



MARINE DEPARTMENT
GOVERNMENT OF THE HONG KONG
SPECIAL ADMINISTRATIVE REGION

**Certificates of Competency and Licences
for Marine Engineer Officers and
Electro-technical Officers Determinations**

(2012 Edition)

Made under Regulations 8, 10 and 15 of the
Merchant Shipping (Seafarers)(Certification of Officers) Regulation

M.O. 841 (Rev. 02/2012)

Marine Department
The Hong Kong Special Administrative Region

First Edition 1995
Second Edition 1998
Third Edition 2003
Fourth Edition 2008
Fifth Edition 2012

MERCHANT SHIPPING (SEAFARERS) ORDINANCE
(CHAPTER 478)

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TABLE OF CONTENTS

		<u>Page</u>
<u>Chapter 1</u>	- Commencement, Interpretation and General Requirements	1
<u>Chapter 2</u>	- Seagoing and River Trade Certificates	
	General Provisions	4
<u>Chapter 3</u>	- Seagoing Certificates	
Part I	Types and Classes of Certificates	11
Part II	Initial Education and Training	14
Part III	Qualifying Sea Service and Workshop Skill Training	20
Part IV	General Provisions as to Eligibility	23
Part V	Examinations and Exemptions	26
Part VI	Endorsements and Certificates of Proficiency for Dangerous Cargo Operation	30
Part VII	Revalidation of Certificates	32
<u>Chapter 4</u>	- River Trade Certificates	
Part I	Classes of Certificates	34
Part II	General Requirements	36
Part III	Revalidation of Certificates	37
<u>Chapter 5</u>	- Seagoing Certificates Examination Syllabuses	
Part I	Class 3 Marine Engineer Officer Certificate	38
Part II	Class 2 Marine Engineer Officer Certificate	45
Part III	Class 1 Marine Engineer Officer Certificate	61
Part IV	Electro-technical Officer Certificate	76
<u>Chapter 6</u>	- River Trade Certificates Examination Syllabuses	
Part I	Class 3 Marine Engineer Officer Certificate (River Trade)	83
Part II	Class 2 Marine Engineer Officer Certificate (River Trade)	87
Part III	Class 1 Marine Engineer Officer Certificate (River Trade)	96

	<u>Page</u>
<u>Chapter 7</u> - Issue of Licences to Persons Holding Non-Hong Kong Certificates	108
<u>Chapter 8</u> - Type Rating Certificate (TRC) for Dynamically Supported Craft (DSC) or High Speed Craft (HSC)	110

APPENDIX

Appendix I	Standard Form of Documents	
	Form 1. Sea Service Testimonial	113
	Form 2. Report of Shipboard Service or Training for Endorsement or Certificate of Proficiency for Dangerous Cargo Operation	114

CHAPTER 1

COMMENCEMENT, INTERPRETATION AND GENERAL REQUIREMENTS

1.1 Commencement

1.1.1 These Determinations are made by the Seafarers' Authority under powers granted by the Merchant Shipping (Seafarers)(Certification of Officers) Regulation and shall come into operation on 1st January 2012.

1.1.2 These Determinations supersede all previously published Rules and Determinations regarding certification and licensing of marine engineer officers for sea-going ships and river-trade vessels.

1.2 Interpretation

1.2.1 In these Determinations, unless the context otherwise requires:

“approved” means approved or recognized by the Director of Marine;

“certificate of competency” means a certificate of competency issued by the Director under the Merchant Shipping (Seafarers)(Certification of Officers) Regulation;

“chemical tanker” means a ship constructed or adapted and used for the carriage in bulk of any liquid product listed in chapter 17 of the International Bulk Chemical Code;

“Director” means the Director of Marine;

“dynamically supported ship or craft (DSC)” means any vessel as defined in the International Maritime Organization's Assembly Resolution A.373(X) “Code of Safety for Dynamically supported Craft”;

“electro-technical officer” means an officer qualified in accordance with the provisions of regulation III/6 of the STCW Convention;

“examiner” in these Determinations means a person appointed by the Director to be an Examiner of Marine Engineers;

“fishing vessel” means a vessel for the time being employed in sea fishing or a Government fishery research vessel, but does not include a vessel used otherwise than for commercial purposes;

“high speed craft (HSC)” means any vessel as defined in the International Maritime Organization's “International Code of Safety for High Speed Craft”;

“liquefied gas tanker” means a ship constructed or adapted and used for the carriage in bulk of any liquefied gas or other product listed in chapter 19 of the International Gas Carrier Code;

“oil tanker” means a ship constructed and used for the carriage of petroleum and petroleum products in bulk;

“pleasure craft” means a vessel used primarily for sport and recreation purposes;

“river trade” means within the limit of the River Trade area as defined in the Shipping and Port Control Ordinance;

“Seafarers’ Authority” means the Director for the purposes of these Determinations;

“seagoing” means beyond the limit of the River Trade area as defined in the Shipping and Port Control Ordinance;

“service endorsement” means a service endorsement endorsed on a certificate of competency by the Director under section 6(8) of the Merchant Shipping (Seafarers)(Certification of Officers) Regulation;

“STCW Convention” means the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers, 1978 as amended;

“Type Rating Certificate (TRC)” means a Certificate to man a specific station on a particular type and model of dynamically supported craft or high speed craft.

1.3 **General Requirements**

1.3.1 The subsequent chapters of these Determinations set out the training and qualification requirements for marine engineer officers and electro-technical officers and the conditions to be satisfied by any person to qualify for a certificate of competency as a marine engineer officer, or electro-technical officers or an extension of the validity of such a certificate, or an endorsement to such a certificate, the manner in which the attainment of such standards or the satisfaction of such conditions is to be established, the procedure for the conduct of examinations, and the subjects and syllabuses for those examinations.

1.3.2 The officers manning the stations of Chief Engineer, Second Engineer, Watchkeeping Engineer, Electro-technical Officer and any other person assigned specific duties and responsibilities or having an immediate responsibility for the cargo, in the following types of tanker:

- (a) oil tanker;
- (b) chemical tanker;
- (c) liquefied gas tanker

shall hold their certificates of competency that bear endorsements to the effect that the holders have satisfied the Director in regard to the requirements for training and service set out in Part VI of Chapter 3 of these Determinations.

1.3.3 An officer manning the station of Chief Engineer or Second Engineer of any passenger DSC/HSC or any cargo DSC/HSC of 500 gross tonnage and upwards shall, in addition to hold the appropriate certificate of competency, be required to hold a

valid Type Rating Certificate (TRC) for the type and model of craft in which he intends to serve. The conditions to be satisfied by any person to qualify for, or revalidate a TRC, the procedure for the conduct of examinations and the syllabus to be examined are set out in Chapter 8 of these Determinations.

- 1.3.4 Any candidate who considers himself to be aggrieved by any decision of the examiner may appeal to the Director within 30 days of being informed of such decision.
- 1.3.5 The Director may, at his discretion, permit exemption from all or any provision of these Determinations.

1.4 **Transitional Provisions**

- 1.4.1 Until 1 January 2017, the Director may continue to issue, recognize and endorse certificates in accordance with the fourth edition of this Determinations in respect of those seafarers who commenced approved seagoing service, an approved education and training programme or an approved training course before 1 July 2013.
- 1.4.2 Until 1 January 2017, the Director may continue to renew and revalidate certificates and endorsements in accordance with the fourth edition of this Determinations.

CHAPTER 2

SEAGOING AND RIVER TRADE CERTIFICATES

GENERAL PROVISIONS

2.1 Types and Classes of Certificates and their Validity

2.1.1 There are the following types and classes of certificates:

Seagoing

Certificate of Competency (Marine Engineer Officer) Class 1
Certificate of Competency (Marine Engineer Officer) Class 2
Certificate of Competency (Marine Engineer Officer) Class 3
Certificate of Competency (Electro-technical Officer)

River Trade

Certificate of Competency (Marine Engineer Officer)(River Trade) Class 1
Certificate of Competency (Marine Engineer Officer)(River Trade) Class 2
Certificate of Competency (Marine Engineer Officer)(River Trade) Class 3

2.1.2 Seagoing certificates are valid without limit of trading. River trade certificates are only valid on ships trading within river trade limits. All types and classes of certificates including seagoing and river trade are valid for a period of not more than 5 years and fall due for revalidation on the expiry date shown on the certificate.

2.1.3 In order to revalidate a certificate the holder must show that he meets the conditions for revalidation which are set out in Part VII of Chapter 3 and Part III of Chapter 4.

2.2 Proof of Nationality

2.2.1 All candidates for examination for a certificate of competency will be required to produce proof of name, nationality and date of birth.

2.3 Certificate of Medical Fitness

2.3.1 All candidates for any certificate of competency will be required to produce a valid certificate of medical fitness issued by an approved medical practitioner. A certificate of medical fitness is not to be valid for more than two years from the date of issue.

2.4 Date and Place of Examination

2.4.1 The dates upon which examinations are to be held in the following year will be published annually in a Gazette Notice issued by the Director.

2.4.2 Candidates for examination will be informed, at the time of making application, of the place at which the examination will be held.

2.4.3 Candidates who are making application for any examination should follow the procedure set out under paragraph 2.5, ensuring that their application is lodged at least thirty days prior to the commencement date of the examination upon which they wish to be examined. The time and date of the examination will then be advised.

2.5 **Application**

2.5.1 Candidates for either a part, or for the whole, of any certificate of competency examination must complete an application form which may be obtained from the Marine Department, Seafarers' Certification Section, or by post from:

Marine Department,
Seafarers' Certification Section,
3/F Harbour Building,
38 Pier Road,
Central,
Hong Kong.

2.5.2 Applicants should return the completed form to the Seafarers' Certification Section at least thirty days prior to the commencement date of the examination upon which the applicants intend to sit for the examination, together with:

- (a) the examination fee;
- (b) two passport type photographs (50mm x 40mm);
- (c) sea service testimonials;
- (d) Seaman's Discharge Book or Certificates of Discharge;
- (e) proof of nationality, name and date of birth;
- (f) where appropriate
 - (i) existing certificates of competency;
 - (ii) certificate of medical fitness;
 - (iii) subsidiary course certificates;
 - (iv) training record books.

