IV / IV B.Tech REGULAR DEGREE EXAMINATIONS

JAN / FEB - 2021
Sub code: 14OE706
Sub Name: Automation Technology

scheme and evaluation of the subject "Automation Technology(14OE706)"

1. what is the advantage and disadvantage of hydraulic systems?

A Advantages: accuracy, efficiency and ease of maintenance

Disadvantages: leakage of tubes causes messy.

2. Mention the differences between hydraulics and pneumatics?

A Hydraulics we use them for high pressure and large forces
Pneumatics: used for instrumentation purpuse.

3. Mention the applications of pneumatics in engineering ?

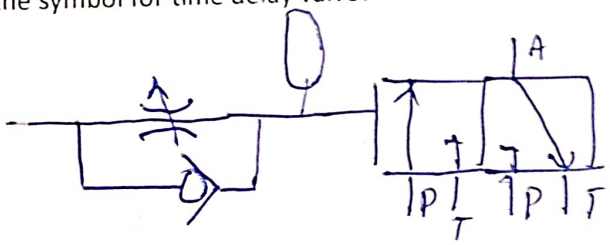
A They are mainly used for instrumentation purpose.

4. Name the basic components of hydraulic system

A Hydraulic source, oil, pumps and regulator

5. Sketch the symbol for time delay valve?

A

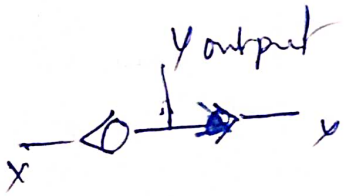


6. Define stroke length?

A It is the distance travelled by the piston in one revolution is calledm stroke length.

7. Give the graphic symbol for shuttle valve

A



8. Deference between sensor and transducer?

A **sensor is** used to measure the physical changes that occur **in the** surroundings like temperature, light, etc, and convert it into a readable signal.

A **transducer is** a device that **is** used to convert a non-electrical signal into an electrical signal

9. What is force sensor?

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A Force sensors are responsible for measuring the force acting on an object

- Pneumatic load cells
- Hydraulic load cells
- Piezoelectric crystal load cells
- Inductive load cells

any two examples

10. Define resolution?

A The smallest value that can be measured by the instrument is known as resolution.

11. What is the liquid flow measuring device?

A Orifice flow meter
Venturi flow meter

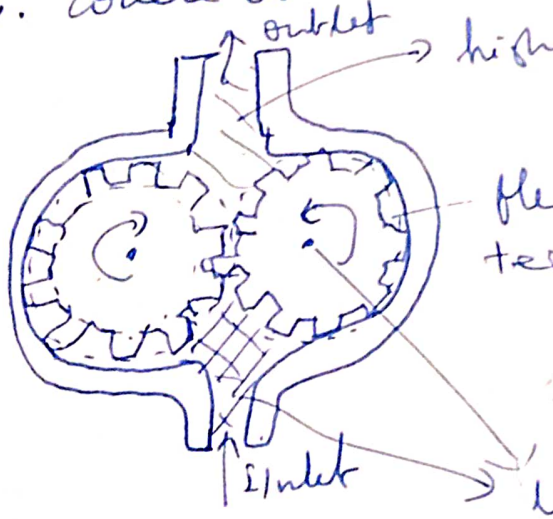
12. Define programmable logic controller?

A A programmable logic controller (PLC) or programmable controller is an industrial digital computer that has been ruggedized and adapted for the control of manufacturing processes,

Qas. Explain the working principle of gear pumps and determine its performance?

Ans The gear pump is a positive displacement pump and having two movable parts. The parts are non reciprocating type and moves with constant speed. and experience uniform force.

As the teeth come out of the mesh at the centre, a partial vacuum is created which draws fluid into the inlet chamber. The fluid is trapped between the outer teeth and the pump housing. causing a continual transfer of fluid. from inlet chamber to the outlet chamber. where it is discharged to the system.



