



سازمان بنادر و دریانوردی

دستور العمل اجرایی برگزاری دوره آموزش و آزمونهای شایستگی سمت

افسر مهندس سوم بر روی کشتی های با قدرت رانش ۷۵۰ کیلووات یا بیشتر سفرهای نامحدود

(ورودی کاروانی مکانیک دریایی)

Code of practice for conducting third engineer officer training course and competency assessment on ships of Propulsion Power $KW \geq 750$ engaged on Unlimited Voyages (With marine engine higher diploma entrance)

کد مدرک : P6-W107

شماره بازنگری	تاریخ بازنگری	شرح تغییرات (علت و محل)	تهیه کننده	تایید کننده	تصویب کننده
۰۱	۹۳/۰۶/۱۷	بر اساس بازنگری کلی کنوانسیون STCW 78, As Amended	رئیس اداره استانداردهای دریانوردان نصرت اله علی پور	مدیرکل امور دریانوردان حسین میرزایی	معاون امور دریایی سید علی استیری

صفحه: ۱ از ۱۵





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مقدمه

سازمان بنادر و دریانوردی در راستای اجرای وظایف و اختیارات قانونی ناشی از ماده ۱۹۲ قانون دریایی جمهوری اسلامی ایران مصوب شهریور ماه ۱۳۴۳ و بند ۱۰ ماده ۳ آئین نامه تشکیل سازمان بنادر و دریانوردی مصوب بهمن ماه ۱۳۴۸ کمیسیون های خاص دو مجلس که صدور هر گونه سند یا گواهینامه و پروانه مربوط به کشتی، فرماندهان، افسران و کارکنان کشتیها را در صلاحیت این سازمان قرار داده و در راستای رعایت مفاد کنوانسیون بین المللی استانداردهای آموزش، صدور گواهینامه و نگهداری دریانوردان (STCW- as amended) مصوب مرداد ماه ۱۳۷۵ مجلس شورای اسلامی ایران و با عنایت به مقرره III/1 کنوانسیون، این " دستورالعمل اجرایی برگزاری دوره آموزش با ورودی کاروانی مکانیک دریایی به افسر مهندس سوم بر روی کشتیهای با قدرت رانش ۷۵۰ کیلووات یا بیشتر سفرهای نامحدود " را تدوین نموده و پس از تصویب هیأت عامل سازمان قابل اجرا می باشد.

یادداشت: قانون تغییر نام سازمان بنادر و کشتیرانی به سازمان بنادر و دریانوردی در تاریخ ۱۳۸۷/۰۲/۱۰ به تصویب مجلس شورای اسلامی رسید.





۱- هدف از تدوین

هدف از تدوین این دستورالعمل ارائه حداقل نیازمندیهای برگزاری دوره آموزش با ورودی کاروانی مکانیک دریایی جهت حضور در آزمونهای شایستگی سمت افسر مهندس سوم بر روی کشتی های با قدرت رانش ۷۵۰ کیلووات یا بیشتر سفرهای نامحدود می باشد.

۲- دامنه کاربرد

این دستورالعمل برای کلیه مراکز آموزشی مورد تایید سازمان و مجری برگزاری دوره آموزش با ورودی کاروانی مکانیک دریایی جهت حضور در آزمونهای شایستگی مهندس سوم بر روی کشتی های با قدرت رانش ۷۵۰ کیلووات یا بیشتر سفرهای نامحدود کاربرد دارد.

۳- تعاریف

اصطلاحات استفاده شده در راستای اهداف این دستورالعمل دارای معانی ذیل می باشند.

۳-۱ تایید (Approved):

به معنای تایید اداره استانداردهای دریانوردان مطابق با دستورالعمل های سازمان می باشد.

۳-۲ گواهی خدمت دریایی (Seagoing Service Documentary Evidence):

به معنای تأییدیه خدمت دریایی دریانوردان جهت شرکت در دوره های آموزشی، آزمونهای دریانوردی و صدور گواهینامه های دریانوردی می باشد که علاوه بر ثبت در شناسنامه دریانوردی، توسط شرکت کشتیرانی / مالک کشتی و یا اتحادیه مالکان کشتیها به صورت فرم کامپیوتری (computer sheet)، نامه اداری شماره شده و یا فرم تعریف شده (به ضمیمه این دستورالعمل) قابل ارائه می باشد.

۳-۳ گواهینامه شایستگی دریانوردی (Certificate of Competency):

به معنای گواهینامه صادره و یا شناسایی شده ای است که مطابق الزامات فصل های ۲، ۳، ۴ و ۷ کنوانسیون برای فرماندهان، افسران و افسران مهندس الکترونیک صادر و یا تایید می شود و دارندهی قانونی آن محق به خدمت در سمت و عمل به وظایف مربوطه در سطح مسئولیت مشخص شده در آن است.

۳-۴ گواهینامه مهارت دریانوردی (Certificate of Proficiency):

به معنای گواهینامه ای به غیر از گواهینامه شایستگی صادر شده برای دریانورد است که نشان می دهد الزامات آموزشی، شایستگی ها یا خدمت دریایی مندرج در کنوانسیون را برآورده می نماید.





۳-۵ دستورالعمل (Code of Practice):

به معنای مجموعه قوانین، مقررات ملی و الزامات مندرج در این دستورالعمل است که توسط اداره کل امور دریانوردان تدوین و به تصویب هیات عامل سازمان رسیده است.

۳-۶ شرکت کشتیرانی (Company):

به معنای مالک کشتی، هر شخصی مانند مدیر یا اجاره کننده در بست کشتی است، که مسئولیت عملیات کشتی از طرف مالک کشتی بر وی فرض شده است، و با قبول چنین مسئولیتی، کلیه وظایف و مسئولیت های محول شده بر شرکت کشتیرانی توسط این دستورالعملها را بر عهده گرفته است.

۳-۷ گواهی طی دوره (Course Completion Certificate or Documentary Evidence):

به معنای گواهی است که مرکز آموزشی مورد تایید سازمان به فراگیر پس از گذراندن موفقیت آمیز دوره مربوطه ارائه می دهد.

۳-۸ افسر مهندس (Engineer Officer):

به معنای افسری است که مطابق با الزامات مقرر ۳/۱، ۳/۲ یا ۳/۳ کنوانسیون دارای صلاحیت است.

۳-۹ آئین نامه ی امنیت کشتی ها (ISPS Code):

به معنای آئین نامه بین المللی امنیت کشتی ها و تسهیلات بندری است که در تاریخ ۲۰۰۲ میلادی طی قطعنامه شماره ۲ کنفرانس دولتهای متعاقد به کنوانسیون بین المللی ایمنی جان اشخاص در دریا ۱۹۷۴ (SOLAS) به تصویب رسیده و ممکن است توسط سازمان بین المللی دریانوردی براساس اصلاحیه های بعدی تغییر یابد.

۳-۱۰ فرمانده (Master):

به معنای شخصی است که عهده دار فرماندهی کشتی می باشد.

۳-۱۱ گواهینامه سلامت پزشکی (Medical Fitness Certificate):

به معنای گواهینامه ای است که توسط پزشک معتمد سازمان طبق دستورالعمل مربوطه و جهت متقاضیانی که از نظر پزشکی از سلامت برخوردار باشند، صادر می گردد.

۳-۱۲ کشتی تجاری (Merchant Ship):

به معنای هر نوع شناوری است (به استثنای شناورهای خدماتی، سکوهای متحرک فراساحلی، صیادی و یا نظامی) که در امر جابجایی کالاهای تجاری، مسافر و بار تسهیلات مربوط به کالاهای تجاری بکار گرفته می شود.

۳-۱۳ ماه (Month):

جهت محاسبه خدمت دریایی هر ماه متشکل از ۳۰ روز می باشد.





۳-۱۴ سازمان (Ports & Maritime Organization):

به معنای سازمان بنادر و دریانوردی جمهوری اسلامی ایران می باشد.

۳-۱۵ دستگاه نظارت بندر (Port's Monitoring Office)

به معنای معاونتی که اداره امتحانات و اسناد دریانوردان بنادر زیر مجموعه آن می باشد و به نیابت از اداره استانداردهای دریانوردان، وظیفه صدور مجوز دوره های آموزشی و نظارت بر مراکز آموزشی محل استان جغرافیایی خود را به عهده دارد. اداره یا بخشهای دیگر در مجموعه معاونت مربوطه به عنوان دستگاه نظارت محسوب نمی گردند.

۳-۱۶ قدرت رانش موتور (Propulsion Power):

به معنای مجموع حداکثر قدرت موجود در موتورهای کشتی بر حسب کیلووات که در گواهینامه ثبت کشتی و یا دیگر مدارک مربوطه درج شده باشد.

۳-۱۷ خدمت دریایی (Seagoing Service):

به معنای مدت زمان دریانوردی بر روی کشتی است که می بایست مرتبط با صدور و یا تجدید گواهینامه های شایستگی و یا مهارت در یانوردان می باشد.

۳-۱۸ کشتی دریا پیمای (Seagoing Ship):

به معنای کشتی است به غیر از آنهاییکه منحصرأ در آبهای سرزمینی، نزدیک یا مجاور آبهای پناه گاهی و یا مناطق مشمول مقررات بندری، تردد می کنند.

۳-۱۹ وظایف امنیتی (Security Duties)

به معنای تمامی مسئولیتها و وظایف امنیتی روی کشتی ها مطابق با تعریف مندرج در کنوانسیون بین المللی جان اشخاص در دریا، ۱۹۷۴ (اصلاح شده) و آیین نامه بین المللی امنیت کشتی و تسهیلات بندری (ISPS) می باشد.

۳-۲۰ کنوانسیون (Convention):

به معنای کنوانسیون اصلاح شده بین المللی استانداردهای آموزشی، صدور گواهینامه و نگهبانی دریانوردان (STCW-78 as amended) می باشد.

۳-۲۱ آئین نامه ی کنوانسیون (STCW Code):

به معنای آئین نامه ی استانداردهای آموزشی، صدور گواهینامه و نگهبانی دریانوردان که طی قطعنامه ی شماره ۲ کنفرانس سال ۱۹۹۵ میلادی تصویب و ممکن است توسط سازمان بین المللی دریانوردی بر اساس اصلاحیه های بعدی تغییر یابد، می باشد.





سازمان بازرگانی دریانوردی

دستورالعمل اجرایی برگزاری دوره آموزش و آزمونهای شایستگی ست افسر مهندس سوم بر روی کشتی های با قدرت رانش ۷۵۰ کیلووات یا بیشتر سرنواری نامحدود (ورودی کار درانی تکلیف دریایی)
Code of practice for conducting third engineer officer training course and competency assessment on ships of Propulsion Power KW≥750 engaged on Unlimited Voyages (With marine engine higher diploma entrance)

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۲۲-۳ سطح پشتیبانی (Support Level)

به معنای سطحی از مسئولیت اطلاق می گردد که وظایف، تکالیف و مسئولیتهای محوله بر روی کشتی را تحت نظر افراد سطح مدیریتی و یا عملیاتی انجام می پذیرد.

۲۳-۳ افسر مهندس سوم (Third Engineer Officer):

به معنای افسر مهندسی است که مسئولیت نگهداری در موتورخانه را در زمان معینی بر عهده دارد و بر اساس مفاد مربوطه واجد شرایط باشد.

۲۴-۳ مرکز آموزشی (Training Center):

به معنای دانشگاه، شرکت، موسسه یا هر ارگانی که بر اساس مجوز اخذ شده از سازمان در زمینه آموزشهای دریانوردی فعالیت می کند.

۲۵-۳ سفرهای نامحدود (Unlimited Voyages):

به معنای سفرهای است که محدود به سفرهای نزدیک به ساحل نباشد.

۴ - مسئولیت ها

۴-۱ مسئولیت بازنگری این دستورالعمل بر عهده دستگاه نظارت مرکز می باشد.

۴-۲ مسئولیت تایید اصلاحیه ها به این دستورالعمل بر عهده اداره کل امور دریانوردان می باشد.

۴-۳ مسئولیت تصویب اصلاحیه ها به این دستورالعمل بر عهده معاون امور دریایی به نیابت از هیات عامل سازمان می باشد.

۴-۴ مسئولیت اجرای کامل دوره آموزشی بر اساس عناوین اعلام شده بر عهده مرکز آموزشی می باشد.

۴-۵ مسئولیت نظارت بر حسن اجرای این دستورالعمل در مراکز آموزشی دریانوردی بر عهده دستگاه نظارت مرکز می باشد.



هیات عامل سازمان بازرگانی دریانوردی



۵- روش اجرا

۵-۱- هدف از برگزاری دوره آموزشی

هدف از برگزاری این دوره آموزشی، آماده نمودن فراگیران برای کسب توانمندی های مندرج در بند ۲-۶-۵ دستورالعمل اجرایی برگزاری دوره آموزشی و آزمونهای شایستگی دریانوردی سمت افسر مهندس سوم بر روی کشتی های با قدرت رانش ۷۵۰ کیلووات یا بیشتر سفرهای نامحدود می باشد.

۵-۲- طول دوره

- ۵-۲-۱- حداقل ۸۰۰ ساعت می باشد که شامل ۷۱۱ ساعت به صورت نظری (تئوری)، ۶۰ ساعت تمرین و ۲۹ ساعت عملی می باشد.
- ۵-۲-۲- حداکثر مدت زمان آموزش روزانه برای هر فراگیر ۸ ساعت می باشد.

۵-۳- تعداد شرکت کنندگان در دوره

- ۵-۳-۱- حداکثر فراگیران شرکت کننده در هر دوره ۲۰ نفر می باشد.
- ۵-۳-۲- در صورت افزایش حداقل فضا، تجهیزات و امکانات کمک آموزشی مرتبط بر اساس دستورالعمل صدور مجوز و نظارت بر اجرای دوره ها در مراکز آموزشی دریانوردی و پس از اخذ تاییدیه از دستگاه نظارت ذیربط، تعداد شرکت کنندگان در دوره می تواند حداکثر تا ۳۰ نفر افزایش یابد.

۵-۴- شرایط ورود به دوره

- ۵-۴-۱- دارای حداقل ۱۸ سال تمام
- ۵-۴-۲- دارا بودن گواهینامه سلامت پزشکی معتبر بر اساس دستورالعمل مصوب سازمان
- ۵-۴-۳- دارا بودن حداقل مدرک تحصیلی کاردانی مکانیک دریایی

۵-۵- دانش، درک و مهارت مورد انتظار

- ۵-۵-۱- کسب اطلاعات کافی در خصوص راه بری نیروی انسانی و ماشین آلات موتور خانه
- ۵-۵-۲- کسب اطلاعات کافی در خصوص تعمیر و نگهداری ماشین آلات موتورخانه
- ۵-۵-۳- کسب توانایی بر عهده گیری مدیریت مستقل فنی کشتی در غیاب افسر مهندس دوم





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دستورالعمل اجرایی برگزاری دوره آموزش و آزمونهای شایستگی سمت افسر مهندس سوم بر روی کشتی های با قدرت رانش ۷۵۰ کیلووات یا بیشتر سرنه ای نامحدود (درودی کاردانی مکانیک دریایی)
Code of practice for conducting third engineer officer training course and competency assessment on ships of Propulsion Power $KW \geq 750$ engaged on Unlimited Voyages (With marine engine higher diploma entrance)

۴-۵-۵- کسب مهارت در اتخاذ تدابیر لازم و عملی به جهت پیاده سازی قوانین ایمنی

۵-۵-۵- کسب مهارت در اتخاذ تدابیر لازم به جهت حفاظت از محیط زیست

۶-۵-۵- کسب توانایی در پیاده سازی دستورات مافوق و ایجاد ارتباط در محیط کاری

۶-۵- عناوین دروس و ریز مواد درسی و آزمون

عناوین دروس و جدول نمایانگر تعداد سؤالات، مدت، نوع، حدنصاب قبولی و مواد درسی آزمونهای شایستگی دریانوردی برای کاردانی مکانیک دریایی داوطلب سمت " افسر مهندس سوم بر روی کشتی های با قدرت رانش ۷۵۰ کیلووات یا بیشتر سفرهای نامحدود " به شرح ذیل می باشد.



