Model Answer: Winter - 2022

Subject: Hydraulics

Sub. Code: 22401

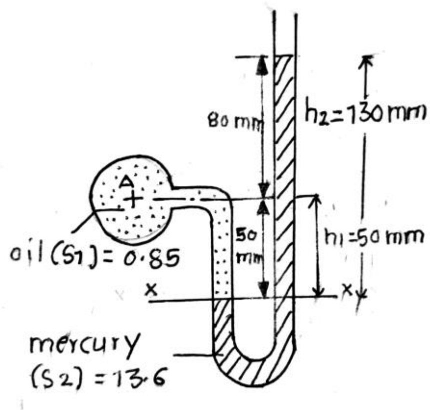
Important Instructions to examiners:

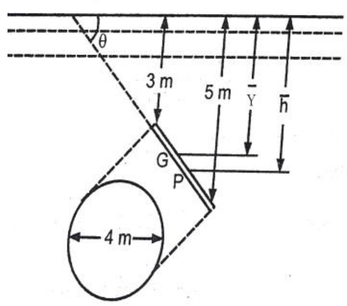
1) The answers should be examined by key words and not as word-to-word as given in the model answer scheme.
2) The model answer and the answer written by candidate may vary but the examiner may try to assess the understanding level of the candidate.
3) The language errors such as grammatical, spelling 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.

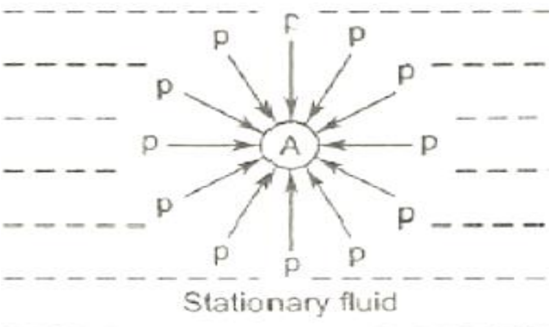
Que. No.	Sub. Que.	Model Answer	Marks	Total Marks
Q.1		**Attempt any FIVE of the following:**		(10)
	a)	**Define specific mass and specific volume.**		
	Ans.	**i) Mass density or Specific mass:** It is defined as the mass per unit volume. $\rho = \frac{\text{Mass}}{\text{Volume}} = \frac{m}{V}$ S.I. Unit: kg/m^3	1	
		ii) Specific Volume: It is the volume occupied by unit mass of liquid. $V_s = \frac{\text{Volume}}{\text{Mass}} = \frac{V}{m}$ S.I. Unit : m^3/kg	1	2

Que. No.	Sub. Que.	Model Answer	Marks	Total Marks
Q.1	b)	**Calculate the weight density and specific gravity of liquid, if 600ml liquid weighs 6N.**		
	Ans.	Given data: $V = 600\text{ ml} = \frac{600}{1000} = 0.6\text{ lit} = 0.6\times10^{-3}\text{ m}^3$ $W = 6N$		
		i) Weight density $\gamma_L = \frac{W}{V}$	½	
		$= \frac{6}{0.6\times10^{-3}} = \boxed{10\times10^3\text{ N/m}^3}$	½	
		ii) Specific gravity $S_L = \frac{\gamma_L}{\gamma_W}$	½	
		$= \frac{10\times10^3}{9810} = \boxed{1.02}$	½	2
	c)	**Define pressure and It's S.I. units.**		
	Ans.	**Pressure:** The ratio of force to the cross sectional area is known as pressure.	1	
		P = force / area SI unit – N/m^2 or Pascal	1	2
	d)	**State Bernoullis theorem.**		
	Ans.	It states that in a steady ,ideal flow of an incompressible fluid, the total energy at any point of the fluid is always constant. Total energy = Constant Pressure energy + Kinetic energy + Potential energy = Constant	2	2
	e)	**Define Hydraulic gradient line (H.G.L.) and Total Energy Line (T.E.L.).**		
	Ans.	**Hydraulic Gradient Line (H.G.L.)** 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.	1	
		Total Energy Line (T.E.L.) is defined as the line which gives the sum of pressure head, datum head and velocity head of a flowing fluid in a pipe with respect to some reference line.	1	2

