

Enrollment No.....



Faculty of Engineering
End Sem (Even) Examination May-2018
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.

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|-----|------|--|---|
| Q.1 | i. | For electromechanical energy conversion process, it is essential that coupling magnetic field reacts on
(a) Electrical system
(b) Mechanical system
(c) Electrical and mechanical system
(d) Electrical or mechanical system | 1 |
| | ii. | Electromagnetic energy is developed in the following winding
(a) Resistive winding (b) Inductive winding
(c) Capacitive winding (d) All of these | 1 |
| | iii. | The rating of transformer is given by
(a) KW (b) KVAr (c) $\cos\phi$ (d) KVA | 1 |
| | iv. | The no load current of a certain transformer is 2A at 0.3 P.F.. Its working component may be :
(a) 0.8A (b) 0.6A (c) 0A (d) 2A | 1 |
| | v. | Scott connection is used for the purpose of
(a) Single phase to three phase conversion
(b) Two phase to three phase conversion
(c) Three phase to two phase conversion
(d) Both (b) and (c) | 1 |
| | vi. | Percentage increase in load on each transformer when one transformer is removed in the V-V connection:
(a) 57% (b) 73% (c) 50% (d) 25% | 1 |
| | vii. | Which motor is called asynchronous motor:
(a) Induction motor (b) Synchronous motor
(c) Both (a) and (b) (d) None of these | 1 |

P.T.O.

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- viii. Which motor is called rotating transformer: **1**
 (a) Induction motor (b) Synchronous motor
 (c) Both (a) and (b) (d) None of these
- ix. Rotor bars of a squirrel cage motor are made slightly skewed in order to reduce **1**
 (a) Cogging (b) Crawling
 (c) Ohmic losses (d) Core losses
- x. Induction machine operates as generator when slip(s) is **1**
 (a) Less than zero (b) One
 (c) More than one (d) 0.5
- Q.2 i. State the advantages of analysing energy conversion devices by field energy concept? **2**
 ii. Draw and explain the general block diagram of an electromechanical energy conversion device. **3**
 iii. A toroid is excited by a single coil. Discuss the conditions under which this toroid can extract energy from the supply system. **5**
- OR iv. For a singly excited magnetic system derive the relation for the magnetic stored energy in terms of reluctance. **5**
- Q.3 i. Draw the phasor diagram of ideal and no load single phase transformer. **2**
 ii. A transformer is designed to have hot rolled steel lamination with a flux density of 1.2T and the weight of core and wire is found to be 100kg and 80kg respectively. If the transformer is redesigned with CRGO steel laminations, which permit a higher flux density of 1.6T; find the saving in core and wire material. The two types of core material have the same densities and total flux remain same. **8**
- OR iii. A transformer has its maximum efficiency of 98% at 15kVA at unity P.F. , During the day it is loaded as under: **8**
 12 hours: 2KW at 0.5 p.f. lagging
 6 hours: 12KW at 0.8 p.f. lagging
 6 hours: 18KW at 0.9 p.f. lagging
 Find the all-day efficiency.

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- Q.4 i. Explain the concept of pulse transformer with the help of equivalent circuit and also write its application and advantages. **3**
 ii. A three phase 4 wire supply system has a line voltage of 400V. Three non-inductive loads of 16KW, 8KW and 12KW are connected between R, Y and B phases and the neutral respectively. Calculate the current flowing through the neutral wire. **7**
- OR iii. A 400kVA load at 0.7 p.f. lagging is supplied by three single phase transformer connected in Δ - Δ . Each of the Δ - Δ transformer is rated at 200kVA, 2300/230V. If one defective transformer is removed from service, calculate for the V-V connection: **7**
 (a) The kVA load carried by each transformer
 (b) Percentage rated load carried by each transformer
 (c) Total KVA ratings of the transformer bank in V-V
 (d) Ratio of V-V bank to Δ - Δ bank transformer ratings
 (e) Percentage increase in load on each transformer when one transformer is removed
- Q.5 i. Explain working principle of induction motor with the help of construction diagram. **4**
 ii. An induction motor has an efficiency of 90% when the shaft load is 45kW. At this load, stator ohmic loss and rotor ohmic loss each is equal to the iron loss. The mechanical loss is one third of the no load losses. Neglect ohmic loss at no load. Calculate the slip. **6**
- OR iii. Explain the production of torque in a 3 phase slip ring induction motor through the interaction of flux and mmf waves, when the rotor is running at a speed less than synchronous speed. **6**
- Q.6 Write short note on any two of the following: **5**
 i. Cogging and Crawling of Induction motor **5**
 ii. Starting of squirrel cage Induction motor **5**
 iii. Speed control of Induction motor **5**

Q.6	Write short note on any two of the following:		
i.	Cogging of Induction motor	2.5 marks	5
	Crawling of Induction motor	2.5 marks	
ii.	Starting of squirrel cage Induction motor		5
	Diagram	2 marks	
	Explanation	3 marks	
iii.	Speed control of Induction motor (two methods)		5
	Diagram 1 mark each (1 mark * 2)	2 marks	
	Explanation 1.5 mark each (1.5 mark * 2)	3 marks	