سازمان بازرسی دریانوردی



۱-۶-۵ جدول آزمونهای شایستگی با ورودی کاردانی مکانیک دریایی به افسر مهندس سوم بر روی کشتی های با قدرت رانش ۷۵۰ کیلووات یا بیشتر سفرهای نامحدود

ردیف	نام آزمون	تعداد سوالات	مدت (ساعت)	نوع آزمون	حد نصاب قبولی (درصد)	مواد امتحانی (بند دستور العمل)	ملاحظات
۱	دانش مهندسی دریایی (موتور)	۶	۳	کتبی	۶۰	4-4-1-1, 4-4-1-2-2, 4-4-1-2-3, 4-4-1-2-4, 4-4-1-3, 4-4-1-4-1, 4-4-1-4-2, 4-4-1-5, 4-4-1-7-2, 4-4-1-7-3, 4-4-3-1-1, 4-4-3-1-2	
۲	دانش مهندسی دریایی (عمومی)	۸	۳	کتبی	۶۰	4-1-1-1, 4-1-1-2, 4-1-1-3, 4-1-1-4, 4-1-2, 4-2-1, 4-4-1-2-1, 4-4-1-6, 4-4-1-7-1, 4-4-1-7-4, 4-4-1-7-5, 4-4-1-7-6, 4-4-1-8, 4-4-1-9, 4-4-1-10, 4-4-2, 4-4-3-1-3, 4-4-3-1-4, 4-5-1, 4-5-2-1, 4-5-2-2, 6-1-1, 6-1-2, 6-1-3-1, 6-1-3-2, 6-1-3-3, 6-1-3-4, 6-1-4-1, 6-1-5-1, 6-2-1, 6-2-2, 6-2-3, 6-2-4, 6-2-5, 6-2-6, 6-2-7, 3-7-1, 3-7-2, 3-7-3-1, 3-7-3-2, 3-7-3-3, 3-7-3-4, 3-7-4-1, 3-7-4-2, 3-7-4-3, 3-7-4-4, 3-7-4-5, 3-7-5-1, 3-7-5-2, 3-7-5-3, 3-7-5-4	
۳	الکترونیک و فناوری دریایی	۶	۲/۵	کتبی	۵۵	5-1-1-1-1, 5-1-1-1-2-1, 5-1-1-1-2-2, 5-1-1-1-3, 5-1-1-1-4-1, 5-1-1-1-4-2, 5-1-1-1-5, 5-1-1-1-6, 5-1-1-2-1, 5-1-1-2-2, 5-1-1-2-3, 5-1-1-3-1, 5-1-1-3-2, 5-2-1, 5-2-2, 5-2-3, 5-2-4, 5-2-5-1, 5-2-5-2, 5-2-5-3, 5-2-6	
۴	آرشیفتکت دریایی، ایمنی کشتی و حفاظت از محیط زیست	۶	۲/۵	کتبی	۵۵	4-5-3-1, 4-5-3-2, 4-5-3-3, 3-1-1-1, 3-1-1-2, 3-1-1-3, 3-1-1-4, 3-1-2, 3-1-3, 3-2-1-1, 3-2-1-2, 3-2-1-3, 3-2-1-4, 3-2-1-5, 3-2-1-6, 3-2-1-7, 3-2-2, 3-2-3, 3-2-4-1, 3-2-4-2, 3-2-4-3, 3-2-4-4, 3-2-4-5, 3-2-4-6, 3-2-4-7, 3-6-1	
۵	شفاهی / عملی / شبیه ساز	نامحدود	حداکثر ۳ ساعت	شفاهی	نمره ندارد	4-1-1-1, 4-1-1-2, 4-1-1-3, 4-1-1-4, 4-1-2, 4-1-3-1, 4-1-3-2, 4-1-3-3, 4-1-3-4, 4-1-3-5, 4-3-1-1, 4-3-1-2, 4-4-1-2-1, 4-4-2, 4-5-1, 4-5-2-1, 4-5-2-2, 4-5-3-1, 4-5-3-2, 4-5-3-3, 6-1-4-1, 6-1-5-1, 6-2-1, 6-2-2, 6-2-3, 6-2-4, 6-2-5, 6-2-7, 3-1-1-1, 3-1-1-2, 3-1-1-3, 3-1-1-4, 3-1-2, 3-1-3, 3-6-1, 3-7-1, 3-7-2, 3-7-3-1, 3-7-3-2, 3-7-3-3, 3-7-3-4, 3-7-4-1, 3-7-4-2, 3-7-4-3, 3-7-4-4, 3-7-4-5, 3-7-5-1, 3-7-5-2, 3-7-5-3, 3-7-5-4	

یادداشت - ورودی های کاردانی مکانیک دریایی میبایست پس از گذراندن موفقیت آمیز دوره در مراکز آموزشی مورد تایید سازمان، مطابق دستورالعمل شماره P6-W-62/1 قوانین سازمان بنادر و دریانوردی در کلیه آزمونهای شایستگی مهندس سوم حضور یافته و در صورت اخذ نمرات قبولی در تمام دروس مربوطه، جهت دریافت گواهینامه شایستگی افسر مهندس سوم بر روی کشتی های با قدرت رانش ۷۵۰ کیلووات یا بیشتر سفرهای نامحدود اقدام نمایند

۲-۶-۵ حداقل مواد درسی دوره آموزش کاردانی مکانیک دریایی جهت حضور در امتحانات سمت افسر مهندس سوم بر روی کشتی های با قدرت رانش ۷۵۰ کیلووات یا بیشتر سفرهای نامحدود در بخش انگلیسی این دستورالعمل می باشد.





۷-۵- امکانات مورد نیاز جهت برگزاری دوره

جهت برگزاری دوره های آموزشی علاوه بر فضای آموزشی قید شده در "دستورالعمل نحوه صدور مجوز و نظارت بر مراکز آموزشی دریانوردی" مصوب سازمان، تجهیزات کمک آموزشی مشروحه زیر نیز مورد نیاز می باشد:

۷-۵-۱- سالن / کلاسها می بایست مجهز به سیستم تهویه و نور کافی و وسایل سمعی و بصری و امکانات مورد نیاز برای تدریس باشد.

۷-۵-۲- کتابخانه مجهز به کتب تخصصی مورد نیاز تدریس و اطلاعات جامع دیگر در خصوص دوره.

۷-۵-۳- سالن سمعی و بصری و امکانات مورد نیاز برای تدریس زبان انگلیسی تخصصی و عمومی.

۷-۵-۴- آزمایشگاه و کارگاه مکانیک

Mechanical laboratory (Materials and equipment)

- 1- Portable refrigeration demonstration unit, to show evaporation and condensation.
- 2- Four-stroke diesel engine on a test bed, fitted with a dynamometer, fuel flow meter, cooling water thermometer and RPM indicator (tachometer).
- 3- Acidic, alkaline and neutral solutions.
- 4- Alkalinity/acidity indicators such as litmus papers.
- 5- Samples of aluminum and copper with an oxide.
- 6- Samples of pitting corrosion.
- 7- Samples of graphitized cast Iron.
- 8- Samples of gasoline, kerosene, diesel fuel, boiler residual fuel oil and a viscometer.
- 9- A flash point apparatus, a water- content measurement apparatus.
- 10- Salinometer(s) and hydrometer(s).
- 11- Work benches fitted with vices, tool storage lockers and cabinets.
- 12- Portable power tools such as drilling machines, small bench or pedestal grinder.
- 13- Measuring equipment: external and internal verniers, inside and outside calipers, standard adjustable inside and outside micrometers, depth and dial gauges (Mechanical or electronic).



- 14- Hand tools: chisels, center punches, hacksaws, scrapers, drills, bits, reamers, hammers, taps and dies, nuts, spanners and wrenches, files.
- 15- A marking table.
- 16- Scribes, scribing blocks, try-square, trammels, protector, dividers, odd-leg calipers, straight-edge, bevel gauge.
- 17- Vee blocks, leveling devices.
- 18- Power tools: one pedestal or pillar drilling machine; one radial drilling machine.
- 19- One forge for heat treatment.
- 20- Bending rollers for sheet metal.
- 21- Bending machine for small-diameter pipes.
- 22- Oxy-acetylene brazing and cutting equipment.
- 23- Electric arc-welding equipment.
- 24- Working benches.
- 25- Soldering equipment.
- 26- Protective clothing, including aprons, gloves, masks, goggles and welding boots.
- 27- Fume extraction/ventilation.
- 28- Gas bottles storage.
- 29- Welding electrodes.
- 30- Filler rods.
- 31- Steel plates up to 10 mm thick.
- 32- Various steel bars, pipes angles and sections.
- 33- Metal-turning lathes including:
 - a- Three –and four-jaw chucks
 - b- Face-plates
 - c- Drill bits, arboring tools
 - d- Tool holders
 - e- Protective equipment
 - f- Various lathe tools: straight parting tool, round nose, finishing, cranked and boring tools
- 34- A range of cutting tools.

35- Work-securing vice.

36- A dividing head.

۵-۷-۵- کارگاه و آزمایشگاه برق و الکترونیک و ابزار دقیق

Electrical and electronic engineering laboratory and workshop

1. Apparatus to demonstrate static electricity, examples of electrical diagrams (i.e., block system, circuit and wiring diagrams); apparatus to demonstrate control circuit; apparatus to demonstrate PLC; ammeters, voltmeters, watt meters, megger tester, wiring connectors, resistors, electrical source, a selection of marine cables, equipment and cable runs for testing purpose, insulation testers, continuity testers, digital and analogue multi-meters, thermistors, diodes, a clampmeter, live-line tester, lead-acid and alkaline batteries, a charging circuit distilled water, hydrometer, magnets, iron filing solenoid iron-cored solenoid, induction coil, model A.C and D.C generators used A.C and D.C generators and motor, motor starters, switches, circuit breakers, fuses, a sectioned transformer, and earth lamp model system, equipment suitable for use in oil, gas and chemical tankers (intrinsically safe).
2. Over currents, reverse-power and under voltage-protection relays, high-rupturing-capacity fuses and housings, preferential trips, instrument and relay transformers, a main switch board, emergency switch board, operational three-phase terminal box, automatic voltage regulator, induction motors with direct on-line and star-delta and autotransformer starters, speed controllers, a selection of lighting equipment, a model navigation light system.



۸-۵- شرایط مدرسین و مربیان دوره

مدرسین و مربیان دوره های آموزشی مندرج در این دستورالعمل می بایست علاوه بر گذراندن دوره مدرسی (TFT) مورد تأیید سازمان دارای حداقل مدارک و تجارب مشروحه زیر باشند:

۸-۵-۱- مدرسین

۸-۱-۱- جهت آرایه مواد درسی مندرج در جدول مربوطه ردیف ۱، ۲، و ۴ ماده ۱-۶-۵ این دستورالعمل، گواهینامه شایستگی معتبر مهندس دوم بر روی کشتی های با قدرت رانش ۳۰۰۰ کیلووات یا بیشتر سفرهای نامحدود و یک سال خدمت دریایی در آن سمت.

۸-۱-۲- جهت آرایه مواد درسی مندرج در جدول مربوطه ردیف ۳، ماده ۱-۶-۵ این دستورالعمل، فوق لیسانس مرتبط با موضوع درس و یا حداقل دارای گواهینامه شایستگی افسر مهندس الکترونیک بر روی کشتی های با قدرت رانش ۳۰۰۰ کیلووات یا بیشتر سفرهای نامحدود و یک سال خدمت دریایی در آن سمت.

۸-۱-۳- دارندگان مدرک فوق لیسانس در رشته های معماری و سازه کشتی یا فرمانده در کشتی های با ظرفیت ناخالص ۳۰۰۰ یا بیشتر سفرهای نامحدود با حداقل ۱۲ ماه خدمت دریایی در آن سمت می توانند مدرس بخشهای آرشیتکت کشتی باشند.

۸-۵-۲- مربیان

۸-۲-۱- گواهینامه شایستگی معتبر مهندس سوم بر روی کشتیهای با قدرت رانش ۷۵۰ کیلووات یا بیشتر سفرهای نامحدود و حداقل ۱۲ ماه خدمت دریایی در آن سمت یا.

۸-۲-۲- لیسانس مرتبط (مهندسی کشتی، مهندسی کشتی سازی یا مهندسی مکانیک) با حداقل ۲ سال تجربه کاری.

۸-۲-۳- برای آرایه دروس "برق عملی" کلیه دوره ها دارندگان گواهینامه شایستگی افسر مهندس الکترونیک با ۱۲ ماه خدمات دریایی در آن سمت یا لیسانس برق با دو سال تجربه کاری مورد نیاز می باشد.





۹-۵- ارزیابی و صدور گواهینامه

۹-۵-۱ در صورت موفقیت فراگیران در ارزیابی‌های حین و یا پایان دوره، گواهی طی موفقیت آمیز دوره مربوطه توسط مرکز آموزشی مورد تایید و مجری برگزاری دوره صادر می‌گردد.

۹-۵-۲ سپس فراگیران می‌توانند درخواست حضور در آزمون‌های شایستگی و مهارت دریانوردی سازمان را بر اساس مفاد بند ۱-۶-۵ این دستورالعمل ارائه نمایند؛ و

۹-۵-۳ نهایتاً اداره امتحانات و اسناد دریانوردان سازمان برای آن دسته از شرکت کنندگان که آزمون‌های مربوطه را با موفقیت طی نموده باشند و حائز دیگر شرایط لازم باشند، گواهینامه مرتبط بر اساس دستورالعمل صدور، تمدید و تجدید گواهینامه‌های دریانوردان صادر می‌نماید.

۱۰-۵- شرایط تمدید / تجدید گواهینامه

گواهینامه‌های شایستگی و مهارت دریانوردی بر اساس مفاد دستورالعمل صدور، تمدید و تجدید گواهینامه‌های دریانوردان تمدید و یا تجدید می‌گردد.

۱۱-۵- روش تأیید دوره

بر اساس مفاد مندرج در دستورالعمل صدور مجوز و نظارت بر اجرای دوره‌ها در مراکز آموزش دریانوردی

۶- سوابق

کلیه سوابقی که نشان دهنده رعایت موارد مندرج در این دستورالعمل باشد.

۷- مراجع

۷-۱ کنوانسیون اصلاح شده STCW و آیین نامه مربوطه

۷-۲ مدل کورس سازمان بین‌المللی دریانوردی (IMO) شماره ۷/۰۴

۷-۳ دستورالعمل صدور، تمدید و تجدید گواهینامه‌های دریانوردان

۷-۴ دستورالعمل صدور مجوز و نظارت بر اجرای دوره‌ها در مراکز آموزشی دریانوردی

۸- ضمیمه

ندارد.



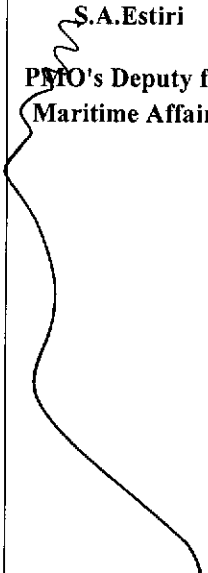




PMO

Code of practice for conducting third engineer officer training course and competency assessment on ships of Propulsion Power $KW \geq 750$ engaged on Unlimited Voyages (With marine engine higher diploma entrance)

P6-W107

Revision No.	Date of revision	Comment on revision	provider	approving amendments authority	endorsing amendments authority
01	08/SEP/2014	STCW Convention, as amended	N.Alipour Head of Seafarers' Standards' Directorate 	H.Mirzaei Director General of Seafarers' Affairs 	S.A.Estiri PMO's Deputy for Maritime Affairs 

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Introduction

Ports and Maritime organization (P.M.O) of the Islamic republic of Iran in performing its duty and in exercising its prerogative resulting from article 192 of the Islamic republic of Iran maritime code, 1964 and paragraph 10 of article 3 of P.M.O manifesto, 1970 enabling it to issue any document, certificate or license for ships, masters, officers and other ship personnel and also in accordance with the provisions of the international convention on standards of training, certification and watch keeping for seafarers (STCW), 1978, as amended adopted by the Islamic consultative assembly in 1996 and taking into account regulations III/1 of the mentioned Convention develops this "Code of practice for conducting third engineer officer training course with marine engine higher diploma entrance in order to appear in Competency Assessments of third engineer officer on ships of propulsion power KW \geq 750 engaged on unlimited Voyages" which is applicable after endorsement by the board of executives of Ports & Maritime Organization.

NOTE: The title of Ports and Shipping Organization changed to Ports and Maritime Organization dated 29.04.2008 through parliamentary act and approved by Islamic council assembly.



1- Objective

The objective of this code of practice is to specify the minimum requirements for conducting training course for marine engine higher diploma in order to appear in Competency Assessments of third Engineer Officer on Ships of Propulsion power KW \geq 750 engaged on Unlimited Voyages.

2- Scope of application

This code of practice is applicable to all approved training centers that conduct training course for marine engine higher diploma in order to appear in Competency Assessments of third Engineer Officer on Ships of Propulsion power KW \geq 750 engage on Unlimited Voyages.

3- Definition

For the purpose of this code of practice, unless expressly provided otherwise;

3-1 Approved

Means approved by the Seafarer's Standards Directorate in accordance with the PMO's Codes of practices.

3-2 Approved Seagoing Service / Documentary Evidence

Means approved sea going service required to be presented for participating in a training course, maritime examination and issuance of certificate. These documentary evidence should be inserted in CDC and authenticated by company or ship owner or ship owner's associations and in addition be presentable in a form of computer sheet, official letter or other forms as defined in the annex to this code of practice.

3-3 Certificate of Competency (COC)

Means a certificate issued and endorsed for masters, officers and GMDSS radio operators in accordance with the provisions of chapters II, III, IV or VII of the STCW Convention and entitling the lawful holder thereof to serve in the capacity and perform the functions involved at the level of responsibility specified therein.

3-4 Certificate of Proficiency (COP)

Means a certificate, other than a certificate of competency issued to a seafarer, stating that the relevant requirements of training, competencies or seagoing service in the STCW Convention have been met.

3-5 Code of Practice





Means all national rules, regulations and requirements specified in this document which have been drafted by the PMO's General Directorate of Maritime affairs and endorsed by the PMO's board of executive.

3-6 Company

Means the owner of the ship or any other organization or person such as the manager, or the bareboat charterer, who has assumed the responsibility for operation of the ship from the ship owner and who, on assuming such responsibility, has agreed to take over all the duties and responsibilities imposed on the company by these Codes of practices.

3-7 Course Completion Certificate or Documentary Evidence

Means a certificate issued through the training center, after successfully completion of training program by the applicants

3-8 Engineer officer

Means an officer qualified in accordance with the provisions of regulation III/1, III/2 or III/3 of the Convention

3-9 ISPS Code

Means the International Ship and Port Facility Security (ISPS) Code adopted on 12 December 2002, by resolution 2 of the Conference of Contracting Governments to the International Convention for the Safety of Life at Sea (SOLAS), 1974, as may be amended by the Organization.

3-10 Master

Means the person having command of a ship

3-11 Medical Fitness Certificate

Means a certificate issued by the PMO's recognized medical practitioner to the candidates who found to be medically fit.

3-12 Merchant Ship

Means any ship (other than servicing vessel, mobile offshore platform, fishing and naval ships) used for carriage of cargoes, passenger and/or provisions

3-13 Month

Means a calendar month or 30 days made up of periods of less than one month.

3-14 PMO

Means Ports & Maritime Organization (PMO) of the Islamic Republic of Iran.





3-15 Port's Monitoring Office

Means the deputy of general directorate in ports in which the directorate of examinations & seafarers' documents is included and on behalf of seafarers' standards directorate is responsible for approving and monitoring training courses conducted in the province that port is situated

3-16 Propulsion Power

Means the total maximum continuous rated output power, in kilowatts, of all the ship's main propulsion machinery which appears on the ship's certificate of registry or other official document.

3-17 Seagoing service

Means service on board a ship relevant to the issue or revalidation of a certificate or other qualification.

