NATIONAL UNIVERSITY OF ENGINEERING
COLLEGE OF MECHANICAL ENGINEERING
NAVAL ENGINEERING PROGRAM

MV211 – VESSEL THEORY I

I. GENERAL INFORMATION

CODE	: MV211 Vessel Theory I
GRADE	: 5
CREDITS	: 4
HOURS PER WEEK	: 6 (Theory - Practice)
REQUIREMENTS	: MV108 Naval Drawing
CONDITION	: Mandatory

II. SUMMARY

Study of the geometry of the navy. Application of approximate integration methods for the study of navies. Determination of displacement and tons per centimeter of immersion. BM, MTC, shape coefficients, KM, careening centers. International Convention on Tonnage Measurement of Ships. Study of loads. VCG, LCG. Relationship between loads and stability of the vessel. Stability criteria, transversal stability.

III. COMPETENCES

At the end of the course, the student will be able to:

1. Evaluate the intact stability of floating ships.
2. Perform stability studies of existing ships.
3. Perform stability studies of ships in project.
4. Perform the tonnage measurement of ships.

IV. LEARNING UNITS

1. **INTRODUCTION TO THE COURSE and FUNDAMENTALS OF NAVAL ARCHITECTURE / 6 hours.**
   Features of the hull. Main dimensions. Definitions and general concepts. Middle section, body and middle parallel. Geometry of the ship. Practical applications.
2. **DISPLACEMENT IN THE VESSEL, COEFFICIENTS OF FORM / 6 hours**

Total displacement. Effect of density on the draft of the vessel. Weight and displacement estimation. Definition and use of the coefficients. Coefficients of block, section, mean, prismatic, CPV. Relations of dimensions. Shape coefficients problems.

3. **METHODS AND INTEGRATION RULES / 6 hours.**
   Trapezoid rule. 1st Simpsom rule. 2nd Simpsom Rule. Rule of simple intervals. Spraying of ordered means. Tchbycheffs rule. Polar integration.
4. **OTHER METHOD OF INTEGRATION 16 hours.**
   Mechanical Integration. Integrator Planimeter. Determination of Volumes. Problems.
5. **HYDROSTATIC CURVES / 6 hours**
   Areas of water level, tons per unit of immersion. Displacement. Center of longitudinal flotation. Transverse metacentric radio. Metacentric transverse height from the keel. Longitudinal metacentric radio. Longitudinal metacentric height from the keel.
6. **HYDROSTATIC CURVES (cont.) / 6 hours**
   Fencing centers integrated by water plans and cross sections. Approximate formula for the vertical underwater hull center. Change of displacement by variation of seat. Moment to change the seat. ARCH, usual terminology.
7. **TONNAGE MEASUREMENT / 6 hours.**
   Difference between gross and net tonnage Analysis of articles and rules of the international tonnage convention. Analysis of the importance of the tonnage measurement certificate Discussion of the content of the information given.
8. **BONJEAN CURVES / 6 hours**
   Area curves of cross sections. Construction of Bonjean curves. Uses and applications of Bonjean curves.
9. **CHARGE AND CAPACITY / 6 hours.**
   Loading capacity. Capacity of capacity flat tanks. Sounding. Consumables.
10. **INTACT STABILITY. ELEMENTARY PRINCIPLES / 6 hours.**
    Stable equilibrium Weight and center of gravity. Weight ratio and center of fairing, equilibrium conditions. Right moment. Transverse metacentric radius. Weight and location of the center of gravity. Estimated detail of the weight and position of the center of gravity. Variation of displacement and center of gravity by weight embarkation.
11. **INITIAL STABILITY / 6 hours.**
    Balancing condition of floating bodies. Metacentric and transverse metacentric height. Metacentric and longitudinal metacentric height. Movement of the center of gravity due to change of weights. Localization of longitudinal metacentric height. Effect of the trimming on the metacenter.
12. **STABILITY AT LARGE ANGLES / 6 hours.**
    Cross curves of stability. Methods for obtaining cross-curves of stability. Methods of the wedges to calculate the cross curves. Methods for straight sides.
13. **STATIC STABILITY CURVE / 6 hours.**
    Effect of strut on stability. Effect of the sleeve on stability. Effect of shape changes on stability. Meaning of the static stability curve. Representation of the heeling moment.

14. EFFECT OF LIQUID SURFACE AND SPECIAL CHARGES. EVALUATION OF THE STABILITY / 6 hours.

Free surface effect. Evaluation of the free surface effect on metacentric height. Evaluation of the free surface effect on the righting lever. Free surface effect over the surface of tanks.

V. METHODOLOGY

During the theoretical classes, students will be actively involved, which will be regularly checked before starting each class. Also, practical examples will be developed on the board, with the procedures to be studied and a series of questions on the part of the teacher to make the same students to develop and explain the problem or the job of finding information, this participation being considered as an oral examination, which will be part of the overall evaluation.

VI. EVALUATION SYSTEM

The course will be evaluated according to the "F"

Average of quizzes (P.P.)	Weight 1
Midterm exam (EP)	Weight 1
Final exam (E.F.)	Weight 2

Number of quizzes: 04 four

The average of quizzes (P.P.) is the arithmetic average of the 03 highest marks of the quizzes. Quizzes will not be taken out of date.

The final grade (NF)

$$\text{N.F.} = \frac{1\text{P.P.} + 1\text{E.P.} + 2\text{E.F.}}{4}$$

VII. BIBLIOGRAPHY

1. **LEWIS, E.V.** *Principles of Naval Architecture, Vol. I*. The Society of Naval Architects and Marine Engineers.
2. **K.J. RAWSON AND E.C. TUPPER**. *Basic Ships Theory, Butterworth-Heinemann Fifth Edition Volume I.* 373 pages.
3. **A.B. BIRAN**. *Ship Hydrostatics and Stability, Butterworth-Heinemann, First,344 pages.*
4. **D.R. DERRITT**. *Ship Stability for Masters and Mates. Stanford Maritime Limited.* Fourth Edition, 1984. ISBN 0-540-073388