AE-660: Preliminary Design of Helicopter (Semester II, 2011–12)
Department of Aerospace Engineering, IIT Kanpur

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Course Contents

- Introduction to: design process, design goals, types of rotorcraft
- Understanding mission requirements, use of Analytical Hierarchy Process in configuration selection
- Concept selection methodology: collection of statistical data, Pugh's method, key performance indices, life cycle costs
- Generating design alternatives: preliminary sizing using Tischenko's Method, preliminary weight estimation, rotor propulsive efficiency, Lift/Drag ratio, engine performance, main rotor blade weight estimation, rotor hub and swashplate
- Performance: power required for hover, climb, level flight, maximum level speed, speed for best endurance, best range, autorotative performance
- Main rotor configuration design: rotor structural and aerodynamic design (number of blades, rotor diameter, blade chord, rotor inertia, blade twist, blade taper, blade tip shape, sweep, root cutout, tip speed, hinge offset, airfoils, frequency placement, material selection)
- Rotor component design: hub design, control power, helicopter stability considerations; Tail rotor / anti-torque systems: diameter, tip speed, disk area, number of blades, pusher vs tractor
- Fuselage and landing gear design; Vibration sources, vibration reduction
- Life cycle cost estimation: environmental cost, purchase cost, operating cost

References

1. Leishman, J. G., *Principles of Helicopter Aerodynamics*, Cambridge Aerospace Series, 2000.
2. Prouty, R. W., *Helicopter Performance, Stability, and Control*, Krieger Publishing Company, Florida, 1986.
3. Stepniewski, W. Z., and Keys, C. N., *Rotary-Wing Aerodynamics*, Dover, New York, 1984.
4. Venkatesan, C., "Lecture Notes on Helicopter Technology," Department of Aerospace Engineering, IIT Kanpur, 2000.
5. Filippone, A., *Flight Performance of Fixed and Rotary Wing Aircraft*, AIAA Education Series, 2006.

Grading

40% Design Report
40% Weekly reports + Presentations
20% Viva voce