3-18 Seagoing Ship

Means a ship other than those which navigate exclusively in inland waters or in waters Within, or closely adjacent to, sheltered waters or areas where port regulations apply.

3-19 Security duties

include all security tasks and duties on board ships as defined by chapter XI-2 of the International Convention for the Safety of Life at Sea (SOLAS 1974, as amended) and the International Ship and Port Facility Security (ISPS) Code

3-20 STCW Convention

Means international convention on standards of training, certification and watch keeping for Seafarers, 1978, as amended.

3-21 STCW Code

Means the seafarers' training, certification and watchkeeping (STCW) code as adopted by the 1995 conference resolution 2, as it may be amended by the international maritime organization.

3-22 Support Level

Means the level of responsibility associated with performing assigned tasks, duties or responsibilities on board a seagoing ship under the direction of an individual serving in the operational or management level.

3-23 Third Engineer Officer

Means officer in charge of an engineering watch qualified in accordance with the relevant provisions of the Code of practice for issuing, revalidation, renewal certificates of competency and proficiency for seafarers.



3-24 Training center

Means maritime university/center/ directorate/ department/company and/or any organization conducting maritime training course approved by PMO.

3-25 Unlimited Voyages

Means voyages not limited to the near coastal voyages.

4- Responsibilities

4-1 Central monitoring office is responsible for revising this code of practice.

4-2 General Director of Seafarers' Affairs is responsible for approving amendments to this code of practice.

4-3 Deputy of maritime affairs is responsible to endorse amendments to this code of practice on behalf of PMO's board of executive.

4-4 Training centers are to conduct training course in accordance with this Code of practice.

4-5 Central monitoring office is responsible for supervising the implementation of this code of practice in training centers.

5- Procedure

5-1 course objective

The objective of this Training Course is to prepare trainees to achieve competencies required to perform as third Engineer Officer on Ships of Propulsion power KW \geq 750 engaged on Unlimited Voyages.

5-2 course duration

5-2-1 A minimum of 800 hours which includes 711 theoretical, 60 hours exercise and 29 hours practical for each trainee.

5-2-2 Maximum daily contact hours for each trainee is 8.

5-3 number of trainees

5-3-1 the maximum number of trainees in each course is 20.

5-3-2 the number of trainees may be increased to 30 when the relevant facilities, teaching aids and class-room space are increased as per criteria set out in the code of practice for approving and monitoring training courses and is approved by the relevant monitoring office.

5-4 Course entry requirement

The course trainees should, at least;

5-4-1 be at least 18 years old;

5-4-2 hold valid medical fitness certificate issued by a medical practitioner recognized by the PMO;

5-4-3 possess marine engine higher diploma .

5-5 Expected Knowledge, Understanding and Proficiency

5-5-1 Knowledge of how machineries work in engine room under supervision of ship senior engineers.

5-5-2 Gaining information and proficiency in repairing and maintaining machineries in engine room under supervision of ship senior engineers.

5-5-3 Ability to take engineering watch in the engine room independently.

5-5-4 Proficiency in practicing safeties in the vicinity of working environment and at the time of taking duties.



5-5-5 Proficiency in practicing and protecting environmental safeties;

5-5-6 Ability to manage and practice superior instructions as well as being
able to communicate in the working environment.





5-6 course syllabi and competency assessment:

5-6-1 Competency assessment details;

No	Title	Number of Question	Time (hours)	Type	Pass mark	Subjects as per syllabi mentioned in 5-6-2	Remarks (if any)
1	Motor	6	3	written	60	4-4-1-1, 4-4-1-2-2, 4-4-1-2-3, 4-4-1-2-4, 4-4-1-3, 4-4-1-4-1, 4-4-1-4-2, 4-4-1-5, 4-4-1-7-2, 4-4-1-7-3, 4-4-3-1-1, 4-4-3-1-2	
2	General	8	3	written	60	4-1-1-1, 4-1-1-2, 4-1-1-3, 4-1-1-4, 4-1-2, 4-2-1, 4-4-1-2-1, 4-4-1-6, 4-4-1-7-1, 4-4-1-7-4, 4-4-1-7-5, 4-4-1-7-6, 4-4-1-8, 4-4-1-9, 4-4-1-10, 4-4-2, 4-4-3-1-3, 4-4-3-1-4, 4-5-1, 4-5-2-1, 4-5-2-2, 6-1-1, 6-1-2, 6-1-3-1, 6-1-3-2, 6-1-3-3, 6-1-3-4, 6-1-4-1, 6-1-5-1, 6-2-1, 6-2-2, 6-2-3, 6-2-4, 6-2-5, 6-2-6, 6-2-7, 3-7-1, 3-7-2, 3-7-3-1, 3-7-3-2, 3-7-3-3, 3-7-3-4, 3-7-4-1, 3-7-4-2, 3-7-4-3, 3-7-4-4, 3-7-4-5, 3-7-5-1, 3-7-5-2, 3-7-5-3, 3-7-5-4	
3	Electro technology	6	2.5	written	55	5-1-1-1-1, 5-1-1-1-2-1, 5-1-1-1-2-2, 5-1-1-1-3, 5-1-1-1-4-1, 5-1-1-1-4-2, 5-1-1-1-5, 5-1-1-1-6, 5-1-1-2-1, 5-1-1-2-2, 5-1-1-2-3, 5-1-1-3-1, 5-1-1-3-2, 5-2-1, 5-2-2, 5-2-3, 5-2-4, 5-2-5-1, 5-2-5-2, 5-2-5-3, 5-2-6	





No	Title	Number of Question	Time (hours)	Type	Pass mark	Subjects as per syllabi mentioned in 5-6-2	Remarks (if any)
4	Naval Architecture	6	2.5	written	55	4-5-3-1, 4-5-3-2, 4-5-3-3, 3-1-1-1, 3-1-1-2, 3-1-1-3, 3-1-1-4, 3-1-2, 3-1-3, 3-2-1-1, 3-2-1-2, 3-2-1-3, 3-2-1-4, 3-2-1-5, 3-2-1-6, 3-2-1-7, 3-2-2, 3-2-3, 3-2-4-1, 3-2-4-2, 3-2-4-3, 3-2-4-4, 3-2-4-5, 3-2-4-6, 3-2-4-7, 3-6-1	
5	Oral	unlimited	maximum 3 hours	oral	No mark	4-1-1-1, 4-1-1-2, 4-1-1-3, 4-1-1-4, 4-1-2, 4-1-3-1, 4-1-3-2, 4-1-3-3, 4-1-3-4, 4-1-3-5, 4-3-1-1, 4-3-1-2, 4-4-1-2-1, 4-4-2, 4-5-1, 4-5-2-1, 4-5-2-2, 4-5-3-1, 4-5-3-2, 4-5-3-3, 6-1-4-1, 6-1-5-1, 6-2-1, 6-2-2, 6-2-3, 6-2-4, 6-2-5, 6-2-7, 3-1-1-1, 3-1-1-2, 3-1-1-3, 3-1-1-4, 3-1-2, 3-1-3, 3-6-1, 3-7-1, 3-7-2, 3-7-3-1, 3-7-3-2, 3-7-3-3, 3-7-3-4, 3-7-4-1, 3-7-4-2, 3-7-4-3, 3-7-4-4, 3-7-4-5, 3-7-5-1, 3-7-5-2, 3-7-5-3, 3-7-5-4	

Notes;

The marine engine higher diploma candidates after passing the above mentioned examinations subjects shall also have to take third engineer examination on ships of propulsion power KW \geq 750 Engaged on Unlimited Voyage as per code of practice number P6-W62/1





5-6-2 Course minimum syllabi

(711 hours Theoretical, 29 hours Practical, 60 hours Exercise)

FUNCTION 4 : MARINE ENGINEERING AT THE OPERATIONAL LEVEL *(393 hours Theoretical)*

Competence 4-1: Maintain a safe engineering watch (12 hrs.T)

**4-1-1-Thorough knowledge of principles to be observed in keeping
an engineering watch, including: (4 hrs.T)**

4-1-1-1Duties associated with taking over and accepting a watch (1 hr.T)

Knowledge and understanding of: Ensuring the members of the relieving engineering watch are fully capable of performing their duties, standing orders and special instructions of the chief engineer officer relating to the operation of the ship's system and machinery effectively; The nature of all work being performed on machinery and systems; The personnel involved and potential hazards; The level and the condition of water or residues in bilge's, ballast tanks, slop tanks, reserve tanks, fresh water tanks, sewage tanks and any special requirements for/ or disposal of the contents there of; The condition and level of fuel in the reserve tanks, settling tank, day tank and other fuel storage facilities; Special requirements relating to sanitary system disposal; Condition and mode of operation of the various main and auxiliary systems, including the electrical power distribution system; The condition of monitoring and control console equipment, and which equipment is being operated manually; The condition and mode of operation of automatic boiler controls such as flame safeguard control systems, limit control systems, combustion control systems, fuel supply control systems and other equipment related to the operation of steam boilers; Any special modes of operation dictated by equipment failure or adverse ship conditions; The availability and use of fire fighting appliances; The state of completion of engine room log; Dead man alarm and when should it be used.

4-1-1-2 Routine duties undertaken during a watch (1 hr.T)

Knowledge and understanding of: Performing watch keeping duties as per schedule approved by chief engineer; Use of appropriate internal communication system; Escape routes from machinery spaces; Engine room alarm systems and be able to distinguish between the various alarms, with special reference to the fire extinguishing media alarm; The number, location and types of firefighting equipment and damage control gear in the machinery spaces to be observed; Operating the propulsion equipment in response to needs for changes in direction or speed; Keeping the main propulsion plant and auxiliary system under constant supervision until properly relieved and periodically inspect the machinery and steering gear spaces are made for the purpose of observing and reporting equipment malfunctions or break downs, performing or directing routine adjustment, required upkeep and any other necessary task; Take the action necessary to contain the effects of damage resulting from equipment malfunction or failure and take immediate remedial actions to ensure the safety of the ship, cargo operation, the port and its environment when vessel in port.





4-1-1-3 Maintenance of the machinery space logs and the significance of the readings taken (1 hr.T)

Knowledge and understanding of: Keeping the machinery space log book up date; Performing the engine room machinery repairs as instructed by senior engineer officer; Co-operating with any engineer in charge of maintenance work during all preventive maintenance, damage control or repairs; Isolating and bypassing machinery to be worked on; Adjusting the remaining plant to function adequately and in a safe manner during the maintenance period, recording in the engine room log book, the equipment worked on and the personnel involved, and safety steps have to be taken, for the benefit of relieving officers and for record purposes; Testing and putting into service when necessary the repaired machinery or equipment; Ensuring any engine room rating who perform maintenance duties are available to assist in the manual operation of machinery in the event of automatic equipment failure; Detailed repair maintenance involving repairs to electrical, mechanical, hydraulic, pneumatic or application electronic equipment throughout the ship shall be performed and recorded.

4-1-1-4 Duties associated with handing over a watch (1 hr.T)

Knowledge and proficiency in: The officer in charge of the engineering watch should not hand over the watch to the relieving officer if there is reason to believe that the latter is not capable of carrying out the watch keeping duties effectively, in which case the chief engineer officer to be notified; The state of any special modes of operation dictated by equipment failure to be reported to take over officer; Condition and mode of operation of the various main and auxiliary systems including the electrical power distribution system to be reported to take over officer; Ensuring that all events related to the main and auxiliary machinery which have occurred during the watch are suitably recorded.

4-1-2 Safety and emergency procedures; changing-over of remote/automatic to local control of all system (3 hrs.T)

Knowledge and understanding of: Stating what is meant by emergency in accordance with components of the machinery; Taking necessary action to assess the effects of damage resulting from equipment breakdown, fire, flooding, collision, stranding, or other cause; When the engine room put in a stand by condition, the officer in charge of the engineering watch shall ensure that all machinery and equipment which may be used during maneuvering is in a state of immediate readiness and that an adequate reserve of power is available for steering gear and other requirements; Directing any other member of the engineering watch to inform them of the potentially hazardous conditions of which may adversely affect the machinery or jeopardize the safety of life or the ship; Changing in speed resulting from machinery malfunction or any loss of steam which may imperil the safety of the ship and life at sea, bridge should be immediately notified, in the event of fire and of any impending action in machinery spaces that may cause reduction in the ship's speed, imminent steering failure, stoppage of the ship's propulsion system or any alteration in the generation of electric power or similar threat to safety; Chief engineer to be notified, when engine damage or a malfunction occurs; Ensuring all machinery involved with the maneuvering of the ship is facing troubles; Emergency steering, generator and other auxiliary equipment should be ready for immediate operation; Measures to be taken to protect the environment from pollution by the ship and that applicable pollution prevention regulations are





complied with; All damage control and fire fighting systems are in readiness; In emergencies, sound the alarm when the situation so demands and take all possible measures to prevent damage to the ship, its cargo and persons on board; Beware of the duty officer's needs relating to the equipment repaired in the loading or unloading of the cargo and the additional requirements of the ballast and other ship stability control systems; Remote and local control of all machineries; Limitations of each; Actions to be taken prior to change over from remote to local and vice versa; Correct change over procedure; The key important parameters that may affect the safe operation of machinery while on local control; Safeties and automation which are by passed /affected when change over takes place; Personal attendance while in local control; Points and parameters to pay more attention while control position is shifted; Slowdown and shutdown activation /reset of main machinery in both remote and local control; Being familiar with the operation & procedure of the changing /taking over of the remote /local control of the main engine and steering gear systems.

4-1-3-Engine-room resource management, knowledge of engine-room resource management principles, including: (5 hrs.T)

4-1-3-1-Allocation, assignment, and prioritization of resources (1 hr.T)

Knowledge and understanding of: The main tenets of resource management relate to the non-technical skills associated with the social interaction between team members, situation awareness and the decision-making, Planning and Prioritizing; Efficient use of resources and delegation; Proper arrangements for watchkeeping personnel shall be ensured in accordance with the situations; Any limitation in qualifications or fitness of individuals shall be taken into account when deploying watchkeeping personnel; Understanding of watchkeeping personnel regarding their individual roles, responsibility and team roles shall be established; Identification of cause of problem and timely correct response; Environmental issues; Safety of Operations.

4-1-3-2-Effective communication (1 hr.T)

Knowledge and understanding of: Communications, Methodical and logical approach to fault diagnosis and problem solving and Error Trapping; Watchkeeping personnel shall understand information and how to respond to information from each station/installation/equipment; Information from the stations/installations/equipment shall be appropriately shared by all the watchkeeping personnel; Watchkeeping personnel shall maintain an exchange of appropriate communication in any situation; and; Watchkeeping personnel shall notify the master/chief engineer officer/officer in charge of watch duties without any hesitation when in any doubt as to what action to take in the interest of safety.

4-1-3-3-Assertiveness and leadership (1 hr.T)

Knowledge and understanding of: Leadership and Workload Management; Human Factors and Human Error; Contingency Planning; The officer in charge of watch duties shall maintain a proper watch, making the most effective use of the resources available, such as information, installations/equipment and other personnel.





4-1-3-4-Obtaining and maintaining situational awareness (1 hr.T)

Knowledge and understanding of: Situational Awareness Management; Risk Assessment and Risk Management; Emergency Preparedness; Watchkeeping personnel shall understand functions and operation of installations/equipment, and be familiar with handling them.

4-1-3-5-Consideration of team experience (1 hr.T)

Knowledge and understanding of: Co-operation and Teamwork, Identification of and breaking error chains, team building and Development.

Competence 4-2: Use English in written and oral form (100 hrs.)

**4-2-1-Adequate knowledge of the English language to enable the officer to
use engineering publications and to perform engineering duties (100 hrs.T)**

Proficiency in: Using English language to communicate correctly with members of watch in normal and emergency situations; Using engineering publications, operational manuals, shipboard drawings and fault finding instructions written in English; Writing letters, precise reporting and filling all reports and forms relevant to engineering duties in English; Developing correctness in English communication through speech, written skill and understanding; Standard communicative and technical marine words used during watch keeping, repair, maintenance and emergency.

Competence 4-3: Use internal communication systems (3 hrs.T)

4-3-1-Operation of all internal communication systems on board (3 hrs.T)

4-3-1-1-Transmission and reception of messages (2 hrs.T)

Knowledge of: Means to be provided for communicating orders from navigating bridge to the position in the machinery space or in the control room; Principle operation of an engine room telegraph; Appropriate mean of communication provided to any other positions from which the engines controlled, purpose of using engineer's alarm and where they are located; Means of communication provided between the navigation bridge and the steering gear compartment; Means of local communication provided between the main machinery control room and the engineer officer's accommodation; Means provided in a centralized control position with alarm panels and instrumentation indicating any alarm; Alarm system provided for all important pressures, temperatures and other essential parameters; Alarm for automatic change-over; Communicating through the medium of normal ship board reporting procedure; The officers and crew should communicate with each other in a common language; Principles of using public address, talk back system; Sound power phone, internal walkie talkie and telephone exchange on board the ship; Distinguishing between the various alarms.

4-3-1-2-Communication recordings (1 hr.T)

Knowledge and proficiency in: Ship's movement recording during maneuvering and passage in the navigation bridge and in engine control room; Automatic and manual recording of important and essential parameters in engine log book; Standing orders and special instructions of the chief





engineer officer; Recording of reports for ship staff and machinery performances; Records of any events related to the main and auxiliary machinery occurred during the engineering watch.

Competence 4-4: Operate main and auxiliary machinery and associated control systems (265 hrs.T)

4-4-1-Basic construction and operation principles of machinery systems, including: (249 hrs.T)

4-4-1-1-Basic engineering science, mechanics and hydromechanics (113 hrs.T)

1-Static (10 hrs.T)

Knowledge and proficiency in: Definition of mass, force, weight, scalar and vector quantities; Vector diagrams, resultant and equilibrium; Parallelogram of forces to obtain the resultant of two forces; Triangle of forces; Polygon of forces; Equilibrium in the polygon of forces; Moment of a force about a point; Conditions required for equilibrium; Force analysis of simple frame structures; Solving simple numerical and graphical problems related to objectives.

