



SUMMER – 2022 EXAMINATION

Subject Name: Hydraulic and Pneumatic Controls

Subject Code: 22650

Model Answer

Important Instructions to examiners:

- 1) The answers should be examined by key words and not as word-to-word as given in the model answer scheme.
- 2) The model answer and the answer written by candidate may vary but the examiner may try to assess the understanding level of the candidate.
- 3) The language errors such as grammatical, spelling errors should not be given more Importance (Not applicable for subject English and Communication Skills).
- 4) While assessing figures, examiner may give credit for principal components indicated in the figure. The figures drawn by candidate and model answer may vary. The examiner may give credit for any equivalent figure drawn.
- 5) Credits may be given step wise for numerical problems. In some cases, the assumed constant values may vary and there may be some difference in the candidate's answers and model answer.
- 6) In case of some questions credit may be given by judgement on part of examiner of relevant answer based on candidate's understanding.
- 7) For programming language papers, credit may be given to any other program based on equivalent concept.
- 8) As per the policy decision of Maharashtra State Government, teaching in English/Marathi and Bilingual (English + Marathi) medium is introduced at first year of AICTE diploma Programme from academic year 2021-2022. Hence if the students in first year (first and second semesters) write answers in Marathi or bilingual language (English +Marathi), the Examiner shall consider the same and assess the answer based on matching of concepts with model answer.

Q. No	Sub Q. N.	Answer	Marking Scheme
1.		Attempt any Five of the Following	10
	a	Define Specific Weight	2
	Ans.	Specific weight is defines as ratio between the weights of a fluid to its volume. $\rho = \frac{W}{V} = \frac{mg}{V} \quad \rho = \rho g$ Unit of specific weight is N/m ³	2
	b	State law of Continuity.	2
	Ans.	Law of continuity: For a fluid flowing through the pipe at all cross section, the quantity of fluid per second is constant. OR It states that if an incompressible liquid is continuously flowing through a pipe or a channel whose cross sectional area may or may not be constant then quantity of liquid passing through it per second is same at all sections.	2



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c	State the reason for using mercury in manometer.	2	
Ans.	<ol style="list-style-type: none"> 1. Mercury is a useful material to use in a manometer because of its high density. 2. Mercury has a low vapour pressure, so it does not evaporate easily. 3. Its freezing point is much lower than that of water. 4. It is shiny and can be easily noticed while taking the readings. 	Any 2 2 marks	
d.	Define Hydraulic Actuator.	2	
Ans.	Hydraulic actuator is defined as a device that converts pressure energy of fluid/oil into mechanical energy.	2 Marks	
e.	List valves for hydraulic systems.	2	
Ans.	<ol style="list-style-type: none"> 1. Hydraulic Flow Control Valves. 2. Hydraulic Pressure Control Valves. 3. Hydraulic Directional Control Valves. 4. Hydraulic Four-Way Valves. 	2 ½ marks for each	
f.	Write two applications of pneumatic circuits.	2	
Ans.	<ol style="list-style-type: none"> 1. Air brakes on buses and trucks. 2. Air brakes on trains. 3. Air compressors. 4. Air engines for pneumatically powered vehicles. 5. Dental drill. 6. Rock drills 7. Paint sprayers 	Any 2 Each 1 marks	
g.	List two applications of hydro-pneumatic circuits in an automobile.	2	
Ans.	<ol style="list-style-type: none"> 1. Hydro-pneumatic suspension. 2. Hydro-pneumatic brakes. 	1 marks for each	
h.	Draw a neat sketch of meter in circuit.	2	
Ans.	<p>The diagram illustrates a hydraulic circuit. At the bottom, there is an oil storage tank/reservoir connected to a positive displacement pump. A prime mover (motor, labeled 'M') is connected to the pump. The pump output goes through a pressure relief valve to a 4 X 3 solenoid-operated spring return directional control valve (DCV). The DCV is connected to a double-acting hydraulic cylinder (DA Cylinder). A variable flow control valve with a built-in check valve is connected to the cylinder's ports. The return line from the cylinder goes back to the reservoir.</p>	Correct figure give full marks 2	

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2.	Attempt any Three of the following.	12
a.	Explain with sketch construction and working of pitot tube. Show how the discharge is measured with it.	4
Ans.	<div data-bbox="360 472 1295 787" data-label="Diagram"> </div> <p>Construction: A right angled glass tube, large enough for capillary effects to be negligible, is used for the purpose. One end of the tube faces the flow while the other end is open to the atmosphere.</p> <p>Working: The liquid flows up the tube and when equilibrium is attained, the liquid reaches a height above the free surface of the water stream. Since the static pressure, under this situation, is equal to the hydrostatic pressure due to its depth below the free surface, the difference in level between the liquid in the glass tube and the free surface becomes the measure of dynamic pressure.</p> <p>Therefore, we can write, neglecting friction,</p> $p_0 - p = \frac{\rho V^2}{2} = h \rho g$ <p>where p_0, p and V are the stagnation pressure, static pressure and velocity respectively at point A</p> $V = \sqrt{2gh}$ <p>Such a tube is known as a Pitot tube and provides one of the most accurate means of measuring the fluid velocity.</p> <p>By knowing the value of V we can find the measured the discharge by equation Discharge</p> <p style="text-align: center;">Q = Area of pipe x V.</p>	<p>1 marks for Sketch</p> <p>1 marks for Construction</p> <p>1 marks for Working</p> <p>1 marks for Discharge</p>



