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

GUJARAT TECHNOLOGICAL UNIVERSITY

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

Subject Code: 2180102 **Date: 02/05/2017**

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)**	Explain the velocity distribution over a helicopter rotor in forward flight and hover. A neat sketch of both is compulsory.	**07**
	(b)	Define mass flow rate and derive an equation of induced velocity for high climb conditions.	**07**
Q.2	**(a)**	Using blade element theory, derive equations for thrust, torque and power for helicopter in hover.	**07**
	(b)	The helicopter has a weight of 31,000 kg has a tip speed of 180 m/sec. Wake velocity for such a rotor is 19 m/sec. Evaluate the Thrust coefficient and Power coefficient based on the power estimated by momentum theory	**07**
		OR	
	(b)	Explain in your own words, problems arising due to following situations: 1. If one of the rotor in a co-axial rotor fails 2. If one of the rotor in a tandem rotor fails 3. If one of the rotor in a side-by-side rotor fails	**07**
Q.3	**(a)**	Explain Autorotation and ground effect	**07**
	(b)	Define the following: 1.Downwash Angle 2. Inflow ratio 3. Blade solidity 4. Power loading 5. Disk loading 6. Lock number 7. Figure of Merit	**07**
		OR	
Q.3	**(a)**	State the technical differences between a rotary wing a/c and a fixed wing a/c. Sketch necessary drawings.	**07**
	(b)	Explain in detail about the flow patterns in axial flight with sketches, graph and its explanation	**07**
Q.4	**(a)**	Explain the distribution of power consumptions with respect to flight speed. Describe the role of each of the power with respect to the flight condition.	**07**
	(b)	Derive the induced velocity in forward flight using momentum theory along with the assumptions	**07**
		OR	
Q.4	**(a)**	Describe the types of rotor configurations used in helicopters and explain their functioning in detail	**07**
	(b)	Define mass flow rate and derive an equation of induced velocity for high descent conditions.	**07**
Q.5	**(a)**	Find out total CT 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	**07**
	(b)	Explain the reason of providing twist and taper in a blade.	**07**
		OR	
Q.5	**(a)**	What is the purpose of providing hinges in helicopter rotor blades? Which are these hinges and which degrees of freedom do they facilitate?	**07**
	(b)	Write a short note on Coriolis Force and Induced Velocity	**07**

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