2-Kinematics (2 hrs.T)

Knowledge and proficiency in : Definition of linear motion, speed, calculating mean speed, linear and resultant velocity and acceleration; Plotting speed time graph for straight motion; Newton's first law; Solving simple numerical and graphical problems related to objectives.

3-Dynamics (6 hrs.T)

Knowledge and proficiency in: Definition of force of gravity, inertia, momentum and friction; Newton's second law; Accelerating force; Coefficient of friction; Friction force required to overcome friction on a horizontal plane; Solving simple numerical problems related to objectives.

4-Inertia (2 hrs.T)

Knowledge of: Definition of mass in terms of inertia; Relation of mass to weight; Inertia force; Active and reactive forces; Active resistance and its components.

Proficiency in: Applying the principles of inertia force to connected bodies; Solving simple problems which illustrate the effect of inertia forces.

5-Circular motion (4 hrs.T)

Knowledge of: Forces due to circular motion; Derivation of formula " $\omega^2 r = v^2/r$ "; Definition of centripetal/ centrifugal forces and related formula; Similarities between a conical pendulum and simple engine governor; Principles of balancing two forces acting on either side of a pivoted beam; Static and dynamic balancing of several masses in one plane; Dynamic force on bearings and its variations.





Proficiency in: Sketching the arrangement of a conical pendulum; Solving simple problems with regard to varying mass, radius and rotational speed; Solving problems involving three or four masses in one plane; Calculation of max. and min. forces on bearings; Calculation of balancing three masses rotating in different planes.

6-Periodic Motion (2 hrs.T)

Knowledge of: Simple harmonic motion; Variation of velocity and acceleration of piston in a reciprocating engine; Deriving at the expression " $v = \omega r \sin \theta$ " and " $a = \omega^2 r \cos \theta$ " in simple harmonic motion; Definition of periodic time, frequency and amplitude.

Proficiency in: Solving problems which illustrate the principles of above objectives; Sketching graphs with regard to velocity and acceleration during one complete cycle; Identifying mechanisms where simple harmonic motion is applicable.

7-Dynamics of rotation (2 hrs.T)

Knowledge of: Linear and angular acceleration; Accelerating torque and its value in relation to angular acceleration and second moment of mass; Radius of gyration.

Proficiency in: Solving practical problems concerning the above objectives with given values to find accelerating/ driving and retarding torque; Explaining the effect of bearing friction when accelerating/ retarding a shaft.

8-Impulse and momentum (2 hrs.T)

Knowledge of: Impulse of a force; Momentum of a body; Angular impulse; Angular momentum; Derivation of formula and units of equation relating to impulse and momentum.

Proficiency in: Solving problems to demonstrate variation of speed when the position and magnitude of rotating mass are changed; Describing examples where the principle of conservation of momentum applies; Application of equation of the above objective to determine the thrust of, and power developed by a jet.

9-Hydrostatics (6 hrs.T)

Knowledge of: Definition of volume, density as mass over volume, relative density; Formula for pressure exerted by a liquid at any given vertical depth; Deducing the equipment " $f = \rho \times g \times h \times A$ " to give force on the surfaces of a rectangular tank when filled with liquid; Effect of liquid in "sounding pipe"; Centre of pressure; Centroid of a wetted surface area; Position of centre of pressure with regard to centroid; Derivation of formula: (Second moment of area of the wetted surface area about the water surface; First moment of area of the wetted surface area about the water surface).

Proficiency in: Calculating the forces at the bottom and top of rectangular bulkheads when compartments are flooded on: (One side only/ two sides, but to different heights); Solving simple numerical problems related to objective.





10-hydrodynamics (6 hrs.T)

Knowledge of: Energies stored in a liquid; Potential, pressure and kinetic energy; Definition of "head of a liquid"; Energy component in a moving liquid in term of its head; Volumetric flow of liquid as its velocity x cross-section area x density; Rate of flow; Bernoulli's equation for unit mass over unit weight of liquid and its application; Derivation of pressure energy, potential and kinetic energy per unit weight in terms of liquid head; Laminar flow; Viscosity; Changes in flow pattern of a liquid as the liquid speed is increased until turbulence occurs; Critical velocity; Effect of liquid density over velocity and pipe diameter on critical velocity; Factors affecting turbulent flow; Factors affecting the head loss of a liquid, eddies, coefficient of discharge.

Proficiency in: Solving problems to find flow rate and pressures in sloping and horizontal pipes of varying diameter with negligible friction; Sketching the principal features of a venturi meter; Developing an equation for the flow rate through a venture meter in terms of head loss and cross-sectional area; Sketching a graph to show the relationship between flow rate and head loss; Solving simple problems to find flow rates through an orifice or through a pipe when the coefficient of discharge is given.

11-Thermodynamics and heat transmission (45 hrs.T)

11-1-Heat transfer (8 hrs.T)

Knowledge and Understanding in: Methods of heat transfer (Induction, radiation and conduction); Factors influencing the rate of heat transfer by conduction, convection and radiation; Specific heat transfer; Specific heat Capacity; Fourier law; Developing an equation for the temperature drop across the outer surfaces of a three-layer composite wall.

Proficiency in: Solving simple numerical problems involving heat transfer between substances when placed in contact with each other; Solving simple problems in the application of the Fourier law to solid materials; Solving simple problems concerning above objectives to determine surface and interface temperatures and the heat transfer; Application of above to a simple treatment of thin cylinders with not more than one layer of insulation attached to the cylinder; Sketching diagrams showing the nature of temperature gradients across a two layer composite wall and surface films.

11-2-Thermodynamic energy (4 hrs.T)

Knowledge of: The term "the conservation of energy" and its application to the flow of fluid in a system; Steady-flow energy equation (SFEE); Potential and kinetic energy; Internal energy; Displacement energy; Heat transfer; External work done; First law of thermodynamics.

Proficiency in: Developing the (SFEE) to incorporate specific enthalpy; Solving simple problems which prove sufficient understanding of the principles of (SFEE); Explaining the equation: Heat transferred= change of internal energy + work transferred.

11-3-Energy change (2 hrs.T)

Knowledge and proficiency in: "Non-flow" equation and its application; Solving simple problems concerning energy changes in practice.





11-4-Vapours (6 hrs.T)

Knowledge and Understanding in: Process of steam generation from water or generation of vapor from any other liquid at constant pressure; Relationship between temperature change and different phases; Molecular activity with regard to temperature change (Solid to liquid / liquid to vapor and vice versa); Vapor phase; Saturated vapor; Dry vapor; Wet vapor; Dryness fraction and superheated vapor conditions; Relationship between pressure and temperature of a saturated liquid or saturated vapor and demonstrating it using laboratory equipment; Use of table of thermodynamic properties to determine values for enthalpy, internal energy and volume at any given condition of pressure and temperature.

Proficiency in: Sketching a temperature/enthalpy diagram depicting complete range of change of states from liquid to superheated vapor with regard to: (Saturated vapor line, saturated liquid line, critical point of change of state, dryness fraction); Effect of compression and expansion at constant temperature for a gas/ a vapor; Effect of throttling a dry saturated vapor where total enthalpy is considered to remain constant.

11-5-Behavior of gases (6 hrs.T)

Knowledge of: Boyle's law; Charles' law; Characteristics equation of a perfect gas to problems related to marine engineering; Meaning of the terms specific heat capacity at constant volume (c_v) and at constant pressure (c_p); Effect of heating gases at constant volume and constant pressure with regard to: (Raise in temperature/raise in internal energy); $T_1/T_2 = (P_1/P_2)^{n-1/n} = (V_1/V_2)^{n-1/n}$; Behavior of a perfect gas when compressed or expanded adiabatically; Polytropic process (Where $n = c_p/c_v$); Introduction of ($n = \gamma = 1.4$) for air; Dalton's law of Partial Pressure.

Proficiency in: Solving problems related to above objectives and concerning marine heat-engine cycles; Ability to sketch a P-V diagram which shows isothermal, adiabatic and polytropic expansion/ compression from a common starting point; Solving simple problems concerning mixture of a gas and a vapor/ or mixture of two gases.

11-6-Thermodynamic processes (6 hrs.T)

Knowledge and Understanding in: Defining a thermodynamic process; The 2nd law of thermodynamics; Constant pressure, volume and temperature processes; Zero heat transfer process; Polytropic expansion and compression; Isothermal and adiabatic processes; Solving simple numerical problems relating to objective.

11-7--Work transfer (2 hrs.T)

Knowledge and Understanding in: Calculating work by force x distance; relation of area or a P.V diagram to the work done when a fluid exerts constant pressure on a piston in a cylinder; Work transfer for a vapor or ideal gas; Work transfer; Apply simple numerical calculations related to objective.

11-8-Thermal efficiency (2 hrs.T)

Knowledge of: Irreversibility of thermodynamic processes; Hypothetically reversible cycles; Carnot





cycle; Carnot thermal efficiency.

Proficiency in: Calculating Carnot thermal efficiency, given the maximum and minimum temperatures.

11-9-Steam plant (2 hrs.T)

Knowledge of: Thermal efficiency of a boiler and methods for calculating its value given steam conditions/ steam flow rate/ fuel combustion rate and fuel calorific value; Meaning of equivalent evaporation of a boiler; Rankine efficiency.

Proficiency in: Calculating the Rankine thermal efficiency and its comparison to the Carnot efficiency.

11-10-Nozzles (3 hrs.T)

Knowledge of: Identifying parts of a nozzle (Entry, throat and exit); Convergent nozzle; Divergent nozzle; and combination of convergent-divergent nozzle.

Proficiency in: Developing the steady-flow equation to produce an expression for the exit velocity from a nozzle in terms of enthalpy; Solving simple problems involving the expression in above objective; Obtaining the max. mass flow of a liquid through a nozzle with regard to fluid velocity; Sketching a diagram which shows the effect of different pressure gradients on liquid flow along the length of a nozzle.

11-11-Engine Trail Data (4 hrs.T)

Knowledge of: The terms usually used in engine performance such as: (Dynamometers, brake power, indicated power, friction power, torque, brake mean effective pressure); Calculation of brake power using the equation $\text{brake power} = 2\pi NT$; Calculation of turbine indicated power by using changes of enthalpy from inlet to outlet; Specific fuel consumption in terms of grams/kWh; Energy balance of a diesel engine.

Proficiency in: Sketching the following graphs, drawing attention to the significant features and giving brief explanations where appropriate: (Torque versus speed for a variable speed engine; Torque versus brake power for a constant-speed engine; Power versus speed for a variable-speed engine; Indicated power versus brake power for a constant-speed engine; Mechanical efficiency versus speed or brake power for variable and constant-speed engines; Fuel consumption versus speed for a variable-speed engine; Fuel consumption versus brake power for a constant-speed engine; Specific fuel consumption versus speed or brake power for variable and constant speed engines; Thermal efficiency versus speed or brake power for variable and constant-speed engines).

12-Marine heat engines, refrigeration and air compressors (16 hrs.T)

12-1-Heat engines (10 hrs.T)

Knowledge and Understanding in: Ideal gas cycles as those which use perfect gaseous; Constant volume cycle (Otto Cycle); Constant Pressure (Diesel Cycle); Dual Combustion Cycle; Joule cycle





(Gas Turbine Cycle); Carnot Cycle and thermodynamic processes in each cycle; Practical engines modeled on the aforementioned cycles; Processes in 2 and 4 stroke diesel and petrol engines shown with timing and P-V diagrams; Practical heat engines and their input energy; Efficiency of heat engines; Ideal output energy and proof of Work Done; Cycle efficiency Definition of swept volume and its unit; Mean effective pressure (m.e.p) and its unit; Indicated power produced in a 4 and 2 stroke engines and its unit; Indicator diagram and way of obtaining m.e.p from it; friction and brake power; Mechanical efficiency of an engine; Compression ratio in a cylinder $p v^n = \text{constant}$; Rankine cycle and its application to steam power; Four main components of steam plant and their function; Rankine cycle efficiency and output energy of the cycle; Turbine work (w) as difference of energy contained in input superheated steam and energy contained in leaving exhaust steam; Using of table of thermodynamic properties; Solving simple numerical problems related to the objective.

12-2-Theory of air/gas compression (6 hrs.T)

Knowledge and Understanding in: Compression of air/gas (Isothermal, polytropic and adiabatic); Corresponding pressure-volume diagram of an air compressor, showing suction, delivery, and clearance volume; Factors governing valve opening and closing in a compressor; Swept volume and effective swept volume; Definition of volumetric efficiency and need for high volumetric efficiency; Meaning of the term "free air delivery"; Reason for cooling of air and need for using intercoolers; Application of " $Pv^n = \text{constant}$ " during compression process; Application of " $Pv^n = \text{constant}$ " on air storage tank.

Proficiency in: Using the characteristic equation to convert free air delivery to actual delivery conditions and vice versa; Sketching diagrammatic arrangement of a multi-stage compressor; Sketching a pressure-volume diagram for a two stage compressor showing ideal isothermal/ poly tropic compression. Solving simple numerical problems related to the objective.

13-Industrial chemistry (10 hrs.T)

13-1-Fundamentals (2 hrs.T)

Knowledge and Understanding in: Definition of an atom, a molecule, chemical element, chemical compound, mixture, an oxide and chemical reaction; Meaning of solution, solubility, a saturated solution, suspension and precipitation.

13-2-Acidity/Alkalinity (2 hrs.T)

Knowledge and Understanding in: Composition of an atom and result of losing or gaining electron; Hydrogen and hydroxyl ions; PH value of a solution.

13-3-Corrosion (4 hrs.T)

Knowledge and Understanding in: Formation of metallic hydroxide when iron is immersed in an acidic solution (State boiler water should be alkaline and free of oxygen); Fundamental process of corrosion; Common engineering materials which produce passive oxide films; Main causes of corrosion; Galvanic cell components; Electrolyte; And anode and common metals selected as relative anodes; Sacrificial anodes; Galvanic action and means of reducing it; Pitting corrosion;





Graphitization of cast iron; Stress corrosion and metals commonly effected; Dezincification and de-aluminification and preventive measures; Fretting corrosion and factors causing increase of fretting; Corrosion fatigue; Major factors affecting the corrosion process; Methods of surface protection.

13-4-Water testing and treatment (2 hrs.T)

Knowledge and Understanding in: Controlling the PH value of aqueous solution and chemical additives used; Condition of water required for steam boiler and engine cooling system; Methods used for conditioning the water; Main metallic salt found in fresh water and average sea water; Permanent and temporary hardness; Scale and sludge formation in a steam boiler; Effect of using sea water, fresh water and distilled water; principal objects of treatment of boiler feed water.

4-4-1-2-Marine diesel engine (56 hrs.T)

4-4-1-2-1-Marine plants and operation (2 hrs.T)

Familiarization with: Correct procedures for the preparation, starting up, normal running and shutting down of marine machineries; Importance of data recorded from running machineries (Temperature, pressure and speed); Using data to locate fault; Appropriate procedure following discovery of fault.

4-4-1-2-2-Engine types (36 hrs.T)

Knowledge of: Marine diesel engine types; Large bore diesel engines and their major difference with smaller diesel engines; Low, medium and high speed engines; Their application and how can be used as main propulsion engines; Approximate speed ranges related to low, medium and high speed engines; P-V diagram and relative processes; Irregularities in P-V diagrams; Ways and methods of scavenging 2- stroke and 4- stroke engines; Reasons for a supercharging system; Different type of turbochargers (Radial & axial); Principle components of turbochargers such as impeller, turbine, turbine blades, labyrinth seals, bearings, inducer, diffuser and etc.; Principle components of medium and high speed (4-stroke) diesel engines and the material of manufacture (Main strength member, crank shaft, con. Rod, fuel pump, piston, cylinder, cylinder cover and mountings); Describes in simple terms the principal features of a typical "V" type medium speed diesel engine; Principle components of a large bore 2- stroke diesel engines and the material of manufacture (Bed plate, Crank shaft, Frame, Connecting rod, Cross head arrangement, camshaft, chain and gear, piston, Cylinder block, Tie rod, Liner and cylinder head); Principle parts, materials and operation of exhaust valves, cylinder lubricator, piston gland, fuel pump, fuel valve for diesel engines; Engine speed control mechanism including governor to maintain the normal running speed under condition of variable load; How engine over speed is prevented.

4-4-1-2-3-Engine Operation and Safeties (14 hrs.T)

Knowledge of: Internal combustion engines; Compression ignition engines and processes occur in such engine; Spark ignition engines and processes in such engines; Combustion process in compression ignition engines; Processes in 2 and 4 stroke engines; Interpretation of indicator diagrams with respect to engine timing diagrams; Describes, with the aid of diagrams, the distribution of lubricating oil to the guides, top-end, bottom-end and main bearings when pistons are oil-cooled and when water-cooled in a 2-stroke engine; Describes, with the aid of diagrams, a





lubrication and piston cooling system for a medium speed diesel engine; Turbocharger washing during running (Dry and water washing); Turbocharger surging (Causes and remedies); Running engine while turbocharger is out of service.

Knowledge of: Conditions which can lead to dangerous oil mists in crank case; Principle of operation of oil mist detector; Crank case relief door; Importance of keeping scavenge air spaces drained and clean; Correct procedure and actions during scavenge air space fire while engine is running; Starting air line explosion (Causes and remedies); List of essential alarms, slowdowns and shut downs.

Proficiency in: Sketching typical indicator diagrams for 2- stroke and 4- stroke engines; Calculating indicated power of an engine; Using of engine builders manuals to obtain applicable information.

Knowledge of: Starting air system including preparation for starting, stopping and reversing, when maneuvering and when at full speed.

Familiarization with: Main components of an air starting system including main starting air valve, air starting valve, air starting distributor and etc.; Reversible of large cross head type engines and their function; The purpose of a turning gear and the need for interlocks; To be familiar with the safety devices employed in the system.

4-4-1-2-4-Fuels and combustion systems (4 hrs.T)

Knowledge of: Types of crude oil and refining processes; Characteristics of marine residual fuel; Undesirable elements in marine fuels; Standard fuel; Combustion process in an internal combustion engine; Chemical reaction in a combustion; Result of combustion; Average proportions by percentage of oxygen and nitrogen in atmospheric air; Combustion products; Role of nitrogen in combustion process; Effect of excess in combustion; Signs of poor combustion; Range of CO for good, poor or bad combustion; Atomization of fuel and its importance; Effect of viscosity, atomization, penetration and turbulence on good combustion; Good combustion and its indication; Explain how to keep running of main engine under the condition of cutting fuel oil to one cylinder or more.