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	b.	State Bernoulli's theorem and its application.	4																																												
	Ans.	<p>Bernoulli's Theorem:- It State that in steady, ideal flow of incompressible fluid, the total energy at any point of the fluid is constant. The total energy consist of pressuer energy, kinetic energy and potential energy of the fluid.</p> <p>Applications of Bernoulli's Theorem:- 1) Venturi meter 2) Orifice meter 3) Pitot tube 4) Rota meter 5) Nozzle meter or Flow nozzle 6) Elbow meter or Pipe bend meter.</p>	<p>2 Marks for Statement</p> <p>2 Marks for Applications</p>																																												
	c.	Compare Centrifugal and Reciprocating pump. (Four Points)	4																																												
	Ans.	<p>Differenace between Centrifugal and Reciprocating pump.</p> <table border="1" data-bbox="240 800 1385 1906"> <thead> <tr> <th data-bbox="240 800 329 894">Sr. No.</th> <th data-bbox="329 800 532 894">Factor</th> <th data-bbox="532 800 963 894">Reciprocating pump</th> <th data-bbox="963 800 1385 894">Centrifugal pump</th> </tr> </thead> <tbody> <tr> <td data-bbox="240 894 329 982">1</td> <td data-bbox="329 894 532 982">Discharge</td> <td data-bbox="532 894 963 982">The discharge is fluctuating and pulsating.</td> <td data-bbox="963 894 1385 982">The discharge is continuous and smooth.</td> </tr> <tr> <td data-bbox="240 982 329 1045">2</td> <td data-bbox="329 982 532 1045">Pressure</td> <td data-bbox="532 982 963 1045">Applicable for high pressure</td> <td data-bbox="963 982 1385 1045">Applicable for low pressure</td> </tr> <tr> <td data-bbox="240 1045 329 1108">3</td> <td data-bbox="329 1045 532 1108">Speed</td> <td data-bbox="532 1045 963 1108">Low speed</td> <td data-bbox="963 1045 1385 1108">High speed</td> </tr> <tr> <td data-bbox="240 1108 329 1192">4</td> <td data-bbox="329 1108 532 1192">Weight of pump</td> <td data-bbox="532 1108 963 1192">More than centrifugal pump</td> <td data-bbox="963 1108 1385 1192">Less than reciprocating pump</td> </tr> <tr> <td data-bbox="240 1192 329 1318">5</td> <td data-bbox="329 1192 532 1318">Floor area used</td> <td data-bbox="532 1192 963 1318">More floor area required for installation</td> <td data-bbox="963 1192 1385 1318">Less floor area required for installation</td> </tr> <tr> <td data-bbox="240 1318 329 1402">6</td> <td data-bbox="329 1318 532 1402">Maintenan cecost</td> <td data-bbox="532 1318 963 1402">More</td> <td data-bbox="963 1318 1385 1402">Less</td> </tr> <tr> <td data-bbox="240 1402 329 1497">7</td> <td data-bbox="329 1402 532 1497">Noise</td> <td data-bbox="532 1402 963 1497">Operation is complicated and with much noise</td> <td data-bbox="963 1402 1385 1497">Operation is smooth and without much noise</td> </tr> <tr> <td data-bbox="240 1497 329 1644">8</td> <td data-bbox="329 1497 532 1644">Applications</td> <td data-bbox="532 1497 963 1644">In service stations for washing vehicles</td> <td data-bbox="963 1497 1385 1644">In sugar factories, oil, chemical factories milk dairies and domestics applications.</td> </tr> <tr> <td data-bbox="240 1644 329 1707">9</td> <td data-bbox="329 1644 532 1707">Efficiency</td> <td data-bbox="532 1644 963 1707">Efficiency is low.</td> <td data-bbox="963 1644 1385 1707">Efficiency is high.</td> </tr> <tr> <td data-bbox="240 1707 329 1906">10</td> <td data-bbox="329 1707 532 1906">Type of fluid handled</td> <td data-bbox="532 1707 963 1906">It can be used for lifting pure water or less viscous liquid from impurities , lifting oil, from very deep oil wells.</td> <td data-bbox="963 1707 1385 1906">It can be used for lifting highly viscous liquid such as oil, muddy ,and sewage water, paper pulp, suger molasses , chemical etc.</td> </tr> </tbody> </table>	Sr. No.	Factor	Reciprocating pump	Centrifugal pump	1	Discharge	The discharge is fluctuating and pulsating.	The discharge is continuous and smooth.	2	Pressure	Applicable for high pressure	Applicable for low pressure	3	Speed	Low speed	High speed	4	Weight of pump	More than centrifugal pump	Less than reciprocating pump	5	Floor area used	More floor area required for installation	Less floor area required for installation	6	Maintenan cecost	More	Less	7	Noise	Operation is complicated and with much noise	Operation is smooth and without much noise	8	Applications	In service stations for washing vehicles	In sugar factories, oil, chemical factories milk dairies and domestics applications.	9	Efficiency	Efficiency is low.	Efficiency is high.	10	Type of fluid handled	It can be used for lifting pure water or less viscous liquid from impurities , lifting oil, from very deep oil wells.	It can be used for lifting highly viscous liquid such as oil, muddy ,and sewage water, paper pulp, suger molasses , chemical etc.	1 Marks for each Any 4
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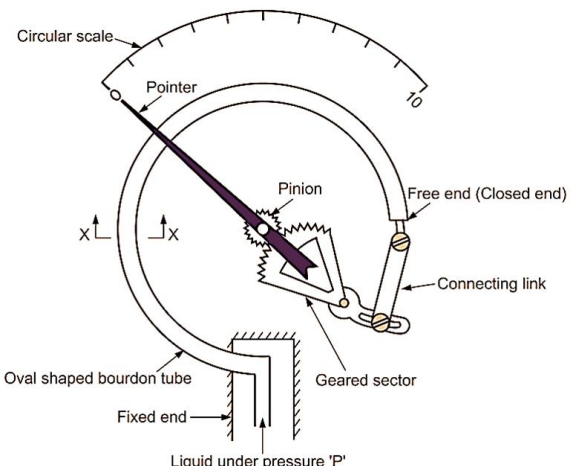


