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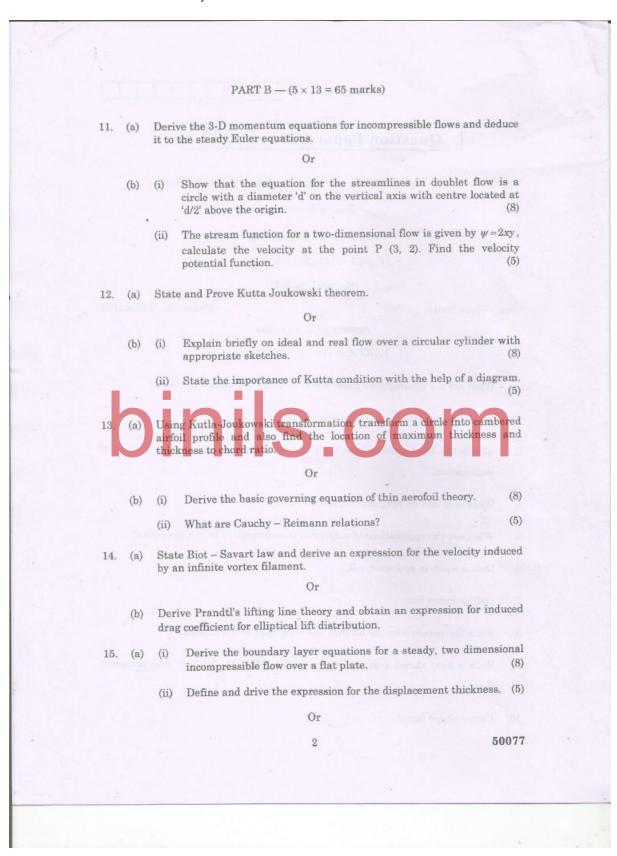
Reg. No. :
Question Paper Code: 50077
B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2023.
Fourth Semester
Aeronautical Engineering
AE 8401 – AERODYNAMICS - I
(Regulations 2017)
Time : Three hours Maximum : 100 marks
Answer ALL questions.
PART A — $(10 \times 2 = 20 \text{ marks})$
<ol> <li>What are the assumptions made while deriving Bernoulli's equation?</li> <li>Give the condition for 2-D irretational flows.</li> <li>Sketch the fluid pattern over bluff bodies and streamlined bodies with brief</li> </ol>
explanation.
4. What is meant by Magnus effect?
5. What are the applications of conformal transformation in aerodynamics?
6. Define wash-in and wash-out.
7. Define vortex line.
Provide tel si a se se o a para della consequenta and parall a bimed sweet - (d)
8. State the reason why the lift over the wing span is not uniform
9. With a neat sketch compare the velocity profiles for laminar and turbulent
flows.
10. Define shape factor.

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(b) Arrive at Blasius solution for incompressible two dimensional flow over a flat plate at zero angle of attack. Also give the expression for local skin friction coefficient, boundary layer thickness, displacement thickness and momentum thickness for an incompressible flow over a flat plate.

## PART C -- $(1 \times 15 = 15 \text{ marks})$

- 16. (a) (i) The velocity potential for an ideal fluid flowing around a long cylinder is given by  $\left\{\frac{B}{r} + Ar\right\} \cos \theta = \phi$ . The cylinder has a radius R and is placed in a uniform flow of velocity which affects the velocity near to the cylinder. Determine the constants A and B and determine where the maximum velocity occurs. (8)
  - (ii) The potential for flow around a cylinder of radius 'a' is given by  $\phi = ux \left[ 1 + \frac{a^2}{x^2 + y^2} \right], \text{ where x and y are the Cartesian co-ordinates}$  with the origin at the middle. Derive an expression for the stream function  $(\psi)$ .

(b) (i) A wing with an elliptical planform and an elliptical lift distribution has an aspect ratio of 6 and a span of 12 m. The wing loading is 900 N/m<sup>2</sup> when flying at a speed of 150 km/hr at sea level. Compute the induced drag for this wing.

(ii) Write a short note on boundary layer separation with necessary sketches. Also state the factors that encourage BL separation. (7)

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