Reg. No.									

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent unit of MAHE, Manipal)

VII SEMESTER B.TECH. (AERONAUTICAL ENGINEERING)

END SEMESTER EXAMINATIONS, DECEMBER 2020

SUBJECT: UNSTEADY AERODYNAMICS [AAE 4004]

REVISED CREDIT SYSTEM

(01/01/2021)

Duration: 3 Hours Max. Marks: 50

Instructions to Candidates:

- **Answer all the questions.**
- **Assume missing data if any.**

1A) List out seven primary equations that plays an important role in unsteady aerodynamics. **(02)**

1B) At which condition, potential flow equation becomes invalid in studying the aeroelastic effects based on unsteady aerodynamics? **(03)**

1C) Briefly explain the following: **(05)**

a. Kelvin Circulation Theorem

b. Kutta condition

2A) State the boundary condition to solve an unsteady aerodynamic problem of an airfoil. **(02)**

2B) Write a short note on symmetry and anti-symmetry condition. **(03)**

2C) What is meant by quasi-steady condition? Why unsteady aerodynamics is so important to analyze the aeroelastic effects of a lifting surface? What is the significance of Bernoulli's equation in unsteady aerodynamics? **(05)**

3A) Describe the conditions at which the full potential equation becomes Laplace equation. **(03)**

3B) Write a short note on the following: **(05)**

a. Strip theory

b. Piston theory.

3C) What is meant by resonant condition in structural engineering? **(02)**

4A) What is the major cause for the aeroelastic effects in a lifting surface in terms of aerodynamic loads? **(02)**

4B) What is reduced frequency parameter? How does it influence the unsteady aerodynamic problem? **(03)**

4C) How to obtain the solution from potential flow equation for a simple harmonic motion of an airfoil under supersonic and subsonic flow? **(05)**

5A) Explain the importance of Prandtl–Glauert transformation? **(02)**

5B) Derive the relation to get the velocity potential for an unsteady aerodynamics problem? **(05)**

5C) What is meant by limit-cycle oscillation? **(03)**