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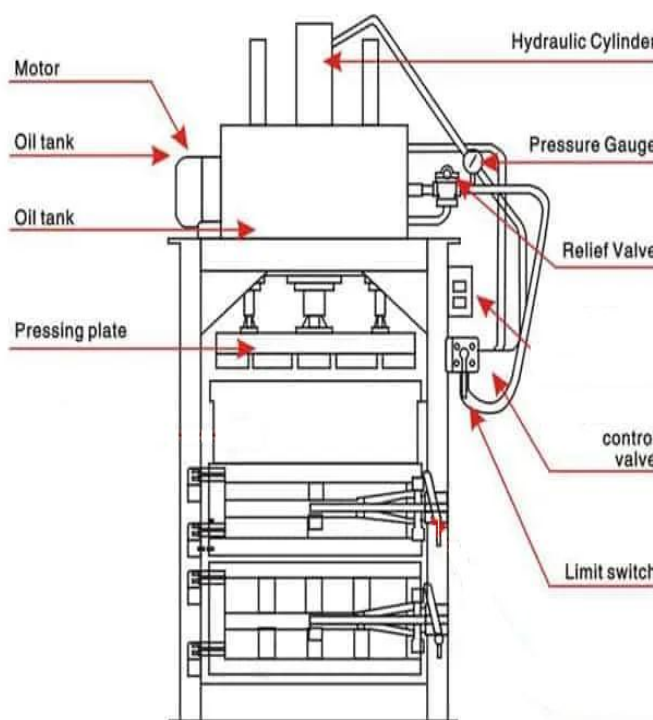
	<p>d. Explain negative slip in reciprocating pump.</p>	<p>4</p>
	<p>Ans. Slip of a pumps defined as the difference between the theoretical discharge and actual discharge of the pump.</p> <p>If actual discharge is more than the theoretical discharge, slip of the reciprocating pump will be negative. In this case, the slip of the pump is known as negative slip. Negative slip will occur when suction pipe is long, delivery pipe is short and pump is running at high speed.</p>	<p>4 Marks</p>
<p>3.</p>	<p>Attempt any Three of the following.</p>	<p>12</p>
	<p>a. Draw a labelled sketch of Bourdon's pressure gauge.</p>	<p>4</p>
	<p>Ans.</p>	<p>Figure 2 marks Labeling 2 marks</p>
		
	<p>b. Explain with sketch the working principle of hydraulic press.</p>	<p>4</p>
	<p>Ans. Working Principle: - The hydraulic press work based on Pascal's law. This law state that the intensity of pressure in a static fluid is transmitted equally in all direction.</p> <p>There are two cylinders of different diameter. The first cylinder is of larger diameter and it carries the ram, the other small cylinder carries the plunger.</p> <p>These two cylinders are connected by a pipe which contain a liquid through which liquid is transmitted. Whenever a little force is applied on the plunger in the downward direction, a pressure is produce. This pressure is produced on the liquid in contact with the plunger. The pressure produce is equally transmitted to all directions and let the ram play it role by the upward direction. While the heavier weight placed on the ram move along with it.</p>	<p>2 Marks for working</p>

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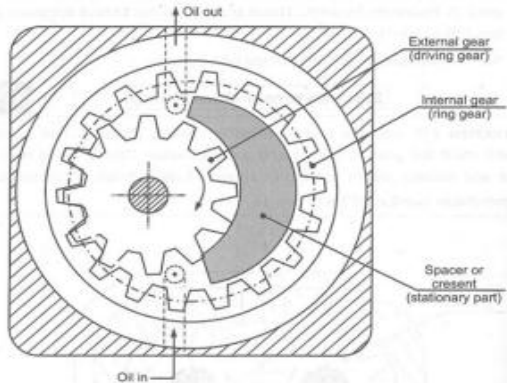
	 <p style="text-align: center;">Fig. Hydraulic Press</p>	<p>2 Marks for Diagram Similar diagram give full marks</p>
<p>c.</p>	<p>Explain with neat sketch the working of gear pump.</p>	<p>4</p>
<p>Ans.</p>	<p>Internal Gear Pump</p> <p>Working: - It consists of one external and one internal meshing gear pair. External gear is connected to electric motor and hence is driving gear. Internal gear or ring gear is driven gear which rotates in same direction as that of external gear. Between two gear a spacer called 'crescent' is located which is a stationary pieces connected to housing. Inlet and outlet ports are located in end plates. External gear (driving gear) drives the internal gear (Ring Gear). Portion where teeth start meshing, a tight seal is created near port the vacuum is created due to quick un meshing and oil enters from oil tank through inlet port. Oil is trapped between the internal and external gear teeth on both sides of crescent (spacer) and is then carried from inlet to outlet port. Meshing of gear near outlet port reduces the volume or gap and oil gets pressurized. These pumps make very less noise.</p>	<p>2 Marks for figure</p>

