HELICOPTER ENGINEERING

PROFESSIONAL ELECTIVE - V

VIII Semester

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	Total
A5AE56	PCC	3	0	0	3	30	70	100

COURSE OBJECTIVES:

The course should enable the students to:

1. To provide knowledge about aerodynamics, flight performance, stability and control of a helicopter with particular emphasis to rotor blades.
2. To provide knowledge about working principle and performance estimation of ground effect machines

UNIT-I **ROTORCRAFT AND ROTOR CONTROL**

TYPES OF ROTORCRAFTS: Helicopter - main rotor system, Features of Fully Articulated Rotor System, Features of Semi Rigid Rotor System, Features of Rigid Rotor System. Transmission system - Main Rotor drive system, Tail Rotor Drive System. Configurations based on torque reaction, Jet rotors and compound helicopters.

ROTOR CONTROL: Methods of control, Collective and cyclic pitch changes, Lead-lag and flapping hinges

UNIT-II **IDEAL ROTOR THEORY AND ROTOR PERFORMANCE**

IDEAL ROTOR THEORY: Hovering performances, Momentum and simple blade element theories.

ROTOR PERFORMANCE: Figures of merit, Profile and induced power estimation, Constant chord and ideal twist rotors.

UNIT-III **POWER ESTIMATES AND STABILITY AND TRIM**

POWER ESTIMATES: Induced, Profile and Parasite power requirements in forward flight, Performances curves with effects of altitude.

STABILITY AND TRIM: Hover Trim, Trim in Forward Flight, Damping – Static Stability, Static Longitudinal Stability, Angle of Attack Stability, Static Directional Stability.

UNIT-IV **LIFT AND CONTROL OF V/S TOL AIRCRAFT**

Various configuration, Propeller, Rotor ducted fan and jet lift, Tilt wing and vectored thrust, Performances of VTOL and STOL aircraft in hover, Transition and Forward motion

UNIT-V **GROUND EFFECT MACHINES**

Types, Hover height, Lift augmentation and power calculations for plenum chamber and peripheral jet machines. Drag of hovercraft on land and water. Applications of hovercraft

Text Books:

1. Johnson Wayne (2011), *Helicopter Theory*, 1st edition, Sterling Publishing House, New York.
2. McCormick B. W. (2010), *Aerodynamics, Aeronautics and Flight Mechanics,* 2nd edition, Wiley India Ltd, New Delhi, India

Reference Books:

1. Alfred Gessow, Garry C. Myers (2007), Aerodynamics of Helicopter, 2nd edition, F. Ungar Pub. Co, New York.
2. B.W. (1998), Aerodynamics of V/STOL Flight, Dover Publications, USA.
3. John M. Seddon (2011), Basic Helicopter Aerodynamics, John Wiley & Sons, USA.

Web References:

http://www.khaiedu.com/airplanes-and-helicopters.html
https://nptel.ac.in/courses/101104017

E-Text Books:

Helicopter Theory by Wayne Johnson (Kindle edition)

COURSE OUTCOMES:

At the end of the course the student should be able to:

1. Determine the working characteristics of rotors and flight controllers for flights.
2. Derive the blade element theory and profile induced power estimation.
3. Derive the stability and coefficient of performance of forward flight
4. Determine the performance analysis of VTOL and STOL aircraft.
5. Relate the power requirement for jet machines and drag of hovercraft on land and water.