FACULTY OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF MEDICAL ENGINEERING

UNIVERSITY EXAMINATION FOR:

DIPLOMA IN MEDICAL ENGINEERING (DME 315)

EEP 2251 : ELECTRICAL MACHINES & UTILIZATION II

END OF SEMESTER EXAMINATION

SERIES: APRIL 2016

TIME: 2 HOURS

DATE: Pick DateSelect MonthPick Year

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 question ONE (Compulsory) and any other TWO questions.
Do not write on the question paper.

Question ONE (Compulsory)

(a)   Describe the following systems used in the distribution of electrical power:-

    (i)   3-phase, 3-wire
    (ii)   3-phase, 4-wire
    (iii)   3-phase, 5-wire.

(6 marks)

(b)   A 220-V, 3-phase voltage is applied to a balanced delta-connected load of phase impedance $(15 + j20)\Omega$. Calculate

    (i)   the phase current in each line
    (ii)   the power consumed per phase.

(10 marks)

(c)   A balanced, 3-phase load consists of three coils, each of resistance 6Ω and inductive reactance 8Ω. Calculate the line current and power absorbed when the coils are:

(i)   star-connected
(ii)   delta-connected
across a 400-V, 3-phase supply.

(14 marks)

Question TWO

(a)   The transmission stage of electric power supply system involves 11/132-KV, 100MVA, delta-delta, 3-phase transformer. For this transformer determine

(i)   the current rating of the primary winding
(ii)   the maximum current that can be carried by the secondary winding
(iii)   the turns-ratio $N_s : N_p$
(iv)   the number of similar units to be operated in parallel to satisfy a total demand of 440MVA.

(9 marks)

(b)   A 100 – KVA distribution transformer consists of star-connected, 3-phase windings on a shell-type iron core. Calculate

(i)   the primary line voltage, assuming the primary line current to be 18.18A.
(ii)   the primary phase voltage
(iii)   the value of primary phase current

(11 marks)

Question THREE

(a)   Compare and contrast the wound-rotor induction motor and the squirrel-cage-rotor induction motor.   **(2 marks)**

(b)   State any **THREE** applications of 3-phase induction motors.   **(3 marks)**

(c)   A 50Hz, 4-pole, 3-phase induction motor has a rotor current of frequency 2Hz. Calculate:

(i)   the per-unit slip
(ii)   the speed of the motor.

(7 marks)

(d)   Describe the following parts of a 3-phase induction motor:-

     (i)   stator
     (ii)   rotor
     (iii)   slip-rings
     (iv)   fan.

(8 marks)

Question FOUR

(a)   Distinguish between a 3-phase synchronous motor and a 3-phase alternator. **(2 marks)**

(b)   State **THREE** applications of 3-phase synchronous motors.   **(3 marks)**

(c)   Explain

     (i)   the term **synchronous capacitor**.
     (ii)   why a synchronous machine is called a **doubly-excited machine**.

(15 marks)

Question FIVE

Explain how electrical system faults can be caused by the following:-

(i)   Power failure
(ii)   Over-voltage
(iii)   Wrong operating procedure
(iv)   Unfavourable working environment

(20 marks)