OCR (TABLES 2)

FORMULAE SHEET

for use in GCSE Design & Technology Examinations

Area of rectangle $= l \times w$

Area of triangle $= \dfrac{b \times h}{2}$

Area of circle $= \pi r^2$

Circumference of circle $= 2\pi r$

Volume of rectangular prism $= l \times w \times h$

Volume of cylinder = area of base circle $\times$ h

Volume of cone $= \dfrac{\text{area of base circle} \times h}{3}$

$V = I \times R$ where V = voltage in volts, I = current in amps, R = resistance in ohms

$P = V \times I$ where P = power in watts, V = voltage in volts, I = current in amps

Resistors in series

$$R_{total} = R_1 + R_2 + R_3 \text{ etc.}$$

Resistors in parallel

$$\frac{1}{R_{total}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} \text{ etc.}$$

OR

$$R_{total} = \frac{R_1 \times R_2}{R_1 + R_2}$$

Potential divider

$$\text{Voltage out} = \frac{R_2}{R_1 + R_2} \times \text{Supply Voltage}$$

(Where R_1 is connected to supply voltage)

Resistor colour code

1st Colour Band 1st Digit		2nd Colour Band 2nd Digit		3rd Colour Band Number of Zeros		4th Colour Band Tolerance	
Black	0	Black	0	Black	No zeros	Gold	5%
Brown	1	Brown	1	Brown	One zero	Silver	10%
Red	2	Red	2	Red	Two zeros		
Orange	3	Orange	3	Orange	Three zeros		
Yellow	4	Yellow	4	Yellow	Four zeros		
Green	5	Green	5	Green	Five zeros		
Blue	6	Blue	6	Blue	Six zeros		
Violet	7	Violet	7	Silver	0.01		
Grey	8	Grey	8	Gold	0.1		
White	9	White	9				

Transistor current gain $(h_{fe}) = \dfrac{I_c}{I_b}$

where I_c = collector current in amps, I_b = base current in amps

Emitter current (I_e) = $I_b + I_c$

Voltage gain = $\frac{V_{out}}{V_{in}}$

Capacitor time constant $T = C \times R$

where T = time in seconds
C = capacitance in farads
R = resistance in ohms

Capacitors in series

$$\frac{1}{C_{total}} = \frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3} \text{ etc.}$$

Capacitors in parallel

$$C_{total} = C_1 + C_2 + C_3 \text{ etc.}$$

Mark space ratio = $\frac{t_1}{t_2}$

where t_1 is mark time in seconds
t_2 is space time in seconds

Astable frequency (f) = $\frac{1}{1.4 \times C_1 \times R_1}$

555 astable frequency (f) = $\frac{1.44}{(R_a + 2R_b)C}$

output high time (t_1) = $0.693 (R_a + R_b)C$
output low time (t_2) = $0.693 (R_b)C$

555 monostable time constant

on time = $1.1 R_aC$

Op amp gain (A_v) = $\frac{\text{change in output voltage}}{\text{change in input voltage}}$

Differential amplifier

output voltage (V_{out}) = $A(V_2 - V_1)$
where A = open loop gain
V_1 = inverting input voltage
V_2 = non inverting input voltage

Inverting amplifier

Voltage gain (A_v) = $\frac{-R_f}{R_{in}}$

Non inverting amplifier

Voltage gain = $\frac{R_f + R_{in}}{R_{in}}$

where R_f = feedback resistor value in ohms
R_{in} = input resistor value in ohms

Moment = force × distance

where moment is in newton metres
force is in newtons
distance is in metres

In equilibrium $M_c = M_{ac}$

where M_c = clockwise moment
M_{ac} = anticlockwise moment

$$\textbf{Stress} = \frac{\text{force}}{\text{cross sectional area}}$$

where force is in newtons
area is in mm^2

$$\textbf{Strain} = \frac{\text{change in length}}{\text{original length}}$$

$$\textbf{Young modulus of elasticity} = \frac{\text{stress}}{\text{strain}}$$

Change in length due to change in temperature = coefficient of linear expansion × original length × temp rise

where coefficient is given
length is in m or mm
temperature is in °C

$$\textbf{Factor of safety} = \frac{\text{ultimate stress}}{\text{working stress}}$$

Heat loss = u × temperature difference × area

where heat loss is in watts
u is in $W/m^2/°C$
temperature is in °C
area is in m^2

Force = pressure × area

where force is in newtons
pressure is in newtons per mm^2
area is in mm^2

$$\textbf{Mechanical advantage} = \frac{\text{load moved}}{\text{effort applied}}$$

where load is in newtons
effort is in newtons

$$\textbf{Velocity ratio} = \frac{\text{distance moved by effort}}{\text{distance moved by load}}$$

$$\textbf{Efficiency} = \frac{MA \times 100}{VR} \ (\%)$$