1) Examine the power supply and motor for a final control element to the proper place in the relay circuit on the left. The objective is to have the motor run when an active high Temperature Sense low device, an active high Pressure Sense High device, or an active low Flow Sense High device goes into alarm. Show proper connections to the coil and contact portions of the circuit. Assume that the logic components used are TTL devices.

2) The control idea you created as a function diagram in problem 1 can also be implemented in a Programmable Logic Controller (PLC). Show the correct wire connections of the devices to the programmable control shown to the right.

3) Write the correct line of Ladder Logic program code to meet the control requirements of question 1.
4. What logic value is needed at input a) of item 24 to turn the motor off?  

5. What type of logic device is item (3)  

6. Examine the TSH shown as item 17;  
   (a) if it is an N.C. device, it is an active low device.  
   (b) if it is an N.C. device, a line is needed over the TSH.  
   (c) if it is an N.O device, a line is not needed over the TSH.  
   (d) if it is an N.O. device, it is an active high device.  

7. Item (23) is an OR device.  

8. The LED (item 13) is ON when both inputs are passive.  

9. The LED (item 13) is ON when either input is active  

10. The LED (item 13) is ON when one input is active  

11. Which item above is the best symbol to represent a decoder?  

12. The R3 in item (14) is an example of a "current limiting" resistor.  

13. Item (25) is a function diagram for an active low motor starter circuit.  

14. Item (4) is a NOR device.  

15. Item (19) is a npn transistor?  

16. The motor starter circuit in Item (24) is active low.  

17. The motor starter circuit in Item (19) is active low.   

18. If R1 (14) is very much smaller than R2 or R3, voltage at node = V1/2  

19. The motor relay is energized in Item (21) if the start P.B. is engaged.  

20. The motor relay is energized, Item (22), if the start P.B. is not engaged.  

21. The control relay in Item (21) remains energized after P.B. is released.  

22. The control relay in Item (22) remains energized after P.B. is released.   

23. Item (23) is a NAND device.  

24. Which item on page 2 is probably a flip-flop  

25. The motor control circuit in Item 19 is an active low circuit  

26. Item (21) seems strange because of the use of the CR 1 symbol.  

27. Item (11) is a npn transistor  

28. Does item (5) function like a counter?  

29. Is item (7) a closed set of normally open contacts?  

30. All item (13) inputs must be active for the LED to be ON.  

Test 4 (4 pages) 3
31) OSHA requires that Stop Push buttons be active low normally closed push buttons. Draw the function diagram of a Stop Push Button that meets this requirement.

32) Add the Stop Push button from question 31 to the wiring diagram in problem 2.

33) Write a new ladder language program that includes you answer from problem 3 and the addition of the Stop Push Button.

34) Examine the decoder provided to the right. Channel 1Y2 (pin 6) will be active if pin 1 is active and both the pressure sensor (pin 3) and the level sensor (pin 2) are passive. If this condition exists is the LED labeled 1L2 ON or OFF? ______

36) Is the level sensor connected to pin 2 in its active or passive state if the LED labeled 1L3 is ON? __________

37) If FSH 25 and TSH 25 are active, and pin 15 is passive, is the LED labeled 2L0 ON or OFF ______

38) If the LED labeled 2L0 is ON, is FSH active or passive ______

39) If the 1G input is active, the Status PB 25 is engaged. Yes ___ No ___

40) If input 2G is active, and LED 2L3 is ON, TSH 25 is active. Yes ___ No ___

41) Item (13) is know as a ____________

41) How many questions did you answer YES? ______

42) Good instrumentation engineers are observant, what is the theme of the ties that I wear on Mondays? ____________