

Reg No.: _____

Name: _____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
EIGHTH SEMESTER B.TECH DEGREE EXAMINATION, MAY 2019

Course Code: EE402

Course Name: Special Electrical Machines

Max. Marks: 100

Duration: 3 Hours

PART A

Answer all questions, each carries 5 marks.

Marks

- | | | |
|---|--|-----|
| 1 | Draw and explain the Torque speed curves of an AC servomotor for various values of control voltage | (5) |
| 2 | Define Step angle and detent torque for a Stepper motor. | (5) |
| 3 | Explain working principle of two-pole single-phase AC series motor with diagram. | (5) |
| 4 | Explain why rotor position sensor is required for the operation of switched reluctance motor. | (5) |
| 5 | What are the advantages of PMBLDC motor over DC motor? | (5) |
| 6 | Differentiate trapezoidal type BLDC motor and sinusoidal type PMBLDC motor | (5) |
| 7 | Enumerate linear motors and list any four applications. | (5) |
| 8 | Write short note on linear induction motor. | (5) |

PART B

Answer any two full questions, each carries 10 marks.

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|----|---|-----|
| 9 | a) Explain the types of series split field DC servomotor. | (4) |
| | b) With relevant diagrams explain field controlled DC Servomotors | (6) |
| 10 | a) Explain any two modes of excitation used in three phase permanent magnet stepper motor. | (5) |
| | b) Explain the construction of multi stack Variable reluctance stepper motor with neat sketches. | (5) |
| 11 | a) Compare the performance of AC and DC servo motors and list the applications. | (6) |
| | b) Define the following terms as applied to a Stepper motor (1) Start-stop mode (2) Slewing mode. | (4) |

PART C

Answer any two full questions, each carries 10 marks.

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|----|---|-----|
| 12 | a) Draw the phasor diagram of AC series motor and derive the voltage equation | (5) |
| | b) Derive the torque equation of hysteresis motor | (5) |

- 13 a) With neat sketches explain the construction and operation of 6/4 SRM (10)
- 14 a) Write short notes on the principle of hysteresis motor with necessary diagrams (5)
- b) Draw and explain $n+1$ switches and diode configuration power converter for SRM. (5)

PART D

Answer any two full questions, each carries 10 marks.

- 15 Explain the principle of operation of PMBLDC motor for 120° commutation with neat circuit diagram. (10)
- 16 With necessary diagrams explain Longitudinal flux linear switched reluctance motor and Transverse flux linear switched reluctance motor. (10)
- 17 a) Draw and explain the performance characteristics of PMBLDC motor. (6)
- b) Derive the expression for linear force. (4)

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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
EIGHTH SEMESTER B.TECH DEGREE EXAMINATION(S), OCTOBER 2019

Course Code: EE402
Course Name: SPECIAL ELECTRIC MACHINES

Max. Marks: 100

Duration: 3 Hours

PART A*Answer all questions, each carries 5 marks.*

Marks

- | | | |
|---|---|-----|
| 1 | Explain the constructional details and importance of Drag Cup Servomotor | (5) |
| 2 | Explain the dynamic characteristics of stepper motor. | (5) |
| 3 | What are the advantages and limitations of Universal motor? | (5) |
| 4 | Draw and explain n+1 switches and diode configuration power converter for SRM | (5) |
| 5 | Compare Mechanical Commutation and Electronic Commutation? | (5) |
| 6 | Differentiate trapezoidal type BLDC motor and sinusoidal type PMBLDC motor | (5) |
| 7 | Write short note on linear synchronous motor. | (5) |
| 8 | List the application of linear motor | (5) |

PART B*Answer any two full questions, each carries 10 marks.*

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|----|--|------|
| 9 | a) List the applications of Servomotors | (4) |
| | b) With relevant diagrams explain armature controlled DC Servomotors | (6) |
| 10 | a) With neat sketches, explain the constructional details and working principle of variable reluctance stepper motor. List any four applications of stepper motor. | (10) |
| 11 | a) Compare the performance of AC and DC servo motors | (4) |
| | b) Discuss 2 phase ON mode excitation of three phase and four phase stepper motors | (6) |

