---|---|
| 58 | III | POWER EFFECTS | Video | https://drive.google.com/file/d/12fTzNMhpPWDXHRV3RSP1PKDjZx4lOwZK/view?usp=sharing |
| 59 | III | EFFECTS OF ELEVATOR | Video | https://drive.google.com/file/d/1VV5gzC6_w9CTFE1ehd7h1rqt-Pq1FWGg/view?usp=sharing |
| 60 | III | STICK FREE CONDITION | Video | https://drive.google.com/file/d/1wmCexUTAUpwMTOMz43fHMOeOV2yBEPGQ/view?usp=sharing |
| 61 | III | STICK FORCE PER G | Video | https://drive.google.com/file/d/1Ce2J-GzhPuNICs6byqwz4WwfJ8X8dMkC/view?usp=sharing |
| 62 | III | ELEVATOR ANGLE PER G | Video | https://drive.google.com/file/d/1ZID9gFweArZUgwi1VGRwMaiClwG14hJV/view?usp=sharing |
| 63 | III | EXAMPLE PROBLEMS | Video | https://drive.google.com/file/d/1YzyFJG4qfnmyCKSXJpWd_YOxztwU0LOH/view?usp=sharing |
| 64 | IV | DIHEDRAL EFFECT | Video | https://drive.google.com/file/d/1nISl9iV5oLROWgpBMdOLykf3eeqNHXn2/view?usp=sharing |
| 65 | IV | EFFECT OF WING SWEEP AND RUDDER ON ROLL STABILITY | Video | https://drive.google.com/file/d/1WmDfRqDtjO0DAfUUzCeixMiQ8vCI9mNI/view?usp=sharing |
| 66 | IV | POWER EFFECTS AND ROLL CONTROL | Video | https://drive.google.com/file/d/1eSCemy8wDC2CVvOtM77jmvDUx2AQztTZ/view?usp=sharing |
| 67 | IV | LATERAL DIRECTIONAL STABILITY DERIVATIVES AND FUSELAGE VERTICAL FIN CONTRIBUTION | Video | https://drive.google.com/file/d/1MpgwNFnLitRbrkZpkKkhGxQRh0OKH3vR/view?usp=sharing |
| 68 | IV | EXAMPLE PROBLEMS | Video | https://drive.google.com/file/d/1wdJ4Xsb2Z6WwbulZMBea6dRn9TBu-8F5/view?usp=sharing |
| 69 | V | STEADY ROLL MANEUVER | Video | https://drive.google.com/file/d/1jcBgMv0Cepbd6AP3kBYd-b2nwlAvaeA_/view?usp=sharing |
| 70 | V | ROUTH'S CRITERIA | Video | https://drive.google.com/file/d/1m48BpDY-aLjotSFMsj0pgjj8p965iN4F/view?usp=sharing |
| 71 | V | DYNAMIC MODES IN LATERAL STABILITY | Video | https://drive.google.com/file/d/1n-yGItq0IJYwbbtL8rJmPpA67h36nuAD/view?usp=sharing |
| 72 | V | DYNAMIC MODES IN DIRECTIONAL STABILITY | Video | https://drive.google.com/file/d/1qL-RcYoQ1trE4xgX1b-AmvUcsccEj9jc/view?usp=sharing |
| 73 | V | SHORT PERIOD MOTION | Video | https://drive.google.com/file/d/17fg5y-CcLbMz2UPC3NDaw2FNxOuOftBV/view?usp=sharing |
| 74 | V | PHUGOID MOTION | Video | https://drive.google.com/file/d/15mV2Akwh0ocUvbM5ZUIV_gWJmMUgL_yu/view?usp=sharing |
| 75 | V | LINEAR MODEL | Video | https://drive.google.com/file/d/1yOkcRve6nqVOzw72IF3dKovA_bJKSyca/view?usp=sharing |
| 76 | V | AERODYNAMIC DERIVATIVES | Video | https://drive.google.com/file/d/1ndek5rQCafg3cF9ALYvOjgJX0QIcfnu4/view?usp=sharing |

Course Instructor

HoD

# AE 8501 - Flight Dynamics Pre Analysis Survey

40 responses

Publish analytics

## Your Name

40 responses

Manoj E

Mohamed Rajik M

Naveen Kumar V

Nigamanth Girish Seshadri

Pragadeesh S

Balamurugan P

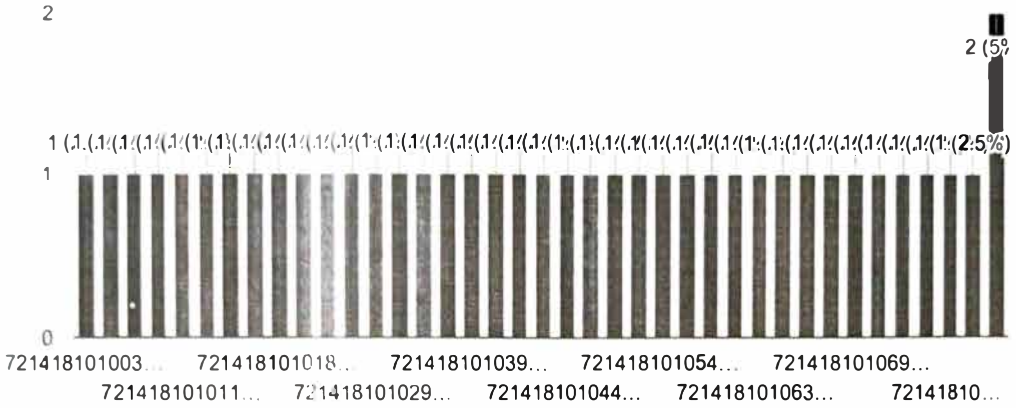
Bhuvaneshwaran D

Dhilip P

Dhuvya. A R

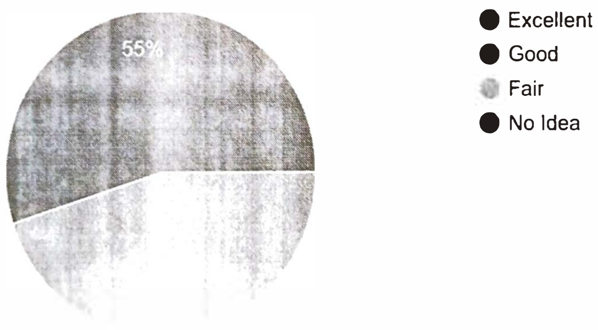
## Register Number

40 responses



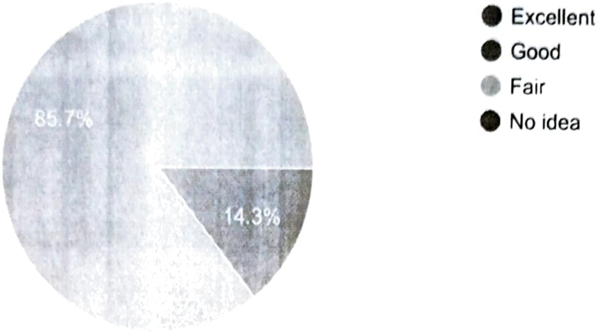
## C5O1.1 Your knowledge on the variation of pressure and density with altitude, SFC and TSFC, Power and thrust with velocity and altitude

40 responses



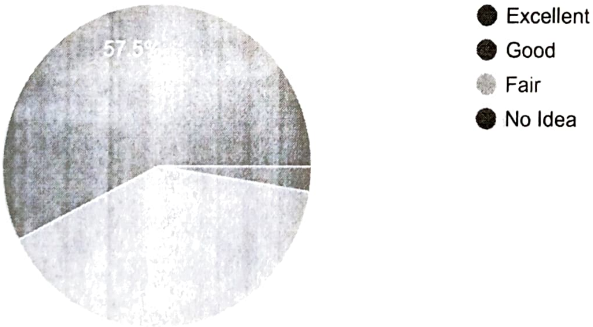
C501.2 Your knowledge about forces acting on a gliding, climbing, cruising and turning flight and factors influencing the range and endurance of an airplane..

7 responses



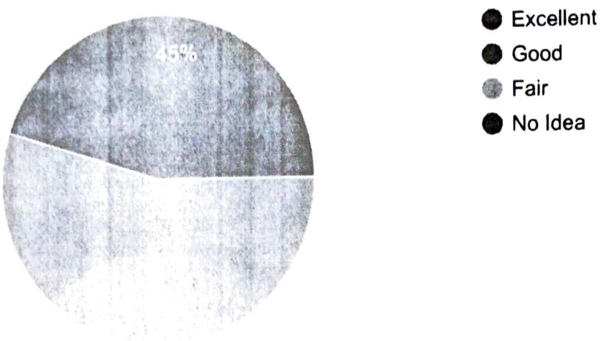
C5O1.3 Your knowledge about the stick fixed and stick free static longitudinal stability and contribution of aircraft components towards static longitudinal stability

40 responses



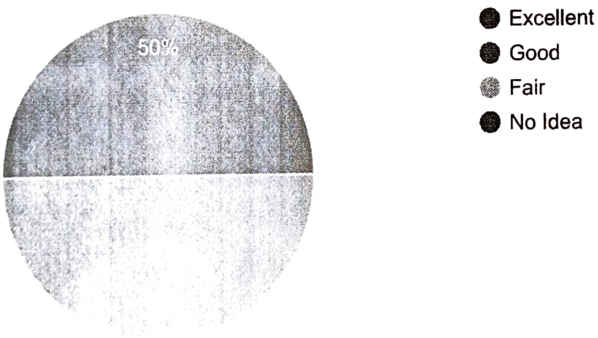
C5O1.4 Your knowledge about the contribution of aircraft components towards static yaw stability and static roll stability

40 responses



C5O1.5 Your knowledge about the dynamic modes in Pitch, yaw and roll stability

40 responses



Course Instructor

IQAC (Department)

HOD

# NEHRU INSTITUTE OF ENGINEERING AND TECHNOLOGY

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Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai
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## DEPARTMENT OF AERONAUTICAL ENGINEERING

| **Knowledge Level** | **K1 : Remembering** | **K2 : Understanding** | **K3 : Applying** | **K4 : Analyzing** | **K5 : Evaluating** | **K6 : Creating** |
|---|---|---|---|---|---|---|

## INTERNAL TEST – I (ONLINE MODE) – JULY 2020
## AE8501 – FLIGHT DYNAMICS (R2017)

| | | | | | |
|---|---|---|---|---|---|
| Course Instructor | : | **Mr. J. Karthikeyan, AP/AERO** | Portion | : | **Unit 1** |
| Class / Sem | : | **III – B / V** | Date / Session | : | **10/07/2020 & FN** |
| Duration | : | **90 Mins** | Max. Marks | : | **50** |

**Question Type – Objective (25×2 = 50 Marks)**

**READ ALL THE QUESTIONS PROPERLY AND ANSWER CORRECTLY (USE OF CALCULATOR IS ALLOWED, IF NEEDED)**

| | | | | |
|---|---|---|---|---|
| 1. | An airplane has ______ degrees of freedom | | C501.1 | K1 |
| | **a)** | **Six** | | |
| | b) | Three | | |
| | c) | One | | |
| 2. | Induced drag can be minimized by providing | | C501.1 | K2 |
| | **a)** | **Fairings** | | |
| | b) | Wing lets | | |
| | c) | Canard | | |
| 3. | The relation between the lift coefficient and the drag coefficient is | | C501.1 | K1 |
| | **a)** | **Drag Polar** | | |
| | b) | Drag bucket | | |
| | c) | Wave Drag | | |
| 4. | The proper area for estimating the parasite drag coefficient, if the pressure drag is dominant | | C501.1 | K2 |
| | a) | Wing surface area | | |
| | **b)** | **Frontal area** | | |
| | c) | Both | | |
| 5. | If the aspect ratio increases, the induced drag | | C501.1 | K2 |

**Vision of the Department:**
Producing competent and exemplary Aeronautical Engineers to meet the needs of global industries

**Mission of the Department:**

- To impart quality education in cutting edge technologies, in state of art laboratories with intellectual and ethical principles.
- To propel the young students to face the challenges of global industries through their sound technical knowledge.
- To build formidable skills in aeronautical engineering and turn the students into entrepreneurs and global leaders.

| | | | | |
|---|---|---|---|---|
| | **a)** | **Decreases** | | |
| | b) | Increases | | |
| | c) | Constant | | |
| 6. | If fairing is provided in the junction between wing and the fuselage, then the total drag can be reduced by reduction in | | C501.1 | K2 |
| | a) | Induced drag | | |
| | **b)** | **Interference drag** | | |
| | c) | Form drag | | |
| 7. | Calculate the aspect ratio of the rectangular wing such that the wing span and the chord are 11m and 1.1 m | | C501.1 | K3 |
| | a) | 10.1 | | |
| | **b)** | **10** | | |
| | c) | 12.1 | | |
| 8. | Find the zero lift drag coefficient of the airplane such that the drag polar is given by Cd=0.018+0.15 Cl^2 | | C501.1 | K3 |
| | **a)** | **0.018** | | |
| | b) | 0.15 | | |
| | c) | 0.0027 | | |
| 9. | The airplane is moving at an altitude in which the pressure is constant over the top and the bottom, at a speed which Mach number = 1, thenthe velocity of the airplane is | | C501.1 | K3 |
| | a) | 396 m/s | | |
| | **b)** | **330 m/s** | | |
| | c) | 440 m/s | | |
| 10. | If the velocity of an airplane is at minimum thrust required, then * | | C501.1 | K2 |
| | **a)** | **Zero lift drag coefficient is equal to drag due to lift** | | |
| | b) | Zero lift drag coefficient is three times the drag due to lift | | |
| | c) | Zero lift drag coefficient is one third of the drag due to lift | | |

| | | | | |
|---|---|---|---|---|
| 11. | The lift coefficient at which the drag is minimum | | C501.1 | K2 |
| | a) | Sqrt (Cdo / 3 K) | | |
| | b) | Sqrt (3 Cdo / K) | | |
| | **c)** | **Sqrt (Cdo / K)** | | |
| 12. | In drag polar curve, the drag coefficient varies as square of | | C501.1 | K2 |
| | a) | $C_{d0}$ | | |
| | b) | K | | |
| | **c)** | **$C_L$** | | |
| 13. | The drag polar is given by Cd=0.018+0.15 Cl^2 and the lift coefficient is 1.2, then the drag coefficient is given by | | C501.1 | K3 |
| | a) | 0. 1716 | | |
| | **b)** | 0.2016 | | |
| | c) | 0.234 | | |
| 14. | If the propeller driven airplane flies at sea level, then the thrust available | | C501.1 | K2 |
| | a) | Higher | | |
| | b) | Lower | | |
| | **c)** | **No change with altitude** | | |
| 15. | The power available with velocity for a turbo prop engine | | C501.1 | K2 |
| | **a)** | **Decreases** | | |
| | b) | Increases | | |
| | c) | Constant | | |
| 16. | For a low by pass turbo fan engine the thrust availablewithincrease of velocity at subsonic speed | | C501.1 | K2 |
| | a) | Decreases | | |
| | b) | Increases | | |
| | **c)** | **Constant** | | |
| 17. | The thrust available of a powerplant at which the speed of aircraft is zero | | C501.1 | K2 |
| | a) | Minimum | | |

| | | | | |
|---|---|---|---|---|
| | b) | Maximum | | |
| | **c)** | **No change** | | |
| 18. | When the velocity of the aircraft is zero the thrust available is called | | C501.1 | K1 |
| | a) | Idle thrust | | |
| | **b)** | **Static thrust** | | |
| | c) | Inert thrust | | |
| 19. | If an aircraft is flying with no acceleration, then the thrust is equal to the | | C501.1 | K1 |
| | **a)** | **Drag** | | |
| | b) | Lift | | |
| | c) | Weight | | |
| 20. | When there is no change in altitude the amount of weight force is balanced by | | C501.1 | K2 |
| | a) | Drag | | |
| | **b)** | **Lift** | | |
| | c) | Thrust | | |
| 21. | The maximum ratio of lift to drag for an airplane, if the drag polar is Cd=0.018+0.15 Cl^2 | | C501.1 | K3 |
| | **a)** | **9.62** | | |
| | b) | 10.18 | | |
| | c) | 8.89 | | |
| 22. | The velocity of minimum drag is_to the speed at minimum power | | C501.1 | K3 |
| | a) | 0.759 | | |
| | b) | (1/3) ^ (1/4) | | |
| | **c)** | **1.317** | | |
| 23. | The lift coefficient for an aircraft when there is a minimum power condition, such the drag polar is given by Cd=0.018+0.15 Cl^2 | | C501.1 | K3 |
| | a) | 0.006 | | |
| | **b)** | **0.6** | | |

| | | | | |
|---|---|---|---|---|
| | c) | 0.06 | | |
| 24. | If the power required is equal to the power available, then the excess power is | | C501.1 | K2 |
| | **a)** | **Zero** | | |
| | b) | Maximum | | |
| | c) | Minimum | | |
| 25. | The ratio of CL3/2/Cd for an airplane if the drag polar is given by Cd=0.018+0.15 Cl^2 | | C501.1 | K3 |
| | **a)** | **6.45** | | |
| | b) | 5.26 | | |
| | c) | 8.29 | | |

COURSE INSTRUCTOR

HOD

# Assessment

Internal Exam

* Required

1. Email address *

**AE8501 - FLIGHT DYNAMICS**

2. Name *

3. Register Number *

4. An airplane has _____ degrees of freedom * 2 points

*Mark only one oval.*

○ Six
○ Three
○ one

5. Induced drag can be minimized by providing * 2 points

*Mark only one oval.*

○ Fairings
○ Wing lets
○ Canard

6. The relation between the lift coefficient and the drag coefficient is * 2 points

*Mark only one oval.*

○ Drag Polar
○ Drag bucket
○ Wave Drag

7. The proper area for estimating the parasite drag coefficient, if the pressure drag is dominant * 2 points

*Mark only one oval.*

○ Wing surface area
○ Frontal area
○ Both

8. If the aspect ratio increases, the induced drag * 2 points

*Mark only one oval.*

○ Decreases
○ Increases
○ Constant

9. If fairing is provided in the junction between wing and the fuselage, then the total drag can be reduced by reduction in * 2 points

*Mark only one oval.*

○ Induced drag
○ Interference drag
○ Form drag

10. Calculate the aspect ratio of the rectangular wing such that the wing span and the chord are 11m and 1.1 m * 2 points

*Mark only one oval.*

○ 10.1
○ 10
○ 12.1

11. Find the zero lift drag coefficient of the airplane such that the drag polar is given by Cd=0.018+0.15 Cl^2 * 2 points

*Mark only one oval.*

○ 0.018
○ 0.15
○ 0.0027

12. The airplane is moving at an altitude in which the pressure is constant over the top and the bottom, at a speed which Mach number = 1, then the velocity of the airplane is * 2 points

*Mark only one oval.*

○ 396 m/s
○ 330 m/s
○ 440 m/s

13. If the velocity of an airplane is at minimum thrust required, then * 2 points

*Mark only one oval.*

○ Zero lift drag coefficient is equal to drag due to lift
○ Zero lift drag coefficient is three times the drag due to lift
○ Zero lift drag coefficient is one third of the drag due to lift

14. The lift coefficient at which the drag is minimum * 2 points

*Mark only one oval.*

○ Sqrt (Cdo / 3 K)
○ Sqrt (3 Cdo / K)
○ Sqrt (Cdo / K)

15. In drag polar curve, the drag coefficient varies as square of * 2 points

*Mark only one oval.*

○ Cdo
○ Cl
○ K

16. The drag polar is given by Cd=0.018+0.15 Cl^2 and the lift coefficient is 1.2, then the drag coefficient is given by * 2 points

*Mark only one oval.*

○ 0.1716
○ 0.2016
○ 0.234

17. If the propeller driven airplane flies at sea level, then the thrust available * 2 points

*Mark only one oval.*

○ Higher
○ Lower
○ No change with altitude

18. The power available ________ with velocity for a turbo prop engine * 2 points

*Mark only one oval.*

○ Decreases
○ Increases
○ Constant

19. For a low by pass turbo fan engine the thrust available _____ with increase of velocity at subsonic speed. * 2 points

*Mark only one oval.*

○ Decreases
○ Increases
○ Constant

20. The thrust available of a powerplant at which the speed of aircraft is zero * 2 points

*Mark only one oval.*

○ Minimum
○ Maximum
○ No change

21. When the velocity of the aircraft is zero the thrust available is called * 2 points

*Mark only one oval.*

○ Idle thrust
○ Static thrust
○ Inert thrust

22. If an aircraft is flying with no acceleration, then the thrust is equal to the * 2 points

*Mark only one oval.*

○ Drag
○ Lift
○ Weight

23. When there is no change in altitude the amount of weight force is balanced by * 2 points

*Mark only one oval.*

○ Drag
○ Lift
○ Thrust

24. The maximum ratio of lift to drag for an airplane, if the drag polar is Cd=0.018+0.15 Cl^2 * 2 points

*Mark only one oval.*

○ 9.62
○ 10.18
○ 8.89

25. The velocity of minimum drag is _____ to the speed at minimum power * 2 points

*Mark only one oval.*

○ 0.759
○ (1/3) ^ (1/4)
○ 1.317

26. The lift coefficient for an aircraft when there is a minimum power condition, such the drag polar is given by Cd=0.018+0.15 Cl^2 * 2 points

*Mark only one oval.*

○ 0.006
○ 0.6
○ 0.06

27. If the power required is equal to the power available, then the excess power is * 2 points

*Mark only one oval.*

○ Zero
○ Maximum
○ Minimum

28. The ratio of CL3/2/Cd for an airplane if the drag polar is given by Cd=0.018+0.15 Cl^2 * 2 points

*Mark only one oval.*

○ 6.45
○ 5.26
○ 8.29

Course Instructor Date. HOD.

