AMITY UNIVERSITY
UTTAR PRADESH

Course Title: PRINCIPLES OF HELICOPTER ENGINEERING **Credit Units: 03**

Course Code: AERO409

Course Level: UG

L	T	P/S	SW/ FW	TOTAL CREDIT UNITS
3	-	-	-	3

Course Objectives

This course is designed to provide knowledge about various terms connected with aerodynamics, flight performance, stability and control of a helicopter with particular emphasis to rotor blades. The students will also understand various parameters of propulsion systems used in helicopters and certain salient aspects of rotor performance and design.

Pre-requisites: Aircraft Stability & Control, Airplane Performance and Propulsion-I.

Course Contents/Syllabus:

	Weightage (%)
Module I : Introduction	**20**
Descriptors/Topics *:* Helicopter as an aircraft, Basic features, Layout, Generation of lift, Gearbox, tail rotor, power plant, drive to main tail rotor, considerations on blade, feathering and flapping, Rotor controls, various types of rotor, Geometry of the rotor, Blade loading, Effects of solidity, Profile drag, compressibility etc., blade area required, Number of blades, blade form, power losses, rotor efficiency.	
Module II : Aerodynamics of Rotor Blades	**20**
Descriptors/Topics : Aerofoil characteristics in forward flight, hovering and state vortex ring, Blade stall, Maximum lift of the helicopter, calculation on induced power high speed limitations; parasite drag, power leading, tip speed ratio on performance Ground effect.	
Module III : Power Units and Flight Performance	**15**
Descriptors/Topics : Piston engines, Gas turbines, Ramjet principle, gross weight of a jet helicopter, Comparative performance, Horse power required, Range and Endurance, rate of climb, best climbing speed, Ceiling in vertical climb, Autorotation.	

Module IV : Dynamic Stability and Control	**15**
Descriptors/Topics : Physical description of effects of disturbances, longitudinal dynamic stability, Stick fixed dynamic stability, longitudinal stability characteristics, lateral dynamic stability, lateral stability characteristics, control response.	
Module V : Rotor Vibrations	**15**
Descriptors/Topics : Dynamic model of the rotor, motion of the rigid blades, flapping motion, lagging motion, feathering motion, properties of vibrating systems, phenomenon of vibrations, fuselage response, Vibration absorbers, Measurement of vibration in flight.	
Module VI : Rotor Blade Design	**15**
Descriptors/Topics : General considerations, Airfoil selection, blade constructions, materials, factors affecting weight and cost, Design conditions, stress analysis.	

Student Learning Outcomes:

- Describe helicopter controls, airflow thro Rotor / Tail rotor, performance and stability aspects.
- Analyze helicopter propulsion systems, its vibrations and prevention.
- Analyze effect of disturbances on stability of the helicopter.
- Design rotor blade of the helicopter.

Pedagogy for Course Delivery: Session Plan / course-material uploading, Class-room teaching associated with assignments, Model Demonstration, presentations**,** quiz, viva-voce and evaluation.

Assessment/ Examination Scheme:

Theory L/T (%)	Lab/Practical/Studio (%)	Total
100	**NA**	**100**

Theory Assessment (L&T):

Continuous Assessment/Internal Assessment - 30					End Term Examination
Components (Drop down)	**A**	**CT**	**S/V/Q**	**HA**	**70**
Weightage (%)	5	10	8	7	70

Text & References:

- Young R.A, “Helicopter Engineering”.
- Bramwell, A.R.S, “Helicopter Dynamics”.
- Jacob Shapiro, “Principles of Helicopter Engineering”.
- John Fay, “The Helicopter and How it Flies”.

Any other Study Material:

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