

NCC CADET HANDBOOK

NAVY

SPECIALISED SUBJECT

SD/ SW

INDEX			
CHAPTER-I NAVAL ORIENTATION		Period	Pg No.
Section - 1	History of the Indian Navy	2	4 - 6
Section - 2	Organisation of Navy - NHQ, Commands, Ships & Shore Establishment	2	7 - 13
Section - 3	Types of Warships and their roles	2	14 - 17
Section - 4	Organisation of Ships	2	18 - 20
Section - 5	Organisation of Army & Air Force	1	21 - 24
Section - 6	Naval Customs and Traditions	1	25 - 27
Section - 7	Ranks of Officers and Sailors, Equivalent Ranks	1	28 - 30
Section - 8	Mode of entry into Indian Navy	1	31 - 43
Section - 9	Branches of the Navy and their functions	1	44 - 46
Section - 10	Role of IN INDO PAK war – 1971 & Kargil War	2	47 - 51
Section - 11	Naval Campaign (Pearl Harbour, Falkland war, Battle of Atlantic/ Fleet PFR, IFR	1	52 - 56
CHAPTER-II NAVAL WARFARE AND ITS COMPONENTS (NW)			
Section - 1	Introduction to Anti-Submarine Warfare & Fleet Operation	2	58 - 63
Section - 2	Role of Aviation – Naval Aircrafts & Helicopters	2	64 - 65
Section - 3	Types of Submarine and its role ASW Weapon & sensor	1	66 - 71
Section - 4	Elementary knowledge of Gunnery & Missile	2	72 - 79
CHAPTER-III NAVAL COMMUNICATION			
Section - 1	Introduction to Naval Modern Communication	2	81 - 83
Section - 2	Semaphore	3	84 - 86
Section - 3	Phonetic Alphabets	1	87 - 88
Section - 4	Radio Telephony Procedure	1	89 - 90
Section - 5	Wearing National Flag, Ensign and Admiral's Flag	1	91 - 93
CHAPTER-IV NAVIGATION			
Section - 1	Navigation of ship – Basic Requirements	2	95 - 97
Section - 2	Types of Compass	1	98 - 100
Section - 3	Chart Work	1	101 - 104
Section - 4	Electronic aids for navigation	2	105 - 107
Section - 5	Tides	1	108 - 110
Section - 6	Clouds	1	111 - 112
Section - 7	Introduction to astronomy	1	113 - 114
CHAPTER-V SEAMANSHIP			
Section - 1	Anchorwork – Parts of anchor and cable	1	116 - 117
Section - 2	Anchorwork - Purpose of anchor and holding ground	1	118 - 119
Section - 3	Rigging – Types of ropes	1	120 - 122
Section - 4	Rigging – Bends and Hitches	1	123 - 124
Section - 5	Rigging – Introduction to Shackles	1	125 - 127
Section - 6	Boatwork – Parts of Boat	1	128 - 129
Section - 7	Boatwork – Boat Pulling Instruction	1	130 - 132

Section - 8	Boatwork - Steering of Boat	2	133 - 133
Section - 9	Boatwork – Rigging of sails in boats	2	134 - 135
Section - 10	Boatwork – Enterprise class boat, Elementary Sailing	2	136 - 138
Section - 11	Boatwork – Whaler Sailing Instructions	1	139 - 139
Section - 12	Boatwork – Power Boats	1	140 - 142
CHAPTER-VI FIRE FIGHTING FLOODING & DAMAGE CONTROL			
Section - 1	Types of Fire, Extinguishers, Fire Fighting	2	144 - 152
Section - 2	Causes of damage, flooding and damage control	2	153 - 155
CHAPTER – VII SHIP AND BOAT MODELLING			
Section - 1	Principal of Ship Modeling	1	157 - 160
Section - 2	Maintenance and Care of Tools	1	161 - 163
Section - 3	Types of Models	1	164 - 165
Section - 4	Calculation of sail area of a model	2	166 - 168
Section - 5	Introduction to ship model competition	1	169 - 171
Section - 6	Care and handling of power tools used	1	172 - 173
Section - 7	Repairing and stabilizing of Ship Models	1	174 - 177
Section - 8	Handling and operation of remote control models	2	178 - 179
Section - 9	Practical Training	9	180 - 180
CHAPTER – VIII SEARCH AND RESCUE			
Section - 1	SAR organization in the Indian Ocean	1	182 - 183
Section - 2	Role of Indian Coast Guard	1	184 - 186
CHAPTER – IX SWIMMING			
Section - 1	Swimming – Floating and Breathing techniques	3	188 - 191
Section - 2	Swimming – Floatation for 3 Mins and Swimming for 50 Mtr	6	192 - 192

CHAPTER - I

NAVAL ORIENTATION

SECTION-1(SD/SW)

HISTORY OF THE INDIAN NAVY

Period	-	02
Type	-	LEC
Term	-	1

Training Aids

1. Blackboard, chalk, White board, Marker, Pointer & Projector

Time Plan

2.	(a)	Introduction	-	05 min
	(b)	Early History/ Goa Operations	-	10 min
	(c)	Indo Pak War / Post war till date	-	20 min
	(d)	Conclusion	-	05 Mins

				40 Mins

3. **Introduction.** On 26 January 1950 when India became a Republic , the Royal Indian Navy was re-designated and the new Indian Naval Ensign (Naval Flag) was adopted on this date. The Indian National flag had earlier taken the place of Union Jack on 15th Aug 1947. Soon after independence the first cruiser INS Delhi and 03 'R' class destroyers Rajput, Ranjit & Rana joined the Indian Navy. In late 50's the second cruiser INS Mysore & 02 Frigate INS Trishul & Talwar were acquired, this was followed by the acquisitions of the anti Submarine Frigates INS Khukri, Kuthar, Kirpan & Anti Air Craft Frigates Brahmaputra, Beas & Betwa. With the joining of these ships the Indian Naval

Flotilla was constituted into a Fleet. The Air Craft carrier INS Vikrant was commissioned in February 61. This added an Integral Air Defence & strike capability to our Fleet.

4. **Goa Operation**. Indian Naval Ships were deployed for action for the first time in the liberation of Goa in Dec 1961. In the encounter that took place off Goa. Portuguese warship Albuquerque was disabled, after which the Indian Navy established its command of the Sea off Goa and was able to enforce a blockade of this port there by denying the Portuguese of any further assistance from the Sea.

5. In the mid 60's the only addition to the Indian Navy was an oil tanker acquired from West Germany. With the addition of this oil tanker the range of the Fleet increased as also its capacity and endurance at Sea.

6. **Indo- Pak War**. With the change in the Geo political situation in the Indian Ocean there was a need for faster and more sophisticated ships to meet the maritime defence needs of the Indian Navy. The result was the acquisition of ships, missile boats and submarines in the late 60's and early 70's with systematic and sustained growth, proper training and courage and initiative in battle, it was possible for the Indian Navy to give a good account of itself both in the Bay of Bengal and Arabian Sea in the 1971 conflict with Pakistan for the liberations of Bangladesh.

7. **Post 1971**. After the 1971 war, the Navy has been acquiring more ships and Aircraft to enable to discharge its responsibility effectively. It acquired an Aircraft Carrier from Britain which was christened as INS Viraat and two more 'R' class ships Ranvir & Ranvijay. The Indian Navy has also become self sufficient in building of frigate of Leander Class and Godavari Classes, Corvette of Khukri Class, Missile boats of Nishank Class, Submarine of Shalki class which were built indigenously and Helicopters of 'Chetak' class. We have increased our warship building capabilities phenomenally, the recent production of Destroyers INS Delhi, Mumbai & Mysore proves this. The Indian Navy recently commissioned the latest of Delhi class Destroyers INS Mysore which was built indigenously in the Mazagaon Dock in Mumbai. The Navy also acquired sophisticated vertical/ short take off and landing(VSTOL)'Sea Harrier' Aircraft from Britain which can take off from a small deck of ships and maritime reconnaissance and anti submarine role Aircraft TU142 from Russia which increased the capacity of our Navy by leaps and bounds making it a world class Navy.

