

Contents

1	Job Description of the Ship Operation Technician	1
	Reference	3
2	Rules and Regulations	5
2.1	Hierarchy of Laws and Standards	5
2.2	International Law Regulations	7
2.2.1	SOLAS	7
2.2.2	MARPOL	8
2.2.3	Collision Avoidance Rules	8
2.3	European Union regulations	9
2.4	German Laws and Regulations	10
2.5	Construction Regulations of the Classification Societies	11
2.6	Technical Standards	11
	References	12
3	Hulls, Cordage, Superstructures, Anchor Gear, Corrosion Protection, and Deck Coverings	13
3.1	Hull	13
3.1.1	Buoyancy and Stability	14
3.1.2	Important Designations and Principal Dimensions	17
3.2	Superstructure, Deckhouse, Chimney	19
3.3	Nonintegrated Foundations	21
3.3.1	Excursus on Vibrations	25
3.4	Anchor Gear, Lines, and Cordage	30
3.4.1	Anchor Gear	30
3.4.2	Design or Dimensioning of Anchor and Chain	34
3.4.3	Line and Cordage	36
3.4.4	Bollards	45
3.5	Ladders, Stairs, Railing	47
3.5.1	Ladders	47
3.5.2	Fixed Ladders	49

3.5.3	Stairs	50
3.5.4	Railing	56
3.6	Corrosion Protection and Deck Coverings/floors	61
3.6.1	Corrosion Protection	61
3.6.2	Deck Coverings/Floors.	70
	References.	74
4	Propulsion Systems	77
4.1	Introduction	77
4.2	Ship Resistance	78
4.2.1	Economic Aspects of Shipping	78
4.2.2	Examples From Nature	79
4.2.3	Fluid Mechanical Considerations on the Hull	80
4.2.4	The Effect of Bulbous Bow on Tow Resistance.	86
4.2.5	Required Propulsion Power	87
4.2.6	Summary	88
4.3	Power Generation.	90
4.3.1	Internal Combustion Engines.	100
4.3.2	Gas Engines	118
4.3.3	Turbines	119
4.3.4	Electric Propulsion.	130
4.3.5	Fuel Cell Propulsion.	143
4.3.6	Sail Propulsion.	148
4.4	Power Transmission.	154
4.4.1	Direct Propulsion	156
4.4.2	Propeller.	157
4.4.3	Propulsion Shaft Assembly	169
4.4.4	Stern Tube Seal	194
	References.	203
5	Ship Operating Systems/Auxiliary Systems	207
5.1	Steering Gear	207
5.1.1	Size of the Rudder Area	207
5.1.2	Calculation of the Rudder Force and Rudder Moment	208
5.1.3	Kort Nozzle	213
5.2	Stabilization Systems.	215
5.2.1	Introduction	215
5.2.2	Bilge Keels.	216
5.2.3	Fin Stabilizers	216
5.2.4	Roll Damping Tanks	217
5.3	Heel Compensation and Ballast Water Systems	217

5.4	Pumps, Pipelines, and Fittings	218
5.4.1	Pumps	218
5.4.2	Pipelines and Fittings	231
5.5	Heat Exchanger	246
5.5.1	Introduction	246
5.5.2	Types of Heat Exchangers	247
5.5.3	Construction of Heat Exchangers	250
5.5.4	Characteristics of Heat Exchangers	251
5.6	Refrigeration, Ventilation and Air-Conditioning Technology, Heating Systems.	257
5.6.1	Refrigeration	257
5.6.2	Ventilation and Air-Conditioning Systems	264
5.6.3	Heating Systems.	278
5.7	Fresh and Drinking Water Production	288
5.7.1	Introduction	288
5.7.2	Fresh Water Production by Evaporation	289
5.7.3	Fresh Water Production by Reverse Osmosis	291
5.7.4	Treatment of Drinking Water	294
5.7.5	Drinking and Hot Water System	294
5.7.6	Bunkering of Drinking Water.	295
5.8	Transshipment Facilities	296
5.8.1	Board Cranes	296
5.8.2	Handling of Bulk Cargo	312
5.8.3	Vehicle Ramps on Ferries	315
5.8.4	Tankers	317
5.8.5	RAS Device	321
5.8.6	Passenger Ships: Gangway/stelling	326
	References.	327
6	Onboard Power Supply and Electrical Circuit Examples.	331
6.1	Introduction	331
6.2	Onboard Electricity Generation	333
6.2.1	Generators	334
6.3	Shore-Side Power Supply	335
6.3.1	Background	335
6.3.2	Technology of Shore-Side Power Supply	336
6.4	The Electrical System	336
6.5	Electrical Circuit Examples	341
6.5.1	Switch-off.	341
6.5.2	Alternating Circuit	342
6.5.3	Motion Detector.	343

6.6	Electronic Circuits	344
	References	346
7	Occupational Safety and Ship Safety, Fire Protection	347
7.1	Occupational Health and Safety, Safety at Work, and Ship Safety	348
7.1.1	SOLAS	351
7.2	Fire Protection	356
7.2.1	Introduction	356
7.2.2	Introduction to Fire Training	357
7.2.3	Structural Fire Protection, Requirements for Components and Materials	363
7.2.4	Fire Detection and Alarm	365
7.2.5	Firefighting Equipment and Installations	366
7.2.6	Firefighting by Firefighting Teams	371
7.3	Safety Marking at the Workplace, Ship Safety Guidance System	376
7.3.1	Safety Marking at the Workplace	376
7.3.2	Safety Guidance System	378
7.4	Bilge Pumping Systems	382
7.4.1	Introduction	382
7.4.2	Essential Requirements, Design Notes	382
7.5	Navigation Equipment, Light Guidance, Radio	384
7.5.1	Navigation Facilities	384
7.5.2	Light Guidance	388
7.5.3	Radio Equipment	391
7.6	Survivability of Warships	399
	References	402
8	Environmental Protection in Maritime Transport	405
8.1	Maritime Environmental Legislation	405
8.2	Possible Environmental Damage	407
8.2.1	Contamination by Oil	408
8.2.2	Pollution from Ship Sewage	408
8.2.3	Pollution by Ship-Generated Waste	410
8.2.4	Air Pollution by Ship Exhaust Gases	410
8.2.5	Carryover of Organisms by Ballast Water	411
8.3	Technical Measures for Marine Environmental Protection	412
8.3.1	Waste Management on Board	412
8.3.2	Exhaust Emissions of the Propulsion and EDiEng Systems, Liquefied Natural Gas (LNG) Propulsion	453
8.4	Wastewater Management	460
8.4.1	Introduction	460
8.4.2	Discharge Regulations for Ship Sewage According to MARPOL Annex IV	461

8.4.3	Wastewater on Board	464
8.4.4	Wastewater Storage	464
8.4.5	Wastewater Treatment Plants	467
8.4.6	Assessment of Existing Technologies with Regard to Their Achievable Discharge Values	477
8.5	Bilge Water Treatment	478
8.5.1	Bilge Water Treatment Plants.	479
8.6	Ballast Water Treatment.	489
8.6.1	Introduction	489
8.6.2	Ballast Water Exchange	490
8.6.3	Ballast Water Treatment.	491
	References.	494
	Tables, Diagrams, and Overviews	499
	Index.	543