

TECHNICAL UNIVERSITY OF MOMBASA

University Examinations 2015/2016

**THIRD YEAR EXAMINATION FOR THE DIPLOMA OF SCIENCE IN MARINE
ENGINEERING**

EMR 2316: MARINE ELECTRICAL TECHNOLOGY II

DATE:

TIME:

INSTRUCTIONS

Answer any three questions. All questions carry 20 marks each.

QUESTION ONE

- a) With the aid of a schematic diagram, briefly explain the working principle of the transformer (**6 marks**)
- b) Explain the factors that determine the number of feeders that are connected to a ring main electrical power distribution system (**6 marks**)
- c) The ohmic values of the circuit parameters of a transformer having a turn ratio of 5 are $R_1=0.5\Omega$, $R_2=0.021\Omega$, $X_1=3.2\Omega$, $X_2=0.12\Omega$. Draw appropriate equivalent circuit of transformer and show numerical values of circuit parameters referred to
- The primary. (**4marks**).
 - The secondary (**4 marks**).

QUESTION TWO

- a) A 100-kVA single-phase transformer steps down from 2000/400 V. It has a primary resistance of 0.17Ω and a secondary resistance of 0.0068Ω ; the reactance's are 0.25Ω and 0.01Ω respectively. Calculate the total resistance, reactance and impedance referred (scaled) to the secondary. Hence find the percentage voltage regulation on full secondary load of 250 A at a PF of 0.8 lagging. (**9 marks**)
- b) Briefly explain the different types and different configurations of earthed systems (**6 marks**)
- c) A single-phase, 50 Hz transformer has 25 primary turns and 300 secondary turns. The cross-sectional area of the core is 300 cm^2 . When the primary winding is connected to a 250V supply, determine (a) the maximum value of the flux density in the core, and (b) the voltage induced in the secondary winding. (**5 marks**)

QUESTION THREE

- a) A transformer has 600 primary turns and 150 secondary turns. The primary and secondary resistances are 0.25Ω and 0.01Ω respectively and the corresponding leakage reactance's are 1.0Ω and

0.04 Ω respectively. Determine (a) the equivalent resistance referred to the primary winding, (b) the equivalent reactance referred to the primary winding, (c) the equivalent impedance referred to the primary winding, and (d) the phase angle of the impedance. **(8 marks)**

b) A 400 kVA transformer has a primary winding resistance of 0.5 Ω and a secondary winding resistance of 0.00 Ω . The iron loss is 2.5kW and the primary and secondary voltages are 5 kV and 320V respectively. If the power factor of the load is 0.85, determine the efficiency of the transformer (a) on full load, and (b) on half load **(6 marks)**

c) With the aid of a well labeled diagram explain the system characteristics and advantages of an TT system directly earthed system **(6 marks)**

QUESTION FOUR

a) A three-phase transformer has 500 primary turns and 50 secondary turns. If the supply voltage is 2.4 kV find the secondary line voltage on no-load when the windings are connected

(a) Star-delta, (b) delta-star. **(5 marks)**

b) State the advantages and disadvantages of autotransformers (**6 marks**)

c) State two types of systems depending on the earthing **(2 marks)**

d) Explain the open circuit test and derive the parameters that can be determined from it. **(3 Marks)**

e) A 2400V/400V single-phase transformer takes a no-load current of 0.5A and the core loss is 400W. Determine the values of the magnetizing and core loss components of the no-load current. (3 marks)

QUESTION FIVE

a) A 5 kVA single-phase transformer has a turns ratio of 10:1 and is fed from a 2.5 kV supply. Neglecting losses, determine (a) the full-load secondary current, (b) the minimum load resistance which can be connected across the secondary winding to give full load kVA, (c) the primary current at full load kVA. **(6 marks)**

b) State the 5 main parts of an electrical power distribution network **(5 marks)**

c) State and explain the two main types of electrical power distribution system **(4 marks)**

d) A 75 kVA transformer has step-down ratio of 12:1, 2400 primary turns and a primary voltage of 3.3 kV. Calculate

- i. the number of secondary turns
- ii. the secondary voltage
- iii. the volts per turn
- iv. The full load primary and secondary currents. **(5 marks)**