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2
Marks
for
descrip
tion

OR

External Gear Pump

Working: - External gear pump are similar in pumping action to internal gear pumps in that two gears come into and out of mesh to produce flow. However, the external gear pump uses two identical gears rotating against each other -- one gear is driven by a motor and it in turn drives the other gear. Each gear is supported by a shaft with bearings on both sides of the gear. As the gears come out of mesh, they create expanding volume on the inlet side of the pump. Liquid flows into the cavity and is trapped by the gear teeth as they rotate. Liquid travels around the interior of the casing in the pockets between the teeth and the casing -- it does not pass between the gears. Finally, the meshing of the gears forces liquid through the outlet port under pressure.

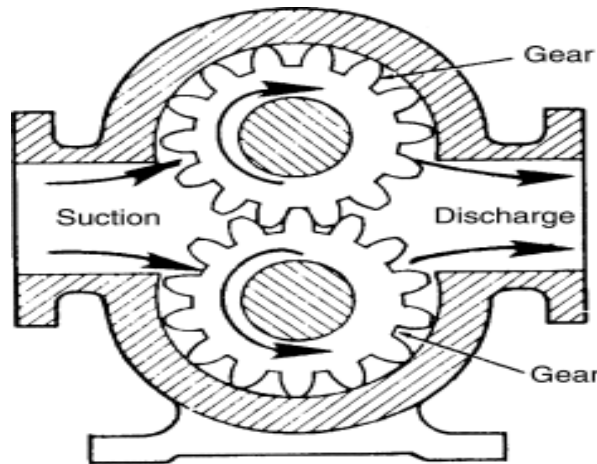


Fig- External Gear Pump

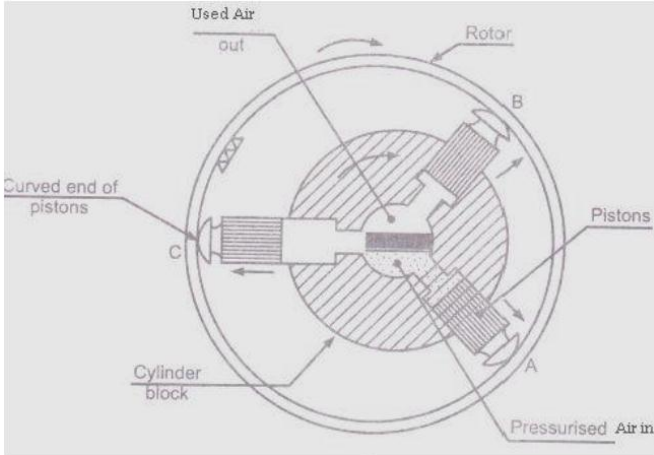


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	d.	Differentiate between gear pump and vane pump on the basis of construction, pressure, speed, and application.			4																			
	Ans.	<table border="1"> <thead> <tr> <th data-bbox="321 367 347 449">Sr. No</th> <th data-bbox="347 367 524 449">On the basis of</th> <th data-bbox="524 367 846 449">Gear Pump</th> <th data-bbox="846 367 1369 449">Vane Pump</th> </tr> </thead> <tbody> <tr> <td data-bbox="321 449 347 590">1</td> <td data-bbox="347 449 524 590">Construction</td> <td data-bbox="524 449 846 590">More robust type-external type, positive displacement type pump.</td> <td data-bbox="846 449 1369 590">Less robust type Balance/unbalance, fixed/variable displacement.</td> </tr> <tr> <td data-bbox="321 590 347 632">2</td> <td data-bbox="347 590 524 632">Pressure</td> <td data-bbox="524 590 846 632">125 to 175 bar</td> <td data-bbox="846 590 1369 632">Above 200 bar</td> </tr> <tr> <td data-bbox="321 632 347 674">3</td> <td data-bbox="347 632 524 674">Speed</td> <td data-bbox="524 632 846 674">200 – 300 r.p.m.</td> <td data-bbox="846 632 1369 674">Upto 25000 r.p.m.</td> </tr> <tr> <td data-bbox="321 674 347 894">4</td> <td data-bbox="347 674 524 894">Applications</td> <td data-bbox="524 674 846 894">Oil pump, hydraulic pack, earthmover</td> <td data-bbox="846 674 1369 894">In light air craft to drive gyroscopic, flight instruments, Vacuum pump, as automatic transmission pumps in power steering, during the Installation of air conditioner</td> </tr> </tbody> </table>	Sr. No	On the basis of	Gear Pump	Vane Pump	1	Construction	More robust type-external type, positive displacement type pump.	Less robust type Balance/unbalance, fixed/variable displacement.	2	Pressure	125 to 175 bar	Above 200 bar	3	Speed	200 – 300 r.p.m.	Upto 25000 r.p.m.	4	Applications	Oil pump, hydraulic pack, earthmover	In light air craft to drive gyroscopic, flight instruments, Vacuum pump, as automatic transmission pumps in power steering, during the Installation of air conditioner		1 Marks for each
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4		Attempt any Three of the following.			12																			
	a	Explain Working of Piston type air Motor with sketch.			4																			
	Ans.	<p>1) Radial Piston Motor Working:- Here three pistons fitted in cylinder block. The curve ends of Pistons can rest on smooth surface of rotor. Cylinder block and rotor are rotating member of motor. If compressed air is introduced in cylinder under pressure, piston will pushed outward this principle is used in this motor, suppose compressed air is under pressure is admitted to cylinder No A piston will move outward in its cylinders. Now curved end of piston will slide inside the rotor with force and rotor will turn in clockwise direction Then the cylinder B will occupy the position of A since cylinder block also starts rotating and same cycle will starts which results in rotational motion of rotor.</p> 			2 Marks for Working																			

