TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Engineering and Technology

DEPARTMENT OF MECHANICAL AND AUTOMOTIVE ENGINEERING

DIPLOMA IN MARINE ENGINEERING (DMAE 6)

EMR 2320

MARINE ELECTRICAL TECHNOLOGY

END OF SEMESTER EXAMINATIONS

YEAR 3 SEMESTER 2

SERIES: DECEMBER, 2013

TIME: 2 HOURS

INSTRUCTIONS TO CANDIDATES:

1. You should have the following for this examination:
   - Answer Booklet

2. This paper consists of **FIVE** Questions.
3. Answer **ANY THREE** Questions the marks are as shown.
4. All Questions carry equal marks.
5. **This paper consists of THREE *printed* pages.**

Question ONE

(a) (i) Define the term "Transformer". **(2 marks)**

(ii) Give **TWO** reasons why three phase systems are used in power supply distribution. **(4 marks)**

(b) With the aid of diagrams, differentiate between the following tyres of transformer construction:

(i) Core Type Transformer
(ii) Shell Type Transformer

(4 marks)

(c) The open-circuit and short-circuit tests on a transformer led to the following data:

$V_{oc} = 8000V$ $V_{cc} = 489V$
$I_{oc} = 0.214A$ $I_{sc} = 2.5A$
$P_{oc} = 400W$ $P_{sc} = 240W$

Determine the equivalent circuit impedances of a 20KVA, 8000/240V, 60Hz transformer; and Draw the equivalent circuit of the transformer circuit. (**12 marks)**

Question TWO

(a) Explain the purpose of Automatic voltage regulators on ships. **(4 marks)**

(b) With the aid of a detailed diagram, explain the principle of operation of an ac generator (or alternator). **(10 marks)**

(c) Give the **THREE** methods of cooling ac generators. **(6 marks)**

Question THREE

(a) (i) Define the term 'synchronization'. **(3 marks)**

(ii) State the conditions for synchronization to occur. **(6 marks)**

(b) (i) Describe the automatic synchronizing procedure for two generators onboard ships. **(6 marks)**

(ii) Describe the steps to be carried out after synchronizing generations. **(5 marks)**

Question FOUR

(a) Briefly describe the following three-phase transformer connection methods; using appropriate diagrams:

(i) Star-Delta connection
(ii) Delta-Delta connection
(iii) Delta-Star connection
(iv) Star-Star Connection

(8 marks)

(b) (i) State the basic properties of a three-phase transformer bank.

(ii) Three single-phase transformers are connected in delta-delta to step down a line voltage of 150KV, to 4200V to supply power to a ship manufacturing plant. The plant draws 32MW at a lagging power factor of 0.75 lagging. Calculate:

(I) The apparent power drawn by the plant
(II) The apparent power furnished by the High Voltage line
(III) The current in the Higher Voltage lines
(IV) The current in the Low Voltage lines
(V) The currents in the primary and secondary windings of each transformer
(VI) The load carried by each transformer

(12 marks)

Question FIVE

(a) State the **THREE** methods of starting a squirrel cage induction motor. **(6 marks)**

(b) With the aid of a diagram, explain how a split-phase induction motor is started using the resistance-start method. **(8 marks)**

(c) State any **SIX** benefits of using shaft alternators on modern ships. **(6 marks)**