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M.E. DEGREE EXAMINATIONS: JUNE 2016

(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. The Sequence of operation of power converters of SRM CO1 [K_2]
(1) Conduction mode (2) Current Regulation mode (3) Commutation mode

a) 1-2-3 b) 1-3-2

c) 2-3-1 d) 2-1-3

2. The energizing sequence of 4- phase (A, B, C & D), 2 pole, single stack VR stepper motor. CO1 [K_2]

a) A - D+A - D -D+C - C- B+C- B- B+A b) A - A+C- C - C+D -D -D+A - A+B - B

c) A - B- B+C -C - C+D -D -D+A - A+B d) A - A+B - B -B+C - C - C+D -D -D+A

3. Torque of a synchronous reluctance motor is maximum at torque angle CO2 [K_2]

a) $\delta=0°$ b) $\delta=45°$

c) $\delta=60°$ d) $\delta=90°$

4. Match the following CO2 [K_2]

ω- speed of SRM, ω_b – base speed, T- torque of the motor

List I	List II
A. $0 < \omega \leq \omega_b$	1. ωT constant
B. $\omega_b < \omega \leq 2\omega_b$	2. $T\omega^2$ constant
C. Greater than $2\omega_b$	3. T constant

	A	B	C
(a)	3	2	1
(b)	2	1	3
(c)	3	1	2

5. Which of the following relation is correct for power factor of synchronous reluctance motor is close 0.8? CO2 [K_2]

a) Xd = Xq b) Xd < Xq

c) Xd > Xq d) Either a, b or c

6. The brushless PM DC motor operates on the principle of CO1 [K_1]

a) Faradays law of electromagnetic induction b) Fleming's right hand rule

c) Fleming's left hand rule d) Variable reluctance

7. The following statements are with respect to Permanent magnet synchronous motor CO2 [K_2]
Assertion (A): The power factor of motor cannot be controlled.
Reason (R): The rotor flux is constant.

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

c) A is correct but R is wrong d) A is wrong but R is correct

8. **Assertion (A):** For acceleration mode of SRM, the phase winding is energised during positive slope of the inductance CO2 [K_2]
Reason (R): Torque produced is proportional to $\frac{\partial L}{\partial \theta}$.

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

c) A is correct but R is wrong d) A is wrong but R is correct

9. Smaller step angles can be realized using CO1 [K_2]
1. Single stack variable reluctance stepper motor 2. Permanent magnet stepper motor
3. Multi stack variable reluctance stepper motor 4. Hybrid stepper motor

a) 1,2 b) 2,3

c) 3,4 d) 1,4

10. The flux distribution in the air gap of brushless PM DC motor depends on CO1 [K_2]
1. Armature winding 2. Shape of permanent magnet 3. PWM inverters

a) 1,3 b) 1,2

c) 2,3 d) 1,2,3

PART B (10 x 2 = 20 Marks)

11. List the types of synchronous reluctance motors. CO1 [K_1]

12.	Write the torque equation of SRM.	CO1	[K_1]
13.	Mention position sensors used in switched reluctance motor?	CO1	[K_1]
14.	State the applications of switched reluctance motors.	CO3	[K_2]
15.	Define pull out torque of stepper motor?	CO1	[K_1]
16.	What is the function of drive circuit in stepping motor?	CO2	[K_1]
17.	What are the classifications of brushless permanent magnet motor?	CO2	[K_2]
18.	State the important applications of PMDC motor.	CO3	[K_2]
19.	What is meant by self control of PMSM?	CO1	[K_1]
20.	Define synchronous reactance in PMSM?	CO1	[K_1]

PART C (6 x 5 = 30 Marks)

21.	Draw the phasor diagram of synchronous reluctance motor.	CO2	[K_2]
22.	Derive the torque equation of SRM.	CO1	[K_2]
23.	A variable reluctance stepper motor has 8 poles in the stator and they have five teeth in each pole. If the rotor has 50 teeth, calculate the step angle and resolution.	CO2	[K_2]
24.	Distinguish between mechanical and electronic commutators.	CO2	[K_2]
25.	Explain the principle of operation of Hall sensor.	CO1	[K_2]
26.	Draw the speed torque characteristics of PMSM.	CO2	[K_2]

PART D (4 x 10 = 40 Marks)

27.	Describe the constructional features of synchronous reluctance motor and explain its characteristics	CO1	[K_2]
28.	With a neat block diagram, describe in detail the microprocessor based controller for switched reluctance motor.	CO2	[K_2]
29.	Describe the construction and full step mode of operation of VR stepper motor.	CO1	[K_2]

30. Explain the operation of 3 phase bipolar BLDC motor drive. CO1 [K_2]

31. Derive the expression for power input and torque of a PMSM. CO1 [K_2]

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