

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. **07**
 2. Explain Coriolis Force
- 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 **07**
 2. Explain Autorotation
 (b) 1. Describe reverse flow region **07**
 2. Write a short note on pre-twist and taper
- 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. **07**
 Given: Main rotor rpm = 360. Assume necessary data.
 (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**
