

MOHAMED SATHAK A.J. COLLEGE OF ENGINEERING, CHENNAI-103

DEPARTMENT OF MECHANICAL ENGINEERING

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QUESTION BANK

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ME-8694- HYDRAULICS AND PNEUMATICS

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UNIT-I FLUID POWER PRINCIPLES AND HYDRAULIC PUMPS

Introduction to Fluid power – Advantages and Applications – Fluid power systems – Types of fluids - Properties of fluids and selection – Basics of Hydraulics – Pascal’s Law – Principles of flow -Friction loss – Work, Power and Torque Problems, Sources of Hydraulic power : Pumping Theory –Pump Classification – Construction, Working, Design, Advantages, Disadvantages, Performance, Selection criteria of Linear and Rotary – Fixed and Variable displacement pumps – Problems.

PART A

1	Describe fluid power.	BT1	Remembering
2	List out the advantages and disadvantages of fluid power systems.	BT1	Remembering
3	Define Pascal law.	BT1	Remembering
4	Why are the hydraulic system is preferred for heavy work than pneumatic system	BT2	Understanding
5	Describe the primary functions of a fluid in the fluid power systems.	BT1	Remembering
6	Discuss the properties of hydraulic fluids which is used in the fluid power systems.	BT3	Applying
7	Name the basic component which is employed in the hydraulic systems.	BT3	Applying
8	State the effect of temperature on viscosity of fluids in the fluid power Systems.	BT1	Remembering
9	Define demulsibility.	BT1	Remembering
10	Define neutralization number of hydraulic fluids.	BT1	Remembering
11	State the pumping theory.	BT2	Understanding
12	Define pump.	BT1	Remembering
13	List any four hydraulic fluids that are commonly used in fluid power systems	BT1	Remembering
14	Why water is not used as hydraulic fluid in fluid power systems	BT2	Understanding
15	Differentiate fixed and variable displacement pump.	BT3	Applying
16	Describe the term volumetric efficiency and mechanical efficiency.	BT2	Understanding
17	List the losses in the fluid power systems.	BT1	Remembering

18	Describe work and power of fluid power systems.	BT1	Remembering
19	Write the Darcy's equation and explain the uses of Darcy's equation.	BT2	Understanding
20	What is positive displacement pump? Why are they called so?	BT2	Understanding

PART B

1	State Pascal's law and Explain in details about the application of Pascal's law with neat sketch.	BT1	Remembering
2	Discuss the following, (i) Draw and name the graphic symbols used for pump and motor. (6) (ii) Draw and name the graphic symbols used for cylinder and flow control valves. (7)	BT4 BT4	Analyzing Analyzing
3	Explain with neat sketch about working principle of basic hydraulic system and pneumatic system	BT2	Understanding
4	Discuss the following (i) Various types of hydraulic fluids used in the hydraulic systems. (5) (ii) Properties of hydraulic fluids. (8)	BT4 BT4	Analyzing Analyzing
5	Explain the following (i) Fluid power system based on control system. (7) (ii) Fluid power system based on type of control. (6)	BT2 BT2	Understanding Understanding
6	Explain in details about the various losses in hydraulic fluid power systems.	BT2	Understanding
7	(i) Explain the pumping theory with suitable sketch. (6) (ii) Explain the working of Lobe pump with suitable sketch. (7)	BT2 BT2	Understanding Understanding
8	Explain the working principle of following pumps with neat sketch (i) Lobe pump (7) (ii) Screw pump (6)	BT2 BT2	Understanding Understanding
9	(i) Explain the external gear pump with suitable sketch.(6) (ii) Explain the working of internal gear pump with suitable sketch. (7)	BT1 BT1	Remembering Remembering
10	Discuss the following (i) Balanced vane pump. (6) (ii) Unbalanced vane pump. (7)	BT3 BT3	Applying Applying
11	Explain the construction and working principle of in-line axial piston pump with suitable sketch.	BT2	Understanding