# Assessment

37 responses

Publish analytics

## AE8501 - FLIGHT DYNAMICS

Name

37 responses

Lavanya.s

Kamaleshwari. V

Prasath .S.V

Sain Aaryan Shravan

Mahathir mohamed

Bagavath Pandi .v

vishnu rohith.k

Nigamanth Girish Seshadri

A Garry kiristen

Register Number

37 responses

721418101042

721418101034

721418101057

721418101303

721418101043

721418101008

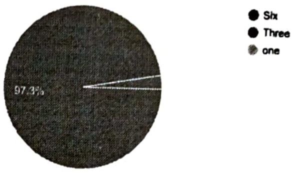
721418101083

721418101050

721418101020

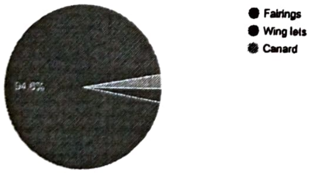
An airplane has _____ degrees of freedom

37 responses



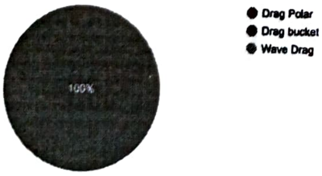
Induced drag can be minimized by providing

37 responses



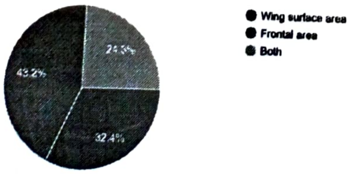
The relation between the lift coefficient and the drag coefficient is

37 responses



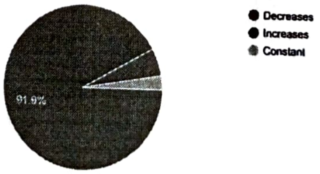
The proper area for estimating the parasite drag coefficient, if the pressure drag is dominant

37 responses



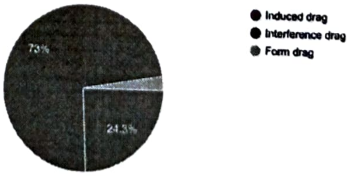
If the aspect ratio increases, the induced drag

37 responses



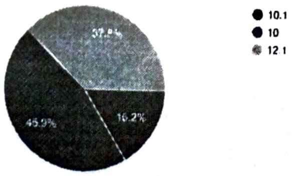
If fairing is provided in the junction between wing and the fuselage, then the total drag can be reduced by reduction in

37 responses



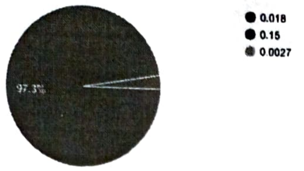
Calculate the aspect ratio of the rectangular wing such that the wing span and the chord are 11m and 1.1 m

37 responses



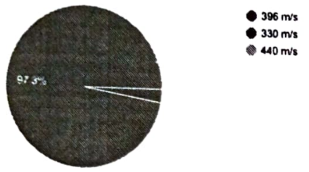
Find the zero lift drag coefficient of the airplane such that the drag polar is given by Cd=0.018+0.15 Cl^2

37 responses



The airplane is moving at an altitude in which the pressure is constant over the top and the bottom, at a speed which Mach number = 1, then the velocity of the airplane is

37 responses



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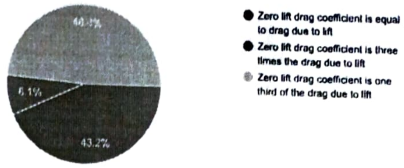
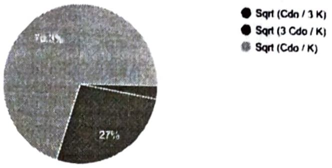
If the velocity of an airplane is at minimum thrust required, then

37 responses



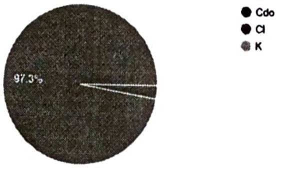
The lift coefficient at which the drag is minimum

37 responses



In drag polar curve, the drag coefficient varies as square of

37 responses



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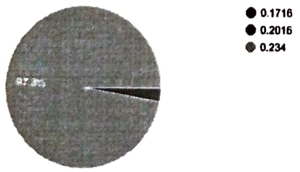
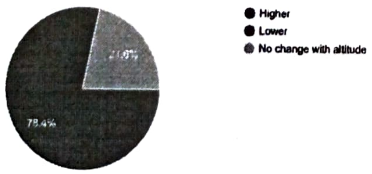
The drag polar is given by Cd=0.018+0.15 Cl^2 and the lift coefficient is 1.2, then the drag coefficient is given by

37 responses



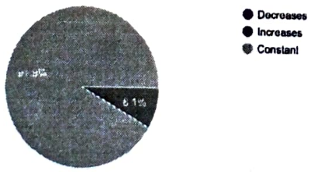
If the propeller driven airplane flies at sea level, then the thrust available

37 responses



The power available ________ with velocity for a turbo prop engine

37 responses



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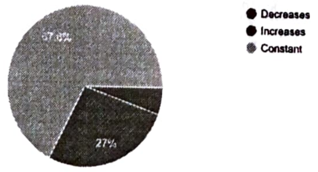
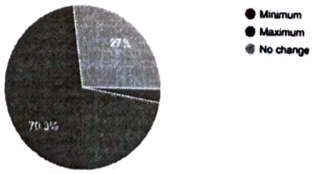
For a low by pass turbo fan engine the thrust available _____ with increase of velocity at subsonic speed.

37 responses



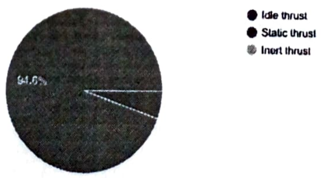
The thrust available of a powerplant at which the speed of aircraft is zero

37 responses



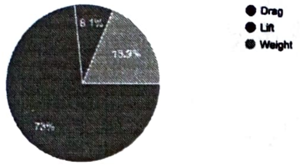
When the velocity of the aircraft is zero the thrust available is called

37 responses



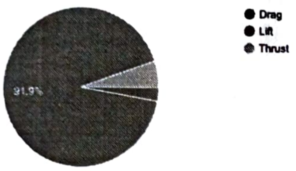
If an aircraft is flying with no acceleration, then the thrust is equal to the

37 responses



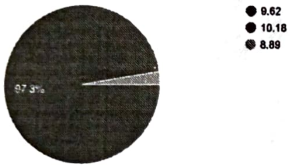
When there is no change in altitude the amount of weight force is balanced by

37 responses



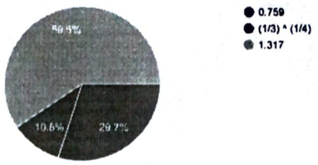
The maximum ratio of lift to drag for an airplane, if the drag polar is Cd=0.018+0.15 Cl^2

37 responses



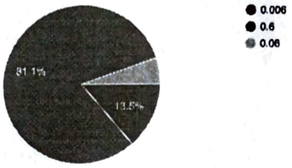
The velocity of minimum drag is _____ to the speed at minimum power

37 responses



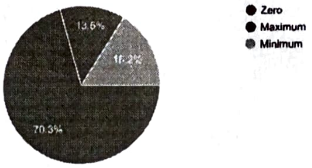
The lift coefficient for an aircraft when there is a minimum power condition, such the drag polar is given by Cd=0.018+0.15 Cl^2

37 responses



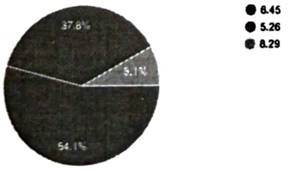
If the power required is equal to the power available, then the excess power is

37 responses



The ratio of CL3/2/Cd for an airplane if the drag polar is given by Cd=0.018+0.15 Cl^2

37 responses



Course Instructor

IQAC

HOD

# NEHRU INSTITUTE OF ENGINEERING AND TECHNOLOGY

COIMBATORE - 641105.

## MICRO ANALYSIS FOR THE COURSE

**Name of the Department** : Department of Aeronautical Engineering

**Course Name** : Flight Dynamics

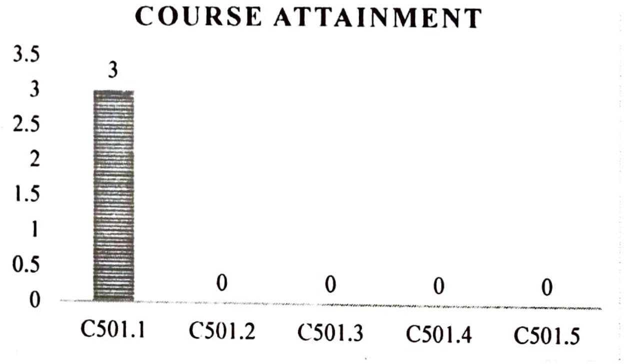
**Course Code** : AE8501

**Class /Sem** : III/V B

**Internal Test** : I

| | | | Part - A<br>(25 x 2 = 50) | Total |
|---|---|---|---|---|
| | | CO's | C501.1 | |
| | | Marks out of 25 | | |
| S.No | Reg No | Name of the Student | | 100 |
| 1 | 721418101003 | Akhilesh.S.J | 44 | 88 |
| 2 | 721418101008 | Bagavath Pandi.v | 48 | 96 |
| 3 | 721418101009 | K.balaji | 48 | 96 |
| 4 | 721418101010 | Balamurugan p | 44 | 88 |
| 5 | 721418101011 | Bhuvaneshwaran.D | 42 | 84 |
| 6 | 721418101015 | DHILIP.P | 42 | 84 |
| 7 | 721418101016 | DHUVYA.A.R | 48 | 96 |
| 8 | 721418101017 | Dinesh Kumar M | 36 | 72 |
| 9 | 721418101018 | Donin J Njarathadam | 46 | 92 |
| 10 | 721418101020 | A Garry kiristen | 46 | 92 |
| 11 | 721418101025 | Hariharan R | 46 | 92 |
| 12 | 721418101026 | Hariharan S | 36 | 72 |
| 13 | 721418101029 | Harishma Priyadharshini | 48 | 96 |
| 14 | 721418101031 | S.JEEVIKA | 40 | 80 |
| 15 | 721418101032 | Jegan.m | 44 | 88 |
| 16 | 721418101034 | Kamaleshwari.V | 40 | 80 |
| 17 | 721418101039 | k.krishna gopal | 40 | 80 |
| 18 | 721418101041 | Kuthala Aishwarya K | 44 | 88 |
| 19 | 721418101042 | lavanya.S | 44 | 88 |
| 20 | 721418101043 | Mahathir Mohamed | 46 | 92 |
| 21 | 721418101044 | MANOJ E | 38 | 76 |
| 22 | 721418101046 | Mohamed rajik M | 36 | 72 |
| 23 | 721418101049 | Naveen kumar.V | 36 | 72 |
| 24 | 721418101050 | Nigamanth Girish Seshadri | 46 | 92 |
| 25 | 721418101054 | Pragadeesh S | 36 | 72 |
| 26 | 721418101057 | PRASATH S.V. | 36 | 72 |
| 27 | 721418101059 | PRAVIN G | 40 | 80 |
| 28 | 721418101063 | Rajaselvam S | 42 | 84 |
| 29 | 721418101064 | Rakesh B | 36 | 72 |
| 30 | 721418101067 | Sakthivel P | 46 | 92 |
| 31 | 721418101068 | SANTHOSH A | 36 | 72 |
| 32 | 721418101069 | Saran V | 48 | 96 |
| 33 | 721418101074 | srihari chandran | 48 | 96 |
| 34 | 721418101075 | Steeve caleb. J | 46 | 92 |
| 35 | 721418101079 | Vignesh. M | 36 | 72 |
| 36 | 721418101080 | V.VIGNESHWARAN | 44 | 88 |
| 37 | 721418101083 | Vishnu rohith k | 48 | 96 |
| 38 | 721418101303 | Sain Aaryan Shravan | 43 | 86 |
| 39 | 721418101501 | Bala Murugan A | 36 | 72 |
| 40 | 721418101502 | Mohamed abul haier .i | 36 | 72 |

| | | C501.1 |
|---|---|---|
| No of Students scored set attainment level | | 40 |
| % of Students scored set attainment level | | 100 |
| Level of Attainment | | 3 |



| CO | Observations |
|---|---|
| ***C501.1*** | Target Attained |
| ***C501.2*** | |
| ***C501.3*** | |
| ***C501.4*** | |
| ***C501.5*** | |

**Course Instructor** **IQAC** **HOD**

# NEHRU INSTITUTE OF ENGINEERING AND TECHNOLOGY

T. M. Palayam, Coimbatore-641 105
(Approved by AICTE, New Delhi and Affiliated to Anna University, Chennai)
Accredited by NAAC, Recognized by UGC with Section 2(f) and 12(B)
NBA Accredited UG Courses: AERO, MECH, CSE

## AE8501 – Flight Dynamics – Internal Exam – I Mark statement

### III YEAR / V th SEMESTER

| Sl. No | Register Number | Name of the Student | Marks |
|---|---|---|---|
| 1 | 721418101003 | AKILESH S J | 88 |
| 2 | 721418101008 | BAGAVATH PANDI V | 96 |
| 3 | 721418101009 | BALAJI K | 96 |
| 4 | 721418101010 | BALAMURUGAN P | 88 |
| 5 | 721418101011 | BHUVANESHWARAN D | 84 |
| 6 | 721418101015 | DHILIP P | 84 |
| 7 | 721418101016 | DHUVYA A R | 96 |
| 8 | 721418101017 | DINESH KUMAR M | 72 |
| 9 | 721418101018 | DONIN J NJARATHADAM | 92 |
| 10 | 721418101020 | GARRY KIRISTEN A | 92 |
| 11 | 721418101025 | HARIHARAN R | 92 |
| 12 | 721418101026 | HARIHARAN S | 72 |
| 13 | 721418101029 | HARISHMA PRIYADHARSHINI A | 96 |
| 14 | 721418101032 | JEGAN M | 80 |
| 15 | 721418101034 | KAMALESHWARI V | 88 |
| 16 | 721418101036 | KARTHICK RAJA M | 80 |
| 17 | 721418101039 | KRISHNAGOPAL G K | 80 |
| 18 | 721418101041 | KUTHALA AISHWARYA K | 88 |
| 19 | 721418101042 | LAVANYA S S | 88 |
| 20 | 721418101043 | MAHATHIR MOHAMED M | 92 |
| 21 | 721418101044 | MANOJ E | 76 |
| 22 | 721418101046 | MOHAMED RAJIK M | 72 |
| 23 | 721418101049 | NAVEEN KUMAR V | 72 |
| 24 | 721418101050 | NIGAMANTH GIRISH SESHADRI | 92 |
| 25 | 721418101054 | PRAGADEESH S | 72 |
| 26 | 721418101057 | PRASATH SV | 72 |
| 27 | 721418101059 | PRAVIN G | 80 |
| 28 | 721418101062 | PRIYA HARSHINI S | 84 |
| 29 | 721418101063 | RAJASELVAM S | 72 |
| 30 | 721418101064 | RAKESH B | 92 |
| 31 | 721418101067 | SAKTHIVEL P | 72 |
| 32 | 721418101068 | SANTHOSH A | 96 |
| 33 | 721418101069 | SARAN V | 96 |
| 34 | 721418101074 | SRIHARI C | 92 |
| 35 | 721418101075 | STEEVE CALEB J | 72 |
| 36 | 721418101080 | VIGNESHWARAN V | 88 |
| 37 | 721418101083 | VISHNU ROHITH K | 96 |
| 38 | 721418101303 | SAIN AARYAN SINGH | 86 |
| 39 | 721418101501 | BALAMURUGAN A | 72 |
| 40 | 721418101502 | MOHAMMED ABUL HAIER | 72 |

Course Instructor IQAC HoD

# NEHRU INSTITUTE OF ENGINEERING AND TECHNOLOGY

ISO 14001:2004 Certified, Accredited by NAAC, Recognized by UGC with 2(F) & 12(B)
Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai
Nehru Gardens, Thirumalayampalayam, Coimbatore – 641 105.
NBA Accredited UG Courses: AERO | CSE | MECH

## DEPARTMENT OF AERONAUTICAL ENGINEERING

| | | | | | | |
|---|---|---|---|---|---|---|
| **Knowledge Level** | **K1 : Remembering** | **K2 : Understanding** | **K3 : Applying** | **K4 : Analyzing** | **K5 : Evaluating** | **K6 : Creating** |

## INTERNAL TEST – II (ONLINE MODE) – AUGUST 2020
## AE8501 – FLIGHT DYNAMICS (R2017)

| | | | | | |
|---|---|---|---|---|---|
| Course Instructor | : | **Mr. J. Karthikeyan, AP/AERO** | Portion | : | **Unit 1** |
| Class / Sem | : | III – B / V | Date / Session | : | **06/08/2020 & FN** |
| Duration | : | 90 Mins | Max. Marks | : | **50** |

**Question Type – Objective (25×2 = 50 Marks)**

**READ ALL THE QUESTIONS PROPERLY AND ANSWER CORRECTLY (USE OF CALCULATOR IS ALLOWED, IF NEEDED)**

| | | | | |
|---|---|---|---|---|
| 1. | The condition for maximum possible range for a propeller driven airplane is | | C501.2 | K1 |
| | a) | Lift coefficient = Sqrt (Cdo / 3 K) | | |
| | b) | Lift coefficient = Sqrt (3Cdo / K) | | |
| | **c)** | **Lift coefficient = Sqrt (Cdo / K)** | | |
| 2. | The airplane is flying at an altitude of 30000ft from the sea level, the dragpolar is given by Cd=0.018+0.15 Cl^2, find the maximum possible gliding range | | C501.2 | K2 |
| | **a)** | **3117.6** | | |
| | b) | 2876.4 | | |
| | c) | 6225.2 | | |
| 3. | The SFC for a single engine reciprocating engine airplane 0.32 kg/kw-hr, the velocity for the airplane is 70 m/s and the propeller efficiency is 85%, find the TSFC? | | C501.2 | K1 |
| | **a)** | **0.82 kg/kN-hr** | | |
| | b) | 0.63 kg/kN-hr | | |
| | c) | 0.32 kg/kN-hr | | |
| 4. | The condition for Maximum possible Range for a jet powered airplane is | | C501.2 | K2 |

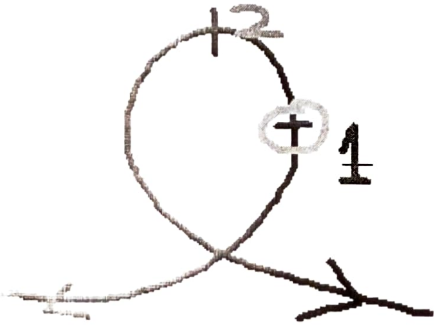
| | | | | |
|---|---|---|---|---|
| | a) | TSFC should be low | | |
| | b) | The aircraft should fly at Cl^(1/2)/Cd | | |
| | c) | The aircraft should carry a lot of fuel | | |
| | **d)** | **All the above** | | |
| 5. | The total time taken for an airplane to sustain in an air on one load of fuel is | | C501.2 | K2 |
| | a) | Range | | |
| | **b)** | **Endurance** | | |
| | c) | Rate of descent | | |
| | d) | Rate of climb | | |
| 6. | The condition for Maximum possible Endurance for a jet powered airplaneis | | C501.2 | K2 |
| | a) | Lift coefficient = Sqrt (3Cdo / K) | | |
| | **b)** | **Lift coefficient = Sqrt (Cdo / K)** | | |
| | c) | Lift coefficient = Sqrt (Cdo / 3 K) | | |
| | d) | All the above | | |
| 7. | Calculate the endurance for an airplane such that the SCF is 0.32 kg/kW-hr, L/D is 14, the gross weight of an airplane is 9000kg, and the fuel weight of an airplane is 400kg | | C501.2 | K3 |
| | **a)** | **1.98 hr** | | |
| | b) | 19.8 hr | | |
| | c) | 19.8 Minutes | | |
| | d) | 1.98 Minutes | | |
| 8. | Find the minimum glide angle for an airplane, the drag polar is given by Cd=0.018+0.15 Cl^2. | | C501.2 | K3 |
| | a) | 7.93 | | |
| | b) | 6.93 | | |
| | **c)** | **5.93** | | |

| | | | | |
|---|---|---|---|---|
| | d) | 4.93 | | |
| 9. | The condition for gliding flight | | C501.2 | K3 |
| | a) | $L=W\ Sin\theta$ | | |
| | b) | $T=D+W\ Sin\theta$ | | |
| | c) | $T=D\ Sin\theta$ | | |
| | **d)** | **$L=W\ Cos\theta$** | | |
| 10. | The graph drawn between the vertical velocity and the horizontal velocity component is called | | C501.2 | K2 |
| | a) | Drag Curve | | |
| | b) | Lift Curve | | |
| | **c)** | **Hodograph curve** | | |
| | d) | Pitching Moment curve | | |
| 11. | The airplane is flying at an altitude of 1 km above the sea level, the velocity to obtain minimum rate of sink is | | C501.2 | K2 |
| | **a)** | **the speed at minimum power** | | |
| | b) | 0.759 times the speed of minimum | | |
| | c) | powerthe speed of minimum drag | | |
| | d) | the speed of minimum thrust required | | |
| 12. | For a fixed value of CL and CD between sea level and altitude, which oneis right? | | C501.2 | K2 |
| | **a)** | **Pr at altitide = Pr at sea level * Sqrt(ρ0 / ρ)** | | |
| | b) | Pr at altitide = Pr at sea level * Sqrt(ρ / ρ0) | | |
| | c) | Pr at sea level = Pr at altitude * Sqrt(ρ / ρ0) | | |
| | d) | None of the above | | |
| 13. | For a better climbing performance | | C501.2 | K3 |
| | a) | Thrust should be low | | |
| | b) | Drag should be high | | |
| | **c)** | **Power required should be low** | | |

| | | | | |
|---|---|---|---|---|
| | d) | Weight of the airplane should be high | | |
| 14. | At Low velocity, Increasing of wing loading,__Rate ofclimb at constant velocity | | C501.2 | K2 |
| | a) | Increases | | |
| | **b)** | **Decreases** | | |
| | c) | Constant | | |
| 15. | The airplane is moving with increase in thrust to weight ratio, then the Rate of climb is | | C501.2 | K2 |
| | a) | Decreases | | |
| | **b)** | **Increases** | | |
| | c) | Constant | | |
| 16. | An airplane is flying with maximum the rate of climb of 18.2m/s and the corresponding angle of climb is 36 degree, then calculate its corresponding velocity is | | C501.2 | K2 |
| | a) | 0.55 m/s | | |
| | b) | 26.83 m/s | | |
| | **c)** | **30.96 m/s** | | |
| | d) | 655 m/s | | |
| 17. | The height at which the rate of climb is zero | | C501.2 | K2 |
| | a) | Service ceiling | | |
| | **b)** | **Absolute Ceiling** | | |
| | c) | Geometric ceiling | | |
| | d) | All the above | | |
| 18. | A condition where the accelerate-stop distance required is equal to the takeoff distance required for the aircraft weight | | C501.2 | K1 |
| | a) | Airborne distance | | |
| | b) | Flare Distance | | |
| | **c)** | **Balanced Field Takeoff** | | |

| | | | | |
|---|---|---|---|---|
| | d) | Total Ground roll distance | | |
| 19. | During the airborne, the lift coefficient is______than the maximum lift coefficient | | C501.2 | K1 |
| | a) | Greater | | |
| | **b)** | **Slightly Lesser** | | |
| | c) | very low | | |
| 20. | Calculate the turn radius for the airplane, such that the velocity is 78 m/s, mass of the airplane is 9500 kg, the lift force is 46643 N and the bank angle is 6.8 degree | | C501.2 | K3 |
| | a) | 4003 | | |
| | **b)** | **5201** | | |
| | c) | 5926 | | |
| 21. | If the load factor reaches the local maximum value, then the load factor will be | | C501.2 | K3 |
| | a) | one | | |
| | b) | Less than one | | |
| | **c)** | **Greater than n max** | | |
| | d) | negative | | |
| 22. | The load factor for the airplane is 2.1, Calculate the bank angle | | C501.2 | K3 |
| | **a)** | **61.56** | | |
| | b) | 0.476 | | |
| | c) | 2.1 | | |
| | d) | 52.6 | | |
| 23. | Why bank angle is maintained as minimum? | | C501.2 | K3 |
| | **a)** | **Drag increases as bank angle increases** | | |
| | b) | Thrust required decreases as bank angle increases | | |
| | c) | Thrust required increase as bank angle decreases | | |
| | d) | Drag increases as bank angle decreases | | |

| | | | | |
|---|---|---|---|---|
| 24. | Find the turn radius and turn rate for the location 1 shown in figure | | C501.2 | K3 |
| | a) | **(V^2)/gn & gn/V** | | |
| | b) | gn/V & (V^2)/gn | | |
| | c) | (V^2)/g(n-1) & g(n-1)/V | | |
| | d) | (V^2)/g(n+1) & g(n-1)/V | | |
| 25. | Find the turn radius and turn rate for the location 2 shown in figure | | C501.2 | K3 |
| | a) | (V^2)/gn & gn/V | | |
| | b) | gn/V & (V^2)/gn | | |
| | c) | (V^2)/g(n-1) & g(n+1)/V | | |
| | d) | **(V^2)/g(n+1) & [illegible]** | | |



COURSE INSTRUCTOR

HOD

**Vision of the Department:**
Producing competent and exemplary Aeronautical Engineers to meet the needs of global industries

**Mission of the Department:**
- To impart quality education in cutting edge technologies, in state of art laboratories with intellectual and ethical principles.
- To propel the young students to face the challenges of global industries through their sound technical knowledge.
- To build formidable skills [illegible] engineering and turn the students into entrepreneurs and global leaders.

