

ME 2305 – APPLIED HYDRAULICS AND PNEUMATICS

III Year

V Sem.,

**UNIT - I HYDRAULICS - FLUID POWER SYSTEMS AND
FUNDAMENTALS
PART – A**

- 1.1. Define Fluid Power. [AU, Nov / Dec – 2005,06,Nov/Dec-2010]
- 1.2. Differentiate between oil hydraulic and pneumatics.
- 1.3. What are the advantages of fluid power? [AU, Nov / Dec – 2009,Nov/Dec-2010]
- 1.4. List five fields of application of fluid power [AU, May / June - 2007]
- 1.5. What is the basic law that is important in applying fluid power and what is its significance?
- 1.6. List the three basic types of Fluid Power control systems.
- 1.7. Mention different types of pumps used in fluid power systems. [AU, Nov / Dec – 2004,Apr/May-11]
- 1.8. List any four advantages of using the fluid power system. [AU, Apr / May – 2008,Nov/Dec-2010]
- 1.9. Why are hydraulic systems preferred for heavy work than the pneumatic systems?

[AU, Nov / Dec - 2010]
- 1.10. Name any four drawbacks of fluid power systems. [AU, Apr / May - 2005]
- 1.11. What is the main difference between a open-loop and closed-loop fluid power system?
- 1.12. Give any two differences between hydraulic power and pneumatic power. [AU, Apr / May - 2010]
- 1.13. What are the four primary functions of hydraulic fluid?
- 1.14. Name few properties which a hydraulic fluid should posses? [AU, May / June – 2009, Nov / Dec – 2008,Apr/May-2011]
- 1.15. State the effect of temperature and pressure on viscosity of gases. [AU, Nov / Dec - 2008]
- 1.16. Why must a hydraulic fluid have good lubricating ability?
- 1.17. What is the significance of the neutralization number? [AU, Nov / Dec - 2010]
- 1.18. What type of fluid is more generally used to transmit power in a hydraulic system? [AU, Apr/May - 2008]
- 1.19. What is viscosity Index? What do you infer from V.I. number at a oil? [AU, Apr / May - 2008]
- 1.20. Explain the term friction factor. [AU, Nov / Dec - 2006]
- 1.21. Give the hydraulic symbol for a 3-position, 4-way, closed centre solenoid operated direction control valve. [AU, Apr / May - 2004]
- 1.22. Write symbols for any four of the hydraulic elements. [AU, Nov / Dec - 2004]
- 1.23. For the following graphic symbol shown, identify their modes of operation. [AU, Nov / Dec - 2008]
- 1.24. State Pascal's Law. [AU, Nov / Dec - 2009]
- 1.25. Give the symbol of variable vane pump and pressure compensated flow control valve. [AU, May / June - 2009]
- 1.26. Differentiate Laminar and turbulent flow.
- 1.27. Give the expression used to determine friction factor for laminar flow through pipes. [AU, Apr / May - 2010]
- 1.28. Explain what is meant by Reynolds number.
- 1.29. What is the purposed of Darcy – Weisbach equation?
- 1.30. Draw the ANSI symbol of pressure relief valve. [AU, Nov / Dec - 2010]
- 1.31. State the used of moody diagram.
- 1.32. What is Equivalent length?

1.33. Name two undesirable results when oil with a viscosity that is too high. *[AU, Apr / May - 2011]*

1.34. What are the minor Energy losses in pipes?

PART – B

1.35. (i) List out the advantage and disadvantage of hydraulic Power System

(ii) What are the functions of a fluid in any fluid power systems?

(iii) What are the required properties of a good hydraulic fluid? *[AU, Apr / May - 2008]*

1.36. (i) Describe the criteria for the choice between hydraulic and pneumatic system.

(ii) Describe the properties of hydraulic fluids. *[AU, Nov/Dec - 2010]*

1.37. (i) With neat sketch explain the hydraulic and pneumatic fluid power systems.

(ii) Discuss the properties of the hydraulic fluids. *[AU, Nov/ Dec - 2006]*

1.38. (i) Sketch any 8 neutral position for 3-position 4-way valves. *[AU, Apr / May - 2005]*

(ii) Give any four important properties of a hydraulic fluid. Also state the different types of fluids used.

1.39. (i) What are basic considerations in the design of hydraulic circuit? Explain.

(ii) Enumerate the properties of oils for use in fluid power systems. *[AU, Nov/ Dec - 2004]*

1.40. Write Short notes on the following *[AU, Apr / May - 2008]*

- (i) Laminar and turbulent flow (ii) Energy losses in valves and fittings
(iii) Darcy's Equation [AU, Apr / May - 2011]
1.41. (i) Describe any four advantages of fluid power systems. [AU, Apr / May - 2011]
- (ii) Differentiate between laminar and turbulent flow with examples.
[AU, May / June - 2009, Nov/Dec - 2010]
1.42. (i) What are the functions of a fluid in any fluid Power System? [AU, Apr / May - 2008]
- (ii) Compare the various characteristics of the liquid and gaseous fluid in fluid power system.
(iii) Enumerate the properties that a good hydraulic fluid should possess.
1.43. (i) Discuss any four hydraulic principles used in hydraulic systems. [AU, Nov/Dec - 2009] (ii)
Discuss any four applications of fluid power. [AU, Apr / May - 2011]
1.44. (i) What are the essential and desirable properties of a hydraulic fluid? Discuss.
- (ii) List the precautions to be taken when a mineral oil based fluid is changed into fire resistant
fluid. [AU, Apr / May - 2010]
1.45. Compare and contrast between hydraulic Pneumatic and Electromechanical Power systems.
[AU, May / Jun - 2007, Nov / Dec - 2008, Nov/Dec 2010]
1.46. Compare the use of fluid power to a mechanical system by listing advantages and
disadvantages. [AU, Apr / May - 2011]
1.47. Write Pascal's law. explain any one application of Pascal's law with neat diagram
[AU, Nov/Dec - 2010]
1.48. (i) Write briefly about the following hydraulic fluids [AU, Nov/Dec - 2008]
(i) Petroleum Oils
(ii) Emulsions
(iii) Glycols
1.49. (i) Describe any four applications of fluid power system [AU, May / June - 2009, Nov/Dec 010]
- (ii) Draw a schematic layout of hydraulic power pack with symbols.
1.50. (i) List all properties that a good hydraulic Fluid should possess
- (ii) Fluid is flowing through a tapering pipe having diameters 50mm and 25mm at sections 1 and
2 respectively. The discharge through the pipe is 7.5 LPS (litres per second). The section 1 is 3m
above datum and section 2 is 1.25m above datum. If the pressure at section 1 is 200 kpa, find the
pressure at section 2. The specific gravity of the fluid is 0.9. [AU, Nov / Dec - 2008, Nov/Dec 2010]
1.51. (i) When designing a hydraulic circuit, enunciate the important factors that must be taken
into account?
- (ii) What are the main parameters affecting the performance of a pump? Briefly discuss
1.52. (i) Discuss the factors to be considered in the selection of hydraulic fluids.
- (ii) Explain the factors which affect the selection of pump and discuss in detail the classification
and performance features of different types of hydraulic pumps.
1.53. (i) With neat sketch explain the hydraulic and Pneumatic Fluid Power Systems.
- (ii) Discuss the properties of the hydraulic fluids.
(iii) List and explain various hydraulic fluids. [AU, Nov/Dec - 2010]
1.54. Describe various losses in pipe, valves and fittings in hydraulic system. [AU, Apr / May -
2011]
1.55. (i) How to calculate frictional losses in common valves and fittings.

