MAHARASHTRA STATE BOARD OF TECHNICAL EDUCATION

(Autonomous)

(ISO/IEC-270001 – 2005 certified)

SUMMER-14 EXAMINATION

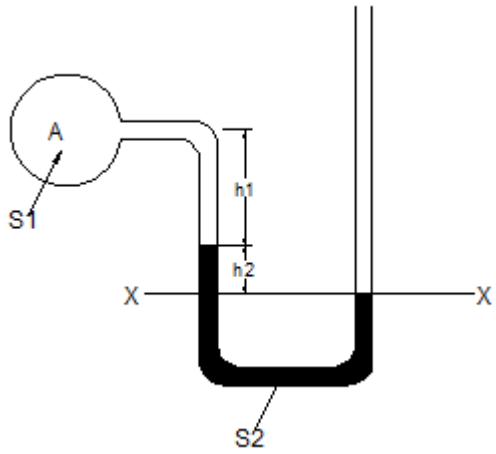
Subject code: 17421 **Model Answer** Page No: 1/20

Important Instructions to examiners:

1) The answer should be examined by keywords 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 error such as grammatical, spelling errors should not be given more importance.(Not applicable for subject English and communication skill).
4) While assessing figures, examiner may give credit for principal components indicated in the figure. The figure 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 the some cases, the assumed constants values may vary and there may be some difference in the candidates answer and model answer.
6) In case of some questions credit may be given by judgment on part of examiner of relevant answer based on candidates understanding.

Q1) A).Attempt any Three of the following	12
i)Define real fluid and give one example	
Real Fluid:-A fluid, which posses viscosity, is known as real fluid. **Practical Example:-** All Fluids are Real Fluid.	1 1
ii) State Pascal's law of fluid pressure..	
Ans :-Pascal's Law:-Pascal's Law states that the pressure or intensity of pressure at a point in a static fluid is equal in all directions	2
iii) Define total pressure.	

Total Pressure:-Total pressure is defined as the force exerted by a static fluid on a surface either plane or curved when the fluid in contact with the surfaces .	2
iv) State the devices used for pressure measurement in pipe.	
Ans:- The Following are the Pressure measuring devices a) Manometers Piezometer. Simple Manometers. Differential manometers. b) Mechanical Gauges Bourdon tube pressure gauge. Dead weight pressure gauge.	 1 1
v)State the practical example for steady non uniform and unsteady non uniform flow.	
Steady non-uniform flow:- Flow of water in a pipe of uniform diameter. Constant discharge through pipe. **Unsteady non-uniform flow:-** The flow of water in a river, nallas	1 1
vi) Define HGL and TEL.	
HGL:- HGL is defined as the line which gives the sum of pressure head and datum head of a flowing fluid in a pipe with respect to some reference line. **TEL:-** TEL is defined as the line which gives the sum of pressure head ,datum head and kinetic head of a flowing fluid in a pipe with respect to some reference line.	1 1
vii) What is equivalent pipe?	
. **Equivalent Pipe:-**Equivalent pipe is defined as the pipe of uniform diameter having loss of head and discharge equal to the loss of head and discharge of a compound pipe consisting of several pipes of different lengths and diameters. **OR** A compound pipe consists of several pipes of different lengths and diameters. These several pipe of different lengths and diameters can be replaced by a pipe of uniform diameter and one length. Hence equivalent pipe is a single pipe of uniform diameter whose discharge and loss of head are same as that of compound pipe.	2 2

viii) define Froude's number	
The Froude's number is defined as the square root of the ratio of inertia force of flowing fluid to the gravity force. Fe = $\sqrt{\frac{Fi}{Fg}}$	2
B)Attempt any **Two** of the following	8
i)If specific gravity of oil is 0.80 what is specific weight in N/m2	
.**Given data:-** S_{oil} = 0.80 To find, γ_{oil} Solution:- S_{oil}= γ_{oil}/γ_w ---------- 0.80 = γ_{oil}/9810---------- γ_{oil}= 0.80 x 9810---------- γ_{oil} = 7848 N/m^3----------	1 1 1 1
ii)**How will you measure negative pressure?**	
Mercury in the U-tube is deflected by h_2 due pressure at point A,as deflection occurs in the left limb indicates that, pressure at A is negative (vacuum), pressure above the horizontal datum x-x in the left and right limb of the manometer should be same  Pressure above x-x in the left limb = $S_1h_2 + S_1h_1 + P_A$---------- Pressure above x-x in the right limb = 0 P_A = - (S_1h_2 + S_1h_1)----------	1 1 1 1
iii) State any four different between simple and different manometers.	

U- tube differential manometer	U- tube inverted differential manometer	*
1) It is a device used for measuring the difference of pressure between two points in a pipe 2) A differential U-tube manometer consists of regular U- tube 3) It contains heavy measuring liquid than flowing liquid. 4) This type of monometer measures positive pressure difference 5) Less sensitive comparative to U-tube inverted differential manometer 6) Sketch	1) It is a device used for measuring the difference of pressure between two points in a pipe 2) A differential U-tube manometer consists of inverted U- tube 3) It contains lighter measuring liquid than flowing liquid 4) This type of monometer measures Negative pressure difference 5) More sensitive comparative to U-tube differential manometer 6) Sketch	

**(Any four Points each 1 Mark each)*

Q.2 Attempt any **Four** of the following

a) A 400 ml of certain fluid weight 7.25 N calculate specific weight and specific gravity of liquid.

