

Government of Karnataka
Department of Technical Education
Board of Technical Examinations, Bengaluru

Course Title: Electro Pneumatics Lab	Course Code: 15MC35P
Mode (L:T:P) : 0:2:4	Credits: 3
Type of course: Tutorials and Practical's	Total Contact Hours: 78
CIE- 25 Marks	SEE- 50 Marks

Pre-requisites: Knowledge of Fluid power Engineering

Course Objectives: Understanding of Electro pneumatic components and development of Electro pneumatic circuit for a given Applications

Course Outcomes: At the end of the semester, the students must be able to

1. Know the salient features related to components of Electro-pneumatic system
2. Develop and execute Electro Pneumatic circuits for an Engineering application

Course Outcome		Cognitive Level	Linked with PO	Teaching Hours
CO1	Know the salient features related to components of Electro-pneumatic system.	U	1,2,	12
CO2	Develop and execute Electro Pneumatic circuits for an engineering application	A	1,2,3,4	66
		Total sessions		78

Legend: R; Remember, U: Understand A: Application

Mapping of Course Outcomes with Program Outcomes

Course	Programme Outcomes									
	1	2	3	4	5	6	7	8	9	10
Electro pneumatics Lab	3	3	3	3	-	-	-	-	-	-

Level 3- Highly Addressed, Level 2-Moderately Addressed, Level 1-Low Addressed.

Method is to relate the level of PO with the number of hours devoted to the COs which address the given PO.

If $\geq 40\%$ of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 3

If 25 to 40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 2

If 5 to 25% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 1

If $< 5\%$ of classroom sessions addressing a particular PO, it is considered that PO is considered not-addressed.

Contents

Unit -I

1. Study of salient features related to components of Electro-pneumatic system:

- a) Energy Supply (source): Air compressor, Air receiver, Air filter, Air dryer, Air Lubricator Pressure Regulator, Air service equipment, Air distribution.
- b) Input Elements (sensors): Directional control valves, Limit switches, Push buttons, Proximity sensors.
- c) Processing Element: Directional control valves, Logic elements, Pressure control Valves, Final Control Element: Directional control valves.
- d) Actuating devices (Actuators): Pneumatic cylinder, Air motors, Rotary actuators, Indicators.

2 Familiarization of circuit symbols

Unit -II

- 1. Build a pneumatic circuit for Stamping operation by using single acting cylinder being controlled by 3way 2 position directional control valves
- 2. Build a pneumatic circuit for automatic opening and closing of a door by using double acting cylinder being controlled by 4way 2 position directional control valves.
- 3. Build a pneumatic circuit for forward and reverse speed control of a double acting cylinder (meter in meter out)
- 4. Build a pneumatic circuit of a pilot controlled double acting cylinder of being controlled by 3way 2 position directional control valves and 4way 2 positions impulse valve.
- 5. Build Circuit a pneumatic circuit of a double acting cylinder being controlled by 4way 2 position solenoid operated direction control valves.
- 6. Build Circuit a pneumatic circuit of a double acting cylinder advances then actuated by a solenoid valve but it's retract movements is delayed by time lag through a timer.
- 7. Build Circuit a pneumatic circuit for automatic reciprocating motion of double acting cylinder.

8. Design a pneumatic circuit for feeding a strip with following sequences:
9. Holding the strip, moving the strip forward on to the tool, maintaining the strip in that position and returning the strip to its original position after work is over.
10. Design a Circuit for pneumatic circuit to press fit a pin to a hole with a precondition that while actuating of the cylinder, both the hands of the operator should be engaged.
11. Design a feeding mechanism for milling machine so that the cylinder moves rapidly as machine is started then, its speed gets reduced towards end of the stroke and after completion of feeding, the cylinder retracts at higher speed.
12. Build Circuit a pneumatic transport system, a pneumatic cylinder has to push a trolley to its desired rail with a pre condition that cylinder will start advancing after a time delay and retract to its original positions back from its advanced position also after a time delay.
13. Build Circuit a pneumatic circuit for a machine device driven by a single acting cylinder with actuation at least two mutually operated DC valves (Safety circuit with OR and AND gates).
14. Design a pneumatic circuit for a clamping device having variable clamping forces.
15. Build Circuit a pneumatic circuit for a serial breaking action in a number of wagons placed one after the other.
16. Build Circuit a pneumatic circuit for a clamping device of a drilling machine such that the clamps are activated before the drill is fed to the work
17. A piston rod of a double acting cylinder is to extend when two 3/2 DC valves are actuated if one of the 3/2DC valve is released the cylinder returns to its initial position(AND function),
18. A double acting cylinder extends if one or both 3/2DC valve are operated. If both 3/2 DC valves are released then cylinder retracts (OR function).

Reference Books:

- 1: Pneumatic system principles and maintenance by S.R. Majumdar. Tata McGraw hill Education private Ltd. New Delhi.
2. Hydraulic and pneumatic control – K.Shanmuga sundaram, S.CHAND Publishing Company

Note: Above exercises must be carried out first by using appropriate **simulation software** and then practice on Electro pneumatic **trainer kit**.

