Course code	Course Name	L-T-P-Credits	Year of Introduction
SB204	STABILITY OF SHIPS AND SUBMARINES	3-1-0-4	2016

Prerequisites: -Nil

Course Objectives:

1. To impart the basic principles and conditions of stability of ships.
2. To familiarise solving of Naval Architectural stability problems.
3. To familiarise stability considerations of submerged bodies.

Syllabus:

Introduction to Stability of Ships; Initial Stability- Transverse Stability; Longitudinal Stability; Stability at Large Angles; Dynamical Stability, Inclining Experiment, Cross Curves of Stability; Damaged Stability and Calculation by Lost Buoyancy and Added Weight Methods; Recommendations of Classification Societies and Government Authorities; Stability of Submarines.

Expected Outcome:

On successful completion of the course, the student will be able to:

1. Understand the equilibrium conditions of stability of ships.
2. Solve ship stability problems using numerical integrations methods.
3. Read and understand ship stability booklet meeting IMO Stability criteria.
4. Understand the purpose and procedure of inclining experiment.
5. Provide subdivision and solve trim calculations.
6. Understand the stability problem of submarines.

Text Books:

- Rawson and Tupper; Basic Ship Theory; Butterworth-Heinemann.
- D.R. Derret; Ship Stability for Masters and Mates 5E; Butterworth-Heinemann.

Reference Books:

- Eric Tupper, Introduction to Naval Architecture.
- Lewis, E.U.; Principles of Naval Architecture, SNAME, New Jersey, U.S.A.
- D. Vassalos et al 2000; Contemporary Ideas on Ship Stability; Elsevier Science Ltd.
- A.B. Biran; Ship Hydrostatics and Stability; Butterworth-Heinemann.
- Colin S. Moore; Edited by J. Randolph Paulling (2010); Principles of Naval Architecture Series: Intact Stability, The Society of Naval Architects and Marine Engineers.
- H. Schneekluth and V. Bertram; Ship Design for Efficiency and Economy.

Course Plan

Module	Content	Hours	Sem. Exam Marks
I	**Introduction to Stability of Ships-** Potential Energy and Equilibrium.	1	15%
	Equilibrium Conditions- Stable Unstable, Neutral Conditions; Stability Terms.	2	
	Equivolume Inclinations- Shift of C.O.B. due to Inclinations, C.O.B Curve, Metacentre, Pro-Metacentre and Metacentric Radius, Metacentric Height, Metacentric Curve, Surface of Floatation, Curve	4	

	of Floatation, Righting Moment and Righting Lever.		
	Heeling Moments due to Wind, Shift of Cargo, Passengers, Turning and Non-Symmetrical Accumulation of Ice.	3	
	Effect of Superstructure on Stability.	1	
II	**Transverse Stability**- Introduction.	1	15%
	Initial Stability– GM_0, GZ at Small Angles of Inclinations, Angle of Loll, Wall Sided Ships; Stability due to Addition, Removal and Transfer (Horizontal, Lateral and Vertical) of Weight, Suspended Weight and Free Surface of Liquids; Stability while Docking and Grounding; Inclining Experiment.	5	
	Large Angle Stability- Diagram of Statistical Stability (GZ-Curve), Characteristics of GZ-Curve; Methods for Calculating the GZ-Curve (Krylov, Prohaska, Etc.); Cross Curves of Stability.	4	
	Dynamical Stability– Definition, Dynamical Stability Criteria.	2	
FIRST INTERNAL EXAM			
III	**Longitudinal Stability**– Trim, Longitudinal Metacentre, Longitudinal Centre of Flotation, Moment to Change Trim, Trimming Moment; Trim Calculations– Addition, Removal and Transfer of Weight.	9	15%
IV	**Damage Stability** – Calculations by Lost Buoyancy and Added Weight Methods; Deterministic and Probabilistic Approach, Stability in Waves.	8	15%
SECOND INTERNAL EXAM			
V	**Recommendations of Classification Societies and Governmental Authorities**– Intact and Damage Stability Criteria.	8	20%
VI	**Stability of Submarine**s- Items of Weight & its Relations, Equilibrium Conditions, Equilibrium Polygon, Stability in Depth.	8	20%
END SEMESTER EXAM			

QUESTION PAPER PATTERN:

Maximum marks : 100 Time : 3 hours

PART A

- Answer all 8 questions of 3 marks each.
- 1 question each from modules I to IV and 2 questions each from modules V & VI.

PART B

- Answer any 2 full questions out of 3 for each module.
- Each question from module I to IV carries 6 marks.
- Each question from module V & VI carries 7 marks.
- Each full question can have maximum of 4 sub questions, if needed.