Reg No.:_____ Name:_____

**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY**

Seventh Semester B.Tech Degree Regular and Supplementary Examination December 2021 (2015 Scheme)

**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) Draw pressure distribution around an aerofoil in an inviscid flow? (5)

b) Show angle of attack in a schematic of an 2D aerofoil. Sketch angle of attack vs. coefficient of lift diagram (5)

2 Comment on the importance of atmospheric conditions like temperature, pressure and air density in route planning of an aircraft. (10)

3 a) What is Drag Polar? Sketch the Drag Polar and indicate the coefficient of drag due to zero lift? (5)

b) How a finite wing can replace with a horse shoe vortex system? (5)

4 a) Explain about wing load distribution. What is aspect ratio? (5)

b) Compare the performance of monoplane and biplane for lift and drag. (5)

**PART B**

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

5 What are propeller coefficients? Obtain the general form of thrust coefficient, torque coefficient, power coefficient. Explain the concept of airscrew. (10)

6 a) Prove that the minimum thrust required for a steady and level flight will be obtained when the airplane is flying where $(\frac{L}{D})$ is maximum. (5)

b) Draw the power available and power required curves of a) propeller driven airplane b) jet propelled airplane. (5)

7 What are the technical options available for take-off from warships? Comment on the usage of rocket assisted take off. (10)

8 a) Derive Breguet formula for range during cruise flight of an airplane and find the condition for the maximum range for a jet propelled airplane? (5)

b) How the total length of runway required is found? What is the radius of tightest turn. (5)

## PART C

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

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| 9 | a) | Distinguish between mass balance and aerodynamic balance? | (5) |
| | b) | Explain the action of control tabs in providing balancing of controls | (5) |
| 10 | | A high speed subsonic DC-10 airline is flying at a pressure altitude of 10km. A pitot tube on the wing tip measured a pressure of $4.24\times10^{4}N/m^{2}$. Calculate the Mach number at which the airplane is flying. If the ambient temperature is 230K, calculate the true airspeed and calibrated airspeed | (10) |
| 11 | | Describe with the aid of a schematic diagram the working principle of a closed circuit supersonic wind tunnel. Why a high molecular weight gas sometimes preferred over a high Mach number test | (10) |
| 12 | | With the help of neat sketches explain the working principle of<br>i)Vertical speed indicator<br>ii)Turn and Back indicator<br>iii)Altimeter | (10) |
| 13 | | An astronaut is about to explore an asteroid of average density $5000kg/m^{3}$. He is worried that he may accidently jump from its surface and float off into space. How big must it be before he can neglect this possibility? The astronaut knows that his mass 'm' including space suit is 91kg. He knows that on earth he can raise his centre of gravity 0.6m by jumping his space suit on. It seems reasonable to assume that the maximum energy output of his legs will be the same on asteroid as on earth. $G=6.67\times10^{-11}N/m^{2}kg$. | (10) |
| 14 | a) | Describe the working principle of a supersonic Airplane Engine with neat sketch? | (5) |
| | b) | Write short notes on space travel. | (5) |

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