12	Explain the construction and working principle of bend axis axial piston pump with suitable sketch.	BT2	Understanding
13	Describe the working principle of radial piston pump with suitable sketch.	BT1	Remembering
14	Explain the performance characteristics of pump with suitable sketch and specific term associated with performance.	BT2	Understanding
PART C			
1	Design the hydraulic circuit and explain with neat sketch for the application of hand operated hydraulic jack.	BT6	Creating
2	Write short notes about the various application of hydraulic systems with suitable example.	BT1	Remembering
3	A pump has displacement of 8.19 cm^3 . It delivers $75.8 \times 10^{-3} \text{ m}^3/\text{min}$ at 1000 rpm at 67 bars. If the prime mover input torque is 100 Nm. Find (i) Overall and volumetric efficiency. (ii) Theoretical torque required to operate the pump.	BT5	Evaluating
4	List and explain the design criteria of Linear and Rotary pump in the hydraulic systems.	BT4	Analyzing

UNIT II HYDRAULIC ACTUATORS AND CONTROL COMPONENTS

Hydraulic Actuators: Cylinders – Types and construction, Application, Hydraulic cushioning – Hydraulic motors - Control Components: Direction Control, Flow control and pressure control valves – Types, Construction and Operation – Servo and Proportional valves – Applications – Accessories: Reservoirs, Pressure Switches – Applications –Fluid Power ANSI Symbols – Problems.

PART A

1	Describe actuator.	BT2	Understanding
2	Classify the various types of actuator.	BT2	Understanding
3	Discuss about telescoping cylinder.	BT2	Understanding
4	Name the types of cylinder mountings.	BT1	Remembering
5	What is the function of hydraulic motor and how does it differ from the hydraulic pump?	BT1	Remembering
6	Describe the term cylinder cushioning.	BT1	Remembering
7	What is a semi-rotary actuator? List the application of semi -rotary actuator.	BT2	Understanding
8	What are the advantages of double acting cylinder over a single acting cylinder?	BT2	Understanding
9	What is the function of seals in the hydraulic system and list the type of seals used in the systems?	BT2	Understanding
10	Draw the ANSI symbol for bidirectional fixed displacement unidirectional motor and variable displacement bidirectional motor.	BT4	Analyzing
11	Describe the three important parameters should controlled the hydraulic system.	BT1	Remembering
12	Draw the symbols for a pressure relief valve and pressure reducing valve	BT4	Analyzing
13	Describe the purpose of Shuttle valve and mention types of control valve based on their function.	BT1	Remembering
14	Draw the ANSI symbol for Pilot operated check valves and shuttle valves.	BT4	Analyzing
15	What is the function of sequence valve and pressure reducing valve?	BT2	Understanding
16	Discuss the function of pressure control valve	BT2	Understanding
17	What are flow control valves? Why are they referred as speed-control valves?	BT2	Understanding

18	List out the various types of pressure control valve.	BT1	Remembering
19	Describe the function of check valves.	BT1	Remembering
20	What is solenoid valve and how does it actuate the spool of a DC valve?	BT1	Remembering
PART B			
1	Explain the working principle following types of cylinders i) Single acting cylinder (5) ii) Cylinder Cushioning (8)	BT2 BT2	Understanding Understanding
2	Explain the construction and working of following with neat sketch (i) Gear motor (7) (ii) Double acting cylinder (6)	BT2 BT2	Understanding Understanding
3	With neat sketch explain the construction of Telescopic cylinder and state its application with example.	BT3	Applying
4	Explain with neat sketch about the construction and working principle of vane motor and state its applications.	BT4	Analyzing
5	Explain the following with neat sketch (i) Poppet valve. (6) (ii) Pilot operated check valve. (7)	BT2 BT2	Understanding Understanding
6	Explain the following (i) 4/3- Direction Control Valve (7) (ii) 3/2-Direction Control Valve (6)	BT2 BT2	Understanding Understanding
7	Explain with neat sketch about different types of flow control valve used in the hydraulic systems.	BT4	Analyzing
8	Explain with neat sketch about the following (i) Meter-in (7) (ii) Meter-out (6)	BT3 BT3	Applying Applying
9	Explain with neat sketch about spring loaded pressure relief valve and pressure reducing valve.	BT4	Analyzing
10	Explain with neat sketch about compound pressure relief valve.	BT2	Understanding
11	Explain with neat sketch about the following (i) Unloading valve (6) (ii) Sequence valve (7)	BT3 BT3	Applying Applying
12	Explain the construction and working principle of rotary spool valve used in the hydraulic systems.	BT2	Understanding

