P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belgaum)
Seventh Semester, B.E. - Mechanical Engineering
Semester End Examination; Dec - 2016/Jan - 2017
Hydraulics and Pneumatics

Time: 3 hrs   *Max. Marks: 100*

Note: i) Answer **FIVE** full questions, selecting **ONE** full question from each unit.
   ii) Missing data, if any, may be suitably assumed.

UNIT - I

1 a. Discuss the significance of 'Pascal's law' in the design of oil hydraulic systems.   4

b. Explain with the help of a neat sketch, the working principle of a pressure compensated vane pump.   10

c. A bent axis design piston pump has nine 15 mm diameter pistons arranged on a 125 mm diameter piston circle. Determine the actual flow rate of the pump at 1100 rpm, if the offset angle is set at 8°. The volumetric efficiency of the pump is 90%.   6

2 a. Give a classification of hydraulic motors.   4

b. For the crane shown in Fig. 2(b) determine the hydraulic cylinder force required to lift a load of 10,000 N. What class of lever system is this?   8
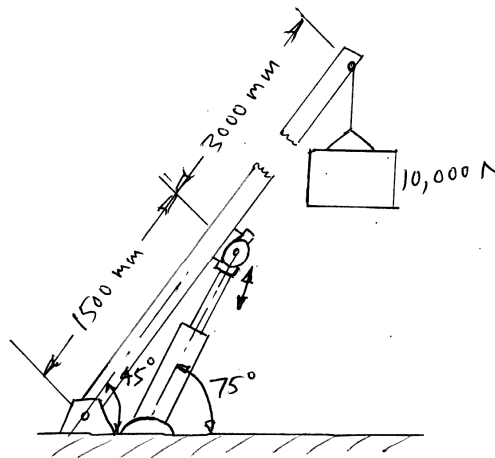

Figure 2(b)

c. A Hydraulic motor has volumetric displacement of 98 cm^3. It has a pressure rating of 150 bars and receives oil from a pump at flow rate of 0.0015 m^3/s. Determine motor speed and output power, if the motor has overall efficiency of 85%.   8

UNIT - II

3 a. Differentiate between the following :   8
   i) Check valve and Pilot check value   ii) Pressure relief valve and pressure reducing valve.

b. Discuss any two types of central configurations of 3 position DCVs with their relative merits and demerits.   4

c. Design a hydraulic circuit to operate a double acting cylinder using a $4/3$ solenoid actuated spring centered and close centered DCV. The pump should be unloaded once the system pressure is reached using a pressure unloading valve.   8

4 a. Design a hydraulic circuit to operate a heavy platform, which needs to be raised and lowered on command from a $4/3$ double lever operated, spring centered and tandem centered DCV. Employ a counter-balance valve for safe operation.   10

   b. Design a hydraulic circuit to operate a double acting cylinder using a gas loaded accumulator. The accumulator should provide compensation for leakage of oil when the pump is switched off using a pressure switch.   10

UNIT - III

5 a. List any four desirable properties of hydraulic oils.   4

   b. State the common sources of heat in hydraulic systems. Discuss what action needs to be taken to dissipate heat.   8

   c. Write a note on filters.   8

6 a. List any four advantages of pneumatic system compared to hydraulic systems.   4

   b. Discuss how end position cushioning is achieved in pneumatic cylinders.   8

   c. With the help of a sketch, explain any one type of limited rotation pneumatic actuator.   8

UNIT - IV

7 a. List, along with symbols, any four types of actuators in pneumatic DCVs.   4

   b. Differentiate between the following :
       i) Direct and indirect actuation of pneumatic cylinders
       ii) Supply air throttling and Exhaust air throttling.   8

   c. With the help of a sketch, explain the working principle of a poppet valve.   8

8 a. What is quick exhaust valve? Design a pneumatic circuit to operate a single acting cylinder using a quick exhaust valve.   10

   b. A pneumatic circuit has to be designed to operate a double acting cylinder. Propose a circuit using the following components to ensure continuous reciprocation:
       i) One $5/3$ memory valve   ii) Two $3/2$ roller lever switches
       iii) FRL unit   iv) Compressed air supply at 6 bars.   10

UNIT - V

9 a. What is FRL unit? With the help of a neat sketch, explain the working principle of a lubricator.   8

   b. Illustrate with sketch only, with construction of a pneumatic reservoir showing all the accessories.   4

   c. Discuss the working principle of pressure switch employed for automatic cut in and cut-out of air compressor.   8

10 a. Write a note on motion and control diagram.   8

   b. Two double acting pneumatic cylinders needs to be controlled to ensure the sequence A+, B+, B-, A-. Explain the step by step procedure of designing pneumatic circuit using 'cascading' method.   12

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