



Rewarding Learning

General Certificate of Secondary Education
2011

Technology and Design

Unit 2:

Systems and Control

Element 2: Mechanical and
Pneumatic Control Systems

[GTD22]

MONDAY 6 JUNE, MORNING

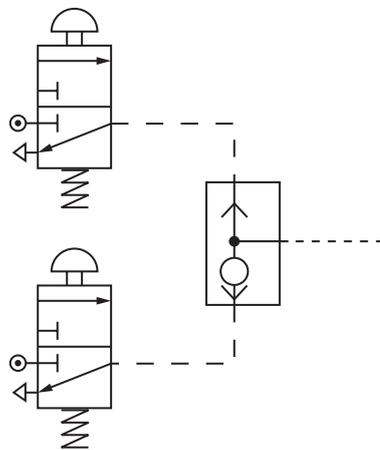
**MARK
SCHEME**

Element 2

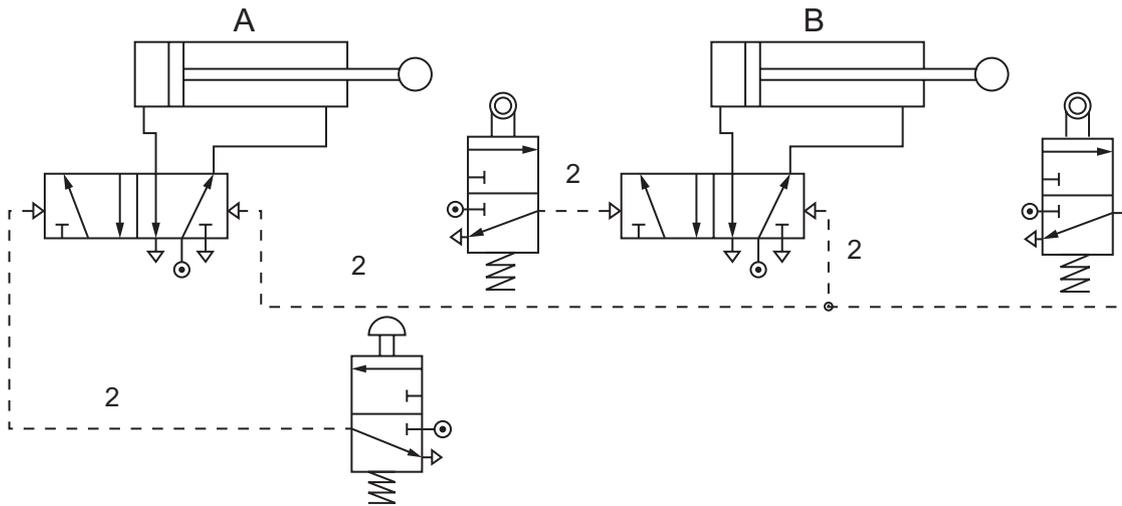
Mechanical and Pneumatic Control Systems

AVAILABLE
MARKS

- 1 (a) (i) Double acting cylinder [1]
- (ii) $F = P \times A$
 $300 = 0.6 \times A$ [1]
 $A = 300/0.6$ [1]
 $= 500 \text{ mm}^2$ [1]
Piston Area = $500 + 100 = 600 \text{ mm}^2$ [2]
- (b) (i) A 3/2 valve
B 5/2 valve
C Reservoir
D One way flow restrictor or Flow control valve [4]
- (ii) Signal to switch 5/2 valve **B**, cylinder **outstrokes** slowly [2]
3/2 roller valve **F** operated – **time delay** [2]
Valve B reset, cylinder **instrokes**. [2]
- (iii) Adjust flow control valve E [3]
Change the position of valve F [3]
- (iv) Additional 3/2 start valve [2]
Shuttle valve [2]
Correct piping for shuttle valve [2]



(c) (i)



- Connection from start valve to 5/2 valve at cylinder A [2]
- Signal from 3/2 roller valve at A+ to 5/2 valve at cylinder B [2]
- Signal from 3/2 roller valve at B+ to 5/2 valve at cylinder A [2]
- Signal from 3/2 roller valve at B+ to 5/2 valve at cylinder B [2]

- (ii) Insert 3/2 roller valve at B- [2]
- Connect signal from this valve to supply port of start valve [2]

AVAILABLE MARKS

40

2 (a) Solutions

Name	Function
Ratchet and Pawl	B
Worm and wormwheel	D
Compound gear train	A
Bell crank lever	C

8 × 1 [8]

- (b) (i) The load transmitted
The distance between
Is an exact speed ratio required
Can the transmission slip if overloaded etc
Any two appropriate factors

2 × 2 [4]

- (ii) belts
Gears
Chains *any two*

2 × 2 [4]

- (iii) Gears

Advantages: large loads, exact speed ratios etc 1 off

Disadvantage: lubrication required, short distance etc 1 off

Belts

Advantages: large distance, slip on overload, no lubrication etc 1 off

Disadvantage: inexact ratios unless toothed, noisy etc 1 off

Chains

Advantages: large loads, large distance, exact ratios 1 off

Disadvantage: noisy, lubrication required etc 1 off

Any two of the above methods

[4]

AVAILABLE
MARKS

		AVAILABLE MARKS
(c) (i) Rack and pinion	[2]	
(ii) Input – Rotary	[2]	
Output – Linear	[2]	
(iii) Bore hole in handle and attach lever using adhesive. or Bore hole in handle, thread hole and end of lever. Screw on handle	[4]	
(iv) Effort distance = $\Pi \times D/4$		
$= \Pi \times 600/4$	[2]	
$= 471.2$	[2]	
Drill distance = $\frac{20 \times 4}{4}$	[2]	
$= 20$	[2]	
Velocity ratio = $\frac{471.2}{20}$	[1]	
$= 23.6$	[1]	40
Total		80