8. **Present Status.** Modernisation is a constant process. Indian Navy is in the process of acquiring Air Craft Carrier from Russia, **Admiral Gorshkhav** named **INS Vikramaditya** along with **MIG 29K**. It also acquired an USA LPD, **INS Jalashwa**. It has indigenously built **stealth** Frigates in its service.

9. Post -Indo Pak war 1971, Navy has been engaged in various operations like Pawan, Cactus, TASHA, etc. besides providing humanitarian assistance during Tsunami etc. During Kargil war, though no naval action took place, Navy embarked upon OP Talwar and brought all its force to bear upon Arabian Sea prompting Pakistan to desist from further misadventure. Presently it is active in Anti-Piracy ops off Somalia as part of UN ops.

10. **Conclusion.** Indian Navy has come a long way since our Independence. Starting with a small number of ships at the time of Independence, it has grown over the years both in terms of number and quality of platforms in order to become a three dimensional Navy. It has acquired itself with glory whenever called up to meet national interest both during war and peace.

Note. The lecture needs to be supplemented by pictures/ movies clips for better assimilation by cadets.

SECTION- 2 (SD/SW)

ORGANISATION OF NAVY - NHQ, COMMANDS, SHIPS & ESTABLISHMENTS

Period	-	02
Type	-	LEC
Term	-	1

Training Aids

1. Blackboard, chalk, White board, Marker, Pointer & Projector

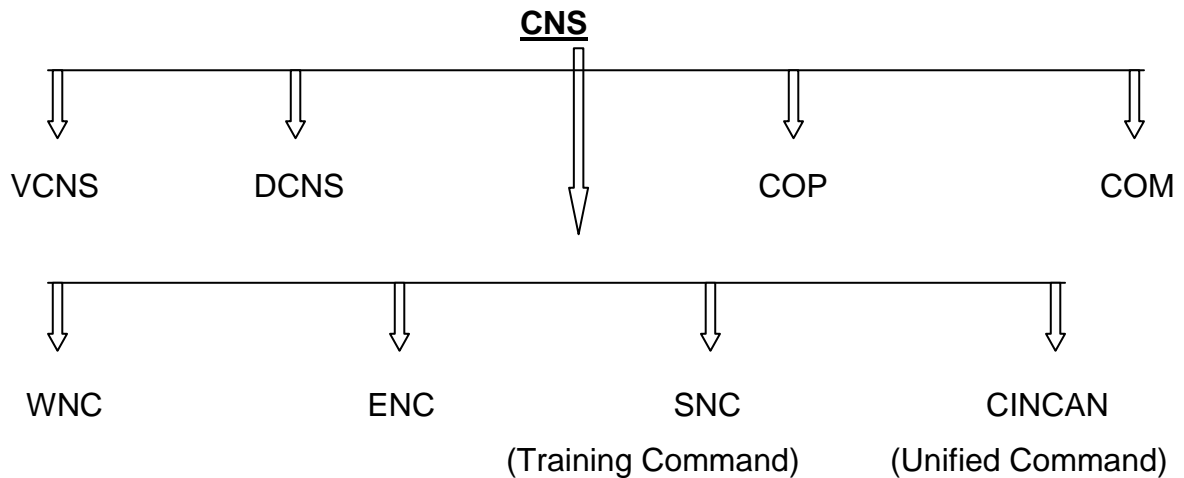
Time Plan

2.	(a)	Introduction	-	05 Min
	(b)	Organisation of NHQ, Command	-	15 Min
	(c)	Ships & Shore establishments	-	15 Min
	(d)	Conclusion	-	05 Min

				40 Min

3. **Introduction.** The Indian Navy is organized to meet its charter of duties as an important component of the Armed Forces of our country. The aim of the organization is for effective administrative control and functional operational efficiency from apex HQ to unit level.

4. **ORGANISATION OF NHQ /IHQ MOD (NAVY)**



5. The NHQ stands for Naval Head Quarters. It is located at New Delhi and is over all responsible for smooth functioning of the Navy. The Chief of the Naval Staff (CNS) controls the functioning of the Navy from NHQ and is assisted by his Principal Staff Officer (PSO's). The CNS is assisted by four PSO's namely VCNS, DCNS, COP and COM.

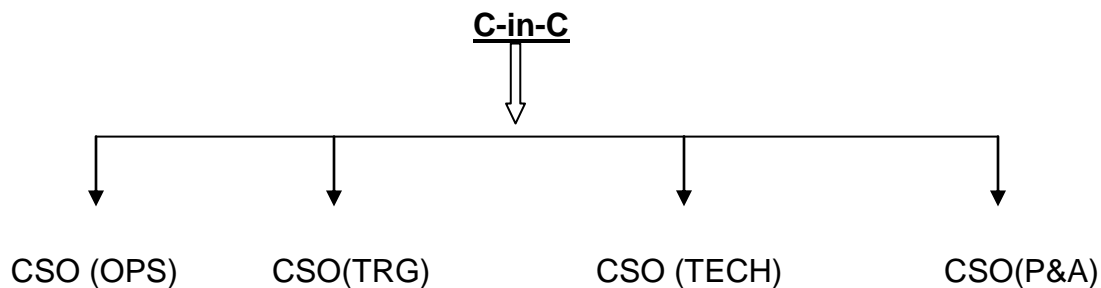
(a) **Vice Chief of Naval Staff (VCNS)**. The VCNS is the head of the staff Branch - I. He is responsible for planning programming and all administrative services. He co-ordinates the NHQ and officiates as CNS in his absence.

(b) **Deputy Chief of Naval Staff (DCNS)**. The DCNS is the head of staff Branch – II. He is responsible for Operation, Intelligence, Communications, Submarine and Naval Aviation.

(c) **Chief of Personnel (COP)**. The COP controls the manning requirement of the Navy. He is responsible for recruitment, training, welfare and discipline of naval personnel.

(d) **Chief of Material (COM)**. The Chief of Material is responsible for providing maintenance and assistance to the ship's of the Indian Navy. He is also responsible for design, construction and maintenance of ship's and craft including Engineering, Electrical and Weapon aspects.

6. **Commands.** The Indian Navy is divided into four commands for administrative and operational purpose. Typical Organization of a Command is:-



SL. NO	COMMAND	HEADED	HQ	Remarks
1	Western Naval Command (WNC)	FOCINC(W)	Mumbai	1. Commanded by a Vice Admiral designated as the FOC- in-C West. 2. It is an operational command and is responsible for naval operation on the western coast of India.
2.	Eastern Naval Command (ENC)	FOCINC(E)	Visakhapatnam	1. Commanded by a Vice Admiral designated as the FOC- in-C East. 2. It is an operational command and is responsible for naval operation on the Eastern coast of India
3	Southern Naval Command(SNC)	FOCINC (South)	Kochi	1. Commanded by a Vice Admiral designated as the FOC- in-C West. 2. It is a training command and all training

				establishments come under this command.
4	Unified Command	A & N Is	Port Blair	<p>1. Commanded by a Vice Admiral designated as the CINCAN</p> <p>2. This has the operational control of all Army, Navy, Airforce and Coast Guard components under respective component Commander. ACC, NAVCC, AFCC, CGCC.</p>

7. **Fleets**. Fleet is a group of various types of warships and aircraft organized in a unit to fight a war. The IN has two Fleets:-

(a) **Western Fleet**. It is based at Mumbai and commanded by a Rear Admiral designated as the Flag Officer Commanding Western Fleet (FOCWF)

(b) **Eastern Fleet**. It is based at Visakhapatnam and commanded by a Rear Admiral designated as the Flag Officer Commanding Eastern Fleet (FOCEF).

8. **Flotilla**. Flotilla is a group of small vessels. The IN has many small warships. These warships are organized in groups called Local Flotilla. These local Flotillas are generally placed under the Command of NOIC (Naval Officer –in - Charge) who is area Commander of a small area. The Biggest Local Flotilla is based in Bombay under the command of Flag Officer Maharashtra Area & Gujarat (FOMAG).