2.5.3 Candidates who have made a previous attempt when making application for re-examination must also submit their copy of the record of results issued by the examiner following their previous attempt.

2.5.4 It is important that the correct procedure for application is followed as seaman's discharge book and sea service testimonials should be submitted for verification which can take time. In the absence of such verification the candidate cannot be accepted for examination.

2.5.5 Application from candidates abroad may be made by post to the Seafarers' Certification Section, accompanied by the prescribed examination fee and copies of the relevant supporting documents. Original documents should not be sent through the post in such cases, but should be presented to the examiner on the applicant's next return to Hong Kong prior to the date of examination. Notification by the examiner of acceptance for the examination will be given as soon as possible after receipt of the application.

2.5.6 Candidates who fail in all, or in a part, of an examination, may attend for the next scheduled examination for the relevant certificate provided that accommodation is available in the examination hall, even if this means that they are unable to give the full one month notice as required by paragraph 2.5.2. In order to take advantage of this facility candidates must submit written application to resit the examination, or part of examination, together with the appropriate fee, immediately upon receiving notification of the examination results.

2.6 Enquiries

2.6.1 Candidates may make enquiries about examinations and in doing so should ensure that the point on which information is sought is clearly stated. Enquiries from candidates abroad should be addressed to:

The Examiner of Engineers,
Marine Department,
3/F Harbour Building,
38 Pier Road,
Central,
Hong Kong.

Tel: (852) 2852 4364
Fax: (852) 2541 6754
E-mail: seexam@mardep.gov.hk

2.6.2 Candidates writing to request a provisional estimate of their sea service should include a detailed summary of their service with the enquiry but should not include original documents.

2.7 Particulars of Sea Service

2.7.1 A candidate's eligibility for examination will depend, amongst other factors, on the amount of sea service performed and upon the seagoing ranks in which the candidate has served. It is therefore imperative that the particulars which candidates record on the application form are accurately stated.

2.7.2 The amount of sea service set down in these Determinations for each class of certificate is the absolute minimum that can be accepted. Unless candidates can prove the full amount they will not be admitted to the examination.

2.8 Testimonials

- 2.8.1 Candidates for certificates of competency must produce testimonials in respect of all sea service performed. These testimonials, which should state the seniority on watch, the type of main propelling machinery and the nature of duties performed, are to be signed by the Chief Engineer Officer and endorsed by the Master or the Engineer Superintendent. In the case of service as Chief Engineer Officer, the testimonials should be signed by the Engineer Superintendent or some other responsible representative of the employer. A specimen copy of the form of testimonial recommended for this purpose is shown in the Appendix I. Testimonials will be returned to candidates when the examination is completed.
- 2.8.2 Testimonials or certificates of sea service should include reports as to the candidate's character, sobriety, experience and ability for the full period of service covered by the application for examination.

2.9 **Use of Information**

- 2.9.1 Information required by the application form will be used by Marine Department for process of application for examination and issue of certificate. This information may be divulged to other departments and agencies authorised to process the information for the mentioned purposes. Limited personal data of successful applicant may be used via the Marine Department's web site for verification of the issued certificate of competency by any third parties.
- 2.9.2 The supply of information is obligatory. A candidate should ensure that all the information filled in the application form is accurate. Failure to do so may, besides subject to paragraph 2.10, result in an unsuccessful application.
- 2.9.3 For making correction and access to personal data after submission of application form, a candidate may contact the following officer:

Officer-in-charge
Marine Department,
Seafarers' Certification Section,
3/F Harbour Building,
38 Pier Road,
Central,
Hong Kong.

2.10 **Fraud or Misrepresentation**

- 2.10.1 Candidates are reminded that the Merchant Shipping (Seafarers)(Certification of Officers) Regulation provides that any person who, in connection with an application for the issue of a certificate of competency, or in connection with the endorsement to, or extension of validity of, a certificate of competency:

- (a) makes a false pretence; or
- (b) supplies false information;

knowing it to be false, or not believing it to be true, commits an offence and is liable to a fine and to imprisonment.

2.11 **Attempted Bribery**

- 2.11.1 Any candidate who offers an advantage to any officer of the Marine Department shall be guilty of an offence under the Prevention of Bribery Ordinance and shall be liable on summary conviction to a fine and to imprisonment. Such a candidate will not be re-examined for such a period as may be decided by the Director.

2.12 **Unsatisfactory Conduct**

- 2.12.1 Candidates, who have neglected to join their vessels after signing crew agreements, or who have left their vessels after joining, other than upon discharge, or who have committed misconduct on board, will be required to produce satisfactory proof of two years subsequent service at sea with good conduct unless the Director, after investigation, should see fit to reduce this period.

2.13 **Deafness and other Physical or Mental Handicaps**

- 2.13.1 If, in the course of any examination, the examiner finds that a candidate is afflicted with deafness, an impediment in speech, or with some other physical or mental handicap which he considers sufficient to render the candidate incapable of discharging adequately the ordinary seagoing duties of the holder of a certificate of competency, he will not allow the candidate to complete the examination and the candidate will be refunded of the examination fee.
- 2.13.2 If such a candidate subsequently produces a medical certificate to the effect that the particular handicap has been overcome or has improved or that the candidate's condition is now normal, the Director will consider the candidate for re-examination.

2.14 **Knowledge of English and Languages for Conduct of Examination**

- 2.14.1 All candidates for seagoing and river trade classes of certificates of competency must demonstrate to the satisfaction of the examiner that they can speak and write English sufficiently well to perform the duties required on a Hong Kong registered ship.
- 2.14.2 Candidates for seagoing and river trade classes of certificates of competency may choose to have the examination conducted in English or Chinese. Candidate must specify their language of choice at the time of making the application. Candidates who choose to have the examination conducted in English may have all the written and oral examinations conducted in English. But candidates who choose to have the examination conducted in Chinese will be required to have at least one professional subject in the written examination to be examined in English and also part of the oral examination to be conducted in English.
- 2.14.3 Candidates for written examinations which are conducted in English will be expected to demonstrate a reasonable standard of grammar, spelling and composition in their answers.

2.14.4 Candidates for written examinations which are conducted in Chinese will be expected to demonstrate a reasonable standard of grammar, fluency, accuracy and the comprehensive ability in the use of Chinese language.

2.15 **Issue of Certificates**

2.15.1 Candidates who are successful in all parts of an examination, and who meet all the requirements for the issue of a certificate of competency of the class applied for, will be issued with a certificate of competency. When the certificate of competency is ready, it will be forwarded by registered post to the candidate's address as given on the application form, unless the candidate wishes to make other arrangements.

2.15.2 A candidate who has passed all parts of the examination but who has not yet obtained the subsidiary qualifications necessary to become eligible for the issue of a certificate of competency will be issued with a record of results form. Upon production of this form and proof that the requisite subsidiary qualifications have been obtained the candidate will be issued with a certificate of competency in the normal manner.

2.15.3 All other candidates for the examination will receive a record of results form which should be retained and produced at any subsequent examinations.

2.15.4 To avoid unnecessary delays in the issue of certificates, it is important that candidates should inform the examiner promptly of any change in the address given on the application form.

2.16 **Insufficient Service**

2.16.1 If after a candidate has passed the examination, it is discovered that his sea service is insufficient to entitle him to receive a certificate of the class for which he has been examined, he will not be issued with such a certificate. If, however, the Director is satisfied that the error in the calculation of sea service did not occur through any fault or misrepresentation on the part of the candidate, the appropriate certificate will be granted when he has made up the deficiency in sea service.

2.17 **Fees**

2.17.1 Applicants for examination will be required to pay the appropriate examination fees before any steps are taken to verify their eligibility for examination. Candidates who are found to be ineligible will have their fees returned.

2.17.2 The fee paid for examination for a certificate of competency is not refundable in the event of a candidate's failure to pass. A candidate who fails to appear in any part of any examination at the appointed time may be regarded as having failed by default in that part of the examination and the examination fee will be forfeited unless the candidate produces reasonable proof that failure to attend was unavoidable.

2.17.3 Details of the current scale of fees may be obtained from the CAP 478AB Merchant Shipping (Seafarers)(Fees) Regulation (<http://www.legislation.gov.hk/09/eng/pdf.htm>).

- 2.17.4 A candidate who due to circumstances beyond his control, has to postpone an examination for which he has already made application, may do so for one opportunity only in a maximum period of one year beyond the date of the examination applied for. A candidate wishing to postpone an examination should apply in writing not less than 3 working days in advance of the examination. When he subsequently applies to sit the postponed examination, he will be required to pay any increase in fee which may have come into effect since his original application.
- 2.17.5 If the candidate wishes to be examined at a date one year after the date of the previously arranged examination, his paid examination fee will be forfeited and he will be required to resubmit his application with fee as if it were a new application.

2.18 **Issue of Replacement Certificate**

- 2.18.1 If a certificate of competency is lost, the holder may apply to the Seafarers' Certification Section for a replacement certificate. A fee will be charged for the replacement certificate unless the holder can show that the loss was as a result of shipwreck or fire. An applicant for a replacement certificate will be required to make a declaration to the examiner regarding the circumstances in which the certificate was lost.

CHAPTER 3

SEAGOING CERTIFICATES

PART I

TYPES AND CLASSES OF CERTIFICATES

3.1 General

3.1.1 Certificates of competency are granted as follows:

- (a) Marine engineer officer certificates
 - (i) Motor certificates qualifying the holders to serve as engineer officers in motor ships, being ships propelled by internal combustion engines, or in ships being propelled by gas turbines.
 - (ii) Steam certificates qualifying the holders to serve as engineer officers in steam ships, being ships propelled by steam turbines or steam engines, or in ships being propelled by gas turbines.
 - (iii) Combined certificates qualifying the holders to serve as engineer officers in steam ships, motor ships, or in ships being propelled by gas turbines.
- (b) Electro-technical officer certificate
 - (i) Electro-technical officer certificates qualifying the holders to serve as electro-technical officers in steam ships, motor ships, or in ships being propelled by gas turbines.