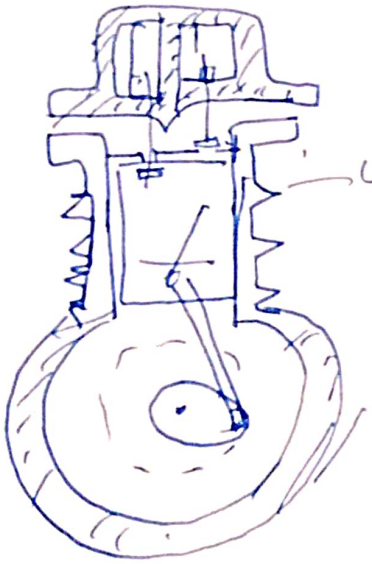
Gear pump.

The performance of the pump is limited by the leakage and ability of the pump to with stand the pressure differential between the input and output ports. Typically gear pumps are used at pressures up to about 150 bars. Volumetric efficiency is about 90%.

and:

2(b) Explain and working of a compressor with a neat sketch

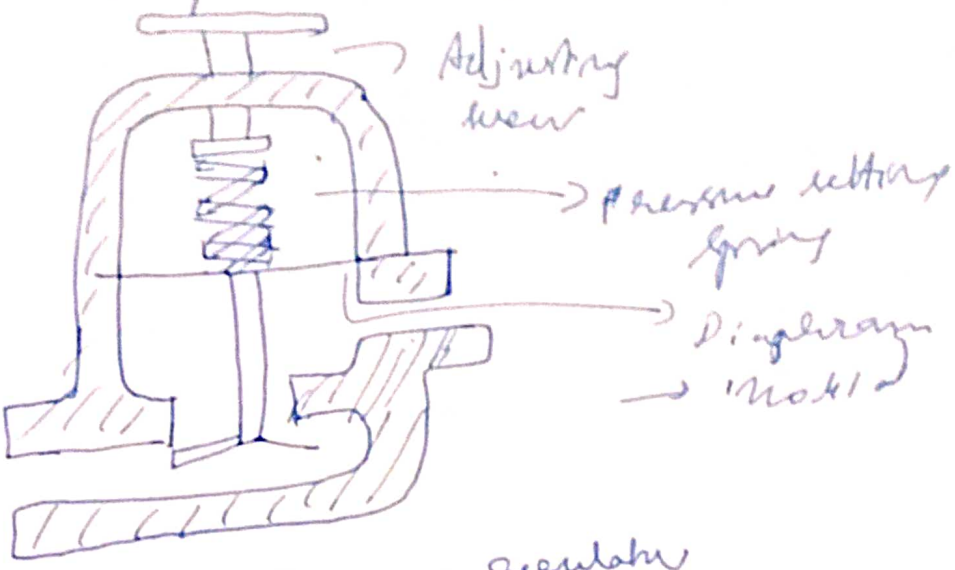
Ans. The pneumatic system uses compressed atmospheric air as the operating medium. The pneumatic systems uses compressed gases for as an operating medium. A compressor is selected by the pressure it should be operated to meet the requirements & loads. The pressure in the receiver is generally higher than the transmitter. At the receiver the regulator is used to control the pressure manually or automatically. The simple compressor is the piston compressor as shown in figure below



Valve of the Compressor

A compressor which produces one pulse of air per piston stroke is called single acting cylinder on the other hand it produces two pulses of air per piston strokes is known as double acting cylinder —

