Scheme of Evaluation.

Fluid Mechanics & Pneumatics

Question No:	Scoring Indicator	Split up score	Sub Total	Total
I	**Part A**			
1)	Ideal Fluid - Incompressible, No Viscosity Real Fluid – Fluids which posess Viscosity	1 1		2
2)	Fluid is Ideal. Flow is Steady, Incompressible Irrotational, one dimensional			2
3)	Accurate Speed, Simple & cheaper maintenance Reduced Vibration, Easy control of Speed Uniform Torque, Low cost (Any 4)	½ each		2
4)	Mining, Press Work, Power hammers, Air brakes, Material handling (Lifts, Cranes) Machine tools (Any 4)	½ each		2
5)	Absolute pressure - Pressure measured with ref to absolute Vacuum pressure It is the Sum of atmospheric and gauge pressure	1		2
	Gauge Pressure - Pressure measured with a device with atmospheric pressure as datum.	1		

Qn No:	Scoring Indicators FMP (3) (2)	Split Score	Sub Total	Total
	Part B			
II				
1)	Stable Equillibrium - Meta Center above CG. On giving a small tilt Weight & Upthrust will form a restoring couple	2		6
	Unstable Equillibrium - Metacenter below CG. On giving a small tilt, body will not be restored to easly position	2		
	Neutral Equillibrium : Meta Center & CG Coincide. Body will remain in eqbm even when tilted.	2		
2)	Orifice / Notch			
	Small Opening in the Side of a tank / Large Opening on a tank or dam	Any 4	1½ each	6
	Upper edge below free Surface / Upper edge above free Surface			
	Large Head Compared to Orifice dimension / Small head Compared to Notch dimension			
	Stream of water flowing is termed as jet / Here it is known as Nappe or Vein			

I

(3) Losses due to

1) Sudden enlargement of Pipe Crosssection
2) Sudden Contraction " " "
3) Bend in Pipe
4) Pipe fittings
5) Obstruction in Pipe
6) Loss of head at inlet
7) Loss of head at exit

Any 6 — 1 mark each — 6

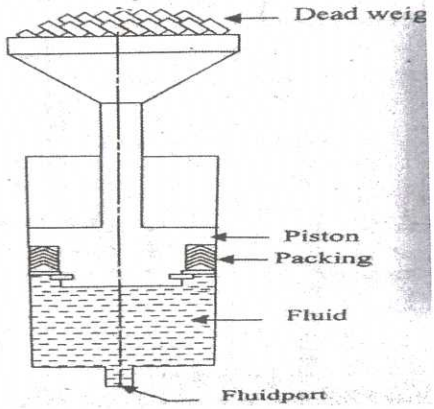
(4)

Consists of Vertical, heavy wall Steel cylinder with a piston. Dead weight is attached to the piston. Force of gravity of the dead weight provides PE to accumulator. This type of accumulator creates a Constant fluid pressure throughout the full volume output of the unit regardless of rate and quantity of output

Disadv: Large size and heavy weight

3 — 6

(6)



3

Weight loaded

5. Pumps in which fluid displacement is accomplished mechanically are called Positive displacement pumps. It lifts a given volume of fluid for each cycle. Volume displaced depends on stroke length & Cross sectional area of piston.

