College of Micronesia – FSM
P.O. Box 159
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Course Outline Cover Page

Vessel Stability and Stress — Course Title
MM 231 — Department and Number

Course Description: This course provides the student with the knowledge and skills required to manage the stability related requirements of a vessel of up to 1600 gross tons.

Prepared by: Brent Villiers **State:** FSM-FMI

	Hours per Week	No. Of Weeks	Total Hours	Semester Credits
Lecture	3/6/12/24	16/8/4/2	48	3
Laboratory	3/6/12/24	16/8/4/2	48	1
		Total Semester Credits:		4

Purpose of Course

Degree Requirement	XX
Degree Elective	
Advanced Certificate	
Certificate	
Remedial	
Other (Workshop)	

Prerequisite Course(s): MM 211 Small Vessel Stability

_____ _____
Signature, Chairman, Curriculum Committee **Date Approved by Committee**

_____ _____
Signature, President, COM-FSM **Date Approved by the President**

General Objective: By successfully completing this course, students will have been provided with the skills required to manage the stability related requirements of a vessel of up to 1600 gross tons.

Learning Outcomes: On successful completion of this course the student will be able to:

1. Explain the fundamental principles of transverse statical stability.
2. Calculate the position of centre of gravity of the vessel.
3. Correct the height of centre of gravity (KG) for free surface effect.
4. Draw and interpret a righting lever curve.
5. Determine the draught after adding, removing or shifting weights.
6. Extract, interpret and use ships stability and stress data from relevant sources.

STUDENTS SHOULD BE MADE AWARE OF OCCUPATIONAL HEALTH AND SAFETY ISSUES IN ALL SITUATIONS AND BE EXPECTED TO DEMONSTRATE SAFE WORKING PRACTICES AT ALL TIMES.

Outline of Content: This course contains:

1. Transverse Statical Stability
- Righting lever
- Righting moment
- Stiff and tender vessels
- Metacentric height
- Equilibrium
- Angle of loll
- KM
- Moment of statical stability.

2. Centre of Gravity
- Adding, removing, or shifting weights
- Final KG
- Final GM
- List
- Free surface effect
- Free surface moment
- KG (fluid).

3. Righting Lever Curve
- Angles of flooding and deck edge immersion
- KN values
- Drawing GZ curve
- Information available from a GZ curve

- IMO criteria.

4. Draught and trim
   - Calculation of draught and trim using trimming moments
   - Calculation of draught and trim using trimming tables
   - Bodily rise or sinkage.
5. Stability and Stress Data
   - Data sources
   - Extraction, interpretation and use of stability and stress data.

Learning Outcomes: On completion of this course the learner will be able to:

Learning Outcome 1 **Explain the fundamental principles of transverse statical stability.**

Assessment criteria

1.1 Meaning of the following terms is explained :
- Righting lever/Capsizing lever (GZ);
- Righting moment/ Capsizing moment;
- Stiff and tender ships;
- Metacenter;
- Initial metacenter and height of initial
- metacenter above the keel (KM);
- Initial metacentric height (GM);
- Height of centre of gravity above the keel (KG).

1.2 The change in the length of righting lever with the following changes are explained:
- When displacement is changed, keeping the KG and the angle of heel constant;
- When the angle of heel is changed, keeping the displacement and KG constant:
- When the KG is changed, keeping the displacement and heel angle constant.

1.3 Conditions of stable, unstable and neutral equilibrium are described.

1.4 Angle of loll is described and methods of correcting an angle of loll explained.

1.5 The height of transverse metacentre (KM) above the keel for a box shape is calculated.

1.6 Moment of statical stability at a small angle of heel for a given GM is calculated.

Conditions and Method of assessment

As specified in the Assessment Strategy listed at the end of this outline and by a combination of:

- Written test involving the use of sketching, diagram interpretation, descriptive answer questions, short answer questions, multiple choice questions, calculations
- Oral questioning
- Practical exercises on simulator or ship models.

Learning Outcome 2 **Calculate the position of centre of gravity of the vessel.**

Assessment criteria

2.1 The movement of the centre of gravity of the vessel is explained when a weight is added to, removed from, or shifted on the vessel

2.2 The movement of the centre of gravity of the vessel is explained when a weight is suspended by ship's gear.

2.3 Calculations are performed to find the final vertical position of the centre of gravity (KG) above the keel after adding, removing, shifting or suspending weights.

2.4 Final GM (solid) for a given KM is determined.

2.5 Calculations are performed to find the final horizontal position of the centre of gravity off the centre line after adding, removing, shifting or suspending weights.

2.6 Final list of the vessel is determined.

Conditions and Method of assessment

As specified in the Assessment Strategy listed at the end of this outline and by a combination of:

- Written test involving the use of sketching, diagram interpretation, descriptive answer questions, short answer questions, multiple choice questions, calculations
- Oral questioning
- Practical exercises on simulator or ship models.

