Chief Mate Unlimited Stability and Structure Syllabus

Notes

1. The syllabus is based on the HND in Nautical Science. It covers Outcomes 1 & 2 of Unit 24 (Ship Stability 2) and part of Outcomes 1 & 3 of Unit 25 (Structures & Maintenance)
2. Calculations are to be based wherever possible on the use of real ship stability information
3. Longitudinal stability calculations are to be based on taking moments about the After Perpendicular and using formula;

   Trim = Displacement x (LCB~LCG) / MCTC
4. Formula sheets will be provided to candidates for the examination

1. Stability information carried on board ship. The inclining experiment

a) Explains the use of stability information to be carried on board ship

b) Explains the purpose of the inclining experiment

c) Identifies the occasions when the inclining experiment must be undertaken

d) Describes the procedure and precautions to be taken before and during the inclining experiment

e) Calculates the lightship KG and determines the lightship displacement for specified inclining experiment conditions

f) Explains why a vessel's lightship displacement and KG will change over a period of time

2. Application of 'Free Surface Effect'

a) Describes Free Surface Effect (FSE) as a virtual loss of GM and relates it to the Free Surface Correction (FSC)

b) Calculates FSC given rectangular area tank dimensions and tank liquid density

c) Describes the effect on FSC of longitudinal sub-divisions in tanks

d) Calculates FSC given Free Surface Moment (FSM)

e) Applies FSC or FSM to all calculations as necessary

3. The effect on vessel's centre of gravity of loading, discharging, weights. Final list. Requirements to bring vessel upright

a) Calculates the final position of vessel's centre of gravity relative to the keel and centreline taking into account loaded, discharged and shifted weights

b) Calculates the resultant list

c) Calculates the minimum GM required prior to loading/discharging/shifting weights to limit the maximum list

4. Stability during drydocking. Using real ship stability information

a) Explains the virtual loss of metacentric height during dry-docking and the requirements to ensure adequate stability

b) Calculates the virtual loss of metacentric height and hence effective GM during drydocking

c) Determines the maximum trim at which a vessel can enter drydock to maintain a specified GM

d) Calculates the draught at which the vessel takes the blocks fore and aft

e) Describes the practical measures that can be taken to improve stability prior to drydocking if it is found to be inadequate

f) Explains why it is beneficial to have a small stern trim when entering drydock

5. Increase in draught due to list / heel. Angle of heel when turning

a) Explains increase in draught due to list / heel

b) Calculates increase in draught due to list / heel

c) Explains angle of heel due to turning and the effect on stability

d) Calculates angle of heel due to turning

6. The effect of loading, discharging, shifting weights on trim, draught and stability. Using real ship stability information

a) Defines ‘Centre of Flotation’ with respect to waterplane area

b) Defines ‘Longitudinal Centre of Flotation’ (LCF) with respect to the after perpendicular and explains change in LCF with change in draft

c) Defines ‘True Mean Draught’ (TMD)

d) Calculates TMD

e) Calculates final draughts and effective GM for various conditions of loading

f) Calculates where to load / discharge a weight to produce a required trim or draught aft

g) Calculates the weight to load / discharge at a given position to produce a required trim or draught aft

h) Calculates final draughts when vessel moves from one water density to a different water density

i) Calculates the maximum cargo to discharge to pass safely under a bridge

j) Calculates the minimum ballast to load to safely pass under a bridge

k) Calculates the final draughts in i) and j)

7. Draught survey

a) Calculates the correction to the observed forward and after draughts to forward perpendicular and after perpendicular respectively

b) Calculates the correction to the observed midship draught to amidship

c) Calculates the correction of the amidship draught for hull deflection

d) Calculates the correction of the amidship draught to True Mean draught (TMD) when CF not amidship

e) Calculates the correction for the position of the CF if trimmed hydrostatics are not supplied

8. Curves of righting levers (GZ), using real ship stability information. Determine compliance with 'Intact Stability' requirements of the current loadline regulations

a) Constructs a curve of righting levers (GZ), for a given condition

b) Defines 'righting moment' (moment of statical stability) and 'dynamical stability'

c) Extracts stability information from a curve of righting levers (GZ)

d) Calculates appropriate areas under a curve of righting levers (GZ), using Simpson's rules

e) Assesses whether vessel complies with the 'Intact Stability' requirements of the current loadline regulations

9. Simplified Stability. Using real ship stability information

a) Describes the appropriate use of 'Simplified stability' information.

b) Assesses whether a vessel complies with 'Maximum permissible KG' requirements for a given condition

