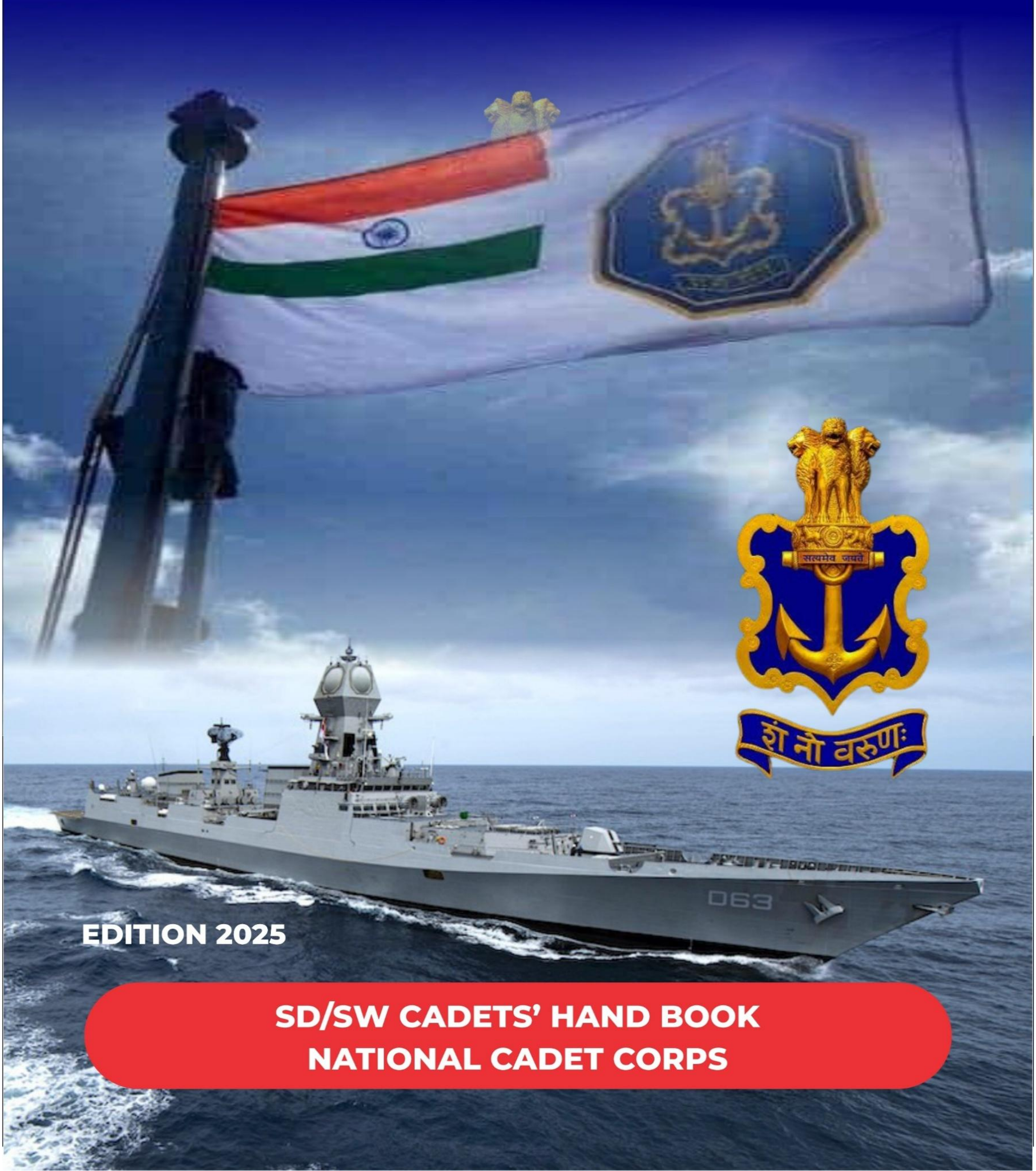
NCC SPECIAL SUBJECT: NAVY



EDITION 2025

SD/SW CADETS' HAND BOOK
NATIONAL CADET CORPS

National Cadet Corps

Published By: The Director General, National Cadets Corps
Delhi-110030

सत्यमेव जयते

CONSTITUTION OF INDIA

PREAMBLE

WE, THE PEOPLE OF INDIA, HAVING
solemnly resolved to constitute India into
a sovereign socialist secular democratic republic
and to secure to all its citizens :

JUSTICE,
Social, Economic And Political; LIBERTY
of thought, expression, belief, faith and worship;

EQUALITY
of status and of opportunity; and to promote among them all

FRATERNITY
assuring the dignity of the individual and
the [unity and integrity of the nation];

IN OUR CONSTITUENT ASSEMBLY
this twenty-sixth day of november, 1949, do
HEREBY ADOPT, ENACT AND GIVE TO
OURSELVES THIS CONSTITUTION.

NATIONAL ANTHEM

Jana-Gana-Mana-Adhinayak Jaya He

Bharat-bhagya-vidhata

Punjab-Sindhu-Gujrat-Maratha

Dravid-Utkal-Banga

Vindhya-Himachal-Yamuna-Ganga-

uchchala-jaladhi-taranga

Tava Subha name jage,

tava subha asisa mage, gahe tava jaya-gatha.

Jana-gana-mangala-dayaka

jaya he Bharata-bhagya-vidhata

Jaya he, Jaya he, Jaya he, jaya jaya jaya jaya he.

FOREWORD

It gives me immense pleasure and pride to present the Revised NCC Précis of Common and Special Subjects, 2025 Edition, marking the culmination of a protracted effort mounted for the purpose for more than two years. This achievement has only been made possible through the collective and whole-hearted effort of all stakeholders, comprising the Directorates, the Board of Officers for revision and for printing, & my staff. Your contribution in bringing the project to fruition merits highest appreciation.

The revision was aimed at structuring and updating the syllabus to reflect contemporary thought & realities, as also equip cadets with skills to apply their NCC training in real-life situations. The challenge was to simultaneously keep the language simple for easy comprehension, avoiding too much jargon or pedantry. Endeavour was also to make the presentation interesting and the layout reader-friendly, enabling cadets to engage with each topic meaningfully even through self-study. I extend my sincere appreciation to the entire team for successfully achieving these objectives in their entirety.

This endeavour also aligns the NCC syllabus with tenets of *Vikasit Bharat* for the youth, familiarising NCC cadets with history, geo-strategy, and contemporary technological advances, while remaining rooted in our cultural heritage and ethos. I am sanguine that this vision will be carried forward by present and future generations of cadets, ensuring strong foundations for a robust nation, enabled and ready to achieve greater heights and our rightful place on the global stage.

GOD bless and JAI HIND

Director General,
National Cadet Corps

INDEX: NCC SPECIAL SUBJECT, NAVY - SD/SW

NAVAL ORIENTATION

SECTION INDEX : NAVAL ORIENTATION (SD/SW)

NCC SPECIAL SUBJECT (NAVY)

NAVAL ORIENTATION

CHAPTER 1: INTRODUCTION TO INDIAN ARMED FORCES (CODE- NO 1)

"The safety, honour and welfare of your country come first, always and every time. The honour, welfare and comfort of the men you command come next. Your own ease, comfort and safety come last, always and every time".

TEACHING INSTRUCTIONS

Period	**:**	**1 (40 Min)**
Type	**:**	**Theory**
Year	**:**	**First**
Conducting Officer	**:**	**PI**

Training Aids : **Blackboard, chalk, whiteboard, marker, projector.**

Time Plan

➢ **Introduction to Indian Armed Forces**	**:**	**05 Min**
➢ **Indian Army**	**:**	**10 Min**
➢ **Indian Navy**	**:**	**10 Min**
➢ **Indian Air Force**	**:**	**10 Min**
➢ **Conclusion**	**:**	**05 Min**

INTRODUCTION

1. The responsibility for national defence rests with the Cabinet. This is discharged through the Ministry of Defence (MoD) which provides the policy framework and wherewithal to the Armed Forces to discharge their responsibilities in the context of the defence of the country. Even though all elements of national defence and national security continuously strive to achieve the assigned roles and tasks the Defence Services play the most vital role in maintaining the sovereignty and territorial integrity of our nation from both; external and internal threats. Based on the major wars fought, struggles and the present-day relations with our neighbouring countries and strategic allies the Defence forces of our nations have transformed significantly to ensure compliance with the given mandate. Having read the overview of the current structures of the Indian Armed Forces as discussed in the succeeding paragraph the NCC Cadets will be able to appreciate how well these organizations have emerged to meet India's needs of national defence, security, integration and other associated requirements.

2. Even though the responsibility of national defence rests with the Cabinet and is discharged through Ministry of Defence, the President of India is the Supreme Commander of Indian Armed Forces. Like in all other developed and developing countries, the Indian Armed Forces comprises of three main constituents, namely, Indian Army, Indian Navy and Indian Air Force which look after the multi-dimensional defence needs of the country. Recently the chief of Defence Staff (CDS) was established with the intension of enhancing tri-service effectiveness coordination and overall integration of the Indian Armed Forces' combat capabilities. CDS is the chief advisor to the Government of India in all matters pertaining to Indian Defence Forces. General Bipin Rawat, PVSM, UYSM, AVSM, YSM, SM, VSM, ADC was appointed as the first CDS on 27 Dec 2019.

3. Throughout this chapter, we will delve into the history, structure, and key functions of each branch of Indian Armed Forces, enabling the Cadet to obtain a basic understanding of these vital national assets.

PREVIEW	LEARNING OBJECTIVES
The lecture will be covered in following parts:- ➢ Part I: The Indian Army ➢ Part II: The Indian Navy ➢ Part III: The Indian Air Force	➢ Brief introduction about Indian Armed forces – Army, Navy & Air Force ➢ Their constituents, organization, key elements and role ➢ Introduction to combat arms, combat support arms and supporting services of Indian Army.

PART I: THE INDIAN ARMY

4. Indian Army is the land-based branch and the largest component of the Indian Armed Forces. Historically, the army of India was raised under the British Raj in the 19th century by taking the erstwhile 'Presidency Armies', merging them and bringing them under the Crown. The British Indian Army, as it was called then fought both the World Wars and at many places across

the world, courageously and valiantly, winning many laurels as well as respect of all professional armies of that time. The Indian Army as we know it today became operational after the country gained independence from British colonialism. As of today, Indian Army is the second largest standing army in the world, with 12,73,693 active troops and 9,60,000 reserve troops.

5. The Indian Army Headquarters is in New Delhi and functions under the Chief of the Army Staff (COAS), a four-star general, who is responsible for the command, control and administration of Indian Army. He is assisted by a Vice Chief of Army Staff (VCOAS), three Deputy Chiefs of Army Staff, Principal Staff Officers (PSOs) and the Heads of Arms and Services. The Army is divided into six operational commands (field armies) and one Training Command each under the command of a Lieutenant General who has an equal status to the VCOAS working under the control of the Army Headquarters. Indian Army's primary role is to ensure national security and unity, defend the nation from external aggression and internal threats, and maintain peace and security within its borders. It also undertakes humanitarian rescue operations during natural disasters and other disturbances as well as participates in UN Peace keeping missions.

Soldiers of The Sikh Light Infantry during a Republic Day Parade

Constituents and Organisation

6. The Indian Army is divided into six Operational Commands and one Training Command which have subordinate formations namely the Corps, Divisions and Brigades under them. As the names below suggest, each operational command is responsible for the defence of a specific region or area of our country. Each field Army or command is commanded by an officer of the rank of 'Lieutenant General', who is known as the Army Commander or General Officer Commanding-in-Chief. These seven commands are:-

(a) Northern Command.

(b) Western Command.

(c) Eastern Command.

(d) Southern Command.

(e) Central Command.

(f) South Western Command.

(g) Training Command.

DID YOU KNOW?
➢ The modern Indian Army was officially formed on April 1, 1895, as the British Indian Army, amalgamating the Bombay, Bengal, and Madras Armies established by the British East India Company in the 18th century.
➢ Before this, India's military history was marked by various regional armies and kingdoms that defended their territories.
➢ According to the Global Firepower Military Strength Ranking, India is the 4th most powerful country in the World.

<u>Components of Indian Army</u>

7. The Indian Army has three main constituents namely the Combat Arms, the Combat Support Arms and the Services which are organized in field formations forming the Brigades, Divisions, Corps and Commands. All three together fight the war as a team as part of the field formations. These three key constituents, namely the Combat Arm, Combat Support Arm and Services, which are further divided into sub-components have their own unique quality and characteristics.

(a) **<u>Combat Arms</u>**. These are the primary fighting forces of the Army, directly involved in combat operations.

(b) **<u>Combat Support Arms</u>**. These support the combat arms by providing essential wherewithal and capabilities vital for war fighting which are not integral to the Combat arms like long range fire power, protection from hostile aircraft, mobility and communications in war fighting areas.

(c) **<u>Services</u>**. These units provide logistical and administrative support to the Army, ensuring that combat and supporting arms can function effectively both during war and peace.

8. **<u>Combat Arms</u>.**

(a) **<u>Infantry (Inf)</u>**. The backbone of the Army is an Infantry man who fights on foot and is responsible for destroying the enemy in close combat and holding ground.

(b) **<u>Mechanized Infantry (Mech Inf)</u>**. Combines the mobility of armoured vehicles with the flexibility of infantry and is an essential component of mobile warfare.

(c) **<u>Armoured Corps</u>**. Equipped with tanks and armoured vehicles, it provides mobility and firepower on the battlefield and is the key element of any battle of manoeuvre.

9. **Combat Support Arms**

(a) **Artillery**. Provides fire support to the infantry and armoured units using various types of guns, howitzers, and rocket systems.

(b) **Army Aviation Corps (AAC)**. Provides aerial reconnaissance, logistics support, and casualty evacuation.

(c) **Corps of Engineers**. Provides engineering support, including construction, demolition, and maintenance of infrastructure.

(d) **Army Air Defence (AAD)**. Protects the Army from aerial threats using anti-aircraft weapons and missile systems.

(e) **Corps of Signals**. Manages military communications and information systems.

10. **Services**

(a) **Army Service Corps (ASC)**. Responsible for logistics, supply, and transportation.

(b) **Army Medical Corps (AMC)**. Provides medical care and health services for Army personnel.

(c) **Corps of Electronics and Mechanical Engineers (EME)**. Maintains and repairs equipment and vehicles.

(d) **Army Ordnance Corps (AOC)**. Manages the supply of ammunition, weapons, and other military equipment.

(e) **Remount and Veterinary Corps (RVC)**. Manages the care and training of animals used by the Army.

(f) **Judge Advocate General's Department (JAG)**. Provides legal services and advice.

(g) **Army Dental Corps (ADC)**. Provides dental care to Army personnel.

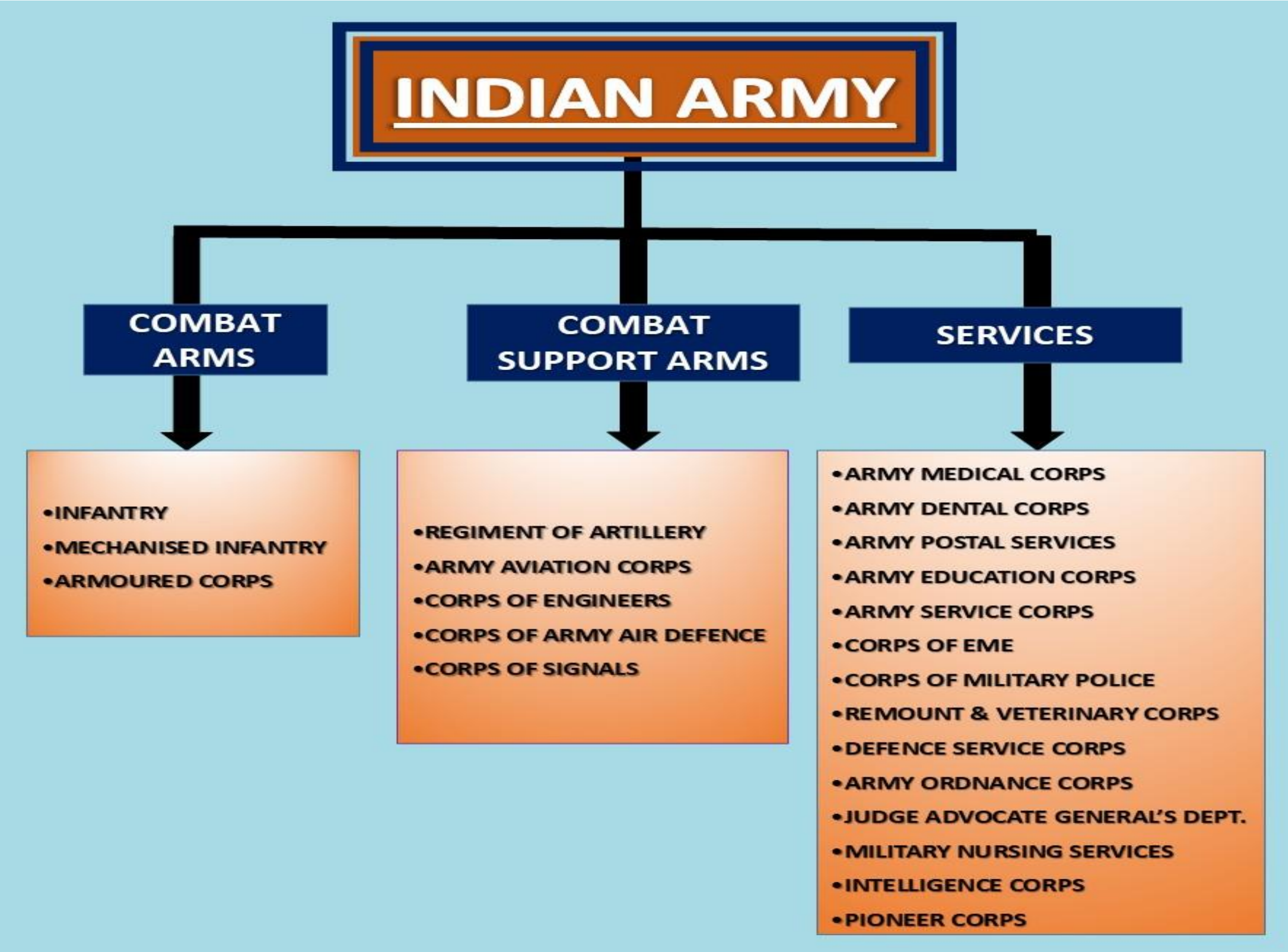
(h) **Army Educational Corps (AEC)**. Responsible for the education and training of Army personnel.

(j) **Corps of Military Police (CMP)**. Maintains discipline and law enforcement within the Army.

(k) **Army Postal Service (APS)**. Manages postal services for the Army.

(l) **Intelligence Corps**. Responsible for providing military intelligence to support operations.

(m) **Pioneer Corps**. Provides engineering and logistical support to the Indian Army.



Components of Indian Army

PART II: THE INDIAN NAVY

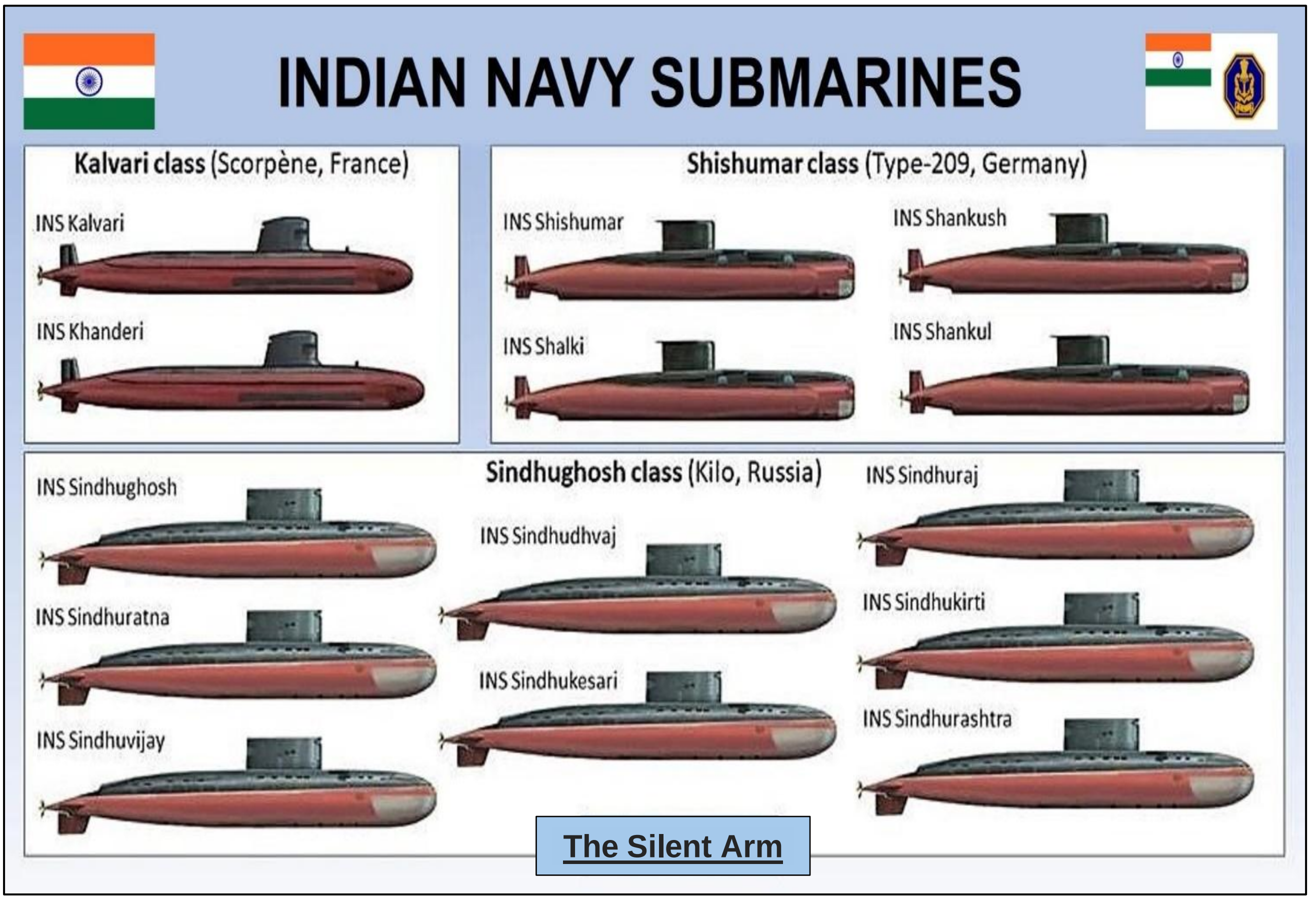
11. Our nation has one of the largest peninsulas and has open water on three sides with a coastline of approximately 7500 kms. As, it has been historically proven, the seas around our country have an impact/effect on our freedom, trade, commerce and culture The Indian Navy (Bhartiya Nau Sena), the maritime Branch of the Indian Armed Forces is the primary organization which ensures our maritime security. It is also supported by Indian Coast Guard which protects our maritime interests and enforces maritime laws. The Indian Navy today is a multidimensional force that has been organized to safeguard India's maritime territorial integrity and other maritime interests. It plays a crucial role in securing India's vast coastline, protecting maritime trade routes and ensuring the nation's maritime sovereignty. The Navy also engages in humanitarian missions, disaster relief and international peacekeeping efforts. Established in its modern form on January 26, 1950, the Indian Navy has evolved into a formidable blue-water navy capable of operating across the globe.

Constituents and Organisation

12. The Indian Navy has a vast strength of personnel and a large operational fleet consisting of aircraft carriers, amphibious transport docks, landing ship tanks, destroyers, frigates, nuclear-powered attack submarines, ballistic missile submarines, conventionally-powered attack

submarines, corvettes, mine countermeasure vessels, patrol vessels, fleet tankers and various other auxiliary vessels.

Three Components of Indian Armed Forces



The Silent Arm

Type of Warship	Description	Examples
Aircraft Carriers	Large ships capable of carrying and launching aircraft.	INS Vikramaditya, INS Vikrant
Destroyers	Versatile warships with anti-air, anti-ship, and anti-submarine capabilities.	INS Kolkata, INS Visakhapatnam, INS Imphal
Frigates	Smaller than destroyers, with multi-role capabilities.	INS Shivalik, INS Nilgiri
Corvettes	Compact warships designed for coastal defense and patrol duties.	INS Kamorta, INS Kiltan
Submarines	Submersible vessels used for stealthy underwater operations.	INS Kalvari, INS Arihant
Patrol Vessels	Smaller craft used for patrolling, search and rescue, and other coastal missions.	INS Saryu, INS Sunayna
Mine Countermeasures Vessels	Designed for mine-clearing operations.	INS Nireekshak, INS Karwar
Landing Platform Docks	Amphibious assault ships for launching troops and equipment ashore.	INS Jalashwa, INS Shardul
Offshore Patrol Vessels	Used for patrolling and surveillance in offshore waters.	INS Vikram, INS Vajra
Research Vessels	Ships dedicated to scientific research and oceanographic studies.	INS Sagardhwani, INS Sindhughosh (research variant)
Training Ships	Used for training purposes and instruction of naval cadets.	INS Tarangini, INS Sudarshini

Types of Warships in Indian Navy

Organisation and Administration

13. The Indian Navy is a multi-dimensional force organized to operate above, on and under the surface of the oceans. It is headed by the Chief of the Naval Staff (CNS), a four-star admiral. The CNS is assisted by four Principal Staff Officers (PSOs), namely the Vice Chief of Naval Staff (VCNS), the Deputy Chief of Naval Staff (DCNS), the Chief of Personnel (COP) and the Chief of Material (COM), all being Vice Admirals.

14. The Indian Navy operates two operational commands and one training command. Each command is headed by a Flag Officer Commanding-in-Chief (FOC-in-C) of the rank of Vice Admiral.

COMMAND	HEADQUARTER
Western Naval Command	Mumbai
Eastern Naval Command	Visakhapatnam
Southern Naval Command	Kochi

15. Naval operations in the operational commands are carried out by fleets and flotillas. A fleet is a large formation of warships under one command, designed to conduct extensive naval operations. The Indian Navy has two main fleets:-

(a) **Western Fleet**. Based in Mumbai, it includes the Navy's largest and most powerful ships, responsible for operations in the Arabian Sea.

(b) **Eastern Fleet**. Based in Visakhapatnam, it operates in the Bay of Bengal and beyond, ensuring maritime security in the eastern waters.

16. **Flotillas**. A flotilla is a smaller formation of ships, typically consisting of a mix of different types of vessels. The Indian Navy has flotillas based in Mumbai, Visakhapatnam and Port Blair, which provide local naval defence and support fleet operations.

17. **Submarine Squadrons**. Operate from various bases, including Visakhapatnam and Mumbai.

18. **Indian Navy Air Arm**. The air arm is a fighting arm of the Indian Navy which is tasked to provide an aircraft carrier-based strike capability, fleet air defence, maritime reconnaissance, and anti-submarine warfare. Some prominent fighter aircraft that Indian Navy operates include MiG 29 K and Hawk. It also employs other aircraft including Chetak and Sea King helicopters. It was raised in 1948 and today has approximately 23 squadrons, 5000 personnel and approximately 300 various types of aircraft.

DID YOU KNOW?

- As of August 2015, the Indian Navy is classified as a Rank 3 Navy (Power projection to regions adjacent to its own) on the Todd-Lindberg navy classification system of naval strength.
- The Navy also includes specialized units such as the Marine Commandos (MARCOS) for special operations and the Indian Naval Air Arm for aerial operations.
- **Fleet Composition.** The Indian Navy's fleet includes aircraft carriers, destroyers, frigates, corvettes, submarines, and various auxiliary vessels. As of 2024, the Navy operates two aircraft carriers, INS Vikramaditya and INS Vikrant, along with a variety of other advanced ships and submarines.

Sea King

MiG 29K

19. **Naval Air Stations**. The Navy operates several air stations equipped with aircraft for reconnaissance, anti-submarine warfare, and logistics support. Key air stations include INS Hansa in Goa and INS Rajali in Arakkonam.

20. The Indian Navy's organizational structure ensures it can effectively manage and deploy its resources to protect India's maritime interests and respond to various challenges and threats.

PART III: THE INDIAN AIR FORCE

21. The Indian Air Force (IAF) is the aerial warfare branch of the Indian Armed Forces, tasked with securing Indian airspace and conducting aerial operations during armed conflicts. It was established on October 8, 1932, as the Royal Indian Air Force, which took part in many gallant air actions during World War II. After India gained independence the prefix Royal was removed. On 1st Apr 1954, Air Marshal Subroto Mukherjee, one of the founding members of the Royal Indian Air Force took over as the first Chief of the Air Staff of the Indian Air Force.

22. The primary mission of the Indian Air Force is to secure Indian airspace both during peace and war. The IAF plays the crucial role of conducting aerial warfare during armed conflicts: conducting strategic bombing, destroying enemy air assets, engaging in reconnaissance missions and providing air support to ground and naval forces where and when required. Additionally, the IAF participates in humanitarian missions, disaster relief, and international peacekeeping efforts.

23. The IAF is the world fourth largest air force in terms of both personnel and aircraft. The Indian Air Force comprises of undermentioned aircraft, helicopters and the associated equipment with which they execute their tasks and responsibilities:-

(a) Fighter Aircraft.

(b) Bombers.

(c) Transport aircraft.

(d) Attack Helicopters.

(e) Transport Helicopters.

(f) Reconnaissance Assets (aircraft, helicopters and drones).

(g) Missiles.

(h) Radars.

Boeing C-17 Globemaster III

Rafale Fighter

LCA Mk 1A

Sukhoi SU-30 MKI

Constituents and Organisation

24. **Air Headquarters**. The IAF's Headquarters is in New Delhi and is commanded by the Chief of Air Staff (CAS), a four-star air officer. The staff of Air Headquarters consists of three branches namely, Air Staff Branch, Administrative Branch and Maintenance Branch.

25. **Commands**. The organizational structure includes several key sub-organisations including Operational Commands, Maintenance Command and Training Command. These seven commands are headed by an Air Officer Commanding-in-Chief (AOC-in-C) of the rank of Air Marshal. Out of these seven, first five are operational commands. They are discussed below:-

(a) **Western Air Command (WAC)**. Based in New Delhi, responsible for operations in the western sector.

(b) **Eastern Air Command (EAC)**. Based in Shillong, responsible for operations in the eastern sector.

(c) **Central Air Command (CAC)**. Based in Prayagraj, responsible for operations in the central sector.

(d) **Southern Air Command (SAC)**. Based in Thiruvananthapuram, responsible for operations in the southern sector.

(e) **South Western Air Command (SWAC)**. Based in Gandhinagar, responsible for operations in the southwestern sector.

(f) **Training Command**. Based in Bengaluru, responsible for training and education of IAF personnel.

(g) **Maintenance Command**. Based in Nagpur, responsible for the maintenance and logistics support of IAF equipment.

26. The equipment profile and the functional division at basic organisation level of IAF are as follows:-

(a) **Fleets and Squadrons**. The IAF's operational capabilities are organized into various fleets and squadrons

(b) **Fighter Squadrons**. Equipped with aircraft such as the Su-30MKI, Rafale, Tejas, MiG-29 and Mirage 2000, these squadrons are responsible for all types of air missions including bombing, ground attack, reconnaissance and close air-support missions.

(c) **Transport Squadrons**. Operate aircraft like the C-130J Super Hercules, C-17 Globemaster III and An-32, providing strategic and tactical airlift capabilities.

(d) **Helicopter Units**. Equipped with helicopters such as the CH-47 Chinook, Mi-17 and Apache AH-64E, these units perform a variety of roles including transport, search and rescue, and close air support.

(e) **Specialized Units**. The IAF includes specialized units such as the Garud Commando Force which is an elite special forces unit trained for airborne operations, counterterrorism and special reconnaissance missions.

(f) **Air Defence Units**. Responsible for protecting Indian airspace from enemy aircraft and missiles using advanced radar and missile systems.

27. Some important missile systems with IAF are:-

(a) **SAMAR**. A short-range air defence system created by the IAF Maintenance Command. The SAMAR system uses repurposed Vympel R-73 and Vympel R-27 air-to-air missiles to target low-flying aircraft, helicopters and drones.

SAMAR Air Defence System

(b) **SPYDER**. A surface-to-air missile system that can engage aircraft, helicopters, drones and other targets. The IAF operates one squadron of SPYDER and has ordered four more.

(c) **Rampage**. A supersonic missile with a range of over 190 miles and a payload of 150 kilograms of explosives. The Rampage missile can operate in all weather conditions and has GPS/INS navigation with anti-jamming capabilities.

28. **Training Institutions**. The IAF operates several training institutions to ensure the continuous development of its personnel, including the Air Force Academy in Dundigal and the Flying Training Establishment in Hakimpet.

Air Force Academy, Dundigal, Hyderabad

29. The Indian Air Force’s organizational structure and diverse capabilities enable it to effectively protect India’s airspace and contribute to national and international security.

CONCLUSION

30. The Indian Armed Forces, comprising of the Indian Army, Navy and Air Force, play a pivotal role in safeguarding the nation's sovereignty and territorial integrity. The responsibility for national defence rests with the Cabinet, discharged through the Ministry of Defence, while the President of India serves as the Supreme Commander of the Armed Forces. The establishment of the Chief of Defence Staff (CDS) has further enhanced tri-service coordination and integration.

31. The Indian Army, the largest component, ensures national security and unity, defends against external aggression and internal threats, and participates in humanitarian and UN peacekeeping missions. The Indian Navy, a multidimensional force, protects India's maritime interests and engages in humanitarian missions and disaster relief. The Indian Air Force secures Indian airspace, conducts aerial operations, and participates in humanitarian missions and international peacekeeping efforts.

32. The structured organization of the armed forces, with their respective commands and specialized units, ensures effective operational capabilities. The Indian Armed Forces’ commitment to excellence, discipline and patriotism continues to inspire and uphold the nation's

security and sovereignty. Through their dedicated service, the armed forces not only protect the nation but also contribute to global peace and stability.

SUMMARY

➢ **National Defence Responsibility**. Rest with the Cabinet, discharged through the Ministry of Defence (MoD).

➢ **Supreme Commander**. The President of India.

➢ **Main Constituents**. Indian Army, Indian Navy and Indian Air Force.

➢ **Chief of Defence Staff (CDS)**. Established to enhance tri-service effectiveness and coordination.

➢ **Indian Army**:

- Largest component of the Indian Armed Forces.
- Ensures national security, unity, and peace.
- Participates in humanitarian and UN peacekeeping missions.
- Divided into six operational commands and one training command.

➢ **Indian Navy**:

- Multidimensional force safeguarding maritime interests.
- Engages in humanitarian missions and disaster relief.
- Divided into three commands: Western, Eastern, and Southern.
- Includes the Indian Navy Air Arm.

➢ **Indian Air Force**:

- Secures Indian airspace and conducts aerial operations.
- Participates in humanitarian missions and international peacekeeping efforts.
- Divided into seven commands: Western, Eastern, Central, Southern, South Western, Training, and Maintenance.
- Includes various fleets and squadrons for different operational capabilities.

➢ **Historical Context**:

- **Indian Army**. Formed in 1895 as the British Indian Army.
- **Indian Navy**. Modern form established on January 26, 1950.
- **Indian Air Force**. Established on October 8, 1932, as the Royal Indian Air Force.

ASSESSMENT EXERCISE

Multiple Choice Questions

Q1. Who is the Supreme Commander of the Indian Armed Forces?

(a) Prime Minister
(b) President of India
(c) Chief of Defence Staff
(d) Defence Minister

Q2. Which ministry is responsible for national defence in India?

(a) Ministry of Home Affairs
(b) Ministry of Defence
(c) Ministry of External Affairs
(d) Ministry of Finance

Q3. What is the primary role of the Indian Army?

(a) Maritime security
(b) Aerial warfare
(c) Ensuring national security and unity
(d) Space exploration

Q4. Who was appointed as the first Chief of Defence Staff (CDS) of India?

(a) General Manoj Pande
(b) Air Chief Marshal RKS Bhadauria
(c) General Bipin Rawat
(d) Admiral Karambir Singh

Q5. How many operational commands does the Indian Army have?

(a) 4
(b) 5
(c) 6
(d) 7

Q6. What is the main function of the Army Service Corps (ASC)?

(a) Combat operations
(b) Providing logistics, supply, and transportation
(c) Training personnel
(d) Air defence

Q7. Which of the following is NOT a combat arm of the Indian Army?

(a) Infantry
(b) Armoured Corps
(c) Corps of Signals
(d) Mechanized Infantry

Q8. Where is the headquarters of the Indian Navy located?

(a) Visakhapatnam
(b) Kochi
(c) Mumbai
(d) New Delhi

Q9. What is the name of India's first indigenous aircraft carrier?

(a) INS Vikrant
(b) INS Vishal
(c) INS Arihant
(d) INS Vikramaditya

Q10. Which of the following commands is responsible for training in the Indian Navy?

(a) Western Naval Command
(b) Eastern Naval Command
(c) Southern Naval Command
(d) Central Naval Command

Q11. The Indian Air Force was established in which year?

(a) 1930
(b) 1932
(c) 1947
(d) 1954

Q12. What is the primary role of the Indian Air Force?

(a) Securing Indian airspace
(b) Conducting naval warfare
(c) Managing ground-based logistics
(d) Providing legal support

Q13. Which of the following is a fighter aircraft used by the Indian Air Force?

(a) C-17 Globemaster III
(b) CH-47 Chinook
(c) MiG-29
(d) Apache AH-64E

Q14. The Indian Armed Forces participate in which of the following international efforts?

(a) UN Peacekeeping missions
(b) Space exploration programs
(c) Foreign elections monitoring
(d) Global financial aid distribution

Q15. Which of the following is a missile system used by the Indian Air Force?

(a) SPYDER
(b) BRAHMOS
(c) Prithvi
(d) Agni

Short Answer Type Questions

1. What are the three main constituents of the Indian Armed Forces?

2. Describe the role of the Chief of Defence Staff (CDS) in the Indian Armed Forces.

3. What is the primary mission of the Indian Air Force?

4. Name the three commands of the Indian Navy and their respective headquarters.

5. What is the significance of Services in the Indian Army?

Long Answer Type Questions

1. Discuss the historical evolution of the Indian Army from the British Indian Army to its current form.

2. Explain the organizational structure and key functions of the Indian Navy.

3. Describe the various components and operational capabilities of the Indian Air Force.

4. How does the Ministry of Defence (MoD) support the Indian Armed Forces in discharging their responsibilities?

5. Analyse the importance of Combat Arms and Combat Support Arms in Indian Army?

NCC SPECIAL SUBJECT (NAVY)

NAVAL ORIENTATION

CHAPTER 2: HISTORY AND GROWTH OF THE INDIAN NAVY (CODE – NO 2)

"A good navy is not a provocation to war. It is the surest guaranty of peace"

TEACHING INSTRUCTIONS

Period:	**:**	**1 (40 Min)**
Type	**:**	**Theory**
Year	**:**	**First**
Conducting Officer	**:**	**PI**
Training Aids	**:**	**Blackboard, chalk, whiteboard, marker, projector**

Time Plan

➢ **Introduction**	**:**	**05 Min**
➢ **Early History Pre-Independence**	**:**	**10 Min**
➢ **Growth of Indian Navy Post-Independence**	**:**	**10 Min**
➢ **Organisation structure and Roles**	**:**	**10 Min**
➢ **Layered Concept of Maritime Security**	**:**	**05 Min**

INTRODUCTION

1. India's maritime history dates to the Harappan civilization (3000 BC), where seafarers navigated the Rann of Kutch using dugout boats. By 327-326 BC, Alexander the Great's Admiral Niarchus sailed from the Indus to the Euphrates, using boats built by the Ksatri/ Xethroi tribe. The Rig Veda (2500-500 BC) contains references to sea voyages and invocations to Varuna, the ocean deity. Chinese junks reached Kerala by 125 AD for trade, leaving behind the iconic Chinese fishing nets in Kochi. The Cholas (985-1054 AD) maintained a formidable naval fleet, launching expeditions to Sri Lanka and the Malayan Peninsula.

2. India's maritime routes evolved over time, from the Silk Route's semi-sea passage to the Cape Route (15th century) and Suez Canal (19th century). Indian seafarers established routes from Puri to Java by the 1st century. While naval activity declined after the 15th century, Kanhoji Angre revived it in the 18th century. The Indian Navy traces its roots to the East India Company's fleet in 1612 and became a combat force under the British in 1830, regaining its identity as the Indian Navy on January 26, 1950.

PREVIEW	LEARNING OBJECTIVES
The lecture will be conducted in the following parts:- ➢ Part I: Early history Pre-Independence. ➢ Part II: Growth of Indian Navy Post-Independence ➢ Part III: Organisation Structure, Roles and Responsibilities of Indian Navy	➢ Origins and evolution of the Indian Navy. ➢ Historical progression and organizational structure and major commands, roles, and notable leaders. ➢ Layered concept of Maritime security and roles of Navy, ICG and Marine Police.

PART I: EARLY HISTORY PRE-INDEPENDENCE

3. **Introduction to the Indian Navy's History**. India has a longstanding maritime heritage, dating back to ancient times. References to sea voyages can be found in the Vedic texts, particularly the *Rig Veda*. Over the centuries, India's naval traditions have evolved, influenced by different rulers and cultural exchanges. However, the structured formation of the Indian Navy as we know it today began in the colonial era and underwent significant transformations post-independence.

4. **Early Foundations and Development**.

(a) **Establishment and Colonial Influence**. The Indian Navy has a long history, with its roots dating back to ancient times when powerful naval forces like those of the Cholas and Marathas dominated the seas. However, the modern Indian Navy was established during the colonial period. The British East India Company created the "Bombay Marine" in 1612 to protect its trade routes and ships from pirates. Over time, his force evolved into the Royal Indian Navy (RIN) under British rule, primarily serving the interests of the British Empire.

(b) During the colonial era, the Indian Navy played a role in both World Wars, though its operations were under British control. However, Indian sailors faced discrimination, and their contributions often went unrecognized. This frustration culminated in the Royal Indian Navy Revolt of 1946 also called 1946 Naval Uprising, where Indian sailors protested poor conditions and British authority. The uprising was a turning point, showcasing growing nationalist sentiments. After India gained independence in 1947, the Royal Indian Navy was renamed the Indian Navy in 1950, and it began to transform into a strong and self-reliant force, focused on protecting India's maritime interests. The Indian Navy's journey reflects both colonial influence and its subsequent evolution into a symbol of national pride and strength.

(c) **Post-Independence Reformation**. After gaining independence in 1947, the Indian Navy underwent significant reforms to transform itself into a modern and self-reliant maritime force. At the time of independence, the Navy inherited a modest fleet that was primarily geared towards supporting British colonial interests. In 1950, when India became a republic, the Royal Indian Navy was renamed the Indian Navy, and it began focusing on safeguarding India's maritime borders, trade routes, and interests.

(d) The 1960s and 1970s were crucial decades for the Navy's reformation. During the 1961 Liberation of Goa, the Navy played a key role in Operation Vijay. However, its decisive involvement came during the 1971 Indo-Pakistan War, where the Indian Navy executed successful operations like the Blockade of East Pakistan and Operation Trident. This marked its emergence as a formidable force in the Indian Ocean. Post-1971, India began to focus on indigenous shipbuilding, establishing naval infrastructure like Mazagon Dockyard and the Cochin Shipyard to reduce dependency on foreign powers.

(e) Since independence, the Indian Navy has evolved into a blue-water navy with modern warships, submarines, and aircraft carriers. It has also expanded its role in humanitarian assistance, disaster relief, and international maritime cooperation. Today, the Indian Navy is a key pillar of India's defence forces, reflecting the nation's strategic vision and technological progress in the maritime domain.

(f) **<u>Growth and Modernization</u>**. Over the years, the Indian Navy expanded its fleet and capabilities, acquiring modern warships, submarines, and aircraft. This growth was fuelled by the need to safeguard India's expanding maritime interests and maintain a formidable presence in the Indian Ocean.

DID YOU KNOW?
➢ **The first recorded Navy**. The Navy of the Magadh kingdom is considered the first recorded Navy in the world.
➢ **The word "Navy"**. The word "Navy" comes from the Latin word *navigium*, which means "a vessel, a ship, bark, boat".

<u>PART II: GROWTH OF INDIAN NAVY POST INDEPENDENCE</u>

5. **<u>Key Milestones in Indian Navy's Evolution</u>**.

(a) **<u>1961 - Liberation of Goa</u>**. The Liberation of Goa took place on December 19, 1961, when the Indian armed forces successfully ended 450 years of Portuguese rule in Goa, Daman, and Diu. After India gained independence in 1947, most of the country became free from colonial rule, but Goa remained under Portuguese control. Despite peaceful attempts and diplomatic efforts to convince the Portuguese to leave, they refused to give up the territory. As a result, the Indian government decided to take military action to liberate Goa and integrate it into India. The operation, known as Operation Vijay, involved coordinated efforts by the Indian Army, Navy, and Air Force. The mission lasted just 36 hours, and the Portuguese surrendered without much resistance. On December 19, 1961, Goa officially became a part of India, marking the end of colonial rule in the region. The liberation of Goa was celebrated across the nation as a major victory for India's unity and freedom. Today, Goa observes December 19 as Goa Liberation Day to honour the sacrifices and celebrate the state's integration into the country.

(b) **<u>1971 - Indo-Pakistan War</u>**. The Indo-Pakistan War of 1971 was a significant conflict between India and Pakistan, fought from December 3 to December 16, 1971. The war was triggered by political and humanitarian issues in East Pakistan (now Bangladesh), where the local population faced severe oppression from the Pakistan military after demanding independence. Millions of refugees fled to India, creating a major crisis. India, led by Prime Minister Indira Gandhi, extended support to the people of East Pakistan and decided to intervene militarily to help them gain freedom. The war lasted just 13 days and resulted in a decisive victory for India. The Indian Armed Forces fought courageously on both the Eastern and Western fronts, defeating the Pakistan military. On December 16, 1971, Pakistan's forces in East Pakistan surrendered, leading to the creation of the new independent nation of Bangladesh. This war is remembered as a significant moment in Indian history, showcasing India's military strength and humanitarian support. Vijay Diwas is celebrated on December 16 every year to commemorate this victory and honour the sacrifices of the soldiers.

(c) **<u>Recent Developments</u>**. The commissioning of advanced vessels, including the aircraft carrier INS Vikramaditya and the indigenous aircraft carrier INS Vikrant, reflects the Indian Navy’s commitment to modernization and self-reliance. These additions have bolstered India’s maritime power, extending the Navy's operational reach.

6. The Indian Navy's evolution from its ancient maritime heritage to a modern force reflects a journey of transformation and growth. Beginning with powerful naval traditions of the Cholas and Marathas, the colonial era saw the establishment of the Bombay Marine, later evolving into the Royal Indian Navy under British rule. Post-independence, the Navy focused on safeguarding India’s maritime interests, showcasing its strength during the 1961 Liberation of Goa and the 1971 Indo-Pakistan War. Recent advancements, including the commissioning of INS Vikrant, INS Vikramaditya, and nuclear submarines like INS Arihant and INS Arighat, highlight India’s commitment to self-reliance and modernization. Today, the Indian Navy stands as a symbol of national pride and strategic vision, ensuring maritime security and stability in the Indian Ocean region.

DID YOU KNOW?

The Indian Navy's history includes:-

➢ **The Bombay Marine**. The Bombay Marine became the Indian Navy in 1830.

➢ **The First Opium War**. The Indian Navy fought in the First Opium War of 1840.

➢ **The Second Anglo-Burmese War**. The Indian Navy fought in the Second Anglo-Burmese War of 1852.

➢ **The Indian Rebellion of 1857**. Sailors of the Indian Navy breached the Delhi gates during the Indian Rebellion of 1857.

➢ **The Royal Indian Marine**. In 1892, the Indian Navy was renamed the Royal Indian Marine in recognition of its services in various campaigns.

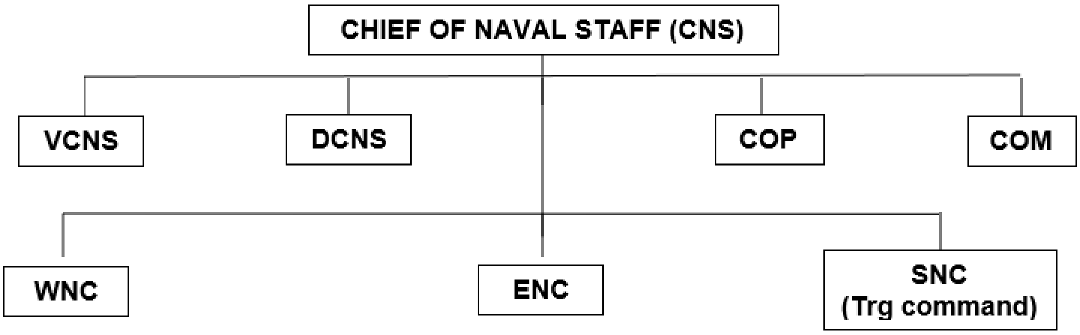
Signing of Instrument of Surrender by Pak Army in 1971

1st Made in India Scorpene Class Submarine

PART III: ORGANISATION STRUCTURE, ROLES AND RESPONSIBILITIES OF THE INDIAN NAVY

7. **Organisational Structure of the Indian Navy**.

(a) The Indian Navy is organized to maximize operational efficiency and ensure robust administrative control from the highest headquarters down to unit levels.



(b) **Naval Headquarters**:-

(i) **Chief of Naval Staff (CNS)**. The CNS is the senior-most officer responsible for the operational, administrative, and logistical functioning of the Navy.

(ii) **Vice Chief of Naval Staff (VCNS)**. The VCNS heads Staff Branch - I and is responsible for planning, programming, and coordinating administrative functions. The VCNS also acts as CNS in his absence.

(iii) **Deputy Chief of Naval Staff (DCNS)**. Heading Staff Branch-II, the DCNS manages operations, intelligence, communications, and naval aviation.

(iv) **Chief of Personnel (COP)**. The COP oversees personnel management, including recruitment, training, welfare, and discipline.

(v) **Chief of Materiel (COM)**. The COM handles maintenance, design, construction, and engineering support for the naval fleet.

(c) **Naval Commands**. The Indian Navy is divided into several command structures, each responsible for distinct operational zones:-

(i) **Western Naval Command**. Based in Mumbai, this command covers the Arabian Sea and is led by the Flag Officer Commanding-in-Chief Western Naval Command.

(ii) **Eastern Naval Command**. Based in Visakhapatnam, responsible for operations in the Bay of Bengal and is headed by Flag Officer Commanding-in-Chief Eastern Naval Command.

Guard of Honour

(iii) **Southern Naval Command**. Located in Kochi, focusing on training and operational preparedness. Headed by Flag Officer Commanding-in-Chief Southern Naval Command.

(d) **Andaman & Nicobar Command**. A tri-services command, based in Port Blair, securing the strategic Andaman Sea and approaches to the Malacca Strait. Headed by Commander-in-Chief Andaman and Nicobar Command (CINCAN).

(e) **Fleet Organisation**. The Navy operates two main fleets:-

(i) **Western Fleet**. Operating from Mumbai, this fleet is equipped with destroyers, frigates, submarines, and support vessels to ensure security, particularly in the Arabian Sea.

(ii) **Eastern Fleet**. Operating from Visakhapatnam, this fleet focuses on the Bay of Bengal and surrounding maritime regions. It is equipped with similar capabilities to those of the Western Fleet.

Fleet Operations

8. **Shore Establishments**. These facilities provide essential support, including training and logistics, to ensure the operational readiness of naval assets:-

(a) **Training Establishments**. The Navy operates training facilities for both officers and sailors to develop technical, operational, and leadership skills.

(b) **Logistics and Support Bases**. Key logistical facilities provide berthing, repair, maintenance, and recreation amenities for naval personnel and vessels.

DID YOU KNOW?
➢ Oldest Naval Air Squadron in Asia is INAS 550 commissioned in 1953.The Indian Navy's Naval Air Arm holds the distinction of being the oldest in Asia.
➢ **Chhatrapati Shivaji Maharaj.** Chhatrapati Shivaji Maharaj is considered the father of the Indian Navy.

Roles and Responsibilities of the Indian Navy

9. **EEZ & International Waters** In order to understand the Role of Indian Navy & concept of maritime security, it is essential to be familiar with some commonly used terms:-

(a) **Coastline**. Coastline or seashore is where the land meets the sea or ocean and forms the boundary between the land and the ocean. India has a coastline of 7517 kms.

(b) **Inland Waterways**. An extensive network of inland water bodies in the form of rivers, canals, backwaters and creeks generally navigable in nature.

(c) **Territorial Waters**. An area of water over which a state has jurisdiction, including internal waters like gulfs, bays, creeks, inlets and swampy/marshy areas and extending upto 12 NM into sea.

(d) **Contiguous Zone**. The contiguous zone is a band of water extending further from the outer edge of territorial waters up to 24 NM from the baseline within which a state can exert limited control for the purpose of preventing or punishing infringement of its customs, fiscal, immigration or sanitary regulations.

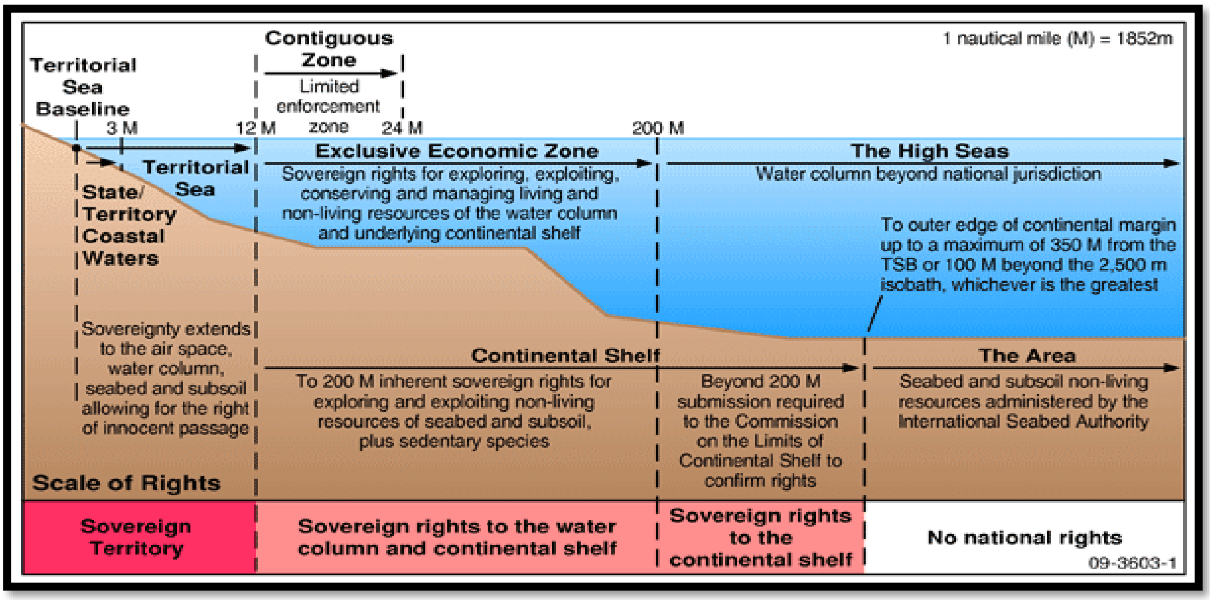
(e) **Exclusive Economic Zone (EEZ)**. An area of coastal water and sea bed within a certain distance of a country’s coastline, to which the country claims exclusive rights for fishing, drilling and other economic activities. India’s EEZ extends to approx 200 NM into sea covering 20,13,410 sq km.

(f) **International Waters**. Area of sea beyond territorial waters where ships of all states enjoy right of innocent passage.

10. **Layered Concept of Maritime Security**. Coastal and Offshore Safety is ensured by various agencies in a layered concept. The innermost layer is manned by CISF, Customs, State Maritime Police and BSF in their respective areas of operation. The next layer is manned by Coast Guard and the outermost layer at high seas is manned by Indian Navy. Close coordination

is required within all agencies as the threat may rapidly cross from one layer to another. The overall responsibility of coordination rests with Indian Navy:-

(a) **<u>Role of the Indian Navy</u>**. Entrusted with the responsibility for overall maritime security, including coastal security and offshore security. The Indian Navy is assisted by the Indian Coast Guard, State Marine Police, and other Central and State agencies for the coastal defence of the nation, and controls all Navy - Coast Guard joint operations. The Indian Navy supports the Indian Coast Guard within the maritime zones as required, and provides presence, including surveillance and patrol, on the high seas beyond the EEZ. The Indian Navy also undertakes patrolling in the Offshore Drilling Area (ODA), and its Sagar Prahari Bal (SPB) specialised force undertakes patrolling of naval harbours.



<u>Maritime Zones Around a Country's Coastline</u>

<u>Helo-Operation at Sea</u>

(b) **<u>Role of State Marine Police</u>**. The State Marine Police is responsible for patrolling the inner layer from the coastline up to the territorial waters, in coordination with Customs, Central Industrial Security Force (CISF) and respective port authorities, as relevant.

(c) **<u>Indian Coast Guard</u>**. Roles and functions of the Indian Coast Guard are:-

(i) To protect by such measures as it thinks fit the maritime and other national interests of India in its maritime zones.

(ii) Ensuring safety and protection of artificial islands, offshore terminals, installations and other structures and devices in any maritime zones.

(iii) Take action to preserve and protect maritime environment and control marine pollution.

(iv) Protection to fishermen in distress at sea.

(v) Assisting customs and other authorities in anti-smuggling operations.

(vi) Measures for safety of life and property at sea and collection of scientific data as may be prescribed.

<u>CONCLUSION</u>

11. The Indian Navy's rich history, spanning ancient maritime traditions to its modern stature as a formidable force, highlights its critical role in safeguarding India's maritime interests. The Navy's evolution from the colonial Royal Indian Navy to the independent Indian Navy symbolizes resilience, growth, and adaptability. Its organizational structure, advanced fleets, and strategic commands ensure operational efficiency across diverse maritime zones. The integration of inland waterways, EEZ, and international waters into its operations demonstrates the Navy's comprehensive approach to maritime security. Furthermore, its layered security framework, coordinated with agencies like the Coast Guard and State Marine Police, strengthens national defence against multifaceted threats. With a robust commitment to modernization and self-reliance, exemplified by the commissioning of indigenous vessels, the Indian Navy remains a cornerstone of India's maritime strategy and a symbol of its sovereignty.

<u>Visit Board Search and Seizure Operation at Sea</u>

SUMMARY

- **Royal Navy to Indian Navy**. The Indian Navy was established in 1612 as the "East India Company Marine" before becoming the Royal Indian Navy in 1934, and finally the Indian Navy after independence in 1950.
- **INS Vikrant**. The first aircraft carrier of India, INS *Vikrant*, was commissioned in 1961, making India the first country in Asia to operate a carrier.
- **Naval Day**. Indian Navy Day is celebrated on December 4th every year, commemorating the Navy's successful attack on Karachi Harbour during the 1971 Indo-Pak war.
- **Modernization Drive**. The Indian Navy has undergone a massive modernization in recent years, incorporating nuclear submarines, aircraft carriers, and advanced destroyers into its fleet.
- **Multinational Presence**. The Indian Navy has played an integral role in various multinational naval exercises and peacekeeping missions, establishing itself as a key player in global maritime security.
- The Indian Navy is structured into three main naval commands: Western (Mumbai), Eastern (Visakhapatnam), and Southern (Kochi) Command.
- The Chief of the Naval Staff (CNS), a four-star admiral, is the highest-ranking officer in the Indian Navy.
- The Navy's operational fleet includes aircraft carriers, destroyers, frigates, submarines, and aircraft for a powerful blue-water navy.
- The Indian Navy has specialized forces like MARCOS (Marine Commandos) trained for special operations, including anti-terror and amphibious warfare.
- The Navy's organizational divisions support combat, logistics, and training, ensuring readiness for national defence and international peacekeeping.
- **IN** is responsible for Overall Coordination and security of area beyond EEZ.
- **State Marine Police** is responsible for Security of Coastal villages and up to Territorial Waters.
- **ICG** is responsible for Security of Territorial waters and up to EEZ.

SUGGESTED READ

- **Trilogy on Indian Navy by Vice Admiral G. M. Hiranandani.**
- **Transition to Triumph: History of the Indian Navy, 1965-1975**
- **Transition to Eminence: The Indian Navy, 1976-1990**
- **Transition to Guardianship: The Indian Navy, 1991-2000**

ASSESSMENT EXERCISE

Multiple Choice Questions

Q1. When was the Indian Navy officially renamed from the Royal Indian Navy?

(a) August 15, 1947
(b) January 26, 1950
(c) December 19, 1961
(d) March 3, 1971

Q2. Which ancient Indian civilization had a maritime tradition dating back to 3000 BC?

(a) Vedic Civilization
(b) Gupta Empire
(c) Harappan Civilization
(d) Maurya Empire

Q3. Who was the admiral of Alexander the Great that navigated from the Indus to the Euphrates?

(a) Kanhoji Angre
(b) Niarchus
(c) Vasco da Gama
(d) Marco Polo

Q4. Which empire had a powerful naval fleet and launched expeditions to Sri Lanka and the Malayan Peninsula?

(a) Maurya Empire
(b) Chola Empire
(c) Mughal Empire
(d) Gupta Empire

Q5. What was the name of the East India Company's fleet established in 1612?

(a) Bombay Marine
(b) Royal Indian Navy
(c) Indian Maritime Force
(d) Bengal Flotilla

Q6. What significant event marked a major uprising by Indian sailors against British authority in 1946?

(a) Battle of Plassey
(b) Royal Indian Navy Revolt
(c) Operation Vijay
(d) Kargil War

Q7. In which year did the Indian Navy play a key role in the Liberation of Goa?

(a) 1947
(b) 1950
(c) 1961
(d) 1971

Q8. Which operation was carried out by the Indian Navy during the Indo-Pakistani War of 1971?

(a) Operation Blue Star
(b) Operation Trident
(c) Operation Cactus
(d) Operation Meghdoot

Q9. Which dockyard was established post-1971 to promote indigenous shipbuilding?

(a) Visakhapatnam Dockyard
(b) Mazagon Dockyard
(c) Kolkata Shipyard
(d) Goa Shipyard

Q10. What is the role of the Chief of Naval Staff (CNS)?

(a) Responsible for recruitment and training
(b) Managing naval operations and logistics
(c) Head of the Indian Navy
(d) Overseeing coastal security

Q11. The Western Naval Command is headquartered in which city?

(a) Chennai
(b) Visakhapatnam
(c) Kochi
(d) Mumbai

Q12. Which Indian naval fleet operates from Visakhapatnam?

(a) Eastern Fleet
(b) Western Fleet
(c) Southern Fleet
(d) Andaman Fleet

Q13. What is the extent of India's Exclusive Economic Zone (EEZ)?

(a) 12 NM
(b) 24 NM
(c) 100 NM
(d) 200 NM

Q14. What is the outermost layer of India's maritime security framework?

(a) Customs and CISF
(b) State Marine Police
(c) Indian Coast Guard
(d) Indian Navy

Q15. Which aircraft carriers are part of the Indian Navy's modernization efforts?

(a) INS Vikrant and INS Virat
(b) INS Arihant and INS Arighat
(c) INS Vikrant and INS Vikramaditya
(d) INS Shakti and INS Chakra

One-word Questions

1. When was the Royal Indian Navy established?
2. Who leads the Indian Navy?
3. Where is the Western Naval Command based?
4. What year was Goa liberated?

Short Questions

1. Name the text that mentions India's ancient maritime heritage.
2. What was the Indian Navy’s original name during British rule?
3. Which command is responsible for training and operational preparedness?
4. What role does the Chief of Material (COM) have in the Navy?

Long Questions

1. Describe the evolution of India’s maritime heritage from ancient times to the colonial period.

2. How did the Indian Navy transform post-independence, and what was its impact on national defence?

3. Discuss the key milestones in the Indian Navy’s evolution, including major events like the 1961 Liberation of Goa and the 1971 Indo-Pakistani war.

4. Explain the structure and responsibilities of each level within the Integrated Headquarters of the Ministry of Defence (Navy).

5. What are the roles of the Indian Navy's Western and Eastern Fleets, and how do they contribute to India's maritime security?

NCC SPECIAL SUBJECT (NAVY)

NAVAL ORIENTATION

CHAPTER 3: TYPES OF WARSHIPS AND THEIR ROLE, ORGANISATION ONBOARD SHIPS (CODE-NO 3)

"We are tied to the ocean. And when we go back to the sea, whether it is to sail or to watch - we are going back from whence we came."

TEACHING INSTRUCTIONS

Period	**:**	**1 (One)**
Type	**:**	**Theory**
Conducting Officer	**:**	**PI**
Year	**:**	**First**

Training Aid : **Blackboard, chalk, whiteboard, marker, projector**

Time Plan

➢ **Introduction**	**: 05 Min**
➢ **Types of Warships based on their Role**	**: 10 Min**
➢ **Organisation Onboard Ship**	**: 10 Min**
➢ **Various Branches in Navy and Watch System**	**: 10 Min**
➢ **Conclusion**	**: 05 Min**

INTRODUCTION

1. The Indian Navy operates a diverse fleet of warships, each meticulously designed to address specific operational needs. These vessels, ranging from aircraft carriers to fast attack craft, form the backbone of India's maritime security apparatus. Each warship type contributes uniquely, ensuring the Navy's ability to safeguard territorial waters, project power across oceans, and fulfil humanitarian responsibilities. The fleet's composition reflects a blend of advanced technology, strategic foresight, and operational efficiency, underlining the Navy's role as a key player in the region.

PREVIEW	LEARNING OBJECTIVES
➢ Part I: Classification of Indian Navy Warships based on their Role ➢ Part II: Internal Organisation onboard Naval Ships ➢ Part III: Roles of different Departments and Watch System Onboard	➢ To understand the types of Indian Navy Warships based on their role in national security and defence strategies. ➢ To familiarise with the roles of various departments onboard a Naval Ship ➢ To understand the Watch stations and Watch system followed onboard

PART I: CLASSIFICATION OF INDIAN NAVY WARSHIPS BASED ON THEIR ROLE

2. The Indian Navy operates a variety of warships, each designed for specific missions to defend India's maritime interests. An overview of the main types of warships and their roles is enumerated in the subsequent paragraphs.

3. **Aircraft Carriers**.

(a) **Description**. Aircraft carriers are massive, floating airbases equipped with a runway for launching and recovering fighter jets and helicopters.

(b) **Role**. They serve as the centrepieces of the fleet, providing air support and power projection over long distances, essential for defending India's maritime territories.

(c) **Example**. INS Vikramaditya and INS Vikrant are the two aircraft carriers in service in the Indian Navy.

Indian Aircraft Carriers

4. **Destroyers**.

(a) **Description**. Destroyers are fast, heavily armed ships capable of engaging various threats, including enemy ships, submarines, and aircraft.

(b) **Role**. They act as escorts to protect the fleet's larger vessels (like aircraft carriers) and are used in offensive and defensive roles.

(c) **Examples**. The Kolkata-class and Delhi-class destroyers.

Visakhapatnam Class Destroyer

5. **Frigates**.

(a) **Description**. Frigates are versatile warships, slightly smaller and lighter than destroyers but still well-armed.

(b) **Role**. Primarily used for escort missions and defence against submarines and air threats. They also serve as patrol vessels to monitor territorial waters.

(c) **Examples**. The Shivalik-class and Talwar-class frigates.

Talwar Class Frigate

6. **Corvettes**.

(a) **Description**. Corvettes are smaller, fast, and highly manoeuvrable warships.

(b) **Role**. They are generally used for anti-submarine warfare and coastal patrol duties, ensuring the security of India's nearshore areas.

(c) **Examples**. The Kamorta-class corvettes are used by the Indian Navy for anti-submarine warfare.

Kora Class Corvette

7. **Submarines**.

(a) **Description**. Submarines are underwater vessels designed to operate covertly, remaining hidden below the surface.

(b) **Role**. They carry out stealth missions, such as surveillance, gathering intelligence, and launching attacks from below the water. Submarines are vital for maintaining underwater dominance.

(c) **Types**. The Indian Navy operates both conventional (diesel-electric) and nuclear-powered submarines, including the Scorpene-class and Arihant-class.

8. **Offshore Patrol Vessels (OPVs)**.

(a) **Description**. OPVs are lightly armed vessels designed for extended patrolling.

(b) **Role**. They are used for patrolling India's Exclusive Economic Zone (EEZ), anti-piracy operations, and humanitarian missions.

(c) **Examples**. The Sukanya-class and Saryu-class OPVs.

INS Sukanya

9. **Mine Countermeasure Vessels (Mine Sweepers)**.

(a) **Description**. These ships are equipped with specialized tools to detect and neutralize mines.

(b) **Role**. Mine sweepers protect shipping lanes by detecting and safely removing mines that could endanger naval and civilian vessels.

(c) **Examples**. Pondicherry Class

Pondicherry Class Mine Sweeper

10. **Amphibious Ships (Landing Ships)**.

(a) **Description**. These ships can carry troops, vehicles, and equipment directly onto shore.

(b) **Role**. They are used for transporting and deploying forces for land assaults during amphibious operations.

(c) **Examples**. The INS Jalashwa landing ship.

INS Jalashwa

11. **Fast Attack Craft (FAC)**.

(a) **Description**. FACs are small, fast, and agile vessels designed for quick attacks.

(b) **Role**. Primarily used for short-range engagements and patrolling coastal areas. They can carry out quick strikes against enemy ships and installations.

(c) **Examples**. The Super Dvora-class and Car Nicobar-class fast attack craft

Fast Attack Craft

12. **Tankers and Support Ships**.

(a) **Description**. These ships carry fuel, food, ammunition, and other supplies.

(b) **Role**. Support ships enable warships to stay at sea for extended periods by providing essential supplies, allowing them to operate further from home ports without returning for resupply.

(c) **Examples**. INS Jyoti and INS Deepak are tankers that provide fuel to the fleet at sea.

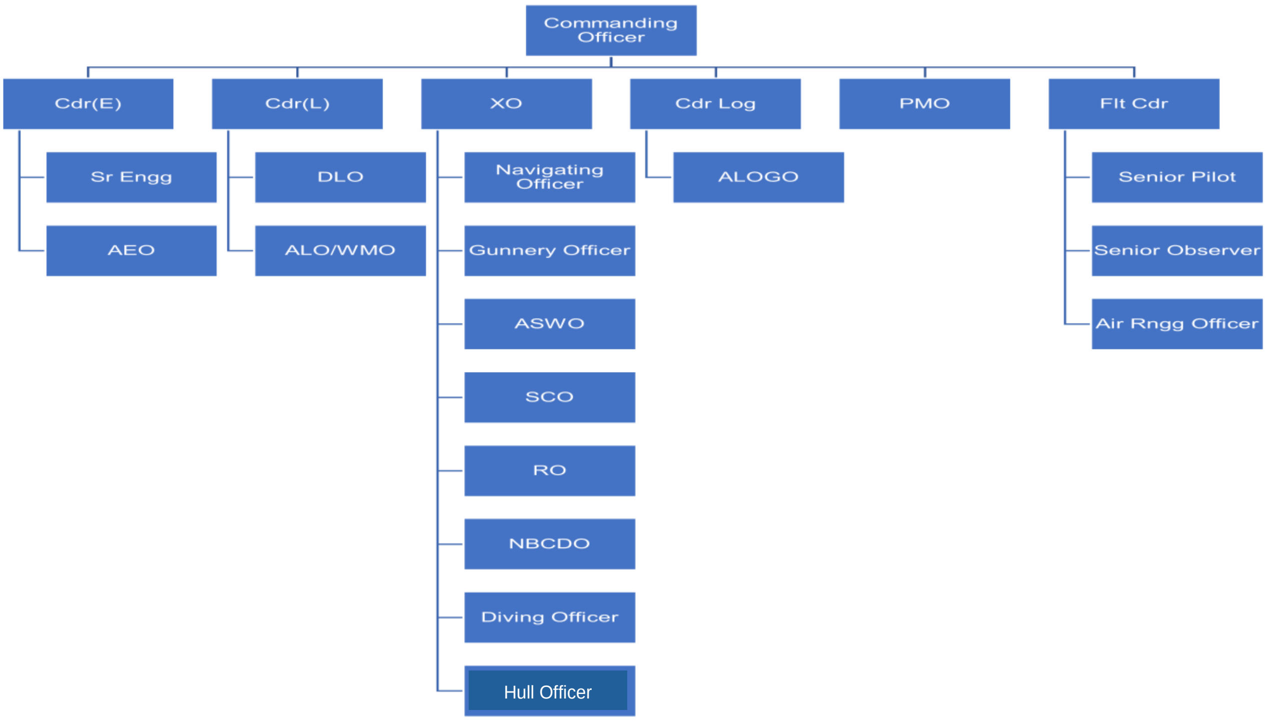
INS Deepak

13. Each of these warship types plays a specific role in the Indian Navy, enabling it to perform a wide range of operations from coastal defence to deep-sea patrols and power projection across the Indian Ocean. Together, they form a balanced fleet capable of responding to various maritime threats.

PART II: INTERNAL ORGANISATION ONBOARD NAVAL SHIPS

14. A naval ship is a marvel of organization, functioning like a self-contained city at sea. It operates through a meticulously planned hierarchy and systemized departmental divisions that ensure seamless functioning, even in the most challenging conditions. At the helm is the Commanding Officer, supported by the Executive Officer and department heads, managing critical operations such as navigation, engineering, logistics, and medical care. Each department, from the Executive to Engineering, plays a specialized role, contributing to the ship's mission readiness and operational efficiency. Watches and routines further ensure constant vigilance and readiness, safeguarding the ship's crew and operations. This intricate system reflects the Indian Navy’s commitment to excellence, discipline, and preparedness in serving the nation’s maritime interests.

15. Onboard a ship, roles are structured under a well-defined hierarchy which ensures the efficient functioning of the vessel. Each ship is led by the Commanding Officer with other officers and crew managing specific departments. Irrespective of the rank of the Commanding officer, he is addressed as the Captain of the Ship. The typical organisation of a naval ship is as shown:-



Organisation Onboard Ship

16. The roles and responsibilities of important officers are as follows:-

(a) **<u>Commanding Officer (CO)</u>**. The Commanding Officer is responsible for the overall operations, safety, and mission execution of the ship. He makes strategic decisions and leads the crew.

(b) **<u>Executive Officer (XO)</u>**. The XO is second-in-command and assists the CO in administrative and operational tasks. The XO ensures that all departments are running smoothly and that the crew adheres to protocols.

(c) **<u>Heads of Departments</u>**. The ship is divided into several main departments, each handling different operational aspects essential to the ship's performance. Each department on the ship is led by a Department Head, responsible for managing their team and ensuring that departmental tasks are completed effectively. These officers coordinate amongst themselves to support the ship's mission.

DID YOU KNOW?
➢ **Strict hierarchy**. Onboard a ship, there is a very defined hierarchy with the captain at the top, followed by senior officers, then junior officers, and finally the crew, ensuring clear lines of command and responsibility in critical situations.
➢ **Watch system**. Seafarers typically work in shifts called "watches," where they are divided into groups and rotate between periods of duty and rest, ensuring continuous monitoring of the ship's operations around the clock.

<u>PART III: ROLES OF DIFFERENT DEPARTMENTS AND WATCH SYSTEM ONBOARD</u>

17. **<u>Major Departments Onboard Ship</u>**. Each ship has several departments with specialized roles, staffed by officers and sailors with expertise in specific areas. An overview of these departments is enumerated in the subsequent paragraphs.

18. **<u>Executive Department</u>**. This department is responsible for overall operations of the ship. It includes various sub-divisions:-

(a) **<u>Communications</u>**. Manages internal and external communications for the ship, including radio and satellite links.

(b) **<u>Nuclear, Biological, Chemical and Damage Control including Fire Fighting (NBCD)</u>**. Responsible for firefighting and damage control onboard the ship including maintaining air tight integrity while passing through nuclear/ biological/ chemical fall-out areas.

(c) **<u>Gunnery</u>**. Responsible for managing the ship's weapon systems, including guns and missiles. This department handles all aspects of weapons like loading, targeting, and firing etc.

(d) **Hull Department**. This team is in-charge of the ship's structural integrity, including maintenance and repair of the hull and related fittings.

(e) **Anti-Submarine Warfare (ASW)**. Focuses on detecting and defending against submarines. This team primarily uses the SONAR to monitor underwater threats. They are also responsible for managing the underwater weapon systems of ships like torpedoes and antisubmarine rockets.

Submarine's Torpedo Room

(f) **Navigation and Direction (ND)**. Responsible for guiding the ship's course and ensuring it stays on its planned route. It includes tasks related to radar operations, GPS, and other navigational aids.

Ship's Operations Room

19. **Engineering Department**. This department maintains the ship's propulsion systems, including engines, boilers, turbines and other mechanical components. It ensures the ship remains operational at sea, handling repairs and regular maintenance.

20. **Electrical Department**. The Electrical Department is responsible for the ship's electrical systems, including power generation, lighting, and electronic equipment. This team also handles maintenance of radars, sonar systems, and other electronic systems essential for navigation and combat.

21. **Logistics Department**. Handles supply management, food, clothing, and general crew welfare. This department ensures that the ship has all necessary provisions for prolonged operations at sea.

22. **Medical Department**. Provides medical care to the crew including emergency medical procedures. The department ensures availability of medicines for prolonged operations at sea.

23. **Aviation**. This branch consists of personnel trained for the operation and maintenance of naval aircraft. They provide air support, reconnaissance, and transport as needed for naval missions.

Flying Operation onboard Aircraft Carrier

Watch Keeping

24. The ship at sea is manned at all times to ensure safety and operational readiness. The following are the major (places) watches:-

(a) **Bridge Watch**. Manages the ship's navigation and overall command during their watch period and includes the Officer of the Watch (OOW) and lookouts.

(b) **Engine Room Watch**. Maintains and operates machinery and power systems during their watch.

(c) **Operations Room Watch**. Overseas tactical operations and situational awareness.

25. **Watch System**. The seaman complement on a ship is normally large. It is divided into Forecastle (Foxle), Midship and Quarter Deck divisions. In war, depending on the threat the whole or a portion of the ship's armament must be ready for instant action. To make this possible the ship's company (entire crew) is divided into a "Watch System". The various types of Watch Systems on Naval ships are given below:-

(a) **Two Watch System**. In this system, the men are equally divided into two groups and are called Starboard Watch and Port Watch.

(b) **Three Watch System**. In this system, men are equally divided into three watches - Red, White and Blue.

(c) **Four Watch System**. In this system, men are divided into four watches, namely, Port I, Port II, Starboard I, Starboard II.

DID YOU KNOW?
➢ **Watch system:** Seafarers typically work in shifts called "watches," where they are divided into groups and rotate between periods of duty and rest, ensuring continuous monitoring of the ship's operations around the clock.

26. **Stations & Routines**. The ship's company is closed up in stations to meet various requirements. The onboard routine is structured to maintain operational efficiency while ensuring the crew receives adequate rest. Depending on the operational requirement and the threat level, the routine of the ship is decided and the ship is said to be in the following stations:-

(a) **Cruising Stations**. Peacetime routine at sea in three-watch system.

(b) **Defence Stations**. Routine followed during heightened threat assessment in two-watch system.

(c) **Action Stations**. Routine followed when threat is imminent. All personnel close up in their designated areas.

(d) **Sea & Action**. To check system's serviceability before proceeding to sea.

(e) **<u>SSD & Cable Party</u>**. While entering / leaving harbour and while passing through restricted waters, the Special Sea Dutymen (SSD) and Cable party also close up in addition to the normal crew compliment.

(f) **<u>Muster Station</u>**. To muster the ship's company.

DID YOU KNOW?
➢ **Emergency drills**. Regular safety drills are mandatory to prepare the crew for potential emergencies like fire, flooding, or man overboard situations, ensuring everyone knows their roles and procedures.

<u>CONCLUSION</u>

27. The efficient operation of a naval ship is rooted in its clear organization and specialized roles. From the leadership of the Commanding Officer to the expertise within various branches and departments, every individual contributes to the mission's success. Watch systems, structured routines, and station assignments ensure that the ship remains operationally ready, even under extreme circumstances. The seamless coordination among departments exemplifies the Indian Navy's dedication to discipline and teamwork, essential for safeguarding the nation's maritime sovereignty. This structure, honed through tradition and innovation, underscores the Navy's capacity to perform diverse missions with precision and resilience, protecting India's seas and ensuring global maritime cooperation.

SUMMARY

- **Captain's Authority**. The Captain holds absolute authority onboard, responsible for every aspect of the ship, from operations to discipline—like a "floating city" mayor.
- **Executive Officer (XO)**. Known as the "second-in-command," XO ensures smooth day-to-day functioning and often acts as a bridge between the Captain and the crew.
- **Operations Branch**. The operations team, known as the "eyes and ears" of the ship, manages navigation, radar, and communication, keeping the ship aware of its surroundings at all times.
- **Engineering Branch**. Known as the "heart of the ship," engineers ensure everything from propulsion to power generation runs smoothly, often working in challenging, high-temperature conditions.
- **Logistics Branch**. This branch ensures the ship has everything it needs, from food and fuel to medical supplies, making it essential for long missions at sea.

SUGGESTED READ

Indian Navy: A Thrilling Service by Commander Ashok Kumar (Retd)

ASSESSMENT EXERCISE

Multiple Choice Questions (MCQs)

Q1. Which type of warship serves as the centrepiece of the fleet, providing air support and power projection?

(a) Destroyers
(b) Corvettes
(c) Aircraft Carriers
(d) Frigates

Q2. What is the primary role of destroyers in naval operations?

(a) Patrolling the Exclusive Economic Zone
(b) Escorting larger vessels and engaging threats
(c) Laying underwater mines
(d) Conducting amphibious assaults

Q3. Which class of warships is primarily used for anti-submarine warfare and coastal patrol duties?

(a) Frigates
(b) Corvettes
(c) Destroyers
(d) Tankers

Q4. Which of the following is an example of an Indian Navy submarine?

(a) Shivalik-class
(b) Kamorta-class
(c) Arihant-class
(d) Talwar-class

Q5. Offshore Patrol Vessels (OPVs) are primarily used for.

(a) Launching fighter jets
(b) Escorting aircraft carriers
(c) Anti-piracy operations and patrolling
(d) Conducting underwater surveillance

Q6. What is the main purpose of mine countermeasure vessels?

(a) Detecting and neutralizing naval mines
(b) Carrying troops and equipment
(c) Conducting intelligence operations
(d) Providing logistics support

Q7. Which department on a naval ship is responsible for ensuring navigation and maintaining the ship's course?

(a) Gunnery Department
(b) Logistics Department
(c) Navigation and Direction (ND)
(d) Medical Department

Q8. What is the responsibility of the Executive Officer (XO) onboard a naval ship?

(a) Commanding the ship during battle
(b) Assisting the CO in administrative and operational tasks
(c) Operating sonar systems
(d) Managing shipboard logistics

Q9. The role of the Engineering Department onboard a naval ship is to.

(a) Handle supply management
(b) Maintain propulsion and mechanical systems
(c) Operate aircraft and helicopters
(d) Oversee anti-submarine warfare operations

Q10. In the Watch System, how many groups are there in the Three Watch System?

(a) Two
(b) Three
(c) Four
(d) Five

Q11. Which watch is responsible for maintaining and operating ship machinery and power systems?

(a) Bridge Watch
(b) Engine Room Watch
(c) Operations Room Watch
(d) Gunnery Watch

Q12. What is the function of the NBCD (Nuclear, Biological, Chemical, and Damage Control) department?

(a) Handling electronic communication systems
(b) Firefighting and damage control onboard
(c) Managing missile launches
(d) Piloting naval aircraft

Q13. What is the role of Fast Attack Craft (FAC)?

(a) Engaging enemy aircraft carriers
(b) Conducting short-range attacks and patrolling coastal areas
(c) Deploying naval mines in deep waters
(d) Providing medical assistance to the crew

Q14. The term "Muster Station" refers to.

(a) A type of naval attack manoeuvre
(b) Mustering the ship's company
(c) A training exercise for navigation
(d) A damage control drill

Q15. Which warship type is used for transporting and deploying forces for land assaults?

(a) Offshore Patrol Vessels
(b) Amphibious Ships
(c) Mine Countermeasure Vessels
(d) Destroyers

<u>One-word Questions</u>

Q1. What is India's notable aircraft carrier called?

Q2. Which type of ship is mainly used for anti-submarine warfare?

Q3. What type of vessel is INS Jyoti?

Q4. Which class do Indian Navy's fast attack crafts belong to?

Q5. What is the primary role of mine countermeasure vessels?

Q6. Who is the leader of the ship responsible for its overall operations and safety?

Q7. Which department is responsible for guiding the ship's course?

Q8. What branch specializes in the ship's electrical and electronic systems?

Q9. Which department manages food, medical care, and general welfare on a ship?

Q10. What branch in the Navy handles the operation and maintenance of naval aircraft?

<u>Short Questions</u>

Q1. Name two destroyer classes used by the Indian Navy.

Q2. What is the primary role of offshore patrol vessels (OPVs)?

Q3. Describe the main purpose of tankers in the Indian Navy.

Q4. What type of warship is primarily used for long-distance power projection?

Q5. Which warships are designed for amphibious operations?

Q6. What are the main responsibilities of the Executive Officer (XO) onboard a ship?

Q7. Describe the role of the Anti-Submarine Warfare (ASW) team in the Executive Department.

Q8. Name three main sub-divisions in the Engineering Department.

Q9. What is the Logistics Department responsible for onboard a ship?

Q10. Explain the role of the Hull Department in maintaining the ship

Long Questions

Q1. Explain the roles and importance of aircraft carriers in the Indian Navy's fleet.

Q2. Describe the differences between destroyers and frigates, focusing on their roles and capabilities.

Q3. Discuss the significance of submarines in India's maritime defence strategy, including the types operated by the Indian Navy.

Q4. How do offshore patrol vessels contribute to the security of India's Exclusive Economic Zone (EEZ)?

Q5. Outline the types and roles of amphibious ships in the Indian Navy and their importance in coastal and landing operations.

Q6. Describe the functions of the Executive Department onboard a ship and its sub-divisions.

Q7. Explain how the Engineering Department contributes to the operational efficiency of a ship.

Q8. Compare the roles of the Electrical and Logistics Departments onboard a ship.

Q9. Discuss the various branches within the Indian Navy and their importance to naval operation

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NCC SPECIAL SUBJECT (NAVY)

NAVAL ORIENTATION

CHAPTER 4: INTRODUCTION TO ANTI-SUBMARINE WARFARE, SURFACE WARFARE, AND FLEET OPERATIONS (CODE- NO 4)

"A ship in port is safe, but that is not what ships are built for." – Grace Hopper

TEACHING INSTRUCTIONS

Period	:	1 (40 Min)
Type	:	Theory
Conducting Officer	:	PI
Year	:	Second
Training Aid	:	Blackboard, chalk, whiteboard, marker, projector

Time Plan

- Introduction : 05 Min
- Anti Submarine warfare : 15 Min
- Surface warfare : 15 Min
- Conclusion : 05 Min

INTRODUCTION

1. The Indian Navy stands as a guardian of India's vast maritime interests, ensuring security and stability in the surrounding seas. Central to its operational prowess are the three pillars of naval warfare: Anti-Submarine Warfare (ASW), Surface Warfare, and Fleet Operations. ASW focuses on neutralizing underwater threats, safeguarding naval assets through advanced detection and tracking technologies. Surface Warfare deals with engaging and defending against enemy vessels, utilizing a range of weaponry and strategic manoeuvres. Fleet Operations represent the seamless coordination of multiple naval assets to achieve strategic objectives, combining various warfare elements for maximum combat effectiveness. Together, these components showcase the Navy's commitment to maintaining control, ensuring maritime security, and projecting power across diverse maritime domains.

PREVIEW	**LEARNING OBJECTIVES**
➢ Part I: Fundamental Concepts of different Naval Warfare ➢ Part II: Fleet Operations	➢ To understand the key naval warfare strategies including anti-submarine and surface warfare, as well as fleet coordination

2. The Indian Navy conducts various types of naval warfare and fleet operations to secure India's maritime interests. Here is an overview of the fundamental components of anti-submarine warfare, surface warfare, and fleet operations, which are essential for maintaining control and defence in naval engagements.

PART I: FUNDAMENTAL CONCEPTS OF DIFFERENT NAVAL WARFARE

3. **Anti-Submarine Warfare (ASW)**. Anti-Submarine Warfare (ASW) involves detecting, tracking, and neutralizing enemy submarines to prevent them from threatening surface ships, submarines, or coastal assets. ASW is crucial for maintaining dominance underwater and ensuring the safety of naval vessels and installations. ASW is essential for protecting naval assets from underwater threats, ensuring secure operations and maintaining control in the underwater domain.

(a) **Detection and Tracking**. ASW relies on various detection systems, such as sonar (Sound Navigation and Ranging), which uses sound waves to locate submarines. Both active sonar (emitting sound pulses) and passive sonar (listening for sounds) are used to detect enemy submarines.

(b) **ASW Equipment**. Modern ASW employs sonobuoys (floating devices dropped from aircraft or ships to detect submarines), depth charges, torpedoes, and anti-submarine missiles.

(c) **Role of ASW Aircraft and Helicopters**. Aircraft and helicopters play a key role in ASW by deploying sonobuoys and conducting aerial surveillance, allowing them to cover large areas quickly and support ships in submarine detection.

Helo Operation with a Submarine

4. **Surface Warfare**. Surface Warfare involves engagements between naval ships and other surface vessels, focusing on neutralizing enemy ships and defending against hostile threats. This type of warfare relies on offensive and defensive tactics, involving a range of weaponry and strategies. Surface Warfare is critical for establishing control over surface waters, protecting maritime interests, allowing the Navy to secure strategic sea lanes and defend against enemy incursions.

(a) **Key Objectives**. Surface Warfare aims to engage and destroy enemy ships, protect merchant shipping, secure maritime routes, and support other naval operations.

(b) **Weapons and Equipment**. Surface combatants use an array of weaponry, including missiles (anti-ship and anti-air), guns, and electronic warfare systems. These systems enable ships to detect, track, and engage enemy targets at various distances.

(c) **Surface Combatant Ships**. Destroyers, frigates, and corvettes are the primary vessels used in surface warfare, equipped with advanced radar, missiles, and guns to counter threats effectively.

Fleet Operations

DID YOU KNOW?

- **Chhatrapati Shivaji as the "Father of the Indian Navy".** Considered the pioneer of Indian naval power, Shivaji established a strong fleet to protect trade routes and challenge European dominance along the Indian coast, earning him the title "Father of the Indian Navy."

- **Operation Trident during the Indo-Pakistan War.** This significant naval operation, carried out by the Indian Navy against Pakistan during the 1971 war, saw a successful attack on Karachi harbour, demonstrating India's maritime capabilities.

PART II: FLEET OPERATIONS

5. Fleet operations are coordinated manoeuvres involving multiple ships, aircraft, and submarines to achieve a strategic goal. These operations combine different warfare elements—such as ASW, surface warfare, and air defence—to strengthen the fleet's capabilities and ensure mission success.

(a) **Fleet Composition**. A fleet typically consists of a range of ships, including aircraft carriers, destroyers, frigates, submarines, and support vessels, organized to provide a balanced force for various combat and support roles.

(b) **Coordination and Communication**. Effective fleet operations require precise coordination among all vessels and aircraft, facilitated through communication systems, tactical data links, and real-time intelligence sharing. Fleet command and control centres oversee these operations to synchronize efforts.

Fleet Operation

(c) **Fleet Manoeuvres**. Operations may involve formations, such as strike groups centered around an aircraft carrier, designed to maximize the fleet's defensive and offensive reach. These manoeuvres can include fleet escort, blockade enforcement, amphibious assaults, and maritime patrols.

6. Fleet operations showcase the Navy's combined strength, enhancing combat effectiveness through strategic coordination and enabling the execution of complex missions across diverse maritime environments.

DID YOU KNOW?

- **India's oldest Naval Air Squadron in Asia.** The Indian Navy's air arm holds the distinction of being the oldest in Asia.
- **First Nuclear Submarine Lease.** India made history by leasing the nuclear-powered attack submarine, INS Chakra, from Russia in 1988, marking a significant advancement in its underwater warfare capabilities.
- **Strategic Importance of the Indian Ocean.** Due to its long coastline and geographical location, India considers the Indian Ocean region crucial for its maritime security and actively works to maintain stability in the area.

CONCLUSION

7. The three elements — Anti-Submarine Warfare, Surface Warfare, and Fleet Operations, together form the core capabilities required to maintain maritime security, project power, and respond effectively to various threats. They ensure that the Indian Navy can secure its waters and support broader defence and diplomatic objectives.

SUMMARY

- **Sonar Technology.** In Anti-Submarine Warfare (ASW), ships and submarines use sonar to detect and track enemy submarines by sending out sound waves and listening for their echoes.
- **Surface Warfare Tactics.** Surface Warfare (SW) involves engaging enemy ships using weapons like missiles and guns, with tactics including stealth and surprise to gain an advantage in battle.
- **Carrier Strike Groups.** Fleet Operations often revolve around powerful Carrier Strike Groups, which include aircraft carriers, destroyers, and submarines working together for offensive and defensive operations.
- **Helicopters in ASW.** Helicopters equipped with advanced sonar systems play a key role in ASW, providing aerial surveillance and depth charge capabilities to track and neutralize submarines.
- **Integrated Combat Systems.** Modern Fleet Operations involve integrating numerous platforms (ships, submarines, aircraft) and systems, allowing for real-time communication and coordination to carry out complex naval missions.

SUGGESTED READ

Naval Warfare: by Capt. S.L.Soni (Retd.)

ASSESSMENT EXERCISE

Multiple Choice Questions

Q1. What are the three core pillars of naval warfare?

(a) Coastal defence, Aerial Surveillance, Cyber Warfare
(b) Anti-Submarine Warfare, Surface Warfare, Fleet Operations
(c) Amphibious Warfare, Missile Defence, Special Operations
(d) Maritime Trade Protection, Naval Exercises, Search & Rescue

Q2. What is the primary goal of Anti-Submarine Warfare (ASW)?

(a) Protecting surface ships from aerial threats
(b) Detecting, tracking, and neutralizing enemy submarines
(c) Conducting missile strikes against enemy bases
(d) Escorting merchant vessels in high-risk areas

Q3. Which technology is essential for detecting submarines in ASW?

(a) Sonar
(b) Radar
(c) GPS
(d) Infrared Sensors

Q4. What is the difference between active sonar and passive sonar?

(a) Active sonar emits sound pulses, while passive sonar listens for sounds
(b) Active sonar is used in the air, while passive sonar is used underwater
(c) Passive sonar emits sound waves, while active sonar detects magnetic fields
(d) Active sonar is only used at night, while passive sonar operates during the day

Q5. Which of the following is NOT an ASW equipment?

(a) Sonobuoys
(b) Depth charges
(c) Torpedoes
(d) Surface-to-air missiles

Q6. How do ASW aircraft and helicopters assist naval operations?

(a) By engaging enemy ships directly
(b) By deploying sonobuoys and conducting aerial surveillance
(c) By conducting amphibious landings
(d) By refuelling naval ships at sea

Q7. What is the primary objective of Surface Warfare?

(a) Engaging and destroying enemy ships
(b) Conducting underwater reconnaissance
(c) Protecting satellites in space
(d) Conducting peacekeeping missions

Q8. Which of the following ships are typically used in Surface Warfare?

(a) Submarines and fishing boats
(b) Destroyers, frigates, and corvettes
(c) Amphibious assault ships and cruise liners
(d) Oil tankers and civilian vessels

Q9. What types of weapons are commonly used in Surface Warfare?

(a) Air-to-ground missiles and torpedoes
(b) Anti-ship missiles, anti-air missiles, and naval guns
(c) Land mines and sniper rifles
(d) Chemical and biological warfare agents

Q10. Why is Surface Warfare crucial for a navy?

(a) It enables naval forces to control surface waters and secure sea lanes
(b) It focuses only on coastal patrols
(c) It is used mainly for ceremonial naval parades
(d) It ensures that no naval engagement takes place

Q11. What is the main purpose of Fleet Operations?

(a) To conduct coordinated manoeuvres involving multiple ships, aircraft, and submarines
(b) To operate a single vessel in open waters
(c) To conduct naval diplomacy missions only
(d) To focus solely on intelligence gathering

Q12. What is a typical composition of a naval fleet?

(a) Only aircraft carriers
(b) A combination of aircraft carriers, destroyers, frigates, submarines, and support vessels
(c) Only submarines and patrol boats
(d) Primarily cargo and fuel supply ships

Q13. What is essential for effective Fleet Operations?

(a) Independent operation of all vessels
(b) Precise coordination through communication systems and real-time intelligence sharing
(c) Relying on visual signalling only
(d) Avoiding electronic warfare systems

Q14. Which of the following is NOT a fleet manoeuvre?

(a) Fleet escort
(b) Blockade enforcement
(c) Maritime patrol
(d) Land-based missile deployment

Q15. Why are Anti-Submarine Warfare, Surface Warfare, and Fleet Operations vital for the Indian Navy?