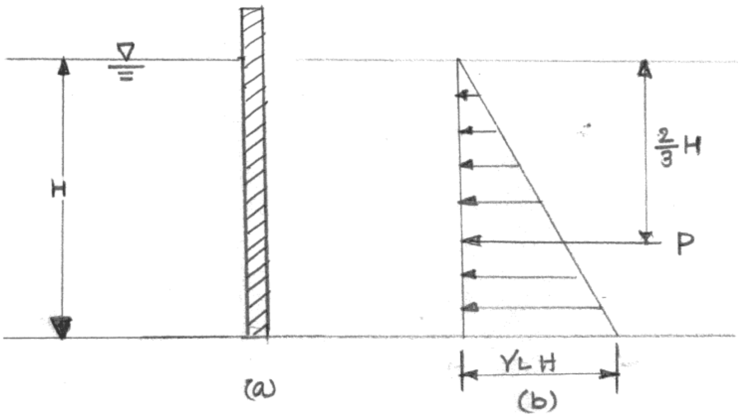
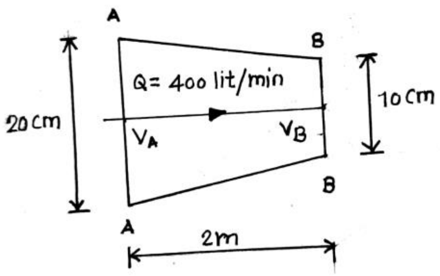
Que. No.	Sub. Que.	Model Answer	Marks	Total Marks
Q.1	f)	**Describe uniform and Non-uniform flow.**		
	Ans.	**i) Uniform flow:** If the depth of flow, the discharge and mean velocity flow at a given instant do not change along the length of channel, the flow is called as Uniform flow.	1	
		ii) Non-uniform flow: If the depth of flow, the discharge and mean velocity flow at a given instant changes along the length of channel, the flow is called as non-uniform flow.	1	2
	g)	**Enlist any two discharge measuring devices.**		
	Ans.	i) Venturimeter ii) Orifice iii) Notch	1 each (any two)	2

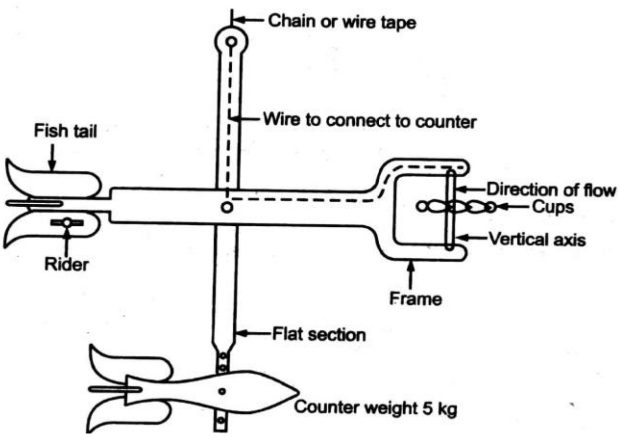
Que. No.	Sub. Que.	Model Answer	Marks	Total Marks
Q.2		**Attempt any THREE of the following:**		(12)
	a)	**Give Importance of Hydraulics with respect to Irrigation Engineering and Environmental Engineering.**		
	Ans.	**Applications of hydraulics with respect to Irrigation Engineering are as follows:** i) To calculate discharge flowing through canal. ii) For distribution of equal water for city or agriculture purpose using water meter. iii) To determine velocity of flow at a point in open channel. iv) The total pressure and Centre of pressure acting on the wall of dam can be determined. v) Spillway can also designed to pass off water on D/S of a dam.	½ each (any four)	
		Applications of hydraulics with respect to Environmental Engineering are as follows: i) To design the pipe line system for water supply and drainage. ii) To find the pressure acting on the side and bottom of the tank iii) To determine the discharge through the pipe iv) To determine the power of the pump required v) To design water treatment plant and sewage treatment plant	½ each (any four)	4
	b)	**An oil of specific gravity 0.85 is flowing through a pipe. A simple manometer is connected to the pipe containing mercury. The deflection of mercury level in left limb from center of pipe is 50mm, whereas right limb (from center of pipe), it is 80mm. Calculate the pressure in KPa.**		
	Ans.			