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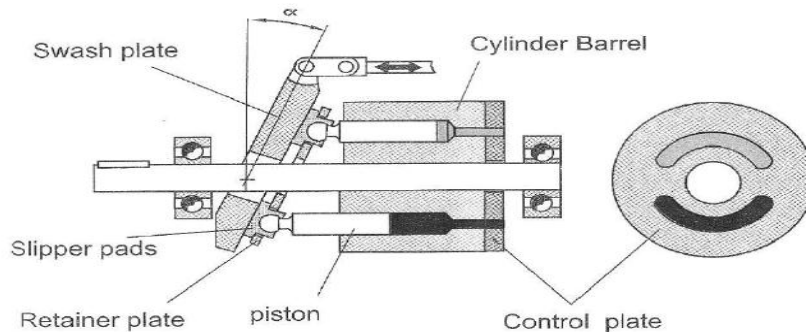
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OR

2) Axial Piston motor :

Working: - In axial piston motors, the piston reciprocates parallel to the axis of the cylinder block. These motors are available with both fixed-and variable-displacement feature types. They generate torque by pressure acting on the ends of pistons reciprocating inside a cylinder block. Above figure illustrates the inline design in which the motor, drive shaft and cylinder block are centered on the same axis. Pressure acting on the ends of the piston generates a force against an angled swash plate. This causes the cylinder block to rotate with a torque that is proportional to the area of the pistons. The torque is also a function of the swash-plate angle. The inline piston motor is designed either as a fixed- or a variable-displacement unit. The swash plate determines the volumetric displacement.



2
Marks
for
Sketch

b. Explain working of proportionating valve with neat sketch.

4

Ans Working :

The proportionating valves are nearly similar to the solenoid valve but only difference is that in normal solenoid valves the position of actuator is fixed and cannot be determined. In proportional valves the exact position of actuators can be determined of control by controlling the supply current to the electromagnet. The given figure shows the construction of 3/2 normally closed proportional valve. The valve is having 3 ports i.e pressure, actuator and tank port. The spring loaded spool is mounted inside the bore. When the regulated current from the amplifier or from power supply control unit is supplied to the electromagnet then due to controlled magnetism the valve spool is moved against the spring force and according to that flow of fluid is controlled. Hence the proportional valves are used to control the definite motion of actuators

2
marks
for
workin
g

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	<p style="text-align: center;">3/2- Way Normally Closed Proportional Valve</p>	<p>2 marks for sketch</p>
<p>c.</p>	<p>Sketch and explain working of 4/2 direction control valve used in hydraulic system.</p>	<p>4</p>
<p>Ans.</p>	<p>Working: of 4/2 DC valve: It has two switching positions. In the normal position, pump flow is sent to outlet B. Outlet A is connected to the tank. In the actuated position, the pump flow is sent to port A. Port B connected to tank T. As soon as actuating force is released from spool, compression force of spring brings the spool back to original position.</p> <p style="text-align: center;">Normal Position</p> <p style="text-align: center;">Actuated Position</p>	<p>2 Marks for Worki ng</p> <p>2 Marks for Sketch</p>
<p>d.</p>	<p>Sketch and explain working of sequence valve</p>	<p>4</p>
<p>Ans.</p>	<p>Working: Sequence valve is nothing but pilot operated relief valve. It has a special spool having specially drilled oil passage with internal orifice drain is directed to main drain. In normal position sequence valve is closed when the operation of consumer 1 is completed pressure starts building and when reaches set value of pilot relief valve fluid flows through spool to drain/ tank. As the fluid flows through spool the orifice causes pressure difference between spring side and spool side. This pressure difference results in differential force which lifts the spool causing it to uncover the port 'A' thus supplying fluid to another consumer 'A'</p>	<p>2 Marks for Worki ng</p>

