

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

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

**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY**  
SEVENTH SEMESTER B.TECH DEGREE EXAMINATION(R&S), DECEMBER 2019

**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) Derive the expressions for the pressure and density distributions in isothermal regions of atmosphere. (7)
- b) Explain geometric, kinematic and dynamic similarity in model study. (3)
- 2 a) If an airplane is flying at an altitude where the actual pressure and temperature are 0.5bar and 159.5K respectively, what are the pressure, temperature and density altitudes? (7)
- b) Draw the pressure distribution around a 2-D aerofoil (3)
- 3 a) Derive the expression for induced drag. (7)
- b) What is span efficiency factor? Explain. (3)
- 4 Calculate the total drag and power requirement of an aircraft flying at 450km/h. (10)  
The wing area is  $26.5\text{m}^2$  and aspect ratio is 8. The total mass of the flight is 8ton and is flying at an altitude of 5km. The parasite drag coefficient is 0.006 and the Oswald efficiency factor is 0.85

**PART B**

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

- 5 a) What are propeller coefficients? Explain. (4)
- b) Derive the expression for thrust required for a level unaccelerated flight (6)
- 6 a) Obtain the condition for minimum power required for a level unaccelerated flight. (7)

- b) Draw the variation of zero lift power requirement, lift induced power requirement and Net power requirement for a level unaccelerated flight (3)
- 7 Calculate the maximum rate of climb of an aircraft of mass 360ton, flying at 200m/s at 6km altitude. The coefficient of parasitic drag is 0.002. The Oswald efficiency factor for the flight is 0.85, span 73.8m, wing area  $688\text{m}^2$ , the flight is powered by four turbojet engines, each producing 300kN thrust at this altitude. (10)
- 8 (a) Derive the expression to find out the length of ground roll required for a lift off. (7)  
(b) With help of a schematic explain the variation of forces acting on an aircraft during landing (3)

### PART C

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

- 9 (a) Distinguish between 'mass' balance and 'aerodynamic' balance. (6)  
(b) Explain the working of air temperature indicator. (4)
- 10 a) Explain the working of vertical speed indicator (7)  
b) How aerodynamic balancing of control surfaces are done in aircrafts? (3)
- 11 How stability is maintained in aircrafts? Explain how control surface deflections influence Roll, Pitch and Yaw of an aircraft. (10)
- 12 With the help of neat sketch explain the working of Turbojet engine (10)
- 13 a) What are the uses of wind tunnels? (3)  
b) Explain the working of a Supersonic wind tunnel. (7)
- 14 (a) What is meant by escape velocity? Derive the expression. Calculate its approximate value for the earth? (6)  
(b) Sketch and explain a wind tunnel balance. (4)

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