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Question Paper Code : 80004

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2019.

Third Semester

Aeronautical Engineering

AE 8302 — ELEMENTS OF AERONAUTICAL ENGINEERING

(Regulation 2017)

Time : Three hours — Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Explain hot air balloon flight.

2. When aeronautical / aerospace discipline was not there, who are the first few persons recognized as Primary / First / Primitive / Formative Aeronautical Engineers in the world?

3. Draw a neat diagram of a military airplane.

4. Distinguish between the following subsonic and supersonic airplanes.

5. Are the atmospheres of all the planets the same? Justify.

6. Why are control surfaces so differently designed?

7. What is the requirement and responsibility of structures from Aircraft point of view?

8. Provide details of dual combustor engines in aircraft.

9. What are the materials used in airplane making?

10. Define the factor of safety in aircraft design.

PART B — (5 × 13 = 65 marks)

11. (a) (i) What are the design philosophies followed in airplane making?

(ii) Write in detail on the history of cold air and hot air balloon flights. Which would be more useful?

(iii) How is ornithology successful with various efforts? (3 + 7 + 3)

Or

(b) (i) Explain the pains, efforts, visions, failures and successes experienced by the participants in the attempt to realize the first acceptable powered flying vehicle.

(ii) How are the "Wright brothers" and Langley's airplanes modified and became recognized as successful powered airplanes? (8 + 5)

12. (a) (i) With neat sketches, explain how the control surfaces of an aircraft are powered and actuated. What is the role of an aircraft computer? (7)

(ii) List the different sensors employed on a typical aircraft and explain the working principle of any one of the sensors which you have listed. (6)

Or

(b) (i) What are the things optimized while designing airplanes and launch vehicle?

(ii) Explain elaborately on EVOLUTION of : control surfaces, sensors, actuators and controls of airplanes.

(iii) Provide details of existing aircraft with exceptional geometry, usage, performance and flight characteristics. (3 + 7 + 3)

13. (a) (i) What are the different uses of aeronautical and aerospace vehicles and systems? (7)

(ii) Classify broadly different types of aircraft. Define range and endurance. (6)

Or

(b) (i) Classify the earth's atmosphere. What is International standard atmosphere? (3)

(ii) Discuss about the variation of physical and state parameters with respect to altitude. Calculate pressure and other atmospheric parameters at 5 km altitude. (8)

(iii) Provide the limitations and usability of atmosphere from aerospace engineering points of view. (2)

14. (a) With the help of a neat diagram, explain how a turbojet engine works. What types of aircraft use turbojet engines, and why? What are the performance characteristics of a turbo-jet engine?

Or

(b) Compare the advantages and disadvantages of different types of aircraft engines. What fuel is used for aircraft propulsion? Define engine efficiency and explain how losses can be minimized.

15. (a) Write technical notes on 'developments and roles of materials, structures, aerodynamics and avionics in aeronautical engineering over the past 40 years.

Or

(b) (i) List the various loads acting on an aircraft in flight. How are these loads resisted? What type of loads is an aircraft landing gear subject to? (7)

(ii) Differentiate between monocoque and semi-monocoque construction. List the materials used in modern aircraft construction and state their properties. (6)

PART C — (1 × 15 = 15 marks)

16. (a) (i) Neatly sketch and indicate the structural components of a typical aircraft using and fuselage. (6)

(ii) Explain Hooke's law with a neat diagram. What are the important points in a typical stress-strain diagram of a material? What is fracture and how is it different from yielding? (9)

Or

(b) An atmospheric vehicle of height 16 m, diameter 2 m, propellant mass 1515 kg [it is burnt at a uniform rate to produce Thrust] and Launch ready mass 20002 kg is fired at an angle of 44.44 degrees with the ground surface. In ISA, it experiences Cd = 0.36 – 0.16 * (H / MAXIMUM H)

H [Geometric altitude in m) = [A * t^3 + B*r^2 + C * t]

H [t=0.1 sec] = 352m;

H [t=1.0 sec] = 3591 m;

H [t=2.0 sec] = 7325.5 m.

(i) What would be the Rocket's range, altitude, velocity and acceleration distribution with time? (7)

(ii) When will the acceleration be zero? (3)

(iii) What would be the corresponding 'altitude and range' covered and total elapse time' while the acceleration = 0?

From that altitude, the rocket moves further up. But now, with out any acceleration, with the same value of the thrust and constant velocity for 3 more seconds to reach the maximum altitude [here, all propellant is used-up and no further production of thrust]. (5)

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