Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VIII EXAMINATION – SUMMER 2016

Subject Code:180102 **Date:18/05/2016**

Subject Name: Helicopter Engineering

Time:10:30 AM to 01:00 PM **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1	**(a)**	Explain flow patterns surrounding a rotor in axial flight. Draw relevant sketches	**07**
	(b)	Draw the velocity distribution of helicopter main rotor in hover and forward flight with a clear neat sketch and ad necessary labeling.	**07**
Q.2	**(a)**	Using blade element theory, derive equations for thrust, torque and power in forward flight.	**07**
	(b)	Using momentum theory, derive the equations for induced velocity in forward flight.	**07**
		OR	
	(b)	1. Define Figure of Merit, disc loading and power loading. Derive the relation between disc loading and power loading. 2. Explain Coriolis Force	**07**
Q.3	**(a)**	Write a short note on types of stall.	**07**
	(b)	Define Figure of Merit, disc loading and power loading. Derive the relation between disc loading and power loading. Comment and compare the disc loadings for a commercial and a fighter helicopter.	**07**
		OR	
Q.3	**(a)**	Using blade element theory derive the equations for thrust, power and torque for axial flight and hover	**07**
	(b)	Write a short note on types of power and its behavior.	**07**
Q.4	**(a)**	Explain mass flow rate and derive an equation of induced velocity for high climb conditions	**07**
	(b)	Explain the concept of boundary layer in detail	**07**
		OR	
Q.4	**(a)**	Explain mass flow rate and derive an equation of induced velocity for high descent conditions	**07**
	(b)	Describe the selection criteria for an airfoil in helicopter rotor and give justification and also explain the significance for each one of them.	**07**
Q.5	**(a)**	1. Define advance ratio and inflow ratio 2. Explain Autorotation	**07**
	(b)	1. Describe reverse flow region 2. Write a short note on pre-twist and taper	**07**
		OR	
Q.5	**(a)**	Find out total C_T at 75 percent radial station for a 4 bladed rotor having 12 m radius and 0.2 m chord, use NACA 0012 for blade cross-section. Given: Main rotor rpm = 360. Assume necessary data.	**07**
	(b)	Find out advance ratio and inflow ratio for a rotor advancing at 100 m/s rotating at 1000 rpm and having a radius of 10 m. Consider the cross-section of the airfoil as NACA 0012 and operating at its stalling conditions.	**07**

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