(ii) Define Reynolds number

(iv) Differentiate between laminar and turbulent fluid flow. [AU, Nov / Dec - 2006]

1.56. (i) Explain how Bernoulli's equation can be used to determine the pressure drop between two stations in a hydraulic system. Assume that there are some number of bends, tees, elbows, globe and gate valves in between these two station separated by a long distance.

(ii) Oil with specific gravity 0.9 enters a tee, shown in figure with velocity $v_1 = 5 \text{ m/s}$. The diameter at section 1 is 10 cm, the diameter at section 2 is 7 cm and the diameter at section 3 is 6cm. If equal flow rates are to occur at sections 2 and 3, find v_2 and v_3 is m/s. [AU, Apr / May - 2010]

UNIT - II HYDRAULICS SYSTEMS & COMPONENTS

PART - A

2.1 Name the basic components required in hydraulic system. [AU, Apr/May-2011]

2.2 What is a hydraulic fuse? [AU, Apr / May - 2005]

2.3 How do specify a pump [AU, Nov / Dec - 2008]

2.4 Name any four desirable characteristics of hydraulic pumps. [Au, Apr / May - 2005]

2.5 What is positive displacement pump, and in what ways does it differ from a centrifugal pump?

2.6 What do you mean by non positive displacement pump? State its implications. [AU, Nov / Dec - 2006]

2.7 Name the three popular construction types of positive displacement pumps.

2.8 Distinguish between positive and variable displacement pumps. [AU, Apr / May - 2011]

2.9 What are the advantages of positive displacement pumps? [AU, May / June - 2007]

2.10 Name different designs of gear pump.

2.11 What is pump cavitations? How can you avoid it ? [Au, Apr / May - 2008]

2.12 What is the difference between fixed displacement and variable displacement pumps?

2.13 What is meant by variable displacement pump? [AU, Nov / Dec - 2010]

2.14 Why gear pump cannot be used as variable displacement pump ?

2.15 What is the pressure compensated vane pump and how does it work ?

2.16 What is pressure compensated flow control? How a variable vane pump can provide this feature? [Au, Apr / May - 2010]

2.17 When is Lobe pump preferred? [AU, Nov / Dec - 2009]

2.18 Name the two basic types of piston pumps.

2.19 How is volumetric efficiency, mechanical efficiency and overall efficiency of a positive displacement determined?

2.20 A pump has a displacement volume of 98.4 cm³/rev. It delivers 1.52 litres/sec at 1000 rpm and 70 bar. If the prime mover input torque is 124.3 Nm what is the over all efficiency of the pump?

[AU, April/May - 2004]

2.21 What are pump characteristics curves? [AU, Nov/Dec - 2004]

2.22 A positive displacement pump has an overall efficiency of 87% and volumetric efficiency of 93%, what its mechanical efficiency? [AU, May / June - 2009]

2.23 Draw the graphical symbols for the following pump types.

a. Fixed displacement b. Variable displacement

c. Bi-directional d. Pressure compensated.

2.24 Draw the graphical symbol for : push button operated, four way, two position, spring offset DCV [AU, Nov/Dec - 2008]

- 2.25 What is a hydraulic actuator?
2.26 What are the types of hydraulic actuator?
2.27 What is the purpose of hydraulic motor and how does it differ from the hydraulic pump?
2.28 Mention few applications where piston motors are employed. [AU, Nov / Dec - 2010]
2.29 Write the classifications of hydraulic motors [AU, May / June - 2007]
2.30 Where are external gear motors used?
2.31 What is a semi – rotary actuator?
2.32 Name common types of semi-rotary actuators
2.33 List few applications of semi – rotary actuator.
2.34 What is the difference between Semi – rotary actuator and a fluid motor?
2.35 Why are double acting cylinders known as differential cylinders? [AU, Nov / Dec - 2010]
2.36 What is cylinder cushion? What is its purpose? 2.37 Where are rodless cylinders used? [AU, Nov / Dec - 2010] 2.38 Why is end cushioning provided for cylinders? [AU, Nov/Dec - 2004]
2.39 Where Tandem type of cylinders are used? [AU, Apr / May - 2011]
2.40 What is the advantages and disadvantage of tandem cylinder?
2.41 For what application, double rod cylinder is best suited?
2.42 What is telescoping cylinder? When is it normally used?
2.43 What are the advantages of telescopic cylinders? [AU, May / June - 2009]
2.44 Name four types of cylinder mountings. [AU, Apr/May-2011]

