Q3) a) Derive Darcy-weisbach equation and state its utility 10

b) A uniform flow of velocity 7 m/s is flowing along x axis over a source and sink which are situated along x axis. The strength of source and sink is 18 m^2/s and they are at a distance of 1.9 m apart. Determine 10

i) Location of stagnation points
ii) Length & width of the Rankine oval
iii) Equation of profile of the Rankine body

Q4) a) Starting from Navier stokes equation for incompressible laminar flows derive an equation for velocity profile for Couette flow. State the assumptions made 10

b) Explain Reynold's transport theorem with its proof 10

Q5) a) Obtain Von Karman momentum integral equation 10

b) A sliding gate 3m wide and 1.5m high situated in a vertical plane has a coefficient of friction between itself and guide of 0.18. If the gate weight is 19 kN and if its upper edge is at a depth of 9 m, what vertical force is required to raise it? Neglect buoyancy force on gate 10

Q6) a) Three pipes of diameters 300 mm, 200 mm & 400 mm and lengths 450 m, 255 m & 315m respectively are connected in series. The difference in water surface levels in two tanks is 18 m. Determine the rate of flow of water if coefficients of friction are 0.0075, 0.0078 & 0.0072 respectively (consider minor losses) 10

b) i. A stream function is given by $\psi = 5x-6y$. Calculate the velocity components and also magnitude and direction of the resultant velocity at any point. 05

ii. Discuss the phenomenon of boundary layer separation 05

Q7) a) i) Define: Source, Sink, Vortex, Circulation 04
ii) Write a note on Prandtl's mixing length theory 04
iii) Define Control Volume and Control Surface 04

b) Write short note on the following 08

i) Elbow Meter
ii) Moody's Diagram