PART C*Answer any two full questions, each carries 10 marks.*

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|----|---|------|
| 12 | a) Why compensating winding is used in AC series motor? Draw series motor with different types of compensating windings | (5) |
| | b) Discuss the torque speed characteristics of hysteresis motor | (5) |
| 13 | a) With neat sketches explain the construction and operation of 8/6 SRM | (10) |

- 14 a) Explain the torque-speed characteristics of SRM with necessary diagrams (6)
b) What are the modifications to be made in DC series motor to operate it in AC supply? (4)

PART D

Answer any two full questions, each carries 10 marks.

- 15 a) Explain the principle of operation of PMSBLDC motor for 180° commutation with neat circuit diagram. (10)
- 16 a) With necessary diagrams explain Longitudinal flux linear switched reluctance motor and Transverse flux linear switched reluctance motor. (10)
- 17 a) Derive the torque equation of PM BLDC motor (6)
b) Derive the expression for linear force. (4)

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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Eighth semester B.Tech degree examinations, September 2020

Course Code: EE402**Course Name: Special Electrical Machines**

Max. Marks: 100

Duration: 3 Hours

PART A*Answer all questions, each carries 5 marks.*

Marks

- | | | |
|---|--|-----|
| 1 | What is a drag cup servo motor? What is its significance? | (5) |
| 2 | With the help of a diagram, explain the construction and working of Hybrid type stepper motor. | (5) |
| 3 | Draw and explain the phasor diagram of an AC series motor. | (5) |
| 4 | Explain the torque slip characteristics of a Reluctance motor. | (5) |
| 5 | Explain the constructional details of Permanent Magnet DC Motor with relevant diagrams. | (5) |
| 6 | List any five applications of Brushless DC motors. | (5) |
| 7 | Write short note on Linear Reluctance Motor. | (5) |
| 8 | Explain the working principle of a Linear Synchronous Motor. | (5) |

PART B*Answer any two full questions, each carries 10 marks.*

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|----|--|-----|
| 9 | a) Enumerate the features of DC servo motor. List two applications of DC servo motors. | (5) |
| | b) Explain the operation of armature controlled DC servomotor with circuit diagram. | (5) |
| 10 | a) Explain the principle of operation of an AC Servomotor with the help of a block diagram. | (5) |
| | b) Describe a unipolar drive circuit for a Permanent Magnet stepper motor. | (5) |
| 11 | a) Draw and explain Static and Dynamic characteristics of a stepper motor. | (5) |
| | b) Explain the construction of multi stack Variable Reluctance Stepper motor with the help of neat sketches. | (5) |

PART C*Answer any two full questions, each carries 10 marks.*

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|----|--|------|
| 12 | Give the constructional details and working principle of a hysteresis motor. | (10) |
|----|--|------|

Derive its torque equations and explain its torque-slip characteristic.

- 13 a) Why is compensating winding required in an AC Series motor? Explain the two ways of providing compensating winding. (5)
- b) Derive the torque equation of a Reluctance motor. (5)
- 14 a) Draw and explain any two power converter circuits for Switched Reluctance motors. (6)
- b) What are the advantages of Switched Reluctance Motor? (4)

PART D

Answer any two full questions, each carries 10 marks.

- 15 a) Differentiate between trapezoidal type and sinusoidal type PMBLDC motor (5)
- b) Derive the expression for force of linear induction motor. (5)
- 16 a) Explain the construction and principle of operation of a Permanent Magnet DC Motor. Compare it with an ordinary dc motor. (6)
- b) Compare Mechanical and Electronic Commutation. (4)
- 17 Draw and explain the working principle of Linear Induction Motor. Also develop its equivalent circuit. (10)

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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
EIGHTH SEMESTER B.TECH DEGREE EXAMINATION, MAY 2019

Course Code: EE404

Course Name: INDUSTRIAL INSTRUMENTATION AND AUTOMATION

Max. Marks: 100

Duration: 3 Hours

PART A

Answer all questions, each carries 5 marks.

