



TECHNICAL UNIVERSITY OF MOMBASA

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

SPECIAL/SUPPLEMENTARY EXAMINATION

SERIES: SEPTEMBER 2018

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.

- (a) (i) Define the per unit (p.u.) system.
(ii) State FOUR reasons justifying the per unit system in electrical system analysis. (6 marks)
- (b) Explain why transformers are rated in KVA. (4 marks)
- (c) A generator rated 1000VA and 200V has internal impedance of $j10\Omega$. The generator impedance is stamped on the name plate as $j25\%$ together with the other ratings. The generator is short circuited at its terminals.
Determine:
- (i) The short circuit current
(ii) The short circuit power delivered by the generator in:
(iii) Per unit
(iv) Percentage (%)
(v) Actual units
- (10 marks)

Question TWO

- (a) State the conditions to be met for a three phase synchronous machine to be connected to the supply. (6 marks)
- (b) Explain the methods of starting synchronous machines. (6 marks)
- (c) Explain the effect of the following on a running synchronous motor:
(ii) Increasing load
(iii) Decreasing the load
- (6 marks)
- (d) Explain 'pull out Torque' for a synchronous machine. (2 marks)

Question THREE

- (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 FOUR

- (a) State TWO applications of the following:

- (i) Stepper motor
- (ii) Hysteresis motor

(4 marks)

(b) With reference to stepper motors explain:

- (i) Holding torque
- (ii) Step accuracy

(4 marks)

(a) A stepper motor has a step angle of 2.5° and a stepping frequency of 3600 pulses per second. Determine:

- (i) Resolution
- (ii) Number of steps required for the shaft to make 25 revolutions
- (iii) Shaft speed

(12 marks)

Question FIVE

(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)

(b) 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 KVA_r of the motor
- (ii) KVA rating of motor
- (iii) Power factor at which motor operates

(8 marks)