3.1.2 To qualify for the issue of an initial certificate of competency of any type or class in Hong Kong, a candidate must:

- (a) have completed approved basic training courses in accordance with Section A-VI/1 of the STCW Code on:
 - (i) personal survival techniques;
 - (ii) fire prevention and fire fighting;
 - (iii) elementary first aid; and
 - (iv) personal safety and social responsibilities.
- (b) have completed an approved advanced fire-fighting course or equivalent;
- (c) have completed and passed the assessment of an approved medical first aid or first aid at sea course or equivalent;
- (d) have completed and passed the assessment of an approved proficiency in survival craft and rescue boats course or equivalent; and

- (e) have completed and passed the assessment of an approved course on security-awareness training or equivalent in accordance with the transitional provision under Section A-VI/6 paragraph 5 of the STCW Code.

3.2 Class 3 Marine Engineer Officer Certificate

3.2.1 To qualify for the issue of a Class 3 marine engineer officer certificate a candidate must:

- (a) be not less than 18 years of age;
- (b) satisfy the initial education and training requirements set out in Part II of this Chapter;
- (c) have completed combined workshop skills training and an approved sea service set out in Part III of this Chapter. During such sea service, the candidate must complete the on-board training requirements documented in an approved training record book;
- (d) pass the examination set out in Part V of this Chapter; and
- (e) hold an approved and valid certificate of medical fitness.

3.3 Class 2 Marine Engineer Officer Certificate

3.3.1 To qualify for the issue of a Class 2 marine engineer officer certificate a candidate must:

- (a) hold a Class 3 marine engineer officer certificate or an equivalent certificate recognized by the Director;
- (b) have completed the qualifying sea service set out in Part III of this Chapter;
- (c) pass the examination set out in Part V of this Chapter; and
- (d) hold an approved and valid certificate of medical fitness.

3.4 Class 1 Marine Engineer Officer Certificate

3.4.1 To qualify for the issue of a Class 1 marine engineer officer certificate a candidate must:

- (a) hold a Class 2 marine engineer officer certificate or an equivalent certificate recognized by the Director;
- (b) have completed the qualifying sea service set out in Part III of this Chapter;
- (c) pass the examination set out in Part V of this Chapter; and

- (d) hold an approved and valid certificate of medical fitness.

3.5 **Electro-technical Officer Certificate**

3.5.1 To qualify for the issue of an electro-technical officer certificate a candidate must:

- (a) be not less than 18 years of age;
- (b) satisfy the initial education and training requirements set out in Part II of this Chapter;
- (c) have completed combined workshop skill training and an approved sea service set out in Part III of this Chapter. During such sea service, the candidate must complete the on-board training requirements documented in an approved training record book;
- (d) pass the examination set out in Part V of this Chapter; and
- (e) hold an approved and valid certificate of medical fitness.

3.6 **Service Endorsement**

3.6.1 To qualify for a service endorsement to a Class 2 marine engineer officer certificate of competency a candidate must:

- (a) whilst holding a Class 2 marine engineer officer certificate of competency have completed the qualifying sea service set out in Part III of this Chapter;
- (b) pass the examination set out in Part V of this Chapter; and
- (c) hold an approved and valid certificate of medical fitness.

3.7 **Equivalent Certificates**

3.7.1 Recognition of equivalent certificates is subject to approval by the Director.

PART II

INITIAL EDUCATION AND TRAINING

3.8 Age

- 3.8.1 Workshop service or other industrial training performed before the age of 15 years will not be accepted.

3.9 Quality Standards

- 3.9.1 The education and training courses which a candidate attends to satisfy the initial education and training requirements shall generally follow a quality standards system or an alternative system acceptable to the Director.

3.10 Forms of Education and Training

- 3.10.1 A candidate must have completed basic education to the secondary level standard or equivalent and, in addition, one of the forms of technical education and training specified in paragraphs 3.11, 3.12 and 3.13.

3.11 Full Time Course in Institute, College or University

- 3.11.1 A candidate of marine engineer officer certification must have completed an approved technical education and practical training in mechanical and electrical of theory and workshop skills, which may be a full time course as below:

Higher Diploma or Degree course in marine, mechanical or other related engineering.

- 3.11.2 A candidate of electro-technical officer certification must have completed an approved technical education and practical training in electrical of theory and workshop skills, which may be a full time course of Higher Diploma or Degree course in electrical, electronic or other related engineering.

3.12 Training as Engineering Craftsman

- 3.12.1 A candidate of Marine Engineer Officers or Electro-technical Officers must have satisfactorily completed an engineering craft training and approved education of relevant discipline. The training shall include mechanical and electrical workshop skills. Such engineering craft training and education may be any one of the following:

- (a) not less than 2 years apprenticeship relating to marine or electrical engineering in a workshop approved by Marine Department, plus a certificate in engineering, or a technical qualification obtained from completion of the courses as in paragraph 3.17 or equivalent; or

- (b) Vocational Training Council (VTC) registered apprenticeship in marine, mechanical, electrical or other related engineering with training period of not less than 2 years, plus a certificate in related engineering, or a technical qualification obtained from completion of the courses as in paragraph 3.17 or equivalent; or
 - (c) Full time craft course and practical training of not less than 2 years in a VTC workshop or training centre of relevant discipline.
- 3.12.2 Candidate with apprenticeship in a non-approved workshop, or craft apprenticeship in an engineering field which is not directly related to marine or electrical engineering would be assessed individually. Any deficiency in training should be made good by appropriate industrial training or workshop training.

3.13 **Training as Cadet of Marine Engineer or Electro-technical Officer**

- 3.13.1 A candidate who has completed a cadet scheme of Marine Engineer or Electro-technical Officer which is approved and monitored by the Marine Department is considered completion of the initial education and training requirement as well as the combined workshop skill training and on-board training requirement set out in paragraph 3.20.
- 3.13.2 Candidates under this scheme should have gone through the approved full time Higher Diploma or Degree course offered by the approved institution as per paragraph 3.11. Candidates who have completed this training scheme can appear for Marine Engineer class 3 or Electro-technical Officer examination directly.
- 3.13.3 Candidates who have completed this training scheme can appear for Class 3 certificate examination directly and may also be exempted from academic examination papers of the Class 2 and Class 1 certificate examination on a subject for subject basis except Engineering Knowledge subjects.

3.14 **Deficiency in Training**

- 3.14.1 Any deficiency from the practical training requirements of paragraphs 3.11, 3.12 or 3.13 will be assessed in each case by the Director and must be made good by relevant training.
- 3.14.2 Period of time spent by the candidate attending pre-sea or in-service training courses recognized by the Director may normally be accepted in full towards initial training.

3.15 **Engine Room Rating to Marine Engineer Officer or Electro-technical Officer Scheme**

- 3.15.1 Engine room rating with two years' sea service as fitter or mechanic would be accepted as completed the initial training requirement provided that they must also have completed an approved upgrading training course.

3.15.2 Electro-technical rating with two years' approved sea service would be accepted as completed the initial training requirement provided that they must also have completed an approved upgrading training course.

3.16 Testimonials

3.16.1 All candidates will be required to produce authoritative testimonials covering all their training and post training employment in the engineering industry. These testimonials should include the name of the employee concerned, the dates of commencement and termination of employment, the capacities in which the person was employed, and give a summary of the work undertaken. Testimonials must be signed by the employer or a responsible representative and will be returned to candidates when the examination is completed.

3.17 Training Courses

3.17.1 Shore based training courses would be necessary for candidates who received training as engineering craftsman, and for the upgrading of engine room ratings. They can also be used to top up the deficiency in training. These courses may be in modular form and provided by the Vocational Training Council or other recognized training institutes. Other courses similar to these modules may also be acceptable.

3.18 Overseas Education and Training

3.18.1 Education and training outside Hong Kong may be acceptable, subject to the conditions of this Part of this Chapter, and the Director being satisfied with the standard of such overseas education and training.

3.19 Workshop Skills Training

3.19.1 During the initial education and training, candidates for certificate of Class 3 Marine Engineer Officer must complete training in mechanical and electrical workshop skills which should cover the content and be assessed as detailed below:

Function: Maintenance and repair at the operational level

Competence (i): Appropriate use of hand tools, machine tools and measuring instruments for fabrication and repair on board

Content	Criteria for evaluating competence
Characteristics and limitations of materials used in construction and repair of ships and equipment.	Identification of important parameters for fabrication of typical ship related components is appropriate.
Characteristics and limitations of processes used for fabrication and repair.	Selection of material is appropriate.
Properties and parameters considered in the fabrication and repair of systems and	Fabrication is to designated tolerances.

<p>components.</p> <p>Methods for carrying out safe emergency/temporary repairs.</p> <p>Safety measures to be taken to ensure a safe working environment and for using hand tools, machine tools and measuring instruments.</p> <p>Use of hand tools, machine tools and measuring instruments.</p> <p>Use of various types of sealants and packings.</p>	<p>Use of equipment, hand tools and machine tools and measuring instruments is appropriate and safe.</p>
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Competence (ii): Maintenance and repair of shipboard machinery and equipment

Content	Criteria for evaluating competence
<p>Safety measures to be taken for repair and maintenance, including the safe isolation of shipboard machinery and equipment required before personnel are permitted to work on such machinery or equipment.</p> <p>Appropriate basic mechanical knowledge and skills.</p> <p>Maintenance and repair, such as dismantling, adjustment and reassembling of machinery and equipment.</p> <p>The use of appropriate specialized tools and measuring instruments.</p> <p>Design characteristics and selection of materials in construction of equipment.</p> <p>Interpretation of machinery drawings and handbooks.</p> <p>The interpretation of piping, hydraulic and pneumatic diagrams.</p>	<p>Safety procedures followed are appropriate.</p> <p>Selection of tools and spare gears is appropriate.</p> <p>Dismantling, inspecting, repairing and reassembling equipment is in accordance with manuals and good practices.</p> <p>Re-commissioning and performance testing is in accordance with manuals and good practices.</p> <p>Selection of materials and parts is appropriate.</p>

Competence (iii): Maintenance and repair of electrical and electronic equipment

Content	Criteria for evaluating competence
<p>Safety requirements for working on shipboard electrical systems, including the safe isolation of electrical equipment required before personnel are permitted to work on such equipment.</p>	<p>Safety measures for working are appropriate.</p> <p>Selection and use of hand tools, measuring instruments, and testing equipment are appropriate and interpretation of results is</p>