# Assessment

Internal Exam - II

* Required

1. Email address *

**AE8501 - FLIGHT DYNAMICS**

2. Name *

3. Register Number *

4. The condition for maximum possible range for a propeller driven airplane is * 2 points

*Mark only one oval.*

○ Lift coefficient = Sqrt (Cdo / 3 K)
○ Lift coefficient = Sqrt (3Cdo / K)
○ Lift coefficient = Sqrt (Cdo / K)

---

5. The airplane is flying at an altitude of 30000ft from the sea level, the drag polar is given by Cd=0.018+0.15 Cl^2, find the maximum possible gliding range * 2 points

*Mark only one oval.*

○ 3117.6
○ 2876.4
○ 6225.2

6. The SFC for a single engine reciprocating engine airplane 0.32 kg/kw-hr, the velocity for the airplane is 70 m/s and the propeller efficiency is 85%, find the TSFC? * 2 points

*Mark only one oval.*

○ 0.82 kg/kN-hr
○ 0.63 kg/kN-hr
○ 0.32 kg/kN-hr

7. The condition for Maximum possible Range for a jet powered airplane is * 2 points

*Mark only one oval.*

○ TSFC should be low
○ The aircraft should fly at Cl^(1/2)/Cd
○ The aircraft should carry a lot of fuel
○ All the above

---

8. The total time taken for an airplane to sustain in an air on one load of fuel is * 2 points

*Mark only one oval.*

○ Range
○ Endurance
○ Rate of descent
○ Rate of climb

9. The condition for Maximum possible Endurance for a jet powered airplane is * 2 points

*Mark only one oval.*

○ Lift coefficient = Sqrt (3Cdo / K)
○ Lift coefficient = Sqrt (Cdo / K)
○ Lift coefficient = Sqrt (Cdo / 3 K)
○ All the above

10. Calculate the endurance for an airplane such that the SCF is 0.32 kg/kW-hr, L/D is 14, the gross weight of an airplane is 9000kg, and the fuel weight of an airplane is 400kg. * 2 points

*Mark only one oval.*

○ 1.98 hr
○ 19.8 hr
○ 19.8 Minutes
○ 1.98 Minutes

---

11. Find the minimum glide angle for an airplane, the drag polar is given by Cd=0.018+0.15 Cl^2. * 2 points

*Mark only one oval.*

○ 7.93
○ 6.93
○ 5.93
○ 4.93

12. The condition for gliding flight * 2 points

*Mark only one oval.*

○ L=W Sinθ
○ T=D+W Sinθ
○ T=D Sinθ
○ L=W Cosθ

13. The graph drawn between the vertical velocity and the horizontal velocity component is called * 2 points

*Mark only one oval.*

○ Drag Curve
○ Lift Curve
○ Hodograph curve
○ Pitching Moment curve

14. The airplane is flying at an altitude of 1 km above the sea level, the velocity to obtain minimum rate of sink is * 2 points

*Mark only one oval.*

○ the speed at minimum power
○ 0.759 times the speed of minimum power
○ the speed of minimum drag
○ the speed of minimum thrust required

15. For a fixed value of CL and CD between sea level and altitude, which one is right? * 2 points

*Mark only one oval.*

○ Pr at altitude = Pr at sea level * Sqrt(ρ0 / ρ)
○ Pr at altitude = Pr at sea level * Sqrt(ρ / ρ0)
○ Pr at sea level = Pr at altitude * Sqrt(ρ / ρ0)
○ None of the above

16. For a better climbing performance * 2 points

*Mark only one oval.*

○ Thrust should be low
○ Drag should be high
○ Power required should be low
○ Weight of the airplane should be high

---

17. At Low velocity, Increasing of wing loading, ____________ Rate of climb at constant velocity. * 2 points

*Mark only one oval.*

○ Increases
○ Decreases
○ No change

18. The airplane is moving with increase in thrust to weight ratio, then the Rate of climb is * 2 points

*Mark only one oval.*

○ Decreases
○ Increases
○ Constant

19. An airplane is flying with maximum the rate of climb of 18.2m/s and the corresponding angle of climb is 36 degree, then calculate its corresponding velocity is * 2 points

*Mark only one oval.*

○ 0.55 m/s
○ 26.83 m/s
○ 30.96 m/s
○ 655 m/s

---

20. The height at which the rate of climb is zero * 2 points

*Mark only one oval.*

○ Service ceiling
○ Absolute Ceiling
○ Geometric ceiling
○ All the above

[illegible]1. A condition where the accelerate-stop distance required is equal to the takeoff distance required for the aircraft weight * 2 points

*Mark only one oval.*

○ Airborne distance
○ Flare Distance
○ Balanced Field Takeoff
○ Total Ground roll distance

22. During the airborne, the lift coefficient is _______ than the maximum lift coefficient * 2 points

*Mark only one oval.*

○ Greater
○ Slightly Lesser
○ very low

---

23. Calculate the turn radius for the airplane, such that the velocity is 78 m/s, mass of the airplane is 9500 kg, the lift force is 46643 N and the bank angle is 6.8 degree * 2 points

*Mark only one oval.*

○ Lift
○ Thrust
○ Drag

24. If the load factor reaches the local maximum value, then the load factor will be * 2 points

*Mark only one oval.*

○ one
○ Less than one
○ Greater than n max
○ negative

25. The load factor for the airplane is 2.1, Calculate the bank angle. * 2 points

*Mark only one oval.*

○ 61.56
○ 0.476
○ 2.1
○ 52.6

26. Why bank angle is maintained as minimum? * 2 points

*Mark only one oval.*

○ Drag increases as bank angle increases
○ Thrust required decreases as bank angle increases
○ Thrust required increase as bank angle decreases
○ Drag increases as bank angle decreases

27. Find the turn radius and turn rate for the location 1 shown in figure * 2 points

*Mark only one oval.*

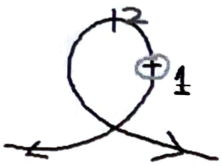
○ (V^2)/gn & gn/V
○ gn/V & (V^2)/gn
○ (V^2)/g(n-1) & g(n+1)/V
○ (V^2)/g(n+1) & g(n-1)/V

28. Find the turn radius and turn rate for the location 2 shown in figure 2 points

*Mark only one oval.*

○ gn/V & (V^2)/gn
○ (V^2)/gn & gn/V
○ (V^2)/g(n-1) & g(n-1)/V
○ (V^2)/g(n+1) & g(n+1)/V

---



# Assessment

37 responses

Publish analytics

**AE8501 - FLIGHT DYNAMICS**

## Name

37 responses

Lavanya.s

SANTHOSH A

Kamaleshwari.V

Prasath S.V

Aaryan Sain

Mahathir Mohamed

A Garry kiristen

Bagavath Pandi.v

vishnu rohith.k

---

## Register Number

37 responses

721418101042

721418101068

721418101034

7214181010157

721418101303

721418101043

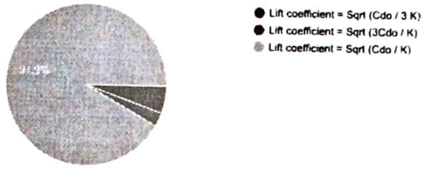
721418101020

721418101008

721418101083

## The condition for maximum possible range for a propeller driven airplane is

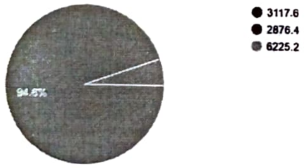
37 responses



---

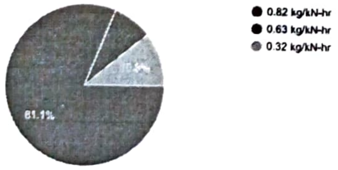
## The airplane is flying at an altitude of 30000ft from the sea level, the drag polar is given by Cd=0.018+0.15 Cl^2, find the maximum possible gliding range

37 responses



## The SFC for a single engine reciprocating engine airplane 0.32 kg/kw-hr, the velocity for the airplane is 70 m/s and the propeller efficiency is 85%, find the TSFC?

37 responses



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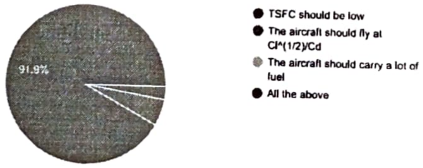
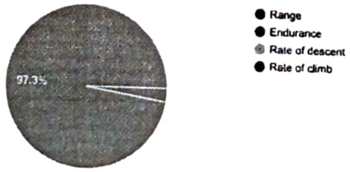
## The condition for Maximum possible Range for a jet powered airplane is

37 responses



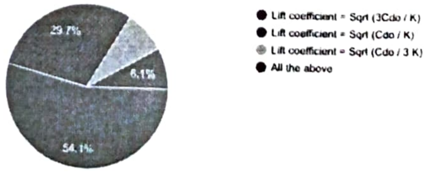
## The total time taken for an airplane to sustain in an air on one load of fuel is

37 responses



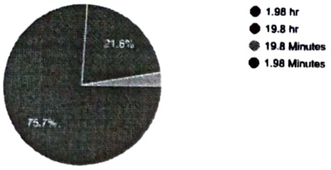
## The condition for Maximum possible Endurance for a jet powered airplane is

37 responses



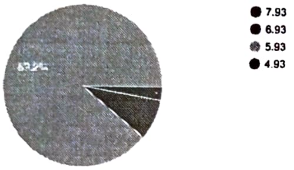
Calculate the endurance for an airplane such that the SCF is 0.32 kg/kW-hr, L/D is 14, the gross weight of an airplane is 9000kg, and the fuel weight of an airplane is 400kg.

37 responses



Find the minimum glide angle for an airplane, the drag polar is given by Cd=0.018+0.15 Cl^2.

37 responses



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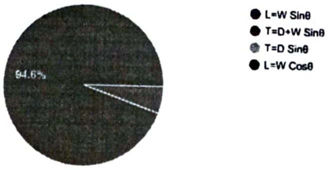
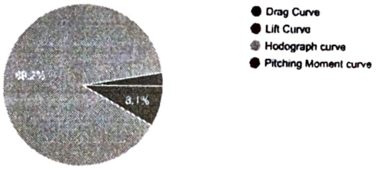
The condition for gliding flight

37 responses



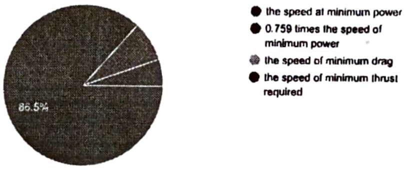
The graph drawn between the vertical velocity and the horizontal velocity component is called

37 responses



The airplane is flying at an altitude of 1 km above the sea level, the velocity to obtain minimum rate of sink is

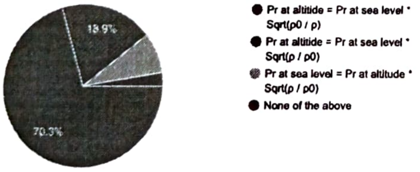
37 responses



---

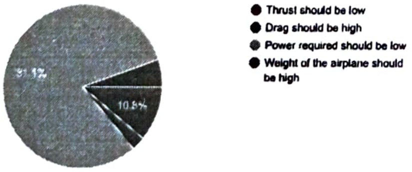
For a fixed value of CL and CD between sea level and altitude, which one is right?

37 responses



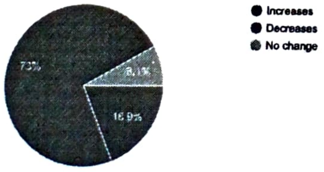
For a better climbing performance

37 responses



At Low velocity, Increasing of wing loading, ______________ Rate of climb at constant velocity.

37 responses



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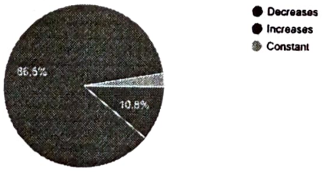
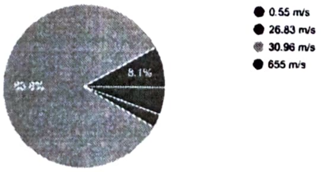
The airplane is moving with increase in thrust to weight ratio, then the Rate of climb is

37 responses



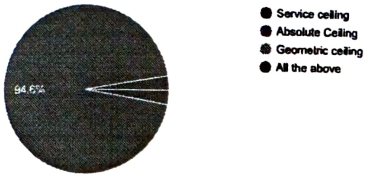
An airplane is flying with maximum the rate of climb of 18.2m/s and the corresponding angle of climb is 36 degree, then calculate its corresponding velocity is

37 responses



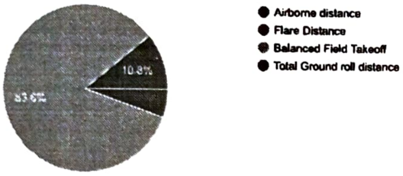
The height at which the rate of climb is zero

37 responses



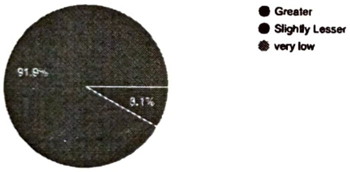
A condition where the accelerate-stop distance required is equal to the takeoff distance required for the aircraft weight

37 responses



During the airborne, the lift coefficient is _______ than the maximum lift coefficient

37 responses



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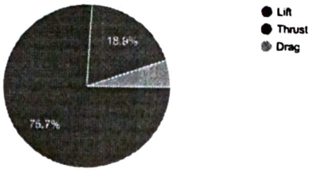
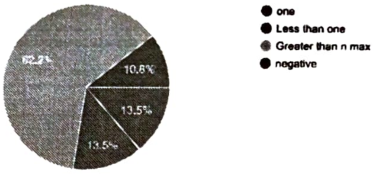
Calculate the turn radius for the airplane, such that the velocity is 78 m/s, mass of the airplane is 9500 kg. the lift force is 46643 N and the bank angle is 6.8 degree

37 responses



If the load factor reaches the local maximum value, then the load factor will be

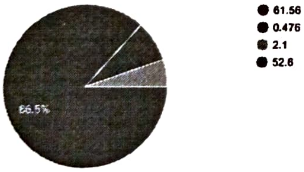
37 responses



---

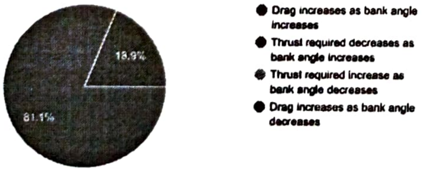
The load factor for the airplane is 2.1, Calculate the bank angle.

37 responses



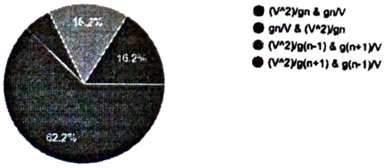
Why bank angle is maintained as minimum?

37 responses



Find the turn radius and turn rate for the location 1 shown in figure

37 responses



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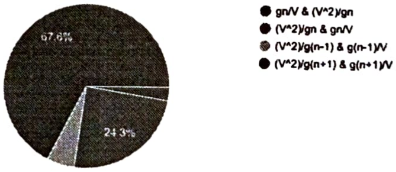
Find the turn radius and turn rate for the location 2 shown in figure

37 responses



## NEHRU INSTITUTE OF ENGINEERING AND TECHNOLOGY

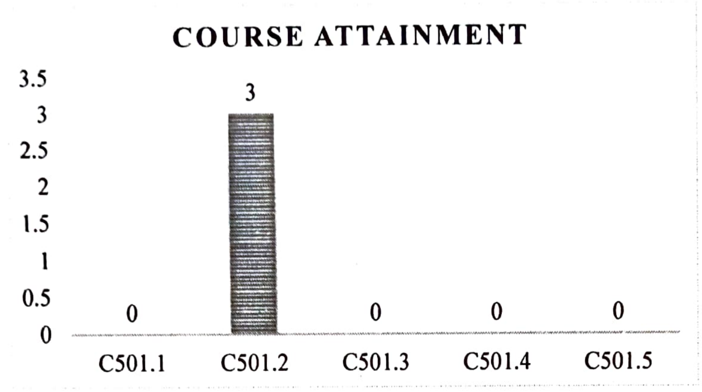
### COIMBATORE - 641105.

### MICRO ANALYSIS FOR THE COURSE

| | |
|---|---|
| **Name of the Department** | **: Department of Aeronautical Engineering** |
| **Course Name** | **: Flight Dynamics** |
| **Course Code** | **: AE8501** |
| **Class /Sem** | **: III/V B** |
| **Internal Test** | **: II** |

| | | | Part - A<br>(5 x 2 = 10) | |
|---|---|---|---|---|
| | | CO's | | Total |
| | | | C501.2 | |
| | | | Marks out of 25 | |
| S.No | Reg No | Name of the Student | | 100 |
| 1 | 721418101003 | Akhilesh.S.J | 36 | 72 |
| 2 | 721418101008 | Bagavath Pandi.v | 50 | 100 |
| 3 | 721418101009 | K.balaji | 40 | 80 |
| 4 | 721418101010 | Balamurugan p | 48 | 96 |
| 5 | 721418101011 | Bhuvaneshwaran.D | 40 | 80 |
| 6 | 721418101015 | DHILIP.P | 42 | 84 |
| 7 | 721418101016 | DHUVYA.A.R | 50 | 100 |
| 8 | 721418101017 | Dinesh Kumar M | 36 | 72 |
| 9 | 721418101018 | Donin J Njarathadam | 40 | 80 |
| 10 | 721418101020 | A Garry kiristen | 36 | 72 |
| 11 | 721418101025 | Hariharan R | 50 | 100 |
| 12 | 721418101026 | Hariharan S | 46 | 92 |
| 13 | 721418101029 | Harishma Priyadharshini | 50 | 100 |
| 14 | 721418101031 | S.JEEVIKA | 36 | 72 |
| 15 | 721418101032 | Jegan.m | 48 | 96 |
| 16 | 721418101034 | Kamaleshwari.V | 50 | 100 |
| 17 | 721418101039 | k.krishna gopal | 36 | 72 |
| 18 | 721418101041 | Kuthala Aishwarya K | 48 | 96 |
| 19 | 721418101042 | lavanya.S | 50 | 100 |
| 20 | 721418101043 | Mahathir Mohamed | 36 | 72 |
| 21 | 721418101044 | MANOJ E | 48 | 96 |
| 22 | 721418101046 | Mohamed rajik M | 36 | 72 |
| 23 | 721418101049 | Naveen kumar.V | 46 | 92 |
| 24 | 721418101050 | Nigamanth Girish Seshadri | 38 | 76 |
| 25 | 721418101054 | Pragadeesh S | 36 | 72 |
| 26 | 721418101057 | PRASATH S.V. | 36 | 72 |
| 27 | 721418101059 | PRAVIN G | 46 | 92 |
| 28 | 721418101063 | Rajaselvam S | 48 | 96 |
| 29 | 721418101064 | Rakesh B | 36 | 72 |
| 30 | 721418101067 | Sakthivel P | 35 | 70 |
| 31 | 721418101068 | SANTHOSH A | 48 | 96 |
| 32 | 721418101069 | Saran V | 40 | 80 |
| 33 | 721418101074 | srihari chandran | 40 | 80 |
| 34 | 721418101075 | Steeve caleb. J | 40 | 80 |
| 35 | 721418101079 | Vignesh. M | 48 | 96 |
| 36 | 721418101080 | V.VIGNESHWARAN | 48 | 96 |
| 37 | 721418101083 | Vishnu rohith k | 42 | 84 |
| 38 | 721418101303 | Sain Aaryan Shravan | 44 | 88 |
| 39 | 721418101501 | Bala Murugan A | 36 | 72 |
| 40 | 721418101502 | Mohamed abul haler .I | 36 | 72 |

|  | *C501.2* |
|---|---|
| **No of Students scored set attainment level** | 40 |
| **% of Students scored set attainment level** | 100 |
| **Level of Attainment** | 3 |



| CO | Observations |
|---|---|
| ***C501.1*** |  |
| ***C501.2*** | Target Attained |
| ***C501.3*** |  |
| ***C501.4*** |  |
| ***C501.5*** |  |