3. (a) non & relieving pressure regulator

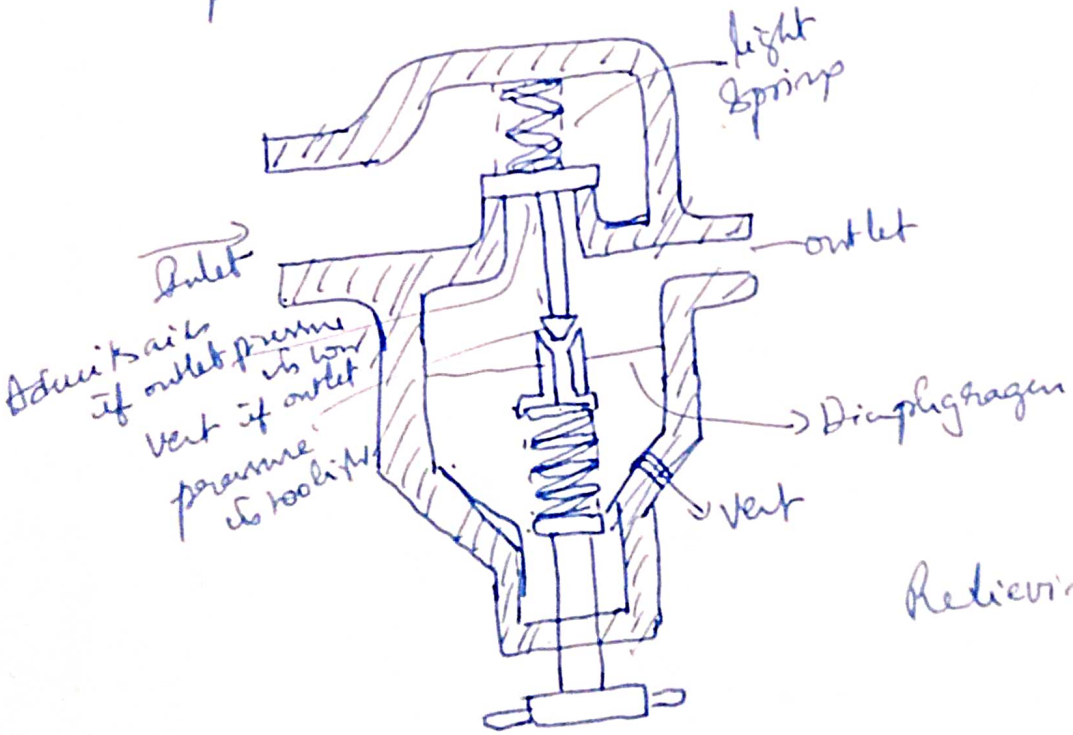


non relieving pressure regulator

If the outlet pressure is too low the spring forces the diaphgram and poppet down opening the valve to admit more air. and raise outlet pressure.

Relieving pressure regulator

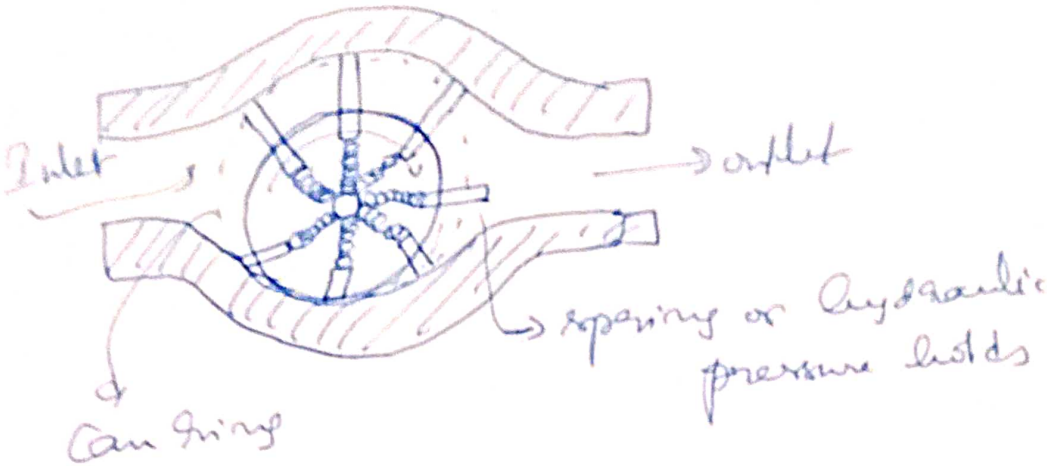
The outlet pressure is sensed by the diaphragm pre loaded with adjustable pressure.



Relieving pressure regulator

3(a) Explain the working of vane pumps with a neat sketch

Ans The vane pumps reduces leakages by using spring loaded vanes slotted into driven rotor



The rotor is offset with in the housing and the vanes constrained by cam rings as they cross inlet and outlet ports.

