



Q6- A type T thermocouple :

What is the temperature of the measurement junction if a voltage of 3.2mV is measured with at a 0C reference.

What is $V_{T20}(150C)=?$.

Good luck

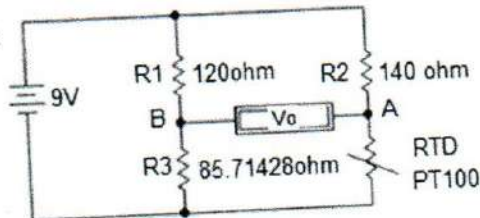
Thermocouple

TYPE T: COPPER-CONSTANTAN

	0	5	10	15	20	25	30	35	40	45
-150	-4.603	-4.712	-4.817	-4.919	-5.018	-5.113	-5.205	-5.294	-5.379	
-100	-3.349	-3.488	-3.624	-3.757	-3.887	-4.014	-4.138	-4.259	-4.377	-4.492
-50	-1.804	-1.971	-2.135	-2.296	-2.455	-2.611	-2.764	-2.914	-3.062	-3.207
-0	0.000	-0.191	-0.380	-0.567	-0.751	-0.933	-1.112	-1.289	-1.463	-1.635
+0	0.000	0.193	0.389	0.587	0.787	0.990	1.194	1.401	1.610	1.821
50	2.035	2.250	2.467	2.687	2.908	3.132	3.357	3.584	3.813	4.044
100	4.277	4.512	4.749	4.987	5.227	5.469	5.712	5.957	6.204	6.453
150	6.703	6.954	7.208	7.462	7.719	7.987	8.236	8.497	8.759	9.023
200	9.288	9.555	9.823	10.093	10.363	10.635	10.909	11.183	11.459	11.735
250	12.015	12.294	12.575	12.857	13.140	13.425	13.710	13.997	14.285	14.573
300	14.864	15.155	15.447	15.740	16.035	16.330	16.626	16.924	17.222	17.521
350	17.821	18.123	18.425	18.727	19.032	19.337	19.642	19.949	20.257	20.565

الفصل الدراسي : خريف/2019 اسم الأستاذ/المنسق: م. زياد حمزة شنيب الزمن : ساعتان.
 اسم الطالب : رقم القيد : 162107 المجموعة :

Q1- Using PT100 in the following wheatstone bridge ,what is the output voltage V_o if the temperature is $140F^\circ$.
 What is the temperatur if $V_o = 0.165254V$

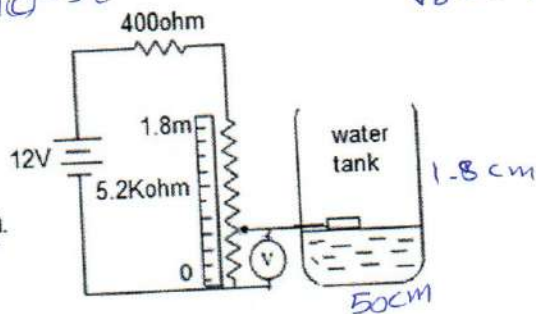


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$$R_{PT100} = \frac{5}{9} (T_C - 32)$$

$$V_o = 9 \left(\frac{100}{100} \right)$$

Q2- Using 5.2Kohm Pot. for measuring water level in cylindrical water tank, what is the output voltage if there is 40 liter in the tank.
 What is quantity of the water if water level is 120cm.



Q3- A sample of metal resistance versus temperature has the following measured values:

T(C)	40	50	60	70	80	90	100
R(Ω)	97.1	99.3	101.4	103.0	105.6	107.3	109.6

Find the linear approximation of resistance versus temperature between (40 and 100C).

What is the approximate value of resistance if temperature is $63C^\circ$?

.....
300

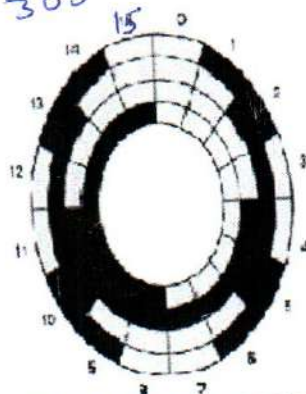
Q4- A position sensor (Incremental optical encoder) uses a 300-slot disk. The current value of the counter is 01001001. What is the angle of the shaft being measured?. What is the minimum angle we can measure using this slot disk?

