Reg. No.



MANIPAL INSTITUTE OF TECHNOLOGY

(A constituent unit of MAHE, Manipal)

V SEMESTER B.TECH. (AUTOMOBILE ENGINEERING)

END SEMESTER EXAMINATIONS, NOV/DEC 2018

SUBJECT: ACTUATION SYSTEMS [AAE 3153]

REVISED CREDIT SYSTEM (23/11/2018)

Time: 3 Hours

MAX. MARKS: 50

Instructions to Candidates:

- Answer **ALL** the questions.
- Missing data may be suitable assumed.
- 1A. Classify the air compressor system and explain the working of multistage (03) compressor,
- **1B.** A pneumatic cylinder has a bore of 200 mm and a piston rod diameter of 140 **(04)** mm. For an extend speed of 5m/min. Calculate
 - a) The supply flow rate
 - b) The flow rate from the annulus side on extend
 - c) The retract speed using Q_E
 - d) The flow rate from the full bore end on retract
- **1C.** With neat sketch, explain the working of lubricator used in secondary air **(03)** treatment stage.
- 2A. Using a diverting device parts are to be removed from one conveyor track (04) onto another in linear sequence. By pressing a pushbutton switch the oscillating piston rod of a cylinder pushes the turntable via a pawl in stepped sequence. The parts are diverted and transported onwards in the opposite direction. The oscillation motion automatically switch off after a time duration of 30 seconds. Forward and return motion of actuator independently controllable. Develop pneumatic circuit to perform the task.
- **2B.** With suitable example, explain the difference between direct and indirect **(02)** electro-pneumatic actuation system using single solenoid 5/2 valve.
- 2C. Some components are to be stamped using a stamping device. A double (04) acting cylinder pushes the die attached down to a fixture when two push buttons pressed simultaneously and after a delay of 10 seconds. The die is to return to the initial position upon reaching sufficient stamping pressure as sensed by pressure switch. Develop an electro pneumatic circuit to implement task using inductive proximity sensors.
- **3A.** With suitable example, explain the working of ON delay timer in PLC system. (03)
- **3B.** Design and explain the working of latching circuit in PLC system. (02)

- **3C.** Pieces of stainless steel sheet of 0.6 mm thickness are placed by hand into the input station. After a valve has been operated by push button, the ejector cylinder retracts with exhaust air restricted while, at the same time, clamping cylinder also advances with its exhaust air restricted; the sieve blank is pushed along and clamped. The time for retraction of ejector cylinder and extension of clamping cylinder is to be adjustable. During an adjustable clamping time of t = 5 seconds and a clamping pressure 5 of bar, a laser cutting head produces a fine mesh sieve. After this operation, the clamping cylinder is retracted without restriction, following which the ejector cylinder pushes out the finished sieve, which is free of burred edges by a forward thrusting action. Develop pneumatic circuit to perform the task and draw displacement diagram.
- **4A.** Discuss in detail the application of hydraulic accumulators as energy storage **(03)** elements. Draw a hydraulic circuit for this application.
- **4B.** Design and explain the working of a regenerative circuit and derive the **(04)** expression for extension and retraction velocity ratio.
- 4C. A hydraulic pump has a displacement volume of 98.4 cm³. It delivers 0.0152 (03) m³/s of oil at 1000 RPM and 70 bar. If the prime mover input torque is 124.3 N-m. What is the overall efficiency of pump? What is the theoretical torque required to operate the pump?
- **5A.** Draw schematically a pilot-operated pressure relief valve and explain its **(03)** function.
- **5B.** Sketch and explain with suitable example the working of pressure sequence **(04)** valve.
- 5C. An axial piston pump has nine pistons arranged on a piston of circle 125 mm (03) diameter. The diameter of the piston is 15mm. The cylinder block is set to an offset angle of 10°. If pump runs at 1000 RPM with an volumetric efficiency of 94 %. Find the flow rate in LPS.