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Helicopter Theory

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1. Relevant data pertaining to a helicopter are given in the following.

Weight of the helicopter: 36000 N

Density of air: ρ	1.225 kg/m^3
Number of blades: N	4
Blade radius: R	6 m
Blade chord: C	0.4 m
Profile drag coefficient: C_{d0}	0.01
Lift curve slope: a	5.73
Rotor angular rate: Ω	10π rad/sec
Tip loss factor: B	0.97
Root cut-out:	0.15R

Blade twist for 4 different configurations: θ_{tw}= 0 deg,
-10 deg. (linear twist)
-20 deg. (linear twist)
ideal twist with θ_{tip}

The helicopter is under hovering condition.

Assuming non-uniform inflow, evaluate the following and show each item in one figure:

i) Variation of pitch angle with non-dimensional radial location (all 4 twist cases).

ii) Variation of angle of attack with non-dimensional radial location (all 4 twist cases)

iii) Variation of induced velocity with non-dimensional radial location (all 4 twist cases)

iv) Variation sectional induced drag with non-dimensional radial location (all 4 twist cases)

v) Variation sectional profile drag with non-dimensional radial location (all 4 twist cases)

Note: Show the plots for non-dimensional radius from 0.15 to 1.0