

**VALLIAMMAI ENGINEERING COLLEGE
SRM NAGAR KATTANKULATHUR
DEPARTMENT OF MECHANICAL ENGINEERING**

M.E CAD/CAM

ED7004 DESIGN OF HYDRAULIC AND PNEUMATIC SYSTEMS

QUESTION BANK

UNIT-I

OIL HYDRAULIC SYSTEM AND HYDRAULIC ACTUATORS

PART-A(2 MARKS)

1. What is the function of pump?
2. Distinguish between single acting and double acting actuators?
3. Name the basic components required in hydraulic system.
4. What is the difference between fixed displacement and variable displacement pump?
5. What is a piston pump?
6. What is a differential cylinder?
7. State the advantages of a positive displacement pumps over non positive displacement pump.
8. What is meant by pump optimization?
9. What is a fluid? What are hydraulic fluids?
10. Define volumetric efficiency, mechanical efficiency and overall efficiency of hydraulic motor ?
11. What is meant by Q-H curve and explain?
12. What is meant by positive displacement pump?
13. Explain difference between linear and rotary actuators?
14. Define actuators also explain main types of actuators?
15. Name few applications of hydraulics?
16. What is a telescopic cylinder? When would it normally be used?
17. What is the main difference between a open loop and closed loop fluid power system?
18. What is a fluid? What are the functions and characteristics of hydraulic fluids?
19. Write short notes on specifications of hydraulic pumps?
20. What are the main aspects of selection of hydraulic pumps?

PART-B(16 MARKS)

1. (i) What is the different between a variable displacement pump and fixed displacement pump?
When do the users prefer a variable displacement pump and fixed displacement pump. (6)
(ii) Where telescopic cylinder is preferred? Explain the working of telescopic cylinder with neat sketch. (10)
2. (i) List all the properties that a good hydraulic fluid should possess. (6)
(ii) Why is cushioning needed in a hydraulic cylinder? Explain with a neat sketch, the principle of operation of a fixed cushioned cylinder.(10)
3. (i) With a sketch, explain the working of vane pump. Derive an expression for the theoretical discharge of the pump. (12)
(ii) Write a note on rotary actuators. (4)
4. (i) Write a note on the classification of pumps. (4)
(ii) Briefly discuss the working of a pressure unloading valve. Also sketch a circuit incorporating the valve. (12)
5. (i) Classify hydraulic pumps. Describe the working of rotary piston pumps? What are the advantages of it? (8)
(ii) Explain meter in circuit and meter out circuit. Also mention their application. (8)
6. (i) Write down various styles of cylinder mounting. What is a clevis joint? Why is it used?
(ii) State various types of linear actuators used in hydraulic system. What is a telescopic cylinder? State at least three applications of such a cylinder.
7. (i) What is a semi-rotary actuator and explain any one with neat sketch.
(ii) Explain open loop and closed loop circuit.
8. (i) Explain detail about selection, specification and characteristics of hydraulic pump.
(ii) Explain the construction and function of external gear motor.
9. (i) Explain detail about selection, specification and characteristics of linear Rotary Actuators.
(ii) Explain the construction and function of internal gear motor.

- 10.(i) A cylinder has a bore of 125mm diameter and a rod of 70mm diameter. It drives a load of 2000 kg vertically up and down at a maximum velocity of 3m/s. the load is slowed down to rest in the cushion length of 50mm. if the relief valve is set at 140 bar, determine the average pressure in the cushions while extending and retracting.
- (ii) Explain the construction and function of a swash plate motor.

UNIT-II

CONTROL AND REGULATION ELEMENTS

PART- A(2 MARKS)

1. Draw symbols of the following (a) check valve (b) flow control valves.
2. Name any four pressure control valves used in hydraulics systems.
3. Sketch any two centre configurations of 4/3 DCV.
4. List the drawbacks of simple relief valve.
5. What is the function of an unloading valve?
6. How do a simple pressure relief valve and compound relief valve differ in operation?
7. What is the purpose of the check valve in sequence circuit?
8. How does a pilot operated check valve differ from a simple check valve?
9. What is a safety valve? Name one application.
10. What is the purpose of a flow control valve?
11. What is a solenoid and how does it work?
12. State the specification of a DC valve?
13. Why is a pressure relief valve used in a hydraulic system? State the basic types of pressure relief valve?

14. When is a pressure reducing valve used in a hydraulic system?
15. What is cracking pressure?
16. What is the difference between an open-center and closed-center type of directional control valve?
17. What is a four way direction control valve?
18. What is overlap in valves?
19. What is a pressure compensated flow control valve?
20. What is the need for temperature compensation in flow control valve?