<p>Maintenance and repair of electrical system equipment, switchboards, electric motors, generator and DC electrical systems and equipment.</p> <p>Detection of electric malfunction, location of faults and measures to prevent damage.</p> <p>Construction and operation of electrical testing and measuring equipment.</p> <p>Function and performance tests of the following equipment and their configuration:</p> <ul style="list-style-type: none"> i) monitoring systems ii) automatic control devices iii) protective devices <p>The interpretation of electrical and simple electronic diagrams.</p>	<p>accurate.</p> <p>Dismantling, inspecting, repairing and reassembling equipment are in accordance with manuals and good practice.</p> <p>Reassembling and performance testing in accordance with manuals and good practice.</p>
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3.19.2 During the initial education and training, candidates for Electro-technical Officer certificate must complete training in mechanical and electrical workshop skills which should cover the content and be assessed as detailed below:

Function: Maintenance and repair at the operational level

Competence (i): Maintenance and repair of electrical and electronic equipment

Content	Criteria for evaluating competence
<p>Safety requirements for working on shipboard electrical systems, including the safe isolation of electrical equipment required before personnel are permitted to work on such equipment.</p> <p>Maintenance and repair of electrical system equipment, switchboards, electric motors, generator and DC electrical systems and equipment.</p> <p>Detection of electric malfunction, location of faults and measures to prevent damage.</p> <p>Construction and operation of electrical testing and measuring equipment.</p> <p>Function and performance tests of the following equipment and their configuration:</p> <ul style="list-style-type: none"> i) monitoring systems ii) automatic control devices iii) protective devices 	<p>Safety measures for working are appropriate.</p> <p>Selection and use of hand tools, measuring instruments, and testing equipment are appropriate and interpretation of results is accurate.</p> <p>Dismantling, inspecting, repairing and reassembling equipment are in accordance with manuals and good practice.</p> <p>Reassembling and performance testing is in accordance with manuals and good practice.</p>

The interpretation of electrical and electronic diagrams.	
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Competence (ii): Maintenance and repair of:

- a) **automation and control systems of main propulsion and auxiliary machinery;**
- b) **bridge navigation equipment and ship communication systems;**
- c) **electrical, electronic and control systems of deck machinery and cargo-handling equipment; and**
- d) **control and safety systems of hotel equipment.**

Content	Criteria for evaluating competence
<p>Appropriate electrical and mechanical knowledge and skills.</p> <p><i>Safety and emergency procedures:</i></p> <p>Safe isolation of equipment and associated systems required before personnel are permitted to work on such plant or equipment.</p> <p>Practical knowledge for the testing, maintenance, fault finding and repair.</p> <p>Test, detect faults and maintain and restore electrical and electronic control equipment to operating condition.</p> <p>Knowledge of the principles and maintenance procedures of navigation equipment, internal and external communication systems.</p> <p><i>Theoretical knowledge:</i></p> <p>Electrical and electronic systems operating in flammable areas.</p> <p><i>Practical knowledge:</i></p> <p>Carrying out safe maintenance and repair procedures.</p> <p>Detection of machinery malfunction, location of faults and action to prevent damage.</p>	<p>The effect of malfunctions on associated plant and systems is accurately identified, ship's technical drawings are correctly interpreted, measuring and calibrating instruments are correctly used and actions taken are justified.</p> <p>Isolation, dismantling and reassembly of plant and equipment are in accordance with manufacturer's safety guidelines and shipboard instructions and legislative and safety specifications. Action taken leads to the restoration of the followings by the method most suitable and appropriate to the prevailing circumstances and conditions.</p>

PART III

QUALIFYING SEA SERVICE AND WORKSHOP SKILL TRAINING

3.20 **Class 3 Marine Engineer Officer Certificate**

3.20.1 To qualify for the issue of a Class 3 marine engineer officer certificate of competency, a candidate shall have completed combined workshop skill training and an approved seagoing service of not less than 12 months as part of an approved training programme and is documented in an approved training record book. The minimum approved seagoing service of various types of certificates are as follows:

- (a) Motor Certificate, six months, during which the on-board training must have been carried out on the main propelling and auxiliary machinery in motor ships.
- (b) Steam Certificate, six months, during which the on-board training must have been carried out on boiler, main propelling and auxiliary machinery in steam ships.
- (c) Combined Certificate, eight months, during which the on-board training programme must have been carried out for at least four months on the main propelling and auxiliary machinery in motor ships and at least four months on the boilers, main propelling and auxiliary machinery in steam ships.

3.21 **Class 2 Marine Engineer Officer Certificate**

3.21.1 To qualify for the issue of a Class 2 marine engineer officer certificate of competency, a candidate must have obtained a Class 3 marine engineer officer certificate of competency or equivalent and, have completed a period of qualifying sea service in ships of not less than 750 kW registered power as follows:

- (a) Motor Certificate, 18 months, of which at least 12 months must be in the capacity of a qualified engineer officer. Out of this 12 months' sea service, as an engineer officer at least nine months must have been spent on the main propelling machinery in motor ships. The remaining period may have been spent on the main propelling or auxiliary machinery in ships, or on day work (see Part IV of this Chapter).
- (b) Steam Certificate, 18 months, of which at least 12 months must be in the capacity of a qualified engineer officer. Out of this 12 months' sea service as an engineer officer, at least nine months must have been spent on the boilers and main propelling machinery in steam ships. The remaining period may have been spent on the main propelling or auxiliary machinery in ships, or on day work (see Part IV of this Chapter).
- (c) Combined Certificate, at least 18 months as a qualified engineer officer, of which nine months must have been spent on the main propelling machinery in motor ships and nine months must have been spent on the boilers and main propelling machinery in steam ships.

3.22 **Service Endorsement**

3.22.1 To qualify for a Service Endorsement to serve on a ship of 750 kW or more but under 3,000 kW registered power as Chief Engineer a candidate must have completed a period of qualifying sea service in ships of not less than 750 kW registered power as follows:

- (a) 12 months, whilst in possession of a Class 2 marine engineer officer certificate of competency, provided that this period together with the period of qualifying sea service actually performed before obtaining a Class 2 certificate of competency amounts to not less than 36 months. This additional service of not less than 12 months must be performed in motor ships for a Service Endorsement to a Motor Certificate and in steam ships for a Service Endorsement to a Steam Certificate.
- (b) Where a candidate is in possession of a Class 2 marine engineer officer combined certificate of competency, this additional service of not less than 12 months may be performed in either motor or steam ships.

3.23 **Class 1 Marine Engineer Officer Certificate**

3.23.1 To qualify for the issue of a Class 1 marine engineer officer certificate of competency, a candidate must have obtained a Class 2 marine engineer officer certificate of competency or equivalent, and have completed a period of qualifying sea service in ships of not less than 1,500 kW registered power as follows:

- (a) Motor Certificate, 36 months sea service, of which 12 months must be performed whilst holding a Class 2 certificate or equivalent. Out of this 12 months' sea service, at least nine months must have been spent in charge of a watch in motor ships of not less than 3,000 kW registered power.
- (b) Steam Certificate, 36 months sea service, of which 12 months must be performed whilst holding a Class 2 certificate or equivalent. Out of this 12 months' sea service, at least nine months must have been spent in charge of a watch in steam ships of not less than 3,000 kW registered power.
- (c) Combined Certificate, 36 months sea service, of which at least 18 months must be performed whilst holding a Class 2 certificate of competency or equivalent. Out of this 18 months' sea service, at least nine months must have been spent in accordance with paragraph 3.23.1(a) and at least nine months must have been spent in accordance with paragraph 3.23.1(b).

3.23.2 Service on ships of less than 3,000 kW registered power may be considered at a reduced rate at the discretion of the Director.

3.24 **Electro-technical Officer Certificate**

- 3.24.1 To qualify for the issue of an electro-technical officer certificate of competency, a candidate shall have completed not less than 12 months of combined workshop skill training and approved seagoing service of which not less than 6 months shall be seagoing service as part of an approved training programme and is documented in an approved training record book.
- 3.24.2 Have completed the initial education and training set out in Part II of this Chapter.

3.25 **Remission of Qualifying Sea Service**

- 3.25.1 Remission of qualifying sea service is granted as follows:
- (a) **Class 3** marine engineer officer certificate. A candidate who has satisfactorily completed any course of cadet training covered by paragraph 3.13.2 may be granted remission of the same length and description (motor or steam) as the sea service performed during his cadetship, provided that his "Training Record Book" has been completed to the satisfaction of the Director.
 - (b) **Motor/Steam Endorsement.** A candidate who requires a Class 3 motor/steam endorsement to a Class 1 or 2 steam/motor certificate of competency will be granted full remission.
 - (c) **Class 2 Combined** marine engineer officer certificate. A remission of three months from either of the nine months period specified in sub-paragraph 3.21.1(c) will be granted to a candidate who has spent at least six months of that period whilst holding a Class 2 certificate of competency, provided that the overall qualifying sea service is not less than 18 months.
 - (d) **Class 1 Combined** marine engineer officer certificate. A remission of three months from either of the nine months period specified in sub-paragraph 3.23.1(c) will be granted to a candidate who has spent at least six months of that period whilst holding a Class 1 certificate of competency, provided that the overall qualifying sea service is not less than 36 months.

