Helicopter Dynamics HW#3 **2017-23159 Byeong Uk Im**

1. **Justify the following**

a) **Let us look at the "tennis racket effect" on the tennis ball. To give clockwise spin to the ball how should the racket be tilted.**

b) **Generally pitch bearing is located outboard of flap hinge.**

c) **In-plane rotating frequency is generally kept away from the rotational speed, but that is not the case with the flapping mode.**

d) **If the pitch axis lies on the cg axis, there is no structural coupling between flap and pitch motions, but in actuality, these motions are coupled.**

e) **The Coriolis forces depend on velocity like damping forces, but their nature is quite different from damping forces.**

f) **In a bearingless main rotor (BMR), the pitch bearing is replaced by an elastic flexure consisting of flexbeams and a torque tube to facilitate pitch changes. From outset, the BMR configuration appears quite similar to the hingeless blade, the analysis is quite different for a BMR blade.**

g) **A large δ_3 (like 45°) is not uncommon for tail rotors.**

h) **A zero lag offset is not physical.**

i) **Pitch and lag equations are coupled through Coriolis terms.**

j) **External damping in the lag mode is beneficial, but it is quite difficult to add such damping for a hingeless blade.**

k) **Generally it is possible to achieve a matched stiffness condition with soft lag rotors.**

l) **A small offset of cg from feather axis may have a negligible influence on flap mode, but that may not be the case with torsion mode.**

m) **The Coriolis forces produce a 2/rev lag motion proportional to the square of the 1/rev flap amplitude.**

n) **There will be inherently some pitch-flap and pitch-lag coupling for an elastic blade.**

o) **A vertical gust would induce only vertical oscillations in an articulated rotor with no hinge offset, but that may not be the case with hingeless rotors.**