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Subject Code

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Chapter Name

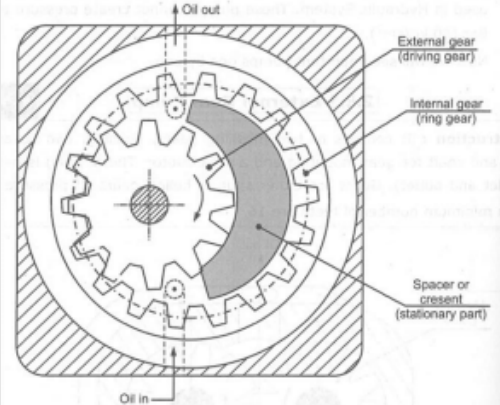
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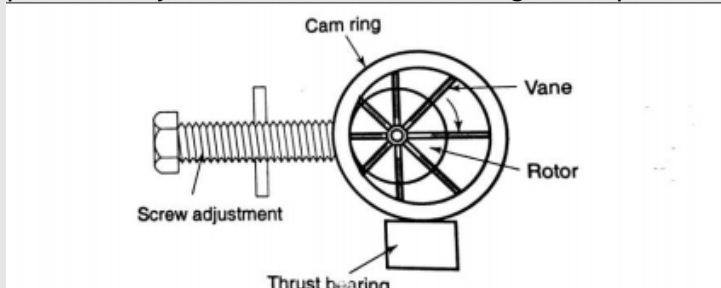
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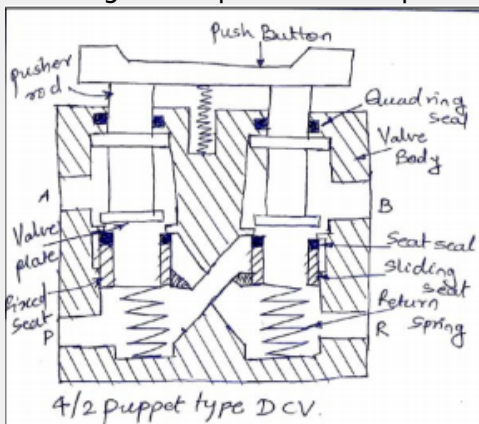
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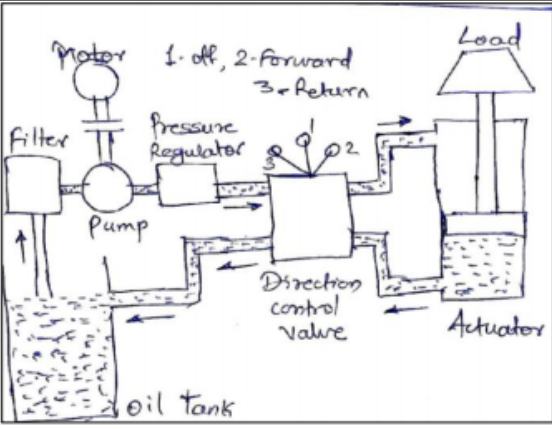
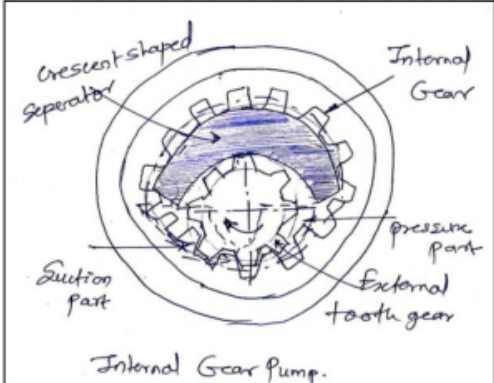
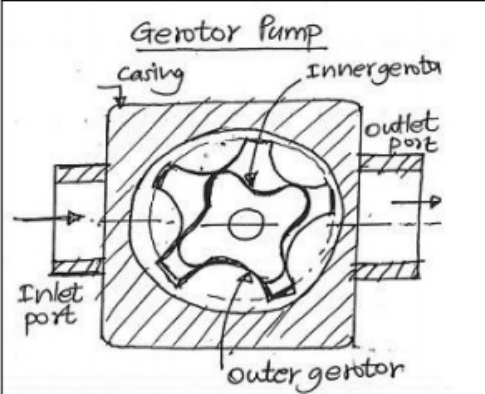
Que.No	Marks	
Q 1a)(a)	4	<p>Question: What is function of (i) oil reservoir (ii) pressure relief valve, (iii) direction control valve, (iv) filters ?</p> <p>Answer: What is function of (i) Oil Reservoir – To store the Hydraulic oil for the circuit (ii) Pressure Relief Valve- To release the extra pressure whenever not required by system (iii) Direction Control Valve- To give the direction to the actuator (iv) Filters- To filter the foreign particle from the oil and to separates sub-micron level contamination</p> <p>-----</p>

