CBCS SCHEME

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15AE743

# Seventh Semester B.E. Degree Examination, July/August 2021
## Helicopter Dynamics

Time: 3 hrs. Max. Marks: 80

**Note:** *Answer any FIVE full questions.*





1 a. Explain the following with neat sketch,
(i) Disc loading. (ii) Power loading
(iii) Thrust and Power coefficient. **(08 Marks)**

b. A tilt rotor air craft has a gross weight of 20,400 kg. The rotor diameter is 11.58 m. On the basis of the momentum theory, estimate the power required for the aircraft to hover at a sea level on a standard day where the density of air is 1.225 kg/m$^3$. Assume that the figure of merit (FM) of the rotor is 0.75 and transmission losses amounts to 5%. **(08 Marks)**

2 a. Explain in brief with neat diagram types of rotors. **(08 Marks)**

b. Explain and derive an expression for equilibrium about the flapping hinge. **(08 Marks)**

3 a. Explain the working principle of Swash-plate in helicopter. **(06 Marks)**

b. Derive an expression for forward flight performance of an helicopter. **(10 Marks)**

4 a. What is the effect of Density altitude during forward flight? **(06 Marks)**

b. Explain with neat graph speed for maximum range during forward flight. **(10 Marks)**

5 a. What are rotor airfoil requirements and how it affects on Reynold's number and Mach number? **(10 Marks)**

b. Explain with neat sketch Pitching moment of rotor airfoil. **(06 Marks)**

6 a. What are the flow visualization techniques used to find rotor wake? **(08 Marks)**

b. What are the characteristics of rotor wake in hover? **(08 Marks)**

7 a. What do you mean by static stability of helicopter? Explain briefly forward speed disturbances of static stability. **(08 Marks)**

b. Explain about vertical speed disturbances and pitching angular velocity disturbances. **(08 Marks)**

8 a. What is meant by Harper-Cooper rating scale? Explain the flying qualities. **(08 Marks)**

b. Explain briefly helicopter performance test. **(08 Marks)**

9 a. Explain in details, the operational requirement for design of under carriage. **(08 Marks)**

b. Explain in details rotor craft vibrations and its reduction method. **(08 Marks)**

10 a. Explain briefly the following:
(i) Rotor solidity. (ii) Blade twist. **(08 Marks)**

b. Briefly explain the designing of a fuse lage of a typical helicopter. **(08 Marks)**

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