KUMARAGURU
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Register Number:…….

M.TECH DEGREE EXAMINATIONS: NOV/DEC 2024

(Regulation 2018)

Second Semester

DEFENCE TECHNOLOGY

P18DTE0022 Unmanned Aerial Vehicle Design

COURSE OUTCOMES

CO1: Understand the design requirements, design parameters of UAV

CO2: Perform the aerodynamic analysis, performance and stability analysis

CO3: Understand the performance testing of the UAVs.

CO4: Understand the airworthiness and safety requirements of UAV

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

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1. **Assertion (A):** Ribs, used in airplane wings, increase the column buckling strength of the longitudinal stiffeners. CO2 [K_2]

   Reason (R): Ribs distribute concentrated loads into the structure and redistribute stresses around discontinuities.

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

2. The _____phase, which provides the final outcome of 3-D modeling of an UAV CO2 [K_1]

   a) Conceptual design
   b) Pre-Conceptual design
   c) Preliminary design
   d) Detailed design

3. For a symmetric airfoil, the lift coefficient for zero degree angle of attack is CO2 [K_2]

   a) – 1.0
   b) 0.0
   c) 0.5
   d) 1.0

4. Matching type item with multiple choice code CO3 [K_1]

List I	List II
A. Euler number	i. Surface tension
B. Weber number	ii. Gravity
C. Mach number	iii. Pressure
D. Froude number	iv. Elastic

A B C D

a) ii i iii iv

b) iv iii ii i

c) ii iv iii i

d) iii i iv ii

5. The _____ has used for the estimation of the altitude of a UAV CO3 [K_1]

a) Infrared Sensor b) Pyroelectric Sensor

c) Piezoelectric Sensor d) Gyroscope Sensor

6. The _____can efficiently execute the missions in between the ranges of 100 km to 300 km CO3 [K_2]

a) MALE UAV b) HALE UAV

c) Tactical UAV d) Close-Range UAV

7. In a manual flying control system, the control inputs to the primary control surfaces are CO1 [K_1]
1. reversible
2. irreversible
3. instinctive for the movement required
4. opposite for the movement required
5. limited in range by flight deck obstructions

a) 1 and 4 only b) 2 and 4 only

c) 1 and 3 only d) 1,3 and 5 only

8. Assertion (A): Reynolds number must be same for the model and prototype immersed in subsonic flows. CO3 [K_2]
Reason (R): Equality of Reynolds number for the model and prototype satisfies the dynamic similarity criteria.

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

9. In UAV, _____ is the type of flight control system, in which all of the operations are executed by microcomputer except the execution of mission plan. CO1 [K_1]

a) Full remote control b) Assisted remote control

c) Exception control d) Full automation control

10. Consider the following fluid flow regimes: CO4 [K_2]

1. Subsonic, 2.Hypersonic, 3.Supersonic, 4. Transonic

The correct sequence of the fluid flow regimes is

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

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

PART B (10 x 2 = 20 Marks)

11. What are the classes of UAV Systems? CO1 [K_2]

12.	Compare Ramp-launched and VTOL Aircraft	CO1	[K_2]
13.	Name the major components and control surfaces of an airplane	CO2	[K_2]
14.	Sketch a typical airfoil and explain its nomenclature	CO2	[K_2]
15.	Compare monocoque and semi-monocoque constructions	CO2	[K_2]
16.	What is meant by directional control?	CO2	[K_2]
17.	Define centre of pressure and aerodynamic centre	CO3	[K_2]
18.	What is meant by design for reliability?	CO3	[K_2]
19.	Name the power plants used in helicopter	CO4	[K_2]
20.	State the need for wind tunnel testing	CO4	[K_2]

PART C (10 x 5 = 50 Marks)

21.	Describe three design stages involved in the development of unmanned aerial vehicles	CO1	[K_3]
22.	Explain Airworthiness of aircrafts and UAVs	CO1	[K_3]
23.	Compare Lift-induced drag and Parasitic drag	CO1	[K_3]
24.	Discuss two basic types of payloads	CO1	[K_3]
25.	Illustrate the working of a gas turbine engine	CO2	[K_3]
26.	Discuss the structure and mechanics of UAV airframe design with suitable examples	CO2	[K_3]
27.	Compare HTOL and VTOL Configurations	CO2	[K_3]
28.	Explain the subsystems incorporated by mission planning and control station	CO3	[K_3]
29.	Explain Inertial Navigation and Way-point Navigation	CO3	[K_3]
30.	Describe about aerodynamic characterization through wind tunnel testing	CO4	[K_3]

Answer any TWO Questions

PART D (2 x 10 = 20 Marks)

31.	Discuss the use of electric motors and batteries for UAVs as a source of propulsion.	10	CO2	[K_4]
32.	What are the functions of an MPCS? Describe the mission planning and control station (MPCS) with a neat block diagram.	10	CO2	[K_4]
33.	Compare Radar tracking, Radio tracking and Direct reckoning	10	CO1	[K_3]

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