Because the vane tips are held against the housing there is little leakage and the vanes compensate to a large degree for wear at ~~the~~ vane tips or in the housing itself. pump capacity is determined by the vane thickness vane cross sectional area and speed of rotation.

The difference in the pressure between inlet and outlet ports creates severe load on the vanes and large radial loads on the rotor shaft which can lead to bearing failure. This pump consequently is known as unbalanced vane pump.

4. Pneumatic Actuators. and explain the types of linear actuators?

A. The hydraulic and pneumatic system is generally concerned with the moving, gripping and applying force to an object. Devices which achieves this objective is called actuator and they are of two types.

1. linear actuators
2. rotary actuator

Linear actuators:

The basic linear actuator is a cylinder where the cylinder consists of piston with rod moving in bore. The piston is connected to a rod of radius R which drives the load. When pressure is applied to a port then the piston extends or retracted based on the construction of the actuator.

The force applied is dependent on pressure and the area

for extension Area is A and pressure 'P' and the force applied is given by

$$F = PA.$$

The radius of the piston is R and hence the area on which pressure applied is given $A = \pi R^2$

and force obtained $= F = P \cdot \pi R^2$

The force exerted during retraction is given by,

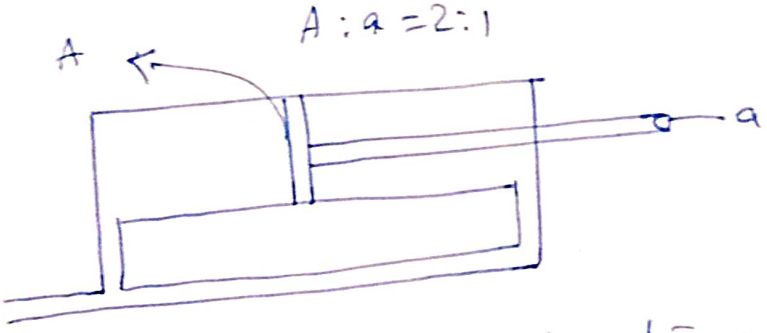
$$F = P \cdot a = P(\pi R^2 - \pi r^2)$$

The retraction force is lower than the extension force.

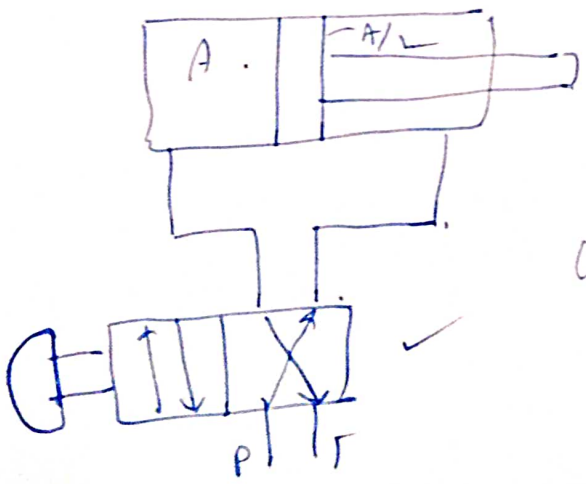
Consider the extended force is represented by f_e and retraction force is given by f_r

$$f_e > f_r$$

If the ratio of A to a is 2:1 then the extention force is twice that of the retraction force and to make the extension and retraction forces both same then the cylinder actuator is connected as follows



