SRM VALLIAMMAI ENGINEERING COLLEGE

(An Autonomous Institution)

SRM Nagar, Kattankulathur – 603 203

DEPARTMENT OF MECHANICAL ENGINEERING

QUESTION BANK

VII SEMESTER

1909706–HYDRAULICS AND PNEUMATICS

Regulation – 2019

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Prepared by

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SUBJECT CODE / NAME : 1909706 /HYDRAULICS & PNEUMATICS

SEM / YEAR   : VII SEM / IV YEAR

UNIT – I – FLUID POWER PRINICIPLES 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 (2 Marks)			
S.No	**Questions**	**Level**	**Competence**
1.	Define fluid power.	BT-1	Remembering
2.	List the advantages of the fluid power.	BT-1	Remembering
3.	Mention the drawbacks of fluid power.	BT-2	Understanding
4.	Point out the applications of fluid power.	BT-2	Understanding
5.	Differentiate between hydraulics and pneumatics.	BT-2	Understanding
6.	Indicate the components of hydraulic system.	BT-1	Remembering
7.	Indicate the components of pneumatic system.	BT-1	Remembering
8.	Interpret the primary functions of a hydraulic fluid.	BT-1	Remembering
9.	List any 4 properties of a hydraulic fluid.	BT-2	Understanding
10.	Indicate the physical differences between liquid and gas.	BT-1	Remembering
11.	Differentiate between gage pressure and absolute pressure.	BT-2	Understanding
12.	Define bulk modulus and viscosity.	BT-1	Remembering
13.	Define Pascal law.	BT-1	Remembering
14.	State the effects of high viscosity hydraulic fluids in the fluid power system.	BT-2	Understanding
15.	State the effects of low viscosity hydraulic fluids in the fluid power	BT-2	Understanding

	system.		
16.	Define absolute viscosity.	BT-1	Remembering
17.	Mention any two applications of Pascal's law.	BT-2	Understanding
18.	State the Bernoulli's equation.	BT-1	Remembering
19.	Differentiate between laminar flow and turbulent flow.	BT-2	Understanding
20.	Write the expression for Darcy equation.	BT-1	Remembering
21.	State the significance of Reynold's number.	BT-2	Understanding
22.	Differentiate between positive pump and non-positive pump.	BT-2	Understanding
23.	Define volumetric efficiency of the pump.	BT-1	Remembering
24.	Define mechanical efficiency of the pump.	BT-2	Understanding
25.	Mention the factors influencing the volumetric efficiency of the pump.	BT-2	Understanding

PART-B (13 Marks)				
S.No	Questions	Marks	Level	Competence
1.	Write short notes on the advantages and disadvantages of fluid power.	13	BT-4	Analyzing
2.	(i) Discuss the applications of fluid power systems. (ii) Explain the components of hydraulic and pneumatic systems.	7 6	BT-3	Applying
3.	Enumerate on the different types of fluid power system.		BT-1	Remembering
4.	A hand operated hydraulic jack as shown in the figure has a piston pump with a cylinder diameter of 30 mm and a stroke of 50 mm. The operator makes one cycle (one suction stroke and one delivery stroke) per second in the pump. The ram cylinder is of 60 mm diameter raises a load of 8000 N. Calculate the following (a) Pressure in the system (b) Force exerted on the rod of the pump. (c) Force on the handle given by the operator (d) the number of cycles of hand pump to lift the load by 500 mm. (e) What is the output power assuming 90% efficiency.	13	BT-5	Evaluating
5.	Elaborate on any one applications of Pascal's law with a neat sketch.	13	BT-3	Applying
6.	Explain any 8 properties of hydraulic fluids.	13	BT-1	Remembering
7.	Discuss the influence of temperature on the viscosity of the	13	BT-4	Analyzing