PART - B

- 2.45 Explain the following [AU, Nov/Dec - 2008]
- (i) Pump characteristic Curves
 - (ii) Pump Cavitation
 - (iii) Pump noise
 - (iv) Pump Selection
- 2.46 (i) Discuss the steps involved in the selection of a pump for a hydraulic circuit.
- (ii) Discuss the working of piston motors with help of neat sketch. What are the practical situations where in rotary actuators preferred over linear actuators? [AU, Nov/Dec - 2009]
- 2.47 (i) With a neat sketch, Explain the end cushion' provided in hydraulic cylinder.
- (ii) Explain with neat sketch, the principle of operation of telescopic cylinder. [AU, Nov/Dec - 2008]
- 2.48 Define
- (i) Volumetric Efficiency (ii) Mechanical Efficiency
 - (iii) Overall Efficiency of a hydraulic pump. [AU, May/June - 2007]
- 2.49 (i) Explain the working principle of external gear pump and determine its performance measures.
- (ii) Write short notes on variable displacement pumps.
- 2.50 Explain the various mechanisms of hydraulic cylinder mountings with neat diagram.
- 2.51 How the capacity of a variable displacement vane pump is adjusted? Explain with a diagram
- 2.52 Explain the working of a variable displacement axial piston pump with a neat sketch. Also write an expression for the theoretical displacement per revolution of the crank. [AU, Apr / May - 2011]
- 2.53 Explain the working of a radial piston pump with a neat sketch. Also write an expression for the theoretical displacement per revolution of the crank. [AU, Nov/Dec - 2010]

2.54 How do you classify pumps? Explain with suitable sketch the working of vane pump?

[AU, Nov/Dec - 2005]

2.55 Classify the positive displacement pumps and describe the constructional features of screw pumps. *[AU, Apr / May - 2011]*

2.56 What are main parameters affecting the performance of a pump? Briefly discuss? *[AU, Nov/Dec - 2005]*

2.57 (i) Describe the working of an external gear pump with a diagram. *[AU, May/June - 2009]*

(ii) Explain briefly about the fluid motors.

2.58 Draw a neat sketch of an unbalanced type vane pump, explain its construction and operation and also show how the same can operate as a reversible pump. Also give its standard graphical symbol. *[AU, May/June - 2009]*

2.59 Enumerate the working principle of balance vane pump with neat sketch. Also write advantage and disadvantage. *[AU, Nov/Dec - 2010]*

2.60 (i) Explain how positive displacement pumps build pressure compared to rotodynamic pumps.

What are the advantages of positive displacement pumps?

(ii) Using a neat sketch explain the construction and operation of an axial piston pump of swash plate type. *[AU, April/May - 2010]*

2.61 List out the various types of hydraulic cylinders. Explain the construction, parts and working of double acting cylinder with neat sketch. *[AU, Apr / May - 2011]*

2.62 (i) What is cylinder cushioning? Explain with a diagram.

(ii) Explain with a diagram the working of telescopic cylinder.

(iii) What is the purpose of cushioning cylinder? *[AU, Nov/Dec - 2010]*

2.63 (i) Describe the constructional details of double acting cylinder with cushioning mechanism and give name for the parts.

(ii) What are fluid motors? *[AU, Nov/Dec - 2010]*

2.64 Explain using a neat sketch end cushioning provided in hydraulic cylinders. Also sketch at least six types of cylinder mounts available. *[AU, April/May - 2010]*

2.65 (i) Explain a hydraulic press circuit which employs double pump unloading principle.

(ii) Draw a single cylinder continuous reciprocation circuit using suitable components and give the specifications of them.

2.66 (i) Give any two application circuits employing accumulator for different purposes.

(ii) Develop a two handed safety circuit for the operation of a press and explain

2.67 (i) How do you classify pumps? Explain with suitable sketch the working of vane pump?

(ii) Explain the working of a four way two position direction control valve.

2.68 With a sketch describe the construction and operation of a pressure compensated flow control valve.

2.69 What are the different types of fluid motors? Also explain the function of them.

[AU, Apr / May - 2011]

2.70 Define the terms used to evaluate the performance of hydraulic motor. [AU, Nov/Dec - 2010]

PART – C

2.71 Find the actual delivering of a gear pump at following specifications.

Number of teeth = 16; Gear width = 0.065m, Module = 6mm;

Pressure angle = 20° ; RPM = 1600; Volumetric efficiency = 88%

2.72 Find the offset angle for an axial piston pump that delivers 1.25Lps at 2000rpm . the pump has nine 120 mm diameter pistons arranged on 130mm diameter piston circle. the volumetric efficiency is 94%. [AU, Nov/Dec - 2010]

2.73 A pump has a displacement of 80 cm^3 . It delivers 1.25 Lps at 1200 rpm and 75 bar. If the prime mover input torque is 110N-m, [AU, May/June - 2007]

(i) Find the overall efficiency of the pump

(ii) What is the theoretical torque required to operate the pump?

2.74 A double acting cylinder is hooked up in regenerative circuit as shown fig (a). The relief valve setting is 105 bar. The piston area is 130 cm^2 and the rod area is 65 cm^2 . If the pump flow is 0.0016 m^3/s . Find the cylinder speed and load carrying capacity for [AU, May/June - 2007]

(i) Extending Stroke (ii) Retracting Stroke

2.75 (i) The power and load carrying capacity of a hydraulic cylinder (Extension) are 10 kW and 20,000 N respectively. Find the piston velocity during extension.

For the above system if the area of piston side and rod side is 2:1, find the retraction speed. The pump delivers oil at 0.2 m^3/min .

(ii) What are the factors to be selected in selection of a pump for automobile lift?

[AU, Apr / May - 2005]

2.76 How much hydraulic power would a pump produce when operating at 125 bars and delivering 1.25 litres per second at oil? What power rated electric motor would be selected to drive this pump if its overall efficiency is 88%? [AU, Apr / May - 2008]

2.77 (i) How will you measure the pump performance? Explain each with suitable examples.

(ii) A pump has a displacement volume of 98.4 cm^3 . It delivers 0.0152 m^3/s of oil 1000 rpm and 70 bars. If the prime mover input torque is 124.3 N-m (1) what is the overall efficiency of the pump? What is the theoretical torque required to operate the pump?

[AU, Apr / May - 2005]

2.78 (i) A hydraulic pump delivers oil at 60 bar, 120 lpm into a circuit laid on a horizontal plane. There are 4 elbows ($k = 0.75$), one globe valve fully open ($k = 10$) and a direction control valve (pressure drop = 3 bar) with the inside diameter of the pipe as 30 mm. The total length

of the straight run pipe is 20 m and the specific gravity of the oil is 0.9. The kinematic viscosity of the oil is 0.0001 m²/s. determine the pressure in bar at the exit point of the pipe.