**Course Instructor** **IQAC** **HOD**

# NEHRU INSTITUTE OF ENGINEERING AND TECHNOLOGY

T. M. Palayam, Coimbatore-641 105
(Approved by AICTE, New Delhi and Affiliated to Anna University, Chennai)
Accredited by NAAC, Recognized by UGC with Section 2(f) and 12(B)
NBA Accredited UG Courses: AERO, MECH, CSE

## AE8501 – Flight Dynamics – Internal Exam – II Mark statement

### III YEAR / V th SEMESTER

| Sl. No | Register Number | Name of the Student | Marks |
|---|---|---|---|
| 1 | 721418101003 | AKILESH S J | 72 |
| 2 | 721418101008 | BAGAVATH PANDI V | 100 |
| 3 | 721418101009 | BALAJI K | 80 |
| 4 | 721418101010 | BALAMURUGAN P | 96 |
| 5 | 721418101011 | BHUVANESHWARAN D | 80 |
| 6 | 721418101015 | DHILIP P | 84 |
| 7 | 721418101016 | DHUVYA A R | 100 |
| 8 | 721418101017 | DINESH KUMAR M | 72 |
| 9 | 721418101018 | DONIN J NJARATHADAM | 80 |
| 10 | 721418101020 | GARRY KIRISTEN A | 72 |
| 11 | 721418101025 | HARIHARAN R | 100 |
| 12 | 721418101026 | HARIHARAN S | 92 |
| 13 | 721418101029 | HARISHMA PRIYADHARSHINI A | 100 |
| 14 | 721418101032 | JEGAN M | 72 |
| 15 | 721418101034 | KAMALESHWARI V | 96 |
| 16 | 721418101036 | KARTHICK RAJA M | 100 |
| 17 | 721418101039 | KRISHNAGOPAL G K | 72 |
| 18 | 721418101041 | KUTHALA AISHWARYA K | 96 |
| 19 | 721418101042 | LAVANYA S S | 100 |
| 20 | 721418101043 | MAHATHIR MOHAMED M | 72 |
| 21 | 721418101044 | MANOJ E | 96 |
| 22 | 721418101046 | MOHAMED RAJIK M | 72 |
| 23 | 721418101049 | NAVEEN KUMAR V | 92 |
| 24 | 721418101050 | NIGAMANTH GIRISH SESHADRI | 76 |
| 25 | 721418101054 | PRAGADEESH S | 72 |
| 26 | 721418101057 | PRASATH SV | 72 |
| 27 | 721418101059 | PRAVIN G | 92 |
| 28 | 721418101062 | PRIYA HARSHINI S | 96 |
| 29 | 721418101063 | RAJASELVAM S | 72 |
| 30 | 721418101064 | RAKESH B | 68 |
| 31 | 721418101067 | SAKTHIVEL P | 96 |
| 32 | 721418101068 | SANTHOSH A | 80 |
| 33 | 721418101069 | SARAN V | 80 |
| 34 | 721418101074 | SRIHARI C | 80 |
| 35 | 721418101075 | STEEVE CALEB J | 96 |
| 36 | 721418101080 | VIGNESHWARAN V | 96 |
| 37 | 721418101083 | VISHNU ROHITH K | 84 |
| 38 | 721418101303 | SAIN AARYAN SINGH | 88 |
| 39 | 721418101501 | BALAMURUGAN A | 72 |
| 40 | 721418101502 | MOHAMMED ABUL HAIER | 72 |

Course Instructor IQAC HoD

# NEHRU INSTITUTE OF ENGINEERING AND TECHNOLOGY

ISO 14001:2004 Certified, Accredited by NAAC, Recognized by UGC with 2(F) & 12(B)
Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai
Nehru Gardens, Thirumalayampalayam, Coimbatore – 641 105.
NBA Accredited UG Courses: AERO | CSE | MECH

## DEPARTMENT OF AERONAUTICAL ENGINEERING

| Knowledge Level | K1 : Remembering | K2 : Understanding | K3 : Applying | K4 : Analyzing | K5 : Evaluating | K6 : Creating |
|---|---|---|---|---|---|---|

## INTERNAL TEST – III(ONLINE MODE) –AUGUST 2020
## AE8501 – FLIGHT DYNAMICS (R2017)

| | | | | | |
|---|---|---|---|---|---|
| Course Instructor | : | **Mr. J. Karthikeyan, AP/AERO** | Portion | : | **Unit 1** |
| Class / Sem | : | **III – B / V** | Date / Session | : | **06/08/2020 & FN** |
| Duration | : | **90 Mins** | Max. Marks | : | **60** |

### Question Type – Objective (25×2 = 50 Marks)

**READ ALL THE QUESTIONS PROPERLY AND ANSWER CORRECTLY (USE OF CALCULATOR IS ALLOWED, IF NEEDED)**

| | | | | |
|---|---|---|---|---|
| 1. | The moment about the aerodynamic centre, $C_{m,acw}$ is -0.162, Tail Volume ratio is 0.48 and Tail lift coefficient is -0.1934 and the lift coefficient to trim the airplane is 2.306. Find the distance between the CG and the Aerodynamic centre. | | C501.3 | K3 |
| | a) | 0.089 | | |
| | b) | 0.068 | | |
| | **c)** | **0.030** | | |
| | d) | 0.126 | | |
| 2. | For a constant free stream velocity and density, a change in lift for a largeaspect ratio straight wing with thin cambered aerofoil sections at small angle of attack leads to | | C501.3 | K2 |
| | a) | a shift of the aerodynamic center and no shift of the center of pressure | | |
| | **b)** | **a shift of the center of pressure and no shift of the aerodynamic center** | | |
| | c) | shift of both the aerodynamic center and the center of pressure | | |
| | d) | no shift either of the aerodynamic center or of the center of pressure | | |
| 3. | The condition for static Longitudinal stability is | | C501.3 | K2 |
| | **a)** | **The Slope of pitching moment curve must be greater than zero** | | |
| | b) | The Slope of pitching moment curve must be less than zero | | |

**Vision of the Department:**
Producing competent and exemplary Aeronautical Engineers to meet the needs of global industries

**Mission of the Department:**
- To impart quality education in cutting edge technologies, in state of art laboratories with intellectual and ethical principles
- To propel the young students to face the challenges of global industries through their sound technical knowledge
- To build formidable skills in aeronautical engineering and turn the students into entrepreneurs and global leaders

| | | | | |
|---|---|---|---|---|
| | c) | The Slope of pitching moment curve must be equal than zero | | |
| | **d)** | **It does not depends on Pitching moment** | | |
| 4. | If an aircraft is performing a positive yawing manoeuvre, the side slip angle | | C501.4 | K2 |
| | **a)** | **is always zero** | | |
| | b) | is never zero | | |
| | c) | is always negative | | |
| | d) | could be any value | | |
| 5. | A positive yawing moment tends to_____sideslip disturbances | | C501.4 | K2 |
| | **a)** | **decrease** | | |
| | b) | increase | | |
| | c) | does not change | | |
| | d) | Sideslip does not depend on yawing moment | | |
| 6. | The airplane has the following characteristics. Xacw = 0.24c, Xcg=0.41c, Lift curve slope of wing is 3.6, Changes in tail lift w.r.t. tail incidence is 3.0,Changes in tail lift w.r.t. elevator deflection is 1.5, effect of downwash angle with wing incidence is 0.4, changes in elevator angle for a change of Lift coefficient is 10 degree. find the tail volume coefficient. | | C501.3 | K3 |
| | **a)** | **0.296** | | |
| | b) | 0.149 | | |
| | c) | 0.389 | | |
| | d) | 0.147 | | |
| 7. | For an airplane to be statically stable, its centre of gravity must always be | | C501.3 | K2 |
| | a) | ahead of wing aerodynamic centre | | |
| | **b)** | **ahead of neutral point** | | |
| | c) | aft of the wing aerodynamic centre | | |
| | d) | aft of neutral point | | |

| | | | | |
|---|---|---|---|---|
| 8. | The vertical ground load factor on a stationary aircraft parked in its hangar is | | C501.4 | K2 |
| | a) | 0 | | |
| | b) | -1 | | |
| | **c)** | **1** | | |
| | d) | Not defined | | |
| 9. | In an aircraft, constant roll rate can be produced using ailerons by applying | | C501.4 | K2 |
| | a) | a step input | | |
| | b) | a ramp input | | |
| | c) | a sinusoidal input | | |
| | **d)** | **an impulse input** | | |
| 10. | An aircraft in trimmed condition has zero pitching moment at | | C501.3 | K1 |
| | a) | Its aerodynamic centre | | |
| | b) | 25% of its mean aerodynamic chord | | |
| | **c)** | **its centre of gravity** | | |
| | d) | 50% of its wing root chord | | |
| 11. | Find the lift coefficient for an airplane such that the lift curve slope of wing is 2.8 per radian and the wing incidence is 15 degree | | C501.3 | K3 |
| | a) | 0.128 | | |
| | **b)** | **0.733** | | |
| | c) | 0.564 | | |
| | d) | 0.611 | | |
| 12. | The pitching moment of a positively cambered NACA airfoil about its leading edge at zero-lift angle of attack is | | C501.3 | K1 |
| | a) | Positive | | |
| | **b)** | **Negative** | | |
| | c) | Zero | | |

| | | | | |
|---|---|---|---|---|
| | d) | Indeterminate | | |
| 13. | Which one of the following modes of a stable aircraft has non oscillatory response characteristics | | C501.5 | K1 |
| | a) | Dutch roll | | |
| | b) | Short Period | | |
| | c) | Phugoid | | |
| | **d)** | **Spiral** | | |
| 14. | The change in downwash angle with lift coefficient is 0.18 and the lift coefficient is 2.4 which includes flap deflection. Due to flap deflection, the lift coefficient is 0.8. The reduction in downwash due to ground effect is 3.9. calculate the effect of downwash with ground effect. | | C501.3 | K3 |
| | **a)** | **20.85 degree** | | |
| | b) | 24.75 degree | | |
| | c) | 77.76 degree | | |
| | d) | 43.20 degree | | |
| 15. | An airplane with symmetric aerofoil was tested in a wind tunnel and estimated pitching moment coefficient about CG to be 0.1 and 0 at +5° and -5°, Find the elevator control Power. | | C501.3 | K3 |
| | a) | 0.08 / degree | | |
| | **b)** | **0.01 / degree** | | |
| | c) | 0.62 / degree | | |
| | d) | 0.25 / degree | | |
| 16. | For a propeller driven aircraft with high wing configuration, if the CG liesabove the propeller axis, the aircraft becomes | | C501.3 | K2 |
| | a) | Stable | | |
| | **b)** | **Unstable** | | |

| | | | | |
|---|---|---|---|---|
| 17. | For an airplane the tail volume ratio is 0.45 lift curve slope of wing is 4.4 per radian, tail lift curve slope is 3 per radian, and the change of downwash angle with wing incidence is 0.35. Find the location of CG. | | C501.3 | K3 |
| | **a)** | **0.2 aft of the aerodynamic center** | | |
| | b) | 0.2 ahead of the aerodynamic center | | |
| | c) | 0.5 aft of the aerodynamic center | | |
| | d) | 0.5 ahead of the aerodynamic center | | |
| 18. | Which one does not contributes the static lateral stability | | C501.4 | K2 |
| | a) | High-wing airplane | | |
| | **b)** | **Low-wing airplane** | | |
| | c) | Low-wing airplane with dihedral | | |
| | d) | Swept back Wing | | |
| 19. | Which statement is wrong, for an equilibrium state to be dynamically stable, the roots of the characteristic equation have to be one of the following two types | | C501.5 | K2 |
| | **a)** | **When the root is real number, it should be positive.** | | |
| | b) | When the root is real number, it should be negative. | | |
| | c) | When the root is complex number, the real part should be negative. | | |
| 20. | Which component Contribute towards Cnβ | | C501.4 | K2 |
| | a) | Wing + Fuselage Configuration | | |
| | b) | Engine | | |
| | **c)** | **Vertical Tail** | | |
| | d) | Nacelle | | |
| 21. | Directional control is primarily achieved by | | C501.4 | K1 |
| | a) | Elevator | | |
| | b) | Aileron | | |
| | **c)** | **Rudder** | | |

| | | | | |
|---|---|---|---|---|
| 22. | If a rudder is deflected to port side, a positive side force is generated by vertical tail. This side force creates a____yawing moment | | C501.4 | K2 |
| | a) | Zero | | |
| | b) | Positive | | |
| | **c)** | **Negative** | | |
| 23. | The positive manoeuvering limit load factor for a light airplane in the utilitycategory in the clean flight configuration is | | C501.3 | K2 |
| | a) | 6.0 | | |
| | **b)** | **4.4** | | |
| | c) | 3.8 | | |
| | d) | 2.0 | | |
| 24. | Which statement is correct for a side slip condition at constant speed and side slip angle, where the geometrical dihedral of an airplane is increased. | | C501.4 | K2 |
| | a) | The required lateral control force does not change | | |
| | b) | The required lateral control force decreases | | |
| | **c)** | **The required lateral control force increases** | | |
| | d) | The stick force per g increases | | |
| 25. | One advantage of movable stabilizer system compared with fixed stabilizer system is that | | C501.5 | K2 |
| | a) | Structural weight is less | | |
| | b) | It leads to greater stability in flight | | |
| | c) | The system's complexity is reduced | | |
| | **d)** | **It is more powerful means of trimming** | | |
| 26. | A twin engine aircraft producing a thrust of 25 kN per engine and the span distance between two engines is 10 m. Calculate the yawing moment developed due to asymmetric thrust. | | C501.4 | K3 |
| | a) | 250000 Nm | | |
| | b) | 100000 Nm | | |

| | | | | |
|---|---|---|---|---|
| | **c)** | **125000 Nm** | | |
| | d) | 500000 Nm | | |
| 27. | Which one of the following aerofoil sections is appropriate for vertical tail | | C501.4 | K2 |
| | a) | NACA 2312 | | |
| | **b)** | **NACA 0012** | | |
| | c) | NACA 65-415 | | |
| | d) | Clarke Y Profile | | |
| 28. | Yawing moment due to Asymmetric thrust is 50kNm Determine the Yawing moment due to rudder deflection to maintain zero sideslip at 100 m/s in level flight at sea level with one engine completely out | | C501.4 | K3 |
| | a) | 50000 kNm | | |
| | **b)** | **50 kNm** | | |
| | c) | 0.5 kNm | | |
| | d) | 0.05 kNm | | |
| 29. | The slope of static directional stability curve is 0.012, Sideslip angle due to cross wind is 7.9696°, Yawing moment coefficient due to rudder deflection is -0.0072 per degree | | C501.4 | K3 |
| | **a)** | **The rudder should be deflected to left 13.28 degrees** | | |
| | b) | The rudder should be deflected to right13.28 degrees | | |
| | c) | The elevator and aileron should be deflected to up13.28 degrees | | |
| | d) | The rudder should be kept as Zero degree | | |
| 30. | Estimate the rolling moment due to rolling at 20rpm at low incidence. Thewing span of rectangular wing is 1.75 m and chord is 0.3 m is tested in a wind tunnel at a speed of 30 m/s. Assume, the lift curve slope of wing is 4.5 per radian | | C501.4 | K3 |
| | a) | 18.55 Nm | | |
| | **b)** | **23.18 Nm** | | |

| | | | | |
|---|---|---|---|---|
| | c) | 37.66 Nm | | |
| | d) | 14.55 Nm | | |
| 31. | Find the lift curve slope of wing. Given that ao = 0.1 and aspect ratio for the wing is 4 | | C501.3 | K3 |
| | **a)** | **0.09921** | | |
| | b) | 0.09995 | | |
| | c) | 0.04847 | | |
| | d) | 0.04245 | | |
| 32 | The roots of the characteristic equation is -0.32, -0.689 and -0.5±2.5i, the non dimensional time is 3.7 air sec. Find the period of oscillation andthe time to halften the oscillation. | | C501.5 | K3 |
| | a) | 1.5 s and 9.29 s | | |
| | b) | 42.02 s and 1.5 s | | |
| | **c)** | **9.29 s and 5.12 s** | | |
| | d) | 5.12 s and 42.02 s | | |
| 33 | The characteristic equation is given as λ^4 + 5.05λ^3 + 13.15 λ^2 + 0.6 λ +0.5 = 0, then the system becomes | | C501.5 | K3 |
| | **a)** | **Stable** | | |
| | b) | UnStable | | |
| 34 | The characteristic equation for lateral-directional dynamic stability yielded to the following roots -0.6, -0.0045, and -0.08±1.7i . Find the damping ratio corresponding to Dutch roll mode. | | C501.5 | K3 |
| | a) | 0.038 | | |
| | **b)** | **0.047** | | |
| | c) | 0.054 | | |
| | d) | 0.039 | | |

| | | | | |
|---|---|---|---|---|
| 35. | A Light airplane develops a physical oscillation which is allowed to persist.the speed is found to vary from 96 to 99 kmph. Estimate the period of oscillation and the vertical amplitude. | | C501.5 | K3 |
| | a) | 10.07 s and 4.4646 m | | |
| | b) | 10.07 s and 2.2646 m | | |
| | **c)** | **12.07 s and 2.2646 m** | | |
| | d) | 12.07 s and 4.4646 m | | |
| 36. | The damping ratio in phugoid motion for gliders is usually less compared to powered aircraft because | | C501.5 | K2 |
| | a) | gliders are unpowered. | | |
| | b) | gliders are light. | | |
| | **c)** | **lift to drag ratio is higher for gliders.** | | |
| | d) | gliders fly at low speed. | | |
| 37. | The pitch angle and the angle of attack for a fixed wing aircraft are equal during | | C501.5 | K2 |
| | **a)** | **wings level constant climb** | | |
| | b) | altitude flight unaccelerated | | |
| | c) | unaccelerated descent | | |
| | d) | landing | | |
| 38. | Which one of the following is the most stable configuration of an airplanein roll | | C501.5 | K2 |
| | a) | Sweep back, anhedral and low wing | | |
| | b) | Sweep forward, dihedral and low wing | | |
| | c) | Sweep forward, anhedral and high wing | | |
| | **d)** | **Sweep back, dihedral and high wing** | | |
| 39. | In most airplanes, the Dutch roll mode can be excited by applying | | C501.5 | K2 |
| | a) | a step input to the elevators | | |
| | b) | a sinusoidal input to the aileron | | |

| | | | | |
|---|---|---|---|---|
| | **c)** | **a step input to the rudder** | | |
| | d) | an impulse input to the elevators | | |
| 40. | In an aircraft, elevator control effectiveness determines | | C501.3 | K2 |
| | a) | turn radius | | |
| | b) | rate of climb | | |
| | **c)** | **forward-most location of the centre of gravity** | | |
| | d) | aft-most location of the centre of gravity | | |
| 41. | In an aircraft, the dive manoeuvre can be initiated by | | C501.5 | K2 |
| | a) | reducing the engine thrust alone | | |
| | b) | reducing the angle of attack alone | | |
| | **c)** | **generating a nose down pitch rate** | | |
| | d) | increasing the engine thrust alone | | |
| 42. | The change in pitching moment coefficient with wing incidence is | | C501.3 | K2 |
| | **a)** | **stability derivative which represents the stiffness in pitch** | | |
| | b) | stability derivative which represents the damping in pitch | | |
| | c) | control derivative in pitch | | |
| | d) | positive for an airplane that is stable in pitch | | |
| 43. | An unswept wing with fixed wing aircraft has a large roll stability if the wing is placed | | C501.4 | K2 |
| | a) | Low on the fuselage and has negative dihedral angle | | |
| | **b)** | **Low on the fuselage and has positive dihedral angle** | | |
| | c) | high on the fuselage and has negative dihedral angle | | |
| | d) | high on the fuselage and has positive dihedral angle | | |
| 44. | A wing rock is a aircraft motion has a property of | | C501.5 | K2 |
| | a) | Coupled roll yaw combinations | | |
| | b) | Velocity remains constant | | |
| | c) | Angle of attack remains constant | | |
| | **d)** | **Roll oscillations** | | |

| 45. | The primary function of the fin in the vertical tail of an aircraft is to | | C501.4 | K1 |
|---|---|---|---|---|
| | a) | Yaw control | | |
| | b) | **Yaw stability** | | |
| | c) | Roll damping | | |
| | d) | Roll stability | | |

COURSE INSTRUCTOR

HOD

# Assessment

Internal Exam - III

* Required

1. Email address *

**AE8501 - FLIGHT DYNAMICS**

2. Full Name *

3. Section *

*Mark only one oval.*

○ A
○ B

4. Register Number *

5. The moment about the aerodynamic centre, Cm,acw is -0.162, Tail Volume ratio is 0.48 and Tail lift coefficient is -0.1934 and the lift coefficient to trim the airplane is 2.306. Find the distance between the CG and the Aerodynamic centre. * 2 points

*Mark only one oval.*

○ 0.089
○ 0.068
○ 0.030
○ 0.126

6. For a constant free stream velocity and density, a change in lift for a large aspect ratio straight wing with thin cambered aerofoil sections at small angle of attack leads to * 1 point

*Mark only one oval.*

○ a shift of the aerodynamic center and no shift of the center of pressure
○ a shift of the center of pressure and no shift of the aerodynamic center
○ shift of both the aerodynamic center and the center of pressure
○ no shift either of the aerodynamic center or of the center of pressure

7. The condition for static Longitudinal stability is * 1 point

*Mark only one oval.*

○ The Slope of pitching moment curve must be greater than zero
○ The Slope of pitching moment curve must be less than zero
○ The Slope of pitching moment curve must be equal than zero
○ It does not depends on Pitching moment

8. If an aircraft is performing a positive yawing manoeuvre, the side slip angle * 1 point

*Mark only one oval.*

○ is always zero
○ is never zero
○ is always negative
○ could be any value

9. A positive yawing moment tends to ___________ sideslip disturbances * 1 point

*Mark only one oval.*

○ decrease
○ increase
○ does not change
○ Sideslip does not depend on yawing moment