Knowledge of: Types of filters used and their relative advantages; Correct procedures for the disposal of waste oil, sludge residue and etc.; Place of storage of fuel oil; Settling tank mountings; Minimum flash point of marine fuels; Minimum fuel oil temperature for transfer and settling.

4-4-1-3-Marine steam turbine (4 hrs.T)

Knowledge of: Steam turbine construction, lubrication; Impulse and reaction turbines; H.P & L.P turbines; Materials of blades and other components; Bearings; Thrust bearings; Turbine glands and gland steam systems; Sequential nozzle operation; Vacuum pumps; Air ejectors; Extraction pumps; Gland condensers; Vibration; Procedures for warming through turbine installations; Warming up procedure from cold; Shut down procedures; Preparing the turbine for sea; Standby period components and materials used; Turbine safety devices (Over speed and excessive axial movement trip mechanism; Low vacuum trip; Lubricating oil pressure trip).





4-4-1-4-Marine gas turbine (4 hrs.T)

4-4-1-4-1-Operation principles (2 hrs.T)

Knowledge of: Explaining how a gas turbine is used for; Describing the feature of a gas turbine; Describing the operation principles in terms of four processes, compression, combustion (heating), expansion and exhaust; Comparing a gas turbine with a steam turbine in terms of advantages and disadvantages; Describing the types of gas turbines.

4-4-1-4-2-Basic construction (2 hrs.T)

Knowledge of: Using visual aids, describes the three main components of gas turbine as: (Compressor; combustion chamber; turbine); Describing the types of compressors and their features; Describing the types of combustion chambers and their features; Describing the types of turbine and their features; Lists the attached equipment and explains their feature and functions in simple terms.

4-4-1-5-Marine boiler (14 hrs.T)

Knowledge of: Uses of steam from an auxiliary boiler on board ships and steam pressure required; Ranges of auxiliary steam boilers; Principle difference between fire tube and water tube boilers; General constructional details of a fire-tube boiler and material used for construction; General requirements for construction of pressure vessels; Different type of boiler tubes and method of expanding tubes in a tube plate; Lay out and general constructional details of a water tube boilers; Principle of operation and control of water and fire tube boilers; Shell mountings of a water and fire tube boilers and their function; List and purpose of boiler mountings (Main steam stop valve; Auxiliary steam stop valve; Safety valves and easing gear; Water level indicators; Feed inlet valves; Blow down valve; Scumming valve; Soot blowers; Connection for pressure gauge; Air vent; Sampling cock and etc.); Methods of supporting, connections steam pipes; Purpose and operation of reducing valve and steam traps; Reason for water hammer and means of avoiding same; Procedure for rising steam and coupling a boiler into the steam system; Correct procedures for checking the water level; Dangers involved with, low and high level of water and procedures to be followed when discovering it; Principle aims of treating the water in a boiler and how the objectives are achieved; Dangers of oil entering a boiler and how the objectives are achieved; Dangers of oil entering a boiler and means used to minimize the possibility of oil contamination; Systems associated with production of steam and safety devices and procedures involved in each; Principle of operation of multi boiler waste heat systems using natural and forced circulation; Meaning of blow back and how can be avoided; Boiler fuel supply system and main components; Types of burners and how they atomize the fuel; Maintenance procedures for oil burning equipment; Need and the use of soot blowers; Boiler uptake fire and methods of detecting and avoiding; Procedure for taking a boiler out of service; Procedure for blowing down a boiler.

4-4-1-6-Shafting installations, including propeller (8 hrs.T)

Knowledge of: Limitations on shaft alignment in ships; Water and oil lubricated stern tubes; Seals and lubricating systems; Plumber blocks; Couplings; Shaft strength; Torque, power and angle of twist; Torsion meter and dynamometer to obtain shaft power; Methods of reversing the direction of thrust; Thrust block; Thrust indicator; Controllable pitch propeller; CPP bridge control; Propellers





fitting and removal; Cavitation & singing of propellers & its generating mechanism; Different propulsion plants (Diesel/turbo electric, podded drives, water jets).

4-4-1-7-Other auxiliaries, including various pumps, air compressor, purifier, fresh water generator, heat exchanger, refrigeration, air-conditioning and ventilation systems (32 hrs.T)

4-4-1-7-1-Pumps (12 hrs.T)

Knowledge of: Requirement of power supply to a pump; Stating that the function of a pump is to transfer fluid between two given points, and the power supplied to a pump must be sufficient to transfer the fluid at a specified rate of flow, and to overcome all resistance in the pump and system also produce the required pressure at the discharge point with respect to Losses of head in a pumping system; Losses of head in pumping system; Relation of fluid viscosity and pumps design; Types of pumps used on ships and the purpose of their use; Basic action of displacement pump and necessity for fitting a relief valve on discharge of it; Operation of a reciprocating pump and purpose of its attachments; Characteristic of a reciprocating pump; Principal of a rotary displacement pump; Construction and principal parts of a gear pump including reversible type gear pump, rotary vane pump; Screw displacement pump; Principles of operation of an axial flow pump; Principles of a centrifugal pump (Parts such as impeller, volute or diffuser) and its characteristics; Single and double entry impeller; Multi stage centrifugal pump; Need and ways of air extraction from a centrifugal pump; Central priming system; Principles of an ejector; Importance of liquid temperature at pump suction in relation to its pressure; Effect of viscosity on pump performance; Effect of suction head on a centrifugal pump; Procedure for starting up and stopping of pumps; Care for satisfactory operation of adjustable and non-adjustable glands seals; Reasons for loss of performance of a pump.

4-4-1-7-2-Air compressor (6 hrs.T)

Knowledge of: Air compressor and its function; Shipboard uses of compressed air; Principal types of air compressors; Simple sketch of a single stage cylinder for a reciprocating air compressor; Principle of compression process in a 2-stage reciprocating air compressor; Reasons for using inter coolers and after cooler; Construction details and materials of reciprocating air compressor's components; Cylinder lubrication for correct and safe operation; Purpose of relief valve, fusible plugs and water-space pressure relief facility; Construction details of rotary compressors; Giving materials used for main component parts; Means of drive and uses of centrifugal air compressors; Means of storing compressed air; Material and construction requirements of a reservoirs; Important mountings of an air reservoir; Means of protection against corrosion, and overpressure; Purpose of pressure reducing valve in air distribution systems; Attention needed for filters fitted in air distribution system.

4-4-1-7-3-Purifier (2 hrs.T)

Knowledge and understanding of: Explaining the function of purifier parts including bowl, operating water valve, gravity disc, etc.; Differentiate between static and dynamic separation; Differentiate between purifying and clarifying; Purification process of fuel oil; Correct and safe operating procedure for centrifuges.





4-4-1-7-4-Fresh water generator (4 hrs.T)

Knowledge and Understanding of: Construction and fittings of fresh water generators; Approved standard for materials; Construction and mountings of a shell and coil fresh water generator; Methods of obtaining vapour from sea water; Purpose of reducing orifice in steam supply line; Reasons for using low-pressure fresh water generators; Meaning of single and double effect fresh water generators; Principle of flash evaporation and principle operation of single and two stage flash fresh water generators; Multi-effect evaporation and its advantage over single fresh water generators; Definition of "distillation" as used in marine engineering practice; Uses of fresh water onboard ship; Quality of drinking water and arrangement of making distillate water potable.

4-4-1-7-5-Heat exchanger (2 hrs.T)

Knowledge and Understanding of: Definition of contact heat transfer; Principle of construction of shell and tube and plate type heat exchangers; Single and two pass heat exchangers; Lists the types of heat exchangers used for the following: (Lubricating-oil coolers; Fuel-oil heaters; Fresh-water coolers; Compressed-air coolers; Fresh-water heaters; Steam condensers; Seawater evaporating and distilling plant; Seawater heaters; Evaporators and condensers in refrigerators); Materials used for shell, tubes and tube plate of heat exchangers; Explains how: Differential expansion is allowed for, An effective seal is maintained between the fluids, Leakage is detected.

4-4-1-7-6-Refrigeration (6 hrs.T)

Knowledge of: Distinguishing between refrigeration, air conditioning and ventilation; Marine refrigeration systems operate on a reversed Rankine cycle (Vapour-compression cycle); Principle of operation of a refrigeration system; System components and their function; Processes which take place in each part of the system; Common primary and secondary refrigerants and the requirement of each; Types of compressors in common use and their application; Automatic control of the system using cold room temperatures; Correct operating condition of the system; Principle of insulation of storage spaces; Temperature range for meat, vegetable and fresh fruit rooms; Sketching a simple line and block of an air conditioning system; Stating how to control temperature and humidity in the air conditioning system.

4-4-1-8-Steering gear (8 hrs.T)

Knowledge of: Vitality of steering gear with respect to safety of ship and need for its correct operation; Need for two means of steering; Control of steering gear provided in steering compartment; Steering system and function of major components and their relation; Hydraulic telemotor system and properties of telemotor fluid; Malfunction in hydraulic telemotor system (Electrical telemotor system); Hydraulic power operated rudder system; 2 and 4 rams steering system and materials used for main components; Radial vane type steering system and materials used for main components; Function of rotary positive-displacement pumps and their means of drive; Principle operation of radial cylinder pump, swash plate pump and their means of pumping control; Type and condition of oil used in a hydraulic system; Means of absorbing shocks in the system; How a steering is tested according to IMO recommendation; Electrical steering system based on a Wheatstone bridge; Principle of the ward-Leonard and single motor system; Emergency steering and its possible locations; Identifying the particular requirements of oil tankers.





**4-4-1-9-Fluid flow and characteristics of lubricating oil, fuel oil and cooling systems
(4 hrs.T)**

Knowledge of: Means by which length of pipes are joined together and materials used to seal joints for steam, sea water, fire main, bilge and ballast, starting air and control air pipes; Way of supporting pipe to reduce vibration; Way of controlling pipes expansion and contraction; Materials used for construction of pipes for carrying various liquids; Principle of construction of a cock; Features of a globe valve, screw lift valve, screw down non return valve, non-return valve, gate valve; Features of a relief valve; Applications of quick closing valve; Purpose and application of a change over chests; Blanking of pipelines; Features of a mud box.

4-4-1-10-Deck machinery (6 hrs.T)

Knowledge of: Basic electric /hydraulic systems including constant flow, constant pressure and demand flow hydraulic systems, and the common use and application of these systems; Familiar with the construction and operating mechanism of deck machineries including mooring winch and windlass, boat winch, hatch cover systems, cargo handling gears, gang way system and etc.

**4-4-2-Safety and emergency procedures for operation of propulsion plant machinery,
including control systems (2 hrs.T)**

Knowledge and proficiency in: Being familiar with the emergency operation of the main engine from emergency stand; Main engine safeties including slow down and shut down; How they operate; How to reset; Main engine control system and it's malfunctions; Procedure of local and emergency operation of steering gear system.

**4-4-3-Preparation, operation, fault detection and necessary measures to prevent damage
for the following machinery items and control systems: (14 hrs.T)**

**4-4-3-1-Other auxiliaries, including refrigeration, air-conditioning and ventilation
systems (14 hrs.T)**

4-4-3-1-1-Purifier and fuel oil treatment (2 hrs.T)

Knowledge and proficiency in: Explaining the operation of a purifier; Explaining the function of gravity disk; Explaining the function of low and high pressure water; Sludge discharging mechanism of an oil purifier; Approximate temperatures of the oil necessary both in the supply tank and immediately prior to centrifuging; Explaining precautions for starting purifiers and checking points to ensure a good working order; Describing the correct procedures for the disposal of waste oil, sludge residue.

4-4-3-1-2-Air Compressor (2 hrs.T)

Knowledge and proficiency in: Stating that cylinder lubrication must be kept to a minimum; Stating that cylinder lubricating oil should not have a flashpoint below 210°C and the use of synthetic lubricating oil to reduce a hazard; Describing the attention required to keep the intake air filter working effectively; Explaining the reason for fitting drain valves after air coolers; Describing the starting-up and stopping procedures; Explaining the principles upon which air compressors are run



automatically; Describing the required quality for compressed air that is to be used in control systems.

4-4-3-1-3-Evaporators and distillers (4 hrs.T)

Knowledge and proficiency in: Describing the need for starting fresh water generator and the limitation of its use; Explaining the starting procedure for fresh water generator; Explaining how the formation of scale on the heating surfaces of coils, tubes and other heat-transfer elements are controlled; Stating the limiting pressure and temperature in the shell in order to control the formation of scale; Explaining why the density of the brine must be carefully controlled; Describing the type of scale deposited on the heating surfaces; Explaining how the scale described in the above objective is removed; Describing the function of a distiller as that of condensing fresh water from the vapour produced in an evaporator; Stating that cooling is usually achieved by heat exchange with seawater flowing through tubes or coils; Stating that if, during the evaporation process, a temperature of 75°C is not achieved, chemical agents must be added to the water to destroy any harmful bacteria which may be present; Explaining how the water is made potable.

4-4-3-1-4-Refrigeration (6 hrs.T)

Knowledge and proficiency in: Stating the preparation and precautions for starting a refrigeration system; Stating precautions and checking points on a refrigeration system during running; Stating how the operating conditions is identified; Stating what malfunctions/troubles likely to occur in refrigeration equipment; Describing the effect of variations in seawater temperature on the running of a refrigerating system; Describing the effect in refrigeration unit of air, moisture and oil; Explaining how to charge refrigerant into a refrigeration system and collection of gas in recovery bottle; Explaining how to charge lubricating oil into a refrigerator; Explaining how to remove air from a refrigeration system; Stating how to make a leak test for a refrigerator unit such as pressure test/ vacuum test.

Competence 4-5: Operate fuel, lubrication, ballast and other pumping systems and associated control systems (13 hrs.T)

4-5-1-Operational characteristics of pumps and piping systems, including control systems (2 hrs.T)

Knowledge and proficiency in: The performance will deteriorate if the temperature of the liquid being handled approaches that at which vapor are produced at the pressure in the suction pipe; Performance deteriorates if the viscosity of the fluid increases; Stating that, if there is no positive head at the inlet to a centrifugal pump, a priming device must be used; The correct procedures for starting up and stopping; Explaining possible reasons for a loss of performance of a pump.

4-5-2-Operation of pumping systems (6 hrs.T)

Knowledge and proficiency in: On board training scheme as per requirements of IMO regulations for various pumping systems.





4-5-2-1-Routine pumping operations (2 hrs.T)

Knowledge and proficiency in: Pumping system with refers to piping diagrams and location of concerned valves in the system; Recording of pumping operation; Ship stability consideration; Considerations of fluid temperature and viscosity for the optimum performance.

4-5-2-2-Operation of bilge, ballast and cargo pumping systems (4 hrs.T)

Knowledge and proficiency in: Operations are planned and carried out in accordance with established rules and procedures to ensure safety of operations and avoid pollution of marine environment; Routine pumping operations including bilge, ballast and cargo pumping systems; Stating that the viscosity of the fluid to be pumped must be within the range specified in the pump design; Sketching diagrammatic arrangement of a bilge pumping system, ballast pumping system, domestic fresh water and sea water pumping systems and states the function of each component in the system; Explaining, using a single line sketch, how a fire main is supplied, including connections with other pumps; Stating the minimum number of independently driven fire pump as laid down by international law; Explaining the purpose of the isolating valve.

4-5-3-Oily-water separators (or-similar equipment) requirements and operation (5 hrs.T)

4-5-3-1-Oily water separator (2 hrs.T)

Knowledge and proficiency in: Describing the general requirements necessary for oily water separators; Function of an oily water separator; Principle of operation of an oily water separator; General construction and material of components parts used; Maintenance and care required; Stating the reasons to use positive-displacement pump for oily water separators; Stating the principles of oil content meter attached to oily water separators/similar equipment; Explaining how to prevent oil being mixed into discharging bilge when oil content exceeds 15 ppm; Stating that pollution of the sea is an offence under international law; Stating that the dumping of oil or oil-water mixtures is strictly prohibited; Stating that there is a legal maximum oil content of water to be discharged overboard; Stating that the effluent should be further filtered to give an output containing a maximum of 15 p.p.m. of oil; Describing, with the aid of a single line sketch, the operation of an automatic oily-water separator.

4-5-3-2-Sewage treatment plant (2 hrs.T)

Knowledge and proficiency in: Principles of operation of a biological sewage treatment plant; Discharge tests of aerobic sewage plant (Suspended solid, biochemical oxygen demand, coliform count); Principles of operation of zero discharge system; Sewage retention system.

4-5-3-3-Incinerator plant (1 hr.T)

Knowledge and proficiency in: Function of an incinerator; Principle of operation of an incinerator; General construction and sections in plant used; Maintenance and care required.





**FUNCTION 5 : ELECTRICAL, ELECTRONIC AND CONTROL ENGINEERING AT
THE OPERATIONAL LEVEL (86 hours Theoretical, 24 hours Practical)**

Competence 5-1: Operate electrical, electronic and control systems (54 hrs.T, 12 hrs.P)

**5-1-1-Basic configuration and operation principles of the following electrical,
electronic and control equipment: (54 hrs.T, 12 hrs.P)**

5-1-1-1-Electrical equipment: (38 hrs.T, 6 hrs.P)

5-1-1-1-1-Introduction (4 hrs.T, 2 hrs.P)

Knowledge and understanding of: Materials used in electrical systems: conductors, semi-conductors and insulators etc. ,Simple electrical circuit; Ohm's Law; Magnetic and thermal effects of electric current; Series and parallel circuits; Simple circuits theorem; Kirchhoff's Laws (KVL and KCL); Electromotive force; Units of voltage, current, resistance and energy; Wheatstone bridge and applications; Distribution of current in circuits; Resistance of conductors including variation with dimensions, material and temperature; Temperature coefficient of resistance; Resistance of Insulators; DC supply Primary and secondary cells; Secondary cells common types (Acid and Alkaline); Construction; Capacity in Ampere-hour and watt-hour; Ideal and real batteries and internal resistances; Different types of cell connections; Max. power transfer theorem; Magnetic field; Lines of force; Electro-magnetic field, flux, density and intensity; Field due to current in a straight ,loop and solenoids conductor; Motors and generators basic rules; Magneto-motive force.

