

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 07
2. Explain Autorotation
- (b) 1. Explain reverse flow region 07
2. Write a short note on pre-twist and taper
- 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 = _____ 07
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
- 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.
(b) Draw the velocity profile for hover and forward flight.

07

07