(a) They help secure India's waters and support broader defence and diplomatic goals
(b) They focus only on military parades
(c) They are used mainly for historical preservation
(d) They are solely defensive measures without any strategic impact

One-word Questions

1. What system uses sound waves to locate submarines?
2. Which warfare involves neutralizing enemy surface ships?
3. Name the floating devices used in ASW to detect submarines.
4. What vessel typically leads a fleet strike group?
5. What type of missile is used against enemy ships?

Short Questions

1. Define the main objective of anti-submarine warfare (ASW).
2. What role do aircraft and helicopters play in ASW?
3. List two types of weapons commonly used in surface warfare.
4. Which ships are primarily involved in surface combat?
5. What is the purpose of fleet manoeuvres?

Long Questions

1. Explain the detection methods and equipment used in anti-submarine warfare and their significance.

2. Describe the objectives and tactics of surface warfare, including the types of ships and weapons involved.

3. How do fleet operations enhance the Indian Navy's strategic capabilities, and what roles do various vessels play in these operations?

4. Discuss the coordination and communication systems essential for successful fleet operations.

NCC SPECIAL SUBJECT (NAVY)

NAVAL ORIENTATION

CHAPTER 5: TYPES OF NAVAL AIRCRAFT, SUBMARINES AND THEIR ROLE (CODE- NO 5)

"Without air power, the Navy is a defensive and ineffective force."
– Admiral William F. Halsey

TEACHING INSTRUCTIONS

Period	:	1 (40 Min)
Type	:	Theory
Year	:	Second
Conducting Officer	:	PI
Training Aids	:	Blackboard, chalk, whiteboard, marker, projector.

Time Plan

➢ Introduction	:	05 Min
➢ Role of Naval aviation and types of Aircraft	:	15 Min
➢ Types of Submarines and their roles	:	15 Min
➢ Conclusion	:	05 Min

INTRODUCTION

1. Naval aircraft and helicopters are vital components of the Indian Navy, enhancing its operational reach, flexibility, and mission effectiveness. These aerial assets support a diverse range of operations, from reconnaissance and anti-submarine warfare to logistics and combat support. Maritime Patrol Aircraft (MPA) and helicopters equipped with advanced sensors provide extensive surveillance capabilities, ensuring maritime security over vast areas. Anti-Submarine Warfare (ASW) operations are significantly bolstered by aircraft and helicopters capable of detecting and neutralizing underwater threats. Furthermore, Airborne Early Warning (AEW) systems extend the fleet's defensive perimeter, while Search and Rescue (SAR) missions demonstrate the Navy's commitment to humanitarian assistance. Whether transporting supplies or executing precision strikes, these aircraft play an indispensable role in enabling the Indian Navy to secure maritime interests and respond to emerging challenges.

2. Submarines represent the pinnacle of naval stealth and strategic capability, operating as silent sentinels beneath the waves. Their ability to remain undetected while carrying out critical missions makes them invaluable assets in modern maritime warfare. The Indian Navy's submarine fleet comprises both conventional diesel-electric and nuclear-powered vessels, each tailored for specific roles, including reconnaissance, anti-submarine warfare, and strategic deterrence. These submarines are equipped with cutting-edge technologies, enabling them to execute complex missions with precision and efficacy. Beyond their operational roles, submarines symbolize the Navy's commitment to safeguarding national security and projecting power across the oceans. With their versatility, endurance, and advanced weaponry, submarines ensure that India maintains a strong maritime defence capable of addressing both traditional and emerging threats. By mastering the art of stealth and versatility, the Indian Navy's submarine fleet has cemented its place as a cornerstone of India's naval strength.

PREVIEW	**LEARNING OBJECTIVES**
The lecture will be covered in following parts:- ➢ Part I: Function and Importance of Naval Aviation Assets in Operations ➢ Part II: Various Submarine Classes and their Unique Contributions to Naval Warfare	➢ To learn about the roles of various naval aircraft and helicopters in supporting naval operations. ➢ To understand the classification and strategic roles of submarines.

PART I: FUNCTION AND IMPORTANCE OF NAVAL AVIATION ASSETS IN OPERATIONS

3. Naval aircraft and helicopters play a critical role in enhancing the Indian Navy's operational reach, flexibility, and effectiveness. They are essential assets for a variety of missions, from reconnaissance and surveillance to anti-submarine warfare and logistics support.

4. **Reconnaissance and Surveillance**. Naval aircraft and helicopters provide extensive surveillance capabilities, essential for monitoring vast ocean areas and identifying potential threats. These include:-

(a) **Maritime Patrol Aircraft (MPA)**. These aircraft are equipped with advanced radar, sensors, and imaging systems, allowing them to detect and track enemy ships and submarines over large distances. They can perform prolonged reconnaissance missions, providing real-time intelligence to fleet commanders.

(b) **Helicopter Surveillance**. Helicopters, due to their ability to hover and move at lower speeds, are effective for close-range reconnaissance, especially in littoral (nearshore) regions. They help detect suspicious activities and monitor maritime zones of interest.

(c) **Remotely Piloted Aircraft (RPA)**. These aircraft are equipped with advanced radar, sensors and imaging systems, allowing them to detect enemy platforms over large distances. Being unmanned they have more endurance and can carry out prolonged reconnaissance missions and provide real time intelligence to fleet commanders.

5. **Anti-Submarine Warfare (ASW)**. Naval aircraft and helicopters play a pivotal role in Anti-Submarine Warfare, enabling detection, tracking, and neutralization of submarines.

(a) **ASW Aircraft**. Equipped with sonobuoys, magnetic anomaly detectors, and depth charges, ASW aircraft can locate submarines and attack them if necessary. These aircraft are essential for covering extensive areas quickly, locating underwater threats that could be challenging for ships to detect alone.

(b) **ASW Helicopters**. Helicopters like the Indian Navy's Sea King and MH-60R can deploy sonobuoys and torpedoes, allowing them to detect and engage submarines at shorter ranges. They are also agile and can work closely with surface ships in ASW operations.

Sea King Helicopter

6. **Airborne Early Warning (AEW)**. Airborne Early Warning aircraft extend the Navy's ability to detect and track threats from the air, enhancing the fleet's defensive capabilities. AEW

aircraft have sophisticated radar systems to monitor and identify air and surface threats far beyond the ship’s radar range. By providing early warnings of incoming threats, AEW aircraft improve the fleet's response time to potential dangers.

DID YOU KNOW?
➢ **Oldest in Asia**. India's Naval Air Arm holds the title of being the oldest in Asia, established on May 11, 1953, with the Indian Naval Air Squadron (INAS) 550 as its first squadron.
➢ **INS Vikrant Legacy**. India's first aircraft carrier, INS Vikrant, played a pivotal role in the 1971 war, particularly in the naval blockade of East Pakistan, and was crucial in the liberation of Goa from Portugal in Operation Vijay.
➢ **First Naval Air Station**. The first Indian naval air station, called INS Garuda, was commissioned in Cochin on May 11, 1953.

7. **Search and Rescue (SAR)**. Naval helicopters are crucial for Search and Rescue (SAR) missions, particularly in emergencies at sea.

(a) **Rescue Operations**. Equipped with hoists and rescue gear, naval helicopters can quickly reach and assist stranded or distressed personnel in difficult-to-access areas.

(b) **Disaster Relief and Humanitarian Assistance**. Helicopters are also used to deliver emergency supplies, evacuate civilians, and provide medical assistance during natural disasters or crises in coastal regions.

8. **Logistics and Transport**. Naval aircraft and helicopters support logistics by transporting personnel, equipment, and supplies to ships and remote locations.

(a) **Replenishment and Transport**. Helicopters can move essential supplies, ammunition, and fuel to ships without them needing to return to port, extending their operational endurance.

(b) **Personnel Transfer**. Helicopters facilitate the movement of personnel between ships or to shore, enabling efficient crew rotations and operational continuity.

DID YOU KNOW?
➢ **Aircraft Types**. Early Indian naval aviation included aircraft like the Sealand, Fairey Firefly, and Hawker Sea Hawk, with later additions like the Breguet Alizé and the BAE Sea Harrier.
➢ **Naval Aviation Museum**. The history of the Indian Naval Air Arm is showcased at the Naval Aviation Museum located in Goa.

Personnel Transfer at Sea by Helo

9. **Combat Support and Strike Missions**. Some naval aircraft are equipped for direct combat support, including strikes against enemy positions or support for ground operations.

(a) **Strike Capabilities**. Fighter jets operating from aircraft carriers can engage in air-to-surface and air-to-air combat, providing naval forces with offensive options against land or sea-based targets.

(b) **Close Air Support**. These aircraft can also offer support during amphibious or ground operations, enhancing the Navy's ability to project power ashore.

PART II: VARIOUS SUBMARINE CLASSES AND THEIR UNIQUE CONTRIBUTIONS TO NAVAL WARFARE

10. Submarines are a critical part of the Indian Navy's fleet, designed to operate underwater, often undetected, to perform a range of strategic and tactical missions. The Navy's submarine fleet includes different classes of submarines, each suited for specific roles and capabilities in naval warfare.

11. **Types of Submarines**. The Indian Navy operates two main types of submarines namely conventional (diesel-electric) submarines and nuclear-powered submarines:-

(a) **Conventional Submarines (Diesel-Electric)**. These submarines use diesel engines on the surface and battery power when submerged. They are often quieter than nuclear submarines, making them well-suited for stealth operations in coastal waters. The Scorpene-class (Kalvari-class) and Sindhughosh-class submarines are diesel-electric submarines used by the Indian Navy.

Submarine Surfacing at Sea

(b) **Nuclear-Powered Submarines**. These submarines use nuclear reactors for propulsion, allowing them to remain submerged for extended periods without surfacing. They have greater endurance and can travel longer distances at higher speeds than conventional submarines.

(c) **Types of Nuclear Submarines**:-

(i) **Ballistic Missile Submarines (SSBNs):** Equipped with nuclear missiles, SSBNs are designed for deterrence, capable of delivering strategic nuclear strikes from hidden locations.

(ii) **Attack Submarines (SSNs)**. These are armed with torpedoes and missiles and are used to engage enemy vessels, conduct surveillance, and support fleet operations. The Arihant-class (SSBN) is India's nuclear-powered ballistic missile submarine class, providing a credible second-strike capability.

Arihant Class Submarine

12. **Role of Submarines in Naval Operations.** Submarines serve multiple roles, from strategic deterrence to intelligence gathering and direct engagement in naval conflicts as given below:-

(a) **Stealth and Surveillance**. Submarines can operate undetected beneath the surface, making them ideal for covert surveillance missions. They gather intelligence, monitor enemy movements, and assess naval activity in areas of strategic importance.

(b) **Anti-Ship and Anti-Submarine Warfare**. Attack submarines (SSNs) are armed with torpedoes and missiles, allowing them to target enemy surface ships and submarines. This capability is crucial for disrupting enemy fleets, securing sea lanes, and protecting high-value naval assets.

(c) **Strategic Nuclear Deterrence**. Nuclear-powered ballistic missile submarines (SSBNs) are equipped with nuclear missiles, providing a second-strike capability in the event of a nuclear conflict. These submarines act as a deterrent, ensuring that any adversary knows that a counterattack is possible even after a surprise strike.

(d) **Special Operations**. Submarines are used to support special forces operations by transporting commandos close to hostile shores covertly. They can deploy Special Forces for reconnaissance, sabotage, and other clandestine missions without detection.

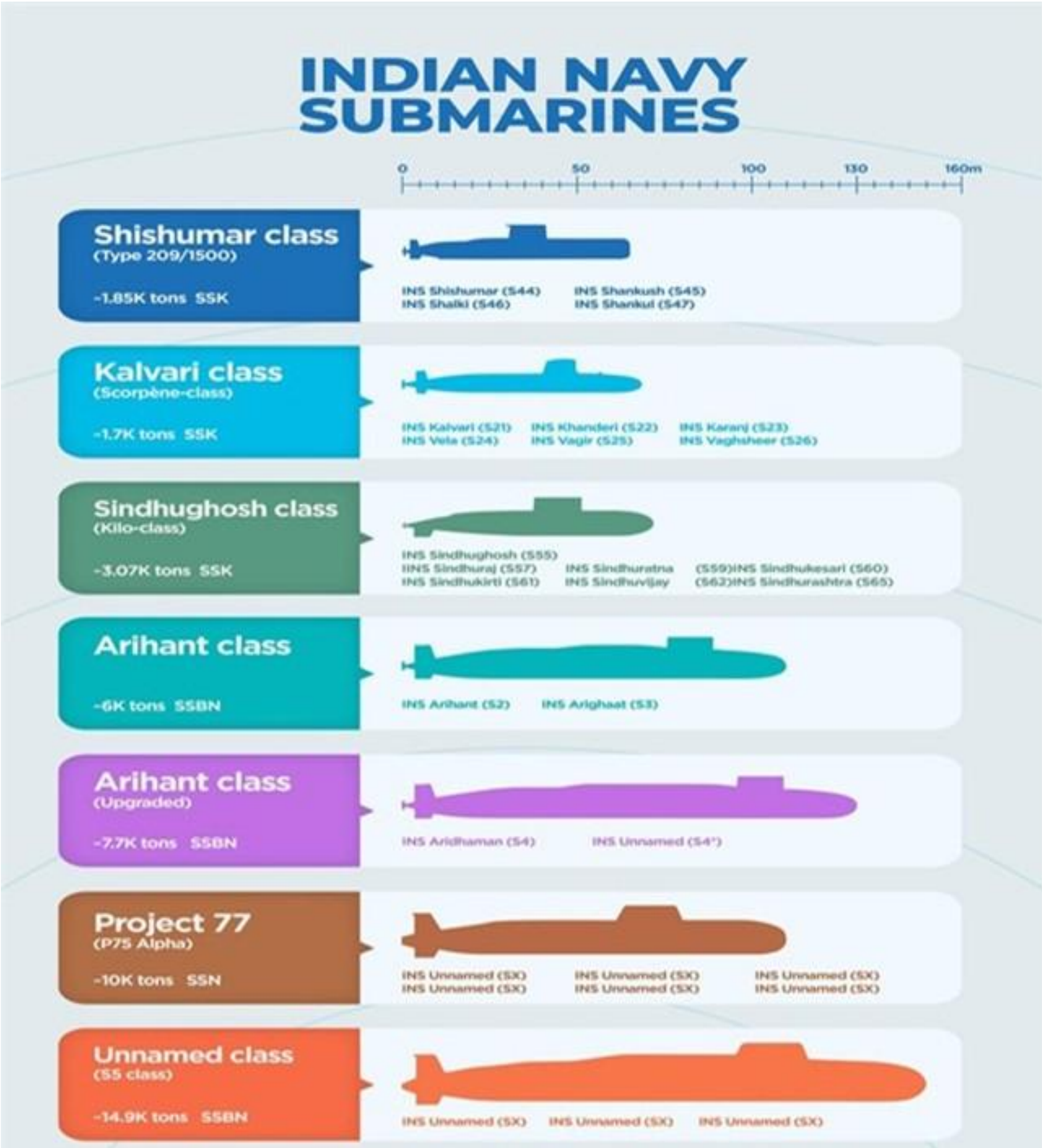
(e) **Mine Warfare**. Some submarines are capable of laying naval mines in enemy waters, creating obstacles and threats that can damage or destroy enemy vessels.

13. **Advantages of Submarines in Naval Warfare**

(a) **Surprise and Stealth**. Submarines can approach targets quietly and launch surprise attacks, giving them a strategic advantage in engagements.

(b) **<u>Extended Endurance (Nuclear Submarines)</u>**. Nuclear submarines have the unique ability to remain submerged indefinitely, allowing them to patrol vast areas and maintain a hidden, continuous presence.

(c) **<u>Versatility</u>**. Submarines perform multiple roles across defence, offense, intelligence, and deterrence, making them valuable assets in any naval force.



DID YOU KNOW?

➢ **Deep Diving Capabilities**. Submarines can reach depths of thousands of meters below the ocean surface, allowing them to explore the deepest parts of the sea.

➢ **Extended Underwater Endurance**. Modern submarines can stay submerged for several months at a time due to their advanced nuclear power systems and life support capabilities.

➢ **"Submarine Sandwich" Origin**. The popular "sub" sandwich derives its name from its long, cylindrical shape, which closely resembles that of a submarine.

Aircraft onboard Aircraft Carrier

CONCLUSION

14. The versatility and indispensability of naval aircraft and helicopters underscore their critical role in the Indian Navy's operations. From safeguarding maritime boundaries through reconnaissance and ASW to providing logistical support and combat readiness, these assets enhance the Navy's ability to adapt to a wide range of missions. Their advanced technologies and capabilities ensure the fleet remains agile, effective, and prepared to address defence and humanitarian needs alike. By integrating aerial assets into naval operations, the Indian Navy fortifies its position as a formidable maritime force, capable of securing India's maritime interests and contributing to global security.

15. Submarines are indispensable to the Indian Navy's efforts to maintain maritime security, project strategic deterrence, and protect national interests. Their stealth, versatility, and advanced capabilities enable them to dominate beneath the waves, delivering significant tactical and strategic advantages. From intelligence gathering and anti-ship operations to nuclear deterrence and supporting special forces, submarines operate as multi-role assets in diverse operational scenarios. As the Indian Navy continues to evolve, its submarine fleet stands as a testament to its resolve to remain a formidable maritime force. With ongoing advancements in technology and expanding operational roles, submarines will play an even more pivotal role in the future of naval warfare. By harnessing their potential, the Navy ensures that India's waters remain secure, its interests defended, and its status as a leading maritime power upheld.

SUMMARY

- **Surveillance and Recon**. Naval helicopters are often equipped with radar and cameras to perform reconnaissance and surveillance, providing real-time intelligence for naval operations.
- **Anti-Submarine Warfare**. Helicopters like the Sea King are key players in anti-submarine warfare, using sonar to detect submarines and drop depth charges to neutralize threats.
- **Search and Rescue**. Naval helicopters are the go-to vehicles for search and rescue missions at sea, rescuing stranded sailors or passengers in distress, even in harsh weather conditions.
- **Combat Support**. Naval aircraft provide vital combat support, including air strikes, close air support for ground forces, and air superiority, enhancing the capabilities of a naval fleet in battle.
- **Ballistic Missile Submarines (SSBNs)**. These stealthy submarines are armed with nuclear missiles and are a key part of a nation's strategic defense, able to launch missiles from beneath the ocean.
- **Attack Submarines (SSNs)**.Faster and more maneuverable, attack submarines are primarily used for hunting enemy submarines and surface ships, as well as gathering intelligence.
- **Diesel-Electric Submarines**. These are powered by diesel engines on the surface and electric batteries underwater, offering a balance of cost and stealth, often used in smaller navies.
- **Nuclear-Powered Submarines**. These submarines run on nuclear power, allowing them to stay submerged for long periods, often for months, without needing to surface for fuel.
- **Special Purpose Submarines**. Used for covert operations, these submarines may carry elite troops or specialized equipment for underwater missions, such as reconnaissance or sabotage.

SUGGESTED READ

Naval Warfare: by Capt. SL Soni (Retd)

ASSESSMENT EXERCISE

Multiple Choice Questions

Q1. What is the primary role of naval aviation assets in the Indian Navy?

(a) Land warfare operations
(b) Enhancing operational reach, flexibility, and effectiveness
(c) Diplomatic negotiations
(d) Only transport of personnel

Q2. Which of the following is a function of Maritime Patrol Aircraft (MPA)?

(a) Deploying torpedoes in anti-submarine warfare
(b) Conducting prolonged reconnaissance missions
(c) Engaging in amphibious assaults
(d) Laying naval mines

Q3. How do helicopters contribute to reconnaissance and surveillance?

(a) By carrying nuclear warheads
(b) Through their ability to hover and operate at lower speeds
(c) By remaining submerged for long periods
(d) By engaging in air-to-air combat

Q4. What is a key advantage of Remotely Piloted Aircraft (RPA) in naval operations?

(a) They can be used for deep-sea mining
(b) They have longer endurance for prolonged reconnaissance missions
(c) They replace submarines in anti-ship warfare
(d) They conduct amphibious landings

Q5. Which equipment is used by ASW aircraft to detect submarines?

(a) Radar-guided bombs
(b) Sonobuoys and magnetic anomaly detectors
(c) Surface-to-air missiles
(d) Ballistic missiles

Q6. How do ASW helicopters aid in anti-submarine warfare?

(a) By deploying sonobuoys and torpedoes
(b) By providing mid-air refuelling to fighter jets
(c) By conducting deep-sea resource exploration
(d) By engaging in nuclear deterrence

Q7. What is the primary function of Airborne Early Warning (AEW) aircraft?

(a) Laying naval mines
(b) Providing early detection of threats
(c) Refuelling submarines at sea
(d) Engaging in electronic warfare

Q8. Which naval asset is most commonly used in search and rescue (SAR) missions?

(a) Aircraft carriers
(b) Fighter jets
(c) Naval helicopters
(d) Nuclear submarines

Q9. What role do helicopters play in disaster relief operations?

(a) Conducting amphibious assaults
(b) Delivering emergency supplies and evacuating civilians
(c) Engaging in missile strikes
(d) Performing mid-air dogfights

Q10. How do naval aircraft and helicopters support logistics operations?

(a) By transporting personnel, equipment, and supplies
(b) By conducting offensive strikes against enemy bases
(c) By providing air support to ground troops
(d) By laying defensive minefields

Q11. What is a key capability of fighter jets operating from aircraft carriers?

(a) Conducting air-to-surface and air-to-air strikes
(b) Engaging in submarine warfare
(c) Conducting deep-sea explorations
(d) Deploying underwater mines

Q12. What is the primary advantage of nuclear-powered submarines over conventional submarines?

(a) They are quieter than diesel-electric submarines
(b) They can remain submerged for extended periods without surfacing
(c) They are only used for intelligence gathering
(d) They require frequent refuelling

Q13. Which class of submarines in the Indian Navy is designed for nuclear deterrence?

(a) Scorpene-class submarines
(b) Sindhughosh-class submarines
(c) Ballistic Missile Submarines (SSBNs)
(d) Attack Submarines (SSNs)

Q14. How do submarines contribute to anti-ship and anti-submarine warfare?

(a) By using torpedoes and missiles to target enemy vessels
(b) By engaging in aerial combat
(c) By providing airborne early warning
(d) By refuelling aircraft carriers at sea

Q15. What is a strategic advantage of submarines in naval warfare?

(a) Their ability to conduct stealth operations
(b) Their ability to perform long-range missile strikes on land
(c) Their use as primary aircraft carriers
(d) Their reliance on surface refuelling stations

One-word Questions

Q1. What aircraft type is used for long-range surveillance?

Q2. Which helicopter is used in ASW operations?

Q3. What type of missions does AEW enhance?

Q4. Name a mission type naval helicopters are essential for.

Q5. What is the term for supplying fuel and equipment to ships at sea?

Q6. What is the full form of RPA?

Q7. What type of propulsion do diesel-electric submarines use underwater?

Q8. What is the primary function of ballistic missile submarines (SSBNs)?

Q9. Name a class of conventional submarine used by the Indian Navy.

Q10. Which type of submarine is suited for stealth operations in coastal waters?

Q11. What capability do nuclear-powered submarines provide in terms of endurance?

Short Questions

Q1. What is the main function of Maritime Patrol Aircraft (MPA)?

Q2. Describe one role of helicopters in anti-submarine warfare (ASW).

Q3. What role do AEW aircraft play in fleet operations?

Q4. Why are naval helicopters critical in search and rescue (SAR) missions?

Q5. How do helicopters contribute to logistics and transport in the Navy?

Q6. Advantages of UAV over conventional MPA?

Q7. What makes conventional submarines suitable for stealth missions?

Q8. Describe the primary role of SSBN submarines in a strategic conflict.

Q9. How do attack submarines (SSNs) contribute to anti-ship warfare?

Q10. In what ways do submarines support special operations?

Q11. Explain one advantage nuclear-powered submarines have over conventional submarines

Long Questions

Q1. Explain how reconnaissance and surveillance aircraft enhance the Indian Navy's capabilities in monitoring ocean regions and identifying threats.

Q2. Describe the role of ASW aircraft and helicopters in detecting and neutralizing submarine threats.

Q3. Discuss the function of Airborne Early Warning (AEW) aircraft and how they improve the Navy's defensive response time.

Q4. Outline the importance of naval helicopters in search and rescue (SAR) operations, including their role in disaster relief and humanitarian aid.

Q5. How do naval aircraft and helicopters support logistics and transport, and why is this essential for extended naval missions?

Q6. Compare the roles and capabilities of diesel-electric and nuclear-powered submarines in the Indian Navy.

Q7. Discuss how submarines enhance stealth and surveillance capabilities for the Indian Navy's strategic missions.

Q8. Explain the concept of nuclear deterrence in the context of SSBN submarines and their importance in maintaining national security.

Q9. Describe the various combat and intelligence-gathering roles submarines play in naval warfare.

Q10. How do submarines' unique stealth and endurance capabilities make them versatile assets in both defensive and offensive naval strategies?

NCC SPECIAL SUBJECT (NAVY)

NAVAL ORIENTATION

CHAPTER 6: CUSTOMS AND TRADITIONS IN INDIAN NAVY (CODE- NO 6)

"Customs and traditions in the Navy are not merely rituals, but the living threads that weave together our shared history, forging a strong sense of identity and esprit de corps, reminding us of the legacy we carry on the seas."

TEACHING INSTRUCTIONS

Period : **1 (One)**
Type : **Theory**
Year : **Second**
Conducting Officer : **PI**

Training Aids : **Blackboard, chalk, whiteboard, marker, projector.**

Time Plan

- **Introduction** : **05 Min**
- **Naval Customs and Traditions** : **30 Min**
- **Conclusion** : **05 Min**

INTRODUCTION

1. The traditions and customs of Indian Navy are expressions of respect, courtesy, rejoicing and have developed as part of a sea faring profession with international echo. The cadets will be made aware of the unique traditions being followed in navies the world over like pipping the side, colours/sunset ceremony, crossing the line ceremony etc.

PREVIEW	LEARNING OBJECTIVES
➢ Part I: Customs and Traditions that Define the Culture of the Indian Navy.	➢ Understand the significance of customs and traditions in the Indian Navy. ➢ Learn about specific ceremonies, salutes, and practices that reflect naval values and heritage. ➢ Appreciate the role of customs in promoting discipline, morale, and unity among naval personnel.

PART I: CUSTOMS AND TRADITIONS THAT DEFINE THE CULTURE OF THE INDIAN NAVY

2. The traditions and customs of Indian Navy are expressions of respect, courtesy, rejoicing and have developed as part of a sea faring profession with international echo. Rooted in history, these customs foster a strong sense of unity and pride among naval personnel. Understanding these traditions is essential for preserving the values of discipline, respect, and loyalty that underpin naval service. Some of these are enumerated in the succeeding paragraphs.

3. **Commissioning Pennant**. This pennant is hoisted on the main mast on the day of Commissioning of the ship and is not struck down till the ship is decommissioned.

4. **Colours**. This is a general term describing the 'National Flag' and the "Naval Ensign" flown on ship between colours (0800 hrs) to sunset in harbour only.

Colours Ceremony

5. **Illuminating Ship**. Ships are illuminated by flood lights or illuminating circuits on special occasions/ ceremony of festivity as and when ordered by Naval Headquarters/ Administrative Authorities.

6. **Crossing the line Ceremony**. Whenever Indian Naval Ships cross the Equator, this ceremony is observed. The ship goes out of routine and all officers and sailors join the Ceremony.

DID YOU KNOW?
➢ **The Tradition of the Naval Ensign:** The Indian Navy's ensign has undergone several changes post-independence. The current white ensign features the Indian national flag in the top left corner and a navy-blue octagonal emblem inspired by the Maratha Navy, paying tribute to Chhatrapati Shivaji Maharaj, considered the "Father of the Indian Navy

Illumination of Ship during Navy Day

7. **Piping the Side**. Except for foreign Naval Officers, for whom the side is piped at all times, the side is piped only between colours and sunset to the following persons:-

(a) The President and Heads of States.

(b) All the Flag Officers in Uniform

(c) All Commanding officers of commissioned Ships and Establishments.

(d) The president or a member of a court martial proceeding to or returning from the court.

(e) The officer of the guard when flying a pendant.

(f) A body when being brought onboard or sent out of a ship.

Boatswain Pipe

8. **Salutes between Warships**. When a warship passes another in harbour/ sea they exchange salutes. It may include parading of guard and band or by sounding the alert on the bugle or piping the still. At sea, salutes are exchanged by pipe only.

9. **Sunset**. This is a ceremony where the national Flag and the Naval Ensign are lowered during Sunset.

10. **Dressing Ship**. The Ship is dressed overall on special occasions like Independence Day, Republic Day, National Maritime Day and Navy Day.

Dressing Ship

11. **OOG**. When a ship visits a foreign port, an officer of the Executive branch is detailed as Officer of the Guard (OOG).

12. **Man and Cheer Ship**. The Ship's Company mans the ship by standing on the catwalks from Foxle to Quarter deck facing outwards.

13. **Ringing in the New Year**. During the mid-night at 0001 hrs on 01 Jan every year, the ship's bell at gangway is rung eight times to mark the New Year.

14. **Launching Ceremony**. This ceremony is conducted whenever the keel of a ship or submarine is launched for construction at shipyards.

Launching Ceremony of Ship and Submarine

15. **Entering/ Leaving a Boat**. All officers when getting into or leaving a boat are saluted by the coxswain. Officers enter a boat as per seniority; the senior-most enters last and leaves first.

16. **Gun Salutes**. Gun salutes are fired in harbour for eminent personnel such as President, Flag Officers etc. The following are the personnel who are entitled to gun salutes.

(a) President : 21 Gun Salutes

(b)	Admiral	: 17 Gun Salutes
(c)	Vice Admiral	: 15 Gun Salutes
(d)	Rear Admiral	: 13 Gun Salutes
(e)	Commodore	: 11 Gun Salutes
(f)	Captain	: 07 Gun Salutes

17. **Change of Command**. A formal ceremony that symbolizes the transfer of responsibility and authority from one Commanding Officer to another. It emphasizes continuity and respect for leadership.

18. **Naval Uniforms**. Uniforms reflect the pride, discipline, and unity of the Navy. Different uniforms are worn for specific occasions, duties, and ceremonies, each symbolizing a different aspect of naval life.

Guard of Honour

19. **Insignias and Badges**. Rank insignias, medals, and badges worn on the uniform are symbols of authority, achievements, and service within the Navy.

Specialisation Badges in Indian Navy

20. **Ship Crest and Motto**. Each ship in the Indian Navy has its own crest and motto, symbolizing its unique identity and the spirit of the crew. These are respected and displayed prominently as part of the ship's heritage.

21. **Adherence to Naval Etiquette**. Naval etiquette, such as standing at attention when addressing superiors and observing discipline in speech and behaviour is a vital part of naval traditions.

22. **Respect for Heritage**. The Indian Navy's customs honour both Indian traditions and the naval heritage shared with other navies worldwide. This respect for tradition builds continuity and pride among personnel.

DID YOU KNOW?
➢ **Celebrating Navy Day on December 4th:** India celebrates Navy Day on December 4th every year to commemorate Operation Trident, a successful naval attack on Karachi Harbor during the 1971 Indo-Pak war. It showcases the might and bravery of the Indian Navy

CONCLUSION

23. The customs and traditions of the Indian Navy are deeply rooted in its history and heritage, embodying values such as respect, honour, and unity. From saluting protocols and naval ceremonies to uniforms and insignias, these practices promote discipline, morale, and a strong sense of identity among naval personnel. Each tradition, whether it's the daily sunset ceremony or the passing honours at sea, reinforces the principles of service and camaraderie within the Navy. Respect for heritage and values such as courage and commitment are integral to life in the Navy, shaping both individual conduct and the collective spirit of naval service.

SUMMARY

- **Commissioning Pennant and Naval Colours**. The commissioning pennant is hoisted when a ship is commissioned and remains until decommissioning, while the national flag and naval ensign are flown from 0800 hrs to sunset in harbor.
- **Illuminating and Dressing Ships**. Ships are illuminated during festive occasions and dressed overall on special events like Independence Day, Republic Day, and Navy Day.
- **Crossing the Line Ceremony**. This traditional ceremony is observed when naval ships cross the equator, with all personnel participating.
- **Piping the Side and Salutes**. The "side" is piped for dignitaries like heads of states, flag officers, and commanding officers, while warships exchange salutes when passing in harbor or at sea.
- **Gun Salutes**. Gun salutes are reserved for VIPs, with specific numbers of gun rounds for ranks such as the President (21), Admiral (17), and Vice Admiral (15).
- **Man and Cheer Ship**. On dignitaries' arrival, the crew stands along the ship's catwalks, showcasing respect and naval discipline.
- **Naval Etiquette and Uniforms**. Respectful naval customs like saluting, adherence to etiquette, and wearing specific uniforms reflect discipline, pride, and unity.
- **Symbols of Heritage**. Ship crests, mottos, and insignias symbolize the identity, achievements, and spirit of naval ships and their personnel.
- **Tradition and Respect**. Naval customs honour both Indian heritage and shared international naval traditions, fostering pride, continuity, and professionalism in the Indian Navy.

SUGGESTED READ

Indian Navy: Time Tide and Traditions

ASSESSMENT EXERCISE

Multiple Choice questions

Q1. What time is the 'Colours' ceremony conducted in the Indian Navy?

(a) 0600 hrs
(b) 0700 hrs
(c) 0800 hrs
(d) 0900 hrs

Q2. What is the significance of the 'Crossing the Line' ceremony?

(a) It marks the completion of a ship's first voyage
(b) It is conducted when a ship crosses the Equator
(c) It is a ceremony held for a retiring officer
(d) It signifies the transfer of command

Q3. In which of the following situations is 'Piping the Side' performed?

(a) When a ship departs for war
(b) During a change of command
(c) When a Flag Officer boards a ship
(d) During the decommissioning of a ship

Q4. How do warships exchange salutes at sea?

(a) By hoisting flags
(b) By firing gun salutes
(c) By piping the still
(d) By turning on all lights

Q5. What happens during the Sunset Ceremony in the Indian Navy?

(a) The ship's bell is rung eight times
(b) The National Flag and Naval Ensign are lowered
(c) The crew gathers for a roll call
(d) The ship illuminates itself with lights

Q6. When is a ship dressed overall?

(a) During battle exercises
(b) On special occasions like Independence Day and Navy Day
(c) While crossing the Equator
(d) During a war deployment

Q7. What does the Officer of the Guard (OOG) do when a ship visits a foreign port?

(a) Manages naval salutes
(b) Serves as the commanding officer of the fleet
(c) Ensures security and ceremonial protocol
(d) Leads navigation of the ship

Q8. How is the New Year marked aboard naval ships?

(a) A special dinner is hosted for the crew
(b) The ship's bell is rung eight times at 0001 hrs
(c) The ship illuminates itself for an hour
(d) The national flag is hoisted at midnight

Q9. What is the primary purpose of a ship's crest and motto?

(a) To distinguish different naval fleets
(b) To symbolize the ship's identity and heritage
(c) To mark the ship's combat achievements
(d) To honor the commanding officer

Q10. Who receives a 21-gun salute in the Indian Navy?

(a) Admiral
(b) Vice Admiral
(c) Rear Admiral
(d) President of India

Q11. In what order do officers enter a boat?

(a) Senior-most enters first and leaves last
(b) Senior-most enters last and leaves first
(c) Officers enter randomly
(d) The captain always enters first

<u>One-word Questions</u>

1. What ceremony marks the transfer of responsibility from one commanding officer to another?

2. What is the ceremony called when a ship crosses the Equator?

3. What is the term used for the left side of a ship?

4. On which day is Navy Day celebrated?

5. How many gun salutes are given to the President?

Short Answer Questions

1. What is the significance of gun salutes in naval traditions?

2. Explain the purpose of the Sunset and Colours Ceremony.

3. What role do rank insignias and badges play in naval uniforms?

4. Who all are authorized for side pipe?

Long Answer Questions

1. Explain the different types of naval ceremonies and their significance in fostering tradition, respect, and camaraderie among naval personnel.

2. Discuss the Navy's core values of Honour, Courage, and Commitment. How do these values shape behaviour and decision-making in the Navy?

3. What is the importance of naval etiquette and how does it contribute to discipline within the Navy?

4. Describe the role of naval uniforms, insignias, and ship crests in building a sense of identity, pride, and unity within the Navy.

5. Discuss the commemoration of Navy Day and its historical significance in honouring the contributions of the Indian Navy, particularly Operation Trident.

NCC SPECIAL SUBJECT (NAVY)

NAVAL ORIENTATION

CHAPTER 7 – HONOURS, AWARDS AND RANK STRUCTURE IN ARMED FORCES (CODE- NO 7)

"There is no honour greater than the honour of serving in the Indian Armed Forces."

TEACHING INSTRUCTIONS

Period	:	**1 (One)**
Type	:	**Theory**
Conducting Officer	:	**ANO**
Year	:	**First**

Training Aids : **Blackboard, whiteboard, projector**

Time Plan

- **Introduction** : **05 Min**
- **Honours and Awards:** **15 Min**
- **Rank Structure** : **15 Min**
- **Conclusion** : **05 Min**

INTRODUCTION

1. Honours and awards in the armed forces are a significant means of recognizing and celebrating the bravery, dedication and exceptional service of military personnel. These accolades not only serve as a testament to the courage and commitment of the recipients but also inspire others to strive for excellence and selfless service.

2. The armed forces have a structured system of honours and awards to ensure that acts of gallantry, distinguished service and exceptional contributions are appropriately recognized. These awards are categorized based on the nature of the act and the context in which it was performed, ensuring that each act of bravery or service is celebrated in a manner befitting its significance.

3. In this chapter, we will explore the various categories of gallantry awards, distinguished service awards, and commendation cards, along with specific awards relevant to the National Cadet Corps (NCC).

PREVIEW	LEARNING OBJECTIVES
The lecture will be covered in following parts: ➢ Part I: Gallantry Awards ➢ Part II: NCC Specific Awards ➢ Part III: Rank Structure	➢ All three types of gallantry awards, commendation cards and NCC specific awards ➢ Interesting facts about most important gallantry awards and awardees ➢ Learn about Rank structure in armed forces

Havildar Sanjay Kumar receiving Param Vir Chakra from the Honourable President of India KR Narayanan

PART I: GALLANTRY AWARDS IN ARMED FORCES

4. Gallantry awards are presented to individuals who display exceptional bravery and courage, often in life-threatening situations. These awards are categorized based on the context in which the act of gallantry was performed. Here are the main categories.

Category 1: Gallantry in the Face of the Enemy (War Time)

5. This category includes awards given for acts of bravery during armed conflict. The most prestigious awards in this category are:-

(a) **Param Vir Chakra**. India's highest military decoration awarded for the highest degree of valour or self-sacrifice in the face of the enemy.

(b) **Maha Vir Chakra**. The second-highest military decoration in India, awarded for acts of conspicuous gallantry in the face of the enemy.

(c) **Vir Chakra**. The third-highest military decoration in India, awarded for acts of gallantry in the face of the enemy.

Category 2: Gallantry Other Than in the Face of the Enemy (Peace Time)

6. This category includes awards for acts of bravery that occur outside of combat situations. These awards recognize the courage displayed in situations such as natural disasters, rescue operations, counter insurgency operations, low intensity conflict and other life-threatening scenarios. Key awards in this category include:-

(a) **Ashoka Chakra**. India's highest peacetime military decoration awarded for valour, courageous action or self-sacrifice away from the battlefield.

(b) **Kirti Chakra**. The second-highest peacetime military decoration in India, awarded for valour, courageous action or self-sacrifice away from the battlefield.

(c) **Shaurya Chakra**. The third-highest peacetime military decoration in India, awarded for valour, courageous action or self-sacrifice away from the battlefield.

DID YOU KNOW?

➢ Param Vir Chakra (PVC) is the highest award of bravery given to Armed Forces personnel for gallant life-threatening actions or gallant actions in which supreme sacrifice is made by a soldier in the face of enemy. The PVC is equivalent to Victoria Cross in the United Kingdom and the Medal of Honour in the United States. Maj Somnath Sharma was awarded the first PVC. As of date 21 PVCs have been awarded. Below is the list of all awardees and their gallant action in brief

PARAM VIR CHAKRA (PVC) : AWARDEES

Ser No.	Name	Regiment	Date of Action	Course of Action
1.	Major Somnath Sharma	4 KUMAON	3 Nov 1947	Defended Badgam aerodrome against Pakistani raiders despite being injured.
2.	Naik Jadunath Singh	1 RAJPUT	6 Feb 1948	Commanded a forward post and repelled enemy attacks despite heavy losses.
3.	2nd Lt Rama Raghoba Rane	Bombay Engineers	8-11 Apr 1948	Cleared mines and roadblocks under heavy fire, enabling tank advance.
4.	Company Havildar Major Piru Singh	6 RAJPUTANA RIFLES	18 Jul 1948	Single-handedly occupied enemy post and destroyed bunkers despite being hit.
5.	Lance Naik Karam Singh	1 SIKH	13 Oct 1948	Repelled multiple enemy attacks despite being wounded.
6.	Captain Gurbachan Singh Salaria	3/1 GORKHA RIFLES	5 Dec 1961	Charged a roadblock in Congo, killing 40 enemies and knocking out two cars.
7.	Major Dhan Singh Thapa*	1/8 GORKHA RIFLES	21 Oct 1962	Defended his post in Ladakh against Chinese attacks until reinforcements arrived.
8.	Subedar Joginder Singh	1 SIKH	23 Oct 1962	Held off Chinese attacks at Bum La Pass despite being wounded.
9.	Major Shaitan Singh	13 KUMAON	18 Nov 1962	Defended Rezang La against Chinese forces, inspiring his men to fight on.
10.	Company Quartermaster Havildar Abdul Hamid	4 GRENADIERS	10 Sep 1965	Destroyed enemy tanks with a recoilless gun during the Battle of Asal Uttar.
11.	Lt. Col Ardeshir Tarapore	17 HORSE	11 Sep 1965	For leading the regiment while injured, during Battle of Chawinda.
12.	Lance Naik Albert Ekka	14 GUARDS	3 Dec 1971	Neutralized enemy bunkers and machine gun positions in Gangasagar, Bangladesh.
13.	Major Hoshiar Singh	3 GRENADIERS	5 Dec 1971	Led his company to capture enemy positions in Shakargarh sector.
14.	Flying Officer Nirmal Jit Singh Sekhon **	18 Squadron, IAF	14 Dec 1971	Defended Srinagar airbase against Pakistani air attacks, shooting down enemy aircraft.
15.	2nd Lt Arun Khetarpal	17 HORSE	16 Dec 1971	Destroyed enemy tanks in the Battle of Basantar despite being mortally wounded.
16.	Nb Sub Bana Singh*	8 JAKLI	23 May 1987	For leading the team that wrested control of the highest peak on the Siachen Glacier as part of Operation Rajiv.
17.	Major Ramaswamy Parameswaran	8 MAHAR	25 Nov 1987	Led a successful counter-ambush in Sri Lanka, neutralizing enemy positions.
18.	Lt Manoj Kumar Pandey	1/11 GORKHA RIFLES	3 Jul 1999	For his audacious courage and leadership during the Kargil War.
19.	Rifleman Sanjay Kumar*	13 JAK RIFLES	4 Jul 1999	Charged enemy positions in Kargil, capturing bunkers and neutralizing enemies.
20.	Grenadier Yogendra Singh Yadav*	18 GRENADIERS	4 Jul 1999	Scaled a cliff face under heavy fire to capture Tiger Hill in Kargil.
21.	Captain Vikram Batra	13 JAK RIFLES	7 Jul 1999	Captured Point 4875 in Kargil, inspiring his men with his bravery.

**** The only Indian Air Force officer to have been honoured with the award**

*** Living recipients of the award**

DID YOU KNOW?

- 21 Islands of the Andaman and Nicobar were named after the **Param Vir Chakra Awardees** on the occasion of Parakram Diwas, **Birthday of Netaji Subhash Chandra Bose,** on 23 Jan 2023.

Gallantry Awards War time and Peace time - All Chakras with the Ribbons

Category 3: Distinguished Service Awards

7. These awards are given for distinguished service and exceptional performance in duties. They recognize the dedication and commitment of individuals in their professional roles. Some notable awards in this category are:-

(a) **Param Vishisht Seva Medal**. Awarded for distinguished service of the most exceptional order.

(b) **Ati Vishisht Seva Medal**. Awarded for distinguished service of an exceptional order.

(c) **Vishisht Seva Medal**. Awarded for distinguished service of a high order.

8. **Commendation Cards**. Commendation Cards are awarded to individuals for their meritorious service, acts of bravery or exceptional performance in their duties. These cards serve as a formal recognition of the recipient's contributions and achievements. Here are the types of commendation cards and the authorities who award them.

9. **Types of Commendation Cards**.

(a) Army Commendation Card

(b) Navy Commendation Card

(c) Air Force Commendation Card

10. **Who Awards Them**?

(a) **Chief of Army Staff (COAS) Commendation Card**. Awarded by the Chief of Army Staff for acts of bravery or distinguished service.

(b) **Chief of Naval Staff (CNS) Commendation Card**. Awarded by the Chief of Naval Staff for exceptional service or acts of bravery.

(c) **Chief of Air Staff (CAS) Commendation Card**. Awarded by the Chief of Air Staff for meritorious service or acts of bravery.

11. These commendation cards are highly regarded and serve as a testament to the recipient's dedication and excellence in their respective fields.

12. **Importance of Honour and Awards in Armed Forces**. Honour and awards in the Army, Navy and Air Force play a crucial role in recognizing and celebrating the bravery, dedication and exceptional service of military personnel. They serve as powerful motivators, fostering a culture of excellence and commitment; and enhancing the morale and esprit de corps within the armed forces.

13. **Recognition and Ceremony**. Recognition and ceremonies for honour and awards provide a formal platform to publicly acknowledge the achievements of military personnel. These events not only highlight the standards of excellence and bravery but also inspire others to strive for similar accomplishments, reinforcing the values and traditions of the armed forces. The ceremonies usually involve senior government officials, military leaders and dignitaries, adding to the prestige and significance of the awards.

PART II: NCC SPECIFIC AWARDS

14. NCC-specific awards are designed to recognize the exceptional contributions and achievements of cadets and officers within the National Cadet Corps. Here are the details of the key awards:-

(a) **Governor's Medal**. The Governor's Medal is awarded to NCC cadets for their exemplary performance and contribution at the state level. This medal is a prestigious recognition of the cadet's dedication, leadership and service to the NCC and the community.

(b) **Raksha Mantri Medal**. The Raksha Mantri Medal is awarded for outstanding performance at the national level. This medal is given to cadets who have demonstrated exceptional courage, dedication and service, significantly contributing to the NCC's mission and objectives.

(c) **Raksha Mantri Commendation Card**. The Raksha Mantri Commendation Card is awarded for acts of outstanding courage or devotion to duty that enhance the image of the NCC. This commendation is given to whole-time and part-time NCC officers, UOIs (Under Officer Instructors), SMIs (Senior Military Instructors) and NCC cadets. The commendation recognizes acts that involve significant bravery or exceptional service.

(d) **Defence Secretary Commendation Card**. The Defence Secretary Commendation Card is awarded for notable acts or deeds in the fields of adventure, sports, training, or outstanding contributions in social or cultural activities. This commendation is given to whole-time and part-time NCC officers, UOIs, SMIs and NCC cadets. The commendation highlights the recipient's significant contributions to the NCC and the community.

(e) **DG NCC Commendation Card**. The Director General NCC Commendation Card is awarded to recognize outstanding and distinguished service rendered by Civilian Employees, NCC officers, ANOs, GCIs and cadets. This commendation is given for dedication and devotion to work, efficient management of NCC activities and significant contributions to the NCC's mission.

Best Cadet Award

15. The Best Cadet Award is one of the most prestigious recognitions within the National Cadet Corps (NCC). This award is given to cadets who have demonstrated exceptional performance, leadership and dedication across various activities and training programs

16. The Best Cadet Award is presented at various levels within the NCC.

(a) **Unit Level**. Awarded to the best cadet within an NCC unit.

(b) **Group Level**. Awarded to the best cadet within an NCC group, which comprises several units.

(c) **Directorate Level**. Awarded to the best cadet within an NCC directorate, which covers a larger geographical area.

(d) **National Level**. The highest level, awarded to the best cadet in the country. This award is often presented during the Republic Day Camp (RDC) in New Delhi.

17. The Best Cadet Award not only acknowledges the cadet's hard work and dedication but also serves as an inspiration for other cadets to strive for excellence in their NCC activities.

Director General's Commendation Card being presented to Cadet Tsewang Dolma for her outstanding performance during the summit of Mt. Kang Yatse

PART III: RANK STRUCTURES

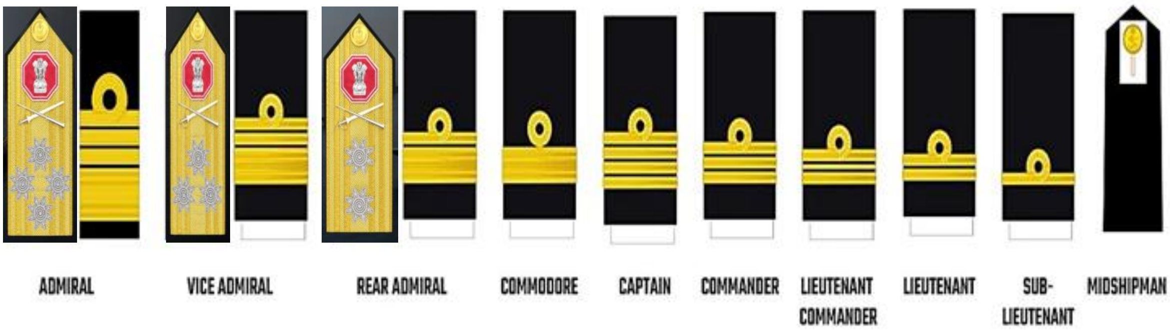
18. **Equivalent Ranks in the Three Services**. Every person in the Armed Forces is given a rank to denote his position and is recognized by it. It is the 'rank' which groups the service personnel as Officers, Senior and junior sailors. The word 'promotion' indicates a person moving up to a higher rank:-

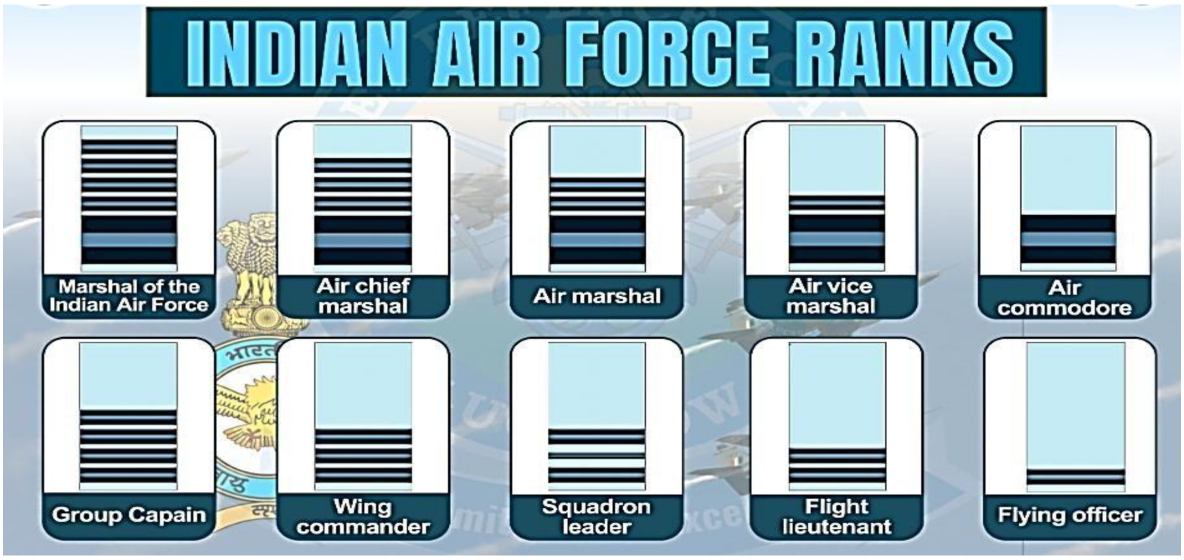
(a) **Officers**. The rank structure of officers of the Indian Navy and equivalent ranks in other Services in descending order of seniority are as given below:-

NAVY	ARMY	AIRFORCE
Admiral of the Fleet	Field Marshal	Marshal of the Air Force
Admiral	General	Air Chief Marshal
Vice Admiral	Lt General	Air Marshal
Rear Admiral	Major General	Air Vice Marshal
Commodore	Brigadier	Air Commodore
Captain	Colonel	Group Captain
Commander	Lt Colonel	Wing Commander
Lt Commander	Major	Squadron Leader
Lieutenant	Captain	Flight Lieutenant
Sub Lieutenant	Lieutenant	Flying Officer

COMMISSIONED OFFICERS OF THE INDIAN ARMY

COMMISSIONED OFFICERS OF THE INDIAN NAVY





(b) **Sailors**. Rank structure of sailors of the IN and equivalent ranks of other services in descending order of seniority are as follows:-

Navy	**Army**	**Air Force**
MCPO I	Sub Major	Master Warrant Officer
MCPO II	Subedar	Warrant Officer
Chief Petty Officer	Naib Subedar	Junior Warrant Officer
Petty Officer	Havildar	Sergeant
Leading Seaman	Naik	Corporal
Sea I	Lance Naik	Leading Aircraftsman
Sea II	Sepoy	Aircraftsman

JCOs and OTHER RANKS OF THE INDIAN ARMY

SAILOR RANKS and THEIR BADGES IN THE INDIAN NAVY

MASTER CHIEF PETTY OFFICER I

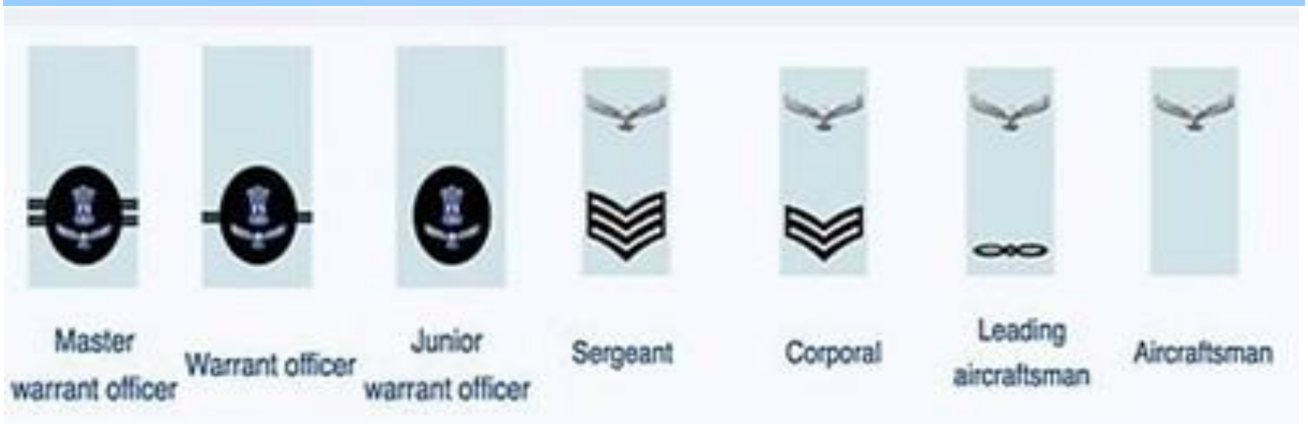
MASTER CHIEF PETTY OFFICER II

CHIEF PETTY OFFICER

PETTY OFFICER

LEADING

WARRANT OFFICERS and AIRMEN RANKS IN THE INDIAN AIR FORCE



Importance of the Rank Structure

19. **Discipline and Authority**. The rank structure ensures that there is a clear chain of command, which is vital for maintaining discipline and operational effectiveness.

20. **Operational Efficiency**. Officers and enlisted personnel at every rank have clearly defined roles and responsibilities, contributing to the overall success of military operations.

21. **Career Progression**. The rank system allows for career advancement based on merit, experience, and leadership capabilities. It ensures that the armed forces are always equipped with well-trained and capable leaders.

CONCLUSION

22. Honours and awards in the armed forces are more than just symbols of recognition; they are a testament to the bravery, dedication, and exceptional service of military personnel. These accolades serve to inspire others within the armed forces and the National Cadet Corps (NCC) to strive for excellence and selfless service. The structured system of honours and awards ensures that acts of gallantry, distinguished service and exceptional contributions are appropriately recognized, fostering a culture of valour and dedication.

23. Gallantry awards, whether in the face of the enemy or during peacetime, highlight the courage and self-sacrifice of individuals who go above and beyond the call of duty. Distinguished service awards recognize the exceptional performance and dedication of military personnel in their professional roles. Commendation cards, awarded by the Chiefs of Army, Navy and Air Staff, as well as specific awards for NCC cadets and officers, further emphasize the importance of recognizing meritorious service and acts of bravery.

24. NCC-specific awards, such as the Governor's Medal, Raksha Mantri Medal, DGNCC Commendation Card and the Best Cadet Award, play a crucial role in motivating cadets to uphold the values of discipline, leadership and patriotism. These awards not only acknowledge the hard work and dedication of the recipients but also serve as an inspiration for others to strive for excellence in their NCC activities.

25. In conclusion, the honours and awards system in the armed forces and the NCC is integral to maintaining high standards of service and fostering a culture of excellence. By recognizing and celebrating the achievements of military personnel and cadets, these awards contribute to the overall mission of the armed forces and the NCC, ensuring that the values of bravery, dedication and exceptional service continue to be upheld.

<u>Different Uniforms in the Indian Navy</u>

SUMMARY

Honours and awards in the armed forces recognize and celebrate the bravery, dedication and exceptional service of military personnel. These accolades inspire others to strive for excellence and selfless service.

- **Gallantry in the Face of the Enemy (War Time)**
    - **Param Vir Chakra**. Highest military decoration for valour or self-sacrifice in the presence of the enemy.
    - **Maha Vir Chakra** Second-highest military decoration for conspicuous gallantry in the presence of the enemy.
    - **Vir Chakra** Third-highest military decoration for gallantry in the presence of the enemy.
- **Gallantry Other Than in the Face of the Enemy (Peace Time)**
    - **Ashoka Chakra**. Highest peacetime military decoration
    - **Kirti Chakra**. Second-highest peacetime military decoration
    - **Shaurya Chakra**. Third-highest peacetime military decoration
- **Distinguished Service Awards**
    - Param Vishisht Seva Medal, Ati Vishisht Seva Medal and Vishisht Seva Medal
- **Commendation Cards**
    - **Types**. Army, Navy, and Air Force Commendation Cards.
    - **Awarded by**. Chief of Army Staff, Chief of Naval Staff, and Chief of Air Staff for acts of bravery, distinguished service, or meritorious service.
- **NCC Specific Awards**
    - **Governor's Medal**. Awarded to NCC cadets for exemplary performance at the state level.
    - **Raksha Mantri Medal**. Awarded for outstanding performance at the national level.
    - **Raksha Mantri Commendation Card**. Recognizes acts of outstanding courage or devotion to duty.
    - **Defence Secretary Commendation Card**. Awarded for notable acts in adventure, sports, training, or social/cultural activities.
    - **DG NCC Commendation Card**. Recognizes outstanding service by civilian employees, NCC officers, and cadets.
    - **Best Cadet Award**. Given at unit, group, directorate, and national levels for exceptional performance, leadership, and dedication.

These awards play a crucial role in motivating military personnel and NCC cadets to uphold the values of discipline, leadership and patriotism.

SUGGESTED READ

Indian Navy: Time Tide and Traditions

ASSESSMENT EXERCISE

Multiple Choice Questions

Q1. What is the highest gallantry award for bravery in the face of the enemy in India?

(a) Vir Chakra
(b) Param Vir Chakra
(c) Ashoka Chakra
(d) Maha Vir Chakra

Q2. The Maha Vir Chakra is awarded for acts of?

(a) Distinguished service in peacetime
(b) Exceptional leadership in training
(c) Conspicuous gallantry in the face of the enemy
(d) Acts of bravery during disaster relief operations

Q3. Which gallantry award is the highest recognition for courage in peacetime?

(a) Vir Chakra
(b) Kirti Chakra
(c) Shaurya Chakra
(d) Ashoka Chakra

Q4. Which of the following is NOT a wartime gallantry award?

(a) Param Vir Chakra
(b) Maha Vir Chakra
(c) Vir Chakra
(d) Kirti Chakra

Q5. What is the third-highest peacetime gallantry award in India?

(a) Param Vir Chakra
(b) Kirti Chakra
(c) Shaurya Chakra
(d) Vishisht Seva Medal

Q6. Who was the first recipient of the Param Vir Chakra?

(a) Captain Vikram Batra
(b) Major Somnath Sharma
(c) Rifleman Sanjay Kumar
(d) Lance Naik Albert Ekka

Q7. The Vishisht Seva Medal is awarded for?

(a) Distinguished service of an exceptional order
(b) Gallantry in the face of the enemy
(c) Distinguished service of a high order
(d) Acts of bravery during peacetime

Q8. Which of the following commendation cards is NOT awarded by the armed forces?

(a) Chief of Army Staff Commendation Card
(b) Chief of Naval Staff Commendation Card
(c) Chief of Defence Staff Commendation Card
(d) Chief of Air Staff Commendation Card

Q9. How many living recipients of the Param Vir Chakra are there?

(a) Two
(b) Three
(c) Four
(d) Five

Q10. What is the highest award given at the national level to an NCC cadet?

(a) Governor's Medal
(b) Defence Secretary Commendation Card
(c) Raksha Mantri Medal
(d) DG NCC Commendation Card

Q11. The Best Cadet Award is presented at which levels?

(a) Unit, Group, Directorate, and National
(b) Unit and Group only
(c) National only
(d) Directorate and National only

Q12. Who among the following is the only Indian Air Force officer to receive the Param Vir Chakra?

(a) Flying Officer Nirmal Jit Singh Sekhon
(b) Captain Vikram Batra
(c) Major Shaitan Singh
(d) Lt. Manoj Kumar Pandey

Q13. The DG NCC Commendation Card is awarded to?

(a) Only NCC cadets
(b) NCC cadets, ANOs, GCIs, and civilian employees
(c) Only NCC officers
(d) Only military personnel

Q14. Which award is equivalent to the Param Vir Chakra in the United Kingdom?

(a) Medal of Honour
(b) Distinguished Service Cross
(c) Victoria Cross
(d) Purple Heart

Q15. Which of the following awards is given specifically at the state level for NCC cadets?

(a) Raksha Mantri Medal
(b) Governor’s Medal
(c) Best Cadet Award
(d) Defence Secretary Commendation Card

<u>Short Answer Type Questions</u>

Q1. What is the Param Vir Chakra awarded for?

Q2. Name the three highest peacetime gallantry awards.

Q3. Who awards the Chief of Air Staff (CAS) Commendation Card?

Q4. What is the purpose of the Best Cadet Award in the NCC?

Q5. Describe the significance of the Governor’s Medal in the NCC.

<u>Long Answer Questions</u>

Q1. Explain the difference between gallantry awards given during wartime and peacetime. Provide examples of each.

Q2. Discuss the role and importance of distinguished service awards in the armed forces.

Q3. Describe the importance of the Param Vir Chakra and Ashoka Chakra and provide the names of a few recipients/awardees.

Q4. What are the NCC-specific awards and how do they contribute to the motivation and recognition of cadets?

Q5. Analyse the impact of the honours and awards system on the morale and performance of armed forces personnel and NCC cadets.

NCC SPECIAL SUBJECT (NAVY)

NAVAL ORIENTATION

CHAPTER 8: MODE OF ENTRY INTO THE INDIAN NAVY (CODE- NO 8)

"To command is to serve, nothing more and nothing less." **– André Malraux**

TEACHING INSTRUCTIONS

Period	**:**	**1 (One)**
Type	**:**	**Theory**
Year	**:**	**Third**
Conducting Officer	**:**	**PI**
Training Aids	**:**	**Blackboard, chalk, whiteboard, marker, projector.**

Time Plan

➢ **Introduction**	**:**	**05 Min**
➢ **Officers Entry**	**:**	**15 Min**
➢ **Sailors Entry**	**:**	**05 Min**
➢ **Conclusion**	**:**	**05 Min**

INTRODUCTION

1. The Indian Navy stands as a beacon of honour, courage, and commitment, offering unparalleled opportunities for individuals to serve the nation with pride. Catering to diverse educational backgrounds and skill sets, the Navy recruits officers and sailors through a variety of entry pathways, including Permanent Commission (PC), Short Service Commission (SSC), and the Agniveer schemes. These pathways are meticulously designed to attract and nurture talent, ensuring the Navy remains a formidable force in safeguarding India's maritime interests. From rigorous academic programs at the National Defence Academy to dynamic training for Agniveers at INS Chilka, the Indian Navy is a symbol of excellence and dedication, welcoming aspirants to become part of its legacy.

PREVIEW	LEARNING OBJECTIVES
The lecture will be covered in following parts:- ➢ Part I: Officers' Entry ➢ Part II: Sailors' Entry	➢ Cadets will learn about the various Entry Pathways into the Indian Navy, including eligibility and selection criteria

2. The Indian Navy offers various entry pathways to recruit individuals as officers or sailors, with opportunities for both men and women. These entry modes are designed to attract talented candidates from diverse educational and professional backgrounds, enabling them to join the Navy in different roles.

PART I: OFFICER ENTRY

3. The Indian Navy commissions officers through several pathways, offering both Permanent Commission (PC) and Short Service Commission (SSC).

(a) **Permanent Commission (PC)**. PC officers serve in the Navy until retirement, allowing for a long-term career.

(b) **Short Service Commission (SSC)**. SSC officers serve for a specified period, typically up to 10 years, with the option for extension or a Permanent Commission based on performance and service requirements.

4. Officers' commission is advertised through Employment News, national and regional newspapers/ dailies and social media. Selection for Permanent Commission through NDA/NA cadet entry and CDSE (Graduate) entry is through a written examination conducted by UPSC, followed by an interview by the Service Selection Board (SSB). Selection is through merit alone. The details are enumerated in the subsequent paragraphs.

5. Induction of officers in the various Branches of the Indian Navy is undertaken through one of the following modes/schemes:-

(a) **<u>Union Public Service Commission (UPSC) Entries</u>**.

(i) Combined Defence Services Examination (CDSE) / NCC

(ii) National Defence Academy (Navy)

(iii) National Defence Academy (Naval Academy)

(b) **<u>Direct Entry</u>**. Permanent Commission for Undergraduate Level Entry 10+2 (B.Tech).

(c) **<u>Indian Navy Entrance Test (INET)</u>**. Short Service Commission for Graduate Level Entries

(i) Pilot

(ii) Naval Air Operations

(iii) Air Traffic Control (ATC)

(iv) General Service - Executive (GS/X)

(v) Hydro

(vi) General Service (Technical – Electrical & Engineering)

(vii) Naval Constructor

(viii) Information Technology (IT)

(ix) Logistics

(x) Education

(xi) Naval Armament Inspectorate Cadre (NAIC)

(xii) Sports

(xiii) Musician

(xiv) Law

Guard of Honour

6. **National Defence Academy (Navy) and National Defence Academy (Naval Academy)**. This entry is controlled by UPSC with IHQ MoD (Army)/ ADG (Recruiting) as nodal agency. It consists of written examination conducted by the UPSC followed by conduct of the SSB interview, medical test by Indian Navy (Naval candidates only) and final preparation of merit list by UPSC. The appointment letter for NDA (Navy and Naval Academy) is issued by IHQ MoD (Army)/ ADG (Recruiting) and IHQ MoD/ DMPR, respectively. The training of officers selected

through this entry, commences in the month of Jan/ Jul every year. The advertisement for this entry is published in Jun/ Dec. Tentative examination schedule of NDA entry is as follows:-

S No	Name of Exam	Notification by UPSC	Written Test Conducted by UPSC	SSB Conducted by Navy	Joining at Academy
(a)	NDA & NA Exam(I)	Dec/Jan	Apr	Aug-Sep	January next year
(b)	NDA & NA Exam(II)	Jun/Jul	Oct/Nov	Jan-Feb	July next year

<u>Indian Naval Academy, Ezhimala</u>

7. **<u>Combined Defence Services Exam (CDSE)</u>**. This entry also consists of written exam conducted by the UPSC, followed by conduct of the SSB interview, medical test by Indian Navy (Naval candidates only) and final preparation of merit list by UPSC. The appointment letter is issued by IHQ MoD/ DMPR. The training of officers selected through this entry commences in the month of Jan/ Jul and the advertisement is published in Nov/ Jul. Tentative examination schedule of CDS entry is as follows:-

S No	Name of Exam	Notification by UPSC	Written Test Conducted by UPSC	SSB Conducted by Navy	Joining at Academy
(a)	CDS Exam (I)	Nov	Feb/Mar	Sep-Oct	January next year
(b)	CDS Exam (II)	Jul	Oct/Nov	Jan-Feb	July next year

8. **<u>NCC Entry</u>**. The vacancies for Naval Wing Senior Div NCC ‘C’ certificate holders with B.E./ B.Tech degree are published along with CDSE advertisement. No written test is conducted for this entry. The eligible candidates are required to forward their application directly to IHQ MoD (N)/ DMPR through DGNCC. The candidates are deputed for SSB interview. After qualifying SSB these candidates undergo medical examination and if found fit, are inducted into the Indian Navy on the basis of All India Merit. The training of officers selected through this entry normally commences in the month of Jan/Jul every year.

9. **Direct Entry: Permanent Commission for Undergraduate Level 10+2(B.Tech)**. 12th Pass with 70% in PCM and 50% in English in 10th or 12^{th} standard can apply for IN officers' entry viz 10+2(B.Tech). With effect from Jan 17, JEE (Mains) rank has been made compulsory to apply for 10+2 (B.Tech) entry. This entry is open twice a year for Spring Term & Autumn Term. NHQ prepares and releases the advertisement in Employment News/ Important Newspapers for inviting applications 6-8 months prior to the commencement of the course. Post receipt of applications, candidates are shortlisted for SSB based on JEE (Main) – All India Rank (AIR) for BE/ B Tech curriculum. Validity of the JEE (Main) rank for applying for the scheme is one year from the date of declaration of the JEE (Main) ranking by CBSE/ NTA. On completion of all SSBs, merit list is prepared in respect of all SSB qualified candidates and candidates are thereafter appointed in order of merit based on the number of vacancies.

10. **Direct Entry: Short Service Commission for Graduate Level Entries**. The Direct entries are controlled by IHQ-MoD(Navy)/ DMPR and cater for Short Service Commission. Advertisements calling for applications from eligible unmarried candidates for such entries are published in the leading newspapers and Employment News based on the availability of vacancies. Post receipt of applications, preliminary scanning of candidates is conducted at IHQ-MoD(Navy) for their professional ability in respect of Musician and Sports entries. Successful candidates are thereafter detailed for SSB interviews at Bangalore / Bhopal / Vizag / Kolkata. The SSB qualified candidates undergo medical examination and if found fit, are inducted into the Indian Navy on the basis of All India Merit. The training of these entries normally commences in the months of January and July.

Indian Naval Academy, Ezhimala

11. **Indian Navy Entrance Test (INET)**. Indian Navy Entrance Test (INET) is the officers' entry under the control of IHQ MoD (Navy) / DMPR and caters to both Permanent Commission (PC) and Short Service Commission (SSC). The INET is conducted twice a year. The selection procedure is as follows:-

(a) **Exam**. INET (Officer) is a computer based written examination. There will be four sections and candidate is required to pass all four sections separately with a minimum of 40% marks.

(b) **Examination Centre**. All eligible candidates, whose applications are received by due date, will be called for Indian Navy Entrance Test (INET) to be conducted at one of the INET centres as per their choice, subject to availability of slots at that centre. Call up letters cum Admit Card for online examination indicating date, time and place, would be required to be downloaded from the official website www.joinindiannavy.gov.in. Only Electronic mode of communication will be used while contacting the candidates at all stages of selection. Once the centre is opted by a candidate, it cannot be changed under any circumstances.

(c) **INET Syllabus**. INET exam will be of two hours duration. It will contain 100 Multiple Choice Questions comprising Questions on English, Reasoning & Numerical Ability, General Knowledge, General Science & Mathematical Aptitude. Each section will be of 100 marks with negative marking of one mark for every incorrect answer.

(d) **Shortlisting for SSB**. IHQ of MoD (N) reserves the right to shortlist candidates strictly on the basis of INET rank cum preference & choice. However, candidates are required to qualify in all sections of INET Exam to be considered for shortlisting to appear in SSB interview. No communication will be entertained on this account. SSB interviews for short-listed candidates will be tentatively scheduled at Bangalore for Pilot & NAO candidates and at Bangalore/ Bhopal/ Visakhapatnam/ Kolkata for other branches/ entries. Shortlisted candidates will be informed about their selection for SSB interview via their e-mail or through SMS (provided by candidates in their application form). Candidates are advised not to change their e-mail/ mobile number till the selection process is over.

(e) **Merit List & Appointment Letter**. Merit list is based on combined marks of INET (50% weightage) & SSB (50% weightage). Candidates recommended by the SSB and declared medically fit will be appointed for training as per all India merit of each branch / cadre based on availability of number of vacancies in various branches/ cadres.

(f) **Examination Fees**. Examination fee will be as per the extant government regulations. The stipulated fee is to be paid through online mode. Admit card will be issued for the examination only to those candidates who have successfully paid the examination fee and who are entitled to waiver of examination fee.

PART II: SAILOR ENTRY

12. **Agniveer (Senior Secondary Recruit)**. An Agniveer (SSR), is part of a highly technical Organization. He is required to serve in powerful, modern ships such as Aircraft Carriers, Guided Missile Destroyers and Frigates, Replenishment Ships and highly technical and fascinating submarines and aircraft. The work is divided among different teams that do

different kinds of jobs. It could be operations of various equipment such as radars, sonars or communications or firing of weapons such as missiles, guns or rockets. Candidates selected will undergo Basic Training at INS Chilka followed by Professional training in the allotted trade in various Naval Training Establishments. Branch / Trade will be allotted as per the requirements of the service.

13. **Qualification & Requirement**. Candidates who have appeared in class 12th Board Exam and are awaiting declaration of results are also eligible to apply provided they fulfil all other eligibility criteria. Such candidates, however, shall only be selected when they produce the original marksheet during Stage II of the recruitment process (Internet copy of marksheet not acceptable). Such candidates must also secure the minimum marks laid down in their aggregate as well as in individual subjects for respective category in order to be eligible to participate in Stage II. The qualification and requirements are as follows:-

(a) Qualified in 10+2 with Mathematics & Physics from Boards of School Education recognized by Ministry of Education, Govt of India, with minimum 50% marks in aggregate.

OR

(b) Passed Three year diploma course in Engineering (Mechanical/ Electrical/ Automobiles/ Computer Science/ Instrumentation Technology/ Information Technology) from Central, State and UT recognized Polytechnic Institute with 50% marks in aggregate.

OR

(c) Passed Two year Vocational Course with Non-vocational subject viz, Physics and Mathematics from Education Boards recognized by Central, State and UT with 50% marks in aggregate.

14. **Agniveer (Matric Recruit)**. Candidates must have passed Matriculation Examination with a minimum of 50% marks in aggregate from the Boards of School Education recognised by

Ministry of Education, Govt. of India. Candidates who have appeared in class 10th Board Exam and are awaiting declaration of results are also eligible to apply provided they fulfil all other eligibility criteria. Such candidates, however, shall only be selected when they produce the original marksheet during Stage II of the recruitment process (Internet copy of marksheet not acceptable). Such candidates must also secure the minimum marks laid down in their aggregate as well as in individual subjects for respective category in order to be eligible to participate in Stage II.

(a) **Agniveer (MR): Chef**. You will be required to prepare food as per menu (vegetarian and non-vegetarian including handling of meat products), and accounting of ration. In addition, you will also be trained in firearms and will be allotted other duties for efficient running of the organisation.

(b) **Agniveer (MR): Steward**. You would be required to serve food in the Officers' messes as waiters, housekeeping, accounting of funds, wine and stores, preparation of menu etc. In addition, you will also be trained in firearms and will be allotted other duties for efficient running of the organisation.

(c) **Agniveer (MR): Hygienist**. They will be required to maintain hygiene in wash-rooms and other areas. In addition, you will also be trained in firearms and will be allotted other duties for efficient running of organization

(d) **Work Environment**. Besides their professional work, these branches are trained for onboard lookout duties as well as small arms handling and also trained for ship's landing and boarding parties. They are involved in all the activities which are conducted by a ship.

Ship's Galley

DID YOU KNOW?
➢ The first batch of Agniveers, inducted in November 2022, included women sailors for the first time in Indian Naval history.

15. **Training & Advancement**. Candidates selected will undergo Basic Training at INS Chilka followed by Professional training in the allotted trade in various Naval Training Establishments. Branch / Trade will be allocated as per the requirement of Service.

16. **Physical Standards for Agniveer**.

GENDER	1.6 KM RUN	SQUATS (UTHAK BAITHAK)	PUSH-UPS	BENT KNEE SIT-UPS
Male	06 min 30 sec	20	15	15
Female	08 min	15	10	10

CONCLUSION

17. The Indian Navy offers a diverse and rewarding career for those with the determination and passion to serve. Through meticulously planned entry schemes for officers and Agniveers, the Navy ensures that recruits are equipped with the skills and training needed to excel in their roles. Whether joining as a Permanent Commission officer, a Short Service Commission officer, or an Agniveer, each role contributes significantly to the Navy's mission of protecting the nation's maritime interests. With a focus on professional development, teamwork, and the spirit of service, the Indian Navy continues to inspire and empower individuals to reach their fullest potential, embodying the values of commitment, honour, and excellence.

SUMMARY

➢ **Officer Entry Pathways**. The Navy commissions officers through Permanent Commission (PC) for long-term careers and Short Service Commission (SSC) for a fixed tenure of up to 10 years, with potential extensions.

➢ **Recruitment Advertisements**. Recruitment details are published in Employment News, national newspapers, and social media, with entries based on merit through written exams, interviews, and medical evaluations.

➢ **UPSC Entries**. Includes Combined Defence Services Examination (CDSE) and National Defence Academy (NDA) exams for officer induction, followed by Service Selection Board (SSB) interviews and medical tests.

➢ **Direct Entry Options**. Undergraduate-level Permanent Commission is offered through the 10+2 (B.Tech) entry based on JEE (Mains) rank, while graduate-level Short Service Commission roles span diverse branches like Pilot, Logistics, and Information Technology.

➢ **Indian Navy Entrance Test (INET)**. INET is a computer-based exam for both PC and SSC candidates, with a merit list based on combined scores from INET and SSB interviews.

➢ **NCC Special Entry**. Senior Division Naval Wing NCC 'C' certificate holders with engineering degrees are eligible for direct SSB interviews without a written test, based on merit.

➢ **Agniveer (SSR) Role**. Agniveer (SSR) recruits serve aboard advanced naval platforms and are trained in technical operations, including handling radars, sonars, and weapon systems.

➢ **Agniveer (MR) Roles**. Specific roles like Chef, Steward, and Hygienist focus on culinary, hospitality, and hygiene duties while also training in firearms and shipboard operations.

➢ **Training Programs**. Recruits undergo Basic Training at INS Chilka, followed by specialized training at various naval establishments, ensuring skill development for operational efficiency.

➢ **Physical Fitness Standards**. Rigorous physical fitness tests are mandatory for both male and female candidates, emphasizing endurance, strength, and readiness for the demanding naval environment.

SUGGESTED READ

Website: https://www.joinindiannavy.gov.in

ASSESSMENT EXERCISE

Multiple Choice Questions

Q1. What does the Indian Navy primarily stand for?

(a) Economic growth
(b) Honour, courage, and commitment
(c) Political influence
(d) Only maritime security

Q2. What are the two types of commissions available for officer entry in the Indian Navy?

(a) Permanent Commission and Short Service Commission
(b) Direct Commission and Indirect Commission
(c) Technical Commission and Administrative Commission
(d) General Commission and Provisional Commission

Q3. Which examination is conducted by UPSC for Permanent Commission entry into the Indian Navy?

(a) JEE Advanced
(b) Civil Services Examination
(c) Combined Defence Services Examination (CDSE)
(d) AFCAT

Q4. Which of the following is NOT a branch for Short Service Commission (SSC) entry?

(a) Hydro
(b) Pilot
(c) Civil Services
(d) Information Technology

Q5. What is the minimum percentage required in Physics and Mathematics for the 10+2 (B.Tech) entry?

(a) 80%
(b) 50%
(c) 70%
(d) 40%

Q6. Where does Basic Training for Agniveer (SSR) take place?

(a) NDA Pune
(b) INS Chilka
(c) IMA Dehradun
(d) Naval Dockyard Mumbai

Q7. What is the primary work of an Agniveer (MR) - Steward?

(a) Serving food and handling mess accounts
(b) Operating submarines
(c) Maintaining aircraft engines
(d) Leading boarding parties

Q8. What is the full form of INET in the context of the Indian Navy?

(a) Indian Naval Engineering Test
(b) Indian Navy Entry Test
(c) Indian National Eligibility Test
(d) Indian Naval Efficiency Test

Q9. Which of the following qualifications is NOT accepted for Agniveer (SSR) recruitment?

(a) 10+2 with Physics and Mathematics
(b) Three-year diploma in Engineering
(c) Two-year Vocational Course with Physics and Mathematics
(d) Master's degree in Mathematics

Q10. Which branch is responsible for training cadets entering through the NDA (Naval Academy)?

(a) Ministry of Home Affairs
(b) IHQ MoD (Army)/ ADG (Recruiting)
(c) Naval Dockyard
(d) Defence Research and Development Organization (DRDO)

Q11. What is the primary objective of the INET exam?

(a) To recruit sailors for submarines
(b) To recruit officers for Permanent and Short Service Commissions
(c) To conduct technical training for naval engineers
(d) To assess fitness levels of Navy recruits

Q12. What is the duration of service for officers under Short Service Commission (SSC)?

(a) 5 years
(b) 10 years (extendable)
(c) 15 years
(d) Until retirement

Q13. What is the role of the Service Selection Board (SSB) in the officer selection process?

(a) Conducting written exams
(b) Conducting personality and intelligence assessments
(c) Conducting physical fitness tests only
(d) Recruiting only technical officers

Q14. What is the primary eligibility criterion for NCC entry into the Indian Navy?

(a) Senior Division NCC ‘C’ certificate with B.E./B.Tech degree
(b) 10th pass with minimum 80% marks
(c) Diploma in Physical Education
(d) Rank of Captain in NCC Army Wing

Q15. What is the final step in the officer selection process before joining the Indian Navy?

(a) Passing the written exam
(b) Clearing medical examination and merit list placement
(c) Completing the JEE (Main) exam
(d) Submitting documents to UPSC

NAVAL COMMUNICATION

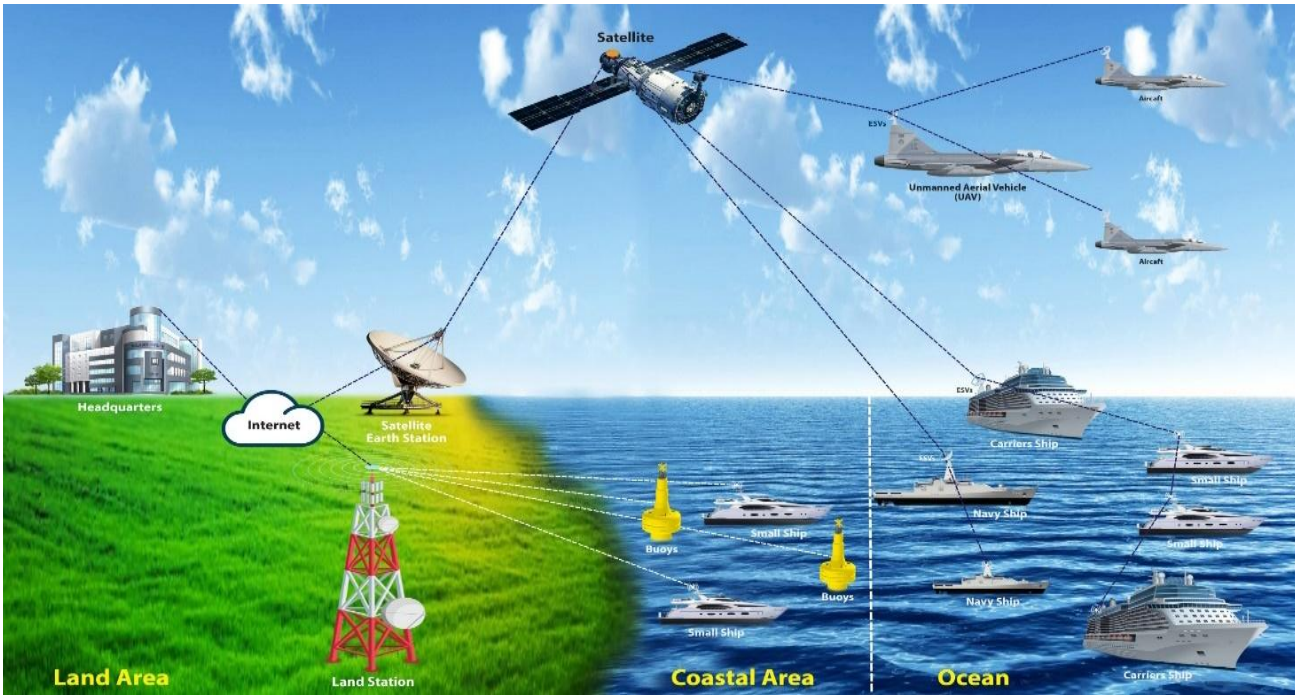
SECTION INDEX : NAVAL COMMUNICATION (SD/ SW)

SPECIAL SUBJECT (NAVY)

NAVAL COMMUNICATION

CHAPTER 1: INTRODUCTION TO NAVAL COMMUNICATION (CODE-NC1)

"Effective communication is the backbone of naval operations, turning strategy into action." — Anonymous



TEACHING INSTRUCTIONS

Period	**:**	**1 (40 Min)**
Type	**:**	**Theory**
Year	**:**	**First**
Conducting Officer	**:**	**PI**

Training Aids : **Blackboard, chalk, whiteboard, marker, projector.**

Time Plan

➢ **Introduction**	**:**	**05 Min**
➢ **Significance & Principle**	**:**	**10 Min**
➢ **Radio Communication**	**:**	**10 Min**
➢ **Duties of various sub departments**	**:**	**10 Min**
➢ **Conclusion**	**:**	**05 Min**

INTRODUCTION

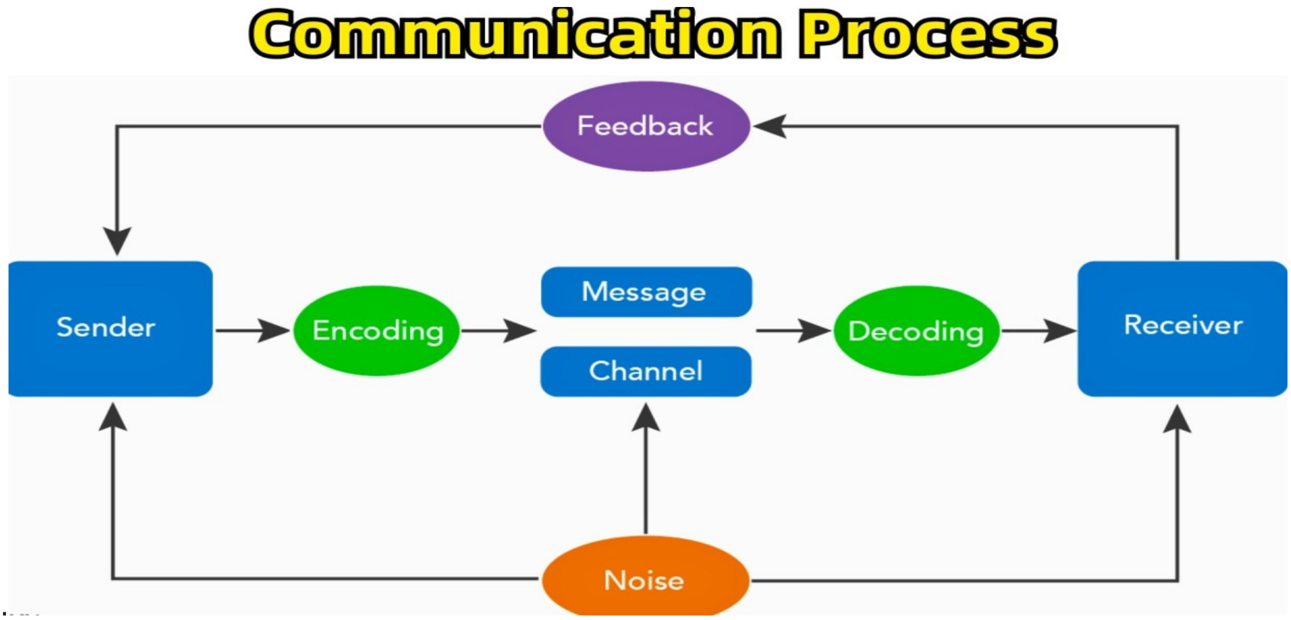
1. Communication is vital for the exchange of thoughts, ideas, and information within the Navy, ensuring the effective execution of commands. Clear, concise, and accurate communication between ships, aircraft, and shore establishments enhances operational efficiency and combat readiness. The Signal Communication Officer (SCO) oversees the communication department aboard a ship, ensuring smooth information flow. Effective communication involves both transmitting and receiving ideas in their original form, fostering coordination and understanding among naval personnel.

2. Various forms of communication include sign language, voice, written scripts, line transmission, radio waves, space waves, and advanced digital communication. On modern battlefields, military operations have become highly complex, requiring continuous coordination between commanders and troops. Communication plays a crucial role in modern warfare, influencing strategy and execution. The invention of the telephone by Alexander Graham Bell revolutionized global communication, enabling individuals to converse directly and significantly improving information exchange in both civilian and military domains.

PREVIEW	LEARNING OBJECTIVES
The lecture will be covered in following parts:- ➢ Part I: Significance and Principle of Communication ➢ Part II: Radio Communication ➢ Part III: Various Sub-branches in Indian Navy	➢ Significance & principles of communication in naval operations. ➢ Basics of radio communication and its applications. ➢ Roles of communication sub-branches in the Indian Navy.

PART I: SIGNIFICANCE AND PRINCIPLE OF COMMUNICATION

3. **Significance of Communication Network in Defence Forces**. Communication helps the armed forces and the Special Forces Command share situational awareness for a faster decision-making process. It improves prompt response time through integrated technology and ensures network centricity across the three services. It strengthens the defence forces' capabilities during critical operations and rescue missions. The sender, who initiates communication, plays a crucial role, as their experiences, attitudes, and knowledge shape the message. The sender is responsible for the success of the message, with their skills, perceptions, and cultural background influencing its clarity. They must carefully decide what to transmit based on the receiver's knowledge and assumptions. The elements involved in completing the communication process are shown in the following diagram and discussed in succeeding paragraphs.



4. Communications systems and equipment designed for use by Armed Forces are as under :-

(a) High-frequency and land mobile radio tactical communications.

(b) Combat Net radios and accessories.

(c) Secure and tactical Radio communications and satellite navigation systems.

(d) Military neck microphones, handsets, headsets, and speakers. Military broadband, radio frequency (RF) filters, receivers, and threat detectors.

5. **Purpose & Principles**. Naval communication aims to minimize the risk of miscommunication during operations. Nations invest heavily in communication technology to ensure reliable and uninterrupted communication, critical for achieving Maritime Domain Awareness (MDA). Advanced systems, including satellite communication and secure modems like Rukmani, LINK II, MSS, and SB (Satellite Broadcast), have transformed naval communication, making it faster and more reliable.

PART II: RADIO COMMUNICATION

6. **Components of Basic Radio Equipment**. Radio is the technology of using radio waves to carry information such as sound, by systematically modulating properties of electromagnetic energy waves. The information in the waves can be extracted when radio waves strike an electrical conductor and transform it back into its original form. Radio communication requires the use of both transmitting and receiving equipment. The transmitting equipment, which includes a radio transmitter and transmitting antenna, is installed at the point from which messages are transmitted. The receiving equipment, which consists of a radio receiver and receiving antenna, is installed at the point at which messages are received.

7. The Indian Armed Forces utilise various components in its radio communication systems to ensure efficient and secure communication for operations. The key components of radio communication in the Indian Army are as follows:-

(a) **Radio Transmitters and Receivers**. Transmitters are used to send signals across different frequencies. Receivers are used to receive signals from other communication devices. These devices can be portable (for infantry units), vehicle-mounted (for armoured or mechanized units), or fixed (for headquarters or base stations).

(b) **Communication Radios**. The Indian Armed Forces use different types of radios based on the operational requirement:

(c) **HF (High Frequency) Radios**. These radios are used for long-range communication, typically beyond 50-100 km, and are often used for communication with base stations and remote units.

(d) **UHF (Ultra High Frequency) Radios**. They are used for short-range communication (within a few kilometres) and are ideal for dense terrains or urban operations.

(e) **VHF (Very High Frequency) Radios**. Used for medium-range communication, typically between 30 to 50 km. They are widely used for communication between tactical units on the battlefield.

(f) **Antennas**. Antennas play a crucial role in radio communication by transmitting and receiving signals. Depending on the type of radio, antennas vary in size and configuration:-

(i) **Whip Antennas**. Common in handheld radios.

(ii) **Long Wire Antennas**. Used for HF radios.

(iii) **Dish Antennas**. Used for SATCOM and high-frequency communications.

8. **Satellite Communication (SATCOM)**. Provides global communication capabilities, often used for secure, long-distance communication when traditional methods are not available.

Types of Waves

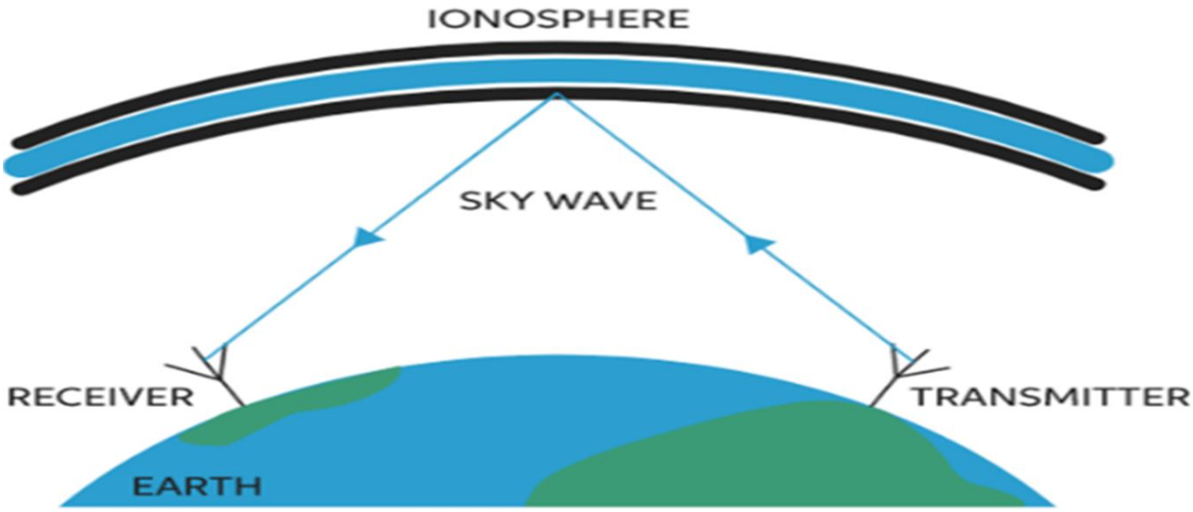
9. A wave can be described as a disturbance that travels through a medium from one location to another location. Types of waves can broadly be divided into two parts:-

(a) **Mechanical Waves**. A mechanical wave is a wave that is an oscillation of matter and therefore transfers energy through a medium.

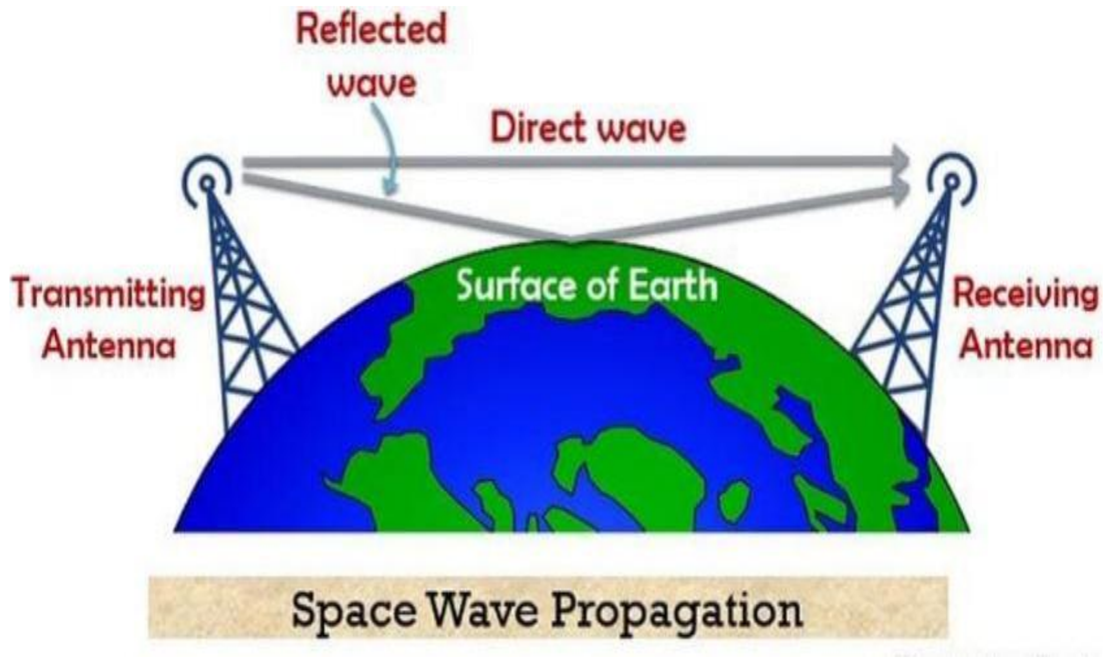
(b) **Electromagnetic Waves**. Electromagnetic waves are waves that can travel through the vacuum of outer space.