Marks

- | | | |
|---|---|-----|
| 1 | Explain the factors that govern the output characteristics of a transducer. | (5) |
| 2 | Explain the concept of Nano instrumentation. | (5) |
| 3 | List any five important features of instrumentation amplifiers. | (5) |
| 4 | What are the advantages and disadvantages of MEMS? | (5) |
| 5 | Explain the selection criterion for control valves? | (5) |
| 6 | Define an industrial automation system and enlist its components. | (5) |
| 7 | Compare programmable logic controller with personal computer. | (5) |
| 8 | What are the key features of DCS? | (5) |

PART B

Answer any two full questions, each carries 10 marks.

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|----|---|-----|
| 9 | (a) Explain the factors influencing the choice of a transducer for an industrial instrumentation system | (6) |
| | (b) Draw and explain second order sensor time response | (4) |
| 10 | a) With the help of a diagram explain the working of an eddy current sensor. | (6) |
| | b) Draw and explain the working of a capacitive differential pressure transducer. | (4) |
| 11 | a) Draw the block diagram representation of a process control system and explain the functions of each block. | (5) |
| | b) Explain the measurement of torque using strain gauges. | (5) |

PART C

Answer any two full questions, each carries 10 marks.

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|----|---|-----|
| 12 | a) Explain the importance of signal conditioning in industrial instrumentation systems. | (5) |
| | b) Explain the principle of operation of phase sensitive detector. | (5) |
| 13 | a) With the help of a diagram explain the principle of MEMS accelerometer. | (5) |
| | b) Differentiate between bulk and surface micromachining. | (5) |

- 14 a) Derive an expression for the output voltage of a logarithmic amplifier and show that it is proportional to logarithm of input voltage. (5)
- b) Explain the concept of graphical programming in virtual instruments (5)

PART D

Answer any two full questions, each carries 10 marks.

- 15 a) What is the role of actuators in automation system? How they are classified? (5)
- b) How can you convert an open loop system to an automatic system? Explain with the help of an example. (5)
- 16 a) Draw the PLC ladder diagrams to realize two input AND, OR and XOR gates (5)
- b) What are the main components of SCADA? (5)
- 17 a) With the help of a neat diagram explain the working of butterfly valve. (5)
- b) Give the significance of timers and counters in PLC. (5)

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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
EIGHTH SEMESTER B.TECH DEGREE EXAMINATION(S), OCTOBER 2019

Course Code: EE404

Course Name: INDUSTRIAL INSTRUMENTATION AND AUTOMATION

Max. Marks: 100

Duration: 3 Hours

PART A

Answer all questions, each carries 5 marks.

Marks

- | | | |
|---|--|-----|
| 1 | Draw the step response of a first order sensor. Explain the effect of time constant on the nature of response of the sensor. | (5) |
| 2 | Explain the principle of operation of a variable reluctance tachometer. | (5) |
| 3 | What is an instrumentation amplifier and discuss its role in instrumentation systems? | (5) |
| 4 | What are the advantages and disadvantages of MEMS? | (5) |
| 5 | Explain the characteristic features of shape memory alloy. | (5) |
| 6 | Define an industrial automation system and enlist its components. | (5) |
| 7 | Compare programmable logic controller with personal computer. | (5) |
| 8 | What are the main components of SCADA? | (5) |

PART B

Answer any two full questions, each carries 10 marks.

