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 [AAE4071]

REVISED CREDIT SYSTEM

(01/01/2020)

Duration: 3 Hours Max. Marks: 50

Instructions to Candidates:

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1A) How the unsteady aerodynamics play a significant role in the study of aeroelastic effects of airfoil/or wing? **(02)**

1B) What is quasi-steady aerodynamics? How it is different from steady and unsteady aerodynamics? **(03)**

1C) List out five major factors that significantly affects the aerodynamic loads on a lifting surface. **(05)**

2A) Derive the Laplace equation from the following potential flow equation. **(02)**

$$\nabla^2\Phi - \frac{1}{a^2}\left[\frac{\partial^2\Phi}{\partial t^2} + \frac{\partial}{\partial t}(q^2) + q.\nabla\left(\frac{q^2}{2}\right)\right] = 0$$

2B) Explain the major cause for the failure of Helios, the solar- and fuel-cell system powered unmanned aerial vehicle manufactured by AeroVironment? **(03)**

2C) In the linearization, aerodynamic problem is divided into two distinct cases viz., thickness case and lifting case. Which one of these has the major contribution in lift generation. Justify it. **(05)**

3A) How does the Bernoulli's equation help in solving an unsteady aerodynamic problem? **(03)**

3B) Derive the potential flow equation with the help of seven primary equations that plays an important role in fluid dynamics. **(07)**

4A) If the aerodynamic load value becomes complex number, how does it lead to flutter? **(02)**

4B) Show the two important relations of inversion formula namely Sohngen Inversion integral for the finite interval integral problem. **(03)**

4C) Explain in detail the off-body boundary condition of an unsteady aerodynamic problem. **(05)**

5A) Specify a problem to which the Laplace equation can be used to solve for unsteady aerodynamics. **(02)**

5B) Write a short note on free wake and prescribed wake model. **(06)**

5C) Why do we need the Kutta condition in solving an aerodynamics of an airfoil and/ or wing? **(02)**