10. **Propagation of Waves**. The mode of propagation of electromagnetic waves (EMW) from transmitter to receiver depends upon the frequency employed. These can be of the following types:-

(a) **Sky Wave Propagation**. The sky waves are the radio waves that use an ionosphere layer existing to a height of 150 - 200 km from the surface of the earth and are reflected by the ionosphere of the earth's atmosphere.



(b) **Space Wave Propagation**. Space waves can travel through the atmosphere from the transmitter antenna to the receiver antenna either directly or after reflection from the ground in the earth's troposphere region. Their range is limited by the curvature of the earth; therefore, the distance between two neighbouring stations is approximately 50 Km.



(c) **Ground Wave Propagation**. It is a method of radio frequency propagation that uses the area between the surface of the earth and the ionosphere for transmission. Ground wave radio signal propagation is ideal for relatively short-distance propagation on these frequencies during the daytime with a limited range of approximately 30 km.

DID YOU KNOW?

- **The Advent of Morse Code and Wireless Telegraphy**: In 1899, the first wireless distress signal at sea was sent using **Morse code**. The invention of Guglielmo Marconi's wireless telegraph made real-time long-distance communication at sea possible, marking the beginning of modern maritime communication.

- **Introduction of the SOS Distress Signal**: The **Titanic disaster of 1912** highlighted the importance of standardized communication at sea. After this tragedy, the SOS signal (•••---•••) became the universal distress call, solidifying its place in maritime history.

PART III: DUTIES OF VARIOUS COMMUNICATION SUB-DEPARTMENTS

Communication Branch Arm Badge

11. **Duties of Various Communication Sub-departments**. The communication department is divided into two sub-departments and their duties are as follows:-

(a) **Operations**. The erstwhile sub-branches of Communication branch i.e. Tactics and Radio were merged into a single cadre i.e. Operations. The operations department covers both tactical communication and equipment associated with it. Tactical Communication plays a vital role in fleet operations by managing essential communication aspects such as visual signaling, offline cryptography, and traffic management. Visual signaling involves the use of flags, lights, and semaphores for short-range communication, ensuring secure and silent exchanges between vessels. Offline cryptography is used to encode sensitive messages before transmission, maintaining secrecy in operations. Additionally, traffic management ensures the smooth flow of information across naval units, preventing miscommunication and ensuring operational efficiency. In present era, tactical communication is not limited to visual range. With advent of technology, tactical communication has expanded its limits to thousands of miles. The modern communication equipment provides real-time communication at greater distances through various means, including satellite, radio telegraphy, automatic telegraphy, and radio telephony. This equipment also manages online cryptography to secure transmissions, ensuring that classified information remains protected. The operations sub-department is crucial for maintaining connectivity in dynamic and challenging operational environments.

(b) **Electronic Warfare (EW)**. The EW sub department focuses on advanced electronic warfare techniques and traffic handling to ensure secure and resilient communication channels. Electronic warfare involves monitoring, intercepting, and countering enemy transmissions to gain a strategic advantage. This sub-department plays a crucial role in safeguarding the fleet platforms and operations by providing early warning of the enemy's platforms. This particular sub-department was earlier known as Special Branch

DID YOU KNOW?
➢ **Smoke Signals and Flags**: In ancient times, sailors used smoke signals and colored flags to convey messages across short distances. This primitive form of communication evolved into the sophisticated flag signaling systems, like the **International Code of Signals**, still used today.

INS Dhruv

CONCLUSION

12. Effective communication is the backbone of naval operations, ensuring seamless coordination, operational efficiency, and combat readiness. The integration of various communication systems-ranging from tactical radio and visual signalling to advanced satellite-based systems-enables swift and accurate information exchange across naval units, aircraft, and shore establishments. The ability to securely transmit and receive critical data enhances decision-making, strengthens situational awareness, and bolsters the overall effectiveness of defence forces during both routine operations and high-intensity combat scenarios.

13. Furthermore, the structured organization of communication sub-departments—Operations and EW—ensures that different aspects of naval communication are efficiently managed. From cryptography and electronic warfare to real-time radio transmissions and traffic handling, each sub-department plays a crucial role in maintaining a secure and reliable communication network. As technology continues to evolve, modern advancements in digital communication and satellite systems will further enhance the Navy's ability to operate in complex and dynamic environments, reinforcing its strategic and operational capabilities.

DID YOU KNOW?

- **The Invention of the Mariner's Compass**: The 12th-century introduction of the magnetic compass revolutionized maritime communication by allowing sailors to share precise directions and navigate unfamiliar waters, facilitating global exploration.
- **Semaphore Signaling**: During the 18th and 19th centuries, semaphore towers and flag-based systems were widely adopted. Sailors used flag semaphore to communicate over distances by positioning flags in specific patterns to spell out messages.

Signal School, INS Venduruthy, Kochi

SUMMARY

- **Essential for Operations**. Naval communication is vital for coordinating complex operations, allowing ships, submarines, and aircraft to stay connected in real-time, even across vast distances.

- **Secure Messaging**. The Navy uses highly secure encrypted systems to transmit sensitive information, ensuring that enemy forces cannot intercept or decipher communications.

- **Signal Flags**. Before modern technology, the Navy used semaphore signals and flag signaling to send messages between ships, a colorful and visual way to communicate at sea.

- **Radio Waves**. Naval communication relies heavily on radio waves, allowing ships and submarines to communicate over long distances, even in the most remote locations of the ocean.

- **Satellite Integration**. Modern naval communications have advanced to include satellite communication systems, allowing global connectivity and real-time video feeds from remote operational areas.

SUGGESTED READ

Naval Communications Systems by Louis Piollet Spear

ASSESSMENT EXERCISE

Multiple Choice Questions

Q1. What is the primary role of naval communication?

(a) To ensure secure and uninterrupted trade routes
(b) To facilitate seamless coordination and execution of commands
(c) To provide entertainment for naval personnel
(d) To replace traditional navigation systems

Q2. Who oversees the communication department aboard a naval ship?

(a) Executive Officer
(b) Communication Chief
(c) Signal Communication Officer (SCO)
(d) Chief of Naval Staff

Q3. Which of the following is NOT a form of communication in the Navy?

(a) Sign language
(b) Radio waves
(c) Written scripts
(d) Morse Code only

Q4. Which invention revolutionized global communication and enhanced military operations?

(a) Radar
(b) Steam Engine
(c) Telephone by Alexander Graham Bell
(d) Submarine Sonar

Q5. What is the key objective of naval communication?

(a) To minimize risk of miscommunication during operations
(b) To increase public awareness about naval activities
(c) To provide entertainment during long voyages
(d) To ensure fast transmission of non-military information

Q6. Which of the following is NOT a primary type of military communication equipment?

(a) Combat Net Radios
(b) Secure tactical radios
(c) Laser-guided torpedoes
(d) Satellite navigation systems

Q7. What is the purpose of Rukmani, LINK II, MSS, and SB (Satellite Broadcast) in naval communication?

(a) Enhancing underwater sonar detection
(b) Providing advanced satellite communication systems
(c) Training naval personnel in cybersecurity
(d) Securing financial transactions for naval trade

Q8. Which of the following radio communication systems is typically used for long-range communication?

(a) UHF (Ultra High Frequency) radios
(b) VHF (Very High Frequency) radios
(c) HF (High Frequency) radios
(d) Infrared signal devices

Q9. What is the role of antennas in radio communication?

(a) To detect enemy aircraft
(b) To transmit and receive radio signals
(c) To decode encrypted messages
(d) To enhance satellite imagery

Q10. What is the main advantage of SATCOM (Satellite Communication) in the Indian Navy?

(a) Real-time and global communication capabilities
(b) Reducing the need for visual signals
(c) Replacing radio-based communication entirely
(d) Limiting enemy interception

Q11. Which type of wave requires a physical medium for propagation?

(a) Electromagnetic waves
(b) Mechanical waves
(c) Radio waves
(d) Space waves

Q12. Sky Wave Propagation is primarily used for:

(a) Communication between submarines
(b) Short-range tactical operations
(c) Long-distance radio transmission using the ionosphere
(d) Direct satellite communication

Q13. Which of the following is NOT a function of tactical communication under the operations sub-department?

(a) Visual signalling using flags, lights, and semaphores
(b) Offline cryptography for encoding sensitive messages
(c) Managing traffic flow of information across naval units
(d) Intercepting and countering enemy transmissions

Q14. Which of the following duties is primarily handled by the Operations sub-department of the Communication Department?

(a) Monitoring and intercepting enemy transmissions
(b) Tactical communication and associated equipment
(c) Providing early warning of enemy platforms
(d) Advanced electronic warfare techniques

Q15. The Electronic Warfare (EW) sub-department was earlier known as which branch?

(a) Tactics Branch
(b) Radio Branch
(c) Special Branch
(d) Cryptography Branch

One-word Objective Questions

Q1. Which technology has transformed naval communication?

Q2. What sub-department handles cryptography (offline)?

Q3. What does MDA stand for?

Q4. Which system handles traffic management for fleet operations?

Q5. Which department deals with electronic warfare?

Short Answer Type Questions

Q1. What is the purpose of naval communication during operations?

Q2. How does secure communication technology contribute to Maritime Domain Awareness (MDA)?

Q3. Describe the main role of the Operations sub-department of Communication Branch.

Q4. What functions are managed by the Electronics Warfare sub-department in Naval Communication?

NCC SPECIAL SUBJECT (NAVY)

NAVAL COMMUNICATION

CHAPTER 2: SEMAPHORE, PHONETIC ALPHABETS AND RADIO TELEPHONY (CODE-NC2)

"Clarity in communication is the bridge between confusion and understanding."

TEACHING INSTRUCTIONS

Period : **5 (200 Min)**
Type : **Theory/ Practical**
Year : **First Year – Theory, Second & Third Year - Practical**
Conducting Officer : **PI**

Training Aids : **Blackboard, whiteboard, projector, Semaphore Flags**

Time Plan

- **Introduction** : **05 Min**
- **Semaphore** : **20 Min**
- **Phonetic Alphabets** : **15 Min**
- **RT Procedure** : **20 Min**
- **RT Practical** : **15 Min**
- **Semaphore Practical** : **120 Min**
- **Conclusion** : **05 Min**

INTRODUCTION

1. Effective communication is crucial in naval operations, ensuring seamless coordination between units. Semaphore, a visual signalling method, allows for the rapid transmission of messages over short distances during daylight. By using flags in specific positions, it provides a reliable means of communication when radio silence is necessary or electronic systems are unavailable. Semaphore plays a vital role in fleet manoeuvres, maritime operations, and emergency situations, allowing ships to convey essential information efficiently.

2. In voice communication, certain alphabets may sound similar, leading to potential confusion, especially over radio circuits. To mitigate this, standardized phonetics are used, ensuring clarity and reducing misinterpretation. Maintaining brevity and accuracy in voice signalling is essential for effective communication, particularly during high-pressure situations. By following established voice procedures, naval personnel can exchange critical information swiftly and accurately, enhancing operational efficiency and safety

PREVIEW

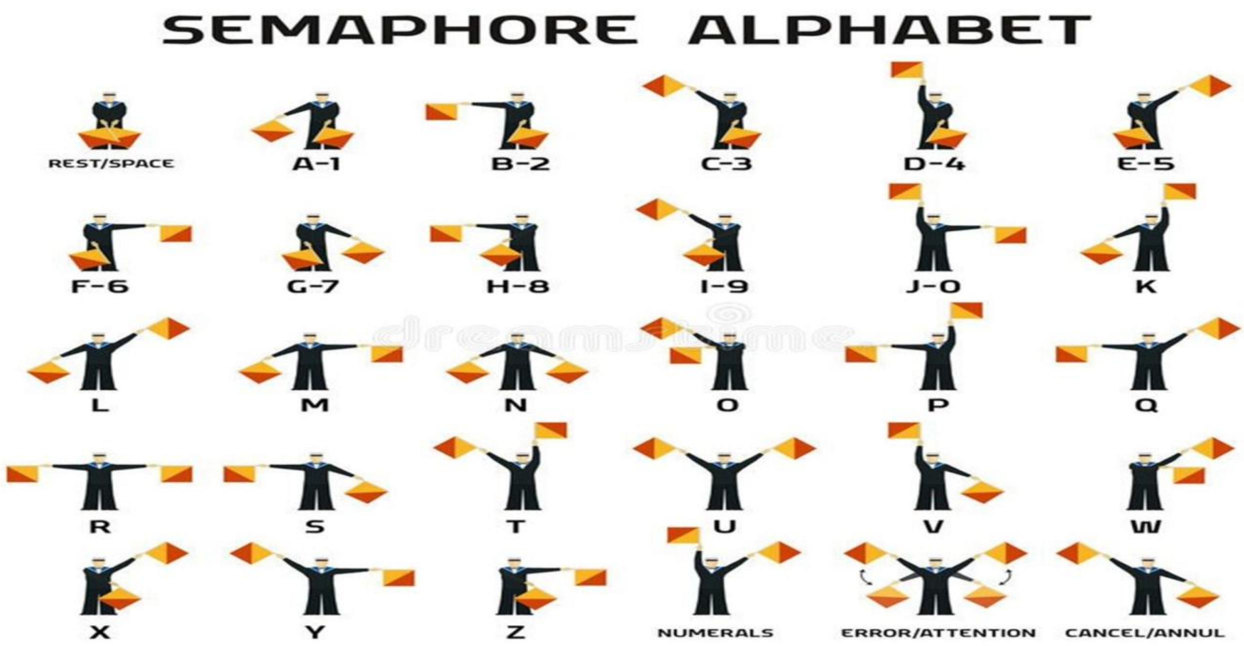
The lecture will be covered in following parts:-

- Part I: Semaphore Communication
- Part II: Phonetic Alphabets
- Part III: Radio Telephony

LEARNING OBJECTIVES

- Learn the basics of semaphore and its applications.
- Familiarize themselves with prosigns and techniques for remembering semaphore signals.
- Understand the importance of phonetic alphabets and radio telephony in clear communication.

PART I: SEMAPHORE



3. Semaphore is a visual means of communication which provides a rapid means for passing messages over short distances during daylight. The different semaphore signs are made by moving one or two hand flags so that they form various angles with the perpendicular. Each angle must be formed accurately, as precise communication relies on this correctness.

4. Alphabet and Special Signs. The alphabet and the special signs used are shown below. It should be noted that there are no special signs for numerals, which are always spelled out. The numeral sign is used to indicate that the numerals that follow are to be recorded as digits.

(a)	Answering Sign	By making 'C'
(b)	Attention Sign	By making 'U' and arms waved up and down
(c)	Direction Sign	By making 'J'
(d)	Front Sign	Made by crossing both flags in front of the body (to indicate the end of group or word)
(e)	Error sign	Made by succession of E's
(f)	Numerical Sign	Right hand at 'D' position, left hand at 'E' Position (numerals follow)

Semaphore Exercise

DID YOU KNOW?
➢ **Origins in Ancient Greece**. The concept of semaphore signaling dates back to ancient Greece, where fire and smoke signals were used for long-distance communication. However, the modern semaphore system as we know it was developed in the late 18th century.

5. **Prosigns used in Semaphore**. Prosign is a single letter or a combination of letters which are transmitted as a single character to convey a specific meaning. Some prosigns which are used in Semaphore and their use are given below:-

Sign	Meaning	Sign	Meaning
BT	Break	**WB**	Word Before
MIM	Comma	**AR**	End of Transmission
KN	(Open Brackets	**II**	Separative Sign
KK	) Close Brackets	**AS**	Wait
AAA	Full Stop	**XE**	Slant
DU	Hyphen	**B**	More to follow
C	Correct	**WA**	Word After

6. **Learning Semaphore**. How to Remember

1st Circle : A to G (Single arm signs)

2nd Circle : H to N (omitting J, Right hand at A position)

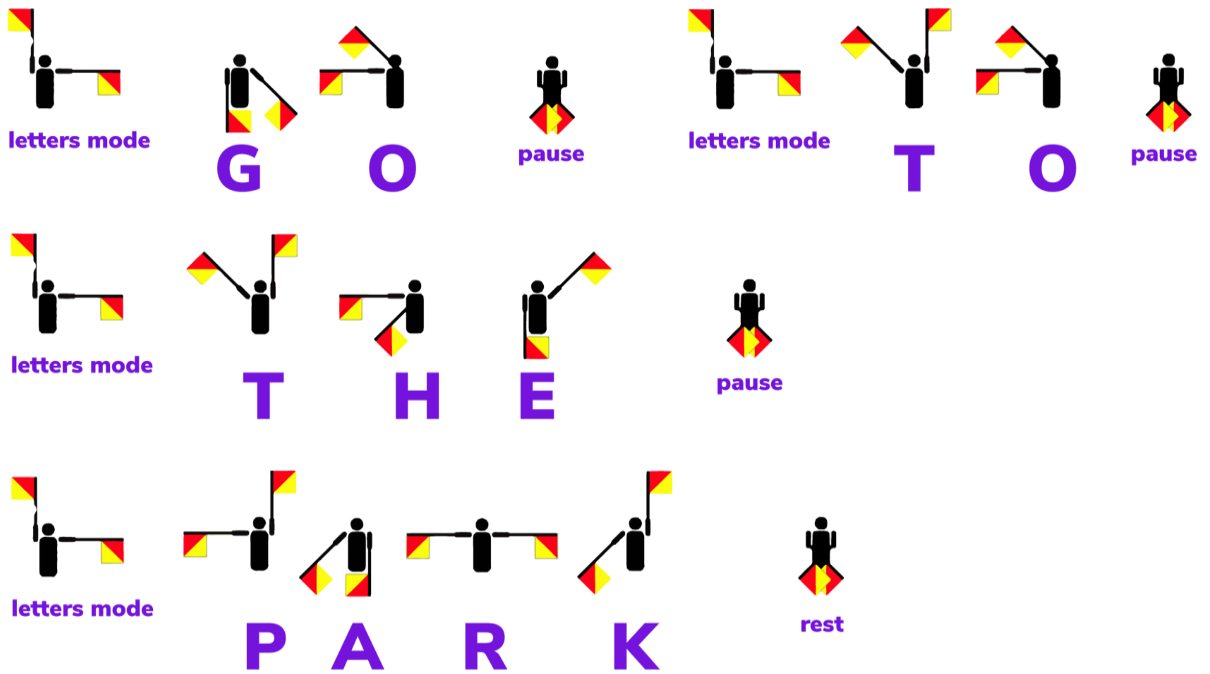
3rd Circle : O to S (Rt hand at B Position)

4th Circle : T, U, Y (Rt hand at C position)

5th Circle : J, V (Right hand at D position)

To complete : W, X, Z

7. **Semaphore Demonstration**. Suppose one has to tell someone to 'GO TO THE PARK' using semaphore flags. Here is the demonstration:-



8. **Semaphore Practical**. Practical training will be conducted by PI Staff to provide hands-on experience with semaphore signalling.

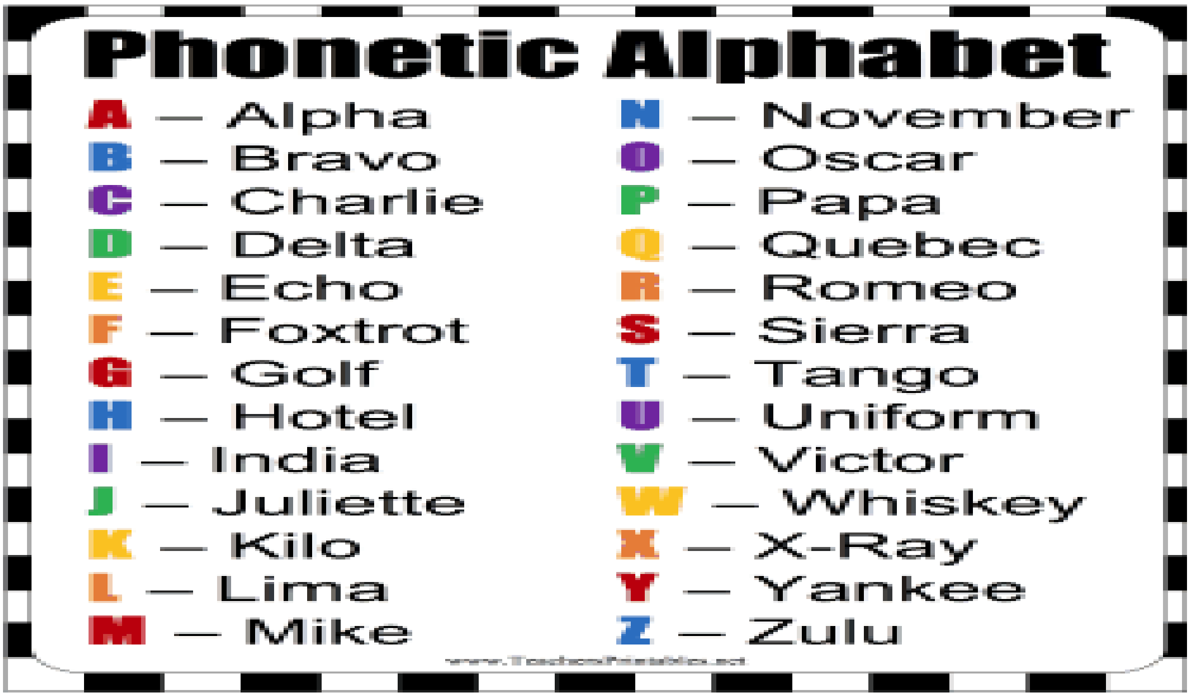
DID YOU KNOW?

- **Invention of the Semaphore Telegraph**. The semaphore telegraph, invented by Claude Chappe in 1792, was one of the first forms of long-distance communication. It consisted of a series of towers with pivoting arms to convey messages over great distances, often used in military and postal services.

- **Visual Communication**. Semaphore signaling involves two hand-held flags or mechanical arms that are positioned at specific angles to represent letters and numbers. The system relies on the visual observation of these signals, making it an essential tool for communication in areas with no radio or telecommunication infrastructure.

PART II: PHONETIC ALPHABETS

9. **Phonetic Alphabets**. When the letters of the alphabet are read out it will be observed that some of them sound very similar especially on radio telephone. This can cause confusion when important messages are being passed. To minimize confusion during radio communication, phonetic alphabets are used, where each letter corresponds to a specific word. The Phonetic alphabets are as follows:

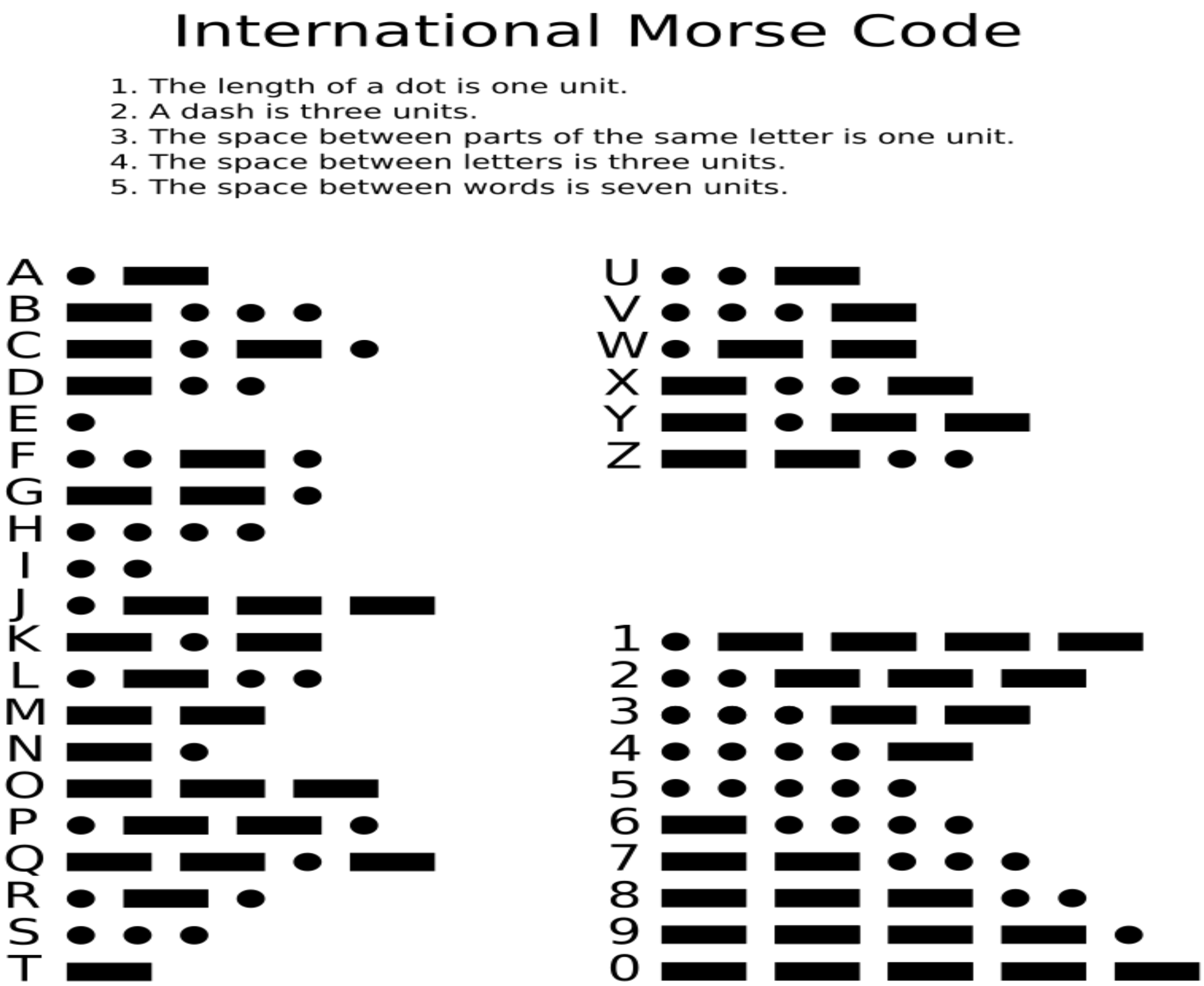


Morse Code

10. Morse code is a telecommunications method which encodes text characters as standardized sequences of two different signal durations, called dots and dashes, or dits and

dahs. Morse code is named after Samuel Morse, one of the early developers of the system adopted for electrical telegraphy.

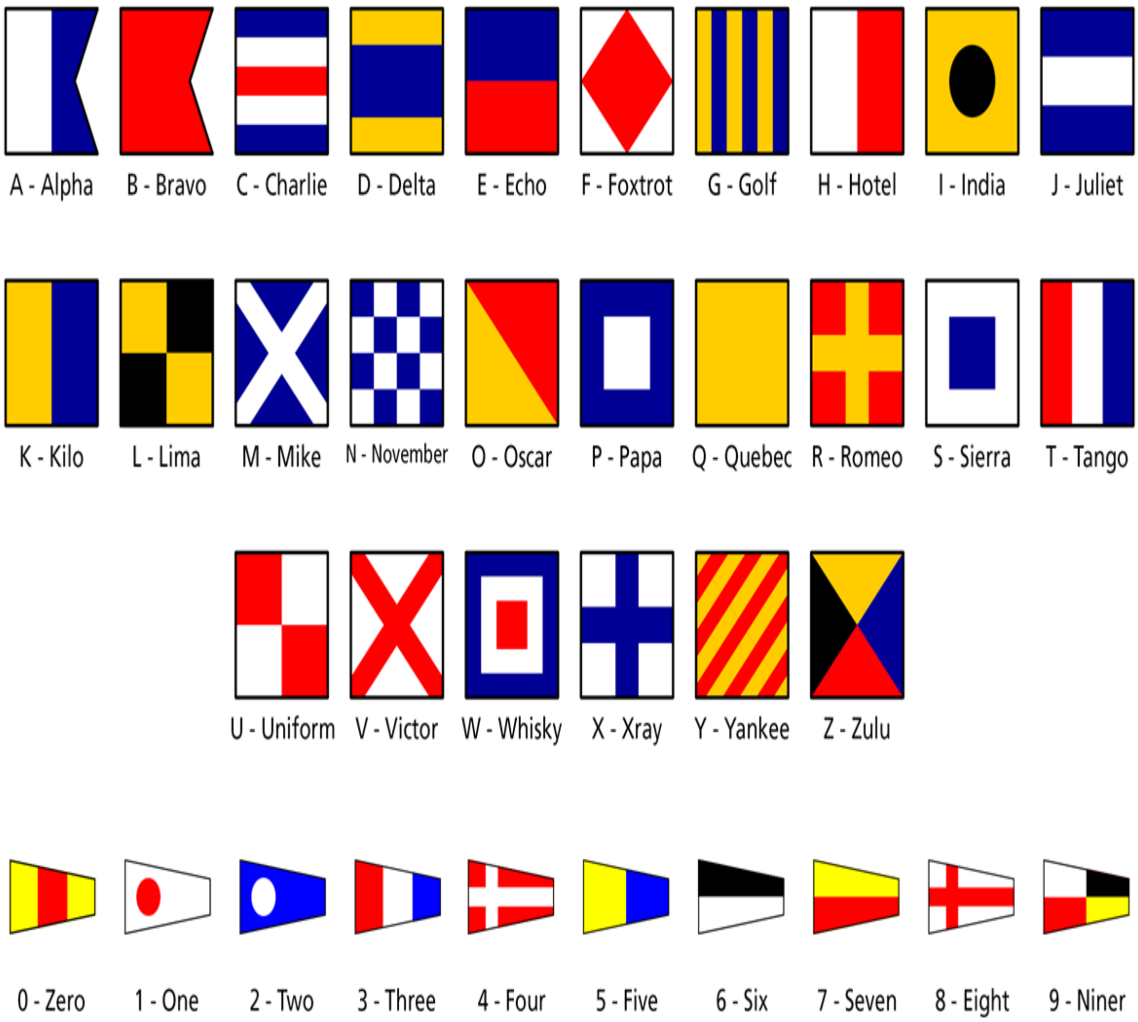
DID YOU KNOW?
➢ **Used at Sea and in Railways**. Semaphore signaling was widely used both in maritime contexts and in railway systems for controlling train traffic. In the maritime world, ships used semaphore flags to signal with each other over short distances, while railroads used semaphore signals to indicate track conditions and train statuses.
➢ **International Semaphore Code**. The International Code of Signals (ICS), which includes semaphore as one of its methods, allows ships worldwide to communicate messages about navigation, distress, and safety. It became the foundation for maritime signaling, alongside the use of other methods like Morse code and radio communication.



International Flags

11. International maritime signal flags are various flags used to communicate with ships. The principal system of flags and associated codes is the International Code of Signals. Various navies have flag systems with additional flags and codes, and other flags are used in special

uses, or have historical significance. Ships communicate using flags that represent letters and numerals.



International Flags for Communication

PART III: RADIO TELEPHONY

12. Radio Telephony (R/T) is a crucial method of naval communication that involves the transmission of voice messages over radio waves. It allows for real-time, secure, and efficient communication between ships, aircraft, and shore establishments. Unlike Morse code or digital signals, R/T enables direct speech transmission, reducing the chances of misinterpretation and ensuring rapid information exchange during operations.

13. In naval operations, radio telephony is widely used for tactical coordination, emergency communication, and command execution. It operates on different frequency bands, including Very High Frequency (VHF) and Ultra High Frequency (UHF), depending on the range and operational requirements. To enhance clarity and avoid confusion due to similar-sounding words, naval forces use a standardized phonetic alphabet and voice procedure protocols, ensuring smooth and effective communication during critical missions.

Radio Set for Communication

14. **Example of Radio Telephony in Naval Communication**. A naval warship communicating with a shore command centre during an operation:

> *Ship: "Command, this is INS Vikrant. Requesting permission to proceed to waypoint Alpha, over."*
>
> *Shore Command: "INS Vikrant, this is Command. Permission granted. Proceed to waypoint Alpha and maintain radio silence until further orders, over."*
>
> *Ship: "Roger, Command. Proceeding to waypoint Alpha. Vikrant out."*

15. In this example, clear and concise voice communication is used, following standard radio telephony procedures like using call signs, structured messages, and "over" to indicate the end of a transmission.

Communication using Ship's Main Broadcast

DID YOU KNOW?
➢ **Morse code** was invented in 1837 by Samuel Morse and Alfred Vail, nearly 40 years before the telephone.

CONCLUSION

16. Effective communication is the backbone of naval operations, ensuring the seamless exchange of information between ships, aircraft, and shore establishments. Semaphore, as a visual signalling method, remains an essential tool for short-distance communication, particularly when electronic systems are unavailable or radio silence is necessary. By mastering semaphore signs, prosigns, and practical demonstrations, naval personnel can transmit critical messages accurately and efficiently. Additionally, phonetic alphabets play a crucial role in eliminating ambiguity in voice transmissions, enhancing clarity, and preventing errors in radio communication.

17. Furthermore, radio telephony stands as a vital component of naval communication, enabling real-time coordination and rapid response in tactical and emergency situations. By employing standardized protocols and designated frequency bands, naval forces ensure secure and effective information exchange. The integration of semaphore, phonetic alphabets, and radio telephony reinforces operational efficiency, safety, and mission success. Mastery of these communication techniques remains essential for naval personnel, enabling them to navigate complex maritime environments with precision and confidence.

SUMMARY

➢ **Visual Signaling**. Semaphore uses two handheld flags to communicate messages by positioning them at specific angles to represent letters, allowing for visual communication over long distances.

➢ **Quick and Efficient**. Semaphore is one of the fastest forms of visual communication, with skilled operators able to transmit messages at impressive speeds, even in poor weather.

➢ **International Use**. Semaphore signaling was widely adopted by navies and militaries worldwide, including the Indian Navy, for ship-to-ship and ship-to-shore communication.

➢ **Flag Positions**. There are 8 standard positions for the flags, each corresponding to a letter of the alphabet, making it easy to send coded messages without needing a complex codebook.

➢ **Legacy in Modern Communication**. Although modern technology has surpassed semaphore, it is still used today in maritime training and during power outages when electronic systems fail.

SUGGESTED READ

Naval Communications Systems: by Louis Piollet Spear

ASSESSMENT EXERCISE

Multiple Choice Questions

Q1. What is the primary purpose of semaphore communication in naval operations?

(a) Long-range communication
(b) Secure voice transmission
(c) Rapid short-distance messaging during daylight
(d) Satellite-based communication

Q2. Which of the following signs is used to indicate an error in semaphore?

(a) C
(b) E (successive E's)
(c) J
(d) U

Q3. What does the semaphore sign "BT" stand for?

(a) Break
(b) End of transmission
(c) Word After
(d) Hyphen

Q4. Which of the following letters does NOT have a separate sign in semaphore?

(a) J
(b) K
(c) Z
(d) Numerals

Q5. In the phonetic alphabet, what word represents the letter "B"?

(a) Bravo
(b) Beta
(c) Baker
(d) Boston

Q6. Why is the phonetic alphabet used in radio communication?

(a) To speed up transmissions
(b) To avoid misinterpretation of similar-sounding letters
(c) To replace Morse code
(d) To ensure encryption of messages

Q7. Which of the following is NOT a prosign used in semaphore?

(a) KN
(b) AR
(c) XE
(d) TQ

Q8. What is the role of "AR" in radio telephony communication?

(a) Acknowledgement of message
(b) End of transmission
(c) Indicating urgency
(d) Requesting clarification

Q9. What frequency bands are commonly used for naval radio telephony communication?

(a) AM and FM
(b) HF and LF
(c) VHF and UHF
(d) Microwave and Infrared

Q10. What is the correct response when receiving an unclear radio transmission?

(a) "Repeat"
(b) "Say Again"
(c) "Over"
(d) "Copy that"

Q11. What type of wave propagation is primarily used for Very High Frequency (VHF) radio communication?

(a) Sky wave
(b) Ground wave
(c) Space wave
(d) Water wave

Q12. In the example of radio telephony communication given in the content, which phrase indicates the end of a transmission?

(a) "Roger, over"
(b) "Vikrant out"
(c) "Proceed to waypoint"
(d) "Permission granted"

Q13. What is the primary purpose of radio telephony (RT) in naval operations?

(a) Encrypting naval messages
(b) Transmitting voice messages in real time
(c) Providing digital data links
(d) Communicating via Morse code

Q14. What does the prosign "AS" indicate in semaphore communication?

(a) Break
(b) More to follow
(c) Wait
(d) Full stop

Q15. What practical activity is included in the training schedule for this module?

(a) Coding and decoding Morse code
(b) Outdoor semaphore practice
(c) Submarine radio telephony drills
(d) Visual signalling with flashing lights

One-word Objective Questions

Q1. What minimizes confusion in radio communication?

Q2. Which code uses dots and dashes to relay messages?

Q3. What communication method involves two flags and outstretched arms?

Q4. What letter in the phonetic alphabet corresponds to “India”?

Q5. What sign in semaphore indicates “attention”?

Short Answer Type Questions

Q1. What is the purpose of using phonetic alphabets in radio communication?

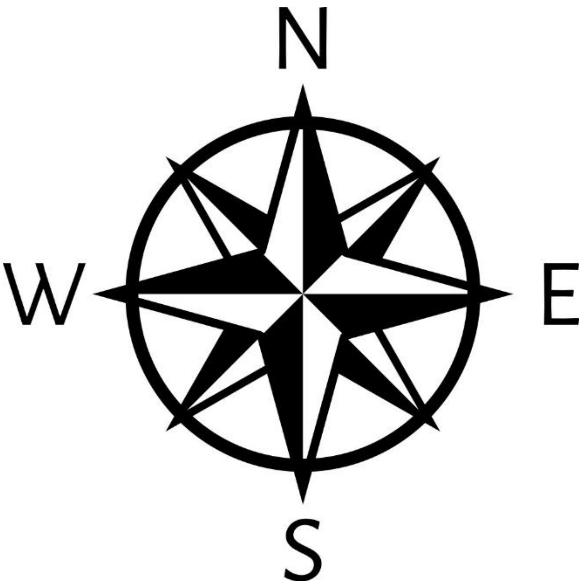
Q2. How is Morse code used to relay messages?

Q3. Explain how semaphore is used for visual communication.

Q4. What are prosigns, and why are they important in semaphore signalling?

Q5. How can cadets categorize semaphore signs for easier memorization?

3



NAVIGATION

3

SECTION INDEX : NAVIGATION (SD/ SW)

NCC SPECIAL SUBJECT (NAVY)

NAVIGATION

CHAPTER 1: INTRODUCTION TO BASICS OF SHIP NAVIGATION (CODE N-1)

"True navigation begins in the mind and ends in the heart, where purpose aligns with the stars."   Captain Mohan Singh Kohli *(Indian mountaineer and Naval officer)*

TEACHING INSTRUCTIONS

Period : 1 (40 Min)
Type : Theory
Year : First
Conducting Officer : PI

Training Aids : Blackboard, chalk, whiteboard, marker, projector.

Time Plan

- **Introduction** : 05 Min
- **Basic of Navigation** : 10 Min
- **Navigation Terminology** : 10 Min
- **Methods of Navigation** : 10 Min
- **Conclusion** : 05 Min

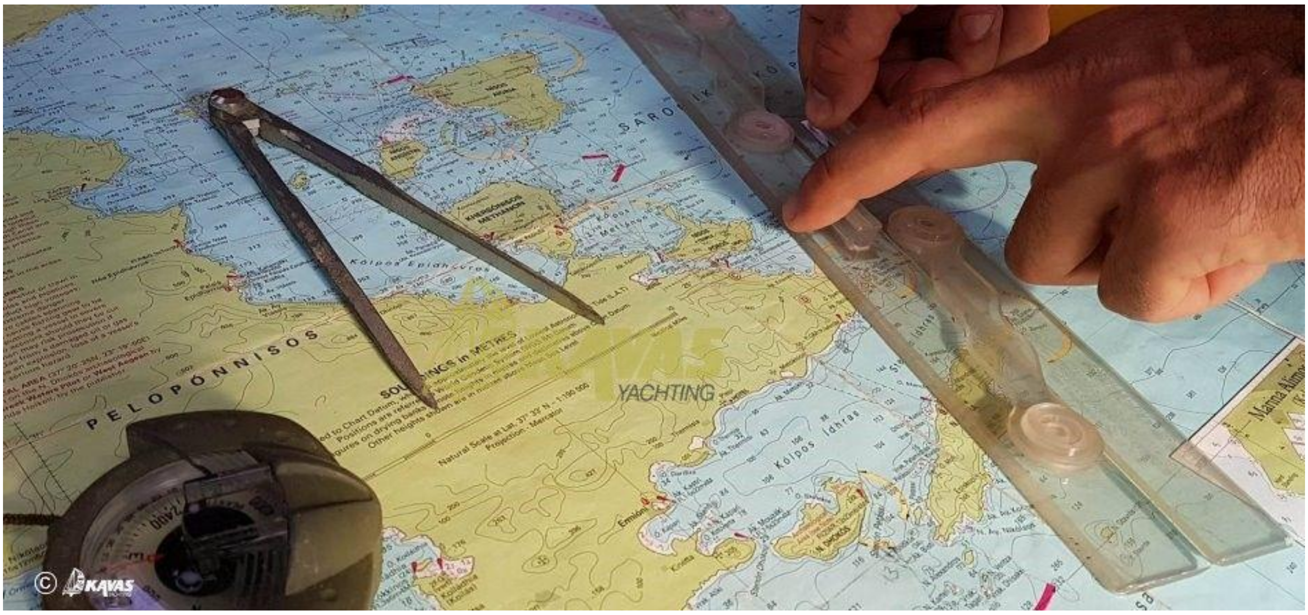
INTRODUCTION

1. Navigation is a fundamental skill that allows us to guide vehicles such as ships, aircraft, and even spacecraft safely from one location to another. In the context of marine navigation, it plays a crucial role in ensuring vessels stay on course, avoid hazards, and reach their destinations efficiently. Over the centuries, navigation techniques have evolved from simple celestial observations to advanced satellite-based systems like GPS, which can pinpoint a ship's location with remarkable accuracy. Understanding the principles of navigation is essential for sailors, as it enables them to make informed decisions and maintain control over their vessels in different maritime conditions.

2. This lesson will introduce cadets to the core concepts of navigation, including key terminology and measurement systems used at sea. By exploring fundamental ideas such as latitude, longitude, meridians, and the nautical mile, cadets will gain a solid foundation in marine navigation. Additionally, they will learn about the various types of compasses and their significance in guiding ships. With a strong grasp of these basics, cadets will be better equipped to navigate safely and effectively, preparing them for further studies in advanced navigational techniques and real-world maritime operations.

PREVIEW	LEARNING OBJECTIVES
The lecture will be covered in following parts:- ➢ Part I: Introduction to Navigation ➢ Part II: Basic Terminologies ➢ Part III: Methods of Navigation	➢ To learn basics of navigation and its terminologies ➢ To learn about methods of navigation.

PART I: WHAT IS NAVIGATION



3. **Introduction to Navigation**. Navigation is the process of planning, directing, and controlling the movement of a vehicle—such as a ship, aircraft, car, or spacecraft—from one place to another. It involves determining the current position, choosing the best route, and ensuring the vehicle stays on course to reach its destination safely and efficiently.

4. In marine navigation, sailors use tools like maps, compasses, GPS, and other instruments to track their position and avoid obstacles. Traditional methods, such as celestial navigation using the stars, have evolved into modern systems like satellite-based GPS, which provides highly accurate positioning. Navigation is essential for safe travel, helping to prevent collisions, avoid hazards, and optimize routes

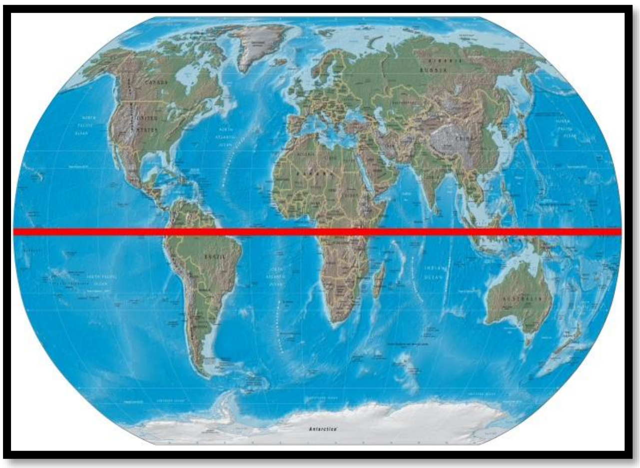
DID YOU KNOW?
➢ **Phoenician Pioneers**. The Phoenicians, who lived around 1200 BCE, are often credited as some of the first to master long-distance sea navigation. They used the North Star for nighttime navigation and created detailed maps of their routes across the Mediterranean, laying the foundation for future maritime exploration.
➢ **The Age of Exploration and Portolan Charts**. During the 14th and 15th centuries, sailors began using portolan charts—detailed maps showing coastlines, ports, and the directions of prevailing winds. These charts were essential during the Age of Exploration, as they helped navigators' chart more accurate courses across the world's oceans.

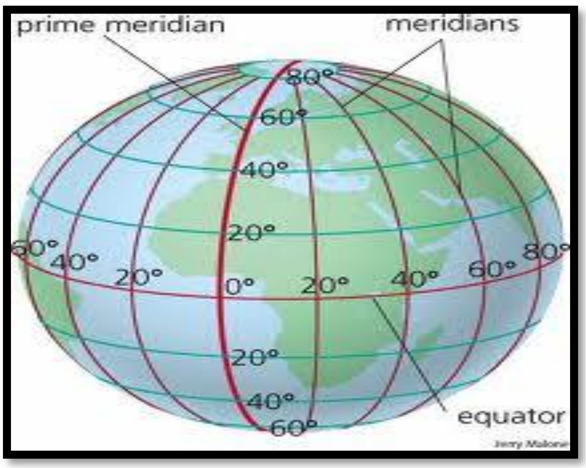
PART II: BASIC TERMINOLOGY

5. **East and West**. The direction in which the Earth spins is called east, and the opposite direction is called west.

6. **Great Circle**. When a plane cuts through the centre of the Earth, the shape it makes is called a great circle.

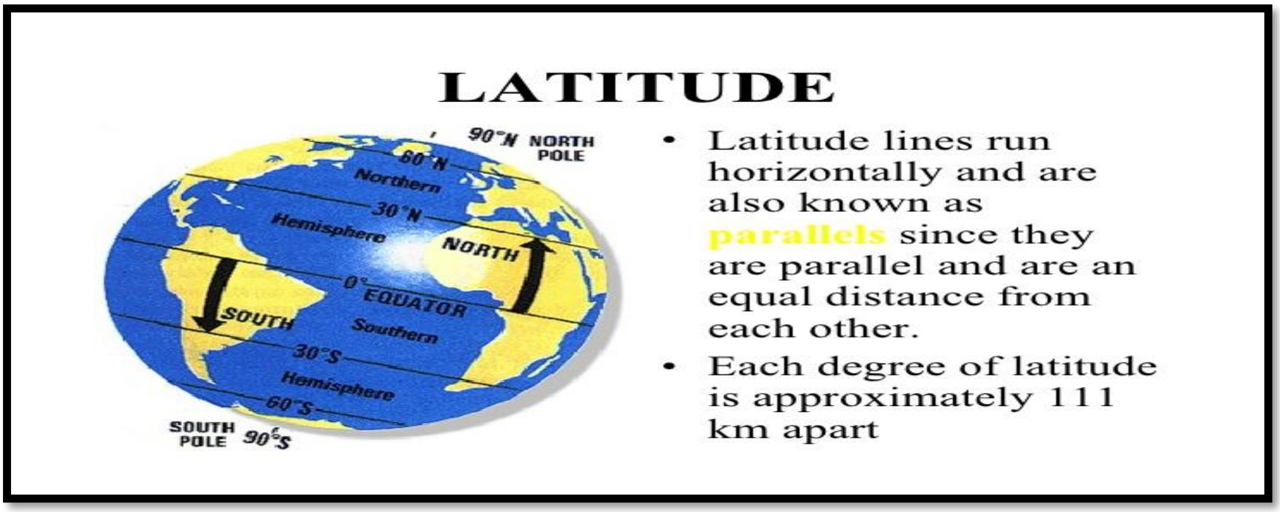
7. **Meridians**. These are half-circles that connect the North and South Poles and are at a right angle to the equator.



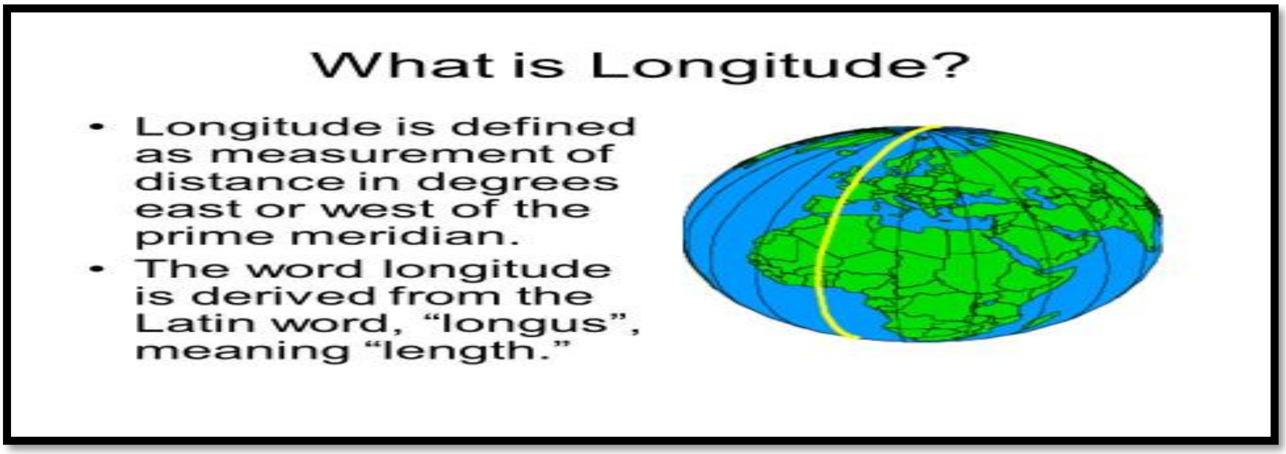


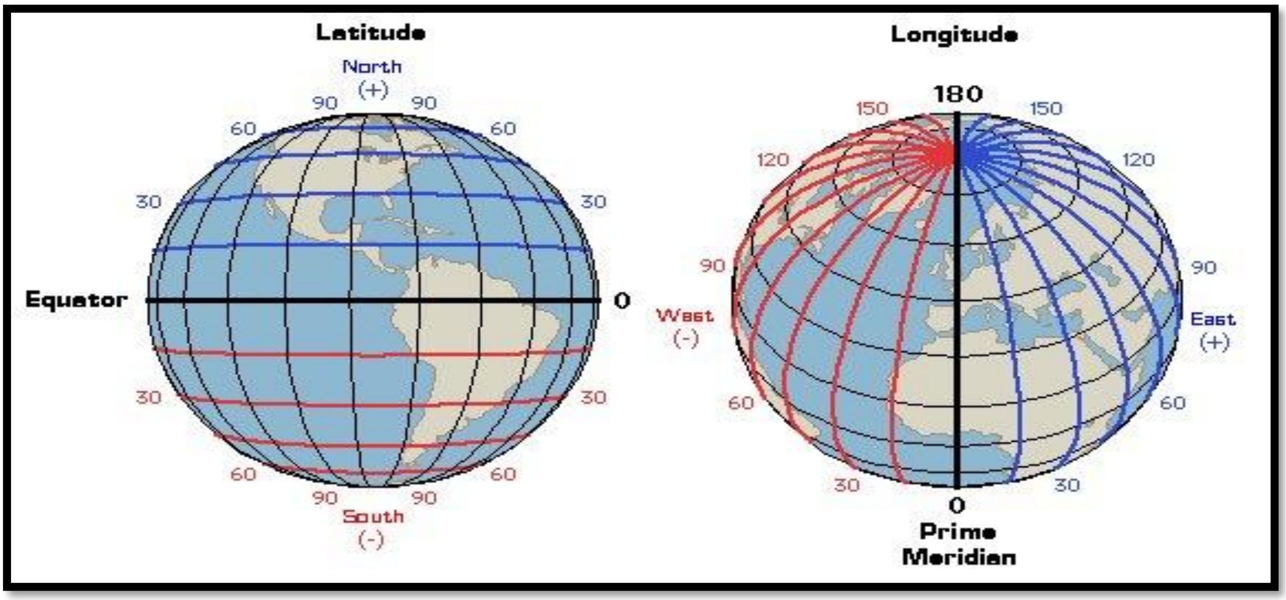
Equator

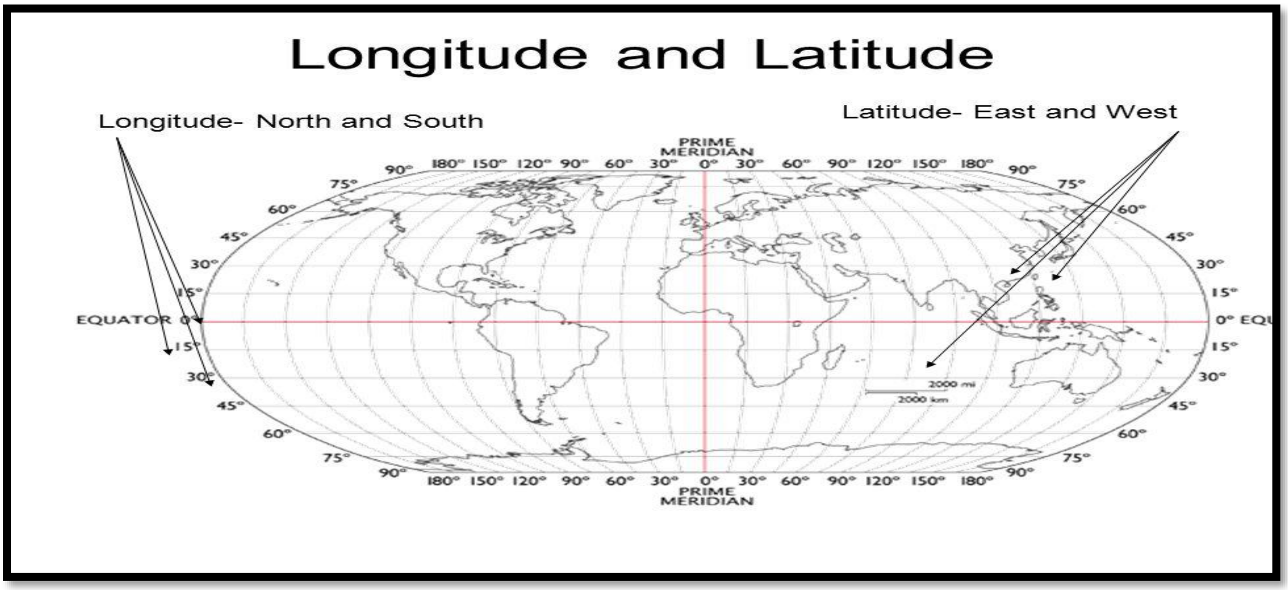
8. **Latitude**. The latitude of a place is the angle between that place and the equator. It is measured from 0 to 90 degrees, either north or south of the equator.



9. **Longitude**. The longitude of a place is the angle between the Prime Meridian (which runs through Greenwich) and the line of that place. It is measured from 0 to 180 degrees, either east or west of Greenwich.

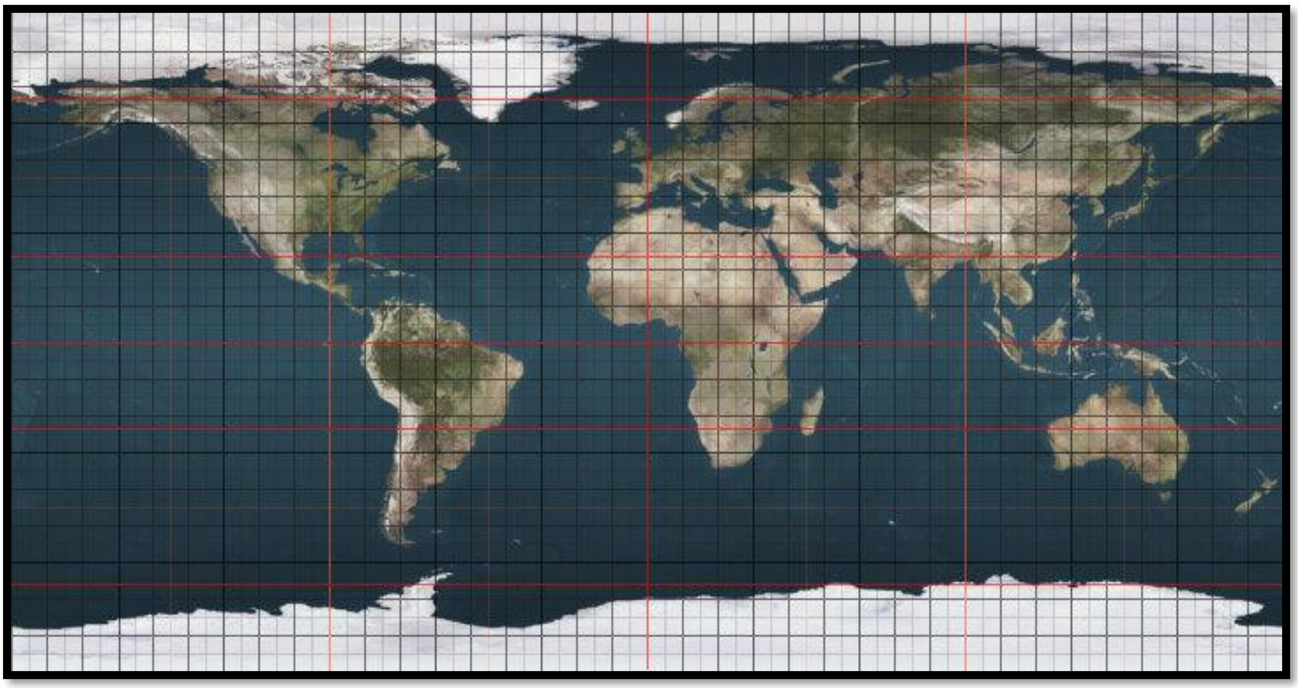






10. **The Sea Mile**. A sea mile is the distance along the Earth's surface measured in degrees, and it changes based on where you are. At the equator, a sea mile is about 1,843 meters long, but as you get closer to the poles, it can be longer, up to about 1,862 meters. On average, a sea mile is somewhere in between these two lengths, depending on your location. Also, a cable is a measurement used at sea that is about 200 yards long, which helps sailors navigate more easily.

11. **Geographical Mile**. A geographical mile is the distance of 1 minute of arc (which is a small part of a circle) measured along the equator. Since the equator is a complete circle, the length of a geographical mile is the same everywhere along it. This distance is about 1,855.4 meters.



12. **International Nautical Mile**. The standard length of a nautical mile is 1,852 meters, and it's usually written as "NM". When you look at distance tables for ships or maps of ocean routes, the distances are measured in international nautical miles.

13. **Knot**. In navigation, it's helpful to have a standard way to measure speed. This standard unit is called a knot, which means one international nautical mile (1,852 meters) per hour. It's usually written as "kn".

DID YOU KNOW?
➢ **The Invention of the Astrolabe**. In the 15th century, navigators in Europe began using the astrolabe, a device that allowed them to measure the angle between the sun or stars and the horizon. This helped sailors calculate their latitude at sea and greatly improved the accuracy of navigation.
➢ **The First Chronometer**. The invention of the marine chronometer in the 18th century by John Harrison revolutionized navigation by allowing sailors to accurately calculate longitude. Before the chronometer, sailors could only estimate their position based on latitude, but this device enabled precise mapping of both latitudes and longitudes.
➢ **The Advent of Radio Navigation**.In the early 20th century, the advent of radio navigation systems significantly changed ship navigation. By using radio signals, ships could determine their position even when far from shore. This innovation laid the groundwork for modern GPS systems and the ability to navigate in all conditions.

PART III: METHODS OF NAVIGATION

14. Navigation methods have evolved over time, incorporating both traditional and modern techniques to ensure safe and accurate travel. The primary methods of navigation include celestial navigation, dead reckoning, pilotage, electronic navigation, and satellite navigation.

(a) **Celestial Navigation**. This is one of the oldest methods, relying on the positions of celestial bodies like the sun, moon, stars, and planets. Using a sextant and nautical almanacs, navigators calculate their position based on the angles of these celestial objects. This method was widely used before the invention of modern navigation systems.

(b) **Dead Reckoning (DR)**. This method estimates a vessel's position based on its previously known position, speed, time, and direction. It does not account for external factors like wind or currents, so errors can accumulate over time. DR is often used in combination with other navigation techniques for greater accuracy.

(c) **Pilotage**. This method involves navigating using visible landmarks, such as lighthouses, buoys, and coastlines. It is commonly used in coastal waters and harbours where navigators can rely on fixed objects for orientation.

(d) **Electronic Navigation**. With advancements in technology, electronic systems such as radar, sonar, and radio navigation aids (like LORAN and VOR) help determine a ship's location. These systems provide real-time data and are widely used for precise navigation.

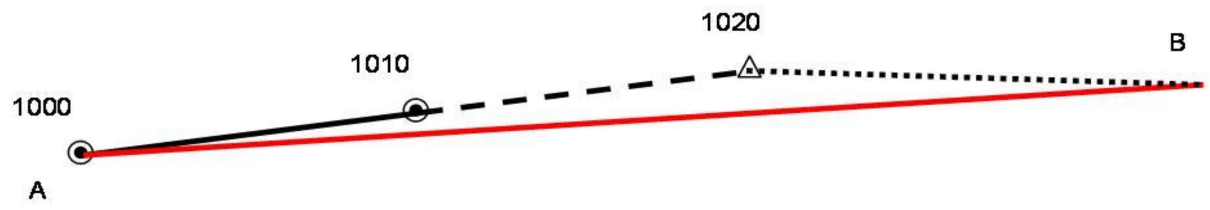
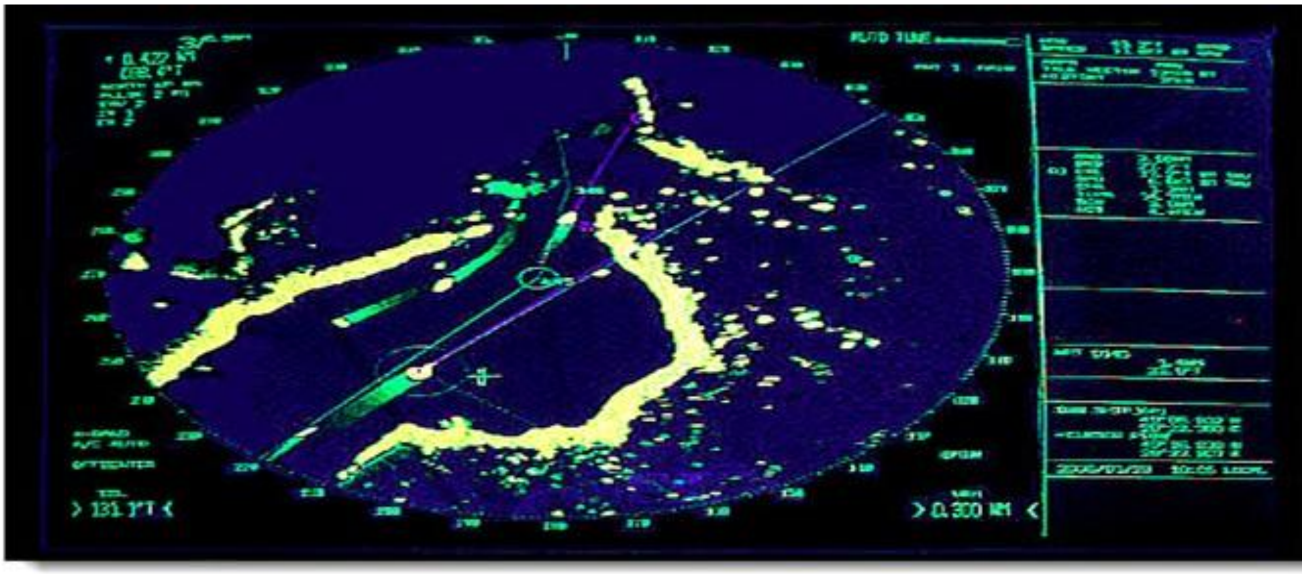


Figure 1. DR Navigation
At 1000 the aircraft position is fixed with a pinpoint. Ten minutes later the aircraft position is again fixed over a pinpoint. Assuming the heading, airspeed and wind have remained the same, in the next ten minutes the aircraft will continue on the same track and will travel the same distance as between the 1000 and 1010 fixes. This position at 1020 is known as the DR Position. The track between DR position and destination can be measured and at 1020 an alteration of heading made to regain track.

Dead Reckoning

Pilotage inside Harbour



Radar Display

(e) **Satellite Navigation (GPS)**. The most advanced and widely used method today, satellite navigation systems like the GPS provide accurate position data using signals from satellites. This method enables precise tracking of location, speed, and direction, making it indispensable for modern maritime and air navigation.

Multiple Sensor Display

CONCLUSION

15. In conclusion, navigation is a fundamental skill that ensures the safe and efficient movement of vessels across vast distances. Over time, navigation techniques have evolved from traditional methods like celestial navigation and dead reckoning to advanced electronic and satellite-based systems. Understanding key concepts such as latitude, longitude, meridians, and different nautical measurements helps navigators determine precise positions and avoid potential hazards at sea. The ability to navigate accurately is crucial for maritime operations, ensuring ships reach their destinations safely while optimizing routes for efficiency.

16. With the advent of modern technology, navigation has become more precise and reliable. GPS and other satellite-based systems now provide real-time data, significantly reducing the chances of errors. However, traditional methods like pilotage and dead reckoning remain essential, especially in situations where electronic systems may fail. A strong foundation in navigation principles equips individuals with the skills needed to adapt to different conditions and challenges at sea. As technology continues to advance, integrating both traditional knowledge and modern innovations will ensure safe and effective navigation for future generations.

SUMMARY

- **Compass is Key**. The magnetic compass is a sailor's best friend, helping them determine direction even when visibility is poor or in remote locations.
- **Dead Reckoning**. Early sailors relied on dead reckoning, which involves calculating a ship's position by using the speed, time, and direction of travel—long before GPS was available.
- **Celestial Navigation**. Sailors used to navigate by the stars, using instruments like the sextant to measure the angle of celestial bodies above the horizon and determine their position at sea.
- **Charts and Maps**. Ships use nautical charts, which are specially designed maps that show depths, hazards, and other important features to guide the crew safely to their destination.
- **Radar**. Modern navigation systems use radar to detect other ships, landmasses, and obstacles, allowing for safe navigation even in poor visibility or at night.

SUGGESTED READ

BR 45 Vol-1

ASSESSMENT EXERCISE

Multiple Choice Questions

Q1. What is the primary purpose of marine navigation?

(a) To explore new territories
(b) To guide ships safely and efficiently from one location to another
(c) To improve ship speed
(d) To track the weather conditions

Q2. What does a great circle represent?

(a) A small circle on the Earth's surface
(b) A circle passing through the centre of the Earth
(c) A circular route of a ship
(d) A fixed route between two points

Q3. Which of the following is the oldest method of navigation?

(a) Satellite Navigation
(b) Dead Reckoning
(c) Celestial Navigation
(d) Electronic Navigation

Q4. What is the angle measured north or south of the equator called?

(a) Longitude
(b) Latitude
(c) Meridian
(d) Compass heading

Q5. Which of the following meridian is considered as 0 degrees longitude?

(a) International Date Line
(b) Equator
(c) Prime Meridian
(d) Tropic of Cancer

Q6. What is the standard length of an international nautical mile?

(a) 1,600 meters
(b) 1,852 meters
(c) 1,500 meters
(d) 2,000 meters

Q7. A vessel's speed is measured in which unit?

(a) Miles per hour
(b) Kilometres per hour
(c) Knots
(d) Meters per second

Q8. What is the term for estimating a ship's position based on its last known position, speed, time, and direction?

(a) Celestial Navigation
(b) Dead Reckoning
(c) Pilotage
(d) GPS Navigation

Q9. Which method of navigation relies on visible landmarks like lighthouses and coastlines?

(a) Dead Reckoning
(b) Pilotage
(c) Celestial Navigation
(d) Satellite Navigation

Q10. What is the main advantage of GPS navigation?

(a) It requires no electricity
(b) It provides highly accurate real-time positioning
(c) It does not require satellites
(d) It depends only on the weather

Q11. What instrument is traditionally used in celestial navigation?

(a) Radar
(b) Sextant
(c) GPS Receiver
(d) Sonar

Q12. Which of the following is NOT an electronic navigation method?

(a) GPS
(b) Radar
(c) Sonar
(d) Dead Reckoning

Q13. What is the significance of the Prime Meridian in navigation?

(a) It marks the division between the Northern and Southern Hemispheres
(b) It is the reference point for measuring longitude
(c) It is used to measure latitude
(d) It is where the Earth spins fastest

Q14. What is a "knot" in navigation?

(a) A loop in a rope
(b) A measure of depth
(c) A unit of speed equal to one nautical mile per hour
(d) A ship's turning angle

Q15. Which of the following is a benefit of traditional navigation methods like celestial navigation and dead reckoning?

(a) They are not affected by electronic failures
(b) They require no skill to use
(c) They are more accurate than GPS
(d) They do not require training

One-word Objective Questions

Q1. What direction is opposite to East?

Q2. What term refers to half-circles connecting the North and South Poles?

Short Answer-Type Questions

Q1. Explain the concept of a "great circle" in marine navigation.

Q2. What is the difference between the geographical mile and the international nautical mile?

NCC SPECIAL SUBJECT (NAVY)

NAVIGATION

CHAPTER 2: SIMPLE CHART WORK (CODE N-2)

"An accurate chart is a captain's most trusted ally on unpredictable seas"
K. M. Nanavati

TEACHING INSTRUCTIONS

Period : 2 (80 Min)
Type : Theory/ Practical
Conducting Officer : PI
Year : Second

Training Aids : Whiteboard, Projector, Compass, Charts, Ruler

Time Plan

- Introduction : 05 Min
- Types of Projection : 10 Min
- Types of Charts : 10 Min
- Information on Charts : 10 Min
- Conclusion : 05 Min
- Practical : 40 Min

INTRODUCTION

1. Maps and charts play a crucial role in navigation, helping sailors and navigators determine their position and plot accurate routes. To represent the curved surface of the Earth on a flat surface, different types of projections are used, each designed to minimize distortion in specific ways. Projections such as Mercator, Gnomonic, and Lambert conformal are commonly used in marine navigation, with each serving different purposes based on the navigator's needs. Understanding these projections is essential for interpreting charts correctly and ensuring precise navigation at sea.

2. Marine charts, which are specialized maps designed for navigation, come in various types, including general charts, coastal charts, and harbor charts, each offering different levels of detail. These charts contain crucial information such as depth soundings, navigational hazards, tidal data, and landmarks that help sailors safely traverse the waters. By understanding the different types of charts and the information they provide, navigators can make informed decisions to ensure safe and efficient voyages.

PREVIEW	LEARNING OBJECTIVES
➢ Part I: Types of Projection. ➢ Part II: Types of Charts. ➢ Part III: Information on Charts	➢ To learn about different types of navigational charts. ➢ To understand how to gather important information from charts. ➢ To practice using charts to plot and navigate courses for ships.

PART I: TYPES OF PROJECTIONS

3. **Mercator Projection**. The Mercator Projection is a cylindrical map projection in which the Earth's surface is projected onto a cylinder that touches the equator. It was introduced by Gerardus Mercator in 1569 and is widely used in maritime navigation. This projection preserves direction, making it highly valuable for plotting straight-line courses, also known as rhumb lines or loxodromes. However, it distorts size and shape, especially near the poles, where landmasses appear much larger than they actually are.

4. **Properties of Mercator Projection**.

(a) **Conformal Projection**. It preserves angles and shapes locally, making it useful for navigation, but it distorts area, especially towards the poles.

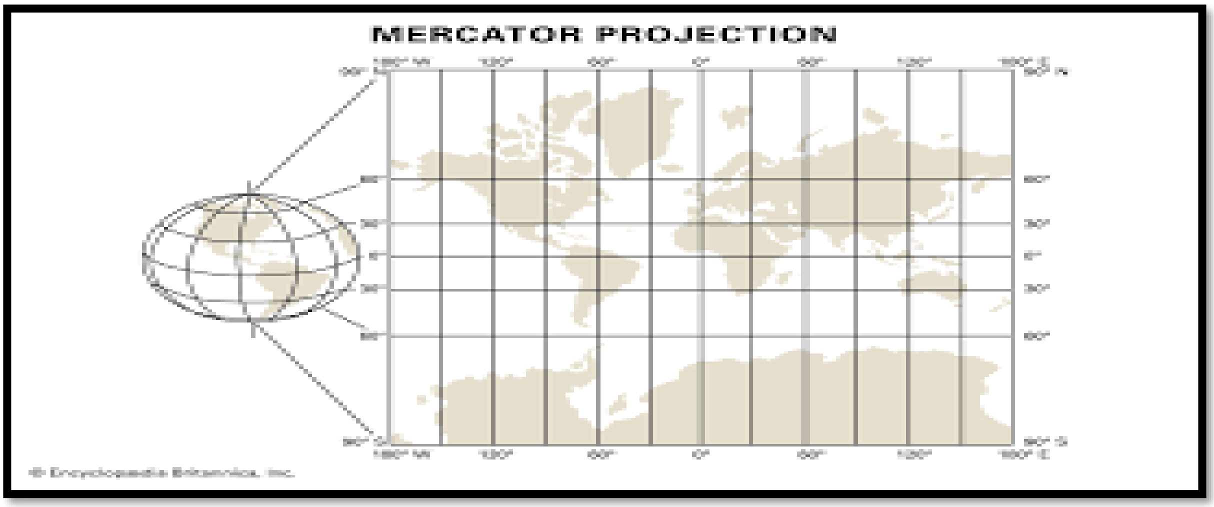
(b) **Straight Rhumb Lines**. A key advantage is that loxodromes appear as straight lines, simplifying course plotting for ships and aircraft.

(c) **Scale Variation**. The scale increases as latitude increases, causing distortion in size. Landmasses near the poles appear disproportionately larger than those near the equator.

(d) **<u>Equatorial Accuracy</u>**. The projection is most accurate near the equator, where distortion is minimal.

(e) **<u>Infinite at Poles</u>**. The poles cannot be represented on a Mercator projection because their latitude would extend to infinity.

(f) **<u>Navigational Utility</u>**. It remains a preferred choice for naval and aeronautical charts due to its ability to represent constant bearings as straight lines.



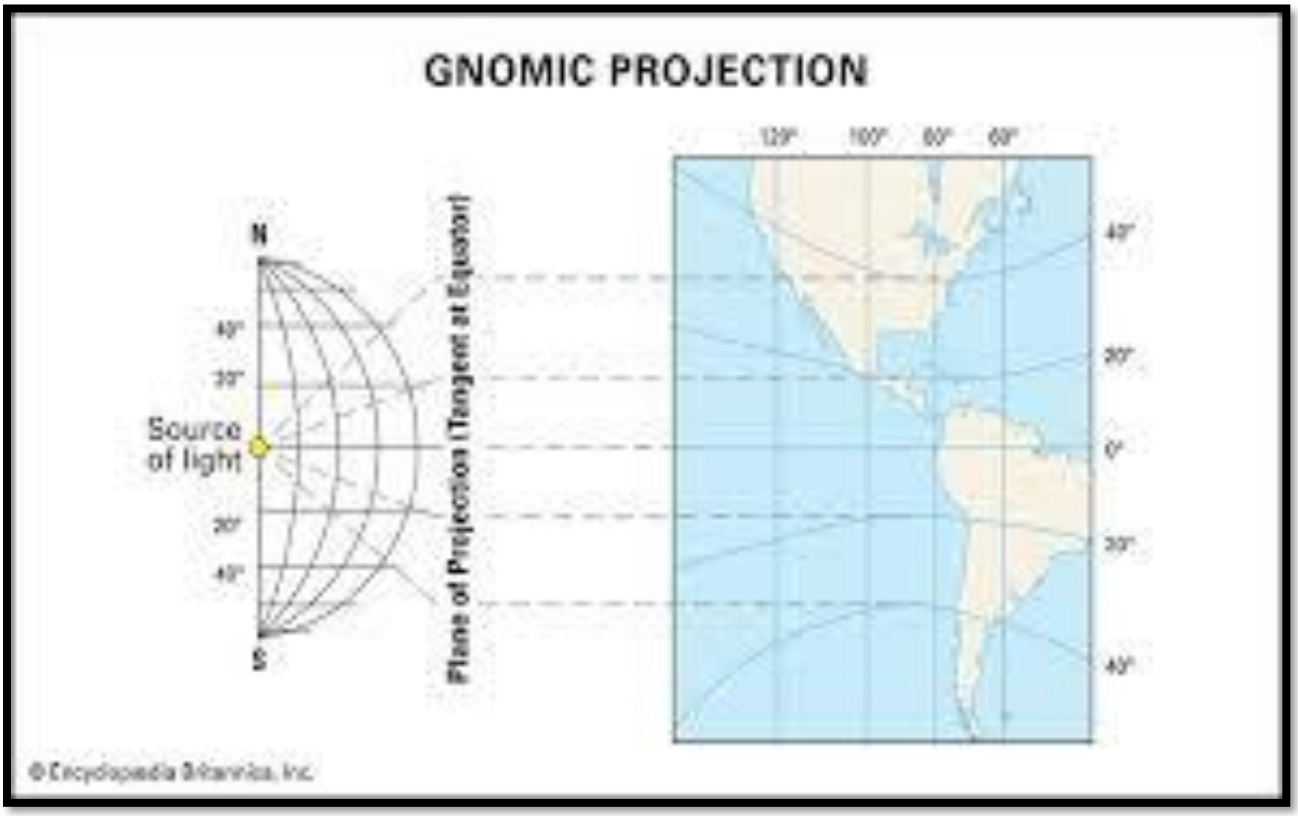
DID YOU KNOW?

- **Ancient Mediterranean Charts**. The earliest known naval charts date back to the Phoenician era (around 1200 BCE). These ancient maps were primarily used for coastal navigation and were based on landmarks and visual references along the Mediterranean coast. The portolan charts of the Middle Ages were an evolution of this practice, with more detailed coastlines and maritime routes.

- **The Origin of Portolan Charts**. Portolan charts emerged in the 13th century and were highly detailed, showing coastlines, ports, and navigational routes. These charts were drawn using compasses and wind rose symbols to represent directions. They were crucial during the Age of Exploration, enabling sailors like Christopher Columbus to chart new territories.

5. Despite its distortions, the Mercator Projection remains a fundamental tool for global navigation and charting, particularly for military and commercial maritime operations.

6. **<u>Gnomonic Projection</u>**. The Gnomonic Projection is a type of azimuthal projection in which the Earth's surface is projected onto a flat plane from the center of the Earth. This results in a map where great circles, the shortest paths between two points on a sphere, appear as straight lines. Due to this property, the Gnomonic Projection is widely used in navigation, especially for plotting long-distance routes in oceanic and aerial navigation.



7. **Properties of Gnomonic Projection**.

(a) **Great Circles as Straight Lines**. The most significant feature of the Gnomonic Projection is that all great circles appear as straight lines, making it valuable for planning shortest-distance routes.

(b) **Distortion Increases Away from the Center**. While the projection is accurate at the central point, distortion increases rapidly as one moves away from the center, making it impractical for large-scale mapping.

(c) **Non-Conformal and Non-Equal Area**. Shapes and areas are distorted, particularly near the edges, meaning it does not preserve angles or proportionality.

(d) **Covers Only a Limited Area**. Since distortion becomes extreme at the edges, Gnomonic maps usually cover only small regions, often focusing on polar areas or strategic navigation routes.

(e) **Used in Navigation and Meteorology**. It is primarily used for plotting transoceanic and transpolar navigation routes and for analyzing global weather patterns.

8. Despite its limitations, the Gnomonic Projection remains a crucial tool in naval and aviation navigation, helping planners determine the most efficient travel routes over long distances.

Chart Scales

9. **Small-Scale Chart (1:1,000,000 or smaller)**.

(a) **Example**. A chart covering the entire Indian Ocean region, including the Indian subcontinent and surrounding seas.

(b) **Usage**. Used for long-distance voyage planning, showing major landmasses, ocean currents, and international shipping routes.

(c) **Example Chart: Indian Ocean Navigation Chart**. It provides a broad overview of naval operations and strategic planning.

10. **Medium-Scale Chart (1:100,000 to 1:1,000,000)**.

(a) **Example**. A navigation chart of the Bay of Bengal and the Arabian Sea showing major ports like Mumbai, Chennai, and Kolkata.

(b) **Usage**. Useful for coastal navigation, maritime security operations, and naval exercises.

(c) **Example Chart: Approach Chart of Western Indian Coast**. It helps ships transition from open ocean to coastal waters.

11. **Large-Scale Chart (Larger than 1:100,000)**.

(a) **Example**. A harbor chart of Mumbai Port or Visakhapatnam Port, showing detailed depth contours, anchorage areas, and navigational hazards.

(b) **Usage**. Used for precise maneuvering during docking, port entry, and naval base operations.

(c) **Example Chart: Mumbai Harbour Chart**. It provides detailed information for safe navigation in congested port areas.

12. **Fixing a Ship's Position**.

(a) **Dead Reckoning (DR)**. This method calculates the ship's position using its course and speed. The position is marked with a plus sign (+).

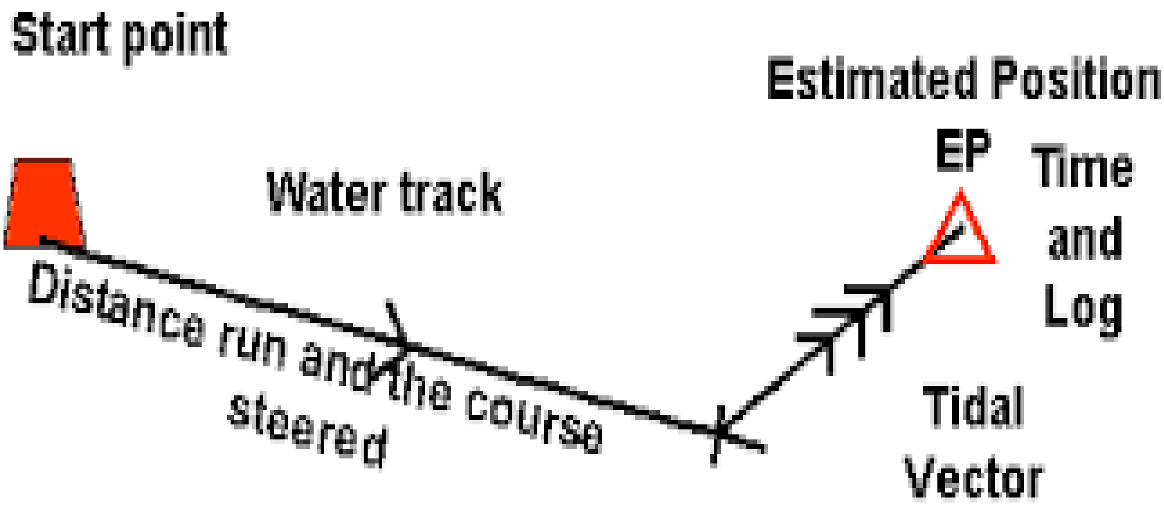
(b) **Estimated Position (EP)**. This is calculated by adjusting the DR position for factors like wind, tide, and current. It is marked with a triangle and time.

13. **Arrows on Tracks**.

(a) **Single Arrow**. Shows the course steered.

(b) **Double Arrow**. Shows the ship's actual path.

(c) **Triple Arrow**. Shows the effects of tides and currents.



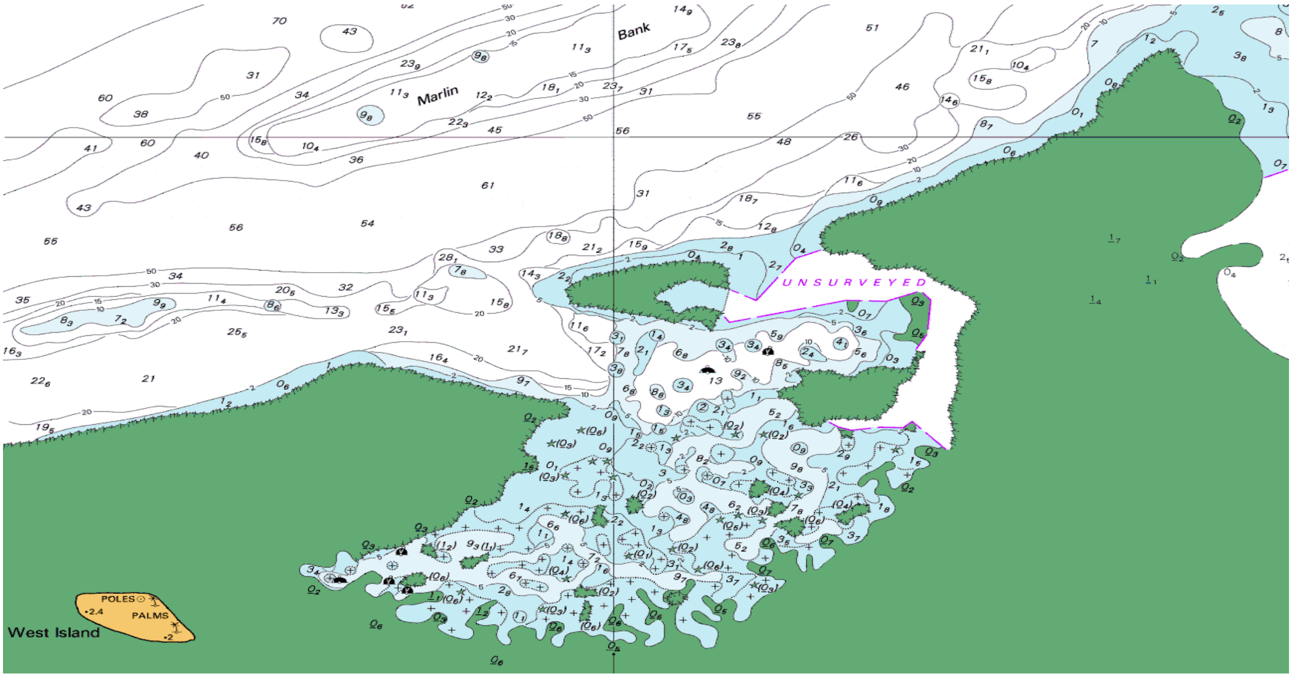
Arrow Representation While Plotting Route on Chart

DID YOU KNOW?
➢ **The Influence of Ptolemy's Geographia**. In the 2nd century CE, the Greek scholar Ptolemy created a work called Geographia, which included the first known systematic map projections. Though not specifically naval charts, Ptolemy's ideas influenced later cartographers in creating more accurate maps, including those used by sailors to navigate the seas.
➢ **The Invention of Mercator Projection**. In 1569, Gerardus Mercator introduced the Mercator projection, a cylindrical map projection that became the standard for nautical charts. It allowed sailors to plot a straight-line course, known as a rhumb line, which made navigation easier. The Mercator projection remains widely used for navigation today.

PART II: TYPES OF CHARTS

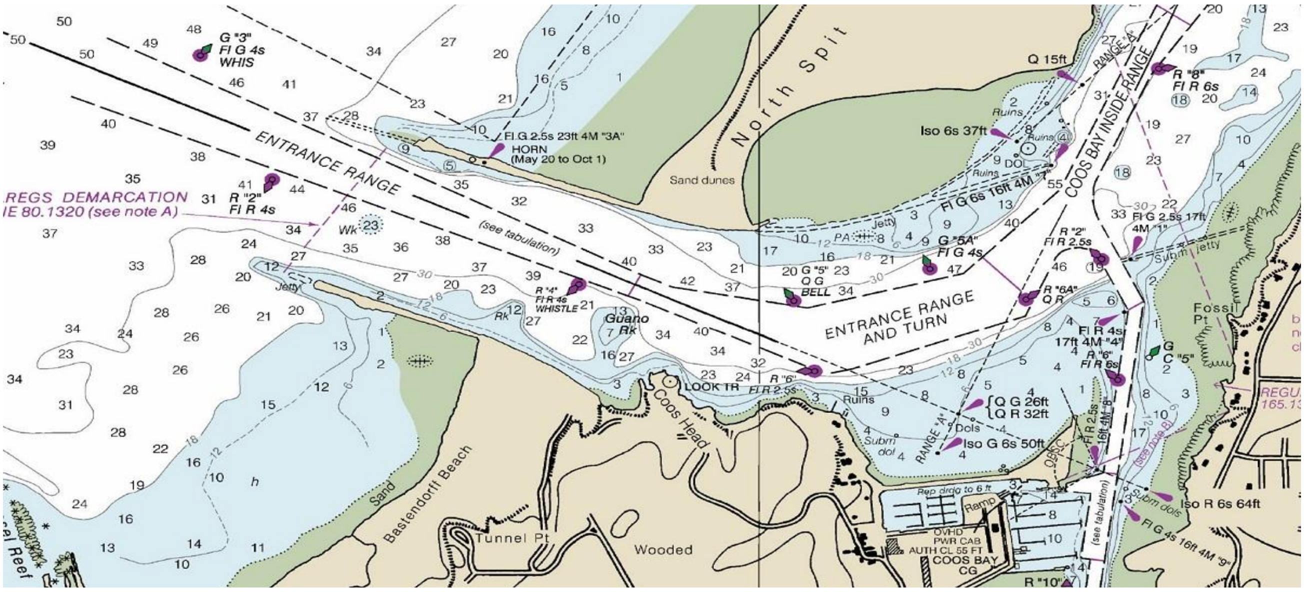
Types of Charts

14. **Navigational Chart**. A navigational chart is a specially designed map used by mariners to safely navigate through seas, coastal waters, and harbors. It provides essential details such as water depths, coastal features, hazards, buoyage systems, and aids to navigation. These charts are crucial for route planning and collision avoidance.



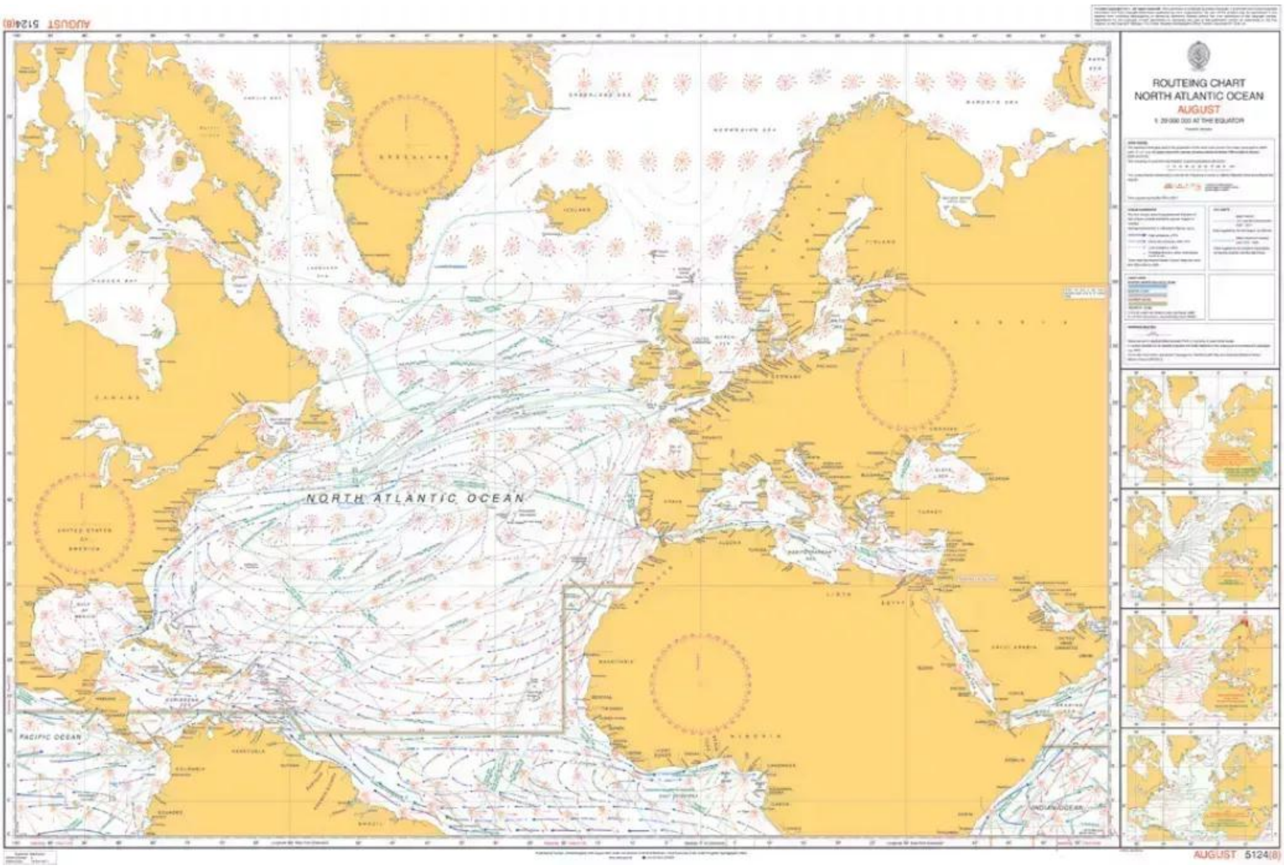
Navigation Chart

15. **Ship's Boat Chart**. A ship's boat chart is a small-scale chart carried on a vessel's lifeboat or smaller craft, intended for emergency navigation. It typically includes key coastal outlines, major ports, and emergency navigation information to help sailors find their way if they need to abandon the main ship.



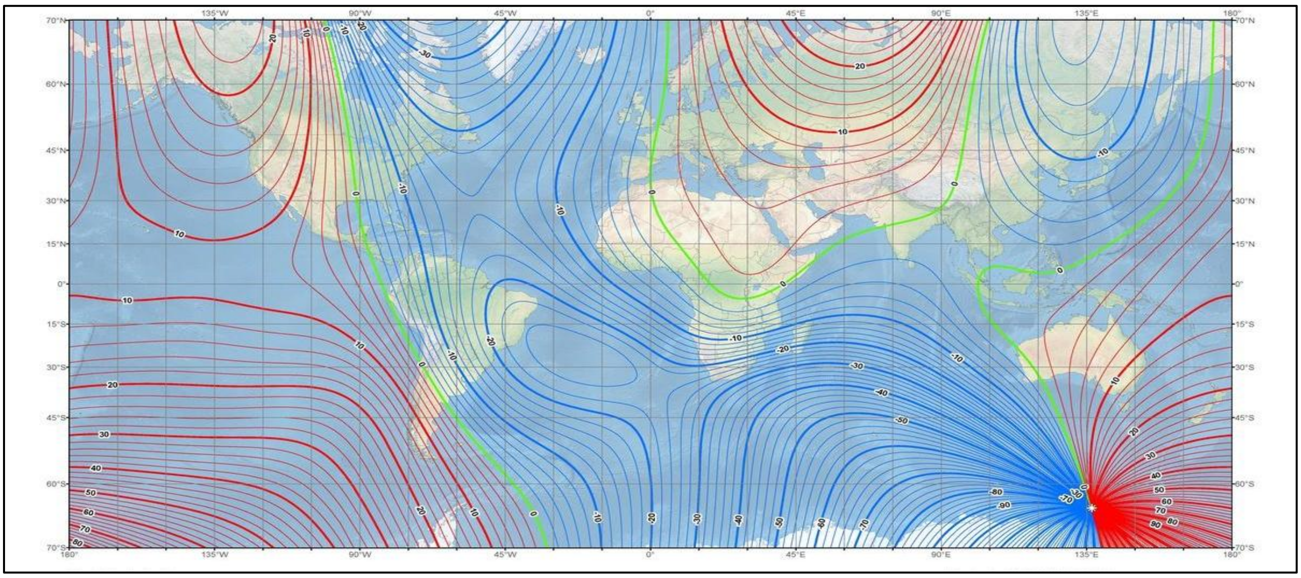
Ship's Boat Chart

16. **Routing Chart**. A routing chart is a specialized chart that provides information on recommended shipping routes, prevailing winds, ocean currents, and seasonal weather patterns. It helps navigators choose the safest and most efficient routes for long-distance voyages, considering climatic conditions and maritime traffic separation schemes.



