MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL
(A constituent institution of MAHE, Manipal)

VII SEMESTER B.TECH. (MECHATRONICS ENGINEERING)
END SEMESTER EXAMINATIONS, NOV 2019
SUBJECT: HYDRAULIC AND PNEUMATIC SYSTEMS [MTE 4103]
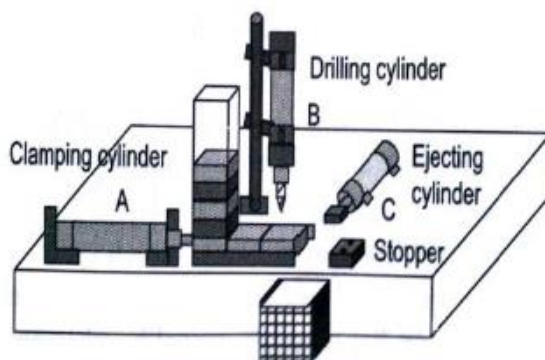**(23/11/2019)**

Time: 3 Hours   MAX. MARKS: 50
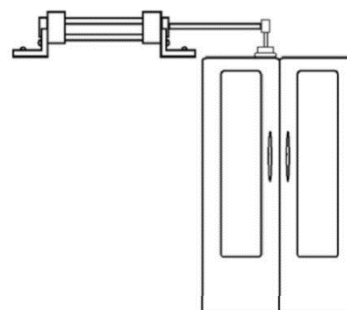

Instructions to Candidates:
❖ Answer **ALL** the questions.
❖ Missing data if any may be suitably assumed

1A How can an unbalanced vane pump be designed to produce variable flow out put? Explain with a simple sketch. **04**

1B What is the purpose of a pressure reducing valve? Describe its operation with proper circuit. **03**

1C A mass of 2000 kg is to be accelerated horizontally up to a velocity of 1 m/s from rest over a distance of 50 mm. The coefficient of friction between the load and the guides is 0.15. Calculate the bore of the cylinder required to accelerate this load if the maximum allowable pressure at the full bore end is 100 bar. Take seal friction to be equivalent to a pressure drop of 5 bar. Assume the back pressure at the annulus end of the cylinder as zero. **03**

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. **04**

2B Describe the construction and operation of a pilot-operated relief valve. **03**

2C What is the use of quick exhaust valve? Sketch and explain the working of a quick exhaust valve. **03**

3A Rectangular shaped work pieces are drilled using a pneumatically controlled drilling machine as shown in the **fig Q3A**. The work pieces are arranged in a gravity feed magazine. These work pieces are pushed and clamped by means of clamping cylinder A, drilled by drilling cylinder B and ejected by ejecting cylinder C. Draw the displacement step diagram, develop and explain the working of an electro pneumatic control circuit to implement the given control task. **05**

3B Describe the construction of a double –rod cylinder. For what type of application is it best suited? **02**

3C A three stage displacement type telescopic cylinder is used to tilt the body of a   **03**
lorry. When the lorry is fully laden the cylinder has to exert a force equivalent to
4000 kg at all points in its stroke. The outside diameters of the tubes forming the
three stages are 60, 80 and 100 mm. If the pump powering the cylinder delivers
10 lpm, calculate the extend speed and pressure required for each stage of the
cylinder when tilting a fully laden lorry.

4A Compare and contrast electrical, mechanical, hydraulic and pneumatic energy   **03**
media with respect to the following parameters: Leakage, energy transportation,
linear motion, rotary motion, linear thrust and rotary thrust.

4B Cylinder A (1.O) extends and brings a job under the stamping cylinder B (2.0).   **04**
Cylinder B then extends and stamps the job. Cylinder B can return back only
after cylinder A has retracted fully. Draw and explain an electro-pneumatic
control circuit developed for realizing the control task.

4C Mention the use, advantages and disadvantages of the different forms of location   **03**
of the filter in a hydraulic system with neat sketches.

5A A pump having a displacement of 14 cm^3/rev is driven at 1440 rev/min and   **04**
operates against a maximum pressure of 150 bar. The volumetric efficiency is
0.9 and the overall efficiency is 0.8. Calculate:
   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.

5B Draw and explain a pneumatic circuit to operate a door of public transport   **03**
vehicles as shown in **figQ5B**. Assuming that the opening and closing of the
doors are controlled by two button switches ON and OFF. When the button
switch ON/OFF is pressed, the door will open/close respectively and when
both the buttons are pressed door should remain open.

5C Explain with a neat sketch the working of a lubricator.   **03**

fig Q3A   **figQ5B**