PART IV

GENERAL PROVISIONS AS TO ELIGIBILITY

3.26 **Qualifying Sea Service and Workshop Skill Training**

- 3.26.1 Unless where otherwise specified, qualifying sea service for any certificate of competency must be performed in the engine room department on regular watch keeping duty or on day work over main propelling and auxiliary machinery on board seagoing ships.
- 3.26.2 The minimum qualified sea service for Class 3 Marine Engineer or Electro-technical Officer certificate examination is 12 months combined workshop skill training and seagoing service in engine room capacity. The qualified sea service for Class 2 and Class 1 certificate examination should be performed after completion of the initial training.
- 3.26.3 After completion of required training and sea service, a candidate may apply for assessment of sea service to check if additional training is required for the Class 3 Marine Engineer or Electro-technical Officer certificate examination.
- 3.26.4 In order to cover the following services, testimonials produced in accordance with paragraph 2.8 must carry a statement as to the number of days actually spent under way with the main propelling machinery in use:
- (a) service performed in ships where for considerable periods the main propelling machinery is not used, is reckoned as one and half times the number of days actually spent under way, but in no case it can exceed the time served under crew agreement.
 - (b) service on ships with no time under way will be accepted at half rate provided ship's generators and other auxiliaries are in use. Such service will not be accepted as counting towards the minimum required to be spent in watchkeeping on main propelling machinery.
- 3.26.5 In the case of candidates who hold Class 1 certificates of competency, either motor or steam, and who require further service for the examination leading to the issue of Class 1 combined certificates, service performed in ships of not less than 3,000 kW registered power, not in charge of a watch, but on watch or otherwise substantially concerned with main propelling machinery of the appropriate description (motor or steam), may be accepted at half rate.
- 3.26.6 Service performed in ships where the main propelling machinery operates regularly in the periodically unattended mode may be accepted at full rate.
- 3.26.7 Service which consists of work of an unusual nature, but which may be considered pertinent to the operational experience of engineer officers, may be accepted up to a maximum of nine months, either at full rate, or at some proportional rate dependent upon the nature of the work involved. Such service will not be accepted as counting towards the minimum required to be spent on the main propelling machinery. Service

is not generally acceptable if it consists of work not usually performed by engineer officers.

3.27 Service on Auxiliary Machinery

3.27.1 Watchkeeping service on auxiliary machinery may be accepted at full rate for any examination class for Marine Engineer. Such service will not be accepted as counting towards the minimum period required to be spent in watchkeeping on the main propelling machinery.

3.28 Day Work

3.28.1 Marine Engineer Officer

Engineering work carried out by engineer officer at sea, other than that performed on regular watch, may be accepted at full rate. Such service will not be accepted as counting towards the minimum period required to be spent in watchkeeping on the main propelling machinery.

3.28.2 Electro-technical Officer

Day work carried out at sea may be accepted at full rate for electro-technical officer examination.

3.29 Lake, River, Smooth or Partially Smooth Waters Service

3.29.1 Service on lakes, rivers or within smooth or partially smooth water limits may be accepted at half rate up to a maximum of half of the required qualifying sea service.

3.30 Verification of Sea Service

3.30.1 Sea service is to be verified by proper entries in both the crew agreements and the official discharges from the ships.

3.30.2 Sea service which cannot be verified by proper entries will not be accepted except upon written confirmation by (i) either a Consul or some other recognized official of the country of registry, in the case of service performed in ships that are foreign ships; (ii) some responsible person having personal knowledge of the facts to be established in the case of service performed in Hong Kong Ships.

3.31 Calculation of Service

3.31.1 Sea service as entered in official discharges and testimonials will be reckoned by the calendar month, that is, the time included between any given day in any month and the preceding day of the following month, both inclusive. The number of complete months from the commencement of the period, ascertained in this way, should be computed, after which the number of odd days should be counted. The day on which the crew agreement commences, as well as that on which it terminates, should both be

included, all leave of absence excluded and all odd days added together and reckoned at thirty days to the month.

PART V

EXAMINATIONS AND EXEMPTIONS

EXAMINATIONS

3.32 **Class 3 Marine Engineer Officer Certificate**

3.32.1 The examination for a Class 3 marine engineer officer certificate will be oral only.

3.33 **Class 2 Marine Engineer Officer Certificate**

3.33.1 The examination for Class 2 marine engineer officer certificate consists of two parts as follows:

<u>Part A (Academic Subjects)</u>	<u>Duration</u>
a) Applied Mechanics	3 hours
b) Applied Heat	3 hours
c) Electro-technology	3 hours
d) Naval Architecture	3 hours
 <u>Part B (Professional Subjects)</u>	
a) Engineering Knowledge (General)	3 hours
b) Engineering Knowledge (Motor) (for motor candidate)	3 hours
c) Engineering Knowledge (Steam) (for steam candidate)	3 hours
d) Oral examination in engineering knowledge	1 hour

3.34 **Service Endorsement**

3.34.1 The examination for a Service Endorsement to the Class 2 marine engineer officer certificate will be oral only and will be based upon the responsibilities and duties of a Chief Engineer Officer.

3.35 **Class 1 Marine Engineer Officer Certificate**

3.35.1 The examination for Class 1 marine engineer officer certificate consists of two parts as follows:

<u>Part A (Academic Subjects)</u>	<u>Duration</u>
a) Applied Mechanics	3 hours
b) Applied Heat	3 hours
c) Electro-technology	3 hours
d) Naval Architecture	3 hours

Part B (Professional Subjects)

a) Engineering Knowledge (General)	3 hours
b) Engineering Knowledge (Motor) (for motor candidate)	3 hours
c) Engineering Knowledge (Steam) (for steam candidate)	3 hours
d) Oral examination in engineering knowledge	1 hour

3.36 Combined Marine Engineer Officer Certificates

3.36.1 Class 2 Combined and Class 1 Combined marine engineer officer certificate - the candidate is required to complete both the Engineering Knowledge (Motor) paper and the Engineering Knowledge (Steam) paper either in the same examination or in separate examinations. If the candidate chooses to attempt Engineering Knowledge (Motor) paper and Engineering Knowledge (Steam) paper in separate examinations, then an oral examination will be required in each of these examinations.

3.37 Electro-technical Officer Certificate

3.37.1 The examination for Electro-technical Officer certificate consists of two parts as follows:

<u>Part A (Academic Subjects)</u>	<u>Duration</u>
a) Engineering Theory for Electro-technical Officer	3 hours

Part B (Professional Subjects)

a) Engineering Knowledge for Electro-technical Officer	3 hours
b) Oral examination in engineering knowledge	1 hour

3.38 **Admission to Examinations**

- 3.38.1 Candidates may present themselves for either the whole, or any part, of Part A of the Class 2, Class 1 Marine Engineer Officer or Electro-technical Officer examination, at any time after completing the initial education and training required in Part II of this Chapter.
- 3.38.2 Candidates applying for Marine Engineer Officer Class 3, Class 2 Part B examination, Class 1 Part B examination or Electro-technical Officer Part B examination, must have completed the requisite qualifying sea service in addition to the initial education and training. Candidate for a Steam Certificate will not be examined on the Motor paper and candidate for a Motor Certificate will not be examined on the Steam paper.
- 3.38.3 There is no restriction on the number of subjects for a candidate to attempt in either Part A or Part B of the examination. A candidate who has passed any subject in Part A of the examination will not be required to resit that subject again in a subsequent attempt.
- 3.38.4 Candidates must pass the written part of the Engineering Knowledge examination and the oral part of the examination, for a particular type or class of certificate, within a two years period to retain the validity of a pass in either part.
- 3.38.5 Candidates may opt for Class 1 or Class 2 level for the written part of their Class 2 Marine Engineer Officer certificate examination. Candidates who opt for Class 1 level in their Class 2 Marine Engineer Officer written examination will have their examination results recorded in the Examination Result Form and a Class 2 Marine Engineer Officer certificate will be issued upon passing of the examination and meeting other conditions as specified under paragraph 3.3. Such candidates will not be required to resit those written subjects when they next appear for their Class 1 Marine Engineer Officer certificate examination.
- 3.38.6 For a Combined Marine Engineer Officer Certificate, Class 1, Class 2 or Class 3 candidates may present themselves for the remaining Engineering Knowledge examination i.e. steam or motor, provided they already hold either motor or steam certificate of competency of the same class and have the required qualified sea service.

3.39 **Pass Marks**

- 3.39.1 Candidates will be required to obtain not less than fifty percent marks in each subject attempted in the written examinations.

EXEMPTIONS

3.40 **General**

- 3.40.1 Candidate who has completed an approved course in Hong Kong and passed the terminal examinations leading to the award of any of the qualifications specified in

paragraph 3.41 and to the standard required by the Director, may be granted exemptions from the written examinations on a subject for subject basis except Engineering Knowledge.

3.41 **Exemption from Written Examinations**

3.41.1 The following qualifications may afford exemption in Class 2 marine engineer officer certificate examination:

- (a) Ordinary Certificate in marine, mechanical or other related engineering;
- (b) Ordinary Diploma in marine, mechanical or other related engineering;
- (c) Higher Certificate in marine, mechanical or other related engineering;
- (d) Higher Diploma in marine, mechanical or other related engineering;
- (e) Degree in marine or mechanical or other related engineering; and
- (f) Any other engineering qualifications recognized by the Director.

3.41.2 The following qualifications may afford exemption in Class 1 marine engineer officer certificate examination:

- (a) Higher Certificate in marine, mechanical or other related engineering;
- (b) Higher Diploma in marine, mechanical or other related engineering;
- (c) Degree in marine or mechanical or other related engineering; and
- (d) Any other engineering qualifications recognized by the Director.

3.41.3 The following qualifications may afford exemption in electro-technical officer certificate examination:

- (a) Ordinary Certificate in electrical or other related engineering;
- (b) Ordinary Diploma in electrical or other related engineering;
- (c) Higher Certificate in electrical or other related engineering;
- (d) Higher Diploma in electrical or other related engineering;
- (e) Degree in electrical or other related engineering; and
- (f) Any other engineering qualifications recognized by the Director.

PART VI

ENDORSEMENTS AND CERTIFICATES OF PROFICIENCY FOR DANGEROUS CARGO OPERATION

- 3.42 The types of dangerous cargo endorsement and certificate of proficiency are as follows:
- a) Oil Tanker;
 - b) Chemical Tanker;
 - c) Liquefied Gas Tanker.
- 3.43 Engineer officers and electro-technical officers on the various types of tanker are required to hold certificates of competency or licences that carry basic dangerous cargo endorsement(s) or certificates of proficiency for dangerous cargo operation.
- 3.44 Chief engineer, second engineer, and any other person having an immediate responsibility for the loading, discharging, care in transit, handling of cargo, tank cleaning or other cargo-related operations on the various types of tanker are required to hold certificates of competency or licences that carry advanced dangerous cargo endorsement(s) or certificates of proficiency for dangerous cargo operation.
- 3.45 All applicants of the dangerous cargo endorsement or certificate of proficiency shall hold a certificate in basic training in accordance with provisions of section A-VI/1 of the STCW Code.
- 3.46 To qualify for the issue of a basic dangerous cargo endorsement or certificate of proficiency, applicants should have to complete, within the five years before the date of application, an approved basic training course for the carriage of the relevant dangerous cargo or have an approved seagoing service on board an appropriate type tanker for at least three months and meet the applicable standard of competence specified in section A-V/1-1 or A-V/1-2 of the STCW Code;
- 3.47 To qualify for the issue of an advanced dangerous cargo endorsement or certificate of proficiency, applicants must have met the requirements for the certification in basic dangerous cargo of the relevant type and must have to complete, within the five years before the date of application, an approved advanced training course for the carriage of the relevant dangerous cargo and a period of shipboard service or training on an appropriate type tanker with the following:
- a) at least three months of approved seagoing service on the tanker; or
 - b) at least one month of approved onboard training on the tanker in a supernumerary capacity, which include at least three loading and three unloading operations and is documented in an approved training record book taking into account guidance in section B-V/1 of STCW Code.