Routing Chart

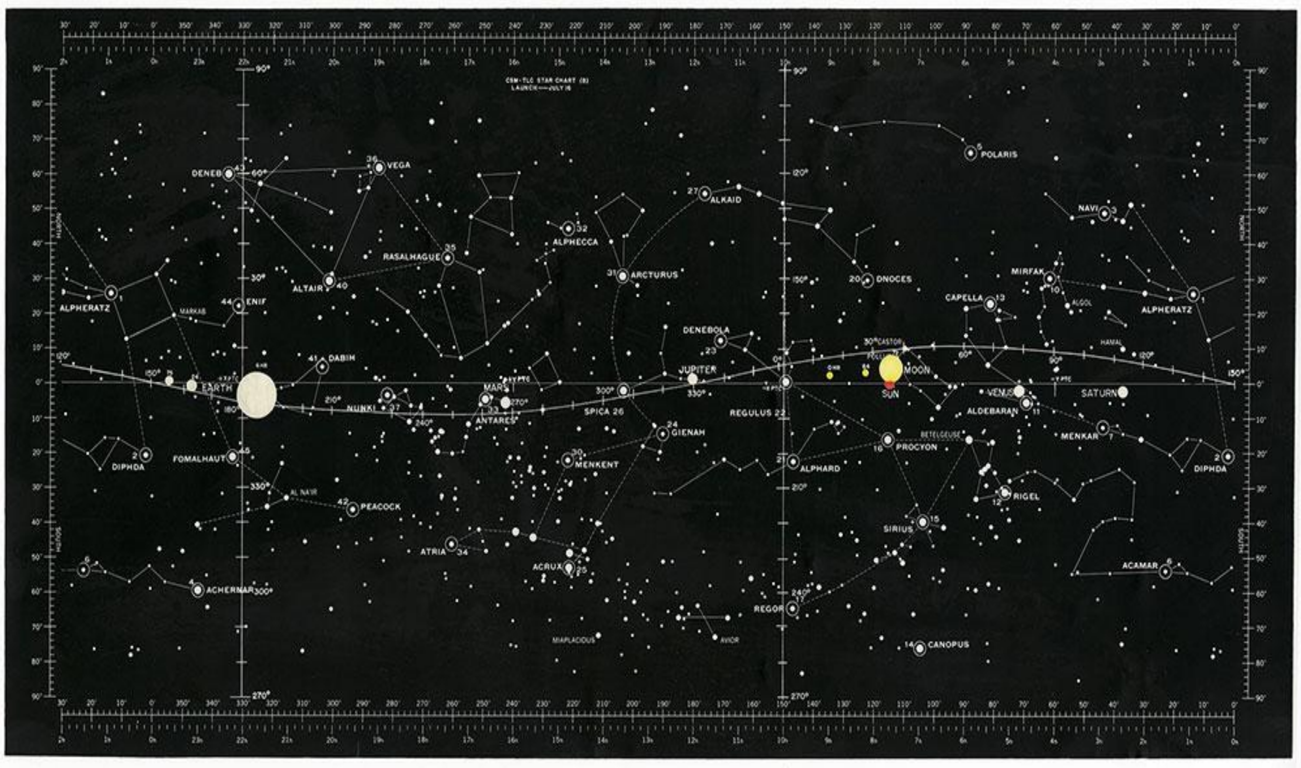
17. **Magnetic Chart**. A magnetic chart displays the Earth's magnetic field variations, including magnetic declination (variation), inclination (dip), and intensity at different locations. These charts assist in correcting compass errors and ensuring accurate navigation by accounting for magnetic influences on a vessel's heading.



Magnetic Chart

18. **Ocean Sounding Chart**. An ocean sounding chart represents the depths of the seabed using contour lines and numerical depth values obtained through echo sounding and hydrographic surveys. These charts are essential for submarine navigation, underwater operations, and deep-sea exploration, ensuring safe passage in varying underwater terrains.

19. **<u>Astronomical Charts and Diagrams</u>**. Astronomical charts and diagrams are used for celestial navigation, showing the positions of stars, planets, and other celestial bodies. These charts help navigators use a sextant to determine their location at sea by measuring angles between celestial objects and the horizon. They are still used as a backup to electronic navigation systems.



<u>Astronomical Charts</u>

DID YOU KNOW?
➢ Admiralty Charts and Modern Navigation. By the early 19th century, the British Admiralty began producing authoritative maritime charts, which became the gold standard for navigation. These charts included accurate representations of sea depths, currents, hazards, and safe navigation routes, significantly improving safety at sea. Today, modern digital charts and GPS systems have continued to evolve from these early navigational tools.

<u>PART III: INFORMATION ON CHARTS</u>

20. **<u>Information Shown on Charts</u>**. The following information is depicted on charts:-

(a) Chart Number

(b) Chart Title

(c) Survey Data

(d) Source Data Diagram

(e) Date of Publication

(f) New Edition

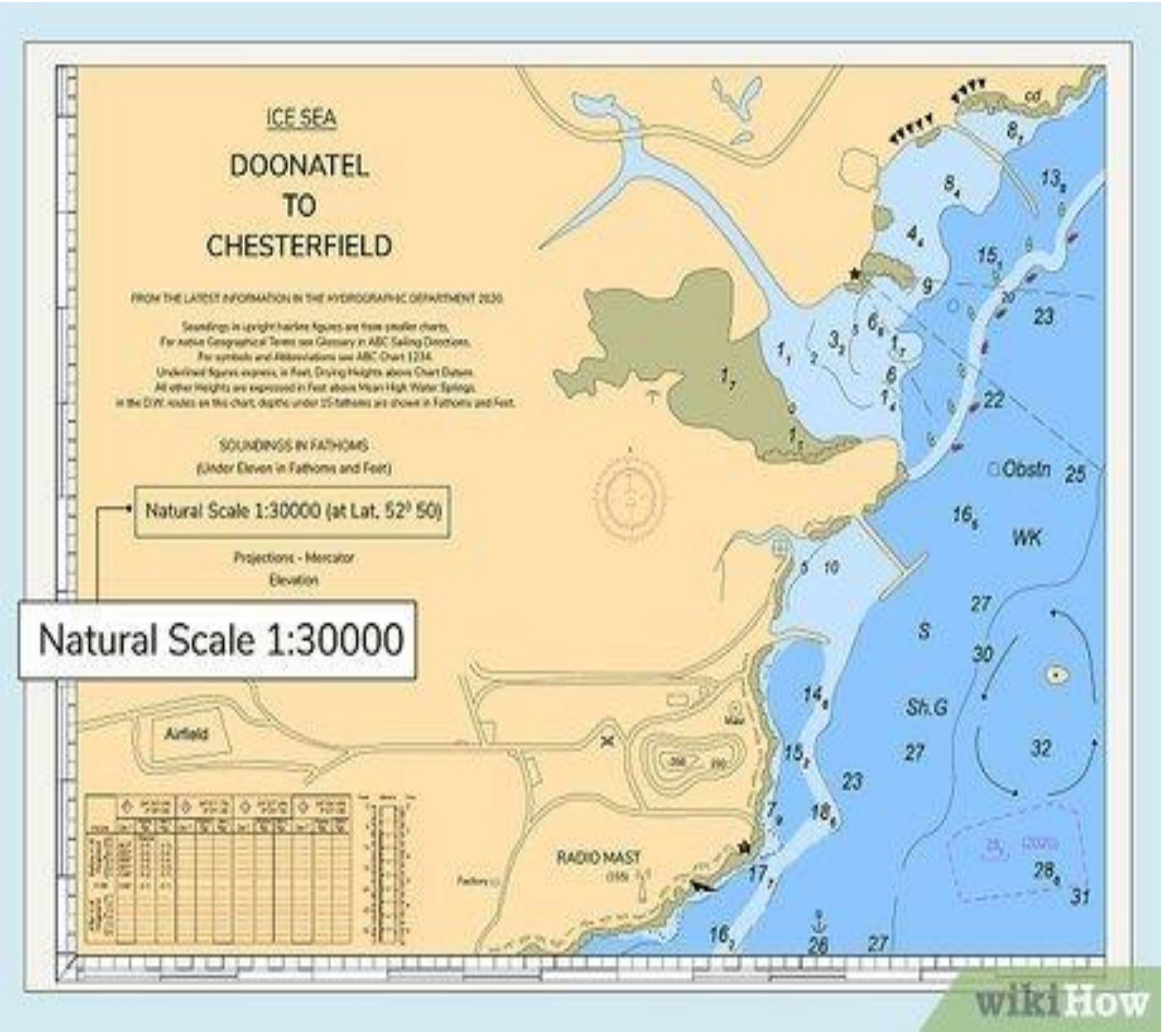
(g) Date of Printing

(h) Chart Dimensions

(i) Scale of the Chart

(j) Symbols and Abbreviations

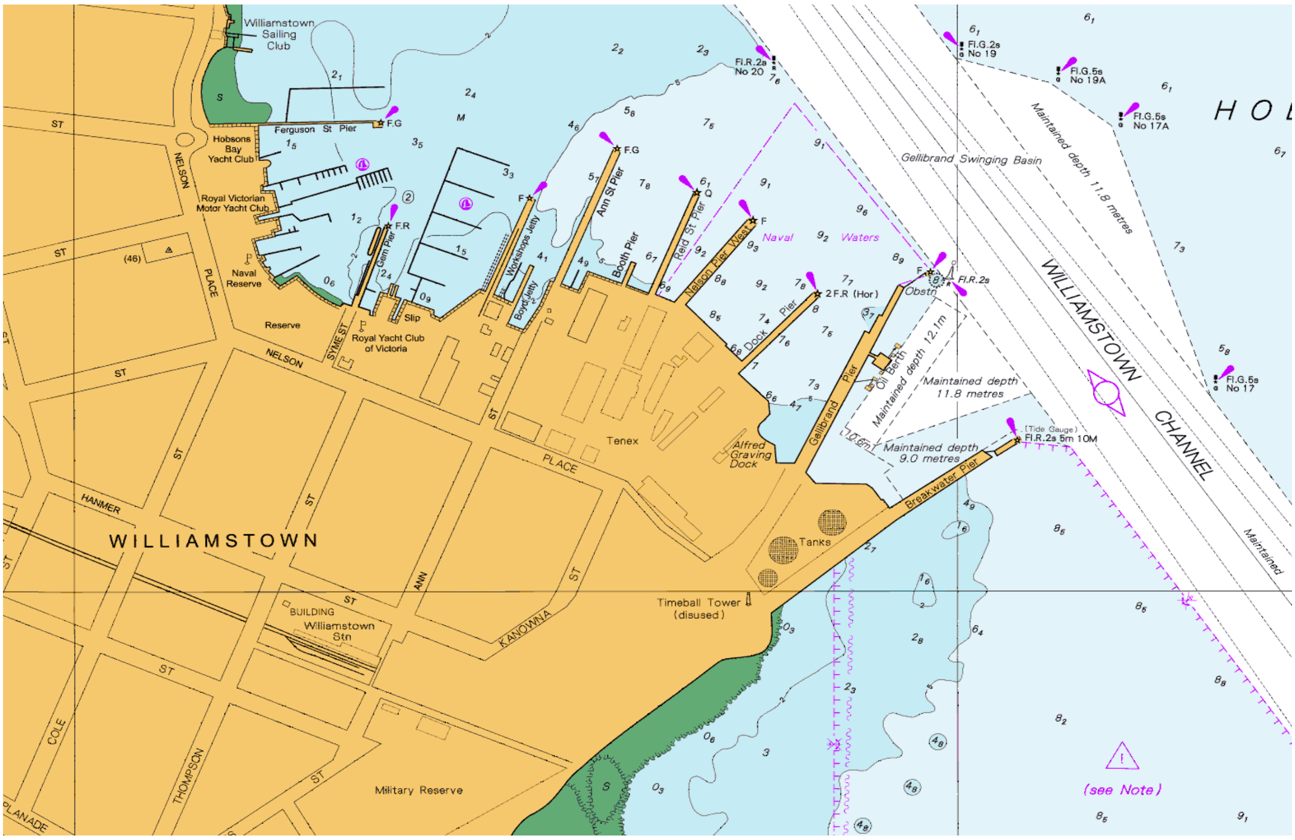
(k) Heights and Tidal Information



Information Shown on Charts

Practical Chart Work

21. Cadets will practice reading charts and plotting ship positions on a chart. The instructor will demonstrate how to gather important information and plot a fix (the ship's location) on the chart.



CONCLUSION

22. In conclusion, the study of maps, charts, and projections is fundamental to safe and effective navigation at sea. Different types of projections, such as the Mercator and Gnomonic projections, offer unique advantages depending on the navigational needs, helping sailors chart courses and plan routes. Understanding the various types of charts—ranging from small-scale general charts to detailed harbor charts—is crucial for interpreting key information like depth soundings, hazards, and tidal data. As navigational tools, these charts ensure that sailors can safely navigate through vast and often perilous waters, making informed decisions based on accurate, real-time information. The knowledge gained from this study empowers cadets to confidently navigate ships, apply theoretical concepts practically, and safeguard their vessels during voyages. Mastery of chart reading and position fixing ensures a well-rounded skill set essential for every mariner, enhancing both operational efficiency and safety at sea.

SUMMARY

- Navigational Charts. Nautical charts, used in simple chart work, provide detailed information about water depths, coastlines, and navigational hazards to guide ships safely.
- **Latitude and Longitude**. Chart work involves plotting a ship's position using the grid system of latitude and longitude, which helps determine precise locations on Earth.
- **Depth Soundings**. Charts show depth soundings, which indicate the depth of water at various points, helping sailors avoid underwater obstacles and navigate safely.
- **Course Plotting**. Sailors use charts to plot courses by connecting a series of waypoints, ensuring they stay on track while navigating through open waters.
- **Tidal Information**. Many charts include tidal data, which is crucial for understanding the rise and fall of sea levels, especially when approaching ports or shallow areas.

SUGGESTED READ

BR 45 Vol-1

ASSESSMENT EXERCISE

Multiple Choice Questions

Q1. What is the primary purpose of a navigational chart?

(a) To display political boundaries
(b) To provide maritime weather forecasts
(c) To assist in safe maritime navigation
(d) To show airline routes

Q2. The Mercator Projection is best known for which of the following characteristics?

(a) Distorting distances while preserving directions
(b) Representing the Earth as a perfect sphere
(c) Providing an accurate representation of all landmasses
(d) Making great circles appear as straight lines

Q3. In the Gnomonic Projection, which type of line appears straight?

(a) Rhumb lines
(b) Great circles
(c) Meridians only
(d) Latitude lines

Q4. What is the main limitation of the Gnomonic Projection?

(a) It cannot be used for short-distance navigation
(b) It distorts areas away from the centre
(c) It is only useful for air navigation
(d) It does not represent great circles

Q5. A small-scale chart is primarily used for which type of navigation?

(a) Coastal navigation
(b) Long-distance voyage planning
(c) Port entry and docking
(d) Emergency navigation

Q6. A large-scale chart is most useful for which of the following?

(a) Planning transoceanic voyages
(b) Identifying ocean currents
(c) Navigating within a harbour
(d) Determining weather patterns

Q7. What does an estimated position (EP) account for that dead reckoning (DR) does not?

(a) The ship’s course and speed
(b) The Earth's rotation
(c) The effects of wind, tide, and current
(d) The crew’s navigation skills

Q8. What do double arrows on a navigational track indicate?

(a) The course steered
(b) The ship's actual path
(c) The estimated time of arrival
(d) The wind direction

Q9. A ship's boat chart is primarily used for what purpose?

(a) Long-distance voyage planning
(b) Large-scale mapping of ocean currents
(c) Emergency navigation in lifeboats
(d) High-speed naval operations

Q10. Which type of chart is specifically designed for showing ocean depth variations?

(a) Routing Chart
(b) Ocean Sounding Chart
(c) Magnetic Chart
(d) Astronomical Chart

Q11. What is the significance of a magnetic chart?

(a) It shows variations in Earth's magnetic field
(b) It helps identify underwater shipwrecks
(c) It is used only for astronomical navigation
(d) It is mainly for meteorological purposes

Q12. Which of the following is a key feature of a routing chart?

(a) It provides details of ocean currents and prevailing winds
(b) It is used for short-distance navigation
(c) It primarily assists in submarine navigation
(d) It shows details of magnetic variation

Q13. What does the chart number on a navigational chart represent?

(a) The scale of the chart
(b) The date of printing
(c) A unique identification number for reference
(d) The tidal information

Q14. What is one of the key reasons mariners still use astronomical charts today?

(a) They are easier to read than electronic charts
(b) They provide a backup navigation method if electronic systems fail
(c) They are the most accurate method for positioning
(d) They replace GPS completely

Q15. What is the main goal of practical chart work in training cadets?

(a) To test their knowledge of world geography
(b) To improve their ability to navigate and fix ship positions accurately
(c) To study historical navigation routes
(d) To prepare them for weather forecasting

One-Word Objective Questions

Q1. What projection shows rhumb lines as straight lines?

Q2. Which type of chart is used for planning long trips over large areas?

Q3. What method calculates a ship's position using course and speed?

Q4. Which chart is used for harbors and provides detailed information for navigation?

Q5. What symbol represents the ship's estimated position (EP) on a chart?

Short Answer-Type Questions

Q1. What is the difference between Mercator and Gnomonic projections?

Q2. How are small-scale charts used in navigation?

Q3. Explain the purpose of dead reckoning (DR) in fixing a ship's position.

Q4. What does the double arrow on a chart track represent?

Q5. Name three types of charts used in marine navigation and their purpose.

Long Answer-Type Questions

Q1. Explain the differences between Mercator and Gnomonic chart projections and their uses in marine navigation.

Q2. Discuss the different types of charts and their applications in marine navigation.

Q3. Describe how to use a chart for practical navigation, including how to gather information and plot a ship's position.

Q4. What are the essential elements that must be included in a chart for effective navigation, and why are they important?

Q5. How does the use of different chart scales (small, medium, and large) benefit a navigator during a voyage?

NCC SPECIAL SUBJECT (NAVY)

NAVIGATION

CHAPTER 3: ELECTRONIC AIDS FOR NAVIGATION (CODE-N 3)

"Technology is the new compass for sailors in the vast, unpredictable oceans"

TEACHING INSTRUCTIONS

Period : **1 (40 Min)**
Type : **Theory**
Conducting Officer : **PI**
Year : **Second**

Training Aids : **Blackboard, whiteboard, projector, compass**

Time Plan

- **Introduction** : **10 Min**
- **Purpose of Navaids** : **20 Min**
- **Types of Navaids** : **10 Min**
- **Conclusion** : **05 min**

INTRODUCTION

1. Navigational equipment plays a pivotal role in ensuring the safe and efficient movement of vessels at sea. Onboard ships, these instruments help navigators determine their position, monitor the course, and avoid potential hazards. The complexity of maritime navigation demands an array of specialized tools, from traditional instruments like compasses and sextants to modern technologies such as radar and GPS. These aids, when used effectively, enable the crew to maintain situational awareness, especially in challenging conditions like poor visibility or high seas. Understanding the functionality and application of each piece of equipment is essential for ensuring the ship's safety and optimizing its route during voyages.

2. The integration of various navigation aids onboard modern ships has revolutionized the way maritime navigation is conducted. These devices provide accurate, real-time data that assists in course plotting, position fixing, and collision avoidance. This chapter will delve into the different types of navigation equipment found on ships, discussing their specific roles and how they contribute to the overall navigation system. From radar systems that detect distant objects to GPS systems that offer precise position information, the synergy of these tools is crucial in maintaining a safe journey through the vast oceans.

PREVIEW	**LEARNING OBJECTIVES**
➢ Part I: Purpose of Navigation Aids. ➢ Part II: Types of Electronic Navigation Aids	➢ Cadets will learn about the key navigation aids used on ships. ➢ To understand the function of each tool and how it helps in navigation. ➢ To recognize the importance of these tools in making sea travel safer and easier.

PART I: PURPOSE OF NAVIGATION AIDS

3. **Purpose of Navigation Aids**. The primary purpose of navigation aids onboard ships is to ensure the vessel's safe and efficient operation at sea. These aids are designed to assist navigators in determining the ship's precise position, maintaining its course, and avoiding potential hazards. By providing real-time information about the ship's location, speed, and surrounding environment, navigation aids help minimize the risks associated with poor visibility, unpredictable weather conditions, and busy maritime traffic. In combination, these devices enable the crew to plan and execute voyages with greater accuracy, ensuring timely arrivals while safeguarding the vessel and its crew from accidents or navigational errors.

4. Furthermore, navigation aids support the decision-making process by offering a variety of data points that enhance situational awareness. For example, radar and GPS provide vital information for detecting nearby vessels, landmasses, or obstacles, while gyrocompasses and magnetic compasses assist in maintaining the correct heading. Echo sounders and AIS systems enhance safety by monitoring water depth and tracking surrounding vessels'

movements. By utilizing these technologies, navigators can make informed choices about altering course, avoiding collisions, or adjusting to environmental conditions, ultimately contributing to smooth and secure maritime operations.

DID YOU KNOW?
➢ **The First Use of Radar for Navigation**. During World War II, radar technology was adapted for maritime navigation. Initially developed for military purposes, radar allowed ships to detect other vessels and land masses even in poor visibility conditions, such as fog or at night. This was a significant leap in navigation, enhancing safety at sea.
➢ **The Development of LORAN (Long Range Navigation)**. The LORAN system was introduced in the early 1940s by the U.S. military during World War II for long-range navigation. It used low-frequency radio signals from land-based stations to allow ships and aircraft to determine their position. LORAN became widely used in the civilian sector for over 40 years before being replaced by GPS.

PART II: TYPES OF ELECTRONIC NAVIGATION AIDS

5. **Radar (Radio Aided Detection and Ranging)**. Navigation radar is a crucial onboard system that enhances a ship's situational awareness by detecting and tracking objects in its vicinity. It operates by emitting radio waves that bounce off nearby objects such as other vessels, landmasses, buoys, and even weather formations, then returning to the radar receiver to generate a visual representation of the surroundings. This technology is especially valuable in low-visibility conditions, such as fog, heavy rain, or nighttime navigation, where visual observations are limited. By providing real-time data on the distance, bearing, and movement of obstacles, radar helps navigators plot safe courses, avoid collisions, and respond to dynamic maritime environments. Additionally, modern radars integrate with other navigation systems, such as AIS and GPS, further enhancing the accuracy and reliability of maritime navigation.

Radar Display

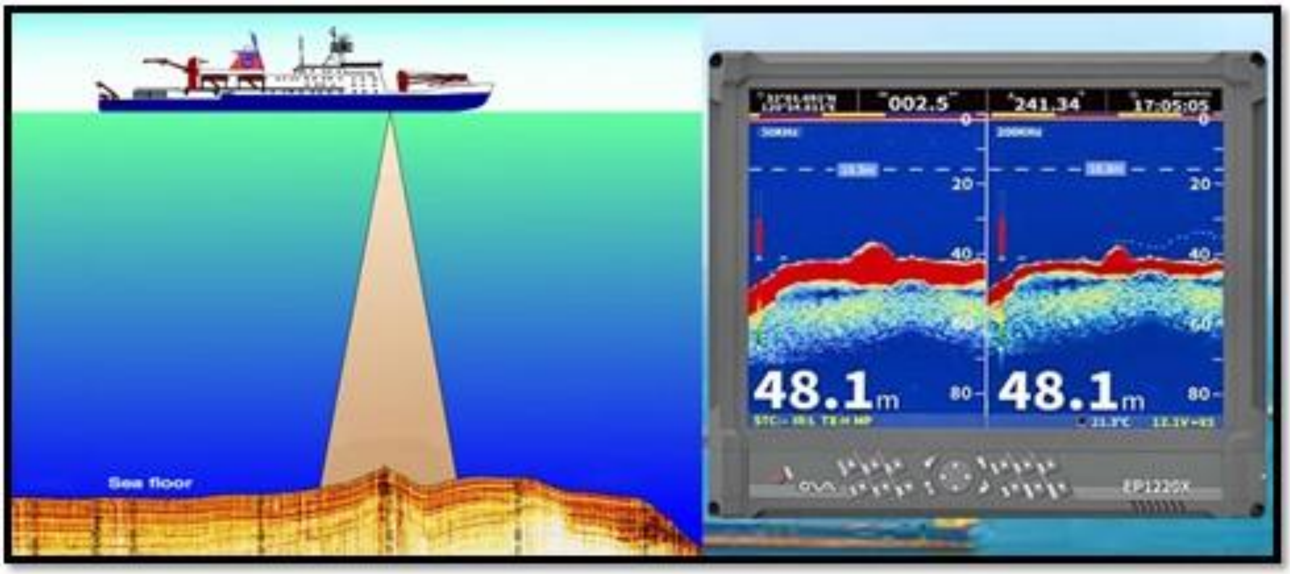
6. **Compass (Magnetic and Gyro)**. Both the magnetic and gyro compasses are essential navigational instruments used onboard ships to determine and maintain the vessel's heading. The magnetic compass operates based on the Earth's magnetic field, aligning its needle to the magnetic north. It is simple, reliable, and does not require external power, making it a crucial backup navigation tool. However, it is susceptible to errors caused by magnetic deviations from onboard metal structures and electromagnetic interference. In contrast, the gyro compass is an advanced navigational device that uses a rapidly spinning gyroscope to find true north, independent of the Earth's magnetic field. It provides greater accuracy, especially in high latitudes where magnetic compasses can be unreliable. The gyro compass is widely integrated with other navigational systems such as autopilot, radar, and ECDIS, enhancing overall steering and course-keeping efficiency. Together, these compasses play a vital role in ensuring precise and safe navigation at sea.

Magnetic and Gyro Compass

7. **GPS (Global Positioning System)**. The Global Positioning System (GPS) is a vital navigation tool used onboard ships to determine precise location, speed, and course in real time. It operates through a network of satellites that transmit signals to GPS receivers on the vessel, allowing navigators to pinpoint their exact position anywhere on the globe. GPS is crucial for route planning, position fixing, and ensuring the ship stays on its intended course, significantly improving navigational accuracy and efficiency. It also enhances safety by providing data for collision avoidance, search and rescue operations, and integration with other navigation systems such as Electronic Chart Display and Information System (ECDIS) and Automatic Identification System (AIS). With its high reliability and continuous global coverage, GPS has become an indispensable tool for modern maritime navigation.

GPS

8. **<u>Echo Sounder</u>**. An echo sounder is a crucial navigational instrument used onboard ships to measure the depth of water beneath the vessel, helping to prevent grounding and ensuring safe passage in shallow waters. It operates by transmitting sound waves downward from the ship's hull; these waves reflect off the seabed and return to the sensor, allowing the system to calculate depth based on the time taken for the echo to return. Echo sounders are essential for coastal navigation, port entry, and anchoring, as they provide real-time depth readings to help navigators avoid underwater hazards. Modern echo sounders also display seabed characteristics, aiding in hydrographic surveys and fishing operations. Integrated with electronic charts and other navigational aids, the echo sounder enhances situational awareness and contributes to the safe and efficient operation of a vessel.



<u>Echo Sounder</u>

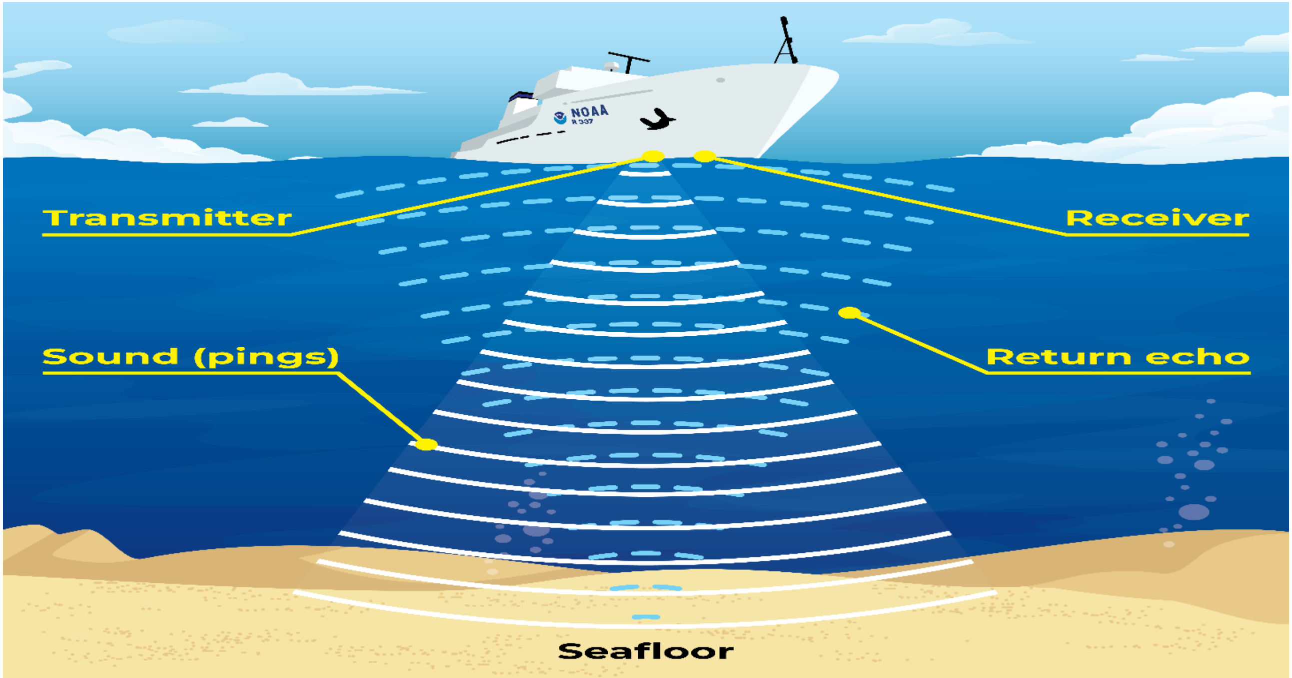
DID YOU KNOW?
➢ **The Birth of GPS (Global Positioning System)**. The GPS system, initially launched in 1978 by the U.S. Department of Defense, revolutionized navigation. Unlike previous systems relying on terrestrial signals, GPS uses a constellation of satellites orbiting the Earth to provide continuous, accurate location information to users anywhere on the planet. This has become the primary method for navigation at sea, on land, and in the air.
➢ **The Advent of the Electronic Chart Display and Information System (ECDIS)**. ECDIS, introduced in the 1990s, marked a milestone in electronic navigation aids. This system combines GPS with electronic charts, allowing for real-time monitoring of a ship's position and navigation. It is now mandatory for large commercial vessels to use ECDIS, replacing traditional paper nautical charts and improving safety

9. **<u>Electromagnetic Log (EM Log)</u>**. The EM Log is a crucial instrument used onboard ships to measure the vessel's speed and the distance traveled through water. It operates on the principle of electromagnetic induction, where a sensor, usually mounted on the hull, generates a magnetic field and measures the voltage induced by the movement of

seawater. This voltage is directly proportional to the ship's speed, providing real-time speed data essential for navigation, fuel efficiency calculations, and voyage planning. Unlike traditional mechanical logs, the EM Log has no moving parts, making it more reliable and less prone to wear and tear. Integrated with other navigational systems, such as GPS and ECDIS, the EM Log enhances the accuracy of speed monitoring, ensuring efficient and safe maritime operations.

Log

10. **Sonar (Sound Navigation and Ranging)**. Sonar is an essential navigational and detection system used onboard ships to map the seabed, detect underwater obstacles, and locate other vessels or submarines. It operates by emitting sound waves into the water and analyzing the returning echoes to determine the distance, shape, and movement of objects. There are two main types of sonar: active sonar, which sends out sound pulses and listens for echoes, and passive sonar, which only listens to underwater sounds without emitting signals. Sonar is widely used in naval operations, underwater exploration, fishing, and submarine detection. Integrated with modern navigation systems, sonar enhances maritime safety by providing critical underwater awareness, helping ships avoid hazards, and supporting search and rescue operations.



Sonar

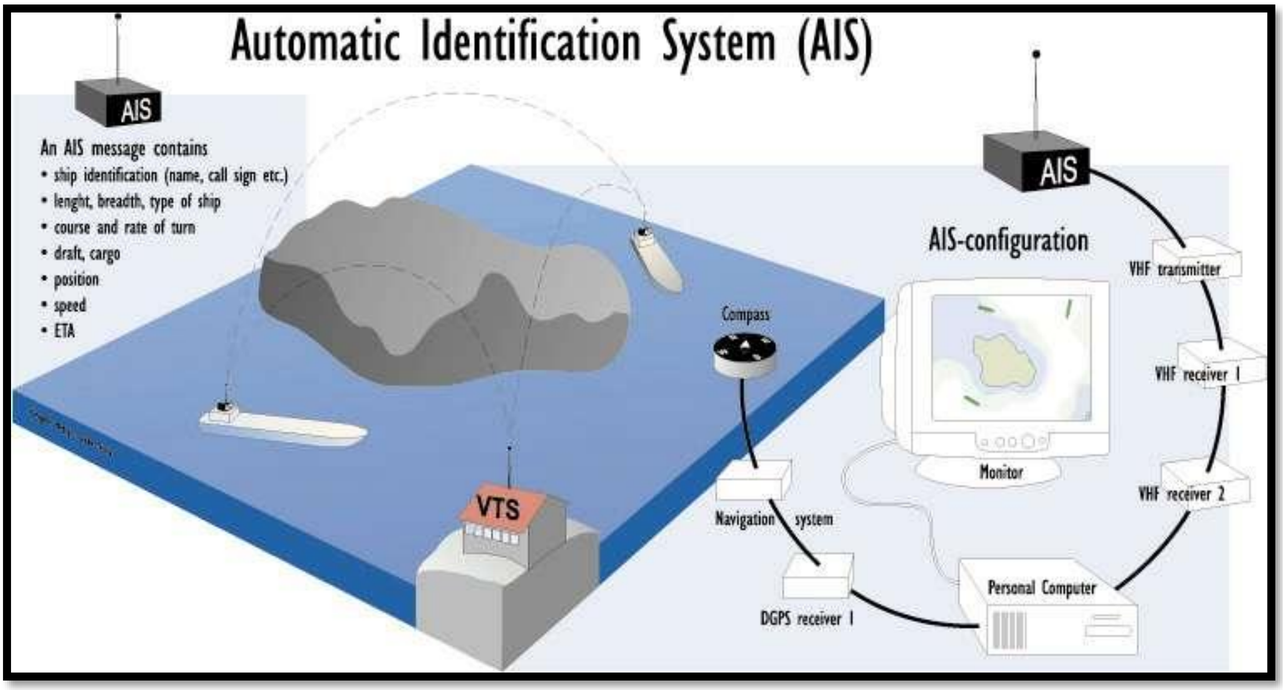
11. **Electronic Chart Display and Information System (ECDIS).** The Electronic Chart Display and Information System (ECDIS) is an advanced digital navigation system that enhances maritime safety by replacing traditional paper charts with real-time electronic charting. Integrated with GPS, radar, AIS (Automatic Identification System), and other navigational sensors, ECDIS provides accurate positioning, route planning, and collision avoidance assistance. It continuously updates navigational data, displaying crucial information such as depth contours, hazards, and ship movements, improving situational awareness for mariners. Additionally, ECDIS offers automated alerts for dangers like shallow waters and restricted zones, ensuring safer navigation. Widely adopted in commercial and naval vessels, ECDIS has become a mandatory requirement under IMO regulations, revolutionizing modern maritime navigation with greater precision and efficiency.

Electronic Chart Display and Information System (ECDIS)

12. **Autopilot**. Autopilot systems onboard ships are essential for enhancing navigation efficiency and reducing the workload of the crew during long voyages. These systems utilize advanced sensors, such as gyrocompasses, GPS, and radar, to maintain the vessel's course with high precision. The autopilot can be manually set to follow a predetermined heading or course, adjusting automatically to changing sea conditions, such as wind and currents. This technology helps to ensure steady navigation while allowing the crew to focus on other operational tasks. Modern autopilot systems are also integrated with the ship's integrated bridge system (IBS), enabling seamless interaction with other navigation equipment for improved situational awareness and decision-making. However, while autopilots are invaluable for routine navigation, they require constant monitoring by the crew to ensure safe operation, especially in congested or challenging waters.

13. **Automatic Identification System (AIS)**. The Automatic Identification System (AIS) is a vital communication and tracking technology used in maritime navigation to enhance safety at sea. AIS enables vessels to transmit and receive real-time information

such as their identity, position, course, speed, and other relevant data. This information is broadcasted via VHF radio frequencies and can be received by other ships, coastal stations, and satellites, providing a comprehensive view of surrounding vessels. AIS helps prevent collisions by allowing mariners to detect and track nearby ships, particularly in congested or restricted waters. It also supports search and rescue operations and improves vessel traffic management. Additionally, AIS can be used for regulatory compliance, as it is mandated for certain types of vessels, such as those above a certain size or involved in international voyages. Through this system, AIS contributes significantly to maritime safety, situational awareness, and overall operational efficiency.



DID YOU KNOW?
➢ **The Integration of AIS (Automatic Identification System)**. Introduced in the 1990s, AIS is a system that allows ships to exchange information such as position, course, and speed with other vessels and shore stations. Initially developed for collision avoidance, AIS is now widely used for fleet management, tracking, and maritime traffic control, enhancing maritime safety and operational efficiency.

14. **<u>Plotting Table</u>**. A plotting table is a vital navigational tool used on ships for manually tracking the vessel's position, course, and movements of other ships. It consists of a large, flat surface where navigators use charts, parallel rulers, dividers, and plotting instruments to mark positions and plot courses. Primarily used in naval and merchant vessels, the plotting table helps in collision avoidance, tactical manoeuvring, and situational awareness, especially in restricted waters or during complex operations. Despite advancements in digital navigation, the plotting table remains a crucial backup for ensuring safe and accurate navigation.

Plotting Table

15. **Charts**. Navigational charts are specialized maps designed to assist mariners in safely navigating through seas, coastal waters, and harbours. These charts provide critical information such as water depths, tidal patterns, underwater hazards, navigational aids, and coastal landmarks, enabling accurate route planning and collision avoidance. They come in different types, including general charts for oceanic navigation, coastal charts for nearshore sailing, and harbour charts for precise manoeuvring in ports. Modern electronic charts, such as those used in the Electronic Chart Display and Information System (ECDIS), have enhanced traditional paper charts by providing real-time data and integration with GPS and radar. Regardless of format, navigational charts remain an essential tool for safe and efficient maritime operations.

Navigation Chart

CONCLUSION

16. In conclusion, navigational aids (NavAids) are crucial components in ensuring the safe and efficient movement of vessels across the world's seas and oceans. These aids, including buoys, lighthouses, radar beacons, and electronic systems like GPS and AIS, provide essential information regarding navigational routes, hazards, and positioning. By enhancing the mariner's ability to determine their location and avoid dangers, NavAids play a vital role in reducing the risk of accidents and improving overall maritime safety. As technology continues to advance, modern NavAids are becoming more integrated and automated, offering greater precision and reliability, which ultimately supports safe, efficient, and sustainable maritime operations.

SUMMARY

- **GPS Revolution.** The Global Positioning System (GPS) is a key electronic aid, allowing ships to pinpoint their exact position anywhere on Earth with incredible accuracy.
- **Radar Power.** Radar is used to detect nearby vessels, landmasses, and obstacles, helping sailors avoid collisions, especially in poor visibility like fog or night-time navigation.
- **Electronic Chart Display.** Modern ships use ECDIS (Electronic Chart Display and Information Systems) to display real-time digital charts, simplifying navigation and route planning.
- **Automatic Identification System (AIS).** The AIS helps vessels communicate automatically, sharing important details like position, speed, and course to improve safety and avoid collisions.
- **LORAN-C.** Though now largely replaced by GPS, LORAN-C (Long Range Navigation) was once a vital electronic system used for maritime and air navigation, based on radio signals.

SUGGESTED READ

BR 45 Vol-1

ASSESSMENT EXERCISE

Multiple Choice Questions

Q1. What is the primary purpose of navigation aids onboard ships?

(a) To increase ship speed
(b) To enhance crew comfort
(c) To ensure the vessel's safe and efficient operation
(d) To reduce fuel consumption

Q2. Which of the following is NOT a type of navigation aid?

(a) Radar
(b) GPS
(c) Autopilot
(d) Windmill

Q3. What does GPS stand for in maritime navigation?

(a) Global Positioning System
(b) General Port Survey
(c) Guided Path System
(d) Geographic Placement Service

Q4. How does radar assist navigators?

(a) By measuring sea depth
(b) By detecting and tracking objects in the vicinity
(c) By controlling ship speed
(d) By monitoring weather patterns only

Q5. Which navigation aid measures the angle between celestial bodies and the horizon?

(a) Compass
(b) Sextant
(c) Radar
(d) GPS

Q6. What is the primary function of an echo sounder?

(a) Measuring wind speed
(b) Determining water depth
(c) Identifying ship speed
(d) Plotting a course on a chart

Q7. Which of the following is a traditional navigation aid?

(a) ECDIS
(b) AIS
(c) Sextant
(d) Autopilot

Q8. The gyro compass finds which direction?

(a) Magnetic north
(b) True north
(c) East
(d) South

Q9. What does AIS stand for?

(a) Automated Identification System
(b) Automatic Identification System
(c) Advanced Information System
(d) Automated International Signals

Q10. What is the purpose of ECDIS?

(a) Displaying real-time electronic charts
(b) Measuring water depth
(c) Detecting underwater objects
(d) Predicting weather patterns

Q11. Which navigation aid uses electromagnetic induction to measure a ship's speed?

(a) Radar
(b) Echo sounder
(c) Electromagnetic log
(d) AIS

Q12. What is the main advantage of a gyro compass over a magnetic compass?

(a) It is cheaper
(b) It finds true north and is not affected by magnetic fields
(c) It works without electricity
(d) It does not require calibration

Q13. Which of the following helps in collision avoidance?

(a) Sextant
(b) Autopilot
(c) AIS
(d) Compass

Q14. What type of sonar does not emit signals but only listens to underwater sounds?

(a) Passive sonar
(b) Active sonar
(c) Radar sonar
(d) ECDIS sonar

Q15. What is the significance of modern NavAids?

(a) They ensure safer and more efficient maritime operations
(b) They replace human navigators completely
(c) They make ships faster
(d) They reduce fuel consumption drastically

One-Word Objective Questions

Q1. What tool uses radio waves to detect nearby objects?

Q2. Which navigation system is satellite-based and provides real-time location?

Q3. What traditional tool helps sailors measure angles between celestial objects?

Q4. Which system helps ships avoid submerged objects using sound waves?

Q5. What electronic system automatically tracks the ship's position using GPS?

Short Answer-Type Questions

Q1. What is the role of radar in modern navigation?

Q2. Explain how a sextant is used to determine a ship’s position.

Q3. How does a gyrocompass differ from a magnetic compass?

Q4. What is the function of an echo sounder in navigation?

Q5. What is the purpose of the Automatic Identification System (AIS) in maritime navigation?

Long Answer-Type Questions

Q1. Describe the various electronic and traditional navigation aids used in modern maritime navigation and their importance.

Q2. How do tools like the GPS, sonar, and ECDIS work together to improve navigation and safety?

Q3. Explain the operation of the autopilot system and how it helps in navigation, especially during long voyages.

Q4. Discuss the advantages of the Automatic Identification System (AIS) in preventing collisions at sea.

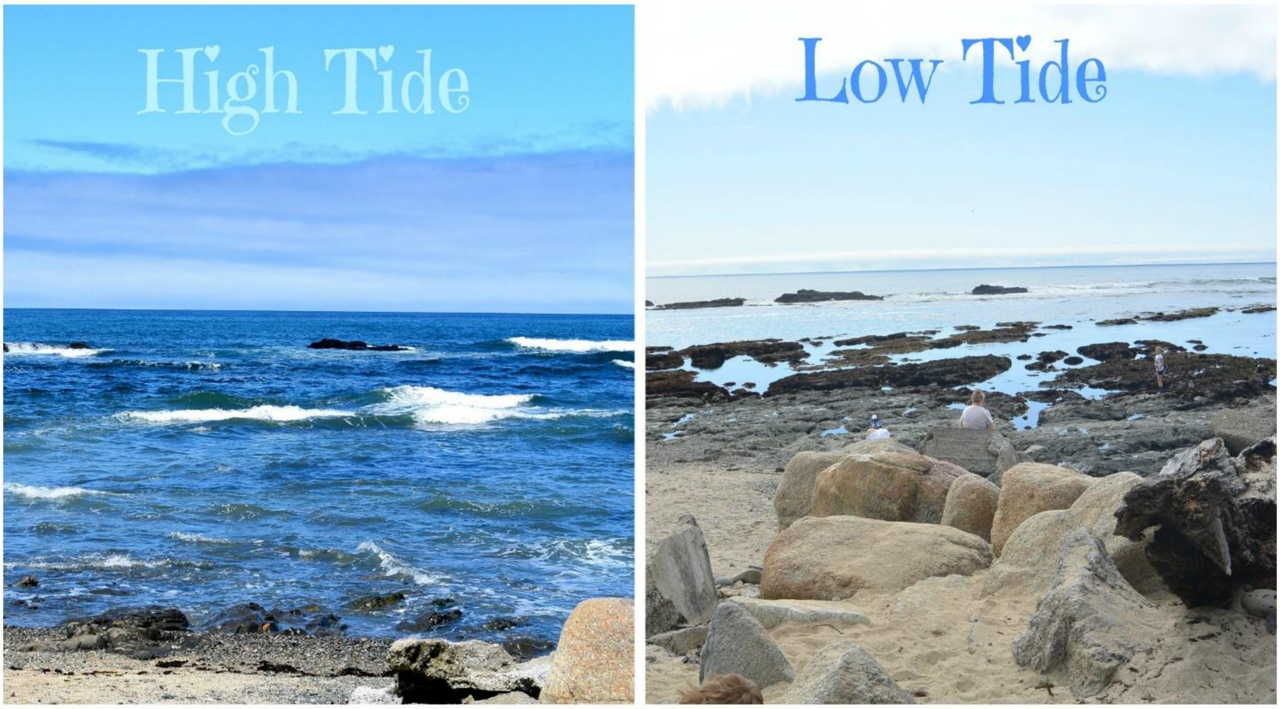
Q5. What are the roles of the compass, sextant, and radar in maintaining accurate navigation, and how do they complement each other?

NCC SPECIAL SUBJECT (NAVY)

NAVIGATION

CHAPTER 4: INTRODUCTION TO TIDES (CODE N-4)

"Nature's rhythm is reflected in the rise and fall of the tides"
-Rabindranath Tagore



TEACHING INSTRUCTIONS

Period	**: 1 (40 Min)**
Type	**: Theory**
Conducting Officer	**: PI**
Year	: **Third**
Training Aids	: **Blackboard, whiteboard, projector**

Time Plan

Introduction	**: 05 Min**
Purpose of Navaids	**: 20 Min**
Types of Navaids	**: 10 Min**
Conclusion	**: 05 Min**

INTRODUCTION

1. Tides are a fascinating and powerful natural phenomenon that plays a significant role in shaping the coastal environment. These rhythmic rises and falls of sea level, which occur on a regular basis, are most commonly observed along shorelines, especially in coastal regions. The movement of tides can be seen as the water level surges and retreats, influenced by the gravitational pull of the moon and the sun. In some places, the tide can be barely noticeable, while in others, such as in the Bay of Fundy, the difference between high and low tide can be dramatic, reaching over 50 feet. Tides affect a wide range of activities, from navigation and fishing to the behaviour of marine life and coastal ecosystems.

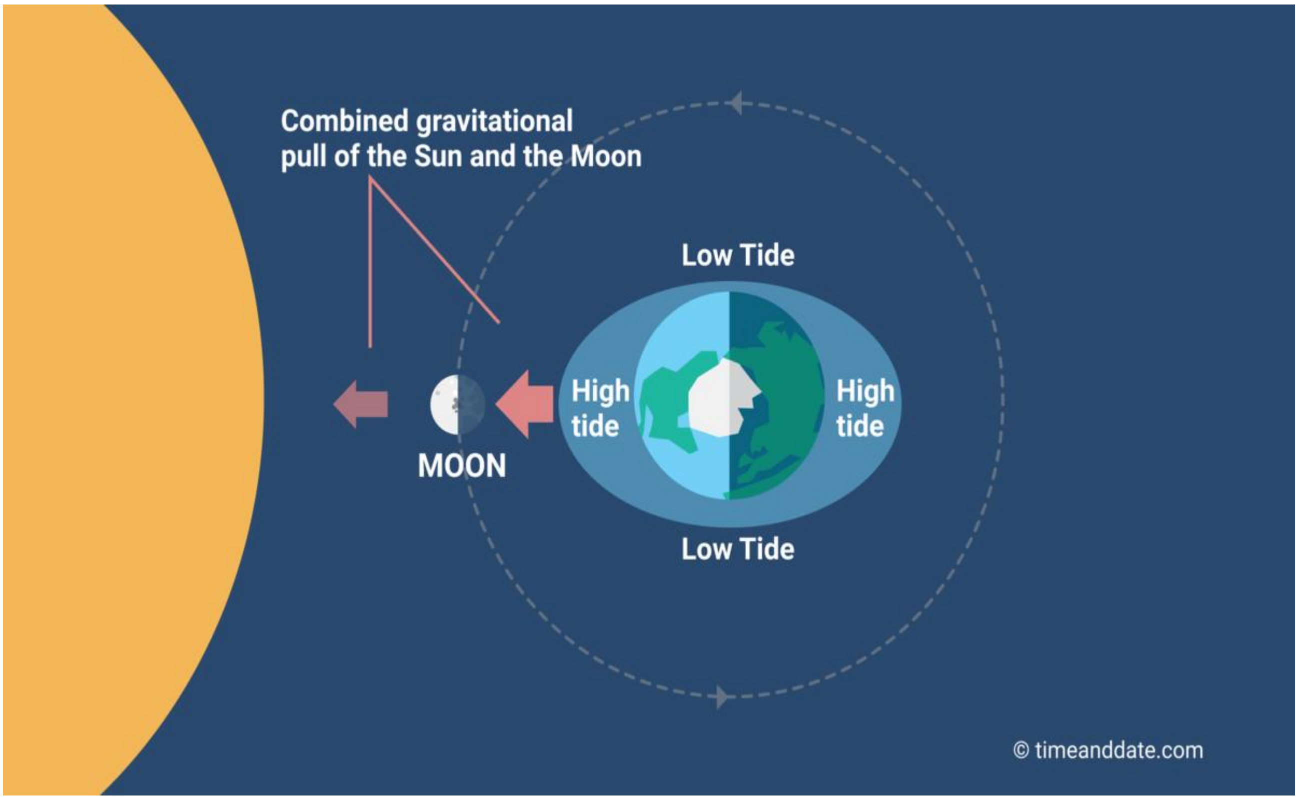
PREVIEW	LEARNING OBJECTIVES
➢ Part I – What are tides ➢ Part II - Characteristics of Tides ➢ Part III – Other Related Terms	➢ Cadets will learn how tides are created. ➢ To understand the key terms related to tides. ➢ To learn how tides impact the movement of ships near coastal areas.

PART I: WHAT ARE TIDES

2. Tides are the periodic rise and fall of sea levels caused by the gravitational forces exerted by the moon and the sun, along with the Earth's rotation. The primary driver of tides is the moon's gravitational pull, which creates a bulge in the ocean on the side of Earth closest to it, resulting in a high tide. On the opposite side of Earth, another high tide occurs due to the centrifugal force caused by the Earth-moon system's rotation. The sun also plays a role in influencing tides, although its effect is weaker than the moon's. As the Earth rotates, different regions experience alternating high and low tides, typically occurring twice a day. Tides vary in size and frequency depending on the location, with some areas experiencing large tidal ranges while others have minimal changes. Tides are important for navigation, coastal ecosystems, and various human activities.

How Tides affect Navigation?

3. Navigation is significantly affected by the tides, as the rise and fall of sea levels can impact the depth of water, the strength and direction of currents, and the overall safety of maritime operations. During high tide, vessels can access areas that may be too shallow at low tide, allowing them to enter harbours, ports, or narrow channels that might otherwise be impassable. Conversely, at low tide, certain areas can become dangerously shallow, increasing the risk of grounding, especially in regions with large tidal ranges. Mariners must be aware of tide schedules to avoid running aground or damaging the vessel.



<u>Cause of Tides</u>

4. Additionally, tidal currents, which flow in and out with the tide, can strongly influence navigation speed and course. These currents can either assist or hinder a ship's progress, depending on whether they are flowing in the same direction as the vessel or against it. In narrow waterways, tidal streams can create strong currents that make it challenging to maintain a steady course, requiring careful planning and precise manoeuvring. To mitigate these risks, mariners rely on tidal charts, real-time tide predictions, and tidal stream information to adjust their routes and timing, ensuring safe and efficient navigation.

DID YOU KNOW?
➢ **The Sun Also Affects Tides.** While the Moon is the dominant force, the Sun also influences tides. When the Sun, Moon, and Earth align (during new moons and full moons), the gravitational forces of the Sun and Moon combine, resulting in spring tides – higher than usual high tides and lower-than-usual low tides. Conversely, when the Sun and Moon are at right angles (during the first and last quarters), the tidal effect is lessened, leading to neap tides, where high tides are lower and low tides are higher.
➢ **Tidal Patterns Vary by Location.** The tidal range and pattern can vary significantly depending on where you are on Earth. There are diurnal tides (one high and one low tide per day), semidiurnal tides (two high and two low tides of similar size per day), and mixed tides (two high and two low tides per day, but of different sizes). Local geography, including the shape of the coastline and the depth of the ocean, can affect the exact timing and height of tides.

PART II: CHARACTERISTICS OF TIDES

5. **High Water**. High water refers to the highest point the tide reaches during one tidal cycle. It occurs when the water level is at its peak due to the gravitational pull of the moon and the sun, typically twice daily. The timing and height of high water can vary depending on the location and the phase of the moon, with spring tides resulting in higher high waters and neap tides in lower ones.

6. **Low Water**. Low water is the lowest point the tide reaches during one cycle. It marks the moment when the water level is at its minimum, typically occurring just after the high water. Low water occurs twice a day as well, with its timing and height being influenced by the same tidal forces, such as the positions of the moon and sun.

High Water and Low Water

7. **Range of Tides**. The range of tides refers to the difference in height between high water and low water during a tidal cycle. It is a key indicator of the size of the tidal fluctuation and can vary significantly depending on the location and the phase of the moon. A large tidal range is typical in areas like the Bay of Fundy, while smaller ranges are common in regions close to the equator.

8. **Height of Tide**. The height of the tide refers to the vertical distance between the sea level and a fixed reference point known as chart datum, which is typically a standard low water mark. It is measured to determine the water depth and to assist in navigation, ensuring vessels avoid shallow areas and safely travel through tidal waters.

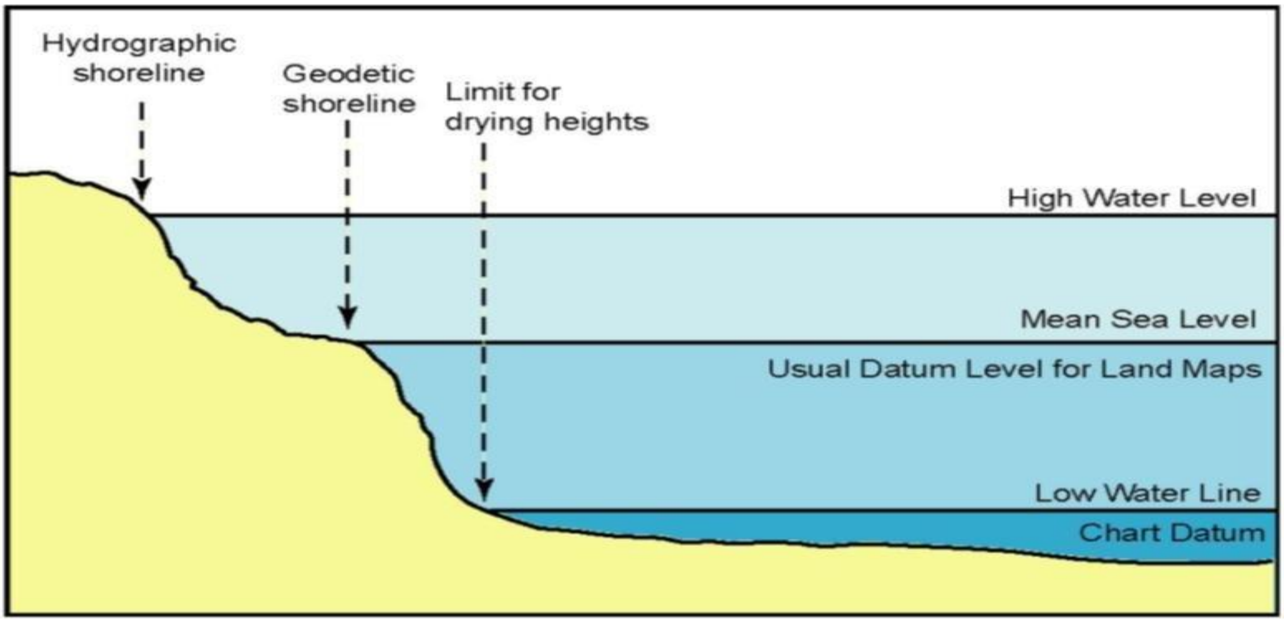
9. **Slack Water**. Slack water is the period during a tidal cycle when the tidal current is weakest. It occurs just before or after the maximum flow of water, either at high water or low water. During slack water, the water movement comes to a temporary halt, offering a brief period of calm before the current reverses direction.

10. **Maximum Rate**. The maximum rate is the fastest speed that the tidal current reaches during each cycle. It occurs when the tide is changing most rapidly, usually around the time of

high or low water, when the gravitational forces are exerting their greatest influence on the movement of the water. The maximum rate can be crucial for navigating tidal currents, as it determines the strength and direction of water movement.

Terminology Related to Tides

11. **Chart Datum**. Chart datum is a reference level used to measure tides, typically set at the lowest astronomical tide that can be expected. It represents the level below which the tide rarely falls, providing a standard base to assess changes in water levels. Mariners rely on chart datum to ensure safe navigation by determining the depth of water and avoiding shallow areas.



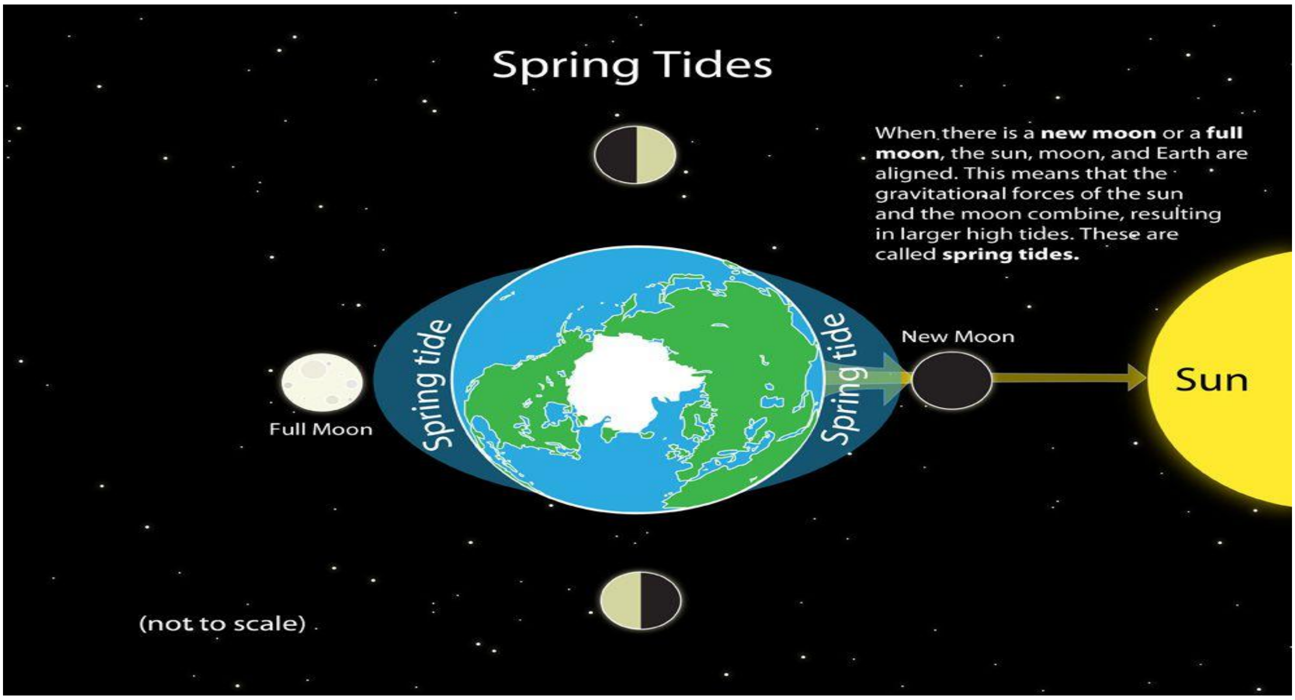
Tide Terminologies

12. **Tidal Stream**. A tidal stream refers to the horizontal movement of water caused by the gravitational pull of the sun and moon. As tides rise and fall, they create currents that flow in specific directions along the coastline, influencing navigation, fishing, and other maritime activities. The strength and direction of tidal streams vary with the phases of the moon and the positions of celestial bodies.

13. **HAT & LAT**. HAT (Highest Astronomical Tide) and LAT (Lowest Astronomical Tide) represent the extreme predicted tide levels at any port. HAT is the highest water level that can be expected during the year, while LAT is the lowest. These measurements are crucial for safe port operations, ensuring that vessels can be safely docked or navigated without risk of running aground.

14. **Spring Tides**. Spring tides occur when the moon is either new or full, leading to the greatest tidal range. During these phases, the sun, moon, and Earth align, amplifying the gravitational pull and creating higher high tides and lower low tides. Spring tides happen twice a month, offering the largest fluctuations in water levels.

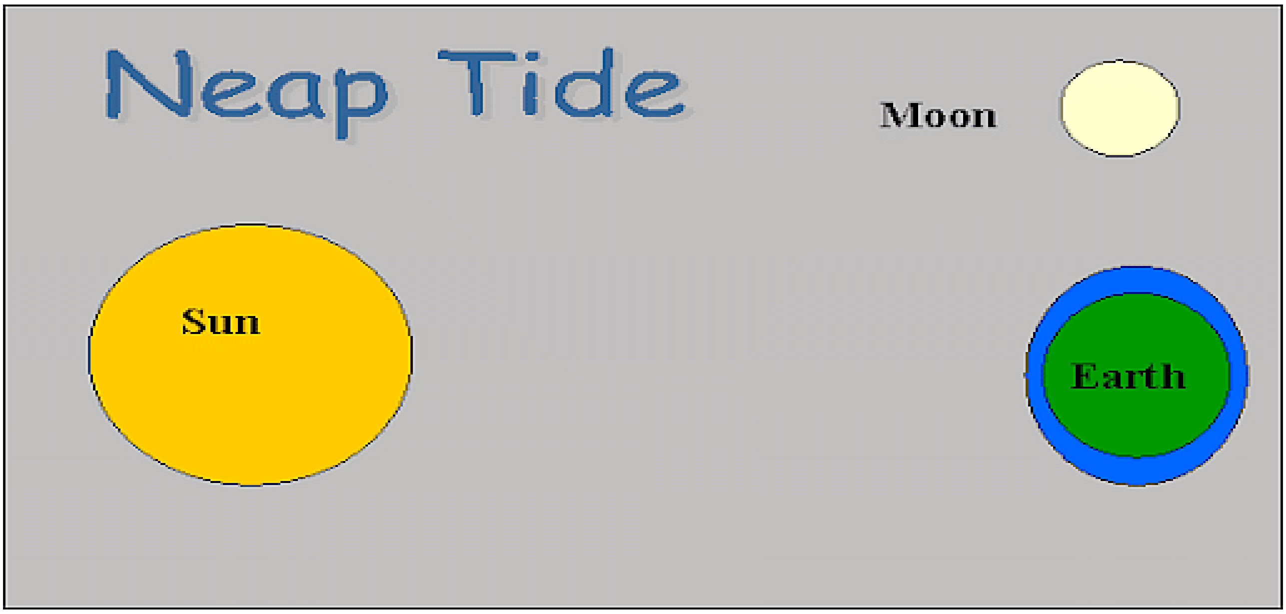
15. **Neap Tides**. Neap tides occur when the tidal range is at its smallest, typically between the new and full moon phases. During neap tides, the sun and moon are at right angles to each other, which weakens their combined gravitational effect, resulting in less dramatic changes in sea level. Neap tides are characterized by smaller high tides and higher low tides.



DID YOU KNOW?

- **The Moon's Effect on Tides Is Gradually Decreasing.** The Moon is slowly moving away from Earth, at an estimated rate of about **3.8 cm per year**. This means that over millions of years, tides will become less pronounced. The Moon's gravitational pull will become weaker, causing a decrease in the tidal range.

- **Tides Can Be Predicted.** With high accuracy, tides can be predicted for many years into the future due to the regularity of the Moon's orbit and the Earth's rotation. Tidal predictions are essential for navigation, fishing, and coastal planning, and are made using complex mathematical models that account for factors like the Moon's position, the Sun's effect, and local geographic features.



PART III: OTHER RELATED TERMS

16. **Wind Speed**. Wind speed is the rate at which the wind moves, measured in knots, which equates to nautical miles per hour. It is an essential factor for navigation, weather forecasting, and maritime operations, as it determines the intensity of the wind's effect on ships, sails, and sea conditions. Strong winds can significantly impact ship handling and safety, while light winds can limit sailing efficiency.

Wind Sock

17. **Wind Direction**. Wind direction refers to the origin of the wind, indicating the direction from which it is blowing. It is crucial for navigation, as it helps sailors adjust sails and course to harness the wind effectively. Wind direction is typically expressed in degrees, relative to true north, and plays a key role in predicting weather patterns and sea conditions.

18. **Sea Breeze**. A sea breeze is a cool wind blowing from the sea to the land, typically during the day. This phenomenon occurs due to the differential heating of the land and water, with the land heating up faster than the sea, causing the air over the land to rise and draw cooler air from the sea. Sea breezes can affect coastal weather, cooling the land and providing relief during hot days.

19. **Land Breeze**. A land breeze is the reverse of a sea breeze, occurring at night when the land cools faster than the sea. As the air over the land cools and becomes denser, it moves towards the sea, creating a breeze blowing from the land to the water. Land breezes are generally weaker than sea breezes and can contribute to cooling coastal regions during the night.

20. **Beaufort Scale**. The Beaufort Scale is a system used to measure and describe wind speed based on its observed effects on the environment. Developed by Sir Francis Beaufort in 1805, it ranges from 0 (calm) to 12 (hurricane-force winds), with each number corresponding to specific wind conditions and their impact on sea or land. For example, at a level 0, the wind is calm with no movement of leaves, while at level 6, winds are classified as a "strong breeze," causing large branches to move and walking against the wind becomes difficult. The scale helps

sailors, meteorologists, and others assess wind conditions to make decisions about navigation, safety, and preparation for severe weather.

BEAUFORT WIND SCALE

WIND SPEED

KPH	MPH	KNOTS	#	DESCRIPTION		
0	0	0	0	Calm		
1 - 5	1 - 3	1 - 3	1	Light air		
6 - 11	4 - 7	4 - 6	2	Light Breeze		
12 - 19	8 - 12	7 - 10	3	Gentle Breeze		
20 - 28	13 - 18	11 - 16	4	Moderate Breeze		
29 - 38	19 - 24	17 - 21	5	Fresh Breeze		
39 - 49	25 - 31	22 - 27	6	Strong Breeze	Small Craft Advisory	
50 - 61	32 - 38	28 - 33	7	Near Gale		
62 - 74	39 - 46	34 - 40	8	Gale	Gale Warning	Tropical Storm Warning
75 - 88	47 - 54	41 - 47	9	Strong Gale		
89 - 102	55 - 63	48 - 55	10	Storm	Storm Warning	
103 - 117	64 - 72	56 - 63	11	Violent Storm		
> 118	> 73	> 64	12	Hurricane	Hurricane Warning	

CONCLUSION

21. In conclusion, tides are a fundamental and predictable natural phenomenon that plays a crucial role in shaping maritime operations and coastal environments. Driven by the gravitational forces of the moon and the sun, tides create regular fluctuations in sea levels, which vary in magnitude and frequency across different regions. Understanding the various aspects of tides, such as high and low water, tidal range, and the timing of tidal streams, is essential for safe navigation, coastal management, and environmental monitoring. By monitoring tide patterns, mariners can plan their routes more effectively, avoiding shallow waters and maximizing fuel efficiency.

22. Moreover, the study of tides is vital for understanding the broader dynamics of the Earth's oceans and atmosphere. The interactions between tidal forces, weather patterns, and ocean currents contribute to the health of marine ecosystems and influence coastal activities like fishing, shipping, and recreation. As technology advances, tools like tide gauges and satellite-based systems enable more precise predictions, offering enhanced safety for those navigating tidal waters. Ultimately, tides are not only a fascinating aspect of Earth's natural systems but also a crucial consideration in ensuring safe and efficient maritime practices.

DID YOU KNOW?

- **The Sun Also Affects Tides.** While the Moon is the dominant force, the Sun also influences tides. When the Sun, Moon, and Earth align (during new moons and full moons), the gravitational forces of the Sun and Moon combine, resulting in spring tides—higher-than-usual high tides and lower-than-usual low tides. Conversely, when the Sun and Moon are at right angles (during the first and last quarters), the tidal effect is lessened, leading to neap tides, where high tides are lower and low tides are higher.

- **Tidal Patterns Vary by Location.** The tidal range and pattern can vary significantly depending on where you are on Earth. There are diurnal tides (one high and one low tide per day), semidiurnal tides (two high and two low tides of similar size per day), and mixed tides (two high and two low tides per day, but of different sizes). Local geography, including the shape of the coastline and the depth of the ocean, can affect the exact timing and height of tides.

- **The Moon's Effect on Tides Is Gradually Decreasing.** The Moon is slowly moving away from Earth, at an estimated rate of about 3.8 cm per year. This means that over millions of years, tides will become less pronounced. The Moon's gravitational pull will become weaker, causing a decrease in the tidal range.

- **Tides Can Be Predicted.** With high accuracy, tides can be predicted for many years into the future due to the regularity of the Moon's orbit and the Earth's rotation. Tidal predictions are essential for navigation, fishing, and coastal planning, and are made using complex mathematical models that account for factors like the Moon's position, the Sun's effect, and local geographic features.

SUMMARY

➢ **Gravitational Pull.** Tides are caused by the gravitational pull of the Moon and the Sun on Earth's oceans, with the Moon having the strongest effect due to its proximity.

➢ **High and Low Tides.** A full tidal cycle includes two high tides and two low tides every 24 hours and 50 minutes, creating a regular rhythm of rising and falling water levels.

➢ **Spring and Neap Tides.** Spring tides occur during full moons and new moons, when the gravitational forces of the Sun and Moon align, causing higher-than-usual high tides. Neap tides happen during the first and third quarters of the moon, when the Sun and Moon's forces are perpendicular, leading to lower high tides.

➢ **Tidal Range.** The difference between high tide and low tide is called the tidal range, which can vary significantly depending on the location, with some places experiencing over 50 feet of difference.

➢ **Tidal Bore.** In certain rivers, like the Qiantang River in China, the incoming tide can create a "tidal bore," a wave that travels upstream, sometimes reaching over 10 feet high.

SUGGESTED READ

➢ BR 45 Vol-1

➢ Admiralty manual of Tide Table

ASSESSMENT EXERCISE

Multiple Choice Questions

Q1. What is the primary cause of tides?

(a) Wind currents
(b) Gravitational pull of the Moon and the Sun
(c) Earth's rotation alone
(d) Movement of ocean currents

Q2. What is the term used for the highest point the tide reaches in a tidal cycle?

(a) Low water
(b) Tidal range
(c) High water
(d) Slack water

Q3. Which area is known for experiencing the world's highest tides?

(a) Mediterranean Sea
(b) Bay of Bengal
(c) Bay of Fundy
(d) Pacific Ocean

Q4. How many high tides and low tides typically occur in most coastal areas each day?

(a) One high tide and one low tide
(b) Two high tides and two low tides
(c) Three high tides and three low tides
(d) Four high tides and four low tides

Q5. What is the effect of high tide on navigation?

(a) Reduces water depth, making entry to ports difficult
(b) Allows access to areas that may be too shallow at low tide
(c) Stops all maritime activities
(d) Has no effect on ship movement

Q6. What is the term for the difference in height between high water and low water?

(a) Slack water
(b) Tidal range
(c) Neap tide
(d) Chart datum

Q7. What is the period called when tidal currents are at their weakest?

(a) High water
(b) Low water
(c) Slack water
(d) Maximum rate

Q8. What is the Lowest Astronomical Tide (LAT)?

(a) The average tide level of the sea
(b) The highest tide recorded in history
(c) The lowest predictable tide level at a given location
(d) A tide that occurs only during earthquakes

Q9. When do spring tides occur?

(a) During quarter moon phases
(b) When the Moon and Sun are at right angles
(c) During full moon and new moon phases
(d) Only in the summer season

Q10. What is the name of the horizontal movement of water caused by tides?

(a) Tidal stream
(b) Wind current
(c) Land breeze
(d) Ocean swell

Q11. What does the term "Chart Datum" refer to in navigation?

(a) The highest tide level recorded
(b) A reference point for measuring tides
(c) The speed of tidal currents
(d) The time at which high tide occurs

Q12. Why are tidal predictions important for mariners?

(a) To avoid running aground in shallow waters
(b) To measure ocean salinity
(c) To determine ship speed only
(d) To identify wind direction changes

Q13. What happens to tidal currents during neap tides?

(a) They become stronger
(b) They completely stop
(c) They become weaker
(d) They reverse direction

Q14. What natural phenomenon influences both sea breezes and land breezes?

(a) Ocean currents
(b) Differential heating of land and water
(c) Lunar eclipses
(d) The Earth's core temperature

Q15. What is the Beaufort Scale used for?

(a) Measuring tide height
(b) Predicting earthquake activity
(c) Measuring wind speed based on observed effects
(d) Calculating tidal range

One-word Objective Questions

1. What is the highest point the tide reaches during a cycle?

2. What is the lowest point the tide reaches during a cycle?

3. What term describes the horizontal movement of water caused by the sun and moon?

4. What is the term for the time when the tidal current is weakest?

5. Which type of tides occurs when the moon is either new or full?

Short Answer-Type Questions

1. What is the range of tides and how is it calculated?

2. Explain the difference between Spring Tides and Neap Tides.

3. What is the significance of the Chart Datum in tide measurements?

4. How does the Beaufort Scale relate to wind speed and wave height?

5. What are the characteristics of a Sea Breeze and a Land Breeze?

Long Answer-Type Questions

1. Discuss the different tidal terms such as high water, low water, slack water, and maximum rate, and their importance in navigation.

2. Explain how the wind speed and direction influence tides, waves, and currents in coastal navigation.

3. Describe the Beaufort Scale and its role in maritime navigation, including how it helps sailors estimate wind speed and wave height.

4. Explain the causes and effects of Spring Tides and Neap Tides on ships and coastal navigation.

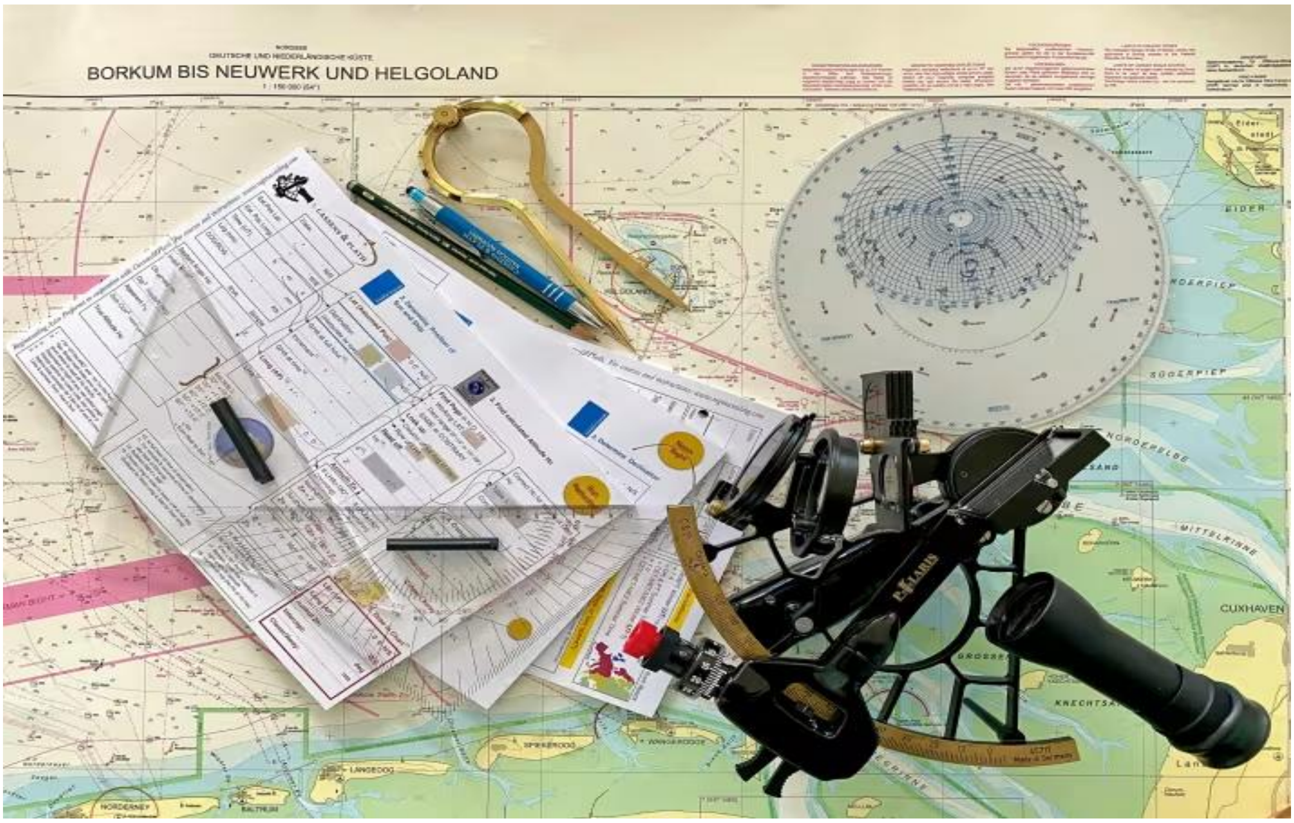
5. Discuss the relationship between tides, winds, and safe navigation in and out of harbours.

NCC SPECIAL SUBJECT (NAVY)

NAVIGATION

CHAPTER 5: INTRODUCTION TO ASTRONAVIGATION (CODE N-5)

"Look to the stars not just for inspiration, but for direction." — Kalpana Chawla



TEACHING INSTRUCTIONS

Period	: **1 (40 Min)**
Type	: **Theory**
Conducting Officer	: **PI**
Year	: **Third**
Training Aids	: **Blackboard, whiteboard, projector**

Time Plan

Introduction	**: 05 Min**
Astronavigation Basics	**: 20 Min**
Tools for Astronavigation	**: 10 Min**
Conclusion	**: 05 Min**

INTRODUCTION

1. Astronavigation is an ancient yet highly reliable method of determining a ship's position at sea using celestial bodies like the sun, moon, stars, and planets. Before modern GPS technology, sailors relied on this technique to navigate vast oceans, especially during long voyages. By measuring the angles between the horizon and key celestial objects using instruments like a sextant, navigators could determine their latitude and, in some cases, longitude.

2. Astronavigation requires a deep understanding of the stars' positions, which change depending on the time of day, year, and the ship's location. Navigators would use celestial tables, or almanacs, to calculate the expected positions of stars at specific times. With precise calculations, they could plot their position on a chart, which often involved navigating by dead reckoning between sightings. This method remains an essential skill for navigators today, particularly in the event of a failure of modern navigation systems. It's not only about understanding the science but also about developing a sense of connection with the sea and the natural world, as sailors of the past once did.

PREVIEW	LEARNING OBJECTIVES
➢ Part I: Basics of Astronavigation ➢ Part II: Tools for Astronavigation ➢ Part III: Example of Astronavigation	➢ Learn how sailors navigate using celestial bodies like stars and the sun. ➢ Understand the tools needed for astronavigation, such as the sextant and almanacs. ➢ Appreciate the historical significance of astronavigation in maritime history.

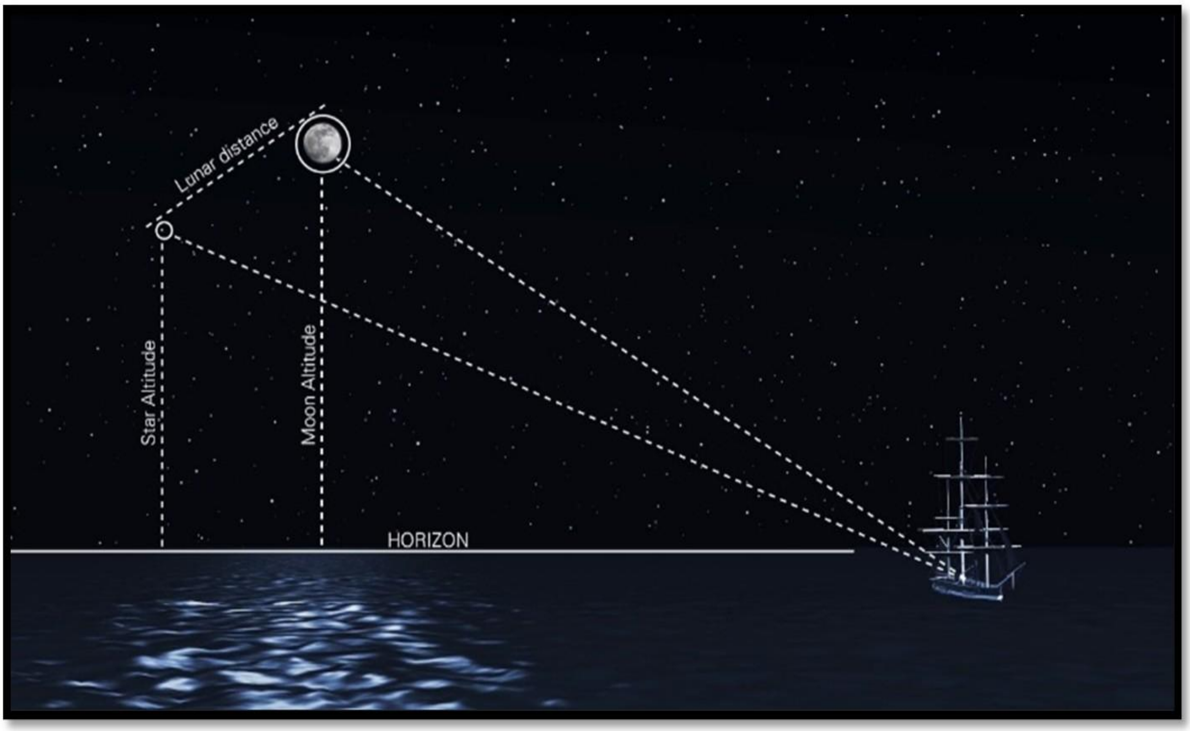
PART I: BASICS OF ASTRONAVIGATION

3. Astronavigation is a fascinating method that allows sailors to determine their position on Earth using celestial bodies like the sun, stars, moon, and planets. By observing these celestial bodies in relation to the horizon, navigators can measure their latitude and longitude, essential for safe and accurate maritime travel. The technique has been fundamental in guiding sailors across vast oceans for centuries and remains a reliable skill even in the age of modern navigation technology. There are various ways of doing astronavigation:-

(a) **Using the Sun**. One of the simplest ways to determine latitude is by measuring the height of the sun at noon. The angle between the sun and the horizon gives a direct correlation to how far north or south the observer is from the equator. For instance, at the equator, the sun will be directly overhead at noon, while at higher latitudes, it will appear lower in the sky. By using a sextant to measure this angle, navigators can reference tables, such as the Nautical Almanac, to pinpoint their latitude.

(b) **Using the Stars**. Stars have long been a key tool for night navigation. The North Star, or Polaris, is especially useful in the Northern Hemisphere. Unlike other stars that move across the sky, Polaris stays nearly fixed in the same spot, making it a reliable indicator of true north. By measuring the angle between Polaris and the horizon, sailors can easily determine their latitude, since the angle corresponds directly to their distance from the equator. This method has been essential for sailors for centuries, offering a sense of direction even in the darkest of nights.

(c) **Using the Moon and Planets**. The moon and planets can also serve as navigational aids, but their use is more complex due to their rapid movement across the sky. Unlike stars, the positions of the moon and planets change quickly, requiring more detailed calculations. Mariners often use a technique known as "lunar distance" to determine their longitude, comparing the moon's position to that of specific stars or the sun at a given time. This method involves precise timing and knowledge of the celestial almanacs, making it a more advanced form of astronavigation.



PART II: TOOLS FOR ASTRONAVIGATION

4. **Sextant**. A sextant is a precise, handheld instrument used in astrological navigation to measure the angle between a celestial body (like the sun, moon, or a star) and the horizon. By taking these measurements, a navigator can determine their latitude and, with additional calculations, their longitude. The sextant consists of a graduated arc, a movable index arm, a mirror, and an eye piece. It works by reflecting the image of the celestial body through the mirror onto the horizon, allowing the user to align both images accurately.

DID YOU KNOW?
➢ **Ancient Origins of Astronavigation.** The practice of using celestial bodies for navigation dates back to ancient civilizations. The Babylonians (around 2000 BC) are believed to be among the first to use the stars for navigation. They relied on the positions of the stars and constellations to orient themselves during their travels.
➢ **The Polynesians' Advanced Techniques.** The Polynesians were exceptional navigators who mastered the art of astronavigation long before European explorers. They used the stars, the sun, and ocean swells to navigate across vast distances in the Pacific Ocean. Their technique, known as "wayfinding," allowed them to travel without maps or compasses, relying solely on the natural world.
➢ **We only see one side of the Moon** because it is tidally locked to Earth. This means that the Moon takes the same amount of time to rotate once on its axis as it does to orbit around the Earth—about 27.3 days. As a result, the same hemisphere of the Moon is always facing us, while the other side (often called the "far side" or mistakenly the "dark side") remains hidden from direct view.

5. **How to Use a Sextant?**

(a) **Prepare the Sextant**.

(i) Ensure the sextant is calibrated properly.

(ii) Hold it with the arc facing you, and the handle in your dominant hand.

(b) **Position the Sextant**. Point the instrument towards the celestial body (e.g., the sun, moon, or a star). The horizon mirror should face the sky, while the index mirror reflects the celestial body towards the horizon.

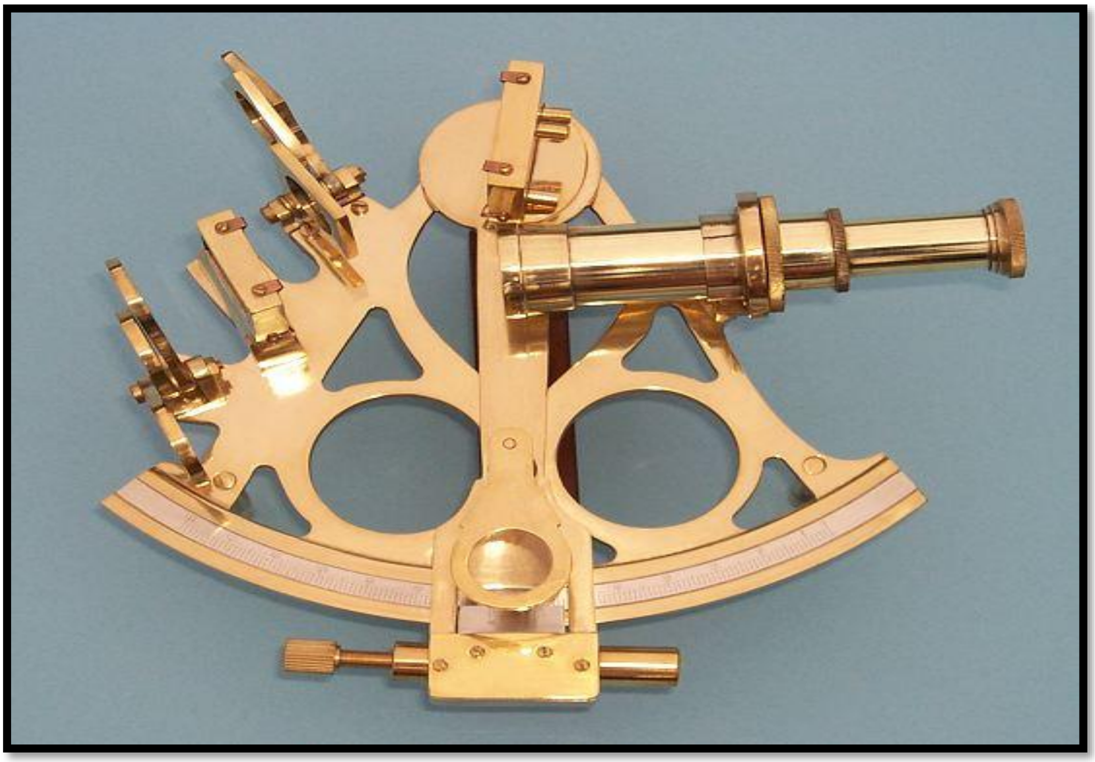
(c) **Align the Horizon and Celestial Body**.

(i) Looking through the eyepiece, adjust the index arm until the image of the celestial body is aligned with the horizon. This is done by turning the micrometre screw to fine-tune the adjustment.

(ii) If using the sun, ensure that you are not looking directly at it to avoid eye damage, often achieved by using a sun filter.

(d) **Record the Angle**. Once the celestial body and the horizon are aligned, read the angle off the graduated scale. This angle is known as the "altitude" of the celestial body above the horizon.

(e) **Make Calculations**. After taking the measurement, consult a Nautical Almanac or a set of pre-calculated tables to determine your position. The recorded angle allows you to calculate your latitude (and longitude, with additional steps). Typically, for latitude, the angle between the sun and the horizon is used, and for longitude, time-based measurements involving the moon or planets are considered.



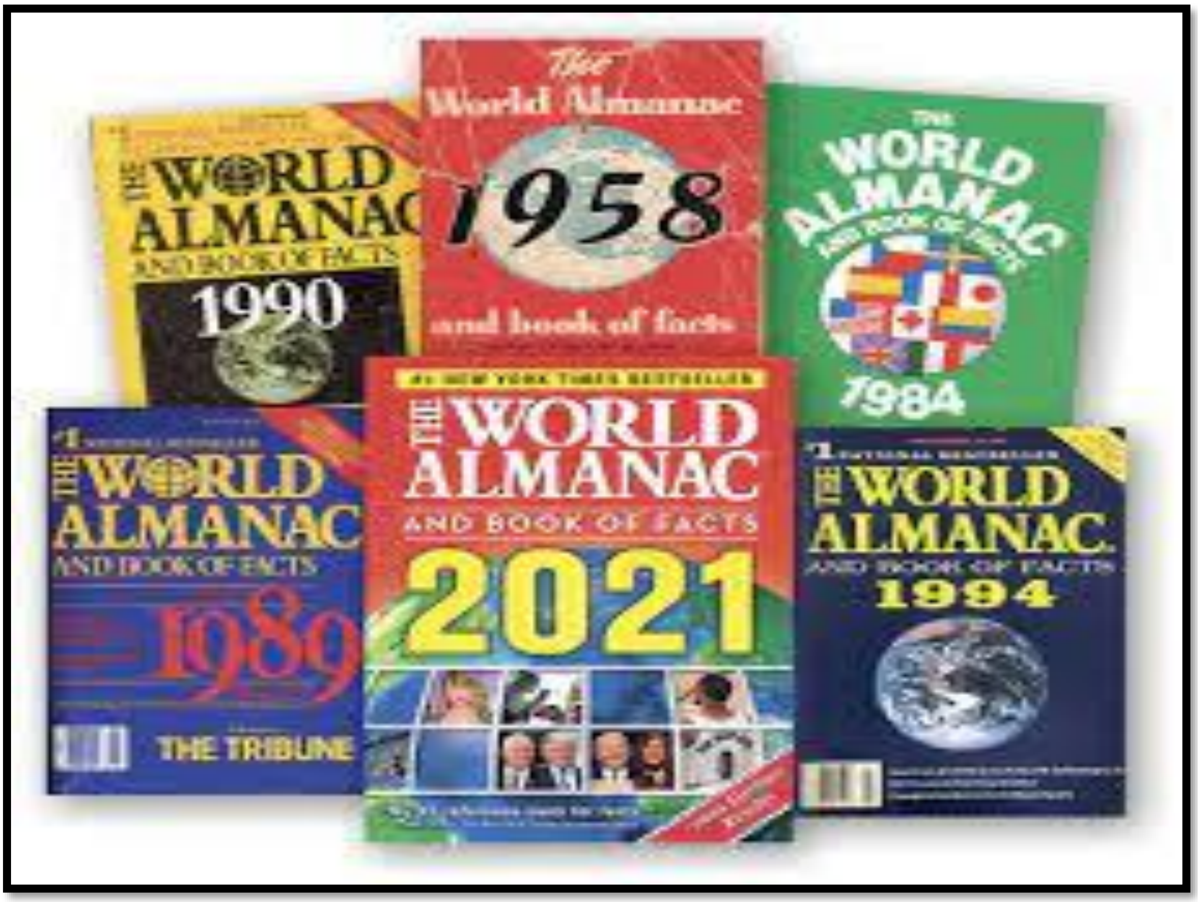
Sextant

6. The accuracy of the sextant depends on careful measurement and timing, as even a small error in the angle can result in a significant error in position. While modern technology like GPS has largely replaced sextants, they remain an important backup tool for navigators and a valuable skill for those studying traditional methods of navigation.

7. **Almanac**. An almanac is an essential navigational tool used by sailors and astronomers to determine the positions of celestial bodies at specific times of the year. It contains detailed tables of the sun, moon, planets, and major stars, providing their coordinates for each hour of the day. By comparing real-time celestial observations with the almanac data, navigators can calculate their latitude and longitude, helping them determine their precise

location at sea. This practice has been a cornerstone of astronavigation for centuries, allowing sailors to travel vast distances even before modern GPS technology.

8. The most widely used almanac for navigation is the Nautical Almanac, which includes data such as Greenwich Mean Time (GMT) positions of celestial bodies, sunrise and sunset timings, and other astronomical information necessary for celestial navigation. To use it effectively, a navigator measures the altitude of a celestial body using a sextant, notes the exact time of the observation, and then references the almanac to find the corresponding position of that body. This data is then used in calculations to plot the ship's position on a nautical chart. Despite advancements in electronic navigation, the almanac remains an indispensable backup tool, ensuring safe navigation in case of technological failures.



Nautical Almanacs

9. **Chronometer (Clock)**. A chronometer is a highly accurate timekeeping device used in navigation to determine a ship's longitude at sea. Unlike regular clocks, a marine chronometer is designed to remain precise even in harsh maritime conditions, resisting temperature changes, humidity, and the motion of the ship. Since the Earth rotates 15 degrees of longitude per hour, knowing the exact time difference between the ship's local time (determined by the sun's highest point in the sky) and a fixed reference time, usually Greenwich Mean Time (GMT), allows sailors to calculate their position east or west of the Prime Meridian. Even a small error in timekeeping could lead to significant navigational miscalculations, making the chronometer an essential tool for long voyages.