PART-B(16 MARKS)

1. Draw the neat sketch of a compound relief valve and discuss its operation. What is its use?
2. Explain the construction and working of the following with neat sketches?
 - (i) Three-Way valves
 - (ii) solenoid-Actuated valves.
3. (i) With a sketch explain the working of a 4/3 closed centre DCV.(8)
(ii) Sketch a fixed flow pressure compensated flow control valve and explain its working. (8)
4. (i) Briefly discuss the working and application of counter balance valve with suitable sketches. (12)
(ii) Give a note on hydraulic fuse. (4)
5. Explain the construction and working of the following with neat sketches? (16)
 - (i) Pilot operated check valve
 - (ii) Pressure compensated flow control valve
6. Explain the functioning of the following valves with applications? (16)
 - (i) Counter balance valve.
 - (ii) Unloading valve.
7. Explain the function and working principle of pressure reducing valves and sequence valves?

8. Differentiate with sketches the function and characteristics of closed center and open center DC valves.
9. Draw the neat sketch of any two safety valves and discuss its operations.
10. (i) Explain detail about non-return valve with neat sketch.
(ii) Explain detail about needle valve with neat sketch.

UNIT-III
HYDRAULIC CIRCUITS

PART-A(2 MARKS)

1. Give the applications of synchronizing circuits.
2. How are the accumulators used in Hydraulics circuits?
3. What is oil hammer?
4. What is a pilot operated check valve?
5. What is a failsafe circuit?
6. Can a hydraulic cylinder be designed so that for the same pump flow, the extending and retracing in speeds will be equal? Explain your answer?
7. What is the function of sequencing valve?
8. What is the function of accumulator?
9. What is the function of intensifier in hydraulic circuit?
10. What is meant by synchronization of cylinder motion? Name the various methods to obtain it.
11. What is banked unit? Mention one of its applications.
12. What is meant by quick return? Given an example.
13. What are the difference between the relief valve and the sequence valve?
14. List three important considerations to be taken into account while designing a hydraulic circuit
15. List various types of accumulators.
16. What is intensifier? State its application.
17. What do you understand by the term power pack?
18. What is meant by forklift? Given an example.

19. What is a bladder type accumulator? What precautions are generally taken when one uses a bladder type accumulator?
20. What type of gas is used in a gas charged accumulator? Why is oxygen not used?

PART-B(16 MARKS)

1. Construct a hydraulic circuit for earth mover and explain its working principle.
2. List and explain all the steps required for designing a hydraulic power unit.
3. (i) Develop a pressure sequencing circuit using a clamping and drilling cylinder for the following sequence :
 - (1) Clamping
 - (2) Feeding the drill
 - (3) Withdrawing the drill
 - (4) De-clamping. (12)(ii) Give a note on synchronizing of hydraulic cylinders. (4)
4. (i) Develop an accumulator circuit for leakage compensation and explain its working. (8)
(ii) Sketch the setup for hydraulic copying and explain. (8)
5. Draw a neat sketch and explain the function of following. (16)
 - (i) Hydraulic circuit for quick return mechanism.
 - (ii) Pressure intensifier circuit
6. What is an accumulator? State the application of accumulators. Explain the use of accumulator as leakage compensator with a hydraulic circuit?
7. Draw a hydraulic circuit for a hydraulic planner and explain its working principle.
8. Construct a hydraulic circuit for forklift and explain its working principle.
9. Draw a neat sketch and explain the function of following.
 - (i) Synchronizing with flow control valves.
 - (ii) Synchronizing with matching pumps.
10. Draw a hydraulic circuit for a grinding machine and explain its working principle.
11. Construct a hydraulic circuit for vertical milling machine and explain its working principle.

UNIT-IV
PNEUMATIC SYSTEMS AND CIRCUITS

PART- A(2 MARKS)

1. Distinguish between hydraulic and pneumatic systems.
2. What is meant by FRL in pneumatics?
3. What are the advantages of step counter method?
4. What is the condition for grouping in Cascade method?
5. What is meant by fluid conditioner?
6. How do pneumatic actuators differ from hydraulic actuators?
7. What do you meant by logic control?
8. What is a cascade system?
9. How is logic circuit classified?
10. List common method for designing pneumatic logic circuit?
11. What is meant by step-counter method
12. Define a MEMORY function.
13. Name the different pneumatic position sensor?
14. What are moving part logic elements (MPL)?
15. What is fluidics?
16. What are the advantages of fluidic elements?
17. What is meant by mapping?
18. What is the purpose of providing quick exhaust valve in a pneumatic circuit?
19. What is the purpose of providing lubricator in a pneumatic circuit?
20. What is the function of reservoir in a pneumatic system?