Learning Outcome 3 **Correct the height of centre of gravity (KG) for free surface effect.**

Assessment criteria

3.1 Free surface effect is described.
3.2 Effect of sub-dividing a tank into a number of transverse compartments is described.
3.3 KG (fluid) is defined.
3.4 The effect of free surface on the centre of gravity is calculated and applied to obtain KG (fluid).
3.5 The change of free surface moment (FSM) with the change of the density of liquid in the tank is identified.

Conditions and Method of assessment

As specified in the Assessment Strategy listed at the end of this outline and by a combination of:

- Written test involving the use of sketching, diagram interpretation, descriptive answer questions, short answer questions, multiple choice questions, calculations
- Oral questioning
- Practical exercises on simulator or ship models.

Learning Outcome 4 **Draw and interpret a righting lever curve.**

Assessment criteria

4.1 Meaning of the following terms is explained:
- Angle of flooding;
- Potential angle of flooding;
- Angle of deck edge immersion.

4.2 KN values for a given displacement are extracted from tables or curves.
4.3 Calculations are performed to find the righting lever values (GZ) for various angles of heel, for a given condition, using KG (fluid) and KN.
4.4 The righting lever (GZ) curve is drawn, against the heel angle.
4.5 IMO minimum stability criteria are outlined.
4.6 Following information is obtained from the GZ curve:
- Angle of loll, if applicable
- Range of stability
- Angle of vanishing stability
- Maximum GZ value

- Angle at which the maximum GZ occurs
- Point of contraflexion

4.7 Effect of increasing the beam and freeboard on stability is described using the GZ curve.

Conditions and Method of assessment

As specified in the Assessment Strategy listed at the end of this outline and by a combination of:

- Written test involving the use of sketching, diagram interpretation, descriptive answer questions, short answer questions, multiple choice questions, calculations
- Oral questioning
- Practical exercises on simulator or ship models.

Learning Outcome 5 **Determine the draught after adding, removing or shifting weights.**

Assessment criteria

5.1 The following terms are described:

- Draughts at the draught marks;
- Draughts at the perpendiculars:
- Centre of flotation;
- True mean draught/Hydrostatic draught;
- Moment to Change Trim by one Centimetre (MCT lcm).

5.2 Final draughts and trim after shifting a weight are calculated, using trimming moments and MCTC.

5.3 Final draughts after shifting, adding, discharging weights or any combination of these operations, are calculated using trimming tables.

5.4 Bodily rise or sinkage caused as a result of discharging or adding a weight is calculated using TPC.

Conditions and Method of assessment

As specified in the Assessment Strategy listed at the end of this outline and by a combination of:

- Written test involving the use of sketching, diagram interpretation, descriptive answer questions, short answer questions, multiple choice questions, calculations
- Oral questioning

- Practical exercises on simulator or ship models.

Learning Outcome 6 **Extract, interpret and use ships stability and stress data from relevant sources.**

Assessment criteria

6.1 Following data relevant for various calculations is obtained from the ship's stability booklet and curves:
- Light ship displacement and KG
- Length between perpendiculars (LBP)
- Load-line and draught mark information
- The following for a given draught:
  a. Displacement
  b. Height of center of buoyancy (KB)
  c. KM
  d. TPC
  e. MCTC
  f. Longitudinal center of floatation (LCF)
- Angle of flooding
- Angle of deck edge immersion
- Trim and draught corrections
- Capacities and KG of compartments
- FSM or moment of inertia of tanks.

6.2 Aids available on the ship for assessing stability and stress are listed and outlined.

6.3 Ships stability and stress data is extracted from tables and computer programs and interpreted.

Conditions and Method of assessment

As specified in the Assessment Strategy listed at the end of this outline and by a combination of:
- Written test involving the use of sketching, diagram interpretation, descriptive answer questions, short answer questions, multiple choice questions, calculations
- Oral questioning
- Practical exercises on simulator or ship models.

Delivery strategy	This course provides for off-the-job delivery in a classroom, supported by simulation and/or laboratory equipment and access to a vessel in survey. Students will need to be provided with access to a vessel that has stability data available or access to an equipment laboratory with simulation equipment that will allow practical exercises in stability to simulate actual circumstances onboard a vessel.
Resource requirements	Delivery of the training will require: • A suitable theory teaching space • Simulation and/or laboratory equipment • Vessel in survey • Vessel's stability data.
Assessment Method	Knowledge, skills and attitudes may be measured by using a combination of practical exercises, oral assessment, and written tests.
Condition of Assessment	This course may be assessed on-the-job and off the job. Competence may be assessed in the following situations: a vessel under survey; approved training vessel/facility; approved equipment laboratory; approved simulator facility.

Evaluation:

Final Grade for this course will be based on meeting the course requirements at the following percentage rates:

96% - 100%	A – Superior
90% - 95%	B – Above Average
80% - 89%	C – Average
69% - 79%	D – Below Average
0 % - 69%	F – Failure

Attendance:

The COM-FSM attendance policy will apply.