Que. No.	Sub. Que.	Model Answer	Marks	Total Marks
Q.2	b) Ans.	Given data: $h_1 = 0.05m, S_1 = 0.85$ $h_2 = 50+80 = 130mm = 0.13m, S_2 = 13.6$ $P_A + \gamma_1 h_1 = \gamma_2 h_2$ $P_A + \rho g h_1 = \rho g h_2$ $P_A + 1000\times0.85\times9.81\times0.05 = 1000\times13.6\times9.81\times0.13$ $\boxed{P_A = 16.93 \text{ KPa}}$ OR $h_A = S_2h_2 - S_1h_1$ $h_A = 13.6\times0.13 - 0.85\times0.05$ $h_A = 1.725m$ $P_A = \gamma_L h$ $P_A = S_L \times \gamma_w \times h_A$ $P_A = 1\times9.81\times1.725$ $\boxed{P_A = 16.92 KPa}$	1 1 1 ½ ½ OR 1 1 1 ½ ½	4
	c) Ans.	**A circular plate of 4m diameter is immersed in water such that its greatest and least depth below the free surface of water are 5m and 3m respectively. Calculate** **i) Total pressure on one face of plate** **ii) The position of center of pressure**  $A = \frac{\pi}{4}\times4^2$ $A = 4\times\pi$ $\boxed{A = 12.566 \text{ m}^2}$ $\bar{y} = \frac{5+3}{2}$ $\boxed{\bar{y} = 4m}$ $\sin\theta = \frac{2}{4}$ $\theta = \sin^{-1}(\frac{1}{2})$ $\boxed{\theta = 30^0}$	 ½ ½ ½	

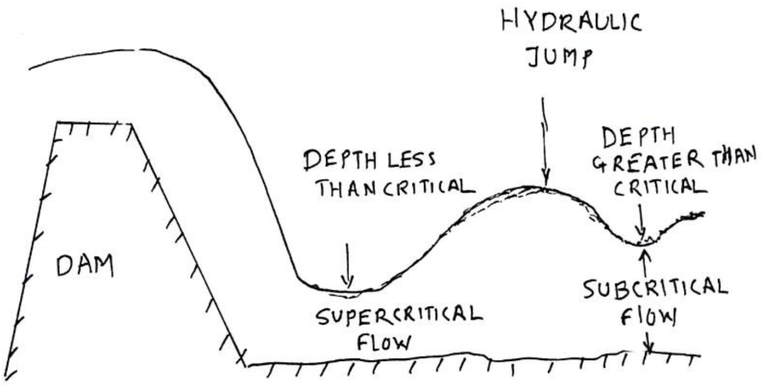
Que. No.	Sub. Que.	Model Answer	Marks	Total Marks
Q.2	c) Ans.	$I_G = \frac{\pi}{64} \times D^4$ $I_G = \frac{\pi}{64} \times 4^4$ $\boxed{I_G = 12.57\ m^4}$ $P = \gamma_w \times A \times \bar{y}$ $P = 9.81 \times 12.566 \times 4$ $\boxed{P = 493.10kN}$ $\bar{h} = \frac{I_G \sin^2\theta}{A\bar{y}} + \bar{y}$ $\bar{h} = \frac{12.57 \times \sin^2 30^0}{12.566 \times 4} + 4$ $\boxed{\bar{h} = 4.0625m}$	½ ½ ½ ½ ½	4
	d)	**State Pascal's Law of fluid pressure. Enlist any four applications of it.**		
	Ans.	**Pascal's Law:** It states that the pressure intensity or pressure at a point in a static fluid is equal in all directions. 	2	

Que. No.	Sub. Que.	Model Answer	Marks	Total Marks
Q.2	**d)** **Ans.**	**Applications:** Pascal's Law is applied in the construction of machines and used for multiple purposes. i) Hydraulic Jacks ii) Hydraulic Press iii) Hydraulic Lifts iv) Hydraulic Crane v) Braking system of motor vi) Artesian well vii) Dam	**½ each (any four)**	**4**

