Name:

Enrolment No:

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

End Semester Examination, December 2018

Course : Helicopter Engineering **Semester: VII**

Programme : B.Tech ASE **Time: 03 hrs.**

Course Code: ASEG 4007 **Max. Marks: 100**

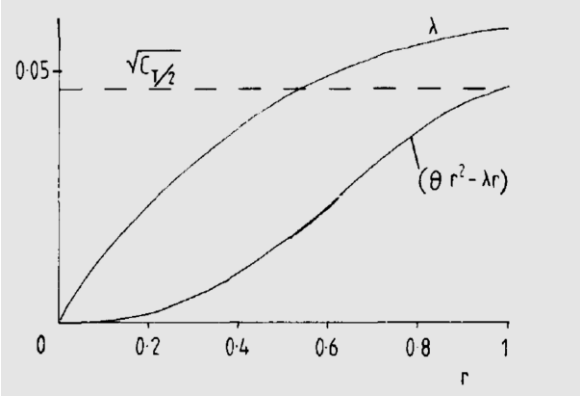
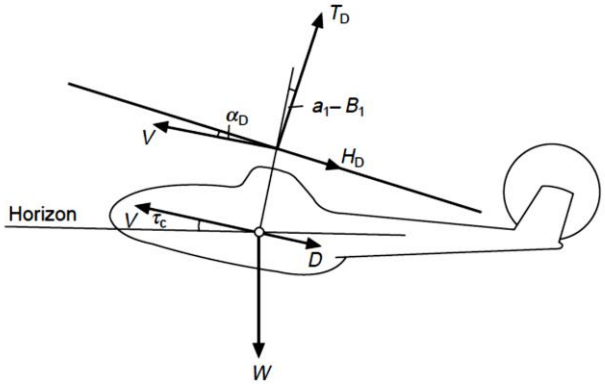
Instructions : Provide neat sketch(s)

SECTION A (20 MARKS)

S. No.		Marks	CO
Q 1	Explain the *articulated rotor hinge* system of Helicopter.	**4**	**CO1**
Q 2	Show that rotor *induced velocity* is half of *free stream* velocity in hover	**4**	**CO2**
Q 3	Define *Figure of Merit* term for Helicopter.	**4**	**CO3**
Q 4	Derive equation for flapping motion of rotor blade.	**4**	**CO4**
Q 5	How *shock absorbers* function in Helicopter?	**4**	**CO5**

SECTION B (40 MARKS)

Q 6	Explain different flight control mechanism of Helicopter.	**10**	**CO1**
Q 7	Show that inflow factor for rotor in forward flight is given by $\lambda = \frac{V \sin \alpha_r + v_i}{\Omega R}$ Where α_r is angle of tip path plane with incoming flow.	**10**	**CO2**
Q 8	Derive expressions for flapping coefficients in Helicopter rotor.	**10**	**CO3**
Q9	What are different factors affecting stability of Helicopter. Explain them briefly.	**10**	**CO4**

	SECTION-C		
Q 10	Show that helicopter rotor thrust coefficient is given by $C_T = \frac{1}{2}\sigma a \left[\frac{1}{3}\theta - \frac{1}{2}\lambda\right]$ Calculate thrust coefficient of rotor for three-quarter of radius with blade twist of 12 deg at root and 6 deg at tip, blade Solidity 0.08, section lift curve slope 5.7/rad, and  	**20**	**CO2**
	or		
	Derive the longitudinal trim equation and *trim angle of attack* expression of Helicopter as shown below:  Calculate the trim angle of attack of four bladed helicopter in level flight at sea level at tip speed ratio 0.35. The Helicopter is represented by following data: $W = 45\ 000$ N, solidity $s = 0.05$, $R = 8$ m, $h = 0.25$ $\delta = 0.013$, $\Omega R = 208$ m/s, $S_{FP} = 2.3$ m^2, $b = 4$, $a = 5.7$ Blade data: $M_b = 74.7$ kg; in terms of R, $x_g = 0.45$, $e = 0.04$	**20**	**CO3**
Q 11	Derive the non-dimensional longitudinal dynamic stability equation of Helicopter longitudinal motion.	**10**	**CO4**
	Compare the Active and passive methods of vibration control in Helicopter.	**10**	**CO5**