# MANIPAL INSTITUTE OF TECHNOLOGY
## MANIPAL
*A Constituent Institution of Manipal University*

**VII SEMESTER B.TECH. (MECHATRONICS ENGINEERING)**
**END SEMESTER EXAMINATIONS, NOV 2017**
SUBJECT: **HYDRAULIC AND PNEUMATIC SYSTEMS**
**REVISED CREDIT SYSTEM**
**(23/11/2017)**

Time: 3 Hours                                                                    MAX. MARKS: 50

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**Instructions to Candidates:**

❖ Answer *ALL* the questions.
❖ Draw neat sketches using scale and pencil where ever applicable.

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**1A** How can an unbalanced vane pump be designed to produce variable flow out put? Explain with a simple sketch.   **3**

**1B** With a relevant hydraulic circuit explain how to raise and lower a large weight using a four-way DCV with a tandem neutral.   **3**

**1C** A pump having a displacement of 14 cm$^3$/rev is driven at 1440 rev/min and operates against a maximum pressure of 150 bar. The volumetric efficiency is 0.9 and the overall efficiency is 0.8. Calculate:   **4**
   a) The pump delivery in LPM.
   b) The input power required at the pump shaft in kilowatts.
   c) The drive torque at the pump shaft.

**2A** In a press shop, stamping operation is to be performed using a stamping machine. Before stamping, work piece has to be clamped under stamping station. Then stamping tool comes and performs stamping operation. Work piece must be unclamped only after stamping operation. Draw the displacement step diagram and develop a manual pneumatic circuit by using group changing cascading method.   **4**

**2B** Describe the operation of a pilot-operated solenoid DCV. What is the advantage of these valves over the simple solenoid type?   **4**

**2C** What is the advantage of a telescopic cylinder over a standard cylinder? Are there any disadvantages?   **2**

**3A** Draw pneumatic circuit to carry out the following operation. Use idle return roller lever valve to eliminate signal overlapping.   A+, B+, B-, A-   **4**

**3B** What is the purpose of a pressure reducing valve? Describe its operation with proper circuit.   **3**

**3C** A fluid with specific weight 8800 $N/m^3$ flows at a constant rate through the system. 3
The areas are $A_1$=0.002 $m^2$ and $A_2$=0.001 $m^2$. The pressures were measured to be
$p_1$=900 kPa and $p_2$=800 kPa. Determine the velocity $v_1$ at the inlet and hence
determine the flow rate of this fluid in liters per minute.

**4A** Using a lid lifting device snap on lids is to be pressed 3
onto plastic buckets. By pressing push button switch
the domed press is advanced & the snap - on lid is
pressed on. Once the fully advanced position is
reached, the cylinder is to remain for a time of T = 6
seconds and then immediately retract to the initial
position. A new start cycle is only possible after the
cylinder has fully retracted. Draw a manual
pneumatic circuit for the function of this.
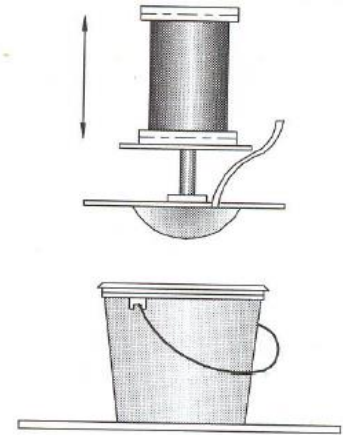


**4B** With an example show that accumulator reduces pump requirements in a hydraulic 4
system.

**4C** Draw a pneumatic circuit to operate a door of public 3
transport vehicles as shown in figure. Assuming that
the opening and closing of the doors are controlled
by two button switches ON and OFF. When the
button switch ON is pressed, the door will open.
When the button switch OFF is pushed, the doors will
close.
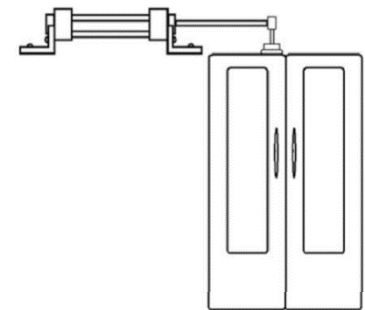


**5A** Describe the construction of a tandem cylinder. What is its advantage over a 3
standard cylinder? Are there any disadvantages?

**5B** Sketch and explain the working of a lobe pump. 3

**5C** Two double-acting pneumatic cylinders, A and B in a process industry should 4
extend and retract to open and close two different valves. The starting is by a detent
switch. Both the cylinders are of the same size with the same stroke length. In terms
of notation the sequence is A+, A-, B+, B-. The cycle is to go on till the detent start-
up switch is pressed again. Draw the electro-pneumatic circuit by using group
changing cascading method.