CHAPTER 39 - ELECTRICIAN

PART I - GENERAL REQUIREMENTS OF APPLICANTS

39.1 (1) Every applicant for an Electrician Certificate shall:

(a) hold a certificate as Fourth-Class Engineer, Steamship or Motor Ship;

(b) have a minimum of six months sea service as an engineer officer or electrician on a ship having a rated generator capacity of not less the 300 kW;

(c) pass a written examination in Second Class Electrotechnology; and

(d) pass an oral examination.

PART II - EXAMINATIONS

39.2 (1) An applicant is not entitled to attempt the examination referred to in paragraphs 39.1 (1)(c) and (d) until the applicant has completed the service requirements set out in paragraph 39.1 (1)(b).

(2) Answers to questions in the examination referred to in paragraph 39.1 (1)(c) shall consist of mathematical computations, sketches, and written descriptions.

(3) A successful applicant for the Electrician Certificate will also receive an exemption from the Electrotechnology examinations for a Second-Class Engineer Certificate.

39.3 (1) The following table lists the written and oral-examinations for the Electrician Certificate, the qualifying service required before each may be attempted, and other requirements.

EXAMINATIONS	**QUALIFYING SERVICE**	**OTHER REQUIREMENTS**
Electrotechnology (2nd Class)	6 months > 300 kW generated power	Fourth-Class Steam, Motor
Oral	-	Pass Electrotechnology

(2) An applicant shall be allowed three and a half hours to complete the paper for each subject referred to in subsection (1).

(3) The written examination for an Electrician Certificate shall consist of nine questions, of which six shall be attempted. If more than six questions are answered, all the answers shall be marked and only the six questions awarded the lowest marks taken to determine the overall result.

(4) The knowledge to be shown by an applicant for an Electrician Certificate shall be sufficient to ensure the safe and efficient operation, surveillance and running maintenance of ship's machinery.

PART III - VALIDITY OF CERTIFICATE

39.4 The Electrician Certificate is valid as an electrician on a vessel making any voyage.

PART IV - SYLLABUSES OF EXAMINATIONS

39.5 Electrotechnology

Companion to Section 31.12

ITEM	COLUMN
1.	The Electric Circuit Units, ampere, ohm, volt; difference between electromotive force and potential difference; Ohm's law; Kirchoff's laws; simple series and parallel circuits involving EMF current and resistances; non-linear resistors in parallel with constant value resistors; power and energy; specific resistance; temperature coefficient of resistance; conductor resistance, effect of length, area, material and temperature; DC 2 wire distribution system; types of insulation; Wheatstone network bridge, slide wire bridge; applications to steering gears, resistance pyrometers, strain gauges, etc.
2.	Electrolytic Action and Secondary Cells Theory of electrolytic dissociation applied to common solutions; uses of electrolysis; secondary cells (acid or alkaline); construction and principles; maintenance, charging; watt- and ampere-hour efficiencies.
3.	Electromagnetism Electromagnetic induction, simple magnetic circuit; simple magnetic theory; magnetic field; lines of force.; field strength and intensity; magnetic fields due to current in straight conductors, loops, coils and solenoids; relative directions of current and field; Faraday's and Lenz's laws; magnitude and direction of induced EMF produced on a current carrying conductor; flux density; effect of iron; magneto motive-force (m.m.f.); permeability; reluctance; simple magnetic circuit, typical B/H and u/B curves.
4.	Electronics Qualitative treatment of atomic structure and bonding; semi-conductors; junction diodes, junction transistors and their operating characteristics; simple transistor circuits; conduction in gases, insulators, semi-conductors and conductors; photo-electric effect.
5.	Alternating Current Theory Simple continuous periodic waves, frequency, amplitude, instantaneous, maximum r.m.s. and average values, form factor; phasor representation of AC quantities; phase difference; the inductor; inductance and its effect on the circuit; the capacitor; capacitance and its effect on the circuit; simple series and parallel circuits; relationship between resistance, reactance and impedance; simple treatment of power factor; power in single-phase AC circuit.
6.	Instruments Qualitative treatment of the principles and functions of AC and DC indicating instruments and relays; uses of shunts and series resistances to increase the range; rectifiers and transducers.
7.	Power Distribution Systems for AC and DC shipboard installations; protective devices such as fuses, circuit breakers, earth lamps; cable material and installation; connection of shore supply; operation, testing by standard methods and maintenance of additional and control equipment to be observed during testing, and evaluation of test results.
8.	DC Machine The principles, constructional details and protection of DC series, shunt and compound-wound motors and generators; self-excitation, EMF and load voltage equations; load characteristics; methods of voltage control, paralleling procedures and load sharing for generators; need for and types of starter, speed and torque equations, speed control of DC motors.
9.	AC Machines Simple explanation of the principles, constructional details and protection of alternators, squirrel-cage induction motors and single-phase transformers; parallel running and synchronising theory.
10.	Propulsion Principles and operation of electric propulsion, construction details, control of excitation, killer circuits, connection of armatures, monitoring and control of field current, basic circuitry.

Oral Examination

39.6 The oral examination will be based on practical knowledge, with particular reference to the applicant's answers in the written examination, and will include questions on safe working practices.