भारत सरकार / GOVERNMENT OF INDIA.
(पोत परिवहन, सड़क परिवहन तथा राजमार्ग मंत्रालय),
MINISTRY OF SHIPPING, ROAD TRANSPORT AND HIGHWAYS,
(पोत परिवहन,विभाग)(Department of Shipping),
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No.TR/CIR/6(3)/2011

दिनांक/Dated: 10th February, 2011

TRAINING CIRCULAR NO. 1 OF 2011

Subject : Guidelines for conducting Pre-sea Training and Certification of Electro-Technical Officers for Merchant Ships

1. IMO in its Manila Conference held in June, 2010 adopted a fresh set of amendments to the STCW 78 as amended in 1995. These amendments concerns with new education, training and assessment programmes for the increased Electro Technology /Control Engineering, Computerization etc. which have invaded modern ship design, construction, instrumentation and operation. These amendments also concerns with new certificates of Competency /Proficiency that need to be issued by the Directorate to a new category of technically qualified and trained officers /crews that are required to be generated to man merchant ships of today and tomorrow.

2. Considering the amendments to include training and certification for the Electro-Technical Officers, the Director General of Shipping has formulated the **Guidelines for Pre-sea Training and Certification of Electro-Technical Officers for Merchant Ship,** which is enclosed herewith.

3. The processing fee for the said course is fixed as Rs.50,000/- which is required to be paid alongwith the proposal for the approval of the course.

4. The above guidelines shall come into force w.e.f. the date of issue of this guideline.

5. This issues with the approval of the Director General of Shipping and ex-officio Addl. Secretary to the Government of India.

(S.K. Jaiswal)
Asstt. Director General of Shipping

To,
1. All Training Institutes
2. All Academic Councils
3. NA
4. CS
5. Crews Branch
6. Computer Cell
7. Guard File
8. Sr.PS to DG for DG's kind information

GUIDELINES FOR CONDUCTING

PRE-SEA TRAINING AND CERTIFICATION OF ELECTRO-TECHNICAL OFFICERS FOR MERCHANT SHIPS

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GUIDELINES FOR CONDUCTING
PRE-SEA TRAINING AND CERTIFICATION OF ELECTRO-TECHNICAL OFFICERS FOR MERCHANT SHIPS

1. PREAMBLE

1.1 International Maritime Organization adopted the International Convention of Standards of Training, Certification and Watch keeping in 1978. The Govt. of India implemented STCW 78 by amending the Merchant Shipping Act in recognizing STCW 78 under Chapter VI of the Merchant Shipping Act. The said International Convention underwent major Amendments in the year 1995. The said STCW Convention Amendments amounted to a new code of STCW, maintaining its link with STCW 78 by retaining 17 Articles of the STCW 78. STCW 95, through its Resolution 1, adopted detailed and exhaustive Annexes prescribing the complex education, training and assessment criteria towards Human Resource Development for Merchant Ships. It has now been 15 years since STCW 95 has been implemented internationally.

1.2 During the last 15 years however, world trade has undergone considerable increase in size and complexity. This has led to an increase in number and size of the fleet of merchant ships operating in international trade. Further, new trades such as gas, chemicals, ro-ro ships, cruise have emerged in this period, necessitating development of new types of ships engaged in international trade. Accidents to merchant ships such as collisions, ship board fires, ship board explosions, founderings as well as accidents and injuries to the crew have also increased in this period. Further, man made calamities involving huge loss of human life and property have given rise to security and environment pollution prevention concerns.

1.3 It therefore became necessary to respond to these developments in the world of merchant ships for the International Maritime Organization. For this purpose, a conference was held in Manila in June 2010 and that Conference adopted a fresh set of amendments to the STCW 78 as amended in 1995. The Manila Amendments 2010 to STCW 78 are not as exhaustive as the 1995 Amendments. However, there are some substantial changes. These changes can be segregated into two classes: The 1st set of changes deal with new education, training and assessment programmes for the increased Electro Technology/ Control Engineering, Computerization etc. which have invaded modern ship design, construction, instrumentation and operation. The 2nd set of changes concern new Certificates of Competency /Proficiency that need to be issued by the Directorate to a new category of technically qualified and trained Officers/Crew that are required to be generated to man merchant ships of today and tomorrow.

1.4 Recognizing the importance of establishing detailed mandatory standards of competence and other mandatory provisions necessary to ensure that all seafarers shall be properly educated and trained, adequately experienced, skilled and competent to

perform their duties in a manner which provides for the safety of life, property and security at sea and the protection of the marine environment;

1.5 Also recognizing the need to allow for the timely amendment of such mandatory standards and provisions in order to effectively respond to changes in technology, operations, practices and procedures used on board ships;

1.6 Recalling that a large percentage of maritime casualties and pollution incidents are caused by human error;

1.7 Appreciating that one effective means of reducing the risks associated with human error in the operation of seagoing ships is to ensure that the highest practicable standards of training, certification and competence are maintained in respect of the seafarers who are or will be employed on such ships;

1.8 Desiring to achieve and maintain the highest practicable standards for the safety of life, property and security at sea and in port and for the protection of the environment;

1.9 Having considered amendments to the Seafarers' Training, Certification and Watchkeeping (STCW) Code, comprised in part A – Mandatory standards regarding provisions of the annex to the 1978 STCW Convention, as amended, and part B – Recommended guidance regarding provisions of the 1978 STCW Convention, as amended, proposed and circulated to all Members of the Organization and all Parties to the Convention;

1.10 The Government of India giving cognizance to the International Maritime Organization (IMO) having adopted Resolution 1 on Adoption of the Manila amendments to the annex to the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW), 1978, and coming into force from 1st January, 2012,

1.11 Also, considering that the existing rules are being revised to incorporate the amendments to the STCW 95, and provision to include training and certification for the **Electro-Technical Officers** has been made in the draft amendments, the Director-General of Shipping has formulated the following guidelines for the training **and certification of Electro-Technical Officers for ships.**

2. Basic Details of the course

.1 Aims

To provide pre-sea training that would balance theoretical knowledge, practical skills, safety consciousness and efficiency for those who wish to take up seafaring as Electro-technical officer on merchant ships.

.2 Objectives

By conducting compulsorily residential, regimented and disciplined courses to impart training that would, after adequate sea service experience, enable an electro technical officer, to comply with the competencies specified for ETO in the STCW document No. STCW/CONF.2/34, Section A-III/6 (Mandatory minimum requirements for certification of electro-technical officers) and same being incorporated in Maritime Education, Training and assessment (META) manual, Volume 1.

.3 Scope for Approval of the Institute

Recognising that on board service is an essential component of training electro-technical officers, their placement on board ships as trainees immediately on completion of Institutional training is of essence and also keeping in mind the fact the quality and the requirements of Electro Technical Officers on board ships, approval for training of electro technical officers shall be granted only to Maritime Training Institutes owned and operated by ship owning companies and companies directly engaged in technical management of the ships.

.4 Infrastructure and other requirements :

Infrastructure and other requirements to be in line with DGS Order No.2 of 2007.

.5 Faculty Requirements :

Faculty requirements to be in line with Training Circular No.1 of 2004.