Que. No.	Sub. Que.	Model Answer	Marks	Total Marks
Q.3		**Attempt any THREE of the following:**		(12)
	a)	**Explain the concept of pressure diagram with neat sketches and explain the use of pressure diagram.**		
	Ans.	Pressure diagram is defined as "It is the graphical representation of variation of pressure on the surface with depth". The total pressure per unit length is the area of pressure diagram. The position of center of the pressure is the position of center of gravity of the pressure diagram.	1	
			1	
		Uses: i) To Calculate pressure exerted by liquid on the one side of surface. ii) To Calculate pressure due to liquid on both the side of surface iii) To Calculate pressure on vertical and inclined faces of dam. iv) To Calculate pressure on sluice gate, side and bottom of water tank. v) To find position of centre of pressure.	**1 each (any two)**	**4**
	b)	**A horizontal pipe carrying water tapers from 20cm diameter at A and 10cm diameter at B in length of 2m. The pressure at 'A' is 100N/cm^2. If the discharge 400 lit/min. Calculate pressure at 'B' in N/cm^2. If the loss of head from A to B is 10cm.**		
	Ans.			

Que. No.	Sub. Que.	Model Answer	Marks	Total Marks
Q.3	b) Ans.	Given data: diameter at A = 0.2 m, diameter at B = 0.10m $P_A = 100 N/cm^2 = \frac{100}{(10^{-2})^2} = 100 \times 10^4\ N/m^2$	½	4
		$Q = 400\ lit/min = \frac{400 \times 10^{-3}}{60} = 6.67 \times 10^{-3}\ m^3/sec$	½	
		$h_L = 10cm = 0.1m$ by using continuity equation $Q = A_A \times V_A$	½	
		$6.67 \times 10^{-3} = \frac{\pi}{4}(0.2)^2 \times V_A$ $V_A = 0.21\ m/s$	½	
		$Q = A_B \times V_B$	½	
		$6.67 \times 10^{-3} = \frac{\pi}{4}(0.10)^2 \times V_B$ $V_B = 0.85\ m/s$	½	
		Applying bernaulli's thereom: assuming flow from A to B $\frac{P_A}{\gamma_L} + \frac{V_A^2}{2g} + Z_A = \frac{P_B}{\gamma_L} + \frac{V_B^2}{2g} + Z_B + h_L$	½	
		$\frac{100 \times 10^4}{9810} + \frac{(0.21)^2}{2 \times 9.81} + 0 = \frac{P_B}{9810} + \frac{(0.85)^2}{2 \times 9.81} + 0 + 0.10$ $101.93 + 2.24 \times 10^{-3} = \frac{P_B}{9810} + 0.0368 + 0.10$ $\boxed{P_B = 998.613 \times 10^3 N/m^2}$	½	
	c)	**Draw a neat sketch of cup type current meter and explain it's working.**		
	Ans.	 ***(Note: 1 mark for sketch and 1 mark for labeling.)***	2	

Que. No.	Sub. Que.	Model Answer	Marks	Total Marks
Q.3	c) Ans.	**Working:** i) In a cup type current meter the wheel or revolving element has the form of a series of conical cups, mounted on a spindle. Spindle is held vertical at right angle to the direction of flow. ii) Current meter is used to find out velocity of water. Current meter consists of a wheel containing blades on cups. iii) These cups are vertically immersed in stream of water. The thrust exerted by water on the cups. iv) The number of revolutions of the wheel per unit time is proportional to the velocity of flow. v) The revolution counter operated by dry cell. The counter is calibrated or a calibration curve is provided to read velocity.	2	4
	d)	**A circular plate of 2m diameter immersed vertically in a liquid having specific gravity 0.8, so that center of plate is 3.5m below free surface. Determine total pressure and center of pressure.**		
	Ans.	Given data: d = 2 m, s = 0.8, $\bar{y}$ = 3.5m		
		Area of plate A = $\frac{\pi}{4}d^2 = \frac{\pi}{4}2^2 = 3.14\ m^2$	½	
		$I_G = \frac{\pi}{64}d^4 = \frac{\pi}{64}2^4 = 0.78m^4$	½	
		$P = \gamma_L \times A \times \bar{y}$		
		$P = 0.8 \times 9810 \times 3.14 \times 3.5$	½	4
		$\boxed{P = 86.24 \times 10^3\ N}$	1	
		$\bar{h} = \frac{I_G}{A \times \bar{y}} + \bar{y}$	½	
		$= \frac{0.78}{3.14 \times 3.5} + 3.5$		
		$\boxed{\bar{h} = 3.57\ m}$	1	