	hydraulic fluids.			
8.	Explain in detail about the various losses in hydraulic fluid power systems.	13	BT-1	Remembering
9.	(i)A gear pump has a 75 mm outside diameter, 1 50 mm inside diameter and a 25 mm width. If the volumetric efficiency is 90 % at the rated pressure, what is the corresponding actual flow rate? The pump speed is 1000 rpm.	7	BT-5	Evaluating
	(ii) A gear pump with the following specification runs at 1400 rpm. Module = 3 mm/tooth, Gear width = 15 mm, Number of teeth = 12, Pressure angle = 20°. Determine (i) Theoretical discharge (ii) Hydraulic power produced by the pump when the working against a pressure of 100 bar.	6		
10.	A hydraulic pump delivers oil at 60 bar, 120 l/min into a circuit laid on a horizontal plane. There are four 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 0.0001m^2/s. Determine the pressure at the exit point of the pipe.	13	BT-5	Evaluating
11.	(i) A pump has a displacement of 81.9 cm^3. It delivers 75.8 x 10^{-3} m^3/min at 1000 rpm at 67 bar. If the prime mover input torque is 100 Nm. Determine the overall efficiency, volumetric efficiency and theoretical torque required to operate the pump.	8	BT-5	Evaluating
	(ii) A vane pump is to have a volumetric displacement of 121.8 cm^3. It has a rotor diameter of 65 mm, a camring diameter of 90 mm and a vane width of 50 mm. Determine its eccentricity.	5		
12.	Describe the construction and working principle of radial piston pump with neat sketch.	13	BT-2	Understanding
13.	Explain the construction and working principle of bend axis axial piston pump with suitable sketch.	13	BT-2	Understanding
14.	Explain the construction and working principle of in-line axial piston pump with suitable sketch.	13	BT-2	Understanding

15.	(i) Explain the pumping theory with suitable sketch.	6	BT-3	Applying
	(ii) Explain the working of Lobe pump with suitable sketch.	7		
16.	Explain the working principle of following pumps with neat sketch (i) Lobe pump (ii) Screw pump	7 6	BT-2	Understanding
17.	(i) Explain the external gear pump with suitable sketch.	6	BT-2	Understanding
	(ii) Explain the working of internal gear pump with neat sketch.	7		
18.	Discuss the following (i) Balanced vane pump. (ii) Unbalanced vane pump.	 6 7	BT-2	Understanding

PART-C (15 Marks)

S.No	Questions	Marks	Level	Competence
1.	The system shown in the figure contains a pump delivering high pressure oil of specific gravity 0.9 and kinematic viscosity 1.25×10^{-4} m^2/s to a hydraulic motor. A pipe connects the pump and motor has an inner diameter of 25 mm and length 15 m. The pipe has two elbow fittings (K=0.75) and one check valve (K=4.0). The motor is placed 6m above the pump. The inlet pressure to the motor is 34 bar. Determine the pump discharge pressure, if the discharge from the pump os 150 *l*/min.	15	BT-5	Evaluating
2.	(i) A radial piston pump has the following specificcations: Maximum pressure = 30 bar, Diameter of the plunger = 50 mm, number of plungers = 7, maximum eccentricity = 10 mm, Speed of rotation of the shaft = 1500 rpm. Calculate (a) Theoretical discharge and actual discharge. (b) theoretical and actual power required to drive the pump, given that mechanical efficiency is given as 80 % and volumetric efficiency is given as 90 %.	7	BT-5	Evaluating
	(ii) A hydraulic system requires 32 *l*/min of a fluid pressure of 260 bar. The pump to be used is a manually variable axial piston pump having a maximum displacement per revolution	8		

	of 28 cm^3. The pump is driven at 1430 rpm and has an overall efficiency of 0.85 and a volumetric efficiency of 0.9.			
3.	List and explain the design criteria of Linear and Rotary pump in the hydraulic systems.	15	BT-3	Applying
4.	Design the hydraulic circuit and explain with neat sketch for the application of hand operated hydraulic jack.	15	BT-6	Creating
5.	Design the hydraulic circuit and explain with neat sketch for the application of air-to-hydraulic pressure booster.	15	BT-6	Creating

UNIT – II – HYDRAULIC ACTUATOR & 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 (2 Marks)