Chronometer Clock

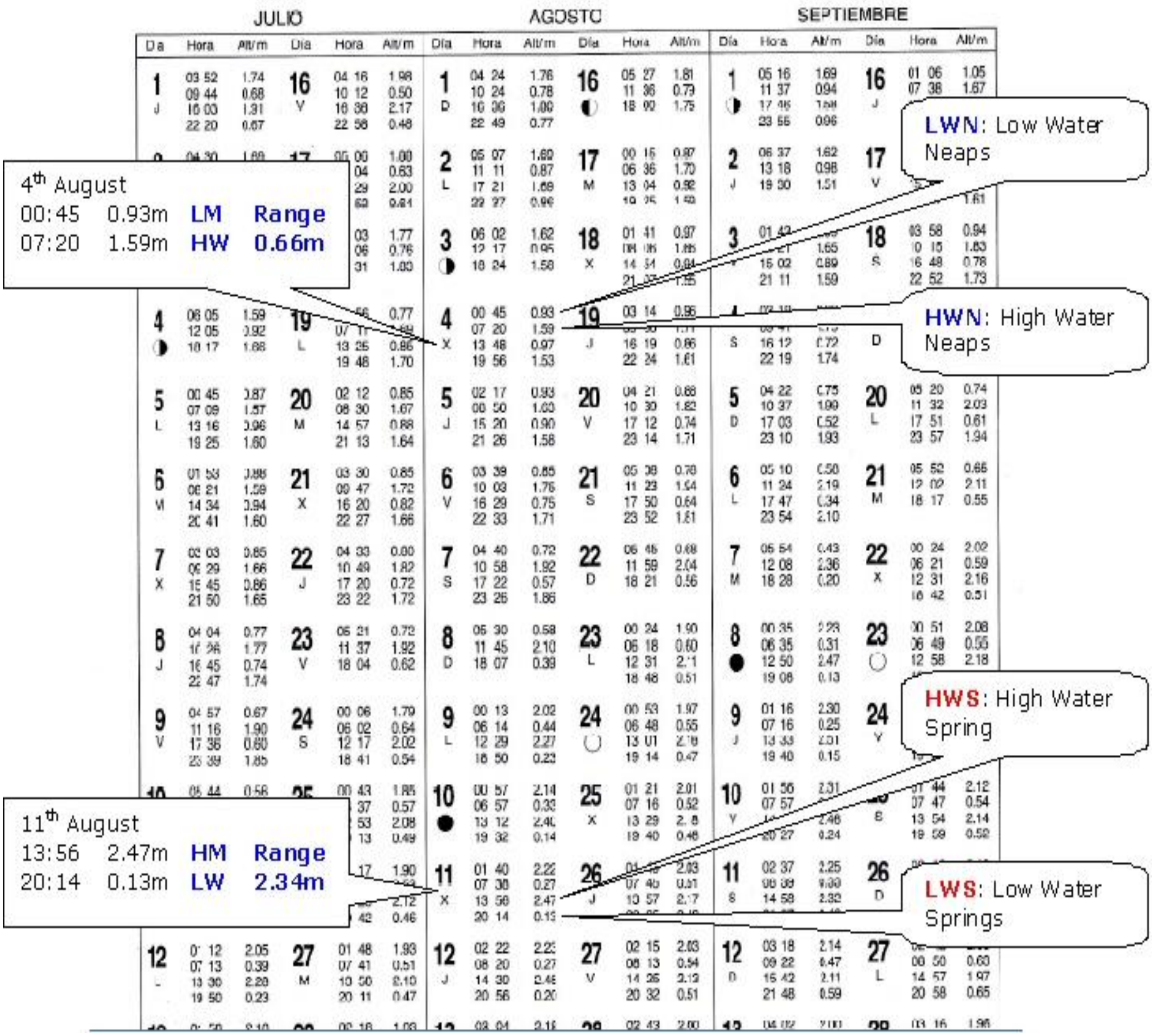
10. To use a chronometer for navigation, sailors take a sighting of the sun or another celestial body using a sextant and record the exact time of the observation from the chronometer. This data is then compared to the Nautical Almanac, which provides the positions of celestial bodies at specific times based on GMT. By calculating the difference between local noon (when the sun is highest) and GMT, sailors can determine how many degrees they are from the Prime Meridian, thereby finding their longitude. The invention of the marine chronometer by John Harrison in the 18th century revolutionized navigation, significantly improving the accuracy of sea travel and reducing the risks associated with uncertain positioning. Even today, despite the widespread use of GPS, chronometers remain a valuable backup for traditional celestial navigation.

DID YOU KNOW?

- **The Development of the Sextant**. The sextant, invented in the 18th century by John Campbell and later refined by Jesse Ramsden and others, revolutionized astro navigation. It allowed sailors to measure the angle between a celestial body (usually the sun or a star) and the horizon, providing accurate readings of latitude and longitude. This invention drastically improved the accuracy of navigational charts.

- **The Importance of the Chronometer**. The problem of determining longitude at sea was solved by the invention of the marine chronometer by John Harrison in the 18th century. Prior to its development, determining longitude at sea was nearly impossible. Harrison's accurate timepiece allowed sailors to calculate longitude by comparing the local time at a ship's position with the time at a known location.

- **Sun, Moon, and Earth Connection**. The average distance from the Earth to the Sun is approximately 108 times the Sun's diameter. The average distance from the Earth to the Moon is about 108 times the Moon's diameter. This is why the Moon and Sun appear nearly the same size in the sky, making total solar eclipses possible.



Tide Table Extract

11. **Nautical Almanac and Tables**. The Nautical Almanac and Tables are essential tools for celestial navigation, providing sailors with precise information about the positions of celestial bodies, such as the sun, moon, planets, and major stars, for any given day and time. These publications contain precomputed tables that help navigators determine their position at sea by comparing their sextant observations with the listed celestial coordinates. By knowing the exact time of an observation (using a chronometer) and referring to the almanac, sailors can calculate their latitude and longitude accurately, ensuring safe and efficient navigation even in the absence of modern technology like GPS.

12. Using the Nautical Almanac, a navigator first takes a sextant reading of a celestial body's altitude above the horizon. The exact time of this observation is recorded, and the corresponding celestial data from the almanac is used to find the body's Greenwich Hour Angle (GHA) and Declination—values that are essential for plotting a position. Additional navigation tables, such as sight reduction tables, help simplify complex calculations, allowing for quick determination of a ship's coordinates. These almanacs have been crucial for maritime travel for centuries, and despite advancements in digital navigation, they remain a fundamental backup tool for sailors and navigators worldwide.

PART III: EXAMPLES OF ASTRONAVIGATION

Taking Bearing of Astronomical Object using Sextant

13. **Example 1: Finding Latitude Using the Sun**. A sailor in the middle of the ocean wants to determine their latitude. At solar noon (when the sun is at its highest point in the sky), they use a sextant to measure the angle between the sun and the horizon. Let's say the angle is 50 degrees. They then check the Nautical Almanac to find the sun's declination for that day. Using a simple formula, they subtract the measured angle from 90 degrees and adjust for the sun's declination. This calculation gives them their latitude, helping them stay on course.

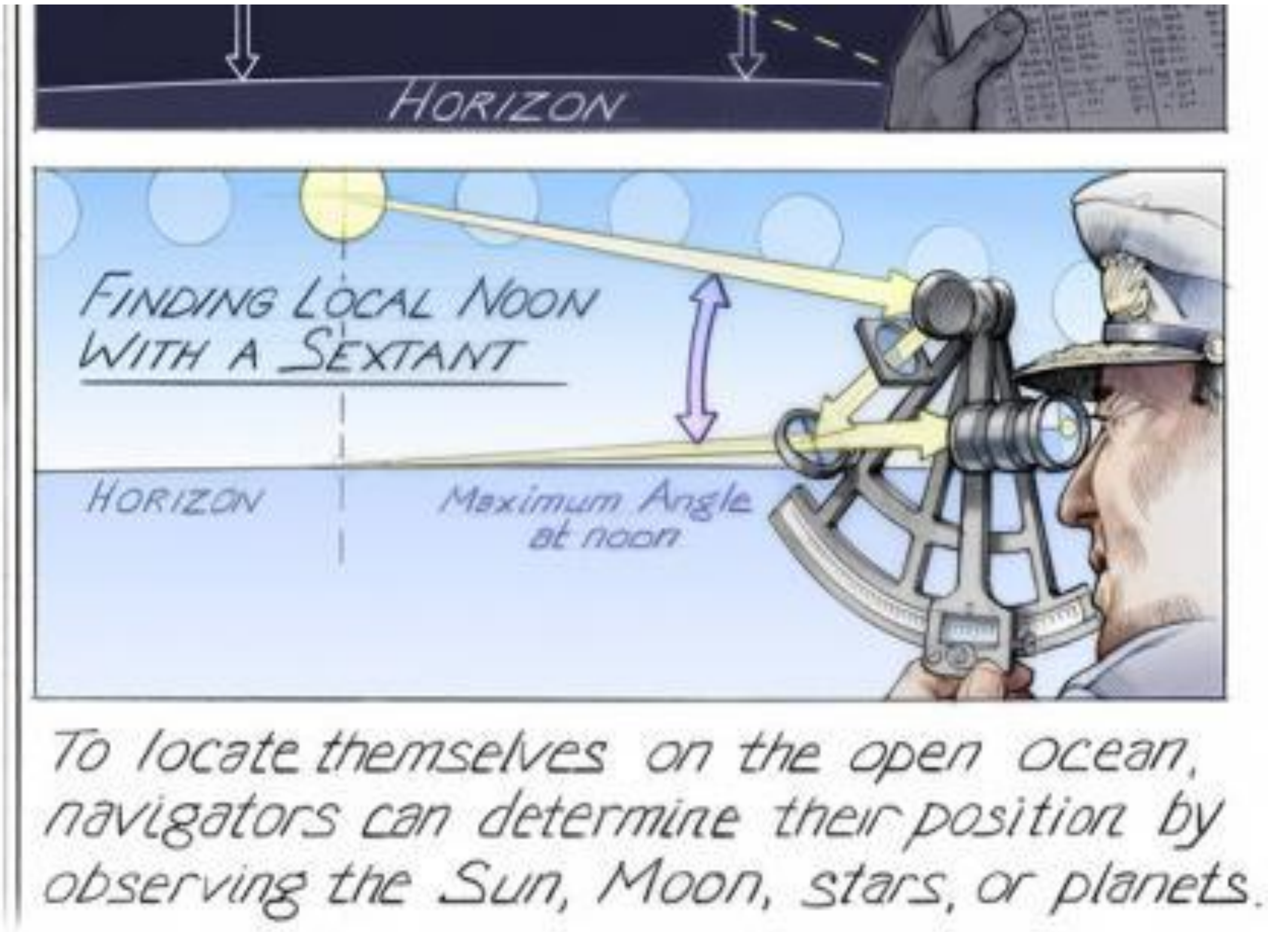
14. **Example 2: Finding Longitude Using a Chronometer and the Sun**. A sailor wants to determine their longitude. They measure the time when the sun reaches its highest point in the sky (local noon) and compare it with Greenwich Mean Time (GMT) from their chronometer. If local noon happens 4 hours after GMT noon, they know they are 60 degrees west of the Prime Meridian (since the Earth rotates 15 degrees per hour). By combining this information with their latitude, they can pinpoint their exact location on a nautical chart.

DID YOU KNOW?
➢ **The Role of Celestial Spheres**: Before modern computers and GPS, navigators used celestial spheres—globes that represented the stars and planets in the sky—to calculate positions. These instruments helped sailors chart their courses by allowing them to visualize the night sky and match the stars to their positions on Earth, a technique that remains a part of traditional navigation training today.

CONCLUSION

15. Astronavigation remains a vital skill in maritime history, blending science, mathematics, and careful observation to determine a ship's position at sea. While modern GPS technology has revolutionized navigation, celestial navigation techniques using the sun, stars, and precise instruments like the sextant, chronometer, and nautical almanac continue to serve as reliable backups. Understanding these traditional methods not only enhances a navigator's ability to operate in technology-limited environments but also preserves an important legacy of seafaring knowledge. By mastering these techniques, sailors can confidently navigate the vast oceans, ensuring accuracy and safety even in challenging conditions.

16. Despite advancements in electronic navigation, the principles of astronavigation remain relevant in modern times. The ability to determine latitude and longitude using celestial observations fosters self-reliance and a deeper understanding of the natural world. For professional mariners, naval officers, and explorers, proficiency in astronavigation is a testament to their expertise and adaptability. As technology evolves, these traditional skills continue to be an essential part of maritime training, ensuring that navigators are prepared for any situation where conventional tools may be required.



SUMMARY

- **Navigating by the Stars.** Astronavigation is the practice of using celestial bodies like the Sun, Moon, stars, and planets to determine a ship's position on the Earth.
- **Sextant.** The sextant, a key tool in astronavigation, is used to measure the angle between a celestial body and the horizon, helping sailors calculate their latitude and longitude.
- **The North Star.** The North Star (Polaris) has been a vital reference point for navigators in the Northern Hemisphere, as it stays nearly stationary in the sky, indicating true north.
- **No Need for GPS.** Before GPS, astronavigation was crucial for long-distance sea voyages, enabling sailors to find their way even in remote ocean areas without modern technology.
- **Ancient Techniques.** Astronavigation dates back to ancient civilizations, such as the Polynesians, who used the stars to navigate vast ocean distances, often without written maps.

SUGGESTED READ

BR 45 Vol-5

ASSESSMENT EXERCISE

Multiple Choice Questions

Q1. What is the primary purpose of astronavigation?

(a) To predict weather patterns
(b) To determine a ship's position at sea using celestial bodies
(c) To track ocean currents
(d) To communicate with satellites

Q2. Which celestial body is most commonly used to determine latitude at noon?

(a) The moon
(b) The sun
(c) Mars
(d) Jupiter

Q3. Which instrument is primarily used in astronavigation to measure angles between celestial bodies and the horizon?

(a) Chronometer
(b) Compass
(c) Sextant
(d) Barometer

Q4. Which star remains almost fixed in the sky and is used for navigation in the Northern Hemisphere?

(a) Sirius
(b) Vega
(c) Betelgeuse
(d) Polaris

Q5. What information does a nautical almanac provide?

(a) Ocean depth readings
(b) The positions of celestial bodies at specific times
(c) Wind speed predictions
(d) Sea current patterns

Q6. What is the primary function of a marine chronometer in navigation?

(a) To measure the altitude of celestial bodies
(b) To determine longitude by providing accurate time readings
(c) To find the direction of ocean currents
(d) To estimate the speed of a ship

Q7. Why is a sextant an essential tool in astronavigation?

(a) It measures wind direction and speed
(b) It helps determine underwater terrain
(c) It helps determine latitude and longitude through angle measurements
(d) It tracks the movement of celestial bodies over time.

Q8. What time reference is used in celestial navigation for longitude calculations?

(a) Local time
(b) Standard time
(c) Greenwich Mean Time (GMT)
(d) Universal Coordinated Time (UTC)

Q9. Who invented the marine chronometer, which revolutionized celestial navigation?

(a) Isaac Newton
(b) Galileo Galilei
(c) John Harrison
(d) Ferdinand Magellan

Q10. Why is astronavigation still relevant despite modern GPS technology?

(a) It is faster than GPS calculations
(b) It does not rely on electronic systems and remains functional in case of GPS failure
(c) It is the only method used for long-distance navigation
(d) It is a mandatory skill for all sailors

Q11. How do sailors determine their latitude using the sun?

(a) The angle between the sun and the horizon
(b) The colour of the sunset
(c) The distance between the sun and the moon
(d) The direction of the sun at sunrise

Q12. Why is a chronometer crucial for longitude calculations?

(a) It measures latitude directly
(b) It helps calculate the altitude of stars
(c) It records the exact time difference between local noon and GMT
(d) It predicts ocean currents

Q13. Which of the following is **not** a tool used in astronavigation?

(a) Nautical Almanac
(b) Sextant
(c) Compass
(d) Chronometer

Q14. What is the purpose of the lunar distance method in celestial navigation?

(a) It is used to determine latitude using the moon’s shadow
(b) It is used to determine longitude by comparing the moon’s position to stars
(c) It helps predict the moon’s orbit around Earth
(d) It is used to measure the depth of the ocean

Q15. Why do modern navigators still study astronavigation?

(a) Because it is a more accurate method than GPS
(b) Because GPS signals can be disrupted or unavailable
(c) Because it is required by all ships under international law
(d) Because it allows ships to travel faster

One-word Objective Questions

1. What celestial bodies are used in astronavigation to calculate a ship's position?

2. Which instrument is primarily used to measure the angle between a celestial body and the horizon?

3. What is the name of the book that provides information on the positions of celestial bodies?

4. Which star is commonly used for navigation in the Northern Hemisphere?

5. What device is used to determine the exact time for calculating longitude?

Short Answer Type Questions

1. How do sailors use the Sun to determine their latitude?

2. Explain the role of the chronometer in determining longitude.

3. What is the importance of the Almanac and Nautical Tables in astronavigation?

4. Describe how a sextant is used to measure the angle of the sun or a star.

5. What is the significance of the North Star (Polaris) in navigation?

Long Answer Type Questions

1. Describe the process of using astronavigation to determine a ship's location at sea. Include the role of the sextant, almanac, and chronometer.

2. Explain how astronavigation is still relevant today, even with the advent of GPS technology. What role does it play as a backup system?

3. Discuss the tools used in astronavigation, such as the sextant, chronometer, and almanac. How do these tools work together to calculate latitude and longitude?

4. How do sailors use the positions of the sun, stars, and planets to navigate? Include the use of the Nautical Almanac and Tables in your explanation.

5. Explain the significance of astronavigation in the history of maritime exploration. Why is it still taught to cadets despite modern navigation tools like GPS?

4

SEAMANSHIP

4

SECTION INDEX : SEAMANSHIP (SD/ SW)

NCC SPECIAL SUBJECT (NAVY)

SEAMANSHIP

CHAPTER 1: RIGGING AND TYPES OF ROPES (CODE- SS 1)

"When you reach the end of your rope, tie a knot in it and hang on"

TEACHING INSTRUCTIONS

Period	: 2 (80 Min)
Type	: Theory/ Practical
Conducting Officer	: PI
Year	: First

Training Aids : Blackboard, whiteboard, projector, compass

Time Plan

- Introduction : 05 Min
- Types of Ropes : 15 Min
- Breaking Strength/ Maintenance : 25 Min
- Rope Work Terms : 30 Min
- Conclusion : 05 Min

INTRODUCTION

1. Ropes are a fundamental part of seamanship, playing a crucial role in nearly every aspect of maritime operations, from securing vessels to hoisting sails and handling cargo. A solid understanding of rope types, their construction, and their proper use is essential for cadets as they develop their maritime skills. Ropes are broadly classified into natural fibre, manmade, and steel wire ropes, each offering distinct advantages based on strength, flexibility, and durability. Whether used for anchoring, mooring, or rigging, the correct selection and handling of ropes ensures efficiency and safety on board.

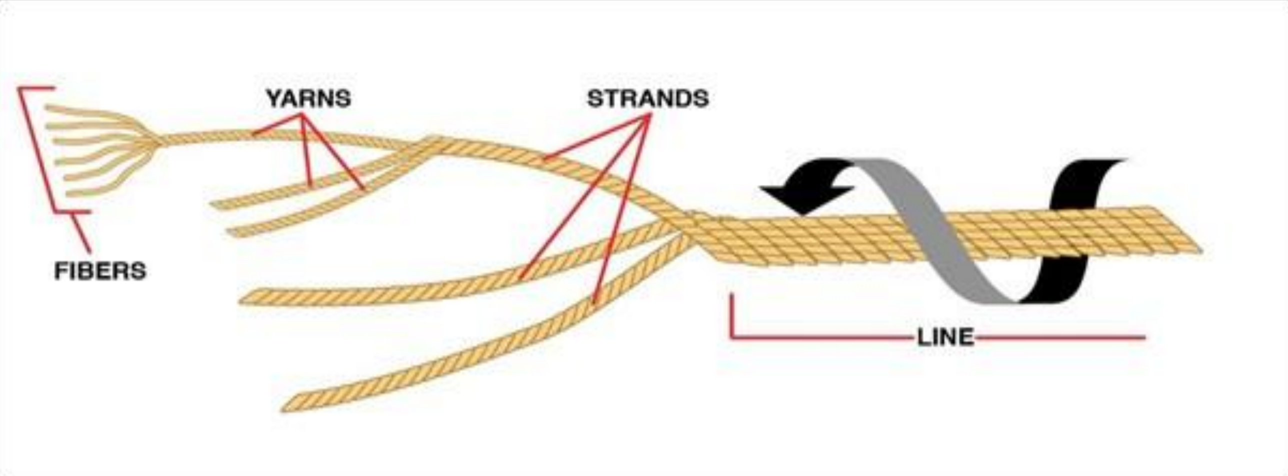
2. Beyond their immediate applications, ropes require proper care and maintenance to preserve their strength and longevity. Exposure to saltwater, friction, and heavy loads can weaken ropes over time, making routine inspection and upkeep a critical part of seamanship. This chapter equips cadets with the foundational knowledge to identify different types of ropes, understand their practical uses, and apply essential handling techniques. Mastering these skills will not only enhance their effectiveness as seafarers but also instill the discipline and attention to detail necessary for safe and efficient maritime operations.

PREVIEW	**LEARNING OBJECTIVES**
➢ Part I: Types of Ropes. ➢ Part II: Breaking Strength/ Maintenance. ➢ Part III: Rope Work Terms.	➢ Cadets will learn about. ➢ Different types of ropes, their construction, and their use in rigging. ➢ Identifying and differentiating types of ropes ➢ Understanding the importance of rigging, and learning to handle ropes safely.

PART I: TYPE OF ROPES

Components of Rope

3. In seamanship, ropes used onboard ships are classified into three main types: natural fibre ropes, manmade fibre ropes, and steel wire ropes**.** Natural fibre ropes, made from materials like coir, sisal, or manila, are flexible and grip well but are less durable in marine conditions. Manmade fibre ropes, such as nylon, polyester, and polypropylene, offer greater strength, resistance to water, and longer lifespan, making them ideal for mooring, towing, and general rigging. Steel wire ropes are used for heavy-duty applications like lifting, anchoring, and hoisting, as they provide exceptional strength and durability. Each type of rope serves a specific purpose onboard, ensuring safe and efficient operations at sea.



Types of Ropes

4. **Natural Fiber Ropes**. Natural fibre ropes are made from plant-based materials such as sisal, manila, coir, and hemp. They are biodegradable, have good grip, and are easy to handle, making them suitable for general-purpose tasks onboard. However, they absorb water, are prone to rot, and have lower strength compared to synthetic ropes. These ropes are often used for decorative purposes, traditional rigging, and temporary lashings.

5. **Manmade Fiber Ropes**. Manmade fibre ropes are synthetic ropes made from materials like nylon (polyamide), polyester, and polypropylene. These ropes are stronger, more durable, and resistant to moisture, chemicals, and UV degradation. They are widely used for mooring, towing, and rigging operations due to their high load-bearing capacity and long service life. Some synthetic ropes, such as Aramid and Parafil, are specially designed for extreme conditions.

6. **Steel Wire Ropes**. Steel wire ropes are made from strands of steel wires twisted together to form a strong and flexible rope. They are primarily used for heavy-duty applications such as anchoring, hoisting, lifting, and towing, where high tensile strength is required. Steel wire ropes are resistant to abrasion, high tension, and mechanical stress, making them essential for maritime and industrial use.

Types of Natural Fiber Ropes

7. **Sisal**. Sisal ropes are made from the leaves of the Agave plant and are known for their rough texture and durability. They are often used for temporary lashings, agricultural purposes, and light-duty applications on ships. Sisal ropes are cost-effective but tend to degrade quickly in marine environments due to water absorption.

8. **Manila**. Manila ropes, made from the fibers of the abacá plant, are among the strongest natural fibre ropes. They have excellent flexibility, grip, and resistance to saltwater, making them ideal for ship mooring, rigging, and lifeboat lashing. Despite their durability, they are susceptible to rot and require proper drying and maintenance.

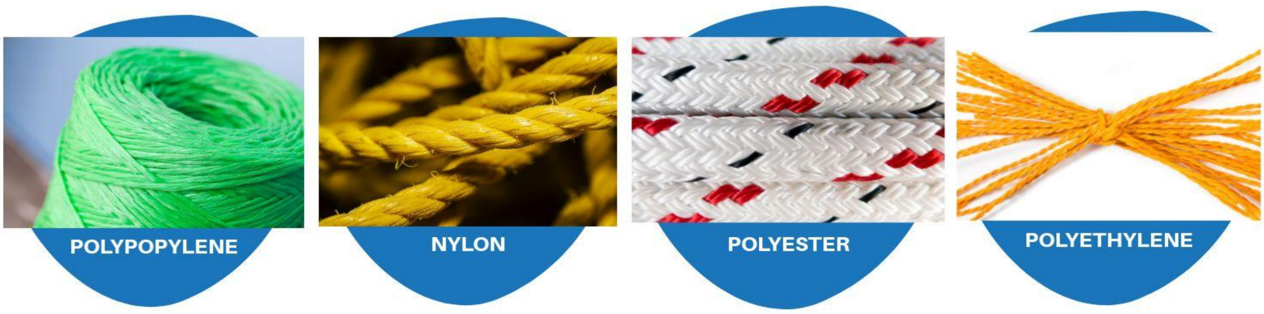
9. **Coir**. Coir ropes are derived from coconut husk fibers and are lightweight yet coarse in texture. They have excellent buoyancy and are commonly used for fenders, fishing nets, and floating barriers. However, coir ropes have lower strength compared to other natural fibre ropes and wear out quickly when exposed to heavy loads.

10. **<u>Hemp</u>**. Hemp ropes are made from the stalks of the hemp plant and are valued for their strength, flexibility, and resistance to wear. Traditionally used in naval rigging and anchor lines, hemp ropes have now been largely replaced by synthetic alternatives due to their tendency to rot when exposed to moisture.

<u>Types of Manmade Fiber Ropes</u>

11. **<u>Polyamide, Polyester, Polyethylene</u>**. Polyamide (nylon) ropes are highly elastic, durable, and shock-absorbent, making them ideal for mooring and towing. Polyester ropes offer excellent UV resistance, low stretch, and high strength, making them suitable for heavy-duty marine applications. Polyethylene ropes are lightweight, resistant to chemicals, and commonly used for fishing nets and general-purpose rigging.

12. **<u>Polyethylene Paraphile and Aramid</u>.** Polyethylene paraphile ropes are designed for high-load applications, providing exceptional strength and weather resistance. Aramid ropes, such as Kevlar, are extremely strong, heat-resistant, and lightweight, making them suitable for high-performance maritime and industrial uses. These ropes are often used in lifelines, safety equipment, and extreme environmental conditions.



DID YOU KNOW?
➢ **Rope Making Dates Back to Ancient Civilizations**. The use of ropes at sea has been essential for centuries. Ancient Egyptians are believed to have been among the first to make ropes, using plant fibers like papyrus and flax. By the time of the Greeks and Romans, ropes had become crucial for sailing and shipbuilding.
➢ **Manila Rope and its Resilience**. Historically, Manila rope - made from the fibers of the Manila hemp plant - was widely used for ship rigging. It was prized for its strength, durability, and resistance to saltwater, making it ideal for maritime applications. Manila rope was especially favored in the 19th and early 20th centuries before synthetic ropes became more common.
➢ **The Importance of Rope in Rigging.** Ropes are essential for controlling the sails, steering the rudder, and managing various ship functions. In traditional sailing ships, ropes were used in rigging, which included setting up the masts and sails. There were hundreds of ropes on a large ship, and sailors needed extensive training to handle them properly.
➢ **Knot Tying as an Essential Skill.** Knots have always been vital on the sea for securing sails, attaching equipment, and ensuring safety. There are specific knots designed for different purposes, such as the bowline (used for creating a fixed loop) and the clove hitch (for securing a rope to a post). Sailors still study and master these knots, as they remain integral to modern sailing.
➢ **Synthetic Ropes Revolutionized the Industry.** In the 20th century, the development of synthetic ropes made from materials like nylon and polypropylene revolutionized maritime use. These ropes are stronger, lighter, and more resistant to wear and UV damage compared to natural fibre ropes, making them a crucial tool for modern shipping, offshore oil rigs, and recreational boating.

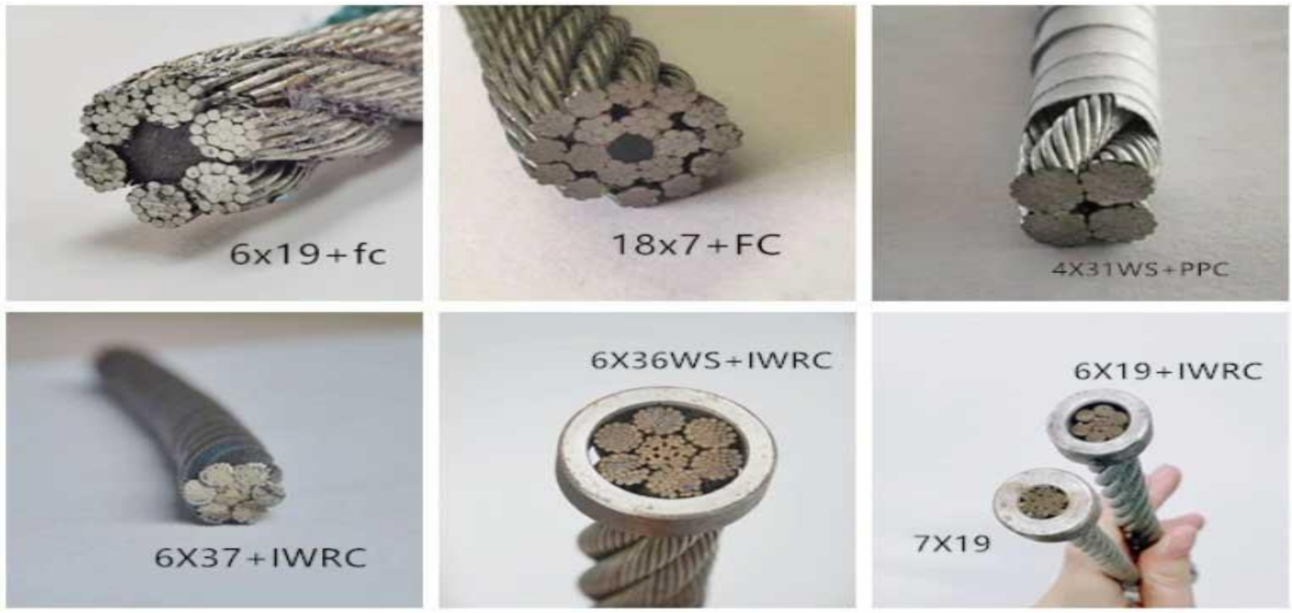
Types of Steel Wire Ropes

13. **Steel Wire Rope**. Steel wire ropes consist of multiple strands of steel wires twisted together, providing high tensile strength and resistance to abrasion. They are used in lifting, towing, and mooring operations where durability and load-bearing capacity are crucial.

14. **Flexible Steel Wire Rope**. Flexible steel wire ropes have more strands and finer wires, making them more pliable and easier to handle while maintaining high strength. These ropes are used in winches, cranes, and rigging where both flexibility and strength are required.

15. **Extra Flexible Steel Wire Rope**. Extra flexible steel wire ropes have an increased number of smaller wires per strand, making them highly bendable while retaining strength. They are used for dynamic applications such as hoisting machinery, elevators, and control cables.

16. **Mild Steel Wire Rope**. Mild steel wire ropes are made from low-carbon steel, offering good flexibility and moderate strength. These ropes are primarily used in light-duty lifting, fencing, and general-purpose applications where extreme tensile strength is not required.



Types of Steel Wire Ropes

PART II: BREAKING STRENGTH / MAINTENANCE OF ROPE

Breaking Strength

17. The breaking strength (BS) of a natural fibre rope is a critical factor in determining its load-bearing capacity and safety limits. It is the maximum force a rope can withstand before breaking under tension. The approximate breaking strength of natural fibre cordage rope can be calculated using the formula, **BS = $d^2/200$ tons,** where **d** represents the rope's diameter in millimeters. This formula provides a quick estimation, helping seafarers and riggers select the appropriate rope for different tasks such as mooring, anchoring, and cargo handling. Since natural fibre ropes have lower strength compared to synthetic or steel wire ropes, it is essential to consider safety factors and proper maintenance to prevent premature failure during operations.

Breaking of Rope

Care and Maintenance of Rope

18. Proper care and maintenance of ropes are essential to ensure their longevity, strength, and reliability in maritime operations. Regular inspections and adherence to best practices in handling, storage, and exposure to environmental factors help prevent deterioration and maintain the rope's structural integrity. Whether dealing with natural fibre, manmade fibre, or steel wire ropes, a systematic approach to upkeep is necessary to ensure their continued effectiveness in seamanship tasks.

19. **Stowing**. Natural fibre ropes should never be stowed while wet, as this can lead to rotting and loss of strength. If unavoidable, the rope should be dried at the earliest opportunity. Before use, these ropes must be thoroughly inspected for damage, chafing, rot, and fatigue. Rot can often be detected by smell or by opening the strands to examine their inner surfaces. Regular checks help prevent failure during critical operations.

Rope Stowage

20. **Exposure to Sunlight**. Manmade fibre ropes, while resistant to rot, can degrade under prolonged exposure to sunlight due to UV radiation. To maintain their durability, unnecessary exposure should be minimized by storing them in shaded or covered areas when not in use.

21. **Exposure to Chemicals**. Ropes must be protected from chemical contamination, as exposure to fumes or direct contact with hazardous substances can weaken the fibers. If a rope is contaminated, it should be thoroughly washed with cold running water to remove any chemical residue before further use.

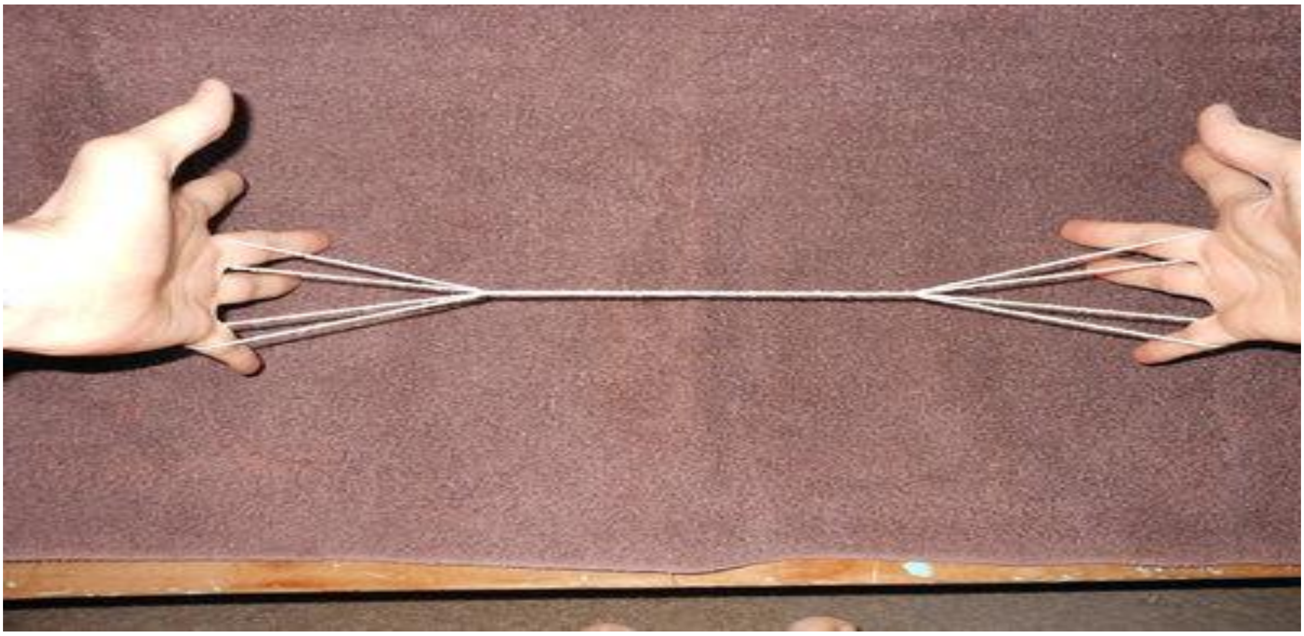
22. **Handling**. Dragging ropes over sharp or rough surfaces should be avoided, as this can cause abrasions and reduce their strength. Additionally, ropes should be protected from embedded particles that could lead to premature wear and tear. Proper handling techniques help extend their service life.

23. **Stowage**. Unlike natural fibre ropes, manmade fibre ropes are resistant to bacterial degradation and can be stored for long periods without deterioration. They can be stowed

while wet, but they should be arranged in a way that allows air circulation to prevent mildew or unwanted moisture retention. Coiled ropes should be kept in bins or on raised boards to facilitate airflow.

24. **Wear**. Over time, fibers on the surface of a rope may form a fuzzy or nap-like texture, which is a sign of normal wear. While this does not immediately affect strength, excessive fuzzing may indicate the need for closer inspection and possible replacement.

25. **Crows Footing**. Crows footing, also known as cockling, occurs when strands become distorted due to back twisting. This deformation weakens the rope's structure and should be corrected or the affected section replaced to prevent failure under load.



Crow Footing

26. **Chafing**. Chafing appears as heavy wear along the rope's surface, often recognized by a tufted appearance. This is typically caused by friction against hard surfaces. To mitigate chafing, chafing gear or protective coverings should be used in high-wear areas.

Chaffing of Rope

27. **Rust**. If a rope comes into contact with corroding steel, it may develop yellow or brownish-black stains. While removable stains do not affect the rope's integrity, persistent rust stains should be assessed to ensure that they do not indicate deeper fibre degradation.

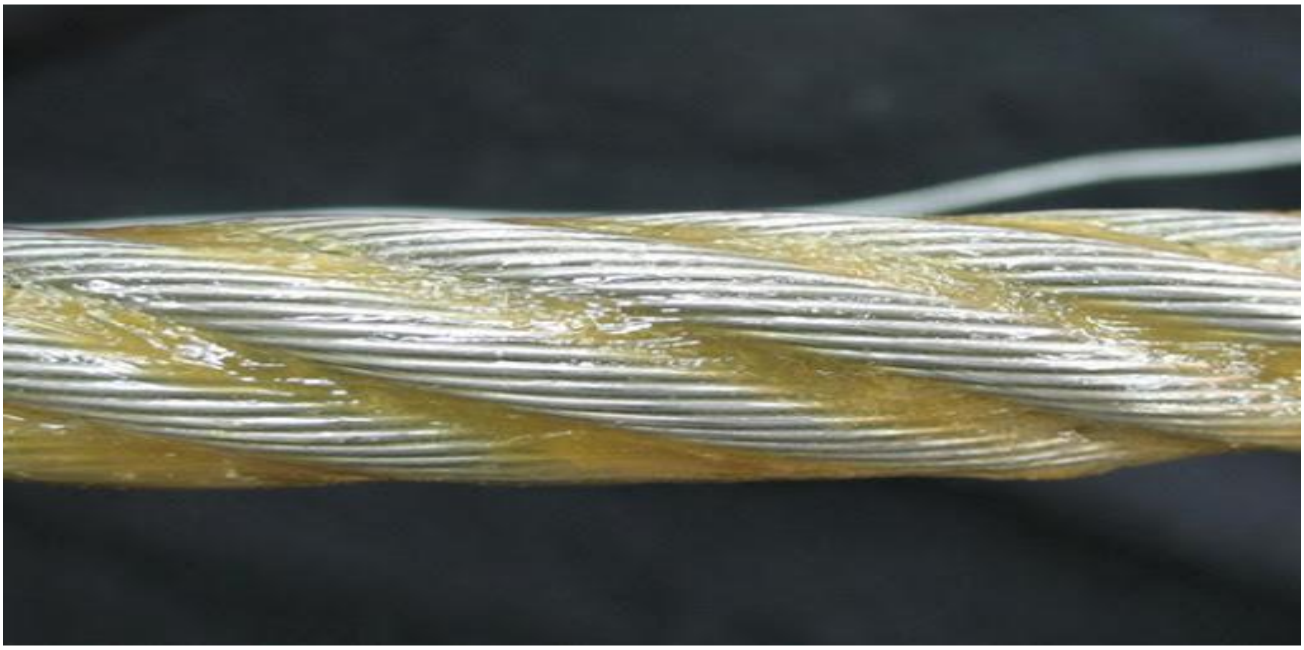
28. **Heat**. Ropes should not be stored in areas exposed to excessive heat, as high temperatures can weaken fibre structure, especially in synthetic ropes. Keeping ropes away from heat sources extends their lifespan.

29. **Icing**. Manmade fibre ropes are generally resistant to very low temperatures (as low as minus 80°C for polyamide and polyester). However, if a rope becomes iced, it should be thawed at a moderate temperature before storage to avoid brittleness or cracking.

30. **Stretching**. Manmade fibre ropes have good resistance to repeated loading, but temporary elongation may occur under strain. Regularly spaced markings on the rope can help monitor stretching, and a reduction in diameter after use can indicate fibre compression. Proper usage and load distribution minimize excessive stretching.

Stretching of Rope

31. **Oil and Grease**. Oil and grease can compromise a rope's grip and handling. They should be cleaned off using a mild soap solution and rinsed thoroughly with fresh water. Strong detergents should be avoided, as they can damage the fibers. By following these care and maintenance guidelines, ropes remain reliable, safe, and effective for maritime applications, ensuring their longevity and optimal performance in seamanship operations.



Greasing of Steel Wire Rope

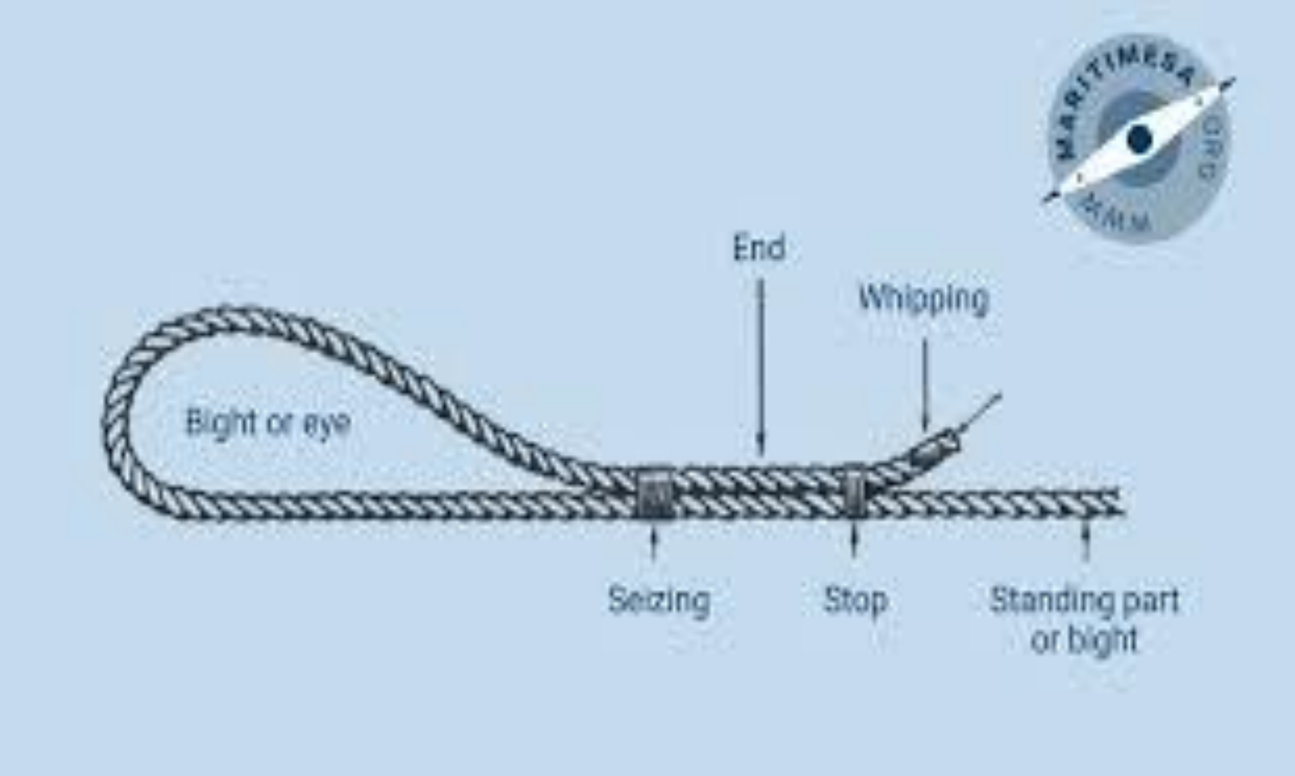
PART III: ROPE WORK TERMS

32. **Bight**. A bight is a simple loop or curve formed in a rope without crossing over itself. It is commonly used in knot tying, allowing for quick and easy fastening or securing of a rope without forming a complete knot. Bights are essential in many maritime applications, such as creating loops for mooring lines, forming parts of knots like the bowline, and preparing ropes for splicing. Since a bight does not require the rope's end to be free, it is particularly useful for making adjustments in the middle of a rope without untying other sections.

33. **Sizing**. Sizing is the process of reducing the thickness of a rope's end to make it easier to pass through a block, pulley, or small opening. This is typically done by tightly wrapping the end with twine or tape and cutting it to the desired diameter. In traditional seamanship, sizing ensures that a rope fits into designated fittings, allowing for smooth operation in rigging and sail handling. Proper sizing prevents unnecessary strain on the rope and equipment, enhancing its usability and longevity.

34. **Whipping**. It is a technique used to prevent the end of a rope from fraying or unraveling by tightly binding it with twine or thread. This is especially important for natural fibre ropes, which tend to fray over time with repeated use. The most common method is the sailmaker's whipping, which involves wrapping and securing the twine around the rope's end to create a firm and durable hold. Whipping extends the rope's lifespan, maintains its strength, and ensures a neat and professional appearance.

35. **Splicing**. It is the process of interweaving the strands of a rope to create a secure and permanent join. Unlike knots, which can reduce a rope's strength, splicing retains most of the rope's original strength and is commonly used for forming loops (eye splice), joining two ropes (short splice), or adding reinforcement (back splice). Splices are widely used in maritime operations for mooring lines, rigging, and towing applications, ensuring reliable and durable rope connections.



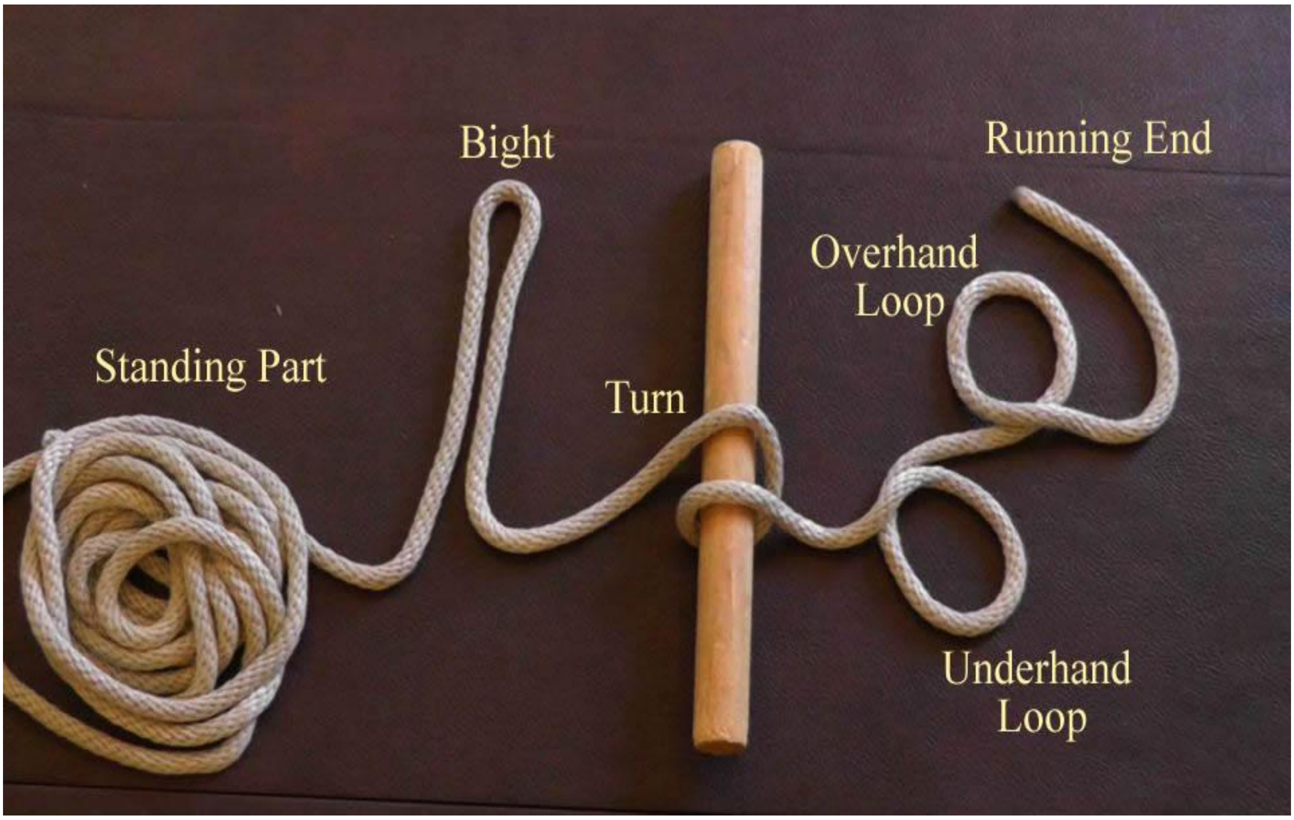
Components of Rope Work

36. **Seizing**. It involves binding two ropes together or securing loose strands using a tightly wound cord or wire. This technique is commonly used to reinforce the structure of a rope, particularly where it joins another piece of rigging or forms an eye. Seizing ensures that ropes do not slip or unravel under tension, making it a crucial method in maintaining the integrity of rigging, cable splices, and lashing applications.

37. **Hitching**. It refers to a method of securing a rope to an object, such as a post, ring, or another rope. Hitches are temporary and designed to be easily tied and untied when needed. Common hitches in seamanship include the clove hitch**,** round turn and two half-hitches, and rolling hitch, each serving different functions like securing a boat to a dock or fastening loads. A well-tied hitch provides strong holding power and prevents slippage, ensuring safety in maritime tasks.

38. **Bend**. A bend is a type of knot used to securely join two ropes together. Unlike hitches, which fasten a rope to an object, bends are specifically designed for connecting two separate ropes. Some of the most reliable bends used in seamanship include the sheet bend**,** double sheet bend, and carrack bend, which provide strong and stable connections. Bends are crucial in maritime operations where ropes of different sizes or materials need to be joined for towing, mooring, or securing loads.

39. **Knots**. Knots are fundamental in rope work and seamanship, used for securing, binding, adjusting, or fastening ropes in various applications. Different knots serve different purposes, such as the reef knot for binding, the bowline for creating a secure loop, and the figure-eight knot for preventing rope ends from slipping through fittings. Learning and mastering knots is essential for cadets and sailors, as they play a critical role in handling sails, anchoring, mooring, and emergency situations at sea.



Components of Rope Work

CONCLUSION

40. Rope work is an essential skill in seamanship, encompassing a wide range of techniques such as knot tying, splicing, whipping, hitching, and bending. These skills ensure that ropes are used effectively for mooring, anchoring, rigging, and securing loads, which are fundamental tasks onboard a ship. Understanding the different types of ropes—natural fibre, manmade fibre, and steel wire ropes—along with their properties and care requirements, allows cadets to select the right rope for specific applications. Proper maintenance, including protection from environmental factors, correct stowage, and regular inspections for wear and damage, is crucial to preserving the strength and longevity of ropes. By mastering rope handling and upkeep, cadets not only improve their seamanship skills but also enhance safety and efficiency in maritime operations.

41. The practical application of rope work extends beyond routine shipboard tasks, playing a vital role in emergency situations such as rescue operations, towing, and damage control. Knowing how to tie the right knots, secure hitches, and properly splice ropes can make a significant difference in critical moments at sea. Additionally, understanding the principles of breaking strength, stretching, and wear ensures that ropes are used within their limits to prevent failures. Seamanship relies heavily on the effective use of ropes, and proficiency in rope work is a mark of a skilled and capable sailor. By developing expertise in these techniques, cadets build confidence and readiness for real-world challenges in naval and maritime environments.

SUMMARY

➢ **The Art of Rigging**. Rigging involves setting up ropes, sails, and other equipment on a ship to control its sails and masts, ensuring safe and efficient sailing.

➢ **Natural vs Synthetic**. Traditional ropes were made from natural fibers like hemp and manila, but modern ropes are often made from synthetic materials like nylon and polyester for added strength and durability.

➢ **The Splice**. A spliced rope is created by interweaving the strands at the ends, making the rope stronger and more secure than simply tying knots.

➢ **Types of Rope**. Different types of rope serve various purposes; for example, moorings ropes are used for securing a ship to the dock, while lifelines are essential for safety.

➢ **Coiling for Safety**. Properly coiled ropes are essential on ships to prevent tangling and ensure they are ready for use, with certain coiling methods even named after famous sailors.

SUGGESTED READ

Admiralty Manual of Seamanship - BR- 67

ASSESSMENT EXERCISE

Multiple Choice Questions

Q1. What are the three main types of ropes used in seamanship?

(a) Cotton, Nylon, and Manila
(b) Natural fibre, Manmade fibre, and Steel wire
(c) Sisal, Polyester, and Steel
(d) Hemp, Coir, and Polyamide

Q2. Which natural fibre rope is known for its excellent resistance to saltwater?

(a) Coir
(b) Sisal
(c) Manila
(d) Hemp

Q3. What is the main disadvantage of natural fibre ropes compared to synthetic ropes?

(a) They are too flexible
(b) They absorb water and rot easily
(c) They have poor grip
(d) They are expensive

Q4. Which synthetic rope is known for its high elasticity and shock absorption?

(a) Polyester
(b) Polypropylene
(c) Polyamide (Nylon)
(d) Aramid

Q5. What are steel wire ropes primarily used for?

(a) Fishing nets
(b) Temporary lashings
(c) Heavy-duty lifting and towing
(d) Decorative rigging

Q6. Which formula is used to estimate the breaking strength (BS) of a natural fibre rope?

(a) $BS = d^2/100$
(b) $BS = d^2/150$
(c) $BS = d^2/200$
(d) $BS = d^2/250$

Q7. What is the primary purpose of whipping a rope?

(a) To make it easier to handle
(b) To prevent the rope from fraying
(c) To increase the strength of the rope
(d) To add flexibility/

Q8. Which type of synthetic rope is lightweight, resistant to chemicals, and commonly used for fishing nets?

(a) Nylon
(b) Polyester
(c) Polyethylene
(d) Polypropylene

Q9. Which factor does NOT contribute to rope deterioration?

(a) Exposure to saltwater
(b) Regular inspections
(c) Sunlight and UV radiation
(d) Contact with chemicals

Q10. What is the correct definition of a bight in rope work?

(a) A technique for joining two ropes together
(b) A simple loop or curve in a rope without crossing over itself
(c) A method of securing a rope to an object
(d) A process used to reduce the thickness of a rope

Q11. What is a bend used for in rope work?

(a) To secure a rope to an object
(b) To prevent fraying
(c) To reduce the thickness of a rope
(d) To join two ropes together

Q12. What is crows footing (cockling) in rope maintenance?

(a) The process of whipping a rope end
(b) A type of rope used for mooring
(c) A distortion in rope strands due to back twisting
(d) A technique for creating a loop

Q13. Which material is used to make Manila ropes?

(a) Coconut husk
(b) Hemp plant stalks
(c) Abacá plant fibres
(d) Agave plant leaves

Q14. What is the primary advantage of steel wire ropes over natural and synthetic fibre ropes?

(a) They are lightweight and buoyant
(b) They are cheaper to produce
(c) They have higher tensile strength and durability
(d) They require no maintenance

Q15. Why should natural fibre ropes not be stowed while wet?

(a) They become too heavy
(b) They lose their flexibility
(c) They can rot and weaken
(d) They become too stiff to use

One-word Objective Questions

Q1. What is the term for the process of examining a rope for damage, chafe, rot, and fatigue?

Q2. Which type of rope is most resistant to bacteriological attack?

Q3. What is the formula for calculating the breaking strength (BS) of a natural fibre rope?

Q4. Which type of rope is particularly sensitive to prolonged exposure to sunlight?

Q5. What is the term for the localised distortion of a rope strand caused by a back twist?

Short Answer-Type Questions

Q1. What are the three main types of ropes used on board ships?

Q2. How should natural fibre ropes be stowed to prevent damage and deterioration?

Q3. What is crows footing, and how does it affect a rope's strength?

Q4. How can chafing on a rope be identified?

Q5. Why should ropes not be exposed to chemicals or fumes, and how should ropes be cleaned if contaminated?

Long Answer-Type Questions

Q1. Describe the different types of ropes used on board ships, including their materials and uses.

Q2. Explain the importance of proper care and maintenance for ropes, including stowing, exposure to sunlight, and handling to prevent damage.

Q3. Discuss the process of identifying and addressing common issues with ropes, such as stretching, rust, and wear.

Q4. Explain the role of breaking strength in rope safety and how it can be calculated for natural fibre ropes.

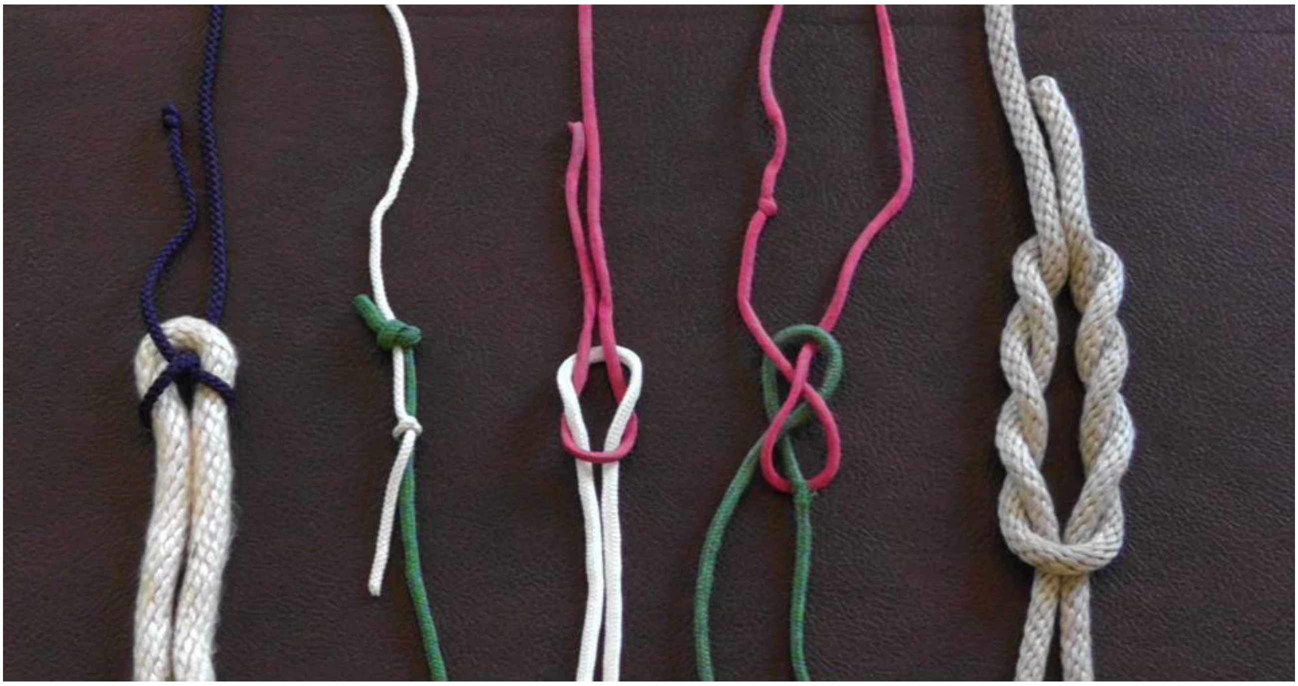
Q5. How do environmental factors like heat, ice, and chemicals affect rope maintenance and durability? What steps should be taken to protect ropes from these factors?

NCC SPECIAL SUBJECT (NAVY)

SEAMANSHIP

CHAPTER 2: BENDS AND HITCHES (CODE- SS 2)

"Two half hitches saved a Queen's Ship" - Anonymous



TEACHING INSTRUCTIONS

Period	**:**	**5 (40 Min Theory + 160 Min Practical)**
Type	**:**	**Theory/ Practical**
Conducting Officer	**:**	**PI**
Year	**:**	**First – 1, Second - 4**
Training Aids	**:**	**Blackboard, whiteboard, projector, ropes**

Time Plan

- **Introduction** : **05 Min**
- **Methods of Joining Ropes** : **15 Min**
- **Types of Knots** : **15 Min**
- **Conclusion** : **05 Min**
- **Demo** : **40 Min**
- **Practice** : **120 Min**

INTRODUCTION

1. Bends, hitches, and knots are fundamental skills in seamanship, enabling sailors to securely fasten ropes for various maritime tasks. Each technique has a unique function—bends are used to join two ropes, hitches secure ropes to objects or fittings, and knots create loops or other useful configurations. Mastering these skills is crucial for ensuring the safety and efficiency of ship operations, whether for mooring, rigging, or rescue operations. This chapter introduces cadets to the essential methods of rope joining, explaining the key elements that make bends and hitches effective, while also covering a range of commonly used knots.

2. Ropes must be secured properly to withstand tension and environmental factors at sea. The selection of a bend or hitch depends on the specific purpose, as each technique has distinct advantages and cannot be used interchangeably. A firm understanding of when and how to apply these techniques ensures reliability in critical situations, preventing slippage, breakage, or misalignment. By practicing these methods, cadets will gain confidence in handling ropes effectively, reinforcing their seamanship skills and enhancing overall maritime safety.

PREVIEW	LEARNING OBJECTIVES
➢ Part I – Methods of Joining Ropes ➢ Part II – Types of Knots	➢ Cadets will learn to tie and utilize a variety of bends and hitches. ➢ Understand their specific applications and benefits in maritime tasks

PART I: METHODS OF JOINING ROPES

3. **Bend**. A bend is a temporary method of joining two ropes together, ensuring they remain securely fastened while under tension. Bends are particularly useful in maritime operations where ropes of similar or different materials need to be connected without slipping. Common bends include the reef bend, sheet bend, and double sheet bend, each designed for specific load-bearing and stability requirements. Properly tying a bend ensures that the ropes can be easily untied when needed, making them a crucial part of rope work in seamanship.

4. **Hitch**. A hitch is a technique used to secure a rope to a fixed object, such as a spar, post, or ring. Unlike bends, which join two ropes, hitches provide a firm grip around structures, preventing slippage due to movement or load shifts. Examples of commonly used hitches include the clove hitch, rolling hitch, and round turn and two half hitches. These knots are essential in various maritime operations, such as mooring, securing cargo, and fastening equipment on deck.

5. **Knots**. Knots are formed within the strands of a single rope to create loops, stoppers, or secure ends. They serve various purposes, from tying off loose ends to forming loops for hoisting and securing loads. Commonly used knots include the bowline, figure-eight

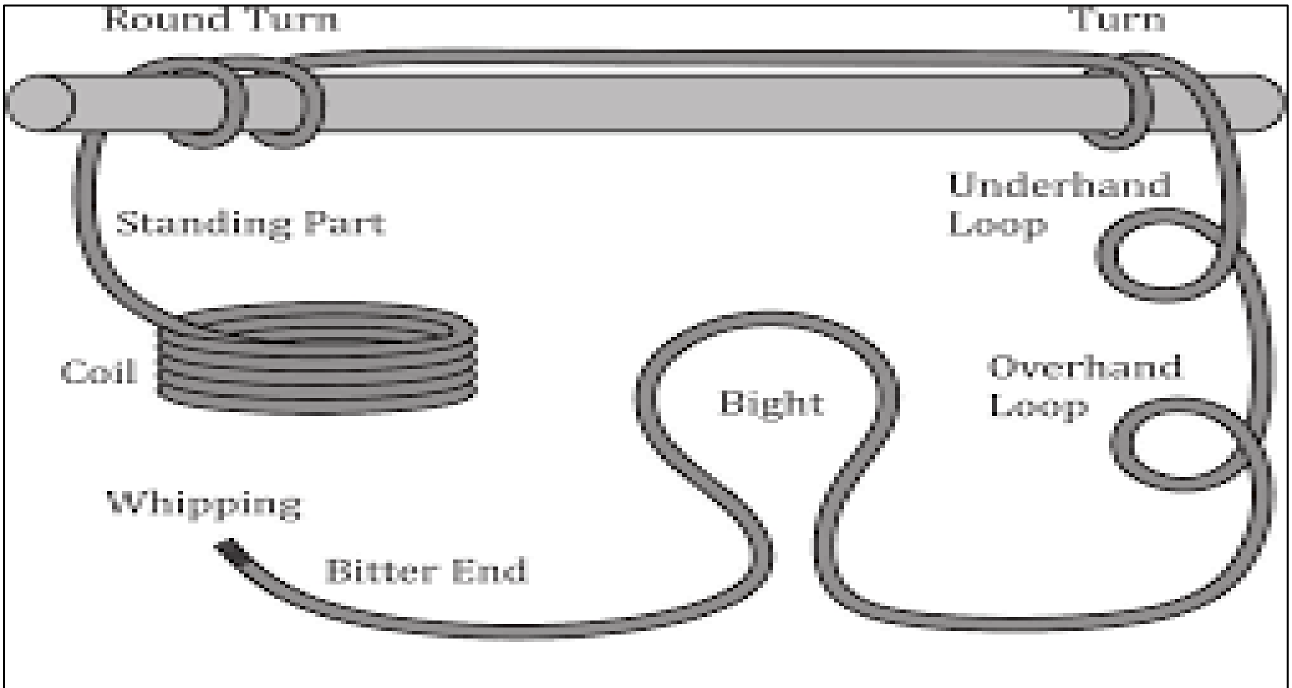
knot, and square knot, each offering distinct advantages in strength and ease of untying. Properly tied knots are crucial in seamanship, as they enhance safety and efficiency in handling ropes.

DID YOU KNOW?
➢ **Versatility in Everyday Tasks.** Bends and hitches are used beyond maritime operations and are integral in many activities, including climbing, camping, rescue operations, and construction. The versatility of knots like the sheet bend and clove hitch makes them essential tools in diverse settings where securing or joining ropes is needed.
➢ **The Essential Role in Sail Handling.** Historically, sailors relied on bends and hitches to secure sails and rigging. The bowline hitch was especially vital for sailors because it created a secure loop that didn't slip, even under heavy wind loads. This allowed sailors to secure sails quickly and reliably during unpredictable weather conditions

Elements of Bends and Hitches

6. **A Bight**. A bight is a simple U-shaped curve in a rope without crossing the ends. It forms the basis of many knots and bends, allowing for quick and easy adjustments without having to pass the entire length of the rope through a loop.

7. **Round Turn**. A round turn involves wrapping the rope completely around an object, such as a post or ring, at least once. This technique provides added friction and security, often used in mooring and securing loads.



Elements of Knots, Bends and Hitches

8. **A Half Hitch**.A half hitch is a simple loop around an object, secured by passing the working end of the rope through the loop. Often used in combination with other hitches, it provides additional security to prevent slipping under strain.

9. **A Twist**. A twist occurs when a rope is turned upon itself, forming a basic element in many knots and hitches. It helps create friction and stability in a rope structure, preventing it from unravelling under tension.

10. **An Overhand Knot**. The overhand knot is one of the simplest knots, made by tying a small loop and passing the working end through it. This knot serves as the foundation for more complex knots, acting as a stopper or securing loose rope ends.

PART II: TYPES OF KNOTS

11. **Reef Knot**. It is used to join two ropes of equal size.

12. **Clove Hitch**. A Clove hitch is useful for tying a line to a post, even when the end of the line is not available.

13. **Rolling Hitch**. This hitch is also used for securing a rope to a spar, rail or similar fitting when the pull is expected to be from one side or the other

14. **Timber Hitch**. This hitch is used to secure a rope's end to a spar or bale.

15. **Bow Line**. This is the most useful knot for making temporary eyes in ropes of all sizes. It is used for bending a heaving line to a hawser/ as a lifeline around a man's waist.

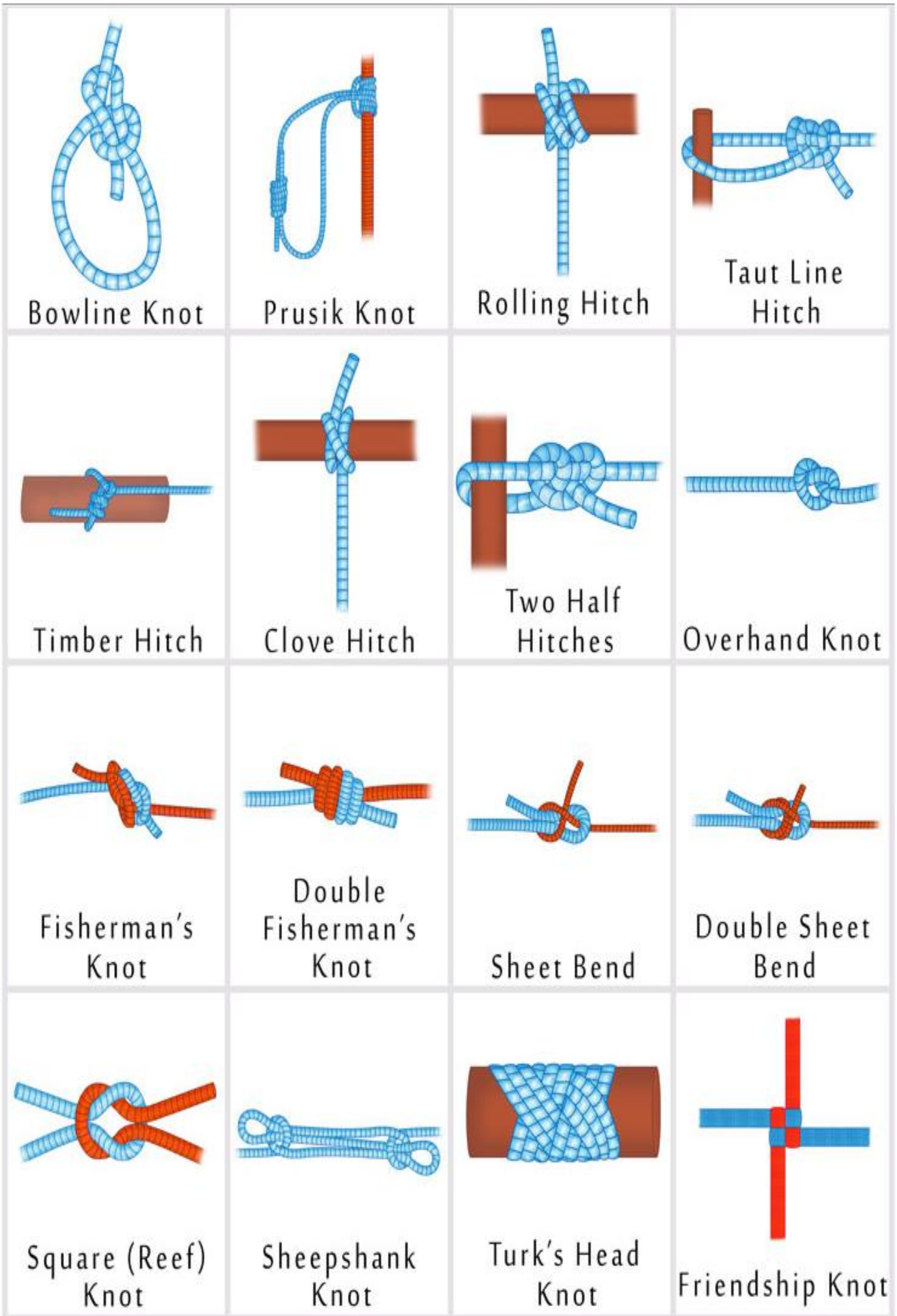
16. **Round Turn and Two Half Hitch**. This combination is used to secure a heavy load to a spar, ring or a shackle.

17. **Bow Line on the Bight**. Bowline is made on the bight. It can be used for lowering a man from aloft or over the ship's side. The short bight is placed under his arms and the long one under his buttocks.

DID YOU KNOW?
➢ **Tying Emergency Rescue Ropes**. Bends and hitches are often used in emergency situations. For example, in search-and-rescue operations, the water knot (a bend) or knotless hitch is used to join ropes quickly, allowing rescuers to create longer lengths of rope or secure a victim without delay, sometimes in life-or-death situations. ➢ **Firefighting and Utility Work**. In the world of firefighting and utility maintenance, bends and hitches are commonly used to secure hoses or cables, ensuring they don't become tangled or slip during urgent operations. The clove hitch, which can be quickly tied and untied, is a favored hitch for securing hoses to hydrants or posts during firefighting. ➢ **Historical Precision and Craftsmanship**. In historical contexts, especially during the age of exploration and naval warfare, sailors had to be highly skilled in knot tying. The knots were not just for functional use but were often used as a form of craftsmanship. The ability to tie precise, strong bends and hitches was crucial for maintaining ships' sails, rigging, and cargo. The knowledge was passed down through generations and remains a cornerstone of seamanship today.

CONCLUSION

18. Bends, hitches, and knots form the cornerstone of practical seamanship, enabling sailors to tackle diverse operational challenges with precision and confidence. This chapter has provided an overview of their uses and types, from the simple reef knot for joining ropes to the versatile bowline for creating secure loops. Understanding the elements of these techniques, such as bights, round turns, and overhand knots, equips cadets with the ability to handle ropes effectively and adapt to various maritime contexts. By mastering these skills, cadets enhance their readiness to perform critical tasks, ensuring safety and efficiency in all naval operations.



Types of Knots

SUMMARY

- **Essential Knots.** Bends and hitches are types of knots used in sailing and seamanship, with bends used to join two ropes and hitches used to attach a rope to an object like a post or ring.
- **The Square Knot.** The square knot (or reef knot) is a commonly used bend for joining two ropes of similar size, especially for first aid or bundling items together.
- **The Bowline.** Known as the "king of knots," the bowline is a type of hitch used to make a secure loop at the end of a rope, crucial for mooring or attaching items to a line.
- **The Clove Hitch.** The clove hitch is a quick and easy hitch used to secure a rope to a post, rail, or ring, widely used in tying boats to docks.
- **Safety and Strength.** Understanding the right bend or hitch for each situation is vital, as some knots, like the double fisherman's knot, are designed for maximum strength and security, while others, like the slip knot, are used for quick release.

SUGGESTED READ

Admiralty Manual of Seamanship - BR- 67

ASSESSMENT EXERCISE

Multiple Choice Questions

Q1. What is the primary function of a bend in ropework?

(a) To create a loop in a single rope
(b) To secure a rope to an object
(c) To join two ropes together
(d) To act as a stopper knot

Q2. Which of the following knots is commonly used for securing a rope to an object?

(a) Sheet Bend
(b) Reef Knot
(c) Clove Hitch
(d) Square Knot

Q3. Why is it important to secure ropes properly in maritime operations?

(a) To make them look neat
(b) To prevent them from getting tangled
(c) To withstand tension and environmental factors
(d) To make untying easier

Q4. Which knot is referred to as the "king of knots" due to its versatility?

(a) Reef Knot
(b) Clove Hitch
(c) Bowline
(d) Overhand Knot

Q5. What is the main characteristic of a hitch?

(a) It joins two ropes together
(b) It forms a decorative knot
(c) It secures a rope to an object
(d) It cannot be untied once fastened

Q6. Which of the following is NOT a type of bend?

(a) Reef Bend
(b) Sheet Bend
(c) Rolling Hitch
(d) Double Sheet Bend

Q7. Which element of bends and hitches provides added friction by wrapping the rope around an object at least once?

(a) Bight
(b) Round Turn
(c) Half Hitch
(d) Twist

Q8. Which hitch is specifically used when the pull is expected from one side or the other?

(a) Clove Hitch
(b) Timber Hitch
(c) Rolling Hitch
(d) Bowline on the Bight

Q9. What is the purpose of an Overhand Knot?

(a) To secure cargo
(b) To act as a stopper knot
(c) To join two ropes together
(d) To create a loop for hoisting

Q10. Which knot is primarily used to join two ropes of equal size?

(a) Bowline
(b) Sheet Bend
(c) Reef Knot
(d) Timber Hitch

Q11. What is a "Bight" in ropework?

(a) A type of knot used for securing loads
(b) A U-shaped curve in a rope without crossing the ends
(c) A method of joining two ropes
(d) A technique used for hoisting loads

Q12. Which of the following is NOT a primary function of bends, hitches, and knots in seamanship?

(a) Ensuring safety in operations
(b) Enhancing the appearance of ropes
(c) Providing reliability in securing objects
(d) Preventing slippage and breakage

Q13. The "Round Turn and Two Half Hitches" combination is used for what purpose?

(a) Joining two ropes together
(b) Securing a rope to an object under heavy load
(c) Forming a loop at the end of a rope
(d) Creating a decorative knot

Q14. Which hitch is commonly used for securing a rope's end to a spar or bale?

(a) Bowline
(b) Reef Knot
(c) Timber Hitch
(d) Overhand Knot

Q15. Which knot is particularly useful for lowering a person from aloft or over the ship's side?

(a) Sheet Bend
(b) Clove Hitch
(c) Bowline on the Bight
(d) Rolling Hitch

One-word Objective Questions

Q1. Which knot is used to join two ropes of equal size?

Q2. What type of hitch is used to secure a rope to a spar when the pull is expected from one side?

Q3. What is the knot used to make temporary eyes in ropes?

Q4. Which hitch is used to secure a rope's end to a spar or bale?

Q5. What is the combination used to secure a heavy load to a spar, ring, or shackle?

Short Answer-Type Questions

Q1. What is the difference between a bend and a hitch?

Q2. What are the elements that make up bends and hitches?

Q3. Explain the purpose of a reef knot and when it should be used.

Q4. Describe the use and purpose of a clove hitch.

Q5. How is a bowline knot made, and what are its primary uses?

NCC SPECIAL SUBJECT (NAVY)

SEAMANSHIP

CHAPTER 3: INTRODUCTION TO SHACKLES AND BLOCKS (CODE- SS 3)

"Without tools, we are nothing. With tools, we are everything." – Anonymous

TEACHING INSTRUCTIONS

Period	**: 1 (40 Min)**
Type	**: Theory/ Practical**
Conducting Officer	**: PI**
Year	**: Third**
Training Aids	**: Blackboard, Whiteboard, Projector & Compass**
Time Plan	
➢ **Introduction**	: **05 Min**
➢ **Shackles**	: **15 Min**
➢ **Hooks and Blocks**	: **15 Min**
➢ **Conclusion**	: **05 Min**

INTRODUCTION

1. Shackles and blocks are fundamental components in maritime operations, essential for lifting, securing, and managing heavy loads safely and efficiently. Shackles act as strong, reliable connectors in rigging systems, enabling the secure attachment of ropes, chains, and other lifting equipment. Their robust construction ensures stability under immense strain, making them indispensable in various shipboard tasks. Blocks, on the other hand, play a crucial role in reducing the physical effort required for lifting by utilizing mechanical advantage. Through pulleys and sheaves, blocks allow sailors to move heavy loads with greater ease, enhancing both efficiency and safety in daily operations.

2. A thorough understanding of the types, functions, and proper handling of shackles and blocks is vital for ensuring smooth and secure shipboard activities. Cadets must familiarize themselves with different shackle types, such as bow and D-shackles, and learn to use them appropriately in rigging setups. Likewise, mastering the use of single, double, and triple-sheave blocks enables optimal load management and control. By developing proficiency in these essential tools, cadets can contribute to safer, more effective maritime operations, minimizing risks and ensuring the seamless execution of critical tasks.

PREVIEW	LEARNING OBJECTIVES
➢ Part I – Shackles ➢ Part II – Hooks and Blocks	➢ Cadets will learn about the different types of shackles and blocks, their functions, and safe handling techniques.

PART I: SHACKLES

3. **Shackles**. Rigging shackles are coupling links used for joining ropes, webbing, and chain together or to some fitting usually forged from carbon – magnesium steel.

<u>Types of Shackles</u>.

4. **<u>Screw Shackle</u>**. A screw shackle is a type of shackle that has a threaded pin that screws into the body of the shackle, providing a secure and tamper-resistant fastening. This design ensures that the pin cannot easily become detached, making it ideal for high-security applications.

5. **<u>Forelock Shackle</u>**. A forelock shackle is a type of shackle that features a pin secured by a forelock, which is a small metal clip. This design prevents the pin from slipping out of the shackle, providing added safety and security, especially in situations where the pin is under heavy load.

6. **<u>Clenched Shackle</u>**. A clenched shackle is a type of shackle where the pin is permanently secured by the "clenching" process, which involves deforming the pin or the body of the shackle to lock it in place. This type of shackle is commonly used in applications where permanent fastening is required.

7. **<u>Joining Shackle</u>**. A joining shackle is a shackle used to connect two sections of chain or rope, providing a secure, easily detachable link. It is commonly used in rigging and other applications that require the ability to join components together quickly and efficiently.

8. **<u>Joggle Shackle</u>**. A joggle shackle is a type of shackle designed with a stepped or offset body, which allows it to connect components at an angle. This design provides a more stable connection when the components being joined are not aligned in a straight line.

9. **<u>Feathered Shackle</u>**. A feathered shackle is a specialized shackle with a pin that is designed to remain securely attached even under extreme loads. The pin's unique design allows it to withstand the stresses of high-tension applications while maintaining its connection.

DID YOU KNOW?
➢ **Ancient Origins.** Shackles and blocks have been used for centuries in various forms. Early versions of shackles were simple iron or bronze rings used by the ancient Egyptians and Greeks for securing ships, cargo, and even prisoners. The use of blocks (pulleys) dates back to ancient civilizations as well, with the Greeks using simple wooden blocks and ropes to lift heavy loads, laying the foundation for modern mechanical advantage systems.
➢ **Introduction of the Modern Shackle.** The modern shackle, a U-shaped device with a pin or bolt used to secure ropes or chains, began to evolve during the Industrial Revolution in the 18th century. These shackles were designed to handle the increasing size and weight of ships and the loads they carried, contributing to advancements in rigging and shipbuilding technology.

PART I: HOOKS AND BLOCKS

Types of Hooks

10. **Spring Hook.** A spring hook is a type of hook equipped with a spring-loaded mechanism that allows it to open and close easily, making it simple to attach and detach from equipment. It is often used in rigging, lifting, and securing applications.

11. **Tackle Open Hook**. A tackle open hook is a type of hook used in lifting and rigging applications that is designed to be used with a tackle system. It features an open design that allows for easy attachment and detachment of ropes or chains.

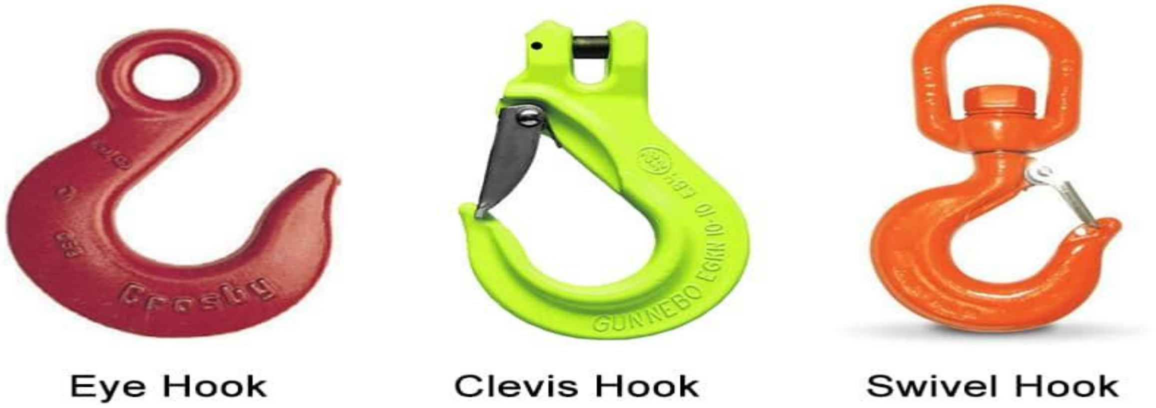
12. **Swivel Spring Hook**. A swivel spring hook is a hook that incorporates a swivelling mechanism and a spring-loaded latch. This allows it to rotate freely while maintaining a secure connection, which is especially useful in applications requiring movement or rotation.

13. **Release Hook**. A release hook is a type of hook designed with a mechanism that allows it to be released quickly and easily, often remotely. This feature is crucial for applications where fast detachment is required, such as in rescue or emergency situations.

14. **Recovery Hook**. A recovery hook is a specialized hook used in towing and recovery operations. It is designed to withstand heavy loads and provide secure attachment points for lifting or pulling operations in recovery scenarios.

15. **'S' Hook or Awning Hook**. An 'S' hook, also known as an awning hook, is shaped like the letter "S" and is used to secure items like ropes or chains in place. It is often used in tents or awning setups where a quick and adjustable fastening is needed.

16. **RFD Automatic Release Hook**. The RFD automatic release hook is a specialized hook designed for use in life-saving equipment, such as life rafts. It automatically releases under certain conditions, ensuring the safety and reliability of the equipment in emergency situations.



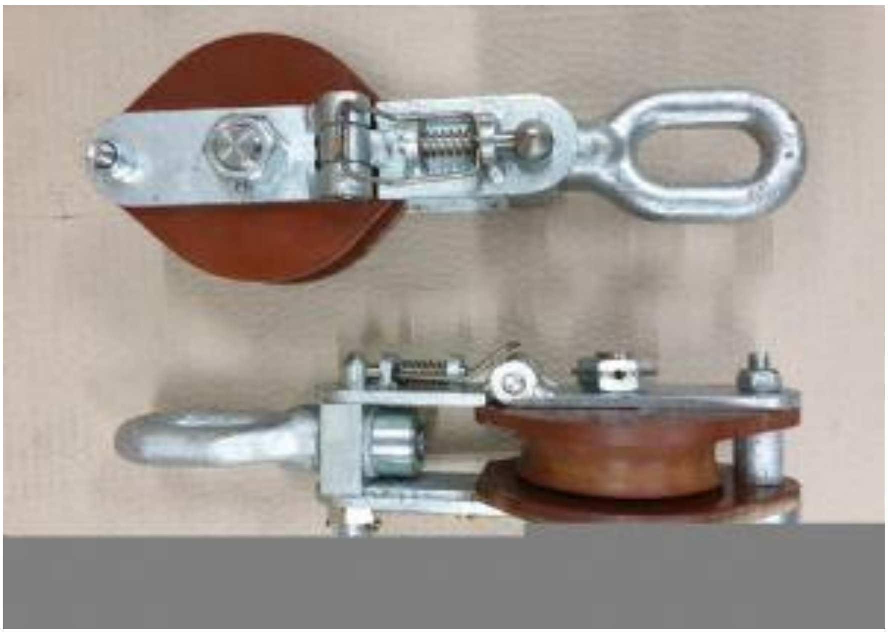
Types of Hooks

17. **Block**. A block is a portable pulley device used to change the direction of a force applied to a rope or to gain a mechanical advantage. It is made of various materials like metal, synthetic resin-bonded fibre (SRBF), or wood, and is commonly used in rigging, lifting, and

securing operations aboard ships. Blocks are designed to hold a rope or cable and provide a smooth surface for it to move, allowing for easier handling of heavy loads.

Types of Blocks

18. **Synthetic Resin-Bonded Fibre (SRBF) Block**. An SRBF block is made from a combination of synthetic resin and fibre materials, providing a lightweight, strong, and corrosion-resistant option. These blocks are typically used in environments where durability and resistance to weather conditions are essential.

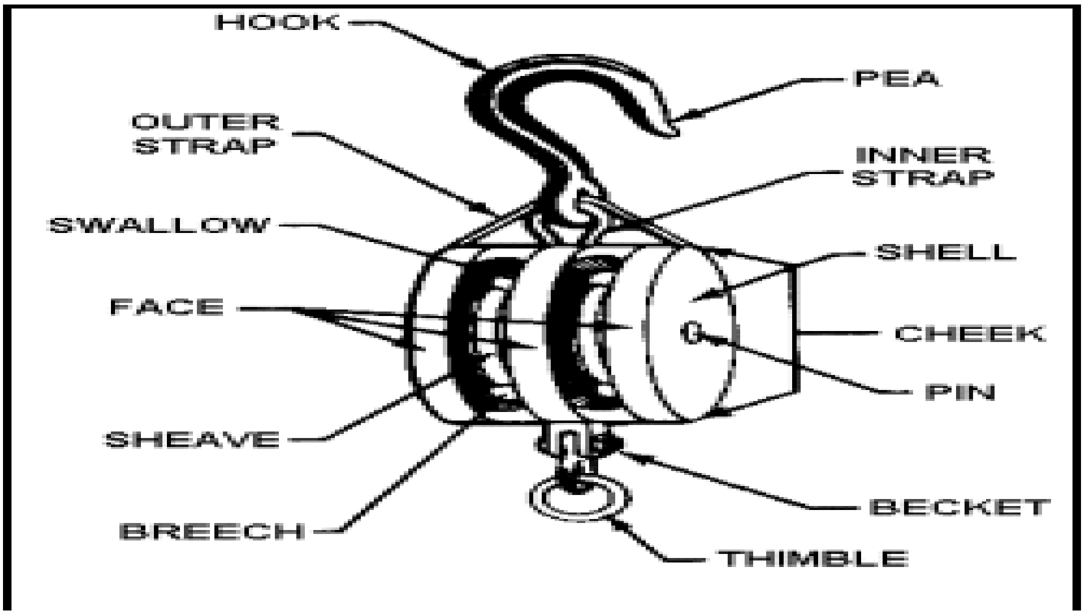


Synthetic Resin-Bonded Fibre (SRBF) Block

19. **Metal Block**. A metal block is made of materials such as steel or aluminium, offering greater strength and load-bearing capacity than other types. Metal blocks are ideal for heavy-duty applications and are commonly used in marine and industrial settings for lifting and rigging.

Metal Blocks

20. **Wooden Block**. A wooden block is traditionally made from strong hardwood and is often used in historical or classic rigging systems. While not as commonly used today in modern vessels, wooden blocks are still valued for their smooth surface and low friction, making them suitable for specific applications where their traditional properties are preferred.



Wooden Block

DID YOU KNOW?
➢ **Technological Advancements in Blocks.** The evolution of blocks, or pulleys, revolutionized how ships handled sails, cargo, and heavy equipment. In the 19th century, block and tackle systems, which use multiple pulleys to lift or move heavy objects with less force, became a key part of naval operations. These systems allowed sailors to manage massive sails and move cargo with greater ease and efficiency.   ➢ **Advancements in Block Design** Modern blocks have seen significant evolution in their design, particularly with the introduction of roller bearings. These allow for smoother, more efficient operation, reducing friction and the amount of force needed to lift or move heavy loads. Today, blocks are also designed to be lightweight and corrosion-resistant, often made from high-strength composites or stainless steel, which is essential for the harsh conditions of the open sea.

CONCLUSION

21. By mastering the concepts of shackles and blocks, cadets are equipped with the knowledge to handle essential shipboard tasks efficiently and safely. This understanding not only enhances operational effectiveness but also instills confidence in performing demanding maritime operations. The ability to identify the right tools, utilize them correctly, and maintain them ensures that cadets are well-prepared to contribute to seamless shipboard operations.

SUMMARY

➢ **Shackles for Securing.** Shackles are U-shaped metal fasteners with a pin, used to securely attach ropes, cables, or other components, commonly seen in rigging and anchoring on ships.

➢ **Types of Shackles.** There are different types of shackles, including anchor shackles, which are larger and stronger for heavy-duty applications, and bow shackles, which can connect multiple attachments.

➢ **Blocks for Mechanical Advantage.** Blocks are used with ropes to create mechanical advantage, allowing sailors to lift or move heavy loads more easily by changing the direction of the force.

➢ **Pulley Systems.** Block and tackle is a system of pulleys and ropes that provides leverage, making it easier to haul or lift objects, often seen in loading cargo onto ships.

➢ **Material Matters.** Shackles and blocks are typically made from stainless steel or galvanized steel to withstand the harsh marine environment, providing strength and resistance to rust and corrosion.

SUGGESTED READ

Manual of Seamanship - BR- 67

ASSESSMENT EXERCISE

Multiple Choice Questions

Q1. What is the primary function of shackles in maritime operations?

(a) To secure sails
(b) To connect rigging components securely
(c) To measure wind speed
(d) To store ropes on board

Q2. Which of the following is NOT a type of shackle?

(a) Bow Shackle
(b) Forelock Shackle
(c) Double Shackle
(d) Joggle Shackle

Q3. What is the main advantage of a screw shackle?

(a) It allows for quick detachment under load
(b) It provides a secure and tamper-resistant fastening
(c) It is permanently fastened
(d) It can rotate freely

Q4. A forelock shackle prevents the pin from slipping out by using:

(a) A welded seal
(b) A forelock clip
(c) A screw mechanism
(d) A double knot

Q5. Which type of shackle is designed for permanent fastening?

(a) Clenched Shackle
(b) Screw Shackle
(c) Joining Shackle
(d) Bow Shackle

Q6. What makes a joggle shackle unique?

(a) It has a swivelling mechanism
(b) It has an offset or stepped body
(c) It is made from lightweight aluminium
(d) It cannot be detached once fastened

Q7. Which type of hook is designed for quick release in emergencies?

(a) Swivel Hook
(b) Tackle Open Hook
(c) Release Hook
(d) Recovery Hook

Q8. What is the primary function of blocks in rigging?

(a) To store ropes
(b) To provide a mechanical advantage in lifting
(c) To secure chains
(d) To fasten sails

Q9. Which material is commonly used to make synthetic resin-bonded fibre (SRBF) blocks?

(a) Hardwood
(b) Stainless Steel
(c) Composite materials
(d) Galvanized iron

Q10. Why are metal blocks preferred in heavy-duty applications?

(a) They are lightweight
(b) They offer high load-bearing capacity
(c) They are easy to replace
(d) They reduce friction

Q11. A wooden block is primarily valued for:

(a) Low weight
(b) Low cost
(c) Smooth surface and low friction
(d) High corrosion resistance

Q12. What is the purpose of a "block and tackle" system?

(a) To store cargo
(b) To secure lifeboats
(c) To lift or move heavy loads with reduced force
(d) To anchor a ship in place

Q13. Why is it important to use shackles and blocks made of corrosion-resistant materials?

(a) To reduce maintenance costs
(b) To improve aesthetics
(c) To ensure durability in harsh marine environments
(d) To make them lighter

Q14. Which hook is specifically used in life-saving equipment such as life rafts?

(a) ‘S’ Hook
(b) Tackle Open Hook
(c) RFD Automatic Release Hook
(d) Spring Hook

Q15. What is the historical significance of blocks and pulleys in maritime operations?

(a) They were used only in modern ships
(b) They originated in ancient Greece and improved lifting efficiency
(c) They were developed during the Industrial Revolution
(d) They were used exclusively for anchoring ships

One-word Objective Questions

1. What type of shackle is used for joining ropes, webbing, and chains?

2. Which hook is used for automatic release in rescue operations?

3. What is the primary material used to make shackles?

4. Which type of block is made from synthetic resin-bonded fibre (SRBF)?

5. What is the method used to join two ropes by interlocking their strands?

Short Answer-Type Questions

1. What are shackles used for in rigging, and how do they differ from hooks?

2. Explain the types of hooks and their uses in lifting heavy items at sea.

3. Describe the purpose and types of blocks used in lifting heavy loads.

4. What is the function of a derrick, and what types of materials are used to construct it?

5. How is coiling down of cordage performed, and why is it important?

Long Answer-Type Questions

1. Explain the different types of shackles and their specific uses in maritime rigging operations.

2. Describe the different types of splicing techniques and explain how each is used to join ropes or make eyes.

3. Discuss the advantages and functions of using blocks in lifting heavy weights and reducing effort.

4. Describe the process of splicing and how it affects the strength of a rope. Why is splicing an essential skill for mariners?

5. Discuss the role of a derrick in lifting operations and how it is rigged to hoist various items onboard a ship.

NCC SPECIAL SUBJECT (NAVY)

SEAMANSHIP

CHAPTER 4: PARTS OF ANCHOR AND CABLE (CODE- SS 4)

"A ship at anchor is safe, but safety requires mastery of the tools that hold it fast."

TEACHING INSTRUCTIONS

Period	**:**	**1 (40 Min)**
Type	**:**	**Theory**
Conducting Officer	**:**	**PI**
Year	**:**	**Third**
Training Aids	**:**	**Blackboard, Whiteboard, Projector**

Time Plan

➢ **Introduction**	**:**	**05 Min**
➢ **Parts of Anchor**	**:**	**15 min**
➢ **Parts of Cable**	**:**	**15 Min**
➢ **Conclusion**	**:**	**05 min**

INTRODUCTION

1. Anchoring is one of the most essential aspects of seamanship, ensuring that a ship remains securely in place when needed. Whether a vessel is stopping at a port, waiting offshore, or facing rough weather, a strong and reliable anchor prevents unwanted drifting. Anchors work by digging into the seabed, using their weight and design to hold the ship steady. Along with the anchor, the cable or chain plays a crucial role in maintaining stability, absorbing the forces of wind and waves. Understanding how anchors and cables function is vital for all cadets, as improper anchoring can lead to serious accidents, loss of control, or damage to the ship.

2. In this chapter, cadets will learn about different types of anchors, the structure and purpose of anchor cables, and the correct methods of anchoring a ship. They will also explore the principles behind how an anchor grips the seabed and the factors that influence its effectiveness. Mastering these concepts will help cadets develop confidence in handling anchoring equipment and making informed decisions during maritime operations. Proper anchoring is not just about securing a ship, it is about ensuring safety, stability, and operational readiness at sea.

PREVIEW	LEARNING OBJECTIVES
➢ Part I: Anchors ➢ Part II: Chain Cables	➢ To understand significance of anchor and cables. ➢ To learn about parts of anchor and cables.

PART I: ANCHORS

3. An anchor is a heavy device used to secure a ship to the seabed, preventing it from drifting due to wind or currents. It plays a critical role in maritime operations by providing stability and safety when a ship is stationary. The anchor's design ensures that it grips the seabed effectively, using its weight and flukes to hold the vessel in place. Different types of anchors are designed to suit various seabed conditions, ship sizes, and operational requirements. The selection of an anchor depends on factors such as holding power, ease of handling, and storage requirements.

Types of Anchors

4. **Admiralty Pattern Anchor**. This is a traditional anchor with a long shank, a stock at the top, and two large flukes. It provides excellent holding power in different seabeds but is bulky to store.