Que. No.	Sub. Que.	Model Answer	Marks	Total Marks
Q.4		**Attempt any THREE of the following:**		(12)
	a)	**Explain Hydraulic Jump and state it's two applications.**		
	Ans.	**Hydraulic jump:** i) It is the phenomenon in which supercritical flow is converted to subcritical flow. ii) It is the phenomenon occurring in an open channel when rapidly flowing stream abruptly change to slowly flowing stream causing a distance rise or jump in level of liquid surface. iii) Hydraulic jump formed on a horizontal floor of canal and at the downstream side of spillway, at the downstream side of sluice gate, or at the downstream side of canal fall.	½ each	
			½	4
		It's applications are: i) To minimize the energy of flowing water ii) To mix the chemicals in the flow of water iii) To increase the depth of water iv) To minimize and control erosion of channel bed	1 each (any two)	

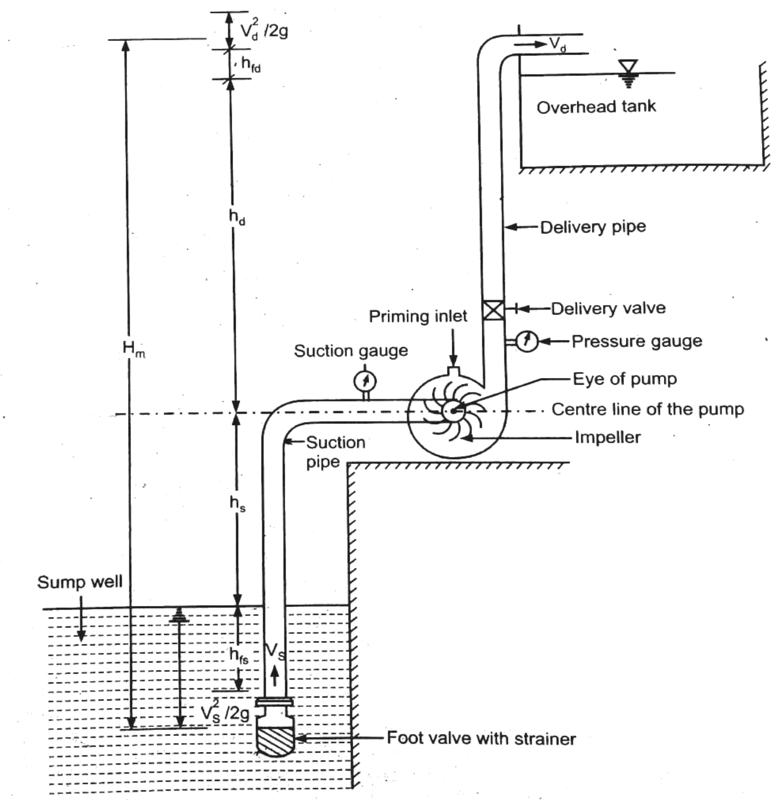
Que. No.	Sub. Que.	Model Answer	Marks	Total Marks
	b)	**Differentiate between centrifugal pump and reciprocating pump.**	1 each (any four)	4

Ans.

Sr. No.	Centrifugal pump	Reciprocating pump
1	For Centrifugal pump discharge is continuous.	For Reciprocating pump discharge is fluctuating.
2	Suitable for large discharge and small heads.	Suitable for less discharge and higher heads.
3	Simple in construction due to less number of parts.	Complicated in construction because of more number of parts.
4	It has rotating elements so there is less wear and tear.	It has reciprocating element, there is more wear and tear.
5	It can run at high speed.	It cannot run at high speed.
6	Air vessels are not required.	Air vessels are required.
7	Starting torque is more.	Starting torque is less.
8	It has less efficiency.	It has more efficiency.
9	It can handle dirty water.	It can not handle dirty water.
10	Requires less floor area and simple foundation.	Requires more floor area and requires heavy foundation.

