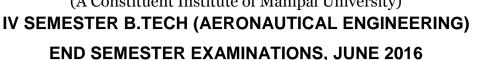
Reg.No.					



Manipal Institute of Technology, Manipal

(A Constituent Institute of Manipal University)





SUBJECT: AERODYNAMICS [AAE 2201] REVISED CREDIT SYSTEM

Τį	ime: 3 Hours.	MAX.MARKS: 50
	Instructions to Candidates:	
	❖ Answer ALL questions.	
	 Missing data may be suitably assumed 	

- 1A. Derive the fundamental equation of thin airfoil theory and what are this theory (05)limitations?
- 1B. Explain the function of Pitot static probe and also write down the calculation of (03)velocity with the help of this Pitot static probe
- 1C. What are Irrotational & Rotational flows in aerodynamics? Also mention one (02)application of these flows when we consider a flow over an airfoil.
- 2A. Derive the Continuity equation which physically explains "mass neither can be (05) created nor destroyed" both in integral and differential forms.
- 2B. Explain what doublet flow is and derive the equation for stream function and (05)velocity potential of doublet flow.
- 3A. Describe the followings (03)
 - a) Bound vortex
 - b) Aerodynamic center
 - c) Karman vortex sheet
- 3B. Explain the Biot-Savart law for infinite span and also mention Helmholtz's theorem.
- 3C. Consider a jet transport and its cruising at a velocity of 220m/s at an altitude of (03) 11km (density at this altitude is 0.4415kg/m³) The weight and wing planform area of the airplane are 72000N and 35m² respectively. Zero lift angle for this airplane is -3deg and the lift slope of the airfoil section is 0.12deg⁻¹. Aspect ratio is equal to 8 and lift efficiency factor (τ) is 0.05. Calculate the angle of attack of the airplane at cruising condition.
- 4A. Describe in detail about leading edge stall and trailing edge stall. How its (03)application varies in civil aviation?
- 4B. What are Kelvin circulation theorem and Starting vortex? (04)

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- **4C.** Consider an aircraft cruising at a standard altitude of 4km (03) (density=0.81935kg/m³). The pressure sensed by the pitot tube on the wing is $6.7 \times 10^4 \text{ N/m}^2$.
 - a) If then at what velocity airplane is flying?
 - b) This aircraft experiences a certain dynamic pressure at its cruising speed of 114.2m/s at 4km altitude. Now assume this aircraft is flying at sea level, if then at what velocity must if fly at sea level to experience the same dynamic pressure?
- **5A.** Consider the lifting flow over a circular cylinder. The lift coefficient is 5. Calculate **(05)** the peak pressure coefficient, location of stagnation points and points on the cylinder where pressure equals freestream static pressure.
- **5B.** Derive and prove that according to aerodynamics elliptical wing shape is ideal **(05)** when we compare it to any other shape.

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