(ii) Draw a neat sketch of any one type of variable displacement, reversible pump and explain its construction and operation. Also give the standard graphical symbol for the same.

[AU, Apr / May - 2005]

2.79 A pump has a displacement volume of 0.0819 x10⁻³m³. It delivers 0.0758 m³/min at 1000 rpm at 67 bar. If the prime mover input torque is 100 N-m.

(i) What is overall efficiency?

(ii) What is the theoretical torque required to operate the pump? [AU, Nov/Dec - 2005]

2.80 A hydraulic motor has a displacement of 150cm³ and operates with a pressure of 85 bars and a speed of 1800rpm. if the actual flow rate consumed by the motor is 5 Lps and the actual torque delivered by the motor is 185N-m, find:

1) volumetric efficiency

2) mechanical efficiency

3) overall efficiency

4) kw power delivered by the motor. [AU, Nov/Dec - 2010]

2.81 A pump has a displacement volume of 100 x10⁻⁶ m³. It delivers 1.5 x10⁻³/s at 1000 rpm and 70 x10⁵ N/m² pressure. If the prime mover input torque is 120 N-m.

(i) What is the overall efficiency of the pump?

(ii) What is the theoretical torque required to operate the pump?

(iii) Discuss any two types of cylinder mountings with neat diagrams. [AU, Nov/Dec - 2009]

2.82 A pump has a displacement volume of 0.0819 x10⁻³ m³. If delivers 0.0758 m³/min at 1000 rpm at 67 bar. If the Prime mover input torque is 100 N-m.

(i) What is overall efficiency?

(ii) What is the theoretical torque required to operate the pump?

UNIT - III DESIGN OF HYDRAULIC CIRCUITS

PART - A

3.1 What are the three important things that are controlled in a hydraulic system?

3.2 What are the constituents of a Hydraulic power pack? How is this represented symbolically?

[AU, Nov/Dec - 2004]

- 3.3 What do you understand by the term power pack? [AU, Apr / May – 2004, Nov / Dec - 2005]
3.4 What is the function of relief valve in a hydraulic system ?
3.5 How do you select hydraulic pipes for a hydraulic system? [AU, Nov/Dec - 2005]
3.6 Give the rule of thumb used in the sizing of reservoirs. [AU, Apr / May - 2004]
3.7 What is the function of an unloading valve ?
3.8 Draw the graphical symbol for : push button operated, four way, two position, spring offset DCV

[AU, Nov/Dec - 2008]

- 3.9 What two-way valve? [AU, Apr / May - 2005]
3.10 What is the difference between pilot operated and direct operated pressure relief valve?

[AU, Apr / May - 2004]

- 3.11 Draw a neat sketch of the graphical symbol for 3 position 4 way solenoid energized pilot operated tandem centre direction control valve. [AU, Apr / May - 2010]
3.12 What is the function of a sequence valve?
3.13 What is the function of a shuttle valve? [AU, Nov / Dec - 2010]
3.14 Name one application of counter balance valve?
3.15 What is the purpose of a direction control valve ?
3.16 How do you classify direction control valves? [AU, Nov/Dec - 2005]
3.17 Draw the ANSI symbol for [AU, Apr / May – 2008, Nov/Dec-2010]

(a) Pilot operated check valve

(b) Shuttle valve

- 3.18 What is a solenoid and how does it work ?
3.19 Draw the symbol of simple pressure relief valve [AU, May/June - 2007]
3.20 Draw the symbol for pressure relief valve. [AU, Nov/Dec - 2005]
3.21 List any four types of Pressure Control Valves. [AU, Nov/Dec - 2004]
3.22 Explain the difference between open center system and closed centre system?
3.23 What is combined flow control and check valve? [AU, Nov/Dec - 2004]
3.24 What is the purpose of a flow control valve ?
3.25 List the three ways of applying flow control valve. [AU, Apr/May-2011]
3.26 What is the purpose of regenerative circuit? [AU, Nov/Dec - 2005]
3.27 Why are quick exhaust valves required? [AU, Apr / May - 2011]
3.28 Write the functions of a solenoid valve. [AU, Nov/Dec - 2006]
3.29 What is meter-in circuit and where is it used?
3.30 What is meter-in circuit? What is its limitation? [AU, Apr / May – 2004,]

- 3.31 What is meter – out circuit and where is it used ?
3.32 Distinguish between meter-in and meter-out circuits with respect to speed control circuits

[AU, Nov / Dec - 2010]

- 3.33 Differentiate between pressure control valve and pressure relief valve. *[AU, Nov/Dec - 2006]*
3.34 What is the function of bleed off circuits? *[AU, Apr / May – 2005, Nov/Dec-2010]*
3.35 What is a flow divider and name the different types?
3.36 What is the function of a sequence valve? *[AU, May/June - 2009]*
3.37 What is a cartridge valve?
3.38 What is the use of a temperature switch?
3.39 What is a hydraulic accumulator?
3.40 What are the functions of accumulators? *[AU, Nov/Dec – 2008, Nov/Dec-2010]*
3.41 Name the basic types of accumulator. *[AU, Apr/May-2011]*
3.42 What is meant by sizing of accumulator? *[AU, Nov / Dec - 2010] [AU, Apr / May - 2011]*
3.43 Name the major classifications at separator accumulator.
3.44 What are the advantages and disadvantages at piston type accumulator?
3.45 What is the advantage of diaphragm type accumulator?
3.46 List the applications of accumulator. *[AU, May/June - 2007]*
3.47 What is the function of intensifier in hydraulic circuit?
3.48 Why weight loaded type accumulator is undesirable for mobile equipment? *[AU, May/June - 2009]*
3.49 What is the advantage of using intensifiers? *[AU, Nov/Dec - 2009]*
3.50 What is air-oil intensifier? *[AU, Nov/Dec - 2005]*
3.51 State the need for synchronization of hydraulic cylinders. *[AU, Apr / May - 2005]*

PART – B

- 3.52 When designing a hydraulic circuit, enuntiate the important factors that must be taken into account. *[AU, Nov/Dec - 2005]*
3.53 Give a detailed procedure for the design of hydraulic circuits with a typical example. *[AU, Nov/Dec - 2004]*

3.54 A double acting cylinder is hooked up in regenerative circuit as shown in figure. The relief valve setting is 105 bars. The piston area is 130 cm² and the rod area is 65cm². If the pump flow is 0.0016 m³/s. find the cylinder speed and load carrying capacity for (1) Extending stroke (2) Retracting stroke.