Given data:-

W = 7.25 N

V= 400 ml = 0.4 Litre = 0.4/1000 =0.0004 m^3

To find, γ_{oil}, S_{oil}

Solution:-

$\gamma_{oil} = W/V$ ---------- 1

$\gamma_{oil}= 7.25/0.0004 = 18125\ N/m^3$ ---------- 1

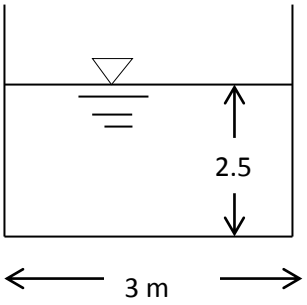
$S_{oil}= \gamma_{oil}/\gamma_w$ ---------- 1

$S_{oil}= 18125/9810$

$S_{oil}= 1.848$ ---------- 1

b) A vertical tank square in plan has side 3 m .It contains oil of sp.gravity 0.4 upto depth of 2.50 m .Calculate the total pressure on bottom and on one side of tank.

Data : L=3m,b=3m,d=2.5m
To find : i) Total Pressure on 3m side of tank
ii) Total Pressure on bottom of tank



i) **Total Pressure on bottom of tank,**

$F = W. A. \bar{x}$

$= 0.4 \times 9810 \times (3x3) \times (2.5)$

$= 88.29 \times 10^3$ N

F = 88.29 kN ----------

2

ii) **Total Pressure on 3m side of tank**

$F = W. A. \bar{x}$

$= 0.4 \times 9810 \times (3x2.5) \times (^1/_2 x2.5)$

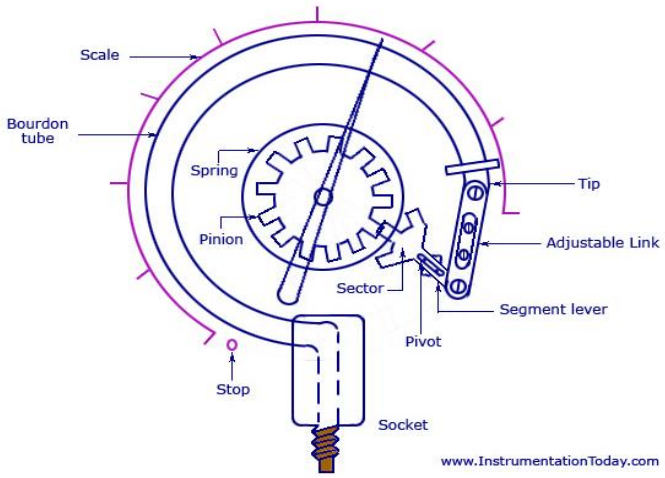
$= 36.89 \times 10^3$ N

F = 36.785 KN ----------

2

b) Explain with sketch bourdon's tube pressure gauge.

Diagram :



Bourdon Tube Pressure Gauge

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Bourdon tube pressure gauge is used to measure high pressure. It consists of tube as shown in fig. having elliptical cross section. This tube is called as Bourdons Tube. One end of this tube is connected the point whose pressure is to be measured and other end free. When fluid enters in the tube elliptical cross section of tube becomes circular. Due to this the free end of tube shifts outward. This motion is transferred through link and pointer arrangement. The pointer moves over a calibrated scale, which directly indicates the pressure in terms of N/m^2 or m head of mercury.

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d) Find the vacuume pressure in a pipe containing a liquid of specific gravuity 0.85 as show in Figure

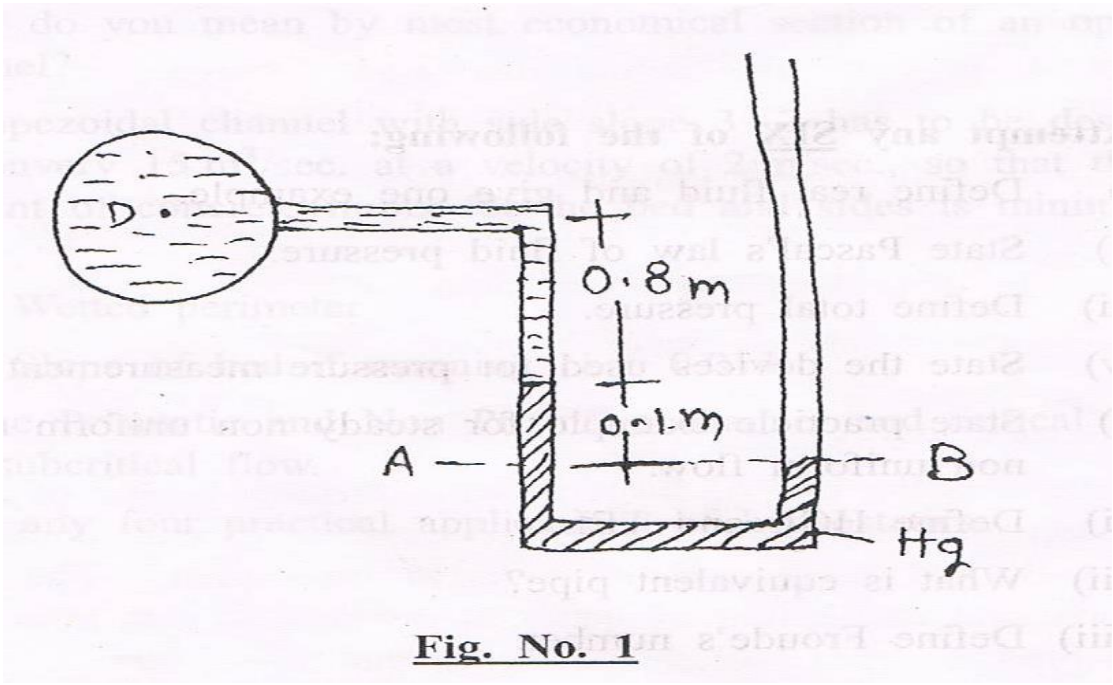
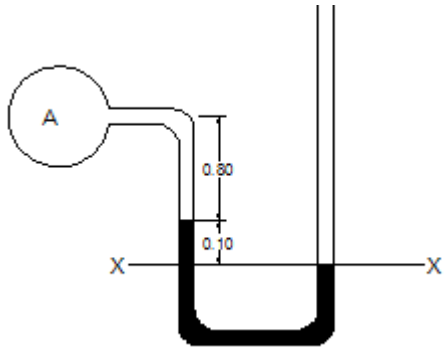