S.No	Questions	Level	Competence
1.	Define actuator.	BT-1	Remembering
2.	List the benefits of choosing the correct cylinder in a hydraulic system.	BT-1	Remembering
3.	Classify the cylinders based on their function.	BT-2	Understanding
4.	Differentiate between linear actuator and rotary actuator.	BT-2	Understanding
5.	Mention the uses of hydraulic shock absorber.	BT-2	Understanding
6.	Define barrel in hydraulics.	BT-1	Remembering
7.	Draw the graphical symbol for single acting hydraulic cylinder.	BT-1	Remembering
8.	Define volumetric efficiency.	BT-1	Remembering
9.	Define mechanical efficiency.	BT-2	Understanding
10.	Define overall efficiency.	BT-1	Remembering
11.	Distinguish between hydraulic power and brake power.	BT-2	Understanding
12.	List the basic types of valves.	BT-1	Remembering
13.	State the significance of directional control valves.	BT-1	Remembering
14.	Classify hydraulic motors.	BT-2	Understanding
15.	Indicate the objecctives of hydraulic valves.	BT-2	Understanding
16.	Mention the types of cylinder mountings.	BT-1	Remembering
17.	Interpret the functions of pressure control valve.	BT-2	Understanding
18.	Point out the advantages of using compound relief valve.	BT-1	Remembering
19.	List the various centre characteristics of three position four way valves.	BT-2	Understanding
20.	Compare open centre and closed centre in three position valves.	BT-1	Remembering
21.	Point out the purpose of tandem centre.	BT-2	Understanding
22.	Classify flow control valve.	BT-2	Understanding
23.	List the applications of pressure reducing valve.	BT-1	Remembering
24.	Indicate some considerations for correct mounting of the cylinder.	BT-2	Understanding
25.	Mention the parameters to be considered while designing a valve.	BT-2	Understanding

	PART-B (13 Marks)			
S.No	Questions	Marks	Level	Competence
1.	Write short notes on gear type motors and vane type motors.	13	BT-1	Remembering
2.	(i) A hydraulic motor has a volumetric displacement of 125 cm^3 and a pressure rating of 150 bar. It receives a theoretical flow rate of oil 0.0015 m^3/s from a pump. Find the (i) motor speed (ii) theoretical torque (iii) theoretical power.	5	BT-5	Evaluating
	(ii) A hydraulic motor has a displacement of 150 cm^3 and operates with a pressure of 120 bar and a speed of 2500 rpm. The actual flow rate consumed by the motor is 0.00781 m^3/s and the actual torque delivered by the motor is 250 Nm. Determine (a) Volumetric efficiency (b) mechanical efficiency (c) Overall efficiency (d) Power delivered by the motor.	8		
3.	Write short notes on single acting cylinder and cylinder cushioning with a neat sketch.	13	BT-2	Understanding
4.	Enumerate on the factors involved in the rating of a hydraulic motors.	13	BT-4	Analyzing
5.	Explain the construction and working principle of rotary spool valve used in the hydraulic systems.	13	BT-2	Understanding
6.	With neat sketch explain the construction of Telescopic cylinder and state its application with example.	13	BT-2	Understanding
7.	Explain with neat sketch about the following (i) Unloading valve. (ii) Sequence valve.	6 7	BT-1	Remembering
8.	(i) Explain the working principle of Mechanical hydraulic servo valve. (ii) Explain the flapper servo valve with neat sketch.	7 6	BT-2	Understanding
9.	List the components used in the hydraulic systems and sketch the ANSI symbol of all the components in the hydraulic systems.	13	BT-1	Remembering
10.	(i) A pressure relief valve has a pressure setting of 200 bar. Determine the power loss across the valve if all the pump flow of 120 l/min flows back to the reservoir through this valve.	5	BT-5	Evaluating

	(ii) A high-low circuit with an unloading valve is employed for press application. The press requires a flow rate of 200 l/min for high-speed opening and closing of the dies at maximum pressure of 30 bar. The workstroke needs a maximum pressure of 30 bar. The workstroke needs a maximum pressure of 400 bar but a flow rate between 12 and 20 l/min will be acceptable. Determine the suitable delivery for each pump.	8		
11.	In a meter-in circuit, a cylinder with 100 mm bore diameter and 70 mm diameter is used to exert a forward thrust of 100 kN with a velocity of 0.5 m/min. Neglect the pressure drop through the piping and valves. If the pump flow is 20 l/min. Determine (a) Pressure required at pump on extend (b) Flow through the flow control valve (c) Relief valve setting (d) Flow out of pressure relief valve (e) System efficiency during extend.	13	BT-5	Evaluating
12.	Explain the following with neat sketch (i) Poppet valve. (ii) Pilot operated check valve	 6 7	BT-1	Remembering
13.	Explain the following (i) 4/3- Direction Control Valve. (ii) 3/2-DirectionControlValve	 7 6	BT-1	Remembering
14.	Explain with neat sketch about different types of flow control valve used in the hydraulic systems.	13	BT-2	Understanding
15.	Explain with neat sketch about the following (i) Meter-in circuit (ii) Meter-out circuit	 7 6	BT-1	Remembering
16.	Explain with neat sketch about spring loaded pressure relief valve and pressure reducing valve.	13	BT-2	Understanding
17.	Explain with neat sketch about compound pressure relief valve.	13	BT-2	Understanding
18.	Discuss the following (i) Proportional pressure relief valve. (ii) Proportional pressure reducing valve.	 7 6	BT-2	Understanding