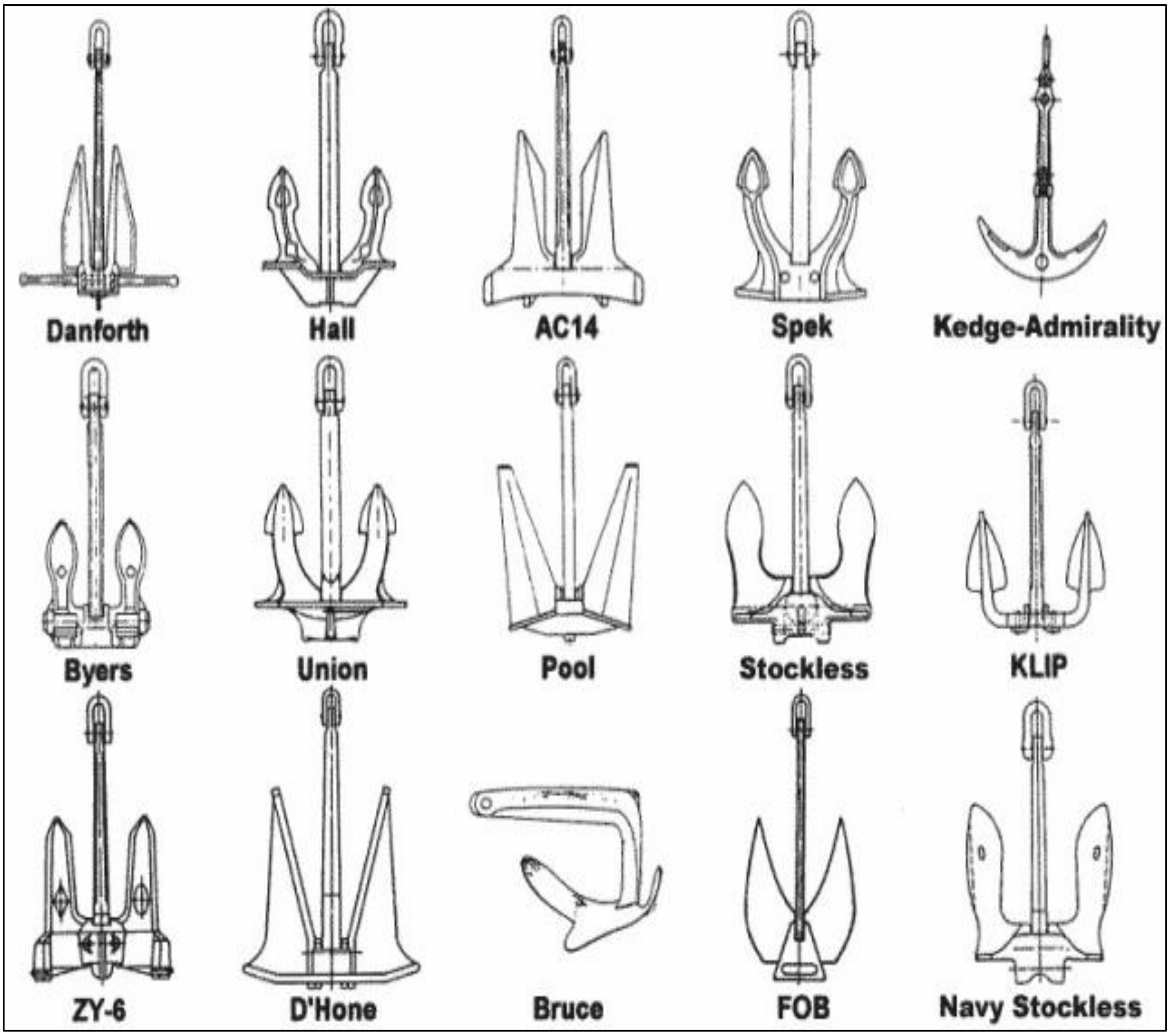
5. **Admiralty Standard Stockless Anchor**. A more modern version of the Admiralty anchor, this design eliminates the stock, making it easier to stow. It is widely used in commercial and naval vessels due to its efficient holding capability.

6. **<u>Admiralty Class (AC)-12,14</u>**. These anchors are improved versions of the stockless anchor with greater holding power and are commonly used in large ships. The numbers 12 and 14 indicate different weight and design specifications.

7. **<u>AC 16A & 17</u>**. These are advanced versions of the AC class anchors, designed for improved performance and holding capacity. They are used in modern naval and commercial fleets.

8. **<u>Stocked Close-Stowing (Danforth) Anchor</u>**. This lightweight anchor has long, wide flukes that dig deep into soft seabed, offering excellent holding power. It is commonly used on smaller vessels and yachts due to its ease of handling and stowage.

9. **<u>Chatham Quick Release (CQR) Anchor</u>**. This anchor, also known as the plow anchor, has a hinged shank that allows it to adjust to shifting seabed. It provides a strong hold and is favored for long-term anchoring in different seabed conditions.



<u>Types of Anchors</u>

DID YOU KNOW?
➢ **Ancient Use of Anchors**. The use of anchors dates back to ancient times. The earliest known anchors were used by the Phoenicians around 3,000 years ago. They were made of stone and had a simple design, often with a large weight at the bottom and a rope attached to hold the ship in place. The ancient Greeks and Romans also used similar designs, though they later introduced metal anchors for added durability.

Classification of Anchor

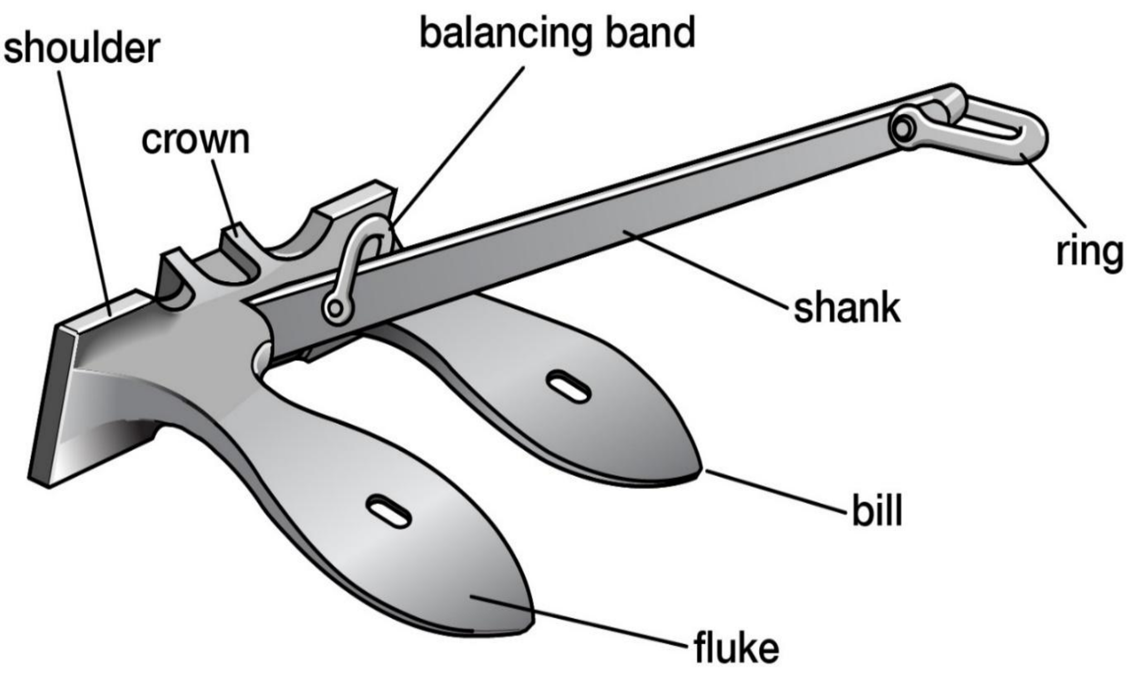
10. **Bower Anchor**. Main anchor used to secure the ship.

11. **Sheet Anchor**. Backup anchor for emergencies.

12. **Stream Anchor**. Used by some ships as a stern anchor

Parts of an Anchor

13. **Anchor Ring**. A circular metal ring at the top of the anchor used to attach the anchor cable or chain, ensuring a secure connection between the anchor and the vessel.



Parts of Anchor

14. **Anchor Shackle**. A U-shaped metal fastener with a removable pin, used to connect the anchor ring to the chain cable or rope, providing flexibility and strength in the anchoring system.

15. **Shank**. The long, central shaft of the anchor that connects the anchor ring to the flukes, providing leverage to ensure the flukes dig into the seabed effectively.

16. **Fluke**. The flat, pointed part of the anchor designed to dig into the seabed, providing grip and holding power to keep the vessel stationary.

17. **Pea or Bill**. The pointed end of the fluke. It is the part which penetrates the seabed first and helps secure the anchor in place.

DID YOU KNOW?
➢ **Development of the Stock Anchor**. In the 16th century, the **stock anchor** was developed in Europe, which became the standard anchor design for many years. This design included a horizontal bar (the stock) that helped the anchor catch the seabed better. It was more reliable than earlier designs and became widely used for sailing ships.

PART II: CHAIN CABLE

18. A ship's anchor cable is generally assumed to be made of chain although a *cable* is strictly speaking a strong thick rope. The bower cables of warships are made of studded chain; the studs are closed in the links by pressure and act to strengthen them and prevent the cable from kinking. Studded chain cable is supplied in lengths of 27.5m and 13.75m, called shackles and half shackles, respectively. A ship's bower cable is usually made up of four half shackles and a number of shackles of cables. The half shackles are usually inserted in pairs, one at the outboard end next to the anchor and the other midway between the outboard and inboard ends. In the future, a ship's cable will be made up of full shackles apart from two half shackles at the outboard end. The half shackles are required when working cable during operations described later in this chapter.

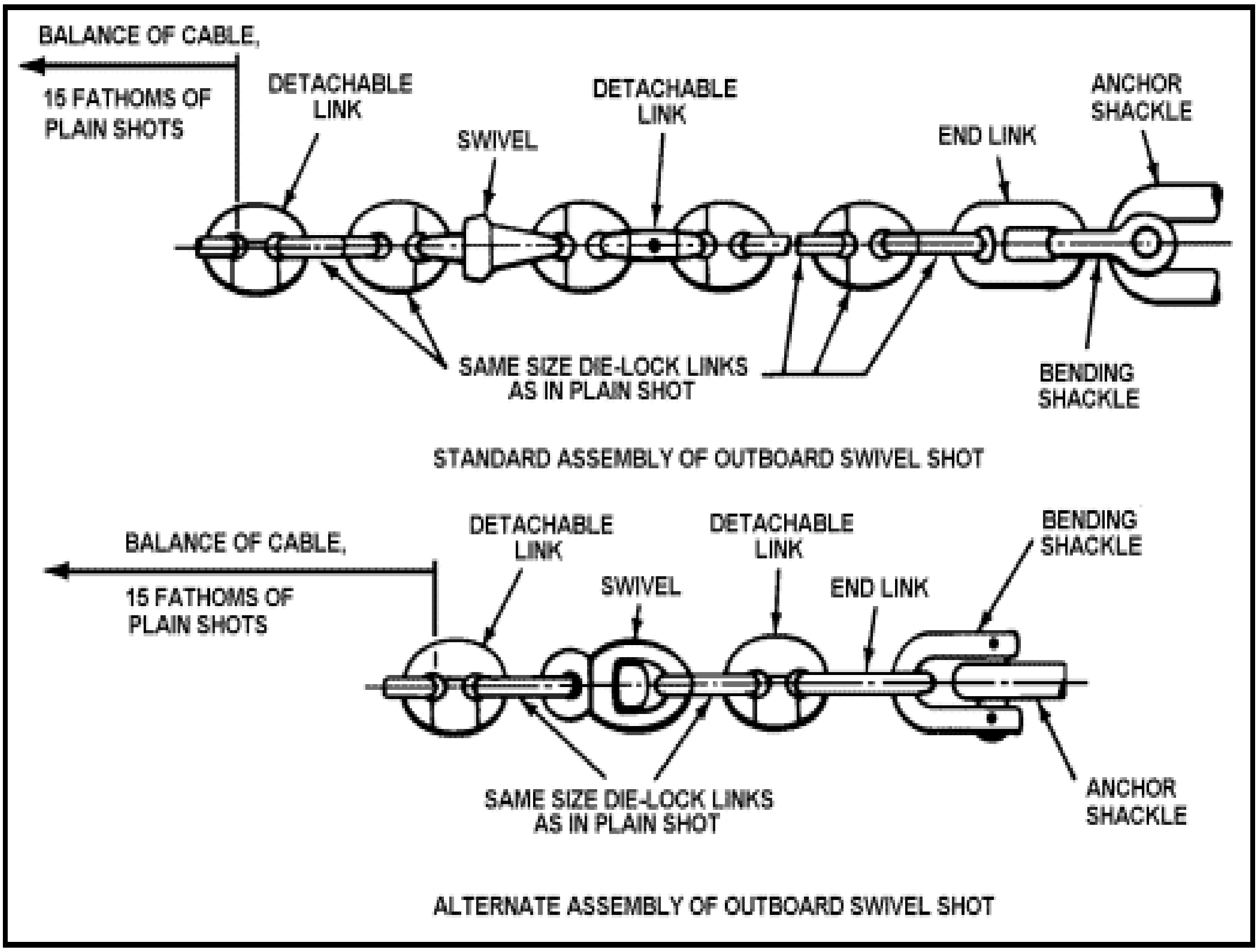
Parts of a Cable

19. **Lugged Anchor Shackle**. A strong metal connector with projecting lugs used to attach the anchor to the cable. It ensures a secure connection between the anchor and the ship's anchoring system.

20. **Lugless Joining Shackle**. A specialized shackle designed for joining two lengths of cable without protruding lugs, allowing smooth passage through the hawse pipe and avoiding snagging.

21. **Securing to Buoy Shackle**. A heavy-duty shackle used to secure the anchor cable to a buoy, allowing the vessel to remain stationary without deploying its anchor to the seabed.

22. **Bottle Screw Slip**. A type of tension-adjusting device that enables fine adjustments to the tension in cables, ensuring a secure and firm anchoring setup.



Parts of Chain Cable

23. **Blake Slip**. A release mechanism that allows for quick detachment of the anchor cable when necessary, commonly used for emergency anchor release.

24. **Cup Swivel**. A component in the anchor cable system that enables free rotation, preventing the cable from twisting and ensuring smooth handling.

25. **Box Swivel**. A robust swivel device encased in a protective housing, used to facilitate cable rotation and prevent kinking or twisting under load.

26. **Adaptor Piece**. A connecting link used to join different types or sizes of cables and fittings, ensuring compatibility and seamless operation of the anchor system.

DID YOU KNOW?

➢ **Rise of Chain Cables.** Early maritime cables were made of ropes, often from hemp or other fibers. However, by the 18th century, sailors began using chain cables for better durability and strength. Chain cables were much stronger than fibre ropes, and their metal links could withstand greater tension, providing greater security for ships at anchor.

Marking of Anchor Cable

Marking of Chain Cable

27. The marking of an anchor cable is essential for determining the length of cable paid out, ensuring proper anchoring, and aiding in retrieval. The standard method of marking involves painting and inserting distinctive marks at regular intervals along the cable.

(a) **Shackle Marking**. The length of an anchor cable is measured in shackles (1 shackle = 27.5 meters or 15 fathoms). The markings are placed at each shackle (joining shackle) to indicate how much cable has been let out.

(b) **Paint Marking**. Specific links near the joining shackles are painted white (or red in some cases) to indicate the number of shackles paid out. The first link on either side of the joining shackle is usually painted.

(c) **Wire or Rope Seizing**. Small pieces of wire or rope (known as seizing) are attached to links near the joining shackle to provide a tactile indication of the shackle number, assisting in identification in low visibility conditions.

(d) **Detachable Links**. The joining shackle itself is often painted red and marked for quick identification, as this is the connection point for two cable lengths.

(e) **Distinctive Patterns**. The marking pattern usually follows a set system:

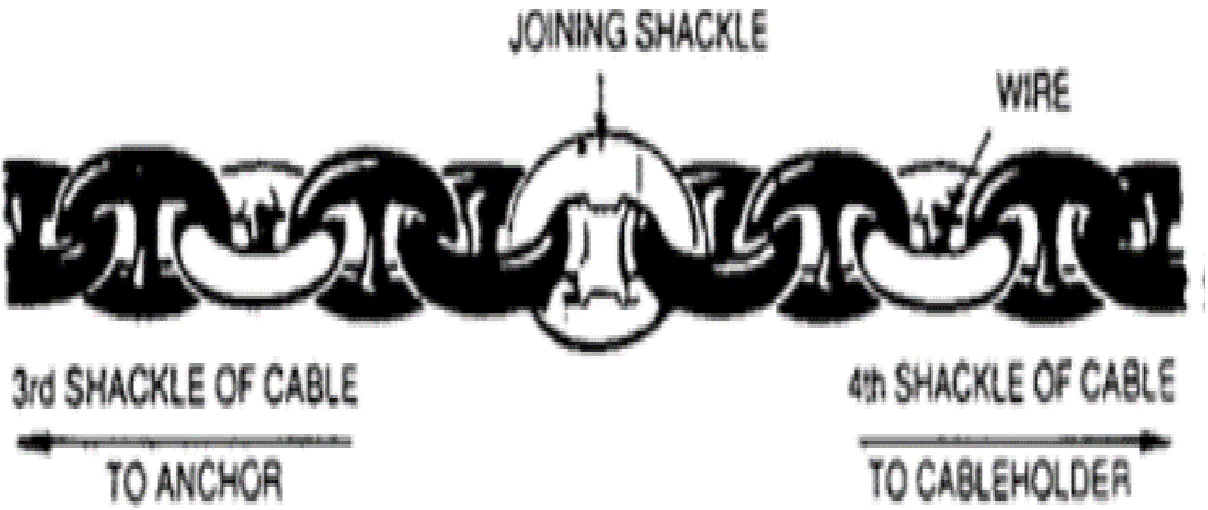
(i) **1st Shackle**. One white-painted link, one seizing wire.

(ii) **2nd Shackle**. Two white-painted links, two seizing wires.

(iii) **3rd Shackle**. Three white-painted links, three seizing wires.

(iv) And so on, continuing for each additional shackle.

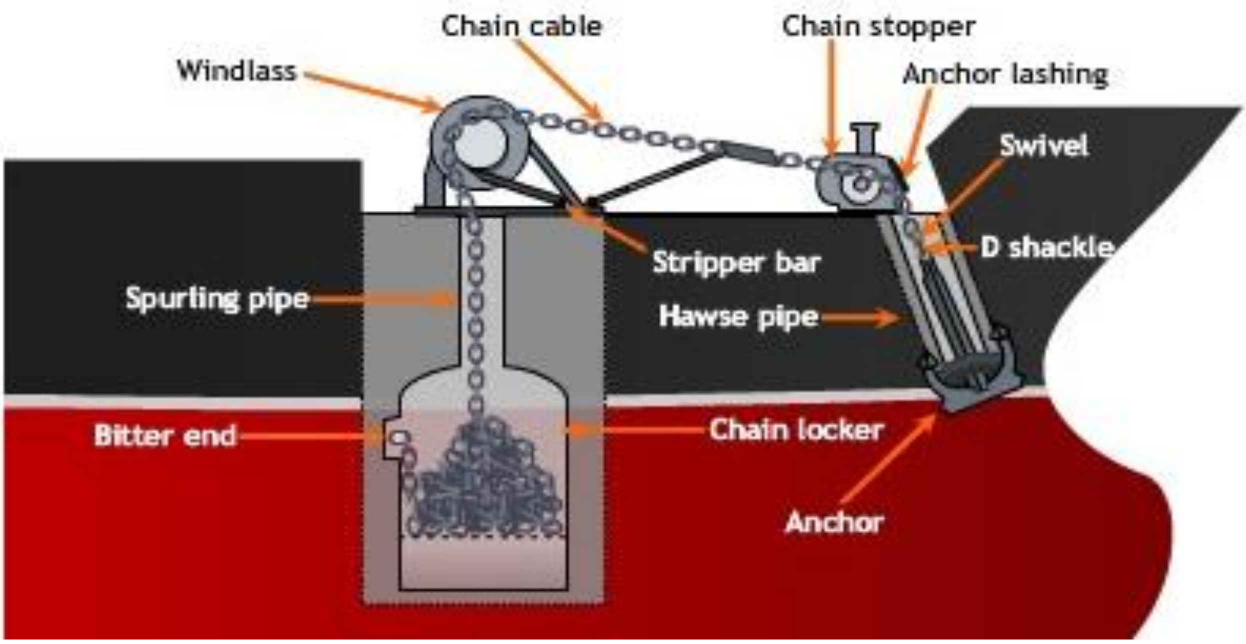
28. This marking system allows sailors to quickly and accurately determine how much cable has been paid out and retrieve it efficiently when weighing anchor.



Marking of cable — Stud-link chain

CONCLUSION

29. Anchors and cables are more than just tools; they are critical for the safety and functionality of vessels at sea. By learning the parts, types, and operational methods, cadets are equipped with essential seamanship skills. Mastery in handling anchors and cables prepares them for real-world challenges, ensuring that vessels remain secure in any maritime situation.



Visualisation of Anchor, Chain Cable and Cable Locker onboard Ship

SUMMARY

- **Anchor Shank**. The shank is the long, vertical part of the anchor, connecting the anchor's flukes to the ship's cable, and plays a key role in holding the anchor in place.
- **Flukes for Gripping**. The flukes are the pointed, curved parts of the anchor that dig into the seabed to secure the ship and prevent it from drifting.
- **Anchor Stock**. The stock is a crossbar at the top of the anchor, ensuring the flukes stay aligned for proper digging into the ground when dropped.
- **Anchor Cable**. The anchor cable (or chain) is the heavy-duty rope or metal chain used to attach the anchor to the ship, typically made from strong, corrosion-resistant materials.
- **Rode**. The rode refers to the complete line of anchor cable, including both the chain and any line used in shallow waters, and is essential for keeping the ship stationary in various seabed conditions.

SUGGESTED READ

Admiralty Manual of Seamanship - BR- 67

ASSESSMENT EXERCISE

Multiple Choice Questions

Q1. What is the primary function of an anchor in seamanship?

(a) To control the vessel's speed
(b) To secure the ship to the seabed
(c) To provide power to the engine
(d) To direct the ship's path

Q2. Which component is essential for securing an anchor to the vessel?

(a) Anchor shank
(b) Anchor fluke
(c) Anchor ring
(d) Anchor stock

Q3. What is the primary function of an anchor’s flukes?

(a) To add weight to the anchor
(b) To dig into the seabed for grip
(c) To connect the anchor to the chain
(d) To reduce the anchor’s movement

Q4. Which type of anchor is known for its hinged shank and adaptability to different seabed conditions?

(a) Admiralty Pattern Anchor
(b) Danforth Anchor
(c) CQR (Chatham Quick Release) Anchor
(d) AC-12 Anchor

Q5. What does the term “bower anchor” refer to?

(a) A backup anchor for emergencies
(b) The main anchor used to secure a ship
(c) A lightweight anchor for small vessels
(d) An anchor used specifically in deep waters

Q6. Which anchor is considered a modern version of the Admiralty anchor and lacks a stock?

(a) Stocked Close-Stowing Anchor
(b) Admiralty Standard Stockless Anchor
(c) Admiralty Pattern Anchor
(d) Sheet Anchor

Q7. How long is one shackle of an anchor cable?

(a) 15 meters
(b) 27.5 meters
(c) 10 meters
(d) 35 meters

Q8. Which part of the anchor is responsible for providing leverage to help the flukes dig into the seabed?

(a) Shank
(b) Fluke
(c) Pea or Bill
(d) Anchor Stock

Q9. What is the purpose of a cup swivel in an anchor cable system?

(a) To strengthen the cable
(b) To prevent kinking and twisting
(c) To increase the length of the cable
(d) To secure the anchor to the ship

Q10. What is the role of an adaptor piece in an anchor cable system?

(a) To join different types or sizes of cables
(b) To secure the anchor cable to a buoy
(c) To indicate the number of shackles used
(d) To act as a tension-adjusting device

Q11. How are anchor cables typically marked for length measurement?

(a) By painting the entire cable
(b) By using rope knots at intervals
(c) By painting links and using seizing wire
(d) By engraving numbers on each link

Q12. What is a stream anchor primarily used for?

(a) As a main anchor
(b) For emergency anchoring
(c) As a stern anchor on some ships
(d) For securing a buoy

Q13. What is the primary material used for modern ship anchor cables?

(a) Hemp rope
(b) Studded chain
(c) Nylon fibre
(d) Steel wire

Q14. Which anchor type is commonly used on smaller vessels and yachts?

- (a) AC 16A Anchor
- (b) Admiralty Standard Stockless Anchor
- (c) Danforth Anchor
- (d) AC-14 Anchor

Q15. Why was the stock anchor an important development in the 16th century?

- (a) It was lighter than previous anchors
- (b) It helped the flukes dig into the seabed more effectively
- (c) It was made entirely of wood
- (d) It could float when not in use

One-word Objective Type Questions

Q1. What is the primary function of an anchor?

Q2. Which type of anchor is used as the main anchor to secure the ship?

Q3. What part of the anchor is attached to the chain or rope (cable)?

Q4. What type of anchor is used for emergency situations?

Q5. Which part of the anchor is the flat, pointed portion that digs into the seabed?

Short Answer Type Questions

Q1. What are the different types of anchors used on ships, and how do they differ?

Q2. Describe the different classifications of anchors and their purposes.

Q3. What are the key parts of an anchor, and what role does each part serve?

Q4. Explain the importance of anchor handling and why it is an essential skill for mariners.

Q5. What is the difference between a bower anchor and a sheet anchor?

NCC SPECIAL SUBJECT (NAVY)

SEAMANSHIP

CHAPTER 5: PURPOSE OF ANCHOR AND HOLDING GROUND (CODE- SS 5)

"An anchor's strength lies in its grip on the unseen ground below".

TEACHING INSTRUCTIONS

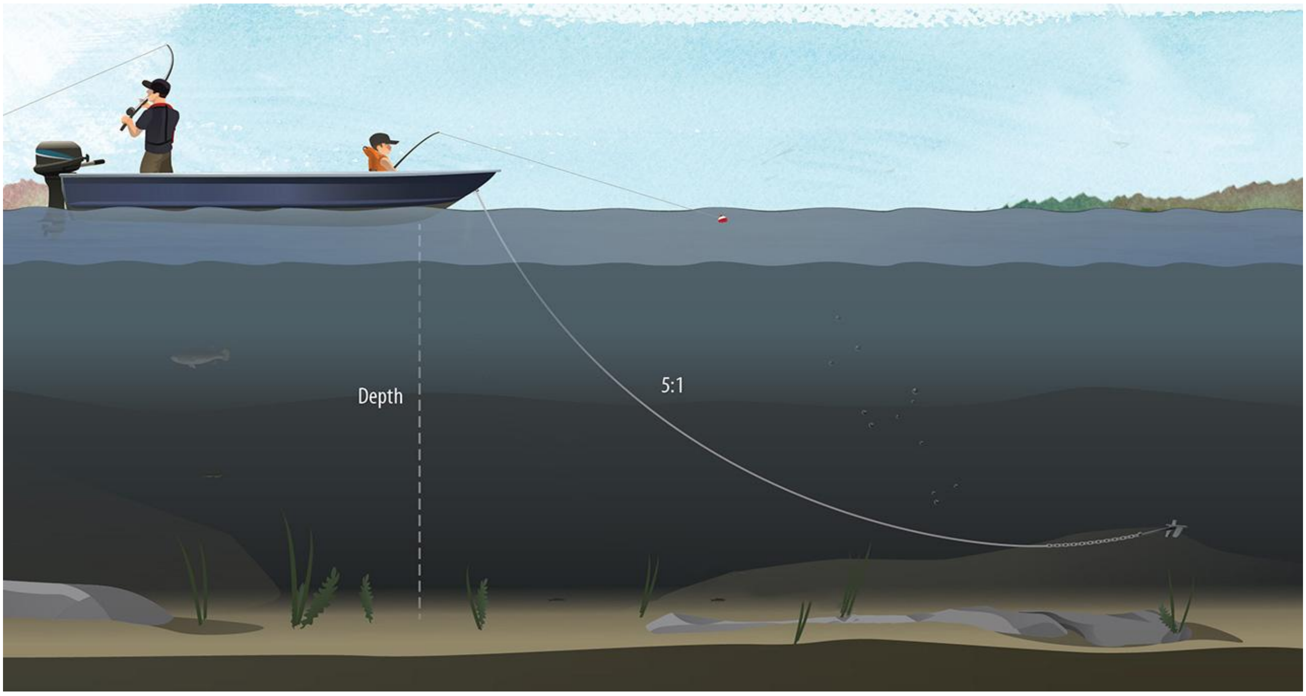
Period	**:**	**1 (40 Min)**
Type	**:**	**Theory**
Conducting Officer	**:**	**PI**
Year	**:**	**Third**
Training Aids	**:**	**Blackboard, whiteboard, projector**
Time Plan		
➢ **Introduction**	**:**	**05 Min**
➢ **Purpose of Anchor**	**:**	**15 Min**
➢ **Holding Ground**	**:**	**15 Min**
➢ **Conclusion**	**:**	**05 Min**

INTRODUCTION

1. Anchoring is a vital seamanship skill, ensuring the stability and security of ships in various maritime environments. Anchors and cables work together to hold a ship's position by gripping the seabed and acting as a spring to absorb strain. The process involves understanding the dynamics of holding grounds, where the anchor embeds itself into the seabed to prevent drifting. Factors like the type of seabed, anchor design, and cable strength are crucial for effective anchoring. This chapter equips cadets with the knowledge to make informed decisions about anchor deployment, emphasizing safety and efficiency in securing vessels.

PREVIEW	LEARNING OBJECTIVES
➢ Part I: Purpose of Anchors ➢ Part II: Holding Ground	➢ To understand the purpose of anchoring. ➢ To learn about significance of the holding ground in ensuring vessel stability

PART I: PURPOSE OF ANCHORS



Anchoring of Boat

2. The primary purpose of an anchor is to secure a ship or boat in a fixed position by gripping the seabed, preventing unwanted drifting due to currents, tides, or wind. This is essential for maintaining stability while a vessel is at rest, whether in a harbor, at sea, or awaiting instructions. Anchors, in conjunction with their cables, act as a critical safety mechanism, ensuring the vessel does not drift into hazardous areas such as rocks, other vessels, or restricted zones.

DID YOU KNOW?

➢ **Anchor Designs Evolved for Different Ships**. As shipbuilding technology advanced, so did anchor designs. For example, admiralty anchors, designed in the 19th century, were improved versions of the stock anchor. These anchors were specifically designed for use with larger ships and were able to hold better in deeper waters with varying seabeds. The Danforth anchor, introduced in the 20th century, featured sharp flukes that dug into the seabed, making it particularly effective for smaller vessels and yachts.

3. When deployed, the anchor settles on the seabed, and as strain is applied through the cable, it digs into the ground, embedding itself securely. The cable, designed to act as a spring, absorbs tension and distributes force evenly, further enhancing stability. Anchors also play a vital role during adverse weather conditions, holding the ship in position and preventing it from being pushed off course by strong winds or waves.

4. The effectiveness of an anchor depends on factors such as its weight, design, and the nature of the seabed, known as the holding ground. Different types of anchors are designed for specific conditions, such as mud, sand, or rocky seabeds. Thus, anchors are indispensable for ensuring safety, stability, and operational readiness in maritime activities.

PART II: HOLDING GROUND

Classification of Holding Ground in Anchoring

5. The holding ground refers to the seabed where an anchor is dropped. The effectiveness of anchoring depends largely on the type of holding ground, as different seabed conditions offer varying levels of grip and resistance. Holding grounds are classified into the following types:-

(a) **Good Holding Ground**. These seabed types provide strong resistance and are ideal for anchoring:

(i) **Clay**. Offers excellent holding power as it allows the anchor to dig in deeply.

(ii) **Firm Sand**. Provides good holding if the anchor penetrates sufficiently.

(iii) **Mud (with clay content)**. Holds well but may cause anchors to get stuck deeply.

(b) **Moderate Holding Ground**. These surfaces provide fair anchoring but may require additional precautions:-

(i) **Soft Mud**. Provides some holding, but the anchor may drag under strong forces.

(ii) **Loose Sand**. Can shift with currents, reducing anchor effectiveness.

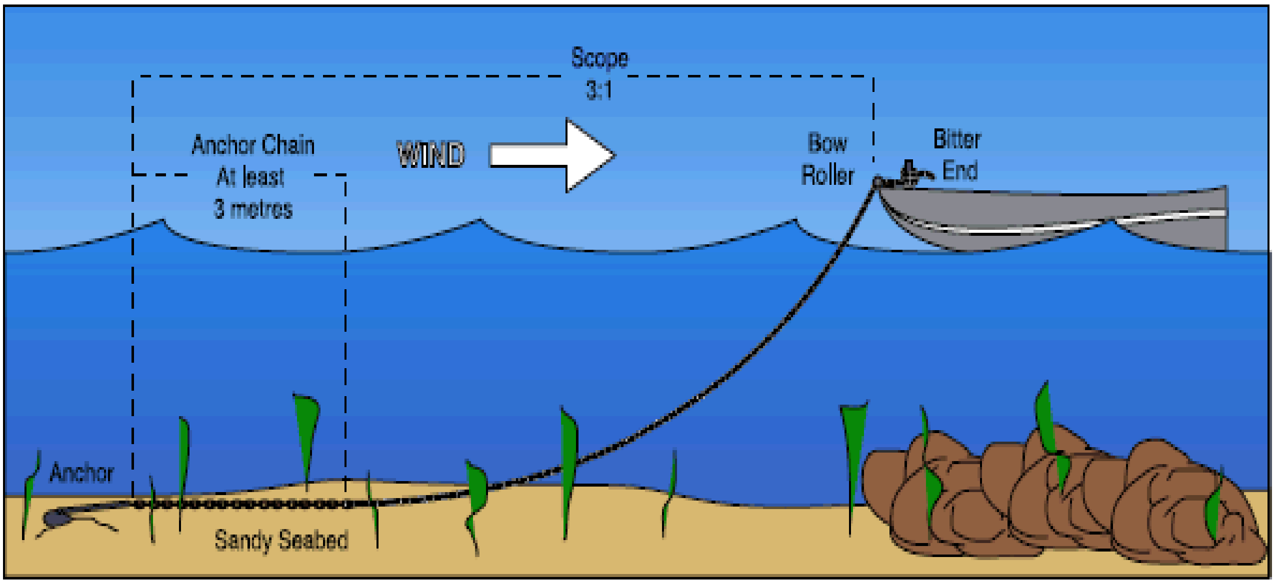
(iii) **Gravel**. Offers inconsistent holding; depends on anchor design.

(c) **Poor Holding Ground**. These surfaces do not provide secure anchoring and should be avoided if possible:

(i) **Rocky Seabed**. Difficult for an anchor to dig in; the anchor may get stuck or fail to grip.

(ii) **Weedy or Coral Beds**. Anchors may slip over the surface without gaining proper hold.

(iii) **Hard Clay**. Can prevent proper anchor penetration, leading to reduced grip.



Effect of Wind on Anchored Ship

6. When selecting an anchorage, mariners must consider the holding ground type to ensure the anchor holds securely and prevents dragging in rough conditions.

The Sequence of Anchor Holding Ground

7. The sequence of anchor holding ground is as follows: -

(a) An anchor reaches/lies on the seabed.

(b) Strain comes on the cable.

(c) The anchor lies flat on the bottom until the pull of the ship on the cable drags the anchor along the bottom.

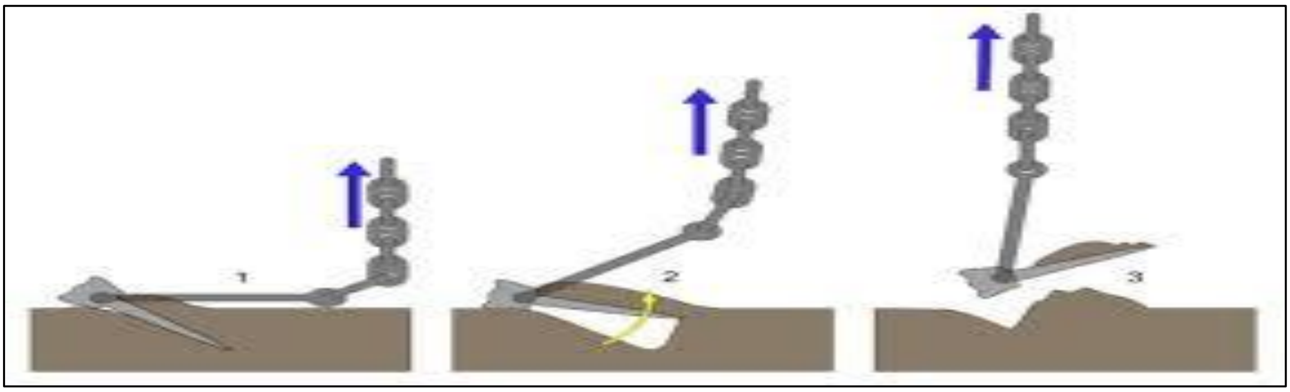
(d) The tripping palms then tilt the flukes, which then dig themselves into the seabed.

(e) After a further amount of dragging the anchor embeds itself completely until it holds the ship in position.

DID YOU KNOW?

➢ **Cable and Anchor Safety Innovations.** In modern times, advancements in materials and technology have significantly improved the performance of anchors and cables. Steel and synthetic fibers, such as nylon, are now used for cables, offering higher strength, less weight, and better resistance to corrosion. These innovations have made anchors and cables more reliable and easier to handle, reducing the risks of dragging or failure.

8. Anchor and cable are used to hold a ship's position in water. The cable is designed to act as a spring with the anchor holding it secured to the bottom of the sea. The size and type of Anchors and cables depend on the tonnage and type of ship.



The Sequence of Anchor Holding Ground

CONCLUSION

9. Mastering anchoring techniques is essential for cadets to ensure a ship's stability and safety in diverse conditions. By understanding the role of holding grounds, anchor types, and cable mechanics, cadets can effectively secure ships, even in challenging weather or sea conditions. These skills are indispensable for safe and efficient ship handling.

SUMMARY

➢ **Prevent Drifting**. The primary purpose of an anchor is to prevent a ship from drifting, securing it in place, whether in a harbour, at sea, or while awaiting instructions.

➢ **Holding Ground**. Holding ground refers to the type of seabed (like sand, mud, or rock) that an anchor can grip onto to prevent the ship from moving, with some grounds offering better holding power than others.

➢ **Anchoring in Storms**. In rough weather, an anchor holds the ship securely, preventing it from being blown off course or into dangerous areas, such as rocks or other vessels.

➢ **Anchor's Weight**. The weight and design of the anchor help it to dig into the seabed, with heavier anchors used in deeper waters and lighter ones used in shallow areas.

➢ **Types of Anchors**. Different anchors, such as plow anchors or danforth anchors, are designed for specific seabed types, ensuring the best possible grip and holding power for the ship.

SUGGESTED READ

Admiralty Manual of Seamanship - BR- 67

ASSESSMENT EXERCISE

Multiple Choice Questions

Q1. What is the primary purpose of an anchor?

(a) To increase the speed of a ship
(b) To secure a ship in a fixed position
(c) To assist in ship navigation
(d) To reduce fuel consumption

Q2. How does an anchor secure a ship in place?

(a) By floating on the water surface
(b) By attaching to another vessel
(c) By gripping the seabed and preventing drifting
(d) By creating a magnetic field

Q3. Which factor does not influence the effectiveness of an anchor?

(a) Anchor weight
(b) Type of seabed
(c) Ship's colour
(d) Cable strength

Q4. What is the role of the anchor cable in anchoring?

(a) It acts as a spring to absorb tension
(b) It helps the ship move faster
(c) It prevents the anchor from touching the seabed
(d) It is used to tow other ships

Q5. Which of the following is considered good holding ground for anchoring?

(a) Hard clay
(b) Rocky seabed
(c) Soft mud
(d) Firm sand

Q6. Why is a rocky seabed considered poor holding ground?

(a) It allows the anchor to dig in too deep
(b) The anchor may slip or fail to grip
(c) It provides too much resistance
(d) Rocks attract marine life

Q7. What happens first in the sequence of anchor holding?

(a) The anchor embeds itself completely
(b) The anchor lies flat on the seabed
(c) The strain comes on the cable
(d) The flukes dig into the seabed

Q8. Which type of anchor is best suited for soft seabed like mud or clay?

(a) Stock anchor
(b) Danforth anchor
(c) Rocky anchor
(d) Floating anchor

Q9. What is the significance of an anchor during rough weather?

(a) It helps the ship move faster
(b) It prevents the ship from drifting off course
(c) It allows the ship to submerge
(d) It reduces ship vibrations

Q10. What is meant by "holding ground" in anchoring?

(a) The speed at which an anchor is deployed
(b) The type of seabed where an anchor grips
(c) The process of retrieving an anchor
(d) The distance a ship drifts before anchoring

Q11. Which of the following is not a type of holding ground classification?

(a) Good holding ground
(b) Moderate holding ground
(c) Poor holding ground
(d) Artificial holding ground

Q12. What happens when the ship's pull drags the anchor along the seabed?

(a) The anchor rises above the seabed
(b) The flukes tilt and dig into the seabed
(c) The ship starts moving uncontrollably
(d) The cable detaches from the anchor

Q13. Why are modern anchor cables often made of synthetic fibres like nylon?

(a) They are heavier than metal cables
(b) They offer higher strength and resistance to corrosion
(c) They allow the anchor to float
(d) They are cheaper to manufacture

Q14. How does the weight of an anchor affect its performance?

(a) Heavier anchors sink deeper and hold better in rough conditions
(b) Lighter anchors are preferred for deep-sea operations
(c) Heavy anchors float better in the water
(d) Anchor weight does not influence its effectiveness

Q15. What role does the tripping palm play in anchoring?

(a) It prevents the ship from moving sideways
(b) It allows the flukes to tilt and dig into the seabed
(c) It makes the anchor heavier
(d) It reduces the anchor's grip on the seabed

One-word Objective Questions

Q1. What type of cable is typically used for a ship's anchor?

Q2. What is the name of the process where the anchor digs itself into the seabed?

Q3. What is the unit of measurement for a ship's anchor cable length?

Q4. What is used to secure the ship's anchor cable to the seabed?

Q5. What is the function of the anchor cable in anchoring operations?

Short Answer Type Questions

Q1. Describe the sequence of events when a ship's anchor holds ground.

Q2. What are the different parts of a chain cable, and what role does each part play in anchor operations?

Q3. Explain how anchor cables are marked and why this is necessary during anchorage.

Q4. What is the purpose of the studded chain in a ship's anchor cable?

Q5. How does the size and type of anchor and cable depend on the ship's tonnage and type?

WATERMANSHIP

5

SECTION INDEX : WATERMANSHIP (SD/ SW)

NCC SPECIAL SUBJECT (NAVY)

WATERMANSHIP

CHAPTER 1: PARTS OF BOAT (CODE- WS 1)

"The wind and the waves are always on the side of the ablest navigator"

TEACHING INSTRUCTIONS

Period : **2 (80 Min)**

Type : **Theory/Practical**

Conducting Officer : **PI**

Year : **First**

Training Aids : **Blackboard, Whiteboard, Projector, 27 Feet DK Whaler**

Time Plan

- **Introduction** : **05 Min**
- **Parts of Whaler** : **10 Min**
- **Parts of Oars** : **30 Min**
- **Pulling Orders** : **30 Min**
- **Conclusion** : **05 Min**

INTRODUCTION

1. Understanding the different parts of a boat is an important skill for cadets learning seamanship, especially when training with the 27-feet DK Whaler. Every part of the boat, such as the apron, backboard, keel, rudder, and thwarts, has a specific role in ensuring smooth movement and stability on water. Knowing the different parts of an oar, like the grip, blade, and loom, helps in proper rowing techniques, making boat handling more efficient and controlled.

2. Boats are classified based on their method of movement—pulling boats use oars, sailing boats use sails, and motorboats run on engines. In any boat, the coxswain is the leader responsible for steering and guiding the crew. They ensure teamwork and proper coordination, making boat operations safe and effective. By understanding these basics, cadets develop essential boating skills that are useful for both training and real-life situations.

PREVIEW	LEARNING OBJECTIVES
➢ Part I: Parts of DK Whaler ➢ Part II: Parts of Oars ➢ Part III: Pulling Orders	➢ To understand different parts of DK Whaler and Oars. ➢ To learn about boat pulling orders.

PART I: PARTS OF A BOAT 27 FEET DK WHALER

3. **27-Feet DK Whaler**. The 27-Feet DK Whaler is a versatile and sturdy boat used for training, transportation, and rescue operations. It is designed to be durable and stable, making it ideal for cadets learning the basics of boat handling and seamanship. This boat can be operated using oars (as a pulling boat), sails (as a sailing boat), or a motor (as a motorboat), giving cadets experience in different types of propulsion. Due to its reliability and ease of maneuverability, the DK Whaler is commonly used in naval and NCC training programs.

4. **Parts of the 27-Feet DK Whaler**. The parts of DK Whaler are as follows:-

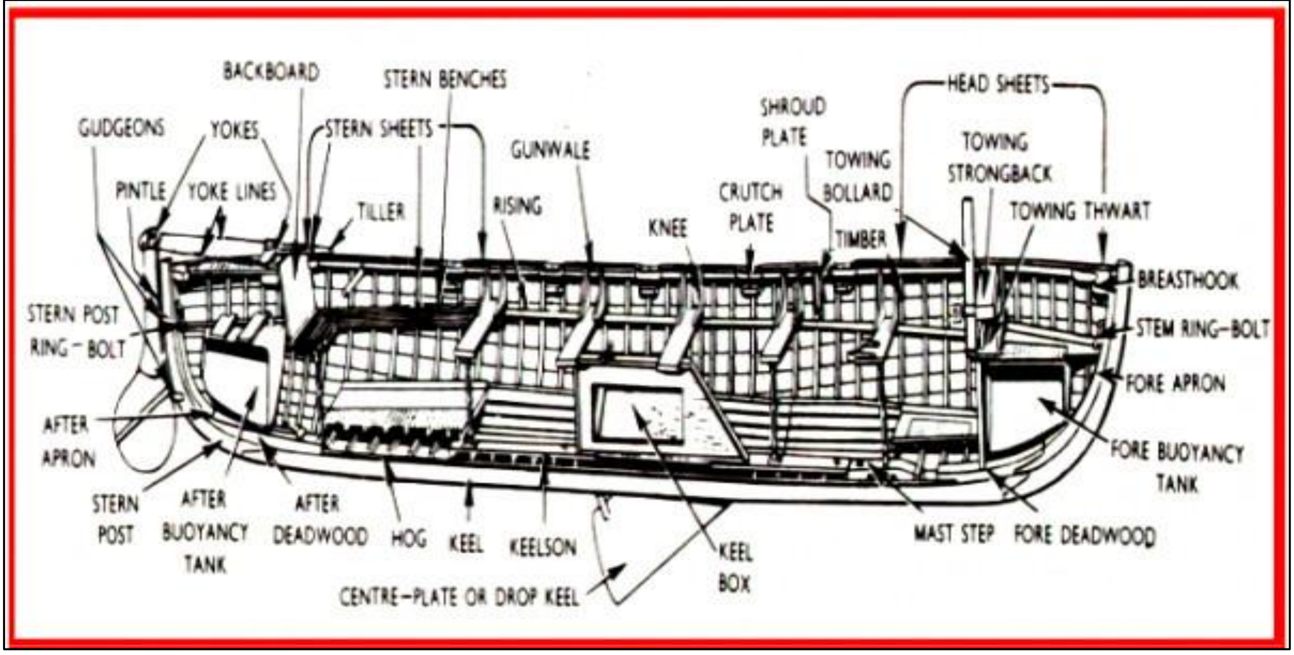
(a) **Apron**. A reinforcing structure at the bow that provides additional strength.

(b) **Backboard**. A flat vertical structure at the stern, often used for mounting the rudder or engine.

(c) **Keel**. The central structural component running along the bottom of the boat, providing stability.

(d) **Rudder**. A movable plate at the stern used for steering the boat.

(e) **Thwarts.** Wooden or metal cross-seats where the rowers sit while using oars.



Parts of DK Whaler

(f) **Gunwale**. The upper edge of the boat's sides, offers structural support.

(g) **Astern**. The rear part of the boat where the coxswain typically sits to steer.

(h) **Bow**. The front part of the boat, designed to cut through water efficiently.

(j) **Oarlocks**. Supports that hold the oars in place while rowing.

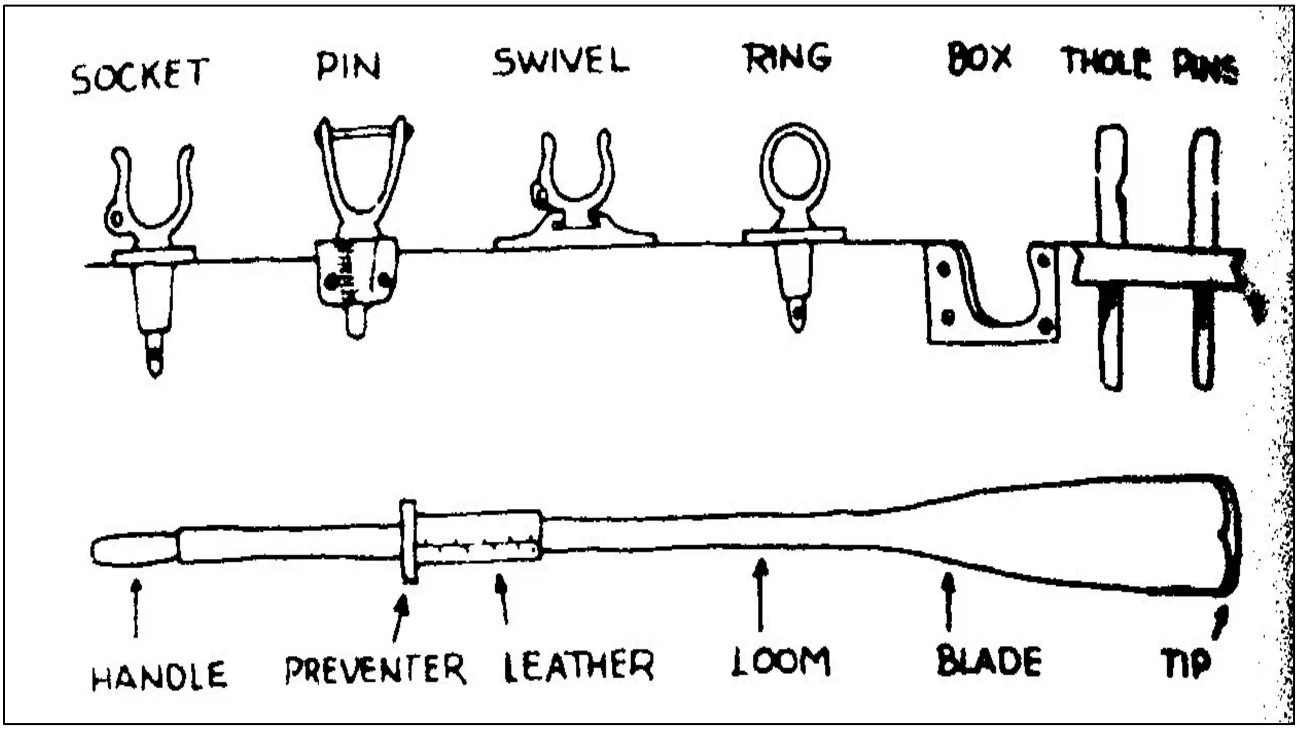
(k) **Mast and Sail (for sailing mode)**. A structure used to support the sail when the boat is operated as a sailing vessel.

DID YOU KNOW?

- **Early Naval Use of Rowing Boats**. In ancient times, the primary form of naval transport was rowing boats, especially during the height of ancient civilizations like Greece and Rome. Warships such as Greek triremes were powered by multiple rows of oarsmen. These boats were crucial in naval battles, allowing for quick manoeuvres and the ability to board enemy ships.
- **The Advent of Sailing Ships**. The transition from rowed boats to sailing ships began around the 16th century. Naval powers like Spain, Portugal, and later England began constructing larger ships with sails for longer journeys and better maneuverability. Ships such as the Spanish galleons were integral in naval warfare, trade, and exploration, marking a pivotal moment in the history of naval boats.
- **The Launch of Steam-Powered Vessels**. The invention of the steam engine in the 19th century revolutionized naval boats. Steam-powered boats replaced sails and oars, enabling naval forces to travel faster and more reliably. Steam frigates, like the USS Savannah (the first steamship to cross the Atlantic), marked the start of a new era in naval warfare and transportation.

PART II: PARTS OF OARS

5. **Oars**. An oar is a long, sturdy tool used for rowing a boat by pushing against the water. It helps in propelling and steering the boat, making it an essential equipment in pulling boats like the 27-feet DK Whaler. Oars are usually made of wood, fiberglass, or metal and are designed to be lightweight yet strong enough to withstand water resistance.



Parts of an Oar

6. **Parts of an Oar**. Parts of an oar are as follows.

(a) **Grip**. The handle part of the oar where the rower holds it while rowing.

(b) **Loom**. The long shaft of the oar that connects the grip to the blade. It provides leverage for rowing.

(c) **Blade**. The flat, broad end of the oar that moves through the water to generate force.

(d) **Leathers**. Protective coverings on the loom where the oar rests against the oarlock, preventing wear and tear.

(e) **Button (Stopper)**. A raised ring around the oar that prevents it from slipping through the oarlock while rowing.

(f) **Oarlock (Rowlock)**. A U-shaped or circular holder mounted on the boat's side, securing the oar in place while allowing free movement for rowing.

PART III: BOAT PULLING ORDERS

DK Whaler Pulling

7. **Pulling Orders**. Pulling a whaler boat requires coordination and teamwork, with clear and precise commands from the coxswain, who is responsible for steering and directing the crew. The pulling orders ensure synchronized rowing, maintaining balance and efficiency. Common orders include:

(a) **Ship Your Oars**. Place the oars in the crutches to prepare for pulling.

(b) **Shove Off**. Push the boat away from the dock or shore using the loom (handle) of the oar.

(c) **Oars Forward**. Crew members bend forward from the hips, keeping arms and back straight. The trunk should be angled between 30 and 40 degrees from vertical, and the oars should be angled around 30 degrees from the fore-and-aft line.

(d) **Give Way Together**. This order signals the crew to begin pulling in unison, moving the boat forward.

(e) **Oars**. A command to cease or stop pulling.

(f) **Easy All**. Crew members pull with reduced force, decreasing the boat's speed.

(g) **Mind Your Oars**. A warning for the crew to keep their oar blades clear of obstacles.

(h) **Eye in the Boat**. Instructs the crew to focus on their tasks and avoid distractions.

(j) **Bow**. Directs the bowman to stop pulling and to boat (stow) his oar.

(k) **Way Enough**. An order to stop pulling, particularly useful when approaching a dock or another vessel.

(l) **<u>Back Together</u>**. Crew members backwater together by pushing on the loom of the oars instead of pulling. If only one side is required to backwater, the command “Back Starboard” or “Back Port” is given.

(m) **<u>Hold Water</u>**. An order to reduce or stop the movement of the boat by holding the oars perpendicular to the water with the blades dipped.

DID YOU KNOW?

- **Development of Submarines.** The introduction of submarines in the late 19th and early 20th centuries drastically changed naval tactics. The first successful military submarine, the HL Hunley, was used during the American Civil War. However, the real impact of submarines was felt during World War I, when nations used them for stealth attacks, fundamentally altering naval strategy.
- **The Role of Boats in Modern Naval Operations**. Today, boats in the navy serve a variety of roles, from small landing craft used in amphibious operations to specialized fast boats for reconnaissance and search-and-rescue missions. The introduction of modern technologies, including radar, GPS, and advanced propulsion systems, has made these boats faster, more versatile, and integral to modern naval forces' operational capabilities.

<u>CONCLUSION</u>

8. In conclusion, mastering the parts of a 27-feet DK Whaler, understanding the function of oars, and following precise pulling orders are essential skills for cadets learning seamanship. The DK Whaler, with its versatile components like the apron, backboard, keel, rudder, and thwarts, provides a solid foundation for both basic and advanced boating techniques. Knowledge of each part's role enhances the cadet's ability to handle the boat efficiently, whether it's rowing, sailing, or using a motor. Similarly, understanding the individual parts of an oar ensures that rowers can maximize their effort and control during boat operation, contributing to smoother and safer movements.

9. Additionally, pulling orders serve as the backbone of coordinated rowing, with the coxswain leading the crew through commands that ensure synchronized efforts. The effectiveness of these orders is paramount in maintaining balance, safety, and efficiency on the water. As cadets practice these skills, they develop a deeper understanding of teamwork, communication, and boat handling, all of which are critical in both training and real-world scenarios. With a comprehensive understanding of these key elements, cadets will be well-prepared to navigate and operate various types of boats with confidence and competence.

SUMMARY

- **Bow.** The front of the boat, often considered the most important part, it cuts through water to help the boat move forward efficiently.

- **Stern.** The back end of the boat, it's where the motor or propeller is often located, and in larger boats, it can have a swim platform or boarding ladder.

- **Hull.** The body of the boat, its shape and design determine how well it floats and handles in different water conditions.

- **Deck.** The flat surface where people stand, walk, and sometimes relax; on larger ships, it can include multiple levels and specialized areas like the bridge or galley.

- **Keel.** The central, bottommost part of the boat that provides stability and prevents the boat from tipping over while sailing.

SUGGESTED READ

Admiralty Manual of Seamanship - BR- 67

ASSESSMENT EXERCISE

Multiple Choice Questions

Q1. What is the primary function of the 27-feet DK Whaler?

(a) Only for sailing operations
(b) Only for rescue missions
(c) Used for training, transportation, and rescue operations
(d) Used only for motor-powered navigation

Q2. What is the keel of a boat responsible for?

(a) Providing stability by running along the bottom of the boat
(b) Steering the boat through water
(c) Supporting the mast and sail
(d) Serving as a seat for rowers

Q3. Which part of the 27-feet DK Whaler is used for steering?

(a) Thwart
(b) Rudder
(c) Keel
(d) Gunwale

Q4. What is the function of the gunwale in a boat?

(a) To provide structural support along the upper edge of the boat's sides
(b) To act as a seat for rowers
(c) To store equipment and supplies
(d) To help in propulsion

Q5. The stern of the boat refers to.

(a) The front part of the boat
(b) The bottom part of the boat
(c) The rear part of the boat
(d) The sides of the boat

Q6. What is the purpose of oarlocks?

(a) To provide additional seating
(b) To prevent water from entering the boat
(c) To hold the oars in place while rowing
(d) To store emergency supplies

Q7. Which part of the oar helps rowers generate force in water?

(a) Grip
(b) Blade
(c) Loom
(d) Button (Stopper)

Q8. What is the function of the button (stopper) on an oar?

(a) To increase speed while rowing
(b) To prevent the oar from slipping through the oarlock
(c) To connect multiple oars together
(d) To provide grip for the rower

Q9. Which of the following is a command given to start synchronized rowing?

(a) Oars
(b) Way Enough
(c) Give Way Together
(d) Hold Water

Q10. Which pulling order instructs rowers to stop pulling and keep their oars still?

(a) Shove Off
(b) Hold Water
(c) Back Together
(d) Mind Your Oars

Q11. What does the command "Ship Your Oars" mean?

(a) To place the oars in the crutches, preparing to row
(b) To stop rowing immediately
(c) To steer the boat in reverse
(d) To remove the oars from the boat

Q12. What does the command "Easy All" instruct the crew to do?

(a) Increase their rowing force
(b) Pull with reduced force to slow the boat
(c) Stop rowing and lift the oars
(d) Turn the boat in the opposite direction

Q13. In which order are crew members instructed to push on the loom instead of pulling?

(a) Hold Water
(b) Back Together
(c) Bow
(d) Mind Your Oars

Q14. What is the role of the coxswain in boat operations?

(a) Rowing with the crew
(b) Steering and guiding the crew
(c) Cleaning the deck of the boat
(d) Handling boat repairs

Q15. Why is it important for cadets to learn about the parts of a boat and pulling orders?

(a) To prepare them for advanced sailing competitions
(b) To improve their fishing techniques
(c) To ensure they can safely and effectively operate a boat
(d) To allow them to design new boat models

<u>One-Word Answer Type</u>

Q1. What is the part of the boat that helps steer it and is located at the back?

Q2. What is the primary function of the coxswain in boat pulling?

Q3. What is the term for the support structure where the mast is fixed on a sailing boat?

Q4. Which part of the oar is used for gripping?

<u>Short Answer Type</u>

Q1. What are the key differences between a pulling boat, sailing boat, and power boat?

Q2. Describe the function of the gunwale in a boat.

Q3. What is the role of the rowlocks in boat rowing?

Q4. What is the purpose of the rudder on a boat?

NCC SPECIAL SUBJECT (NAVY)

SEAMANSHIP

CHAPTER 2: RIGGING OF SAILS AND PARTS OF SAILS (CODE- WS 2)

"Sailing is the closest you can get to nature while still at a distance from the land." - Bernard Moitessier

TEACHING INSTRUCTIONS

Period : 4 (40 Min Theory, 120 Min Practical)
Type : Theory/ Practical
Conducting Officer : PI
Year : First

Training Aids : Blackboard, Whiteboard, Projector, Sails

Time Plan

- Introduction : 05 Min
- Parts of sail : 15 Min
- Rigging of sail : 15 Min
- Conclusion : 05 Min
- Practical : 120 Min

INTRODUCTION

1. Sailing is a fundamental skill for naval cadets, and understanding the parts and operation of sailing boats is essential. Whalers and Enterprise-class boats are among the most commonly used sailing boats in the Navy. The Enterprise-class boats, designed exclusively for sailing, are crewed by two and offer an excellent platform for mastering basic and advanced sailing techniques. Key aspects of sailing include familiarizing oneself with different types of sails, such as the foresail, mainmast sail, and mizzen sail, and learning the anatomy of a sailing boat. Essential components like the mast, boom, jib, rudder, and keel play crucial roles in maneuverability and performance. Grasping these concepts enables cadets to effectively manage sails and navigate with precision, fostering both confidence and competence in handling various sailing conditions.

PREVIEW	**LEARNING OBJECTIVES**
➢ Part I: Parts of Sail. ➢ Part II: Rigging of Sail.	➢ To learn about parts of sails and rigging. ➢ To understand various terms related to sailing.

PART I: PARTS OF SAIL

2. The parts of a sail are fundamental to understanding how sails function to harness wind power for propulsion. A sail is essentially a large fabric structure, and its design is critical in determining how efficiently it captures the wind to move the boat. Here are the main parts of a sail:

(a) **Head**. The top corner of the sail, usually attached to the mast. It is the point where the sail is hoisted.

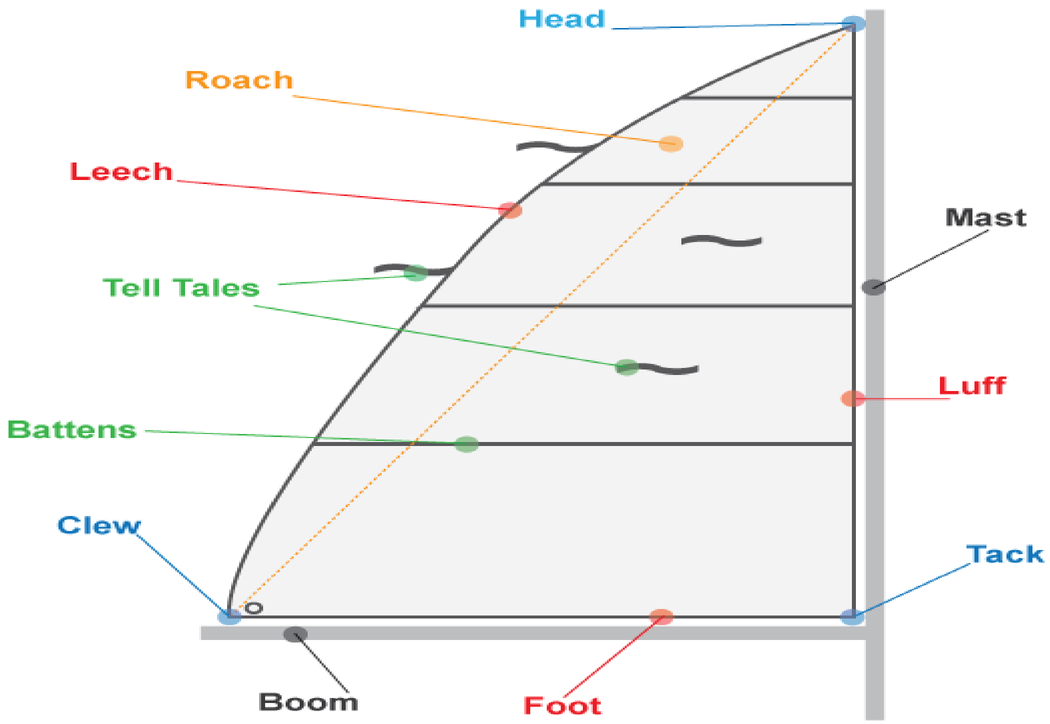
(b) **Foot**. The bottom edge of the sail, which is often attached to the boom and sometimes the boat itself.

(c) **Leech**. The rear edge of the sail, extending from the head to the clew, helps in controlling the sail’s shape and efficiency.

(d) **Luff**. The forward edge of the sail, attached to the mast or forestay, helps to form the sail’s shape as it catches the wind.

(e) **Clew**. The bottom corner of the sail at the rear, typically where the sheet is attached to control the sail’s position.

(f) **Bolt Rope**. A strong rope sewn into the luff of the sail, which helps it stay securely attached to the mast or stay.



Parts of Sail

(g) **Batten**. A thin, flexible strip inserted into the sail to help it maintain its shape, especially when there is little wind.

(h) **Reefing Points**. Lines or ties that allow the sail to be shortened (reefed) in strong winds, making the sail easier to handle and preventing overloading the boat.

(j) **Sheets**. Ropes attached to the clew of the sail that control its position relative to the wind, allowing the crew to trim the sail and change its angle to maximize wind capture.

(k) **Halyard**. A line used to raise or lower the sail by pulling it up to the desired position on the mast.

DID YOU KNOW?

- **Ancient Origins of Sailing**. The concept of sailing dates back over 5,000 years. The earliest recorded sailboats were used by the ancient Egyptians around 3,000 BCE. They used simple, single-sail boats made from papyrus and wood to navigate the Nile River, marking one of the first uses of wind power for transportation.

- **The Birth of the Modern Sailboat.** The development of the modern sailboat, particularly in Europe, began in the 15th and 16th centuries. As maritime trade and exploration expanded, ships like the caravel (used by Portuguese and Spanish explorers) featured advanced sail rigs that made long-distance voyages possible, influencing the design of modern sailboats.

PART II: RIGGING OF SAILS

3. Rigging of sails is the process of setting up and adjusting the sailboat's rigging to ensure that the sails are properly controlled and can efficiently harness wind power. It involves a combination of various lines, ropes, and hardware that enable the crew to hoist, trim, and adjust the sails for optimal performance. Proper rigging is essential for the safe and efficient operation of the vessel, whether it is for cruising or racing. Here's an overview of the rigging process:

(a) **Mast and Boom Setup**. The mast is the vertical structure that supports the sail, while the boom is the horizontal spar attached to the bottom of the sail. The mast is usually secured to the boat's deck using a series of stays (fore, side, and back) to keep it upright. The boom, typically attached to the mast by a gooseneck, allows the crew to control the position of the sail. The rigging process begins by ensuring that both the mast and boom are correctly in place and secure.

(b) **Halyards**. The halyard is a line used to raise and lower the sail. The halyard is attached to the head of the sail, and pulling it upwards hoists the sail onto the mast. Once the sail is in the desired position, the halyard is cleated off to prevent the sail from lowering unintentionally. There may be separate halyards for different sails, such as the mainsail and jib.

(c) **Sheets**. The sheets are lines that control the angle of the sail relative to the wind. For the mainsail, the sheet is attached to the clew (bottom rear corner) of the sail, while for the jib, the sheets control the angle of the foresail. By adjusting the tension on the sheets, the crew can "trim" the sails, making them flatter or more curved depending on the wind conditions. Proper trimming allows the boat to move efficiently in the desired direction.

(d) **Topping Lift and Boom Vang**. The topping lift is used to support the boom when the sail is lowered. It helps to prevent the boom from drooping and ensures that it remains level when the mainsail is not being used. The boom vang, on the other hand, is used to control the downward force of the boom, especially when sailing downwind, and helps to adjust the shape of the mainsail by applying pressure to the boom's base.

(e) **Shrouds and Stays**. The shrouds are side wires that run from the mast to the sides of the boat, keeping the mast upright. They provide lateral support to the mast and prevent it from falling over. The forestay runs from the top of the mast to the bow of the boat and supports the mast against the forward pressure of the jib. The backstay runs from the top of the mast to the stern and helps to maintain mast tension.

(f) **Jib and Genoa**. The jib is the smaller sail at the front of the boat, and the genoa is a larger variation that overlaps the mainsail. Rigging the jib involves attaching the forestay to the bow and securing the jib to the forestay using a set of hanks or a roller furler. The jib sheet controls the trim of the jib and allows the crew to adjust its angle in relation to the wind.

Rigging of DK Whaler

(g) **Reefing**. Reefing is the process of reducing the sail area in strong winds to prevent overpowering the boat. This is typically done by pulling down part of the sail and securing it with reefing lines. Reefing points along the luff and foot of the sail allow the crew to shorten the sail by tying down sections of the sail to the boom.

(h) **Running Rigging and Standing Rigging**. Running rigging refers to all the lines and ropes that are used to control the movement of the sails, such as halyards, sheets, and reefing lines. Standing rigging refers to the fixed support system of the mast, including shrouds and stays that hold the mast in position.

DID YOU KNOW?

- **The Importance of the Clipper Ship.** During the 19th century, the clipper ship became an iconic symbol of speed and efficiency. These ships, with their large sails and sharp, sleek designs, were used for transporting tea, spices, and other goods quickly. The Cutty Sark, built in 1869, is one of the most famous examples of this class of sailing vessels.

- **Sailing as a Sport.** Sailing has evolved from a mode of transportation to a popular recreational activity and competitive sport. The America's Cup, first held in 1851, is one of the oldest international sporting events. It has played a pivotal role in advancing sailing technology and showcasing human ingenuity in sailing design.

- **Environmental Benefits.** Sailboats are considered an environmentally friendly mode of travel, as they rely on wind power rather than fuel. Many modern sailors, especially those involved in eco-conscious cruising, use solar panels and other renewable energy sources to supplement wind power, making sailing one of the most sustainable ways to travel on water.

4. **Parts of sailing boat**. Parts of sailing boat are as follows:-

(a) **Mast**. A vertical pole or spar that supports the sails and rigging on a sailing boat, acting as the backbone of the sail system.

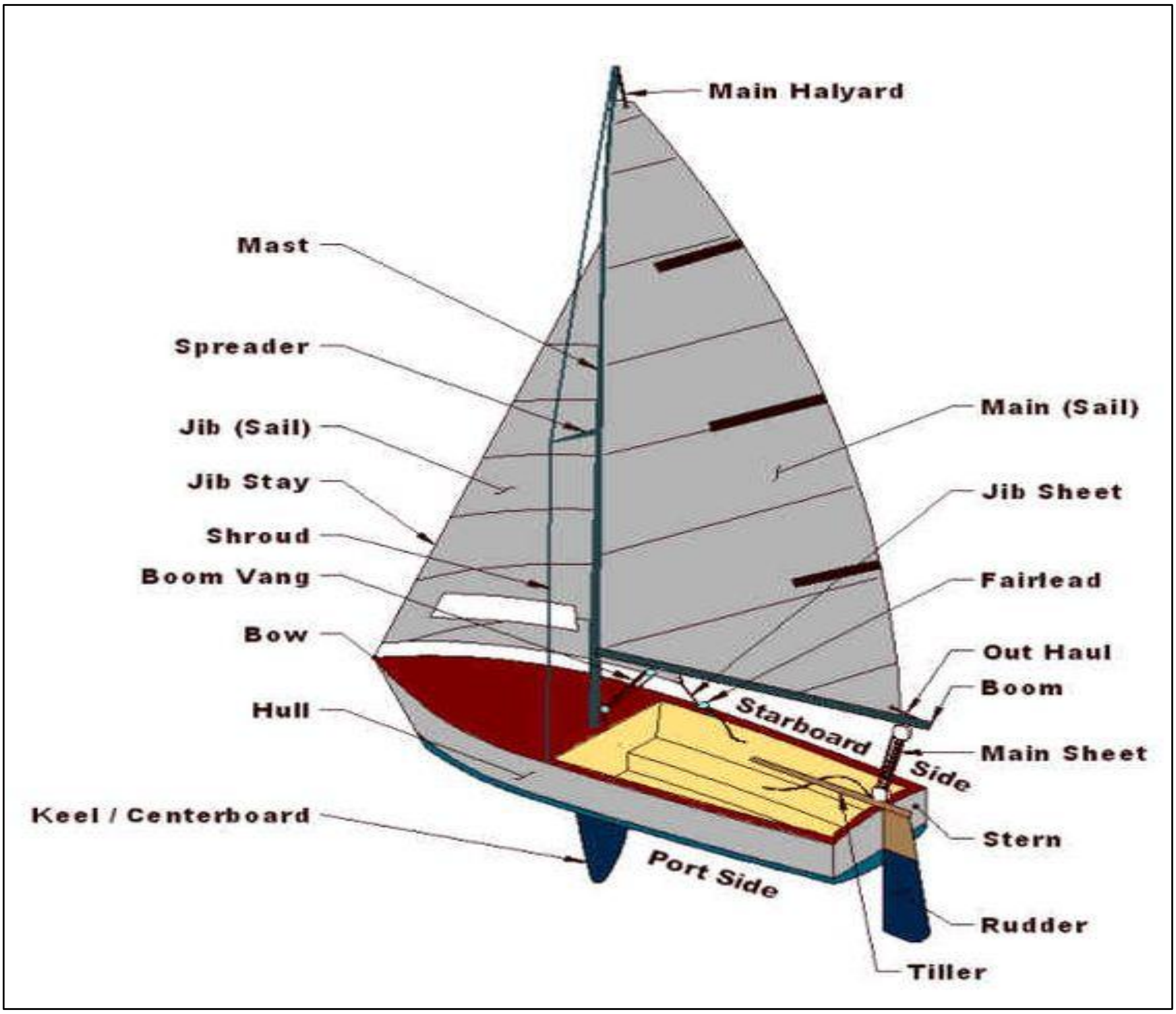
(b) **Spreader**. A horizontal or angled spar attached to the mast that spreads the shrouds apart, providing lateral stability to the mast.

(c) **Jib**. A triangular sail set ahead of the foremast, typically used to improve a boat's speed and balance.

(d) **Jib Stay**. A wire or rope running from the top of the mast to the bow of the boat, supporting the jib and keeping it in place.

(e) **Shroud**. A strong wire or rope running from the mast to the sides of the boat, offering lateral support and stability to the mast.

(f) **Bow**. The front section of the boat, designed to cut through the water efficiently.



Parts of Sailing Boat

(g) **Hull**. The main body of the boat, providing buoyancy and housing critical components.

(h) **Keel**. The central, bottommost structure running along the length of the hull, providing stability and reducing sideways drift.

(j) **Stern**. The rear section of the boat, often housing components like the rudder or propeller.

(k) **Rudder**. A flat, vertical blade positioned at the stern, used to steer the boat by redirecting water flow.

(l) **Tiller**. A lever attached to the rudder, used by the helmsman to steer the boat manually.

(m) **Boom**. A horizontal spar extending from the mast, controlling the bottom edge of the mainsail and allowing it to catch wind efficiently.

CONCLUSION

5. In conclusion, this session has given cadets a solid grasp of the essential components of a sailing boat and their specific roles. By understanding the mast, boom, jib, rudder, and other key parts, cadets are better prepared to navigate and operate sailing vessels with confidence. This foundational knowledge is crucial for effective seamanship and for ensuring smooth, safe operations on the water.

6. Furthermore, mastering the functions of different sails and their respective techniques lays the groundwork for more advanced training and real-world applications. As cadets continue to develop their skills, the ability to work as a cohesive team and apply their knowledge in practical scenarios will be invaluable. These lessons provide the cornerstone for building expertise in sailing, ultimately contributing to their growth as capable and resourceful sailors.

SUMMARY

➢ **Mast and Boom.** The mast is the vertical structure that holds the sails, while the boom is the horizontal spar that controls the bottom of the mainsail, helping it catch wind.

➢ **Sailcloth.** Sail fabric is often made from durable, weather-resistant materials like Dacron, allowing it to withstand powerful winds and harsh marine conditions.

➢ **Halyard.** This is the line used to raise and lower sails, with different halyards for various sails on a boat, making sail handling more efficient.

➢ **Jib and Genoa.** The jib is a small sail set at the front, while the genoa is a larger version that overlaps the mainsail, used for better speed and performance in light winds.

➢ **Tack and Clew.** The tack is the forward lower corner of the sail, while the clew is the rear lower corner, with both serving as key points to adjust the sail's shape and angle.

SUGGESTED READ

Admiralty Manual of Seamanship - BR- 67

ASSESSMENT EXERCISE

Multiple Choice Questions

Q1. Which of the following is NOT a commonly used sailing boat in the Navy?

(a) Enterprise-class boats
(b) Whalers
(c) Clipper ships
(d) Caravel

Q2. What is the function of the keel in a sailing boat?

(a) To support the mast
(b) To provide stability and reduce sideways drift
(c) To hoist the sails
(d) To steer the boat

Q3. The head of a sail is located at which part of the sail?

(a) Bottom rear corner
(b) Forward lower corner
(c) Top corner
(d) Bottom front corner

Q4. What is the purpose of reefing points on a sail?

(a) To help attach the sail to the mast
(b) To allow shortening of the sail in strong winds
(c) To hold the sail open in light winds
(d) To secure the boom to the mast

Q5. Which part of the sail runs from the head to the clew and helps control its shape?

(a) Luff
(b) Leech
(c) Foot
(d) Bolt rope

Q6. The halyard is used for which of the following purposes?

(a) Steering the boat
(b) Hoisting and lowering the sail
(c) Securing the mast to the deck
(d) Controlling the boom

Q7. What is the primary function of the boom vang?

(a) To support the mast
(b) To reduce sideways drift
(c) To control the downward force of the boom
(d) To attach the jib sail

Q8. Which sail is typically set ahead of the foremast and helps with speed and balance?

(a) Genoa
(b) Mainsail
(c) Jib
(d) Mizzen sail

Q9. The shrouds in a sailboat serve what purpose?

(a) Providing lateral support to the mast
(b) Securing the jib to the mast
(c) Steering the boat
(d) Raising the sails

Q10. What is the purpose of the rudder in a sailing boat?

(a) To stabilize the mast
(b) To control the direction of the boat
(c) To reduce sideways drift
(d) To adjust the sail angle

Q11. The topping lift is used to.

(a) Adjust the mast height
(b) Support the boom when the sail is lowered
(c) Trim the jib sail
(d) Secure the forestay

Q12. Which of the following statements about the genoa sail is true?

(a) It is smaller than the jib
(b) It overlaps the mainsail
(c) It is used only in strong winds
(d) It is attached directly to the boom

Q13. What is the main difference between running rigging and standing rigging?

(a) Running rigging supports the mast, while standing rigging controls the sails
(b) Running rigging is fixed, while standing rigging is adjustable
(c) Running rigging controls, the sails, while standing rigging supports the mast
(d) There is no difference; they are the same

Q14. Which of the following sailing terms refers to the forward lower corner of a sail?

(a) Clew
(b) Tack
(c) Luff
(d) Leech

Q15. What is the primary environmental advantage of sailing boats?

(a) They use wind power instead of fuel
(b) They can travel faster than motorboats
(c) They require less maintenance
(d) They do not require trained sailors

One-word Answer Type Questions

Q1. What sail is set immediately before the fore mast?

Q2. Which mast holds the main sail on a sailing boat?

Q3. What sail is set on the mizzen mast?

Q4. What is the part of the boat that helps with steering?

Q5. Which part of the boat provides lateral stability and helps it stay upright?

Short Answer Type Questions

Q1. What is the function of the jib on a sailing boat?

Q2. Describe the role of the shroud on a sailing boat.

Q3. How does the keel contribute to a sailing boat's movement?

Q4. What is the purpose of the spreader on a mast?

NCC SPECIAL SUBJECT (NAVY)

WATERMANSHIP

CHAPTER 3: ELEMENTARY SAILING – ENTERPRISE CLASS (CODE- WS 3)

"To sail is to harness the wind, embrace the sea, and discover the freedom that lies beyond the horizon."

TEACHING INSTRUCTIONS

Period	**: 4 (40 Min Theory, 120 Min Practical)**
Type	**: Theory/ Practical**
Conducting Officer	**: PI**
Year	**: First**
Training Aids	**: Blackboard, whiteboard, projector, EC Dinghy**
Time Plan	
Introduction	**: 05 Min**
Intro to Enterprise Class Boat	**: 15 Min**
Sailing Manoeuvres	**: 10 Min**
Sailing Rules	**: 05 Min**
Conclusion	**: 05 Min**
Practical	**: 80 Min**

INTRODUCTION

1. Enterprise-class sailing boats are widely favoured for introductory sailing training due to their stability, ease of handling, and adaptability to various wind conditions. These boats provide an excellent platform for beginners to learn the fundamentals of sailing, allowing cadets to develop confidence in boat control and manoeuvring. With their simple yet effective design, Enterprise-class boats offer a balanced mix of performance and safety, making them ideal for training purposes.

2. This course equips NCC cadets with essential sailing knowledge, covering key aspects such as basic sailing terminology, sail handling, boat control, and crucial safety measures. Understanding these fundamentals ensures that cadets can navigate and operate the boat efficiently while responding effectively to changing wind and water conditions. By mastering these skills, cadets build a strong foundation in seamanship, preparing them for more advanced sailing challenges in the future.

PREVIEW	LEARNING OBJECTIVES
➢ Part I: Intro to Enterprise Class Boat ➢ Part II: Basic Sailing Manoeuvres and Rules	➢ To familiarise with Enterprise Class Boat ➢ To learn about sailing manoeuvres and rules

PART 1: INTRO TO ENTERPRISE CLASS BOAT

3. **Enterprise Class Boat**. The Enterprise-class sailing boat is a widely used training vessel in the NCC, known for its stability, simplicity, and versatility in different wind conditions. Designed as a two-person dinghy, it features a mainsail and a jib, allowing cadets to learn essential sailing techniques such as tacking, jibing, and sail trimming. Its lightweight yet durable construction makes it easy to handle, providing an ideal platform for beginners to develop confidence and refine their sailing skills. The boat’s responsive nature helps cadets understand the impact of wind and water dynamics, enabling them to manoeuvre efficiently while maintaining control.

4. In the NCC, the Enterprise-class boat plays a crucial role in building cadets' maritime knowledge and seamanship abilities. Through structured training sessions, cadets gain hands-on experience in rigging, sail handling, and navigation, fostering discipline and teamwork—key qualities in naval operations. Practical exposure to sailing enhances their problem-solving skills, decision-making abilities, and adaptability in challenging conditions. By mastering the fundamentals on an Enterprise-class boat, cadets lay the groundwork for advanced sailing proficiency, preparing them for competitive sailing events and future roles in maritime professions.

Enterprise Class Sailing Boat

PART II: BASIC SAILING MANOEUVRES AND SAILING RULES

5. **Basic Sailing Manoeuvres**.

(a) **Tacking**. Process of turning the bow through the wind to change direction while maintaining forward motion.

(b) **Gybing**. Turning the stern through the wind, used primarily when sailing downwind.

(c) **Sailing Free and Close-Hauled**. Sailing with sails set loose or close to the boat's centreline.

6. **Elementary Sailing Rules**.

(a) **Right-of-Way Rules**.

(i) A boat on a port tack yields to a boat on a starboard tack.

(ii) When two boats are running free, the boat with the wind on its port side must give way.

(b) **Safety Considerations**. Wearing life jackets, awareness of weather conditions, and maintaining clear communication on the water.

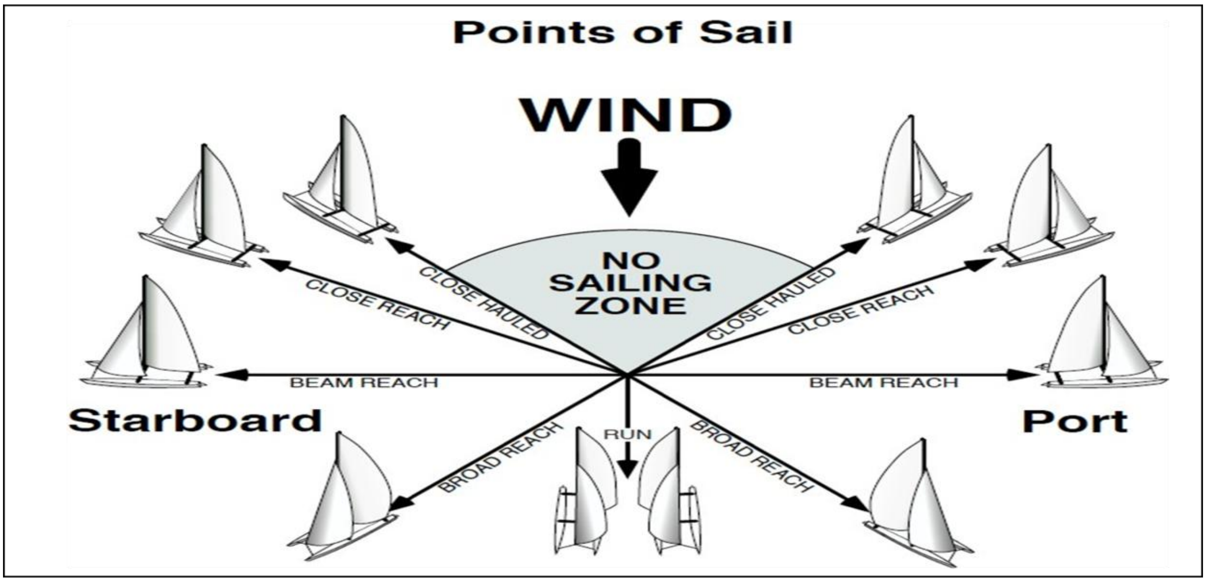
7. **Command Execution and Team Coordination**.

(a) **Standard Commands**:

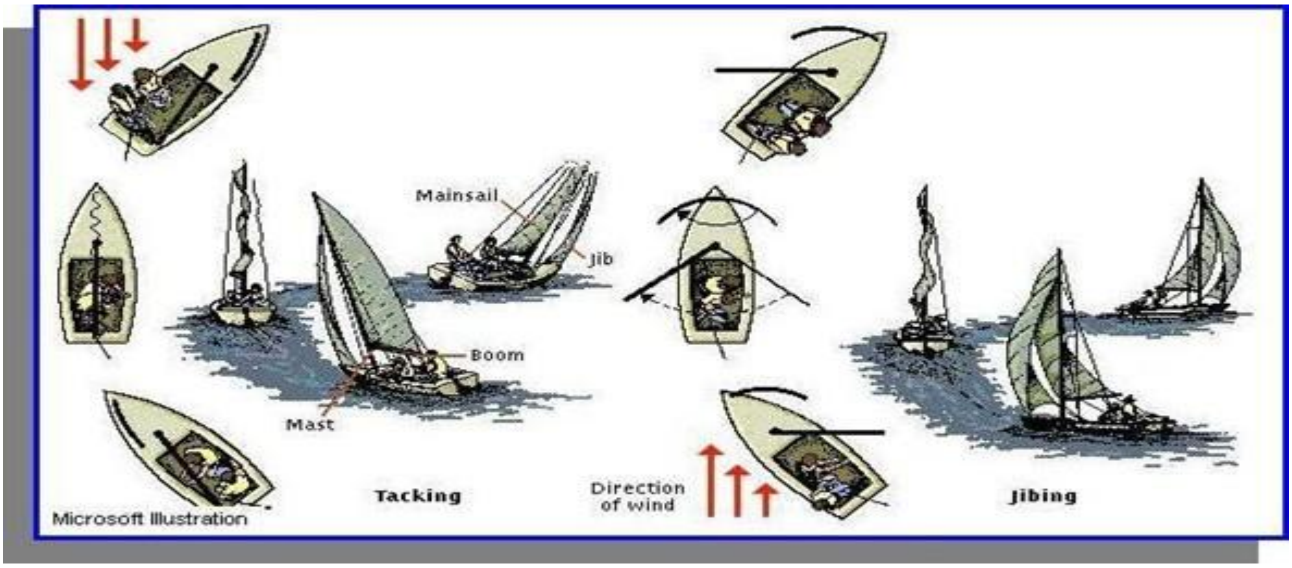
(i) "Ready About" (prepare to tack), "Helm's Alee" (executing tack).

(ii) "Prepare to Gybe", "Gybe Ho" (initiating gybe).

(b) Ensuring each team member understands their role in manoeuvring the boat and responding to commands accurately.



Effects of Wind on Sails



Basic Sailing Manoeuvres

CONCLUSION

8. Elementary sailing in an Enterprise class boat equips cadets with essential skills to operate a sailboat safely and effectively. By mastering basic manoeuvres and adhering to safety protocols, cadets develop confidence and competence in handling sailing vessels. The course builds foundational knowledge in wind utilization, boat control, and teamwork, laying the groundwork for advanced sailing skills and greater nautical awareness.

SUMMARY

➢ Understand the parts of the Enterprise class boat, basic sailing terminology, and wind dynamics.

➢ Master essential sailing manoeuvres like tacking, gybing, and sailing in close-hauled and free modes.

➢ Follow right-of-way rules and prioritize safety by wearing life jackets and monitoring weather conditions.

➢ Practice standard sailing commands such as "Ready About," "Helm's Alee," "Prepare to Gybe," and "Gybe Ho."

➢ Ensure effective teamwork by assigning clear roles and maintaining precise coordination during manoeuvres.

➢ Develop foundational sailing skills to confidently handle boats and prepare for advanced sailing scenarios.

SUGGESTED READ

Admiralty Manual of Seamanship - BR- 67

ASSESSMENT EXERCISE

Multiple Choice Questions

Q1. What makes the Enterprise-class sailing boat ideal for training beginners?

(a) It is the fastest sailboat available.
(b) It has a complex design requiring expert handling.
(c) It is stable, easy to handle, and adaptable to various wind conditions.
(d) It is used only for competitive racing.

Q2. What type of sails does the Enterprise-class boat use?

(a) A mainsail and a jib
(b) A spinnaker and a mainsail
(c) A foresail and a mizzen sail
(d) A square sail and a jib

Q3. Why is hands-on sailing experience important for NCC cadets?

(a) It helps them memorize sailing theory
(b) It fosters discipline, teamwork, and problem-solving skills.
(c) It allows them to win sailing competitions.
(d) It replaces the need for theoretical training.

Q4. What is 'tacking' in sailing?

(a) A manoeuvre used to turn the stern through the wind.
(a) A process of turning the bow through the wind to change direction.
(b) A method of increasing boat speed.
(c) A technique used only for sailing downwind.

Q5. What does 'gybing' mean in sailing?

(a) Turning the stern through the wind, often used when sailing downwind.
(b) Turning the bow through the wind to change direction.
(c) Slowing down the boat by pulling in the sails.
(d) Increasing the sail area to catch more wind.

Q6. What does the term 'close-hauled' refer to in sailing?

(a) Sailing with sails set loose.
(b) Sailing directly into the wind.
(c) Sailing with the sails pulled in close to the boat centreline.
(d) Sailing with no wind assistance.

Q7. What is the primary purpose of the right-of-way rules in sailing?

(a) To allow the fastest boat to have priority.
(b) To ensure safe and orderly navigation of boats.
(c) To make sailing more competitive.
(d) To help boats avoid strong winds.

Q8. According to sailing right-of-way rules, which boat has priority?

(a) A boat on a port tack.
(b) A boat on a starboard tack.
(c) A boat running free on a port side.
(d) A boat that is moving faster.

Q9. What is the purpose of wearing a life jacket while sailing?

(a) It makes sailing more comfortable.
(b) It is only required in stormy conditions.
(c) It ensures safety in case of accidents or falling overboard.
(d) It helps increase boat speed.

Q10. What is the meaning of the command “Ready About”?

(a) Prepare to tack.
(b) Prepare to gybe.
(c) Slow down the boat.
(d) Stop the boat immediately.

Q11. Which sailing manoeuvre involves changing direction by turning the stern through the wind?

(a) Tacking
(b) Gybing
(c) Close-hauled sailing
(d) Running free

Q12. Why is teamwork important in sailing?

(a) To ensure smooth coordination and precise execution of commands.
(b) To allow each sailor to sail independently.
(c) To reduce the importance of wind conditions.
(d) To make sailing more competitive.

Q13. Which of the following is NOT a standard sailing command?

(a) “Helm’s Alee”
(b) “Gybe Ho”
(c) “Prepare to Fly”
(d) “Ready About”

Q14. What is one of the key learning objectives of sailing training in NCC?

(a) To memorize the history of sailing.
(b) To develop foundational sailing skills and understand basic manoeuvres.
(c) To focus only on racing techniques.
(d) To study theoretical aspects of sailing without practical experience.

Q15. How does mastering sailing fundamentals benefit cadets?

(a) It prepares them for advanced sailing challenges.
(b) It allows them to avoid teamwork.
(c) It replaces the need for safety measures.
(d) It helps them memorize sailing commands without practical use.

NCC SPECIAL SUBJECT (NAVY)

WATERMANSHIP

CHAPTER 4: WHALER SAILING (CODE- WS 4)

"A smooth sea never made a skilled sailor." – Franklin D. Roosevelt

TEACHING INSTRUCTIONS

Period	**: 7**
Type	**: Practical**
Conducting Officer	**: PI**
Year	**: Second -3, Third - 4**
Training Aids	**: DK Whaler Boat, Sails**
Time Plan	**: Sailing Practical – 280 Min**

NCC SPECIAL SUBJECT (NAVY)

WATERMANSHIP

CHAPTER 5: INTRODUCTION TO POWER BOATS (CODE WS-5)

"Speed on water is freedom unleashed—powerboats turn waves into a playground and the horizon into a goal."

TEACHING INSTRUCTIONS

Period	**: 2 (80 Min)**
Type	**: Theory**
Conducting Officer	**: PI**
Year	**: Third**
Training Aids	**: Power boat models, engine models, charts, safety equipment, projector, and whiteboard**

Time Plan

- **Introduction : 05 Min**
- **Types Of Power Boats : 35 Min**
- **Safety Protocols and Procedures : 35 Min**
- **Conclusion : 05 Min**

INTRODUCTION

1. Power boats are an essential support vessel used during NCC watermanship activities, primarily serving as safety boats. These motorized boats provide rapid response capabilities, ensuring the safety of cadets during training exercises such as sailing, rowing, and other water-based activities. Their ability to navigate quickly and efficiently in different water conditions makes them ideal for monitoring and assisting participants, especially in case of emergencies or adverse weather conditions.

2. In the NCC, power boats are not part of the cadets' practical training but play a crucial role in overseeing watermanship activities. They are manned by experienced personnel who ensure that all safety protocols are followed, providing immediate assistance if needed. Whether it is rescuing a capsized boat, towing a vessel, or offering guidance during exercises, power boats help maintain a secure training environment. Their presence allows cadets to focus on skill development while ensuring a high level of safety throughout their water-based training sessions.

PREVIEW	**LEARNING OBJECTIVES**
➢ Part I: Types of power boats ➢ Part II: Safety protocols and procedures	➢ To familiarise with Power boats ➢ To understand Safety protocols and procedures during power boat operation

PART I: TYPES OF POWER BOATS

3. Power boats play a crucial role in maritime operations, providing speed, efficiency, and versatility for various tasks. They are commonly used for patrolling, rescue missions, transportation, and safety support during training activities. Depending on their design, engine placement, and purpose, power boats are classified into different types, each with unique advantages suited for specific maritime needs. Below are some of the key types of power boats used in naval and NCC operations.

4. **Inboard Boats**. Inboard boats have their engines located inside the hull, providing better weight distribution and stability. These boats are designed for heavy-duty tasks, such as towing, long-distance navigation, and carrying heavy loads. Their enclosed engines also reduce exposure to water, making them more durable and efficient for prolonged use in rough conditions.

5. **Outboard Boats**. Outboard boats have engines mounted on the exterior, typically at the stern. This design allows for high manoeuvrability, easy maintenance, and quick engine replacement. These boats are commonly used for patrolling, fishing, and recreational purposes, as their lightweight structure and powerful motors enable fast and responsive movement on water.

6. **Rigid Inflatable Boats (RIBs)**. RIBs are lightweight yet highly durable boats with inflatable sides and a rigid hull. Their design provides excellent stability, even in rough waters,

making them ideal for rescue operations, patrolling, and rapid-response missions. Their speed, agility, and durability make them a preferred choice for coast guards and maritime security operations.

7. **Gemini Crafts**. Gemini crafts are known for their combination of speed, durability, and adaptability. These boats are often used in specialized missions, including search and rescue, law enforcement, and military operations. Their sturdy construction and powerful engines make them reliable in demanding environments, ensuring efficiency in both security and emergency response operations.

DID YOU KNOW?

➢ **The Birth of Powerboats**: The first recorded powerboat was built in 1787 by John Fitch, an American inventor. Fitch's boat, called the "Fitch Steamboat," was powered by steam and could travel at 8 miles per hour. This was the beginning of the evolution of boats powered by engines, moving away from manual oars or sail power.