13	(i) Explain the working principle of Mechanical hydraulic servo valve. (7)	BT2	Understanding
	(ii) Explain the flapper servo valve with neat sketch. (6)	BT2	Understanding
14	Discuss the following		
	(i) Proportional pressure relief valve. (7)	BT2	Understanding
	(ii) Proportional pressure reducing valve. (6)	BT2	Understanding
PART C			
1	Design the hydraulic drilling circuit using sequence valve and explain with neat sketch.	BT6	Creating
2	Explain and design the hydraulic circuit by using pressure reducing valve for the weld and clamp unit to weld the Engineering materials.	BT6	Creating
3	Explain with suitable sketch and mention the various possible location of filters in the hydraulic circuit systems.	BT4	Analyzing
4	List the components used in the hydraulic systems and sketch the ANSI symbol of all the components in the hydraulic systems.	BT3	Applying

UNIT III - HYDRAULIC CIRCUITS AND SYSTEMS

Accumulators, Intensifiers, Industrial hydraulic circuits – Regenerative, Pump Unloading, Double-Pump, Pressure Intensifier, Air-over oil, Sequence, Reciprocation, Synchronization, Fail-Safe, Speed Control, Hydrostatic transmission, Electro hydraulic circuits, Mechanical hydraulic servo systems.

PART A

1	Draw the different types of accumulator symbols.	BT2	Understanding
2	Discuss the functions of accumulators.	BT4	Analyzing
3	What is meant by sizing of accumulator?	BT1	Remembering
4	What is the function of pressure intensifier?	BT1	Remembering
5	Define the term “capacity of accumulator”	BT1	Remembering
6	What type of gases used in a gas loaded accumulator? Why oxygen not used for this purpose?	BT1	Remembering
7	Why are non-separator type gas loaded accumulator not preferred in hydraulic systems?	BT2	Understanding
8	What condition in a hydraulic system would require an intensifier?	BT2	Understanding
9	List any four applications of intensifier.	BT1	Remembering
10	Draw fluid power symbol for pressure intensifier and gas loaded type accumulator.	BT4	Analyzing
11	Define the term intensifier ratio.	BT1	Remembering
12	What are the factors to be considered while designing any fluid power system?	BT2	Understanding
13	Why extension stroke faster than the retraction stroke in the regenerative circuit?	BT2	Understanding
14	What is the purpose of using fail safe circuit in any hydraulic system?	BT2	Understanding
15	What is meant by servo control system	BT2	Understanding
16	Define the term lap and null with respect to servo valves.	BT1	Remembering
17	Mention any four applications hydro-mechanical servo valves.	BT1	Remembering
18	What is the purpose of air over oil intensifier circuit?	BT2	Understanding
19	Describe the hydraulic accumulator and its type.	BT2	Understanding
20	What are electrohydraulic servo valves? How do they differ from mechanical servo valves?	BT4	Analyzing

PART B

1	With a neat sketch, explain the construction and working of a piston type accumulator and diaphragm type accumulator?	BT4	Analyzing
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2	Explain the construction and working of the following (i) Dead weight accumulator. (7) (ii) Spring loaded accumulator. (6)	BT2 BT2	Understanding Understanding
3	Design and explain the working of a sequencing circuit.	BT6	Creating
4	Explain the construction and working of pilot operated sequence valve.	BT4	Analyzing
5	Draw and explain the Counterbalance circuit used in the hydraulic circuit.	BT3	Applying
6	Design and explain the working of a regenerative circuit.	BT6	Creating
7	Explain the working principle of pressure intensifier, with neat diagram.	BT4	Analyzing
8	Draw and explain the Air-over-oil circuit used in the hydraulic circuit.	BT3	Applying
9	Describe a hydraulic circuit for synchronizing two cylinder with flow control valves.	BT2	Understanding
10	Design the accumulator circuit for the application of hydraulic shock absorber and Emergency power source in the hydraulic circuit.	BT6	Creating
11	Discuss the construction and working of a Mechanical hydraulic servo system with a diagram.	BT3	Applying
12	Develop a circuit having 4/3 DCV regenerative neutral used to control double acting cylinder	BT6	Creating
13	Design the intensifier circuit for the application of punching press in the hydraulic circuit.	BT6	Creating
14	Design and explain the working of Electro hydraulic circuit.	BT6	Creating
PART C			
1	A double acting cylinder is hooked up in a regenerative circuit for drilling application. The relief valve is set at 75 bar. The piston diameter is 140mm and rod diameter is 100 mm. If the pump flow is 80 l/min. find the cylinder speed and load carrying capacity for various position of direction control valve.	BT5	Evaluating
2	Design the accumulator circuit for the application of leakage compensator and auxiliary power source in the hydraulic circuit.	BT6	Creating
3	Create a failsafe control circuit using emergency cut off valve and two-hand safety control circuit.	BT6	Creating
4	Design the accumulator circuit for the application of hydraulic shock absorber and Emergency power source in the hydraulic circuit.	BT6	Creating

