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MANIPAL INSTITUTE OF TECHNOLOGY
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**I SEMESTER M.TECH. (INDUSTRIAL AUTOMATION AND ROBOTICS)**

**END SEMESTER EXAMINATIONS, NOV 2018**

SUBJECT: SENSORS AND ACTUATORS FOR INDUSTRIAL AUTOMATION [MTE 5101]

**REVISED CREDIT SYSTEM**
**(21/11/2018)**

Time: 3 Hours MAX. MARKS: 50

**Instructions to Candidates:**

- Answer **ANY 5 QUESTIONS OUT OF 6**
- Data missing must be suitably assumed.

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| **1A.** | Following are the excerpts from the specifications of a displacement measurement laser type sensor used in a fabrication plant.<br>(a) Measurement range: ± 10mm<br>(b) Resolution : 3 μm<br>(c) Response time : 0.15ms<br>(d) Linear output : 4-20mA<br>Answer the following questions-<br>i) Describe your inferences of th the meaning of all of them with respect to the instrument. (a,b,c,d)<br>ii) Find out the sensitivity of the sensor in mA/mm.<br>iii) Find out smallest possible measurable change indicated in output in mA. | **4** |
| **1B.** | In a medical equipment temperature of the range 0 to 300'C is to be measured for blood component analysis. The measuring area is 1cm X 1 cm. Choose the suitable temperature measurement sensor. What is the construction working principle and of this sensor? | **3** |
| **1C.** | Describe the operating principle of electromagnetic flow meter. | **3** |
| **2A.** | What are the types of variable capacitance transducers used for displacement measurement? Also explain their advantages and disadvantages. What is the significance of variable capacitance transducers over variable resistance transducers in terms of application? | **4** |
| **2B** | Describe V/F control in induction motor? | **3** |

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| **2C** | Explain how speed control is achieved above and below base speed using Lord Leonard Method and where it is used? | **3** |
| **3A** | A 200 V,150 A,875 r.p.m. separately excited DC motor has armature resistance of 0.06 ohm.It is fed from a single phase fully controlled rectifier circuit of an alternating voltage supply of 220V at 50 Hz.Assuming a continuous conduction, find out the firing angle of power electronic switch so that motor produces the output of 750 r.p.m. at rated torque | **4** |
| **3B** | Which of the following motor is self-starting and why?<br>a) Single phase Ac Induction motor<br>b) Three phase Ac Induction motor<br>c) 3 phase synchronous motor | **3** |
| **3C** | What are the causes and effects of hunting in electric motor? What are the methods to reduce it? | **3** |
| **4A** | What are the factors to be considered while choosing suitable electric drives? | **3** |
| **4B** | Write note on four quadrant operation of an electric drive. | **4** |
| **4C** | Describe the method of static Kramer drive control. | **3** |
| **5A** | Select the instrument to measure the pressure in tires of vehicles for direct pressure measurement used in daily life? Discuss its working principle with diagram and advantages and disadvantages. | **4** |
| **5B** | What are types of motor power duties? Draw their temperature characteristics. | **4** |
| **5C** | A 6 pole 220 V lap wounded DC motor is rewound to wave winding. The ratio of back emf in original condition to the modified condition will be - - - - - - -?<br><br>A multimetre reads 120 oscillations per minute when connected to the rotor of an Induction motor ,the slip of motor is - - - - - - - -if stator frequency is 50 Hz. | **2** |
| **6A** | a)In an installation process of a plant, heavy machineries with different sizes are to be picked and placed from one location to another using a crane where they are to be mounted with other machineries. Precise control is the major criteria of the operation and available source is DC power supply. Suggest suitable motor for the following application.<br>b) Say the motor available is 220V, 40A,1500 rpm specifications with armature resistance of 0.1 ohm, and field resistance of 0.2 ohm. If the motor is to be rotated for 1000 rpm and rated load,<br>i)What will be the ratings of power supply need to feed the motor?<br>ii) Design the power electronic converter circuit and mention the switching angle of device. | **5** |
| **6B** | a) Write down operational difference between full stepping and half stepping modes in variable reluctance stepper motor.<br>b) Compare this motor with servo motor.<br>c) If this motor has a step angle of 2.5°, then determine the resolution. | **5** |