Que. No.	Sub. Que.	Model Answer	Marks	Total Marks
	c)	**Draw neat sketch of centrifugal pump showing all components.**		4

Ans.

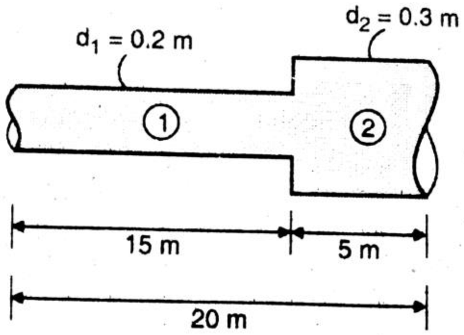


(Note: 2 mark for sketch and 2 mark for labeling.)

Que. No.	Sub. Que.	Model Answer	Marks	Total Marks
	d)	**Explain Reynolds number with its equation and give its significance.**		
	Ans.	The Reynolds number is defined as the ratio of inertia force to viscous force. Reynolds number is dimensionless number. It is used to determine the laminar or turbulent flow type.	1	
		$\text{Re} = \frac{\text{inertial force}}{\text{viscous force}} = \frac{F_i}{F_v}$	1	
		$\text{Re} = \frac{\rho V d}{\mu}$ OR $\text{Re} = \frac{V d}{\vartheta}$		
		where, Re= Reynolds number ρ = Mass density of fluid in (kg/m^3) V = Velocity of flow in (m/sec) d = Diameter of pipe in (m) μ = Dynamic viscosity (N-s/m^3) ϑ = Kinematic viscosity (m^3/s)	1	
		Significance : Using value of Reynold's number the type of flow can be identified. If Re < 2000, Flow is laminar flow If 2000 < Re < 4000, Flow is in transition state if Re > 4000, Flow is turbulent Flow	1	4
	e)	**A centrifugal pump is required to pump 20 lit/sec against a head of 40m. Find the power required by pump if efficiency of pump is 70%.**		
	Ans.	Given data: Discharge (Q) = 20 lit/sec = $20\times10^{-3}\ \text{m}^3/\text{sec}$ Head (H_m) = 40m, Efficiency (η) = 70% = 0.70	1	
		$P = \frac{\gamma_w\ Q\ H_m}{\eta}$	1	
		$P = \frac{9.810 \times 20\times10^{-3} \times 40}{0.70}$	1	
		$\boxed{P = 11.21\ \text{kW}}$	1	4

Que. No.	Sub. Que.	Model Answer	Marks	Total Marks
Q.5		**Attempt any <u>TWO</u> of the following:**		**(12)**
	a)	**Calculate loss of head and direction of flow for pipe 400m long having slope of 1 in 200. It tapers from 1.4m diameter at higher end to 0.6m diameter at lower end. Discharge of water flowing through pipe is 800lit/sec. Pressure at higher end is 8N/cm² and at lower end is 10N/cm².**		
	Ans.	Given data:		
		$L = 400m, d_1 = 0.6m, d_2 = 1.4m,$		
		$Q = 800 \text{ lit/sec} = 800 \times 10^{-3} \text{ m}^3\text{/sec},$	½	
		Slope = 1 in 200,		
		$P_1 = 10 \text{ N/cm}^2 = 100 \text{ kN/m}^2,$		
		$P_2 = 8 \text{ N/cm}^2 = 80 \text{ kN/m}^2$	½	
		$Z_1 = 0, Z_2 = \frac{400}{200} = 2m$		
		$Q = A_1V_1$	½	
		$V_1 = \frac{Q}{A_1} = \frac{800 \times 10^{-3}}{\frac{\pi}{4}\times(0.6)^2} = 2.83 \text{ m/sec}$	½	
		by using continuity equation,		
		$A_1V_1 = A_2V_2$	½	
		$0.28 \times 2.83 = 1.54 \times V_2$	½	
		$V_2 = 0.514 \text{ m/sec}$		
		now, total head at section 1-1		
		$E_1 = \frac{P_1}{\gamma_L} + \frac{V_1^2}{2g} + Z_1$	½	
		$E_1 = \frac{100}{9.81} + \frac{2.23^2}{2\times9.81} + 0$		
		$E_1 = 10.601m$	½	
		now, total head at section 2-2		
		$E_2 = \frac{P_2}{\gamma_L} + \frac{V_2^2}{2g} + Z_2$	½	
		$E_2 = \frac{80}{9.81} + \frac{0.514^2}{2\times9.81} + 2$		
		$E_2 = 10.168m$	½	
		Loss of head $(h_L) = E_1 - E_2 = 10.601-10.168$		
		$\boxed{h_L = 0.432m}$	½	
		Total head at section 1-1 is greater than section 2-2		
		$\therefore$ flow of water is from section 1-1 to section 2-2 i.e. in upward direction.	½	**6**

