

IV B.Tech I Semester Examinations, December 2011
INDUSTRIAL AERODYNAMICS
Aeronautical Engineering

Time: 3 hours

Max Marks: 80

Answer any FIVE Questions
 All Questions carry equal marks

1. Why is wind energy classified as secondary? Explain and justify or give your reasons against. [16]
2. Explain about the general flow pattern of effluents. Discuss the importance of velocity ratio with neat sketches. [16]
3. Explain the effects of environmental winds in city blocks in brief. [16]
4. Does a racing car require a horizontal stabilizer? Explain, starting from the definition of stability in pitching motion of the car. [16]
5. Prove that in case of horizontal axis wind turbine maximum power can be obtained when
 The exit velocity is = (1/3) wind velocity
 and $P_{max} = (8/27) \rho A V^3$
 Explain all the parameters clearly. [16]
6. Define flutter. Explain about wake flutter and fluxural torsion flutter. [16]
7. (a) Derive the relationship between the torque coefficient C_T and tip speed ratio λ .
 (b) A wind mill has a tip speed ratio of 6. What is the torque coefficient? [8+8]
8. From the following parameters
 $\mu_r = 0.015$
 Mass of the car = 1251Kg
 Silhouette area of the car $A=1.77m^2$
 Cd of a car = 0.38.
 (a) Calculate the resistant force of rolling friction?
 $\rho=1.2Kg/m^3$
 (b) Calculate air resistance force for different speeds and calculate the power required.
 $V_1=36kmph$
 $V_2=54kmph$
 $V_3=110kmph$. [16]

Code No: 07A72109

R07

Set No. 4

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1. (a) Define:
 - i. Fraude number
 - ii. Strouhal number(b) Discuss about vortex induced vibrations. [16]
2. Discuss about vertical velocity and inversions in the study of design of chimney with neat sketches. [16]
3. What is down force? What is the importance of it in a racing car? What are the design changes that are required to increase the down force? [16]
4. (a) Define the coefficient of performance for a wind mill.
(b) Define tip speed ratio (TSR).
(c) Show graphically the variation of variation of power coefficient (K_p or C_p) with tip speed for various TSR for different types of wind mills.
(d) What is your conclusion from this graph? [4+4+4+4]
5. How are WEC (Wind Energy Conversion) Systems classified? Discuss in brief. [16]
6. Draw the sketches of
 - (a) a passenger car which is nearly a square and
 - (b) a modern piston engine racing car of high speed. Explain how they are affected by still air and wind. [16]
7. The speed of wind at an altitude of 50 m is 30 m/s. Show graphically, with numbers, the variation of wind from ground to this altitude. Explain the causes for the nature of the curve. [16]
8. What are the special problems of tail buildings discuss in brief . [16]

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R07

Set No. 1

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1. What is a pressure pulse? What is its effect on a passing train? [16]
2. Is there difference between air and wind? If so, what is it? How is the air affected by a racing car? How is the racing car affected by the air? Explain with proper justification. [16]
3. What are the bases on which wind is classified? Explain with details. [16]
4. (a) Explain about interference effect of buildings.
(b) What are the building codes? Discuss. [16]
5. (a) Draw a sketch of a simple aero-generator and explain the components.
(b) Explain the various controls for the aero-generator. [8+8]
6. Wind at 1 standard atmospheric pressure and 15 degree Celsius temperature has a velocity of 10 m/s. The turbine has a diameter of 120 m and its operating speed is 40 rpm at maximum efficiency. Calculate
 - (a) The total power density in the wind stream,
 - (b) The maximum obtainable power density assuming $\eta = 40\%$
 - (c) The total power produced in kilo Watts,
 - (d) The torque and axial thrust. [4+4+4+4]
7. What is a flume rise and discuss the different types of flume rise. [16]
8. Discuss about separation and reattachment and what are the four variables that effects it discuss. [16]

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R07

Set No. 3

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1. Explain in brief about train aerodynamics stability in high winds? [16]
2. What are the types of energy is wind energy converted into? Explain with details. [16]
3. What are the different types of winds? Explain clearly. [16]
4. What are the advantages of vertical axis machines over the horizontal type? Describe a rotor for a relatively low velocity wind. [16]
5. What is a chimney and explain about the various design parameters that effect the flow pattern in a chimney. [16]
6. (a) Describe the aerodynamic forces on a wind turbine (wind mill) blade. Explain all the variables used.
(b) What is the shape you recommend for the blade and why? [8+8]
7. Discuss about the various design parameters that have to be considered for a tail building. Illustrate. [16]
8. Define galloping and discuss various types of galloping. [16]
