KUMARAGURU
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Register Number:……

M.TECH DEGREE EXAMINATIONS: APRIL / MAY 2024

(Regulation 2018)

Second Semester

DEFENCE TECHNOLOGY

P18DTT2007**:** Aerospace System Configuration, Design and Simulation

COURSE OUTCOMES

CO1: Understand the concept of missile system and its design requirements and process.

CO2: Design an aerospace vehicle and articulate its benefits in written and verbal forms.

CO3: Understand the methods for aero-elastic analysis, computational fluid analysis and advances in aerodynamics and performance

CO4: Understand the air to air, ground to air, air to ground weapon system, UAV mounted GW and UCAVs

Time: Three Hours **Maximum Marks: 100**

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1. Which of the following drag is reduced due to surface smoothness CO1 [K_1]

   a) Pressure drag b) Induced drag

   c) Skin friction drag d) Wave drag

2. Drag polar is a graph drawn between CO2 [K_1]

   a) Cl and Cn b) Cl and Cd

   c) Cl and Cm d) Cd and Cm

3. Which of the following is a method to reduce pressure drag CO2 [K_1]

   a) Decreasing surface smoothness b) Promoting laminar flow

   c) Promoting turbulent flow d) Decreasing the wake size

4. Match the Following: CO3 [K_2]

List I	List II
A. High wing	i. Positive Lateral stability
B. Vertical tail ahead of C.G	ii. Negative directional stability
C. Dorsal fin	iii. Negative lateral stability
D. Ventral fin	iv. Positive directional stabiltiy

a) A-i B-ii C-iv D-iii b) A-iii B-iv C-ii D-i

c) A-ii B-iv C-iii D-i d) A-iii B-i C-ii D-iv

5. The maximum lift-to-drag ratio is 13.6. Calculate the minimum glide angle. CO3 [K3]

a) 4.2 degrees b) 40.2 degrees

c) 14.2 degrees d) 7 degrees

6. Rudder helps in CO4 [K2]

a) Directional stability b) Longitudinal control

c) Longitudinal stability d) Directional control

7. Assertion (A): All dynamically stable aircrafts are statically stable and vice versa is not true CO3 [K2]
Reason (R): Aircrafts cannot be dynamically stable without passing through the equilibrium.

a) Both A and R are Individually true and R is the correct explanation of A b) Both A and R are Individually true but R is not the correct explanation of A

c) A is true but R is false d) A is false but R is true

8. When weight is doubled, then the rate of climb CO4 [K3]

a) increases by 50% b) increases by 60%

c) decreases by 70% d) decreases by 50%

9. Sequence the following configuration with their longitudinal stability level (From low to high) CO3 [K1]
1. Tail alone
2. Wing alone
3. Fuselage alone
4. Wing plus tail

a) 2-3-4-1 b) 4-3-2-1

c) 3-2-4-1 d) 4-1-3-2

10. Which of the following is Indian Air to Air missile CO4 [K1]

a) METEOR b) DERBY

c) ASTRA d) PYTHON

PART B (10 x 2 = 20 Marks)

11. State the various launch mode of the missiles. CO1 [K2]

12. State the various guidance system for a missile CO1 [K2]

13. Discuss the use of titanium in aircraft construction CO2 [K1]

14. Explain the steps involved in the structural design of aircraft CO2 [K2]

15. State the various governing equations used in CFD CO3 [K1]

16.	State the purpose of dorsal fin		CO3	[K_2]
17.	Define longitudinal stability		CO4	[K_1]
18.	State any three Indian made UAVs		CO4	[K_1]
19.	Explain strategic UAVs in brief		CO3	[K_1]
20.	Explain the applications of Micro UAVs		CO4	[K_1]

PART C (6 x 5 = 30 Marks)

21.	Compare Air breathing and rocket engines	5	CO1	[K_2]
22.	Explain briefly the classification of missiles	5	CO1	[K_1]
23.	Calculate the load factors of a fighter aircraft taking a steady level coordinated turn at a roll angle of 40 degrees and 60 degrees.	5	CO2	[K_3]
24.	Explain the process of CFD in brief with a flow chart	5	CO3	[K_2]
25.	Explain the categories of Homing Guidance in detail	5	CO4	[K_2]
26.	Explain Aerodynamic control system and Thrust control system in an Air-to-Air missile	5	CO4	[K_2]

Answer any FOUR Questions
PART D (4 x 10 = 40 Marks)

27.	Explain various types of missiles and their operation and limitations in detail	10	CO1	[K_2]
28.	Explain various aircraft structural components and the materials used for construction in detail.	10	CO2	[K_2]
29.	Explain the directional stability of the aircraft with the contribution from various parts of the aircraft	10	CO3	[K_2]
30.	Explain the aerodynamic design aspects, propulsion, power source of a typical unmanned aerial vehicle	10	CO4	[K_2]
31.	Explain the operation, classification and guidance of a typical Surface to Air missile	10	CO4	[K_2]

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