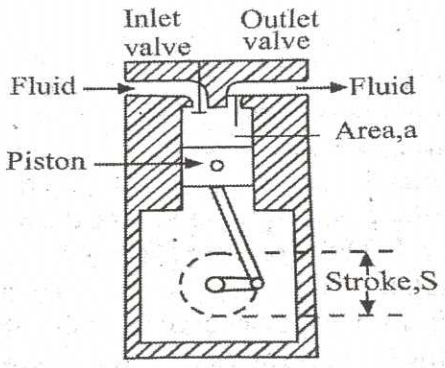


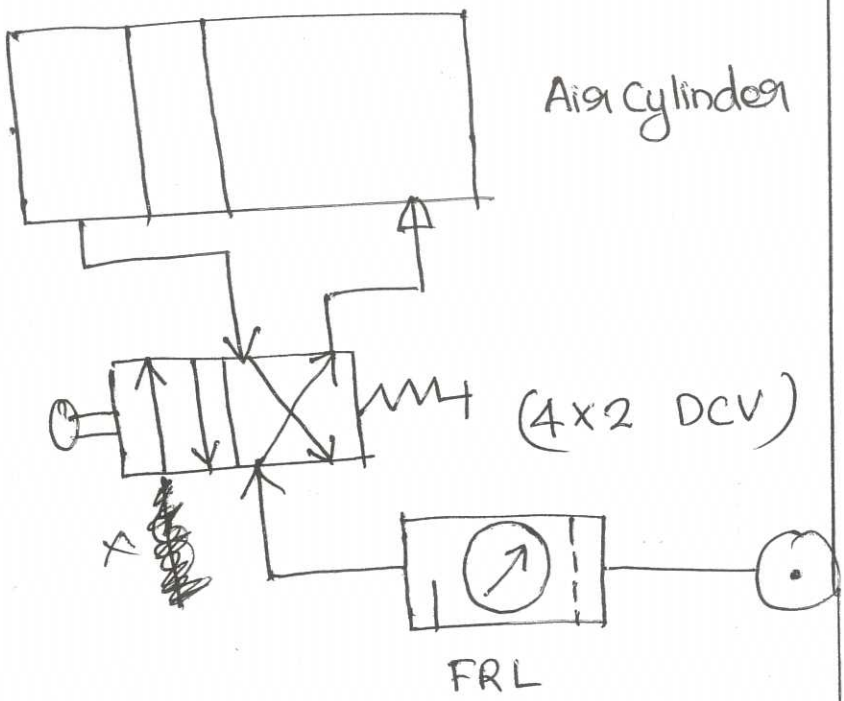
Fig-3

Expn-3

6

As inlet valve opens, fluid is drawn in. As piston moves up Inlet closes, outlet valve opens driving same volume of fluid to pump outlet

6.



6 6

~~Circuit diagram~~

7. Advantages

i) Constant Speed on Variable load (Any 3) 3

2) Simple maintenance

3) Low Operating Cost 6

4) Higher Speed

Applications

1. Press work
2. Moulding machines (Any 3) 3
3. Automobile Elevators
4. High Pressure Clamping device

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III a) i.	Specific Volume = $\frac{\text{Volume of fluid}}{\text{Mass of fluid}}$	2		
ii)	Kinematic Viscosity = $\frac{\text{Dynamic Viscosity}}{\text{Density}}$	2		
iii)	Specific gravity = $\frac{\text{Weight density of liquid}}{\text{Weight density of water}}$	2		8
iv)	Compressibility = Ability to change Volume under Pressure	2		
III b)	$a = 4m \times 6m = 24m^2$			
	$\bar{h} = 2.5m$	1		
	$S = 0.9$			7
	$\rho = S \times 1000 = 900\ kg/m^2$	1		
	Intensity of Pressure, $P = \rho g \bar{h}$ $= 22072.5\ N/m^2$	(2)		
	Total Pressure = $\rho g a \bar{h}$ $= 529740\ N/m^2$	(3)		

IV a.

$S_1 = 0.8$ Height of mercury = 90mm

$S_2 = 13.6$ $h_2 = 150mm$.

