

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-IV • EXAMINATION – WINTER • 2014****Subject Code: 140102****Date: 31-12-2014****Subject Name: Aerodynamics I****Time: 02:30 pm - 05:00 pm****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

- Q.1 (a)** With a neat sketch derive the Navier – Stokes momentum equation in Cartesian coordinates. **07**
- (b)** Write a short note on vortex flow with neat sketch. **07**
- Q.2 (a)** Prove that scalar function velocity potential exist only for potential flow. **07**
- (b)** Derive Bernoulli's equation. **07**
- OR**
- (b)** Explain the terms bound vortex, trailing vortex and explain why Prandtl's single horse theory failed. **07**
- Q.3 (a)** What is Normal shock wave? Explain with neat sketch. **07**
- (b)** How the shock waves are generated into the flow field? Difference between Normal shock and Oblique shock. **07**
- OR**
- Q.3 (a)** State the assumptions for Kutta theorem and prove Kutta-Joukowski lift theorem. **07**
- (b)** Draw and explain the C_L vs α (alpha) curve for symmetrical and unsymmetrical airfoil. **07**
- Q.4 (a)** Derive algebraic form of fundamental lift equation using potential flow theory and show that lift is directly proportional to circulation. **07**
- (b)** Prove that shock is irreversible in nature. **07**
- OR**
- Q.4 (a)** Derive Rankine Hugoniot Relations and prove that density down stream the shock is 6 times the upstream density. **07**
- (b)** Explain with the help of diagram shockwave interaction and reflection. **07**
- Q.5 (a)** Explain airspeed measurement in supersonic aircraft. Derive equation for airspeed in supersonic flow. **07**
- (b)** Derive the Energy equation. **07**
- OR**
- Q.5 (a)** Explain flow over a cylinder for subsonic flow with neat sketch. **07**
- (b)** Explain basic elementary flow in terms of stream function and potential function. **07**
