



# INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

## AERONAUTICAL ENGINEERING

### TUTORIAL ASSIGNMENT

|                    |   |                          |
|--------------------|---|--------------------------|
| Course Name        | : | FLIGHT MECHANICS – I     |
| Course Code        | : | R15- A42105              |
| Class              | : | II B.Tech II semester    |
| Branch             | : | Aeronautical Engineering |
| Year               | : | 2016 – 2017              |
| Course Coordinator | : | Dr. P.K Dash             |
| Course Faculty     | : | Dr. P.K Dash             |

#### OBJECTIVES

To meet the challenge of ensuring excellence in engineering education, the issue of quality needs to be addressed, debated and taken forward in a systematic manner. Accreditation is the principal means of quality assurance in higher education. The major emphasis of accreditation process is to measure the outcomes of the program that is being accredited.

In line with this, Faculty of Institute of Aeronautical Engineering, Hyderabad has taken a lead in incorporating philosophy of outcome based education in the process of problem solving and career development. So, all students of the institute should understand the depth and approach of course to be taught through this question bank, which will enhance learner's learning process

| S. No | Question   | Blooms Taxonomy Level | Course Outcome |
|-------|--|-----------------------|----------------|
|       | <b>ASSIGNMENT-I</b>  |                       |                |
|       | <b>UNIT I : INTRODUCTION TO AIRCRAFT PERFORMANCE- THE FORCE SYSTEM OF THE AIRCRAFT</b>   |                       |                |
| 1     | Describe with the help of a diagram the mission profile of a civil transport aircraft. What is involved in performance estimation process and where performance estimation can be applied? | REMEMBER              | 4              |
| 2     | Define the terms airspeed indicator reading, indicated airspeed, calibrated airspeed, equivalent airspeed and true airspeed as used in the calibration of airspeed indicator.              | UNDERSTAND            | 5              |
| 3     | Discuss vertical structure of the atmosphere and its various layers through a diagram.   | KNOWLEDGE             | 4              |
| 4     | Explain air data computer system using a diagram.  | KNOWLEDGE             | 4              |
|       | Discuss the steps involved in constructing International Standard Atmosphere useful for aircraft operations. State the assumptions involved.   | UNDERSTAND            | 5              |
| 5     | What for aircraft performance measurement is required? Show with the help of diagrams typical military aircraft mission profiles.  | UNDERSTAND            | 5              |
| 6     | Explain with the help of diagrams how the lift characteristic of a plain, cambered aerofoil and how they can be modified by leading edge and trailing edge flaps.                          | REMEMBER              | 5              |
| 7     | Explain minimum drag speed and minimum power speed and their importance in aircraft performance analysis.  | REMEMBER              | 4              |
| 8     | Discuss aircraft force system needed for formulating the performance equations of motion.  | UNDERSTAND            | 4              |
| 9     | Why aerodynamic forces and propulsive forces are of importance to the performance of an aircraft?  | UNDERSTAND            | 4              |

| S. No   | Question   | Blooms Taxonomy Level | Course Outcome |
|---|--|-----------------------|----------------|
| <b>UNIT –II: CRUISE PERFORMANCE</b>   |  |                       |                |
| 1   | Derive expressions for range and endurance for aircraft with thrust producing engines  | UNDERSTAND            | 4              |
| 2   | Explain the cruising method of constant angle of attack and constant Mach number.  | UNDERSTAND            | 5              |
| 3   | Derive Breguet range equation..  | REMEMBER              | 4              |
| 4   | Discuss cruise method for constant angle of attack and constant altitude.  | REMEMBER              | 5              |
| 5   | Derive expressions for range and endurance for aircraft with power producing engines.  | UNDERSTAND            | 5              |
| 6   | Explain through diagrams how range function and endurance function vary with relative speed.   | APPLY                 | 4              |
| 7   | Discuss cruise method for constant mach no and constant altitude.  | APPLY                 | 4              |
| <b>ASSIGNMENT-II</b>  |  |                       |                |
| <b>UNIT –III : CLIMB, DESCENT AND MANOEUVRE PERFORMANCE</b>   |  |                       |                |
| 1   | Describe the phases of descending flight through a diagram   | REMEMBER              | 9              |
| 2   | Discuss the various criteria that govern the manner in which the aircraft is flown in each phase.                                      | REMEMBER              | 5              |
| 3   | Explain the equations of motion of an aircraft with thrust producing engines in a climb.   | APPLY                 | 5              |
| 4   | Derive expressions for climb gradient and climb rate   | APPLY                 | 9              |
| 5   | Why climb performance is one of the critical areas in both the design and operation of an aircraft                                     | EVALUATE              | 4              |
| 7   | Derive expressions for climb gradient and climb rate for aircraft with power producing engines.  | EVALUATE              | 5              |
| 8   | Explain Coriolis effect. How does it impact Earth's atmosphere?  | UNDERSTAND            | 9              |
| 9   | What is the effect of weight, altitude and temperature on cruise performance?  | UNDERSTAND            | 8              |
| 10  | What is the effect of bypass ratio on the optimum speeds for Range   | UNDERSTAND            | 7              |
| <b>UNIT-IV: TAKE-OFF AND LANDING- SAFETY REQUIREMENTS – FLIGHT PLANNING</b>                         |  |                       |                |
| 1   | What are the reasons for the maneuver performance of an aircraft to be limited by the structural strength of the airframe?             | APPLY                 | 10             |
| 2   | Describe the equations of motion of an aircraft undergoing lateral maneuver or level turn and derive an expression for radius of turn. | EVALUATE              | 11             |
| 3   | Discuss how take-off distances are estimated.  | EVALUATE              | 11             |
| 4   | Discuss the space available and space required for take-off performance.   | APPLY                 | 11             |
| 5   | Discuss how landing distances are estimated.   | REMEMBER              | 10             |
| <b>UNIT –V : AIRCRAFT PERFORMANCE MEASUREMENT AND DATA HANDLING-APPLICATION OF PERFORMANCE DATA</b> |  |                       |                |
| 1   | Explain parametric performance data analysis and discuss how it can be used for cruise performance measurement                         | UNDERSTAND            | 11             |
| 2   | Explain parametric performance data analysis and discuss how it can be used for take-off and landing performance measurement.          | UNDERSTAND            | 11             |
| 3   | Discuss cruise performance measurement and climb performance measurement using parametric performance data analysis.                   | REMEMBER              | 10             |
| 4   | Write short notes on the following:<br>a. Block performance<br>b. Drag polar<br>c. Endurance.  | REMEMBER              | 10             |
| 5   | What is the purpose of flight planning?  | EVALUATE              | 11             |