3. Mandatory Intake Requirements:

a. **Educational Qualification:**

i. Passed 10+2 with Physics, Chemistry, Mathematics and English with minimum 50 % marks in final exams or must have obtained 50% marks in English subject either in 10^{th} or 12^{th} standard exam, from a recognised board.

ii. Passed three years' Diploma or four years's Degree with 60% marks in Electrical Engineering, Electronics Engineering, Electrical and Electronics Engineering, Electronics and Telecommunication/ Communication Engineering, or Electronics and Instrumentation or equivalent.

iii. The diploma /degree courses must have been recognised by any State or Central Government or the AICTE,

b. **Age & Medical fitness:** Not more than 35 years on date of commencement of training and medically fit including eye sight and hearing as prescribed in the Merchant Shipping (Medical Examination) Rules, 2000; as amended;

4. The education and training required as per STCW regulation III/6 and as proposed in the Maritime Education, Training and Assessment (META) Manual & rule shall include **12 months** education and training in electronic and electrical workshop skills relevant to the duties of ships' electro-technical officer which includes not less than **17 weeks Institutional education and training** including the four mandatory modular courses i.e. PSCRB, PSSR, AFF & MFA.

5. **Communication Skills**

The institute shall ensure that the candidates admitted for the course possess adequate ability for communication in spoken and written English by relevant examination or tests which may be monitored by the Directorate.

6. Onboard training

6.1 Every candidate for certification as electro-technical officer shall follow an approved programme of onboard training of not less than **six months** which:

6.2 Ensures that, during the required period of seagoing service, the candidate, trainee (electro-technical officer) receives systematic practical training and experience in the tasks, duties and responsibilities of an electro-technical officer;

6.3 Is closely supervised and monitored by qualified and certificated officers aboard the ships in which the approved seagoing service is performed; and

6.4 Is adequately documented in a training record book prescribed by the training Institute.

7. Standard of competence

7.1 Every candidate for certification as electro-technical officer shall be required to demonstrate the ability to undertake the tasks, duties and responsibilities listed in column 1 of table A-III/6 of STCW 1978 as amended.

7.2 The minimum knowledge, understanding and proficiency required for certification is listed in column 2 of table A-III/6 and it shall take into account the guidance given in part B of this Code.

7.3 Every candidate for certification shall be required to provide evidence of having achieved the required standard of competence tabulated in columns 3 and 4 of table A-III/6.

8. Evaluation and Certification

Periodic evaluation shall be carried out by the institutes conducting the course. Certificate of competency shall be issued by the Chief Examiner of Engineers, after satisfactory completion of the course and the sea service requirement. The Certificate of competency shall be issued subsequent to issue of the Gazette notification., in accordance with section 78 (4) of the M.S. Act, 1958 as amended, and after necessary assessment of competence as prescribed by the Director General of Shipping.

9. ELECTROTECHNICAL OFFICER (ETO) Course

The ETO Course (without high voltage segment) and ETO course (for High Voltage segment) as per STCW 2010 have been developed and are attached as Annex I, Annex II and Annex III to this document.

- **Annex –I**

  ETO course (WITHOUT HIGH VOLTAGE SEGMENT)

- **Annex II**

  ETO course FOR HIGH VOLTAGE SEGMENT

- **Annex III**

  Guidelines and additional information of ETO Course

- **Annex IV**

  Specification of minimum standards of competence for Electro-technical officers.

NOTE : Detailed lesson plan for each module of the syllabus are to be prepared by the individual institute which shall be verified during inspection.

Annex –I

Electrotechnical Officer (ETO) course (WITHOUT HIGH VOLTAGE SEGMENT)

Qualification of the candidate for ETO Course: Diploma / Degree in Electrical Engineering

Guide to the documents (applicable for both Annex I and Annex II)

Primarily, the documents addresses following:

i) The competencies specified for ETO is in accordance with the STCW document No. STCW/CONF.2/34, Section A-III/6 (Mandatory minimum requirements for certification of electro-technical officers)

ii) Following competencies excluded in this document are to be covered in the 4 basic STCW courses i.e., PSC(RB), AFF, MFA, PSSR, which are to be attended additionally

   a. "Operate Life-saving appliances"

   b. "Apply medical first aid on board"

   c. "Contribute to the safety of personnel & ship"

iii) The duration of the Electro Technical Officer course to be of **minimum of 14 Weeks** (5.5 working days per week) of 8 hours
   - o 0900 – 1300 (4 hours)
   - o 1300 – 1400 Lunch Break
   - o 1400 – 1800 (4 hours)

   The distribution of available 14 W x 5.5 D x 8H = 616 Hours is to be allocated as below:
   460 Hours to be dedicated for knowledge transfer. Methods to include Theory, Practical's, and Demonstration by Videos
   40 Hours to be dedicated for Review & Evaluation
   10 Hrs for Library / Parade/ Swimming
   10 Hrs for Project / Presentation
   88 Hrs. for STCW basic courses
   8 Hrs. for field trip

Competency No	Competence	Syllabus to be covered	Methodology	No of Hours Th	No of Hours Pr	Reference
1	Monitor the operation of Electrical , Electronic & Control Systems	**Shipboard Machinery Familiarization** 1.1 Prime movers including main propulsion plant (3ö, 3W, Insulated Neutral System) 1.2 Engine Room Auxiliaries including Boilers, Incinerators, purifiers, oily water separator, pump installations 1.3 Steering Gear Systems 1.4 Cargo Handling system overview 1.5 Deck Machinery 1.6 Generators 1.7 Galley / Hotel Equipment 1.8 Ship Construction	Lectures Workshop Practical (industrial visit /Ship in campus / ship visit)	 5 5 2 2 3 5 5 10	 5 5 2 1 5 5	
				60 Hrs		

Explanation:

1.1 This section must be utilised to familiarize the candidates with the

- installations of a typical ship installation power systems,
- usage of the power system
- highlight the interdependencies of the sub-systems.
- type of power systems adapted & their distribution of power throughout the ship. Concurrently the candidate must be educated about the various installations mentioned in the 'Details' section above. These first sessions are to be on a conceptual level followed by greater detail once the course content topics relevant are covered int eh flow of the course. (in keeping with the 'Competence' mentioned)

1.2 The machinery that is explained is to highlight the following

- Purpose
- Usage pattern
- Technical working
- Troubleshooting & down-time concerns

1.3 The institute must highlight the reason for adoption of "Three phase three wires, Insulated Neutral" systems on board the merchant vessels & cover following topics:

- Three phase power systems with & without insulated neutral
- Insulation Resistance & continued operation in case of an 'Earth Fault'
- Power Distribution pattern on modern mercantile vessels
- Switchboards & feeder panels
- LDB (Light distribution boards) & Control power. Emergency power installation & Batteries
- Transitional Lighting systems
- Electrical Drives such as starter panels including DOL, star-delta, auto-transformer & soft starter. This should be related to "Motor Control Centres"

1.4 Prime Movers including propulsion plant

The objective being shipboard familiarization, this module must introduce the candidates to the key components & aids that are responsible in supervision & control of the Main propulsion plant (subsequent modules must provide an insight into the complex interdependency *between sub-systems*)

- Alarm monitoring systems (how inputs register & alarms are raised with inhibit functions)

- Control panel for the Main propulsion unit (Remote, Local & Bridge Control – overview)
- Monitoring parameters & methods (temperatures, pressures, alarms & shutdowns) *this could be through the same alarm monitoring system mentioned in a).*
- Limitations & Emergencies

The practical's must definitely include shutdown systems, LO trips, High temperature / Low JCW pressure trips & over speed functions.

1.5 Engine Room Auxiliary Machinery

Though involves a "host of machinery" but special emphasis on *centrifugal purifiers, compressors & boilers* must be the mainstay of this section.

Boilers should be addressed in this section as a functional unit & the controls aspect of it dealt in later sections. Thus, the sequential functioning of relay based systems & interlocks is to be well addressed in this section.