10. The airplane has the following characteristics. Xacw = 0.24c, Xcg=0.41c, Lift curve slope of wing is 3.6, Changes in tail lift w.r.t. tail incidence is 3.0, Changes in tail lift w.r.t. elevator deflection is 1.5, effect of downwash angle with wing incidence is 0.4, changes in elevator angle for a change of Lift coefficient is 10 degree. find the tail volume coefficient. * 2 points

*Mark only one oval.*

○ 0.296
○ 0.149
○ 0.389
○ 0.147

11. For an airplane to be statically stable, its centre of gravity must always be * 1 point

*Mark only one oval.*

○ ahead of wing aerodynamic centre
○ ahead of neutral point
○ aft of the wing aerodynamic centre
○ aft of neutral point

12. The vertical ground load factor on a stationary aircraft parked in its hangar is * 1 point

*Mark only one oval.*

○ 0
○ -1
○ 1
○ Not defined

13. In an aircraft, constant roll rate can be produced using ailerons by applying * 1 point

*Mark only one oval.*

○ a step input
○ a ramp input
○ a sinusoidal input
○ an impulse input

14. An aircraft in trimmed condition has zero pitching moment at * 1 point

*Mark only one oval.*

○ its aerodynamic centre
○ 25% of its mean aerodynamic chord
○ its centre of gravity
○ 50% of its wing root chord

15. Find the lift coefficient for an airplane such that the lift curve slope of wing is 2.8 per radian and the wing incidence is 15 degree * 2 points

*Mark only one oval.*

○ 0.128
○ 0.733
○ 0.564
○ 0.611

16. The pitching moment of a positively cambered NACA airfoil about its leading edge at zero-lift angle of attack is * 1 point

*Mark only one oval.*

○ Positive
○ Negative
○ Zero
○ Indeterminate

---

17. Which one of the following modes of a stable aircraft has non oscillatory response characteristics * 1 point

*Mark only one oval.*

○ Dutch roll
○ Short Period
○ Phugoid
○ Spiral

18. The change in downwash angle with lift coefficient is 0.18 and the lift coefficient is 2.4 which includes flap deflection. Due to flap deflection, the lift coefficient is 0.8. The reduction in downwash due to ground effect is 3.9. calculate the effect of downwash with ground effect. * 2 points

*Mark only one oval.*

○ 20.85 degree
○ 24.75 degree
○ 77.76 degree
○ 43.20 degree

19. An airplane with symmetric aerofoil was tested in a wind tunnel and estimated pitching moment coefficient about CG to be 0.1 and 0 at +5° and -5°, Find the elevator control Power. * 2 points

*Mark only one oval.*

○ 0.08 / degree
○ 0.01 / degree
○ 0.62 / degree
○ 0.25 / degree

---

20. For a propeller driven aircraft with high wing configuration, if the CG lies above the propeller axis, the aircraft becomes * 1 point

*Mark only one oval.*

○ Stable
○ Unstable

21. For an airplane the tail volume ratio is 0.45 lift curve slope of wing is 4.4 per radian, tail lift curve slope is 3 per radian, and the change of downwash angle with wing incidence is 0.35. Find the location of CG. * 2 points

*Mark only one oval.*

○ 0.2 aft of the aerodynamic center
○ 0.2 ahead of the aerodynamic center
○ 0.5 aft of the aerodynamic center
○ 0.5 ahead of the aerodynamic center

22. Which one does not contributes the static lateral stability * 1 point

*Mark only one oval.*

○ High-wing airplane
○ Low-wing airplane
○ Low-wing airplane with dihedral
○ Swept back Wing

---

23. Which statement is wrong, for an equilibrium state to be dynamically stable, the roots of the characteristic equation have to be one of the following two types. * 1 point

*Mark only one oval.*

○ When the root is real number, it should be positive.
○ When the root is real number, it should be negative.
○ When the root is complex number, the real part should be negative.

24. Which component Contribute towards Cnβ * 1 point

*Mark only one oval.*

○ Wing + Fuselage Configuration
○ Engine
○ Vertical Tail
○ Nacelle

25. Directional control is primarily achieved by * 1 point

*Mark only one oval.*

○ Elevator
○ Aileron
○ Rudder

26. If a rudder is deflected to port side, a positive side force is generated by vertical tail. This side force creates a ___________yawing moment * 1 point

*Mark only one oval.*

○ Zero
○ Positive
○ Negative

27. The positive manoeuvering limit load factor for a light airplane in the utility category in the clean flight configuration is * 1 point

*Mark only one oval.*

○ 6.0
○ 4.4
○ 3.8
○ 2.0

28. Which statement is correct for a side slip condition at constant speed and side slip angle, where the geometrical dihedral of an airplane is increased. * 1 point

*Mark only one oval.*

○ The required lateral control force does not change
○ The required lateral control force decreases
○ The required lateral control force increases
○ The stick force per g increases

29. One advantage of movable stabilizer system compared with fixed stabilizer system is that * 1 point

*Mark only one oval.*

○ Structural weight is less
○ It leads to greater stability in flight
○ The system's complexity is reduced
○ It is more powerful means of trimming

30. A twin engine aircraft producing a thrust of 25 kN per engine and the span distance between two engines is 10 m. Calculate the yawing moment developed due to asymmetric thrust. * 2 points

*Mark only one oval.*

○ 250000 Nm
○ 100000 Nm
○ 125000 Nm
○ 500000 Nm

31. Which one of the following aerofoil sections is appropriate for vertical tail. * 1 point

*Mark only one oval.*

○ NACA 2312
○ NACA 0012
○ NACA 65-415
○ Clarke Y Profile

32. Yawing moment due to Asymmetric thrust is 50kNm Determine the Yawing moment due to rudder deflection to maintain zero sideslip at 100 m/s in level flight at sea level with one engine completely out. * 2 points

*Mark only one oval.*

○ 50000 kNm
○ 50 kNm
○ 0.5 kNm
○ 0.05 kNm

33. The slope of static directional stability curve is 0.012, Sideslip angle due to cross wind is 7.9696°, Yawing moment coefficient due to rudder deflection is -0.0072 per degree * 2 points

*Mark only one oval.*

○ The rudder should be deflected to left 13.28 degrees
○ The rudder should be deflected to right13.28 degrees
○ The elevator and aileron should be deflected to up13.28 degrees
○ The rudder should be kept as Zero degree

34. Estimate the rolling moment due to rolling at 20rpm at low incidence. The wing span of rectangular wing is 1.75 m and chord is 0.3 m is tested in a wind tunnel at a speed of 30 m/s. Assume, the lift curve slope of wing is 4.5 per radian. * 2 points

*Mark only one oval.*

○ 18.55 Nm
○ 23.18 Nm
○ 37.66 Nm
○ 14.55 Nm

35. Find the lift curve slope of wing. Given that ao = 0.1 and aspect ratio for the wing is 4 * 2 points

*Mark only one oval.*

○ 0.09921
○ 0.09995
○ 0.04847
○ 0.04245

36. The roots of the characteristic equation is -0.32, -0.689 and -0.5±2.5i, the non dimensional time is 3.7 air sec. Find the period of oscillation and the time to halften the oscillation. * 2 points

*Mark only one oval.*

○ 1.5 s and 9.29 s
○ 42.02 s and 1.5 s
○ 9.29 s and 5.12 s
○ 5.12 s and 42.02 s

37. The characteristic equation is given as λ^4 + 5.05λ^3 + 13.15 λ^2 + 0.6 λ + 0.5 = 0, then the system becomes * 2 points

*Mark only one oval.*

○ Stable
○ Unstable

38. The characteristic equation for lateral-directional dynamic stability yielded to the following roots -0.6, -0.0045, and -0.08±1.7i . Find the damping ratio corresponding to Dutch roll mode. * 2 points

*Mark only one oval.*

○ 0.038
○ 0.047
○ 0.054
○ 0.039

39. A Light airplane develops a physical oscillation which is allowed to persist. the speed is found to vary from 96 to 99 kmph. Estimate the period of oscillation and the vertical amplitude. * 2 points

*Mark only one oval.*

○ 10.07 s and 4.4646 m
○ 10.07 s and 2.2646 m
○ 12.07 s and 2.2646 m
○ 12.07 s and 4.4646 m

40. The damping ratio in phugoid motion for gliders is usually less compared to powered aircraft because * 1 point

*Mark only one oval.*

○ gliders are unpowered.
○ gliders are light.
○ lift to drag ratio is higher for gliders.
○ gliders fly at low speed.

41. The pitch angle and the angle of attack for a fixed wing aircraft are equal during * 1 point

*Mark only one oval.*

○ wings level constant altitude flight
○ unaccelerated climb
○ unaccelerated descent
○ landing

---

42. Which one of the following is the most stable configuration of an airplane in roll? * 1 point

*Mark only one oval.*

○ Sweep back, anhedral and low wing
○ Sweep forward, dihedral and low wing
○ Sweep forward, anhedral and high wing
○ Sweep back, dihedral and high wing

43. In most airplanes, the Dutch roll mode can be excited by applying * 1 point

*Mark only one oval.*

○ a step input to the elevators
○ a sinusoidal input to the aileron
○ a step input to the rudder
○ an impulse input to the elevators

44. In an aircraft, elevator control effectiveness determines * 1 point

*Mark only one oval.*

○ turn radius
○ rate of climb
○ forward-most location of the centre of gravity
○ aft-most location of the centre of gravity

---

45. In an aircraft, the dive manoeuvre can be initiated by * 1 point

*Mark only one oval.*

○ reducing the engine thrust alone
○ reducing the angle of attack alone
○ generating a nose down pitch rate
○ increasing the engine thrust alone

46. The change in pitching moment coefficient with wing incidence is * 1 point

*Mark only one oval.*

○ stability derivative which represents the stiffness in pitch
○ stability derivative which represents the damping in pitch
○ control derivative in pitch
○ positive for an airplane that is stable in pitch

47. An unswept wing with fixed wing aircraft has a large roll stability if the wing is placed 1 point

*Mark only one oval.*

○ Low on the fuselage and has negative dihedral angle
○ Low on the fuselage and has positive dihedral angle
○ high on the fuselage and has negative dihedral angle
○ high on the fuselage and has positive dihedral angle

48. A wing rock is a aircraft motion has a property of 1 point

*Mark only one oval.*

○ Coupled roll yaw combinations
○ Velocity remains constant
○ Angle of attack remains constant
○ Roll oscillations

---

49. The primary function of the fin in the vertical tail of an aircraft is to * 1 point

*Mark only one oval.*

○ Yaw control
○ Yaw stability
○ Roll damping
○ Roll stability

# Assessment

76 responses

Publish analytics

## AE8501 - FLIGHT DYNAMICS

### Full Name

76 responses

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S.JEEVIKA

lavanya.S

Kamaleshwari.V

PRASATH S.V

Sain Aaryan Shravan

Mukunth solagar

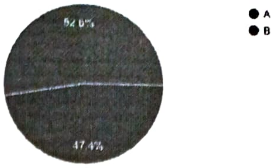
P S VISHNU KARTHIKEYAN

Mahathir Mohamed

---

### Section

76 responses



### Register Number

76 responses

721418101031

721418101042

721418101034

721418101057

721418101303

721418101048

721418101082

721418101043

721418101040

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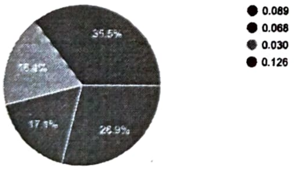
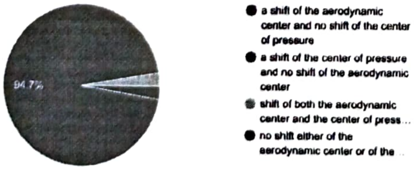
### The moment about the aerodynamic centre, Cm,acw is -0.162, Tail Volume ratio is 0.48 and Tail lift coefficient is -0.1934 and the lift coefficient to trim the airplane is 2.306. Find the distance between the CG and the Aerodynamic centre.

76 responses



### For a constant free stream velocity and density, a change in lift for a large aspect ratio straight wing with thin cambered aerofoil sections at small angle of attack leads to

76 responses



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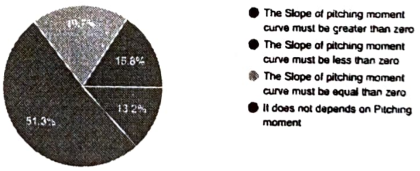
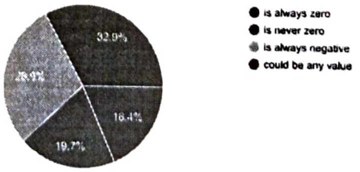
### The condition for static Longitudinal stability is

76 responses



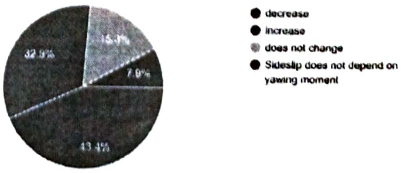
### If an aircraft is performing a positive yawing manoeuvre, the side slip angle

76 responses



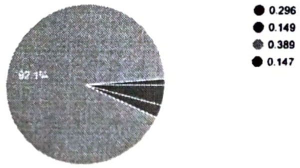
### A positive yawing moment tends to ___________ sideslip disturbances

76 responses



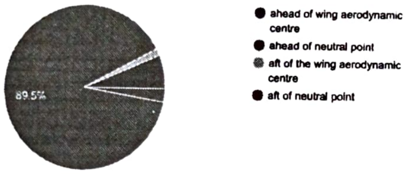
The airplane has the following characteristics. Xacw = 0.24c, Xcg=0.41c, Lift curve slope of wing is 3.6, Changes in tail lift w.r.t. tail incidence is 3.0, Changes in tail lift w.r.t. elevator deflection is 1.5, effect of downwash angle with wing incidence is 0.4, changes in elevator angle for a change of Lift coefficient is 10 degree. find the tail volume coefficient.

76 responses



For an airplane to be statically stable, its centre of gravity must always be

76 responses



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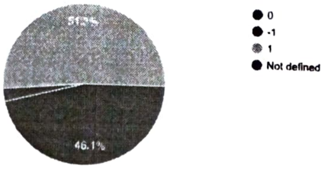
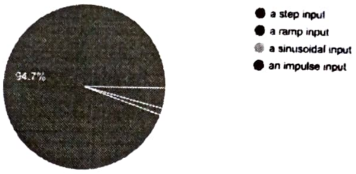
The vertical ground load factor on a stationary aircraft parked in its hangar is

76 responses



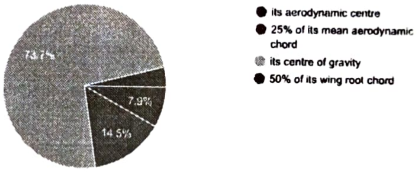
In an aircraft, constant roll rate can be produced using ailerons by applying

76 responses



An aircraft in trimmed condition has zero pitching moment at

76 responses



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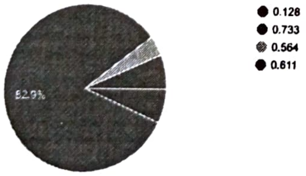
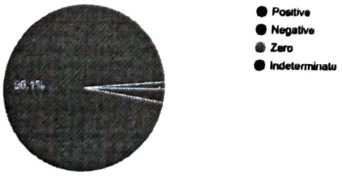
Find the lift coefficient for an airplane such that the lift curve slope of wing is 2.8 per radian and the wing incidence is 15 degree

76 responses



The pitching moment of a positively cambered NACA airfoil about its leading edge at zero-lift angle of attack is

76 responses



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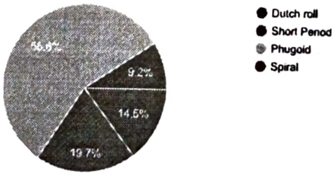
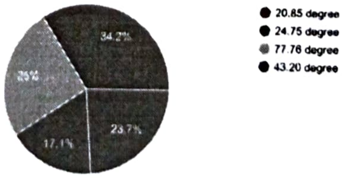
Which one of the following modes of a stable aircraft has non oscillatory response characteristics

76 responses



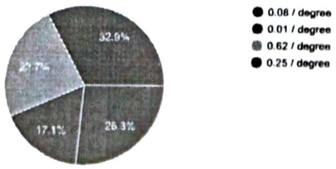
The change in downwash angle with lift coefficient is 0.18 and the lift coefficient is 2.4 which includes flap deflection. Due to flap deflection, the lift coefficient is 0.8. The reduction in downwash due to ground effect is 3.9. calculate the effect of downwash with ground effect.

76 responses



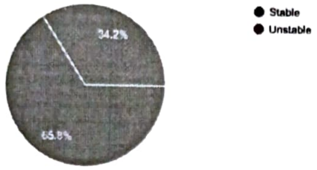
An airplane with symmetric aerofoil was tested in a wind tunnel and estimated pitching moment coefficient about CG to be 0.1 and 0 at +5° and -5°. Find the elevator control Power.

76 responses



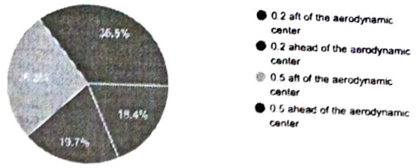
For a propeller driven aircraft with high wing configuration, if the CG lies above the propeller axis, the aircraft becomes

76 responses



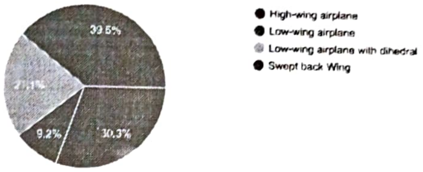
For an airplane the tail volume ratio is 0.45 lift curve slope of wing is 4.4 per radian, tail lift curve slope is 3 per radian, and the change of downwash angle with wing incidence is 0.35. Find the location of CG.

76 responses



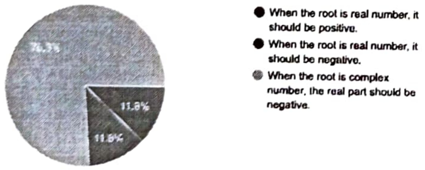
Which one does not contributes the static lateral stability

76 responses



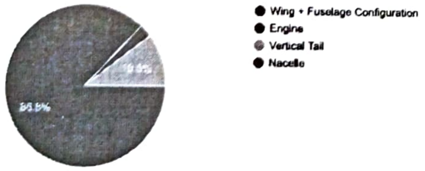
Which statement is wrong, for an equilibrium state to be dynamically stable, the roots of the characteristic equation have to be one of the following two types.

76 responses



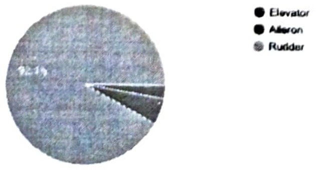
Which component Contribute towards Cnβ

76 responses



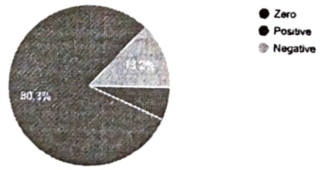
Directional control is primarily achieved by

76 responses



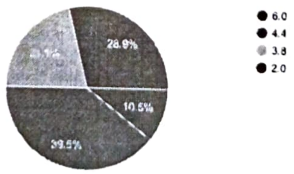
If a rudder is deflected to port side, a positive side force is generated by vertical tail. This side force creates a ___________yawing moment

76 responses



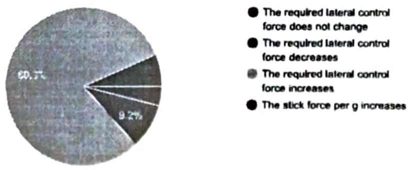
The positive manoeuvering limit load factor for a light airplane in the utility category in the clean flight configuration is

76 responses



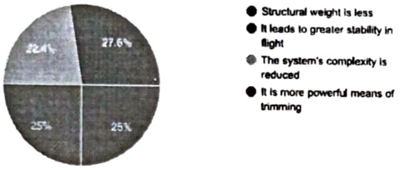
Which statement is correct for a side slip condition at constant speed and side slip angle, where the geometrical dihedral of an airplane is increased.

76 responses



One advantage of movable stabilizer system compared with fixed stabilizer system is that

76 responses



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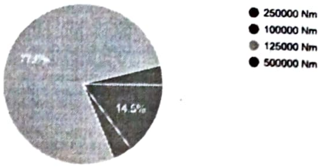
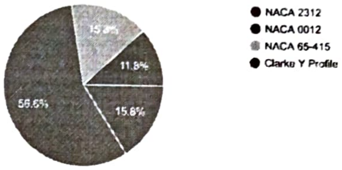
A twin engine aircraft producing a thrust of 25 kN per engine and the span distance between two engines is 10 m. Calculate the yawing moment developed due to asymmetric thrust.

76 responses



Which one of the following aerofoil sections is appropriate for vertical tail.

76 responses



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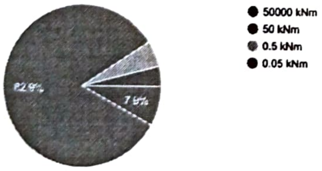
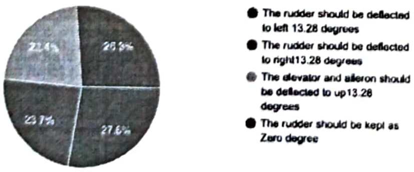
Yawing moment due to Asymmetric thrust is 50kNm Determine the Yawing moment due to rudder deflection to maintain zero sideslip at 100 m/s in level flight at sea level with one engine completely out.

76 responses



The slope of static directional stability curve is 0.012, Sideslip angle due to cross wind is 7.9696°, Yawing moment coefficient due to rudder deflection is -0.0072 per degree

76 responses



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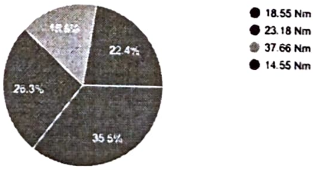
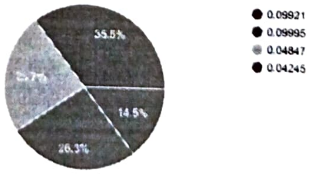
Estimate the rolling moment due to rolling at 20rpm at low incidence. The wing span of rectangular wing is 1.75 m and chord is 0.3 m is tested in a wind tunnel at a speed of 30 m/s. Assume, the lift curve slope of wing is 4.5 per radian.