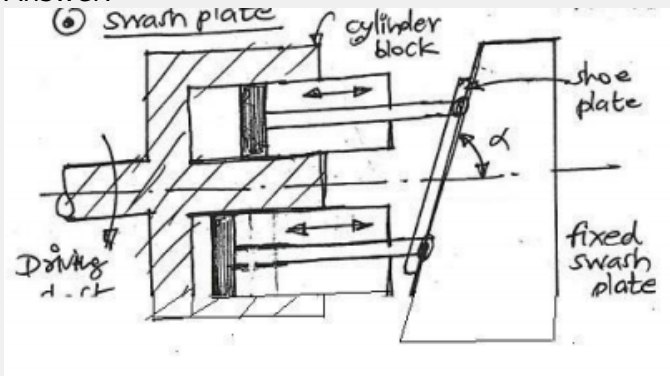
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Q 1a)(c)	4	<p>Question: Explain piston pump with neat sketch.</p> <p>Answer: It's an inclined plate in axial piston pump on which all pistons are connected through piston rod. This swash plate is usually inclined. Use - It is helps to reciprocate the piston of axial piston pump while the cylinder block is rotating Working: Motor drives the shaft, which in turn rotates the entire cylinder block. The pistons are connected to inclined swash plate through piston rod. Now since swash plate is inclined and block is rotating, the piston reciprocates inside the barrel. The reciprocating motion of piston causes suction and delivery of fluid through inlet and outlet ports which come in front of outlet of piston. If we change the angle of swash plate i.e. θ if a) $\theta = 0$ then no flow of oil, because pistons are at same level. When $\theta = 0$ swash plate is vertical. No reciprocation of piston, hence no flow. b) $\theta = \text{max or } + \text{ve}$, then 'x' will be stroke length which is maximum and there will be maximum forward flow. c) $\theta = - \text{ve}$, then 'x' i.e. stroke length will be maximum in reverse direction and hence there will be reverse flow. By changing the swash plate angle we can vary the stroke length of the piston. and also output flow can be changed.</p>

Que.No	Marks	
Q 3 b)	4	<p>Question:</p> <p>Explain gear pump with neat sketch.</p> <p>Answer:</p> <p>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> 
Q 3 c)	4	<p>Question:</p> <p>Explain any four criteria for selection of hydraulic pump in hydraulic system.</p> <p>Answer:</p> <p>1) Pressure: It is the basic selection criteria. Pump pressurizes the hydraulic oil to the level required by actuator. When pressures up to 150 bars are required then gear pumps can be selected. For pressure of 150 to 250 vane pump is suitable and for above 500 bar pressure piston pumps are useful.</p> <p>2) Flow of pressurized oil: Volumetric output of pump is measures in LPM. The flow of oil decides the speed of actuator. The displacement can also be changed for variable displacement pumps.</p> <p>3) Speed of pump: The speed of pump is decided by rated capacity of the manufacturer. If wrong speed is selected for pump then efficiency and working of hydraulic system may get hamper.</p> <p>4) Efficiency of the pump: The selected pump must have good efficiency. We can consider following efficiencies: 1) Volumetric 2) Mechanical 3) Overall</p> <p>5) Oil compatibility: The oils used in pump should be compatible with the material of the pump. If wrong oil gets selected then pump will not work to its rated performance</p>