9. **Shore Establishments**. Shore Establishments function under the Administrative Authority(C-in-C) serve the following function:-

(a) Training officers and sailors.

(b) Providing logistic support, berthing and allied harbour facilities to ships, such as playgrounds, recreation facilities etc.

10. The location and main function of the establishments of the Indian Navy are given below:-

Ser	NAME	PURPOSE/FUNCTION
(a)	New Delhi	
	INS India	Administrative establishment of Naval Headquarters
(b)	Mumbai	
	INS Angre	Administrative establishment of Western Naval Command
	INS Agnibahu	Administrative establishment for Local Flotilla(Small Ships)
	INS Kunjali	Provost establishment, Naval Detention Quarter(Naval Jail), School for Naval Musicians
	INS Shikra	Naval Air Station
	INS Trata	Naval Missile Battery,
	INS Vajrabahu	Submarine Base
	INHS Asvini	Naval Hospital and school for Medical Assistance
	INS Abhimanyu	Marine Commando School
	INS Tunir	Missile storage, assembling and servicing base
	INS Hamla	School for Logistics branch
	INS Abhimanyu II	Marine Commando school
(c)	Lonavala	
	INS Shivaji	Marine Engineering School, Naval Engineering College and NBCD School
	INHS Kasturi	Naval Hospital
(d)	Jamnagar	
	INS Valsura	Training School for Electrical Branch
(e)	Goa	
	INS Mandovi	College of Naval Warfare
	INS Gomantak	Support base for ships and establishments, Hydrographical School
	INS Hansa	Naval Air Station
	INHS Jeevanti	Naval Hospital
(f)	Kochi	
	INS Vendurthuy	Naval base Semanship School, Communication School, ND

		School, PT School, ASW School, NIETT School, Diving School.
	INS Dronacharya	Gunnery School, Naval Coast Battery
	INS Garuda	Naval Air Station,
	INHS Sanjivani	Naval Hospital
(g)	Visakhapatnam	
	INS Circars	Administrative establishment of Eastern Naval Command
	INS Virbahu	Submarine base
	INS Satavahana	Submarine Training School
	INS Kalinga	Missile storage and servicing
	INS Kalyani	Naval Hospital
	INS Dega	Naval Air Station
	INS Eksila	Marine Gas turbine Overhauling Centre
(h)	Port Blair	
	INS Jarawa	Support base
	INS Utkrosh	Naval Air Station
	INHS Dhanvantri	Naval Hospital
	INS Kardip	Naval base in Kardip
(i)	Chennai	
	INS Adyar	Naval base
	INS Rajali	Naval Air Station(Arakonam)
(j)	Kolkata	
	INS Netaji Subash	Naval Base
(k)	Chilka	
	INS Chilka	Sailors Basic Training School
	INHS Nivarini	Naval Hospital
(l)	Coimbatore	
	INS Agrani	Leadership and Management course for sailors.
(m)	Dwaraka	
	INS Dwarka	Administrative support to vessels on forward Area Deployment
(n)	Tirunelveli(IN)	

	INS Kattabomman	Low Frequency transmission centre
(o)	Karwar	
	INS Kadamba	Supporting Base
	INHS Pattanjali	Naval Hospital
(p)	Ezhimala	
	INA Zamorin	Naval Base & Indian Naval Academy
	INHS Navjivni	Naval Hospital

11. **Conclusion.** At HQ, Command and Fleet level, the organization of Navy is aimed at providing efficient administrative and logistics support to meet the operational need of its fighting units like Ships, Air crafts & Submarines.

SECTION- 3 (SD/SW)

TYPES OF WARSHIPS AND THEIR ROLE

Period	-	02
Type	-	LEC
Term	-	1

Training Aids

1. Blackboard, chalk, White board, Marker, Pointer & Projector

Time Plan

2.	(a)	Introduction	-	05 min	-
	(b)	Types of Warships	-	15 min	
	(c)	Role of Ships	-	15 min	
	(d)	Conclusion	-	05 Mins	

				40 Mins	

3. **Introduction.** Ships are designed for specific role. Indian Navy has various class and types of Ships, Submarines and aircraft for deployment to meet requirements of the nation. Ships can be classified into types and classes.

(a) **Types of Ships.** Ship can be classified under a type based on the role and the purpose for which she has been built. For example an Aircraft carrier is built to operate aircrafts and submarines are built to operate under water.

(b) **Class of Ships**. Ships of the same type can be grouped into classes based on their design and built i.e. similar ships built on same design belong to a particular class.

4.

Type	Class	Names
AirCraft Carrier	British Hermes Class	Viraat
Destroyers	1) Rajput Class	Rajput, Rana, Ranjit, Ranvir, Ranvijay
	2) Delhi Class	Delhi, Mysore, Mumbai
	3) Brahmaputra Class	Brahmaputra, Beas, Betwa
Frigates	Godavari Class	Godavari, Ganga, Gomati
	Leander Class	Taragiri
	Talwar Class	Talwar, Trishul, Tabar
Corvettes	Khukri Class	Khukri, Kuthar, Kirpan, Khanjar, Kora, Kulish
Missile Boats	Veer Class	Veer, Nirbhik, Nipat, Nishank, Nirghat, Vipul, Vinash, Vibhuti, Nashak,
	Abhay Class	Ajay, Abhay, Akshay, Agray
Patrol Vessels	Sukanya class	Sukanya, Suvarna, Sarada, Sujata, Subhadra, Savitri, Saryu
Mine Sweepers	Karwar Class	Karwar, Kozhikode, Canannore, Konkan, Cuddalore, Kakinada
LST(L)	Magar Class	Magar, Gharial
LST(M)	Ghorpad Class	Ghorpad, Shardul, Sharabh
LCU		LCU L-32 to LCU L-39
Tankers		Jyoti, Shakti, Deepak
Ocean going Tug	Matanga class	Matanga
Survey ships	Sandhayak class	Sandhayak, Nirdeshak, Nirupak, Investigator, Jamuna, Sutlej, Sarvekshak
Submarines	Foxtrot class	Vagli, Vaghsheer, Vagir, Vela, Karanj,

		Kursura, Kalvari(All decommissioned)
	Kilo class	Sindhughosh, Sindhuvir, Sindhurakshak, Sindhuraj, Sindhudhvaj, Shindhukeshri, Sindhukiriti, Sindhuvijay, Sindhuratna, Sindhushastra
	Shishumar class	Shishumar, Sankush, Shalki, Shankul
Cadet Training Ship	Tir Class	Tir
Diving Support Vessel		Nireekshak
Missile Tender	22 KS	Nipat, Nirbhik, Nishank, Nirgnat, Vipul, Vinash, Vibhuti, Vidyut, Prahar, Nashak, Veer
Fast Attack Craft		T 80, T 81, Trinkat, Tillanchang, Tarasa
Oceanographic Research Vessel		Sagardhwani
Sail Training Ship		Tarangini

5. **Role.**

(a) **Aircraft Carrier.** It is a floating air field. It can operate aircraft and helicopters.

(b) **Destroyers.** These ships are lighter than cruisers and they are also general purpose fighting ships. They carry Surface to Surface Missile (SSM), Surface to Air Missile (SAM), gun, rocket launchers, torpedoes and ASW helicopters.

(c) **Frigates.** Frigates are smaller than Destroyers. These are basically escort ships, and are equipped with guns, missiles, torpedoes etc. They are classified as Anti Aircraft Frigate, Anti Submarine Frigate, Multipurpose Frigate etc based on their function and equipment carried onboard.

(d) **Cruisers**. They are ships of surface action. They carry heavy guns, long range missiles, antisubmarine weapons, helicopters etc,. Presently there are no cruiser in the Indian Navy.

(e) **Corvettes**. These ships are lighter than frigates and they are fitted either with antiaircraft weapons or with antisubmarine weapon. These ships have limited endurance.