5-1-1-1-2-Generator and distribution systems (12 hrs.T)

5-1-1-1-2-1-D.C. generator (4 hrs.T)

Knowledge and understanding of: D.C. generator construction and identifying each associated parts; Commutation and brushes; Classification of D.C. generators; D.C. generator terminal voltage and field current characteristic; Field system and armature; D.C. armature winding arrangement; Difference between shunt, series and compound coils and selective types; Simple D.C. distribution systems and associated parts; D.C. distribution systems on board ship; Their applications for deck machinery; Routine checks and maintenance of DC generators.

5-1-1-1-2-2-A.C. Generator (8 hrs.T)

Knowledge and understanding of: The meaning of alternating current; Instantaneous and average voltage ($e = BLV$ to produce $e = E_m \sin \omega t$); Definition of resultant signals, phasor and drawing of phasor diagrams; Definitions, symbols and conventions of rotation, angular velocity, periodic time, frequency, peak value and amplitude; Expression of $e = E_m (\sin 2\pi ft)$; Solving simple problems in relation to above expression; Phase difference between voltage and current values; Simple sketch to present two sine waves with same frequency but different amplitude and phase angles; Meaning of Root Mean Square value (RMS); RMS value = 0.707 peak value; Reactance, Inductance of a coil and capacitance of a capacitor; Total impedance of an A.C. circuit; The meaning of high (H.V) and low (L.V) voltages; AC series and parallel circuits; Concepts of single and poly phase systems; Power in AC circuits; Active, reactive and apparent power together with power factor; Power factor value, its importance and improvement; Simple construction of three phase alternator; Terms in





three phase alternators i.e. construction of stator, rotor for low and high speed, Salient and cylindrical poles on rotor windings types on stator, excitation types, air gap; How AC is produced; Terms in AC generator i.e. magnetic flux, EMF (Electro magnetic force), frequency and its relation to speed of rotation, self and separate excitation methods; Function of automatic voltage regulator; Block diagram of AVR and purpose of hand trimmer; Cooling of generator; Necessity of space heater; Safeties incorporated in alternator; Definition and arrangement of Delta and Star winding connections; General description of protection of alternator e.g. preference , under-voltage and reverse power protection; Single line diagram of electrical power distribution systems; Diagram of H.V. power distribution system; Ship service distribution system; Lighting distributions; Ship service switchboard; Shore supply requirements; Emergency distribution system; Protection by discrimination; Connection of NER to ship's hull from earthed and insulated type point of views.

5-1-1-3-Preparing, starting, paralleling and changing over Generators (4 hrs.T)

Knowledge and understanding of: Checking and preparing as per procedure before starting and paralleling generators; Parallel running of two generators and required for such an operation; synchronization; Back up 3-lamps method and synchro-scope closing method of circuit breakers; Load sharing: manual, semi-auto and fully auto load sharing types and devices; Emergency generator construction and it's purpose; Electrical circuit safeties; Voltage, frequency and phases; Emergency switch board and it's consumers; Safety interlock and bus-tie; Automatic and manual starting of emergency generator considering applicable rules and regulations.

5-1-1-4-Electrical motors including starting methodologies (10 hrs.T, 4 hrs.P)

5-1-1-4-1-D.C. Motors (4 hrs.T)

Knowledge and understanding of: Back e.m.f in a DC motor; Voltage, current and speed equations; Reason for the starting current to be high; Motor classifications; Meaning of series, shunt plus long shunt, short shunt and cumulative connection in compound motors; Speed, torque and output power controlling factors; Efficiency and losses; Starting arrangements; Protection of motors; different specification curves; Applications of DC motors on board; Routine checks and maintenances.

5-1-1-4-2-A.C. Motors (6 hrs.T, 4 hrs.P)

Knowledge and understanding of: Induction motor operation principle; Induction motor construction and its actual components; Types of motor on board ships (squirrel cage, double squirrel and wound rotor types); Different types of motor enclosure and their differences; IP numbers; Characteristics and relationship between speed and load plus current and load, from no load to full load condition; Production of driving torque; Speed-torque curve of induction motors, Meaning of slip and why it is required; Starting current and starting torque and their effect on electrical supply current; Different means of starting a motor (Reduced voltage, direct on line, star – delta and auto transformer); Motor protection devices and requirement for such protections; Principle of operation of over current relay and differences between possible over load current and fault current; Function of the over current trip, time delays and fuses; Fuse ratings; Principle of thermal relay and its adjustment; Single phasing and its effects on motor; Single phasing protection; Function of under voltage trip; Application of different speeds (Single fixed speed, two or three fixed speed and infinitely variable speed); Variable frequency drive for A.C. motors and methods of



attaining such an ability; Power and control diagram of the motor starting methods.

5-1-1-1-5-High-voltage installations (4 hrs.T)

Knowledge and understanding of: Advantages of utilising High Voltage; Major Risk Factors in HV systems; Maritime HV installations and safe working procedures regulations; Installations of generators, motors and switch-boards; H.V. circuit breakers; Vacuum, air and oil circuit breakers; Dash pots Arc Guard system; Arc step limiters and arc chutes; Cable theory; Inter electrode capacitances and inductances; End terminations, joints and glands, earthing 6.6 kV main switchboard; Safe Withdrawal of main circuit breakers; H.V. life line tester; Portable Earthing connectors; Consequences of short circuit; Arcing sparks and explosions; Preventive maintenance.

5-1-1-1-6-Sequential control circuits and associated system devices (4 hrs.T)

Knowledge and understanding of: Concepts of Sequential Control; Sequential Function Charts (SFC); State Diagrams; Flow charts; Compare with conventional Control and associated diagrams; Input/ output signals; Speed signals; Various control sensors; Digital and Analogue signals; Basics of PLC machine control; Control elements of motors and generators; Advantages of PLC.

5-1-1-2-Electronic equipment: (10 hrs.T, 4 hrs.P)

5-1-1-2-1-Characteristics of basic electronic circuit elements (4 hrs.T, 4 hrs.P)

Knowledge and understanding of: Semi-conductors; Intrinsic and extrinsic Crystal structures, p-type and n-type semiconductors; The p-n junction; Forward and reverse bias; Leakage Current; The diode V-I characteristic; Half-wave rectification; Full-Wave Rectification; Bridge and center tapped transformer rectifier; 3-phase rectifiers (3 and 6 diodes type); Understanding the function of transistors; pnp and npn connections; Emitter, base and collector; Biasing and testing of pnp and npn connections; Common types of amplifiers; Application of transistors.

5-1-1-2-2-Flowchart for automatic and control systems (2 hrs.T)

Knowledge and understanding of: Open loop and close loop systems; Understanding manual and automatic control system; Basic elements in a control loop (The feedback control systems; Reference input; Controlled output; Controller, actuator, plant, transducer; Desired value and comparator); Diagram and flowchart of the actual elements in a control loop.

5-1-1-2-3-Functions, characteristics and features of control systems for machinery items, including main propulsion plant operation control and steam boiler automatic controls (2 hrs.T)

Knowledge and understanding of: Boiler water level control; Steam temperature control; Steam pressure control; Boiler combustion control; Force draught fan control; Feed recirculation control; Lubricating oil temperature control; Cooling water temperature control; Fuel Viscosity control.



5-1-1-3-Control systems: (6 hrs.T, 2 hrs.P)

5-1-1-3-1-Various automatic control methodologies and characteristics (2 hrs.T)

Knowledge and understanding of: Split type control; Cascade type control; Integrated control system; U.M.S ship characteristics; Intelligent ship characteristics; Digital bridge system.

5-1-1-3-2-Proportional- Integral- Derivative (PID) control characteristics and associated system devices for process control (4 hrs.T, 2 hrs.P)

Knowledge and understanding of: Proportional control (P-type); Proportional band; Gain; Proportional control action; Off-set in the system; Derivative and differential controller; D-type derivative action signal; Derivative action time; Integral controller I-type; Integral action signal; Integral action time; Multiple term controllers; Controller's actions in response to process change; Components of pneumatic controller; Flapper; Nozzle; Bellows; Desired value and set point spring; Sensors and motorized valves; Simple explanation of digital and analogue controllers; Operation principle of each component constructing automatic control systems such as Pressure switch; Temperature switch; Resistance bulbs; Electro-pneumatic convertor; Electromechanical transducer; Valve positioned; Control valve; Relays and Pneumatic/electronic PID controller.

**Competence 5-2: Maintenance and repair of electrical and electronic equipment
(32 hrs.T, 12 hrs.P)**

5-2-1-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 (4 hrs.T)

Knowledge and proficiency in: Dangers that can be encountered with electricity; Minimization of the risk; The secondary hazard; Electricity as a form of energy; The amount of shock current (threshold limit); The body resistance; The applied voltage; The effect of frequency; The duration of contact. Safety precaution considerations; List of do,s and don't,s while facing electrical networks; Safe Electrical Systems/Equipments; Protective Devices; Safe Working Practices; Safety Planning; Safety procedures; Proper Maintenances; Special operating procedures; Lockout/tag out High Voltage; Effective isolation of power supply; Clear notification; Safeguard against Direct Contact with Live Electrical system; Adequate insulation of live conductors; Adequate Isolation; Interlocking devices; Safeguards against Indirect Contacts Ground Fault Conditions; Indirect contact with electrical current; Grounding/Earthing on ships; Safe designed equipment; Working on board ship with electric hand tools; Disconnection of fuses and breakers; Automatic Protection; Use of lower voltages, 110 volts or lower suitable for lighting; Electrical safeties in Hazardous area; Documentation of permit to work on hazardous areas; Use of the instruments in hazardous area; Ex- type devices; Zener barriers; Need for a step-down device; Emergency procedures in the event of an accident; Equipment emergency shutdown procedure; Electric shock first aid procedure; The need for first-aid training.





5-2-2-Maintenance and repair of electrical system equipment, switchboards, electric motors, generator and DC electrical systems and equipment (6 hrs.T, 2 hrs.P)

Knowledge and proficiency in: General maintenance method: (Corrective, planned and condition monitoring); Maintenance of general electrical equipments; Cables; Cable repairs; Main switchboard, bus bars insulators; Instruments; Main circuit breakers; Panels; Main and emergency lightings; Main transformer services; Maintaining the correct ratings and calibration of safety devices; Replacement procedure of fuses in 3- phase and high voltage system; Correct procedures and preparation of motors and starters for maintenance; Carrying out maintenance to a cage type electric motor; Checking the insulation resistance of a 3- phase induction motor; Carrying out maintenance and submission of reports on starters and controllers; Cleaning, drying and re-varnishing of electrical motor; Water tightness of the glands and terminal boxes; Enclosure IP protection; Maintaining the ventilation of the motor; Effect of temperature on the windings of the electrical motor; Monitoring the windings temperature; Repair and maintenance of D.C. motor commutator and carbon brushes; Insulation trend; Replacement of bearings; Maintenance of alternators; Periodical insulation measurements and recording; Temperature measurement of windings; Checking the bearings temperature; Checking ventilation; Checking the excitation systems including excitation transformers and diodes; Safety switches; Interlock systems of local panels.

5-2-3-Detection of electric malfunction, location of faults and measures to prevent damage (4 hrs.T, 4 hrs.P)

Proficiency and Understanding in: Detecting and correcting faults in motors, starters and protection equipments; Common faults in power supply system and alternators; Low insulation readings of electrical equipments; Insulation Resistance tests and causes of failure; Fault finding of motors, starters and protection equipment; Short circuit trip; Open circuit and earth fault detection; Over and under voltages; Over and under frequency; Over current rectification of the faults; Precaution and safety consideration of repairs and maintenance carried out in hazardous areas; Rectification of earth faults.

5-2-4-Construction and operation of electrical testing and measuring equipment (4 hrs.T, 2 hrs.P)

Understanding and Proficiency in: Methods of measurement of current (I), voltage (V), resistance (R) and power (P); The importance of insulation readings IR; Megger equipment and safety concerns of electronic devices; Meaning of Continuity test and insulation test; Instrument transformers (CT's and VT's) and safeties; Sensors and transducers ; Calibration and testing; Measurement of insulation of 3-phase induction motor, generators and cables.

5-2-5-Function and performance tests of the following equipment and their configuration: (12 hrs.T, 2 hrs.P)

5-2-5-1-Monitoring systems (4 hrs.T)

Knowledge and proficiency in: Unmanned machinery space; Purpose of fully integrated control rooms; Computerized systems; Monitoring of different physical quantities (speed of ship, temperature measurements, air pressure measurement, tanks levels bilge and sludge, viscosity of



fuel); Critical and Non critical alarms; Recording of the alarms; Change over switch; Display and printing units; Time delays; Analysis of signals from sensors; Memory capacity of the systems; Maintenance of the system and prevention of earth faults from sensors.

5-2-5-2-Automatic control devices (4 hrs.T)

Knowledge and proficiency in: The propulsion control systems, remote control of the main engines from telegraph, maneuvering lever in the wheelhouse and control room; Automatic start-reverse-stop and speed setting signal to the governor; Function of the systems; Back up controls; Start failures; Time limit; General description of automation of boiler main diesel generators and emergency generators; Fire alarm system; Automation of motor driven pumps.

5-2-5-3-Protective devices (4 hrs.T, 2 hrs.P)

Knowledge and proficiency in: Essentiality of protecting electrical equipment; Protection of alternators: The over Current Inverse Time relay; Over Current Trip Instantaneous; Negative Phase Sequence; Differential measurement of current; Earth leakage relay; Under and over voltage; Under and over frequency; Lock out; Reverse power; Preferential trip, Motor protections Alarms; Motor protection such as Fuses; Bimetal relay; Electronic over current Protection; Single phasing; Temperature sensors for monitoring winding temperature; Distribution system protections such as Earth fault monitors, fuses, Protection by discrimination, Short circuit protection; Excitation trip; Interlock system.

5-2-6-The interpretation of electrical and simple electronic diagrams (2 hrs.T, 2 hrs.P)

Knowledge and Understanding of: Block diagram; Wiring diagram; Single line diagram; Power and control diagram. The symbols of electrical and electronic components Block diagram of main engine automation; Direct on line starter power and circuit diagram; Other Simple electronic circuits.

**FUNCTION 6 : MAINTENANCE AND REPAIR AT THE OPERATIONAL LEVEL
(43 hours Theoretical, 5 hours Practical, 60 hours Exercise)**

**Competence 6-1: Appropriate use of hand tools, machine tools and measuring instruments
for fabrication and repair on board (20 hrs.T, 5 hrs.P)**

**6-1-1-Characteristics and limitations of materials used in construction and repair of
ships and equipment (4 hrs.T)**

Knowledge and proficiency in: Choice of materials for marine engineering components; Mechanical properties of marine material and usage of cast iron; Definition of alloys; Usage and composition metals of brass, bronze and white metal; Normal range of carbon content in mild steel, cast steel, and cast iron; Ferrous and non-ferrous metal basic differences; Properties of alloying elements such as nickel chromium and molybdenum in marine steels.

6-1-2-Characteristics and limitations of processes for fabrication and repair (2 hrs.T)

Knowledge of: Various characteristics of metals such as ductility, tensile stress, brittleness.

**6-1-3-Properties and parameters considered in the fabrication and repair of systems
and components (12 hrs.T, 4 hrs.P)**

6-1-3-1-Basic metallurgy, metal and processes (2 hrs.T, 4 hrs.P)

Knowledge of: Basic heat treatment processes, such as tempering, annealing, normalizing and hardening and their objectives; Heat treatment processes for common carbon steels and properties obtained in each case; Basic principle of modern processes for production of steel from pig iron.

Proficiency in: Identifying samples of various metals; Carrying out basic heat treatment; Testing a hardened and tempered cutting edge.

6-1-3-2-Non-metallic materials (2 hrs.T)

Familiarization With: Polymers and other non-metallic materials commonly used and their applications in marine plants; Properties and reactions of various plastic bonds.

6-1-3-3-Materials under load (2 hrs.T)

Knowledge of: Definition and types of stress; Strain in materials; Types of loading on materials; Definition of tensile, compressive and shear forces; Behavior of material under tensile, compressive and shear forces; Definition of elastic limit, yield point, ultimate strength, breaking strength, as applied to an elastic material; Definition and application of hook's law.

6-1-3-4-Vibration (6 hrs.T)

Knowledge of: Vibration; Vibration frequency; Causes of vibration with regard to unbalanced rotational and reciprocating forces; Main sources of vibration on a ship and its effects; Transmission of vibration; Anti-vibration materials; Stating that if a component is vibrating a reversing stress is





present in the material; Stating that in normal working conditions the stresses due to vibrations are well within limits allowed for in the design; Stating that if vibrations become excessive, the stresses induced can cause permanent damage; Stating that excessive vibration should not be allowed to continue; Stating that when varying the rotational speed of machinery, stages may be encountered where vibrations become excessive; Explaining that the condition described in the above objective is normally due to a resonance of vibrations which occurs at 'critical speeds'; Stating that critical speeds are predictable and should be clearly marked on controls and known to engineer officers; Stating that machinery should not be allowed to operate either at or close to a critical speed; Stating that critical speed ranges should be passed through as quickly as possible; Stating that in addition to stress, vibration may cause securing devices to work loose, methods of reducing and importance of eliminating vibration.

6-1-4-Methods for carrying out safe emergency/temporary repairs (1 hr.P)

6-1-4-1-Bonding (1 hr.P)

Knowledge of: The care necessary when using compounds and adhesives to make bonding; Advantage and disadvantages of adhesive bonding; The principles of bonding plastics; Softening temperature for plastics; The care and safeguards necessary when heating plastics; The basic principle of testing for sheer and peel strength of adhesives; Principle of bonding friction lining to steel shoes or discs and smooth surfaces; Sources and elements of adhesives; Purpose of activator in epoxy resin; Significance of pot life; Friction of correct adhesive; Solved welding; Principle of welding Plastics.

