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# Manipal Institute of Technology, Manipal

(A Constituent Institute of Manipal University)

**IV SEMESTER B.TECH END SEMESTER EXAMINATIONS,**

**JUNE 2016 /JULY 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.** What are the advantages of a balloon compared to a winged aircraft in terms of lift and drag? So for what types of flight the balloon is more efficient than the winged aircraft? **(05)**

**1B.** Calculate the weight of air (in kg) contained within a room 6.096 m long. 4.572 m wide and 2.45m high. Assume standard atmospheric conditions and calculate the percentage change in the total weight of air in the room when the air temperature is reduced to 249.82K (a very cold winter day), assuming the pressure remains the same at $1.0135 \times 10^5$ pa and Compare the results. **(03)**

**1C.** If pipe 1 diameter = 50mm, mean velocity 2m/s, pipe 2 diameter 40mm takes 30% of total discharge and pipe 3 diameter 60mm. What are the values of discharge and mean velocity in each pipe? **(02)**

**2A.** Consider the incompressible flow of water through a divergent duct. The inlet velocity and area are 15 m/s and 25 m^2 respectively. If the exit area is four times the inlet area, calculate the water flow velocity at the exit. **(05)**

**2B.** Consider airflow in a flow of air where far ahead of the airfoil, the pressure and density are equal to sea level value. The freestream velocity is 804.7 kmph. At a given point A on the airfoil, the pressure is 0.716 bars. What is the velocity at Point A? Assume isentropic flow. For air CP = 1008 J/kg.K **(03)**

**2C.** At what value of the geometric altitude is the difference $h-h_G$ equal to 2 percent of the geopotential altitude, h? **(02)**

**3A.** Derive the equations which are important for isentropic flow. **(05)**

**3B.** The air temperature and pressure in the reservoir of the wind tunnel are $T_0$ = 1000K and $p_0$ = 10 atm, respectively. The static temperatures at the throat and exit are T* = 833K and $T_e$ = 300K, respectively. The mass flow through the nozzle is 0.5 kg/s. For air $C_p$ = 1008 J/(Kg)(k). calculate **(03)**

(a) Velocity at the throat V*

(b) Velocity at the exit $V_e$

(c) Area of the throat A*

(d) Area at the exit $A_e$

**3C.** A jet transport is flying at a standard altitude of 9144m with a velocity of 885.14 kmph. What is the Mach number? **(02)**

**4A.** Explain with neat sketches the ways an aircraft will be have when disturbed from its path(Degrees of stability of an aircraft) **(05)**

**4B.** Enumerate the six factors of an ideal aerofoil. **(03)**

**4C.** Derive the equation of thrust required for a level and uncelebrated flight. **(02)**

**5A.** Explain the working of liquid propellant rocket with neat sketch. List the advantages and disadvantages. **(05)**

**5B.** Discuss the basic aspects of space vehicle trajectories with neat sketches. **(03)**

**5C.** The period of revolution of the earth about the sun is 365.256 days. The semi-major axis of the earth orbit is $1.49527 \times 10^{11}$m. In turn, the semi-major axis of the orbit of mars is $2.2783 \times 10^{11}$ m. calculate the period of mars. **(02)**