U.S.N.										

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

Autonomous Institute Affiliated to VTU

August 2023 Semester End Make-Up Examinations

Programme: B.E.
Branch: Aerospace Engineering
Course Code: 22AS3PCIAE
Course: Introduction to Aerospace Engineering

Semester: III
Duration: 3 hrs.
Max Marks: 100
Date: 18.08.2023

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

Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

UNIT - I

1 a) List out, with a sketch, and explain the various major parts of an airplane and their function. **4**

b) Trace the development of the IAF, citing various incidents, from its birth till the time India became independent. **4**

c) Trace the progress of the Indian Space Program starting from the formation of the Department of Space in 1972 till the present day. **4**

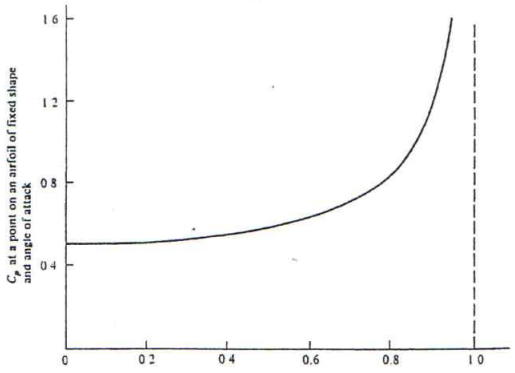
d) An aircraft cruises at a True Airspeed of 100 m/s at an altitude (h) of 4000 m above the sea-level. The outside air temperature (T_o) is 262.15 K. The speed of sound at this altitude (a_s) is 324.57 m/s. At ISA conditions the Lapse rate (L) is 0.0065K/m, the temperature (T_o) is 288.15°K at sea-level, R = specific gas constant for air = 287.05 J/(kg K), atmospheric pressure (P_o) = 101325 Pa and density as 1.226 kg / m^3 **8**

i. Calculate the air pressure Ps at the altitude of 4000 m above sea-level.

ii. Calculate the air density ρs at the altitude of 4000 m above sea-level.

iii. Calculate the Mach number: M

UNIT - II

2 a) 

5

The above graph shows the variation of Cp with Mach No. Give a brief account of the salient features of the graph.

b) An airplane with a weight of 33,181 kg is cruising at 152 m/s at an altitude of 9144 m. Airplane data: S = 88 m^2, AR = 6, $C_{D,0}$=0.015 and K = 0.08. **10**

i. Write the Drag Polar
ii. Calculate the Coefficient of Drag
iii. Calculate the Thrust required

Assume ISA conditions.

c) A Propeller driven aircraft is cruising at near sea level conditions at a speed of 500 kmph. Airplane data: AR = 7, Span = 20 m, Take-off Weight = 5 Tons, K = 0.07, $C_{D,0}$ = 0.015, Power SFC = 7.58e-8 N/s/Watt, Landing Weight = 4.5 Tons. Calculate the Endurance. Assume ISA conditions. **5**

Caution: The weight to be considered in Newtons.

OR

3 a) State the three Laws of Kepler and draw the sketch wherever appropriate. **5**

b) An aircraft weighing 25,000 kg has a wing area of 70 m^2 and its drag polar is CD = 0.015 + 0.04 C_L^2. Calculate at Sea Level conditions– **10**

1. Minimum Thrust required for straight and level flight
2. TAS for the minimum thrust
3. Minimum Power required for straight and level flight
4. TAS for the minimum power

Assume ISA Conditions.

c) An airplane weighing 1,70,000 N has a Semi Span = 10m and AR = 10. The drag polar is given as $C_D = 0.017 + 0.04\ C_L^2$. Obtain the thrust required and power required for a rate of climb of 2000 m/min at a speed of 540 kmph at 3km altitude. Assume ISA conditions. **5**

UNIT - III

4 a) The GE J79 turbojet produces a thrust of 44482 N. The inlet diameter is 1m. If the airplane equipped with the J79 engine is flying at standard sea level conditions at 305 m/s, estimate – **6**

(i) The velocity of the exhaust relative to the airplane
(ii) The propulsive efficiency

b) Explain briefly the functioning of a Turbo-Shaft engine. What is the fundamental difference between a Turbo-Shaft engine and a Turbojet? **5**

c) With the help of appropriate sketches explain the difference between angle of attack and angle of sideslip. **4**

d) A spacecraft's engine ejects mass at a rate of 30 kg/s with an exhaust velocity of 3,100 m/s. The pressure at the nozzle exit is 5 kPa and the exit area is 0.7 m^2. What is the thrust of the engine in a vacuum? **5**

UNIT - IV

5 a) Explain briefly the semi-monocoque construction of a fuselage and wing structure of an aircraft with simple sketches. **10**

b) State the advantages of aluminum which makes it suitable for aircraft industry. **5**

c) Give a brief account of the constructional features of the Canopy and a Windshield highlighting their thicknesses. **5**

OR

6 a) Explain clearly the internal constructional features of the Wing and Fuselage stating the loads transferred by them. **10**

b) Give an account of the Limit and Ultimate loads used for sizing the various airframe members. **5**

c) Justify the usage of Composite materials over metallic materials in the construction of the airframe. Mention the names of two Composite materials used in the aircraft industry. **5**

UNIT - V

7	a)	Write an account about the improvement in the materials used for airframe construction and the advancement in manufacturing methods stating what these advancements have resulted in.	**10**
	b)	Describe briefly how an aircraft can be made crashworthy and draw a sketch to illustrate the concept.	**5**
	c)	Give an account of some of the major National Aerospace Programs that are presently in progress in India and mention some of the major Public and Private Sector industries which are involved in these programs.	**5**

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