Contents linked with CO and PO

Sl No	Contents	CO	PO
1	Study of salient features related to components of Electro-pneumatic system: a) Energy Supply (source): Air compressor, Air receiver, Air filter, Air dryer, Air Lubricator Pressure Regulator, Air service equipment, Air distribution. b) Input Elements (sensors): Directional control valves, Limit switches, Push buttons, Proximity sensors. c) Processing Element: Directional control valves, Logic elements, Pressure control Valves, Final Control Element: Directional control valves. d) Actuating devices (Actuators): Pneumatic cylinder, Air motors, Rotary actuators, Indicators.	1	1,2,
2	Familiarization of circuit symbols	1	1,2
3	Build a pneumatic circuit for Stamping operation by using single acting cylinder being Controlled by 3way 2 position directional control valves.	2	1,2,3,4
4	Build a pneumatic circuit for automatic opening and closing of a door by using double acting cylinder being controlled by 4way 2 position directional control valves	2	1,2,3,4
5	Build a pneumatic circuit for forward and reverse speed control of a double acting cylinder (meter in meter out)	2	1,2,3,4
6	Build a pneumatic circuit of a pilot controlled double acting cylinder of being controlled by 3way 2 position directional control valves and 4way 2 positions impulse valve.	2	1,2,3,4
7	Build Circuit a pneumatic circuit of a double acting cylinder being controlled by 4way 2 Position solenoid operated direction control valves.	2	1,2,3,4
8	Build Circuit a pneumatic circuit of a double acting cylinder advances then actuated by a solenoid valve but it's retract movements is delayed by time lag through a timer	2	1,2,3,4
9	Build Circuit a pneumatic circuit for automatic reciprocating motion of double acting cylinder	2	1,2,3,4
10	Design a pneumatic circuit for feeding a strip with following sequences Holding the strip, moving the strip forward on to the tool, maintaining the strip in that Position and returning the strip to its original position after work is over	2	1,2,3,4
11	Design a Circuit for pneumatic circuit to press fit a pin to a hole with a precondition that while actuating of the cylinder, both the hands of	2	1,2,3,4

	the operator should be engaged		
12	Design a feeding mechanism for milling machine so that the cylinder moves rapidly as machine is started then, its speed gets reduced towards end of the stroke and after completion of feeding, the cylinder retracts at higher speed	2	1,2,3,4
13	Build Circuit a pneumatic transport system, a pneumatic cylinder has to push a trolley to its desired rail with a pre condition that cylinder will start advancing after a time delay and retract to its original positions back from its advanced position also after a time delay	2	1,2,3,4
14	Build Circuit a pneumatic circuit for a machine device driven by a single acting cylinder with actuation at least two mutually operated DC valves (Safety circuit with OR and AND gates.	2	1,2,3,4
15	Design a pneumatic circuit for a clamping device having variable clamping forces.	2	1,2,3,4
16	Build Circuit a pneumatic circuit for a serial breaking action in a number of wagons placed one after the other.	2	1,2,3,4
17	Build Circuit a pneumatic circuit for a clamping device of a drilling machine such that the clamps are activated before the drill is fed to the work	2	1,2,3,4
18	A piston rod of a double acting cylinder is to extend when two 3/2 DC valves are actuated if one of the 3/2DC valve is released the cylinder returns to its initial position (AND function)	2	1,2,3,4
20	A double acting cylinder extends if one or both 3/2 DC valve are operated. If both 3/2 DC valves are released then cylinder retracts (OR function).	2	1,2,3,4

Student Activity

Activity No	Description of the Student Activity
1	Build a pneumatic circuit for an application beyond the syllabus, execute it on simulation software or trainer kit and submit 2 to 3 pages hand written report

Note

1. Group of max four students should do any one of the above activity or any other similar activity related to the course COs and get it approved from concerned Teacher and HOD.
2. No group should have activity repeated or similar
3. Teacher should ensure activities by group must cover all COs
4. Teacher should assess every student by using suitable **Rubrics** approved by HOD

Rubrics

Dimension	Exemplary	Accomplished	Developing	Beginning	Roll No. of the Student				
	5/4	3	2	1	1	2	3	4	5
Organization	Information presented in logical, interesting sequence	Information in logical sequence	Difficult to follow presentation-- student jumps around	Cannot understand presentation-- no sequence of information	Ex: 2				
Subject Knowledge	Demonstrates full knowledge by answering all class questions with explanations and elaborations	At ease with expected answers to questions but does not elaborate	Uncomfortable with information and is able to answer only rudimentary questions	Does not have a grasp of the information. Cannot answer questions about subject	3				
Graphics	Explain and reinforce screen text and presentation	Relate to text and presentation	Occasionally uses graphics that rarely support text and presentation	Uses superfluous graphics or no graphics	4				
Oral Presentation	Maintains eye contact and pronounces all terms precisely. All audience members can hear	Maintains eye contact most of the time and pronounces most words correctly. Most audience members can hear presentation	Occasionally uses eye contact, mostly reading presentation, and incorrectly pronounces terms. Audience members have difficulty hearing	Reads with no eye contact and incorrectly pronounces terms. Speaks too quietly	5				
Total Score=2+3+4+5=14/4=3.5=4									

Scheme of valuation for SEE

Sl. no.	Performance	Max. Marks
1	Familiarization of circuit symbols.	10
2	Writing of circuit diagram for a given task	15
3	Execution on trainer kit	20
5	Viva Voce	05
	TOTAL	50

Course Assessment Pattern

Particulars			Max Marks	Evidence	Course outcomes
Direct Assessment	CIE	Two tests (Average of Two tests)	10	Blue books	1 &2
		Practical record	10	Practical record	1 &2
		Student Activity	05	Student Activity Sheets	1 &2
	SEE	End of the course	50	Answer scripts at BTE	1 &2
Indirect Assessment	Student Feedback on course	Middle of the course		Feedback forms	1 &2
		End of the course		Feedback forms	1 &2

*CIE – Continuous Internal Evaluation

*SEE – Semester End Examination

Note:

1. I.A. test shall be conducted as per SEE scheme of valuation. However obtained marks shall be reduced to 10 marks. Average marks of two tests shall be rounded off to the next higher digit.
2. Rubrics to be devised appropriately by the concerned faculty to assess Student activities.