- 3.48 All applicants for dangerous cargo endorsements and certificates of proficiency are required to produce reports from the chief engineers of the ships in which they have performed their shipboard training or shipboard service as appropriate, and/or a certificate from a training establishment attesting to satisfactory completion of the training course. A specimen form of certificate for the chief engineer report is attached at Appendix I.

Revalidation of Endorsements and Certificates of Proficiency of Dangerous Cargo Operation

- 3.49 Endorsement or certificate of proficiency for dangerous cargo operation is valid for a period of not more than 5 years from the date issued.
- 3.50 Any person who wishes to have his/her dangerous cargo endorsement or certificates of proficiency revalidated must:
- (a) produce evidence of at least 3 months service in a tanker appropriate to the tanker endorsement or certificate during the preceding 5 years, or successfully completed an approved relevant training course;
 - (b) produce a valid certificate of medical fitness which includes the results of a blood test (including a plate count); and
 - (c) pay the prescribed fee.
- 3.51 Failure to meet the requirements of paragraph 3.50 will result in the withdrawal of the dangerous cargo endorsement or certificate. A dangerous cargo endorsement or certificate which has been withdrawn will only be re-issued after the holder has either:
- (a) satisfactorily completed an approved shore based tanker safety course; or
 - (b) satisfactorily completed 3 months supervised shipboard training in the type of tanker in which he intends to serve.
- 3.52 The holder of a dangerous cargo endorsement may opt to have that endorsement revalidated concurrently with the revalidation of his certificate of competency. Such applicants must meet the requirements of paragraph 3.50 in addition to the requirements of Part VII of this Chapter. Provided the necessary criteria are met the endorsement will be revalidated for a period of not more than 5 years concurrent with the validity of the certificate of competency.

PART VII

REVALIDATION OF CERTIFICATES

Introduction

- 3.53 All seagoing classes of certificates of competency will fall due for revalidation on the expiry date stated on the certificate. Once a certificate has been revalidated it will thereafter fall due for further revalidation upon expiry of the extended validity.

Conditions to be satisfied for revalidation

- 3.54 A certificate holder who wishes to revalidate his certificate must pay the prescribed fee and must:

- (a) meet the medical fitness requirements by producing a valid certificate of medical fitness signed by an approved medical practitioner;
- (b)
 - (i) have served as an engineer officer or electro-technical officer as appropriate to his/her certificate in any seagoing ship, other than a pleasure craft or a fishing vessel, for at least:
 - (α) 12 months during the preceding 5 years; or
 - (β) 3 months during the preceding 6 months immediately prior to revalidating; or
 - (ii) have satisfactorily completed an approved shore based updating course; or
 - (iii) have completed not less than 3 months sea service on ships in a supernumerary capacity or in a lower officer rank than that for which the certificate held is valid immediately prior to taking up the rank for which it is valid; or
 - (iv) have performed other functions relating to the duties which ensure an adequate updating of marine engineering knowledge. A list of appropriate functions is contained in paragraph 3.55; and
- (c) have completed a refreshment course or passed an assessment on basic training, survival craft and rescue boats, and advanced fire fighting.

- 3.55 Applications for revalidation of certificates may be made by holders who have been engaged in the following duties for at least half of the preceding 5 years period:

- (a) Marine Engineer Officer.

Marine Surveyors (including Marine Department Surveyors, Examiners, Shipping Safety Officers and Ship Inspectors).

Marine Engineering Superintendents.

Marine Engineering Lecturers.

(b) Electro-technical Officer.

Electrical Engineers.

Electrical Superintendents.

Electrical Engineering Lecturers.

3.56 The list of alternative occupations in paragraph 3.55 is not exhaustive and application for revalidation from certificate holders who have been engaged in other activities will be considered by the Director on their merits.

3.57 Certificate holders who also have a dangerous cargo endorsement to their certificates and who wish their dangerous cargo endorsement to be revalidated at the same time as their certificates must, in addition to the basic requirements outlined in paragraph 3.50, satisfy the requirements for revalidation of a dangerous cargo endorsement, outlined in Part VI of this Chapter.

3.58 Additional information concerning the procedure for revalidation may be obtained from the Seafarers' Certification Section.

3.59 Applications for revalidation from certificate holders abroad may be made by post to the Seafarers' Certification Section.

CHAPTER 4

RIVER TRADE CERTIFICATES

PART I

CLASSES OF CERTIFICATES

4.1 Class 3 Marine Engineer Officer Certificate (River Trade)

4.1.1 To qualify for the issue of a Class 3 marine engineer officer certificate (river trade) a candidate must:

- (a) be of not less than 18 years of age;
- (b) have received basic education to the standard of Form 3 or equivalent;
- (c)
 - (i) have at least two years of acceptable technical education and practical training of suitable quality standard, which are relevant to the duties of a marine engineer, and qualifying sea service as an assistant engineer of at least six months; or
 - (ii) have served at least 2½ years as oiler or assistant fitter in a seagoing ship; or
 - (iii) hold a Local Certificate of Competency as engineer for machinery over 150 BHP or an equivalent local certificate of competency.
- (d) have completed an approved Advanced Fire-Fighting course or equivalent;
- (e) have completed and passed the assessment of an approved Medical First Aid or First Aid At Sea course or equivalent;
- (f) have completed an approved Proficiency in Survival Craft and Rescue Boats or Survival At Sea course or equivalent; and
- (g) pass the examination set out in Chapter 6.

4.2 Class 2 Marine Engineer Officer Certificate (River Trade)

4.2.1 To qualify for the issue of a Class 2 marine engineer officer certificate (river trade) a candidate must:

- (a) hold a Certificate of Competency (Marine Engineer Officer)(River Trade) Class 3 or a Certificate of Competency (Marine Engineer Officer) Class 3, or an equivalent certificate;

- (b) complete a period of qualifying service of at least 12 months as a watchkeeping officer in a vessel powered by engines of over 750 kW; and
- (c) pass the examination set out in Chapter 6.

4.3 **Class 1 Marine Engineer Officer Certificate (River Trade)**

4.3.1 To qualify for the issue of a Class 1 marine engineer officer certificate (river trade) a candidate must:

- (a)
 - (i) complete a period of qualifying service of at least 12 months as a watchkeeping officer in a vessel powered by engines of over 3,000 kW whilst holding a Certificate of Competency (Marine Engineer Officer)(River Trade) Class 2; or
 - (ii) complete a period of qualifying service of at least 24 months as a watchkeeping officer in a vessel powered by engines over 750 kW but less than 3,000 kW whilst holding a Certificate of Competency (Marine Engineer Officer)(River Trade) Class 2; or
 - (iii) complete pro rata qualifying service in accordance with (i) and (ii) above; and
- (b) pass the examination set out in Chapter 6.

PART II

GENERAL REQUIREMENTS

4.4 Qualifying Service

4.4.1 Qualifying service, unless otherwise specified, must be served on vessels with engines of over 120 kW excluding fishing vessels and pleasure craft.

4.4.2 Qualifying service will be reckoned from the date of engagement to the date of discharge from a ship under crew agreement. When there are no articles of agreement, the total time during which the candidate has been employed on a vessel will be accepted. Qualifying service must be attested/certified by the Engineer Superintendent or other representative of the Owners.

4.4.3 When a part or whole of the qualifying service for Class 1 or 2 marine engineer officer (river trade) certificate has been performed in seagoing ships, such service will be accepted at twice the rate applicable to river trade ships.

4.5 Endorsements

4.5.1 Suitable endorsement examinations will be conducted for the operation of a steam vessel. Syllabuses will be developed for these endorsements in the event of a vessel so equipped being engaged in the river trade service.

4.6 Certificates of Competency (Marine Engineer Officer)

4.6.1 Any reference to a Certificate of Competency (Marine Engineer Officer) of any class in this Chapter relates to a certificate for a motor ship, ship being propelled by internal combustion engines or gas turbines.

4.7 Exemption for Class 2 and Class 1 Marine Engineer Officer Examinations

4.7.1 The Director may grant exemption from the river trade examinations on a subject for subject basis to candidates who have completed recognized engineering courses.

PART III

REVALIDATION OF CERTIFICATES

Introduction

- 4.8 All river trade classes of certificates of competency will fall due for revalidation on the expiry date stated on the certificate. Once a certificate has been revalidated it will thereafter fall due for further revalidation upon expiry of the extended validity.

Conditions to be satisfied for revalidation

- 4.9 A certificate holder who wishes to revalidate his certificate must pay the prescribed fee and must:
- (a) meet the medical fitness requirements by producing a valid certificate of medical fitness signed by an approved medical practitioner;
 - (b)
 - (i) have served as an engineer officer in any river trade ship, other than a pleasure craft or a fishing vessel, for at least 12 months during the preceding 5 years; or
 - (ii) have satisfactorily completed an approved shore based updating course; or
 - (iii) have completed not less than 3 months sea service on ships having a registered power of 350 kW or more in a supernumerary capacity or in lower ranks than that for which the certificate held is valid immediately prior to taking up the rank for which it is valid; or
 - (iv) have performed, for at least half of the preceding 5 years period, other functions relating to the duties which ensure an adequate updating of marine engineering knowledge. The duties may be as a marine engineering superintendent. Application for revalidation from certificate holders who have been engaged in other activities will be considered by the Director on its merits; and
 - (c) have completed an approved refreshment course or passed an assessment on basic training, survival craft and rescue boats, and advanced fire fighting.
- 4.10 Additional information concerning the procedure for revalidation may be obtained from the Seafarers' Certification Section.