Que. No.	Sub. Que.	Model Answer	Marks	Total Marks
Q.5	b)	**Explain the major and minor losses in pipe with their expression.**		
	Ans.	**Major loss:** The major loss of head is caused due to friction when fluid flow through a pipe. $$\boxed{h_f = \frac{f\ L\ V^2}{2gd}}$$ **Minor loss:** The minor loss of head is caused due to change in velocity of flowing fluid either in magnitude or direction i) **Loss of head at the entrance.** $$\boxed{H_L = \frac{0.5V^2}{2g}}$$ ii) **Loss of head due to sudden expansion.** $$\boxed{H_L = \frac{(V_1 - V_2)^2}{2g}}$$ iii) **Loss of head due to sudden contraction**. $$\boxed{H_L = \frac{0.5V^2}{2g}}$$ iv) **Loss of head at exit.** $$\boxed{H_L = \frac{V^2}{2g}}$$ v) **Loss of head due to obstruction.** $$\boxed{H_L = \left[\frac{A}{C_c \times a} - 1\right]^2 \frac{V^2}{2g}}$$ vi) **Loss of head due to pipe fitting.** $$\boxed{H_L = K\frac{V^2}{2g}}$$ vii) **Loss of head due to bend.** $$\boxed{H_L = K\frac{V^2}{2g}}$$	**1 each (any six)**	**6**

Que. No.	Sub. Que.	Model Answer	Marks	Total Marks
Q.5	c)	**A pipe 20cm diameter is 20m long and velocity in pipe is 8m/sec. What loss of head would be saved. If the last 5m length of pipe is replaced by 30cm diameter pipe, the change in section being sudden? Assume F = 0.04, for both pipes. Neglect entry and exit losses.**		
	Ans.		½	
		Given data: L = 20m, V_1 = 8m/sec, F = 0.04, d_1 = 20cm = 0.2 m, d_2 = 30cm = 0.3m, L_1 = 15m, L_2 = 5m $Q = A_1V_1$ $Q = \frac{\pi}{4} \times 0.2^2 \times 8 = 0.25 m^3/sec$	½	
		Now, $Q = A_2V_2$ $0.25 = \frac{\pi}{4} \times 0.3^2 \times V_2$	½	
		$V_2 = 3.54 m/sec$	1	
		Case i) head loss for full length of pipe $h_L = \frac{FLV^2}{2gD}$	1	
		$h_L = \frac{0.04 \times 20 \times 8^2}{2 \times 9.81 \times 0.2}$	1	6
		$\boxed{h_L = 13.047m}$ Case ii)) head loss for sudden expansion $h_L = \left(\frac{FL_1V_1^2}{2gd_1}\right) + \left(\frac{FL_2V_2^2}{2gd_2}\right) + \left(\frac{(V_1 - V_2)^2}{2g}\right)$ $h_L = \left(\frac{0.04 \times 15 \times 8^2}{2 \times 9.81 \times 0.2}\right) + \left(\frac{0.04 \times 5 \times 3.54^2}{2 \times 9.81 \times 0.3}\right) + \left(\frac{(8 - 3.54)^2}{2 \times 9.81}\right)$	1	
		$\boxed{h_L = 11.22m}$ Head loss Saved = 13.047-11.22 =1.82m	½	