(f) **Patrol Vessels**. These are lighter vessels for patrolling coastal areas, oil field etc.

(g) **Mine Sweepers**. These ships are fitted with special equipment to detect and sweep mines and keep the sea lanes open by clearing mines laid by enemy.

(h) **LSTs (Landing Ship Tank)**. These ships are specially constructed so that they can beach on shore and off load tanks, troops and other vehicles directly on to the beach.

(j) **LCU (Landing Craft Utility)**. These are smaller landing ships which can beach but cannot carry tanks; they are used to land trucks, jeeps and other utility items. These are small compared to LSTs.

(k) **Tankers**. These ships can store fuel and fresh water and supply it to the fleet at sea by a method know as Replenishment at Sea(RAS), there by increasing the endurance of the ships.

(l) **Submarines**. These vessels can operate under water, i.e. they can navigate and fire their torpedoes in a dived state.

(m) **Survey Ships**. They carry out geographical survey of sea and coastal areas and prepare charts for navigation.

6. **Conclusion**. Indian Navy, in order to fulfill its charter of duties has various types of ships. Each class of Ship has a different role to play during peace and war. This gives flexibility to command for deploying them depending upon kind of mission and threat.

SECTION - 4 (SD/SW)**ONBOARD ORGANISATION OF SHIPS**

Period	-	2
Type	-	LEC
Term	-	II

Training Aids

1. Blackboard, chalk, White board, Marker, Pointer & Projector

Time Plan

2.	(a)	Introduction	-	05 min
	(b)	Organisation of a typical Ship	-	10 min
	(c)	Watch Systems & Stations	-	15 min
	(d)	Conclusion	-	05 Mins

				40 Mins

3. **Introduction.** Every Warship has schemes of complements which show the number of Officers and men required to man her under various condition of war and peace. Officers and men are divided into departments according to their specialization and these in turn form divisions or may be further divided into two or more sub-divisions, according to the number borne.

4. **Department.** A chart of the departmental organization of a Destroyer along with the specialists borne in each department is given below:-

CAPTAIN

Cdr (E)	Cdr(L)	CDR	CDR(Log)	PMO	Met Offr
Snr Engr	DLO	(EXO)	ALOGO(Pay)	MO	
	ALO(P)	First Lt	ALOGO (Vict)	Dental Offr.	
	ALO(R)	Gunnery Officer	ALOGO (Cloth)		
		Navigating Officer			
		Anti Submarine Warfare Officer			
		Signal Communication Officer			
		Regulating Officer			
		NBCDO			
		Shipwright Officer			
		Diving Officer			

5. **Watch System.** The seaman complement on a ship is normally large. It is divided into Foxle, Midship and Quarter Deck division. In war, depending on the threat the whole or a portion of the ships armament must be ready for instant action, to make this possible the ships company is divided into watches. The systems of watches on a naval ship are given below:-

- (a) **Two Watches.** In this system the men are equally divided into the two watches that are Starboard and Port.
- (b) **Three Watches.** In this system men are divided in three watches Red, White and Blue.
- (c) **Four Watches.** In this system men are divided in four watches that are Port I, Port II, Starboard I, Starboard II.

6. **Stations & Routines.** The ships company is closed up in various stations to meet various requirements and routine is so run onboard a ship to balance operational requirement and adequate rest to the crew.

- (a) Cruising Station

- (b) Defence Station
- (c) Action Station
- (d) Sea & Action
- (e) SSD & Cable Party
- (f) Clear Lower Deck

7. **Conclusion**. A ship is a cohesive unit and is organised in such a way that it runs efficiently both administratively and operationally.

SECTION -5 (SD/SW)**ORGANISATION OF ARMY & AIR FORCE**

Period	-	1
Type	-	LEC
Term	-	1

Training Aids

1. Blackboard, chalk, White board, Marker, Pointer & Projector

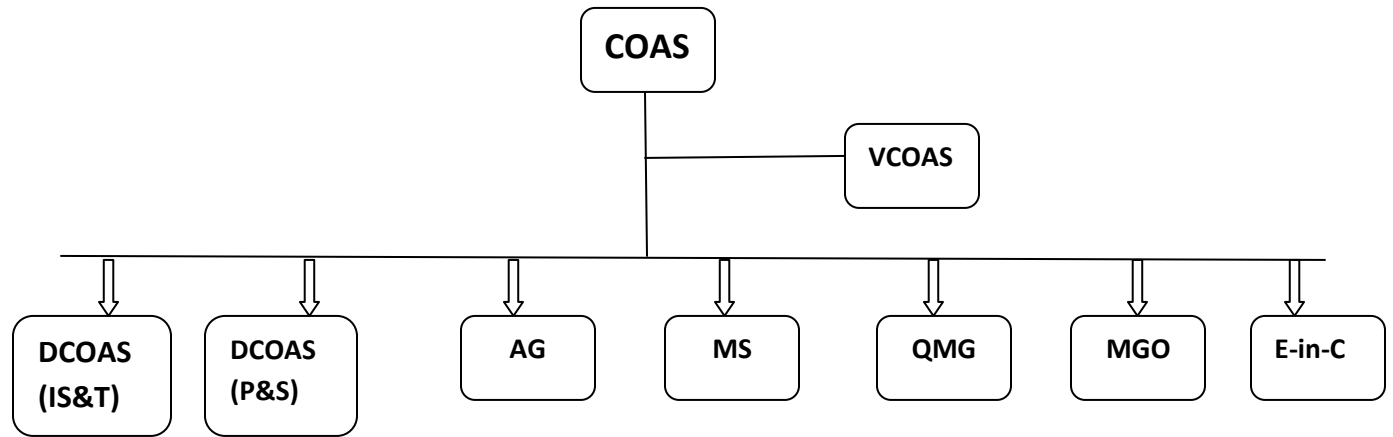
Time Plan

2.	(a)	Introduction	-	05 min
	(b)	Organisation of Army	-	15 min
	(c)	Organisation of Air Force	-	15 min
	(d)	Conclusion	-	05 Mins

				40 Mins

3. **Introduction.** Indian Army is the second largest army in the world. Such a large Army needs to be managed efficiently not only in times of war but also in peace. The Army is organized in Combat Arms, which does the fighting, Combat Support Arms and the Services.

4.

ORGANISATION OF INDIAN ARMY.

- | | | | |
|-----|--------------|---|----------------------------|
| (a) | COAS | - | Chief of Army Staff |
| (b) | VCOAS | - | Vice Chief of Army Staff |
| (c) | DCOAS (IS&T) | - | Deputy Chief of Army Staff |
| (d) | DCOAS (P&S) | - | Deputy Chief of Army Staff |
| (e) | AG | - | Accountant General |
| (f) | MS | - | Military secretary |
| (g) | QMG | - | Quarter Master General |
| (h) | MGO | - | Master General Ordnance |
| (i) | E-in-C | - | Engineer in Command |

5. **Commands.**

- | | | | |
|-----|------------------|---|------------|
| (a) | Northern Command | - | Udhampur |
| (b) | Western Command | - | Chandigarh |
| (c) | Central Command | - | Lucknow |
| (d) | Eastern Command | - | Kolkata |
| (e) | Southern Command | - | Pune |

