Register Number:……..

KUMARAGURU
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B.E DEGREE EXAMINATIONS: NOV/DEC 2018

(Regulation 2015)

Seventh Semester

AERONAUTICAL ENGINEERING

U15AEE020**:** UAV System Design

COURSE OUTCOMES

CO1: Prepare preliminary design requirements for an unmanned aerial vehicle.
CO2: Select the suitable components for making unmanned aerial vehicle.
CO3: Perform calculations and analysis for UAV airframe design.
CO4: Perform stability analysis and control of UAVs.
CO5: Communicate with UAVs from laptop control stations.
CO6: Design unmanned systems by considering practical limitations.

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

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1. Matching type item with multiple choice code CO1 [K_2]

Unmanned Aerial Vehicle [UAV]	Operating Environment / Application
A. NAV	i. within buildings
B. Close range UAV	ii. diverse civilian purposes
C. Micro UAV	iii. ultra-short range surveillance
D. Mini UAV	iv. ship-to-shore surveillance

	A	B	C	D
a)	ii	i	iii	iv
b)	iii	iv	i	ii
c)	i	iii	iv	ii
d)	iii	i	ii	iv

2. Which of the one is most perfect to handling the voltage in mutli-rotor UAV? CO2 [K_2]

a) PDB b) Battery Eliminator Circuit [BEC]

c) FCB d) BLDC Motor

3. Multiple selection item with multiple choice code CO1 [K_2]

1. Unmanned Aircraft can be classified based on Size of the Unmanned Aircraft and its mode of operations.
2. Endurance of Unmanned Aircraft depends upon Payload carrying capacity of an Unmanned Aircraft.
3. For a steady level flight, angle of attack must be zero in fixed wing UAV.
4. Battery lifetime of a Multi-rotor UAV is depends upon its Aerodynamic effect.

a) 1,3,4 are correct
b) 1,2, 4 are correct
c) 1,2, 3 are correct
d) 1,2,3,4 are correct

4. The primary measurement of an accelerometer is_____ CO6 [K_1]

a) Linear acceleration
b) Gravitational acceleration
c) Specific force
d) Deviation angle

5. Assertion (A): For a steady level flight, Flight path angle must be zero in fixed wing UAV. CO3 [K_1]

Reason (R): Unmanned Aircraft can be classified based on Weight of the Unmanned Aircraft

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

6. Which of the sub-component is most perfect to control the speed of the motor in Electronic Speed Controller? CO2 [K_2]

a) IGBT [insulated-gate bipolar transistor]
b) BEC
c) Capacitor
d) Resistor

7. Reorder the given UAVs with the help of their ranges in an ascending manner. CO1 [K_2]

1. Mini UAV
2. Tactical UAV
3. Micro UAV
4. Close range UAV

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

8. What is the discharge rate of battery, which is having capacity of 10mAh, with a constant electron flow of 6.24 X $10^{16?}$ CO6 [K_2]

a) 1 b) 2

c) 0.5 d) 1.5

9. Assertion (A): Endurance of Unmanned Aircraft depends upon Atmospheric conditions in which Unmanned Aircraft is flying. CO3 [K_2]

Reason (R): Magnetometer is one of the primary sensors used in the UAV for direction determination.

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

10. What is the major prime selection factor for UAVs motor? CO3 [K_1]

a) Discharge time b) KV

c) RPM d) Cell

PART B (10 x 2 = 20 Marks)
(Answer not more than 40 words)

11. What are the selection criterions involved in the UAV? CO2 [K_2]

12. Write the primary functions of FCB in Multi-rotor UAV. CO1 [K_1]

13. What did you understand about the effect of Air Turbulence in Unmanned Aircraft? CO3 [K_2]

14. Compare the manuvering achievement of any two different multi-rotor UAVs. CO3 [K_2]

15. The term “Stability”, How closely linked with arrangement of various payloads in UAV? CO4 [K_2]

16. List out the primary components used in the communication system of an UAV. CO4 [K_1]

17. What are the purposes of Inertial Navigation System in UAV? CO5 [K_2]

18. GPS is the primary navigation system used in the UAV. [Yes/No]. Justify your answer. CO6 [K_2]

19. Briefly explain about the types of sub stations available in the Ground Control Stations. CO5 [K_1]

20. In what way, ground control Avionics components are different from UAV on-board components? CO6 [K_2]

Answer any FIVE Questions:-
PART C (5 x 14 = 70 Marks)
(Answer not more than 300 words)

Q. No. 21 is Compulsory

21.	What are the different design stages involved in UAV? Explain in detail about stage by stage construction of Multi-rotor UAV with an appropriate real-time component names.	CO1	[K_3]
22.	Explain in detail about the various sensors used in the Unmanned Aircraft Flight Control.	CO2	[K_4]
23.	What is the current need of propulsive system in multi-rotor UAV? Explain in detail about all the propulsive systems involved in the Unmanned Aircraft with suitable input.	CO3	[K_4]
24.	What are the different types of Control Stations available to control the UAV? Explain in detail about all the sub-classification of Ground Control Station.	CO5	[K_4]
25.	Relate the contribution of payloads in the consideration of UAV construction. Also Explain in detail about all Non-Dispensable payloads with an appropriate structure.	CO4	[K_4]
26.	Explain in detail about the Aspects of Unmanned Aircraft airframe design.	CO3	[K_4]
27.	Construct the 2D wire connections [architecture] of a Quadcopter. Also Explain in detail about its working principle of optimized components.	CO6	[K_3]

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