The cylinder with equal extension and retraction force

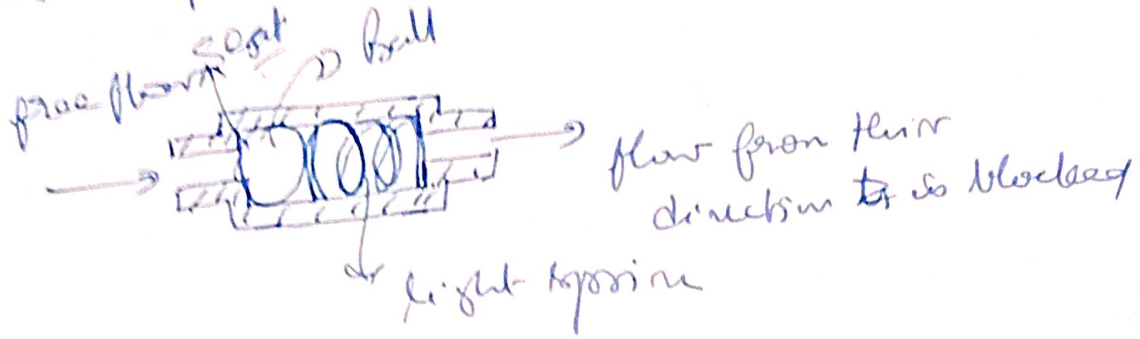


Cylinder with equal extension and retraction forces

(a) Explain the construction and working of the following components

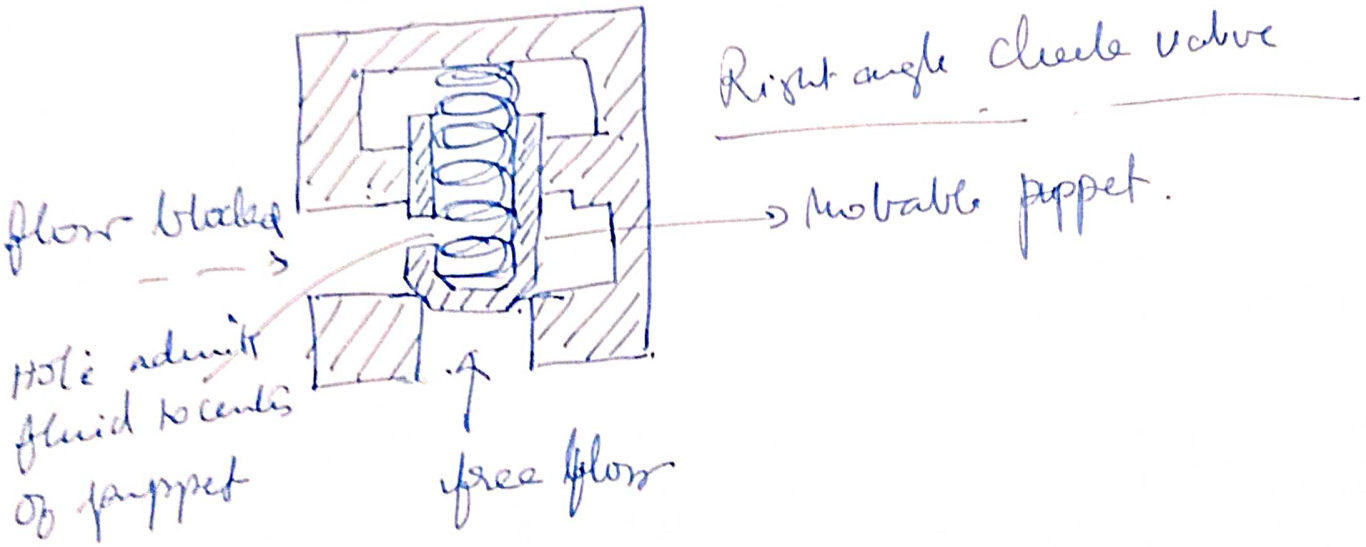
(i) Check Valve

The check valve allow flow in one direction. and is similar to the operation of diode. The simplest construction is the Ball and Seat arrangement. and is commonly used in pneumatic systems. The right angle construction is better suited to higher pressures



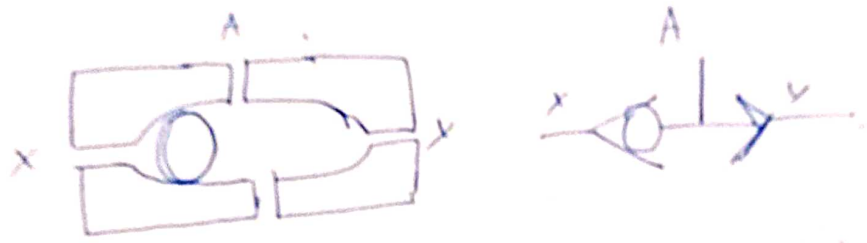
Check Valve

Right angle check valve



(b). A shuttle valve is also known as double check valve. allows pressure in a line to be obtained from alternative sources. It is primarily a pneumatic device and is hardly found in hydraulic systems.