- (f) Southern West Command - Jaipur
- (g) ARTRAC - Shimla

6. Branches of Indian Army are as follows:-

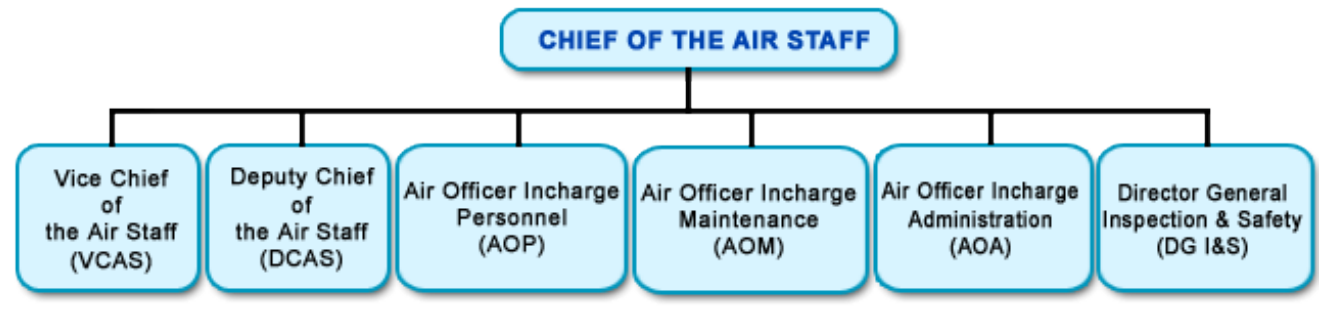
(a) **Arms.**

- (i) Armoured Corps
- (ii) Artillery
- (iii) Army Air Defence
- (iv) Army Aviation
- (v) Engineers
- (vi) Corps of Signals
- (vii) Mech Infantry
- (viii) Infantry – Various Regiments

(b) **Services.**

- (i) Army Supply Corps
- (ii) Army Ordnance Corps
- (iii) Corps of EME
- (iv) Remount and Veterinary Corps
- (v) Army Education Corps
- (vi) Corps of Military Police
- (vii) Army Medical Corps
- (viii) Army Dental Corps
- (ix) Pioneer Corps
- (x) Army Postal Service
- (xi) Territorial Army
- (xii) Defence Security Corps

7. ORGANISATION OF INDIAN AIR FORCE



8. COMMANDS OF INDIAN AIR FORCE

Commands of Indian Air Force are as follows:-

- | | | | |
|-------|---------------------------|---|------------|
| (i) | Western Air Command | - | Chandigarh |
| (ii) | Eastern Air Command | - | Shillong |
| (iii) | Central Air Command | - | Delhi |
| (iv) | South Western Air Command | - | Jodhpur |
| (v) | Southern Air Command | - | Pune |
| (vi) | Maintenance Command | - | Bangalore |

9. **Conclusion.** The Indian Army and Indian Air Force are the other two Arms of the Indian Armed Forces and work closely during Operations with the Indian Navy.

SECTION -6 (SD/SW)

NAVAL CUSTOMS AND TRADITIONS

Period	-	1
Type	-	LEC
Term	-	2

Training Aids

1. Blackboard, chalk, White board, Marker, Pointer & Projector

Time Plan

2.	(a)	Introduction	-	05 min
	(b)	Naval Customs	-	15 min
	(c)	Traditions	-	15 min
	(d)	Conclusion	-	05 Mins

				40 Mins

3. **Introduction**. The tradition and customs of Indian Navy are expression of respect, Courtesy, rejoicing and have developed as part of a sea faring profession with international echo. Some of these are given in succeeding paras.

4. **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.

5. **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.

6. **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.

7. **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.
8. **Piping the Side.** Except for foreign Naval Officers, for whom the side is piped for all times, the side is only piped to the following persons, and only between the times of colours and sunset.
 - (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.
9. **Salutes between Warships.** When a warship passes another in harbor/ 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.
10. **Sunset.** This is a ceremony where, the national Flag and the naval ensign is lowered during Sunset.
11. **Dressing Ship.** The Ship is dressed overall on special occasion like as Independence day, Republic day, National Maritime Day and Navy Day.
12. **OOG.** When a ship visits a foreign port, an officer of the executive branch is detailed as officer of the Guard.
13. **Man and Cheer Ship.** The Ships Company man the ship standing on the catwalks from foyle to Quarter deck facing towards the Ship which boards the dignitary.
14. **Ringling in the New Year.** During the midnight 0001 hrs on 01 Jan every year, the ships bell at gangway is rang eight times to mark the New Year.

15. **Reception of Officers.** The officers are received on different ceremonial occasions in the Navy as a tradition.
16. **Launching Ceremony.** This ceremony is conducted whenever the keel of a ship is launched for construction at shipyards.
17. **Entering/ Leaving a Boat.** All officers when getting into or leaving a boat are saluted by the coxswain. Officers enter a boat seniority wise , the senior most enters last and leaves first.
18. **Boat Hailing.** The coxswain of the boat while passing the warship or the boat carrying flag officers give the proper mark of respect after asking the identification being carried by saying boat hails.
19. **Gun Salutes.** Gun salutes are fired as National salute and in harbour for VIPs such as President, Flag Officers, Governors, and Ambassadors 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	7 gun Salutes

20. **Conclusion.** The customs and traditions of Indian Navy bind the community strongly. Besides being blended into everyday routine, the ceremonies involved are observed with precision and give indication of professional perfection and pride of the white uniform.

SECTION – 7 (SD/SW)

RANKS OF OFFICERS AND SAILORS, EQUIVALENT RANKS

IN THE THREE SERVICES

Period	-	1
Type	-	LEC
Term	-	1

.....

Training Aids

1. Blackboard, chalk, White board, Marker, Pointer & Projector

Time Plan

2.	(a)	Introduction	-	05 min
	(b)	Officers	-	15 min
	(c)	Sailors	-	15 min
	(d)	Conclusion	-	05 Mins

				40 Mins

3. **Introduction.** 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.

4. **Officer.** The rank Structure of Officer of IN and equivalent ranks in other services in descending order are as given below:-

<u>NAVY</u>	<u>ARMY</u>	<u>AIRFORCE</u>
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
Midshipman	—	—
Cadet	Gentleman Cadet	Flight Cadet

Note. The Officers of the rank of Commander and above are called ‘Senior Officer’ and the Officer of the rank of Rear Admiral and above are called ‘Flag Officer’.

5. **Sailors.** Rank structure of sailors of Seaman Branch of IN and equivalent rank of other services in descending order is as follows:-

<u>NAVY</u>	<u>ARMY</u>	<u>AIRFORCE</u>
MCPO I	Sub Major	Master Warrant Officer
MCPO II	Subedar	Warrant Officer
Chief Petty Officer	Naib Subedar	Junior Warrant Officer
Petty Officer	Havaldar	Sergeant
Leading Seaman	Naik	Corporal
Sea I	Lance Naik	Leading Airman

Sea II

Sepoy

Airman

Note. The Sailors of the rank of Petty Officer and above are called 'Senior Sailors' and those of the rank of Leading and below are called 'Junior Sailors'.

6. **Conclusion**. The rank structure in the Armed Forces denotes the responsibility and status of an officer or sailor. The hierarchical structure of Armed Forces facilitates its ease of discharging duty in a smooth manner.

SECTION -8(SD/SW)

MODE OF ENTRY INTO INDIAN NAVY

Period	-	1
Type	-	LEC
Term	-	2

.....

Training Aids

1. Blackboard, chalk, White board, Marker, Pointer & Projector

Time Plan

2.	(a)	Introduction	-	05 min
	(b)	Officers Entry	-	15 min
	(c)	Sailors Entry	-	15 min
	(d)	Conclusion	-	05 Mins

				40 Mins

3. **Introduction**. Like other Armed Forces of the Nations, Indian Navy is a volunteer force. This lecture gives a detail view of how to join Indian Navy as an Officer or Sailor.