Proficiency in: Selecting and using the correct adhesive for a variety of applications and strength testing.

6-1-5-Safety measures to be taken to ensure a safe working environment and for using hand tools, machine tools and measuring instruments (2 hrs.T)

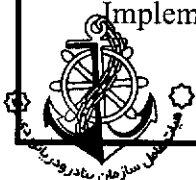
6-1-5-1-Safe working practices (2 hrs.T)

Knowledge of: Risks and Hazards inherent to any workshop or machinery space; Responsibility of the employee under the health and safety at work; Dangers associated with unsuitable clothing, ear muffs, safety harness; Safety and health risks which may arise when using adhesives, dangerous substances, chemicals, noxious liquid and gases.

**Competence 6-2: Maintenance and repair of shipboard machinery and equipment
(23 hrs.T, 60 hrs.E)**

6-2-1-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 (2 hrs.T)

Knowledge and proficiency in: Use of safe working practice principle and safe isolation technics; Outline International Safety Management (ISM) code and Safety Management System (SMS); Implementation of safety procedures; Selection of procedures for the conduct of repair and





maintenance in accordance with instruction manuals and identifying the correct tools for dismantling, inspection, repairing, reassembling and measurement; Commissioning and performance testing of equipment and systems after repair as per instruction manual; Identify risks (risk assessment) before commencing any repair or maintenance according to SMS; Recording the maintenance activity.

6-2-2-Appropriate basic mechanical knowledge and skills (2 hrs.T)

Knowledge and proficiency in: To acquire basic skills in order to carry out machinery maintenance and repair as per instruction manuals; Ability to work with lifting gear, considering the weight of parts; Lifting techniques; Use of correct and calibrated tool; Use of torque spanner, Hydraulic and pneumatic tools; Avoiding excess stress; Correct handling of parts; Application of seals gaskets; Avoiding ingress of impurities during maintenance; Hazards involved in working with cleansers, solvents, carbon remover.

6-2-3-Maintenance and repair, such as dismantling, adjustment and reassembling of machinery and equipment (6 hrs.T)

On board training scheme according to maintenance manuals of machinery.

Knowledge and proficiency in: Being familiar with different machinery documentations; Safety procedures; Selection of tools and spare gear; Considering the techniques such as marking technique, parts inspection before and during dismantling, labeling, taking photographs and recording measurements and replaced parts; Dismantling, examination, reassembling and adjustment of different type of machinery such as centrifugal pump (Casing, impeller, wear rings, shaft, bearings, gland, seal); Reciprocating pump (Cylinders, pistons, rings, valves, glands, relief valve); Screw and gear pump (Rotors, gears, seals, bearings, relief valves); Valves (Seat, lid, spindle); Air compressor (Suction and delivery valves, pistons and rings, bursting disc); Heat exchanger (Leakage, fouling tubes, tube plate); Diesel engines (Pistons, rings, bearings, heads, exhaust valves); Boiler (Mountings and etc.); Refrigeration system (Compressor, condenser, expansion valve) and any other machinery requires maintenance.

6-2-4-The use of appropriate specialized tools and measuring instruments (1 hr.T)

Knowledge and proficiency in: Being trained and familiar with specialized tools and measuring instruments as required by the machinery documentation and maintenance manuals; Importance of certificates and calibration of the tools and measuring instrument.

6-2-5-Design characteristics and selection of materials in construction of equipment (2 hrs.T)

Knowledge of: Basic metallurgy, metal and processes, Non-metallic materials, Materials under load; Selection of materials according to design characteristics and construction of equipment such as diesel engine parts, steam turbine parts, boiler parts, shafting components, heat exchanger parts, purifier parts.





6-2-6-Interpretation of machinery drawings and handbooks (10 hrs.T, 60 hrs.E)

Knowledge and proficiency in: Being familiar with the different machinery documentations; Pictorial Projection; Purpose of general arrangement plan; Component and assembly drawings; Use of collective and pictorial drawings; Meaning of tolerance, actual size, basic size and normal size; Meaning of clearance fit, transition and interference fit; Meaning of geometrical tolerances and related symbols; Application of lines; Meaning of 1st and 3rd angle projection and their symbols; Use of auxiliary projection; Drawing tangents; complete first and third angle projections; Draw third angle projection with hidden detail; Development; Drawing isometric projection of simple sides; Drawing oblique projections of simple solids; Drawing development of 90° intersection of circular trunking, a cone, a square pyramid; 3-dimension drawing; Perspective drawing; Exploded view of drawings; Tolerances; Part material; Parts list; Technical handbooks; Universal and iso standards; Conversion tables.

6-2-7-The interpretation of piping, hydraulic and pneumatic diagrams

Knowledge and proficiency in: On board training scheme machinery modulling and traceability of hydraulic and pneumatic piping system.





**FUNCTION 3 : CONTROLLING THE OPERATION OF THE SHIP AND CARE FOR
PERSONS ON BOARD AT THE OPERATIONAL LEVEL
(189 hours Theoretical)**

**Competence 3-1: Ensure compliance with pollution-prevention requirements
(26 hrs.T)**

**3-1-1-Prevention of pollution of the marine environment, Knowledge of the precautions
to be taken to prevent pollution of the marine environment (22 hrs.T)**

**3-1-1-1-International convention for the prevention of pollution from ships, 1973,
and the protocol of 1978 relating thereto (MARPOL 73/78) (16 hrs.T)**

Knowledge of: The precautions to be taken to prevent pollution of the marine environment;
Procedures for monitoring shipboard operations and ensuring compliance with MARPOL.

1-Annex I (Regulation for the prevention of pollution by oil) (4 hrs.T)

Knowledge of: Oil, Oily mixture, Oil fuel, Oil tanker, Combination carrier, Nearest land, Special area, Instantaneous rate of discharge of oil content, Wing tank, Centre tank, Slop tank, Clean tank, Segregated ballast tank; Surveys and inspections required under the provisions of MARPOL73/78; States that certificate issued after International Oil Pollution Prevention (IOPP) survey; List conditions under which oily mixtures may be discharged into the Sea from an oil tanker; List of conditions under which oily mixtures from machinery-space bilges may be discharged into the sea; Applicable provisions for discharge of clean or segregated ballast; Conditions under which the provisions do not apply to the discharge of oily mixtures from machinery spaces where the oil content without dilution does not exceed 15 parts per million; Residues which cannot be discharged into the sea in compliance with the regulations and must be retained on board or discharged to reception facilities; Special areas for the purposes of Annex I that is Antarctic region, the Baltic Sea, Mediterranean sea, Black Sea, The Persian Gulf, Gulf of Aden, Red Sea and north-west European waters; Any discharge into the sea of oil or oily mixtures from an oil tanker or other ships of 400 tons gross tonnage and above is prohibited while in a special area; Conditions under which a ship, other than an oil tanker, may discharge oily mixtures in a special area; Conditions in which processed bilge water from machinery spaces may be discharged in a special area; Ballast water should not normally be carried in cargo tanks of tankers provided with segregated ballast tanks; Exceptions in which ballast may be carried in cargo tanks; Every oil tanker operating with crude oil washing systems should be provided with an Operations and Equipment Manual; Limitation, in new ships of 4, 000 gross tonnage and above and in new oil tankers of 150 gross tonnage and above, no ballast water should normally be carried in any oil fuel tank; Requirements for the provision of Oil Record Books ; Lists of entries to be made for machinery space operations in part A of the Oil Record Book and List of entries to be made in respect of cargo or ballast operations in oil tankers; Entries required for accidental or other exceptional discharge of oil and States that the Oil Record Book should be kept on board readily available for inspection and should be preserved for a period of three years after the last entry has been made.





**2-Annex II (regulation for prevention of pollution by noxious liquid substances in bulk)
(2 hrs.T)**

Knowledge of: Requirements of Annex II applicable to all ships carrying noxious liquid substances in bulk; Noxious liquid chemicals divided into four categories, X, Y, Z and OS; Conditions for the discharge of any effluent containing substances falling in those categories; More stringent requirements in special areas, which for the purposes of Annex II are the Baltic Sea area and the Black Sea area; Each ship certified for the carriage of noxious liquid substances in bulk should be provided with a Procedures and Arrangements Manual; Surveys required for ships carrying noxious liquid substances in bulk; Certificate issued on satisfactory completion of the survey (International Pollution Prevention); Certificate for the Carriage of Noxious Liquid Substances in Bulk.

3-Annex III (Regulation for the prevention of pollution by harmful substances carried by sea in packaged form) (2 hrs.T)

Knowledge of: Requirement that empty receptacles, freight containers and portable road and rail tank wagons which have been used previously for the carriage of harmful substances are treated as harmful substances themselves unless precautions have been taken to ensure that they contain no residue that is hazardous to the marine environment; Requirement that packaging, containers and tanks should be adequate to minimize hazard to the marine environment; Requirements for marking and labeling of packages, freight containers, tanks and wagons; Documentation relating to the carriage of harmful substances by sea; Requirement that certain harmful substances may be prohibited for carriage of limited as to the quantity which may be carried aboard any one ship; jettisoning of harmful substances is prohibition except for the purpose of securing the safety of the ship or saving life at sea.

4-Annex IV (Regulation for the prevention of pollution by sewage) (2 hrs.T)

Knowledge of: Provisions regarding allowable discharge of sewage into the sea and satisfactory treatment results.

5-Annex V (Regulation for the prevention of pollution by garbage) (2 hrs.T)

Knowledge of: Annex V (Garbage; Nearest land; Special area); The provisions of Annex V applicable to all ships; Disposal into the sea of all plastics is prohibited; Regulations concerning the disposal of other garbage.

**6-Annex VI (Regulation for the prevention by emission from ships; Air pollution)
(4 hrs.T)**

Knowledge of: Annex VI (Continuous feeding; Emission; New installations; NOX technical code; Ozone depleting substances; Sludge oil; Shipboard incineration; Shipboard incinerator; SOX emission control area); Types of inspection required under Annex VI; Provision for the issuance of International Air Pollution Prevention certificate; Duration of validity of the IAPP certificate; Regulation regarding NOX in regulation 13 of Annex VI; requirement for SOX emission control area; Requirement for fuel oil quality in regulation 18 of Annex VI.



3-1-1-2-Convention of the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (London Dumping Convention) (LDC) (2 hrs.T)

Knowledge of: Convention (Dumping; Wastes or other matter; Special permit; General permit); Dumping of wastes or other matter in whatever form or condition, as listed in annex I, is prohibited; Dumping of wastes or other matter listed in annex II requires a prior special permit; Dumping of all other wastes or matter requires a prior general permit; Provisions of Article IV do not apply when it is necessary to secure the safety of human life or of vessels in cases of *force majeure* caused by stress of weather, or in any case which constitutes a danger to human life or a real threat to vessels; Such dumping should be done so as to minimize the likelihood of damage to human or marine life and must be reported immediately; The Addendum to Annex I contains regulations on the incineration of wastes at sea; The appropriate authority of a Contracting Party should issue prior special or general permits in respect of matter intended for dumping: (Loaded in its territory; Loaded by a vessel flying its flag when the loading occurs in the territory of a State not party to the Convention).

3-1-1-3-International convention relating to intervention on the high seas in cases of oil pollution casualties, 1969 (2 hrs.T)

Knowledge of: Describes the rights of Parties to the Convention to intervene on the high seas following a maritime casualty; Personnel liabilities.

3-1-1-4-International convention on civil liability for oil pollution damage, 1969 (CLC 1969) Competence (2 hrs.T)

Knowledge of: Convention (Ship; Owner; Oil; Pollution damage; Preventive measures; Incident); Occurrences to which the Convention applies; Owner of a ship is strictly liable for any oil pollution damage caused by the ship as the result of an incident; Exceptions to liability.

3-1-2-Anti-pollution procedures and all associated equipment (2 hrs.T)

Knowledge of: Major points of typical shipboard oil pollution emergency plan (SOPEP), a detailed description of the actions to be taken by persons on board in event of any pollution; Emergency preparedness plan and safety management system functional requirements.

3-1-3-Importance of proactive measures to protect the marine environment (2 hrs.T)

Knowledge, understanding and proficiency in: Actions to ensure that a positive environmental reputation is maintained in respect to environmental damage; Offence under international law for pollution of the sea; Prohibition of dumping of oil or oil water mixture to sea; Legal maximum oil content of water to be discharged overboard; Requirement of pumping bilges through an approved oily water separator; Recording of information in log book which must be entered in the oil record book when pumping bilges; Precautions to be taken to avoid spilling when bunkering purpose of an incinerator for disposal of sludge and refuse; General requirement for discharge of effluent from a sewage plant; Responsibilities of master, officers and ratings on board for protecting the marine environment; Procedures relating to use of low sulphur fuel.



Competence 3-2: Maintain seaworthiness of the ship (121 hrs.T)

3-2-1-Ship stability, Working knowledge and application of stability, trim and stress tables, diagrams and stress- calculating equipment (82 hrs.T)

3-2-1-1-Understanding, Working knowledge and application of Fundamentals of naval architecture (22 hrs.T)

Knowledge, understanding and proficiency in: Wetted surface area; Wetted surface area calculation; Calculating wetted surface area using transverse girths making; Calculating wetted surface area using Taylor's approximate formula; Stating the rules for area, volume and second moment of area of similar bodies; Pressure exerted by a liquid; Load on an immersed plane; Second moment of area; Theorem of parallel axes; The position of resultant force on submerged plane areas, Center of pressure; Determining the position of the center of pressure; Solving problems involving foreseen submerged areas and Calculation of the position of center of pressure (Limited to rectangular and circular shapes); Stress and strain diagram; Shearing force on bulkhead; Stiffeners; Water plane area coefficient; Mid ship section area coefficient; Block coefficient; Prismatic coefficient; Solving problems relating to the coefficients of form specified; Simpson's first rule for three ordinates; Demonstrating how Simpson's rule may be applied with intermediate ordinates; Using Simpson's rule to determine the first moment of area of a plane about an ordinate; Calculating the centroid of a plane; Using the theorem of parallel axis to determine the second moment of area of a plane about its neutral axis; Calculating the second moment of area of a water plane about a transverse axis passing through its centroid.

3-2-1-2-Displacement (6 hrs.T)

Knowledge, understanding and proficiency in: Archimedes' principle; Applying Archimedes principle to floating bodies; Principle of floatation; The volume of displacement; Displacement; Relationship between displacement and mean draught; Volume of displacement at any given draught is represented by the area of water plane area curve to that draught; Calculating values of displacement for a range of draught and plot the displacement curve; Meaning of light displacement, loaded displacement and dead weight; TPC (Tones Per Centimeter immersion); Water plane area (A_w); Deriving formula for TPC; Solving problems relating to the above objectives.

3-2-1-3-Buoyancy (6 hrs.T)

Knowledge, understanding and proficiency in: Buoyancy; Relationship between buoyancy and displacement; Longitudinal Centre of Buoyancy (LCB); Vertical Centre of Buoyancy (VCB).

3-2-1-4-Fresh water allowance (6 hrs.T)

Knowledge and Understanding in: Changes of mean draught as related to water density; Meaning of Fresh water allowance; Derivation of formula for FWA; Solving problems involving vessels moving into water of different density.



3-2-1-5-Centre of gravity (14 hrs.T)

Knowledge and Understanding in: Centre of gravity; Longitudinal center of gravity (LCG); Vertical center of gravity (VCG); The importance of the position of the center of gravity in stability and trim calculation; Moment of force; Changes in vertical, longitudinal and transverse center of gravity due to loading, discharging or moving one or more masses; Solving problems involving suspended masses.

3-2-1-6-Stability of ships (14 hrs.T)

Knowledge, understanding and proficiency in: Initial stability; Righting moment and righting lever; Tender and stiff ships; Deriving an expression for the distance of the transverse meta-centre above the center of buoyancy; Heights of center of buoyancy and meta-centre above the keel; Meta-centric diagram; Calculating height of meta-centre above keel for a vessel of simple geometric form; Solving problems relating to stability at small angles of heel producing an expression for transverse metacentric height due to moving a small mass across the ship; Inclining experiments; Statical stability; Curves of statical stability and how it is obtained; Meaning of list; List correction; Upsetting or capsizing moment; Angle of loll; Obtain values such as range of stability, maximum GZ and angle of loss of stability from a given curve of statical stability; The effect of a slack tank (Free surface effect); Loss in meta-centric height due to the free surface; Effective meta-centric height; Effect of tank divisions on free surface; Solving problems involving free surface effect.

3-2-1-7-Trim (14 hrs.T)

Knowledge, understanding and proficiency in: Applying the concepts of longitudinal stability; How trim occurs; Longitudinal center of floatation (LCF); Longitudinal meta center and longitudinal meta centric height; Moment to change trim of ship by one centimeter (MCT1C); Calculating change of trim resulting from added, discharged and transferred loads; Constructing shear force and bending moment diagrams; Curves of weights, buoyancy and loads; Preparing shear force and bending moment diagrams for box shape vessels only; Using trim to find the position of the center of floatation; Loading a weight to keep the after draught constant.

3-2-2-Understanding of the fundamentals of watertight integrity (6 hrs.T)

Knowledge, understanding and proficiency in: Calculating the change in vertical center of buoyancy due to a change in mean draught; Free board and its relation to reserve buoyancy; Effect of varying freeboard on stability; Movement of a ship with negative metacentric height; Dynamical stability; Load line rules for satisfactory stability; Load line; Requirement for damage stability for Type A, B, B60, B100 and passenger vessels.

3-2-3-Understanding of fundamental actions to be taken in the event of partial loss of intact buoyancy (8 hrs.T)

Knowledge and Understanding in: Bilging and its effect on stability; Permeability and stowage factor Reserve buoyancy; Evaluating changes in draughts (Including the effect of permeability) due to bilging amidships compartment; Effect of bilging on longitudinal stability (trim); Find the final draughts due to bilging; Purpose of non watertight longitudinal subdivision of tanks.