PART-C (15 Marks)				
S.No	Questions	Marks	Level	Competence
1.	(i) A pump supplies oil at 0.002 m³/s to a 50 mm diameter double acting cylinder and a rod diameter is 20 mm. If the load is 6000 N both in extending and retracting. Determine (a) Piston velocity during the extension stroke and retraction stroke. (b) Pressure during the extension stroke and retraction stroke. (c) Power during the extension stroke and retraction stroke.	8	BT-5	Evaluating
	(ii) A hydraulic cylinder has to move a table of weight 13 kN. Speed of the cylinder is to be accelerated upto a velocity of 0.13 m/s in 0.5 seconds and brought to a stop within a distance of 0.02 m. Assume coefficient of sliding friction as 0.15 and cylinder bore diameter as 50 mm. Calculate the surge pressure.	7		
2.	(i) A cylinder has a bore of 125 mm diameter and a rod of 70 mm diameter. It drives a load of 2000 kg vertically up and down at a maximum velocity of 3 m/s. The load is slowed down to rest in the cushion length of 50 mm. If the relief valve is set at 140 bar, Determine the average pressure in the cushions while extending and retracting.	8	BT-5	Evaluating
	(ii) A two stage telescopic cylinder is used to tilt the body of a lorry. When the lorry is fully laden, the cylinder has to exert a force equivalent to 40 kNat all points in its stroke. The outside diameters of the tubes forming two stages are 75 mm and 100 mm. If the pump powering the cylinder delivers 12 l/min. Calculate the extend speed and pressure required for each stage of the cylinder when tilting fully laden lorry.	7		
3.	A cylinder has a bore of 125 mm diameter and a rod of 70 mm diameter. It drives a load of 2000 kg vertically up and down at a maximum velocity of 3 m/s. The load is slowed down to rest in the cushion length of 50 mm. If the relief valve is set at 140 bar, Determine the average pressure in the cushions while	15	BT-5	Evaluating

	extending and retracting.			
4.	Design the hydraulic drilling circuit using sequence valve and explain with neat sketch.	15	BT-6	Creating
5.	Explain and design the hydraulic circuit by using pressure reducing valve for the weld and clamp unit to weld the Engineering materials.	15	BT-6	Creating

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 (2 Marks)

S.No	Questions	Level	Competence
1.	Draw the different types of accumulator symbols.	BT-1	Remembering
2.	State the functions of accumulators.	BT-1	Remembering
3.	What is meant by sizing of accumulator?	BT-2	Understanding
4.	Identify the function of pressure intensifier.	BT-2	Understanding
5.	Define the term "capacity of accumulator"	BT-2	Understanding
6.	Identify type of gases used in a gas loaded accumulator.	BT-1	Remembering
7.	Mention the reason for non-separator type gas loaded accumulator not preferred in hydraulic systems.	BT-1	Remembering
8.	What condition in a hydraulic system would require an intensifier?	BT-1	Remembering
9.	List any four applications of intensifier.	BT-2	Understanding
10.	Draw fluid power symbol for pressure intensifier and gas loaded type accumulator.	BT-1	Remembering
11.	Define the term intensifier ratio.	BT-2	Understanding
12.	List the factors to be considered while designing any fluid power system.	BT-1	Remembering
13.	Why extension stroke faster than the retraction stroke in the regenerative circuit?	BT-2	Understanding
14.	Indicate the purpose of using fail safe circuit in any hydraulic system.	BT-2	Understanding
15.	Define servo control system.	BT-2	Understanding
16.	Define the term lap and null with respect to servo valves.	BT-1	Remembering
17.	Mention any four applications hydro-mechanical servo valves.	BT-2	Understanding
18.	Indicate the purpose of air over oil intensifier circuit.	BT-1	Remembering
19.	Define hydraulic accumulator and classify its types.	BT-2	Understanding
20.	Differentiate between electro hydraulic servo valve and mechanical servo valves.	BT-1	Remembering
21.	List the sources of dynamic forces occurring in the accumulators.	BT-2	Understanding
22.	Classify the separator type gas loaded accumulator.	BT-2	Understanding