The construction of shuttle valve consists of a ball inside a cylinder. as shown in the figure



If pressure is applied to port x the ball is blown to the right blocking y and binding port x and A. Similarly from other direction also.

6. (a) principle characteristics of sensor.

→ Range and span
→ error
→ Accuracy
→ sensitivity
→ Hysteresis
→ Non linearity error
→ Repeatability
→ Stability.
→ dead time.
→ Resolution.
→ output impedance

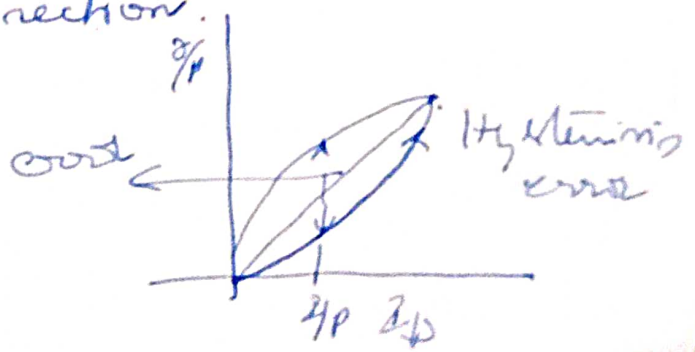
Range and span: the range of transducer defines the limit in which the input can vary.

span: It is the difference between the maximum value and minimum value.

error: It is the difference between the measured value and the true value.

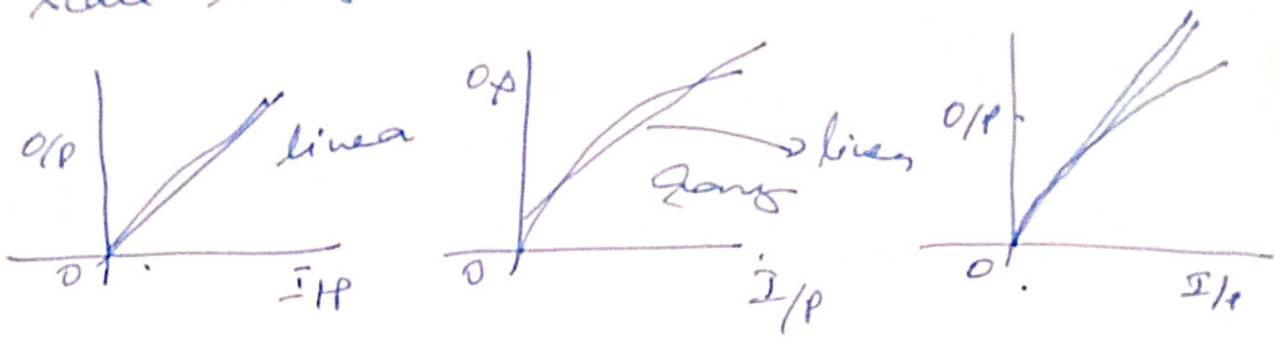
Accuracy: It is the conformity of indicated value to an accepted standard or true value.

Hysteresis: The effect in which a measured value differ from the same value of the input if the input is applied in an increasing direction or decreasing direction.



Sensitivity: The smallest value that can be recognized by the transducer

Non linearity error: For successive equal increments of the input the linearity is the deviation of the plotted transducer output from a straight line. This is often defined in terms of the % of the full scale range.



Repeatability.

The repeatability of a transducer is used to describe the ability to give same output for repeated application of the same input.

Repeatability :- $\frac{\text{Max} - \text{min value given}}{\text{full range}} \times 100\ \%$.

(5). Methods used for temperature measurement.

→ Thermistor
→ Thermocouple
→ Bimetallic strip

(7) Write various parameters to be considered in selecting a sensor for given application