Fluid Mechanic Theoretical Questions

1. Define the following terms in relation to fluid mechanics: viscosity, density, specific gravity, and surface tension.
2. Measure the properties listed above for any given fluid.
3. Calculate hydrostatic pressure at any depth in a fluid or fluid combination.
4. Explain Pascal's Paradox.
5. Apply the principles of manometry to calculate pressure.
6. Determine the magnitude, direction and location of the resultant hydrostatic force acting on any submerged surface.
7. Apply the principles of hydrostatics to derive an expression for buoyancy.
8. Evaluate various designs of locks and dams.
9. Explain the various designs of gates and dams.
10. Evaluate the stability of any object in a fluid.
11. Differentiate between steady flow and unsteady flow.
12. Derive the Bernoulli Equation from Newton's Second Law.
13. Identify the assumptions used to derive the Bernoulli Equation and explain the various restrictions of Bernoulli.
14. Use the Bernoulli Equation to calculate pressure head, velocity head, or elevation head given two of the three.
15. Explain the difference between static, stagnation, dynamic and total pressures.
16. Use the Bernoulli Equation to derive the Torricelli Equation.
17. Combine the Bernoulli Equation and the concept of mass conservation to evaluate flow through a system and calculate the volumetric flowrate of any system.
18. Determine the energy and hydraulic grade lines for any fluid system.
19. Calculate and plot streamlines for flows with given velocity fields.
20. Distinguish the difference between streamlines, streaklines, and pathlines.
21. Define 'system' and 'control volume' and be able to accurately identify and label each for any fluid system.
22. Derive the Reynolds Transport Theorem.
23. Evaluate flow through a moving control volume.
24. Use the Reynolds Transport Theorem to derive the Continuity Equation.
25. Use the Reynolds Transport Theorem to derive the Energy Equation.
26. Use the Reynolds Transport Theorem to derive the Momentum Equation.
27. Use the Momentum Equation to determine the forces due to fluids in motion.
28. Use the Energy Equation to evaluate the work done by a fluid in motion.
29. Compare and contrast the Energy Equation and Bernoulli Equation and explain when either is appropriate to use.
30. Use the Energy Equation to determine the energy loss through any fluid system.
31. Identify the Navier-Stokes Equation and explain its importance in fluid mechanics.
32. Identify the appropriate calculation variables for any fluid system.
33. From those variables, derive a set of dimensionless parameters for the system from either inspection, the method of repeating variables, or the Buckingham Pi Theorem.
34. Define Reynolds Number.
35. Use the concept of similitude to evaluate scale models.
36. Use scale models to predict the behavior of a real system.
37. Define 'laminar' and 'turbulent'.
38. Use Poiseuille's Law to calculate flowrate in a laminar system.
39. Calculate the friction factor of flow through a system using the Moody Diagram and the Colebrook Equation.
40. Define 'major losses' and 'minor losses'.
41. Identify the sources of minor losses in a system.
42. Calculate the total head loss, pressure drop, and flowrate through a system.
43. Design a pipe system that minimizes head loss and optimizes flowrate.
44. Evaluate flow through a pipe system in series or in parallel.

45. Use the Energy Equation to evaluate flow through a multi-pipe system.
46. Derive a method to evaluate flow through a pipe network.
47. Define vena contracta.
48. Define drag and lift force.
49. Distinguish between form drag and friction drag.
50. Calculate drag force on an object submerged in a moving fluid.
51. Identify the appropriate drag force coefficient for any object and/or determine the drag force coefficient from the appropriate charts.
52. Design an object that minimizes its drag force.
53. Calculate the lift force on an object.
54. Use the concepts of Bernoulli, Drag Force, and Lift Force to explain why airplanes fly.
55. Define ‘pump’ and ‘turbine’.
56. Calculate the energy head of a pump or turbine.
57. Classify different types of pumps.
58. Optimize a pump that is appropriate for a given pipe system.
59. Define ‘cavitation’ and ‘net positive suction head’.
60. Design a pipe/pump system that minimizes the risk of cavitation