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

Questtion ONE
(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 j10Ω. 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 l000 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)Ω and (0.0028 +
    j0.005)Ω 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 KVAr of the motor
      (ii) KVA rating of motor
      (iii) Power factor at which motor operates

(8 marks)