ENTRY AS OFFICER IN THE INDIAN NAVY

4. **EXECUTIVE BRANCH**

(a) (Permanent Commission)

<u>SL No</u>	<u>BRANCH/TYPE OF ENTRY</u>	<u>MEN /WOME N</u>	<u>AGE LIMIT (YEARS)</u>	<u>EDUCATIONAL QUALIFICATION</u>
(i)	Cadet Entry (NDA) (UPSC)	Men	16 ¹ / ₂ -19	10+2 or equivalent with Physics & Math

(ii)	Cadet Entry (10+2) B.Tech(INA) (UPSC)	Men	16 ¹ / ₂ -19	10+2 or equivalent with Physics & Math
(iii)	Graduate Special Entry, Scheme ,CDSE (UPSC)	Men	19 -22	B.Sc. (Physics & Maths) or BE
(iv)	NCC Special Entry Naval Academy	Men	19 -24	B.Sc. (Physics & Maths) or BE with Naval wing.NCC 'C' Certificate
(v)	Direct Entry Naval Armament Inspection Cadre	Men	19 ¹ / ₂ -25	Degree in Electronics/ Elect/ Mech Engg. Or post Graduate in Electronics or physics.
(vi)	Direct Entry Law Cadre	Men	22-27	A Degree in Law qualifying for enrolment as an advocate under the Advocates Act 1961 with minimum 55% marks.
(vii)	Logistic Cadre	Men	19 ¹ / ₂ -25	BCom/MCom/MA/ BA(Economics), MBA/ BBA/ BBM, MCA/ BCA/ B.Sc.(IT), B Tech/ BE, Graduate Degree with post graduate Diploma/ Degree in Material Management/ICWA or Chartered Accountancy.

(b) (Short Service Commission)

<u>SL No</u>	<u>BRANCH/TYPE OF ENTRY</u>	<u>MEN /WOME N</u>	<u>AGE LIMIT (YEARS)</u>	<u>EDUCATIONAL QUALIFICATION</u>
(i)	General Service	Men	19 ¹ / ₂ -25	BE/ B Tech in any

	(Executive)			Discipline.
(ii)	General Service (Hydro Cadre)	Men	19 $\frac{1}{2}$ -25	BE/ B Tech in any Discipline.
(iii)	Aviation Pilot	Men	19-24	A Graduate Degree with minimum 60% marks in any discipline with Mathematics & Physics at 10+2 level.
(iv)	Aviation Observer	Men/ Women	19 -24	A Graduate Degree with minimum 55% marks in any discipline with Mathematics & Physics at 10+2 level.
(v)	Logistics Cadre	Men / Women	19 $\frac{1}{2}$ -25	A First class Degree with minimum 60% marks in any of the followings:- BCom/ BA(Economics), MBA/ BBA/ BBM, MCA/ BCA/ B.Sc.(IT), B Tech/ BE, Graduate Degree with post graduate Diploma/ Degree in Material Management/ICWA or Chartered Accountancy.
(vi)	Law Cadre	Men / Women	22-27	A Degree in Law qualifying for enrolment as an advocate under the Advocates Act 1961 with minimum 55% marks.
(vii)	ATC(Air Traffic Control)	Men/ Women	19 $\frac{1}{2}$ -25	A first class science graduate with Physics & Maths or Msc with Physics

				or Math securing min 55% marks.
(viii)	Naval Armament Inspection Cadre	Men	19 $\frac{1}{2}$ -25	Degree in Electronocs/ Elect/ Mech Engg. Or post Graduate in Electronis or physics.
(ix)	University Entry Scheme	Men	19-24	Final/ Pre Final Year student of BE/ B Tech in Mech/ Marine/ Aerospace/ Aeronautical/ Production/ Computer Science/ IT/ Control/ Electrical/ Electronics/ Telecommunication min 60% marks till VIth Semester / IVth Semester respectively.
(x)	SSC(IT)	Men	19 $\frac{1}{2}$ -25	BE / B Tech (Computer Science / Computer Engg (IT), BSc (IT), MTech (Computer Science), MSc (Computer) BCA/ MCA

5. Education Branch

<u>SL No</u>	<u>BRANCH/TYPE OF ENTRY</u>	<u>MEN /WOMEN</u>	<u>AGE LIMIT (YEARS)</u>	<u>EDUCATIONAL QUALIFICATION</u>
(i)	Permanent Commission	Men	21-25	A Masters Degree in one of the following with at least 50% marks. (a) Physics (Math in B.Sc) or

				(b) Maths (Physics in B.Sc) An Engineering Degree in Mech./ Electrical/ Electronics/ Computer Science/ IT with minimum 60% marks
(ii)	Short Service Commission	Men/ Women	21-25	-----do-----

6. Engineering Branch (Marine Engineers)

<u>SL No</u>	<u>BRANCH/TYPE OF ENTRY</u>	<u>MEN /WOMEN</u>	<u>AGE LIMIT (YEARS)</u>	<u>EDUCATIONAL QUALIFICATION</u>
	Permanent Commission			
(i)	Cadet Entry (NDA) (UPSC)	Men	16 1/2 -19	10+2 or equivalent with Physics & Math
(ii)	Cadet Entry (10+2)(Tech)	Men	16 1/2 -19	10+2 or equivalent with Physics, Chem & Maths (Minimum 75% marks in aggregate of PCM, Minimum 50% marks in English either in 10 th or 12 th class.
	Short Service Commission			
(i)	Direct Entry (Technical Branch)	Men	19 1/2-25	A Degree in Marine/ Mech./ Aeronautical/ Control/ Metallurgical/ Production Engineer with minimum 55% marks.

(ii)	Direct Entry (Submarine Cadre)	Men	19 $\frac{1}{2}$ -25	B.E(Mechanical) with minimum 55% marks)
(iii)	University Entry Scheme (UES)	Men	19-24	A Degree in Marine/ Mech./ Aeronautical/ Metallurgical/ Production Engineer with minimum 60% marks up to 6 th semester.

7. Engineering Branch (Naval Architects)

<u>SL No</u>	<u>BRANCH/TYPE OF ENTRY</u>	<u>MEN /WOMEN</u>	<u>AGE LIMIT (YEARS)</u>	<u>EDUCATIONAL QUALIFICATION</u>
	Permanent Commission			
(i)	Cadet Entry (10+2)(Tech)	Men	17 -19- 1/2	10+2 or equivalent with Physics, Chem & Maths (Minimum 70% marks in aggregate of PCM, Minimum 50% marks in English either in 10 th or 12 th class.
	Short Service Commission			
(i)	Direct Entry (Naval Architecture)	Men/ Women	21-25	B.E in Mech./ Aeronautical/ Metallurgical/ Civil/ Naval Architecture with minimum 60% marks.
(ii)	Special Naval Architect Entry Scheme (SNAES)	Men/ Women	19-24	B.E(Naval Architect) with minimum 60% marks)

8. Electrical Branch

<u>SL</u>	<u>BRANCH/TYPE OF ENTRY</u>	<u>MEN /WOMEN</u>	<u>AGE</u>	<u>EDUCATIONAL</u>
-----------	-----------------------------	-------------------	------------	--------------------

<u>No</u>			<u>LIMIT</u> <u>(YEARS)</u>	<u>QUALIFICATION</u>
	Permanent Commission			
(i)	Cadet Entry (NDA) (UPSC)	Men	16 ¹ / ₂ - 19	10+2 or equivalent with Physics & Math
(ii)	Cadet Entry (10+2)(Tech)	Men	17 -19	10+2 or equivalent with Physics, Chem & Maths (Minimum 70% marks in aggregate of PCM, Minimum 50% marks in English either in 10 th or 12 th class.
	Short Service Commission			
(i)	Direct Entry (Technical Branch)	Men	19 ¹ / ₂ -25	A Degree in Electrical/ Electronics/ Instrumentation & control/ Telecommunication Engg. with minimum 55% marks.
(ii)	Direct Entry (Submarine Cadre)	Men	19 ¹ / ₂ -25	A Degree in Electrical/ Electronics/ Telecommunication control Engg. with minimum 55% marks.
(iii)	University Entry Scheme (UES)	Men	19-24	A Degree in Electrical/ Electronics/Powers/ Instrumentation & control/ Telecommunication/ power system Engg. With minimum 60% marks up to VI th / IV th Semester respectively.

9. **Note:**

(a) Women are eligible to apply for Short Service Commission in Law, ATC, Observer, and Education & Naval Architecture.

(b) The duration of Short Service Commission is 10 years, extended to 14 years.

(c) The training of officers selected through the above entries normally commences in the months of Jul/ Jan every year. Advertisements calling for applications from eligible candidates are published in Employment News and important News papers in Apr to Jun and Sep to Nov every year. The selection procedure includes UPSC examination (for NDA, 10+2 Cadet Entry and GSES Scheme), Interview at Service Selection Board and Medical Examination.