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Q 4b)(a)	6	<p>Question:</p> <p>Explain with neat sketch the working of variable displacement vane pump.</p> <p>Answer:</p> <p>) Explain with neat sketch working of variable displacement vane pump. In a hydraulic system the flow rate of the pump needs to be variable this can be easily achieved by varying the rpm of the electric motor. Other method is displacement of a vane inside the pump and therefore its delivery is proportional to the eccentricity between the rotor axis and cam ring. Changing the geometric position of the ring relative to the rotor center will change the delivery volume as per system need. Main components of the vane pumps are: 1. Hardened cam ring 2. Rotor 3. Vanes 4. Screw for position adjustment 5. Thrust bearing 6. Stop</p> <div></div> <p>Working : The rotor containing the vanes is positioned eccentric or off-center with regard to cam ring by means of the adjusting screw hence when the rotor is rotated, in increasing and decreasing volume can be created inside the cylinder bore. If the screw is adjusted slightly so that the eccentricity of the rotor to the cam ring is not sufficient the flow will be less where as with higher eccentricity the delivery volume will be increased with the screw adjustment back completely out the cam ring naturally centers with a rotor and no pumping will be the eccentricity will be zero.</p> <p>-----</p>												
		<p>Question:</p> <p>Compare positive displacement pump with Rotodynamic pump.</p> <p>Answer:</p> <table><thead><tr><th>Positive Displacement Pump</th><th>Rotodynamic Pump</th></tr></thead><tbody><tr><td>1. Delivers fluid in discrete volume per cycle</td><td>1. Delivery is continuous</td></tr><tr><td>2. After finishing on delivery stroke completely , only the next suction stroke can start</td><td>2. Suction & delivery can keep on going continuously & simultaneously.</td></tr><tr><td>3. Discharge is independent of the resisting pressure at delivery</td><td>3. As resistance increases the discharge reduces.</td></tr><tr><td>4. Discharge depends only on speed</td><td>4. Discharge depends on resisting pressure</td></tr><tr><td>5. Work done on the fluid is in the form of pressure energy</td><td>5. Work done is in the form of kinetic energy</td></tr><tr><td>6. There is no limit to the maximum pressure that can be built</td><td>6. The maximum pressure that can be developed is limited</td></tr></tbody></table> <p>-----</p>	Positive Displacement Pump	Rotodynamic Pump	1. Delivers fluid in discrete volume per cycle	1. Delivery is continuous	2. After finishing on delivery stroke completely , only the next suction stroke can start	2. Suction & delivery can keep on going continuously & simultaneously.	3. Discharge is independent of the resisting pressure at delivery	3. As resistance increases the discharge reduces.	4. Discharge depends only on speed	4. Discharge depends on resisting pressure	5. Work done on the fluid is in the form of pressure energy	5. Work done is in the form of kinetic energy
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Q 6 d)	4													

