Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent unit of MAHE, Manipal)

DEPARTMENT OF MECHATRONICS

V SEMESTER B.TECH. MECHATRONICS

END SEMESTER EXAMINATIONS, NOV-DEC 2023

SUBJECT: HYDRAULIC AND PNEUMATIC SYSTEMS [MTE 3153]

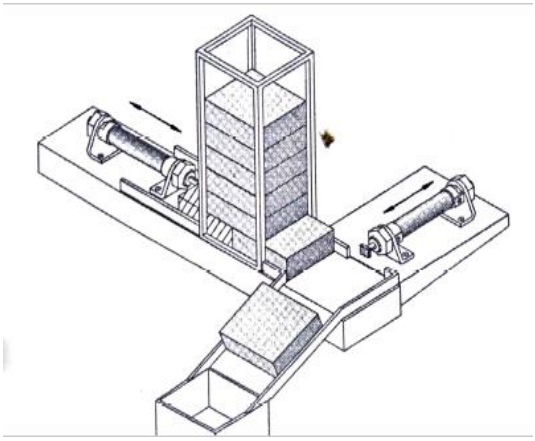
Date: 08.12.2023

Time: 3 Hours **MAX. MARKS: 50**

Instructions to Candidates:

- Answer **ALL** the questions.
- Data not provided may be suitably assumed.

Q. No		M	CO	PO	LO	BL
1A.	The dental scaling application needs a contaminant free compressed air. Select an appropriate air compressor and discuss the working of the same with a conceptual sketch.	**04**	**1**	**1**	**1**	**L3**
1B.	Because of an environmental issue an overused car has to be crushed in a junk yard 10 seconds. The operation requires a stroke of 3 m and a force of 40,000 N. If a pump of pressure 7.5 N/mm^2 has been selected, determine the following: i) Required piston area and piston diameter. ii) The necessary pump flow rate iii) The hydraulic power capacity in kW	**03**	**1**	**1**	**1**	**L3**
1C.	Enumerating the common parts, discuss the construction of a hydraulic reservoir.	**03**	**3**	**1**	**1**	**L2**
2A.	An input cylinder with a diameter of 40 mm is connected to an output cylinder with a diameter of 100 mm. A force of 2000 N is applied to the input cylinder. What is the output force? How far would we need to move the input cylinder to move the output cylinder by 100 mm ?	**03**	**3**	**1**	**1**	**L3**
2B.	Considering the safety of the operator hands, develop an a hydraulic circuit for clamp and bend application.	**04**	**4**	**3**	**13**	**L3**
2C.	Draw the construction of the counterbalance valve and discuss an application where it can be used.	**03**	**4**	**3**	**13**	**L3**

3A.	A process sensitive operation needs a pneumatic control circuit to carry out following operation A+, B+, B-, A. signal conflict has to be avoided for reasons such as failure of the valve itself and mainly for ensuring there is no breakdown of the line which may cause a huge environmental issues due to the stalled process. Design a pneumatic circuit for this requirement.	**04**	**2**	**3**	**13**	**L3**
3B.	State the use of quick exhaust valve? Sketch and explain its working .	**03**	**3**	**1**	**13**	**L2**
3C.	Show how a pneumatic time delay valve can be used for ON delay and OFF delay applications.	**03**	**1**	**1**	**1**	**L1**
4A.	Two cylinders are used to transfer parts from a magazine onto a chute as shown in fig. 4QA. When a push button is pressed, the first cylinder extends. Pushing the part from the magazine and positioning it in preparation station where a robot is used for performing a drilling operation. After the processing is completed the second cylinder pushes out the part to feed chute and then first cylinder retracts, followed by the second. Confirmation of all extended and retracted positions are required because of safety as robot is involved. With the aid of displacement time diagram develop a electro- pneumatic circuit  Fig.4QA: Magazine and Chute System.	**04**	**2**	**3**	**13**	**L3**
4B.	Design an electro-pneumatic circuit for a double acting cylinder to perform a continuous to and fro motion. The cylinder has to stop automatically after performing 50 cycles of operations	**03**	**2**	**3**	**13**	**L3**
4C.	A pump having a mechanical efficiency of 0.92 and a displacement of 0.00002 m^3/rev is to be used in a system with a maximum	**03**	**3**	**1**	**1**	**L3**

	operating pressure of 15,000 kPa. Determine the driving torque developed.					
5A.	Describe the operation of a hydraulic pilot-check valve with a help of an application circuit.	**03**	**4**	**3**	**1**	**L2**
5B.	The safety guidelines of hydraulic press dictates that a cylinder which is connected to the punch of a press be retracted even though the normal supply of oil pressure is lost due to a pump or electrical power failures. Develop two solutions for the problem and justify which would be the better option.	**03**	**4**	**3**	**13**	**L3**
5C.	State the purpose of a pressure unloading valve and describe its operation with a specific application circuit.	**04**	**3**	**1**	**13**	**L3**