



# *TECHNICAL UNIVERSITY OF MOMBASA*

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*Faculty of Engineering and Technology*

*Department of Electrical and Electronic engineering*

**UNIVERSITY EXAMINATION:**

*Diploma in Electrical Power Engineering (DEPE 5)*

**ELECTRICAL MACHINES II**

**EEP 2301**

END OF SEMESTER EXAMINATION

**SERIES: DEC 2016**

**TIME: 2 HOURS**

**Instructions to Candidates**

You should have the following for this examination

-Answer Booklet, examination pass and student ID

This paper consists of **five** Questions;. Attempt any **THREE** Questions.

**Do not write on the question paper.**

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### **Question ONE**

- (a) Explain the need for consumers to improve power factor. (4 marks)
- (b) Explain with the aid of a phasor diagram how a three phase synchronous motor operates with a varying power factor. (8 marks)
- (c) A factory having a three phase load of 600KVA at a power factor of 0.7 lagging is to be connected in parallel with a three phase synchronous motor to cater for an additional 187kW and the motor operates at an efficiency of 90%. The motor is also used to improve the power factor of the factory to 0.95 lagging.  
Determine:
- (i) The leading KVAR of the motor
  - (ii) KVA rating of motor
  - (iii) Power factor at which motor operates
- (8 marks)

### **Question TWO**

- (a) State the condition to be met in order for three phase transformers to be connected in parallel. (4 marks)
- (b) State FOUR transformer groups and state what determines these groupings. (8 marks)
- (c) Two three phase transformers rated at 1000 kVA and 500 KVA are connected in parallel to share a load of 1400 KVA at 0.866 pf lagging. The two transformers have the same transformation ratio of 6600/400 delta star. If the equivalent secondary impedance of the transformers are  $(0.001 + j0.003)\Omega$  and  $(0.0028 + j0.005)\Omega$  respectively. Determine the loading and power factor of each transformer. (8 marks)

### **Question THREE**

- (a) State the conditions to be satisfied in order for three phase transformers to be operated in parallel. (4 marks)
- (b) State the FOUR groups in which transformers are classified and state what determines the classification. (8 marks)
- (c) A 400KVA transformer having 0.01 p.u. resistance and 0.05p.u. reactance is connected in parallel with 200KVA transformer 0.012p.u. resistance and 0.04p.u. reactance. Determine how they share a load of 600KVA at 0.8pf lagging. (8 marks)

### **Question FOUR**

- (a) Explain why it is advisable to improve a consumers power factor. (4 marks)
- (b) Explain why a synchronous motor is referred to as a synchronous condenser. (4 marks)
- (c) A 2300V 60Hz six pole synchronous motor drives a constant torque load of 5000Nm. The synchronous reactance of the motor is  $6\Omega$ . Determine the minimum excitation that the machine must maintain to provide the required torque. (12 marks)

**Question FIVE**

(a) Explain the following:

- (i) Hunting in synchronous motor
- (ii) Causes of hunting
- (iii) How hunting is countered
- (iv) Pull out torque

(10 marks)

(b) Explain the effect of adding load on a synchronous motor.

(5 marks)

(c) Explain the lamps dark method of synchronizing.

(5 marks)