23.	State the drawback of using piston type gas loaded accumulator.	BT-1	Remembering
24.	Interpret the advantages of bladder type accumulator.	BT-2	Understanding
25.	List some applications of intensifier circuits.	BT-2	Understanding

PART-B (13 Marks)

S.No	Questions	Marks	Level	Competence
1.	With a neat sketch, explain the construction and working of a piston type accumulator and diaphragm type accumulator?	13	BT-2	Understanding
2.	Explain the construction and working of the following (i) Dead weight accumulator. Spring loaded accumulator.	7 6	BT-2	Understanding
3.	Write short notes on the application of the accumulator circuits in leakage compensation and auxillary power source.	13	BT-3	Applying
4.	Enumerate on the sizing of the accumulator.	13	BT-2	Understanding
5.	A weight loaded accumulator has a ram of 300 mm diameter and stroke 6 m. It is loaded with 500 kN weight. The packing friction accounts for 3 % of the total force. If the ram falls steadily through its full range in 120 seconds and pump delivers 7.5 l/min at the same time. Determine the total discharge and power supplied at the mains.	13	BT-5	Evaluating
6.	Design and explain the working of a regenerative circuit.	13	BT-6	Creating
7.	(i) What is the size of accumulator necessary to supply 4920 cm^3 of oil with an allowable pressure from 210 bar absolute to 105 bar absolute. The precharge pressure is 70 bar absolute. The charging and discharging processes are isothermal. (ii)With a neat sketch, Explain the application of regenerative circuit in the drilling machine.	5 8	BT-5	Evaluating
8.	Describe a hydraulic circuit for synchronizing two cylinder with flow control valves.	13	BT-3	Applying
9.	Design and explain the working of a sequencing circuit.	13	BT-6	Creating
10.	Design the intensifier circuit for the application of punching press in the hydraulic circuit.	13	BT-6	Creating
11.	A punch press circuit with five stations operated by five	13	BT-5	Evaluating

	parallel cylinders connected to an internsifier. The cylinders are single acting cylinders with spring return and piston diameter of the cylinder is 140 mm. The cylinders are used for punching 10 mm diameter holes on sheet metal 1.5 mm thickness. The ultimate shear strength of the sheet metal is 300 MN/m^2. The punching stroke requires 10 mm travel. If the intensification ratio is 20 and the stroke of the intensifier is 1.3 m. Determine the (a) Pressure of the oil from the pump (b) Diameter of small and large cylinder of intensifier.			
12.	A double acting cylinder is hooked up in a regenerative circuit for drilling application. The relief valve is set as 75 bar. The piston diameter is 140 mm and rod diameter is 100 mm. If the pump flows 80 l/min. Find the cylinder speed and load carrying capacity for various positions of direction control valve.	13	BT-5	Evaluating
13.	(i) Two double acting cylinders are to be synchronized by connecting them in series. The load acting in each cylinder is 4000 N. If one of the cylinder having the piston diameter 50 mm and rod diameter is 28 mm. Determine (a) Diameter of the second cylinder. (b) Pressure requirement of the pump (c) Power of the pump in kW if the cylinder velocity is 4 m/s.	8	BT-5	Evaluating
	(ii) A hydraulic intensifier is meant to enhance the fluid pressure from 50 bar to 200 bar. Its small cylinder capacity is 23 litres and has a stroke of 1.5 m. Determine the diameter of the largest cylinder to be used for this intensifier.	5		
14.	Draw and explain the Air-over-oil circuit used in the hydraulic circuit.	13	BT-2	Understanding
15.	Draw and explain the Air-oil intensifier circuit used in the hydraulic circuit.	13	BT-2	Understanding
16.	Draw and explain the Air-oil cylinder circuit used in the hydraulic circuit.	13	BT-2	Understanding
17.	List the comparison of hydro pneumatic, hydraulic and pneumatic system	13	BT-4	Analyzing
18.	Design and explain the working of Electro hydraulic circuit	13	BT-2	Understanding

	with a neat sketch.			