Fig. No. 1

Diagram :



1

Pressure above x-x in the left limb = $S_2h_2 + S_1h_1 + H_A$ ---------- 1

Pressure above x-x in the right limb = 0

$H_A = -(S_2h_2 + S_1h_1)$

$H_A = -(0.85 \times 0.8 + 13.6 \times 0.1) = -2.04$ m ---------- 1

$P_A = \gamma_{oil} \times H_A$

$P_A = 0.85 \times 9810 \times (-2.04) = -17010.54\ N/m^3$ ---------- 1

e) **Differentiate between laminar and turbulent flow**.

Laminar Flow	Turbulant flow
1) Each Pratical moves in a definite path and do not cross each other. 2) It occurs at low velocity of flow. 3) This flow occurs in viscous fluids 4) Reynold's number is less than 2000 5) Fluid particle move in layers with one layer over the another. 6) Sketch 7) Example	1) The fluid partical continuously mis and cross each other. 2) It occurs at high velocity of flow. 3) This flow occurs in fluid having very less viscosity. 4) Reynold's number is less than 2000 5) Fluid Particle moves in disorderly manner, they cross the path of each other. 6) Sketch 7) Example

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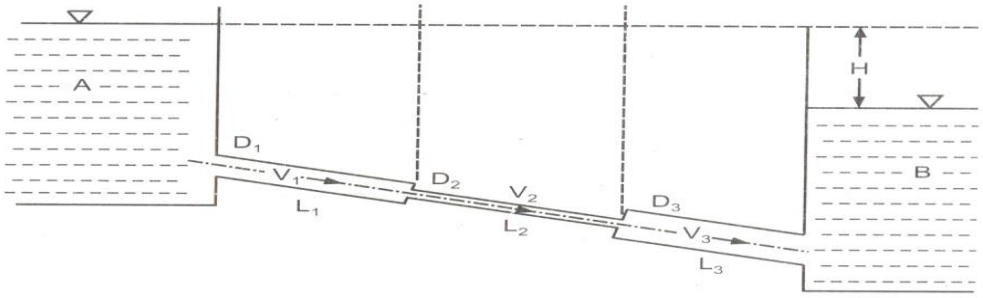
**(Any four Points each 1 Mark)*

f)Explain Dupit's equation for equivalent pipe.



1

From Fig. in a compound pipe line ,

Let D_1, D_2, D_3 etc. be the diameter of pipe and L_1,L_2,L_3 be the lengths respectively

Total Head loss in compound pipe , neglecting the minor losses

$h_L = (f_1L_1V_1^2/2gD_1) + (f_2L_2V_2^2/2gD_2) +(f_3L_3V_3^2/2gD_3)$

$Q = a_1V_1 = a_2V_2 = a_3V_3$

$Q= (\pi/4)D_1^2V_1 = (\pi/4)D_2^2V_2 = (\pi/4)D_2^2V_2$ ----------

1

Assuming $f = f_1 = f_2 = f_3$ $V_1= (Q/(\pi/4)D_1^2)$; $V_2= (Q/(\pi/4)D_2^2)$; $V_3= (Q/(\pi/4)D_3^2)$ Hence $h_L = (fQ^2/2g(\pi/4)^2)[(L_1/D_1^5) + (L_2/D_2^5) + (L_3/D_3^5)]$ ----------	1
Now Let, D = Diameter of Equivalent Pipe L = Length of Equivalent Pipe Q = Discharge passing through Equivalent Pipe h_L = Head loss due to friction in Equivalent Pipe The loss of head due to friction in equivalent pipe $h_L = (fLV^2/2gD) = (fQ^2/2g(\pi/4)^2)(L/D^5)$ Equating the two head losses $(L/D^5) = [(L_1/D_1^5) + (L_2/D_2^5) + (L_3/D_3^5)]$ ----------	1
This equation is known as Duput's Equation for equivalent Pipe	
Q.3 Attempt any **four** of the following	
a)Find maximum power that can be transmitted by a power station through a pipe 2.5 km long and 250 mm diameter .The pressure of water at power station is 1600 KPa and f= 0.01.	
.**Given –** P=1600 KPa , d = 250 mm =0.25 m l = 2.5 Km= 2500 m , f = 0.01 Sol.- H= P/w=1600/9.81=163.09 m---------- For maximum transmition of power, loss of head due to friction h_f = H / 3 =163.09/3 =54.37 m ---------- The loss of head due to friction $h_f=flQ^2/3d^5$ $54.37 =0.01x2500xQ^2/3x0.25^5$ Q = 0.0798 m^3/sec---------- Power transmited = w Q ($H-h_f$) =9.81x0.0798x(163.09-54.37) =85.11 kW----------	1 1 1 1
b) Calculate the discharge through pipe of diameter 20 cm when difference of pressure head between the two ends of pipe 500 m apart is 4m of water ,take f =0.009.	