10. Angle of loll and effective GM at angle of loll

a) Describes the stability at an angle of loll and shows the existence of an effective GM

b) Calculates the angle of loll for vessel with a negative initial GM

c) Calculates the effective GM at an angle of loll

d) Describes the dangers to a vessel with an angle of loll

e) Distinguishes between an angle of loll and an angle of list

f) Describes the correct procedure for correcting an angle of loll

11. Factors affecting a curve of righting levers (GZ)

a) Describes the effects of variations in beam and freeboard on the curve of righting levers (GZ)

b) Describes the effect of trim on KN values and resultant curve of righting levers (GZ)

c) Describes the terms ‘fixed trim’ and ‘free trim’ with respect to KN values and resultant curve of righting levers (GZ)

d) Explains the effects of being in a seaway on the curve of righting levers (GZ)

e) Outlines the conditions for a vessel to be in the stiff or tender condition and describes the effects on the curve of righting levers (GZ)

f) Describes the use of ballast / bunkers to ensure adequate stability throughout the voyage

g) Describes icing allowances

h) Describes the changes in stability which may take place on a voyage

i) Explains the effects on the curve of righting levers (GZ) of the changes described in h)

j) Explains the effects of an angle of list on the curve of righting levers (GZ)

k) Explains the effects of an angle of loll on the curve of righting levers (GZ)

l) Explains the effects of a zero initial GM on the curve of righting levers (GZ)

12. The effect on the curve of righting levers (GZ) of shift of cargo and wind heeling moments

a) Constructs a curve of righting levers (GZ) taking into account shift of cargo/solid ballast and describe the effects on the vessel’s stability

b) Explains the precautions to be observed when attempting to correct a large angle of list

c) Explains how wind heeling moments are calculated

d) Constructs a curve of righting moments taking into account wind heeling moments and describes the effect on the vessel’s stability

e) Describes the minimum stability requirements taking into account wind heeling moments as specified in current Load Line – Instructions for the Guidance of Surveyors

f) Determines that a ship’s loaded condition complies with the minimum stability requirements specified in e)

13. Use of the current IMO Grain Rules to determine if the vessel complies with the specified stability criteria. Real ship stability information to be used

a) Calculates, the 'grain heeling moments' for a specified loading condition

b) Determines from the 'grain heeling moment' calculated in a) whether the vessel complies with the stability requirements by comparison with the 'maximum permissible heeling moments'

c) Calculates the approximate angle of heel in b)

d) Constructs graphs of a righting arm curve and heeling arm curve

e) Assesses whether a grain laden vessel complies with the 'minimum stability requirements' specified in the IMO Grain Rules

f) Discusses factors to be taken into account to minimise grain heeling moments

14. Rolling, pitching, parametric and synchronous rolling

a) Describes rolling and pitching

b) Defines rolling period

c) Explains factors affecting rolling period

d) Describes synchronous rolling and the associated dangers

e) Describes parametric rolling and the associated dangers

f) Describes actions to be taken by ship's officer in event of synchronous rolling or parametric rolling

15. The effect of damage and flooding on stability

a) Calculates, for a box shaped vessel, the effect on draught, trim, list, freeboard and metacentric height if the following compartments are bilged;

i) Symmetrical amidships compartment with permeability

ii) Symmetrical amidships compartment with watertight flat below initial waterline with permeability

iii) Symmetrical amidships compartment with watertight flat above the initial waterline with permeability

iv) Extreme end compartment with 100% permeability

v) Extreme end compartment with watertight flat below the initial waterline with 100% permeability

vi) Amidships compartment off the centreline with 100% permeability

b) Describes countermeasures which may be taken in event of flooding

16. Damage stability requirements for passenger vessels and Type A and B vessels

a) Defines ‘bulkhead deck’, margin line’, ‘floodable length’, ‘permissible length’, ‘factor of sub-division’ for passenger vessels

b) Describes sub-division loadlines for passenger vessels

c) Identifies ‘assumed damage’ for passenger vessels

d) Identifies ‘assumed flooding’ for passenger vessels

e) Identifies ‘minimum damage stability requirements’ for passenger vessels

f) Describes the ‘Stockholm agreement 1996’ with respect to stability requirements of passenger vessels

g) Identifies damage stability flooding criteria for Type A, B-60, B-100 vessels

h) Identifies minimum equilibrium stability condition after flooding for vessels specified in g)

17. Loadline terminology and definitions for new builds

a) Defines Type A, B, B-60, and B-100 vessels

18. Conditions of assignment of loadlines

a) Describes ‘conditions of assignment’ for vessels specified in 17a)

b) Describes ‘tabular freeboard’ with respect to vessels specified in 17a)

c) Explains the corrections to be applied to tabular freeboard to obtain ‘statutory assigned freeboard’

19. Assignment of special loadlines e.g. ‘timber loadlines’

a) Describes the special factors affecting the assignment of timber loadlines

b) Describes the intact stability requirements for vessels assigned timber loadlines

20. Requirements and Codes relating to the stability of specialised vessels

a) Identifies the stability problems associated with RORO vessels, offshore supply vessels and vessels when towing

21. The preparations required for surveys

a) Lists surveys required by the loadline rules for a vessel to maintain a valid loadline certificate

b) Lists the items surveyed at a loadline survey and describes the nature of the survey for each item