Register Number:……..

KUMARAGURU
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B.E DEGREE EXAMINATIONS: NOV/DEC 2022

(Regulation 2018)

Eighth Semester

AERONAUTICAL ENGINEERING

U18AEE0014 HELICOPTER AERODYNAMICS

COURSE OUTCOMES

CO1:	Familiarize on major helicopter components, characteristics and configurations.
CO2:	Apply Momentum and simple blade element theories to helicopter's rotor blades.
CO3:	Analyze the power requirements in forward flight.
CO4:	Understand the stability problems of helicopter
CO5:	Analyze the performance of VTOL and STOL aircrafts
CO6:	Apply the ground effect concept to ground effect machines.

Time: Three Hours **Maximum Marks: 100**

Answer all the Questions:-

PART A (10 x 2 = 20 Marks)
(Answer not more than 40 words)

1.	List the four basic controls of helicopter	CO1	[K_2]
2.	Define: (i) Dissymmetry of lift and (ii) Effective translational lift	CO1	[K_2]
3.	What will be the percentage increase in the thrust coefficient of a rotor with blade tip-loss factor of 0.93, when the number of blades in increased from 2 to 3?	CO2	[K_2]
4.	What is Rotor Figure of Merit and how it decides the performance of a rotor?	CO2	[K_2]
5.	Define the term 'speed stability'. When is the helicopter said to be in the trimmed condition	CO4	[K_2]
6.	What is meant by dihedral effect?	CO4	[K_2]
7.	List the features of V/STOL Aircraft	CO5	[K_2]
8.	What is meant by Coanda effect?	CO5	[K_2]
9.	List the assumptions and applications of ACV	CO6	[K_2]
10.	What is meant by ground effect?	CO6	[K_2]

Answer any FIVE Questions:-
PART B (5 x 16 = 80 Marks)
(Answer not more than 400 words)

11.	a)	Explain the features of the fully articulated rotor system, semi rigid rotor system and rigid rotor system	8	CO1	[K_3]

	b)	Explain the Helicopter control methods with neat sketches	8	CO1	[K_3]
12.	a)	Using momentum theory, show that $b=2a$ and induced velocity $v = \sqrt{\frac{T}{2\rho\pi R^2}}$.	10	CO2	[K_4]
	b)	A helicopter of gross weight W with rotor diameter D, hovers at sea level achieving a figure of merit M. Using momentum theory, calculate the percentage decrease/increase in actual rotor power at 1 km above sea level at same M. Density ratio change of 8% per km may be assumed near sea level.	6	CO2	[K_4]
13.	a)	From blade element theory, using rotor Figure of Merit, estimate the performance of a rotor.	10	CO2	[K_4]
	b)	Determine the maximum thrust that can be produced by a helicopter rotor of diameter 12m, run by a 150 hp engine, hovers at sea level. Also, find the power loading and disc loading of the rotor.	6	CO2	[K_4]
14.	a)	Explain the induced, profile and parasite power requirements in forward flight.	8	CO3	[K_3]
	b)	Discuss the performance curves with effects of altitude	8	CO3	[K_3]
15.	a)	Describe the Tilt-Rotor and Tilt –Wing configurations with neat sketches	8	CO5	[K_4]
	b)	Explain three high lift configurations related to jet flap with neat sketches	8	CO5	[K_4]
16.	a)	Explain the working of a hovercraft system with neat sketch and derive an expression which gives minimum power necessary for sustentation.	10	CO6	[K_3]
	b)	Classify the drag components of Air Cushion Vehicle	6	CO6	[K_3]

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