3.55 Explain the working of a four way two position direction control valve. [AU, Nov/Dec - 2005]

3.56 With a sketch describe the construction and operation of a pressure compensated flow control valve. [AU, Nov/Dec - 2005]

3.57 (i) Sketch and explain commonly used 3-position 4-way direction control valves.

(ii) With the help of circuit diagrams, illustrate the application of accumulators. [AU, May/June - 2009]

3.58 (i) Explain the construction and working of pilot operated sequence valve.

(ii) Make a circuit sketch showing the use of an accumulator, as a hydraulic shock absorber. . [AU, Nov/Dec - 2008]

3.59 (i) With a neat sketch and explain the *end cushion* provided in hydraulic cylinders.

(ii) Distinguish between unloading valve and sequence valve. [AU, Apr / May - 2005]

3.60 (i) With neat sketches explain the construction and operation of a shuttle valve and flow control valve. Also give their symbols.

(ii) Develop a continuous cylinder reciprocation circuit using suitable pneumatic valves. [AU, Apr / May - 2004, Nov/Dec-2010]

3.61 (i) Draw and explain the ladder diagram connections for a regenerative circuit.

(ii) Write and Explain the working principle of pressure intensifier, with neat diagram. [AU, Nov/Dec - 2008]

3.62 (i) Explain the sequencing of two double-acting cylinder with a neat circuit.

(ii) With a neat sketch describe the construction and operation at a pressure compensated flow control valve? [AU, Apr / May - 2008]

3.63 (i) Explain the operational features of the check valve with neat diagram.

(ii) Write short notes on shuttle valve. [AU, Nov/Dec - 2006]

3.64 (i) With a neat sketch, Explain how two hydraulic cylinders motion can be synchronized.

(ii) Make a circuit showing an intensifier in a punching press application [AU, Apr / May - 2008]

3.65 (i) Draw and explain hydraulic cylinder sequence circuit. [AU, Apr / May - 2005]

(ii) Explain the working principle of a fail safe circuit with overload protection.

3.66 With suitable sketches explain following industrial hydraulic circuits. [AU, Nov/Dec - 2004]

(i) Pressure regulating circuit

(ii) Speed control circuit.

3.67 (i) Draw and explain the hydraulic circuit used in a milling machine. [AU, Apr / May - 2005]

(ii) Discuss the application of hydraulic circuits in press and planner.

3.68 (i) How 4/3 direction control valve is working in hydraulic power circuits? explain the construction detail with neat sketch , Draw the graphical symbol of the valve. [AU, Nov/Dec - 2010]

(ii) What is the purpose of pressure compensated flow control valve? [AU, Nov/Dec - 2010]

3.69 (i) Draw and explain the working of a direct acting pressure reducing valve with neat diagram.

[AU, Apr / May - 2011]

(ii) With a neat sketch, Explain the construction and operation at a pilot operated sequence valve.

[AU, Nov/Dec - 2008]

3.70 (i) Discuss the construction and working of a solenoid actuated valve with a diagram.

(ii) Discuss the functioning of an unloading valve with a diagram. [AU, Nov/Dec - 2009]

3.71 (i) What is fail-safe circuit? with suitable diagram, explain two handed safety circuit.

(ii) Enumerate four methods at actuation of hydraulic control valves. [AU, May/June - 2007]

3.72 (i) Explain a hydraulic press circuit which employs double pump unloading principle.

(ii) Draw a single cylinder continuous reciprocation circuit using suitable components and briefly explain [AU, Apr / May - 2004]

3.73 (i) Design and explain the working of a regenerative circuit.

(ii) Design and explain the working of a sequencing circuit. [AU, May/June - 2009]

3.74 (i) Describe a hydraulic circuit for synchronizing two cylinder with flow control valves.

(iii) Design a hydraulic sequence circuit for a milling machine with one cylinder for operating the power vice jaw and the other for controlling the other for controlling the cutler level

[AU, Nov/Dec - 2005]

3.75 (i) List the need and application of synchronizing circuits.

- (ii) With simple sketches, explain the various types of synchronizing circuits.
3.76 (i) Discuss with a diagram the working of a non-return valve.
- (ii) Two hydraulic cylinder have to work in sequence. Design a suitable circuit. Draw the circuit.
3.77 (i) Explain the operational features of the check valve with neat diagram.
- (ii) Write short note on Shuttle Valve.
3.78 (i) Explain air over oil intensifier system with suitable example. [AU, Nov/Dec - 2006]
- (ii) With neat sketch explain the weight loaded accumulator
3.79 Explain the working of an intensifier with an example application. [AU, Apr / May - 2011]
3.80 Briefly describe the construction of any two types of accumulators. [AU, Nov/Dec - 2005]
3.81 With suitable sketches explain the following circuits ; [AU, Nov/Dec - 2004]
- (i) Accumulator circuit
(ii) Counterbalance circuit.
3.82 (i) An accumulator is loaded with 400 kN weight. The ram has a diameter of 250 mm and a stroke of 6 m. Its' friction may be taken as 2%. It takes 120 seconds to fall through its full stroke. Find the total work supplied and power delivered to the hydraulic appliance by the accumulator, when $7.5 \times 10^{-3} \text{ m}^3/\text{min}$ is delivered by a pump, while the accumulator descends with the same velocity.
- (ii) Discuss the use of accumulator in hydraulic circuits. [AU, Nov/Dec - 2009]
3.83 (i) An accumulator is loaded with 400 kN weight. The ram has a diameter of 300 mm and a stroke of 6 m. Its' friction may be taken as 5%. It takes 2 min to fall through its full stroke. Find the total work supplied and power delivered to the hydraulic appliance by the accumulator, when $0.0075 \text{ m}^3/\text{s}$ is delivered by a pump, while the accumulator descends with the same velocity. Take the density of oil is 1000 N/m^3 . [AU, Nov/Dec - 2010]
- (ii) Draw and explain a basic hydraulic circuit employing an intensifier for using in a punching press. [AU, Nov/Dec - 2010]
3.84 (i) Draw a closed circuit hydrostatic transmission circuit and explain the functions of components in it. Also explain the function of replenishing circuit.
- (ii) Draw any two circuits using accumulator for different applications. [AU, Apr / May - 2004]
3.85 Sketch any two circuits which employ hydro pneumatic accumulators for two different applications. Also explain how the size of the accumulator is decided assuming the compression of nitrogen in pneumatic accumulator to follow isothermal process. [AU, Nov/Dec - 2010]
3.86 A press cylinder has to exert a force to lift the crosshead and tooling. The cylinder is rigidly fixed by front flange and the load is pivoted and fully guided. Maximum thrust from the press is 260 kN with a stroke of 1.4 m. Determine the size of suitable cylinder. The system working pressure should not exceed 200 bar. [AU, Nov/Dec - 2005]
3.87 Explain the construction and working of following control components