UNIT IV PNEUMATIC AND ELECTRO PNEUMATIC SYSTEMS Properties of air – Perfect Gas Laws – Compressor – Filters, Regulator, Lubricator, Muffler, Air control Valves, Quick Exhaust Valves, Pneumatic actuators, Design of Pneumatic circuit – Cascade method – Electro Pneumatic System – Elements – Ladder diagram – Problems, Introduction to fluidics and pneumatic logic circuits.			
PART A			
1	Give the standard graphical symbol for FRL unit.	BT3	Applying
2	Discuss the function of an air filter	BT2	Understanding
3	Point out the purpose of a Pressure regulator.	BT2	Understanding
4	Point out the purpose of a quick Exhaust Valve.	BT5	Evaluating
5	Sketch the graphical symbol of pneumatic regulator.	BT1	Remembering
6	Discuss the function at reservoir in a pneumatic system	BT1	Remembering
7	How are logic circuits classified?	BT3	Applying
8	List the purpose of an Air lubricant.	BT4	Analyzing
9	What are the factors affecting the selection of filter?	BT4	Analyzing
10	Define ladder diagram.	BT1	Remembering
11	What is the best type of lubricant for the pneumatic system?	BT3	Applying
12	Mention the few applications of air cylinder.	BT2	Understanding
13	List the components present in PLC.		
14	Conclude that why should a lubricator be used in a pneumatic system?	BT4	Analyzing
15	Discuss the need of lubricator unit in the pneumatic system.	BT1	Remembering
16	Name the various types of filters used in the pneumatic system.	BT2	Understanding
17	Give the truth table for fluidic AND/NAND gate.	BT4	Analyzing
18	Define fluidics	BT1	Remembering
19	Define Programmable Logic Control (PLC).	BT1	Remembering
20	Illustrate about cascade method.	BT4	Analyzing
PART B			
1	Define compressor. Explain the working principle of piston type compressor and screw type compressor with neat sketch.	BT1	Remembering
2	With a neat sketch of the pneumatic filter and explain its construction and working of cartridge filter.	BT3	Applying
3	With a neat sketch of the pneumatic Regulator and explain its construction and working.	BT4	Analyzing

4	Explain the construction and working principle of Muffler with neat sketch.	BT4	Analyzing
5	Sketch the graphical symbol and Explain the construction and working principle of FRL Unit with neat sketch.	BT3	Applying
6	Explain the construction and working of following pneumatic control components 1) check valve 2) Shuttle valve 3) Sequence valve 4) Flow control valve	BT4	Analyzing
7	Explain the construction and operation of quick exhaust valve with neat sketch.	BT2	Understanding
8	Describe pneumatic actuators and explain the types of linear actuators with neat sketch.	BT1	Remembering
9	Discuss the construction and operation of the basic fluidic devices.	BT2	Understanding
10	Draw the circuit of control of air cylinder using Flip-Flop and explain it.	BT3	Applying
11	Explain the ladder logic diagram with a suitable example.	BT4	Analyzing
12	Design a pneumatic circuit for the following sequence using cascade method A+B-B-A- where the + cylinder extension and - cylinder retraction.	BT5	Evaluating
13	Explain the construction and operation of rotary actuators with neat sketch.	BT2	Understanding
14	Design a pneumatic circuit using cascade method for the sequence A+ A- B+ B- and explain its working principle.	BT5	Evaluating
PART C			
1	Give the empirical rules for sizing the compressor.	BT5	Evaluating
2	Define coanda effect. Discuss how this effect useful to develop a mono-stable and bi-stable- flip flop device	BT5	Evaluating
3	(i) Design a pneumatic cascade circuit for the following sequence of operation: $A^+ B^+ B^- C^+ C^- A^-$. (10) (ii) Also develop the travel-step diagram for the above sequence of operation. (5)	BT6 BT6	Creating Creating
4	Explain the various approaches for entering the program into the PLC.	BT4	Analyzing