3-2-4-Ship construction, General knowledge of the principal structural members of a ship and the proper names for the various parts (25 hrs.T)

3-2-4-1-Ship dimension and form (3 hrs.T)

Knowledge of: The general arrangements of the most common type of ocean going merchant ships; Forms and dimensional terms used in ship construction (Free board, camber, rise of floor, bilge radius, tumble home, flare, sheer, rake, parallel middle body, run, forward perpendicular, after perpendicular, length between perpendicular, length overall, moulded and extreme breath, depth and draught).

3-2-4-2-Ship stresses (3 hrs.T)

Knowledge of: Shear force and bending moments; Hogging, sagging, racking, panting, pounding; Stress by localized loading; Constructing shear force and bending moment diagrams; Curves of weights, buoyancy and loads; Preparing shear force and bending moment diagrams for box shape vessels.

3-2-4-3-Hull structure (4 hrs.T)

Knowledge of: Detailed components of main and minor ship's structure; Standard steel sections; Framing system; Deck freeing arrangement.

3-2-4-4-Bow and Stern (4 hrs.T)

Knowledge of: Bow and stern arrangement and construction.

3-2-4-5-Fittings (3 hrs.T)

Knowledge of: Hatch cover arrangement and construction; Anchor, chain and mooring arrangement main components of derricks and deck crane; Cargo hold bilges and ballast system; Air pipe sounding pipes and container fitting arrangement; Water tight doors and fittings.

3-2-4-6-Rudder and Propeller (4 hrs.T)

Knowledge of: Rudder types; Construction and its function; Principle of screw propulsion; Terms and definitions of propeller; Shaft tunnel arrangement.

3-2-4-7-Load Line and draught marks (4 hrs.T)

Knowledge of: Load line marking; maintain seaworthiness of the ship; Reserve buoyancy; Effect of a change of density on draught; Fresh water allowance; Diagram of a load line identifying the various draught markings; Understanding the fundamentals of watertight integrity; Understanding of fundamental action to be taken in the event of partial loss of intact buoyancy; Condition of assignment; General knowledge of principal structural members of a ship and the proper names for the various parts.





Competence 3-3: Prevent, control and fight fires on board

3-3-1-Fire prevention and fire-fighting appliances

Refer to STCW Table A-VI/3 for Competence in Advanced Fire-fighting.

3-3-1-1-Ability to organize fire drills

3-3-1-2-Knowledge of classes and chemistry of fire

3-3-1-3-Knowledge of fire-fighting systems

3-3-1-4-Action to be taken in the event of fire, including fires involving oil systems

Competence 3-4: Operate life-saving appliances

3-4-1-Life-saving

Refer to STCW Table A-VI/2-1 for Competence in Survival Craft and Rescue Boats other than Fast rescue boat.

3-4-1-1-Ability to organize abandon ship drills and knowledge of the operation of survival craft and rescue boats, their launching appliances and arrangements, and their equipment, including radio life-saving appliances, satellite EPIRBs, SARTs, immersion suits and thermal protective aids

Competence 3-5: Apply medical first aid on board ship

3-5-1-Medical aid

Refer to STCW Table A-VI/4-1 for Proficiency in Medical First Aid.

3-5-1-1-Practical application of medical guides and advice by radio, including the ability to take effective action based on such knowledge in the case of accidents or illness that are likely to occur on board ship

Competence 3-6: Monitor compliance with legislative requirements (8 hrs.T)

3-6-1-Basic working knowledge of the relevant IMO conventions concerning safety of life at sea, security and protection of the marine environment (8 hrs.T)

Basic working Knowledge of: The relevant IMO conventions relating to Ship inspections; Marine machinery inspection; Hull construction; Hull inspection; Registration of ships; Steering appliances and equipment; Life saving equipment; Boat and fire drills; Fire detection and extinguishing equipment; Dangerous goods shipping; Oil pollution prevention; Sewage pollution prevention; Garbage pollution prevention; Pollutant discharge reporting; Safe working practices; Shipping casualties reporting; Tackling; Crewing; Engagement and discharge of seafarers; Rights of seafarers; Maintenance of discipline; Distressed seafarers; Provisions, health and accommodation;



The international labour code, as applicable to shipping industry in relation occupational health and safety; Maritime law; United nations specialized agencies (International Maritime Organization and International Labour Organization); Port state and flag state; Law of the sea (UNCLOS) and related definitions (Conventions on the Law of the Sea; Territorial Sea and the Contiguous Zone; International Straits; High Seas; Protection and Preservation of the Marine Environment); International Convention on Load Line, 1966 (LL 1966), as amended; International Convention on Standards of Training, Certification and Watch keeping for Seafarers, 2010 (STCW), International Convention on tonnage Measurement of ships, 1969, International Convention for the safety of life at sea, 1974 as amended (SOLAS), [Chapter1 (General Provisions), Chapter 2(Construction [subdivision and stability, machinery and electrical installation] and [fire protection , fire detection and fire extinction]), Chapter 3 (Life Saving Appliances and Arrangement), Chapter 4 (Radio communication), Chapter 5 (Safety of Navigation), Chapter7 (Carriage of dangerous goods), Chapter 9 (ISM Code), Chapter 12 (ISPS)]; International Convention for the Control and Management of Ship's Ballast Water Sediments, 2004.

Competence 3-7: Application of leadership and team working skills (34hrs.T)

3-7-1-Working knowledge of shipboard personnel management and training (6hrs.T)

Knowledge of: Term "Management"; Following management activities: (Planning; Organizing and Staffing; Directing; Controlling); Roles of company's objectives and goals; Management policy with respect to ships; Managerial issues on: (Operations; Finance; Communications); The company's expectations for ship's officers; Organizing the staff for emergency duties and the use of safety equipment; Organization of repairs and surveys; Training of staff for both normal and emergency duties; Supervision of staff in the absence of ideal safe working conditions.

3-7-2-A knowledge of related international maritime conventions and recommendations and national legislation (2hrs.T)

Knowledge of: General knowledge of Islamic Republic of Iran national legislations for implementing international agreement and conventions.

3-7-3-Ability to apply task and workload management, including (8hrs.T)

3-7-3-1-Planning and coordination (2hrs.T)

Knowledge of: Planning and use of resources for executing a job; Maintenance planning system; Main elements and objectives of a maintenance planning; Planning system on maintenance books and planning board; Operation cycle of a maintenance planning system based on time schedule; Planning in preparation for emergency action.

3-7-3-2-Personnel assignment (2hrs.T)

Knowledge of: Evaluating personnel abilities; Assignment of different maintenance jobs to carry out by competent personnel; Preparation of a maintenance planning system for a ship.

3-7-3-3-Time and resource constraints (2hrs.T)

Knowledge of: Fuel consumption; Reasons for off hire; Port time; Engine efficiency; Machinery break down; Hull corrosion and cracking; Marine growth; Class survey; Lack of spare parts and





service facilities; Maintenance in terms of possible reduction in off hire , repair work and fuel consumption and/or increase in speed.

3-7-3-4-Prioritization (2hrs.T)

Knowledge of: Maintenance jobs according to their importance or urgency, and in relation to the maintenance budget and return on investment; Maintenance planning systems.

3-7-4-Knowledge and ability to apply effective resource management: (10hrs.T)

3-7-4-1-Allocation, assignment, and prioritization of resources (2hrs.T)

Knowledge of: Resources are allocated and assigned as needed in correct priority to perform necessary tasks; Identify type and scale of the tasks; Initiate actions conform to the emergency procedures and contingency plans for the ship; The order of priority, and the levels and time scales of solving problems and informing personnel on board, are relevant to the nature of the emergency and reflect the urgency of the problem, in order to take promptly.

3-7-4-2-Effective communication on board and ashore (2hrs.T)

Knowledge of: English language to enable the officer to use maker's manuals and to perform engineering duties; Communicating clearly and understand others; Transmitting information relating to machinery components by means of simple drawings with supplementary notes and specifications; Demonstrating "effective communication" (Oral, Written & Non-Verbal) with others; Interpretation and carry out verbal instructions.

3-7-4-3-Decisions reflect consideration of team experiences (2hrs.T)

Knowledge of: Processing of group meeting management; Sources of organizational conflict; Techniques for preventing group conflicts; Analyses some important factors that may affect group behavior, discipline and the amount of work done by the crew; Efficient method of establishing an open communication style on board that encourages challenges and appropriate responses from the team; Need for evaluation of outcomes effectiveness; Team member(s) share accurate understanding of current and predicted engine room and associated systems state, and of external environment, and take necessary actions.

3-7-4-4-Assertiveness and leadership, including motivation (2hrs.T)

Knowledge of: Transactional leadership; Transformational leadership; Democratic leadership; Autocratic leadership; Directive leadership; Supportive leadership; Participative leadership; Achievement oriented leadership; Factors that influence the way the leaders' behavior affects subordinates' response: (Job pressure; Job satisfaction; Subordinates' need for information; Subordinates' expectations); Assessment of personnel competence and capabilities and operational Requirements with effective leadership behaviors in order to tackle the jobs.





3-7-4-5-Obtaining and maintaining situational awareness (2hrs.T)

Knowledge of: Keeping the operation of the propulsion plant under control during any situation; responding to bridge maneuvers at any time; Informing the bridge or a superior officer of any abnormal situations; Preparing the main and auxiliary machinery for maneuverings operations; Determining order of priority among problems encountered; Resolving problems in an orderly manner; Writing appropriate entries in a log book and notice unusual readings; Writing appropriate entries in the Oil Record Book; Bringing the propulsion system back on line after a power failure; Transferring controls from bridge to engine room.

3-7-5-Knowledge and ability to apply decision-making techniques: (8hrs.T)

3-7-5-1-Situation and risk assessment (2hrs.T)

Knowledge of: Identifying potential risk on board; Importance of carryout situation and risk assessment before commencing major operation; Risk assessment procedure; Objective and scope of assessment; Implementation of risk reduction measure and preventive actions for the risk factors; The potential risk in safety and health activities for the ship and crew; The change of working condition and operational circumstances and personal resource.

3-7-5-2-Identify and consider generated options (2hrs.T)

Knowledge of: Preparation and plan of risk assessment; Method of risk assessment; Risk grade; Countermeasures for the risk assessment; Risk control affairs on shipboard; Identification of new risk; Monitoring and improvement.

3-7-5-3-Selecting course of action (2hrs.T)

Knowledge of: Preparation, implementation and general management of risk assessment plan; Setting up and distribution of standards for the risk assessment and grade; Training ship' personnel for the technique of the risk assessment and risk control.

3-7-5-4-Evaluation of outcome effectiveness (2hrs.T)

Knowledge of: Review the effectiveness for risk assessment; Evaluate periodically the implementation of the risk assessment and risk control; Updating of safety and health information related to task in charge.

Competence 3-8: Contribute to the safety of personnel and ship

3-8-1-Knowledge of personal survival techniques

Refer to STCW Code Table A-VI/1-1 for Competence in personal survival techniques.

3-8-2-Knowledge of fire prevention and ability to fight and extinguish fires

Refer to STCW Code Table A-VI/1-2 for Competence in fire prevention and fire fighting.



3-8-3-Knowledge of elementary first aid

Refer to STCW Code Table A-VI/1-3 for Competence in elementary first aid.

3-8-4-Knowledge of personal safety and social responsibilities

Refer to STCW Code Table A-VI/1-4 for Competence in personal safety and social responsibility.

5-7 facilities and equipment required for conducting the course:

Apart from those facilities, equipments and or requirements mentioned in Code of practice for approval and monitoring of maritime training courses followings have to be provided:

- 5-7-1 Classroom with air conditioning facilities, sufficient lighting and other facilities, suitable for delivering theoretical subjects
- 5-7-2 library with related technical books and references
- 5-7-3 English lab with audio and visual facilities.
- 5-7-4 Mechanical laboratory (Materials and equipment)
 - 1- Portable refrigeration demonstration unit, to show evaporation and condensation.
 - 2- Four-stroke diesel engine on a test bed, fitted with a dynamometer, fuel flow meter, cooling water thermometer and RPM indicator (tachometer).
 - 3- Acidic, alkaline and neutral solutions.
 - 4- Alkalinity/acidity indicators such as litmus papers.
 - 5- Samples of aluminum and copper with an oxide.
 - 6- Samples of pitting corrosion.
 - 7- Samples of graphitized cast Iron.
 - 8- Samples of gasoline, kerosene, diesel fuel, boiler residual fuel oil and a viscometer.
 - 9- A flash point apparatus, a water- content measurement apparatus.
 - 10- Salinometer(s) and hydrometer(s).
 - 11- Work benches fitted with vices, tool storage lockers and cabinets.
 - 12- Portable power tools such as drilling machines, small bench or pedestal grinder etc.

- 13- Measuring equipment: external and internal verniers, inside and outside calipers, standard adjustable inside and outside micrometers, depth and dial gauges (Mechanical or electronic).
- 14- Hand tools: chisels, center punches, hacksaws, scrapers, drills, bits, reamers, hammers, taps and dies, nuts, spanners and wrenches, files.
- 15- A marking table.
- 16- Scribes, scribing blocks, try-square, trammels, protector, dividers, odd-leg calipers, straight-edge, bevel gauge.
- 17- Vee blocks, leveling devices.
- 18- Power tools: one pedestal or pillar drilling machine; one radial drilling machine.
- 19- One forge for heat treatment.
- 20- Bending rollers for sheet metal.
- 21- Bending machine for small-diameter pipes.
- 22- Oxy-acetylene brazing and cutting equipment.
- 23- Electric arc-welding equipment.
- 24- Working benches.
- 25- Soldering equipment.
- 26- Protective clothing, including aprons, gloves, masks, goggles and welding boots.
- 27- Fume extraction/ventilation.
- 28- Gas bottles storage.
- 29- Welding electrodes.
- 30- Filler rods.
- 31- Steel plates up to 10 mm thick.
- 32- Various steel bars, pipes angles and sections.
- 33- Metal-turning lathes including:
 - g- Three –and four-jaw chucks
 - h- Face-plates
 - i- Drill bits, arboring tools



- j- Tool holders
- k- Protective equipment
- l- Various lathe tools: straight parting tool, round nose, finishing, cranked and boring tools

34- A range of cutting tools.

35- Work-securing vice.

36- A dividing head.

5-7-5 Electrical and electronic engineering laboratory and workshop

- 1- Apparatus to demonstrate static electricity, examples of electrical diagrams (i.e., block system, circuit and wiring diagrams); apparatus to demonstrate control circuit; apparatus to demonstrate PLC; ammeters, voltmeters, watt meters, megger tester, wiring connectors, resistors, electrical source, a selection of marine cables, equipment and cable runs for testing purpose, insulation testers, continuity testers, digital and analogue multi-meters, thermistors, diodes, a clampmeter, live-line tester, lead-acid and alkaline batteries, a charging circuit distilled water, hydrometer, magnets, iron filing solenoid iron-cored solenoid, induction coil, model A.C and D.C generators used A.C and D.C generators and motor, motor starters, switches, circuit breakers, fuses, a sectioned transformer, and earth lamp model system, equipment suitable for use in oil, gas and chemical tankers (intrinsically safe).
- 2- Over currents, reverse-power and under voltage-protection relays, high-rupturing-capacity fuses and housings, preferential trips, instrument and relay transformers, a main switch board, emergency switch board, operational three-phase terminal box, automatic voltage regulator, induction motors with direct on-line and star-delta and autotransformer starters, speed controllers, a selection of lighting equipment, a model navigation light system.

5-8 Lecturers and instructors minimum qualifications:

Lecturers and instructors shall have completed a course in instructional techniques (TFT) in one of the training centers approved by the PMO, and;

5-8-1 for lecturing in theoretical subjects should;

5-8-1-1 For lecturing theoretical subjects mentioned in this code of practice as mentioned in chart 5-6-1 column 1, 2, and 4 lecturers must possess valid second engineer certificate of competency for ships of KW \geq 3000 engaged on unlimited voyages as well as having one year of seagoing service in that rank.

5-8-1-2 For lecturing electro-technology subjects as mentioned in this code of practice as mentioned in chart 5-6-1 column 3 lecturers must possess at least relevant Master of

Science degree or have electro technology valid certificate of competency with one year of seagoing service experiences on ships of KW \geq 3000 engaged on unlimited voyages.

5-8-1-3 holders of Master of Science degree in ship architecture and shipbuilding or Master certificate of competency for ships of GT \geq 3000 engaged on unlimited voyages with one year of seagoing service experience can be assigned in teaching ship stability and ship construction subjects.

5-8-2 for delivering practical training should;

5-8-2-1 have minimum third engineer valid certificate of competency for ships of KW \geq 750 engaged on unlimited voyages as well as having one year of seagoing service in that rank.

5-8-2-2 Possess minimum Bachelor of Science in mechanical or ship building engineering with minimum two years of working experiences.

5-8-2-3 For electro-technology practical subjects possess electro-technology certificate of competency and 12 month of seagoing service experience or have minimum relevant Bachelor Science degree and two years of working experiences.

5-9 Assessment and Certification

5-9-1 upon successful completion of the examination which is carried out during and at the end of the course, the trainee will be awarded relevant course completion certificate issued by the approved training center;

5-9-2 then after trainee applies for the PMO competency assessments specified in above paragraph 5-6-1; and

5-9-3 finally, Seafarers' Examination and Documents Directorate of the PMO will issue CoC for those candidates who have passed above mentioned PMO competency assessments and fulfill other relevant certification requirements set out in the "Codes of practices for issuing, revalidation and renewing certificates for seafarers".

5-10 revalidation/renewal of certificates:

5-10-1 CoPs and CoCs will be revalidated and renewed in accordance with provisions of the "Codes of practices for issuing, revalidation and renewing certificates of competency for seafarers".

5-11 course approval:

5-11-1 It will be carried out as per code of practice for approval and monitoring of maritime training courses.

6-Records

6-1 All records which present the implementation of the content of this code of practice.

7- References

7-1 STCW Convention and STCW Code;

7-2 IMO Model course number 7.04

7-3 Code of practice for approval and monitoring of maritime training courses; and

7-4 Codes of practices for issuing, revalidation and renewing certificates for seafarers.

8- Appendixes

Nil.