1.6 Steering Gear Systems

Position control systems & the integration with the 'Auto-Pilot' for a complete understanding of the purpose & utility of the device with concerns (e.g. Starter panel overload not wired to trips but to alarms in the Engine Room). This section however must deal only with the starter panels, the unique nature of their design (no overload trip function) & the intent of usage.

1.7 Cargo Handling Systems

Based on vessel types a broad functional overview of the equipment that is used to handle cargo systems with due regard to the time frame allotted.

For e.g. on oil tankers – Inert Gas systems & Ullaging equipment in CCR, Ventilation arrangements

Or LPG carriers – Re-liquefaction plant & Ullaging systems, Ventilation arrangements etc.

Hydrocarbon carriers imposing safety requirements on ships (e.g. Vapour concentration diagram for oil & other tankers)

1.8 Deck Machineries

These include mostly fixed equipment that are on deck & not connected with the nature of cargo the vessel is carrying, Thus Winches, Accommodation ladders, Forward house machinery, form a part of this segment 'Winches must include the interdependency of hydraulic power on the ships power systems & explain the criticality of mooring operations. Gantry cranes & hose handling winches are to be addressed in this section

1.9 Generators

The module must include 'engine starting arrangements', safety & interlocks, the fuel systems used, change over fuel systems & shutdowns & monitoring systems. The switchboard details are not be covered in this section as regards the alternator automation. That is covered in a subsequent section.

LO , CFW, overspeed, FO leakage shutdowns & engine heat monitoring must be addressed in this section.

Note: Alternators should be addressed in competency no.4

1.10 Galley & Hotel Equipment

This section is very important & must not be compensated for want of time or other factors. This sections must especially highlight the distribution of three phase low voltage power (for e.g. 220V 3 ö) through the ships LDB's & other arrangements. This msut include Isolation transformers for Galley, earth faults & methods of isolation & identification of the same. The very important aspect of earth faults on the low voltage systems is of critical concern & the need to isolate power supplied to control equipment from LDB systems to be adequately addressed.

1.11 Ship Construction

This is a section that is well documented & references must include the relevant sections as regards installations, electrical sensors, outfitting & Vapour concentration ideologies.[1] This section must also cover the ship constructional details as reqgards hull,outfitting & include one session on stability & the concept of a loadicator with reference to tanks, loading & plimsoll line or other method that details the relevant use of loadicators & stability calculation system. The use of 'on-line' Cargo loadicators is a direct abstraction of the same.

[1] Pump rooms, duct keels, hold spaces, aft trunks & areas that especially concern electrical installations to be discussed in relevant detail

Competency No	Competence	Syllabus to be covered	Methodology	No of Hours Th	No of Hours Pr	Reference
2	Monitor the operation of Electrical, electronic & control systems (Continued)	**Shipboard Machinery Familiarization** 2.1 Electrical Drives 2.2 Technology of Electrical Materials 2.3 Electro Hydraulic & Pneumatic Control Systems 2.4 Transformers, Shore supply for ESB, 2.5 Battery Maintenance 2.6 Normal & Emergency Lighting systems	Lectures Workshop Practical (industrial visit /Ship in campus / ship visit)	 3 2 3 3 1 2	 2 3 2 2 4 3	
				30 Hrs		

Explanation:

2.1 Electrical Drives

Starter panels including DOL, star-delta, auto-transformer & soft starter. This must be related to "Motor Control Centres" Here the focus must be on Group starter panels, their protection techniques for motors & broadly discuss the general formats available.

- Direct-On-Line Starter
- Star-Delta Starter
- Auto-Transformer Starter
- Starter with Drives (Soft Starter)

The section forms the mainstay of the ETO's job function & later sessions that include evaluations should have this in the refresher sessions.

At least one session (2 hrs) dedicated to testing motors, insulation resistance, phase balance & other criteria must be included in the course curriculum.

2.2 Technology of Electrical Materials

This section deals with knowledge about electrical materials; i.e. conductors, insulation materials, Insulation Class, Hot spot temperatures & how this knowledge is applied to approvals for electrical specifications. (IP rating, Ex rating, drip proof construction)

Here the section on cables (electrical cables) must be adequately addressed with candidates being advised on the different types of cables & how to read format. (TPYC, PPC etc)

Creepage, Insulation breakdown & some SF6 components for high voltage systems must be outlined . This section is to also cover in depth knowledge on 'hot-spot' temperatures, insulation class & continuous rating of machinery.

2.3 Electro Hydraulic & Pneumatic Control systems

Fluid systems, Nomenclature, function of primary components, pump displacement (Hi –Lo system for crane) must be covered in this section of the hydraulics session. The extent should be indicated in the lesson plan with greater emphasis on practical's.

The sessions must include the following

- Directional control valves
- Proportional control valve (mechanical & electronic)
- Working circuits for pneumatics & hydraulics
- Power concerns & application differences

Note: It may not be possible to discuss in detail the working of a crane with regard to the circuits (hydraulic) but the key movements & their prime circuits must definitely be covered such as, slewing, luffing & hoisting motions . Counterbalance valves, unloading valves & pressure regulating valves are key components that must be discussed & working demonstrated.

Electo- Hydraulic & electro pneumatic control systems

The principle ***of directional control valves*** is a section that is directly related to this topic. It is recommended that this section be done as a workshop session for best effect. Trainers for this are available in the market & could be easily built for the specific purpose. Power packs , control valves should be suitably addressed. (e.g. types of pumps – pressure control valves, sequence & counterbalance valves, unloading valves) [course length does not permit the study & application of these valves]

Hydraulics – Single & double acting actuators for valves or other motion. Cylinders & the concerns when lifting loads. This section is best addressed on trainers. Reading of hydraulic diagrams & description of the working of a Hi-Lo system for cranes is most essential

Note: In the Cargo machinery section – Cargo valves, valve positoners are important topics that may be brought in after this section has been dealt with here.

Note: Diagrams must be used here to explain the control console connections & interconnections

Micro-switches & IS relays in circuit for cargo valve hydraulics is a good example. This will help the candidates to build circuits using 4/3 or 4/2 valves with rotary or linear actuators.

Pneumatics – Circuits for pneumatic controls, FRL units, small circuits addressing speed / velocity circuits , building a platform to study manoeuvring system for the main engine. Lateral learning for control systems (this area not addressed anywhere in the course).

2.4 Transformers, Shore supply for ESB,

Note : The section 2.6, 2.4 & 11.1 are inter-related. It is of utmost importance that these issues be addressed in the following workflow

1. Description of 'Three Phase – Three wire power systems' & the reason why the neutral wire is not used on such systems.
2. Layout of Generator (Alternator) power to the MSB with schematic representation in 3 wire format addressing bus ties & Left & Right hand section of the switchboard with synchronizing & paralleling sections in the middle
3. Power distribution through feeders (440 & 220)
4. Group Starter Panels
5. Lighting power panels (LDB's)

Liquid free transformers, Connections & use in feeder panels is to be detailed in this section. Shore supply & the methods of ensuring phase sequence is included as a part of this section. Emergency switchboard with 'Auto Transition system' using diagrams from ships or similar schematics must be explained in detail.

The ESB distribution of power with loads must also be covered in this section in greater detail, allowing the candidates to appreciate the function of the Emergency Generator in blackouts.

2.5 Battery Maintenance

Section includes principles of storage batteries, types & applications. More importantly, methods of charging, deep discharge, chargers & rectifiers must be covered in this section.

Battery space concerns & the lighting system used in charging rooms to be properly conveyed to the candidates in this section.

2.6 Normal & Emergency Lighting systems

The need & method of tracing 'earth faults' (low insulation) & creepage to be discussed & practical demonstration provided. The LDB distribution pattern must be schematically conveyed to the candidates with an example demonstration. For this it is required that the candidates must have a filed trip to an installation that adequately permits the demonstration of the same.

