

General Certificate of Education Advanced Level Examination June 2010

Electronics

ELEC5

Data Sheet

Unit 5 ELEC5 Communications Systems

Resistors	Preferred values for resistors (E24) series: 1.0, 1.1, 1.2, 1.3, 1.5, 1.6, 1.8, 2.0, 2.2, 2.4, 2.7, 3.0, 3.3, 3.6, 3.9, 4.3, 4.7, 5.1, 5.6, 6.2, 6.8, 7.5, 8.2, 9.1 ohms etc.				
Resistor Printed Code (BS 1852)	This code consists of letters and numbers: R means \times 1 K means \times 1000 (i.e. 10^3) M means \times 1000 000 (i.e. 10^6) Position of the letter gives the decimal point Tolerances are given by the letter at the end of the code, $F = \pm 1\%$, $G = \pm 2\%$, $J = \pm 5\%$, $K = \pm 10\%$, $M = \pm 20\%$.				
Resistor Colour Code	Number Colour 0 Black 1 Brown 2 Red 3 Orange 4 Yellow 5 Green 6 Blue 7 Violet 8 Grey 9 White	Tolerance Value Multiplier			
	Tolerance, gold = $\pm 5\%$, silver = $\pm 10\%$, no band = $\pm 20\%$				
Silicon diode	$V_{\mathrm{F}} = 0.7 \mathrm{\ V}$				
Silicon transistor	$V_{\rm be} \approx 0.7 \text{V}$ in the on state, $V_{\rm ce} \approx 0.2 \text{V}$ when saturated				
Resistance	$R_{\mathrm{T}} = R_1 + R_2 + R_3 + \dots$	series			
	$\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \dots$	parallel			
Capacitance	$\frac{1}{C_T} = \frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3} + \dots$	series			
	$C_{\rm T} = C_1 + C_2 + C_3 + \dots$	parallel			
Time constant	$T = CR$, $T_{\frac{1}{2}} = 0.69 CR$				
ac theory	$I_{\rm rms} = \frac{I_0}{\sqrt{2}}$				
	$V_{\rm rms} = -\frac{V_0}{\sqrt{2}}$				
	$X_{\rm C} = \frac{1}{2\pi fC}$	reactance			
	$X_{\rm L} = 2\pi f L$	reactance			
	$f = \frac{1}{T}$	frequency, period			
	$f_0 = \frac{1}{2\pi\sqrt{LC}}$	resonant frequency			

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$$G_{\rm V} = \frac{V_{\rm out}}{V_{\rm in}}$$

voltage gain

$$G_{\rm V} = -\frac{R_{\rm f}}{R_{\rm l}}$$

inverting

$$G_{\rm V} = 1 + \frac{R_{\rm f}}{R_{\rm l}}$$

non-inverting

$$V_{\text{out}} = -R_{\text{f}} \left(\frac{V_1}{R_1} + \frac{V_2}{R_2} + \frac{V_3}{R_3} \right)$$

summing

$$V_{\text{out}} = (V_+ - V_-) \frac{R_f}{R_1}$$

difference

555 Astable and Monstable T = 1.1RC

$$T = 1.1RC$$

monostable

$$t_{\rm H} = 0.7 (R_{\rm A} + R_{\rm B})C$$

astable

$$t_{\rm L} = 0.7 \ R_{\rm B}C$$

$$f = \frac{1.44}{(R_{\rm A} + 2R_{\rm B})C}$$

astable frequency

Electromagnetic waves $c = 3 \times 10^8 \text{ m s}^{-1}$

speed in vacuo

Assembler language microcontroller instructions

Mnemonic	Operands	Description	Operation	Flags	Clock cycles
NOP	none	No operation	none	none	1
CALL	K	Call subroutine	stack <=PC PC <=K	none	2
RET	none	Return from subroutine	PC <= stack	none	2
INC	R	Increments the contents of R	$(R) \le (R) + 1$	Z	1
DEC	R	Decrements the contents of R	$(R) \le (R) - 1$	Z	1
					:
ADDW	K	Add K to W	$W \le W + K$	Z, C	1
ANDW	K	AND K with W	W <= W • K	Z, C	1
SUBW	K	Subtract K from W	$W \leq W - K$	Z, C	1
ORW	K	OR K and W	$W \leq W + K$	Z, C	1
XORW	K	XOR K and W	$W \leq W \oplus K$	Z, C	1
JMP	K	Jump to K (GOTO)	PC <= K	none	2
JPZ	K	Jump to K on zero	PC <= K if Z=1	Z=1	2
JPC	K	Jump to K on carry	PC <= K if C=1	C=1	2
MOVWR	R	Move W to the contents of R	(R) <= W	Z	1
MOVW	K	Move K to W	W <= K	Z	1
MOVRW	R	Move the contents of R to W	W <= (R)	Z	1