Ans:- **Given –** h_f=4 m , D = 200 mm=0.20 m

l = 500m , f = 0.009

$$h_f = \frac{4 f l V^2}{2 g D}$$ ---------- 1

$$4 = \frac{4 \times 0.009 \times 500 \times V^2}{2 \times 9.81 \times 0.20}$$

$$V^2 = \frac{4 \times 2 \times 9.81 \times 0.20}{4 \times 0.009 \times 500} = 0.872$$ ---------- 1

V = 0.9338 m/sec

Discharge = Velocity x Area---------- 1

$= 0.9338 \times \pi/4 D^2$

$= 0.9338 \times \pi/4 (0.20)^2$

$= 0.0293\ m^3/sec$ ---------- 1

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c) Differentiate between pipe and open channel flow.

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S.N	Pipe Flow	S.N	Open Channel Flow
1	In case of pipe flow there is no free surface of water.	1	In case of pen channel flow there is free surface of water.
2	In pipe flow water flows under pressure.	2	In open channel flow water flows under atmospheric pressure.
3	There is pressure difference between any two section.	3	There is no pressure difference between any two section.
4	The water levels in piezometric tubes installed at different sections of the pipe indicates the hydraulic gradient line.	4	In case of open channel flow water surface itself indicates hydraulic gradient line.
5	Example	5	Example

**(Any four Points each 1 Mark each)*

d)A rectangular channel having hydraulic mean depth 2 m discharge water with a velocity 1.2 m/sec.Find value of Chezy's constant if bed slope is 1 :8000

Ans:-

Given – R=2 m , V = 1.2 m/sec, S = 1:8000

Chezy's formula for calculating velocity,

$V = C \times R^{1/2} \times S^{1/2}$ OR $V = C \times R^{1/2} \times i^{1/2}$ ---------- 1

$1.2 = C \times (2)^{1/2} \times (1/8000)^{1/2}$ ---------- 1

C = 75.89---------- 2

e) **Differentiate between Notch and weir.**

*

S.N	Notch	S.N	Weir
1	A notch is defined as an opening provide in the side of a tank such that the liquid surface in the tank is below the top edge of the opening.	1	A weir is concrete or masonry structure, placed in an open channel over which the flow occurs.
2	It is small in size.	2	It is bigger in size.
3	It is made of metallic plate.	3	It is made of masonry or concrete structure.
4	It is used for measuring the rate of flow of liquid from tank or in a channel.	4	It is used for measuring the rate of flow of water in rivers or streams
5	Sketch	5	Sketch

**(Any four Points each 1 Mark each)*

f)Give classification of weirs.

*

Classification of Weirs –

a) According to the shape of opening

1.Rectangular weir
2.Triangular weir
3.Trapezoidal weir (Cippoletti weir)

b) According to the shape of the crest

1.Sharp crested weir
2.Broad crested weir
3.Narrow crested weir
4. Ogee shaped weir

c) According to the effect of sides on the emerging nappe

1.Weir with end contraction
2.Weir without end contraction

**(Any two type classification each 2 Mark each)*

Q4 Attempt any **Four** of the following — 16

a)Give classification of orifices.