- 1) 4/2 Direction control valve
 - 2) Shuttle valve
 - 3) Sequence valve
 - 4) Flow control valve [AU, Apr / May - 2011]
- 3.88 (i) Briefly explain the different types of accumulators used in hydraulic systems. Illustrate and explain any four applications of accumulator. [AU, Apr / May - 2011]
- (ii) How are the ports of valves used pneumatics designated? Write down the symbols for following types of pneumatic valves.
- (1) 5/3 way valve
 - (2) 4/2 way valve
 - (3) Check and regulation valve. [AU, Nov/Dec - 2004]

UNIT - IV PNEUMATIC SYSTEMS AND COMPONENTS PART – A

- 4.1 When is pneumatics preferred over hydraulics?
- 4.2 How can you specify an air compressor? [AU, Apr / May - 2008]
- 4.3 What are the basic components of a pneumatic system? [AU, Nov/Dec - 2009]
- 4.4 Name the three types at positive displacement compressors that are commonly used in industry?
- 4.5 What are the functions of FRL unit? [AU, Nov/Dec - 2009, Nov / Dec - 2010]
- 4.6 Give the standard graphical symbol for FRL unit. [AU, Apr / May - 2004]
- 4.7 What is the function of an air filter?
- 4.8 Name the various types of filters used in the pneumatic system. [AU, Nov/Dec - 2006]
- 4.9 What is the purpose of a pressure regulator? [AU, Nov/Dec - 2008]
- 4.10 What is the need of lubricator unit in the pneumatic system? [AU, Nov/Dec - 2006]
- 4.11 Sketch the graphical symbol of pneumatic regulator. [AU, Apr / May - 2010]
- 4.12 Why should a lubricator be used in a pneumatic system? [AU, May/June - 2009]
- 4.13 What is the purpose of a quick Exhaust Valve? [AU, Apr / May - 2011]
- 4.14 State the difference between quick exhaust valve and flow control valve. [AU, Apr/May-2011]
- 4.15 Give the symbol for an electro-pneumatic system. [AU, May/June - 2009]
- 4.16 Name any two pneumatic hydraulic elements. [AU, Nov / Dec - 2010]
- 4.17 Classify the pneumatic cylinders based on operating principle.
- 4.18 What is the function at reservoir in a pneumatic system? [AU, May/June - 2007]
- 4.19 Name the different types of air motors.
- 4.20 How do pneumatic actuator differ from hydraulic actuators? [AU, Apr/May-2011]
- 4.21 What are the advantages of air motor over electric motor?
- 4.22 What are suction cups used?
- 4.23 What is the purpose of synchronized hydraulic circuits? [AU, Nov/Dec - 2009]
- 4.24 Compare hydraulic and pneumatic circuits with respect to their characteristics. [AU, Apr / May - 2004]

- 4.25 How are logic circuits classified?
- 4.26 Mention any two roles of pneumatic systems in low cost automation. [AU, Apr / May - 2005]
- 4.27 What are asynchronous sequential circuits?
- 4.28 What do you understand by single shot sequencing? [AU, Apr / May - 2005]
- 4.29 How is the speed of a cylinder controlled in pneumatic system? [AU, Nov/Dec - 2009]
- 4.30 List the common methods for designing pneumatic logic circuits.
- 4.31 What is a cascade system?
- 4.32 What is meant by an air-over-oil system? [AU, Apr / May - 2008]
- 4.33 What is meant by interlock contacts? [AU, May/June - 2007, April / May - 2005]
- 4.34 What is the purpose of fail-safe circuit? [AU, Nov/Dec - 2008]
- 4.35 What is bitable flip-flop? [AU, Nov/Dec - 2008, Nov/Dec-2010]

PART – B

- 4.36 Make a circuit sketch for control of a double acting hydraulic cylinder. [AU, Nov/Dec - 2005, 08]
- 4.37 (i) What are PLCs? Explain their application in low cost automation.
- (ii) Give the procedure of the cascade method of designing sequencing circuits. [AU, Nov/Dec - 2005]
- 4.38 Compare pneumatic system with hydraulic system. [AU, Apr / May - 2011]
- 4.39 Draw and explain the functions of pneumatic check valve. [AU, May/June - 2009]
- 4.40 Design a pneumatic circuit for the following sequence using cascade method.
- $A+B+B-A-C+C-$ [AU, May/June - 2009]
- 4.41 Design an electropneumatic circuit using cascade method for the following sequence $A+B+B-A-$ where A and B stands for cylinder. (+) indicates extension and (-) indicates retraction of cylinders [AU, Nov/Dec -2008, May/June - 2007, Apr / May - 2008, Nov/Dec-2010]
- 4.42 Design an electrohydraulic circuit for the following sequence $A + B + B - A -$ where A and B stand for cylinders, + indicates extension and – retraction incorporate provision for auto-manual selector and emergency stop. [AU, Nov/Dec - 2005]
- 4.43 Develop a circuit involving two double acting cylinders A and B operating with the following sequence : $A+B+B-A-$ where + represents extension of rod and – represents retraction. Use only sequence valves to obtain the sequencing. [AU, Apr / May - 2010]
- 4.44 Design and develop a sequential circuit using cascade method for the following sequence $A+B+A-B-$. [AU, Apr / May - 2004]
- 4.45 State the various types of air control valves. Also explain the working of quick exhaust valve. [AU, Apr / May - 2011]
- 4.46 (i) Describe the functioning of air control valves
- (ii) Classify the various types of pneumatic actuators. [AU, Nov/Dec - 2010]
- 4.47 (i) Discuss the construction and function of a Quick exhaust valve with a diagram.

