U.S.N.										

B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

February / March 2023 Semester End Main Examinations

Programme: B.E. **Semester: V**
Branch: Aerospace Engineering **Duration: 3 hrs.**
Course Code: 20AE5DCBFM **Max Marks: 100**
Course: Basic Flight Mechanics **Date: 01.03.2023**

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

UNIT - I

1 a) Prove that $C_{D,o} = \frac{1}{3} C_{D,i}$ for the power required for level, unaccelerated flight. **10**

b) Explain the physical considerations for deriving the maximum range and endurance of a jet-airplane and for a propeller driven airplane. **10**

UNIT - II

2 Imagine a Boeing 747 flight sitting on a conveyor belt as wide and long as a runway. The conveyor belt is designed to exactly match the speed of the wheels moving in the opposite direction. Will the plane take-off? Justify your answers for the take-off that happens or not, from the understanding you had in your text book. **20**

OR

3 a) Write short notes on a level-turn, pull up and pull down for a flight. **12**

b) Write short notes on V-n diagram. **08**

UNIT - III

4 a) Explain the contribution of wing to moments about the center of gravity by deriving the equations and also explain how it is applied for a wing-body configuration. **15**

b) Prove that the neutral point is the aerodynamic center of the complete airplane. **05**

UNIT - IV

5 Explain how the elevator helps in changing the value of $C_{M,0}$ and hence changing the trimmed angle of attack for different flight speeds. **20**

UNIT - V

6	a)	Draw and describe the major parts of the helicopter.	**10**
	b)	Derive an expression for showing the effect of induced velocity in forward flight.	**10**

OR

7	a)	A helicopter has the following data: Gross weight =1363.6 kg Main rotor radius = 4.0 m Rotor tip speed = 207.3 m/s Rotor Power = 205 kW For hovering conditions at sea level, compute the following: (i) Rotor disk loading, (ii) Ideal Power loading, (iii) Thrust, Torque and Power coefficients, (iv) Figure of merit and actual power loading.	**12**
	b)	An inventor claims to have built a "flying car" that can hover, where the lifting force is provided by two ducted fans. The car weighs 1000 kg and has a 149.14 kW engine. The ducted fans are 2.13 m in diameter. Is hovering flight possible? [**Hint:** A ducted fan can be considered to have an effective area that is twice that of an unducted rotor.]	**8**

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