

Reg No.: \_\_\_\_\_

Name: \_\_\_\_\_

**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY**

Seventh Semester B.Tech Degree Examination (Regular and Supplementary), December 2020

**Course Code: ME461****Course Name: Aerospace Engineering**

Max. Marks: 100

Duration: 3 Hours

**PART A***Answer any three full questions, each carries 10 marks.*

Marks

- 1 a) Mark the extent of the different regions of Earth's atmosphere in a schematic diagram. (4)
- b) Explain the characteristics of different regions of Earth's atmosphere with respect to Temperature, Pressure and Density. (6)
- 2 a) Demonstrate the use of the 'Buckingham Pi' theorem in dimensional analysis through the expression for lift force,  $L$ , generated by an aerofoil. (4)
- b) Explain 2D aerofoils nomenclature with neat figure. (6)
- 3 a) What are different aerodynamic methods for induced drag reduction? (6)
- b) Explain what is meant by elliptical lift distribution. Give one practical example. (4)
- 4 a) Explain the theoretical procedure for replacement of finite wing by horse shoe vertex system. What is the purpose of the process? (6)
- b) An aeroplane has a weight of 2500kg and span 15m. If it is flying at a speed of 150kmph determine the induced drag of the aeroplane. Assume sea level conditions for the flight. (4)

**PART B***Answer any three full questions, each carries 10 marks.*

- 5 a) What are the 3 different types of propellers based on the pitch setting arrangement? Explain each type. (6)
- b) Define advance ratio of a propeller. Explain the significance of advance ratio. (4)
- 6 a) Define Thrust required and Thrust available for aircrafts at conditions of level, un accelerated flight. (4)
- b) A jet aircraft weighing 9000kg has a wing span of 16m and wing area 30 square meter. Determine the power required by the aircraft if it is flying at 250m/s. Assume: Level flight without acceleration, mean sea level conditions, parasite drag coefficient 0.02 and Oswald efficiency factor 0.8. (6)

- 7 Define (i) Rate of climb (ii) Maximum rate of climb (iii) Absolute ceiling (iv) Service ceiling (v) Time to climb (10)
- 8 a) From the equations for Range and Endurance, obtain the conditions for maximum range and maximum endurance for a jet aircraft in terms of aerodynamic coefficients. (5)
- b) What are high lift devices? Give 4 examples. Explain how each of them help to generate high lift. (5)

**PART C**

*Answer any four full questions, each carries 10 marks.*

- 9 Explain the functions of (i) gyro horizon (ii) direction indicator (iii) vertical speed indicator (iv) turn and bank indicator (v) air temperature indicator (10)
- 10 With appropriate sketches explain the static and dynamic stability of aircrafts. (10)
- 11 a) What is the importance of mass balancing in aircraft stability? (5)
- b) What are the different methods of achieving mass balance on aircrafts? (5)
- 12 With a suitable sketch explain the working of an open type wind tunnel. (10)
- 13 What are 3 major types of aircraft gas turbine engines? What are the relative merits and demerits of each type? (10)
- 14 a) What are the major differences between space shuttles and satellite launch vehicles? (5)
- b) What is meant by space debris? What harm is caused by the space debris for space vehicles? (5)

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