



**PRESIDENCY UNIVERSITY
BENGALURU**

**SCHOOL OF ENGINEERING
END TERM EXAMINATION - JAN 2023**

Semester : Semester V - 2020

Course Code : EEE3004

Course Name : Sem V - EEE3004 - Special Electrical Machines

Program : B.Tech. Electrical and Electronics Engineering

Date : 13-JAN-2023

Time : 9.30AM - 12.30PM

Max Marks : 100

Weightage : 50%

Instructions:

- (i) Read all questions carefully and answer accordingly.
- (ii) Question paper consists of 3 parts.
- (iii) Scientific and non-programmable calculator are permitted.

PART A

ANSWER ALL THE TEN QUESTIONS

10 X 2 = 20M

1. Resolution is given by the number of steps needed to complete one revolution of the rotor shaft. What is the difference between full-step and half-step?
 - a) In full-step two phases are on and in half-step only one phase is on (CO1) [Knowledge]
 - b) More resonance is evident in half-step
 - c) More power required for full-step
 - d) Half-step offers better resolution
2. The simple motor structure and inexpensive power electronic requirement have made the SRM an attractive alternative to both AC and DC machines in adjustable-speed drives.. Which of the following motors is generally used in toys?
 - a) Reluctance motor (CO1) [Knowledge]
 - b) Hysteresis motor
 - c) Shaded-pole motor
 - d) Two-value capacitor motor
3. The direction of rotation can be reversed by reversing the logic sequences in PMBLDC motor. Hall effect sensors are most commonly used in BLDC motors to change the logic sequence. The uses of sensors in BLDC motors are
 - a) to identify the position of the rotor & to excite the coils in proper manner (CO2) [Knowledge]
 - b) to detect the speed & to excite the coils in proper manner
 - c) to identify the position of the rotor & to detect the speed
 - d) none of the above

4. Permanent magnet synchronous motors (PMSM) are typically used for high-performance. The main advantages of using permanent magnet in rotor
- a) Field winding Copper loss is reduced (CO2) [Knowledge]
 - b) High efficient
 - c) more losses
 - d) Option A & B
5. The PMSM is an AC synchronous motor whose field excitation is provided by permanent magnets, and has a sinusoidal back EMF waveform. PMSM stator construction is similar to
- a) synchronous motor (CO2) [Knowledge]
 - b) Induction motor
 - c) Compound motor
 - d) All of the above
6. When two rotor poles are aligned to the two stator poles, another set of rotor poles is out of alignment with respect to a different set of stator poles. The variation of reluctance R_l with space angle θ_r depends on the shape of
- a) stator poles (CO1) [Knowledge]
 - b) rotor poles
 - c) stator or rotor poles
 - d) both stator and rotor poles
7. Interfacing with 8051 microcontroller can be defined as transferring data from interfacing peripherals such as sensors, motors, machines, circuit components, and so on to 8051 microcontroller and vice versa. Why do we need a ULN2803 in driving a relay?
- a) for switching a motor (CO3) [Knowledge]
 - b) for increasing the current
 - c) for increasing the power
 - d) for switching the voltage
8. A stepper motor is a motor in which the motion is in steps and it is an incremental device and may be considered as a digital to analog converter. How can we control the speed of a stepper motor?
- a) by controlling its switching rate (CO3) [Knowledge]
 - b) by controlling its torque
 - c) by controlling its wave drive 4 step sequence
 - d) can't be controlled
9. A linear induction motor (LIM) is an alternating current (AC), asynchronous linear motor that works by the same general principles as other induction motors but is typically designed to directly produce motion in a straight line. Speed of Linear Induction Motor (LIM) is expressed in
- a) rpm (CO4) [Knowledge]
 - b) kg/cm
 - c) m/s
 - d) revolution per second
10. Electric traction is meant locomotion in which the *driving* (or tractive) force is obtained from electric motors. In tramways which of the following motor is used ?
- a) D.C. shunt motor (CO4) [Knowledge]
 - b) D.C. series motor
 - c) A.C. three phase motor
 - d) AC. single phase capacitor start motor

PART B

ANSWER ALL THE FOUR QUESTIONS

4 X 10 = 40M

11. Stepper Motor is an electromechanical device which actuates a train of steps movements of shaft in response to train of input pulses. Formulate the construction & principle of a PM type stepper motor with different modes of excitation.
(CO1) [Comprehension]
12. Mr Virat want to build a drone project but he doesn't know which motor is suitable for this project. If he approaches you regarding the selection of motor criteria, then suggest the suitable motor and its operation with neat sketch to him so that he will be able to select the motor.
(CO2) [Comprehension]
13. The open-loop control of the stepper motor cannot avoid the inherent disadvantages of the stepper motor itself, that is, resonance, oscillation, step loss and difficult to achieve high speed. State how the disadvantages can be eliminated. Justify your answer with suitable explanation.
(CO3) [Comprehension]
14. An actuator is a device that produces a motion by converting energy and signals going into the system. The motion it produces can be either rotary or linear. Explain the construction and working principle of a motor which is used as actuators for door movement.
(CO4) [Comprehension]

PART C

ANSWER ALL THE TWO QUESTIONS

2 X 20 = 40M

15. Illustrate the complete architectures of open loop and closed loop control of stepper motor using a microprocessor or microcontroller. Also comment on the method which is best suited depend on the features and requirements of the user.
(CO3) [Application]
16. State the different types of AC motors used for traction control. Illustrate any two of the listed motors with suitable reasons to select it for traction control.
(CO4,CO3) [Application]