(ii) Discuss in detail the considerations taken while designing pneumatic circuits.

[AU, Nov/Dec - 2009]

4.48 Discuss the construction and working principle of a Rotary vane air compressor

[AU, May/June - 2007]

4.49 Explain the function of an air pressure regulator with neat sketch. [AU, May/June - 2010]

4.50 (i) A rotary vane air motor has a displacement volume of $80 \text{ cm}^3/\text{rev}$ and operates at 1750 rpm using 700 kPa gage pressure air. Calculate the standard m^3/min rate of consumption and kW power output of the motor. Assume the temperature remains constant.

(ii) Describe the function of an air pressure regulator with neat sketch. [AU, Apr / May - 2005]

4.51 (i) Discuss the working principle of an air compressor.

(ii) Discuss the function of FRL Unit

4.52 (i) Explain the working of a pneumatic speed control circuit.

(ii) What is a time delay circuit? Discuss with an example.

4.53 What is compressor ? Explain the working principle of piston type compressor with neat sketch.

[AU, Nov/Dec - 2006]

4.54 What is synchronizing ? Explain the synchronizing circuit with suitable approaches.

[AU, Nov/Dec - 2006]

4.55 Explain with its symbol, diagram and functioning of filter, regulator and lubricator.

[AU, Apr / May - 2011]

4.56 (i) Draw a neat sketch of pneumatic filter and explain its construction and working. Also give the graphical symbol.

ii) Develop a continuous single cylinder reciprocation circuit for pneumatic system using limit switches and relays.

4.57 Develop a pneumatic circuit for the following problem:

An embossing station consists of a double acting cylinder, which extends only when both push buttons are pressed simultaneously within a second to ensure complete safety of the operator. The cylinder should retract immediately if any of the push buttons is released. [AU, Nov/Dec - 2004]

4.58 (i) Draw a neat sketch of an electro-hydraulic for sequencing drilling and clamping cylinder

(ii) Explain the working principle of any two types of pneumatic position sensing devices.

4.59 Design and draw a sequential circuit for a surface grinding machine using cascade method.

[AU, Nov/Dec - 2010, Apr/May-2011]

4.60 (i) Explain with neat sketch the working of semi automatic control of a double acting pneumatic cylinder. [AU, Nov/Dec - 2010]

(ii) Explain the working of a hydraulic circuit used in drilling machine [AU, Nov/Dec - 2010]

4.61 (i) Explain with neat block diagram, an air pilot control circuit for a double-acting cylinder.

(ii) Describe any one of the electro-hydraulic circuits used in robotic systems. [AU, Apr / May - 2005]

4.62 Develop a pneumatic two-step speed control circuit which gives the cylinder the following operation. Fast forward, slow feed and quick return. Also give the full description of valves used in this circuit. [AU, Apr / May - 2004]

4.63 (i) What is displacement-step diagram? Draw a displacement-step diagram for the process of conveying boxes between two floors.

(ii) Develop a pneumatic with three cylinders A,B and C for the above problem. [AU, Nov/Dec - 2004]

4.64 (i) How is the economic cost of energy losses in pneumatic systems calculated? Explain.

(ii) Draw a pneumatic circuit diagram and explain its working for cylinder cycle timing system. [AU, Nov/Dec - 2009]

4.65 (i) Consider the charging and discharging of a hydro pneumatic accumulator to be isothermal

and explain the procedure to arrive at the size of accumulator.

(ii) Draw a circuit employing accumulator for supplying emergency hydraulic power. [AU, Apr / May - 2010]

4.66 A double acting pneumatic cylinder is required to provide the following operation : Fast extension till the mod stroke, slow extension till the end of stroke and on sensing the stroke end provide rapid return. Develop a pneumatic circuit employing a shuttle valve and suitable flow control and other valves. [AU, Apr / May - 2010]

4.67 (i) A 75 % efficient compressor delivers air at 680 kPa and a volume of 7.60 m³/min. Calculate the cost of electricity per year if the efficiency of the electric motor driving the compressor is 95% and the compressor operates 2500 hr per year. The cost of electricity is Rs. 5.0/Kwh.

(ii) Discuss with a circuit diagram how the reciprocation of a cylinder is achieved by using pressure switches in pneumatic circuit.

UNIT - V DESIGN OF PNEUMATIC CIRCUITS PART - A

5.1 What is servo valve, and what is its function in a hydraulic system ? [AU, Nov/Dec - 2008]

5.2 What is servo valve? How does it work? [AU, Nov/Dec - 2006, Apr/May-2011]

5.3 What are the advantages of Electropneumatic control? [AU, Nov/Dec - 2004]

5.4 What is the purpose of feedback in a servo system? [AU, Nov/Dec - 2008]

5.5 Name one application of mechanical-hydraulic servo system ?

5.6 What is the difference between Single Stage and a two stage Servo Valve?

5.7 What are some common application of Servo Valves?

5.8 What are Proportional Control Valves ? [AU, May/June - 2007]

5.9 Where Proportional Valves are preferred over conventional electro-hydraulic Valves.

5.10 How does a servo valve differ from proportional valve? [AU, Apr / May - 2010]

5.11 How servo systems are essential for fluid power circuits? [AU, Apr / May - 2011]

- 5.12 Compare Electro-hydraulic Servo Valve and Proportional hydraulic Valves.
5.13 Define the terms 'Lap' and 'Null' with respect to Servo Valves.
5.14 What is the difference between a pressure Switch and a temperature Switch?
5.15 How does a limit Switch differ from a push button Switch.
5.16 Where can fluidics be applied? [AU, May/June - 2009]
5.17 What are the advantages of fluidic control devices? [AU, Nov / Dec - 2010]
5.18 What is an Electrical relay?
5.19 What is an electromechanical relay? [AU, Nov/Dec - 2004]
5.20 What is ladder diagram? [AU, Nov/Dec - 2005, Apr/May-2011]
5.21 What is Programmable Logic Control (PLC)?
5.22 List the components present in PLC. [AU, May/June - 2009]
5.23 What is the use of PLC in fluid power control application? [AU, Apr / May - 2011]
5.24 List the functions of microprocessor in pneumatic/hydraulic control. [AU, Nov/Dec - 2004]
5.25 How do microprocessors differ from PLCs? [AU, Nov/Dec - 2005]
5.26 What are the various approaches for entering the program in the PLC?
5.27 List the probable cause for the problem of leakage at compressed air in pneumatic system?

