Total No. of Questions: 6 *Total No. of Printed Pages:3*

Enrollment No.....

Faculty of Engineering

End Sem (Odd) Examination Dec-2019

EE3CO04-EX3CO04 Electrical Machines-I

Programme: B.Tech. Branch/Specialisation: EE/EX

Duration: 3 Hrs. **Maximum Marks: 60**

Note: All questions are compulsory. Internal choices, if any, are indicated. Answers of Q.1 (MCQs) should be written in full instead of only a, b, c or d.

Q.1 i. Generator is used to convert energy from **1**

(a) Electrical to mechanical (b) Mechanical to electrical

(c) Chemical to electrical (d) Electrical to chemical

ii. Motor is used to convert energy from **1**

(a) Electrical to mechanical (b) Mechanical to electrical

(c) Chemical to electrical (d) Electrical to chemical

iii. Open circuit test is used to measure **1**

(a) Copper loss (b) Iron loss

(c) Both (a) and (b) (d) None of these

iv. Short circuit test is used to measure **1**

(a) Copper loss (b) Iron loss

(c) Both (a) and (b) (d) None of these

v. A V-V connected transformer can be connected in parallel to delta-delta connected transformer but not to **1**

(a) Delta-star (b) Star-delta (c) Star-V (d) All of these

vi. In three phase star connected circuit relationship between line voltage and phase voltage is given by **1**

(a) Line voltage = phase voltage

(b) Line voltage = (phase voltage)^2

(c) Line voltage = 2×phase voltage

(d) Line voltage = 1.732×phase voltage

vii. Which machine is called a single excited machine? **1**

(a) DC Machine (b) Synchronous Machine

(c) Induction Machine (d) None of these

P.T.O.

viii. Which machine is called a rotating transformer? **1**
(a) DC Machine (b) Synchronous Machine
(c) Induction Machine (d) None of these

ix. In split phase induction motor main field winding and starting field winding are displaced by **1**
(a) 45˚ (b) 60˚ (c) 30˚ (d) 90˚

x. A servomotor may employ **1**
(a) DC motor (b) Induction motor
(c) Synchronous motor (d) All of these

Q.2 i. Define field energy and coenergy. **2**

ii. Write the difference between single excited and double excited energy system. **3**

iii. Derive an expression for the torque in a doubly excited system having salient pole type of stator as well as rotor. **5**

OR iv. State the electromagnetic phenomenon useful for the electromagnetic energy conversion in rotating electric machine **5**

Q.3 Attempt any two:

i. Define voltage regulation of transformer. For which type of load the voltage regulation is negative? Derive the expression using the equivalent circuit. **5**

ii. Explain parallel operation of single phase transformer and write its significance. **5**

iii. Open circuit and short circuit test on a 5kVA, 220/400V, 50Hz, single phase transformer gave the following results: **5**
OC TEST: 220V, 2A, 100W
SC TEST: 40V, 11.4A, 200W
Determine the efficiency and approximate regulation of the transformer at full load 0.9 power factor lagging.

Q.4 Attempt any two:

i. Explain different connection groups of three phase transformer with their working and application. **5**

ii. Explain in brief, different methods of transformer cooling. Also discuss functions of conservator and breather. **5**

iii. Explain the working principle of tap changing and auto transformer. **5**

Q.5 Attempt any two:

i. A 6 pole, 50 Hz, three phase induction motor running on full load develops a useful torque of 150Nm at a rotor frequency of 1.5Hz. Calculate the shaft power output. If the mechanical torque lost in friction be 10Nm, determine **5**
(a) Rotor copper loss (b) Input to the motor
(c) Efficiency

ii. Explain the equivalent circuit of three phase induction motor with the help of schematic diagram. Discuss component equipment to mechanical load. **5**

iii. Explain no load and block rotor test of three phase induction motor with the help of schematic diagram. **5**

Q.6 Write short note on any two:

i. Speed control of three phase induction motor **5**

ii. Starting method of single phase induction motor **5**

iii. Servomotor and linear induction motor **5**

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Marking Scheme
EE3CO04-EX3CO04 Electrical Machines-I

Q.1	i.	Generator is used to convert energy from (b) Mechanical to electrical		**1**
	ii.	Motor is used to convert energy from (a) Electrical to mechanical		**1**
	iii.	Open circuit test is used to measure (b) Iron loss		**1**
	iv.	Short circuit test is used to measure (a) Copper loss		**1**
	v.	A V-V connected transformer can be connected in parallel to delta-delta connected transformer but not to (a) Delta-star		**1**
	vi.	In three phase star connected circuit relationship between line voltage and phase voltage is given by (d) Line voltage = 1.732×phase voltage		**1**
	vii.	Which machine is called a single excited machine? (c) Induction Machine		**1**
	viii.	Which machine is called a rotating transformer? (c) Induction Machine		**1**
	ix.	In split phase induction motor main field winding and starting field winding are displaced by (d) 90˚		**1**
	x.	A servomotor may employ (d) All of these		**1**
Q.2	i.	Definition of field energy	1 mark	**2**
		Definition of coenergy	1 mark	
	ii.	Difference between single excited	1.5 marks	**3**
		Double excited energy system	1.5 marks	
	iii.	Derivation for the torque in a doubly excited system Stepwise marking		**5**
OR	iv.	Electromagnetic induction	1 mark	**5**
		Generator principle	2 marks	
		Motor principle	2 marks	
Q.3		Attempt any two:		
	i.	Voltage regulation of transformer	1 mark	**5**
		Type of load the voltage regulation is negative	1 mark	
		Derivation using the equivalent circuit	3 marks	
	ii.	Parallel operation of single phase transformer	3 marks	**5**
		Its significance	2 marks	
	iii.	Efficiency	3 marks	**5**
		Approximate regulation of the transformer	2 marks	
Q.4		Attempt any two:		
	i.	Different connection groups of three phase transformer		**5**
		Explanation	2 marks	
		Their working	2 marks	
		Application	1 mark	
	ii.	Different methods of transformer cooling	3 marks	**5**
		Functions of conservator and breather	2 marks	
	iii.	Working principle of tap changing	2.5 marks	**5**
		Auto transformer.	2.5 marks	
Q.5		Attempt any two:		
	i.	(a) Rotor copper loss	2 marks	**5**
		(b) Input to the motor	2 marks	
		(c) Efficiency	1 mark	
	ii.	Circuit of three phase induction motor with diagram	3 marks	**5**
		Component equipment to mechanical load	2 marks	
	iii.	No load of three phase induction motor with diagram	2.5 marks	**5**
		Block rotor test of three phase induction motor with diagram	2.5 marks	
Q.6		Write short note on any two:		
	i.	Speed control of three phase induction motor		**5**
		1 mark for each point	(1 mark * 5)	
	ii.	Starting method of single phase induction motor		**5**
		1 mark for each point	(1 mark * 5)	
	iii.	Servomotor	2.5 marks	**5**
		Linear induction motor	2.5 marks	

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