Problem statement

The governing equation of an incompressible potential two-dimensional flow past a Joukowski airfoil section can be written as: $\nabla^2\Psi = 0$ *(Laplace equation) where "*ψ*" is the stream function.*

a) *Construct a suitable boundary fitted grid (*η_1*,* η_2*) using (H-grid) or (O-grid) or (C-grid)*

b) *Write the governing equation in the proposed body fitted grid (*η_1*,* η_2*)*

c) *Choose the numerical method used to solve the governing equation (PSOR) or (LSOR) or (ADI)*

d) *Determine the values of the stream function* ψ *at the outer boundaries*

e) *Choose a suitable initial value of the stream function* ψ *for all points in the grid points*

f) *Obtain the numerical solution until convergence*

g) *Show the results of the convergence history (RMS error with the iteration number)*

h) *Show the iso-velocity and iso-pressure lines in the entire domain*

i) *Show the velocity and pressure distributions over the upper and lower surfaces of the airfoil and compare with the potential flow results obtained by the Joukowski transformation between the circle and the airfoil.*

j) *Solve the airfoil using the numerical solution of the Navier Stokes equation with a suitable turbulence model and compare the results obtained (grid, convergence history, the iso-velocity and iso-pressure lines in the entire domain, the pressure distributions over the upper and lower surfaces of the airfoil) with those obtained using the potential flow solution.*

Joukowski airfoil

Sec(1) alfa = 4 & Sec(2) alfa = 8		
B.N.	**%Camber /chord**	**%Thickness /chord**
1	**4**	**5**
2	**4**	**6**
3	**4**	**7**
4	**4**	**8**
5	**4**	**9**
6	**4**	**10**
7	**4**	**11**
8	**5**	**5**
9	**5**	**6**
10	**5**	**7**
11	**5**	**8**
12	**5**	**9**
13	**5**	**10**
14	**5**	**11**
15	**6**	**5**
16	**6**	**6**
17	**6**	**7**
18	**6**	**8**
19	**6**	**9**
20	**6**	**10**
21	**6**	**11**
22	**7**	**5**
23	**7**	**6**
24	**7**	**7**
25	**7**	**8**
26	**7**	**9**
27	**7**	**10**
28	**7**	**11**