$h_1 = 150 - 90 = 60mm$

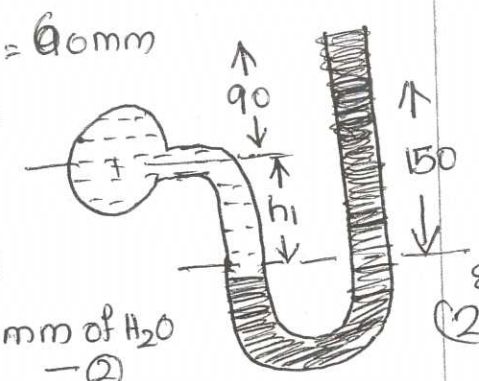


Fig - 2 marks

Left limb (2 marks)

$h_1 + S_1 h_1 = h + (0.8 \times 60)$

$= h + 48$ — ①

Right limb $S_2 h_2 = 2040mm$ of H_2O — ②

Equating $h + 48 = 2040$, $h = 1.992m$ of H_2O

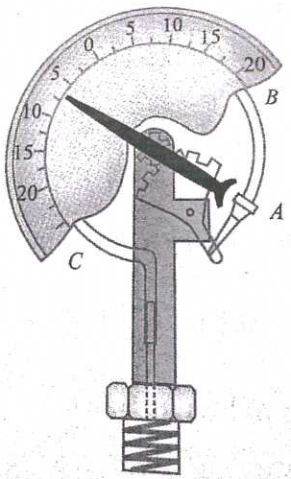
Eqn (2 marks)

3 marks

$P = \omega h = 19.54 \ kN/m^2$

8

IV (b)



3

Pressure above or below atmospheric P can be measured. In simplest form it consists of an elliptical tube bent into an arc. When gauge tube is connected to fluid, fluid flows into the tube. Tube straightens Sine Tube is encased in a Circular cover, it extends to become Circular. With the help of pinion and sector arrangement, the elastic deformation rotates the ~~pinion~~ pointer.

7

4

V

a.

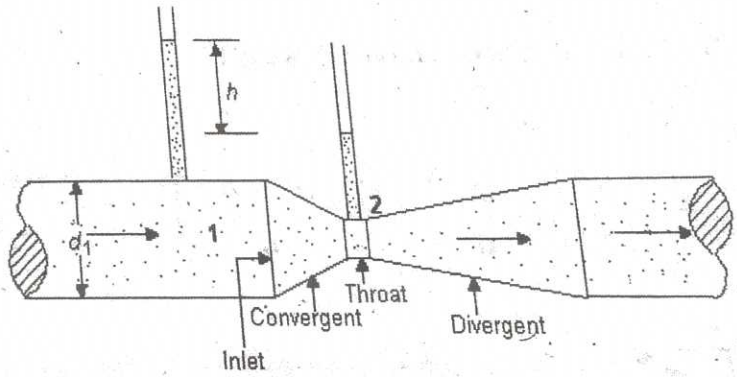


Fig 2 marks 2

Application of bernoulles theorem. 2

Consists of 1. Shoat Convergent Part
2. Throat 3. Divergent part

$$\frac{P_1}{\rho g} + \frac{V_1^2}{2g} + Z_1 = \frac{P_2}{\rho g} + \frac{V_2^2}{2g} + Z_2$$

$Z_1 = Z_2$ (Pipe is horizontal)

$$\frac{P_1 - P_2}{\rho g} = \frac{V_2^2 - V_1^2}{2g}$$

$$h = \frac{V_2^2 - V_1^2}{2g}$$

$a_1V_1 = a_2V_2$, $V_2 = \frac{a_2V_2}{a_1}$

$$h = \frac{V_2^2 - \left(\frac{a_2V_2}{V_1}\right)^2}{2g} \quad \therefore V_2^2 = 2gh\frac{a_1^2}{a_1^2 - a_2^2}$$

