

GUJARAT TECHNOLOGICAL UNIVERSITY
BE – SEMESTER – VIII EXAMINATION – WINTER 2016

Subject Code: 180102**Date: 22/10/2016****Subject Name: Helicopter Engineering****Time: 02:30 PM to 05:00 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) Write in detail about the flow patterns in axial flight with sketches, graph and its explanation **07**
- (b) Explain momentum theory in hover along with all its assumptions and a neat sketch **07**
- Q.2** (a) Explain the importance of Radius, Twist and Taper in a helicopter rotor blade from the perspective of conceptual design. **07**
- (b) Explain the requirements of an airfoil to be used in a rotor. Describe the concept of boundary layer on an airfoil surface. **07**
- OR**
- (b) Sketch the degrees of freedom of a rotor blade. Explain and expand these degrees of freedom and show how they behave in steady state. Explain the meaning of steady state. Explain the physical significance of the terms occurring in the equation of steady state. **07**
- Q.3** (a) Write a short note on: **07**
1. Downwash and Induced angle of attack
 2. Advance ratio and induced velocity
- (b) Draw the velocity profile for hover and forward flight. **07**
- OR**
- Q.3** (a) State the technical differences between a helicopter and an airplane. Sketch necessary drawings. **07**
- (b) Explain Tandem and Co-axial rotor arrangements and the working principles behind the same **07**
- Q.4** (a) Define the following: **07**
1. Solidity
 2. Lock Number
 3. Disk loading
 4. Power loading
 5. Root-cutout
 6. Figure of Merit
 7. Coefficient of Thrust
- (b) Describe main rotor configurations. Explain using a schematic the working principles of all these helicopters. **07**
- OR**
- Q.4** (a) Using blade element theory, derive the equations for hover **07**
- (b) Prove that wake velocity is twice the induced velocity **07**
- Q.5** (a) Write a short note on (Draw neat sketches wherever relevant): **07**
1. Coriolis effect
 2. Explain Reverse flow region
- (b) Explain ground effect **07**

OR

- Q.5** (a) Explain the types of stall in an airfoil of a helicopter rotor blade
(b) Explain the steps of conceptual design

07

07
