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MAX. MARKS: 50

MANIPAL INSTITUTE OF TECHNOLOGY

, (A constituent institution of MAHE, Manipal)

VII SEMESTER B.TECH. (MECHATRONICS ENGINEERING) END SEMESTER EXAMINATIONS, NOV 2017 SUBJECT: HYDRAULIC AND PNEUMATIC SYSTEMS [MTE 4103] REVISED CREDIT SYSTEM (27/11/2018)

Time: 3 Hours

Instructions to Candidates:

- ✤ Answer ALL the questions.
- Draw neat sketches using scale and pencil where ever applicable.
- 1A. Define positive displacement pump and indicate the basic working 03 principle by labelling the relevant parts.
- **1B.** Demonstrate with relevant sketch how an actuator is slowed down? **03**
- 1C. A cylinder with a bore diameter of 50 mm and a rod diameter of 20 mm 04 is to be used in a system with a maximum pressure of 15,000 kPa. What are the maximum extension and retraction forces? For this system, what effect would doubling the bore diameter have on the output force generated on extension?
- 2A. In a press shop, stamping operation is to be performed using a stamping machine. Before stamping, work piece has to be clamped by the clamping cylinder under stamping station. Then stamping tool comes and performs the stamping operation by the stamping cylinder. The clamping cylinder can return back only after the stamping cylinder has retracted fully. Confirmation of all extended and retracted positions are required. Draw the step displacement diagram and discuss briefly the pneumatic circuit developed for the same.
- 2B. Identifying the various central positions explain the working of a 5/3 04 directional control valve.
- 2C. What is the advantage of a telescopic cylinder over a standard cylinder? 02 Are there any disadvantages?
- 3A. In a stamping machine, the stamping cylinder has to move into position 04 very quickly and when it reaches the work piece it has to be slowed down to exert maximum pressure on the job. Two separate pumps with different capacities are used to actuate the cylinder. Draw a hydraulic circuit to carry out this operation and explain its working.

- **3B.** What is the purpose of a counter balance valve? Propose and explain the **03** circuit to demonstrate the use of it.
- 3C. A pump having a mechanical efficiency of 0.94, a displacement of 20 03 cm³/rev and a flow rate of 50 lpm is to be used in a system with a maximum operating pressure of 20,000 kPa. What is the required driving torque and maximum power output of the pump?
- 4A. Compare and contrast electrical, mechanical, hydraulic and pneumatic 03 energy media with respect to the following parameters: Energy source, energy storage, energy transmission, linear thrust, noise and controllability.
- 4B. In a hydraulic press, cylinder must extend quickly under no load then 04 bottoms out and exert full force to the work-piece. A low capacity pump is used to reduce the cost of the system. Using an accumulator, develop a suitable circuit for the given application and explain its working in detail.
- 4C. Design and describe the functioning of an electro-pneumatic circuit for a 03 double acting cylinder to perform a continuous to and fro motion. The cylinder has to stop automatically after performing 50 cycles of operations.
- 5A. Mention the classification of filters based on different forms of location 02 in a hydraulic system.
- **5B.** Discuss the working of a lubricator with a suitably labelled sketch. **03**
- 5C. Rectangular shaped work pieces are drilled using a pneumatically 05 controlled drilling machine as shown in the fig Q5C. 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.



Fig. Q5C