PART-C (15 Marks)

S.No	Questions	Marks	Level	Competence
1.	(i) Determine the size of the accumulator to reduce the hydraulic line shock in a system handling gasoline with a specific gravity of 0.88 with a normal rate of flow 12.65 l/s. The inner diameter of the pipe is 150 mm and the length is 1924 m. The system pressure at normal rate of flow is 10 bar absolute. Maximum allowed shock pressure when shut-off valve is closed is 17 bar absolute. The accumulator is precharged with nitrogen. (ii) What is the size of the accumulator necessary to supply 4920 cm^3 of oil with an allowable pressure from 210 bar absolute to 105 bar absolute. The precharge pressure is 70 bar absolute. The charging and discharging processes are isothermal.	10 5	BT-5	Evaluating
2.	Create a fail safe control circuit using emergency cut off value and two-hand safety control circuit.	15	BT-6	Creating
3.	Enumerate on the hydrostatic transmission with suitable sketches and applications.	15	BT-2	Understanding
4.	Design and explain a hydraulic circuit for the robot arm applications.	15	BT-6	Creating
5.	Design and explain a hydraulic circuit for the hydraulic operations of machine tools.	15	BT-6	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 (2 Marks)

S.No	Questions	Level	Competence
1.	Compare pneumatic system with the hydraulic system.	BT-2	Understanding
2.	List the properties of air.	BT-1	Remembering
3.	State Boyle's law.	BT-1	Remembering
4.	State Charles law.	BT-1	Remembering
5.	List the basic components of pneumatic system.	BT-1	Remembering
6.	Mention the functions of compressor.	BT-2	Understanding
7.	Interpret the necessity of lubricator in a pneumatic system.	BT-2	Understanding
8.	Point out the components of air filter.	BT-1	Remembering
9.	State the functions of pressure regulator.	BT-2	Understanding
10.	Indicate the functions of a lubricator.	BT-2	Understanding
11.	Mention the advantages of double acting pneumatic cylinder over the single acting pneumatic cylinder.	BT-2	Understanding
12.	List the applications of air motors.	BT-3	Applying
13.	A compressor has a rated output of 3 standard m^3/min air delivery. What will be the output at an absolute pressure of 800 kPa at the same temperature.	BT-5	Evaluating
14.	A compressor delivers 2.3 standard m^3/min air through a 25 mm inside diameter pipe at a pressure of 10 bar. Find the pressure loss for a length of 75 m.	BT-5	Evaluating
15.	Compute the size of the receiver that must supply air to a pneumatic circuit using 0.57 standard m^3/min for 6 min between 7 bar and 5.5 bar if the compressor is running and delivering air at 0.14 standard m^3/min.	BT-5	Evaluating
16.	Determine the actual power required to drive a compressor that delivers 1.5 standard m^3/min of air at 6 bar (gauge). The overall efficiency of the compressor is 80 %.	BT-5	Evaluating
17.	Give the standard graphical symbol for FRL unit.	BT-1	Remembering

18.	Point out the purpose of a quick Exhaust Valve.	BT-2	Understanding
19.	Sketch the graphical symbol of pneumatic regulator.	BT-1	Remembering
20.	Mention the function at reservoir in a pneumatic system	BT-2	Understanding
21.	Classify the logical circuits.	BT-2	Understanding
22.	Mention the factors influencing the selection of the filter.	BT-2	Understanding
23.	Give the truth table for fluidic AND/NAND gate.	BT-2	Understanding
24.	Define fluidics	BT-1	Remembering
25.	Define Programmable Logic Control (PLC).	BT-1	Remembering

PART-B (13 Marks)