73

$$\frac{360}{300}$$

Q5- What is the name of this encoder , what is the angle if the encoder output 0101?
 What is the minimum angle we can measure using this encoder?

$$2.2446$$



$$2.614$$

حريف 2019

الطابع الترميزية لمدى حساسية وخواص الطاقة

التميز في الحسابات
التميز في النتائج

$$140 F^{\circ} \Rightarrow ? C^{\circ}$$

حل

$$T(F^{\circ}) = \frac{9}{5} T(C^{\circ}) + 32$$

$$T(C^{\circ}) = \frac{(T(F^{\circ}) - 32) \cdot 5}{9} = \frac{(140 - 32) \cdot 5}{9} = 60^{\circ} \quad (1)$$

قيمة الجهد عند RTD عند 60 درجة مئوية :

$$(60^{\circ} \times 0.39 \frac{\Omega}{^{\circ}}) + 100 \Omega = 123.4 \Omega \quad (1)$$

$$V_A = \frac{9 \times 123.4}{123.4 + 140} = 4.2164 V$$

$$V_B = \frac{9 \times 85.71428}{85.71428 + 120} = 3.75 V$$

$$V_0 = V_A - V_B = 0.4664 V \quad (2)$$

قيمة الجهد عند 0 درجة مئوية :

$$V_0 = V_A - V_B \Rightarrow V_A = V_0 + V_B$$

$$V_A = 0.165254 V + 3.75 V = 3.915254 V \quad (1)$$

$$V_A = \frac{9 \times RTD}{RTD + 140} \Rightarrow 3.915254 RTD + 548.13556 = 9 RTD$$
$$5.084746 RTD = 548.13556$$
$$RTD = 107.8 \Omega$$

$$\text{Temperature} = \frac{107.8 \Omega - 100 \Omega}{0.39 \frac{\Omega}{C^{\circ}}} = 19.99997 C^{\circ} \approx 20 C^{\circ} \quad (4)$$

8

$$2 \quad \pi r^2 \times H = \text{مساحة الخزان} \quad (2 \text{ لتر})$$

$$= 25^2 \times \pi \times 180 \text{ cm} = 353429.1735 \text{ cm}^3$$

$$= \frac{353429.1735 \text{ cm}^3}{1000 \text{ cm}^3} = 353.429 \text{ Liter}$$

فإذا كان لدينا الخزان بارتفاع 40 لتر:

$$353.429 \text{ Liter} \rightarrow 5200 \text{ ل}$$

$$40 \text{ Liter} \rightarrow ?$$

$$\frac{40 \text{ Liter} \times 5200 \text{ ل}}{353.42917 \text{ Liter}} = 588.5196 \text{ ل}$$

$$V_0 = \frac{12 \times 588.5196}{5200 \text{ ل} + 400 \text{ ل}} = \underline{\underline{1.26111 \text{ ل}}}$$

فإذا كان لدينا الخزان بارتفاع 120:

$$180 \text{ cm} \rightarrow 353.429 \text{ Liter}$$

$$120 \text{ cm} \rightarrow ?$$

$$= \frac{120 \text{ cm} \times 353.429 \text{ Liter}}{180 \text{ cm}} = \underline{\underline{235.619 \text{ Liter}}}$$

absolute encoder اسم المشفر

5
2
3

قيمه الزاويه عند القراءة $(5)_{10} \leftarrow (0101)_2$

$$\frac{360^\circ}{16 \text{ slot}} \times 5 \text{ slot} = \underline{\underline{112.5^\circ}}$$

$$= \frac{360^\circ}{16 \text{ slot}} \times 1 \text{ slot} = \text{أقل زاوية}$$

$$\underline{\underline{22.5^\circ}}$$

$$T_M = T_L + \left[\frac{T_H - T_L}{V_H - V_L} \right] (V_m - V_L)$$

6
3

$$V_m = 3.2 \text{ mV}, V_H = 3.357 \text{ mV}, V_L = 3.132 \text{ mV}$$

$$T_M = ?, T_H = 80^\circ, T_L = 75^\circ$$

$$T_M = 75 + \left[\frac{80^\circ - 75^\circ}{3.357 \text{ mV} - 3.132 \text{ mV}} \right] (3.2 \text{ mV} - 3.132 \text{ mV})$$

$$= \underline{\underline{76.5111^\circ}}$$

$$V_{T_0}(150^\circ) = ?$$

$$= V_{T_0}(150) - V_{T_0}(20) = 6.703 \text{ mV} - 0.787 \text{ mV} = \underline{\underline{5.916 \text{ mV}}}$$

$$\alpha_0 = \frac{1}{R(T_0)} \cdot \frac{(R_2 - R_1)}{(T_2 - T_1)}$$

30W

$$= \frac{1}{103.0} * \frac{109.6 - 97.1}{100 - 40} = 2.02265 \times 10^{-3}$$

$$R(T) = R(T_0) [1 + \alpha_0 \Delta T]$$

$$R(T) = 103 [1 + 2.02265 \times 10^{-3} \Delta T]$$

$$\Delta T = T - T_0$$

approximate value at 63°C

$$R(63^\circ) = 103.0 [1 + 2.02265 \times 10^{-3} (63 - 70)]$$

$$= 101.5416667 \Omega //$$

$$(01001001)_2 \rightarrow (73)_{10}$$

40W

فقول الزاوية له 73 درجة

$$\frac{360^\circ}{300 \text{ slot}} \times 73 \text{ slot} = 87.6^\circ$$

اقول اوية 6 في 6 اوية 36 درجة

$$\frac{360}{300 \text{ slot}} \times 1 \text{ slot} = 1.2^\circ$$