

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-VIII(NEW) EXAMINATION – SUMMER 2019****Subject Code: 2180102/2180108****Date:17/05/2019****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.

		MARKS
Q.1	(a) Describe the degrees of freedom of a rotor blade.	03
	(b) State the technical differences between a rotary wing a/c and a fixed wing a/c.	04
	(c) Describe the types of rotor configurations used in helicopters and explain their function.	07
Q.2	(a) List all the characteristics of an airfoil for a rotor.	03
	(b) Write short notes on Figure of Merit and Blade Loading Coefficients.	04
	(c) Evaluate the equation of Thrust, Power and Torque Coefficient using Buckingham pi theorem.	07
	OR	
	(c) Define the following:	07
	(i) Disk loading. (ii) Power loading. (iii) Disk solidity.	
	(iv) Rotor solidity. (v) Lock Number. (vi) Downwash Angle.	
Q.3	(a) Differentiate between Cyclic and Collective pitch.	03
	(b) Find out advance ratio and inflow ratio of a 4 bladed helicopter rotor weighing 25,000 kg and rotating at 360 rpm moving forward at 65m/sec and having a radius of 12m. Assume the angle of attack of 10 degrees. For the calculations use the induced velocity for hover (To be calculated using momentum theory)	04
	(c) Explain the velocity distribution over a helicopter rotor in Forward flight and Hover.	07
	OR	
Q.3	(a) Differentiate between Feathering and Flapping.	03
	(b) Derive the induced velocity in forward flight using momentum theory.	04
	(c) Derive an equation of induced velocity for high Climb and Descent conditions.	07
Q.4	(a) Why does twist provided on main rotor?	03
	(b) Discuss various airfoil sections used for main rotors.	04
	(c) Using blade element theory, derive equations for thrust, torque and power for helicopter in hover.	07
	OR	
Q.4	(a) How will you modify wing tip if found it touches transonic speed?	03
	(b) Discuss climb power, induce power and parasitic power.	04

- (c) Explain in detail about the flow patterns in axial flight with sketches, graph and its explanation. **07**
- Q.5** (a) How will you determine tail rotor power requirement? **03**
- (b) What are difference between power required while hovering and cruising? **04**
- (c) 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**

OR

- Q.5** (a) Explain Autorotation and ground effect. **03**
- (b) Define the Coriolis Force and Induced Velocity. **04**
- (c) What is the purpose of providing hinges in helicopter rotor blades? Which are these hinges and which degrees of freedom do they facilitate? **07**

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