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

END OF SEMESTER EXAMINATION

SERIES: MAY 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.

Question ONE

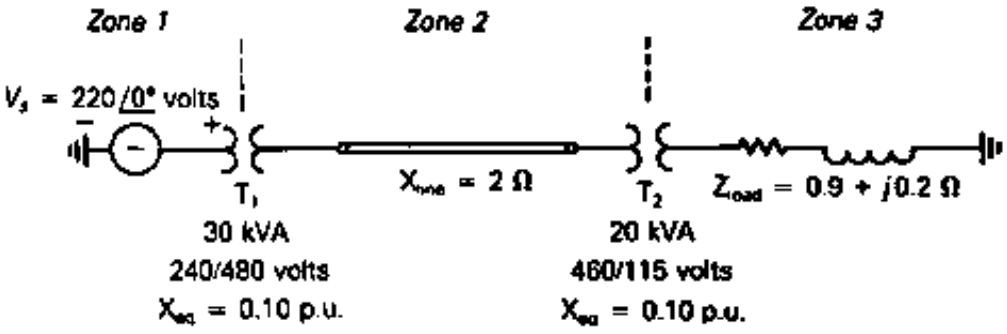
(a) (i) Define the per unit system of analysis.
(ii) State **FOUR** advantage of the pu system.

(6 marks)

(b) Three zones of a single-phase circuit are identified in Figure 1 The zones are connected by transformers T1 and T2. Transformer winding resistances and shunt admittance branches are neglected.

Using base values of 30 kVA and 240 volts in zone 1,

(i) draw the per-unit circuit
(ii) determine the per-unit impedances and the per-unit source voltage
(iii) calculate the load current both in per-unit and in amperes.



(14 marks)

Question TWO

(a) Explain why transformers are rated in KVA. **(3 marks)**

(b) Derive the expression for power sharing of two transmission lines in parallel. **(8 marks)**

(c) Two three phase transformers operating in parallel deliver 500A at a power factor of 0.8 lagging. The resistance and reactance of the transformers are:

$R_1 = 0.02\Omega$ $X_1 = 0.2\Omega$
$R_2 = 0.03\Omega$ $X_2 = 0.3\Omega$

Determine the current delivered by the first transformer and its phase angle with respect to the common terminal voltage. **(9 marks)**

Question THREE

(a) With reference to stepper motors explain:

(i) Holding torque

(ii) Step accuracy

(4 marks)

(b) State TWO applications of the following:

(i) Stepper motor

(ii) Hysteresis motor

(4 marks)

(c) 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 FOUR

(a) Explain why it is advisable for consumers to improve their power factor. **(4 marks)**

(b) Explain with the aid of a diagram (phasor) how a three phase synchronous motor operates with a varying power factor. **(8 marks)**

(b) An over-excited synchronous motor is connected across a 250kVA inductive load of 0.6 lagging power factor. The motor takes 20kW while running on no-load.
Calculate the kVA rating of the motor in order to raise the overall power factor of the motor plus inductive load combination to 0.95 lagging. (8 marks)

Question FIVE

(a) (i) State **THREE** conditions to be met before a synchronous machine is connected to the supply.

(ii) Explain the starting of a synchronous machine as an induction motor.

(10 marks)

(b) With the aid of a circuit diagram explain the lamps dark method of synchronizing.

(6 marks)

(c) Explain **hunting** in synchronous machines (4 marks)