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UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

End Semester Examination, December 2017

Program: M.Tech ASE+UAV	**Semester : I**
Subject (Course): Fundamentals of Aerodynamics	**Max. Marks : 100**
Course Code : ASEG 7009	**Duration : 3 Hrs**
No. of page/s: 02	

Instructions- Read all the below mentioned instructions carefully and follow them strictly

1) Mention Roll No. at the top of the question paper.
2) Do not write anything else on the question paper except your roll number.
3) ATTEMPT ALL THE PARTS OF A QUESTION AT ONE PLACE ONLY.
4) Internal choice is given for question number 12 and 13.

SECTION – A (4 X 5 = 20 MARKS)

1. Explain the following: center of pressure, Aerodynamic center, angle of attack and Aerodynamic forces.
2. Explain the importance of pressure coefficient? Derive the suitable mathematical expression.
3. What are the three conservations laws? Explain the importance of conservations laws in the field of Aerodynamics.
4. A pitot tube is inserted in an air flow (at STP) to measure the flow speed. The tube is inserted so that it points upstream into the flow and the pressure sensed by the tube is the stagnation pressure. The static pressure is measured at the same location in the flow, using a wall pressure tap. If the pressure difference is 30 mm of mercury, determine the flow speed.

SECTION – B (8 X 5 = 40 MARKS)

5. Differentiate between: Continuum flow and molecular flow, compressible and incompressible flow, viscous and inviscid flow, rotational and irrotational flow.
6. Explain the following: stream line, Pathline, Stream function, potential function and vorticity.
7. Consider the velocity field where the x and y components of velocity are given by $u = cx/(x^2 + y^2)$ and $v = cy/(x^2 + y^2)$, where c is constant. Obtain the equation of the streamlines.
8. Consider a lifting flow over a circular cylinder of a given radius and with a given circulation. If V_∞ is doubled, keeping the circulation the same. Does the shape of the streamlines change? Explain.

9. A light plane flies at 150 km/hr in standard air at an altitude of 1000 m. Determine the stagnation pressure at the leading edge of the wing. At a certain point close to the wing, the air speed relative to the wing is 60 m/s. Compute the pressure at this point.

SECTION – C (20 X 2 = 40 MARKS)

10. Consider the lifting flow over a circular cylinder. The lift coefficient is 5. Calculate the peak (negative) pressure coefficient. Calculate the locations of stagnation points and the points on the cylinder where the pressure equals freestream static pressure.

11. Explain the pressure distribution over the symmetrical airfoil ranging from negative angle of attack to higher positive angle of attack with suitable sketches. Compare the pressure distribution with the cambered airfoil.

Or

12. (A) What is viscous flow? Explain the effect of viscosity on airfoil in a moving fluid.
    (B) What is a boundary Layer? Explain the different types of boundary layers with suitable sketches.