Que. No.	Sub. Que.	Model Answer	Marks	Total Marks
Q.6		**Attempt any <u>TWO</u> of the following:**		(12)
	a)	**Explain hydraulic coefficients of an orifice with their expression and show relation between them.**		
	Ans.	**i) Coefficient of discharge (C_d):** The ratio of the actual discharge to the theoretical discharge is called as the coefficient of discharge.	1	
		$\boxed{C_d = \frac{Q_{actual}}{Q_{theoretical}}}$	½	
		ii)Coefficient of contraction (C_c): The ratio of the cross-sectional area of the jet at vena contracta to the cross-sectional area of the orifice is called coefficient of contraction.	1	
		$\boxed{C_c = \frac{\text{area of jet at vena contracta}}{\text{area of orifice}} = \frac{a}{A}}$	½	
		iii)Coefficient of velocity (C_v): The ratio of actual velocity of the jet at vena contracta to the theoretical velocity of the jet is called coefficient of velocity	1	
		$\boxed{C_v = \frac{X}{\sqrt{4yh}} \text{ or } C_v = \frac{V}{\sqrt{2gh}}}$	½	
		Relation between Cc, Cv and Cd: $\boxed{C_d = C_v \times C_c}$	1 ½	6

Que. No.	Sub. Que.	Model Answer	Marks	Total Marks
Q.6	b)	**Design a trapezoidal most economical channel section having side slope 1.5 H: 1V it is required to discharge of 20m³/sec with a bed slope of 1:6000 design section using Mannings formula, Take N = 0.015.**		
	Ans.	Given data:		
		$Q = 20\ m^3/sec$		
		$\text{Bed slope}(S) = \frac{1}{6000}$, Side slope (n) = $\frac{1.5}{1} = 1.5$		
		Manning's constant $(N) = 0.015$		
		Most economical condition for trapezoidal section having following condition		
		i) $R = \frac{d}{2}$ ii) $\frac{(b+2nd)}{2} = d\sqrt{(1+n^2)}$	1	
		$\frac{(b+2nd)}{2} = d \times \sqrt{(1+n^2)}$		
		$b + (2 \times 1.5 \times d) = 2 \times d\sqrt{(1+1.5^2)}$		
		$b + 3d = 3.606\ d$		
		$\boxed{b = 0.606d}$	1	
		$A = bd + nd^2$		
		$= (0.606d) \times d + 1.5d^2$		
		$\boxed{A = 2.106\ d^2}$	1	
		by using Manning formula,		
		$Q = A \times \frac{1}{N} \times (R)^{\frac{2}{3}} \times (S)^{\frac{1}{2}}$	1	
		$20 = 2.106d^2 \times \frac{1}{0.015} \times \left(\frac{d}{2}\right)^{\frac{2}{3}} \times \left(\frac{1}{6000}\right)^{\frac{1}{2}}$		
		$20 = 2.106 \times d^2 \times 66.67 \times 0.629 \times d^{\frac{2}{3}} \times 0.0129$		
		$\boxed{d = 2.92\ m}$	1	
		$b = 0.606d$		
		$\boxed{b = 1.77m}$	1	6

Que. No.	Sub. Que.	Model Answer	Marks	Total Marks
Q.6	**c)**	**Find the discharge over following notches for a head of 20cm.** **i) Triangular notch with $\theta = 60^0$ and $C_d = 0.62$** **ii) Rectangular notch 1.2m long and $C_d = 0.6$**		
	Ans.	Given data: H = 20cm = 0.2m, $\theta = 60^0$, C_d=0.62 - for triangular notch L = 1.2m, C_d=0.6 - for rectangular notch i) Discharge through triangular notch		
		$Q = \frac{8}{15}\times C_d\sqrt{2g}\tan\frac{\theta}{2}H^{5/2}$	1	
		$Q = \frac{8}{15}\times 0.62\sqrt{2\times 9.81}\ \tan\frac{60}{2}\ 0.20^{5/2}$	1	
		$Q=0.014m^3/s$	1	
		ii) Discharge through rectangular notch		
		$Q = \frac{2}{3}\times C_d L\sqrt{2g}\ H^{3/2}$	1	
		$Q = \frac{2}{3}\times 0.6\times 1.2\sqrt{2\times 9.81}\ 0.20^{3/2}$	1	
		$Q=0.190m^3/s$	1	6