



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?

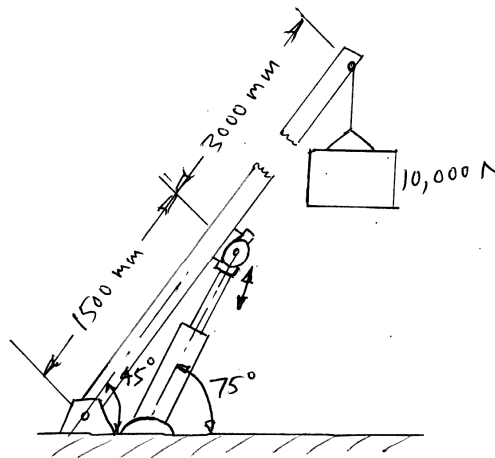


Figure 2(b)

- 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 $0.0015 \text{ m}^3/\text{s}$. 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 valve
 - 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 $\frac{4}{3}$ 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 $\frac{4}{3}$ double lever operated, spring centered and tandem centered DCV. 10
Employ a counter-balance valve for safe operation.
- 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 8
ii) Supply air throttling and Exhaust air throttling.
- 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: 10
i) One $\frac{5}{3}$ memory valve ii) Two $\frac{3}{2}$ roller lever switches
iii) FRL unit iv) Compressed air supply at 6 bars.

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