76 responses



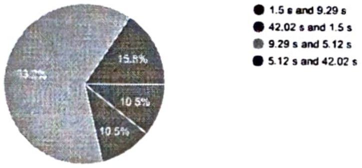
Find the lift curve slope of wing. Given that ao = 0.1 and aspect ratio for the wing is 4

76 responses



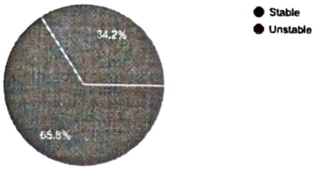
The roots of the characteristic equation is -0.32, -0.689 and -0.5±2.5i, the non dimensional time is 3.7 air sec. Find the period of oscillation and the time to halften the oscillation.

76 responses



The characteristic equation is given as λ^4 + 5.05λ^3 + 13.15 λ^2 + 0.6 λ + 0.5 = 0, then the system becomes

76 responses



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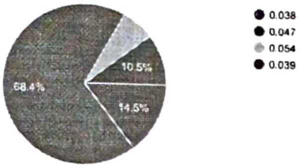
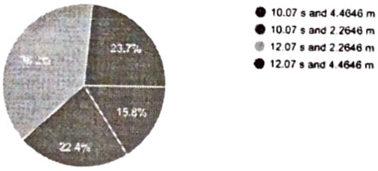
The characteristic equation for lateral-directional dynamic stability yielded to the following roots -0.6, -0.0045, and -0.08±1.7i . Find the damping ratio corresponding to Dutch roll mode.

76 responses



A Light airplane develops a physical oscillation which is allowed to persist. the speed is found to vary from 96 to 99 kmph. Estimate the period of oscillation and the vertical amplitude.

76 responses



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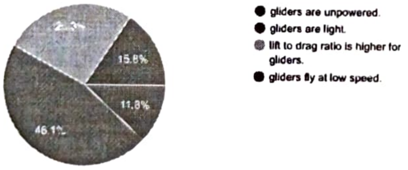
The damping ratio in phugoid motion for gliders is usually less compared to powered aircraft because

76 responses



The pitch angle and the angle of attack for a fixed wing aircraft are equal during

76 responses

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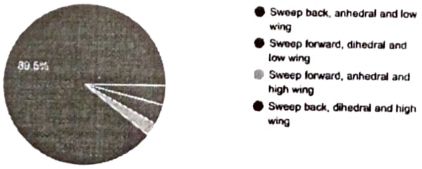
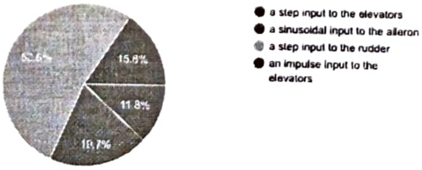
Which one of the following is the most stable configuration of an airplane in roll?

76 responses



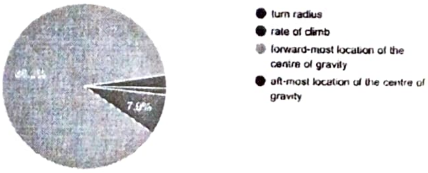
In most airplanes, the Dutch roll mode can be excited by applying

76 responses



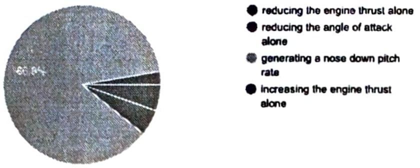
In an aircraft, elevator control effectiveness determines

76 responses



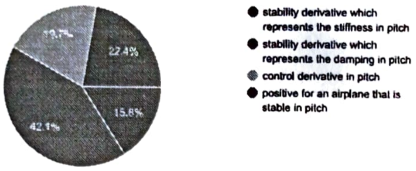
In an aircraft, the dive manoeuvre can be initiated by

76 responses



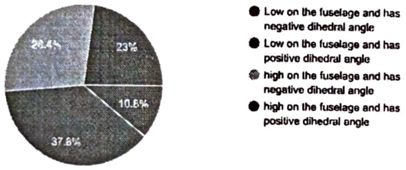
The change in pitching moment coefficient with wing incidence is

76 responses



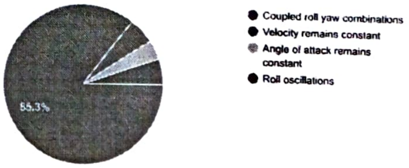
An unswept wing with fixed wing aircraft has a large roll stability if the wing is placed

74 responses



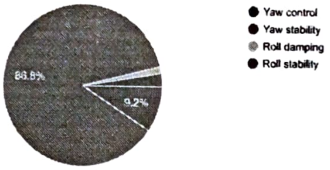
A wing rock is a aircraft motion has a property of

75 responses



The primary function of the fin in the vertical tail of an aircraft is to

76 responses



## NEHRU INSTITUTE OF ENGINEERING AND TECHNOLOGY

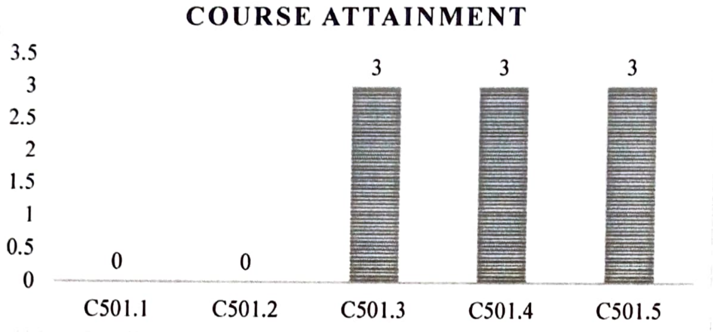
**COIMBATORE - 641105.**

**MICRO ANALYSIS FOR THE COURSE**

**Name of the Department** : Department of Aeronautical Engineering
**Course Name** : Flight Dynamics
**Course Code** : AE8501
**Class /Sem** : III/V B
**Internal Test** : III

| | | CO's | Part A 30 x 1 = 30 | | | Part B 15 x 2 = 30 | | | | | | Out of 60 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | C501.3 | C501.4 | C501.5 | C501.3 | C501.4 | C501.5 | C501.3 | C501.4 | C501.5 | | |
| | | | 9 | 12 | 9 | 14 | 8 | 8 | 23 | 20 | 17 | 60 | 100 |
| S.No | Reg No | Name of the Student | | | | | | | | | | | |
| 1 | 721418101003 | Akhilesh.S.J | 9 | 10 | 5 | 11 | 8 | 5 | 20 | 18 | 10 | 48 | 80 |
| 2 | 721418101008 | Bagavath Pandi.v | 9 | 11 | 9 | 13 | 8 | 8 | 22 | 19 | 16 | 57 | 95 |
| 3 | 721418101009 | K.balaji | 9 | 11 | 7 | 13 | 9 | 6 | 22 | 20 | 13 | 54 | 90 |
| 4 | 721418101010 | Balamurugan p | 9 | 11 | 7 | 13 | 8 | 7 | 22 | 19 | 14 | 54 | 90 |
| 5 | 721418101011 | Bhuvaneshwaran.D | 9 | 11 | 9 | 13 | 8 | 8 | 22 | 19 | 16 | 57 | 95 |
| 6 | 721418101015 | DHILIP.P | 9 | 12 | 9 | 14 | 8 | 8 | 22 | 19 | 16 | 58 | 97 |
| 7 | 721418101016 | DHUVYA.A.R | 9 | 12 | 9 | 14 | 8 | 8 | 22 | 19 | 16 | 58 | 97 |
| 8 | 721418101017 | Dinesh Kumar M | 8 | 11 | 8 | 13 | 7 | 7 | 21 | 18 | 15 | 54 | 90 |
| 9 | 721418101018 | Donin J Njarathadam | 7 | 12 | 8 | 13 | 7 | 7 | 20 | 19 | 15 | 54 | 90 |
| 10 | 721418101020 | A Garry kiristen | 9 | 12 | 9 | 14 | 8 | 8 | 23 | 20 | 17 | 59 | 98 |
| 11 | 721418101025 | Hariharan R | 8 | 11 | 8 | 13 | 8 | 6 | 21 | 19 | 14 | 54 | 90 |
| 12 | 721418101026 | Hariharan S | 9 | 12 | 9 | 14 | 8 | 8 | 23 | 20 | 17 | 59 | 98 |
| 13 | 721418101029 | Harishma Priyadharshini | 8 | 11 | 8 | 13 | 6 | 8 | 21 | 17 | 16 | 54 | 90 |
| 14 | 721418101031 | S.JEEVIKA | 8 | 11 | 8 | 13 | 7 | 7 | 21 | 18 | 15 | 54 | 90 |
| 15 | 721418101032 | Jegan.m | 7 | 12 | 9 | 13 | 8 | 8 | 20 | 20 | 17 | 57 | 95 |
| 16 | 721418101034 | Kamaleshwari.V | 9 | 12 | 9 | 14 | 8 | 8 | 22 | 19 | 16 | 58 | 97 |
| 17 | 721418101039 | k.krishna gopal | 8 | 11 | 9 | 13 | 7 | 7 | 21 | 18 | 16 | 56 | 93 |
| 18 | 721418101041 | Kuthala Aishwarya K | 9 | 11 | 9 | 13 | 8 | 8 | 22 | 19 | 16 | 57 | 95 |
| 19 | 721418101042 | lavanya.S | 8 | 10 | 8 | 14 | 8 | 6 | 22 | 18 | 14 | 54 | 90 |
| 20 | 721418101043 | Mahathir Mohamed | 8 | 11 | 8 | 13 | 7 | 7 | 21 | 18 | 16 | 55 | 92 |
| 21 | 721418101044 | MANOJ E | 9 | 12 | 9 | 14 | 8 | 8 | 23 | 20 | 17 | 59 | 98 |
| 22 | 721418101046 | Mohamed rajik M | 9 | 12 | 8 | 13 | 8 | 8 | 22 | 20 | 16 | 57 | 95 |
| 23 | 721418101049 | Naveen kumar.V | 8 | 11 | 8 | 13 | 8 | 7 | 21 | 19 | 15 | 56 | 93 |
| 24 | 721418101050 | Nigamanth Girish Seshadri | 9 | 12 | 9 | 14 | 8 | 8 | 22 | 19 | 16 | 58 | 97 |
| 25 | 721418101054 | Pragadeesh S | 9 | 11 | 9 | 13 | 8 | 8 | 22 | 19 | 16 | 57 | 95 |
| 26 | 721418101057 | PRASATH S.V. | 7 | 8 | 5 | 14 | 6 | 8 | 21 | 14 | 13 | 48 | 80 |
| 27 | 721418101059 | PRAVIN G | 9 | 12 | 9 | 14 | 8 | 8 | 23 | 20 | 17 | 59 | 98 |
| 28 | 721418101063 | Rajaselvam S | 7 | 11 | 6 | 13 | 5 | 6 | 20 | 16 | 12 | 48 | 80 |
| 29 | 721418101064 | Rakesh B | 9 | 11 | 9 | 14 | 7 | 8 | 23 | 18 | 16 | 57 | 95 |
| 30 | 721418101067 | Sakthivel P | 9 | 12 | 9 | 14 | 8 | 8 | 23 | 20 | 17 | 59 | 98 |
| 31 | 721418101068 | SANTHOSH A | 8 | 11 | 8 | 13 | 8 | 8 | 22 | 19 | 16 | 56 | 94 |
| 32 | 721418101069 | Saran V | 6 | 12 | 9 | 14 | 8 | 8 | 20 | 20 | 17 | 56 | 94 |
| 33 | 721418101074 | srihari chandran | 8 | 11 | 9 | 13 | 8 | 6 | 21 | 19 | 15 | 55 | 92 |
| 34 | 721418101075 | Steeve caleb. J | 9 | 11 | 9 | 13 | 8 | 8 | 22 | 19 | 16 | 57 | 95 |
| 35 | 721418101079 | Vignesh. M | 9 | 11 | 9 | 13 | 8 | 8 | 22 | 19 | 16 | 57 | 95 |
| 36 | 721418101080 | V.VIGNESHWARAN | 7 | 10 | 7 | 11 | 6 | 6 | 18 | 16 | 14 | 48 | 80 |
| 37 | 721418101083 | Vishnu rohith k | 9 | 12 | 9 | 14 | 8 | 8 | 22 | 19 | 16 | 58 | 97 |
| 38 | 721418101303 | Sain Aaryan Shravan | 9 | 12 | 9 | 14 | 8 | 8 | 22 | 19 | 16 | 58 | 97 |
| 39 | 721418101501 | Bala Murugan A | 9 | 12 | 9 | 14 | 8 | 8 | 22 | 19 | 16 | 58 | 97 |
| 40 | 721418101502 | Mohamed abul haier .i | 9 | 12 | 9 | 14 | 8 | 8 | 23 | 20 | 17 | 59 | 98 |

| | C501.3 | C501.4 | C501.5 |
|---|---|---|---|
| No of Students scored set attainment level | 40 | 40 | 40 |
| % of Students scored set attainment level | 100 | 100 | 100 |
| Level of Attainment | 3 | 3 | 3 |



| CO | Observations |
|---|---|
| ***C501.1*** | |
| ***C501.2*** | |
| ***C501.3*** | Target Attained |
| ***C501.4*** | Target Attained |
| ***C501.5*** | Target Attained |

**Course Instructor** **IQAC** **HOD**

# NEHRU INSTITUTE OF ENGINEERING AND TECHNOLOGY

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NBA Accredited UG Courses: AERO, MECH, CSE

## AE8501 – Flight Dynamics – Internal Exam – III Mark statement

### III YEAR / V th SEMESTER

| Sl. No | Register Number | Name of the Student | Marks |
|---|---|---|---|
| 1 | 721418101003 | AKILESH S J | 80 |
| 2 | 721418101008 | BAGAVATH PANDI V | 95 |
| 3 | 721418101009 | BALAJI K | 90 |
| 4 | 721418101010 | BALAMURUGAN P | 90 |
| 5 | 721418101011 | BHUVANESHWARAN D | 95 |
| 6 | 721418101015 | DHILIP P | 97 |
| 7 | 721418101016 | DHUVYA A R | 97 |
| 8 | 721418101017 | DINESH KUMAR M | 90 |
| 9 | 721418101018 | DONIN J NJARATHADAM | 90 |
| 10 | 721418101020 | GARRY KIRISTEN A | 98 |
| 11 | 721418101025 | HARIHARAN R | 90 |
| 12 | 721418101026 | HARIHARAN S | 98 |
| 13 | 721418101029 | HARISHMA PRIYADHARSHINI A | 90 |
| 14 | 721418101032 | JEGAN M | 90 |
| 15 | 721418101034 | KAMALESHWARI V | 95 |
| 16 | 721418101036 | KARTHICK RAJA M | 97 |
| 17 | 721418101039 | KRISHNAGOPAL G K | 93 |
| 18 | 721418101041 | KUTHALA AISHWARYA K | 95 |
| 19 | 721418101042 | LAVANYA S S | 90 |
| 20 | 721418101043 | MAHATHIR MOHAMED M | 92 |
| 21 | 721418101044 | MANOJ E | 98 |
| 22 | 721418101046 | MOHAMED RAJIK M | 95 |
| 23 | 721418101049 | NAVEEN KUMAR V | 93 |
| 24 | 721418101050 | NIGAMANTH GIRISH SESHADRI | 97 |
| 25 | 721418101054 | PRAGADEESH S | 95 |
| 26 | 721418101057 | PRASATH SV | 80 |
| 27 | 721418101059 | PRAVIN G | 98 |
| 28 | 721418101062 | PRIYA HARSHINI S | 80 |
| 29 | 721418101063 | RAJASELVAM S | 95 |
| 30 | 721418101064 | RAKESH B | 98 |
| 31 | 721418101067 | SAKTHIVEL P | 94 |
| 32 | 721418101068 | SANTHOSH A | 94 |
| 33 | 721418101069 | SARAN V | 92 |
| 34 | 721418101074 | SRIHARI C | 95 |
| 35 | 721418101075 | STEEVE CALEB J | 95 |
| 36 | 721418101080 | VIGNESHWARAN V | 80 |
| 37 | 721418101083 | VISHNU ROHITH K | 97 |
| 38 | 721418101303 | SAIN AARYAN SINGH | 97 |
| 39 | 721418101501 | BALAMURUGAN A | 97 |
| 40 | 721418101502 | MOHAMMED ABUL HAIER | 98 |

Course Instructor

IQAC

HoD

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## DEPARTMENT OF AERONAUTICAL ENGINEERING

## Assignment No 1

Course Instructor: J. Karthikeyan Date: 2020-06-21
Topic: Forces and moments acting on an airplane and Types of drag forces
Class / Sem:III / V Max. Marks: 15

1. Explain the six degrees of freedom of an aircraft. (5 Marks)
2. Explain the different types of drag forces acting on an aircraft. (10 Marks)

Last Date of Submission: 2020-06-29

[A. R. Bhuvya. B-07]

## 1) Forces and moments acting on an airplane:

Let x, y and z are the forces acting about ox, oy, and oz respectively.

Let L', M, and N are the moments acting ox, oy and oz respectively.

Rolling motion occurs about x-axis and the associative variable is the 'p' - roll rate.

The force acting along x-axis is the axial force and is given by

$$X = Q_\infty . S . C_x \rightarrow ①$$

The force acting along y-axis is the side force and is given by

$$Y = Q_\infty . S . C_y \rightarrow ②$$

$$Z = Q_\infty . S . C_z \rightarrow ③ .$$

The moment about x-axis rolling moment and is given by.

$$L' = Q_\infty . S . b . C_{L}' \rightarrow ④ .$$

The moment y-axis pitching moment.

$$M = Q_\infty S . \bar{c}\ C_m \rightarrow ⑤$$

The moment about Z-axis yawing moment

$$'' \quad C . b\ C_N \rightarrow ⑥$$

$Q_\infty$ → dynamic pressure = $\frac{1}{2} \rho_\infty V_\infty^2$

S → Wing planform area.

b → wing span.

$\bar{c}$ → Mean dynamic chord of the wing.

$C_x$ → Axial ~~flo~~ force coefficient

$C_y$ → side force coefficient

$C_z$ → Normal force cofficient

$C_L'$ → Rolling moment cofficient

$C_m$ → pitching moment cofficient

$C_N$ → Yawing moment coffecient

---

2) Drag :-

It is the resistance force offered by a body when it is in motion.

$D = Q. S. Cd.$

Types of drag:

Drag
- parasite drag
  - profile drag
    - pressure drag
    - skin friction drag.
  - Interferrance drag
- Induced drag
- wave drag

Parasite drag :-

It is the position of total drag associated with skinfriction and pressure drag due to separation drag due to integrated over the complete airplane surface. It includes interferance drag.

The factors affecting the parasite drag,

The most streamlined an object, the less parasite drag force.

The mass density of air moving part of the airplane, greater the parasite drag force.

As the speed increases, greater the parasite drag.

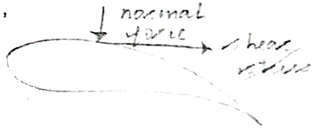
Profile drag :-

Sum of pressure drag and the sk. friction drag. It is otherwise called as section drag.

Pressure drag :-

It is also called as form drg.

It is caused by the frontal area of the airplane components being exposed by the airstream.



$Cdf = Cdo \times \frac{S}{S_{wetted}}$

Cdo → zero lift drag coefficient.

S → surface area of wing.

Swetted → wetted surface area of wing.

Induced drag :-

The pressure difference between the upper and the lower surfaces of the wing result.

Induced drag is a direct result of wing tip vortices greater the angle of attack, greater the lift develops and greater in the induced drag.

$$C_{DI} = \frac{C_L^2}{\pi \cdot e \cdot AR}$$ e → Oswald's efficiency factor.

$$e = \frac{1.1\left[\frac{dC_L}{d\alpha} / AR\right]}{R\left[\frac{dC_L}{d\alpha} / AR\right] + (1-R)\pi}.$$

This above equation for calculation e is applicable for twisted, swept back wings with straight tapered planform.

$e$ theoretical $= 1/1+8$.

$$\frac{dC_L}{d\alpha} = \frac{2\pi \cdot AR}{2 + \sqrt{\frac{AR^2 + \beta^2}{K^2}\left(1 + \frac{\tan^2 \Lambda_{1/2}}{\beta^2}\right) + 4}}$$

$\beta = \sqrt{1 - M^2_\infty}$, $\Lambda_{1/2}$ → sweep of semichord line.

