

**ADVANCED GCE UNIT**

**2525/01**

**D&T: SYSTEMS AND CONTROL TECHNOLOGY**

UNIT 8: Systems and Control Technology 2

**INSERT – FORMULAE SHEET**

**JANUARY 2007**



**INSTRUCTIONS TO CANDIDATES**

- This insert is to be used as required.

This document consists of **4** printed pages.

**General**

Area of rectangle  $= l \times w$

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

Area of circle  $= \frac{\pi d^2}{4}$

Circumference of circle  $= \pi d$

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

Volume of cylinder  $= \text{area of base circle} \times h$

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

**Electrical and Electronic Systems**

$$V = I \times R$$

$$W = V \times I$$

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  $V_{out} = V_{in} \times \frac{R_2}{R_1 + R_2}$

Capacitor time constant  $T = C \times R$

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 =  $\frac{T_{on}}{T_{off}}$

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 =  $0.693(R_a + R_b)C$

output low time =  $0.693(R_b)C$

555 monostable time constant

on time =  $1.1R_a C$

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

Non inverting amplifier  $V_{out} = V_{in} \times \frac{(R_f + R_{in})}{R_{in}}$

Inverting amplifier  $V_{out} = -V_{in} \times \frac{R_f}{R_{in}}$

Summing amplifier  $V_{out} = -R_f \times (\frac{V_1}{R_1} + \frac{V_2}{R_2} + \frac{V_3}{R_3})$  etc.

Differential amplifier  $V_{out} = \frac{-R_f}{R_a} \times (V_2 - V_1)$

MOSFET  $g_m = \frac{\Delta I_d}{\Delta V_{gs}}$

Battery life battery capacity = current x time

## Mechanical Systems

Moment = force x perpendicular distance

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

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

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

Work done = force x distance moved

Power = force x velocity

Work done = torque x angle turned

Power = torque x angular velocity

### **Pneumatic Systems**

Force = pressure x area

Compression ratio =  $\frac{\text{gauge pressure} + \text{atmospheric pressure}}{\text{atmospheric pressure}}$

Volume of air used = area x stroke x compression ratio

Lifting load = vacuum level x area

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