

Semester II Examinations, 2002/2003
Front Page Template

Exam Code(s)	3BM121
Exam(s)	3 rd Mechanical Engineering
Module Code(s)	ME312
Module(s)	Automated Systems
Paper No.	1
Repeat Paper	Special Paper
External Examiner(s)	Prof. P.J. Mallon
Internal Examiner(s)	Prof. J.F. McNamara
	Dr. P. Molloy

Instructions:

Answer 5 questions
All questions marked equally

Duration	3hrs.
No. of Answer books	1

Requirements:

Handout	
MCQ	
Statistical Tables	
Graph Paper	
Log Graph Paper	
Other Material	

No. of Pages	2
Department(s)	

- 1(a) Write what you know about aftercooling, absorption, refrigeration and adsorption drying of compressed air. (10)
- (b) Explain the operation of the following: flow control, quick exhaust valve, pilot assisted solenoid valves, relay memory dominant set, relay memory dominant reset. (10)
2. A form tool is to press a metal plate. Extension of the piston rod must be disabled until the supply pressure to the control valve reaches a preset pressure as measured by an adjustable pressure switch. Providing the preset pressure is reached, the operation of two push button switches advances the form tool. The advance and return speeds are to be adjustable. The piston rod must return when either push button is released. Design an electro-pneumatic system, showing both pneumatic and electrical circuits, which can be used to control this pressing operation. (20)
3. Two cylinders are used to push product from a vertical stack into a container as shown in Figure 3. Design a pneumatic and electrical circuit which will continuously remove product from the stack when a start switch is pressed. Operation will cease if the switch is released but only when the product removal cycle in operation at that time has finished, i.e. product cannot be left half removed. (20)

Use roller limit switches to detect cylinder 1 position and reed switches to detect cylinder 2 position. Use two 5/2 way single solenoid valves in conjunction with double acting cylinders.

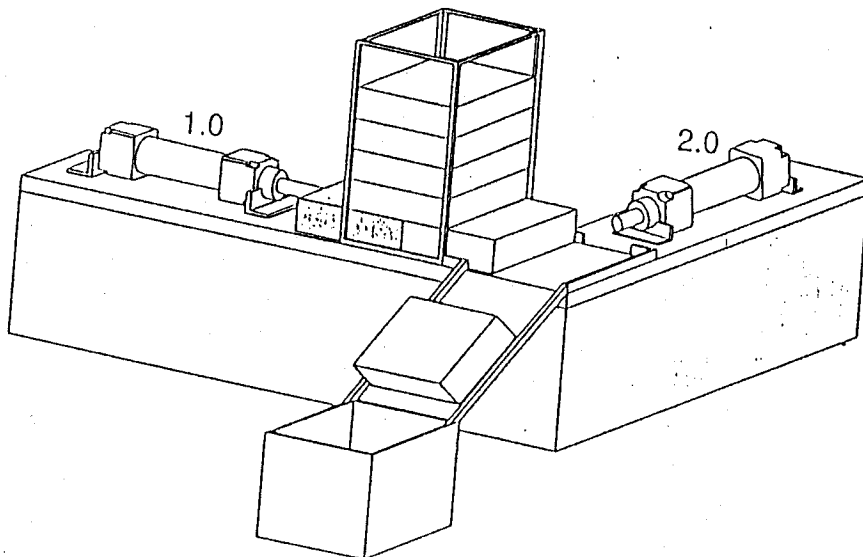


Figure 3

4. A manufacturing operation requires that two components be pressed together for 20 seconds while a bonding agent cures. A push button is to control the forward stroke and after the desired period has elapsed the piston rod is to return automatically to the initial position. The cylinder cannot extend until the initial, or fully retracted position, has been reached and proven. The return stroke cannot occur until the forward end position has been reached and proven. A new start cycle cannot be initiated until the push button has first been released and depressed again.

Design an electropneumatic circuit which will effect this operation. (20)

- 5(a) Indicate the major parameters which affect the choice of hydraulic fluid and how its working life is determined by these. (8)

- (b) Design a simple electro-hydraulic press. The press uses two hydraulic cylinders - one to clamp the workpiece and the other to create the impression. Clamp and press operation are activated by operating electric switches which in turn activate solenoid valves. Pressure is supplied by a gear pump driven by an electric motor.

Show both hydraulic and electrical circuits and indicate what each component in your circuit is and what function it performs. (12)

- 6(a) Show a simple closed-loop circuit for variable hydraulic speed pump and motor control. Explain the elements used. (8)

- (b) Modify the above circuit such that it incorporates an auxiliary pump for the replacement of leakage oil and for the control of the pump, check valves for anti-cavitation, and uses a feed/pressure relief valve to provide system protection. (12)

- 7(a) Draw a block diagram showing the main functional units of a programmable controller. (5)

- (b) What is an opti-isolator? (5)

- (c) What are the basic ladder logic symbols? (5)

- (d) Draw a simple ladder logic circuit to control three outputs, a motor and two solenoids. Each output is controlled by two switches which must be simultaneously activated for there to be a response. All three outputs may be cut off by an emergency stop or override. (5)