Competency No	Competence	Syllabus to be covered	Methodology	No of Hours Th	No of Hours Pr	Reference
3	Monitor the operation of automatic control systems of propulsion & auxiliary machinery	**Main Engine / Auxiliary Machinery Control** 3.1 Description of electrical controls on the Main Engine and Auxiliary engines 3.2 Troubleshooting in the electrical domain of engines 3.3 ODME / OWS 3.4 MGPS 3.5 ICCP	Lectures Workshop Practical (industrial visit /Ship in campus / ship visit)	3 3 2 2 2	7 7 4	
				30 Hrs		

Explanation:

3.1 Description of electrical controls on the Main Engine

The purpose of this section is to highlight the electrical / electronic control of the main engine. For this the following must be sequenced in a manner listed below

Knowledge of the support plant of the Main Engine

Engine Control system

a. Pneumatic Manoeuvring system in conceptual I/O level

b. Electronic / Mechanical Governor for speed control (alternatively CPP control)[2]

c. Troubleshooting in the electrical domain of engines

i. Assuming 7 hours are spent on the practical's, this module must make a mention of 'Process Control'. Other topics will of course be covered but temperature & pressure control systems must be addressed in this section. It is recommended that PID controllers be demonstrated in a Lab space for function. Alternatively, the PID control system can be covered through simulators.

ii. The complex nature of electrical systems on the main engine necessitates that 'Governor' system be addressed here. With the trend to shift to 'Electronic Governors' the need for addressing the controls section is more relevant.

iii. Engine Shutdown / slowdown systems & testing of these sections is a crucial area for practice & demonstration

d. Note : 3.2 section extends this point further

3.2 Troubleshooting in the electrical domain of engines

Extension of section above with the inclusion of manoeuvring systems logic with pneumatic valves & bridge control must be covered in this section.

This section must cover the shutdown & slowdown functions & troubleshooting related thereto.

3.3 ODME / OWS

Knowledge of calibration & operation of the OWS, alarm set points & testing routines with oil dump probe etc must be covered here. Formats of change over valves , their operation & working must be discussed. It is recommended to have a practical demonstration of the OWS.(through lab sessions, field trips or ship in campus)

ODME – general principles, inputs to the ODME computer such as ppm, flow, speed & manual entry of cargo volume to be discussed. Changeover system for overboard & slop recirculation valve to be covered. The computation of the values may be covered as a part of Competency 13, "Ensure compliance with pollution prevention requirements'

[2] Process control systems & governor as applied to Generators should be addressed before this section is covered

3.4 MGPS

Marine Growth prevention system – Installation & operational detail must be covered in this section with working principles.

3.5 ICCP

Impressed cathodic protection systems. Concerns & safety. Eletrostatic & bonding concerns when making alongside. Installation & operational detail must be covered in this section with working principles.

Competency No	Competence	Syliabus to be covered	Methodology	No of Hours Th	No of Hours Pr	Reference
4	Operate Generators and Distribution Systems	**Generator / Alternator Controls** 4.1 Starting a Generator 4.2 Paralleling, load sharing & changing over generators 4.3 Switchboard relays & transducers 4.4 Reverse Power	Lectures Workshop Practical (industrial visit /Ship in campus / ship visit)	 2 2 2 2	 3 3 3 3	
				20 Hrs		

Expanation:

4.1 Starting a Generator

The operational concerns of starting & running a generator having been discussed the focus must be on the 'Engine Management system' of the Alternator engine; starting valve, timing for starting valve, forced shut off periods & all other shutdowns.

Alternator system must include the following in this section

- Space heaters
- Temperature monitoring
- Passive components of the Alternator (Reactor, compensation element etc)

4.2 Paralleling, load sharing & changing over generators

- Alternator circuit schematic with excitation systems (at least two types to be discussed)
- AVR function & concerns (adjustments are very critical & the significance to be properly conveyed)
- Reactive Loading & the role of AVR & Governors
- Phase sequencing & paralleling generators with dark lamp method
- Hands on skill section on ACB's most relevant & it is recommended that the institute should have an ACB & be able to demonstrate & train the candidature in its basic operation & maintenance aspects
- The practical's must include meggering (insulation resistance) routines of alternators, space heaters, alignment & synchronizing & paralleling circuits on the Main Switchboard

4.3 Switchboard relays & transducers

Special purpose relays such as Voltage relays, phase sequence relays, power transducers, their connections & power management systems must be covered in this section of the course. Transducers for sensing KW, KVA, KVAR & cosö must be covered in this section.

4.4 Reverse Power

In this module the candidates must be conveyed the relevance of 'Reverse power' & the protection techniques must be covered. The faculty is to adequately convey the concept of absorbing power & what the 'motoring' effect is.

Competency No	Competence	Syllabus to be covered	Methodology	No of Hours Th	No of Hours Pr	Reference
5	Operate Computers & Computer Networks on Ships	**Networks & Computers** 5.1 General Computer Usage 5.2 Networks 5.3 Communications 5.4 Planned maintenance systems 5.5 Engine monitoring systems	Lectures Workshop Practical (industrial visit /Ship in campus / ship visit)	 2 4 4 6 1	 3 3 1 5 1	
				30 Hrs		

Explanation:

5.1 General Computer Usage

This module must enhance user knowledge of Computer programs. The program applications may be for the purposes of word processing, presentation or calculation in spreadsheet format .

For e.g. Microsoft Office or Open office packages

Restoring systems, reformatting & installation of software must be addressed in this section.

5.2 Networks

a. This section aims to familiarise the candidate with the concept of networks & distribution of a LAN or similar system The course content must include the following sections.

i. Ether net systems

ii. Switches & hubs

iii. Server (what is a server & what role it plays)

iv. Background backup software

5.3 Communications

This module covers the Communications PC for Sat B interface , portal & company policy on startup

E mail or GMDSS knowledge. Candidates must be given an example installation & explained the various methods by which the ship's internal & external communication is facilitated. The SAT – M, Mini-M & other derivatives of the GMDSS interpretation must be discussed.

5.4 Planned maintenance systems

Standard PMS packages such as AMOS or Consultas or RAST etc are to be covered in this module. The candidate must understand the significance & be able to contribute to the overall PMS in relation to the profile.

5.5 Engine monitoring systems

Knowledge or awareness about external interfaces for the purposed of data collection & monitoring by third party vendors such as Engine manufacturers or predictive maintenance systems or condition based monitoring systems are to be highlighted in this section.

Competency No	Competence	Syllabus to be covered	Methodology	No of Hours Th	No of Hours Pr	Reference
6	Maintenance & repair of electrical & electronic equipment	**Electrical Practices & Safe Working** 6.1 Electrical Safety practices on board ships 6.2 Causes of electrical shock & precaution to be observed to prevent shock 6.3 Construction & operational characteristics of shipboard AC & DC system & equipment 6.4 Construction & operation of electrical test & measuring equipment 6.5 Application of Safe working practices	Lectures Workshop Practical (industrial visit /Ship in campus / ship visit)	2 2 3 3 2	3 2 7 1	
				25 Hrs		

Competency No	Competence	Syllabus to be covered	Methodology	No of Hours Th	No of Hours Pr	Reference
7	Use English in Written & Oral Form	**Communication Skills** 7.1 Adequate knowledge of the English language to enable the officer to use engineering publication & perform officers duties	Lectures Workshop Practical (industrial visit /Ship in campus / ship visit)	30		
				30 Hrs		

Competency No	Competence	Syllabus to be covered	Methodology	No of Hours Th	No of Hours Pr	Reference
8	Maintain & repair of Automation & Control system of Main Propulsion & Auxiliary machinery	**Maintenance / Detection of PLC /SCADA based Systems** 8.1 Appropriate electrical & mechanical knowledge & skills, safety & emergency procedures. Safe Isolation of equipment & systems 8.2 PLC / SCADA – Introduction & Applications 8.3 Fault Diagnosis (PLC , Embedded systems) 8.4 Sensors	Lectures Workshop Practical (industrial visit /Ship in campus / ship visit)	4 10 10 15	4 10 10 12	
				75 Hrs		

Note: Although this section is in detail & needs greater depth of understanding than can be afforded by the period that this course is run for the following are to be explained. While this section broadly covers the key aspects, as mentioned earlier, the control systems aspects involve far greater involvement & relevance in general ship keeping. The use of pneumatic / electronic PID controllers & the control loops could be discussed.

