PARUL UNIVERSITY
FACULTY OF ENGINEERING & TECHNOLOGY
B.Tech. Winter 2022 - 23 Examination

Semester: 7   Date: 08/10/2022
Subject Code: 203101433   Time: 10:30am to 1:00pm
Subject Name: Helicopter Engineering   Total Marks: 60

Instructions: 1.
 All questions are compulsory.
2. Figures to the right indicate full marks.
3. Make suitable assumptions wherever necessary.
4. Start new question on new page.

Q.1 Objective Type Questions - (All are compulsory) (Each of one mark)   **(15)**
   1.   When helicopter is flying at constant altitude without moving forward that is called _____.
   2. How many main rotors in tandem rotor configuration?
   3. By using which control helicopter can fly in forward direction?
   4. Figure of merit is the ratio of _____ power required to hover to actual power required to hover.
   5. Power loading is the ratio of _____ to power.
   6. Disc loading is the ratio of thrust to _____.
   7. How many main rotors in coaxial rotor configuration?
   8.   Vertical take-off of helicopter can be done by using which control?
   a. Rudder padel   b. Collective
   c. Cyclic   d. None of the above
   9.   Mechanism which is used to control blade angle of main rotor is known as
   a. Swash plate   b. Rack and Pinion
   c. Cam and Follower   d. Gear and Gear train
   10. Mechanism which is used to control differential lift in main rotor for maneuvers is known as
   a. Tail rotor   b. Collective
   c. Cyclic Pitch   d. None of the above
   11. Throttle control is attached with _____.
   a. Collective Pitch lever   b. Cyclic Pitch lever
   c. Rudder pedal   d. None of the above
   12. For momentum theory analysis, what is rotor modelled as?
   a. Thin actuator disk   b. Thick actuator disk
   c. Angled blade   d. Two dimensional airfoil
   13. A helicopter without tail boom, two rotors mounted on the extreme ends of the helicopter fuselage, the configuration known as _____.
   14. With respect to main rotor configurations, blades of both main rotors passes through gaps between blades of each other, that configuration is called _____.
   15. Azimuth angle represents _____

Q.2 Answer the following questions. (Attempt any three)   **(15)**
   A) Draw and explain different types of main rotor configurations.
   B) Explain cyclic and collective pitch control system for conventional helicopters.
   C) Carry out detailed comparison between fixed wing airplane and helicopter.
   D) Discuss the problems in high speed forward flight of a helicopter.

Q.3 A) Draw the velocity profiles over rotor blades for hover and forward flight in detail. Make suitable   **(07)**
   comments.
   B) Using neat sketch explain the momentum analysis for axial descent and derive the quadratic   **(08)**
   equation.
                                              OR
   B) Using neat sketch explain the momentum analysis for axial climb and derive the quadratic   **(08)**
   equation.

Q.4 A) Using neat sketch explain Blade element theory and derive the thrust and torque equation (for   **(07)**
   smaller element). Make suitable assumptions.
                                              OR
   A) With the help of neat sketch discuss aerodynamic considerations to design helicopter rotor tip.   **(07)**
   B) Explain following with neat sketch: Normal working state, Vortex ring state, Turbulent wake state   **(08)**
   and windmill brake state.