.**Classification of Orifices –**

a) According to size ---------- 1

1.Smaller orifice
2.Largerorifice

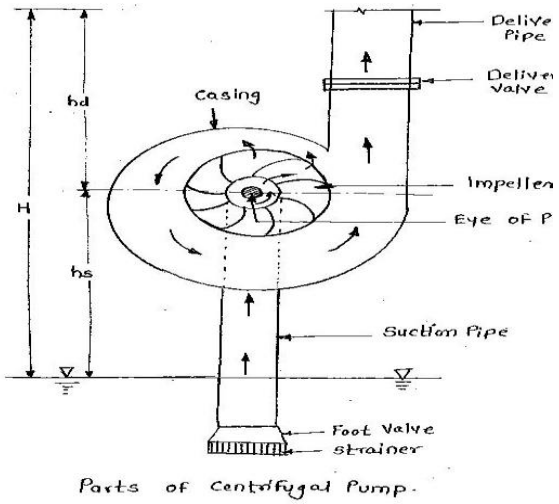
b) According to the shape ---------- 1

1.Circular orifice
2.Rectnagualrorifice
3.Squareorifice
4. Triangular orifice

c) According to the shape of the upstream edges---------- 1

1.Sharp edged Orifice
2.Bell mounted Orifice

d) According to the discharge condition---------- 1.Orifices discharging free 2.Submerged orifices	1
.**b) The head of water over the center of an orifice of diameter 1.5 cm is 1 m .The actual discharge through the office is 0.75 Lit/sec .Find the coefficient of discharge .**	
Ans: - **Given – D=1.5 cm= 0.015 m , H = 1m,** **Q_{act} = 0.75lit/sec = 0.75 x 10^{-3} m^3/sec** **Area of orifice, A = (π /4)x D^2** **= π /4$(0.015)^2$** **= 0.176 x 10^{-3} m^2**---------- **Theoretical velocity , V_{th} = $\sqrt{2.g.H}$** **= $\sqrt{2 x 9.81 x 1}$** **= 4.429 m /sec**---------- **Theoretical discharge , Q_{th} = V_{th} x A** **= 4.429 x 0.176 x 10^{-3}** **= 0.779 x 10^{-3} m^3/sec**---------- **C_d=Q_{act}/ Q_{th}** **= 0.75 x 10^{-3}/0.779 x 10^{-3}** **= 0.962**----------	1 1 1 1
c)Explain with sketch parts of centrifugal pump.	
Parts of Centrifugal Pump- **1. Impeller-** It is wheel or rotor which is provided with series of backward curved blades or vanes. It is mounted on shaft which is coupled to an electric motor which rotates the impeller. It is classified as closed, semi open and open impeller. **2. Casing –** It is an air tight chamber which surrounds the impeller**.** **3. Suction Pipe –**It is the pipe which is connected at its upper end to the inlet of the pump or to the centre of the impeller i.e eye. The lower end of the suction pipe dips into liquid in a suction tank. **4. Delivery Pipe-**It is a pipe which is connected at its lower end to the outlet of the pump and it delivers the liquid to the required height. On delivery pipe delivery valve is provided to control the flow from the pump into delivery pipe.	2



Parts of Centrifugal Pump.

2

e) Differentiate between centrifugal and reciprocating pump .

S.N	Centrifugal Pump	S.N	Reciprocating Pump
1	It is rotodynamic type pump.	1	It is positive displacement type pump.
2	Its discharging capacity is much greater.	2	Its discharging capacity is very small.
3	It is used for lifting highly viscous fluid like muddy and sewage water.	3	It can handle pure water and less viscous fluid only.
4	It can be operated at very high speed.	4	It can be operated at low speed.
5	Maintenance cost is low.	5	Maintenance cost is high.
6.	It requires Priming operation.	6.	It does not require Priming operation.
7.	It cannot build high pressure.	7.	It can build very high pressure.

**(Any four Points each 1 Mark each)*

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f) Explain with sketch types of flow.

Types of flow –

1. Laminar flow- A flow in which fluid particles move in layers with one layer sliding over other is called laminar flow.

2. Turbulent Flow – A fluid flow in which fluid particles move in haphazard manner with mixing of particles of different layer is called turbulent flow..

3. Steady flow – Flow in which pressure, velocity and density at any point do not change with time is called steady flow.

4. Unsteady Flow – Flow in which pressure, velocity and density at any point change with time is called unsteady flow.

5. Uniform flow- Flow with constant velocity at different point at any time is called uniform flow.

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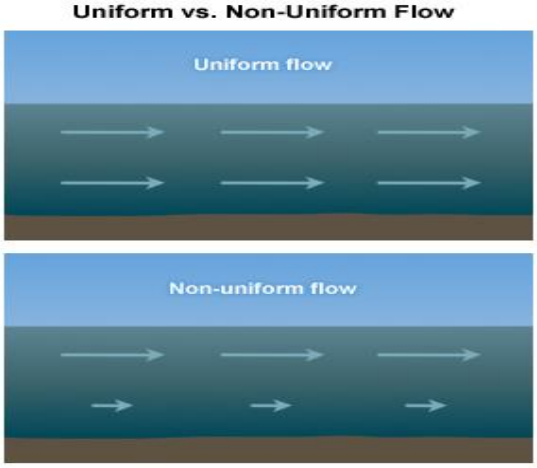
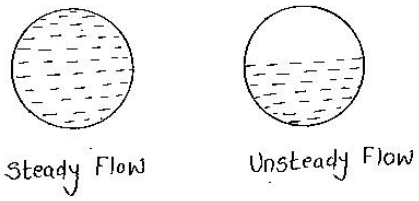
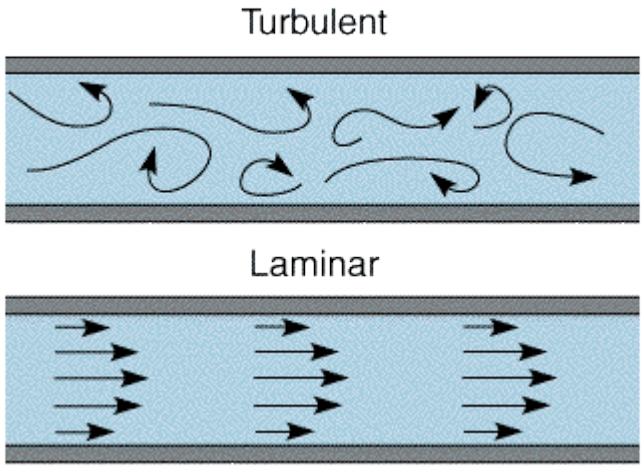
6. Non-Uniform flow- Flow changes its velocity from point to point at any time is called uniform flow.