- Inert Gas control system includes split ranging,
- the use of control valves & calibration of i/p conveters & valve positioners.
- Boilers have FD fan vane actuators or level control valves
- the concept of single element control & feed forward to be addressed at least cursorily.[3]

Explanation:

8.1 Appropriate electrical & mechanical knowledge & skills, safety & emergency procedures. Safe Isolation of equipment & systems

a. This applies to general knowledge about combustion engines , steam plants etc & the methods & practices to isolate equipment

b. Emergency operations of equipment & understanding the limitations

8.2 PLC / SCADA – Introduction & Applications

a. General introduction to 'Programmable Logic Controllers'

b. Functions & Applications on ship board applications

8.3 Fault Diagnosis (PLC , Embedded systems)

a. Troubleshooting PLC based system by querying the I/O interface & understanding analog manipulation in PLC's/ embedded systems

8.4 Sensors[4]

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[3] **Note**: Various sources are available for contribution with more details on these sections & even give a general design for the PLC trainers but this is more extensive. Introduce protocols for data exchange & how these are effected on ships with a central processing unit.

a. Temperature sensors – PT 100, thermocouples & upstream instrumentation
b. Pressure transmitters, pressure switches etc
c. Flow devices - Dp transmitters with orifices

Competency No	Competence	Syllabus to be covered	Methodology	No of Hours Th	No of Hours Pr	Reference
9	Maintain & repair Bridge Navigation Equipment & ships communication systems	**Bridge Electronics Equipment** 9.1 GMDSS – Introduction 9.2 RADAR – Maintenance & brief theory 9.3 UMS operation – BNWAS, Dead Man's Alarm & Watch keeper alarms systems	Lectures Workshop Practical (industrial visit /Ship in campus / ship visit)	7 4 8	4 5 12	
				40 Hrs		

Competency No	Competence	Syllabus to be covered	Methodology	No of Hours Th	No of Hours Pr	Reference
10	Maintain & repair electrical, electronic & control systems of Deck machinery & Cargo Handling equipment	**Defect Diagnosis of Auxiliary machinery** 10.1 Windlass & Mooring Winches 10.2 Tank Gauging systems 10.3 Fixed Gas detection systems 10.4 Alarm monitoring consoles	Lectures Workshop Practical (industrial visit /Ship in campus / ship visit)	5 5 5	5 5 5	
				30 hrs		

Note: A general section on electronics, calibration & scaling is more in keeping with the competency & must be included here. Demonstrations of pressure monitoring by way of building a loop of pressure transmitter, power supply & display unit or similar being included will greatly enhance the understanding of deck & cargo supervision systems.

[4] The depth of these topics should be relevant to the target group. It is for this reason that the details have not been listed

Explanation:

10.1 Windlass & Mooring Winches

Hydraulic power packs, Proportional control & Electrical starter panels. Reading of pressure gauges to interpret work done & help diagnose the possible faults are some of the key sections of this module.

Cargo valve Automation with indication in CCR. Emergency override operation for these valves must be covered in this section

10.2 Tank Gauging systems

Continuous type gauging system, principles of use must be discussed & cover the following types

- Float type with reed switches & magnets on float
- Radar or ultrasonic type
- Pressure head type

Calibration & setting of alarm set points, testing & adjustments for 'hogging' & 'sagging' must be discussed in relation to the target group

Intrinsic barrier safety & Explosion protection techniques is discussed in C-14.

10.3 Fixed Gas detection systems

This section must include ,Gas sampling systems, calibration & knowledge of HC content monitoring for fixed gas detection systems. Concerns for venting arrangements for the same to be highlighted & candidates made aware of the risks & HSE concerns.

10.4 Alarm monitoring consoles

Alarm consoles in CCR (similar to ECR), Alarm inhibit functions, Analog & digital handling of peripheral devices, Adjusting set points or understanding the limitation of the designed Alarm systems which does not permit set point adjustment are topics that must be addressed in this section of the course. A field trip to a ship or lab equipment may be used to demonstrate the installation.

Competency No	Competence	Syllabus to be covered	Methodology	No of Hours Th	Pr	Reference
11	Maintenance & repair of control & safety systems of Hotel Equipment	**Hotel Electrical Systems** 11.1 Accommodation power system 11.2 Galley equipment 11.3 Ships refrigeration system 11.4 Air conditioning 11.5 Motor Overhauls 11.6 Laundry equipment	Lectures Workshop Practical (industrial visit /Ship in campus / ship visit)	5 8 5 5 2 3	5 10 7 5 10	
				65 Hrs		

Expanation:

11.1 Accommodation power system

Power distribution & Earth fault location & tracing are to be addressed in this section.

440 power requirements in the accommodation for domestic use appliances to be detailed to the candidates giving specific details on safety & wiring practices.

11.2 Galley equipment

Heating plates, Ovens & galley air extraction systems are to be cevered in this module.

11.3 Ships refrigeration system

Refrigeration system basics, Control panel for refrigeration systems & defrosting[5] Refrigeration & AC Plants including the HVAC topics must be covered. For this the candidates should be able to draw (at bare minimum) the process instrumentation diagram for the installation in its basic form & identify the thermostatic control for the rooms. Further, "capacity regulation" may be included. The MP22 (oil pressure

[5] This section should be kept rudimentary in keeping with the time frame allotted for the course

shutdown) is crucial for ETO's & must be included in the syllabus. The starter or control panels functions to be demonstrated by means of a trainer if possible. **"Charging"** the system with refrigeration gas & **"pumping down"** the system may be considered in the practical's.

11.4 Air conditioning

Basics of Air conditioning, Filter changing, safety & concerns, Air Re-circulation issues & concerns as regards port entry for tankers must be covered in this section of the course. For this the candidates should be able to draw (at bare minimum) the process instrumentation diagram for the installation in its basic form & identify the thermostatic control for the rooms. Further, "capacity regulation" may be included.

11.5 Motor Overhauls

Standard motor overhauls are to be performed by the candidates with at least one motor above 10kW rating. These motors should be used to detail the candidates about bearings, insulation, winding details, termination, IP ratings & installation & handling of electrical motors.

11.6 Laundry equipment

Washing machines, heaters & driers, Concerns when dealing with equipment in moisture prone areas are topics of discussion in this section of the course.