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Q 1a)(a)	4	<p>Question:</p> <p>State the four advantages and disadvantages of screw pump.</p> <p>Answer:</p> <table><tr><td>Four advantages of screw pump<ol style="list-style-type: none">1. Reliable performance2. Operate at very high speed3. Continuous discharge4. Silent operation</td><td>Four disadvantages of screw pump<ol style="list-style-type: none">1. Screw manufacturing difficult2. Unsuitable for high viscosity oil3. Low efficiency4. Decrease in efficiency with increase in viscosity of oil</td></tr></table>	Four advantages of screw pump <ol style="list-style-type: none">1. Reliable performance2. Operate at very high speed3. Continuous discharge4. Silent operation	Four disadvantages of screw pump <ol style="list-style-type: none">1. Screw manufacturing difficult2. Unsuitable for high viscosity oil3. Low efficiency4. Decrease in efficiency with increase in viscosity of oil
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Q 1a)(b)	4	<p>Question:</p> <p>Explain the construction of 4/2 poppet valve with neat sketch & symbol.</p> <p>Answer:</p> <p>4/2 puppet valve Figure shows a cross sectional schematic view of a poppet type 4/2 direction control valve. Inside the valve housing, a number of bores are engraved and interconnected through number of valve elements. The ports 'P', 'R', 'A', and 'B' shown in the diagram are designated as 'Ppressure port, 'A' and 'B' – cylinder port and 'R' – exhaust port. In the position shown in the sketch, it is found that 'P' connects to 'A' and 'B' to 'R', When the elements are actuated by means of the push button, they are unseat and 'P' connects to 'B' and 'A' to 'R'. The rated size of the valve depends on the cross-section of the valve port. Through proper shaping of the fluid ports or canals, the loss of pressure may be minimized. The actuating elements of the spool in zero position are spring controlled and for accurate controlling may be designed as pressure compensated</p> 		
Q 1a)(c)	4	<p>Question:</p> <p>State the essential properties of hydraulic fluids.</p> <p>Answer:</p> <table><tr><td>Essential properties of hydraulic fluids<ol style="list-style-type: none">1. Compressibility2. Viscosity3. Stable viscosity index4. Demulsibility5. Low foaming tendency6. Flash point</td><td><ol style="list-style-type: none">7. Oxidation8. Good heat dissipation9. Wear resistance10. Corrosion resistance11. Pour point12. Non toxic</td></tr></table>	Essential properties of hydraulic fluids <ol style="list-style-type: none">1. Compressibility2. Viscosity3. Stable viscosity index4. Demulsibility5. Low foaming tendency6. Flash point	<ol style="list-style-type: none">7. Oxidation8. Good heat dissipation9. Wear resistance10. Corrosion resistance11. Pour point12. Non toxic
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Q 1b)(a)	6	<p>Question:</p> <p>Draw general layout of hydraulic system and explain its working.</p> <p>Answer:</p> <p>a) Oil Tank or Reservoir: This is an oil storage tank in which hydraulic oil is stored. The oil passes through various pipelines and after doing useful work in actuator; the oil returns back to oil tank. In the regions of low temperature, oil heaters are attached to air tanks.</p> <p>b) Filter: This element filters the oil before going to the next element i.e. pump.</p> <p>c) Pump: Hydraulic pump is heart of any hydraulic system. Its main function is to create the flow of oil under pressure through entire hydraulic system and hence to assist transfer of power and motion (i.e. useful work). Pump drives by prime mover. (i.e. Motor)</p> <p>d) Direction control valves/Flow control valves/ Pressure Relief Valves (Fluid Controlling Elements): These valves are fitted in hydraulic system at particular locations. These valves control the flow of oil in the system. They also direct the flow of oil in system as also they control the speed of actuator.</p> <p>e) Actuators: (Fluid Power utilization elements): These elements are known as actuators (Either rotary or linear). The pressurized oil acts on actuator elements. The oil gives or transfers its power to actuator to create useful work or Mechanical Advantage.</p> <p>f) Pipelines (Fluid Conducting elements): It is the functional connection for oil flow in the hydraulic system. The efficiency of oil flow is greatly influence by the physical characteristics of piping systems. There are two pipes:</p> <p>a) Pipe which carry pressurized oil are called as pressure pipelines</p> <p>b) Pipes which carry low pressurized oil or used oil (are called as return pipelines). Hoses, pipes, pipe fitting are the parts of fluid power pipeline.</p> 
Q 3 d)	4	<p>Question:</p> <p>Draw neat labelled sketch of (i) Internal gear pump (ii) Gerotor pump</p> <p>Answer:</p> <p>(i) Internal Gear Pump</p>  <p>(ii) Gerotor pump</p> 

Que.No	Marks	
Q 4b)(a)	6	<p>Question: Explain variable displacement axial piston pump with neat sketch.</p> <p>Answer:</p>  <p>Fig. Variable displacement axial piston pump (Sketch 2 Marks and Explanation 2 Marks) Construction and Working: 1. It consists of swash plate which has angular surface with reference to the cylinder block axis. It is used to obtain reciprocating movement of pistons in the cylinder bores. 2. The two or more cylinders are mounted parallel to the axis of driving shaft, the piston rod ends are attached to the angular surface of swash plate with the help of shoe and shoe plate. 3. When driving shaft is rotated it will cause reciprocating movements of pistons in cylinders depending upon the angular surface movement with respect cylinder barrel. 4. It will cause suction of the oil in one cylinder while discharge of high pressure oil in another cylinder. This cycle is repeated for cylinders to give high pressure oil through discharge ports</p>
Q 6 c)	4	<p>Question: Enlist the hydraulic oil manufacturer's in India.</p> <p>Answer: Castrol-Shell-Indian oil</p>
Q 6 d)	4	<p>Question: Enlist applications of hydraulic system.</p> <p>Answer:</p> <p>1 Industrial: Plastic processing machineries, steel making and primary metal extraction applications, automated production lines, machine tool industries, paper industries, loaders, crushes, textile machineries, R & D equipment and robotic systems etc. 2 Mobile hydraulics: Tractors, irrigation system, earthmoving equipment, material handling equipment, commercial vehicles, tunnel boring equipment, rail equipment, building and construction machineries and drilling rigs etc. 3 Automobiles: It is used in the systems like breaks, shock absorbers, steering system, wind shield, lift and cleaning etc. 4 Marine applications: It mostly covers ocean going vessels, fishing boats and navel equipment. 5 Aerospace equipment: There are equipment and systems used for rudder control, landing gear, breaks, flight control and transmission etc. which are used in airplanes, rockets and spaceships. Any four applications</p>