PART- B(16 MARKS)

1. Draw a circuit using step counter method for the following sequence $A^+ B^+ B^- A^-$ Where A and B stands for cylinders, (+) indicates extension and (-) indicates retraction of cylinders.
2. (i) Distinguish between control air and signal air with the help of a circuit. (10)
(ii) Draw a pneumatic circuit to show the application of an AND valve.
3. (i) Develop a circuit for the sequence $A1B1B0A0$ using step counter method for single cycle operation and explain the working. (12)

- (ii) Give a note on FRL units. (4)
4. (i) Develop a circuit for the sequence A1B1B0A0C1C0 using cascade method and explain the working. (12)
- (ii) Give a note on Auto/Manual selector module.(4)
5. (i)Discuss the functions of FRL unit. (6)
- (ii) Draw and explain the working principle of an air compressor. (6)
6. Explain the functioning of the following position sensor with neat sketch?
- (i).Pneumatic limit valves.
- (ii).Back pressure sensor.
- (iii).Proximity sensor.
7. Consider an automatic drilling machine. The complete cycle is as follows: Cylinder A extends to clamp the workpiece, then cylinder B extends to drill a hole and then retracts. Cylinder A then retracts to unclamp the workpiece. Design a control circuit applying the step-counter method. The circuit is provided with a start valve to avoid continuous cycling.
8. Design a pneumatic circuit using cascade method for the sequence $A^+ A^- B^+ B^-$ and explain its working principle.
9. Consider an automatic drilling machine. The complete cycle is as follows: Cylinder A extends to clamp the workpiece, then cylinder B extends to drill a hole and then retracts. Cylinder A then retracts to unclamp the workpiece. Design a control circuit applying the K-V mapping method. The circuit is provided with a start valve to avoid continuous cycling.
10. (i)Explain the functioning of the following switches with neat sketch?
- (a) Push button switches
- (b) Pressure switches
- (c) Limit switches
- (d) Temperature switches.
- (ii) What is meant by fringe conditions modules and explain.

UNIT-V
INSTALLATION, MAINTENANCE AND SPECIAL CIRCUITS

PART-A(2 MARKS)

1. Write down the advantage of hydro pneumatic circuits.
2. Name some common fault occur in pneumatic systems.
3. What do you understand by ladder diagram?
4. Name any two faults observed in hydraulic systems.
5. Show the pressure rating for any four pipe material used in pneumatic systems?
6. Classify pneumatic cylinders?
7. When is pneumatics preferred over hydraulics?
8. What is a multistage compressor?
9. What is the purpose of a pressure regulator?
10. Why should a lubricator be used in pneumatic system?
11. How does a hydro pneumatic system differ from hydraulic system?
12. What is an air-oil intensifier?
13. Explain why interfacing is necessary in a microprocessor control fluid power.
14. What are the various approaches for entering the program in the PLC?
15. What are the important points to be remembered while installing a compressor for pneumatic system?
16. State some of the important parameters which may require constant attention in a pneumatic system.
17. Give six reasons for overheating of fluid in a hydraulic system.
18. What is meant preventive maintenance?
19. If the pneumatic cylinder has erratic motion, name the causes.
20. List the probable causes for the problem of leakage of compressed air in pneumatic systems?

PART- B(16 MARKS)

1. Enlist important problems and remedial measures in a pneumatic system.
2. Briefly explain the following :
 - (i) Selection of pneumatic equipments. (8)
 - (ii) Use of microprocessors for sequencing. (8)

3. (i) With suitable sketches explain the working of any two hydro pneumatic circuits. (12)
(ii) Write a note on combination circuits. (4)
4. (i) Discuss the application of a typical hydraulic circuit used in robotics.(10)
(ii) Briefly discuss the use of microprocessors for sequencing. (6)
5. (i) With a block diagram explain the functions of PLC. (6)
(ii) Sketch a PLC based circuit for the extension and retraction of a cylinder and explains (10)
6. (i) Sketch the various hydro pneumatic feed circuits and explain. (10)
(ii) Write a note on application of hydraulic/pneumatic systems for robotic control? (6)
7. (i) Waite a comparison of hydro pneumatic, hydraulic and pneumatic system.(8)
(ii) Briefly explain the function and working principles of air-oil intensifier hydro pneumatic system. (8)
8. (i) Discuss the trouble, possible causes and remedies of pumps? (10)
(ii) Write shorts notes on maintenance of hydraulic system? (6)
9. (i) Write the oxidation? What is the effect of oxidation on hydraulic oil and the system?
(ii) State the common faults in a hydraulic system?
10. (i)Sketch a typical microcomputer control system and explain.
(ii)What factors influence cylinder friction.