KUMARAGURU
college of technology
character is life

Register Number:……….……

M.E DEGREE EXAMINATIONS: JUNE 2018

(Regulation 2015)

Second Semester

POWER ELECTRONICS AND DRIVES

P15PET204**:** Special Electrical Machines And Their Controllers

COURSE OUTCOMES

CO1: Describe the construction and working of special electrical machines.

CO2: Identify the characteristics of different special electrical machines

CO3: Choose a particular electrical machine for the given requirements.

Time: Three Hours   **Maximum Marks: 100**

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1.   Assertion (A): In Switched Reluctance each phase should be able to conduct   CO1   [K_2]

independent of other phases.

Reason (R): In SRM drives the converter should be able to freewheel during the

chopping period to reduce the switching frequency.

a)	Both A and R are Individually true and R is the correct explanation of A	b)	Both A and R are Individually true but R is not the correct explanation of A
c)	A is true but R is false	d)	A is false but R is true

2.   Switched reluctance motor is   CO1   [K_1]

a)	Singly excited motor	b)	Double salient motor
c)	Single excited and double salient motor	d)	Same as that of synchronous reluctance motor

3.   Saliency ratio in synchronous reluctance motor is given by   CO1   [K_2]

a)	L_{ds}/L_{qs}	b)	L_{qs}/L_{ds}
c)	Maximum value of L_{ds}/L_{qs}	d)	Maximum value of L_{qs}/L_{ds}

4.   Match List I(Special Electrical Machines) with List II(Applications)   CO3   [K_2]

List I	List II
A.BLDC Motor	i. Ship Propulsion
B. Stepper Motor	ii. Robotic Control
C.SRM	iii. Small Appliances
D.PMSM	iv. Printing Machines

	A	B	C	D
a)	ii	i	iii	iv
b)	iii	iv	ii	i
c)	ii	iv	iii	i
d)	iii	i	ii	iv

5. Assertion (A):Stepper motor is suitable for precise control without feedback   CO2   [K2] mechanism

Reason (R):Lower resolution results in precise operation

   a) Both A and R are Individually true and R   b) Both A and R are Individually true but
      is the correct explanation of A   R is not the correct explanation of A

   c) A is true but R is false   d) A is false but R is true

6. What is the step angle of four phase stepper motor with 12 stator teeth and 3 rotor teeth?   CO1   [K1]

   a) 60°   b) 45°

   c) 30°   d) 90°

7. In a Permanent magnet brushless DC motor   CO1   [K1]

     1. Stator is made up of Permanent magnet

     2. Stator and rotor consists of permanent magnet

     3. Rotor is made up of permanent magnet

     4. Stator and rotor made up of forged steel

   a) 1 and 3   b) 4 only

   c) 1 only   d) 3 only

8. Assertion: In BLDC motor, at any instant one switch from upper leg and another   CO2   [K2]
switch from lower leg are commutated.
Reason: The switches are commutated based upon the signal obtained from the rotor
position sensor

   a) Both A & R are individually true and R is   b) Both A & R are individually true and R
      correct explanation of A   is not correct explanation of A

   c) A is true , R is false   d) A is false, R is true

9. In a mechanical commutator arrangement, the commutator segments are separated by   CO1   [K2]

   a) Mica Film   b) Carbon Film

   c) Graphite Film   d) Copper Film

10. Which of the following phase switching sequence represents half-step operation of a   CO1   [K2]
VR stepper motor?

   a) A, B, C, A   b) A, C, B, A

   c) AB, BC, CA, AB   d) A, AB, B, BC

PART B (10 x 2 = 20 Marks)

11.	Define torque angle of synchronous reluctance motor.	CO2	[K_1]
12.	What are the advantages of increasing L_d/L_q ratio in synchronous reluctance motor?	CO1	[K_2]
13.	Define Chopping and single pulse mode of operation of SRM.	CO1	[K_1]
14.	Draw the simple block diagram of SRM.	CO1	[K_1]
15.	What are the essential difference between SRM and stepper motor?	CO3	[K_2]
16.	Distinguish between self control and vector control of PMSM.	CO2	[K_2]
17.	Write the emf equation of PMSM.	CO1	[K_1]
18.	Differentiate PM synchronous motor from BLPM DC motors.	CO3	[K_2]
19.	Define step angle of stepper motor.	CO1	[K_1]
20.	Draw the typical static characteristics of stepper motor.	CO2	[K_2]

PART C (10 x 5 = 50 Marks)

21.	Draw the general torque - speed characteristics of switched reluctance motor and Why rotor position sensor is essential for the operation of switched reluctance motor?	CO2	[K_2]
22.	Write down the torque equation and draw the torque angle characteristics of synchronous reluctance motor.	CO2	[K_2]
23.	What are the primary design considerations of Synchronous reluctance motor? Write the applications of Synchronous reluctance motor.	CO2	[K_3]
24.	Define and explain the timer circuit of SRM.	CO2	[K_2]
25.	List the various classification of BLPM dc motor and mention its applications.	CO1	[K_2]
26.	Why PMSM operating in self controlled mode is known commutatorless DC motor?	CO2	[K_2]
27.	List the applications and features of PMSM.	CO1	[K_2]
28.	Briefly explain about the soft starters of SRM.	CO2	[K_2]
29.	What is synchronism in stepper motor? Define pull in and pull out torque in stepper motor.	CO1	[K_1]
30.	List the advantages of microstepping in stepper motor and explain. What do you mean by bandwidth in stepper motor?	CO2	[K_2]

Answer any TWO Questions

PART D (2 x 10 = 20 Marks)

31.	Draw and explain any four types of converter topologies used in 3-phase SRM. Also write the merits and demerits of each.	CO1	[K_1]

32.   (a) Compare the features of electronic commutator over mechanical commutator.   CO2   [K$_2$]

       (b) Derive the torque equation of PMBLDC motor.

33.   Draw and explain in detail any four types of drive circuits used for stepper motor.   CO3   [K$_1$]

****