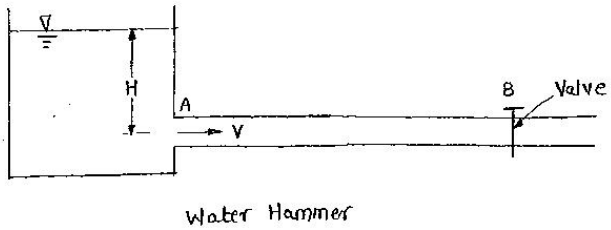






(Note Any four definition 2 marks and sketch 2 marks)

g) Explain with sketch water hammer.



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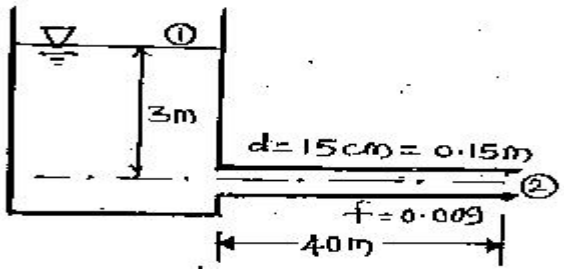
Water Hammer-When the water flowing in a long pipe is suddenly brought to rest by closing the valve, there will be a sudden rise in pressure due to the momentum of the moving water being destroyed. This causes a wave of high pressure to be transmitted along the pipe which creates noise known as water hammer .The rise in pressure in some cases may be so large that the pipe may even burst. Therefore it is essential to take into account this pressure rise in the design of pipes. The magnitude of pressure rise depends on the speed at which the valve is closed, velocity of flow, length of the pipe and elastic

3

properties of the pipe material as well as flowing fluid.

Q5 Attempt any **Four** of the following

a) Determine the rate of flow of water through a pipe of diameter 15 cm and length 40 n when one end of pipe is connected to a tank and other end is open to atmosphere .The pipe is horizontal and height of water in the tank is 3 m above center of pipe .consider all minor losses and f=0.009



Diameter of pipe ,d=15 cm=0.15m

Length of pipe ,L=40m

Height of water in tank ,H=3m

Coefficient of friction ,f=0.009

Let the velocity of water in pipe ,V m/s

Applying Bernoullis theorem at top of the water surface in the tank & at the outlet of pipe (taking point 1 on the top & point 2 at the outlet of pipe)

$P_1/eg+V_1^2/2g+Z_1=P_2/eg+V_2^2/2g+Z_2$+All losses.----------

Considering data m line passing through the center of pipe

$0+0+3=0+^{v2}2/2g+0+hi+hf+hexit$

But the velocity in pipe =V , V=V2

Loss due to entrance =hi=0.5 $xV^2/2g$

Loss due to function=hf=$4fLV^2/2gd$

Loss due to exit =h exit=$V^2/2g$

$3=V^2/2g+ 0.5\ V^2/2g+ 4FLV^2/2gd+V^2/2g$

$=V^2/2g[1+0.5+(4X0.009X40)/0.15+1]$

$= V^2/2g[12.1]$

V^2=(3x2x9.81)/12.1

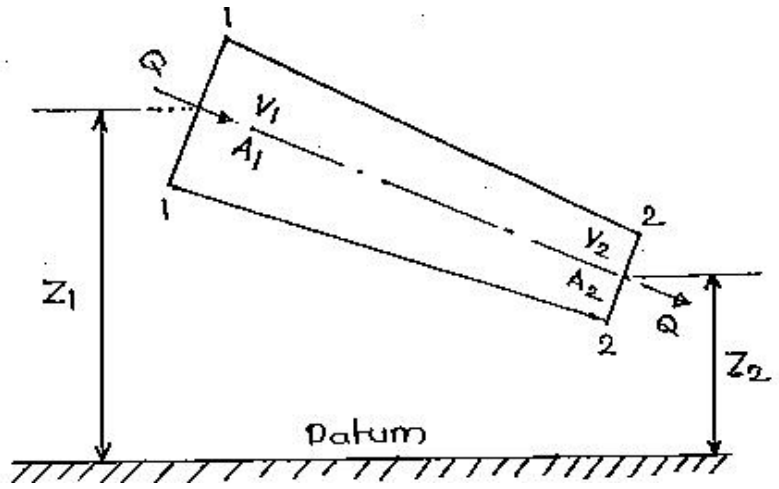
V=2.205 m/s----------

Rate of flaw ,Q =A x V

$= \Pi/4\ x(0.15)^2x2.205$

$=0.038965\ m^3/s$ =38.965 lit /sec.----------

b) Explain with sketch Bernoulli's theorem.



1

Statement:-It states that in a steady, ideal flow of an incompressible fluid, the total energy at the point of fluid is constant ----------

1

The total energy consist of pressure energy ,Kinetic energy and potential energy or datum energy .these energies per unit weight of the fluid are

Pressure energy=P/eg

Kinetic energy =$V^2/2g$

Datum energy=Z

Mathematically ,Bernoulli's theorem is written as

= $P/eg+V^2/2g+Z$=constant

For section 1-1 & 2-2 Bernoulli's theorem is written as

2

$P_1/eg+V^2/2g+Z=P^2/eg+V^2_2/2g+Z_2$ ----------

c) Find the slope of the bed of rectangular channel of width 4 m when depth of water is 2.5 m and rate of flaw 20 m3/sec .Take Chezy constant c=50.

