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BAS-009

B.Tech. AEROSPACE ENGINEERING (BTAE)

Term-End Examination

December, 2018

00363

BAS-009 : INTRODUCTION TO AERONAUTICS

Time : 3 hours *Maximum Marks : 70*

Note : *Attempt any **seven** questions. All questions carry equal marks. Use of scientific calculator is permitted.*

1. (a) Explain the salient features of various atmospheric layers. *4*

(b) Define geopotential altitude. Calculate pressure, density and temperature at an altitude of 19 km using ISA conditions. Assume lapse rate of $-6{\cdot}5$ K/km for troposphere. *1+2+2+1=6*

2. (a) Show primary and secondary control surfaces of a medium transport aircraft with the help of top view and side view. *4*

(b) Explain the functioning of primary and secondary control surfaces. *6*

3. (a) Discuss the development of Aeronautical Science in America and Europe. List aerospace applications. *4+2=6*

(b) Write a note on V/STOL machines. *4*

4. (a) Explain the nomenclature of NACA 4-digit, 5-digit and 6-digit series airfoils. How is 6-digit series different from other NACA series ? *6+2=8*

(b) Explain the characteristics of supercritical airfoils with the help of sketch. *2*

5. Describe the following with the help of sketches : *4+4+2=10*

(a) Drag polar for symmetrical and cambered airfoils

(b) High-lift devices

(c) Area Rule

6. (a) Explain flight envelope for a military aircraft with the help of neat and labelled sketch. How is gust envelope different from flight envelope ? *5+2=7*

(b) Explain the compressibility effects on aerodynamic coefficients. *3*

7. Describe the hodograph diagram for climb and glide performance with the help of neat and labelled diagrams. Explain various terms used in hodographs. *6+4=10*

8. (a) Define range and endurance. Explain the conditions for maximum range and endurance for a propeller type aircraft. *2+2=4*

(b) Calculate the maximum range and endurance for a (turbojet) aircraft using the following data : *6*

$C_D = 0{\cdot}015 + 0{\cdot}08\ C_L^2$

ρ = Density = 0·41 kg/m^3

W_o = Weight = 2,00,000 N
(Total take-off weight)

S = Planform area = 100 m^2

W_f (Fuel weight) = 60,000 N

C_t (Thrust sp. fuel consumption)
= 0·07 kg of fuel/hr/Newton of thrust

9. (a) Derive the expression for total landing distance (approach distance + flare distance + ground roll distance). *6*

(b) Distinguish between Fixed pitch propeller and Constant speed propeller. *4*