➢ **The Steamboat Revolution**: In the early 19th century, steam-powered boats became the dominant form of water transport. The famous **Clermont**, built by Robert Fulton in 1807, was one of the first successful steamboats that could carry passengers and cargo over long distances. Its success revolutionized transportation on rivers and lakes, significantly boosting the development of powerboats.

Gemini Boat

8. **GRP Motor Boats**. GRP (Glass Reinforced Plastic) motor boats are made from fiberglass, offering a balance between speed, durability, and low maintenance. These boats are widely used for patrol, transport, and training purposes due to their strong, lightweight construction. Their resistance to corrosion and harsh marine conditions makes them a long-lasting option for various naval and commercial applications.

Engine Basics and Maintenance

9. A power boat's engine is a crucial component that ensures smooth and efficient operation. To maintain peak performance and longevity, it is important to understand its key systems and follow routine maintenance practices.

10. **Engine Components**

(a) **Fuel System**. The fuel system ensures proper fuel delivery to the engine for smooth operation. It consists of fuel tanks, filters, and injectors, which need to be regularly inspected to prevent blockages or leaks.

(b) **Cooling System**. This system prevents the engine from overheating by circulating coolant or water through the engine. Proper maintenance of the cooling system ensures the engine runs efficiently, especially during prolonged use.

(c) **Lubrication System**. The lubrication system reduces friction between moving parts, preventing wear and tear. Regular oil checks and timely replacement are essential to keep the engine running smoothly.

11. **Routine Maintenance**

(a) **Checking Oil Levels, Fuel Lines, and Filters**. Before starting the engine, it is important to check the oil levels, inspect fuel lines for leaks, and ensure that filters are clean and unclogged.

(b) **Ensuring Fuel Tank is Filled and Leak-Free**. A proper fuel check helps avoid engine failure during operation. The fuel tank should always be filled to the required level and inspected for any leaks.

(c) **Regularly Cleaning Engine Components**. Dust, salt, and grime can accumulate on engine components, leading to performance issues. Regular cleaning prevents build-up, ensuring a longer engine lifespan and optimal functionality.

Stowage of Gemini Boat

DID YOU KNOW?

➢ **The Rise of Gasoline-Powered Boats**: In the late 19th century, the invention of the internal combustion engine led to the rise of gasoline-powered boats. The motorboat became popular in the early 1900s, with companies like Chris-Craft and Riva producing high-quality luxury boats, paving the way for recreational powerboating.

➢ **The Powerboat Racing Industry**: Powerboat racing has a long and thrilling history. The first recorded powerboat race took place in 1904 in the United States. Powerboat racing rapidly grew in popularity, leading to the establishment of prestigious events like the Miami-Nassau Powerboat Race and the Offshore World Championship in the mid-20th century. Racing technology and speed innovations continue to push the boundaries of what these boats can achieve.

➢ **Modern Innovations**: In recent decades, powerboats have seen advancements in design, materials, and technology. The development of lighter composite materials like fiberglass has made boats faster, more fuel-efficient, and durable. Additionally, electric-powered boats are becoming increasingly popular due to environmental concerns, marking a significant shift towards sustainable boating.

PART II: SAFETY PROTOCOLS AND PROCEDURES

Power Boat Operations: Safety, Manoeuvring, and Communication

12. **Safety Equipment**. Every power boat must be equipped with essential safety gear to protect crew members during operations. Life jackets should be available for all personnel onboard, ensuring safety in case of an emergency. Additionally, life buoys, fire extinguishers, and a first aid kit must be on board to handle potential hazards. An anchor is also necessary for emergency stops to prevent drifting in dangerous situations.

13. **Pre-Operational Checks**. Before setting out, a thorough inspection of the boat is required to ensure it is seaworthy. Checking for damages or leaks can help prevent breakdowns. It is also important to verify fuel, oil, and battery levels to avoid operational failures. Lastly, assessing weather conditions and planning accordingly ensures safe and smooth sailing.

14. **Emergency Procedures**. In the event of an engine failure, identifying the problem and addressing it calmly is crucial to restoring function or seeking assistance. If a fire occurs, shutting down the engine and using fire extinguishers promptly can prevent further damage. When encountering rough weather, reducing speed and securing all crew members enhances stability and safety.

Manoeuvring and Handling Techniques

15. **Control Commands**. Starting and stopping a power boat safely requires familiarity with its ignition system and proper techniques. Effective turning and reversing are essential for precise control, particularly in tight spaces or crowded areas.

16. **Basic Navigation**. Docking involves carefully approaching the dock and securing the boat to prevent drifting. Anchoring is used to keep the boat stationary in a designated position.

Maintaining a safe speed is essential to ensure control and avoid collisions, especially in busy waterways.

17. **<u>Crew Communication and Coordination</u>**. Clear communication between the crew and the coxswain is critical for smooth operations. Proper coordination ensures safe manoeuvring, particularly in emergency situations. Effective teamwork enhances overall safety and efficiency during power boat handling.

<u>CONCLUSION</u>

18. This module equips cadets with a foundational understanding of power boat operations. Cadets will gain knowledge of various boat types, engine functions, safety practices, and basic navigation skills. With both classroom and practical exercises, this course prepares cadets for safe and effective power boat handling, ensuring readiness for diverse maritime environments and challenges.

<u>RHIB Operations</u>

<u>SUMMARY</u>

- Gain an understanding of power boat types, including inboard, outboard, RIBs, Gemini crafts, and GRP motor boats, and their specific maritime uses.
- Learn engine basics, including components like fuel, cooling, and lubrication systems, along with routine maintenance and troubleshooting techniques.
- Emphasize safety protocols, such as pre-operational checks, emergency procedures, and the use of safety equipment like life jackets and fire extinguishers.
- Master handling techniques, including starting, stopping, turning, docking, anchoring, and maintaining safe speed under various conditions.
- Develop effective crew communication and coordination for safe and efficient operations during both routine tasks and emergency situations.

<u>SUGGESTED READ</u>

<u>Admiralty Manual of Seamanship - BR- 67</u>

ASSESSMENT EXERCISE

Multiple Choice Questions

Q1. What is the primary role of power boats in NCC watermanship activities

(a) Recreational sailing
(b) Safety and support vessel
(c) Competitive racing
(d) Passenger transport

Q2. Who operates power boats during NCC training?

(a) NCC cadets
(b) Experienced personnel
(c) Civilian volunteers
(d) Senior cadets

Q3. Which of the following is NOT a common use of power boats?

(a) Patrolling
(b) Rescue missions
(c) Farming activities
(d) Transportation

Q4. What is the main advantage of an inboard boat?

(a) Lightweight and easy to manoeuvre
(b) Better weight distribution and stability
(c) Inflatable sides for added buoyancy
(d) Small and easy to transport

Q5. What distinguishes outboard boats from inboard boats?

(a) The engine is placed inside the hull
(b) They use a steam engine for propulsion
(c) The engine is mounted externally at the stern
(d) They do not require an engine for movement

Q6. Why are Rigid Inflatable Boats (RIBs) preferred for rescue operations?

(a) They are heavy and move slowly
(b) They have excellent stability and speed
(c) They require minimal maintenance
(d) They have large storage capacity

Q7. Which type of power boat is widely used for law enforcement and military operations?

(a) GRP Motor Boats
(b) Gemini Crafts
(c) Rigid Inflatable Boats
(d) Outboard Boats

Q8. What material is used to construct GRP motor boats?

(a) Aluminium
(b) Wood
(c) Glass Reinforced Plastic (Fiberglass)
(d) Steel

Q9. What is the primary function of a boat's cooling system?

(a) To increase the boat's speed
(b) To prevent the engine from overheating
(c) To reduce noise from the engine
(d) To clean the fuel system

Q10. Why is regular maintenance of the lubrication system necessary?

(a) To reduce friction and prevent engine wear
(b) To improve the boat's speed
(c) To decrease the boat's weight
(d) To enhance fuel consumption

Q11. What is the purpose of performing pre-operational checks before using a power boat?

(a) To ensure proper fuel efficiency
(b) To verify safety and seaworthiness
(c) To test the boat's speed
(d) To adjust the boat's colour and appearance

Q12. What is the recommended action in case of engine failure on a power boat?

(a) Jump into the water immediately
(b) Identify the problem and attempt repairs or seek assistance
(c) Increase the throttle and try restarting the engine
(d) Continue moving forward without stopping

Q13. Which safety equipment must always be present on a power boat?

(a) Fishing net and harpoon
(b) Life jackets, fire extinguisher, and first aid kit
(c) Oars and paddles
(d) Diving gear and oxygen tanks

Q14. Why is clear crew communication essential during power boat operations?

(a) To entertain the passengers
(b) To ensure coordinated manoeuvres and emergency response
(c) To increase the speed of the boat
(d) To avoid unnecessary radio usage

Q15. What is the significance of maintaining a safe speed while navigating?

(a) To conserve fuel
(b) To prevent collisions and maintain control
(c) To test the boat’s acceleration
(d) To reduce engine noise

NCC SPECIAL SUBJECT (NAVY)

WATERMANSHIP

CHAPTER 6: BOAT PULLING (CODE- WS 6)

"Boat pulling is the rhythm of teamwork and strength, where every oar stroke moves the crew closer to their shared destination."

TEACHING INSTRUCTIONS

Period	: **5 (200 Min)**
Type	: **Practical**
Conducting Officer	: **PI**
Year	: **Second - 4, Third - 1**
Training Aids	: **DK Whaler**
Time Plan	: **Practical – 200 Min**

BOAT PULLING SIMULATOR

NCC SPECIAL SUBJECT (NAVY)

BOAT PULLING SIMULATOR

CHAPTER 1: PULLING PRACTICE (CODE- BP 1)

"Pull hard on the Simulator today, so the Sea feels easier tomorrow."

TEACHING INSTRUCTIONS

Period	**: 2 (80 Min)**
Type	**: Practical**
Conducting Officer	**: PI**
Year	**: Second**
Training Aid	**: Boat Pulling Simulator**
Time Plan	**: Physical Pulling**

SWIMMING PRACTICE

SPECIALISED SUBJECT (NAVY)

SWIMMING

CHAPTER 1: SWIMMING PRACTICE (CODE- SW 1)

" Don't Fight the Water—Befriend it."

TEACHING INSTRUCTIONS

Period	**:**	**5 (200 Min)**
Type	**:**	**Practical**
Conducting Officer	**:**	**PI**
Year	**:**	**First -1, Second – 2, Third - 2**
Training Aid	**:**	**Swimming Pool**
Time Plan	**:**	**Swimming**

SHIP MODELLING

SECTION INDEX : SHIP MODELLING (SD/ SW)

NCC SPECIAL SUBJECT (NAVY)

SHIP MODELLING

CHAPTER 1: PARTS OF SHIP AND PRINCIPLES OF SHIP MODELLING (CODE- SM 01)

"Ship modelling transforms imagination into craftsmanship, where every detail tells a story of innovation and maritime legacy."

TEACHING INSTRUCTIONS

Period : **2 (80 Min)**
Type : **Theory/ Practical**
Conducting Officer : **SMI**
Year : **First**

Training Aids : **Blackboard, whiteboard, projector, ship model, drawings**

Time Plan

- **Introduction** : **05 Min**
- **Parts of Ship** : **10 Min**
- **History of SM** : **10 min**
- **Principle of SM** : **20 Min**
- **Reading of SM Drawing** : **30 Min**
- **Conclusion** : **05 Min**

INTRODUCTION

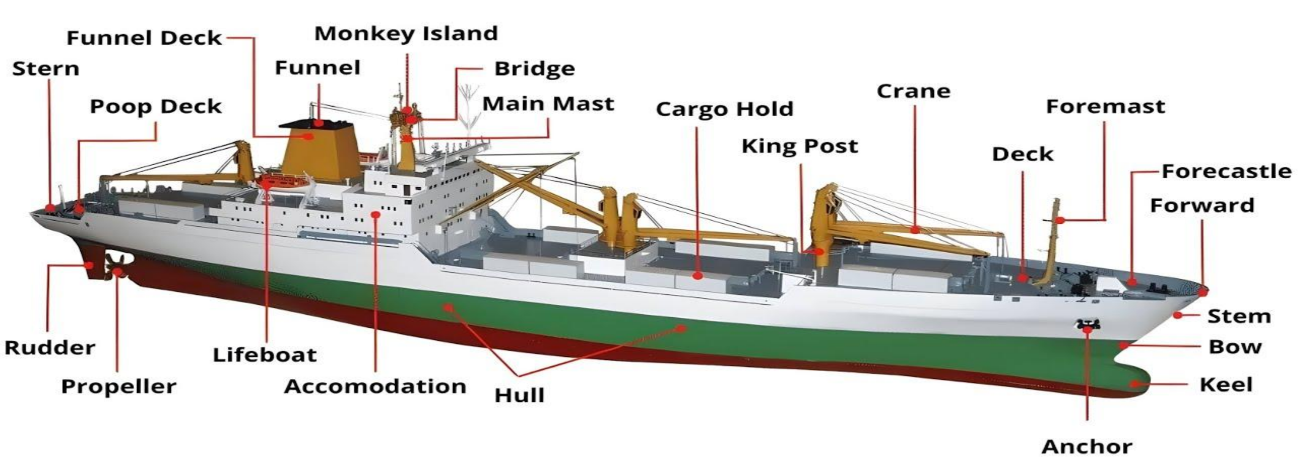
1. Ship modelling is a unique blend of artistry, technical knowledge, and naval heritage. For NCC cadets, it is more than a creative pursuit—it is an immersive learning experience that bridges theoretical concepts and practical skills. By constructing scaled representations of ships, cadets gain insights into naval architecture, hydrodynamics, and structural engineering. This process instils qualities like patience, precision, and problem-solving, essential for both naval and personal development. Moreover, ship modelling showcases the historical evolution of maritime technology, inspiring cadets to appreciate the legacy of seafaring and its role in global progress. The activity also fosters teamwork and creativity, as cadets engage in competitions and collaborative projects. Through ship modelling, cadets cultivate skills that extend beyond the workshop, preparing them for challenges in naval and engineering domains.

PREVIEW	LEARNING OBJECTIVES
➢ Part I: Parts of Ship ➢ Part II: Purpose and History of Ship Modelling ➢ Part III: Principles of Ship Modelling ➢ Part IV: Reading Ship Modelling Drawing	➢ To familiarise with parts of ship ➢ To familiarise with the purpose of ship modelling and its history ➢ To understand principles of ship modelling ➢ To learn to read ship modelling drawing

PART I: PARTS OF SHIP

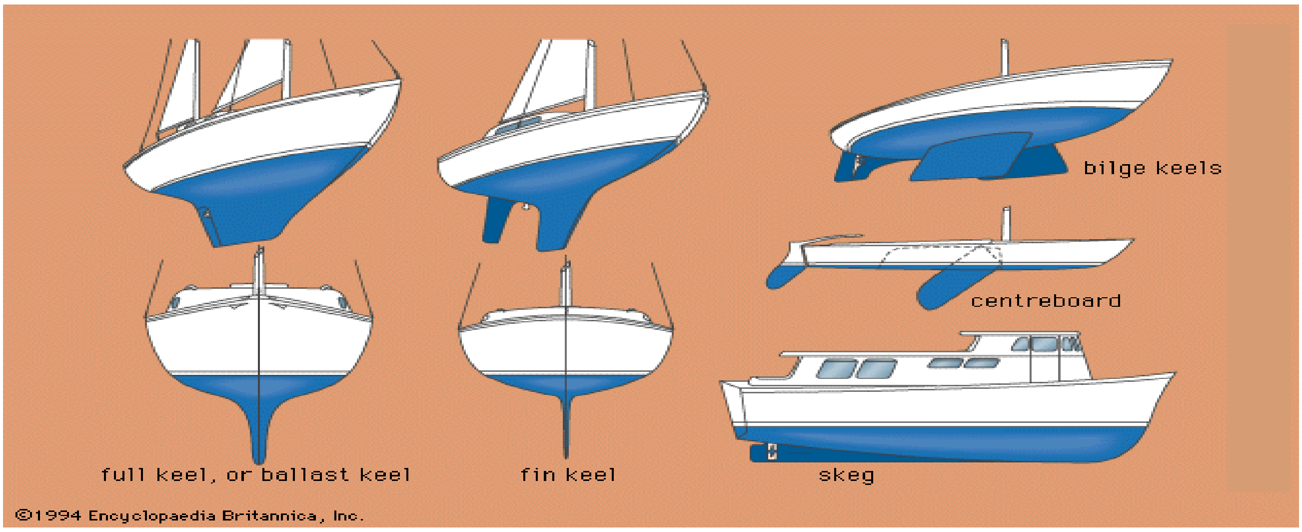
2. Ships are complex structures, carefully engineered for navigation, stability, and safety at sea. Learning about their main parts is essential for anyone involved in maritime operations or naval architecture. The main parts of a ship and their functions are enumerated in the subsequent paragraphs.

Parts of Ship



3. **Hull**. The hull is the main body of the ship, extending from the deck to the keel including the sides. It provides buoyancy and stability. It ensures flotation, stability, and support. The hull design impacts speed, fuel efficiency, and manoeuvrability.

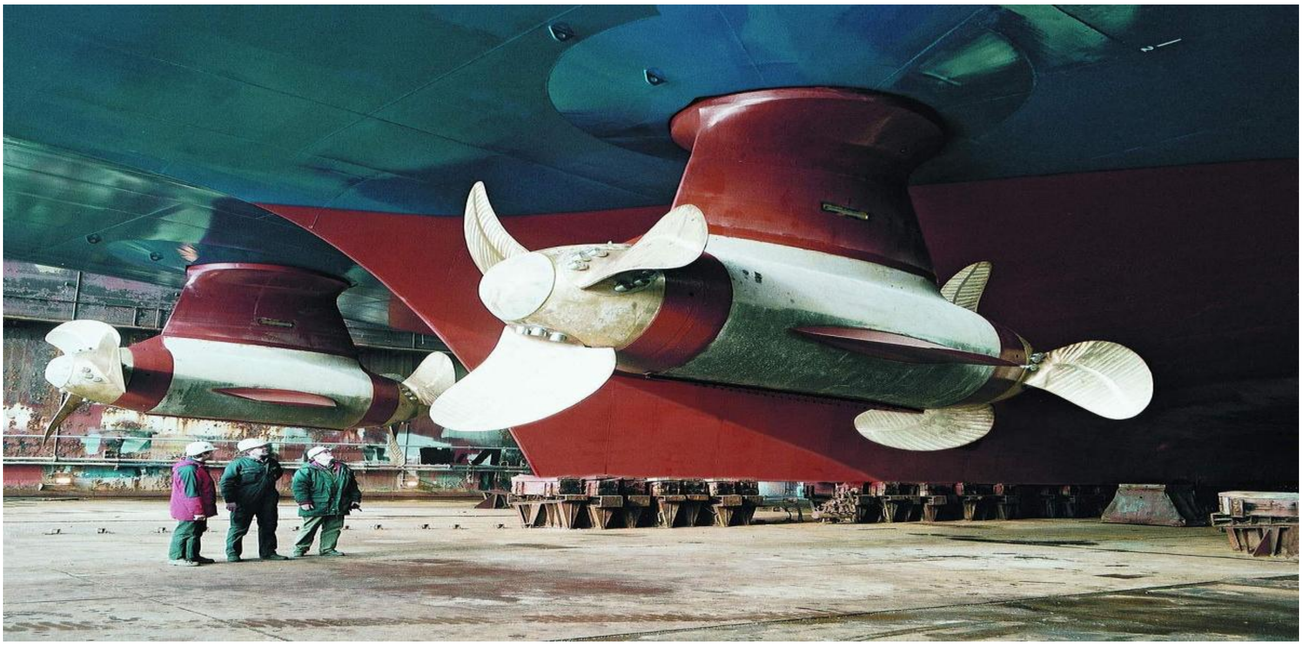
4. **Keel**. The keel is the bottom-most part of the ship and serves as its backbone, running along the entire length of the vessel. It provides structural integrity, keeps the ship balanced, and helps counter the effects of waves.



Ship's Keel

5. **Deck**. The deck is the flat surface covering the hull, typically in multiple layers on larger vessels (e.g., main deck, upper deck, and flight deck). It is used for movement, storage, and various operations on board. It also serves as a working area for personnel.

6. **Bow and Stern**. The bow is the front end of the ship, and the stern is the rear end. The bow is designed to cut through water and improve the ship's efficiency, while the stern houses the propulsion system and provides structural support.



Ship's Rudder and Propeller

7. **<u>Propeller and Rudder</u>**. The propeller is located at the stern and provides thrust to move the ship forward or backward, while the rudder is used to steer. The propeller generates propulsion, and the rudder directs the ship's movement by controlling the angle and flow of water.

8. **<u>Bridge</u>.** The bridge is the control centre of the Ship. It houses all the essential equipment like radars, compasses, and radios. The captain and officers use it for monitoring and navigating the vessel.

<u>Ship's Bridge</u>

9. **<u>Mast</u>**. The mast is a tall structure, usually found on the deck, which holds communication and navigation antennas. It supports equipment like antennas, lights, and flags. It also aids in the visibility of signals and enhances radar transmission.

10. **<u>Superstructure</u>**. The superstructure includes all structures above the deck level, such as the bridge, living quarters, and control rooms. It provides space for the bridge and other operational areas and serves as accommodation for the crew (CO, NO).

11. **<u>Cargo Hold and Tank</u>.** The cargo hold is the section where goods are stored, while **tanks** are used to hold fuel, ballast water, or liquid cargo. The cargo holds secure goods, while tanks ensure stability by controlling the ballast. They also store essential resources like fuel and freshwater.

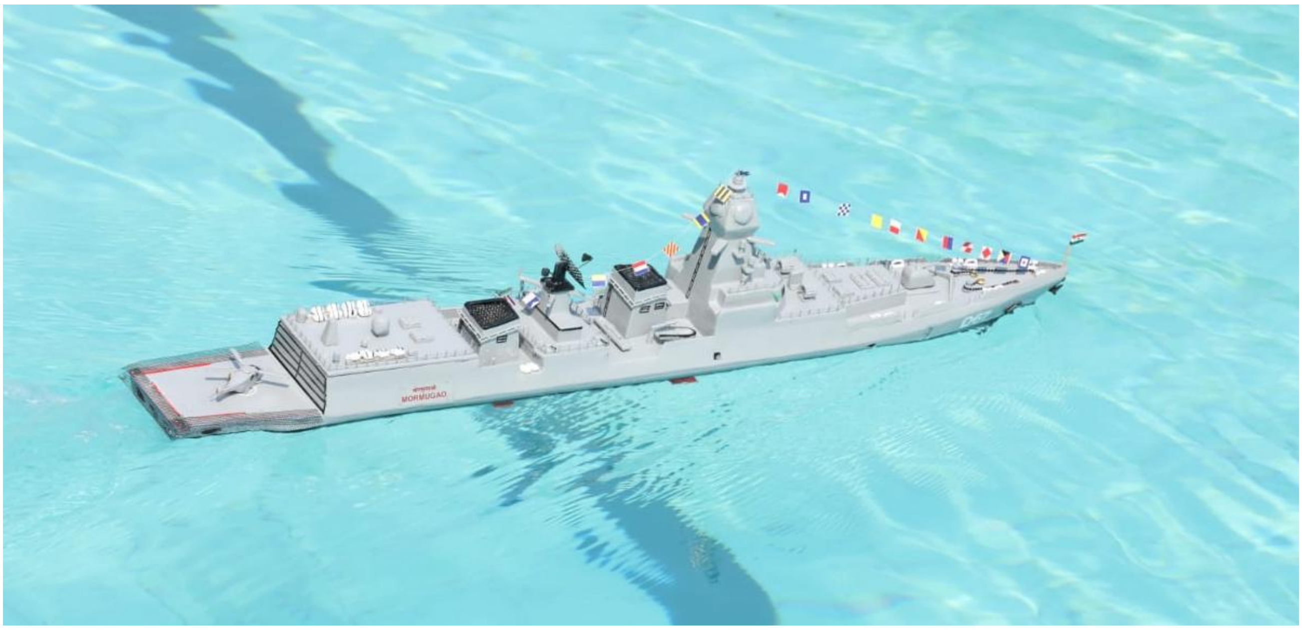
12. **<u>Anchor and Chain</u>.** The anchor is a heavy device dropped into the water to secure the ship in one location, with a chain or rope to connect it to the hull. It prevents the ship from drifting due to currents or winds. It is critical for docking and stability when stationary.

Anchor and Chain Cable

13. **Bulkheads and Compartments.** Bulkheads are vertical partitions dividing the ship into compartments, enhancing structural stability and compartmentalization for safety. They contain potential flooding in case of hull breaches and provide structural strength, ensuring the ship's resilience against waves and impacts.

PART II: PURPOSE AND HISTORY OF SHIP MODELLING

14. Ship modelling is a creative and educational activity within the NCC that enables cadets to build scale models of various vessels. This discipline familiarizes cadets with naval architecture, model crafting, and marine operations. Ship modelling also serves as a hobby for many enthusiasts and fosters qualities like observation, patience, and precision, all of which are vital in naval training.



Purpose of Ship Modelling

15. Ship modelling is significant for NCC cadets in several ways.

(a) **Educational Value**. Helps cadets understand the basics of naval engineering, hydrodynamics, and the structural elements of ships.

(b) **Skill Development**. Cadets gain hands-on experience with crafting, problem-solving, and teamwork. The technical skills acquired are beneficial for both personal development and military training.

(c) **Competitions and Showcases**. NCC organizes ship modelling competitions that allow cadets to demonstrate their craftsmanship and creativity at various levels, from local to national.

DID YOU KNOW?

➢ **Early Designs Were Based on Nature.** The design of early ships was heavily influenced by the natural world. Ancient shipbuilders often modeled their hulls after the shapes of fish or marine animals, allowing for better efficiency in movement through water. These early designs were refined over time through trial and error, leading to the sophisticated vessels we have today.

➢ **Naval Architecture Is a Multidisciplinary Field.** Ship design is a complex process that combines knowledge from various fields, including mechanical engineering, hydrodynamics, materials science, and computer technology. Naval architects must also consider environmental factors such as water resistance, weight distribution, and stability to ensure the ship performs well.

Historical Background of Ship Modelling

16. Ship modelling dates back to ancient civilizations, where models of ships and boats were created by cultures such as the Greeks, Egyptians, and Phoenicians. These ancient models provide insights into historical seafaring practices and the importance of maritime trade, warfare, and exploration. In Europe, ship models were historically built without detailed plans, serving as guides to show potential customers or as demonstration models for shipbuilding methods.

17. **18th and 19th Century**. In Britain, the Admiralty created ship models as representations of proposed warships, contributing to ship design and naval planning.

18. **20th Century Developments**. With the availability of model kits, ship modelling became a popular hobby, transitioning from wood-based materials to plastic and fiberglass, which offered greater durability and ease of crafting.

PART III: PRINCIPLES OF SHIP MODELLING

19. **Scale and Proportion**. Ship models are constructed to a specific scale, accurately representing the dimensions of actual ships. Cadets learn the importance of maintaining proper scale to reflect a realistic appearance and structure.

20. **Design and Structural Components**. Ship models consist of fundamental elements, including the hull, deck, and superstructure. Each component is crafted to match its function on a real vessel. Understanding the purpose of each part helps cadets appreciate ship stability, buoyancy, and structural integrity.

21. **Material Selection**. Common materials used in ship modelling include wood, plastic, metal, and fiberglass. Each material has specific qualities that affect the model's strength, appearance, and manoeuvrability, particularly for working or sailing models.

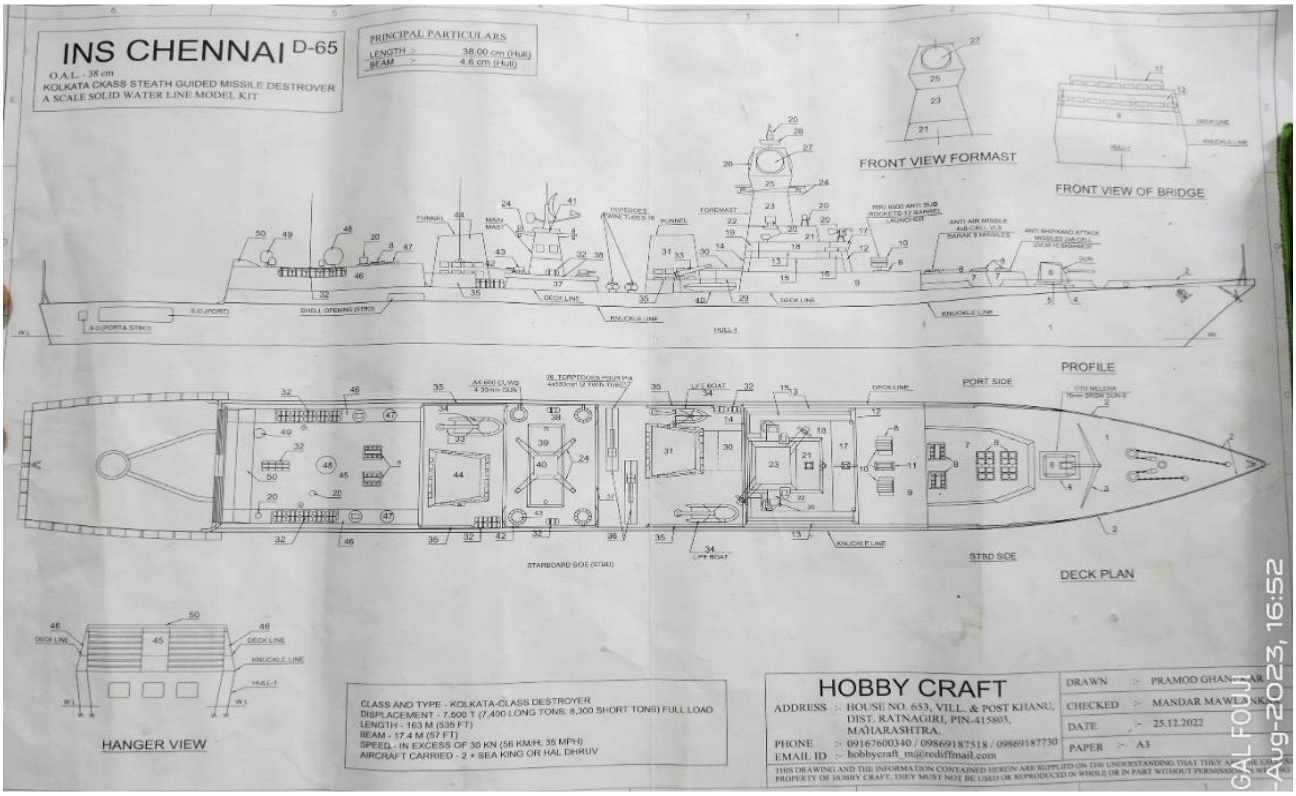
22. **Technical Skills and Precision**. Ship modelling requires precision in measuring, cutting, and assembling parts to ensure accuracy and durability. Cadets are encouraged to develop these technical skills, as they are critical for producing functional and visually accurate models.

23. **Educational and Practical Applications**. Ship modelling provides NCC cadets with hands-on learning experiences, simulating real-life naval engineering tasks on a smaller scale. These activities cultivate skills in design, coordination, and spatial understanding that are valuable in naval careers.

DID YOU KNOW?
➢ **Computer-Aided Design (CAD) Revolutionized Shipbuilding**: In the 20th century, the advent of CAD software transformed ship designing. Engineers can now create digital models of ships, testing different designs virtually before physical construction begins. This reduces the cost and time associated with design modifications and enhances precision in the final product.   ➢ **Ship Hulls Are Designed for Maximum Efficiency**: The shape and design of a ship's hull are crucial for fuel efficiency and speed. Modern hulls are often designed with special features, such as bulbous bows, to reduce water resistance and improve the ship's overall performance. The goal is to optimize fuel consumption while ensuring the ship's stability and speed.

PART IV: READING SHIP MODELLING DRAWINGS

24. Reading ship modelling drawings is an essential skill for understanding the design and construction of a ship model. These technical drawings provide detailed information about the ship's dimensions, structure, and components. To interpret them correctly, one must be familiar with the different views, symbols, and notations used in naval architecture.



Ship Model Drawing

25. **Understanding Different Views**. Ship modelling drawings typically include multiple views to provide a complete representation of the vessel:

(a) **Plan View (Top View)**. Shows the ship from above, illustrating the deck layout.

(b) **Profile View (Side View)**. Displays the ship's side elevation, including hull shape and superstructure.

(c) **Sectional Views**. Vertical or horizontal cross-sections help visualize internal compartments and structures.

(d) **Isometric or 3D Views**. Used to give a realistic perspective of how the ship looks when assembled.

26. **Key Elements in Ship Drawings**.

(a) **Lines Plan**. Depicts the hull shape through waterlines, buttock lines, and station lines.

(b) **Construction Details**. Shows structural elements such as frames, bulkheads, and deck arrangements.

(c) **Scale and Dimensions**. Each drawing is labelled with a scale (e.g., 1:100) to indicate proportional measurements.

(d) **Symbols and Notations**. Standardized symbols represent materials, welds, rivets, and fittings.

27. **Steps to Read a Ship Modelling Drawing**

(a) **Identify the Scale**. Determine the drawing's scale to understand real-world measurements.

(b) **Analyse the Views**. Examine each view separately to understand the ship's shape and structure.

(c) **Follow the Lines Plan**. Observe how different lines correspond to the hull's curves and contours.

(d) **Interpret Sectional Drawings**. Cross-sections reveal the internal arrangement of decks and compartments.

(e) **Check the Assembly Sequence**. Some drawings provide step-by-step assembly instructions for model building.

DID YOU KNOW?
➢ **Sustainability and Eco-Friendly Design**: In recent years, the ship design industry has focused on sustainability. New designs aim to reduce the environmental impact of ships, using alternative fuels like LNG, implementing energy-efficient systems, and employing eco-friendly materials in construction. Innovations like wind-assisted propulsion and solar-powered systems are becoming more common in the quest for greener ships.

CONCLUSION

28. In conclusion, ship modelling is an essential component of NCC training that offers both educational and practical benefits to cadets. By engaging in this hands-on activity, cadets gain a deeper understanding of naval engineering principles, hydrodynamics, and the structural integrity of ships. This knowledge is not only crucial for developing technical skills but also enhances teamwork, problem-solving, and craftsmanship. The historical significance of ship modelling further adds to its value, as it connects cadets to the rich maritime heritage that spans centuries, enabling them to appreciate the evolution of shipbuilding and design.

29. Moreover, understanding the principles and technical aspects of ship modelling, including scale, design components, and materials, fosters a more comprehensive appreciation of naval architecture. As cadets learn to read ship modelling drawings and interpret intricate details, they acquire skills that are directly applicable to real-world naval operations and engineering tasks. The precision and attention to detail required in ship modelling prepare cadets for future careers in the Navy, where such competencies are indispensable for ensuring operational success and safety.

SUMMARY

➢ **Scale Representation.** Ship modeling involves creating a smaller-scale replica of a real ship, with the goal of accurately representing the ship's structure, design, and functionality.

➢ **Hull Design.** The **hull** of a ship model is crucial, as its shape affects how the model moves through water and reflects the original ship's performance in real life.

➢ **Materials Matter.** Models are made from various materials such as wood, plastic, and metal, with each chosen for its durability, ease of use, and ability to replicate the real ship's features.

➢ **Functional Parts.** : Ship models often include functional parts like movable rudders, working propellers, and accurate rigging, allowing for a hands-on understanding of a ship's operation.

➢ **Learning Tool.** Ship modeling isn't just for display—it's a valuable educational tool, helping students and sailors understand ship construction, hydrodynamics, and design principles in a tangible way.

SUGGESTED READ

"Ship Modeling Simplified" by Frank Mastini

"The Complete Beginners Guide to Model Ship Building" by Gary Renshaw

ASSESSMENT EXERCISE

Multiple Choice Questions

Q1. What is one of the key benefits of ship modelling for NCC cadets?

(a) Enhances artistic creativity
(b) Improves knowledge of ship mechanics and naval architecture
(c) Helps in learning how to drive a ship
(d) Focuses only on the historical aspects of ships

Q2. What is the main function of a ship's hull?

(a) Providing living space for the crew
(b) Supporting communication equipment
(c) Ensuring buoyancy and stability
(d) Controlling the movement of the ship

Q3. Which part of the ship acts as its backbone, providing structural integrity?

(a) Deck
(b) Keel
(c) Rudder
(d) Mast

Q4. The stern of a ship is located at the.

(a) Front
(b) Middle
(c) Rear
(d) Below the deck

Q5. What is the primary purpose of the propeller?

(a) Steering the ship
(b) Providing thrust for movement
(c) Stabilizing the vessel
(d) Storing fuel and cargo

Q6. Which ship part is responsible for steering?

(a) Bridge
(b) Keel
(c) Rudder
(d) Cargo hold

Q7. What does the superstructure of a ship include?

(a) Hull and propeller
(b) Bridge, living quarters, and control rooms
(c) Keel and rudder
(d) Cargo hold and anchor

Q8. Why is the anchor important for a ship?

(a) It increases speed
(b) It keeps the ship stationary by preventing drifting
(c) It helps in navigation
(d) It serves as a safety device for emergencies

Q9. What is the historical significance of ship modelling?

(a) It was used only as a hobby in ancient civilizations
(b) It helped in naval warfare strategies and ship design development
(c) It had no role in maritime trade
(d) It was only used for artistic expression

Q10. Which ancient civilizations were known for early ship modelling?

(a) Romans and Indians
(b) Greeks, Egyptians, and Phoenicians
(c) Chinese and Japanese
(d) Vikings and Persians

Q11. What is an essential principle in ship modelling?

(a) Ignoring scale and proportion
(b) Using only wooden materials
(c) Constructing models to accurate scale and dimensions
(d) Avoiding any technical details

Q12. What is the purpose of reading ship modelling drawings?

(a) To create artistic designs only
(b) To understand the ship's structure, components, and assembly
(c) To focus solely on the external appearance of the ship
(d) To avoid technical understanding of shipbuilding

Q13. Which of the following is NOT a common material used in ship modelling?

(a) Wood
(b) Fiberglass
(c) Plastic
(d) Concrete

Q14. Which view in ship modelling drawings provides a side elevation of the ship?

(a) Plan View
(b) Profile View
(c) Isometric View
(d) Sectional View

Q15. How has technology influenced modern ship modelling?

(a) By eliminating the need for physical models
(b) By introducing CAD software for accurate design and testing
(c) By reducing interest in ship modelling
(d) By making manual shipbuilding obsolete

One-word Objective Questions

1. What skill is essential in ship modelling for accurately representing the size of real vessels?

2. Which material commonly used in ship modelling offers durability and ease of crafting?

3. What ancient civilization was known for creating ship models to showcase maritime practices?

4. Name the NCC activity that involves cadets in creating scale models of ships.

5. What quality developed through ship modelling is crucial for naval training?

Short Answer Type Questions

1. Define the primary educational value of ship modelling for NCC cadets.

2. List three benefits of ship modelling as a hobby or discipline for NCC cadets.

3. What were the materials used historically in ship models, and what advancements occurred in the 20th century?

4. Explain the concept of scale and proportion in ship modelling.

5. Why is material selection important in ship modelling, and what factors should be considered?

Long Answer Type Questions

1. Describe the historical development of ship modelling from ancient civilizations to the 20th century.

2. Explain the significance of scale, proportion, and structural components in creating an accurate ship model.

3. Discuss the practical applications of ship modelling in naval training and how it benefits NCC cadets.

4. Outline the fundamental principles of ship modelling and how they relate to real naval architecture.

5. Explain how ship modelling as a discipline fosters qualities like observation, patience, and precision, and why these qualities are essential in naval careers.

NCC SPECIAL SUBJECT (NAVY)

SHIP MODELLING

CHAPTER 2: TYPES OF SHIP MODELS (CODE- SM 02)

"Ship modelling bridges the gap between imagination and engineering, turning miniature vessels into tools of learning and discovery."

TEACHING INSTRUCTIONS

Period	**: 1 (40 Min)**
Type	**: Theory/ Practical**
Conducting Officer	**: SMI**
Year	**: First**
Training Aids	**: Blackboard, Whiteboard, Projector, Ship Model, Drawings**
Time Plan	
Introduction	**: 05 Min**
Types of Model	**: 15 Min**
Explanation with Model	**: 15 Min**
Conclusion	**: 05 Min**

INTRODUCTION

1. Ship models play a vital role in naval training, blending technical skills with practical learning. For NCC cadets, understanding the various types of ship models—static, working, and sailing—provides insights into the principles of naval operations and design. Each model type serves a distinct purpose: static models emphasize structure and detail, working models focus on real-world functionality, and sailing models introduce the mechanics of wind-powered navigation. These models enable cadets to grasp key concepts in ship handling, propulsion, and design, fostering skills such as observation, precision, and problem-solving. Whether used for display, hands-on training, or competitions, ship models help cadets build a foundation in naval engineering and operations while promoting creativity and teamwork.

PREVIEW	LEARNING OBJECTIVES
➢ Part I: Types of Ship Models	➢ To understand the various types of ship models used in naval training, their purposes, and characteristics

PART I: TYPES OF SHIP MODELS

2. Ship models are built for different purposes, such as display, training, and competitive events. In NCC, models range from static to operational, each providing a unique training experience and skill development opportunity for cadets.

Classification of Ship Models

3. Ship models used in NCC can be classified into three main categories; Static Models**,** Working Models**,** and Sailing Models. Each type serves a specific purpose and requires different skills and construction techniques.

Static Models

4. **Definition**. Static models are non-functional models constructed for display or educational purposes. These models focus on capturing the aesthetic and structural details of actual ships without needing to be operational.

5. **Purpose and Usage**.

(a) Serve as educational tools to teach cadets about different classes of ships.

(b) Used to represent naval vessels like aircraft carriers, destroyers, submarines, etc, giving cadets a chance to learn about the variety of ships in service.

(c) Often used in NCC classrooms for training and demonstration.

Static Model

6. **Characteristics**.

(a) Built to scale, meaning they are accurate representations of real ships but on a reduced scale.

(b) Emphasize detailing and craftsmanship, focusing on features like masts, superstructures, and other ship-specific characteristics.

7. **Examples**. Models of historical warships, modern aircraft carriers, and submarines commonly used in naval training.

Working Models

Working Models

8. **Definition**. Working models are functional, remote-controlled models designed to operate in water. They are used to simulate ship handling, navigation, and operational techniques.

9. **Purpose and Usage**.

(a) Primarily used in NCC competitions and training exercises where cadets demonstrate their skill in manoeuvring and controlling the models.

(b) Used to teach cadets about real-world naval operations, including propulsion, stability, and manoeuvrability.

10. **Characteristics**.

(a) Equipped with electronic systems like motors, batteries, and remote-control systems to allow movement.

(b) Built to withstand water exposure and often constructed with durable materials to handle various manoeuvres and competitions.

11. **Examples**. Models that replicate speedboats, frigates, and patrol boats, demonstrating speed and agility in water.

Sailing Models

12. **Definition**. Sailing models are specially designed models fitted with sails and occasionally motors, allowing them to navigate on water using both wind and remote control.

13. **Purpose and Usage**.

(a) These models offer cadets hands-on experience with the principles of sailing, including wind resistance, rudder control, and speed adjustment.

(b) Used in NCC events to test cadets' skills in operating models using both wind and electronic control.

14. **Characteristics**.

(a) Fitted with scaled-down sails that function similarly to full-sized sails on yachts and sailing vessels.

(b) Often include a remote-control feature for additional manoeuvrability.

15. **Examples**. Scale models of yachts or traditional sailing vessels used to demonstrate sailing techniques in competitive environments.

Sailing Model

CONCLUSION

16. In this chapter, cadets learned about the Types of Ship Models used in NCC training; Static Models**,** Working Models**,** and Sailing Models. Each model type serves different educational and training purposes, providing cadets with exposure to various aspects of naval operations and ship design. Static models focus on structural detail, working models allow for real-time operational control, and sailing models offer insights into sailing mechanics and navigation. Understanding these model types is essential for cadets as they progress in ship modelling and NCC training.

SUMMARY

- **Static Models**: **Static ship models** are detailed replicas that focus on accuracy in appearance, with no moving parts, and are often used for display or as collector's items.

- **Radio-Controlled Models**: **RC ship models** are miniature, fully functional versions of ships that can be controlled remotely, simulating real-life manoeuvres in water.

- **Working Models**: These models have functional components, such as motors, rudders, and sails, allowing them to operate in water just like full-sized ships, offering a hands-on learning experience.

- **Concept Models**: **Concept ship models** are built to visualize new, innovative ship designs, helping engineers and designers test ideas before construction of the actual vessel.

- **Waterline Models**: **Waterline models** are cut-off versions that show only the portion of the ship that would be visible above the water, offering a simplified and often more affordable model representation.

SUGGESTED READ

"Ship Modeling Simplified" by Frank Mastini

"The Complete Beginners Guide to Model Ship Building" by Gary Renshaw

ASSESSMENT EXERCISE

Multiple Choice Questions

Q1. What is the primary purpose of ship models in NCC training?

(a) Entertainment
(b) Enhancing artistic skills
(c) Understanding naval operations and design
(d) Increasing shipbuilding costs

Q2. Which type of ship model is primarily used for display and educational purposes?

(a) Working Model
(b) Sailing Model
(c) Static Model
(d) Concept Model

Q3. What is a key characteristic of static ship models?

(a) They are designed to operate in water
(b) They emphasize structure and detailing
(c) They rely on wind for movement
(d) They include motors and batteries

Q4. Which type of ship model is equipped with motors and remote controls?

(a) Static Model
(b) Working Model
(c) Sailing Model
(d) Waterline Model

Q5. What is the main advantage of working models in NCC training?

(a) They enhance painting and detailing skills
(b) They simulate real-world naval operations
(c) They serve as static displays
(d) They are used exclusively in museums

Q6. Sailing models are primarily used to teach cadets about.

(a) Ship stability and hydrodynamics
(b) Wind-powered navigation and rudder control
(c) Warfare strategies
(d) The history of shipbuilding

Q7. Which feature distinguishes a working model from a static model?

(a) Working models are larger
(b) Static models have moving parts
(c) Working models can operate in water
(d) Static models have more detailing

Q8. What type of ship model is commonly used to test new ship designs?

(a) Concept Model
(b) Sailing Model
(c) Static Model
(d) Working Model

Q9. In which type of ship model is a scaled-down sail an essential feature?

(a) Working Model
(b) Static Model
(c) Sailing Model
(d) Concept Model

Q10. Waterline models are designed to show.

(a) The entire ship, including the submerged portion
(b) Only the visible part of a ship above the water
(c) The ship's structural compartments
(d) The internal framework of a ship

Q11. Which ship model type is commonly used for competitions in NCC?

(a) Static Model
(b) Working Model
(c) Waterline Model
(d) Concept Model

Q12. Which characteristic is NOT associated with working models?

(a) They include motorized movement
(b) They require remote control operation
(c) They are primarily built for display
(d) They are used to simulate naval manoeuvres

Q13. Why is understanding ship models important for NCC cadets?

(a) It helps in naval engineering knowledge
(b) It improves swimming skills
(c) It allows cadets to operate real ships
(d) It reduces the need for shipbuilding

Q14. What is a key purpose of static ship models in naval training?

(a) To perform real-time navigation exercises
(b) To develop artistic skills
(c) To serve as educational tools for ship recognition
(d) To conduct ship endurance tests

Q15. Which type of model best represents real-world naval operations?

(a) Static Model
(b) Waterline Model
(c) Working Model
(d) Concept Model

One-word Objective Questions

1. What type of ship model is non-functional and used primarily for display?

2. Which type of model includes remote-controlled capabilities for manoeuvrability?

3. Which model type teaches cadets about wind resistance and rudder control?

4. In which model type would you likely find scaled-down sails?

5. What type of material is often used for working models to withstand water exposure?

Short Answer-Type Questions

1. What is the primary purpose of static ship models in NCC?

2. Explain the key difference between static models and working models.

3. Name two characteristics of sailing models.

4. Why are working models valuable for cadets' training in navigation and manoeuvrability?

5. How do static models aid cadets in understanding different classes of ships?

Long Answer-Type Questions

1. Describe the three main types of ship models used in NCC training and the unique training experiences they provide.

2. Discuss the characteristics of working models and their role in NCC competitions and training exercises.

3. Explain how sailing models help cadets understand principles like wind resistance and speed adjustment.

4. Compare and contrast static models and sailing models in terms of construction and purpose.

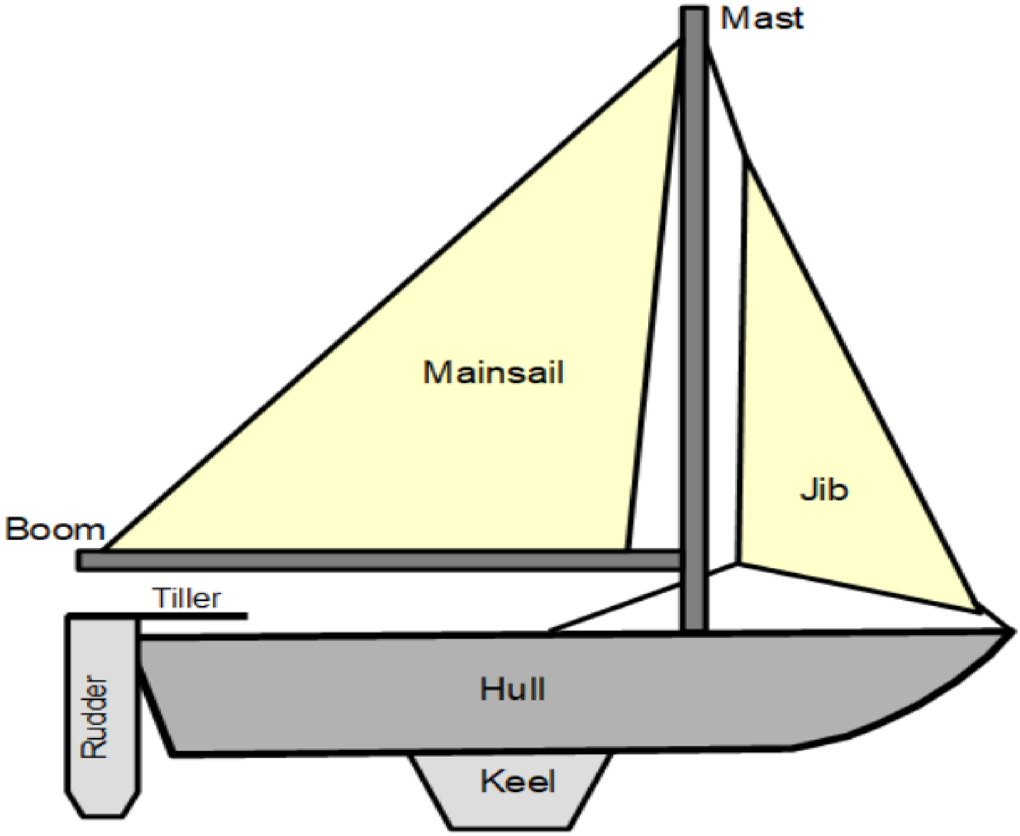
5. Describe how understanding different types of ship models can benefit cadets in their future naval careers and NCC training.

NCC SPECIAL SUBJECT (NAVY)

SHIP MODELLING

CHAPTER 3: CALCULATION OF SAIL AREA (CODE – SM 03)

"Every sail holds the power to harness the wind, and calculating its area is the first step toward mastering the art of sailing."



TEACHING INSTRUCTIONS

Period	**: 1 (40 Min)**
Type	**: Theory/ Practical**
Conducting Officer	**: SMI**
Year	**: First**
Training Aids	**: Blackboard, whiteboard, projector, ship model, drawings**
Time Plan	
Introduction	**: 05 Min**
Sail Plan	**: 15 Min**
Practical Dem	**: 15 Min**
Conclusion	**: 05 Min**

INTRODUCTION

1. Sail area plays a crucial role in determining the performance and handling of a ship model. By calculating the total surface area of sails, cadets can optimize their models for speed, stability, and manoeuvrability. This chapter provides a comprehensive understanding of the methods used to calculate sail area, introduces common sail types, and explains how sail size affects a vessel's response to wind. Mastering these concepts prepares cadets to design efficient and competitive sailing models, enabling them to adapt their designs to various wind conditions and sailing objectives.

PREVIEW	LEARNING OBJECTIVES
➢ Part I: Introduction and Components of Sail ➢ Part II: Formula for Calculating Sail Area	➢ To understand about sail area and its components and how it affects vessel's performance. ➢ To be able to calculate sail area of ship model

PART I: INTRODUCTION TO SAIL AREA

2. The sail area of a model is the total surface area of all the sails that capture wind to propel the vessel. Understanding sail area is critical as it directly affects the speed, stability, and manoeuvrability of a sailing model.

3. Accurate sail area calculation allows cadets to design efficient models that respond realistically to wind and help them prepare for competitions where performance is evaluated.

Components of Sail Area Calculation

4. **Types of Sails**. Sails on ships are typically classified based on their shapes and positions, with common types including:

(a) **Main Sail**. The large sail positioned aft of the mainmast.

(b) **Jib**. A triangular sail positioned forward of the mast, helps in balancing the boat.

(c) **Spinnaker**. A specialized sail used for downwind sailing to increase speed.

5. Each sail contributes to the total sail area, and its dimensions must be accurately measured for effective calculation.

PART II: FORMULA FOR CALCULATING SAIL AREA

6. To calculate the sail area of a ship model, use the formula:

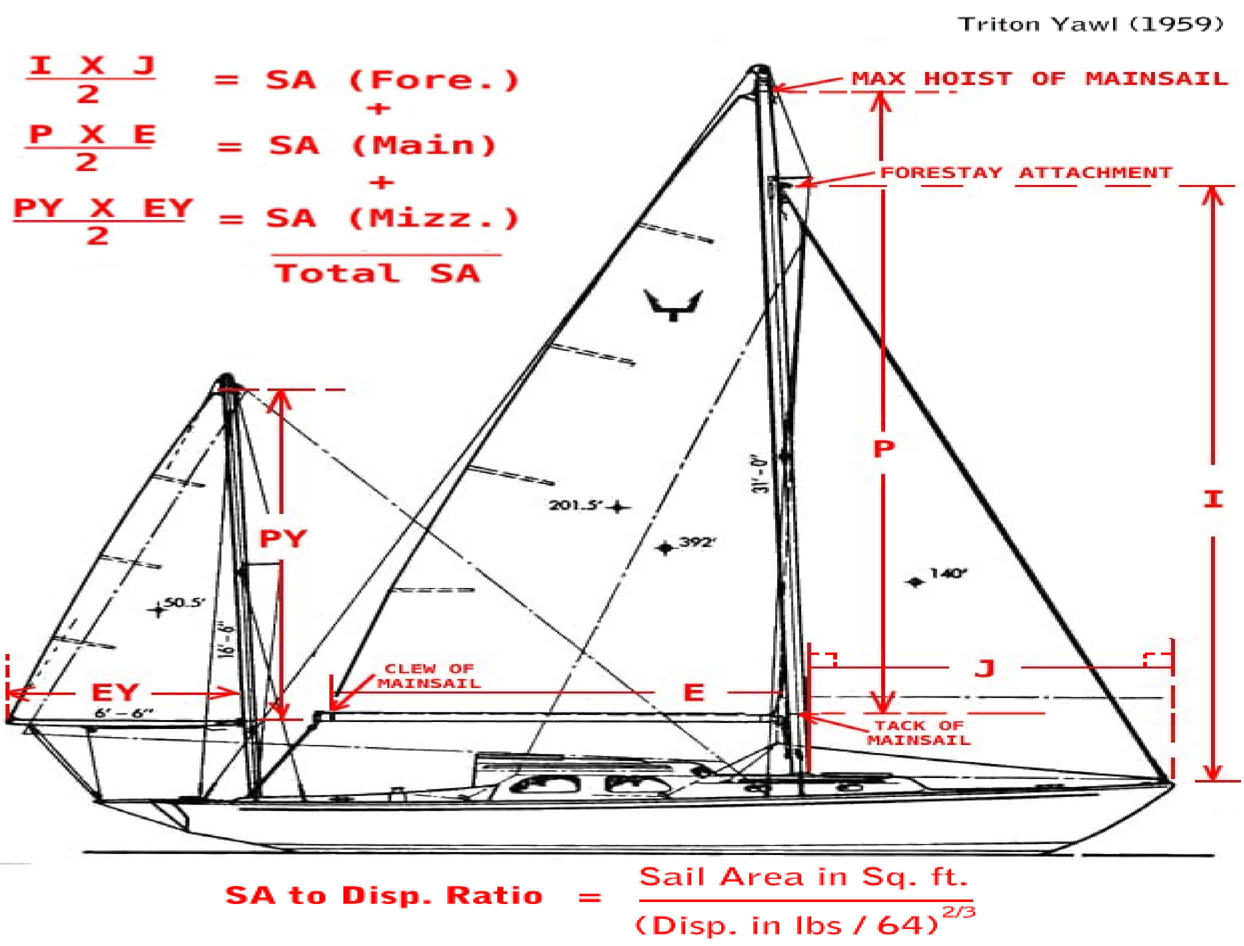
Sail Area = (Luff Length x Foot Length) / 2;
Where
"Luff Length" is the length of the sail along the mast.
"Foot Length" is the length of the sail along the boom essentially treating each sail as a triangle and calculating its area.

Factors Affecting Sail Area

7. **Wind Conditions**. Larger sail areas are generally used in light wind conditions to maximize speed, while smaller sail areas are preferred in stronger winds to maintain stability.

8. **Model Size and Weight**. Heavier models may require a larger sail area for propulsion, while lighter models can operate effectively with a smaller sail area.

9. **Sailing Objectives**. Models designed for speed and manoeuvrability may have different sail configurations compared to those built for stability and endurance.



Application in Competitions

10. Understanding and calculating sail area allows cadets to optimize their models for specific sailing conditions encountered in NCC competitions. This calculation helps cadets adjust the sail size or configuration for improved performance.

CONCLUSION

11. In this chapter, cadets learned the Calculation of Sail Area for ship models, focusing on measuring and calculating the areas of triangular and rectangular sails. They learned that accurate sail area calculations are essential for optimizing model performance in various wind conditions. By understanding the principles of sail area, cadets are better equipped to build and adjust models for effective navigation, competition, and realistic sailing performance.

SUMMARY

- **Key to Speed.** The sail area directly influences a ship's speed and maneuverability, with larger sail areas generally allowing for faster movement in favorable wind conditions.
- **Formula for Sail Area.** Sail area is often calculated using the formula **Area = Height × Width × 0.5**, where height refers to the sail's height and width to its base, adjusting for shape.
- **Types of Sails.** Different sail types, like **square sails** or **triangular sails**, require different methods for calculating their surface area due to varying shapes and angles.
- **Wind Efficiency.** A larger sail area allows the vessel to capture more wind, but it also requires stronger winds to prevent the boat from being overpowered and tipping.
- **Design Considerations.** Sail designers balance sail area with the boat's size, weight, and intended use, optimizing the sail to maximize efficiency while ensuring safe, stable performance.

SUGGESTED READ

"Ship Modeling Simplified" by Frank Mastini

"The Complete Beginners Guide to Model Ship Building" by Gary Renshaw

ASSESSMENT EXERCISE

Multiple Choice Questions

Q1. What is the primary role of sail area in a ship model?

(a) To determine the ship's colour
(b) To capture wind for propulsion
(c) To add weight to the model
(d) To improve the ship's durability

Q2. Why is calculating sail area important for NCC cadets?

(a) It helps them design efficient models
(b) It increases the ship's weight
(c) It reduces the number of sails needed
(d) It allows them to avoid using sails

Q3. What is the function of the mainsail in a sailing model?

(a) To support the mast
(b) To provide primary propulsion
(c) To stabilize the ship in rough waters
(d) To reduce wind resistance

Q4. The jib sail is positioned.

(a) At the rear of the boat
(b) Forward of the mast
(c) Under the hull
(d) Along the keel

Q5. Which type of sail is primarily used for downwind sailing?

(a) Jib
(b) Spinnaker
(c) Mainsail
(d) Square sail

Q6. What is the correct formula for calculating sail area?

(a) Sail Area = (Luff Length × Foot Length) / 2
(b) Sail Area = Luff Length + Foot Length
(c) Sail Area = (Luff Length × Foot Length) × 2
(d) Sail Area = Luff Length ÷ Foot Length

Q7. What does "Luff Length" refer to in a sail?

(a) The length along the boom
(b) The width of the sail
(c) The length along the mast
(d) The diagonal length of the sail

Q8. Why might a smaller sail area be preferable in strong wind conditions?

(a) To increase speed
(b) To maintain stability and prevent tipping
(c) To improve appearance
(d) To make the boat heavier

Q9. What factor influences the ideal sail area for a ship model?

(a) The number of sails used
(b) The model's size and weight
(c) The colour of the sails
(d) The type of wood used in construction

Q10. How does a larger sail area affect a ship model in light wind conditions?

(a) It increases speed
(b) It reduces stability
(c) It prevents the ship from moving
(d) It makes the ship sink

Q11. In NCC competitions, why is understanding sail area important?

(a) It helps in optimizing performance
(b) It allows cadets to build heavier models
(c) It makes ships look more realistic
(d) It determines the height of the mast

Q12. What is a key consideration when designing sails for stability and endurance?

(a) Using the biggest sail possible
(b) Using multiple small sails
(c) Balancing sail area with wind conditions
(d) Ignoring the sail's shape

Q13. What happens if a ship model has too large a sail area in strong winds?

(a) It moves faster
(b) It becomes unstable and may tip over
(c) It becomes more manoeuvrable
(d) It stops moving

Q14. How does sail design impact a ship model's efficiency?

(a) It determines how well the model moves in different wind conditions
(b) It affects the colour of the ship
(c) It decides the number of sails required
(d) It prevents the ship from floating

Q15. What does the spinnaker sail help with?

(a) Balancing the ship
(b) Improving downwind speed
(c) Reducing drag
(d) Supporting the mast

One-Word Objective Questions

1. What type of sail is triangular and positioned forward of the mast?

2. Which sail is commonly used for downwind sailing?

3. What is the main factor that determines the required sail area for a model ship?

4. In what type of wind conditions are larger sail areas typically preferred?

5. Which mathematical shape is the main sail usually associated with?

Short Answer Type Questions

1. Define the sail area and explain its significance in model sailing.

2. List the components needed to calculate the sail area of triangular sails.

3. Describe two factors that affect the choice of sail area in model sailing.

4. Why is it important to consider wind conditions when choosing sail area?

5. How can cadets use sail area calculations to improve their performance in NCC competitions?

Long Answer Type Questions

1. Explain the process of calculating sail area for both triangular and rectangular sails. Provide an example with hypothetical measurements.

2. Discuss the factors affecting sail area and how each factor influences model performance.

3. Why is accurate sail area calculation essential for model sailing, especially in NCC competitions?

4. Describe how understanding sail area contributes to the practical skills cadets need for optimizing their sailing models in different wind and weight conditions.

5. Provide a practical scenario where cadets must adjust sail area based on wind conditions and model weight. How would they determine the optimal sail configuration?

NCC SPECIAL SUBJECT (NAVY)

SHIP MODELLING

CHAPTER 4: SHIP MODELLING COMPETITIONS (CODE- SM 04)

"Building a ship model teaches patience and precision; competing with it fosters teamwork and resilience."

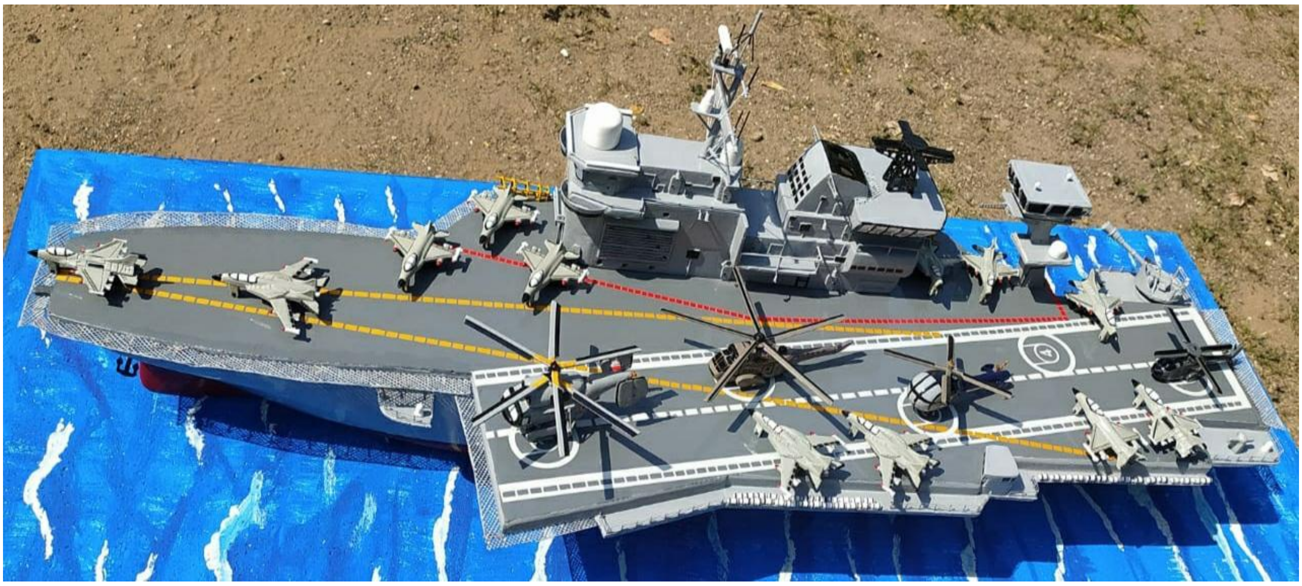
TEACHING INSTRUCTIONS

Period	**: 1 (40 Min)**
Type	**: Theory**
Conducting Officer	**: SMI**
Year	**: Second**
Training Aids	**: Blackboard, whiteboard, projector, ship model**
Time Plan	
Introduction	**: 05 Min**
SM Competition	**: 15 Min**
Criteria for Evaluation	**: 15 Min**
Conclusion	**: 05 Min**

INTRODUCTION

1. Ship modelling competitions are a cornerstone of NCC training, combining technical skill with creativity and precision. These events challenge cadets to craft accurate and functional ship models, reflecting their knowledge of naval architecture and craftsmanship. Competitions not only provide a platform for showcasing talent but also foster teamwork, discipline, and innovative thinking. In this chapter, cadets will explore the various types of ship modelling competitions, the judging criteria, and the numerous benefits of participation.

PREVIEW	LEARNING OBJECTIVES
➢ Part I: Ship Modelling Competition and Types ➢ Part II: Judging Criteria for Ship Modelling Competitions	➢ To learn about ship modelling competition and its types ➢ To familiarise with Judging Criteria for Ship Modelling Competitions and benefits of participation



PART I: SHIP MODELLING COMPETITION AND TYPES

2. Ship modelling competitions are events where cadets showcase their skills by creating detailed and functional ship models. These competitions, held at various levels (local, state, and national), are designed to evaluate the cadets' precision, creativity, and knowledge of naval architecture.

3. The primary NCC competitions include the Nau Sainik Camp (NSC) and the camp at INA, Ezhimala, each with specific objectives to test different aspects of ship modelling.

Objectives of Ship Modelling Competitions

4. **Skill Display**. Competitions provide a platform for cadets to demonstrate their technical and artistic abilities.

5. **Teamwork and Coordination**. Many ship models require group effort, helping cadets learn to work as a cohesive unit.

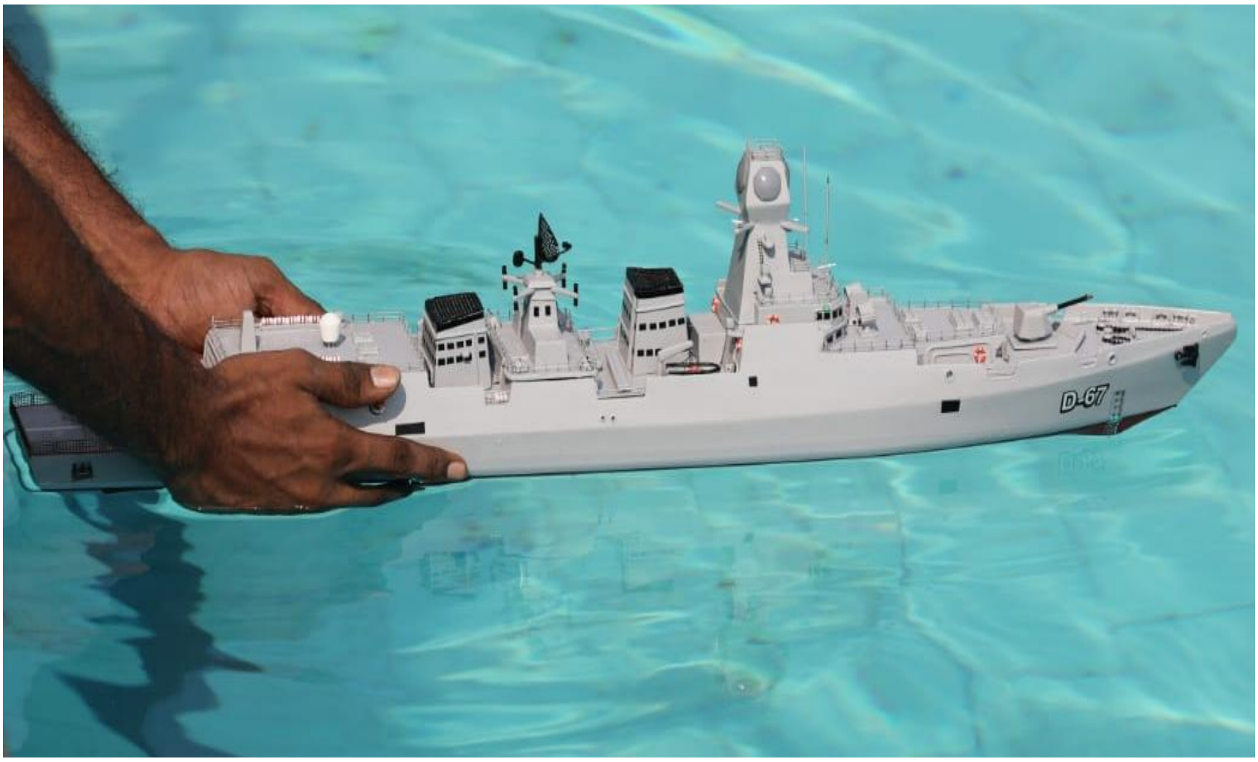
6. **Discipline and Precision**. Competitions instil attention to detail, patience, and persistence, all essential for naval training.

Types of Ship Modelling Competitions

7. **Static Model Competition**. Cadets build non-functional, highly detailed models for display, focusing on accuracy and craftsmanship. These models represent different classes of naval ships, such as destroyers, frigates, and aircraft carriers.

8. **Working Model Competition**. Cadets build functional models, often equipped with remote control for navigation. These models are judged on their ability to float, move accurately, and perform specific tasks in water.

9. **Sailing Model Competition**. Cadets create scaled sailing models with sails and motorized control for manoeuvrability. These models are judged based on speed, control, and navigation in water, emphasizing practical application.



Working Model Competition

PART II: JUDGING CRITERIA FOR SHIP MODELLING COMPETITIONS

10. **Accuracy**. Judges evaluate how closely the model resembles the design and specifications of the actual ship. This includes scale accuracy, placement of features, and adherence to the ship's original design.

11. **Craftsmanship**. The quality of construction, including the detail, neatness, and sturdiness of the model. Cadets should ensure that their model is well-assembled and precise in detail.

12. **Functionality (for Working Models)**. For working models, functionality tests are conducted to assess the model's ability to navigate, float, and respond to control systems. Common performance tests include:

(a) **Straight Run**. The model is required to move towards a centre mark in a water tank, with points deducted based on deviations from a straight path.

(b) **Turning Circle**. The model must complete a turn, and the model with the smallest turning circle earns the highest score.

13. **Aesthetic Appeal**: Judges assess the overall appearance, including painting, detailing, and creativity. Models should have realistic finishes, such as naval insignia, numbering, and flags.

Competitive Events and Performance Testing

14. During events like Nau Sainik Camp and camp at INA, Ezhimala, cadets are assessed on specific performance criteria:

(a) **Operational Performance**. The ability of the model to execute tasks like straight runs, turns, and navigating obstacles.

(b) **Speed and Agility**. In water-based events, models must demonstrate speed while maintaining stability and control.

(c) **Endurance**. Models are tested for durability, ensuring they remain intact and operational during the entire event.

Benefits of Participating in Ship Modelling Competitions

15. **Practical Skills**. Competitions encourage hands-on learning, helping cadets understand concepts like buoyancy, hydrodynamics, and engineering principles.

16. **Self-Confidence**. Successfully building and presenting a ship model builds confidence in cadets, especially when competing at the national level.

17. **Creativity and Innovation**. Cadets are motivated to develop unique models and explore innovative approaches to model-making.

Sailing Model Competition

18. **Peer Learning and Inspiration**. Competitions offer an opportunity for cadets to learn from each other, exchange ideas, and get inspired by other models on display.

CONCLUSION

19. This chapter introduced cadets to the concept of Ship Modelling Competitions in NCC. Cadets learned about the different types of competitions (static, working, and sailing models) and the detailed judging criteria that help determine winners in these events. They also understood how participating in competitions can help them develop practical skills, boost their self-confidence, and foster teamwork. Through these competitions, cadets gain valuable experience and technical knowledge that will serve them well in both NCC activities and future maritime pursuits.

SUMMARY

- **Types of Competitions.** Cadets can participate in static, working, and sailing model competitions, each emphasizing unique skills like craftsmanship, functionality, and navigation.
- **Judging Criteria.** Models are evaluated based on accuracy, craftsmanship, functionality, and aesthetic appeal, with specific tests like straight runs, turning circles, and operational performance.
- **Skill Development.** Ship modelling enhances cadets' understanding of buoyancy, hydrodynamics, engineering, and naval architecture.
- **Teamwork and Coordination.** Many competitions require group efforts, fostering collaboration, patience, and discipline.
- **Confidence and Creativity.** Participation builds self-confidence and encourages innovative problem-solving and artistic expression.
- **Comprehensive Benefits.** Competitions offer practical experience, peer learning opportunities, and the chance to compete at prestigious events like RDC and NSC.

SUGGESTED READ

National Cadet Corp – RED BOOK

ASSESSMENT EXERCISE

Multiple Choice Questions

Q1. What is the primary purpose of ship modelling competitions in NCC?

(a) To create decorative ship models
(b) To test cadets' knowledge, skill, and creativity in naval architecture
(c) To promote tourism
(d) To increase the number of ships in the navy

Q2. At which levels are ship modelling competitions conducted in NCC?

(a) Local, state, and national levels
(b) Only national level
(c) International level only
(d) School-level competitions only

Q3. Which NCC competition includes ship modelling as a key event?

(a) Republic Day Camp (RDC)
(b) Nau Sainik Camp (NSC)
(c) All India Technical Camp (AITC)
(d) All of the above

Q4. What is the main objective of ship modelling competitions?

(a) To improve swimming skills
(b) To develop skills in naval craftsmanship and engineering
(c) To teach cadets how to sail a real ship
(d) To increase the number of ships in NCC

Q5. Which type of ship modelling competition focuses on craftsmanship and detailing rather than functionality?

(a) Working Model Competition
(b) Static Model Competition
(c) Sailing Model Competition
(d) Speed Model Competition

Q6. What is a key feature of a working model competition?

(a) Models are non-functional and for display only
(b) Models must be large and heavy
(c) Models must be operational and able to float and navigate
(d) Models must be painted in bright colours

Q7. Sailing model competitions test.

(a) Speed and manoeuvrability
(b) Strength of materials used
(c) The ship's ability to submerge
(d) The ability to stay stationary in water

Q8. Which judging criterion assesses the accuracy of ship model details compared to the actual design?

(a) Craftsmanship
(b) Functionality
(c) Accuracy
(d) Aesthetic appeal

Q9. What is tested in the "Straight Run" performance evaluation?

(a) The ability to float on water
(b) The model's ability to move in a straight line with minimal deviation
(c) The durability of the model in rough water
(d) The speed of the model

Q10. How is the "Turning Circle" of a working model evaluated?

(a) By testing how fast the model can complete a circle
(b) By checking if the model remains stationary
(c) By ensuring the ship does not turn
(d) By measuring the smallest turning radius

Q11. Why is craftsmanship an important judging criterion?

(a) It ensures the model is visually appealing and structurally sound
(b) It makes the model more expensive
(c) It helps models move faster
(d) It reduces the weight of the model

Q12. What is a major benefit of participating in ship modelling competitions?

(a) Learning practical engineering and naval architecture skills
(b) Winning cash prizes
(c) Getting a chance to join the navy immediately
(d) Avoiding physical training in NCC

Q13. How do ship modelling competitions promote teamwork?

(a) By allowing only solo participants
(b) By requiring cadets to build models in groups, fostering coordination
(c) By discouraging team discussions
(d) By limiting resources for model-making

Q14. Why does ship modelling help in building self-confidence?

(a) It helps cadets develop and showcase their skills in a competitive environment
(b) It allows cadets to work alone without guidance
(c) It does not require effort or planning
(d) It guarantees an easy win for every participant

Q15. Which skill is not directly developed through ship modelling competitions?

(a) Understanding buoyancy and hydrodynamics
(b) Improving leadership and innovation
(c) Practicing high-speed swimming
(d) Enhancing technical precision and problem-solving

One-Word Answer Questions

1. Name a ship modelling competition held at the national level for NCC cadets.

2. What type of ship model is non-functional and created mainly for display?

3. Which ship modelling competition emphasizes hands-on operational performance in water?

4. What is the main material tested during the “straight run” performance test?

5. Which part of the judging criteria assesses the appearance and finish of a model?

Short Answer Questions (1-2 sentences)

1. Describe the main purpose of ship modelling competitions in NCC.

2. List two objectives of participating in ship modelling competitions.

3. What is the difference between working models and static models?

4. Mention two types of sails typically used in sailing models.

5. How does the “turning circle” test contribute to judging in working model competitions?

NCC SPECIAL SUBJECT (NAVY)

SHIP MODELLING

CHAPTER 5 - CARE AND MAINTENANCE OF TOOLS (CODE- SM 05)

"Tools in good condition are an artisan's best ally; their care reflects the craftsmanship they enable."

TEACHING INSTRUCTIONS

Period	**: 1 (40 Min)**
Type	**: Theory**
Conducting Officer	**: SMI**
Year	**: Second**
Training Aids	**: Blackboard, whiteboard, projector, ship model**
Time Plan	
Introduction	**: 05 Min**
Tools for Maintenance	**: 15 Min**
Maintenance Tips	**: 15 Min**
Conclusion	**: 05 Min**

INTRODUCTION

1. Proper tool care and maintenance play a crucial role in the accuracy and quality of ship modelling. Neglecting the upkeep of tools can lead to inefficiencies, safety hazards, and compromised craftsmanship. Sharp blades, clean surfaces, and well-maintained equipment ensure precise cuts, smooth finishes, and sturdy constructions. By understanding the importance of cleaning, sharpening, and proper storage, cadets develop a disciplined approach to using their tools, enhancing both their technical skills and safety awareness.

2. This chapter provides essential guidelines for maintaining ship modelling tools, emphasizing best practices that ensure longevity and reliability. Regular maintenance not only improves efficiency but also fosters a culture of responsibility and professionalism in naval training. By adopting proper care techniques, cadets can extend the lifespan of their tools, reduce the risk of accidents, and achieve superior model-building results, ultimately strengthening their overall seamanship and craftsmanship.

PREVIEW	**LEARNING OBJECTIVES**
➢ Part I: Maintenance tools ➢ Part II: General Maintenance tips	➢ To learn about ship model maintenance tools ➢ To familiarise with general ship modelling tools and maintenance tips

PART I: MAINTENANCE TOOLS

3. **Importance of Tool Care and Maintenance**. Proper maintenance of tools not only extends their lifespan but also ensures safe and effective operation. Well-maintained tools reduce the risk of injury, improve precision, and minimize errors during modelling tasks. Cadets must prioritize tool care as an integral part of their ship modelling training.

Types of Tools Used in Ship Modelling and Their Maintenance Needs

4. **Cutting Tools (e.g., craft knives, precision cutters, saws)**.

(a) **Sharpening**. Regularly sharpen blades using a sharpening stone or fine-grit sandpaper. Dull blades can lead to imprecise cuts and increase the risk of accidents.

(b) **Cleaning**. Wipe blades after each use to remove any debris or adhesive residue, which can reduce sharpness. Use a mild solvent if necessary to clean sticky surfaces.

(c) **Storage**. Store cutting tools in a safe, dry place, preferably with blade covers or in a designated toolbox, to prevent accidental cuts and blade dulling.

Maintenance Tools

5. **Adhesives (e.g., wood glue, super glue, epoxy)**.

(a) **Seal Properly**. Keep adhesive containers tightly sealed after use to prevent drying out. For super glue, consider storing it in a cool, dry place.

(b) **Disposal of Dried Adhesive**. If adhesive residue remains on tools, use a solvent like acetone to clean it off carefully.

(c) **Expiration and Replacement**. Regularly check adhesives for expiry and replace them as needed, as expired adhesives may not bond effectively.

6. **Files and Sandpaper.**

(a) **Cleaning Files**. Use a wire brush or file card to remove any wood or metal particles lodged between the file's teeth.

(b) **Sandpaper Storage**. Store sandpaper in a dry place, flat or in a folder, to prevent it from curling. Moisture can reduce its effectiveness and cause uneven sanding.

(c) **Replacement**. Discard sandpaper once it's worn down or clogged, as ineffective sandpaper can scratch or damage model surfaces.

7. **Painting Tools (e.g., small paintbrushes, airbrushes)**.

(a) **Cleaning**. Clean brushes immediately after each use with water for water-based paints or an appropriate solvent for oil-based paints. Run clean water or solvent through airbrushes after each use to prevent clogging.

(b) **Drying**. Allow brushes to dry thoroughly before storing to prevent bristle deformation and rusting.

(c) **Storage**. Store brushes upright or in a holder to maintain their shape and prevent bristle damage.

PART II: GENERAL MAINTENANCE TIPS

8. **Lubrication**: For tools with moving parts (such as hinges or rotary parts), apply a small amount of machine oil to keep the tool working smoothly. Avoid over-lubricating, as it can attract dust and debris.

9. **Rust Prevention**: Keep tools dry, as moisture can lead to rusting. Wipe tools with a clean, dry cloth after each use, and consider using silica gel packs in toolboxes to reduce humidity.

Ship Modelling Kit

10. **Storage in Proper Cases**. Use a tool case or organizer to prevent tools from being misplaced or damaged. Ensure tools are returned to their designated place after each use.

Safety Measures in Tool Maintenance

11. **Protective Gear**. Wear gloves when handling sharp tools, and use eye protection if sharpening or using solvents.

12. **Proper Disposal**. Dispose of damaged or broken tools safely to prevent injury or misuse. Do not attempt to repair tools beyond basic maintenance unless fully trained.

DC Motor kit for Working Model

13. **Regular Inspection**. Check tools periodically for wear and damage. Replace worn-out parts, such as blades or abrasive pads, to maintain efficiency and safety.

Benefits of Regular Tool Maintenance

14. **Enhanced Efficiency**. Well-maintained tools perform tasks more effectively, saving time and reducing frustration during modelling activities.

15. **Safety Assurance**. Properly maintained tools lower the risk of accidents, cuts, and injuries.

16. **Cost Savings**. By extending the life of tools, regular maintenance helps save money on replacements.

17. **Quality of Work**. Clean, sharp, and well-maintained tools lead to higher-quality models with precise cuts, smooth finishes, and accurate detailing.

CONCLUSION

18. This chapter has emphasized the significance of proper tool care and maintenance in ship modelling. By understanding the importance of cleaning, sharpening, and safely storing their tools, cadets ensure that their equipment remains in peak condition for precise and efficient work. These practices not only enhance the quality of their models but also contribute to a safer working environment, reducing the risk of accidents and tool damage. Regular maintenance fosters a systematic approach to equipment handling, reinforcing the discipline required in both NCC training and broader maritime applications.

19. Beyond technical proficiency, maintaining tools cultivates essential qualities such as responsibility, attention to detail, and long-term planning—skills that are valuable in naval and engineering fields. Through consistent upkeep, cadets develop a mindset of readiness and professionalism, preparing them for ship modelling competitions and real-world maritime challenges. This discipline in equipment care is a fundamental aspect of their training, ensuring they approach every project with efficiency, precision, and a commitment to excellence.

SUMMARY

- **Prolonging Tool Life.** Proper maintenance, like regular cleaning and lubrication, can significantly extend the life of tools, preventing rust and wear over time.
- **Sharpening Blades.** Regularly sharpening tools such as knives, saws, and chisels keeps them efficient and safer to use, reducing the effort required for tasks.
- **Storage Matters.** Storing tools in a dry, cool place, preferably in a toolbox or on a pegboard, prevents rust and damage, ensuring tools are ready when needed.
- **Inspection for Wear.** Regularly inspecting tools for damage, loose parts, or wear and tear helps identify issues before they affect the tool’s performance, making early repairs easier and cheaper.
- **Wooden Handles Need Care.** Wooden-handled tools, like hammers and axes, require occasional sanding and oiling to keep the wood smooth, strong, and crack-free.

SUGGESTED READ

"Ship Modeling Simplified" by Frank Mastini

"The Complete Beginners Guide to Model Ship Building" by Gary Renshaw

ASSESSMENT EXERCISE

Multiple Choice Questions

Q1. Why is proper tool care and maintenance essential in ship modelling?

(a) It improves the colour of the model
(b) It ensures accuracy, efficiency, and safety in model building
(c) It helps models float better
(d) It makes ship models more decorative

Q2. What is the primary benefit of sharpening cutting tools regularly?

(a) It makes the tools heavier
(b) It ensures precise cuts and reduces the risk of accidents
(c) It makes the tools last forever
(d) It prevents tools from getting dirty

Q3. How should cutting tools be stored to maintain their condition?

(a) Left in an open area exposed to air
(b) Placed in a safe, dry place with blade covers or a toolbox
(c) Wrapped in a wet cloth
(d) Stored with adhesive materials

Q4. What should be used to clean adhesive residue from tools?

(a) Water and soap
(b) Vinegar
(c) Acetone or a mild solvent
(d) Sandpaper

Q5. What is the main reason for keeping adhesive containers tightly sealed?

(a) To prevent leakage
(b) To avoid spilling glue on tools
(c) To prevent drying out and maintain bonding effectiveness
(d) To make glue easier to use

Q6. How should sandpaper be stored to maintain its effectiveness?

(a) Rolled up in a tight tube
(b) Placed in a dry place, flat or in a folder
(c) Kept in direct sunlight
(d) Folded multiple times

Q7. What is the best method to clean paintbrushes after use?

(a) Using only dry tissue paper
(b) Cleaning immediately with water for water-based paints or solvent for oil-based paints
(c) Leaving them to soak overnight in any liquid
(d) Rubbing the bristles against sandpaper

Q8. Why is lubrication important for tools with moving parts?

(a) It makes them heavier
(b) It prevents overheating
(c) It ensures smooth operation and reduces wear
(d) It makes them look shiny

Q9. What is a recommended method for preventing rust on tools?

(a) Keeping tools wet after use
(b) Storing tools in a damp place
(c) Wiping tools dry and using silica gel packs to reduce humidity
(d) Applying excessive oil

Q10. Why is it important to store tools in a proper case or organizer?

(a) To display them for decoration
(b) To prevent misplacement and damage
(c) To make them look more professional
(d) To keep them hidden from others

Q11. What safety measure should be followed when handling sharp tools?

(a) Wearing gloves and eye protection
(b) Using the tools as quickly as possible
(c) Keeping the tools in water before use
(d) Sharpening them before every use

Q12. Why should damaged tools be disposed of properly?

(a) To prevent injury and misuse
(b) To recycle the material for new tools
(c) To keep them as souvenirs
(d) To use them for decorative purposes

Q13. How does regular inspection of tools help in ship modelling?

(a) It ensures early identification of damage and prevents performance issues
(b) It reduces the weight of tools
(c) It helps in painting the tools better
(d) It makes tools rust-proof

Q14. What is a major cost-saving benefit of maintaining tools properly?

(a) Tools require no sharpening or cleaning
(b) It reduces the need for frequent replacements
(c) It allows cadets to buy new tools regularly
(d) It eliminates the need for tool storage

Q15. How does proper tool maintenance improve the quality of ship modelling?

(a) It ensures sharp cuts, smooth finishes, and accurate detailing
(b) It makes ship models waterproof
(c) It adds weight to the ship model
(d) It reduces the need for adhesives

One-Word Answer Questions

1. What is applied to moving parts of tools to ensure smooth operation?

2. Name a type of cutting tool commonly used in ship modelling.

3. Which type of brush is used to clean file teeth?

4. What can be used to prevent moisture in tool storage boxes?

5. Where should adhesives be stored to maintain effectiveness?

Short Answer Questions (1-2 sentences)

1. Why is it important to keep blades sharp in cutting tools?

2. How does cleaning tools after each use benefit their longevity?

3. Describe a safe storage method for paintbrushes.

4. Why should cadets replace worn-out sandpaper during model-building?

5. How does regular inspection of tools contribute to safety?

Long Answer Questions (3-4 sentences)

1. Explain the main benefits of regular tool maintenance in ship modelling.

2. How should cadets maintain adhesives to ensure effectiveness, and why is this necessary?

3. Describe three safety measures cadets should follow during tool maintenance.

4. Discuss the importance of rust prevention and provide two methods cadets can use to prevent rust on tools.

5. How does tool maintenance help cadets develop practical skills and a responsible attitude toward equipment handling in NCC training?

NCC SPECIAL SUBJECT (NAVY)

SHIP MODELLING

CHAPTER 6: REPAIRING AND STABILIZING SHIP MODELS (CODE- SM 06)

"Repairing a model is not just about fixing it, but about preserving the craftsmanship and care that went into creating it—stabilizing it for the future."

TEACHING INSTRUCTIONS

Period : **1 (40 Min)**
Type : **Theory**
Conducting Officer : **SMI**
Year : **Second**

Training Aids : **Blackboard, whiteboard, projector, ship model**

Time Plan

Introduction	**: 05 Min**
Common Damages and Repairing	**: 15 Min**
Stabilizing Technique	**: 15 Min**
Conclusion	**: 05 Min**

INTRODUCTION

1. Ship models, whether utilized for training, display, or competition, are prone to wear and damage over time. Developing the ability to repair and stabilize these models is a crucial skill for cadets, ensuring their longevity and structural integrity. This chapter introduces key techniques for addressing common issues such as cracks, loose components, and structural weaknesses. Cadets will also learn reinforcement methods to maintain model stability, particularly during handling and transport. Proper repairs not only restore the model's appearance but also enhance its overall functionality and performance, making it more resilient to frequent use.

2. Mastering repair and stabilization techniques allows cadets to extend the lifespan of their ship models and maintain their quality. These skills are particularly valuable for models used in competitions, where precision and durability are essential. Regular maintenance ensures that models remain in optimal condition, preventing minor damages from escalating into major issues. By applying proper repair practices, cadets develop a disciplined approach to ship modelling, reinforcing their technical expertise and commitment to excellence in both craftsmanship and naval training.

PREVIEW	**LEARNING OBJECTIVES**
➢ Part I: Common Damages and Repair ➢ Part II: Stabilizing Techniques	➢ To learn about common damages in ship model and their repair procedure. ➢ To acquaint with stabilizing techniques for ship models and best practices.

PART I: COMMON DAMAGES IN SHIP MODELS

3. **Surface Cracks and Chips**. Due to minor impacts or environmental factors.

4. **Loose Parts**. Small parts like masts, antennas, or fittings may loosen over time.

5. **Structural Damage**. Occurs in areas such as the hull or superstructure due to mishandling or insufficient support.

6. **Paint Damage**. Chips or scratches in paint caused by rough handling or abrasion.

7. **Buoyancy Issues**. For working models, water seepage or structural wear can affect buoyancy.

Repair of Ship Model

Repair Techniques

8. **Adhesive Repairs**.

(a) **Using Super Glue or Epoxy**. Super glue is effective for quick fixes on small parts, while epoxy offers stronger, more durable bonds for structural repairs.

(b) **Application Tips**. Apply adhesive sparingly to avoid visible excess and allow sufficient drying time. Use clamps to hold parts together for better adhesion.

9. **Filling Cracks and Gaps**.

(a) **Wood or Plastic Filler**. Use wood filler for wooden models and plastic putty for plastic models to fill cracks and gaps. Allow filler to dry, then sand the area to achieve a smooth finish.

(b) **Sandpaper Finishing**. After filling, use fine sandpaper to blend the repaired area with the rest of the model.

10. **Reattaching and Reinforcing Parts**:

(a) **Pinning Method**. For larger parts, use small metal pins or nails to reinforce joints before applying adhesive. This is particularly useful for reattaching masts or structural components.

(b) **Wire Supports**. For delicate or thin parts, add thin wire reinforcements along with adhesive for extra strength and stability.

11. **Repainting and Touch-ups**.

(a) **Primer Use**. Apply a primer before repainting damaged areas to ensure paint adherence.

(b) **Colour Matching**. Use similar shades and types of paint to match the model's original finish. Apply in thin layers to maintain a smooth appearance.

PART II: STABILIZING TECHNIQUES

12. **Weight Adjustment**.

(a) **Ballast Addition**. For floating models, add weights such as small metal pieces or lead weights to adjust balance and stability. Place them carefully within the hull to avoid shifting.

(b) **Distributed Weight**. Distribute weight evenly along the hull to prevent tilting or capsizing.

13. **Structural Supports**.

(a) **Internal Bracing**. Reinforce internal areas using small braces or supports, particularly for larger models that may have fragile sections.

(b) **External Stands and Cradles**. For display purposes, use custom stands or cradles that provide balanced support and prevent tipping.

14. **Securing Small Parts**.

(a) **Using Wax or Putty**. Apply a small amount of wax or removable putty to secure parts that need occasional repositioning. This is useful for antennas, rigging, or other fragile attachments.

(b) **Clamps and Holders**. For models on display, use clamps to secure any loose parts temporarily without causing damage to the model.

Handling and Transport for Model Stability

15. **Safe Handling**.

(a) **Grip Model by Sturdy Sections**. When lifting or moving the model, hold it by its strong, central parts rather than its delicate edges to avoid damage.

(b) **Avoid Moisture Exposure**. For wooden models, avoid excessive moisture, which can cause warping or swelling. Keep models dry and store them in stable conditions.

16. **Protective Transport**.

(a) **Use Padding**. When transporting models, wrap them in soft padding or foam to protect against shocks.

(b) **Secure Containers**. Use hard cases or dedicated transport boxes to prevent parts from shifting or getting damaged during transit.

Stowage of Ship Model

CONCLUSION

17. In this chapter, cadets learned the importance of repairing and stabilizing ship models for long-term use and presentation. Techniques covered include adhesive repairs, filling gaps, structural reinforcement, and weight adjustment, which contribute to the model's durability and appearance. Proper care for transporting and handling models ensures their longevity and stability, particularly in competitive environments. Through these practices, cadets will gain essential repair skills, enabling them to maintain high standards of model performance, precision, and craftsmanship in ship modelling activities.

SUMMARY

➢ **Reinforcing the Hull.** When a ship model's hull cracks or warps, reinforcing it with extra layers of resin or wood helps restore its strength and keeps it from losing shape.

➢ **Fixing Broken Masts.** A broken mast can be replaced by carefully matching the original material and ensuring proper rigging to keep the model functional and looking realistic.

➢ **Stabilizing with Ballast.** Adding ballast (like small metal weights) inside the ship's hull helps stabilize the model, preventing it from tipping over during display or use in water.

➢ **Reglueing and Repainting.** Small pieces or details like windows, railings, and lifeboats can often be reglued or repainted to bring the model back to its original condition.

➢ **Protective Coatings.** Applying a protective coat of varnish or sealant on finished models can prevent environmental damage, like dust buildup, moisture, or fading from light.

SUGGESTED READ

"Ship Modeling Simplified" by Frank Mastini

"The Complete Beginners Guide to Model Ship Building" by Gary Renshaw

ASSESSMENT EXERCISE

Multiple Choice Questions

Q1. Why is repairing and stabilizing ship models important for cadets?

(a) To increase the model's weight
(b) To ensure longevity and structural integrity
(c) To make the model float better
(d) To change the model's colour

Q2. Which of the following is NOT a common type of damage in ship models?

(a) Surface cracks and chips
(b) Loose parts
(c) Paint damage
(d) Increased speed

Q3. What is the best adhesive for quick fixes on small parts of a ship model?

(a) Wood glue
(b) Super glue
(c) Paint thinner
(d) Vinegar

Q4. How should epoxy be used in ship model repairs?

(a) To clean the model
(b) To create a glossy finish
(c) To provide a strong and durable bond for structural repairs
(d) To dissolve old glue

Q5. What should be done after filling cracks in a wooden ship model?

(a) Leave them unpainted
(b) Apply a primer coat immediately
(c) Sand the area smoothly before painting
(d) Apply more adhesive

Q6. What technique is used to reinforce joints before applying adhesive?

(a) Pinning method
(b) Taping method
(c) Glue soaking method
(d) Hammering technique

Q7. Why is it important to apply primer before repainting a ship model?