Type of channel:- rectangular
Width of channel =b= 4m
Depth of water in channel =d=2.5m
Rate of flow=Q=20m^3/sec
Chezy's constant =C=50
Bed slope of channel = i=?
Wetted area =A=b x d =4.25=10 m^2
Wetted Perimeter =P=b+2d=4+2x2.5= 9 m
Hydraulic radius =R=A/P=10/9=1.111 m ---------- 1

Chezy's formula to calculate rate of flow is,

$Q = AC\sqrt{Ri}$ OR $Q = AC\sqrt{RS}$ ---------- 1

$20 = 10x50x\sqrt{1.111xi}$

$\sqrt{i} = 0.0379492$

Squaring both sides

$i = 1.44014x10^{-3}$ 2

Bed slope=i=S=1/694.375= 1: 694.375 ----------

d)determine the discharge through 60 ^{0} triangular notch in Lit/Sec .When the head is 0.20m take C_d=0.6

Type of notch =triangular
Angle of notch =Q=60 ^{0}
Head over notch =H=0.20m
Coefficient of discharge =cd =0.6
Discharge in Lit/sec=Q=?
For triangular notch discharge can be calculated by using formula.

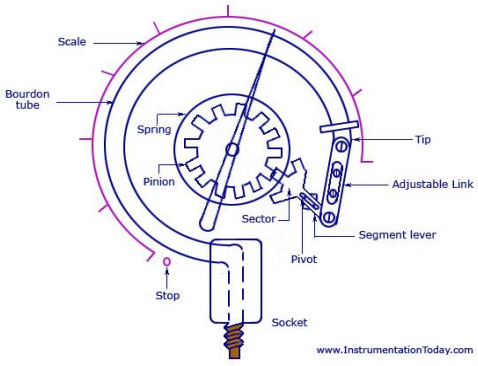
$Q=8/15\ C_d .\sqrt{2g}\ \tan \theta/2 \times H^{5/2}$ ---------- 2

$= 8/15x0.6x\sqrt{2x9.81}x\tan(60/2)x(0.20)^{5/2}$ 2

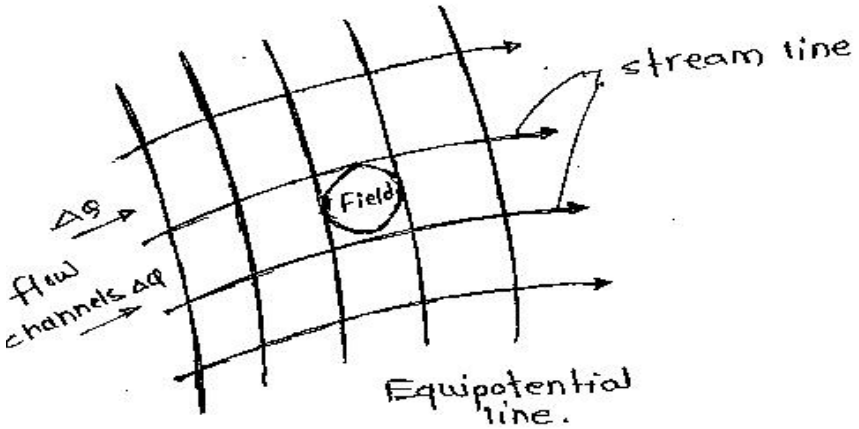
$=0.01463\ m^3$/sec ----------

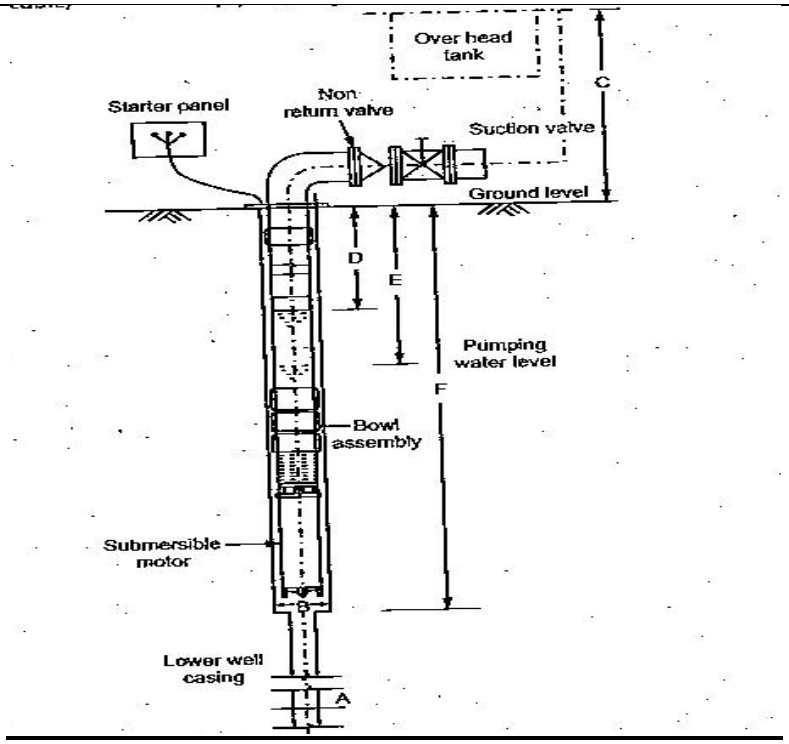
d) Explain with sketches types of gauges.