CHAPTER 5

SEAGOING CERTIFICATES

EXAMINATION SYLLABUSES

PART I

CLASS 3 MARINE ENGINEER OFFICER CERTIFICATE

5.1 Examination

Oral examination on () Approximately
Engineering Knowledge) one hour.

5.2 Engineering Knowledge

In the oral examination, the candidate is required to demonstrate he has the ability to undertake, at the operational level, the tasks, duties and responsibility of a marine engineer officer in charge of an engineering watch which involve the following functions and competencies:

Function 1: Marine engineering at the operational level

Competence (i): Maintain a safe engineering watch

Content of examination	Criteria for satisfactory examination
<p><u>Principles in keeping an engineering watch</u></p> <p>i. Duties associated with taking over and accepting a watch.</p> <p>ii. Routine duties undertaken during a watch.</p> <p>iii. Maintenance of the machinery space log book and the significance of the readings taken.</p> <p>iv. Duties associated with handing over a watch.</p> <p><u>Safety and emergency procedures</u></p> <p>Safety and emergency procedure, changeover of remote/automatic to local control of all systems.</p>	<p>Understanding the principles and procedures in conducting, handover and relief of watch at sea and in port. Understanding the special watchkeeping precautions to be taken under different conditions and in different sea states. Understanding the proper record to be maintained for the movements and activities relating to the ship's engineering systems.</p> <p>Understanding the procedures to isolate, bypass and take emergency control of machinery.</p>

<p><u>Safety precautions</u> Safety precautions to be observed during a watch and immediate actions to be taken in the event of fire or accident with particular reference to oil systems.</p> <p><u>Engine-room resource management</u></p> <ul style="list-style-type: none"> i. Allocation, assignment and prioritization of resource. ii. Effective communication. iii. Assertiveness and leadership. iv. Obtaining and maintaining situational awareness. v. Consideration of team experience. 	<p>Understanding the action that would be necessary in case of accident involving oil systems and damages resulting from equipment breakdown, fire, flooding, rupture, collision or other causes in order to contain the effects.</p> <p>Understanding the principles and procedures in allocating and assigning of resources as need in correct priority to perform necessary task.</p> <p>Understanding of importance of clear and unambiguous communication.</p> <p>Understanding of questionable decisions and/or actions result in appropriate challenge and response.</p> <p>Understanding how effective leadership behaviours are identified.</p> <p>Understanding how team members share accurate understanding of current and predicted engine-room and associate systems state, and of external environment.</p>
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Competence (ii): Use English in oral form

<u>Content of examination</u>	<u>Criteria for satisfactory examination</u>
<p><u>Knowledge of English language</u> Communication ability in English.</p>	<p>Communication in English is clear and understood.</p>

Competence (iii): Use internal communication systems

<u>Content of examination</u>	<u>Criteria for satisfactory examination</u>
<p><u>Internal communication systems</u> Operation of all internal communication systems on board.</p>	<p>Adequate knowledge on the types, system details, function and use of all internal communication equipment or arrangement for effective transmission and reception of messages.</p> <p>Proficiency in formulating communication records in a complete and accurate manner and in compliance with statutory requirements.</p>

Competence (iv): Operate main and auxiliary machinery and associated control systems

Content of examination	Criteria for satisfactory examination
<p><u>Motor (for motor candidates only)</u></p> <p><u>Main and auxiliary machinery</u></p> <p>i. Basic construction and operation principles of machinery systems of a motor ship.</p> <p>ii. Safety and emergency procedures for operations of propulsion plant machinery, including control system.</p> <p>iii. Preparation of main diesel propulsion machinery and preparation of auxiliary machinery for operation.</p> <p>iv. Operation of auxiliary boiler including combustion systems, and water treatment.</p> <p>v. Method of checking water level in boiler and action necessary if water level is abnormal.</p> <p>vi. Fuel and lubricating oil systems for marine diesel plant. Properties and treatment of oils.</p> <p>vii. Scavenge fire and crankcase explosion.</p> <p>viii. Location of common faults in diesel propulsion machinery and auxiliary machinery in engine room, boiler room and steering gear room and action necessary to prevent damage.</p>	<p>Construction and operating mechanisms can be understood and explained.</p> <p>Proficiency in planning and carrying out operations for preparation of main and auxiliary machinery in accordance with established rules and procedures to ensure safety of operations and avoid pollution of the marine environment.</p> <p>Proficiency in identification of deviations from norm.</p> <p>Proficiency in keeping output of plant and engineering systems to meet requirements including bridge orders relating to changes in speed and direction.</p> <p>Understanding properties, handling and treatment of fuel and lubricating oils.</p> <p>Understanding the causes, remedial action and prevention of scavenge fire and crankcase explosion.</p> <p>Proficiency in identifying the causes of malfunction and actions to ensure the overall safety of the ship and the plant having regard to the prevailing circumstances and conditions.</p>
<p><u>Steam (for steam candidates only)</u></p> <p><u>Main and auxiliary machinery</u></p> <p>i. Basic construction and operation principles of machinery systems of a steam ship.</p> <p>ii. Safety and emergency procedures for operations of propulsion plant machinery, including control system.</p> <p>iii. Preparation of main steam propulsion</p>	<p>Construction and operating mechanisms can be understood and explained.</p> <p>Proficiency in planning and carrying out operations for preparation of main and auxiliary machinery in accordance with established rules and procedures to ensure safety of operations and avoid pollution of the marine environment.</p>

<p>machinery, boilers and preparation of auxiliary machinery for operation.</p> <p>iv. Construction and operation of auxiliary boiler including combustion systems.</p> <p>v. Methods of checking water level in boilers and action necessary if water level is abnormal.</p> <p>vi. Boiler water, tests and treatment.</p> <p>vii. Fuel and lubricating oil systems for marine steam propulsion plant. Properties and treatment of oils.</p> <p>viii. Location of common faults in marine steam propulsion machinery and auxiliary machinery in engine room, boiler room and steering gear room and action necessary to prevent damage.</p>	<p>Proficiency in identification of deviations from norm.</p> <p>Proficiency in keeping output of plant and engineering systems to meet requirements including bridge orders relating to changes in speed and direction.</p> <p>Understanding properties, handling and treatment of fuel and lubricating oils.</p> <p>Proficiency in identification the causes of malfunction and actions to ensure the overall safety of the ship and the plant having regard to the prevailing circumstances and conditions.</p>
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Competence (v): Operate fuel, lubrication, ballast and other pumping systems and associated control systems

Content of examination	Criteria for satisfactory examination
<p><u>Operational characteristics of pumps and piping systems, including control systems</u></p> <p>i. Routine pumping operations.</p> <p>ii. Operation of bilge, ballast and cargo pumping systems.</p> <p><u>Oily-water separators (or similar equipment)</u> The requirements and operation of oily-water separators or similar equipment.</p>	<p>Proficiency in planning and carrying out pumping operations in accordance with operating manuals, established rules and procedures to ensure safety of operations and avoid pollution of marine environment.</p> <p>Deviations from the norm are promptly identified and appropriate action is taken.</p>

Function 2: Maintenance and repair at the operational level

Competence: Maintain marine engineering systems including control systems

Content of examination	Criteria for satisfactory examination
<p><u>Marine systems</u> Basic mechanical knowledge and skills of marine systems.</p>	<p>Understanding basic knowledge and skills of engineering systems including control systems.</p>

<p><u>Safety and emergency procedures</u> Safe isolation of electrical and all plant and equipment before personnel are permitted to</p>	<p>Proficiency in isolation, dismantling and re-assembly of plant and equipment in</p>
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work on such plant or equipment. <u>Maintenance and repair</u> Maintenance and repair to main propulsion plant, auxiliary machinery including auxiliary boiler, steering gear, deck machinery and survival equipment.	accordance with accepted practices and procedures. Understanding actions to restore plant and equipment by methods most suitable and appropriate to the prevailing circumstances and conditions.
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Function 3: Electrical, electronic and control engineering at the operational level

Competence: Operate electrical, electronic and control system

Content of examination	Criteria for satisfactory examination
<p><u>Basic configuration and operation principles of the following electrical, electronic and control equipment:</u></p> <p>i. electrical equipment:</p> <ul style="list-style-type: none"> a) generator and distribution systems b) preparing, starting, paralleling and changing over generators c) electrical motors including starting methodologies d) high-voltage installations e) sequential control circuits and associated system devices <p>ii. electronic equipment:</p> <ul style="list-style-type: none"> a) characteristics of basic electronic circuit elements b) flowchart for automatic and control systems c) functions, characteristics and features of control systems for machinery items, including main propulsion plant operation control and steam boiler automatic controls <p>iii. control systems:</p> <ul style="list-style-type: none"> a) various automatic control methodologies and characteristics b) Proportional-Integral-Derivative (PID) control characteristics and associated system devices for process control 	<p>Operations are planned and carried out in accordance with operating manuals, established rules and procedures to ensure safety of operations.</p> <p>Electrical, electronic and control systems can be understood and explained with drawings/instructions.</p>

Function 4: Controlling the operation of the ship and care for persons on board at the operational level

Competence (i): Ensure compliance with pollution prevention requirements

Content of examination	Criteria for satisfactory examination
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<u>Prevention of pollution of the marine environment</u>	
<ul style="list-style-type: none"> i. Knowledge of the precautions to be taken to prevent pollution of the marine environment. ii. Anti-pollution procedures and all associated equipment. iii. Importance of proactive measures to protect the marine environment. 	<p>Procedures for monitoring shipboard operations and ensuring compliance with MARPOL requirements are fully observed. Actions to ensure that a positive environmental reputation is maintained.</p>

Competence (ii): Maintain seaworthiness of the ship

Content of examination	Criteria for satisfactory examination
<p><u>Ship stability</u></p> <ul style="list-style-type: none"> i. Working knowledge and application of stability, trim and stress tables, diagrams and; ii. Stress-calculating equipment. iii. Understanding of the fundamentals of watertight integrity. iv. Understanding of fundamental actions to be taken in the event of partial loss of intact buoyancy. <p><u>Ship construction</u> General knowledge of the principal structural members of a ship and the proper names for the various parts.</p>	<p>The stability conditions comply with the IMO intact stability criteria under all conditions of loading.</p> <p>Actions to ensure and maintain the watertight integrity of the ship are in accordance with accepted practice.</p>