(a) To protect the model from water damage
(b) To ensure better paint adhesion
(c) To make the paint dry faster
(d) To create a glossy effect

Q8. What is the purpose of adding ballast to a floating ship model?

(a) To make it look more realistic
(b) To adjust balance and stability
(c) To make it lighter
(d) To change the ship's speed

Q9. How should ballast be placed inside a ship model for best results?

(a) Randomly distributed inside the model
(b) Concentrated in one area
(c) Evenly along the hull
(d) Placed on top of the model

Q10. What is the function of internal bracing in ship models?

(a) To improve the ship's speed
(b) To reinforce fragile sections and increase durability
(c) To add decorative details
(d) To make the ship heavier

Q11. What material can be used to secure small removable parts without permanent adhesion?

(a) Super glue
(b) Wax or removable putty
(c) Sandpaper
(d) Metal pins

Q12. Why should ship models be handled by sturdy sections?

(a) To maintain balance
(b) To prevent damage to delicate parts
(c) To clean the model faster
(d) To adjust its buoyancy

Q13. What is the best way to transport a ship model safely?

(a) Placing it in an open box
(b) Wrapping it in soft padding or foam
(c) Carrying it without any cover
(d) Storing it in a humid environment

Q14. Why is it important to use secure containers when transporting ship models?

(a) To protect against shifting and damage
(b) To enhance the model's appearance
(c) To make transport easier
(d) To display the model in public

Q15. What is one benefit of applying a protective coating to a finished ship model?

(a) It changes the model's weight
(b) It prevents environmental damage such as moisture and dust build-up
(c) It makes the model heavier
(d) It prevents paint from drying

One-Word Answer Questions

1. What type of glue is recommended for quick fixes on small parts?

2. What is used to fill gaps in plastic ship models?

3. Name the method used to reinforce joints with metal pins.

4. Which material can be added to adjust balance in floating models?

5. What type of stand is used to prevent model tipping during display?

Short Answer Questions (1-2 sentences)

1. Why is it important to apply primer before repainting damaged areas?

2. What does using wax or putty help secure on ship models?

3. How can cadets protect models during transport?

4. What are two common causes of paint damage on ship models?

5. Describe one method for stabilizing loose parts on ship models.

Long Answer Questions (3-4 sentences)

1. Explain the benefits of applying adhesive sparingly when repairing models.

2. Describe two methods cadets can use to reinforce and stabilize delicate parts on ship models.

3. How does ballast addition help in stabilizing floating models, and why must it be placed carefully?

4. Discuss the significance of safe handling techniques to prevent damage to ship models.

5. Why is it important to use matching paint colours for touch-ups, and how does this affect the model's appearance?

NCC SPECIAL SUBJECT (NAVY)

SHIP MODELLING

CHAPTER 7: HANDLING AND OPERATION OF REMOTE-CONTROL MODELS (CODE- SM 07)

"Mastering the art of operating an RC ship model requires not only understanding the mechanics but also ensuring safety and precision with every manoeuvre."

TEACHING INSTRUCTIONS

Period	**: 1 (40 Min)**
Type	**: Theory**
Conducting Officer	**: SMI**
Year	**: Second**
Training Aids	**: Blackboard, whiteboard, projector, ship model, RC transmitter, batteries, water tank or pool for testing**

Time Plan

Introduction	**: 05 Min**
Remote-Controlled Ship Models	**: 15 Min**
Handling and Safety Practices	**: 15 Min**
Conclusion	**: 05 Min**

INTRODUCTION

1. Remote-controlled (RC) ship models are dynamic, functional models that require skill and precision to operate effectively. This chapter introduces cadets to the essential techniques for safely handling, operating, and controlling RC ship models. It covers key components of the RC system, such as the transmitter, receiver, and motor, as well as the controls needed for smooth navigation. Safety practices, proper launching techniques, and post-operation care ensure the longevity and performance of the models. By mastering these techniques, cadets will be prepared to handle RC ship models efficiently in training exercises and competitions, demonstrating precision, control, and safety.

PREVIEW	LEARNING OBJECTIVES
➢ Part I: Remote-Controlled Ship Models ➢ Part II: Handling and Safety Practices	➢ To learn about remote controlled ship models and its components ➢ To familiarise with safe handling and good practices

PART I: REMOTE CONTROLLED SHIP MODELS

2. RC ship models are functional, scaled-down versions of ships that can be controlled remotely. These models are used in NCC ship modelling competitions and exercises to demonstrate skills in ship handling, navigation, and precision.

Components of an RC Model

3. **RC Transmitter**. The handheld device used to control the ship. It typically includes controls for speed, direction, and special functions.

4. **Receiver**. Installed within the ship, it receives signals from the transmitter and directs the model's responses.

5. **Battery Pack**. Powers both the receiver and motor(s) in the RC model. Proper battery maintenance is crucial for consistent performance.

6. **Motor and Propeller System**. Powers the model's movement through the water.

7. **Servo Mechanisms**. These provide directional control by adjusting the rudder or other components.

8. **Antenna**. Ensures stable communication between the transmitter and receiver.

<u>**Pre-Operation Checklist**</u>

9. <u>**Battery Check**</u>. Ensure the batteries in both the transmitter and model are fully charged.

10. <u>**Signal Range Test**</u>. Perform a range test by slowly moving away from the model and verifying control responsiveness.

11. <u>**Hull and Propeller Inspection**</u>. Check for any debris or damage that may affect performance.

12. <u>**Control System Check**</u>. Test all controls (throttle, rudder) to confirm they function correctly.

<u>**Basic Operating Controls**</u>

13. <u>**Throttle Control**</u>. Adjusts the speed of the model, often controlled by a trigger or a joystick. Pushing forward increases speed, and pulling back reduces it.

14. <u>**Directional Control (Rudder)**</u>. Allows left and right movement of the model. This is typically controlled with a separate joystick or wheel.

15. <u>**Combination of Controls**</u>. Operating the throttle and rudder together enables smooth navigation. This is essential for tight turns or complex manoeuvres.

16. <u>**Reversing the Motor**</u>. Some RC models have a reverse function, useful for manoeuvres in confined spaces or backing out of obstacles.

PART II: HANDLING AND SAFETY PRACTICES

17. **Proper Launching Technique**.

(a) **Calm Water Conditions**. Launch RC models in calm, open water to minimize the impact of waves or currents.

(b) **Stable Surface Launching**. Always hold the model firmly by the hull and lower it gently into the water. Release only when the model is steady and oriented in the desired direction.

18. **Maintaining Line of Sight**. Keep the RC model within clear sight and avoid obstacles like trees, rocks, or another watercraft.

19. **Avoiding Overuse**. Continuous operation without breaks can overheat the motor and drain the battery quickly. Operate in short intervals to ensure longevity.

20. **Emergency Recovery Plan**. For RC models operating in open water, ensure a means of recovery (such as a retrieval boat or pole) is available in case of malfunction

.

Operational Techniques for Control and Navigation

21. **Basic Navigation Skills**.

(a) **Straight-Line Movement**. Adjust the throttle and rudder to maintain a straight path, useful for stability and speed control.

(b) **Turning Techniques**. Practice wide and narrow turns by adjusting the rudder angle. Wide turns require gentler control, while tighter turns need sharper rudder movements.

22. **Advanced Manoeuvring**.

(a) **Figure-Eight Practice**. Manoeuvring in a figure-eight pattern helps develop precise control and familiarity with directional changes.

(b) **Docking Skills**. Practice bringing the model close to the edge without hitting the shore or dock. Use gentle, controlled movements for accuracy.

23. **Speed Management**. Balance speed and manoeuvrability based on the environment and model stability. Slower speeds provide greater control, while higher speeds demand better precision.

Battery Care and Maintenance

24. **Battery Storage**. Store batteries in a cool, dry place when not in use and avoid overcharging to extend battery life.

25. **Regular Charging Cycle**. Charge batteries fully before operation and avoid draining them completely during use.

26. **Replacing Batteries**. Replace worn or damaged batteries to ensure safe and efficient operation. Keep spare batteries for extended sessions.

Handling Post-Operation

27. **Drying and Cleaning**. Remove the model from water, drain any remaining water from the hull, and dry thoroughly to prevent corrosion.

28. **Storage**. Store the RC model in a stable environment, away from direct sunlight or extreme temperatures.

29. **Component Inspection**. After each use, inspect the model for any wear or damage, particularly to the propeller, motor, and receiver.

CONCLUSION

30. In this chapter, cadets learned the essential handling and operational techniques for RC ship models. Key areas covered include component familiarity, pre-operation checks, and safety protocols for launching, controlling, and navigating RC models. Cadets practiced essential manoeuvres like straight-line movement, turning, and docking to improve control. Battery care and post-operation handling ensure long-lasting performance and safety. With these skills, cadets are now equipped to handle and operate RC ship models effectively and confidently in various training and competition environments.

SUMMARY

- ➢ Cadets gained essential knowledge of RC ship models, including their components and operational functionality.
- ➢ They learned pre-operation checks and safety protocols to ensure effective and secure handling.
- ➢ Fundamental and advanced navigation techniques were covered, enhancing control and precision.
- ➢ Emphasis was placed on battery care and maintenance for consistent performance and longevity.
- ➢ Post-operation practices, such as cleaning and inspection, were highlighted to preserve model condition.
- ➢ These skills prepare cadets for effective participation in training and competitions, fostering confidence and technical expertise.

SUGGESTED READ

"Ship Modeling Simplified" by Frank Mastini

"The Complete Beginners Guide to Model Ship Building" by Gary Renshaw

ASSESSMENT EXERCISE

Multiple Choice Questions

Q1. What is the primary function of a remote-controlled (RC) ship model?

(a) To act as a decorative display
(b) To provide hands-on experience in ship handling and navigation
(c) To float without movement
(d) To serve as a storage container

Q2. Which component of an RC ship model is responsible for sending control signals?

(a) Battery pack
(b) Motor
(c) Transmitter
(d) Propeller

Q3. What role does the receiver play in an RC ship model?

(a) Generates power for the motor
(b) Sends signals to the transmitter
(c) Receives commands from the transmitter and directs responses
(d) Controls battery usage

Q4. Why is battery maintenance important for RC ship models?

(a) To enhance the model's weight
(b) To ensure consistent performance and longer operational time
(c) To change the colour of the model
(d) To reduce water resistance

Q5. What is the function of servo mechanisms in RC ship models?

(a) They control directional movements such as rudder adjustments
(b) They generate speed
(c) They provide waterproofing
(d) They act as storage compartments

Q6. What should be the first step in a pre-operation checklist for an RC ship model?

(a) Painting the hull
(b) Checking and charging the battery
(c) Replacing the motor
(d) Adding extra weight for stability

Q7. What is the purpose of a signal range test before operating an RC ship model?

(a) To verify control responsiveness over a distance
(b) To check the ship's weight
(c) To test the water temperature
(d) To determine battery life

Q8. How is throttle control typically adjusted in an RC ship model?

(a) By using a voice command
(b) By pushing a button
(c) By using a trigger or joystick to control speed
(d) By manually adjusting the motor

Q9. What is the best way to combine throttle and rudder controls?

(a) Using them separately
(b) Operating both together for smooth navigation and manoeuvring
(c) Only using the rudder in high-speed situations
(d) Avoiding rudder movements in competitions

Q10. Why is launching an RC model in calm water conditions recommended?

(a) To avoid excess water resistance
(b) To ensure stable navigation and minimize external disturbances
(c) To increase speed
(d) To make the model look more realistic

Q11. What is an important safety measure when handling an RC model?

(a) Keeping it on display for long periods
(b) Maintaining a clear line of sight while operating
(c) Overloading the battery for more power
(d) Operating in rough water for excitement

Q12. Why is avoiding overuse of an RC ship model important?

(a) It prevents overheating of the motor and battery drainage
(b) It makes the model slower
(c) It reduces signal range
(d) It prevents the model from floating

Q13. What is the purpose of practicing figure-eight manoeuvres with an RC ship model?

(a) To increase battery life
(b) To enhance control and familiarity with directional changes
(c) To test the water depth
(d) To keep the model in a fixed position

Q14. What is a good practice for post-operation maintenance of an RC ship model?

(a) Leaving the model in water overnight
(b) Drying and cleaning the model to prevent corrosion
(c) Storing the model in direct sunlight
(d) Ignoring battery maintenance

Q15. How should batteries be stored when not in use?

(a) In a humid environment
(b) In a cool, dry place to extend battery life
(c) In direct sunlight
(d) Inside the model while submerged in water

One-Word Answer Questions

1. What powers the RC model's motor and receiver?

2. Which component allows the RC model to turn left or right?

3. What is used to control the RC model remotely?

4. Where should RC models be launched to ensure safety and stability?

5. What component should be checked for responsiveness in a pre-operation checklist?

Short Answer Questions (1-2 sentences)

1. Why is it important to perform a signal range test before operating an RC model?

2. What function does the reverse motor provide in RC models?

3. Explain why RC models should be operated in short intervals.

4. How does adjusting the rudder angle affect the RC model’s turning radius?

5. What basic manoeuvre helps cadets develop control and familiarity with RC model navigation?

Long Answer Questions (3-4 sentences)

1. Describe the role of the receiver and transmitter in operating an RC model.

2. Explain the importance of maintaining a clear line of sight when operating an RC model.

3. What are some essential safety practices cadets should follow during RC model operation?

4. Discuss why battery care, such as avoiding overcharging and storing properly, is crucial for RC model maintenance.

5. Describe the post-operation steps that ensure an RC model remains in optimal condition for future use.

NCC SPECIAL SUBJECT (NAVY)

SHIP MODELLING

CHAPTER 8: - PRACTICAL TRAINING ON SHIP MODELLING (CODE- SM 08)

"Ship modelling is not just about building a replica; it's about building precision, patience, and a deep understanding of maritime engineering."

TEACHING INSTRUCTIONS

Period	**: 9 (360 Min)**
Type	**: Practical**
Conducting Officer	**: SMI**
Year	**: Third**
Training Aids	**: Ship Model Kit, tools, RC transmitter, batteries, water tank or pool for testing.**
Time Plan	**: Construction of Model – 360 Min**

FIRE FIGHTING AND DAMAGE CONTROL

<u>SECTION INDEX : FIRE FIGHTING AND DAMAGE CONTROL (SD/ SW)</u>

NCC SPECIAL SUBJECT (NAVY)

FIRE FIGHTING AND DAMAGE CONTOL

CHAPTER 1: FIRE FIGHTING (CODE DC-01)

"Fire safety: more than a choice, it's a duty"- Lt Cdr Piyush Bhatt

TEACHING INSTRUCTIONS

Period : **1 (40 Min)**
Type : **Theory**
Conducting Officer : **PI**
Year : **Second**

Training Aids : **Computer with OHP, screen, presentation, white board and markers, portable extinguishers**

Time Plan

Introduction : **05 Min**
Causes and Types of Fire : **15 Min**
Fire Fighting Methods : **15 Min**
Introduction : **05 Min**

INTRODUCTION

1. Fire is one of the most dangerous hazards, capable of causing significant loss of life and property if not managed properly. Understanding fire safety is essential for preventing and responding to fire incidents effectively. This chapter provides cadets with fundamental knowledge about fire, including its causes, types, and various methods of extinguishing it. By learning the principles of fire prevention, the proper use of firefighting equipment, and emergency response procedures, cadets will be better prepared to handle fire-related situations safely and efficiently.

2. In addition to theoretical knowledge, this chapter emphasizes practical safety measures and the importance of fire drills in preparedness. Cadets will explore different firefighting techniques such as cooling, starving, and smothering, along with the correct use of fire extinguishers based on the type of fire. They will also learn about essential firefighting equipment, including fire suits and breathing apparatus, which are crucial for protecting firefighters. By mastering these concepts, cadets will develop the awareness and skills necessary to respond effectively to fire emergencies, ensuring safety for themselves and those around them.

PREVIEW	**LEARNING OBJECTIVES**
➢ Part I: Causes and Types of Fire ➢ Part II: Fire Fighting Methods	➢ To learn about causes and various types of fire ➢ To familiarise with various types of firefighting methods depending on types of fire

PART I: CAUSES AND TYPES OF FIRE

3. Common causes include negligence, carelessness with cigarettes, unattended cooking oil, improper electrical equipment use, and unsafe storage of flammable materials.

4. Prevention involves keeping flammable items away from heat, inspecting electrical equipment, installing smoke alarms, and practicing fire drills.

5. **Types of Fire**.

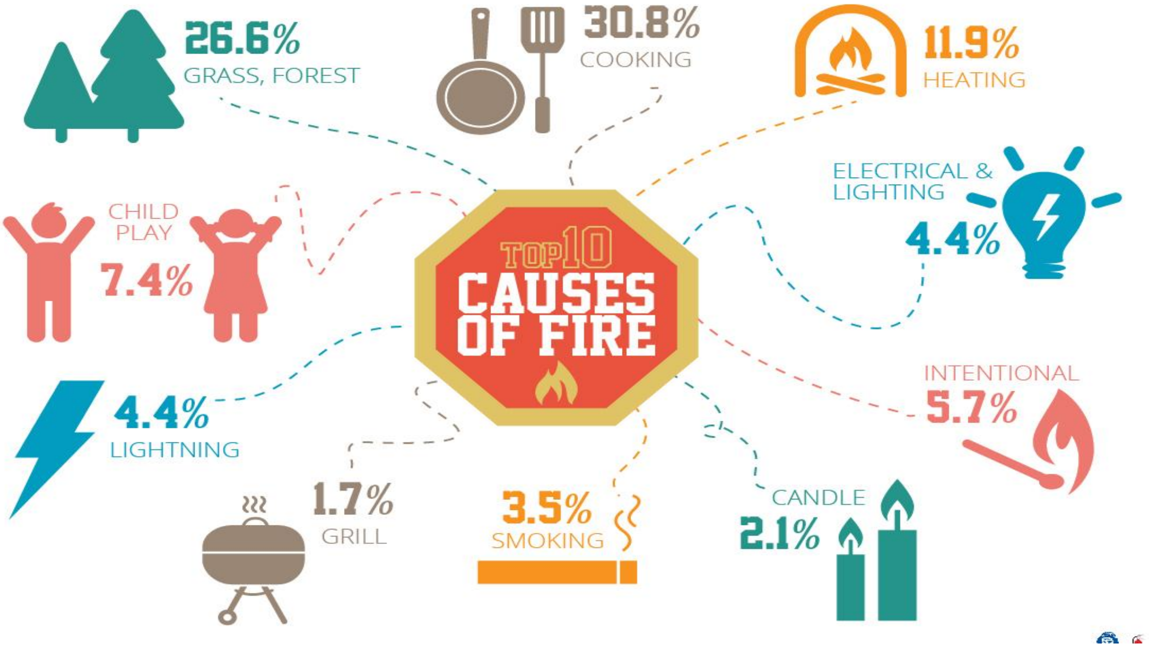
(a) Class A: General fires involving wood, paper, or cloth.

(b) Class B: Fires involving oils and flammable liquids.

(c) Class C: Fires caused by gases.

(d) Class D: Fires involving metals.

(e) Class E: Electrical fires.



Causes of Fire

DID YOU KNOW?
➢ **Ancient Roots.** Organized firefighting dates back to ancient Rome, where the first known fire brigade was established by Emperor Augustus; making it one of the oldest professions. ➢ **Dalmatian Connection.** The reason Dalmatians are often associated with firefighters is because they used to run alongside horse-drawn fire carriages, helping clear paths and guarding equipment.

Fire Class	Symbol	Combustible	Features	Examples	Extinguishing agent
A	A	Solid substances	Glow and flames	Wood, paper textiles	Water, foam ABC powder, AFFF Novec™ 1230
B	B	Liquids	Flames	Oil, gasoline fats	Foam, CO2, AFFF ABC, BC powder Novec™ 1230
C	C	Gases	Flames	Butane, propane naturel gas	CO2, BC powder ABC powder, AFFF Novec™ 1230
D	D	Combustible metal	Glow and flames	Magnesium aluminium, sodium	Dry powder
E	E	Electrical (liquids solid substances)	Glow and flames	Plastics	Novec™ 1230 non-conductive extinguishing agents

Classes of Fire

PART II: FIRE FIGHTING METHODS

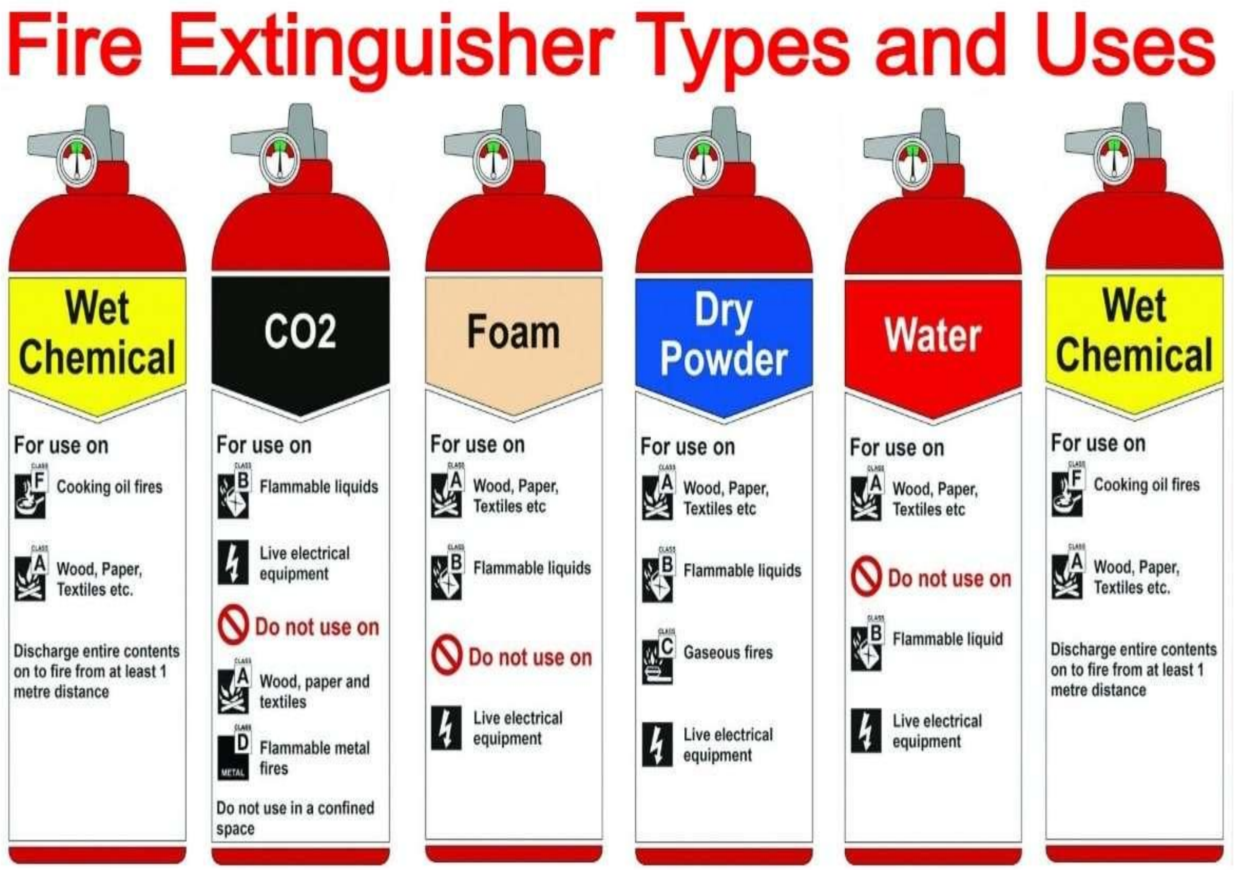
6. **Firefighting Methods**.

(a) **Cooling**. Reducing the temperature using water.

(b) **Starving**. Removing the fuel source.

(c) **Smothering**. Cutting off oxygen supply using fire blankets.

(d) Using appropriate fire extinguishers based on fire type (e.g., AFFF for Class A and B, CO2 for Class E).



7. **Fire Safety Measures**.

(a) Alert others and evacuate promptly.

(b) Use designated evacuation routes and avoid elevators.

(c) Stay low to avoid smoke inhalation.

(d) Close doors to contain the fire.

(e) Install and maintain smoke detectors.

DID YOU KNOW?
➢ **Fast Gear-Up.** Firefighters can typically get fully dressed in their protective gear in less than two minutes, allowing for quick response times.   ➢ **Beyond Fires.** While their primary job is extinguishing fires, firefighters are also trained in medical emergencies, rescue operations, and hazardous materials response, making them versatile first responders.   ➢ **Thermal Imaging Technology.** Modern firefighters use thermal imaging cameras to see through smoke and locate people trapped in burning buildings, even in complete darkness.

8. **<u>Firefighting Equipment</u>**.

(a) Fire Extinguishers: AFFF, CO2, and DCP extinguishers tailored for specific fire types.

(b) Firefighting Suits: Bristol suits provide protection up to 650°C and include helmets, gloves, and boots.

(c) Breathing Apparatus (BASCCA): Self-contained systems to protect firefighters from smoke and toxic gases.

CONCLUSION

9. Fire safety is a critical skill that plays a vital role in protecting lives and property. By understanding the different types of fire, their causes, and the appropriate methods to extinguish them, individuals can significantly reduce fire hazards. Proper knowledge of firefighting techniques, such as cooling, starving, and smothering, ensures that fires are controlled effectively before they escalate. Additionally, being familiar with the correct use of fire extinguishers and other firefighting equipment enhances preparedness and response during emergencies.

10. Beyond fire suppression, preventive measures and safety protocols are essential in minimizing fire risks. Regular fire drills, proper maintenance of fire detection systems, and adherence to evacuation procedures can make a significant difference in emergency situations. Fire safety awareness fosters a proactive approach, helping individuals remain vigilant and prepared. By incorporating these principles, cadets and personnel can contribute to a safer environment, ensuring that fire-related incidents are handled swiftly and efficiently.

SUMMARY

- Common fire causes include negligence, unsafe electrical use, and flammable material mishandling.
- Fire prevention involves regular inspections, smoke alarms, and proper storage of hazardous items.
- Fires are classified into five types: A, B, C, D, and E.
- Cooling, starving, and smothering are primary firefighting techniques.
- Different extinguishers are used for specific fire classes (e.g., CO_2 for electrical fires).
- Fire drills and escape plans enhance preparedness.
- Smoke alarms should be tested monthly and replaced every 10 years.
- Firefighting suits and breathing apparatus ensure firefighter safety.
- Indian Navy uses advanced equipment, including firefighting robots and simulators.
- Always alert others and evacuate safely during a fire.

SUGGESTED READ

Fire Fighting Handbook, by BM Sen

Indian Navy- NBCD Manual

ASSESSMENT EXERCISE

Multiple Choice Questions

Q1. What is the primary objective of fire safety training?

(a) To increase fire awareness without action
(b) To effectively prevent and respond to fire incidents
(c) To promote fire alarm installations only
(d) To teach firefighting as a competitive sport

Q2. Which of the following is NOT a common cause of fire?

(a) Unattended cooking oil
(b) Improper use of electrical equipment
(c) Safe storage of flammable materials
(d) Carelessness with cigarettes

Q3. What is the main purpose of fire prevention measures?

(a) To ensure quick evacuation without controlling fire spread
(b) To minimize fire hazards and prevent fire incidents
(c) To encourage people to fight fire themselves
(d) To only install smoke alarms without inspections

Q4. What type of fire involves burning wood, paper, or cloth?

(a) Class A
(b) Class B
(c) Class C
(d) Class D

Q5. Which fire class includes flammable liquids like oil and petrol?

(a) Class A
(b) Class B
(c) Class C
(d) Class E

Q6. What type of fire is caused by gases?

(a) Class A
(b) Class B
(c) Class C
(d) Class D

Q7. Which firefighting technique involves lowering the temperature of the fire using water?

(a) Smothering
(b) Starving
(c) Cooling
(d) Electrical insulation

Q8. What does the "starving" method of firefighting involve?

(a) Removing the fuel source
(b) Cutting off oxygen supply
(c) Spraying water continuously
(d) Using a fire alarm

Q9. How does the smothering method extinguish a fire?

(a) By reducing temperature with water
(b) By removing the fuel source
(c) By cutting off oxygen supply using fire blankets
(d) By increasing air circulation

Q10. Which type of fire extinguisher is best suited for electrical fires (Class E)?

(a) Water extinguisher
(b) AFFF extinguisher
(c) CO2 extinguisher
(d) Sand extinguisher

Q11. What should be the first action when discovering a fire?

(a) Alert others and evacuate
(b) Try to put it out alone
(c) Run in random directions
(d) Hide and wait for help

Q12. Why should doors be closed during a fire evacuation?

(a) To block smoke and contain fire spread
(b) To avoid damaging the doors
(c) To ensure fresh air circulation
(d) To prevent firefighters from entering

Q13. What is the function of a firefighting suit?

(a) Provides fashion for firefighters
(b) Protects against extreme heat and flames
(c) Enhances running speed
(d) Acts as a flotation device

Q14. What is the role of a breathing apparatus (BASCCA)?

(a) Helps in carrying firefighting tools
(b) Protects firefighters from smoke and toxic gases
(c) Acts as a cooling system
(d) Speeds up fire extinguishing process

Q15. What is the primary reason for conducting fire drills?

(a) To waste time during work hours
(b) To test people's speed in exiting a building
(c) To ensure preparedness and safe evacuation during emergencies
(d) To reduce fire alarm noise complaints

Short Answer Questions

1. What are the five types of fires?

2. List three common causes of fire.

3. Name three methods to extinguish a fire.

4. What is BASCCA, and when is it used?

5. How do fire drills contribute to safety?

Long Answer Questions

1. Explain the different types of fire and their corresponding extinguishing methods.

2. Describe the safety measures to follow during a fire incident.

3. Discuss the equipment used in firefighting and their specific uses.

4. What are the causes of fire due to negligence, and how can they be prevented?

5. Outline the role of the Indian Navy in fire safety and firefighting advancements.

NCC SPECIAL SUBJECT (NAVY)

FIRE FIGHTING AND DAMAGE CONTOL

CHAPTER 2: FLOODING AND DAMAGE CONTROL (CODE DC-02)

"In the face of flooding at sea, preparedness and swift action transform chaos into control, proving that resilience is the strongest lifeline aboard any vessel."

TEACHING INSTRUCTIONS

Period	**: 1 (40 Min)**
Type	**: Theory**
Conducting Officer	**: PI**
Year	**: Third**
Training Aids	**: Computer with OHP, screen, presentation, white board and markers**

Time Plan

Introduction	**: 05 Min**
Causes of Damage	**: 15 Min**
Flooding and Damage Control	**: 15 Min**
Conclusion	**: 05 Min**

INTRODUCTION

1. In naval terms, damage control refers to the emergency management of situations that could threaten a ship with sinking. Damage and flooding in a ship can occur due to collision, grounding, weapon explosion, enemy attack, etc. Therefore, it is crucial to contain flooding and damage within the smallest possible area, and for this purpose, flooding boundaries must be established without delay. The ability of a flooded ship's compartments/spaces to resist damage depends on their watertight integrity.

PREVIEW	LEARNING OBJECTIVES
➢ Part I: Causes and Zones of Damage ➢ Part II: Flooding and Damage Control	➢ To learn about causes and zones of damage ➢ To familiarise with Flooding and various methods of Damage Control

PART I: CAUSES AND ZONES OF DAMAGE

2. Damage control is the emergency management of situations that threaten the safety and stability of a ship. These situations may arise from collisions, groundings, explosions, or enemy attacks. The primary goal of damage control is to ensure the ship's survivability by containing damage and flooding within the smallest possible area.

3. Damage control involves measures taken to mitigate the impact of damage caused by collisions, groundings, weapon explosions, or enemy attacks. Rapid establishment of flooding boundaries is crucial to contain the damage and prevent it from spreading.

Zones of Damage

4. **Primary Zone**.

(a) This zone is located near the source of damage, such as explosions or collisions.

(b) It experiences complete destruction.

5. **Secondary Zone**.

(a) This zone is adjacent to the primary zone and may experience slow and progressive flooding.

(b) Damage to the hull, bulkheads, and decks in this zone is probable.

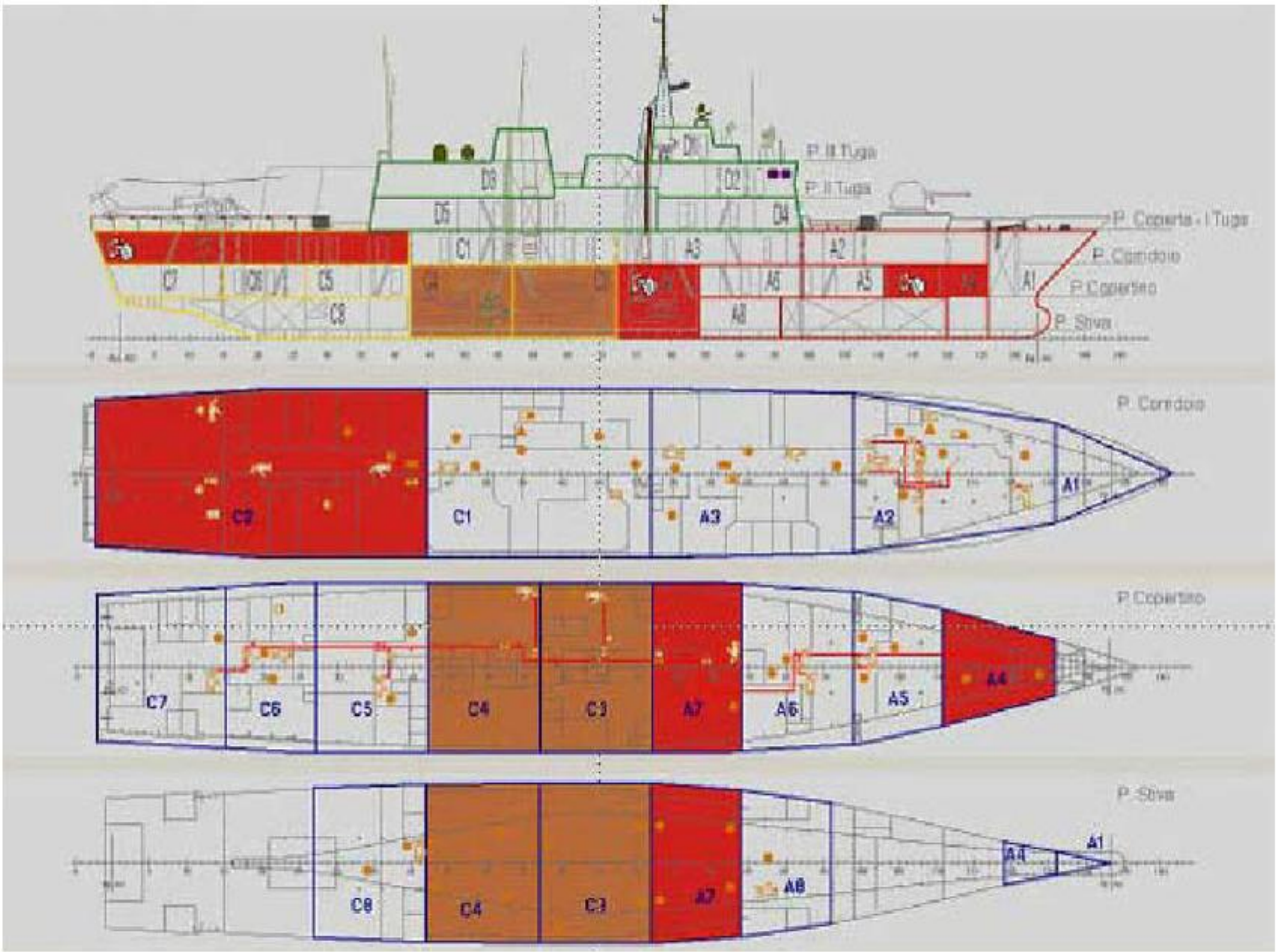
6. **Remote Zone**. Accidents or explosions in this zone may cause shock waves, resulting in structural damage and fires.

DID YOU KNOW?

➢ **Compartmentalization is Key**. Ships are designed with watertight compartments to contain flooding, allowing the vessel to remain afloat even if one area is breached, thanks to the principle of "damage stability."

➢ **"Floodable Length" is Crucial**. Each part of a ship has a "floodable length," which is the maximum section that can be flooded without causing the ship to sink, and is a key factor in damage control planning.

➢ **Intentional Flooding can be used for Stability**. In certain situations, crews might intentionally flood specific compartments on the opposite side of a list to counteract a large tilt caused by flooding on one side.



Compartment Layout onboard Ship for DC and Fire Fighting

PART II: FLOODING AND DAMAGE CONTROL

Leak-Stopping Devices

7. Leak-stopping devices help manage flooding and prevent water from spreading to other compartments. These devices include:-

(a) Wooden shores, plugs, and wedges

(b) Splinter boxes

(c) Stopper plates and pad pieces

(d) Quick-hardening cement

(e) Oakum

(f) Metallic adjustable shores

(g) Dog nails and grid shores

(h) Jubilee clips and multipurpose bands

8. **<u>Watertight Risk Marking</u>**.

(a) The "Red Zone" is marked on areas susceptible to flooding, extending from the keel to above the deep waterline.

(b) Openings within the red zone are marked as "red openings" with red triangles on doors, hatches, and valves, indicating immediate flooding risk.

DID YOU KNOW?
➢ **Intentional Flooding can be used for Stability**. In certain situations, crews might intentionally flood specific compartments on the opposite side of a list to counteract a large tilt caused by flooding on one side.
➢ **Damage Control Parties are Vital**. Every ship has designated "damage control parties" trained to quickly respond to flooding emergencies by isolating the breach, patching leaks, and managing water levels.
➢ **"Free Surface Effect" can Worsen Flooding**. When a large open space within a flooded compartment is present, it creates a "free surface" which can significantly reduce the ship's stability, making it more prone to listing.

<u>Ship's Water Line</u>

9. **<u>Control Marking</u>**. Control markings regulate the opening and closing of doors and hatches under specific conditions. These markings are painted black and categorized as follows:-

(a) **<u>X-Ray</u>.** X doors closed; Z open.

(b) **<u>Yankee</u>.** X and Y doors closed; Z open for passage but shut immediately after use.

(c) **<u>Zulu</u>.** X, Y, and Z doors closed; but Z can open briefly for passage.

<u>Control Markings</u>

CONCLUSION

10. Damage control is a vital aspect of naval operations, ensuring the safety and survivability of a ship and its crew during emergencies. By understanding damage zones, personnel can quickly assess affected areas and implement appropriate containment measures. Leak-stopping devices play a crucial role in preventing water ingress, reducing the risk of flooding, and maintaining the ship's buoyancy. Additionally, marking systems allow for clear communication and coordination, enabling swift and efficient responses to critical situations. Proper training in these areas equips naval personnel with the skills needed to manage and mitigate damage effectively.

11. Beyond immediate emergency response, damage control fosters a culture of preparedness and resilience among naval personnel. Regular drills and training exercises help enhance decision-making and teamwork, ensuring that crew members can act swiftly under pressure. The ability to control and contain damage not only preserves the operational integrity of the vessel but also safeguards lives in high-risk situations. By mastering damage control techniques, naval personnel contribute to the overall mission readiness and long-term sustainability of their fleet.

SUMMARY

- Damage control is essential for managing emergencies that endanger a ship.
- Causes of damage include collisions, groundings, explosions, and enemy attacks.
- The primary zone of damage is the area of complete destruction.
- The secondary zone experiences slow, progressive flooding.
- Remote zones may face structural damage due to shock waves.
- Leak-stopping devices include wooden plugs, cement, and adjustable shores.
- The red zone marks areas at immediate flooding risk.
- Control markings manage the opening and closing of doors and hatches.
- X-Ray, Yankee, and Zulu conditions regulate watertight integrity.
- Rapid containment of damage is crucial for the ship's survival.

SUGGESTED READ

Indian Navy- NBCD Manual

ASSESSMENT EXERCISE

Multiple Choice Questions

Q1. What is the primary goal of damage control on a naval ship?

(a) To abandon the ship as quickly as possible
(b) To ensure the ship's survivability by containing damage and flooding
(c) To fight enemy attacks directly
(d) To prevent all mechanical failures

Q2. Which of the following is NOT a common cause of damage to a ship?

(a) Collision
(b) Grounding
(c) Routine maintenance
(d) Enemy attack

Q3. What is the key factor in preventing a ship from sinking due to flooding?

(a) Rapid abandonment of the ship
(b) Establishing flooding boundaries quickly
(c) Letting water drain naturally
(d) Stopping all ship operations immediately

Q4. Which of the following is the primary zone of damage?

(a) The area farthest from the source of damage
(b) The area completely unaffected by damage
(c) The area near the source of damage, experiencing complete destruction
(d) The area experiencing minor leaks only

Q5. What characterizes the secondary zone of damage?

(a) It remains unaffected by any damage
(b) It is adjacent to the primary zone and may experience slow, progressive flooding
(c) It has no structural damage at all
(d) It is more dangerous than the primary zone

Q6. How can damage in the remote zone affect a ship?

(a) By causing shock waves leading to structural damage and fires
(b) By immediately sinking the ship
(c) By blocking all exits
(d) By shutting down the entire electrical system

Q7. What is the purpose of leak-stopping devices?

(a) To repair engines after battle damage
(b) To prevent water from spreading to other compartments
(c) To improve ship ventilation
(d) To completely remove all water from the ship

Q8. Which of the following is NOT a leak-stopping device?

(a) Wooden shores and plugs
(b) Splinter boxes
(c) Radar systems
(d) Quick-hardening cement

Q9. What does the "Red Zone" indicate on a ship?

(a) Areas at high risk of flooding
(b) Areas used for storage
(c) The safest areas of the ship
(d) Locations of emergency exits

Q10. What do "red openings" marked with red triangles signify?

(a) Structural weaknesses in the ship
(b) Areas that need repainting
(c) Openings that pose an immediate flooding risk
(d) Emergency exit points

Q11. What is the purpose of control markings in damage control?

(a) To indicate escape routes
(b) To regulate the opening and closing of doors and hatches under specific conditions
(c) To identify hazardous chemical storage areas
(d) To mark safe areas for crew members

Q12. Which control marking condition allows all X, Y, and Z doors to remain closed, but Z doors can open briefly for passage?

(a) X-Ray
(b) Yankee
(c) Zulu
(d) Red Zone

Q13. Why is compartmentalization important in ship design?

(a) It helps store more supplies
(b) It isolates flooding to maintain ship stability
(c) It allows faster ship movement
(d) It prevents air circulation

Q14. What is the "free surface effect" in damage control?

(a) The impact of open water movement in flooded compartments reducing stability
(b) The process of draining water from compartments
(c) The use of air pressure to control leaks
(d) A method to increase ship speed during flooding

Q15. Why are regular damage control drills important for naval personnel?

(a) To pass time during long voyages
(b) To ensure preparedness and quick response in emergencies
(c) To test the strength of ship materials
(d) To improve food storage techniques

Short Answer Questions

1. Define damage control in naval terms.

2. List three causes of damage in a ship.

3. What is the primary zone of damage?

4. Name three leak-stopping devices.

5. Explain the purpose of watertight risk marking.

Long Answer Questions

1. Describe the zones of damage and their significance in damage control.

2. Explain the various leak-stopping devices and their uses.

3. Discuss the importance of watertight risk marking in damage control.

4. Elaborate on the control markings used to maintain watertight integrity.

5. Analyse the role of damage control in ensuring the survivability of a ship.

MERCHANT NAVY

SECTION INDEX : MERCHANT NAVY (SD/ SW)

NCC SPECIAL SUBJECT (NAVY)

MERCHANT NAVY

CHAPTER 1: INTRODUCTION TO BASICS OF MERCHANT NAVY (CODE JMN-1)

"You can't cross the sea merely by standing and staring at the water"
Rabindranath Tagore

TEACHING INSTRUCTIONS

Period	**:**	**1 (40 Min)**
Type	**:**	**Theory**
Year	**:**	**Third**
Conducting Officer	**:**	**ANO**
Training Aids	**:**	**Blackboard, whiteboard, projector**

Time Plan

➢ **Introduction**	**:**	**05 Min**
➢ **Overview of Department**	**:**	**15 Min**
➢ **Career in Merchant Navy**	**:**	**15 Min**
➢ **Conclusion**	**:**	**05 Min**

INTRODUCTION

1. The Merchant Navy, also known as the Merchant Marine in some countries, is a vital part of global trade and transportation. Unlike military naval forces, the Merchant Navy operates commercial vessels that transport goods and passengers across international waters. With over 90% of the world's trade relying on maritime shipping, this industry plays a crucial role in economic development and global connectivity. The fleet includes container ships, bulk carriers, tankers, ferries, and cruise liners, each serving a specific function in the smooth operation of international trade.

2. A career in the Merchant Navy offers diverse opportunities across multiple departments, including Deck, Engineering, Catering, and specialized areas such as Electro-Technical, Medical, and Safety. Each department has a structured hierarchy that ensures the efficient operation of ships. Aspiring candidates must undergo rigorous training and obtain relevant certifications, with NCC cadets often receiving preference due to their discipline and maritime exposure. While life at sea offers adventure and international exposure, it also demands resilience, teamwork, and adaptability to overcome the unique challenges of working aboard a vessel for extended periods.

PREVIEW	**LEARNING OBJECTIVES**
➢ Part I: Role of Merchant Navy ➢ Part II: Structure and Departments of Merchant Navy ➢ Part III: Career Opportunities	➢ Understand the Basics of Merchant Navy. ➢ Structure and Departments of Merchant Navy. ➢ Career Opportunities in Merchant Navy for NCC cadets.

PART I: ROLE OF MERCHANT NAVY

3. The Merchant Navy refers to the fleet of commercial ships that are engaged in transporting goods and passengers across sea routes. Unlike military naval forces, the Merchant Navy operates for commercial purposes and plays a crucial role in global trade and economic development. The term is often synonymous with "Merchant Marine" in various countries.

4. **What Does the Merchant Navy Do ?** The primary function of the Merchant Navy is to facilitate international trade by transporting cargo and passengers. Over 90% of goods traded globally are transported by sea, making this sector vital for economies worldwide. Ships in the Merchant Navy include container ships, bulk carriers, tankers, ferries, and cruise ships. Each type of vessel serves specific functions:-

(a) **Container Ships**. Carry large quantities of cargo in containers.

(b) **Bulk Carriers**. Transport unpackaged bulk cargo such as grains or minerals.

(c) **Tankers**. Move liquid cargo like oil or chemicals.

(d) **Ferries**. Provide transport for passengers and vehicles over short distances.

(e) **Cruise Ships**. Offer leisure travel experiences for tourists.

DID YOU KNOW?
➢ **Ancient Merchant Ships**. The earliest known merchant ships date back to around 3,000 BCE in the Mediterranean. Ancient Egyptians, Phoenicians, and Greeks were pioneers in developing trading vessels for transporting goods. The Phoenicians, in particular, are known for their extensive trade networks across the Mediterranean, using their ships to transport valuable commodities like metals, wine, and textiles.
➢ **The Age of Sail and the Rise of Global Trade**: During the 15th to 18th centuries, the Age of Sail marked a significant development in merchant shipping. European powers like Portugal, Spain, and later Britain and the Netherlands, built large fleets of sailing ships that carried goods across vast oceans. These ships played a crucial role in establishing global trade routes, particularly for spices, tea, and sugar

PART II: STRUCTURE AND DEPARTMENTS OF MERCHANT NAVY

5. The Merchant Navy is a crucial part of the global maritime industry, primarily responsible for the transportation of goods and passengers across international waters. It

operates independently from military naval forces and plays a vital role in facilitating global trade. The structure of the Merchant Navy is organized into various departments, each with specific roles and responsibilities.

<u>Overview of Departments</u>

6. The positions on commercial ships are typically divided into three main departments:-

(a) Deck Department.

(b) Engineering Department.

(c) Catering Department.

7. Each department has its own hierarchy and ranks, which ensure efficient operation and management onboard vessels.

<u>Deck Department</u>

8. The Deck Department is responsible for navigation, cargo operations, and overall ship management. The ranking system within this department includes:

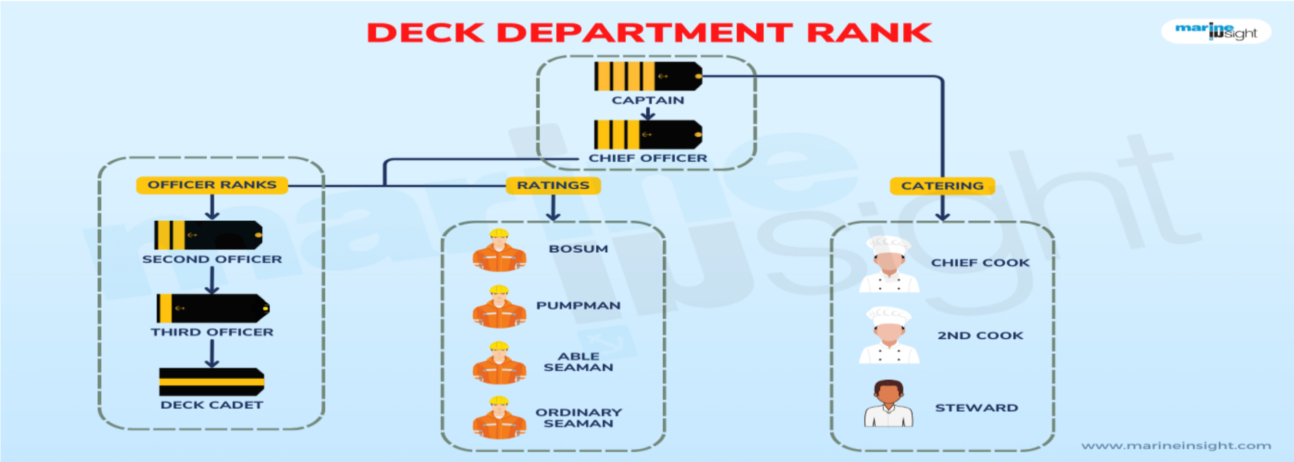
(a) **<u>Captain / Master</u>**. The highest authority on the ship, responsible for all operations.

(b) **<u>Chief Officer / Chief Mate</u>**. Assists the Captain in managing deck operations and safety.

(c) **<u>Second Officer / Second Mate</u>**. Responsible for navigation watch and medical duties.

(d) **<u>Third Officer / Third Mate</u>**. Oversees safety equipment and assists with navigation.

(e) **<u>Deck Cadet</u>**. A trainee learning about navigation and deck operations. Deck ratings include positions such as Bosun (head of deck crew), Able-Bodied Seaman (AB), Ordinary Seaman (OS), among others.



DID YOU KNOW?
➢ **The Industrial Revolution and Steamships**. In the 19th century, the invention of the steam engine revolutionized merchant shipping. Steamships, such as the famous RMS *Titanic* (1912), allowed for more reliable and faster transport of goods compared to traditional sailboats. This transition also led to the establishment of regular, scheduled shipping lines, making international trade more predictable.
➢ **The Introduction of Container Shipping**. The 20th century saw a breakthrough in cargo transport with the introduction of container shipping. In 1956, Malcolm McLean introduced the first containerized shipping system, drastically reducing shipping times and costs. The use of standardized containers allowed ships to carry diverse goods efficiently, leading to the massive growth of global trade.

Engineering Department

9. The Engineering Department manages the machinery that powers the vessel. Its hierarchy includes:

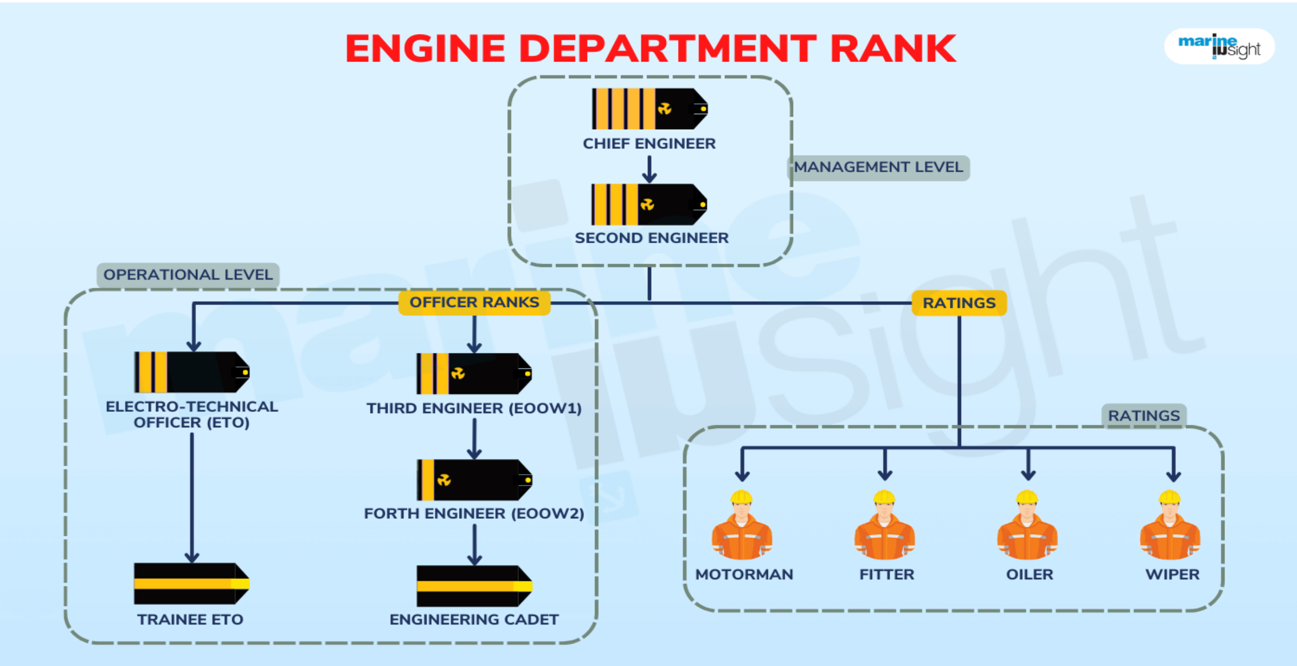
(a) **Chief Engineer**. Oversees all engineering operations and maintenance.

(b) **Second Engineer**. Manages daily engine room activities.

(c) **Third Engineer**. Assists in maintaining machinery systems.

(d) **Fourth Engineer**. Responsible for specific machinery under supervision.

10. Additionally, there are engine ratings like Fitter, Motorman, Wiper, etc., who assist in various mechanical tasks.



Catering

11. Catering branch focuses on food preparation and hospitality services onboard. The ranks include:-

(a) **Chief Cook**. Prepares meals for crew and passengers.

(b) **Trainee Cook**. Assists the Chief Cook in meal preparation.

(c) **Steward**. Manages dining services and living quarters maintenance.

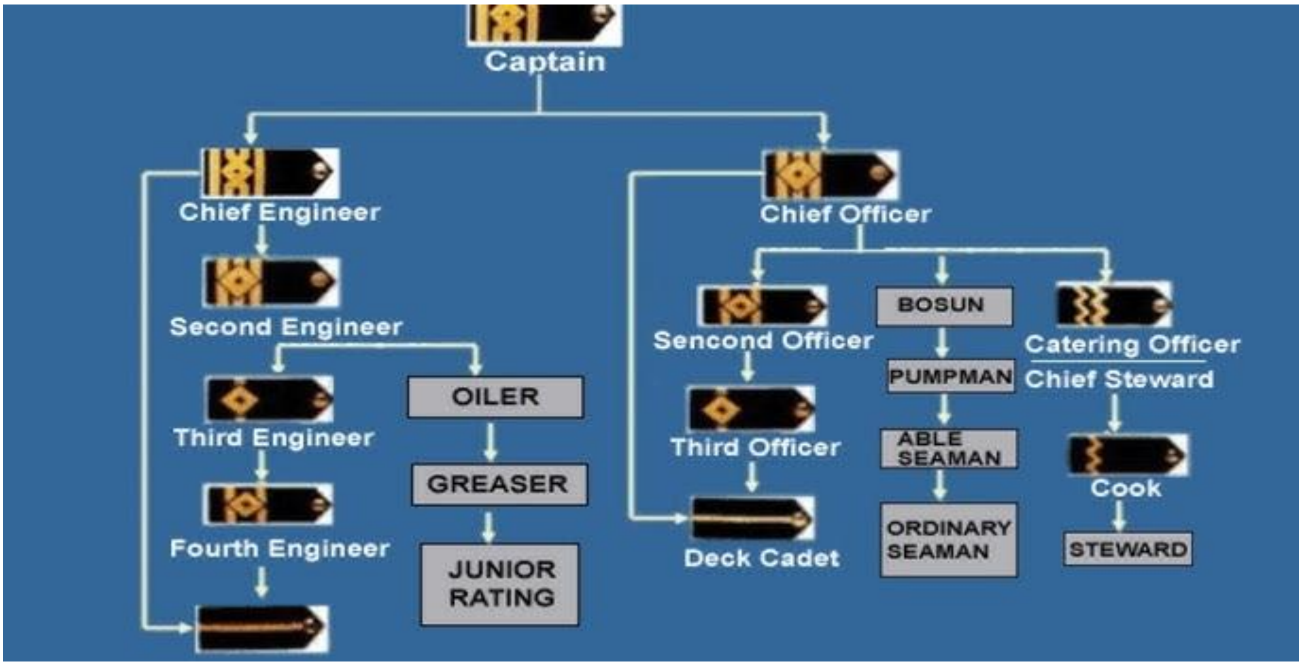
12. **Importance of Structure.** The structured hierarchy within these departments ensures that each member knows their responsibilities, contributing to the safe operation of maritime vessels. This organization is essential not only for operational efficiency but also for compliance with international maritime regulations.

13. The Merchant Navy's structure comprises three primary departments—Deck, Engineering, and Catering—each with its own ranks that facilitate smooth maritime operations.

PART III: CAREER OPPORTUNITIES IN THE MERCHANT NAVY

14. The Merchant Navy is a prestigious career option that involves working on commercial ships transporting goods and passengers worldwide. It offers high salaries, international exposure, and a structured career path.

15. Many aspiring candidates are interested in joining the Merchant Navy but may not be aware of the eligibility criteria, educational qualifications, and training requirements. This guide explains the step-by-step process to join the Merchant Navy and the different entry routes available.



Rank Structure in Merchant Navy

Eligibility Criteria to Join the Merchant Navy

16. To join the Merchant Navy, candidates must meet specific educational, medical, and physical requirements based on the role they are applying for.

17. **Educational Qualifications**. The minimum educational qualification depends on the department and job role:

Entry Level	Course Required	Eligibility Criteria
Deck Officers (Navigation)	B.Sc. Nautical Science (3 years) or Diploma in Nautical Science (DNS) (1 year)	10+2 with PCM (Physics, Chemistry, Mathematics) - Min 60% Marks, English - Min 50% Marks
Marine Engineers	B.Tech in Marine Engineering (4 years)	10+2 with PCM - Min 60% Marks, English - Min 50% Marks
Electro-Technical Officers (ETO)	Diploma/Degree in Electrical, Electronics, or Marine Engineering	10+2 with PCM - Min 60% Marks or Diploma/Degree
GP Rating (Crew Members, Seamen, Deck & Engine Crew)	General Purpose Rating (GP Rating) Course (6 months)	10th or 12th Pass with Min 40% Marks in English
Catering & Hospitality (Steward, Cook, etc.)	Maritime Catering Course (6 months)	10th Pass with Min 40% Marks in English

18. **Age Limit**.

(a) **Officer-level Courses**. 17-25 years.

(b) **GP Rating Course**. 17.5-25 years.

(c) **ETO Course**. Up to 35 years.

19. **Medical & Physical Standards**.

(a) **Vision Requirement**.

(i) **Deck Officers**. 6/6 vision without glasses, no color blindness.

(ii) **Engineering & Ratings**. 6/12 vision, color blindness not allowed.

(b) **Height & Weight**. Minimum height 157 cm, proportionate weight.

(c) **General Medical Condition**. Candidates must be physically fit with no major illnesses or disabilities.

(d) **Hearing Ability**. Normal hearing with no defects.

How to Join the Merchant Navy – Step-by-Step Process

20. **Choose Your Career Path**. The first step is to decide which department you want to join:

(a) Deck Department (Navigation Officers).

(b) Engine Department (Marine Engineers).

(c) Electrical Department (Electro-Technical Officers - ETOs).

(d) Ratings (Deck/Engine Crew, Seamen, Cooks, Stewards, etc.).

Appear for the Required Entrance Exams

21. Most officer-level roles require clearing an entrance exam. Some of the major exams include:-

Exam Name	Purpose
IMU CET (Indian Maritime University Common Entrance Test)	For B.Sc. Nautical Science, B.Tech Marine Engineering, DNS
JEE Advanced	For B.Tech Marine Engineering at IITs
Company Sponsorship Exams	Shipping companies like Anglo-Eastern, Maersk, and TORM conduct their own exams for sponsored training

Note. GP Rating candidates do not need to appear for entrance exams but must complete the required training.

Apply for Pre-Sea Training & Maritime Courses

22. Once you qualify, you need to enroll in a Directorate General of Shipping (DGS) approved training institute for a pre-sea course. Some of the top institutes in India include:-

(a) **Indian Maritime University (IMU)**. Chennai, Mumbai, Kolkata and Visakhapatnam.

(b) **Tolani Maritime Institute (TMI)**. Pune

(c) **Great Eastern Institute of Maritime Studies**. Mumbai

(d) **Anglo-Eastern Maritime Academy**. Karjat

(e) **Samundra Institute of Maritime Studies**. Lonavala

23. The pre-sea training duration varies by course:

(a) DNS (Diploma in Nautical Science) : 1 year

(b) B.Sc. Nautical Science / B.Tech Marine Engineering : 3-4 years

(c) ETO Course : 4-6 months

(d) GP Rating Course : 6 months

24. **<u>Complete Onboard Training (Sea Service)</u>**. After completing pre-sea training, cadets must undergo mandatory onboard training on a merchant vessel for:

(a) Deck Cadets & DNS Graduates : 12 months

(b) B.Tech Marine Engineers : 6-8 months

(c) ETO Officers : 4-6 months

(d) GP Ratings : 6-9 months

25. This sea service provides practical exposure and is necessary for further promotions and certifications.

26. **<u>Obtain Certifications & Licenses</u>**. After completing sea service, candidates must appear for the Certificate of Competency (CoC) Exams conducted by the Directorate General of Shipping (DGS) or the Maritime and Coastguard Agency (MCA).

(a) **<u>Deck Officers</u>**. Need to pass competency exams to become Third Officer → Second Officer → Chief Officer → Captain.

(b) **<u>Marine Engineers</u>**. Need competency exams to become Fourth Engineer → Third Engineer → Second Engineer → Chief Engineer.

(c) **<u>Ratings</u>**. Can appear for competency exams to get promoted to officers with experience and additional qualifications.

DID YOU KNOW?

➢ **Modern Shipping and Automation**. Today, merchant shipping includes some of the largest and most advanced vessels in the world. Modern container ships, such as the *Ever Given*, can carry up to 20,000 containers at a time. Automation and advanced navigation technologies have also significantly improved the safety, efficiency, and speed of cargo transport, with some ships now operating with minimal human crew onboard.

27. **<u>Other Mandatory Certifications</u>**.

(a) **<u>STCW (Standards of Training, Certification, and Watchkeeping)</u>**. Compulsory for all seafarers

(b) **Oil Tanker Familiarization Course**. Required for working on oil tankers

(c) **GMDSS (Global Maritime Distress and Safety System) Certificate**. Needed for radio officers

28. **Opportunities for NCC Cadets**. NCC cadets have several opportunities in the merchant navy, as their training instills discipline, leadership, and maritime skills, which are highly valued in this field. Here are the key opportunities.

29. **Entry Opportunities.**

(a) **Deck Cadet**. NCC cadets with a science background (preferably with Physics, Chemistry, and Mathematics) can apply for deck cadet training programs after completing their 10+2.

(b) **Engine Cadet/Junior Engineer**. Cadets with a mechanical or marine engineering degree can join the engine department after required certifications.

30. **Preference in Selection**. NCC cadets, especially "C" certificate holders, are often given preference during recruitment in merchant navy roles due to their familiarity with maritime practices and discipline.

31. **Specialized Roles**. Opportunities exist in navigation, logistics, and ship management, leveraging their NCC leadership training.

32. **Scholarships and Sponsored Training**. Merchant navy companies sponsor promising cadets for training programs, making it easier for NCC cadets to transition into maritime careers.

33. **Life at Sea**. Life aboard a merchant vessel is distinct from typical land-based jobs. Seafarers work long hours often divided into shifts and may spend several months at sea before returning home. While seafaring can be adventurous with opportunities to travel globally, it also involves challenges such as limited social interaction and harsh working conditions.

CONCLUSION

34. The Merchant Navy offers a dynamic and rewarding career path for individuals passionate about maritime operations and global trade. With structured departments and specialized roles, it provides opportunities for professionals in navigation, engineering, and hospitality. Aspiring candidates must meet specific educational and physical standards, undergo rigorous training, and obtain necessary certifications to ensure competency and safety at sea. Additionally, NCC cadets have a significant advantage in the selection process, benefiting from their leadership training and maritime exposure. The structured progression, coupled with international travel and financial stability, makes the Merchant Navy an attractive career choice.

35. Despite the benefits, life at sea comes with challenges, including long durations away from home, demanding work schedules, and the need for strong discipline and resilience. However, for those who are dedicated and adaptable, the Merchant Navy offers unparalleled experiences, professional growth, and the chance to be a part of the backbone of global trade. By following the right training pathways and obtaining the necessary qualifications, individuals can build a successful and fulfilling career in this vital industry.

SUMMARY

- **Global Trade Backbone**. The Merchant Navy is responsible for transporting about 90% of the world's goods by sea, including essential supplies like food, oil, and raw materials.
- **Diverse Fleet**. The Merchant Navy operates a wide range of vessels, including bulk carriers, oil tankers, container ships, and cargo vessels, each specialized for different types of cargo.
- **Largest Fleet Ownership**. The Panama-flagged ships make up the largest portion of the global merchant fleet, with many companies choosing the Panama flag for its tax and regulatory advantages.
- **Merchant Navy Crew**. Unlike naval forces, Merchant Navy crews often live aboard ships for months at a time while traveling between countries, creating a unique and adventurous lifestyle.
- **Safety at Sea.** Merchant Navy ships must adhere to strict international safety regulations, including the SOLAS (Safety of Life at Sea) convention, which ensures the safety of both the crew and the cargo.

SUGGESTED READ

Guide to the Merchant Navy: Entry, Conditions, Organisations- By CH Milsom

ASSESSMENT EXERCISE

Multiple Choice Questions

Q1. What is the primary function of the Merchant Navy?

(a) National defence
(b) Transporting cargo and passengers internationally
(c) Conducting naval warfare
(d) Exploring new sea routes

Q2. What percentage of global trade is transported via the Merchant Navy?

(a) 50%
(b) 70%
(c) 90%
(d) 100%

Q3. What is another term for the Merchant Navy in some countries?

(a) Naval Fleet
(b) Merchant Marine
(c) Maritime Defence
(d) Oceanic Transport

Q4. Which of the following is NOT a type of ship in the Merchant Navy?

(a) Container ship
(b) Bulk carrier
(c) Fighter jet carrier
(d) Cruise ship

Q5. Who is the highest-ranking officer in the Deck Department?

(a) Chief Officer
(b) Captain / Master
(c) Second Officer
(d) Third Officer

Q6. What is the primary responsibility of the Engineering Department?

(a) Cargo handling
(b) Ship maintenance and machinery operation
(c) Passenger management
(d) Navigation

Q7. What is the minimum educational qualification required for Deck Officers?

(a) 10th grade pass
(b) 10+2 with PCM (Physics, Chemistry, Mathematics)
(c) Any graduate degree
(d) MBA in Marine Logistics

Q8. Which department is responsible for food preparation and hospitality services?

(a) Deck Department
(b) Engineering Department
(c) Catering Department
(d) Navigation Department

Q9. What is the minimum eyesight requirement for Deck Officers?

(a) 6/12 vision with glasses
(b) 6/6 vision without glasses, no colour blindness
(c) 20/20 vision with glasses
(d) 6/9 vision with minor colour blindness

Q10. What is the age limit for joining officer-level courses in the Merchant Navy?

(a) 17-30 years
(b) 17-25 years
(c) 18-40 years
(d) 21-35 years

Q11. Which exam is required for entry into B.Sc. Nautical Science or B.Tech Marine Engineering?

(a) IMU CET
(b) UPSC
(c) NDA
(d) CAT

Q12. Which certification is compulsory for all seafarers?

(a) GMDSS
(b) Oil Tanker Familiarization
(c) STCW (Standards of Training, Certification, and Watchkeeping)
(d) HAZMAT Handling

Q13. Which country has the largest fleet ownership due to its favourable tax and regulatory advantages?

(a) USA
(b) Panama
(c) UK
(d) China

Q14. What advantage do NCC cadets have in the Merchant Navy selection process?

(a) They are given preference due to their discipline and maritime exposure
(b) They receive automatic admission without exams
(c) They only need a 10th-grade qualification
(d) They are trained as naval officers

Q15. What was a major breakthrough in cargo transport introduced in 1956?

(a) Steam engines
(b) Containerized Shipping
(c) GPS-based navigation
(d) Nuclear-powered ships

One-Word Answer Questions

Q1. What is the main purpose of the Merchant Navy?

Q2. Which department is responsible for managing the ship's engine room?

Q3. What type of ship is used primarily for transporting passengers?

Q4. Who holds the highest rank on a merchant ship?

Q5. Which type of vessel transports liquid cargo like oil or chemicals?

Short Answer Questions (1-2 sentences)

Q1. Describe the main function of the Engineering Department in the Merchant Navy.

Q2. What are two types of ships found in the Merchant Navy, and what are their purposes?

Q3. Why is the structured hierarchy important within the Merchant Navy departments?

Q4. How does the Deck Department contribute to the overall safety of a vessel?

Q5. What role does an Electro-Technical Officer (ETO) play on board?

Long Answer Questions (3-4 sentences)

Q1. Explain the primary responsibilities of the Captain and Chief Engineer on a merchant vessel.

Q2. Describe the training qualifications necessary to join the Deck and Engineering Departments.

Q3. What challenges do seafarers typically face in their careers within the Merchant Navy?

Q4. How do merchant ships contribute to global trade, and why is this role significant?

Q5. Discuss the career opportunities available in the Merchant Navy and the qualifications needed for entry.

ANSWER KEY

ANSWER KEY – MULTIPLE CHOICE QUESTIONS

NO 1- INTRODUCTION TO INDIAN ARMED FORCES

Q No	Answer	
1	(b)	President of India
2	(b)	Ministry of Defence
3	(c)	Ensuring national security and unity
4	(c)	General Bipin Rawat
5	(c)	6
6	(b)	Providing logistics, supply, and transportation
7	(c)	Corps of Signals
8	(d)	New Delhi
9	(a)	INS Vikrant
10	(c)	Southern Naval Command
11	(b)	1932
12	(a)	Securing Indian airspace
13	(c)	MiG-29
14	(a)	UN Peacekeeping missions
15	(a)	SPYDER

NO 2- HISTORY AND GROWTH OF INDIAN NAVY

Q No.	Answer	
1	(b)	January 26, 1950
2	(c)	Harappan Civilization
3	(b)	Niarchus
4	(b)	Chola Empire
5	(a)	Bombay Marine
6	(b)	Royal Indian Navy Revolt
7	(c)	1961
8	(b)	Operation Trident
9	(b)	Mazagon Dockyard
10	(c)	Head of the Indian Navy
11	(d)	Mumbai
12	(a)	Eastern Fleet
13	(d)	200 NM
14	(d)	Indian Navy
15	(c)	INS Vikrant and INS Vikramaditya

NO 3- TYPES OF WARSHIPS AND THEIR ROLE & ORGANISATION ON BOARD SHIPS AND VARIOUS BRANCHES IN NAVY

Q No.	Answer	
1	(c)	Aircraft Carriers
2	(b)	Escorting larger vessels and engaging threats
3	(b)	Corvettes
4	(c)	Arihant-class
5	(c)	Anti-piracy operations and patrolling
6	(a)	Detecting and neutralizing naval mines
7	(c)	Navigation and Direction (ND)
8	(b)	Assisting the CO in administrative and operational tasks
9	(b)	Maintain propulsion and mechanical systems
10	(b)	Three
11	(b)	Engine Room Watch
12	(b)	Firefighting and damage control onboard
13	(b)	Conducting short-range attacks and patrolling coastal areas
14	(b)	Mustering the ship's company
15	(b)	Amphibious Ships

NO 4-INTRODUCTION TO ASW, SURFACE WARFARE AND FLEET OPS

Q No.	Answer	
1	(b)	Anti-Submarine Warfare, Surface Warfare, Fleet Operations
2	(b)	Detecting, tracking, and neutralizing enemy submarines
3	(a)	Sonar
4	(a)	Active sonar emits sound pulses, while passive sonar listens for sounds
5	(d)	Surface-to-air missiles
6	(b)	By deploying sonobuoys and conducting aerial surveillance
7	(a)	Engaging and destroying enemy ships
8	(b)	Destroyers, frigates, and corvettes
9	(b)	Anti-ship missiles, anti-air missiles, and naval guns
10	(a)	It enables naval forces to control surface waters and secure sea lanes
11	(a)	To conduct coordinated manoeuvres involving multiple ships, aircraft, and submarines
12	(b)	A combination of aircraft carriers, destroyers, frigates, submarines, and support vessels
13	(b)	Precise coordination through communication systems and real-time intelligence sharing
14	(d)	Land-based missile deployment
15	(a)	They help secure India's waters and support broader defence and diplomatic goals

NO 5 – TYPES OF NAVAL AIRCRAFTS, SUBMARINES, AND ROLES

Q No	Description	
1	(b)	Enhancing operational reach, flexibility, and effectiveness
2	(b)	Conducting prolonged reconnaissance missions
3	(b)	Through their ability to hover and operate at lower speeds
4	(b)	They have longer endurance for prolonged reconnaissance missions
5	(b)	Sonobuoys and magnetic anomaly detectors
6	(a)	By deploying sonobuoys and torpedoes
7	(b)	Providing early detection of threats
8	(c)	Naval helicopters
9	(b)	Delivering emergency supplies and evacuating civilians
10	(a)	By transporting personnel, equipment, and supplies
11	(a)	Conducting air-to-surface and air-to-air strikes
12	(b)	They can remain submerged for extended periods without surfacing
13	(c)	Ballistic Missile Submarines (SSBNs)
14	(a)	By using torpedoes and missiles to target enemy vessels
15	(a)	Their ability to conduct stealth operations

NO 6 – CUSTOMS AND TRADITIONS OF THE INDIAN NAVY

Q.No	Answer	
1	(b)	The ship has been officially commissioned into service
2	(c)	0800 hrs
3	(b)	It is conducted when a ship crosses the Equator
4	(c)	When a Flag Officer boards a ship
5	(c)	By piping the still
6	(b)	The National Flag and Naval Ensign are lowered
7	(b)	On special occasions like Independence Day and Navy Day
8	(c)	Ensures security and ceremonial protocol
9	(b)	The ship’s bell is rung eight times at 0001 hrs
10	(b)	To symbolize the ship’s identity and heritage
11	(d)	President of India
12	(b)	Senior-most enters last and leaves first

NO 7 – HONOURS, AWARDS, AND RANK STRUCTURE IN ARMED FORCES

Q.No	Answer	
1	(b)	Param Vir Chakra
2	(c)	Conspicuous gallantry in the face of the enemy
3	(d)	Ashoka Chakra
4	(d)	Kirti Chakra
5	(c)	Shaurya Chakra
6	(b)	Major Somnath Sharma
7	(c)	Distinguished service of a high order
8	(c)	Chief of Defence Staff Commendation Card
9	(a)	Two
10	(c)	Raksha Mantri Medal
11	(a)	Unit, Group, Directorate, and National
12	(a)	Flying Officer Nirmal Jit Singh Sekhon
13	(b)	NCC cadets, ANOs, GCIs, and civilian employees
14	(c)	Victoria Cross
15	(b)	Governor’s Medal

NO 8 – MODE OF ENTRY INTO INDIAN NAVY

Q.No	Answer	
1	(b)	Honour, courage, and commitment
2	(a)	Permanent Commission and Short Service Commission
3	(c)	Combined Defence Services Examination (CDSE)
4	(c)	Civil Services
5	(c)	70%
6	(b)	INS Chilka
7	(a)	Serving food and handling mess accounts
8	(b)	Indian Navy Entry Test
9	(d)	Master’s degree in Mathematics
10	(b)	IHQ MoD (Army)/ ADG (Recruiting)
11	(b)	To recruit officers for Permanent and Short Service Commissions
12	(b)	10 years (extendable)
13	(b)	Conducting personality and intelligence assessments
14	(a)	Senior Division NCC ‘C’ certificate with B.E./B.Tech degree
15	(b)	Clearing medical examination and merit list placement

NC 1- INTRODUCTION TO NAVAL COMMUNICATION

Q No	Answer	
1.	(b)	To facilitate seamless coordination and execution of commands
2.	(c)	Signal Communication Officer (SCO)
3.	(d)	Morse Code only
4.	(c)	Telephone by Alexander Graham Bell
5.	(a)	To minimize risk of miscommunication during operations
6.	(c)	Laser-guided torpedoes
7.	(b)	Providing advanced satellite communication systems
8.	(c)	HF (High Frequency) radios
9.	(b)	To transmit and receive radio signals
10.	(a)	Real-time and global communication capabilities
11.	(b)	Mechanical waves
12.	(c)	Long-distance radio transmission using the ionosphere
13.	(d)	Intercepting and countering enemy transmissions
14.	(b)	Tactical communication and associated equipment
15.	(c)	Special Branch

NC 2- SEMAPHORE, RADIO TELEPHONY AND PHONETIC ALPHABETS

Q No	Answer	
1.	(c)	Rapid short-distance messaging during daylight
2.	(b)	E (successive E's)
3.	(a)	Break
4.	(d)	Numerals
5.	(a)	Bravo
6.	(b)	To avoid misinterpretation of similar-sounding letters
7.	(d)	TQ
8.	(b)	End of transmission
9.	(c)	VHF and UHF
10.	(b)	"Say Again"
11.	(c)	Space wave
12.	(b)	"Vikrant out"
13.	(b)	Transmitting voice messages in real time
14.	(c)	Wait
15.	(b)	Outdoor semaphore practice

N 1- INTRODUCTION TO SHIP NAVIGATION

Q No	Answer	
1.	(b)	To guide ships safely and efficiently from one location to another
2.	(b)	A circle passing through the centre of the Earth
3.	(c)	Celestial Navigation
4.	(b)	Latitude
5.	(c)	Prime Meridian
6.	(b)	1,852 meters
7.	(c)	Knots
8.	(b)	Dead Reckoning
9.	(b)	Pilotage
10.	(b)	It provides highly accurate real-time positioning
11.	(b)	Sextant
12.	(d)	Dead Reckoning
13.	(b)	It is the reference point for measuring longitude
14.	(c)	A unit of speed equal to one nautical mile per hour
15.	(a)	They are not affected by electronic failures

N 2- INTRODUCTION TO SIMPLE CHART WORK

Q No	Answer	
1.	(c)	To assist in safe maritime navigation
2.	(a)	Distorting distances while preserving directions
3.	(b)	Great circles
4.	(b)	It distorts areas away from the centre
5.	(b)	Long-distance voyage planning
6.	(c)	Navigating within a harbour
7.	(c)	The effects of wind, tide, and current
8.	(b)	The ship’s actual path
9.	(c)	Emergency navigation in lifeboats
10.	(b)	Ocean Sounding Chart
11.	(a)	It shows variations in Earth’s magnetic field
12.	(a)	It provides details of ocean currents and prevailing winds
13.	(c)	A unique identification number for reference
14.	(b)	They provide a backup navigation method if electronic systems fail
15.	(b)	To improve their ability to navigate and fix ship positions accurately

N 3- ELECTRONIC AIDS FOR NAVIGATION

Q No	Answer	
1.	(b)	To ensure the vessel's safe and efficient operation at sea
2.	(d)	Windmill
3.	(a)	Global Positioning System
4.	(b)	By detecting and tracking objects in the vicinity
5.	(b)	Sextant
6.	(b)	Determining water depth
7.	(c)	Sextant
8.	(b)	True north
9.	(b)	Automatic Identification System
10.	(a)	Displaying real-time electronic charts
11.	(c)	Electromagnetic log
12.	(b)	It finds true north and is not affected by magnetic fields
13.	(c)	AIS
14.	(a)	Passive sonar
15.	(a)	They ensure safer and more efficient maritime operations

N 4- INTRODUCTION TO TIDES

Q No	Answer	
1.	(b)	Gravitational pull of the Moon and the Sun
2.	(c)	High water
3.	(c)	Bay of Fundy
4.	(b)	Two high tides and two low tides
5.	(b)	Allows access to areas that may be too shallow at low tide
6.	(b)	Tidal range
7.	(c)	Slack water
8.	(c)	The lowest predictable tide level at a given location
9.	(c)	During full moon and new moon phases
10.	(a)	Tidal stream
11.	(b)	A reference point for measuring tides
12.	(a)	To avoid running aground in shallow waters
13.	(c)	They become weaker
14.	(b)	Differential heating of land and water
15.	(c)	Measuring wind speed based on observed effects

N 5- INTRODUCTION TO ASTRONAVIGATION

Q No	Answer	
1.	(b)	To determine a ship's position at sea using celestial bodies
2.	(b)	The sun
3.	(c)	Sextant
4.	(d)	Polaris
5.	(b)	The positions of celestial bodies at specific times
6.	(b)	To determine longitude by providing accurate time readings
7.	(c)	It helps determine latitude and longitude through angle measurements
8.	(c)	Greenwich Mean Time (GMT)
9.	(c)	John Harrison
10.	(b)	It does not rely on electronic systems and remains functional in case of GPS failure
11.	(a)	The angle between the sun and the horizon
12.	(c)	It records the exact time difference between local noon and GMT
13.	(c)	Compass
14.	(b)	It is used to determine longitude by comparing the moon's position to stars
15.	(b)	Because GPS signals can be disrupted or unavailable

SS 1- RIGGING AND TYPES OF ROPES

Q No	Answer	
1.	(b)	Natural fibre, Manmade fibre, and Steel wire
2.	(c)	Manila
3.	(b)	They absorb water and rot easily
4.	(c)	Polyamide (Nylon)
5.	(c)	Heavy-duty lifting and towing
6.	(c)	$BS = d^2/200$
7.	(b)	To prevent the rope from fraying
8.	(d)	Polypropylene
9.	(b)	Regular inspections
10.	(b)	A simple loop or curve in a rope without crossing over itself
11.	(d)	To join two ropes together
12.	(c)	A distortion in rope strands due to back twisting
13.	(c)	Abacá plant fibres
14.	(c)	They have higher tensile strength and durability
15.	(c)	They can rot and weaken

SS 2- BENDS AND HITCHES

Q No	Answer	
1.	(c)	To join two ropes together
2.	(c)	Clove Hitch
3.	(c)	To withstand tension and environmental factors
4.	(c)	Bowline
5.	(c)	It secures a rope to an object
6.	(c)	Rolling Hitch
7.	(b)	Round Turn
8.	(c)	Rolling Hitch
9.	(b)	To act as a stopper knot
10.	(c)	Reef Knot
11.	(b)	A U-shaped curve in a rope without crossing the ends
12.	(b)	Enhancing the appearance of ropes
13.	(b)	Securing a rope to an object under heavy load
14.	(c)	Timber Hitch
15.	(c)	Bowline on the Bight

SS 3- INTRODUCTION TO SHACKLES AND BLOCKS

Q No	Answer	
1.	(b)	To connect rigging components securely
2.	(c)	Double Shackle
3.	(b)	It provides a secure and tamper-resistant fastening
4.	(b)	A forelock clip
5.	(a)	Clenched Shackle
6.	(b)	It has an offset or stepped body
7.	(c)	Release Hook
8.	(b)	To provide a mechanical advantage in lifting
9.	(c)	Composite materials
10.	(b)	They offer high load-bearing capacity
11.	(c)	Smooth surface and low friction
12.	(c)	To lift or move heavy loads with reduced force
13.	(c)	To ensure durability in harsh marine environments
14.	(c)	RFD Automatic Release Hook
15.	(b)	They originated in ancient Greece and improved lifting efficiency

SS 4- PARTS OF ANCHOR AND CABLE

Q No	Answer	
1.	(b)	To prevent a ship from drifting
2.	(c)	Anchor ring
3.	(b)	To dig into the seabed for grip
4.	(c)	CQR (Chatham Quick Release) Anchor
5.	(b)	The main anchor used to secure a ship
6.	(b)	Admiralty Standard Stockless Anchor
7.	(b)	27.5 meters
8.	(a)	Shank
9.	(b)	To prevent kinking and twisting
10.	(a)	To join different types or sizes of cables
11.	(c)	By painting links and using seizing wire
12.	(c)	As a stern anchor on some ships
13.	(b)	Studded chain
14.	(c)	Danforth Anchor
15.	(b)	It helped the flukes dig into the seabed more effectively

SS 5- PURPOSE OF ANCHOR AND HOLDING GROUND

Q No	Answer	
1.	(b)	To secure a ship in a fixed position
2.	(c)	By gripping the seabed and preventing drifting
3.	(c)	Ship's colour
4.	(a)	It acts as a spring to absorb tension
5.	(d)	Firm sand
6.	(b)	The anchor may slip or fail to grip
7.	(c)	The strain comes on the cable
8.	(b)	Danforth anchor
9.	(b)	It prevents the ship from drifting off course
10.	(b)	The type of seabed where an anchor grips
11.	(d)	Artificial holding ground
12.	(b)	The flukes tilt and dig into the seabed
13.	(b)	They offer higher strength and resistance to corrosion
14.	(a)	Heavier anchors sink deeper and hold better in rough conditions
15.	(b)	It allows the flukes to tilt and dig into the seabed

WS 1- PARTS OF BOAT

Q No	Answer	
1.	(c)	Used for training, transportation, and rescue operations
2.	(a)	Providing stability by running along the bottom of the boat
3.	(b)	Rudder
4.	(a)	To provide structural support along the upper edge of the boat's sides
5.	(c)	The rear part of the boat
6.	(c)	To hold the oars in place while rowing
7.	(b)	Blade
8.	(b)	To prevent the oar from slipping through the oarlock
9.	(c)	Give Way Together
10.	(b)	Hold Water
11.	(a)	To place the oars in the crutches, preparing to row
12.	(b)	Pull with reduced force to slow the boat
13.	(b)	Back Together
14.	(b)	Steering and guiding the crew
15.	(c)	To ensure they can safely and effectively operate a boat

WS 2- RIGGING OF SAILS AND PARTS OF SAILS

Q No	Answer	
1.	(c)	Clipper ships
2.	(b)	To provide stability and reduce sideways drift
3.	(c)	Top corner
4.	(b)	To allow shortening of the sail in strong winds
5.	(b)	Leech
6.	(b)	Hoisting and lowering the sail
7.	(c)	To control the downward force of the boom
8.	(c)	Jib
9.	(a)	Providing lateral support to the mast
10.	(b)	To control the direction of the boat
11.	(b)	Support the boom when the sail is lowered
12.	(b)	It overlaps the mainsail
13.	(c)	Running rigging controls the sails, while standing rigging supports the mast
14.	(b)	Tack
15.	(a)	They use wind power instead of fuel

WS 3- ELEMENTARY SAILING- ENTERPRISE CLASS

Q No	Answer	
1.	(c)	It is stable, easy to handle, and adaptable to various wind conditions.
2.	(a)	A mainsail and a jib.
3.	(b)	It fosters discipline, teamwork, and problem-solving skills.
4.	(b)	A process of turning the bow through the wind to change direction.
5.	(a)	Turning the stern through the wind, often used when sailing downwind.
6.	(c)	Sailing with the sails pulled in close to the boat centreline.
7.	(b)	To ensure safe and orderly navigation of boats.
8.	(b)	A boat on a starboard tack.
9.	(c)	It ensures safety in case of accidents or falling overboard.
10.	(a)	Prepare to tack.
11.	(b)	Gybing.
12.	(a)	To ensure smooth coordination and precise execution of commands.
13.	(c)	"Prepare to Fly."
14.	(b)	To develop foundational sailing skills and understand basic manoeuvres.
15.	(a)	It prepares them for advanced sailing challenges.

WS 5- INTRODUCTION TO POWER BOATS

Q No	Answer	
1.	(b)	Safety and support vessel
2.	(b)	Experienced personnel
3.	(c)	Farming activities
4.	(b)	Better weight distribution and stability
5.	(c)	The engine is mounted externally at the stern
6.	(b)	They have excellent stability and speed
7.	(b)	Gemini Crafts
8.	(c)	Glass Reinforced Plastic (Fiberglass)
9.	(b)	To prevent the engine from overheating
10.	(a)	To reduce friction and prevent engine wear
11.	(b)	To verify safety and seaworthiness
12.	(b)	Identify the problem and attempt repairs or seek assistance
13.	(b)	Life jackets, fire extinguisher, and first aid kit
14.	(b)	To ensure coordinated manoeuvres and emergency response
15.	(b)	To prevent collisions and maintain control

SM 1- PARTS OF SHIPS AND PRINCIPLES OF SHIP MODELLING

Q No	Answer	
1.	(b)	Improves knowledge of ship mechanics and naval architecture
2.	(c)	Ensuring buoyancy and stability
3.	(b)	Keel
4.	(c)	Rear
5.	(b)	Providing thrust for movement
6.	(c)	Rudder
7.	(b)	Bridge, living quarters, and control rooms
8.	(b)	It keeps the ship stationary by preventing drifting
9.	(b)	It helped in naval warfare strategies and ship design development
10.	(b)	Greeks, Egyptians, and Phoenicians
11.	(c)	Constructing models to accurate scale and dimensions
12.	(b)	To understand the ship's structure, components, and assembly
13.	(d)	Concrete
14.	(b)	Profile View
15.	(b)	By introducing CAD software for accurate design and testing

SM 2- TYPES OF MODELS

Q No	Answer	
1.	(c)	Understanding naval operations and design
2.	(c)	Static Model
3.	(b)	They emphasize structure and detailing
4.	(b)	Working Model
5.	(b)	They simulate real-world naval operations
6.	(b)	Wind-powered navigation and rudder control
7.	(c)	Working models can operate in water
8.	(a)	Concept Model
9.	(c)	Sailing Model
10.	(b)	Only the visible part of a ship above the water
11.	(b)	Working Model
12.	(c)	They are primarily built for display
13.	(a)	It helps in naval engineering knowledge
14.	(c)	To serve as educational tools for ship recognition
15.	(c)	Working Model

SM 3- CALCULATION OF SAIL AREA

Q No	Answer	
1.	(b)	To capture wind for propulsion
2.	(a)	It helps them design efficient models
3.	(b)	To provide primary propulsion
4.	(b)	Forward of the mast
5.	(b)	Spinnaker
6.	(a)	Sail Area = (Luff Length × Foot Length) / 2
7.	(c)	The length along the mast
8.	(b)	To maintain stability and prevent tipping
9.	(b)	The model's size and weight
10.	(a)	It increases speed
11.	(a)	It helps in optimizing performance
12.	(c)	Balancing sail area with wind conditions
13.	(b)	It becomes unstable and may tip over
14.	(a)	It determines how well the model moves in different wind conditions
15.	(b)	Improving downwind speed

SM 4- SHIP MODELLING COMPETITION

Q No	Answer	
1.	(b)	To test cadets' knowledge, skill, and creativity in naval architecture
2.	(a)	Local, state, and national levels
3.	(b)	Nau Sainik Camp
4.	(b)	To develop skills in naval craftsmanship and engineering
5.	(b)	Static Model Competition
6.	(c)	Models must be operational and able to float and navigate
7.	(a)	Speed and manoeuvrability
8.	(c)	Accuracy
9.	(b)	The model's ability to move in a straight line with minimal deviation
10.	(d)	By measuring the smallest turning radius
11.	(a)	It ensures the model is visually appealing and structurally sound
12.	(a)	Learning practical engineering and naval architecture skills
13.	(b)	By requiring cadets to build models in groups, fostering coordination
14.	(a)	It helps cadets develop and showcase their skills in a competitive environment
15.	(c)	Practicing high-speed swimming

SM 5- CARE AND MAINTENANCE OF TOOLS

Q No	Answer	
1.	(b)	It ensures accuracy, efficiency, and safety in model building
2.	(b)	It ensures precise cuts and reduces the risk of accidents
3.	(b)	Placed in a safe, dry place with blade covers or a toolbox
4.	(c)	Acetone or a mild solvent
5.	(c)	To prevent drying out and maintain bonding effectiveness
6.	(b)	Placed in a dry place, flat or in a folder
7.	(b)	Cleaning immediately with water for water-based paints or solvent for oil-based paints
8.	(c)	It ensures smooth operation and reduces wear
9.	(c)	Wiping tools dry and using silica gel packs to reduce humidity
10.	(b)	To prevent misplacement and damage
11.	(a)	Wearing gloves and eye protection
12.	(a)	To prevent injury and misuse
13.	(a)	It ensures early identification of damage and prevents performance issues
14.	(b)	It reduces the need for frequent replacements
15.	(a)	It ensures sharp cuts, smooth finishes, and accurate detailing

SM 6- REPAIRING AND STABILISING OF SHIP MODELS

Q No	Answer	
1.	(b)	To ensure longevity and structural integrity
2.	(d)	Increased speed
3.	(b)	Super glue
4.	(c)	To provide a strong and durable bond for structural repairs
5.	(c)	Sand the area smoothly before painting
6.	(a)	Pinning method
7.	(b)	To ensure better paint adhesion
8.	(b)	To adjust balance and stability
9.	(c)	Evenly along the hull
10.	(b)	To reinforce fragile sections and increase durability
11.	(b)	Wax or removable putty
12.	(b)	To prevent damage to delicate parts
13.	(b)	Wrapping it in soft padding or foam
14.	(a)	To protect against shifting and damage
15.	(b)	It prevents environmental damage such as moisture and dust buildup

SM 7- HANDLING AND OPERATION OF REMOTE-CONTROL MODELS

Q No	Answer	
1.	(b)	To provide hands-on experience in ship handling and navigation
2.	(c)	Transmitter
3.	(c)	Receives commands from the transmitter and directs responses
4.	(b)	To ensure consistent performance and longer operational time
5.	(a)	They control directional movements such as rudder adjustments
6.	(b)	Checking and charging the battery
7.	(a)	To verify control responsiveness over a distance
8.	(c)	By using a trigger or joystick to control speed
9.	(b)	Operating both together for smooth navigation and manoeuvring
10.	(b)	To ensure stable navigation and minimize external disturbances
11.	(b)	Maintaining a clear line of sight while operating
12.	(a)	It prevents overheating of the motor and battery drainage
13.	(b)	To enhance control and familiarity with directional changes
14.	(b)	Drying and cleaning the model to prevent corrosion
15.	(b)	In a cool, dry place to extend battery life

DC 1- FIRE FIGHTING

Q No	Answer	
1.	(b)	To effectively prevent and respond to fire incidents
2.	(c)	Safe storage of flammable materials
3.	(b)	To minimize fire hazards and prevent fire incidents
4.	(a)	Class A
5.	(b)	Class B
6.	(c)	Class C
7.	(c)	Cooling
8.	(a)	Removing the fuel source
9.	(c)	By cutting off oxygen supply using fire blankets
10.	(c)	CO_2 extinguisher
11.	(a)	Alert others and evacuate
12.	(a)	To block smoke and contain fire spread
13.	(b)	Protects against extreme heat and flames
14.	(b)	Protects firefighters from smoke and toxic gases
15.	(c)	To ensure preparedness and safe evacuation during emergencies

DC 2- FLOODING AND DAMAGE CONTROL

Q No	Answer	
1.	(b)	To ensure the ship's survivability by containing damage and flooding
2.	(c)	Routine maintenance
3.	(b)	Establishing flooding boundaries quickly
4.	(c)	The area near the source of damage, experiencing complete destruction
5.	(b)	It is adjacent to the primary zone and may experience slow, progressive flooding
6.	(a)	By causing shock waves leading to structural damage and fires
7.	(b)	To prevent water from spreading to other compartments
8.	(c)	Radar systems
9.	(a)	Areas at high risk of flooding
10.	(c)	Openings that pose an immediate flooding risk
11.	(b)	To regulate the opening and closing of doors and hatches under specific conditions
12.	(c)	Zulu
13.	(b)	It isolates flooding to maintain ship stability
14.	(a)	The impact of open water movement in flooded compartments reducing stability
15.	(b)	To ensure preparedness and quick response in emergencies

MN 1- INTRODUCTION TO BASICS OF MERCHANT NAVY

Q No	Answer	
1.	(b)	Transporting cargo and passengers internationally
2.	(c)	90%
3.	(b)	Merchant Marine
4.	(c)	Fighter jet carrier
5.	(b)	Captain / Master
6.	(b)	Ship maintenance and machinery operation
7.	(b)	10+2 with PCM (Physics, Chemistry, Mathematics)
8.	(c)	Catering Department
9.	(b)	6/6 vision without glasses, no colour blindness
10.	(b)	17–25 years
11.	(a)	IMU CET
12.	(c)	STCW (Standards of Training, Certification, and Watchkeeping)
13.	(b)	Panama
14.	(a)	They are given preference due to their discipline and maritime exposure
15.	(b)	Containerized shipping

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