UNIT V TROUBLE SHOOTING AND APPLICATIONS

Installation, Selection, Maintenance, Trouble Shooting and Remedies in Hydraulic and Pneumatic systems, Design of hydraulic circuits for Drilling, Planning, Shaping, Surface grinding, Press and Forklift applications. Design of Pneumatic circuits for Pick and Place applications and tool handling in CNC Machine tools – Low cost Automation – Hydraulic and Pneumatic power packs.

PART A

1	What are the basic requirements for trouble free life of fluid power systems?	BT1	Remembering
2	List any two common faults in hydraulic system.	BT2	Understanding
3	Name any two faults that can be found in pneumatic systems.	BT4	Analyzing
4	How a hydraulic system breaks down?	BT2	Understanding
5	List any two selection criteria of hydraulic systems	BT3	Applying
6	Distinguish between hydraulic and pneumatic systems.	BT1	Remembering
7	What is the purpose of tree branching chart?	BT4	Analyzing
8	List four causes of hydraulic system break down.	BT3	Applying
9	Describe a power pack.	BT1	Remembering
10	List any four pump faults.	BT1	Remembering
11	Name two causes of relief valve faults.	BT2	Understanding
12	What does the term troubleshooting refer?	BT4	Analyzing
13	If a pump is delivering insufficient or no oil, what are all the possible causes and also give remedies for them	BT2	Understanding
14	List any four causes for pump making more noise.	BT3	Applying
15	What will you do to reduce or prevent excessive heating of oil in hydraulic system?	BT1	Remembering
16	List any two types of that can be found in each of the components of FRL unit.	BT4	Analyzing
17	What is meant by interlock contacts?	BT3	Applying
18	Mention any two roles of pneumatic systems in low cost automation	BT1	Remembering
19	What are the parable causes and remedies for the problem of leakage of compressed air in pneumatic system?	BT2	Understanding
20	What is a power pack? What are the important components of a hydraulic power Pack?	BT3	Applying

PART B			
1	Design and draw a circuit using the hydraulic components for the Shaping operation.	BT6	Creating
2	Design and draw a circuit using the hydraulic components for the Drilling operation.	BT6	Creating
3	Design a circuit using the hydraulic components for the Press Operation.	BT6	Creating
4	Tabulate the various faults, probable causes and also the remedial actions for the following hydraulic system components: a. Pump b. DC valve c. Hydraulic motors d. Hydraulic cylinders	BT5	Evaluating
5	Enlist the various faults, probable causes and also the remedial actions for the following pneumatic system components: a. Compressor b. FRL unit b. Air cylinder d. Pipelines and hoses	BT5	Evaluating
6	Explain in detail about how the failure and trouble shooting is carried out in hydraulic system.	BT3	Applying
7	Explain in detail about Various selection criteria for pneumatic components	BT1	Remembering
8	What is the tree branching in pneumatic fault finding system?	BT6	Creating
9	List out any seven types of faults that can be found in pneumatic system. Also write the remedial actions for the faults.	BT1	Remembering
10	What is the tree branching in hydraulic fault finding system?	BT6	Creating
11	Explain in detail about how the failure and trouble shooting is carried out in pneumatic system.	BT4	Analyzing
12	How tools are handled in a CNC machine illustrate with neat sketches	BT1	Remembering
13	What are hydraulic and pneumatic power packs	BT6	Creating
14	List down the features of low cost automation	BT4	Analyzing
PART C			
1	Design and develop a pneumatic system to pick and place objects.	BT6	Creating
2	Design and develop the tool handling system in a CNC machine	BT6	Creating
3	Narrate a case study of low cost automation.	BT6	Creating
4	Draw and explain a pneumatic circuit to actuate a shaping machine ram. Incorporate the following features in the circuit. i. Rapid tool approach ii. Slow cutting and iii. Rapid tool retraction/ return.	BT3	Applying