Competence (iii): Monitor compliance with legislative requirements

Content of examination	Criteria for satisfactory examination
<p><u>IMO conventions</u> Working knowledge of the relevant IMO conventions concerning safety of life at sea and protection of marine environment.</p>	<p>A command of legislative requirements relating to safety of life at sea and protection of marine environment.</p>

Competence (iv): Prevent, control and fight fires on board

Content of examination	Criteria for satisfactory examination
<p><u>Fire prevention and fire-fighting appliances</u></p> <ul style="list-style-type: none"> i. Ability to organize fire drills. ii. Knowledge of classes and chemistry of fire. 	<p>The type and scale of the problem is promptly identified and initial actions conform with the emergency procedure and contingency plans for the ship.</p> <p>Evacuation, emergency shutdown and</p>

<p>iii. Knowledge of fire-fighting systems.</p> <p>iv. Action to be taken in the event of fire, including fires involving oil systems.</p>	<p>isolation procedures are appropriate to the nature of the emergency and are implemented promptly.</p> <p>The order of priority, and the levels and time-scales of making reports and informing personnel on board, are relevant to the nature of the emergency and reflect the urgency of the problem.</p>
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Competence (v): Application of leadership and teamworking skills

Content of examination	Criteria for satisfactory examination
<p><u>Working knowledge of shipboard personnel management and training</u></p> <p>i. A knowledge of related international maritime conventions and recommendations, and national legislation.</p> <p>ii. Ability to apply task and workload management, including:</p> <p>a) planning and co-ordination</p> <p>b) personnel assignment</p> <p>c) time and resource constraints</p> <p>d) prioritization</p> <p>iii. Knowledge and ability to apply effective resource management:</p> <p>a) allocation, assignment, and prioritization of resources</p> <p>b) effective communication on board and ashore</p> <p>c) decisions reflect consideration of team experiences</p> <p>d) assertiveness and leadership, including motivation</p> <p>e) obtaining and maintaining situational awareness</p> <p>iv. Knowledge and ability to apply decision-making techniques:</p> <p>a) situation and risk assessment</p> <p>b) identify and consider generated options</p> <p>c) selecting course of action</p> <p>d) evaluation of outcome effectiveness.</p>	<p>The crew are allocated duties and informed of expected standards of work and behaviour in a manner appropriate to the individuals concerned.</p> <p>Training objectives and activities are based on assessment of current competence and capabilities and operational requirements.</p> <p>Operations are demonstrated to be in accordance with applicable rules.</p> <p>Operations are planned and resources are allocated as needed in correct priority to perform necessary tasks.</p> <p>Communication is clearly and unambiguously given and received.</p> <p>Effective leadership behaviours are demonstrated.</p> <p>Necessary team member(s) share accurate understanding of current and predicted vessel and operational status and external environment.</p> <p>Decisions are most effective for the situation.</p>

PART II

CLASS 2 MARINE ENGINEER OFFICER CERTIFICATE

The syllabuses for the written examination papers of Class 2 marine engineer officer certificate are listed in the following paragraph 5.3 to 5.9 of this Part.

5.3 Applied Mechanics

Function: Marine engineering at the management level

Competence: Plan and schedule operations

Criteria for satisfactory examination:

Adequate knowledge on statics, mechanics of solids, kinematics, kinetics, fluid mechanics and, control theory and its applications to design engineering components and machines and engineering processes. Understanding the design parameters on mechanics and hydromechanics for power installation to suit the planning and preparation of operations.

Statics

Force as a vector. Triangle and polygon of forces. Resultant and equilibrium of a system of concurrent coplanar forces. Equilibrium of three coplanar forces. Moment of a force. Couples. Moments of areas and volumes. Centroids and centres of gravity (limited to geometrical shapes). Conditions of equilibrium of solids. Necessary force applied parallel to an inclined plane to pull body up or down the plane or to hold it stationary (including effect of friction). Work done at uniform speed up the plane.

Friction

Coefficient of friction. Friction angle. Energy and power lost due to friction in simple bearings.

Kinematics

Linear motion. Graphs and equation for displacement, speed, velocity and uniform acceleration. Velocity as a vector. Relative velocities in one plane only. Angular motion. Equations for displacement, velocity and uniform acceleration.

Dynamics

Work and power. Problems with constant force or force with linear variation. Energy. Potential energy. Kinetic energy of translation. Newton's laws of motion. Conservation of momentum. Centrifugal force and its application to conical pendulum, unloaded governor, curved tracks and machine parts. Stress in thin rim due to centrifugal action.

Machines

Simple lifting machine. Graphs of load-effort and load-efficiency. Velocity ratio, mechanical advantage and efficiency of the following machines: wheel and axle, differential wheel and

axle, rope pulley blocks, differential pulley blocks, screw jack, Warwick screw, hydraulic jack, worm-driven chain blocks and single and double purchase crab winches. Reduction gearing.

Strength of Material

Direct stress and strain. Modulus of elasticity. Shear stress and strain. Modulus of rigidity. Factor of safety. Stress due to restricted expansion or contraction on single member. Stress due to bending on beams. Shearing force and bending moment diagrams for cantilevers and simply supported beams with concentrated or uniformly distributed loads. Stress due to torsion. Strength and stiffness of solid or hollow shafts. Power transmitted by shafts and coupling bolts. Circumferential and longitudinal stress in thin cylindrical shells subject to internal pressure.

Hydrostatics

Equilibrium of floating bodies. Variation of fluid pressure with depth. Total force due to liquid pressure on immersed plane surfaces horizontal or vertical. Centre of pressure on a rectangular vertical plane surface or triangular plane surface, both with one edge parallel to the surface of the liquid.

Hydraulics

Full bore flow of liquid through pipes under constant head. Flow through orifice. Coefficients of velocity, contraction of area and discharge.

5.4 Applied Heat

Function: Marine engineering at the management level

Competence: Plan and schedule operations

Criteria for satisfactory examination:

Understanding the basic concepts of thermodynamics and its application to design and engineering processes. Understanding the design parameters on thermodynamics and heat transmission for power installation to suit the planning and preparation of operations.
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Heat and Energy

Temperature and its measurement. Absolute temperature. Specific heat capacity. Specific enthalpy of evaporation and fusion. Problems involving changes of phase. Linear, superficial and volumetric expansion due to temperature changes. Coefficients and the relationship between them.

Basic Thermodynamic Principles

Properties, energy, the First Law of Thermodynamics, flow and non-flow processes.

Heat Transfer

Qualitative treatment of heat transfer by conduction, convection and radiation. Laws of conduction and thermal conductance and applications to problems.

Gas Laws

Boyle's and Charles' laws for perfect gases. Characteristic equation. Constant R and its use in simple problems. Isothermal, adiabatic and polytropic processes. Relationships between pressure, temperature and volume. Work done. Change in internal energy. Specific heat C_p and C_v , and the relationship between them.

Ideal Gas Cycles

Constant volume cycle. Diesel cycle. Dual cycle. Air standard efficiency.

I.C. Engines

Elementary principles and cycles of operation. Actual indicator diagrams. Mean effective pressure. Work done, power developed, indicated and brake thermal efficiencies, mechanical efficiency, overall efficiency. Fuel consumption. Heat balance.

Air Compressors

Elementary principles and cycles of operation. Calculation of work done for single stage compressor. Indicator diagrams.

Properties of Steam

Saturated steam, dry, wet. Dryness fraction. Superheated steam. Internal energy. Enthalpy. Specific volume. Steam tables. Throttling. Separating and throttling calorimeters.

Steam Plant

Advantages of using steam. Thermal, mechanical and overall efficiencies of prime movers. Boiler efficiency, heat balance for engine and boiler trials. Change in dissolved solids in boilers and evaporators due to contaminated feed and effect of blowing down. Elementary principles of steam turbines including simple velocity diagrams for impulse and reaction turbines. Force and work done on blades.

Combustion

Solid and liquid fuels. Calorific value. Chemical equations for complete combustion. Theoretical minimum air required. Excess air.

Refrigeration

Vapour-compression cycle. Refrigerating effect. Cooling load. Use of tables of properties of refrigerants. Coefficient of performance.

5.5 Electrotechnology

Function: Electrical, electronic and control engineering at the management level

Competence: Operate electrical and electronic control equipment

Criteria for satisfactory examination:

Understanding the basic electrical and electronic principles for the design, operation, maintenance and control of electrical machines and power electronic systems.

Electrical Circuit

Units-ampere, ohm, volt. Difference between electromotive force and potential difference. Ohm's Law. Kirchoff's Laws. Simple series and parallel circuits involving e.m.f., 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. D.C. 2-wire distribution system. Types of insulation. Wheatstone network bridge, slide wire bridge; applications to steering gears, resistance pyrometers, strain gauges, etc. Electrolytic action and secondary cells. Theory of electrolytic dissociation applied to common solutions. Use of electrolysis. Secondary cells (acid or alkaline) construction and principles, maintenance, charging, Watt-hour and ampere-hour efficiencies.

Electromagnetism, Electromagnetic Induction and Simple Magnetic Circuit

Simple magnetic theory. Magnetic field. Lines of force. Field strength. Field 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 e.m.f.. Force 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 μ/B curves.

Electronics

Qualitative treatment of: atomic structure and bonding, semi-conductors, junction diodes, junction transistors and their operating characteristics. Simple transistor circuits. Conduction in gases, semi-conductors and conductors. Photo-electric effect.

Alternating Current Theory

Simple continuous periodic waves: frequency, amplitude, instantaneous, maximum, r.m.s. and average values, form factor. Phasor representation of a.c. 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 a.c. circuit.

Instruments

Qualitative treatment of the principles and functions of a.c. and d.c. indicating instruments and relays. Uses of shunts and series resistances to increase the range. Rectifiers and transducers.

Distribution Systems

Systems for a.c. and d.c. shipboard installations. Design features of high-voltage installations. Protective devices such as fuses, circuit breakers, earth lamps. Cable material and installation. Connection of shore supply.

D.C. Machines