$$V_2 = \sqrt{2gh}\,\frac{a_1}{\sqrt{a_1^2 - a_2^2}}$$

$$Q = a_2V_2 = \frac{a_1a_2\sqrt{2gh}}{\sqrt{a_1^2 - a_2^2}}$$

C_d - Part $Q_{act} = C_d\, a_1a_2\sqrt{2gh}$

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Scheme of Evaluation

Fluid Mechanics & Pneumatics

Question No:	Scoring Indicator	Split up Score	Sub Total	Total
V b.	$l = 60m$ $d = 150mm = 0.15m$ $h_f = 2.6m$ $f = 0.01$	1		
	Loss of head due to friction $h_f = 2.6 = \frac{0.5V^2}{2g} + \frac{4flV^2}{2gd} + \frac{V^2}{2g}$	4		7
	$= \frac{V^2}{2g}\left(0.5 + \frac{4 \times 0.01 \times 60}{0.15} + 1\right)$			
	$= \frac{17.5V^2}{2g}$			
	$V = 1.71 m/s$			
	$Q = a \times V = 0.302 m^3/s = 30.2$ lites/s	2		
VI a.	Expression for discharge is more Simple			
	Suitable for low discharges			
	One one reading, H is required for Computing discharge			

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Scheme of Evaluation

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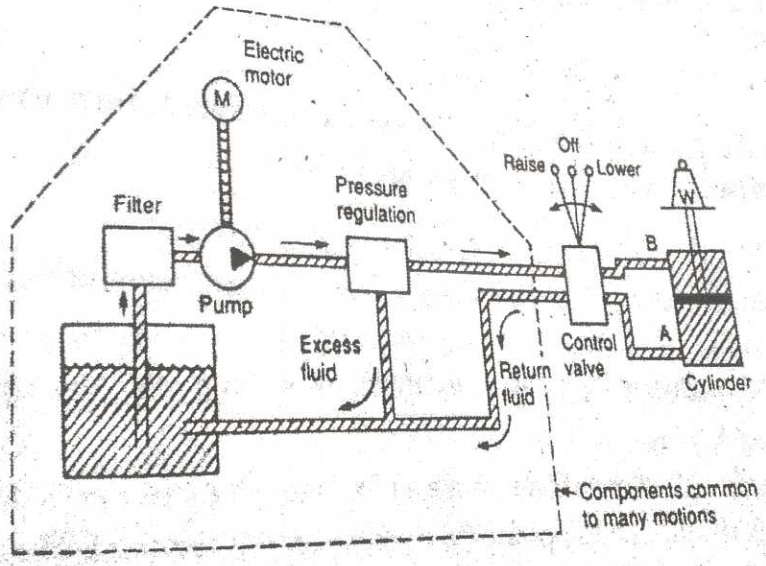
Question No:	Scoring Indicator	Split up Score	Sub Total	Total
	No need for Ventilation. Can measure wide range of flows Head over triangular notch is independent of wetted edge For rectangular notch width of notch crest is constant for all heads by which results are affected.	6 points	8	8
VI b.	$d_1 = 150_{mm}$ $d_2 = 100mm$ $S = 0.9$ $h = 200mm$ $C_d = 0.98$ $a_1 = 17.67 \times 10^{-3} m^2$ $a_2 = 7.854 \times 10^{-3} m^2$	2		7
	$h = 0.2 \left(\frac{13.6 - 0.9}{0.9}\right) = 2.82$ m of oil	@ 1		
	$Q = \frac{C_d a_1 a_2 \sqrt{2gh}}{\sqrt{a_1^2 - a_2^2}} = 63.9 \times 10^{-3}$ m³/s $= 63.9$ litres/s $= 3834$ litres/min	4		

VII

a.



4

Tank - To hold hydraulic oil

Pump - To force oil through System

Electric motor - to drive pump.

Valves - To control oil direction, Pressure, flow rate

Actuator - To convert Pressure to mechanical force.