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Q 1a)(i)	4	<p>Question: Write any four applications oil hydraulic systems</p> <p>Answer: Write any four applications of oil hydraulic systems 1. Earth Moving equipments 2. Broaching machine 3. CNC/VMC/HMC Machines. 4. Hydraulic thread rolling machine 5. Hydraulic press brake. 6. Material handling equipments 7. Hydraulic thread rolling machine 8. Hydraulic cranes</p> <p>-----</p>
Q 1a)(ii)	4	<p>Question: What are the effects of contaminants in the oil?</p> <p>Answer: Following are the effects of contaminants in the oil 1) Contaminants in oil make fluid improper or even hazardous for reuse. 2) Excessive heat gets generated during operation of the hydraulic circuit. 3) Electromagnetic radiation contaminated hydraulic system often generates noise thereby polluting the environment. 4) The system operates at lesser efficiency than the desired.</p> <p>-----</p>

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Question:

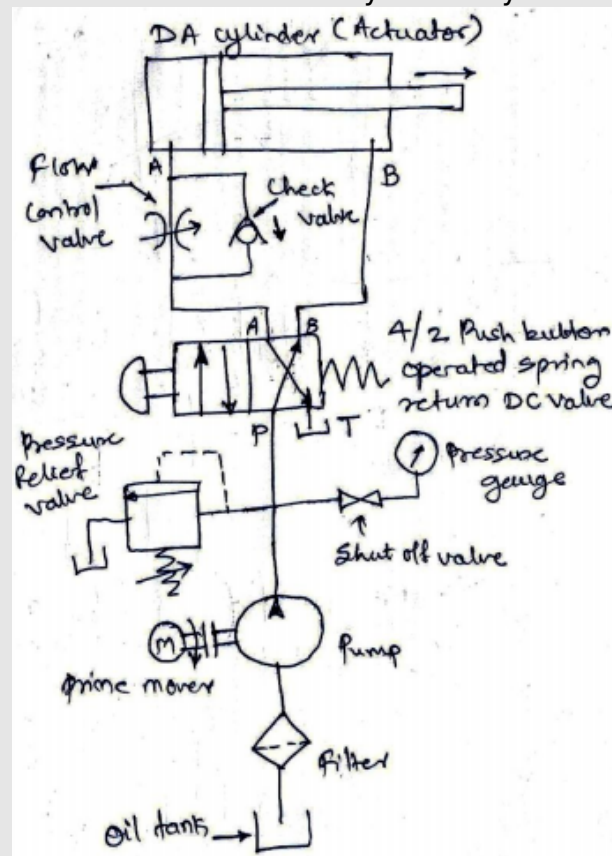
Draw actual hydraulic system and explain its working.

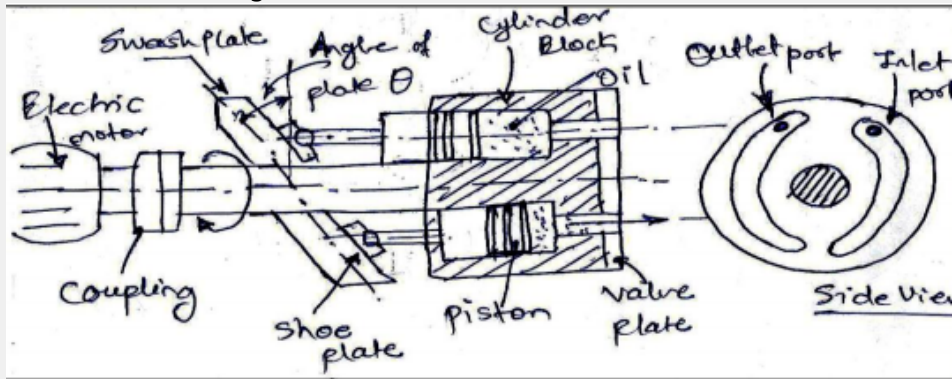
Answer:

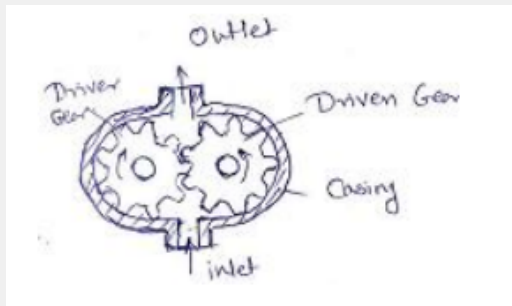
Draw actual hydraulic system and explain its working. Oil hydraulics system uses pressurized oil which is circulated through various components of the hydraulic system to perform the given task. The various components of hydraulic system have to perform its intended function and they are arranged to form a layout of the system as per sequence of operation of hydraulic system. This arrangement of various hydraulic system components as per the nature of equipment/machine is known as actual layout of the system. The oil from reservoir is cleaned by the filter and sucked by the pump when driven by the motor. The pump increases the pressure of oil and high pressure oil is then passed through relief valve to drain excess pressure. Now oil is circulated to the direction to control to the actuator. The oil moves the piston and piston rod to give output force/motion. This motion/force is then utilized for performing the work/task. The oil from the relief valve and outlet of the actuator transferred to the reservoir through drain line and recirculated in the hydraulic system

Q
1b)(i)

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Que.No	Marks	
Q 2 a)	8	<p>Question: What is swash plate? What is its use? What will happen if we change the angle of swash plate? Explain with sketch</p> <p>Answer: It's an inclined plate in axial piston pump on which all pistons are connected through piston rod. This swash plate is usually inclined. Use - It is helps to reciprocate the piston of axial piston pump while the cylinder block is rotating Working: Motor drives the shaft, which in turn rotates the entire cylinder block. The pistons are connected to inclined swash plate through piston rod. Now since swash plate is inclined and block is rotating, the piston reciprocates inside the barrel. The reciprocating motion of piston causes suction and delivery of fluid through inlet and outlet ports which come in front of outlet of piston. If we change the angle of swash plate i.e. θ if a) $\theta = 0$ then no flow of oil, because pistons are at same level. When $\theta = 0$ swash plate is vertical. No reciprocation of piston, hence no flow. b) $\theta = \text{max or } +\text{ve}$, then 'x' will be stroke length which is maximum and there will be maximum forward flow. c) $\theta = -\text{ve}$, then 'x' i.e. stroke length will be maximum in reverse direction and hence there will be reverse flow. By changing the swash plate angle we can vary the stroke length of the piston. and also output flow can be changed.</p> 
Q 3 a)	4	<p>Question: Write any four advantages of oil hydraulic system.</p> <p>Answer: We can generate very high pressures in hydraulic system. Due to this nature of hydraulic system we can use this power to lift, hold, press very heavy loads 2) Weight to power ratio of a hydraulic system is comparatively less than that of an Electro-Mechanical System. Electric motor weigh appropriately 8.5 Kg/kW whereas, same power hydraulic motor weighs 0.85 kg/kW only. 3) The speed control of linear as well as rotary actuators can be achieved with ease. By merely adjusting small flow control valve, wide range of speed and feed can be obtained. 4) The system provides instant and smooth reversible motion</p>

Que.No	Marks	
Q 5 b)	8	<p>Question: Explain construction and working of gear pump.</p> <p>Answer: It consists of a pump housing in which a pair of precisely machined meshing gears runs with minimal radial and axial clearance as shown in fig. One of the gears, called a driver, is driven by a prime mover. The driver drives another gear called a follower. As the teeth of the two gears separate, the fluid from the pump inlet gets trapped between the rotating gear cavities and pump housing. The trapped fluid is then carried around the periphery of the pump casing and delivered to outlet port. The teeth of precisely meshed gears provide almost a perfect seal between the pump inlet and the pump outlet. When the driver is rotated by prime mover and driven will also rotate. Thus partial vacuum is created at the inlet of the pump. Fluid is forced to enter into the pump at atmospheric pressure. Fluid is trapped in the pockets between teeth and the casing and carried towards the outlet port.</p>
		
Q 6 a)	4	<p>Question: In cold climate why oil tank is equipped with oil heaters? Explain.</p> <p>Answer: Oil heaters: □ When hydraulic circuit works in cold climate, then oil is solidifies below 5 o C temperature. □ To liquefy the oil electrical heater or thermostatic heater are equipped with oil tank. □ This increase the operating and maintenance cost of hydraulic system □ The cost of hydraulic system is higher. □ It heats the oil so that its viscosity increases and it can flow in the system smoothly. □ Thermostatically controlled oil heater commonly used</p>