(d) University Entry Scheme is applicable for Final Year students only(VII th semester)

(e) The above information is a broad guideline and is subject to change as per the induction requirements of Indian Navy.

10. **For Recruitment Contact.** Any Naval Establishment or DMPR at Integrated Headquarters of Ministry of Defence (NAVY), Sena Bhawan, New Delhi- 110011 Tel: 011-2301182 (Officers) & 011-23793067 (Sailors) 011-23010498 (publicity) www.nausena-bharati.nic.in

11. **ENTRY AS SAILOR**

Entry	Branch	Age (yrs)	Educational Qualification	Month of Adv.	Method of Recruitment
Artificers					
AA (Artificer Apprentice)	Electrical/ Mech/ Shipwright	17- 20	10+2 or Equivalent with Physics, Chemistry & Maths with minimum 60% marks	Dec & June	Through written examination in science, Maths, English & GK held at

					AROs/ZROs/ASCs/NREs twice in a year in Apr/Oct for the courses commencing in Aug/Feb.
DE(DH) (Direct Entry Diploma Holder)	Electrical/ Mech/ Electronics	18-22	Three Year Diploma with minimum 50% marks in Mechanical/ Electrical/ Electronics/ Telecommunication/ Aeronautical/ Ship-building/ Instrumentation/ Engineering/ Metallurgical from a recognized polytechnic/ Institute.	Dec/ June	Through written examination in Maths, English, GK and additional section as per specialization followed by interview. Held twice a year in Apr/ Oct for courses commencing in Aug/ Feb.
Non Artificers					
SSR (Senior Secondary Recruit)	Seaman/ Communication/Electrical Medical/Engineering/Writer/Store Assistant/ Naval	17-21	Minimum 45% aggregate marks in 10+2/equivalent with compulsory subjects maths & Physics with at least one optional subject such as	Dec/Jan & June/July	Through written examination is English,GK,Maths and Science held at ZROs/AROs/ASCs/NREs twice a year in Apr/Oct

	Aviation Sailor		Chemistry or Biology or Computer		for course commencing in Aug/Feb
MR (Matric Recruit)	I-Musicians	17-21	Matric	March/April	Candidates should have aptitude for music and knowledge of at least one musical instrument is mandatory. Recruitment is conducted once a year.
	II-Stewards	17-21	Matric	Dec & June	Through written examination in Maths, English, GK and Science held twice a year in Apr/ Oct conducted by the Naval Recruiting Establishments for courses commencing in Oct/ Apr for both entries.
	III- Cooks	17-21	Matric	Dec & June	
NMR (Non-Matric Recruit)	Topasses	17-21	VI Class	Dec & June	Through written examination in General

					Awareness and Arithmetic. Held twice a year in Apr/ Oct conducted by the Naval Recruiting Establishments for courses commencing in Oct/ Apr.
Sports Entries					
Direct Entry (Sports)	Seaman (Acting Petty Officer)	17-21	Matric or Equivalent (can be relaxed)	Dec & Jun	Recruitment is conducted twice a year in Apr/Oct for courses commencing in Aug/ Feb. Exceptionally outstanding sportsmen who have represented international/ National level may contact or write directly to :- The Secretary, Indian Naval Sports Control Board, Integrated
SSR (Outstanding Sportsman)	Seaman/ comm./ Elect/ eng/ medical/ writer/ store/ Naval Aviation	17-21	Minimum 45% aggregate marks in 10+2/ equivalent with compulsory subjects math & physics with at least one optional subject such as Chemistry or Biology or Computer.	Dec/Jan & June/ July	
MR (Outstanding Sportsman)	Steward/ Cook	17-21	Matric	Dec & June	

					Headquarters of Ministry of Defence (Navy) Room No.8,'C'Wing, Sena Bhawan, New Delhi- 110011 Tel.: 23010562
--	--	--	--	--	--

12. **Note:**

(a) The above information is a broad guideline and is subject to change as per the induction requirement of the Indian Navy.

(b) All the Advertisements are published in Employment News and National/ Regional/ Leading News Papers.

(c) Minimum % age of marks, for each entry is promulgated through advertisements for particular batch & may differ from the % age mentioned above.

For further Details and Information, Contact or write to:

The Joint Director, Manpower planning and Recruitment (NRO)

Integrated Headquarters of Ministry of Defence (NAVY),

Sena Bhawan, New Delhi- 110011

Tel: 011-23793067 (Sailors) www.nausena-bharati.nic.in

13. **Conclusion.** The Indian Navy is employing cutting edge technology in administration & is operating in a dynamic environment . The recruitment into the Navy is based on selection through merit and calls for bright youth to join this finest service and serve the Nation. It also provides good pay and perks, housing, childrens education and hospital facilities to its service personnel.

(This lecture needs to be supplemented by movies produced by DMPR/ IHQ/ MoD (Navy) periodically for better assimilation by cadets)

SECTION – 9 (SD/SW)

BRANCHES OF THE NAVY AND THEIR FUNCTIONS

Period	-	1
Type	-	LEC
Term	-	2

.....

Training Aids

1. Blackboard, chalk, White board, Marker, Pointer & Projector

Time Plan

2.

(a)	Introduction	-	05 min
(b)	Branches	-	30 min
(c)	Conclusion	-	05 Mins

			40 Mins

3. **Introduction.** Indian Navy has the following six branches:-

- | | |
|------------------------|----------------------|
| (a) Executive branch | (d) Logistics branch |
| (b) Engineering branch | (e) Education branch |
| (c) Electrical branch | (f) Medical branch |

4. **Executive Department.** The primary function of this department is to keep the ship in top fighting efficiency. Maintenance of ship's discipline is also the responsibility of this department. The executive department is headed by an officer from the executive branch and he is called Executive Officer. On big ship's he is also known as Ship's Commander. He is also called **Second in Command**, and in the absence of the

Commanding Officer, he is in charge of the ship. This department is further divided into following 06 sub branches:-

- | | | |
|-------------------|----------------|----------------|
| (a) Gunnery | (b) ASW | (c) Navigation |
| (d) Communication | (e) Regulating | (f) NBCD |

5. **Engineering Department.** The primary responsibility of this department is to maintain the propulsion system of the ship and provide propulsion power to the ship as directed by the Commanding Officer. It also provides assistance to ships NBCD in countering the damage. The HOD of this department is called Engineer Officer (EO).

6. **Electrical Department.** The ship needs electrical supply for domestic purpose i.e cooking, fans, AC, lighting and for operating weapon systems and sensors. This department is responsible for electrical power generation and electrical power supply to the ship borne weapon systems and sensors. The HOD of this department is called the Electrical Officer (LO).

7. **Logistics Department.** The logistics department is responsible to feed the ships company, provide them clothes, look after their Pay and Allowances, provide spares and stores to Engineering, Electrical and Executive department for effecting repairs/replacement. The HOD of this department is called Logistics Officer (LOGO).

8. **Medical Department.** The primary responsibility of this department is to look after the health of the ships company. A qualified Medical Officer (MO) is posted onboard a ship for this purpose.

9. **Education Branch.** This department consists of officers of Education Branch, Civilians Instructors and a few sailors. These instructors look after class room instruction and examination of academic subjects. They also look after extracurricular activities, take classes for ETI and HET exams and conduct examinations for sailor. This department is headed by Senior Education Officer (SEDO).

10. **Flight.** Some ships have air element like helicopter onboard. Such ships have a separate department called ships Flight. This department is headed by a Flight Commander from the Aviation Branch.

11. **Diving**. Certain ships have complements of divers to undertake emergency diving operation both at harbour and sea to meet unforeseen requirements.

12. **Conclusion**. The branches of the Navy are for efficient running of departments when the Officers and Sailors of a particular branch are specially trained to discharge multifarious jobs that they are called upon to perform during their service career.

