



TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF ENGINEERING & TECHNOLOGY

DEPARTMENT OF ELECTRICAL & ELECTRONIC ENGINEERING

UNIVERSITY EXAMINATION FOR:

DIPLOMA IN TECHNOLOGY (MARINE ENGINEERING)

EMR 2316: MARINE ELECTRICAL TECHNOLOGY

END OF SEMESTER EXAMINATION

SERIES : AUGUST 2019

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 any **THREE Questions**

Do not write on the question paper.

QUESTION ONE

- a)
- i) Define a DC machine
 - ii) State TWO differences between a generator and a motor
 - iii) With the aid of a diagram, describe the functions of major components of a DC machine. (13marks)
- b) A 6 pole generator has 250 conductors rotating at 1200rpm. If flux/pole is 0.04Wb. Determine the generated voltage if the generator were:
- i) Lap wound
 - ii) Wave wound (4marks)
- c) State any THREE Essential services which are supplied by an electrical power in a ship (3marks)

QUESTION TWO

- a) State Faraday's law of electromagnetic induction (1mark)
- b)
- i) Define ;
- I) Ferromagnetic materials
- II) Paramagnetic materials
- III) Diamagnetic materials
- ii) Determine the magnitude of induced E.M.F in a coil of 1500 turns when a magnetic flux of $200\mu\text{Wb}$ passing through it is reversed in 0.1 second. (5marks)
- c) From the basic principle, derive E.M.F equation of a transformer. (4marks)
- d)
- i) With the aid of a diagram, describe the construction of a single phase transformer
- ii) A single phase transformer with a ratio 6600/600 V has a head of impedance $(4 + j3) \Omega$, connected across the terminal of the low voltage winding. Calculate:
- i) The power(KW) delivered to the load neglecting the losses of the transformer
- ii) Current taken from the supply by the AC generator on board ship. (10marks)

QUESTION THREE

- a) In your own views, justify the need of power system protection in a ship (4marks)
- b)
- i) Explain any THREE causes of faults in power distribution system on ship board and their possible protection schemes
- c) With the aid of a diagram, explain the operation of an overcurrent differential relay as a protective device used in ship board (10marks)
- d) An air circuit breaker connected to a generator on board ship is rated at 300 A, 2000KVA, 6 – Seconds, 6.6 KV circuit breaker. Find
- i) The rated normal current
- ii) Breaking capacity

- iii) Symmetrical breaking current
- iv) Rated making current
- v) Short-circuit current rating
- vi) Normal rated voltage (6marks)

QUESTION FOUR

- a)
 - i) Explain the use of earthing resistance in earthing of alternator used in board ship
 - ii) State 2 types of AC 3 ϕ motors commonly used on board ships and give one application of each.
 - iii) State two advantages of a wound rotor motor over conventional squirrel cage induction motor (6marks)
- b)
 - i) State the Lenz's law
 - ii) Briefly describe the principle of operation of a DC motor (5marks)
- c) A 3 ϕ induction motor wound with a 4 pole and is supplied from 50Hz frequency system of an AC generator on board ship. Calculate:
 - i) Synchronous speed
 - ii) The rotor speed when the slip is 4%
 - iii) The rotor frequency when the rotor turns at 500 rpm
 - iii) State any one application of dc series motor (7marks)
- d) State ONE application of a DC shunt motor (1mark)

QUESTION FIVE

- a)
 - i) State any TWO safety precautions before carrying out electrical maintenance work on ship board
 - ii) Outline the procedure of detecting faults in a power distribution system on shipboard (7marks)
- b) Operation manuals are very useful before one begins to operate a newly installed machine such as motors and generators on shipboard. State any THREE useful details

that it may provide and be of necessity for the commissioning of the system into operation (3marks)

c) Explain any THREE methods of localising faults on shipboard power distribution system or machines used on shipboard (6marks)

d)

i) Define mean time to failure (MTTF) as applied to maintenance and repair of electrical systems.

ii) A machine manual indicates that the total operating time can be determined to be 126396 hours. If the machine has had 777 failures beyond repair. Calculate the mean time to failure (MTTF) of the machine (4marks)

a)