4

Piping - To Carry oil from one location to another

8

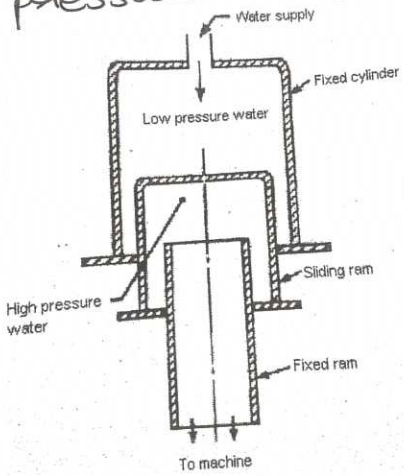
VII

b. Used to increase the pressure in a hydraulic System to a value above pump discharge pressure. It accepts a high volume flow at low pump pressure and converts a portion of this flow to high P. It consists of a fixed ram surrounded by a hollow

Sliding cylinder which itself is engaged with in a bigger and fixed cylinder. Fixed ram and fixed cylinder are provided with low P fluid Liquid under low pressure, presses sliding ram on top forcing it downward to fixed ram, increasing the intensity of pressure of liquid

4

8



4

VIII

a.

To start and Shut off flow
To regulate pressure through a System
To Control and limit flow to actuator
To release pressure of oil in the System.
To prevent back flow of oil to reservoir
To reduce existing pressure of oil Supplied by oil pump.
To perform predetermined operations.
To amplify pressure
To permit use of analog and digital Control in automation.

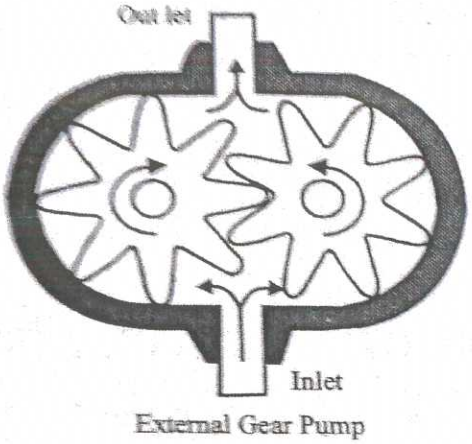
Any Eight point

1 mark each

8

VIII

b



External Gear Pump

Figure – 4
Expln – 4
Total – 8 mark

Can discharge fluid in both direction.
Suitable for low & medium head
Low cost, high efficiency
Subjected to clogging

Simplest of positive displacement pump. Consists of 2 meshing gears, one driven & other free. As teeth comes out of mesh, Partial Vacuum is created, and fluid is drawn in. Then it is transfered to other side by rotating gear teeth & casing

VIII

a.

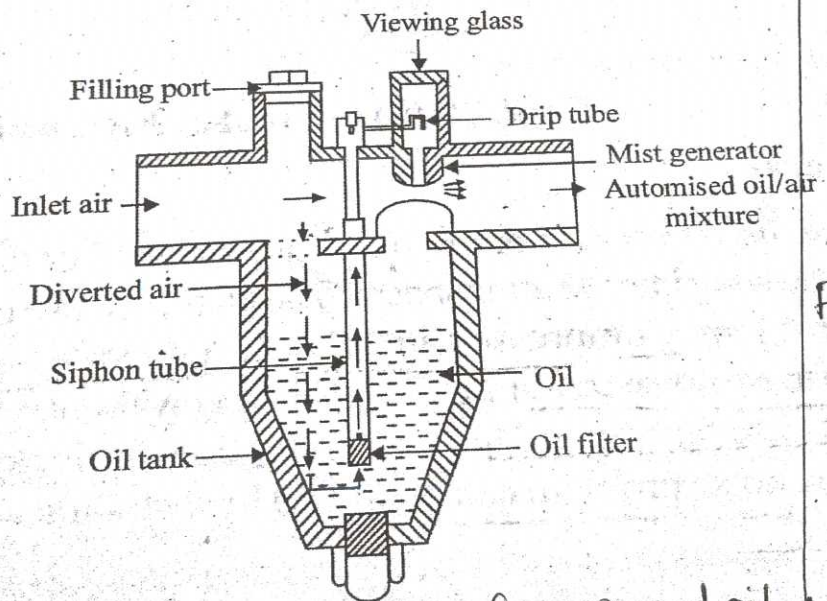


Figure - 4 marks

Purpose is to produce a mist of air and oil for proper lubrication of internal moving parts.

