

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL (A constituent unit of MAHE, Manipal)

FIFTH SEMESTER B. TECH. (INSTRUMENTATION AND CONTROL ENGG.)

END SEMESTER DEGREE EXAMINATIONS, NOVEMBER - 2018

SUBJECT: CONTROL SYSTEM COMPONENTS [ICE 3105]

TIME: 3 HOURS

MAX. MARKS: 50

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Instructions to candidates

- Answer **ALL** questions.
- Missing data may be suitably assumed.
- 1A Draw the closed loop schematic of a servo motor used for position measurement with potentiometer 4 as a feedback element and explain its working.
- **1B** Consider a synchro system in balanced condition as given in Fig. 1B. Calculate the potential 4 between the windings of stator of TX and rotor of TDX (S1-S2, S2-S3, S3-S1) if TX is rotated 40° CW and TDX is rotated 30° CW.
- 1C A 300 g mass is tied with a string which needs to be accelerated upwards at least 5 m/s². The spindle 2 that pulls up has a radius of 5 cm. Calculate the torque and power requirements.
- 2A Explain the working of a variable reluctance stepper motor with neat sketch.
- **2B** For a 6 pole permanent magnet stepper motor, tabulate the sequence of a logic sequencer for 180° 4 clockwise rotation. Make suitable assumptions as required.
- **2C** For a double acting cylinder drive as shown in Fig. 2C, explain the working and position of the 3 cylinder for all the possible combinations of solenoid valve actuation.
- **3A** The maximum flow rate through an equal percentage control valve is $20 \text{ m}^3/\text{hr}$. If the valve has a 3 turndown ratio of 40:1, estimate the flow rate at 60%, 70% and 80% respectively.
- **3B** Consider a chemical mixing process system in which pressure and temperature are process 3 variables. Chemical composition is diluted with steam in the process. Outflow is regulated to maintain the pressure whereas steam inflow is regulated to maintain the temperature. Draw the P&I diagram.
- **3C** Draw the pressure and velocity profile of a control valve and explain the effect of chocked flow. 4 Discuss the methods to avoid cavitation and flashing.
- 4ADescribe the working of a cylindrical cam with the help of a neat diagram34BDiscuss on the following terms with regard to gears with the help of diagram.41. Circular pitch2. Pitch circle3. Diametral pitch
- **4C** An electric motor supplies 40 in. oz of torque while running at 200 rpm and it is driving a load 3 through a 1: 5 gear ratio as shown in Fig. 4C. Find the output torque and velocity.

- 5A Discuss on the working of unbalance vane pump with illustration.
- **5B** Describe the construction and working of Swash plate piston pump.
- **5C** Derive the expression for gyroscopic acceleration.



Fig. 1B



Fig. 2C



Fig. 4C