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Register Number:……..

B.E DEGREE EXAMINATIONS: NOV / DEC 2014

(Regulation 2009)

Sixth Semester

MECHATRONICS ENGINEERING

MCT 114**:** Applied Hydraulics and Pneumatics

Time: Three Hours **Maximum Marks: 100**

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1. Which of the following is not a desired property of hydraulic fluid?
   a) Toxicity b) Low volatility
   c) Ideal viscosity d) Low density
2. Vane motors develop torque by the hydraulic pressure action on the
   a) Exposed surface of vanes b) Axis of vanes
   c) Flowing fluid d) Piping
3. Pressure intensifier increases the pressure in proportion to
   a) Square of ratio of diameters b) Ratio of diameters
   c) Inverse ratio of diameters d) Flow rate
4. Which of the following is a bi-stable device?
   a) Servo valve b) OR gate
   c) NAND gate d) Flip-flop
5. When the external load opposes the direction of motion of the hydraulic cylinder, the type of connection is
   a) Meter-in b) Meter-out
   c) Series d) Parallel
6. A compressor capacity can be controlled by ---------- method
   a) Vary the speed b) Maintain constant speed
   c) Vary the pressure d) Maintain constant pressure

7. Lubricator in the FRL unit follow the principle of
   a) Orificemeter
   b) Venturimeter
   c) Barometer
   d) Manometer
8. The commonly accepted design of gas loaded accumulator is
   a) Spring type
   b) Separator type
   c) Non-separator type
   d) Regulator type
9. Micro filters remove particles down to a size of
   a) 0.01 micron
   b) 1 micron
   c) 0.1 micron
   d) 10 micron
10. OR moving part logic element is a
   a) Shuttle valve
   b) Twin pressure valve
   c) Quick exhaust valve
   d) Check valve

PART B (10 x 2 = 20 Marks)

11. What are the four primary functions of a hydraulic fluid?
12. State Pascal's law.
13. Define Viscosity Index.
14. Why the centrifugal pumps cannot be used for fluid power applications? Justify your answer.
15. Write short notes on Moving Part Logic devices.
16. How does a pilot check valve differ from a simple check valve?
17. Name two ways of regulating flow to a hydraulic actuator.
18. What is a multistage compressor?
19. Compare electro-hydraulic servo valve and proportional hydraulic valve with respect to its control signal and feedback.
20. List any two causes and remedies for the erratic motion of pneumatic cylinder.

PART C (5 x 14 = 70 Marks)

21. a) Explain with a neat sketch about how hydraulics is applied in:
   (i) Industrial lift trucks
   (ii) Robotic dexterous arm

(OR)

   b) Discuss in detail about the various advantages and disadvantages of fluid power.

22. a) Classify the different types of positive displacement pumps. Explain the

operation of following pumps with a neat sketch:

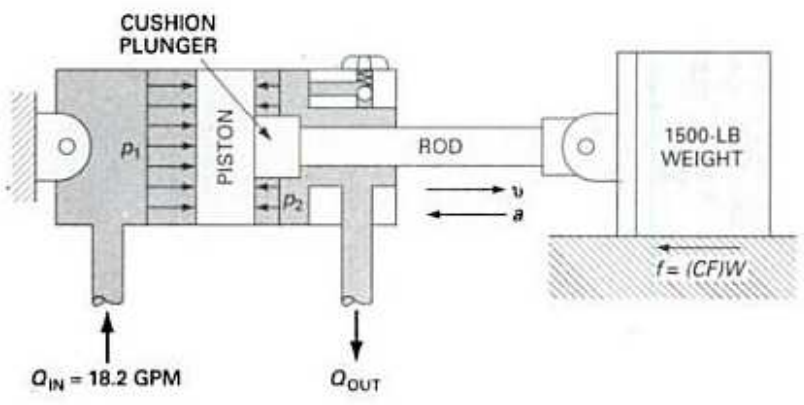
(i) Internal gear pump

(ii) Balanced Vane pump

(OR)

b) (i) A pump delivers oil at a rate of 18.2gpm into the blank end of the 3-in-diameter hydraulic cylinder shown in figure 1. The piston contains a 1-in-diameter cushion plunger that is 0.75 in long and therefore the piston decelerates over a distance of 0.75 in at the end of its extension stroke. The cylinder drives a 1500-lb weight, which slides on a flat horizontal surface having a coefficient of friction equal to 0.12. The pressure relief valve setting equals 750psi. Therefore, the maximum pressure (p_1) at the blank end of the cylinder equals 750psi while the cushion is decelerating at the piston. Find the maximum pressure (p_2) developed by the cushion. (8)

Figure 1



(ii) Briefly explain the following efficiencies of hydraulic motor: (6)

a) Mechanical efficiency

b) Volumetric efficiency

c) Overall efficiency

23. a) (i) Explain the operation of automotive power steering with the use of mechanical-hydraulic servo system. (10)

(ii) Draw the synchronizing circuit for two hydraulic cylinders with series connection. (4)

(OR)

b) (i) A hydraulic intensifier is meant to enhance the fluid pressure from 50 bar to 200 bar. Its small cylinder capacity is 23 litres and has a stroke of 1.5m. Find (4)

the diameter of the larger cylinder to be used for this intensifier.

(ii) Design a hydraulic circuit for the automatic reciprocation of a double acting cylinder using sequence valves. (10)

24. a) Discuss in detail about the different types of compressors with a neat sketch.

(OR)

b) Consider an automatic drilling machine. The complete cycle is as follows: Cylinder A extends to clamp the work piece, then cylinder B extends to drill a hole and then retracts. Cylinder A then retracts to unclamp the work piece. Design a control circuit applying the step-counter method. The push button operated DCV is used to start the cycle.

25. a) (i) Discuss any two fluidic devices, with suitable sketches. (7)

(ii) Draw the electro hydraulic circuit to control the automatic reciprocation of double acting cylinder using two pressure switches to detect the extension and retraction positions. (7)

(OR)

b) Design an electro pneumatic system for sorting two different sized boxes (tall and short) moving on a conveyor. In this system, the short boxes are moved on the same conveyor, but tall boxes are pushed on to a second conveyor by a pneumatic cylinder. Also specify the components used for designing the system.

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