Competency No	Competence	Syllabus to be covered	Methodology	No of Hours Th	Pr	Reference
12	Application of Leadership & Team working Skills	**Organization Structure & Interdependence** 12.1 Job profile awareness 12.2 ISO quality system 12.3 Interdepartmental operations & protocols, motivation, teamwork & Risk assessment 12.4 Risk assessment 12.5 Communication & work load delegation	Lectures Workshop Practical (industrial visit /Ship in campus / ship visit)	1 2 1 2		
				6 Hrs		

Competency No	Competence	Syllabus to be covered	Methodology	No of Hours Th	No of Hours Pr	Reference
13	Ensure Compliance with pollution prevention requirements	**Conventions & IOPP** 13.1 MARPOL Convention Annexe 1 to 6 13.2 SOLAS convention 13.3 IOPP elements ,	Lectures Workshop Practical (industrial visit /Ship in campus / ship visit)	2 1 1		
				4 Hrs		

This section covers the vital information that the ETO must have as regards the IOPP, MARPOL & SOLAS requirements. While MARPOL & SOLAS requirements are discussed with the candidates the IOPP section must include the details as related to OWS, ODME etc. (Calculation of discharge quantity etc in the ODME, OWS 15 ppm testing etc & 'magic pipe' crime & punishment to be conveyed to the candidates)

Competency No	Competence	Syllabus to be covered	Methodology	No of Hours Th	No of Hours Pr	Reference
14	Prevent , Control & fight Fire on board	**Fire Detection Systems** 14.1 Fire Detection & alarm System 14.2 Type of Fire sensors 14.3 Hazardous zones & areas	Lectures Workshop Practical (industrial visit /Ship in campus / ship visit)	2 3 4	3 3	
				15 Hrs		

Explanation:

14.1 Fire Detection & alarm System

This section must include the following

- Fire Detection & control strategy

- Fire Detector, loop faults, termination devices for loops, earth faults of loops'
- External interface for alarm bells & alarm system, door closers stc.
- Fault isolation & loop isolation – concerns & awareness
- Procedures

14.2 Type of Fire sensors

The candidates must be familiarized with the following type of sensors & detection instruments.

- Ionization type
- Rate of Rise type
- Heat type sensor
    - Testing methods, routines & logs

14.3 Hazardous zones & areas

Vapour concentration diagrams for ship indicating the presence of hydrocarbons (possible). Thus the introduction of designated 'Hazardous' zones as in the ship's bibliography must be outlined to the candidates

- Arrangements for lighting based on Vapour concentration diagrams
- Explosion protection techniques
- Ex(d), Ex(ia), Ex(p), Ex(n) etc
- Intrinsic Barrier installations
- Flame proof motors on Deck & their operational & maintenance concerns

Annex II

ETO course / STCW (HIGH VOLTAGE SEGMENT)

Eligibility Criteria:

- Existing ETO with atleast one year sailing experience .

(candidates are aware of the sectional use of HV power, the interdependencies of critical equipment to HV side of power, shaft generators, transformers, cyclo-converters etc based on ship type & propulsion methods. Therefore, it is recommended that the entry level for an ETO is to be at least 2 years of experience (sailing time of 12 months)

- All Engineering officers for Class II & Class I

Objective

To improve the understanding of HV/LV power systems including statutory regulations, safe operation, protection, maintenance and fault diagnosis on a wide range of marine/ offshore power equipment. Also to enable candidates to perform HV switching operations on marine offshore power equipment.

Outline Contents

- Marine/offshore statutory electrical regulations
- Electrical hazards and precautions
- Arrangement of high voltage switchrooms
- Operation and safety features of switchgear
- Operational Procedures
- Marine/offshore high voltage safety rules

- Issue and control of safety documentation (Procedures, Control & policy)
- Safety lockout procedures, key safes/Multi Hasp locking devices
- Treatment of system neutral point (based on type of installation)
- Marine/offshore application of electrical protection
- LV systems , Transformers & other equipment (Frequency control & Bus Management Strategy)
- Cables & Cable Faults, Testing & Diagnosis (Cable Trunking / Ducts & protections)
- Emergency conditions
- Practical exercises (3-switching/ safety documents/ synchronisation) (Will require installation setup)
- Case studies

Competency No	Competence	Details	Methodology	No of Hours Th	No of Hours Pr	Reference
1	Operate and maintain power systems in excess of 1,000 volts	**Shipboard Machinery Familiarization** I. High-voltage technology II. Safety precautions and Procedures III. Electrical propulsion of the ships, electrical motors and control systems.	Lectures Workshop Practical (industrial visit /Ship in campus / ship visit)	15 10 5	5 5 5	
				60 Hrs		

Annex III

GUIDELINES & ADDITIONAL INFORMATION FOR ETO course

DESCRIPTION OF THE EQUIPMENT	SPECIFICATION OF THE EQUIPMENT	Man to machine Ratio
Ammeter analog.	Upto 500 V AC	1:1
Voltmeter analog.		1:1
Multimeter analog.		1:1
Multimeter digital.		1:1
Megohm meter	500 Volt	1:8
Megohm meter 5000v	5000 Volt or highere capacity	1:12
Frequency meter.	60 Hz	1:4
Main contactor auxiliary Contactor Overload relay. Timer relays.	Telemecanique / Mistubhishi or equivalent Omron / Mitsubishi or equivalent marine approved type	1:1 1:1 1:1 1:1
MCCB, marine approved		1:12
ACB of at least 300 KVA		1:12
Practical working bench with the following options: Start button Stop button Contact points Indicating lamps.		1:1
Main contactors		1:1 As per the exercise
Storage battery	12 Volt or above (alkaline/ lead acid)	
Transformers	Step up, step down & isolation transformer	1:12
Ex.proof/ Intrinsically safe equipments	Exi, Exd, Exia/ b Marine approved type	1:12
Lighting equipment with assembly station		1:3

Various types of Lights (Ex equipment, junction light fittings, halogens & Mercury vapour installation)		1:3
Auxiliary contactors		1:1 As per the exercise
1.5 sq mm Single core cable		
Combination pliers		1:1
Wire stripper		1:1
Wire crimper		1:1
Marine Cable crimper		1:12
Assorted cables of marine approved type, multi core & network cable	Multi core marine approved, armoured, PVC insulated. Network cable CAT5 Type	
Assorted Electrical screw drivers.		1:1
Brushless alternator300 KVA or more		1:12
Feeler gauge		1:12
Rotary rectifier unit.		1:12
Live main switch board with at least two generators controls and synchronizing panel. 440 Volt or above		1:12
Live Emergency switch board 440 Volt with tie breaker function		1:12
Squirrel cage induction motor.	10 Kw or more	1:8
Lifting chain block and gears		1:8
Electronic soft starter 3 KW, 3 phase connected into a stating circuit.	Telemecanique or equivalent, marine approved.	1:12
Variable frequency drive three phase	Telemecanique or equivalent, marine approved	

connected into a stating circuit.		
Bow thruster panel or equivalent	Relay type / electronic type	1:12
Fuel oil booster pump for control starter panel No.1 and No.2 or any equivalent thereof		1:12
Air condition control starter panel.		1:12
Air compressor control starter panel.		1:12
Electronic starter controller for starting 3 phase induction motor. Of minimum capacity of 3KW 440 volt three phase motor.	Telemecanique or equivalent, marine approved	1:12
Variable frequency drive for starting Electrical motors	Minimum capacity of 7.5 KW 440 volt or 7 KW three phase squirrel cage induction motor or more capacity.	
High voltage switch board panel with 6.6 KV vacuum circuit breaker / sf6 marine approved type.	KV vacuum circuit breaker / Gas filled breaker.	1:12
Intrinsically safe zener barrier circuit modules.		1:12
Assorted electronic components.		1:1
PNP, NPN Transistor, power transistor, unijunction transistor.		1:1
Assorted PCBs of marine equipments used onboard from Radar, Alarm monitoring system.		
Soldering iron		1:1
Bred Board		1:1
FET		1:1
CRO		1:3
Function Generator		1:3
SCR		1:1

