Seat No.: _____ **Enrolment No._____**

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VIII (OLD) - EXAMINATION – SUMMER 2017

Subject Code:180102 **Date:04/05/2017**

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)**	1. Define advance ratio and inflow ratio 2. Explain Autorotation	**07**
	(b)	1. Explain reverse flow region 2. Write a short note on pre-twist and taper	**07**
Q.2	**(a)**	Explain momentum theory and derive equations for high descent.	**07**
	(b)	Explain the behavior of power vs. forward speed for the main rotor of the helicopter. Discuss different types of power.	**07**
		OR	
	(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**
Q.3	**(a)**	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**
	(b)	Explain mass flow rate and derive an equation of induced velocity for high climb conditions	**07**
		OR	
Q.3	**(a)**	Explain Tandem and Co-axial rotor arrangements and the working principles behind the same	**07**
	(b)	Using blade element theory, derive equations for thrust, torque and power in axial flight.	**07**
Q.4	**(a)**	Using blade element theory and derive the equations for thrust, power and torque for forward flight.	**07**
	(b)	1. Rotor Efficiency = _____ 2. _____ , _____ and _____ are the three degrees of freedom in a helicopter rotor blade. 3. Power required to hover will increase as _____ of velocity. 4.Write down the names of two American Helicopters, 5.Define Slenderness ratio	**07**
		OR	
Q.4	**(a)**	Using momentum theory derive the equations for induced velocity in forward flight	**07**
	(b)	Write a short note on Coriolis effect	**07**
Q.5	**(a)**	Prove that wake velocity is twice the induced velocity.	**07**
	(b)	Write a short note on Rotor Configurations.	**07**
		OR	

Q.5	**(a)**	State differences between blade element theory and momentum theory.	**07**
	(b)	Draw the velocity profile for hover and forward flight.	**07**

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