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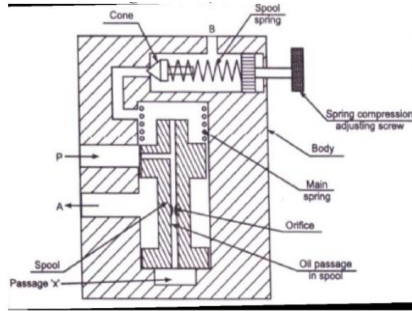
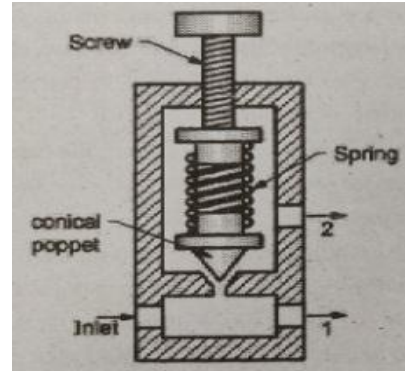


Figure- Sequence Valve

OR



2 Marks for Sketch (Consider any one sketch and its relevance)

e. Differentiate between spool and poppet type valve. (Four points)

4

Ans.

Sr.No	Spool Type Valve	Poppet Type Valve
1.	Construction is simple	Construction is complicated
2.	The valve spool and bore finishing is simple and less costly	The valve finishing is difficult and costly
3.	Wear and tear is uniform	Wear and tear is not uniform
4.	Actuation is easily adaptable	Valve Actuation possible is limited.
5.	Commonly used	Rarely used
6.	Leakage inside the valve is possible	Very minor leakage
7.	Suitable for low/medium pressure applications	Suitable for very high pressure applications

1 Marks for each (Any Four Points)

5 Attempt any Two of the Following

12

a. Predict two faults relevant to centrifugal pump. Write 2 causes and two remedies for each fault.

6



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Ans.	Sr . No	Faults in centrifugal pump	Possible Cause	Remedies	
	1	Zero Flow after Startup	Air in Pump or Suction Pipework	Ensure Pump and Pipework are Completely Filled with Liquid. Pump cannot prime with air in suction line.	One mark for one correct fault. (2x1=02)
			Suction Lift Too High	Check Inlet for obstruction. If there is not an obstruction calculate friction losses. If static lift is too high the liquid in the suction tank must be raised or pump lowered	
			Operation is Reversed	Check motor direction of rotation is in the direction of arrow on pump casing	
			Speed Incorrect	Check supply voltage and frequency. Motor may also have open phase	
			Impeller, strainer or check valve clogged	Clean impeller, valve and strainer	
	2)	Flow Decreases or None at All	Air ingress through shaft seal, suction piping, suction port. Pump lifts liquid with air.	Check suction pipework for leaks, including all joints and fittings. Check shaft seal and if necessary, increase pressure of sealing liquid. Check depth of suction pipework or valve in liquid and deepen if required. Check inlet tank for vortexing.	One mark for one correct cause. (2x1=02)
			Air pocket in suction pipe	Check angle of suction line and ensure there is no possibility for an air pocket and if so ensure air eliminator valves are fitted	
			Increase of Manometric Head	Check valves are fully open and there are no obstructions in discharge pipe	
			Impeller, strainer or check valve clogged	Clean impeller, valve and strainer	
	3)	Driver Overloaded	Pump operating at lower manometric head	The actual head is lower than originally specified. Reduce impeller size to diameter advised by supplier or utilize an inverter to reduce pump speed	One mark
			Speed too high	Decrease pump rotational speed	



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				or trim impeller to required size	for one correct Remedies. (2x1=02)
			Mechanical Friction inside pump	Check pump rotor for any obstruction or deflection	
			Packing wound too tight	Loosen nuts on packing gland	
			Coupling Alignment	Check coupling rubber and realign pump and coupling	
			Motor Defects	Check for motor defects. May not be ventilated correctly and be in a poor location.	
	4)	Vibration	Partially clogged impeller.	Clean Impeller.	
			Worn or defective impeller.	Replace impeller.	
			Poor Coupling Alignment.	Check coupling rubber and realign pump and coupling.	
			Oblique Shaft.	Check shaft and replace if required.	
			Unbalanced parts.	Check and rebalance parts if required	
			Partially clogged impeller.	Clean Impeller.	
	5)	Noise level high	Air in liquid.	Suction pipe needs to be submerged to ensure vortexes are not created on the surface of the liquid. Check liquid level in suction pipe or increase depth of suction pipe.	
			Pump working in cavitation area.	NPSH is too low. Check liquid level in suction tank, check suction losses. Check valve in suction line and ensure fully open. Increase suction head by lowering pump.	
			Pump operating outside of duty range.	Check duty point	
	b.	Classify filter and state their applications.			6
	Ans.	1) According to the filtering methods:- a. Mechanical b. Absorbent c. Adsorbent			Classification of filter 3 marks