Electronic components for building up Electronic circuit with the given PCB		
OP-AMP PCB Electronic components to build OP-AMP Circuit with the given PCB		1:1
Marine Radar with trans-receiver and scanner	Marine approved	
Telephone instruments & EPABX		1:12
Programmable Logic Controller	Telemecanique or equivalent marine type	
PLC Controlled panel	Working panel of Boiler / Air condition plant / any other automated system extensively used onboard.	
P I D Controller used in a marine system	NAKAKITA / ROSMOND or equivalent, marine approved.	
Practical: Generator control panel circuit exercise	Circuit drawing	
Practical: Generator control panel circuit reading exercise (trouble shooting)	Circuit drawing	
Boiler panel circuit Trouble shooting.	Circuit drawing and boiler panel, relay controlled or PLC Controlled or appropriate marine boiler panel	
Thermocouple and PT.100 Calibration	Thermo couples calibration kit upto 300 Deg C	1:4
Pressure Transmitter Calibration	Kit for testing Pressure transmitter vacuum and positive pressure.	1:12
Practical session on the oil mist detector	Oil mist detector of approved marine type	1:12

ANNEX -IV

Specification of minimum standards of competence for electro-technical officers
Function: Electrical, electronic and control engineering at operational level

Column 1	Column 2	Column 3	Column 4	Column 5		Column 6
Competency No.	Competence	Details	Methodology	No. of Hours		Reference
				Theory	Practicals	
1	Monitor the operation of electrical, electronic and control systems	**Ship board Machinery Familiarization:** 1.1 Prime movers including main propulsion plant 1.2 Engine-room auxiliary machineries - Boiler, incinerators, purifiers, oily-water separators, various types of pumps. 1.3 Steering gear systems 1.4 Cargo handling systems 1.5 Deck machineries 1.6 Generators 1.7 Galley equipments, Accommodation power systems 1.8 Ship's construction	1. Lecture & Workshop Practical exercises on auxiliaries. 2. Hands on skill in the electronic lab. 3. Videos on ships Construction/ equipments (videotel)	5 Hrs. 5Hrs. 2Hrs. 2Hr. 3Hrs 5Hrs 5Hrs. 10Hrs.	5Hrs 5Hrs 2Hrs 1Hrs 5Hrs 5Hrs	Elstan .A.Fernandez – Marine electrical Technology – 3rd Edition SOLAS Consolidated Edition 2006 & Amendments. List of Videos from videos from Video Tel
				Total =	**60 Hrs**	

Column 1	Column 2	Column 3	Column 4	Column 5		Column 6
Competency No.	Competence	Details	Methodology	No. of Hrs.		Reference
				Theory	Practicals	
2	Monitor the operation of electrical, electronic and control systems (*continued*	**Marine electrical applications:** 2.1 Electrical drives 2.2 Technology of electrical materials 2.3 Electro-hydraulic and electro-pneumatic control systems 2.4 Transformers, shore supply for ESB, testing of relays in MSB 2.5 Battery maintenance 2.6 Normal & Emergency lighting systems	1. Lecture by electrical faculty. 2. Practicals in Electronic lab. 3. Videos on the equipments & safety procedures from Video Tel.	3Hrs 2Hrs 3 Hrs 3Hrs 1hrs 2Hrs	2Hrs 3Hrs 2 Hrs 2Hrs 4Hrs 3Hr	Elstan .A.Fernandez – Marine electrical Technology – 3rd Edition List of Videos from videos from Video Tel
				Total =	**30 Hrs**	
3	Monitor the operation of automatic control systems of propulsion and auxiliary machinery	**Main engine/ Auxiliary machinery controls** 3.1 Description of Electrical controls of the main engines. 3.2 Trouble shooting in the electrical domain of the main engines. 3.2 Oil discharge monitor / ows 3.3 ICCP	1. Lecture by electrical faculty. 2. Practicals in Electronic lab. 3. Hands on skill in the workshop on main engines. 4. Videos on the equipments & safety procedures from Video Tel.	4 Hrs 4Hrs 4Hrs 2 Hrs	6Hrs 6Hrs 4Hrs 2Hrs	Elstan .A.Fernandez – Marine electrical Technology – 3rd Edition List of Videos from videos from Video Tel
				Total =	**32 Hrs**	

Column 1	Column 2	Column 3	Column 4	Column 5		Column 6
Competency No.	Competence	Details	Methodology	No. of Hrs.		Reference
				Theory	Practicals	
4	Operate of generators	**Generator Controls** 4.1 Starting a generator 4.2 Paralleling, load sharing and changing over generators **4.3Reverse power Relay** **4.4 switch board relays & transducers.**	1 Lecture by electrical faculty. 2. Practicals in Electronic lab. 3. Hands on skill in the workshop on Generators. 4. Hands on Skill on Switch Board Simulator in Electronic lab. 5. Videos on Video-Tel	3 Hrs. 2 Hrs. 2 Hrs 3 Hrs Total =	4 Hrs. 4 Hrs. 2Hrs 4Hrs **2 4 Hrs.**	Elstan .A.Fernande z – Marine electrical Technology – 3rd Edition List of Videos from videos from Video Tel
5	Operate computers and computer networks on ships	**Networking** Understanding of: 5.1 Main features of data processing 5.2 Construction and use of computer networks on ships- **communication** 5.3 Bridge-based, engine-room based and commercial computer use **5.4 PMS** **5.5 Engine Monitoring Systems**	1. Lecture by Computer -faculty. 2. Practicals in Computer lab & Navigation Lab.	4 Hrs. 4Hrs 4 Hrs. 4Hrs 2 Hrs Total =	4 Hrs. 4Hrs 4 Hrs. 4Hrs 2Hrs **36 Hrs**	Elstan .A.Fernande z – Marine electrical Technology – 3rd Edition List of Videos from videos from Video Tel

Column 1	Column 2	Column 3	Column 4	Column 5		Column 6
Competency No.	Competence	Details	Methodology	No. of Hrs.		Reference
				Theory	Practicals	
6	Use hand tools, electrical and electronic measurement equipment for fault finding, maintenance and repair operations	**Safe Electrical Practices** 6.1 Electrical safety practices on board ship 6.2 Causes of electric shock and precautions to be observed to prevent shock 6.3 Construction and operational characteristics of shipboard AC and DC systems and equipment 6.4 Construction and operation of electrical test and measuring equipment 6.5 Application of safe working practices	1. Lecture by electrical faculty. 2. Practicals in Electronic lab. 3. Videos on the equipments & safety procedures from Video Tel.	2 Hrs. 2 Hrs. 4 Hrs. 5 Hrs. 2 Hrs Total =	4 Hrs. 2 Hr. 8 Hrs. 1 Hr. **30 Hrs.**	Elstan .A.Fernande z – Marine electrical Technology – 3rd Edition List of Videos from videos from Video Tel
7.	Use English in written and oral form	**Communication Skills** 7.1 Adequate knowledge of the English language to enable the officer to use engineering publications and to perform the officer.s duties	1. Lecture English faculty. 2. Continuous interaction between faculty & students to enhance communication skills. 3. Marlins English speaking course & Videos from Video tel VOD unit.	30 Hrs. Total =	 **30 Hrs.**	Excellent videos on communicat ion skills downloaded from internet

Column 1	Column 2	Column 3	Column 4	Column 5		Column 6
Competency No.	Competence	Details	Methodology	No. of Hrs. Theory	Practicals	Reference
8	Maintain and repair automation and control systems of main propulsion and auxiliary machinery	**Maintenance/ detection of PLC/SCADA based systems** 8.1 Appropriate electrical and mechanical knowledge and skills *Safety and emergency procedures* Safe isolation of equipment and associated systems required before personnel are permitted to work on automation & control systems of main propulsion & auxiliary machineries. 8.2 Introduction to PLC/SCADA/ & correlate it to their applications for Engine Controls & auxiliary machineries controls. 8.3 Fault diagnosis & rectification procedure of PLC/SCADA/based systems 8.4 Temperature sensors 8.5 Pressure sensors 8.6 Level sensors 8.7 Flow sensors	1. Lecture by electrical faculty. 2. Practicals in Electronic lab. 3. Hands on skill in the workshop on main engines controls/ auxiliary machineries controls. 4. Training on industrial automation/instrumentation at reputed automation institutes like Honey-well. 5. Videos on Instrumentation & automation on Video	4 Hrs. 08 Hrs. 08 Hrs. 4 Hrs. 4 Hrs. 4 Hrs. 4 Hrs. Total =	4 Hrs. 08 Hrs. 08 Hrs. 4 Hrs. 4 Hrs. 4 Hrs. 4 Hrs. 72 Hrs.	

