

5E3177-S

Roll No. : _____

Total Printed Pages : **3****5E3177-S**

B. Tech. (Sem. V) (Main) Examination, December - 2011
Mechanical Engg.
5ME3 Fundamentals of Aerodynamics

Time : 3 Hours]

[Maximum Marks : 80
[Min. Passing Marks : 24

Instructions to Candidates :

Attempt any five questions selecting one question from each unit. All questions carry equal marks. (Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.)

Use of following supporting material is permitted during examination.
(Mentioned in form No. 205)

1. NIL 2. NIL

UNIT - I

- 1 (a) What is Kutta condition and also explain the Kelvin's circulation theorem. 8
- (b) Explain aerodynamics with aerodynamic forces and moments over the body surface. 8

OR

- 1 (a) A wing of an aircraft of 10 m span and 2m mean chord is designed to develop a lift of 45 KN at a speed of 400 km/h. A 1/20 scale model of the wing section is tested in a wind tunnel at 500 m/s and $T = 5.33 \text{ kg/m}^3$. The total drag measured is 400 N. Assuming that the wind tunnel data refer to a section of infinite span, calculate the total drag for the full size wing. Assume an elliptical lift distribution and take air density as 1.2 kg/m^3 . 8
- (b) Explain the concept of lift and drag forces with suitable examples for each. Show the lift and drag forces with the help of diagram. 8

5E3177-S]



1

[Contd...

UNIT - II

- 2 (a) Explain the procedure to transfer the energy in terms of lift and drag forces separately. 8
- (b) What do you mean by Blade Theory ? What is the application of Blade Theory in mechanical engineering ? 8

OR

- 2 (a) Explain cascade nomenclature and turbine cascade nomenclature also differentiate them. 10
- (b) Explain symmetrical and non-symmetrical aerofoil. 6

UNIT - III

- 3 (a) A nozzle is fitted at the end of a pipe of length 300 mm and a diameter 100 mm. For the maximum transmission of power through the nozzle, find the diameter of nozzle. (Take $f = 0.009$). 6
- (b) Derive the condition for maximum power transmission through a nozzle. 10

OR

- 3 (a) Define isentropic flow and derive the expression for steady isentropic flow in non-parallel side ducts neglecting friction. 10
- (b) What do you choked flow ? Explain the supersaturated flow in nozzle. 6

UNIT - IV

- 4 (a) List out the differences between adiabatic flow and diabatic flow with practical examples for each. 8
- (b) Explain the flow with heat transfer and also explain the effect of change in stagnation temperature. 8

OR



- 4 (a) Explain the change in entropy and also explain the choking due to friction. 8
- (b) Define fanno lines. What is the necessity of fanno lines in fluid flow. 8

UNIT - V

- 5 (a) Compare the Rankine-Hugoniot and isentropic curves for $V = 1.4$. Also express the final relation for change in entropy across a shock. 8
- (b) What do you mean by shock waves ? Explain the different types of shock waves graphically. 8

OR

5 Write short note on any four :

- (a) Angle of attack
- (b) Rayleigh line
- (c) Convergent-divergent nozzle
- (d) Lift and drag coefficient
- (e) Prandtl's relation
- (f) Increase in entropy.

4×4=16