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	<p>2) According to working Pressure</p> <ol style="list-style-type: none"> a. Low-pressure filters b. Medium-pressure filters c. High-pressure filters <p>3) According to the size of pores in the material:</p> <ol style="list-style-type: none"> a. Surface filters b. Depth filters <p>4) According to the location of filters:</p> <ol style="list-style-type: none"> a. Intake or inline filters (suction strainers) b. Pressure line filters (high-pressure filters) c. Return line filters (low-pressure filters) <p>5) Depending on the amount of oil filtered by a filter:</p> <ol style="list-style-type: none"> a. Full flow filters b. Proportional filters (bypass filters) <p>Application of filter:-</p> <ol style="list-style-type: none"> 1) Use in Automobile (two wheeler and four vehicle) 2) Use in Industry in hydraulic and pneumatic system 3) Use in milling machine hydraulic circuit 4) Use in Shaper machine hydraulic circuit. 5) Use in Grinder machine hydraulic circuit. 6) Use in pneumatic system. 7) Use in Hydraulic press 8) Use in pneumatic braking system. 	<p>Application of filter any Six points 03 marks. (1/2 mark for each application)</p>
c.	<p>Justify use of flexible hose in hydraulic braking system. Draw relevant connector.</p>	<p>6</p>
Ans.	<p>It is important for brake hoses to be flexible to enable the driver to steer and brake effectively, as well as action over and around obstacles.</p> <p>The fluid in the car's braking system runs from the master cylinder to the brakes themselves mainly via rigid metal pipes. But there needs to be some flexibility in the system to allow the wheels to move in relation to the car body, whether for the purposes of steering or suspension. This is provided by fitting flexible brake hoses. Also These flexible hoses are necessary because the wheel ends are free to move relative to the body</p>	<p>Justification 03 marks.</p>

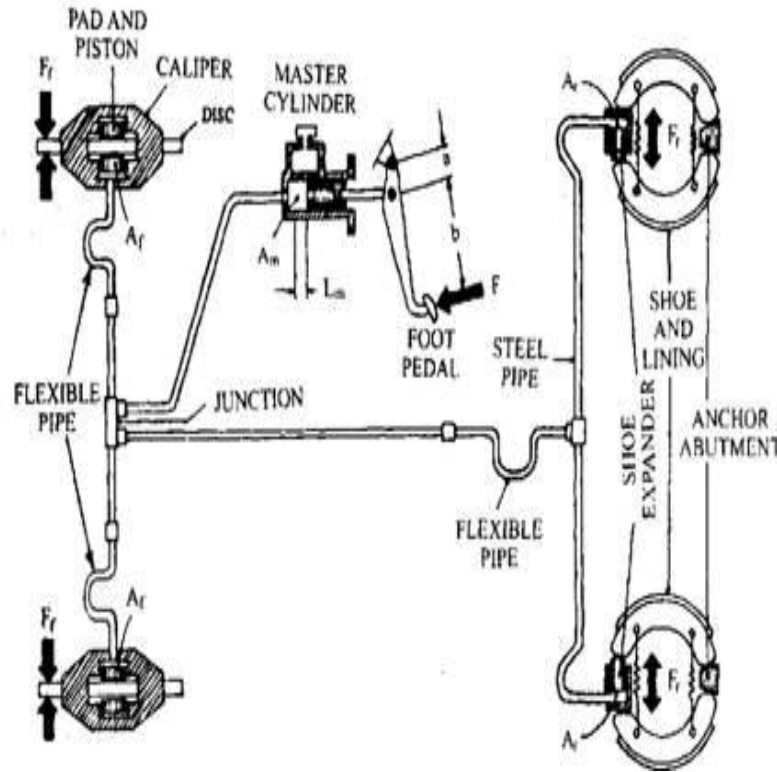
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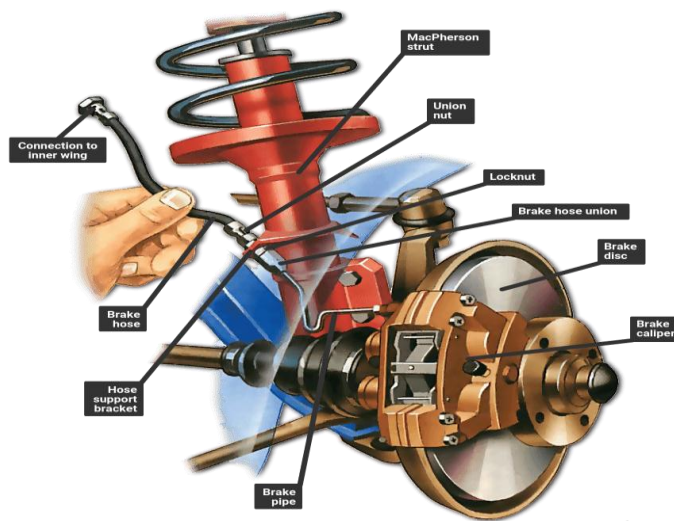
of the vehicle. Inflexible tubes would not allow for the articulation of the wheel ends without subsequent failure.



Sketch Relevant connector 3 marks.

*In above diagram consider flexible pipe as flexible Hose.

