Course code	Course Name	L-T-P-Credits	Year of Introduction
SB202	RESISTANCE AND PROPULSION OF SHIPS	3-1-0-4	2016

Prerequisites: -Nil

Course Objectives:

1. To be familiar with the concept of Resistance and Propulsion of ships.
2. To be familiar with prediction of Resistance of ships, and to estimate machinery power to attain the specified speed.
3. To impart knowledge on various types of marine propellers and to familiarize with design.

Syllabus:

Introduction to Resistance and Propulsion of Ships, Components of Ship Resistance, Laws of Comparison, Viscous Resistance, Wave Making Resistance; Other Resistance Components, Model Testing, Determination of Resistance from Series Test Results; Propeller as a Thrust Producing Mechanism, Screw Propeller, Propeller Theories, Interaction Between Hull and Propeller, Cavitation; Design of Propellers, Open Water Tests , Self-Propulsion Tests, Design Charts, Selection of Engine Power, Propeller Strength, Model Testing of Propellers; Resistance Calculation, Model Ship Correlation, Propeller Design, Ship Standardization Trials, Resistance of Advanced Marine Vehicles, Special Types of Propellers.

Expected Outcome:

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

1. Understand various components of resistance of ships.
2. Predict resistance of ships using statistical / methodical series / model tests and estimate effective power.
3. Understand the geometry of screw propeller, various propeller theories and interaction between hull & propeller.
4. Understand the phenomena of cavitation and its effects of propellers.
5. Design propeller using various methodical series/ design charts/ model experiments.
6. Understand the principle of operation of various unconventional propulsive devices, and resistance of high speed marine crafts.

Text Books:

- J.P. Ghose, R.P. Gokarn; Basic Ship Propulsion.
- Eric Tupper; Introduction to Naval Architecture.

Reference Books:

- D.G.M. Watson; Practical Ship Design; Elsevier Ocean Engineering Book Series.
- Lewis, E.U.; Principles of Naval Architecture, SNAME, New Jersey, U.S.A.
- Rawson and Tupper; Basic Ship Theory; Butterworth-Heinemann.
- Lars Larsson & Hoyte C.; Principles of Naval Architecture.
- Raven; Ship Resistance & Flow; The Society of Naval Architects and Marine Engineers.
- Neil Bose; Marine Powering Prediction and Propulsors; The Society of Naval Architects and Marine Engineers.

- Barnaby K.; Basic Naval Architecture.
- H. Schneekluth; V. Bertram; Ship Design for Efficiency and Economy.

Course Plan

Module	Content	Hours	Sem. Exam Marks
I	**Introduction-** Resistance of Ships, Components of Ship Resistance	2	15%
	Dimensional Analysis- Geometrical, Dynamical and Kinematical Similarity, Laws of Comparison- Model-Ship Correlation.	3	
	Viscous Resistance– Turbulent Plate Friction and Plate Resistance, Viscous Pressure Resistance, Influence of Curvature of Ship's Hull, Form Factor, Hull Roughness and its Influence on Frictional Resistance.	2	
	Wave Making Resistance– Ship Wave System, Interference Effects, Theoretical Calculation of Wave Making Resistance, Wave Breaking Resistance, Bulbous Bow and its Effects.	2	
II	**Other Components of Resistance-** Air and Wind Resistance, Appendage Resistance, Added Resistance in Waves; Resistance in Restricted Waterways– Resistance in Shallow Water, Resistance in Canals.	3	15%
	Model Testing– Modern Tank Testing Facilities, Prediction of Resistance from Model Tests, Tank Wall Effect.	3	
	Determination of Resistance from Test Results – Residuary Resistance, Effect of Hull Form on Resistance, Taylor Series, Series 60, B S R A Series, S S P A Series, Etc.; Statistical Analysis of Resistance Data, Holtrop & Mennen's Method, Guldhammer And Harvald's Method.	3	
FIRST INTERNAL EXAM			
III	**Introduction to Powering of Ships-** Propeller as a Thrust Producing Mechanism; Screw Propeller- Propeller Geometry, Sections, Propeller Drawing, Construction Details.	3	15%
	Law Of Similitude Of Propeller, Propeller Theories- Momentum Theory, Blade Element Theory, Circulation Theory.	3	
	Interaction Between Hull and Propeller-Wake and Wake Fraction, Resistance Augment and Thrust Deduction Factor, Propulsive Efficiency in Open Water and Behind Conditions, Hull Efficiency, Quasi Propulsive Coefficient, Transmission Efficiency.	3	
	Cavitation- Introduction, Types, Cavitation Number, Effects of Cavitation, Prevention of Cavitation, Design for Minimum Cavitation, Cavitation Tests.	2	
IV	Design of Propellers- Propeller Families and Series; Kt-Kq Diagrams; Design Charts- Bp-Δ, T-J, P-J Charts, Use of Charts in Propeller Design and Performance Study.	6	15%

	Propeller Strength- Materials and their Qualities, Strength Calculation.	2	
	Model Testing Of Propellers- Test Facilities, Laws of Comparison, Open Water Tests, Self- Propulsion Tests, Ship Standardization Trials.	3	
SECOND INTERNAL EXAM			
V	**Special Types of Propellers**- Shrouded Propellers– Action of Propeller in a Nozzle, Wake Fraction and Thrust Deduction Fraction in Nozzles, Load Factor of Nozzles, Design of Propeller Nozzle System, Design Charts.	8	20%
	Controllable Pitch Propellers- Advantages, Special Features in Geometry, Design Aspects.		
VI	**Super Cavitating Propellers**, Application.	3	20%
	Other Propulsion Devices- Vertical Axis Propellers, Water Jet Propulsion, Sail, Paddle Wheels, Electromagnetic Propulsion.		
	High Speed Craft and Advanced Marine Vehicles- Introduction, Types; Resistance of Planing Crafts, Catamarans, SWATH, Hydrofoil Crafts.	5	
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.