S.No	Questions	Marks	Level	Competence
1.	(i) A double acting pneumatic cylinder with a 50 mm bore, 20 mm rod and a 100 mm stroke length must cycle 50 times per minute. The supply pressure is 4.5 bar (gauge). Determine (a) what is the force output of the cylinder on the extend and retract strokes. (b) what is the air consumption of the cylinder in standard m^3/min.	8	BT-5	Evaluating
	(ii) A vacuum suction cup having a lip with 80 mm outside diameter and 60 mm inside diameter is used for lifting the sheets. If the suction pressure is -0.5 bar gauge, how heavy sheet can be lifted using this suction cup. Assume a factor of safety of 2.	5		
2.	(i) Write short notes on the laws governing the compressible nature of the air.	5	BT-2	Understanding
	(ii) Write short notes on the basic pneumatic system.	8		
3.	Enumerate on the construction, working of piston type and vane type compressors.	13	BT-2	Understanding
4.	Write short notes on two-way valve and three-way valve.	13	BT-2	Understanding
5.	Explain the construction and working of four-way valve and five-way valve.	13	BT-3	Applying
6.	Explain the factors influencing the selection of the pneumatic components.	13	BT-4	Analyzing
7.	With a help of the pneumatic circuit, Explain the construction	13	BT-3	Applying

S.No	Questions	Marks	Level	Competence
	and working of speed control circuit and quick exhaust circuit.			
8.	With a neat sketch of the pneumatic filter and explain its construction and working of cartridge filter.	13	BT-3	Applying
9.	With a neat sketch of the pneumatic Regulator and explain its construction and working.	13	BT-3	Applying
10.	Explain the construction and working principle of Muffler with neat sketch.	13	BT-3	Applying
11.	Sketch the graphical symbol and Explain the construction and working principle of FRL Unit with neat sketch.	13	BT-4	Analyzing
12.	Design a pneumatic circuit using cascade method for the sequence A+ A- B+ B- and explain its working principle.	13	BT-6	Creating
13.	Explain the construction and operation of rotary actuators with neat sketch.	13	BT-3	Applying
14.	Design a pneumatic circuit for the following sequence using cascade method A+B+B-A- where the + cylinder extraction and - cylinder retraction.	13	BT-6	Creating
15.	Discuss the construction and operation of the basic fluidic devices.	13	BT-2	Understanding
16.	Draw the circuit of control of air cylinder using Flip-Flop and explain it.	13	BT-6	Creating
17.	Explain the ladder logic diagram with a suitable example.	13	BT-3	Applying
18.	Write short notes on step counter method.	13	BT-3	Applying

PART-C (15 Marks)				
S.No	Questions	Marks	Level	Competence
1.	Enumerate the factors influencing the selection of the filter, regulator, lubricator and sizing of the compressors.	15	BT-4	Analyzing
2.	With a help of the pneumatic circuit, Explain the construction and working of two step feed control circuit and time delay circuit.	15	BT-3	Applying
3.	Discuss how the coanda effect is useful to develop a mono-stable and bi-stable- flip flop device	15	BT-4	Analyzing
4.	(i) Design a pneumatic cascade circuit for the following	10	BT-6	Creating

	sequence of operation: $A^+B^+B^-C^+C^-A^-$. (ii) Develop the travel-step diagram for the above sequence of operation.	5		
5.	Explain the various approaches used for entering the program into the PLC.	15	BT-4	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 (2 Marks)

S.No	Questions	Level	Competence
1.	Mention the common defects occurring in the hydraulic system.	BT-1	Remembering
2.	List the parameters to be assessed before the taking the decision of reconditioning a hydraulic system.	BT-2	Understanding
3.	Define preventive maintenance.	BT-1	Remembering
4.	Mention the key properties to be evaluated while inspecting the hydraulic oil.	BT-2	Understanding
5.	Mention the properties of the hydraulic oil apart from transmitting power.	BT-1	Remembering
6.	Point out the properties that are subjected to change service life of the oil.	BT-1	Remembering
7.	Interpret the precaution measures to be taken while inspecting the odour of the oil.	BT-2	Understanding
8.	Indicate the possible ways for the contaminants to enter into the hydraulic system.	BT-2	Understanding
9.	List the problems caused by the contaminants in the hydraulic system.	BT-1	Remembering
10.	Identify the factors influencing the life of a filter in the hydraulic system.	BT-2	Understanding
11.	Define cavitation.	BT-1	Remembering
12.	List the effects of cavitation in the pump.	BT-2	Understanding
13.	Point out the basic requirements for trouble free life of fluid power systems?	BT-1	Remembering
14.	Name any two faults that can be found in pneumatic systems.	BT-2	Understanding
15.	Define pump priming.	BT-1	Remembering
16.	List the four important steps of condition based monitoring.	BT-1	Remembering
17.	Mention the three stages of maintenance.	BT-1	Remembering
18.	Indicate the physical signals that helps to find the fault in a CBM	BT-2	Understanding

