

ME 4511: Fluid Mechanics II

Assignment 1

Turn in a .pdf copy

Q1 [Marks: 3] Consider the velocity field:

$$u = a(x^2 - y^2) \quad (1)$$

$$v = -2axy \quad (2)$$

- (i) Show that stream function exist for this velocity field.
- (ii) Obtain the expression for the stream function and the velocity potential.
- (iii) Plot stream functions for 10 evenly spaced values of the integral constant, C . If the last three digits of your student ID are a,b,c then C varies from $-abc$ to abc . The range of x and y axes should be -10 to 10 . Attach the code that you used to plot the stream functions.

Q2 [Marks: 2] For a Rankine half body, what will be the value of the stream function that passes through the stagnation point ? Find the expression for the streamline corresponding to this stream function.

Q3 [Marks: 5] Take an image of any fluid flow (liquid or gas) of your choice using your own image acquisition system (mobile/camera). Write briefly about the followings:

- (i) What flow you captured and how did you do so?
- (ii) Is it a laminar or turbulent flow ? Justify.
- (iii) Is the flow steady or unsteady? Justify.
- (iv) What forces do you think drive this flow?
- (v) Why did you choose this particular fluid flow?