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**University Examinations 2015/2016**

THIRD YEAR FIRST SEMESTER EXAMINATION FOR DIPLOMA IN ELECTRICAL ENGINEERING

**EEE 2303: SYNCHRONOUS MACHINES I**

 **DATE: AUGUST 2016 TIME: 11/2 HOURS**

**INSTRUCTIONS:** *Answer question* ***one*** *and any other* ***two*** *questions*

**QUESTION ONE (30MARKS)**

1. State the four characteristics features of a synchronous motor. (4 Marks)
2. Distinguish between stator and rotor parts of a three-phase synchronous motor. (4 Marks)
3. Explain why a 3 phase synchronous motor is not self-starting machine. (5 Marks)
4. Draw the following phasor diagrams of a three-phase synchronous motor-power factors at constant load:
5. Lagging (3 Marks)
6. Leading (3 Marks)
7. Unity (3 Marks)
8. Explain the following types of torques development in a three-phase synchronous motor:-
9. Normal pull-in (2 Marks)
10. Pull-up (2 Marks)
11. Reluctance (2 Marks)
12. Pull-in (2 Marks)

**QUESTION TWO (15 MARKS)**

1. Draw three-phase synchronous motor and state any two functions of the motor. (5 Marks)
2. With the aid of a two-pole synchronous motor explain the principle of operation of a three-phase synchronous motor. (10 Marks)

**QUESTION THREE (15 MARKS)**

1. Explain the following methods of starting a three-phase synchronous motor:
2. Pump winding (4 Marks)
3. Variable frequency (4 Marks)
4. (i) Define excitation with reference to synchronous motors. (1 Mark)

(ii) With the aid of phasor diagrams explain the following types of excitation of a three-phase

 synchronous motor:

1. Under excitation (3 Marks)
2. Over excitation (3 Marks)

**QUESTION FOUR (15 MARKS)**

1. With the aid of a graph describe how V-curves of a three-phase synchronous motor are constructed. (4 Marks)
2. With the aid of an equivalent circuit model and phasor diagram of three-phase synchronous motor show that the mechanical power develop is Where

back e.m.f

V= terminal voltage

reactance/phase

Load angle (7 Marks)

1. State any four differences between a three-phase synchronous motor and a three-phase induction motor. (4 Marks)