OR



6

Attempt any Two of the following

12

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a.	<p>Explain with sketch the milling machine hydraulic circuit.</p>	6
Ans.	<div data-bbox="462 399 1161 1144" data-label="Diagram"> </div> <p>Fig. milling machine hydraulic circuit</p> <p>The hydraulic circuit for a milling machine is comparatively different from the hydraulic circuit of the surface grinding machine and hydraulic circuit of the shaper machine. This is because the table movement in milling operation is comparatively slower. Also, the different feeds or you can say adjustable feeds are required for milling different types of work.</p> <p>Hence, in the hydraulic circuit for the milling machines in addition to other elements a flow control valve is incorporated in the circuit.</p> <p>The hydraulic circuit of the milling machine consists of the following components</p> <ul style="list-style-type: none"> ▪ Oil reservoir or tank ▪ Hydraulic pump ▪ Booster pump ▪ Pressure Relief Valve ▪ Spool type of direction control valve ▪ Double-acting cylinder 	<p>Label sketch with all details 03 marks (Relevant simple circuit should also given weight age)</p> <p>Explanation 3 marks</p>



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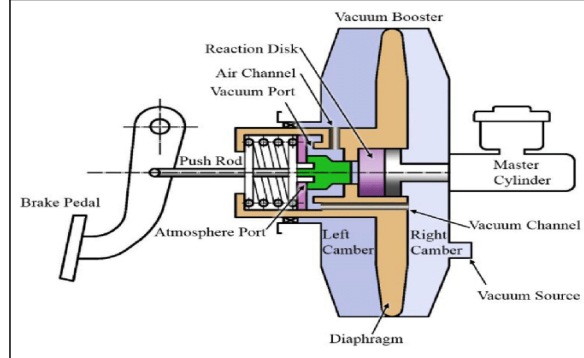
	<ul style="list-style-type: none"> ▪ Flow control valve <p>It has a main pump which is low pressure and a high discharge pump, and one booster pump, which is a low discharge high-pressure pump. The function of the booster pump is to boost the hydraulic pressure to a level above that provided by the main pump.</p> <p>There are two sets of flow control valves and check valves, fitted in both the supply and return line to the cylinder, to achieve speed control in both directions.</p> <p>A manually operated spool valve decides the direction of the flow of the cylinder. The stroke length of the cylinder is adjustable through limit switches. The limit switch disconnects the supply of oil to the cylinder when the table reaches the set position.</p>	
b.	Sketch and describe brake booster of heavy vehicle.	6
Ans.	<p>A brake booster, also known as a ‘brake servo’ or ‘vacuum booster’, does exactly as the name suggests, it helps to ‘boost’ the performance of the brakes. A brake booster makes it easier for the driver to brake by increasing the force exerted without the need for additional force applied on the foot pedal.</p> <p>This effect is achieved through the use of a vacuum system that amplifies the pressure of the brake pedals lever on the master cylinder, and therefore brakes (which will be explained below). It provides assistance to the overall braking system by ensuring the brake pads clamp correctly and with enough force.</p> <p>The brake booster is located between the brake pedal and the master cylinder and functions to multiply the force of the brake pedal further. This is done by having the brake booster function utilize the power of the engine’s vacuum (in petrol-powered cars) to emphasize the force your foot uses on the master cylinder. The booster does this by using a diaphragm system whereby a vacuum (and a little air) is used to add force to the brakes.</p> <p>When you push the brake pedal down, the lever that passes through to the master cylinder cracks open a small valve in the booster that allows air to enter one side of the diaphragm. This increases the pressure on that side of the diaphragm and further pushes the lever along, which pushes the piston in the master cylinder.</p>	<p>. (01 marks for function of brake booster.</p> <p>01 marks construction,</p> <p>01 marks working)</p>

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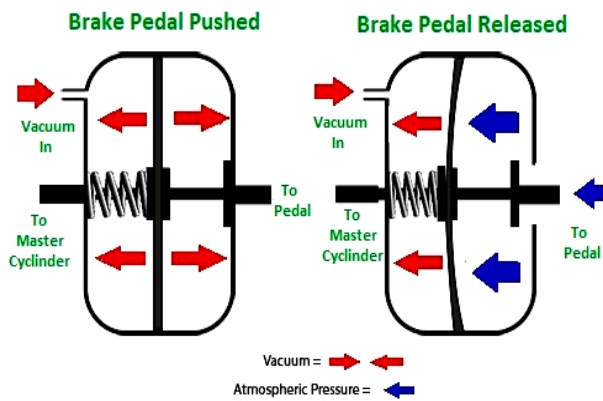
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Model Answer



OR



03
marks
for
label
sketch

c. Compare hydraulic and pneumatic circuits (six points)

6

Ans.

Sr No	Hydraulic circuits	Pneumatic circuits
1	Working medium is pressured oil or fluids.	Working medium is compressed air.
2	Hydraulic Pump is used to increase pressure of Hydraulic circuit.	Air compressor is used to increase pressure of pneumatic circuit.
3	In this circuit hydraulic filter are used.	In this circuit FRL Unit is used.
4	Hydraulic circuits can be operated around pressure of 700 bar.	Pneumatic circuit can be Operated around pressure of 10 bar.
5	As oil is used as working medium, hydraulic circuit required periodic cleaning and maintenance.	As compressed air is used as working medium, pneumatic circuit not required periodic cleaning and maintenance.
6	Oil leakage may affect the performance of circuit.	Due to air leakage may occur in circuit.
7	The accuracy of the hydraulic circuit is high.	The accuracy of the Pneumatic circuits is not high.
8	Contamination control is required in these circuits.	Contamination control is not required in these circuits.
9	A hydraulic circuit is a closed-loop system.	Pneumatic circuit is an open-loop system.

01
marks
For
each
point.
(Any
6)