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## GBGS SCHEME

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

|    |          | Helicopter Dynamics  |                          |
|----|----------|--|--------------------------|
| Ti | ne: 3    | 3 hrs.   | Marks: 100               |
|    | N        | Note: Answer any FIVE full questions, choosing ONE full question from each n |                          |
|    |          |  |                          |
|    |          | Module-1   |                          |
| 1  | a.       | Express the momentum theory analysis in hovering flight with its flow model. | (10 Marks)               |
|    | b.       | Derive and explain equilibrium about lead lag hinge.                         | (10 Marks)               |
|    |          | OR   |                          |
| 2  | a.       | Explain with expression –Disk loading, figure of merit, rotor solidity.      | (10 Marks)               |
|    | b.       | Develop the expressions for blade element analysis in hover.                 | (10 Marks)               |
|    |          |  | (=======)                |
| 2  |          | Module-2   |                          |
| 3  | a.       | Draw and explain the different forces acting on helicopters.                 | (10 Marks)               |
|    | b.       | Summarise with expression, the speed for minimum power.                      | (10 Marks)               |
|    |          | OR   |                          |
| 4  | a.       | Derive and explain speed for maximum range.                                  | (10 Marks)               |
|    | b.       | Write a brief note on:   |                          |
|    |          | i) Total power required in forward flight                                    |                          |
|    |          | ii) Factors affecting forward speed.   | (10 Marks)               |
|    |          | Module-3   |                          |
| 5  | a.       | Explain along with expressions the effect of Reynold's number and mach nu    | mber due to              |
|    |          | rotor airfoil aerodynamics.  | (10 Marks)               |
|    | b.       | Write brief note on:   | (101/14/16)              |
|    |          | i) Rotor airfoil requirements  |                          |
|    |          | ii) Airfoil shape definition.  | (10 Marks)               |
|    |          | OR   |                          |
| 6  | a.       | What are the different flow visualization techniques? Explain.               | (10 Mayles)              |
| •  | b.       | Write a note on characteristics of rotor wakes in hover and forward flight.  | (10 Marks)<br>(10 Marks) |
|    |          | A A A A A A A A A A A A A A A A A A A  | (IO Marks)               |
|    |          | Module-4   |                          |
| 7  | a.       | Explain forward speed disturbance and yawing disturbance.                    | (10 Marks)               |
|    | b.       | Explain the dynamic stability aspects of helicopter.                         | (10 Marks)               |
|    |          | OR   |                          |
| 8  | a.       | Explain the vertical speed disturbance and side-slip disturbance.            | (10 Marks)               |
|    | b.       | Demonstrate the different levels of handling qualities.                      | (10 Marks)               |
|    |          | No. 1 1 5  |                          |
| 9  | 9        | Module-5 Explain the military derivatives of civil rotor craft.              | (10 % )                  |
| ブ  | a.<br>b. | Summarise the different aspects empennage design of helicopters.             | (10 Marks)               |
|    | U.       | communities the different aspects emperimage design of hencopters.           | (10 Marks)               |

flmportant 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.

10

OR

(10 Marks)

(10 Marks)

a. Write a note on general and operational requirements for a rotor craft.

b. Explain the classifications of rotorcraft vibrations.