Reg. No.										

Manipal Institute of Technology, Manipal

(A Constituent Institute of Manipal University)

IV SEMESTER B.TECH END SEMESTER EXAMINATIONS,

MAY 2016

SUBJECT: INTRODUCTION TO AEROSPACE ENGG. [AAE 3281]

REVISED CREDIT SYSTEM

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

- Answer **ALL** the questions.
- Missing data may be suitable assumed.

1A. If 680.4kg of air is pumped into a previously empty 25.485 m^3 storage tank and the air temperature in the tank is uniformly 294.3K, what is the air pressure in the tank in atmospheres? **(05)**

In above case, assume the rate at which air is being pumped into the tank is 0.23 kg/s. Consider the instant in time at which there is 453.6 kg of air in the tank. Assume the air temperature is uniform 283.15K at this instant and is increasing at the rate of 255.4 K/min. calculate the rate of change of pressure at this instant.

1B. Calculate the diameter and volume necessary to lift a person via a helium balloon and water vapor. Given are the densities of air, helium and the mass of a person. ρ_{air} = 1.225 kg/m^3; ρ_{helium} = 0.174 kg/m^3; ρ_{steam} = 0.804 kg/m^3; m_{person} = 72.5 kg. **(03)**

1C. What is biplane interference, explain with neat sketch. **(02)**

2A. Derive the relation between geopotential and geometric altitudes and Present a mathematical model for standard atmosphere variation w.r.t altitude. **(05)**

2B. At 12 km in the standard atmosphere the pressure, density, and temperature are 1.9399 x 10^4 N/m^2; 3.1194 x 10^{-1} kg/m^3; 216.66K respectively. Using these values, calculate the standard atmospheric values of pressure, density and temperature at an altitude of 18 km. **(03)**

2C. The atmosphere of Jupiter is essentially made up of hydrogen, H_2. For H_2, the specific gas constant is 4157 J/ (Kg)(K). The acceleration due to gravity of Jupiter is 24.9 m/s^2. Assuming an isothermal atmosphere with a temperature of 150K and assuming that Jupiter has a definable surface, calculate the altitude above that surface where the pressure is one-half the surface pressure. **(02)**

3A. Derive the energy equation starting from elementary thermodynamics. **(05)**

3B. Consider the flow of air over a small plate that is 5cm long in the flow direction and 1m wide. The free-stream conditions correspond to standard sea level, and the flow velocity is 120m/s. Assuming laminar flow, calculate **(03)**
a) The boundary layer thickness at the downstream edge(trailing edge)
b) The drag force on a plate

3C. Consider a low-speed subsonic wind tunnel with a nozzle contraction ratio of 1:20. One side of a mercury manometer is connected to the settling chamber, and the other side to the test section. The pressure and temperature in the test section are 1 atm and 300K, respectively. What is the height difference between the two columns of mercury when the test section velocity is 90m/s. **(02)**

4A. The maximum lift-to-drag ratio of the world war I sopwith camel was 7.7. If the aircraft is in flight at 1524m when the engine fails, how far can it glide in terms of distance measured along the ground and also calculate the equilibrium glide velocity at 914.4m, corresponding to the minimum glide angle. The aspect ratio of the airplane is 4.11, the Oswald efficiency factor is 0.7, the weight is 6320N, and the wing area is 21.46 m^2. **(05)**

4B. Explain in detail about Static stability and Dynamic stability with example. **(03)**

4C. What makes the difference in lift performance of an infinite wing and finite wing? **(02)**

5A. Sketch a schematic diagram of a turboprop engine mark all the subsystems and explain their functions and write the limitations of turboprop engine? **(05)**

5B. What are the parameters that comply with all geostationary orbits? **(03)**

5C. Describe the Kepler's three laws of planetary motion. **(02)**