- | | | |
|----|--|-----|
| 9 | (a) Explain the factors governing the selection of a transducer for an instrumentation system | (6) |
| | (b) Draw and explain second order sensor time response | (4) |
| 10 | a) The output of an LVDT is connected to a 5V voltmeter through an amplifier of gain 250. The voltmeter has 100 divisions. The scale can be read upto 1/5 th of a division. An output of 2 mV appears across the terminals of LVDT when the core is displaced through a distance of 0.5 mm. Calculate (i) Sensitivity of the LVDT (ii) sensitivity of the whole setup and (iii) resolution of the instrument | (6) |
| | b) Draw and explain the working of a capacitive differential pressure transducer. | (4) |
| 11 | a) Draw the block diagram representation of a process control system and explain the function of each block. | (5) |
| | b) Explain the measurement of flow using a hot wire anemometer | (5) |

PART C

Answer any two full questions, each carries 10 marks.

- 12 a) With the circuit diagram of charge amplifier show how it enables measurement of electrical charge. (6)
- b) Explain the purpose of signal conditioning in instrumentation systems. (4)
- 13 a) Explain the principle of MEMS accelerometer. (5)
- b) With the help of a block diagram explain the architecture of virtual instruments. (5)
- 14 a) What is an isolation amplifier? Discuss its application in instrumentation. (5)
- b) Explain the concept of graphical programming in virtual instruments (5)

PART D

Answer any two full questions, each carries 10 marks.

- 15 a) Give the classification of control valves. (5)
- b) Explain the working of a solenoid actuator with the help of diagram. (5)
- 16 a) Draw the PLC ladder diagrams to realize two input AND, OR and XOR gates (5)
- b) What are the hardware elements of DCS? (5)
- 17 a) With the help of a block diagram explain the working of an automated system. (5)
- b) Give the significance of timers and counters in PLC. (5)

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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
Eighth Semester B.Tech. Degree Examinations, September 2020

Course Code: EE404

Course Name: INDUSTRIAL INSTRUMENTATION AND AUTOMATION

Max. Marks: 100

Duration: 3 Hours

PART A

Answer all questions, each carries 5 marks.

Marks

- | | | |
|---|---|-----|
| 1 | List any five factors affecting choice of transducer. | (5) |
| 2 | Explain the principle of variable reluctance tachometer. | (5) |
| 3 | Explain the working of instrumentation amplifier with basic circuit diagram. | (5) |
| 4 | Explain MEMS accelerometer. List its advantages and disadvantages compared to normal sensors. | (5) |
| 5 | Which are the commonly used actuators and how they are selected for a particular process control application? | (5) |
| 6 | What are the various types of automation used in industrial process? | (5) |
| 7 | Explain about the different types of timers used in PLC. | (5) |
| 8 | What is Distributed control system? Also state the difference between DCS and SCADA in process control. | (5) |

PART B

Answer any two full questions, each carries 10 marks.

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|----|--|-----|
| 9 | a) Explain the block diagram representation of a process control system. | (6) |
| | b) Describe the working of analog and digital phase detectors with suitable diagrams. | (4) |
| 10 | a) What are the factors influencing the selection of a transducer? | (4) |
| | b) With neat diagram explain the working of a LVDT transducer, give any one application of LVDT. | (6) |
| 11 | a) Describe any two methods used for the measurement of linear and torsional displacement. | (6) |
| | b) Explain the working of hot wire anemometer. | (4) |

PART C

Answer any two full questions, each carries 10 marks.

- 12 (a) Describe the steps involved in bulk micromachining fabrication of MEMS. (6)
(b) List any four types of MEMS actuators along with their applications. (4)
- 13 (a) How is photolithography used in the micro machining process of MEMS. (6)
(b) Compare Dry and wet etching in micromachining of MEMS. (4)
- 14 (a) Explain the concept of graphical programming in virtual instruments. (7)
(b) List the techniques used in micromachining. (3)

PART D

Answer any two full questions, each carries 10 marks.

- 15 a) Explain the concept of latching in PLC. Draw the ladder diagram for realising AND & OR logic using PLC. (6)
b) Explain the different input output used in PLC. (4)
- 16 a) Explain with an example the working of counters in PLC. (6)
b) Describe the various electrical actuators used in automation. (4)
- 17 a) Explain the architecture of an industrial automation system. (6)
b) Explain the working principle of a pneumatic actuator. (4)