S.No	Questions		Level	Competence
	technique.			
19.	What is meant by interlock contacts?	BT-1	Remembering
20.	Mention any two roles of pneumatic systems in low cost automation	BT-2	Understanding
21.	Define power pack.	BT-1	Remembering
22.	List the important components of a hydraulic power Pack.	BT-1	Remembering
23.	Suggest remedies for the problem of leakage of compressed air in pneumatic system.	BT-2	Understanding
24.	Suggest a remedy to reduce or prevent excessive heating of oil in hydraulic system.	BT-2	Understanding
25.	List the causes for a noisy operation in a pump.	BT-2	Understanding

PART-B (13 Marks)				
S.No	Questions	Marks	Level	Competence
1.	Design and draw a circuit using the hydraulic components for the Shaping operation.	13	BT-6	Creating
2.	Design and draw a circuit using the hydraulic components for the Drilling operation.	13	BT-6	Creating
3.	List the common type of defects occurring in a hydraulic system.	13	BT-2	Understanding
4.	Write short notes on the various approaches used for reducing the entry the contaminants in the hydraulic system.	13	BT-4	Analyzing
5.	Describe the causes of the contamination occurring in the hydraulic system.	13	BT-4	Analyzing
6.	(i) Explain the preventive action to be taken to control the component fittings and failure due to the entry of the contaminants. (ii) Write short notes on the methods of measurement contamination levels in a hydraulic system.	7 6	BT-4	Analyzing
7.	Discuss the corrective measures taken to enhance the filter life on a regular basis.	13	BT-4	Analyzing
8.	Enumerate the important guidelines given to the maintenance personnel to maintain the effective functioning of the hydraulic system.	13	BT-2	Understanding

S.No	Questions	Marks	Level	Competence
9.	Design a circuit using the hydraulic components for the Press operation.	13	BT-6	Creating
10.	Enumerate on hydraulic and pneumatic power packs with suitable sketches and illustrations.	13	BT-2	Understanding
11.	Explain in detail about how the failure and trouble shooting is carried out in pneumatic system.	13	BT-2	Understanding
12.	Design a circuit using the hydraulic components for the surface grinding operation.	13	BT-6	Creating
13.	Design and draw a circuit using the hydraulic components for the planning machine operation.	13	BT-6	Creating
14.	Tabulate the various faults, probable causes and also the remedial actions for the following hydraulic system components: (i) Pump (ii) DC Valve (iii) Hydraulic motors (iv) Hydraulic cylinders	 3 3 3 4	BT-2	Understanding
15.	Enlist the various faults, probable causes and also the remedial actions for the following pneumatic system components: (i) Compressor (ii) FRL Unit (iii) Air cylinder (iv) Pipelines and hoses.	 3 3 3 4	BT-2	Understanding
16.	Enumerate the rules to be carried out for the installation of tubing.	13	BT-2	Understanding
17.	Write short notes on the trouble- possible causes and remedies for regulator and lubricator.	13	BT-4	Analyzing
18.	Design a circuit using the hydraulic components for any material handling operations.	13	BT-6	Creating

PART-C (15 Marks)				
S.No	Questions	Marks	Level	Competence
1.	Design and develop a pneumatic system to pick and place	15	BT-6	Creating

	objects.			
2.	Design and develop the tool handling system in a CNC machine	15	BT-6	Creating
3.	Narrate a case study of low cost automation using the hydraulic and pneumatic system.	15	BT-6	Creating
4.	Draw and explain a pneumatic circuit to actuate a shaping machine ram. Incorporate the following features in the circuit. (a) rapid tool approach (b) slow cutting (c) rapid tool retraction / return.	15	BT-6	Creating
5.	Design and develop a hydraulic circuit for material handling in a fork lift applications.	15	BT-6	Creating