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15AE743

Seventh Semester B.E. Degree Examination, July/August 2022
Helicopter Dynamics

Time: 3 hrs.

Max. Marks: 80

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

- 1 a. Derive momentum theory analysis during hovering flight. (10 Marks)
b. Obtain the expression for thrust and power coefficient with use of Buckingham π method of dimensional analysis. (06 Marks)

OR

- 2 a. Derive blade element theory in hovering flight. (12 Marks)
b. With a neat diagram, briefly explain the concept of blade flapping. (04 Marks)

Module-2

- 3 a. With the help of suitable diagram, explain the swash plate mechanism for controlling cyclic pitch in a typical helicopter. (08 Marks)
b. Derive the speed for minimum power, for the forward flight performance of the helicopter. (08 Marks)

OR

- 4 a. With a neat diagram, explain ground effects during forward flight near the ground. (12 Marks)
b. List out the factors effecting the maximum attainable forward speed of a helicopter. (04 Marks)

Module-3

- 5 a. Explain the effects of Mach number on rotor airfoil dynamics. (10 Marks)
b. Briefly explain the general requirements for a good helicopter rotor airfoil. (06 Marks)

OR

- 6 a. Explain in detail, the flow visualization techniques used to find rotor wakes. (12 Marks)
b. Schematically represent the wake geometry in hovering flight. (04 Marks)

Module-4

- 7 a. Briefly explain forward speed, side slip and yawing disturbances that affect stability of the helicopter. (06 Marks)
b. Sketch flight and ground handling qualities rating scale and define Cooper harper handling qualities rating scale. (10 Marks)

OR

- 8 a. Describe the general levels of handling qualities for an helicopter. (06 Marks)
b. Elaborate the basics of flying limitations for an helicopter. (10 Marks)

Module-5

- 9 a. Describe the general and operational requirements for an helicopter. (10 Marks)
b. Briefly explain rotor craft vibration classification. (06 Marks)

OR

- 10 a. In detail, explain the selection of tip speed for the conceptual design of main rotors of an helicopter. (08 Marks)
b. Give the overall design requirements and design constraints for an helicopter. (08 Marks)

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Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg. 42+8 = 50, will be treated as malpractice.