

MANIPAL INSTITUTE OF TECHNOLOGY MANIPAL A Constituent Institution of Manipal University

FIFTH SEMESTER B.TECH. (INSTRUMENTATION AND CONTROL ENGG.) END SEMESTER EXAMINATIONS, DEC 2016/JAN 2017

SUBJECT: CONTROL SYSTEM COMPONENTS [ICE 3105]

Time: 3 Hours

MAX. MARKS: 50

Instructions to Candidates:

- ✤ Answer ALL the questions.
- ✤ Missing data may be suitably assumed.
- 1A With neat diagram, explain construction and working of drag cup ac servo motor. 3
- 1B A 4-pole generator having wave wound armature winding has 51 slots. Each slot 3 contains 20 conductors. What will be the voltage generated in the machine when drives at 1500 rpm. Assume flux per pole to be 7 mWb.
- 1C Illustrate the speed and directional control of DC servo motor which is used in 4 robotics
- 2A With neat sketches, explain 4-phase, 2 pole single stack variable reluctance stepper 3 motor.
- 2B Describe the automobile application of synchro using synchro differential generator. 3
- 2C A stepper motor has a phase winding total resistance and average inductance of 15 Ω 4 and 30 mH, respectively. The phase winding rated current is desired to be 3 A. The motor is driven by a bi-polar drive circuit energized from a DC supply of 45 V. When the transistors are turned OFF, determine

i. The time taken by the phase winding current to decay to zero.

- ii. The percentage of the stored inductive energy returned to the DC source.
- 3A With a neat diagram, describe the measurement of time such as hours, minutes and 3 seconds using gear trains.
- **3B** Explain electro hydraulic actuator with positioner. **3**
- 3C A pressure difference of 1.1 psi occurs across a constriction in a 5-cm-diameter pipe.
 2 The constriction constant is 0.009 m³/s per kPa^{1/2}. Find
 - i. The flow rate in m^3/s ii. The flow velocity in m/s.

3D	Define the following	2
	i. Backlash of gear train ii. Prime circle of cam and follower.	
4A	Explain hydraulic cylinder which is used to create a large force with small diameter	3
	of cylinder.	
4B	Describe anyone application of shuttle control valve.	3
4C	Find the hydraulic pressure and working force resulting from 200 N applied to a 1-	2
	cm-radius forcing Piston if the working piston has a radius of 6 cm.	
4 D	Find the proper C_v for a value that must allow 150 gal of ethyl alcohol per minute	2
	with a specific gravity of 0.8 at maximum pressure of 50 psi	
5A	List the applications of gear pump and mention advantages and disadvantages of gear	3
	pump.	
5B	Draw the XNOR and XOR of the fluidic logic gates	2
5C	Describe the construction and working of a gyro scope which is used to measure	3
	pitch and roll of an air craft.	
5D	Design a disk cam and reciprocating at-face follower such that the follower rises 1 inch during the first 120° of cam motion, then returns during the next 240° of cam	2

inch during the first 120° of cam motion, then returns during the next 240° of cam motion. Use simple harmonic motion for both rise and return. Also find the minimum radius of the cylindrical follower.