[AU, May/June - 2007]

- 5.28 State the 'Coanda Effect' [AU, Nov/Dec - 2008, 06, Apr / May - 2008]
5.29 If an air cylinder produces erratic cylinder action, identify the probable causes and also give remedies for them. [AU, Nov / Dec - 2010]
5.30 List the important causes for problems in pneumatic systems. [AU, Nov / Dec - 2010]
5.31 Mention the areas in a pneumatic system, which should be given higher importance during maintenance? [AU, Nov/Dec - 2009]

PART - B

- 5.32 (i) Draw and Explain the working of proportional pressure reducing valve.
(ii) What is meant by ladder programming?
(iii) Draw the basic standard symbols that are used in ladder diagram? Also show rungs in a ladder diagram. [AU, Apr / May - 2008]
5.33 (i) Describe various selection criteria for pneumatic components.
(ii) List out any four operating problems associated with pumps and valves and the corresponding possible causes and suitable remedy for each problem

[AU, Apr / May - 2008]

5.34 (i) Describe various selection criteria for pneumatic components. *[AU, Apr / May - 2005]*

(ii) Explain the application of hydraulic and pneumatic system for low cost automation with suitable examples.

(iii) Write a note on power packs.

5.35 (i) Explain the construction and working principle of hydromechanical servo valves with neat diagram. *[AU, Nov/Dec - 2010]*

(ii) What are proportional control valves? Write the types of proportional control valves.

[AU, Nov/Dec - 2008]

(iii) Draw and explain the construction and operation of proportional pressure relief valve.

[AU, Nov/Dec - 2010]

5.36 Describe the working of electro hydraulic servo valves with a block diagram. state at least two application. *[AU, Apr / May - 2011]*

5.37 What are electro hydraulic servo systems? Write the advantages of the electro hydraulic servo systems over hydro mechanical servo system. *[AU, Nov/Dec - 2010]*

5.38 Draw a neat sketch of an electro hydraulic servo valve and indicate all the components and give their functions. Also develop the transfer function for the open loop gain for this valve.

[AU, Apr / May - 2010]

5.39 Explain with a neat sketch construction and operation of an electro hydraulic servo valve.

Also, deduce the expression for its open loop gain. *[AU, May/June - 2009]*

5.40 (i) Explain the working of fluidic amplifiers. *[AU, May/June - 2009]*

(ii) Describe PLC applications in fluid power control.

5.41 (i) Describe various selection criteria for pneumatic components.

(ii) Explain the working principle of a PLC with neat block diagram *[AU, Nov/Dec – 2008, Nov/Dec-2010]*

5.42 (i) Explain the working principle of a PLC with neat block diagram what are the advantages of PLC

(ii) How does PLC differs from micro processor? *[AU, May/June - 2007]*

5.43 (i) Explain the elements of PLC using block diagram. *[AU, Apr / May – 2004, April/may-2011]*

(ii) Briefly explain the important factors in the maintenance of hydraulic and pneumatic system.

5.44 How PLC is used in fluid power control? Explain with a suitable application. *[AU, Nov/Dec - 2006]*

5.45 (i) What are PLC's? Explain their advantages.

(ii) Explain the ladder logic diagram with an example. *[AU, Nov/Dec - 2004]*

5.46 Enlist the various faults, probable causes and also the remedial action for the following pneumatic system components.

(i) Compressor (ii) FRL Unit (iii) Air Cylinder (iv) Pipe lines.

5.47 (i) What is the selection criteria for pneumatic components?

(ii) What are the factors considered during the installation of pneumatic system?

(iii) What are the advantages of using fluidic system? [AU, Nov/Dec - 2007]

5.48 (i) What is Servo Valve? What is the function of feed back of Servo System?

(ii) Write applications of mechanical-hydraulic Servo System?

5.49 (i) Compare electro-hydraulic Servo Valve and proportional hydraulic Valves.

(ii) What are the various approaches for entering the program in the PLC?

5.50 (i) What are Electro pneumatic system

(ii) What are their advantages?

(i) Write the electro pneumatic circuit for one of the problem [AU, Nov/Dec - 2004]

5.51 Discuss the ladder diagram connection for a dual cylinder sequence circuit for the following sequence of operations: A+ B+ B- A-

5.52 Design and draw an electro hydraulic pneumatic circuit for the sequence. A+ B+B- A. Also write a ladder diagram. [AU, Apr / May - 2011]

5.53 (i) List out various operating problems associated with pumps and valves and the corresponding

possible cause and suitable remedy for each problem.

(ii) Enuntiate various criteria for the selection of pneumatic components. [AU, Nov/Dec - 2005]

5.54 (i) How is AND function achieved in a fluidic circuit? [AU, Nov/Dec - 2009]

(ii) Discuss the circuit for memory function in fluidics.

(iii) Discuss any eight common problems and their remedies in pneumatic circuits.

5.55 Give a detailed account of failure and trouble shooting of hydraulic and pneumatic power packs. [AU, Nov/Dec - 2010]

5.56 (i) Describe the hydro mechanical servo systems with sketch.

(ii) How the failure and trouble shooting is carried out in fluid power circuits

[AU, Apr / May - 2011]

5.57 List out any five types of faults that can be found in compressors. Also write the remedial actions for the faults. [AU, Nov/Dec - 2010]

5.58 (i) Explain various locations at which filters and strainers are fitted giving reasons.

(ii) If a hydraulic circuit has pump inlet and exit ports interchanged, unloading valve given internal pilot. What happens? Explain. [AU, Apr / May - 2010]
