OAE752 PRINCIPLES OF FLIGHT MECHANICS

DETAILED SYLLABUS

OBJECTIVE:

- To make the student understand the performance of airplanes under various flight conditions like take off, cruise, landing, climbing, gliding, turning and other maneuvers.

UNIT I GENERAL CONCEPTS

International Standard atmosphere, IAS, EAS, TAS, Propeller theory- Froude momentum and blade element theories, Propeller co-efficients, use of propeller charts, Performance of fixed and variable pitch propellers, High lift devices, thrust augmentation

UNIT II DRAG OF BODIES

Streamlined and bluff body, types of drag, Effect of Reynold's number on skin friction and pressure drag, drag reduction of airplanes, drag polar, Effect of Mach number on drag polar. Concept of sweep- effect of sweep on drag.

UNIT III STEADY LEVEL FLIGHT

General equation of motion of an airplane. Steady level flight, Thrust required and Power required, thrust available and Power available for propeller driven and jet powered aircraft, Effect of altitude, maximum level flight speed, conditions for minimum drag and minimum power required, Effect of drag divergence on maximum velocity, Range and Endurance of Propeller and Jet aircrafts. Effect of wind on range and endurance.

UNIT IV GLIDING AND CLIMBING FLIGHT

Shallow and steep angles of climb, Rate of climb, climb hodograph, Maximum Climb angle and Maximum Rate of climb- Effect of design parameters for propeller jet and glider aircrafts, Absolute and service ceiling, Cruise climb, Gliding flight, Glide hodograph

UNIT V ACCELERATED FLIGHT

Estimation of take-off and landing distances, Methods of reducing landing distance, level turn, minimum turn radius, maximum turn rate, bank angle and load factor, Constraints on load factor, SST and MSTR. Pull up and pull-down maneuvers, V-n diagram.

OUTCOMES:

Students will be able to

• Understand concepts of take-off, climb, cruise, turn, descent and landing performance.

• understand the performance characteristics of the different types of power plants

• Understand and predict the behavior of fixed wing aircraft undertaking a typical flight profile

• Understand the factors that influence aircraft design and limit aircraft performance.

TEXT BOOKS:

1. Anderson, Jr., J.D. Aircraft Performance and Design, McGraw-Hill International Edition, 1999

2. Houghton,E.L. and Carruthers, N.B. Aerodynamics for engineering students, Edward Arnold Publishers, 1988.

REFERENCES:

1. Anderson, J.D., Introduction to Flight, McGraw-Hill; 8th edition, 2015

2. Clancy, L J., Aerodynamics, Shroff publishers (2006) 3. John J Bertin., Aerodynamics for Engineers, Prentice Hall; 6th edition, 2013. 4. Kuethe, A.M. and Chow, C.Y., Foundations of Aerodynamics, John Wiley & Sons; 5th Edition, 1997.