Expln - 4 marks

Air pushes the oil through Siphon tube

Total - 8 marks.

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Scheme of Evaluation

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Question No:	Scoring Indicator	Split up Score	Sub Total	Total
	then transfered through Centre of Vaeuable oriBice & enters mist generatoa, mixing with oil delivered by dip tube. Air oil mixture rejoins remaeney aia and Continues towards final desbination.			
b.				
	Hydraulic — Pneumatic			
	Limited Speed — High Speed			
	Suitable for feed — Unsuitable	1 mark each (8 points)		7
	Overall Cost is high — Overall Cost is Low			
	Weight to Pressure ratio is low — High			
	Cylinder Cushioning may or may not be needed — Not needed			
	Pump is necessary — No need of Pump			
	Good rigidity — Poor rigidity			

X

a. Used in automatic lathes, boring machines etc Consists of air cylinder, with piston rod passing through hollow spindle of machine, and connected to 3 jaws by lever.

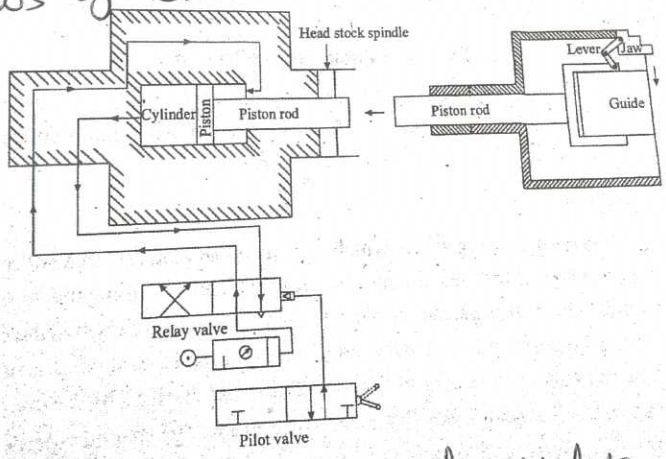


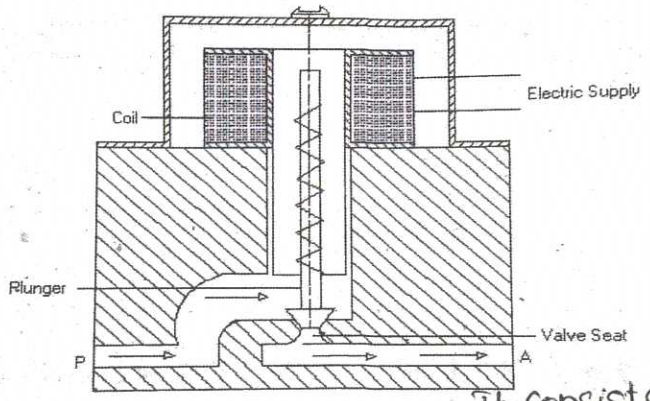
Figure 5marks

Air is supplied by a relay valve, keeping pilot valve in holding position. High Pair enters right side of piston, moving it leftwards actuating a lever which moves the jaws towards centre of the chuck. After machining jaw is released by passing air to left side of the piston by changing position of relay valve

Expln 3

8

b.



4

It consist of Copper coil

It is basically a electromagnet. ~~Piston~~ solenoid is provided with a moving piston inside it. Connected to a actuator.

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Question No:	Scoring Indicator	Split up Score	Sub Total	Total
	Valves are used when large force is required to actuate the valve It is a 2 way valve, normally closed. When electric supply is given, coil is magnetised and the piston moves up, lifting the valve It can be used for three way or four way valve operation.	3		8 7