$K = \frac{dC_L}{d\alpha} / 2\pi \approx 1$ / taken as unity)

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## DEPARTMENT OF AERONAUTICAL ENGINEERING
## Assignment No 2

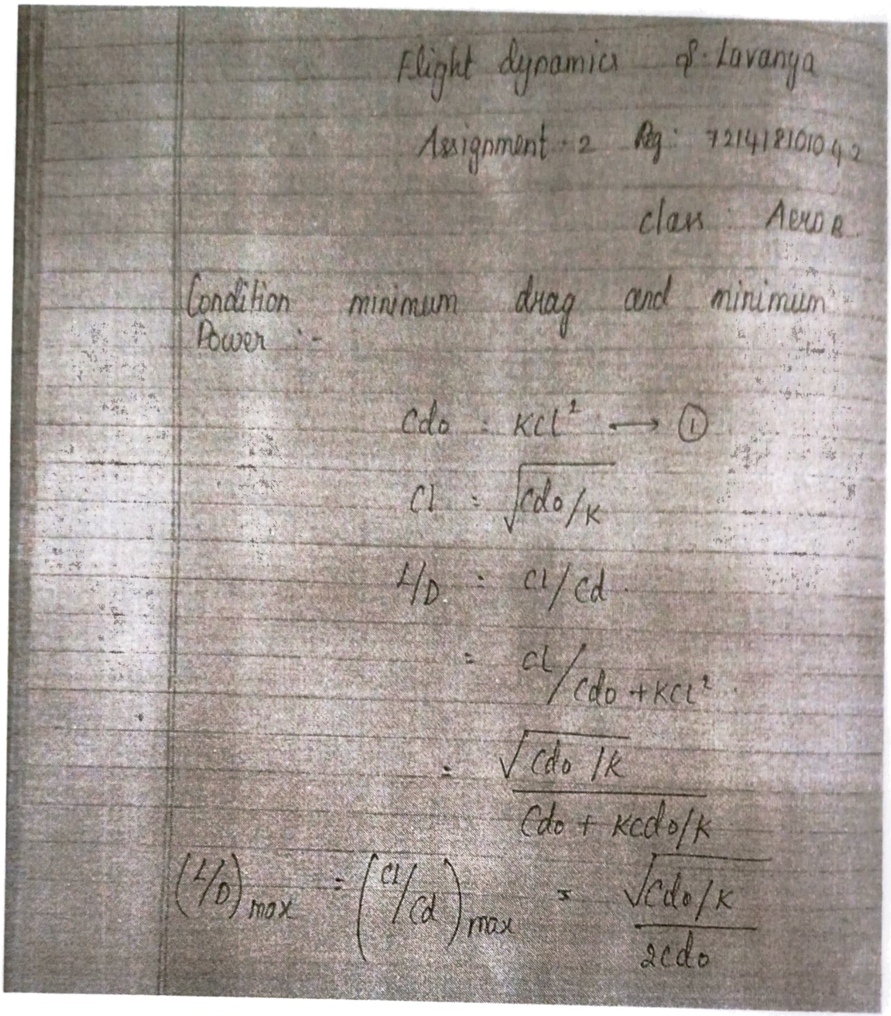
Course Instructor: J. Karthikeyan
Topic: Drag Polar, Power Required and Thrust Required
Class / Sem: III / V

Date: 2020-07-06

Max. Marks: 15

1. Explain the conditions for minimum power and minimum drag. (10 marks)
2. Draw the drag polar curve and explain how to obtain the maximum of L/D ratio. (5 Marks)

Last Date of Submission: 2020-07-18



Flight dynamics  S. Lavanya

Assignment 2  Reg: 721418101042

class: Aero B

Condition minimum drag and minimum Power :-

$$C_{do} = KC_l^2 \longrightarrow ①$$

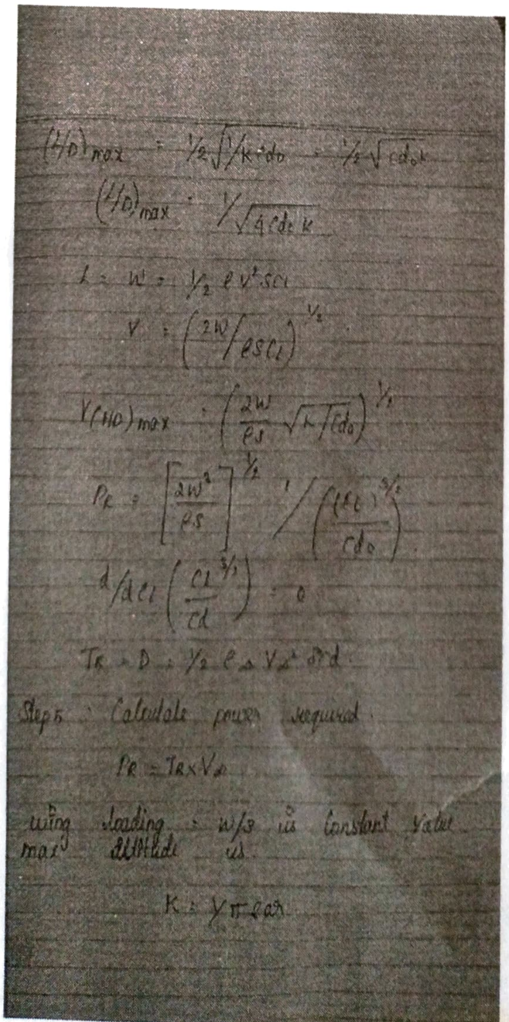
$$C_l = \sqrt{C_{do}/K}$$

$$L/D = C_l/C_d$$

$$= C_l / C_{do} + KC_l^2$$

$$= \frac{\sqrt{C_{do}/K}}{C_{do} + KC_{do}/K}$$

$$(L/D)_{max} = (C_l/C_d)_{max} = \frac{\sqrt{C_{do}/K}}{2C_{do}}$$



$$(L/D)_{max} = \tfrac{1}{2}\sqrt{1/K \cdot do} = \tfrac{1}{2}\sqrt{C_{do}K}$$

$$(L/D)_{max} = 1/\sqrt{4C_{do}K}$$

$$L = W = \tfrac{1}{2}\rho V^2 S C_l$$

$$V = \left(2W/\rho S C_l\right)^{1/2}$$

$$V_{(L/D)max} = \left(\frac{2W}{\rho S}\sqrt{K/C_{do}}\right)^{1/2}$$

$$P_R = \left[\frac{2W^2}{\rho S}\right]^{1/2} 1 \Big/ \left(\frac{(C_l)}{C_{do}}\right)^{3/2}$$

$$d/dC_l\left(\frac{C_l^{3/2}}{C_d}\right) = 0$$

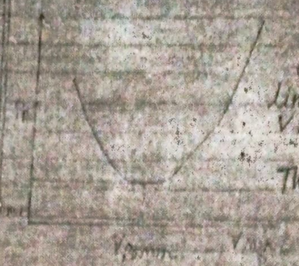
$$T_R = D = \tfrac{1}{2}\rho_\infty V_\infty^2 S C_d$$

Step 5 : Calculate power required.

$$P_R = T_R \times V_\infty$$

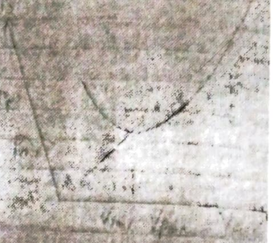
wing loading : W/S is constant value
max altitude is

$$K = 1/\pi e AR$$



draw a tangent line parallel to Vmin power required

Thrust is on Velo



Vpr min < Vmax

$P = TV_\infty$

analytical approach

$P_R = T_R \times V_\infty$

$T_R = W / L/D$

$P_R = W / L/D \times V_\infty$

$P_R = \frac{W}{C_L/C_d} \times V_\infty$

$L = W = \frac{1}{2} \rho_\infty V_\infty^2 S C_L$

$L/D = q_\infty C_L / q_\infty S C_d$

$L/D = C_L / C_d$

---

$$= \frac{(3 C_{d_0} / K)^{3/4}}{4 C_{d_0}}$$

$$\left(C_L^{3/2} / C_d\right)_{max} = \left(\frac{3 \quad C_{d_0}}{K \cdot C_{d_0}^{4/3}}\right)^{3/4} \quad 1/4$$

$$\left(\frac{C_L^{3/2}}{C_d}\right)_{max} = \frac{1}{4}\left[\frac{3}{K C_{d_0}^{1/3}}\right]^{3/4}$$

$$V_\infty = \left[\frac{2W}{\rho S C_L}\right]^{1/2}$$

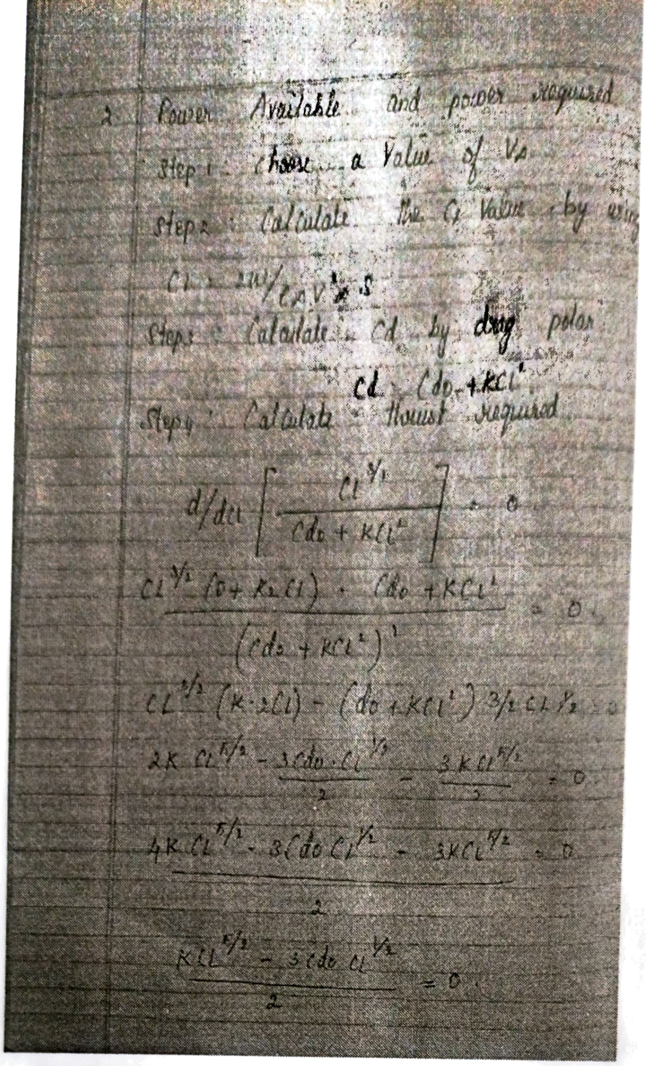
$$\left(C_L^{3/2} / C_d\right)_{max} \left[\frac{2W}{\rho S} \sqrt{K / 3 C_{d_0}}\right]^{1/2}$$

$$V_{PR\,min} = \left(\frac{1}{3}\right)^{1/4} \left(\frac{2W}{\rho S} \sqrt{K / C_{d_0}}\right)^{1/2}$$

$V_{PR\,min} = 0.769 \; V_D\,min$

$= 0.769 \; V(L/D)_{max}$

$V_D\,min = 1.32 \; V_{PR}\,min$



2 Power Available and power required

Step 1 : choose a Value of $V_\infty$

Step 2 : Calculate the $C_L$ Value by using

$$C_L = 2W / \rho_\infty V_\infty^2 \times S$$

Step 3 : Calculate $C_d$ by drag polar

$$C_d = C_{d0} + KC_L^2$$

Step 4 : Calculate thrust required

$$d/dC_L \left[ \frac{C_L^{3/2}}{C_{d0} + KC_L^2} \right] = 0$$

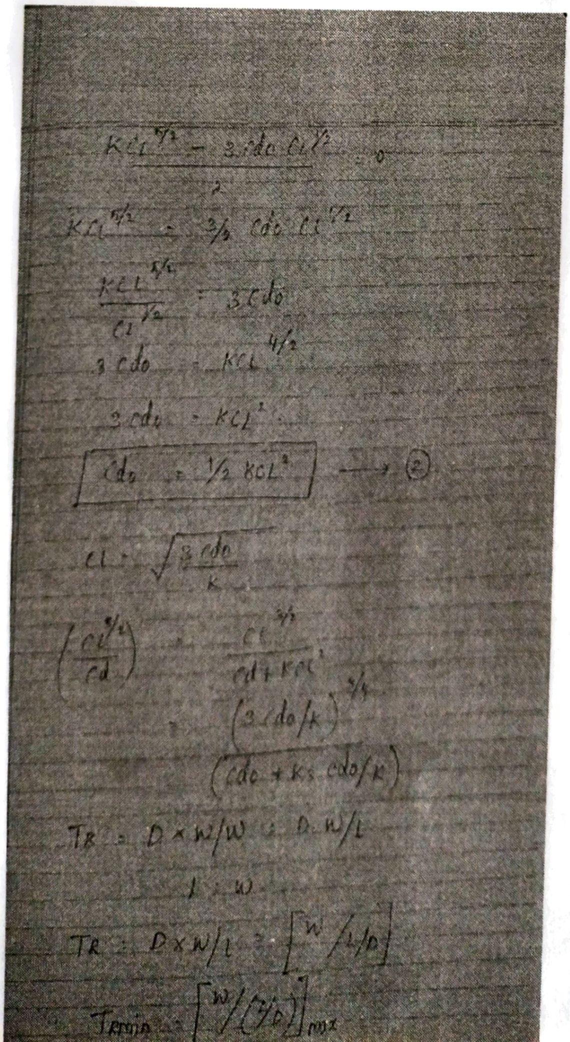
$$\frac{C_L^{3/2}(0 + K 2 C_L) - C_{d0} + KC_L^2}{(C_{d0} + KC_L^2)^2} = 0$$

$$C_L^{3/2}(K \cdot 2C_L) - (C_{d0} + KC_L^2)\, 3/2\, C_L^{1/2} = 0$$

$$2K C_L^{5/2} - \frac{3C_{d0} \cdot C_L^{1/2}}{2} - \frac{3KC_L^{5/2}}{2} = 0$$

$$\frac{4K C_L^{5/2} - 3C_{d0} C_L^{1/2} - 3KC_L^{5/2}}{2} = 0$$

$$\frac{KC_L^{5/2} - 3C_{d0} C_L^{1/2}}{2} = 0$$



$$\frac{KC_L^{5/2} - 3C_{d0} C_L^{1/2}}{2} = 0$$

$$KC_L^{5/2} = 3/2\; C_{d0} C_L^{1/2}$$

$$\frac{KC_L^{5/2}}{C_L^{1/2}} = 3C_{d0}$$

$$3C_{d0} = KC_L^{4/2}$$

$$3C_{d0} = KC_L^2$$

$$\boxed{C_{d0} = 1/2\, KC_L^2} \longrightarrow ②$$

$$C_L = \sqrt{\frac{3C_{d0}}{K}}$$

$$\left(\frac{C_L^{3/2}}{C_d}\right) = \frac{C_L^{3/2}}{C_d + KC_L^2} = \frac{(3C_{d0}/K)^{3/4}}{(C_{d0} + K \cdot 3C_{d0}/K)}$$

$$T_R = D \times W/W = D \cdot W/L$$

$$L = W$$

$$T_R = D \times W/L = \left[ W / L/D \right]$$

$$T_{R\min} = \left[ W/(L/D) \right]_{\max}$$

$C_{d0} = KC_L^2$ is first condition

$$C_L = \sqrt{C_{d0}/K}$$

$$R = W = \frac{1}{2}\rho V^2 S C_L$$

$$V = \sqrt{2W/\rho S C_L} \qquad C_L = \sqrt{C_{d0}/K}$$

$$V_{T_R\min} \text{ (or) } V_{(L/D)\max} = \left(\frac{2W}{\rho S} \cdot \sqrt{K/C_{d0}}\right)^{1/2} \longrightarrow (1)$$

$$V_{P_R\min} = \left(\frac{2W}{\rho S}\sqrt{K/3C_{d0}}\right)^{1/2}$$

$$= \left(\frac{1}{3}\right)^{1/4}\left(\frac{2W}{\rho S}\sqrt{K/C_{d0}}\right)^{1/2}$$

$$V_{P_R\min} = 0.759\, V_{T_R\min}$$

$$T_{R\min} = W/(L/D)_{\max}$$

$$V_{T_R\min} = \left(\frac{2W}{\rho S}\sqrt{K/C_{d0}}\right)^{1/2}$$

$$V_{P_R\min} = 0.759\, V_{T_R\min}$$

$$T_{R\min} = W/(L/D)_{\max}$$

$$V_{T_R\min} = \left(\frac{2W}{\rho S}\sqrt{K/C_{d0}}\right)^{1/2}$$

$$C_{d0} = KC_L^2$$

$$T_R = D = \frac{1}{2}\rho V^2 S C_D$$

$$C_D = C_{d0} + KC_L^2$$

$$C_L = (2W/\rho V^2 S)$$

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## AE8501 - FLIGHT DYNAMICS – Assignment – II Mark statement

### III YEAR / V th SEMESTER

| Sl. No | Register Number | Name of the Student | Marks out of 15 |
|---|---|---|---|
| 1 | 721418101003 | AKILESH S J | 15 |
| 2 | 721418101008 | BAGAVATH PANDI V | 15 |
| 3 | 721418101009 | BALAJI K | 15 |
| 4 | 721418101010 | BALAMURUGAN P | 15 |
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## DEPARTMENT OF AERONAUTICAL ENGINEERING

## Assignment No 3

Course Instructor: J. Karthikeyan
Topic: Range, Climbing Performance and Turning Performance
Class / Sem: III / V

Date: 2020-08-13

Max. Marks: 30

1. Define safe range and gross still air range. Obtain the gross still air range in steady level flight for a turboprop airplane flying at a constant speed of 400 kmph at an altitude where density ratio = 0.65, given that: CD = 0.021 + $0.06C_L^2$ ; Gross Weight = 176, 600 N, Weight of fuel = 35, 300 N, S = 90 $m^2$, Propeller efficiency = 0.82, BSFC = 3.90 N/kW - hr. (Marks: 10)
2. An airplane powered by a turbojet engine weighs 180,000 N, has a wing area of 50 m^2 and the drag polar is CD = 0.016 + 0.048 $C_L^2$. At sea level a rate of climb of 1200 m/min is obtained at a speed of 150 m/s. Calculate the rate of climb at the same speed when a rocket motor giving an additional thrust of 10,000 N is fitted to the airplane. (Marks: 10)
3. What are the values of load factor in (a) level flight (b) free fall (c) at point 2 in a turn of radius 200 m at a speed of 100 m/s and (d) at the bottom of a loop of radius 200 m at a speed of 100 m/s? (Marks: 10)

Last Date of Submission: 2020-08-22

Pravin G
T214 18101059.

① * Safe Range is the maximum Distance between two Destinations over which an airplane can carry out a safe, Reliably Regular service with a given amount of fuel.

* Gross still air Range is defined as the horizontal distance covered in which flight Desired straight Path until the fuel is exhausted.

Given:

$V = 400\,kmph$
$\rho = 0.65$
$C_D = 0.021 + 0.06\,C_L^2$
$W_1 = 176,600\,N$
$W_f = 35,300\,N$
$W_2 = W_1 - W_f$
$= 141,300\,N$
$S = 90\,m^2$
$\eta_B = 0.82$
$BSFC = 3.90\,N/kW\text{-}hr$

Solution:

$$R = \frac{8289.3\,\eta_B}{BSFC\,(C_D/C_L)}\ \log_{10}\left(\frac{W_1}{W_2}\right)$$

$$C_L = \sqrt{\frac{C_{D0}}{K}} \ \&\ C_D = 2C_{D0}$$

②

given:

$W = 180,000\,N$
$S = 50\,m^2$
At sea level $\rho = 1.225\,kg/m^3$
$C_D = 0.016 + 0.048\,C_L^2$
$V_c = 1200\,m/min = 20\,m/s$
$V = 150\,m/s$

To find:

Calculate $V_c$ when additional Thrust is applied.

Solution:

$$\sin\gamma = \frac{V_c}{V}$$

$$\sin\gamma = \frac{20}{150}$$

$$\boxed{\sin\gamma = 0.1333}$$

$$\cos\gamma = \sqrt{1-(\sin\gamma)^2}$$

$$\boxed{\cos\gamma = 0.99107}$$

W.K.T

$$L = W\cos\gamma$$

$$= 180,000 \times 0.99107$$

$$\boxed{L = 178392.825\,N}$$

$$C_L = \left(\frac{0.021}{0.06}\right)^{1/2}$$

$$\boxed{C_L = 0.59160}$$

$$C_D = 2C_{D0}$$

$$C_D = 2\times 0.021$$

$$\boxed{C_D = 0.042}$$

$$\frac{C_D}{C_L} = \frac{0.042}{0.59160}$$

$$\boxed{\frac{C_D}{C_L} = 0.070993}$$

Now,

$$R = \frac{8289.3\times 0.82}{3.90\times 0.070993} \times \log\left(\frac{176,600}{141,300}\right)$$

$$= \frac{6,797.226}{0.2768727} \times \log(1.24982)$$

$$= \frac{6797.226 \times 0.096847}{0.2768727}$$

$$= 2,377.6058\,km$$

$$\boxed{R = 2,377.605\,km}$$

$$C_L = \frac{2L}{\rho V^2 S}$$

$$= \frac{2\times 178,392.825}{1.225 \times (50)^2 \times 50}$$

$$\boxed{C_L = 0.258892}$$

W.K.T

$$C_D = 0.016 + 0.048\,C_L^2$$

$$C_D = 0.016 + 0.048\,(0.2588)^2$$

$$\boxed{C_D = 0.019217}$$

$$D = \frac{1}{2}\rho V^2 S\,C_D$$

$$= \frac{1}{2}\times 1.225 \times (150)^2 \times 50 \times 0.019217$$

$$\boxed{D = 13241.85551\,N}$$

$$T = W\sin\gamma + D$$

$$= 180,000 \times 0.1333 + 13241.85551$$

$$\boxed{T = 37241.85551\,N}$$

$T' = 37241.85551 + 10.000$

$\boxed{T' = 47241.85551\,N}$

W.K.T

$$T' = \frac{1}{2}\rho V^2 S C_{D0} + \frac{2KW^2}{\rho V^2 S}\left[1 - \sin^2\gamma'\right] + W\sin\gamma'$$

$$47241.85551 = \frac{1}{2}\times 1.225\times(150)^2\times 50\times 0.016. + \frac{2\times 0.048\times(180,000)^2}{1.225\times(150)^2\times 50}$$

$$\times\left[1 - \sin^2\gamma'\right] + 180000\sin\gamma'$$

$$26216.85551 = 2256.9795\left(1 - \sin^2\gamma'\right) + 180000\sin\gamma'$$

$$23959.87601 = -2256.9795\sin^2\gamma' + 180000\sin\gamma'$$

Solving the above Quadratic we get

$\sin\gamma' = 0.189114$

or

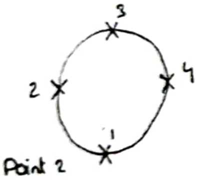
$\sin\gamma' = 79.56349$

Since, Sine Can't be more than 1, so the Possible Solution is

$\sin\gamma' = 0.189114$

$\frac{V_c'}{V} = 0.189114$

$V_c' = 0.189114 \times 150$



At Point 2

$L = \frac{mV^2}{R}$

$L = \frac{WV^2}{Rg}$

$\frac{L}{W} = n = \frac{V^2}{Rg}$

$n = \frac{(100)^2}{200\times 9.81}$

$n = \frac{50}{9.81}$

$\boxed{n = 5.09}$

d) The bottom of the loop is Point 1

At Point ①

$L = W + \frac{mV^2}{R}$

$= W + \frac{WV^2}{gR}$

$L = W\left(1 + \frac{V^2}{Rg}\right)$

$\frac{L}{W} = \left(1 + \frac{100^2}{200\times 9.81}\right) = 6.09$

$V_c' = 28.3671\ m/s$

$\boxed{V_c' = 1702.026\ m/min}$

③

a) At level flight. The altitude remains Constant.

$L = W\cos\phi$

$\frac{L}{W} = \cos\phi$

$\boxed{\cos\phi = n}$

b) During free fall, The only force that acts on aircraft is gravity mg (W). All other forces will be zero.

