

Syllabus for Electro-Technical Officer (ETO) Preparatory Course

(Duration: One Month – 4 Weeks, 20 Working Days, 120 Contact Hours)

The syllabus of the Electro-Technical Officer (ETO) Preparatory Course shall be designed to prepare candidates for the Written and Oral Examinations leading to the issue of the Electro-Technical Officer Certificate of Competency (CoC) in accordance with the requirements of Regulation III/6 and Section A-III/6 of the STCW Convention, 1978, as amended.

The course shall be conducted as a four-week, fully offline programme, with emphasis on classroom instruction and practical troubleshooting. A minimum of two hours of supervised practical training shall be conducted each working day, directly linked to the theoretical subjects covered on that day.

The course shall comprise the following subjects:

1. Marine Electrical Engineering (28 Hours)

Fundamentals of electrical engineering; DC and AC circuits; three-phase systems and electrical measurements; electrical machines, including generators, alternators, transformers and motors; marine electrical power generation and distribution systems; main and emergency switchboards; synchronizing, load sharing and power management systems; protective devices and electrical safety; battery systems, charging arrangements and uninterruptible power supply (UPS) systems; electrical systems of deck machinery, including mooring winches, windlasses and cranes; GMDSS power supply arrangements; internal communication systems; public address (PA) systems; sound-powered telephones; intrinsically safe (Ex-i) and explosion-proof (Ex-d) equipment; and hazardous area electrical installations.

2. Marine Electronics (16 Hours)

Semiconductor devices and electronic components; analogue and digital electronics; power electronic devices and their applications; electronic control circuits; microprocessors and microcontrollers; communication and navigation equipment interfaces; electronic fault diagnosis and testing techniques; digital ship sensors; electronic data loggers; smart ship technologies; Voyage Data Recorder (VDR) interfaces; and networked electronic equipment.

3. Automation and Control Engineering (18 Hours)

Principles of automatic control systems; sensors, transmitters and actuators; Programmable Logic Controllers (PLCs); automation of main engines and auxiliary machinery; boiler automation systems; alarm, monitoring and control systems; Integrated Automation Systems (IAS); Power Management Systems (PMS); Operational Technology (OT) architecture; cyber security of OT systems; advanced PLC diagnostics; Modbus and

Profibus troubleshooting; Variable Frequency Drives (VFDs); harmonic analysis; physical network isolation; and stand-alone OT recovery procedures.

4. High Voltage Technology (12 Hours)

High-voltage generation and distribution systems on board ships; construction and operation of high-voltage equipment; high-voltage protection systems; safety precautions and the use of personal protective equipment (PPE); isolation procedures; Permit-to-Work (PTW) systems; testing and maintenance of high-voltage installations; electrical safety for methanol fuel systems, ammonia fuel systems and hydrogen fuel cells; and Battery Energy Storage Systems (BESS) and hybrid propulsion electrical systems.

5. Instrumentation and Control Systems (10 Hours)

Principles of marine instrumentation; measurement of pressure, temperature, level and flow; speed and position sensing devices; calibration and testing of instruments; signal transmission and conditioning; instrument fault diagnosis; Continuous Emission Monitoring Systems (CEMS); cryogenic instrumentation; cryogenic sensor calibration; cargo automation; and decarbonization automation systems.

6. Electrical Maintenance and Troubleshooting (18 Hours)

Planned maintenance of electrical and electronic equipment; interpretation of electrical drawings and circuit diagrams; testing using electrical measuring instruments; insulation resistance and continuity testing; maintenance and troubleshooting of motors, generators, transformers and switchgear; fault diagnosis in automation and electronic control systems; practical troubleshooting techniques for shipboard electrical equipment; advanced PLC troubleshooting; VFD commissioning; harmonic measurement; OT network fault diagnosis; VDR communication testing; sensor loop calibration; electrical fault simulation; and integrated automation system troubleshooting.

7. Shipboard Safety, Environmental Protection and Maritime Regulations (10 Hours)

Safe working practices on board ships; electrical safety procedures; Lock-Out/Tag-Out (LOTO) procedures; fire prevention and firefighting related to electrical installations; the requirements of SOLAS, MARPOL, the STCW Convention, the ISM Code and the ISPS Code; pollution prevention and environmental protection measures; occupational health and safety requirements; workplace culture on board; prevention of violence and harassment; the human element; cyber risk management; alternative fuel safety; and emerging IMO environmental regulations.

8. Written and Oral Examination Preparation (8 Hours)

Numerical problem-solving; practice of previous examination papers; case studies on shipboard electrical and electronic systems; mock written examinations; mock oral examinations and viva voce; and discussion on practical shipboard fault-finding and troubleshooting scenarios.

Practical Training

Practical training shall be integrated throughout the course and shall include electrical measurements; interpretation of electrical drawings; insulation resistance and continuity testing; testing and maintenance of motors, generators, transformers and switchgear; VFD parameter setting; switchboard operations; protection systems; PLC familiarization and programming; GMDSS power supply testing; VDR testing; automation and instrumentation exercises; high-voltage safety demonstrations; fault diagnosis of deck machinery; reefer electrical troubleshooting; electronic circuit testing; soldering techniques; smart sensor diagnostics; CEMS calibration; and practical fault diagnosis using laboratory equipment or simulators.

The Maritime Training Institute (MTI) shall ensure that all practical sessions are conducted using appropriate instruments, equipment and training aids. Wherever it is not practicable to demonstrate practical exercises using actual equipment, AI-enabled visual demonstrations, virtual simulations and instructional videos may be used to familiarize candidates with the relevant equipment, procedures and practical applications.