Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

A Constituent Institution of Manipal University

VII SEMESTER B.TECH. (AERONAUTICAL ENGINEERING)

END SEMESTER EXAMINATIONS, xxx 2021

SUB: HELICOPTER AERODYNAMICS [AAE 4102]

REVISED CREDIT SYSTEM
(xx/xx/2021)

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

- Answer **ALL** the questions.
- Missing data may be suitable assumed.

1A. With the help of neat diagrams explain the working mechanism of the helicopter collective device. **(4)**

1B. If a rotor of radius 1.8 m hovering at sea level supports 7150 N weight find (a) the induced velocity (b) ideal power (c) actual power if the figure of merit is 0.8 **(6)**

2A. Explain the major historical developments of helicopters. **(4)**

2B. Derive the equation for all the power(s) required in forward flight. **(6)**

3A. With the help of neat diagrams explain the differences between the following helicopter rotors. (i) Tail rotor (ii) Dual rotor (iii) Coaxial rotor and (iv) Notar. **(4)**

3B. A two-bladed helicopter rotor of diameter 4m rotating at 200 rpm flies at 18 m/s. The blades of chord 25 cm, having a uniform twist of 5^0 angles of attack. The induced velocity at the rotor is uniform at 0.9 m/s and the thrust coefficient is 10^{-3}. Find the lift-curve slope of the blades. **(6)**

4A. With the help of neat diagrams explain the helicopter pilot control devices. **(4)**

4B. A helicopter rotor of radius 2.2 m, rotating at 200 rpm, travels at 22 m/s. If the coning angle is 10^0 and angle of attack is 4^0, determine the component of resultant velocity perpendicular to the control axis at azimuthal angle (a) 90^0 and (b) 270^0 **(6)**

5A. Derive the momentum analysis in helicopter forward flight. **(4)**

5B. If the thrust and power coefficients of a helicopter rotor of solidity 0.08 are $6x10^{-04}$ and 10^{-4}, respectively, determine the profile power coefficient and profile drag coefficient of the rotor. **(6)**