$n = \frac{L}{W} = \frac{0}{mg} = 0$

c) given:

$V = 100\,m/s$

$R = 200\,m$

At Point 2

$\frac{L}{W} = \left(1 + \frac{100^2}{200\times 9.81}\right)$

$n\ 6.09$

[illegible] by

Praveen G

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# NEHRU INSTITUTE OF ENGINEERING AND TECHNOLOGY

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NBA Accredited UG Courses: AERO, MECH, CSE

## AE8501 - FLIGHT DYNAMICS – Assignment – III Mark statement

### III YEAR / V th SEMESTER

| Sl. No | Register Number | Name of the Student | Marks out of 30 |
|---|---|---|---|
| 1 | 721418101003 | AKILESH S J | 20 |
| 2 | 721418101008 | BAGAVATH PANDI V | 20 |
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| 39 | 721419101501 | BALA MURUGAN A | 20 |
| 40 | 721419101502 | MOHAMED ABUL HAIER I | AB |

Course Instructor

IQAC

HoD

# NEHRU INSTITUTE OF ENGINEERING AND TECHNOLOGY

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NBA Accredited Departments: AERO, MECH, CSE

## DEPARTMENT OF AERONAUTICAL ENGINEERING
## Tutorial

Course Instructor: J. Karthikeyan
Topic: Dynamic Longitudinal Stability
Class / Sem: III / V

Date: 2020-10-09

Max. Marks: 30

1. An airplane is flying at sea level with wing loading of 4000 $N/m^2$ and velocity of 400 Kmph. The characteristic equation for the dynamic stability is $\lambda^2 + 0.5\lambda + 3=0$. Estimate the period of oscillation and the time to halfen the amplitude. (Marks: 10)
2. An airplane is flying at altitude with density ratio as 0.5, wing loading of 3500 $N/m^2$ and velocity of 380 Kmph. The characteristic equation for the dynamic stability is $\lambda^2 + 0.2\lambda + 6=0$. Estimate the period of oscillation and the time to halfen the amplitude. (Marks: 10)
3. The characteristic equation of a system is given by $\{[\lambda+(1/2)][\lambda+1]\}+10=0$. Find whether the system is dynamically stable and Estimate the period of oscillation and the time to halfen the amplitude.(Marks: 10)

Last Date of Submission: 2020-10-15

921418101050
III Aero 'A'

Flight Dynamics
Assignment Unit 5

① Given Data

Wing loading $W/S = 4000\ N/m^2$

Velocity $V = 400$ kmph

$= \frac{400 \times 1000}{3600}$ m/s

$V = 111.1$ m/s

Density of sealevel $\rho = 1.225\ kg/m^3$

By characteristic equation

$\lambda^2 + 0.5\lambda + 3 = 0$

Consider, $\lambda^2 + 0.5\lambda + 3$

$a = 1,\ b = 0.5,\ c = 3$

$\lambda = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

$= \frac{-0.5 \pm \sqrt{(0.5)^2 - 4(1)(3)}}{2(1)}$

$= \frac{-0.5 \pm \sqrt{0.25 - 12}}{2}$

$= \frac{-0.5 \pm \sqrt{-11.75}}{2}$

$= \frac{-0.5 \pm 3.4270 i}{2}$

$= -0.5 \pm 1.713 i$

$\lambda = \eta + i\omega \quad \eta = -0.25$

$\omega = 1.713$

a) Period of oscillation $T = \frac{\hat{t}\, 2\pi}{\omega}$

Time to half altitude $t_{1/2} = \frac{0.693 \times \hat{t}}{\eta}$

$\therefore \hat{t} = \frac{W}{g\rho SV}$

$= \frac{4000}{9.81 \times 111.11 \times 1.255}$

$\hat{t} = 2.995$ air.sec

$T = \frac{2.995 \times 2 \times \pi}{1.713} = 10.97$ sec

$t_{1/2} = \frac{0.693 \times \hat{t}}{\eta} = \frac{0.693 \times 2.995}{-0.25}$

$t_{1/2} = -8.30$ sec

3) Given.

G.D:

Wing loading $W/S : 3500\ N/m^2$

Velocity $: 380$ kmph

$= \frac{380 \times 1000}{3600}$

$V : 105.5$ m/s

Density ratio $= 0.5$

Density ratio $= \frac{\text{Density}}{\text{Density of sea level}}$

$0.5 = \frac{\rho}{1.225}$

$\rho = 0.6125\ kg/m^3$

Solution:

$\lambda^2 + 0.2\lambda + 6 = 0$

$a = 1 \quad b = 0.2 \quad c = 6$

$= \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

$= \frac{-0.2 \pm \sqrt{(0.2)^2 - 4(1)(6)}}{2(1)}$

$= \frac{-0.2 \pm 4.894 i}{2}$

$= -0.1 \pm 2.447 i$

$\therefore \eta = -0.1 \quad \omega = 2.447$

$\hat{t} = \frac{W}{g\rho SV} = \frac{3500}{9.81 \times 0.6125 \times 105.5}$

$\hat{t} = 5.521$ air sec

$T = \frac{\hat{t}\, 2\pi}{\omega} \quad T = \frac{5.521 \times 2 \times \pi}{2.447}$

$T = 14.176$ sec

$t_{1/2} = \frac{-0.69 \times \hat{t}}{\eta}$

$= \frac{-0.693 \times 5.521}{-0.1}$

$t_{1/2} = 38.260$ sec

RESULT:

i) Period of oscillation $T = 14.176$ sec

ii) Time to half altitude $t_{1/2} = 38.260$ sec

3) **GIVEN:**

C.E ⇒ $[(\lambda+1/2)(\lambda+1)]+10=0$

**SOLUTION:**

$[(\lambda+1/2)(\lambda+1)]+10=0$

$(\lambda^2+\lambda+1/2\lambda+1/2)+10=0$

$\lambda^2+\lambda+0.5\lambda+0.5+10=0$

$\lambda^2+1.5\lambda+10.5=0$

$a=1 \quad b=1.5 \quad c=10.5$

$$=\frac{-b\pm\sqrt{b^2-4ac}}{2a}$$

$$=\frac{-1.5\pm\sqrt{(1.5)^2-4(1)(10.5}}{2(1)}$$

$$=\frac{-1.5\pm\sqrt{2.25-42}}{2}$$

$$=\frac{-1.5\pm\sqrt{-39.75}}{2}$$

$$=\frac{-1.5\pm6.304i}{2}$$

$$=-0.75\pm3.152i$$

$\lambda=-0.75\pm3.15i$

$\eta=-0.75 \quad \omega=3.15$

$$T=\frac{\hat{t}\times2\times\pi}{}$$

$$=\frac{\overset{\omega}{\hat{t}}\times2\times\pi}{3.152}$$

$T=1.998\,\hat{t}$ sec

$$t_{1/2}=\frac{-0.69\times\hat{t}}{\eta}=\frac{-0.693\times\hat{t}}{-0.75}$$

$t_{1/2}=0.924\,\hat{t}$ sec

**RESULT:**

i) Period of oscillation

$T=1.993\,\hat{t}$ sec

ii) time to half amplitude $t_{1/2}=0.924\,\hat{t}$ sec

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Course Instructor IQAC HoD

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# FLIGHT DYNAMICS - 11.06.2020

5 Questions

**1.** The study of forces and the resulting motion of object through an air

23/26 [✓ **A**] Aerodynamics
3/26 **B** Structural Dynamics
0/26 **C** Drag
0/26 **D** Pitching

**2.** A straight line which connects the leading edge to the trailing edge

2/24 **A** Camber line
22/24 [✓ **B**] Chord line
0/24 **C** Maximum camber
0/24 **D** Maximum thickness

**3.** For symmetrical aerofoil, at zero angle of attack the lift will be

20/24 [✓ **A**] zero
0/24 **B** negative
1/24 **C** positive
3/24 **D** does not depends on angle of attack

**4.** For negative cambered aerofoil, at zero angle of attack the lift will be

2/24 **A** positive
17/24 [✓ **B**] negative
4/24 **C** zero
1/24 **D** does not depends on angle of attack

**5.** The mean camber line lies below the chord line

10/24 **A** symmetrical aerofoil
13/24 [✓ **B**] negative cambered aerofoil
1/24 **C** positive symmetrical aerofoil

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010 A. Garry kiristen
JAYALINGAM
June 11, 2020

# FLIGHT DYNAMICS - 11.06.2020

100% (5/5)

---

✓ **1.** The study of forces and the resulting motion of object through an air

[✓ **A**] Aerodynamics

**B** Structural Dynamics

**C** Drag

**D** Pitching

✓ **2.** A straight line which connects the leading edge to the trailing edge

**A** Camber line

[✓ **B**] Chord line

**C** Maximum camber

**D** Maximum thickness

✓ **3.** For symmetrical aerofoil, at zero angle of attack the lift will be

[✓ **A**] zero

**B** negative

**C** positive

**D** does not depends on angle of attack

✓ **4.** For negative cambered aerofoil, at zero angle of attack the lift will be

**A** positive

[✓ **B**] negative

**C** zero

**D** does not depends on angle of attack

✓ **5.** The mean camber line lies below the chord line

**A** symmetrical aerofoil

[✓ **B**] negative cambered aerofoil

**C** positive symmetrical aerofoil

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32 SANTHOSH A
JAYALINGAM
June 11, 2020

# FLIGHT DYNAMICS - 11.06.2020

60% (3/5)

---

✓ **1.** The study of forces and the resulting motion of object through an air

[✓ **A**] Aerodynamics
**B** Structural Dynamics
**C** Drag
**D** Pitching

✓ **2.** A straight line which connects the leading edge to the trailing edge

**A** Camber line
[✓ **B**] Chord line
**C** Maximum camber
**D** Maximum thickness

✗ **3.** For symmetrical aerofoil, at zero angle of attack the lift will be

**A** zero
**B** negative
[✓ **C**] positive
**D** does not depends on angle of attack

✓ **4.** For negative cambered aerofoil, at zero angle of attack the lift will be

**A** positive
[✓ **B**] negative
**C** zero
**D** does not depends on angle of attack

✗ **5.** The mean camber line lies below the chord line

[✓ **A**] symmetrical aerofoil
**B** negative cambered aerofoil
**C** positive symmetrical aerofoil

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Kamali
JAYALINGAM
June 11, 2020

# FLIGHT DYNAMICS - 11.06.2020

80% (4/5)

---

✓ **1.** The study of forces and the resulting motion of object through an air

[✓ A] Aerodynamics
B Structural Dynamics
C Drag
D Pitching

✓ **2.** A straight line which connects the leading edge to the trailing edge

A Camber line
[✓ B] Chord line
C Maximum camber
D Maximum thickness

✓ **3.** For symmetrical aerofoil, at zero angle of attack the lift will be

[✓ A] zero
B negative
C positive
D does not depends on angle of attack

✓ **4.** For negative cambered aerofoil, at zero angle of attack the lift will be

A positive
[✓ B] negative
C zero
D does not depends on angle of attack

✗ **5.** The mean camber line lies below the chord line

A symmetrical aerofoil
B negative cambered aerofoil
[✓ C] positive symmetrical aerofoil

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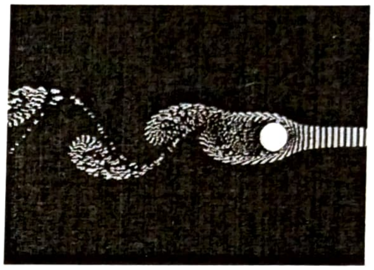
# FLIGHT DYNAMICS - 13.06.2020 5 Questions

**1.** The three critical flight dynamics parameters are?

19/20 [✓ A] Roll, pitch and yaw
1/20 **B** Roll, pitch and jaw
0/20 **C** Roll, play and jaw
0/20 **D** Roll, play and yaw

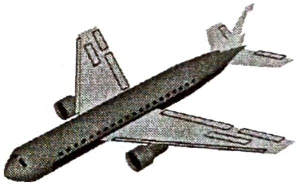
**2.** Which of the following gives the viscosity of flow?

5/20 **A** Mach Number
0/20 **B** Knudsen Number
0/20 **C** Specific heat ratio
15/20 [✓ D] Reynolds Number



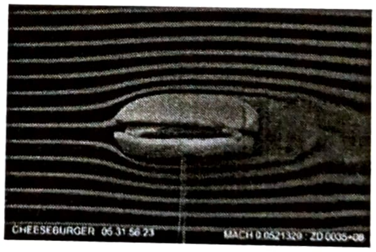
**3.** Which of the following is not true about yaw?

6/20 **A** About the vertical body axis
5/20 **B** Positive with the nose to starboard
8/20 [✓ C] Measured in Hertz
1/20 **D** Type of rotation



**4.** Flight dynamics studies the efficiency of vehicles travelling through air.

14/20 **T** True
6/20 [✓ F] False



**5.** Which is the most dominant force in spacecraft flight dynamics?

13/20 [✓ A] Gravitational force
0/20 **B** Nuclear force
2/20 **C** Air resistance force
5/20 **D** Lift and drag

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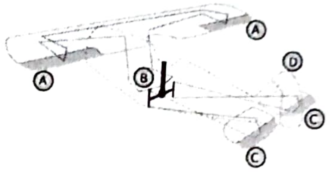
Bagavath
JAYALINGAM
June 13, 2020

# FLIGHT DYNAMICS - 13.06.2020

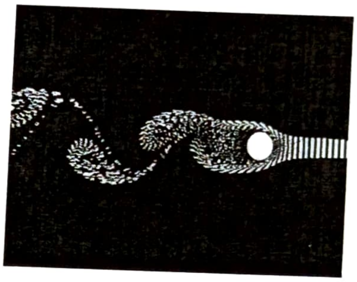
80% (4/5)

✗ **1.** The three critical flight dynamics parameters are?



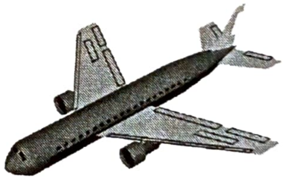
- **A** Roll, pitch and yaw
- [✓ **B**] Roll, pitch and jaw
- **C** Roll, play and jaw
- **D** Roll, play and yaw

✓ **2.** Which of the following gives the viscosity of flow?



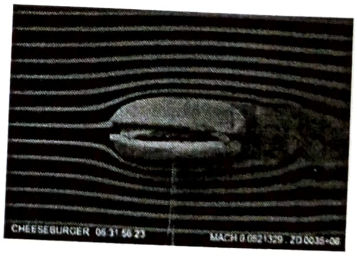
- **A** Mach Number
- **B** Knudsen Number
- **C** Specific heat ratio
- [✓ **D**] Reynolds Number

✓ **3.** Which of the following is not true about yaw?



- **A** About the vertical body axis
- **B** Positive with the nose to starboard
- [✓ **C**] Measured in Hertz
- **D** Type of rotation

✓ **4.** Flight dynamics studies the efficiency of vehicles travelling through air.



- **T** True
- [✓ **F**] False

✓ **5.** Which is the most dominant force in spacecraft flight dynamics?

[✓ **A**] Gravitational force

**B** Nuclear force

**C** Air resistance force

**D** Lift and drag

socrative

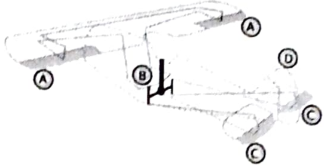
09 Donin
JAYALINGAM
June 13, 2020

# FLIGHT DYNAMICS - 13.06.2020

60% (3/5)

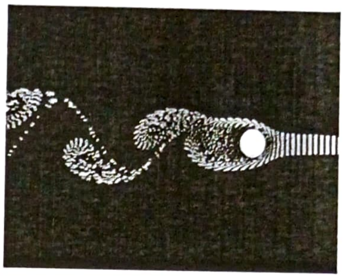
---

✓ **1.** The three critical flight dynamics parameters are?



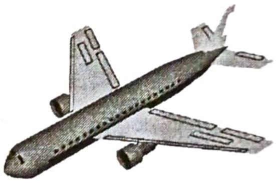
[✓ A] Roll, pitch and yaw
**B** Roll, pitch and jaw
**C** Roll, play and jaw
**D** Roll, play and yaw

✓ **2.** Which of the following gives the viscosity of flow?



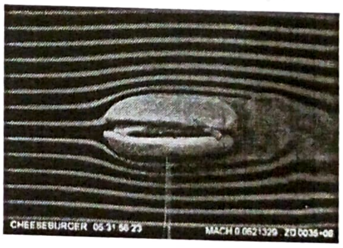
**A** Mach Number
**B** Knudsen Number
**C** Specific heat ratio
[✓ D] Reynolds Number

✗ **3.** Which of the following is not true about yaw?



[✓ A] About the vertical body axis
**B** Positive with the nose to starboard
**C** Measured in Hertz
**D** Type of rotation

✗ **4.** Flight dynamics studies the efficiency of vehicles travelling through air.



[✓ T] True
**F** False

✓ **5.** Which is the most dominant force in spacecraft flight dynamics?

[✓ **A**] Gravitational force

**B** Nuclear force

**C** Air resistance force

**D** Lift and drag

# AE 8501 - Flight Dynamics Post Analysis Survey

40 responses

Publish analytics

## Your Name

40 responses

Prasath S.v

Pravin G

Priya Harshini S

Mahathir Mohammed M

Vishnu Rohith K

Vigneshwaran.v

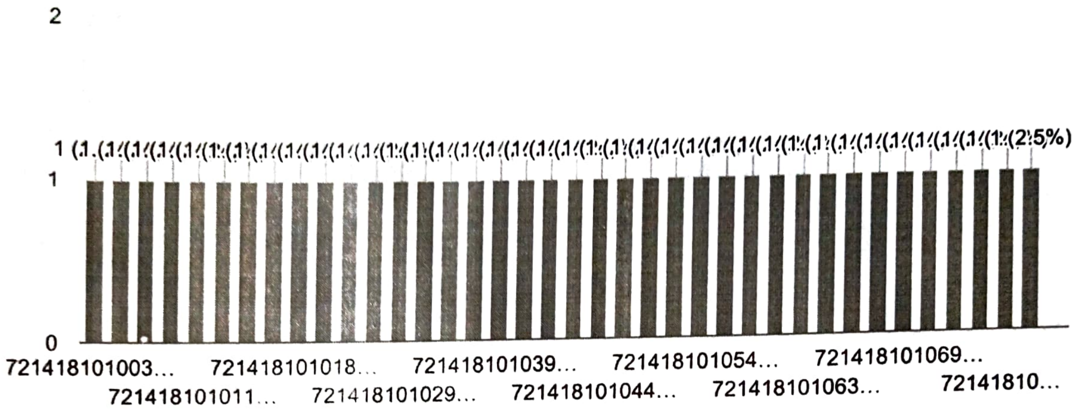
Steeve Caleb J

Sain Aaryan Shravan

Rajaselvam. S

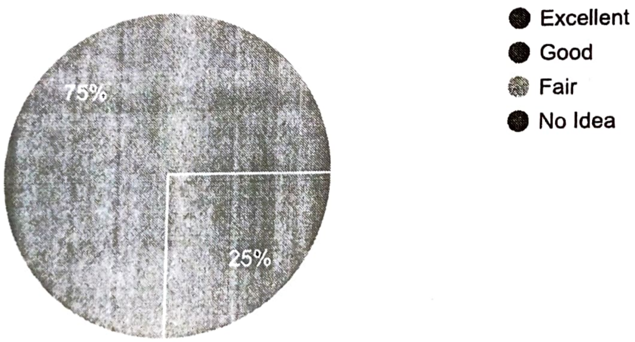
Register Number

40 responses



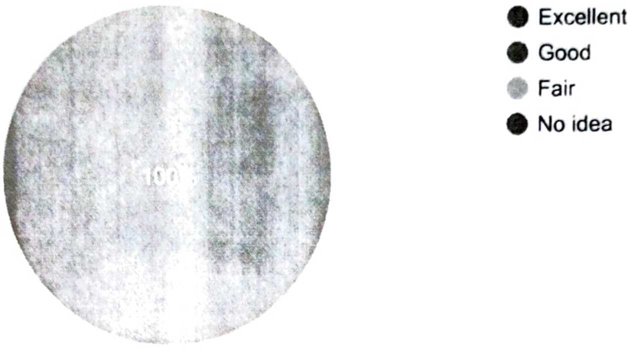
C5O1.1 Have you understood about the variation of pressure and density, SFC and TSFC, Power and thrust with velocity and altitude

40 responses



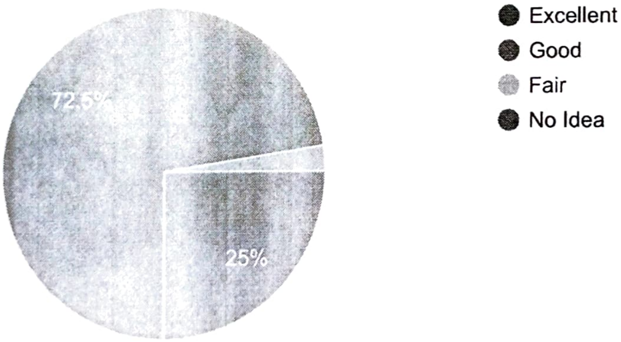
C501.2 Have you understood about forces acting on a gliding, climbing, cruising and turning flight and the factors influencing the range and endurance of an airplane.

40 responses



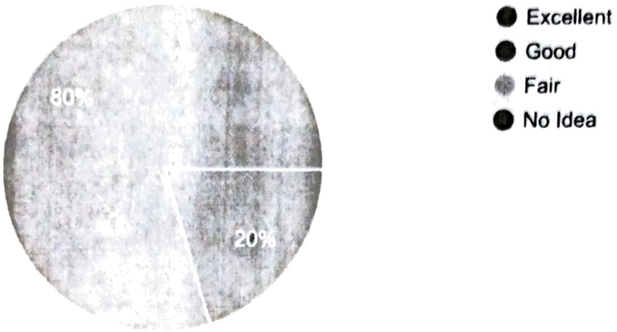
C5O1.3 Have you understood about the stick fixed and stick free static longitudinal stability and the contribution of aircraft components towards static longitudinal stability

40 responses



### C5O1.4 Have you understood about the contribution of aircraft components towards static yaw stability and static roll stability

40 responses



### C5O1.5 Have you understood about the dynamic modes in Pitch stability, Yaw and Roll stability

40 responses