Column 1	Column 2	Column 3	Column 4	Column 5		Column 6
Competency No.	Competence	Details	Methodology	No. of Hrs.		Reference
				Theory	Practicals	
9	Maintain and repair bridge navigation equipment and ship communication systems	**Handling the electronics of bridge equipments (GMDSS)** 9.1 Introduction to GMDSS. 9.2 Radar – Theory, maintenance & safety 9.3 UMS Operation – Dead man alarms, Bridge operation, Engine room machinery requirements for UMS, changing over command E/R to bridge **9.4 watch keeping alarms**	1. Lecture by electrical faculty. 2. Practicals in Electronic lab/ Navigational lab. 3. Practical training on the bridge simulator.	8 Hrs. 6 Hrs. 8 Hrs 2 Hrs	2 Hrs. 2 Hr. 2Hr. 10 Hrs.	Practical Marine Electrical Knowledge by Dennis T Hall & Marine Electrical Technology by E. A Fernandez
				Total =	**40 Hrs.**	

Column 1	Column 2	Column 3	Column 4	Column 5		Column 6
Competency No.	Competence	Details	Methodology	No. of Hrs.		Reference
				Theory	Practicals	
10	Maintain and repair electrical, electronic and control systems of deck machinery and cargo handling equipment	**Defect Diagnosis of auxiliary machineries** 10.1 Windlass & Mooring Winches 10.2 Saab Tank Radar system 10.3 Fixed gas detection system **10.4 Alarm Monitoring System**	1. Lecture by electrical faculty. 2. Practicals in Electronic lab. 3. Hands on skill in the workshop on auxiliary machineries controls. 4. Ship visit for system familiarization.	4 Hrs 2 Hrs 4 Hrs 4Hrs	4 Hrs 2Hrs 2Hrs 4 Hrs.	Practical Marine Electrical Knowledge by Dennis T Hall & Marine Electrical Technology by E. A Fernandez
				Total =	**24 Hrs**	

Column 1	Column 2	Column 3	Column 4	Column 5		Column 6
Competency No.	Competence	Details	Methodology	No. of Hrs.		Reference
				Theory	Practicals	
11	Maintain and repair control and safety systems of hotel equipment	**Maintenance of Hotel Electrical Equipment Onboard the vessel** 11.1 Accommodation power system 11.2 Galley equipments 11.3 Ship's basic refrigeration system 11.4 Ship's Air-conditioning system **11.5 Laundry Equipment** 11.6 Motor Overhauling 11.7 Electrical Fault Finding	1. Lecture by electrical faculty. 2. Practicals in Electrical lab. 3. Hands on skill in the workshop on AC & Ref plants. 4. Practicals on galley equipment in the galley 5. Ship visit for system familiarization. 6. Practicals in workshop	4 Hrs. 6 Hrs. 4 Hrs. 4 Hrs. 4 Hr. 2 Hr. 2Hrs	4Hrs. 6 Hrs. 6 Hrs. 6 Hrs. 4 Hrs. 8 Hrs. 8 Hrs	Practical Marine Electrical Knowledge by Dennis T Hall & Marine Electrical Technology by E. A Fernandez
				Total =	**68 Hrs.**	

Column 1	Column 2	Column 3	Column 4	Column 5		Column 6
				Theory	Practicals	Reference
Competency No. 11 A	**Competence** **Application of leadership and team work**	**11.1 Job profile awareness** **11.2 ISO Quality system** **11.3 Inter-departmental operation & protocols, team work & risk assessment**	**Lecture** **Workshop Practical** **Industrial visit/ship in compass / Ship visit**	**6 Hrs**		

11	Maintain and repair control and safety systems of hotel equipment	**Maintenance of Hotel Electrical Equipment Onboard the vessel** 11.1 Accommodation power system 11.2 Galley equipments 11.3 Ship's basic refrigeration system 11.4 Ship's Air-conditioning system **11.5 Laundry Equipment** 11.6 Motor Overhauling 11.7 Electrical Fault Finding	1. Lecture by electrical faculty. 2. Practicals in Electrical lab. 3. Hands on skill in the workshop on AC & Ref plants. 4. Practicals on galley equipment in the galley 5. Ship visit for system familiarization. 6. Practicals in workshop	4 Hrs. 4Hrs. 6 Hrs. 6 Hrs. 4 Hrs. 6 Hrs. 4 Hrs. 6 Hrs. 4 Hr. 4 Hrs. 2 Hr. 8 Hrs. 2Hrs 8 Hrs Total = 68 Hrs.	Practical Marine Electrical Knowledge by Dennis T Hall & Marine Electrical Technology by E. A Fernandez

Column 1	Column 2	Column 3	Column 4	Column 5		Column 6
Competency No.	Competence	Details	Methodology	No. of Hrs.		Reference
				Theory	Practicals	
12	Organize and manage subordinate crew	**Awareness of International maritime conventions** 12.1 MARPOL Convention Annex I to Annex VI 12.2 SOLAS Convention	Lecture by Engineering / Nautical faculty.	2 Hrs. 2 Hrs. Total =	 **4 Hrs.**	SOLAS Consolidated Edition 2006 & Amendments.
13	Ensure compliance with pollution prevention requirements	**Prevention of pollution of the marine environment** 13.1 Marpol Convention	Lecture by Engineering / Nautical faculty.	4 Hrs. Total =	 **4Hrs**	SOLAS Consolidated Edition 2006 & Amendments.

Column 1	Column 2	Column 3	Column 4	Column 5		Column 6
Competency No.	Competence	Details	Methodology	No. of Hrs.		Reference
				Theory	Practicals	
14	Prevent, control and fight fire on board	**Fire detection system** 14.1 Fire detection & alarm system. 14.2 Type of fire sensors 14.3 Hazardous Zones, Intrinsic safety, flame proof equipments	1. Lecture by Engineering / Nautical faculty. 2. Practicals in Electronic lab. 3. Ship visit for system familiarization.	3 Hrs. 3 Hrs 3 Hrs	2 Hrs. 2 Hrs. 2 Hrs.	Fire Safety at Sea by Dr. James Cowley Marine Electrical Technology by E. A Fernandez
15	**Operation of High Power 1000 Volts**	15.1 High Voltage Technology ,Safety Precautions& Procedures, 15.2 Electrical propulsion of the ship. 15.3 Electrical motors & Control		**10 Hrs** **10Hrs** **05Hrs**	**10 Hrs** **5Hrs** **5Hrs**	
				Total =	**60Hrs**	