Types of gauges (i) Diaphragm pressure gauge (ii) Bourdon tube pressure gauge (iii) Dead weight pressure gauge (iv) Bellows pressure gauge 2



Bourdon Tube Pressure Gauge 1

Bourdon tube pressure:-gauge is used to measured high pressure. It consists of tube as shown in fig. having elliptical cross section. This tube is called as Bourdons Tube. One end of this tube is connected the point whose pressure is to be measured and other end free. When fluid enters in the tube elliptical cross section of tube becomes circular. Due to this the free end of tube shifts outward. This motion is transferred through link and pointer arrangement. The pointer moves over a calibrated scale, which directly indicates the pressure in terms of N/m^2 or m head of mercury. **OR** **Note:-Also consider the manometers as guages, explanation 01 marks, sketch 01marks (any two types)**	1
f**)Explain with sketch flow net**	
 **Flow net**:-Flow net is the graphical method of seepage analysis .The method of flow net construction is based on trial sketching .It is graphical presentation of stream liner & equipotential lines, A set of stream line and equipotential lines constitute a flow net .The flow lines & equipotential lines meet at right angles to one another .the fields are approximately squares ,so that circle can be drawn touching all four sides of the square .	2 2
Q.6**)** Attempt any **Four** of the following	
a) Explain with sketch submersible pump?	
Ans:- **sketch submersible pump**	



2

2

Submersible pump: - Submersible pump are able to handle sandy ,turbid water ,sea water ,corrosive & chemical aggressive water .These dry dock dewatering, mine dewatering & fire fighting .These pump are used where the lowest water level is beyond the reach of centrifugal pump .they are driven by electric motors.

b) Define
i) Coefficient of contraction
ii) Coefficient of velocity
iii) Coefficient of Discharge
iv) Coefficient of resistance

1) Coefficient of contraction:-It is defined as the ratio of the area of the area of the jet at vena contract to the area of the orifice. — 1
2) Coefficient of velocity: - It is defined as the ratio between the actual velocity of a jet of liquid at vena-contracta & the theoretical velocity of jet. — 1
3) Coefficient of Discharge:-It is defined as the ratio of the actual discharge from an orifice to the theoretical discharge from the orifice — 1
4) Coefficient of resistance:-The ratio of loss head in the orifice to the head of water available at the exit of the orifice is known as Coefficient of resistance. — 1

c) What do you mean by most economical section of an open channel?

Most economical section of an open channel:- *

1) A section of a channel is said to be most economical when the cost of construction of the channel is minimum.
2) But the cost of construction of a channel depends upon the excavation & the lining
3)To keep the cost down or minimum ,the wetted perimeter ,for given discharge ,should be minimum
4) Most economical section is also called the best section. or Most efficient section as the

discharge passing through a most economical section of channel for a given cross section area ,slope of the bed & a resistance Coefficient is maximum . **(Note :- One mark each point)*	
d) A trapezoidal channel with side slope 3:2 has to be designed to conveying 15 m^3/sec at a velocity of 2 m /sec., so that the amount of concrete limits for the bed and sides is minimum. **Find : i) Wetted perimeter ii) Slope of bed if manning N=0.014**	
Type of channel : trapezoidal channel Side slope of channel =3: 2 Discharge =Q=15 m^3/sec Velocity flow =V=2m/sec Side is minimum means channel is most economical trapezoidal channel We have continuity equation Q=AxV 15=Ax2 A=7.5m^2 Side slope 3:2 n/1=3/2 n=3/2 $d\sqrt{(n2+1)}$=1/2(b+2nd) d [$(3/2)^2+1]^{1/2}$=1/2[b+2x(3/2) x d] 1.80 d=0.5b +1.5d 0.3d=0.5b **b=0.6 d---** A=(b+ nd) d 7.5=[0.6d +(3/2) x d]d ,(b=0.6d) 7.5=2.1 d^2 d=1.8898 m b=0.6d =0.6x1.8898=1.1338 m Wetted perimeter = P=2d$(n^2+1)^{1/2}$ + b =2x1.8898x[$(3/2)^2+1]^{1/2}$ +1.1338 =7.9475 m Hydraulic radius =R=A/P--- = 7.5/7.9475 = 0.9436 m Manning's formula Q=Ax1/N $R^{2/3}$ $i^{½}$-- 15=7.5x(1/0.014)x$(0.9436)^{2/3}$ $i^{1/2}$ = $(i)^{½}$ =0.02910 i = 8.4709x10^{-4} **Bed slope = i = 1/1180.505 = 1:1180.505--**	1 1 1 1
e) **Define Prismatic and Non Prismatic channel and critical flow and subcritical flow.**	
Prismatic channel: - A channel having the same shape of various section along its length & constructed with constant bottom slope is known as Prismatic channel. **Non Prismatic channel**:-A channel having irregular section along its length with variable bottom slope is called Non Prismatic channel. **Critical flow :- the flow in open channel is said to be** critical if the Froude number is one (Fe=1)	1 1 1

	Sub critical flow.:-The flow is open channel is said to be subcritical if the Froude number is less than one (Fe<1)	1
	f) State any four practical application of hydrostatics	
	i) To calculate hydrostatic pressure on dam, wall,& tank ii) To design dam iii) To design gate of dam iv) To design bridge component v) To design forces on submarine vi) To calculate the forces on submerged surfaces vii) To calculate the forces on retaining wall **(Note :-Any four 1 mark each)*	*