Helicopter Dynamics HW#4 **2017-23159 Byeong Uk Im**

1. **Justify the following**

a) **The unsteady forces are more involved for a rotary wing than a fixed wing.**

b) **Show the similarities and differences between the basic fluid mechanics equations and the basic structural mechanics equations.**

c) Virtual aerodynamic forces play an important role in the pitch dynamics of the blade.

d) In a wind tunnel testing, the unsteady aerodynamic forces on a two-dimensional wing model were measured for a pure pitch motion as well as for a pure vertical vibratory motion. The discrepancy in the two sets of results was observed for identical angle of attack perturbation.

e) The neglecting of the effect of shed wake and other unsteady aerodynamic forces on the analysis of rotor performance is quite justified, but for higher frequency vibrations one cannot ignore these forces.

f) During the forward flight mode, there is a continuous stretching and compressing of the vorticity in the shed wake.

g) One has to be very careful to include the effect of shed vorticity for higher harmonic vibrations.

h) Is there any difference between the induced velocities calculated using the momentum theory and the lifting line theory?

i) For blade aeroelastic analysis (flap-lag), quasi-steady aerodynamics is widely used.

j) The shed wake plays a more important role in hovering flight than the forward flight.

k) There are differences between the thin airfoil theory, lifting line theory, lifting surface theory and the rotor shed wake modeling.

l) The larger the reversed flow region on the retreating side of the rotor, the more the vibration.

m) In a circulation-controlled rotor blade, the steady lift is primarily caused by blowing circulation, causing the aerodynamic center to be close to the half-chord position. To reduce the aerodynamic moment, the elastic axis is positioned at half-chord, but this may result in an unstable torsional motion (single degree flutter).

n) The Theodoresen function C(k) is referred to as a feedback parameter of blade motion.

o) There is no Kutta condition for circulation control airfoils.

p) Dynamic inflow modeling is an approximate representation for unsteady rotor forces.