SECTION -10 (SD/SW)

ROLE OF NAVY IN INDO PAK WAR-1971 & KARGIL WAR

Period	-	02
Type	-	LEC
Term	-	III

Trg Aids

1. Blackboard, chalk, White board, Marker, Pointer & Projector

Time Plan.

2.	(a)	Intro	-	05 Mins
	(b)	Role of IN Indo Pak War-1971	-	15 Mins
	(c)	Kargil War	-	15 Mins
	(d)	Conclusion	-	05 Mins

				40 Mins

3. **Introduction.** The Indo Pak War of 1971 was brought about by the flawed inner dynamics of the Pakistani system of governance where in the Bengalis of the East Pakistan were not dealt with according to democratic norms. Even when ballot gave them overwhelming majority, they were refused their rights by the Pakistani Government, that lead to Mujibur Rahman declaring Bangladesh an independent country on 25 Mar 1971.

NAVAL OPERATIONS IN ARABIAN SEA.

4. The situation in the Arabian Sea was altogether different. The Submarine, surface and air threats were higher and assessment of threats were little confusing.
5. **Missile Boat Attack.** The first missile boat attack on Karachi, launched from Saurashtra (Okha) along the coast, was a success. It sank a Pakistani destroyer and a coastal minesweeper. The Indian Fleet planned its next attack for night 8/9 December. To divert attention from missile attack on Karachi, they had also planned a diversionary

attack on Jiwani (Makran Coast). The bombardment group, under the Cruiser Mysore, apprehended Pakistani Merchant Ship 'Madhumati' south of Jiwani after she had transmitted an SOS to Karachi. After Madhumati was boarded FOCWF called off gun bombardment of Jiwani as SOS was good enough distraction for the missile boats to go through the attack on Karachi. Once again this second strike also was successful. A missile, set Karachi fuel storage tanks aflame and another hit Dacca, the Pakistani Navy's tanker, at the anchorage. These two missile attack on Karachi achieved Western Fleet dominance of Sea approaches to Karachi.

6. **Sinking of INS Khukri.** A submarine was reliably detected off Bombay. On 8th December two frigates Khukri and Kirpan, were sailed from Bombay to 'Flush' this submarine away from the Saurashtra coast where ships were assembling for the next missile attack on Karachi. On the evening of 9th December, the Pakistani submarine Hangor successfully torpedoed and sank Khukri. A sustained anti-submarine operation over the next four days was unable to prevent the Hangor's return to Karachi.

NAVAL OPERATIONS IN BAY OF BENGAL.

7. In the Bay of Bengal there was no Surface threat. At the very beginning of the war, the Submarine threat vanished after, Pakistani Submarine Ghazi exploded at the entrance to Visakhapatnam Harbour whilst laying mines. There was no air threat after Indian Air Force attacks grounded aircraft in East Pakistan. Carrier borne Air Craft avoided attacking neutral Merchant Shipping at Sea. They concentrated on immobilising Pakistani Vessels and damaged all Air Strips, which Pakistani Forces in East Pakistan might use to escape capture. Ships of Eastern Fleet enforced contraband control until tasked with amphibious landing to cut off escape routes into Burma. Pakistan's Forces in the east laid down their arms after thirteen days of war and new Nation Bangladesh came into being.

8. **Lesson Learnt.** The war ended on 17th December when Pakistan accepted India's offer of cease-fire. While Indian Navy gave a good account of itself following lessons were learnt and post war action was taken to address these issues.

(a) **Innovation and Exercise.** Missile boat attack carried out by Indian Navy by towing them near the vicinity of target was a plus point of improvisation.

(b) Submarine is a dangerous enemy in typical hydrological condition where it is difficult to detect and requires attack from air, surface and underwater –all three directions.

(c) Large caliber gun engagement between warships not likely. Anti ship missile would dominate future war at sea.

KARGIL WAR

9. **Introduction.** During 1999 Kargil War, the western and Eastern Fleet were deployed in the Northern Arabian Sea, as part of the Operation Talwar. They safeguarded Indian Maritime assets from a Potential Pakistani Naval Attack as also deferred Pakistan from attempting to block India's sea-trade routes. The Indian Navy's aviators flew sorties and marine commandos fought alongside Indian Army personnel in the Himalayas.

10. **Initial Phase.** The 1999 Kargil War took place between May 8, when Pakistani forces and Kashmiri militants were detected atop the Kargil ridges and July 14 when both sides had essentially ceased their military operations. It is believed that the planning for the operation, by Pakistan, may have occurred about as early as the autumn of 1998. The spring and summer incursion of Pakistan-backed armed forces into territory on the Indian side of the line of control around Kargil in the state of Jammu and Kashmir and the Indian military campaign to repel the intrusion left 524 Indian soldiers dead and 1,363 wounded.

11. **Later Phase.** By 30 June 1999 Indian forces were prepared for a major high-altitude offensive against Pakistani posts along the border in the disputed Kashmir region. Over the previous six weeks India had moved five infantry divisions, five independent brigades and 44 battalions of paramilitary troops to Kashmir. The total Indian troop strength in the region had reached 730,000. The build-up included the deployment of around 60 frontline aircraft. The Pakistani effort to take Kargil occurred after the February 1999 Lahore summit between then Pakistani Prime Minister Nawaz Sharif and the Indian Prime Minister Atal Bahari Vajpayee. This conference was believed to have de-escalated the tensions that had existed since May 1998. The major motive behind the operation was to help in internationalizing the Kashmir issue, and for which global attention had been flagging for some time. The intrusion plan was

the brainchild of Pakistan's Chief of Army Staff, Gen Pervez Musharraf and Lt Gen Mohammed Aziz, the Chief of General Staff. They obtained only an 'in principle' concurrence, without any specifics, from Nawaz Sharif, the Pakistani Prime Minister.

NAVAL ASPECTS OF KARGIL WAR

12. While the Army and the Air Force readied themselves for the battle on the heights of Kargil, Indian Navy began to draw out its plans. Unlike the earlier wars with Pakistan, this time the bringing in of the Navy at the early stages of the conflict served to hasten the end of the conflict in India's favor.

13. **Strategy.** In drawing up its strategy, the Navy was clear that a reply to the Pakistani misadventure had to be two-pronged. While ensuring safety and security of Indian maritime assets from a possible surprise attack by Pakistan, the Indian imperative was that all efforts must be made to deter Pakistan from escalating the conflict into a full scale war. Thus, the Indian Navy was put on a full alert from May 20 onwards, a few days prior to the launch of the Indian retaliatory offensive. Naval and Coast Guard aircraft were put on a continuous surveillance and the units readied up for meeting any challenge at sea.

14. **Operational Talwar.** Time had now come to put pressure on Pakistan, to ensure that the right message went down to the masterminds in that country. Strike elements from the Eastern Fleet were sailed from Visakhapatnam on the East Coast to take part in a major naval exercise called 'SUMMEREX' in the North Arabian Sea. This was envisaged as the largest ever amassing of naval ships in the region. The message had been driven home. Pakistan Navy, in a defensive mood, directed all its units to keep clear of Indian naval ships. As the exercise shifted closer to the Makaran Coast, Pakistan moved all its major combatants out of Karachi. It also shifted its focus to escorting its oil trade from the Gulf in anticipation of attacks by Indian ships.

15. As the retaliation from the Indian Army and the Air Force gathered momentum and a defeat to Pakistan seemed a close possibility, an outbreak of hostilities became imminent. Thus the naval focus now shifted to the Gulf of Oman. Rapid reaction missile carrying units and ships from the fleet were deployed in the North Arabian Sea for carrying out missile firing, anti-submarine and electronic warfare exercises. The Navy

also readied itself for implementing a blockade of the Pakistani ports, should the need arise. In addition, Naval amphibious forces from the Andaman group of islands were moved to the western sea-board.

16. **Conclusion.** In a skillful use of Naval power in the form of 'Operation Talwar', the Eastern Fleet joined the Western Naval Fleet and blocked the Arabian Sea routes of Pakistan. Apart from a deterrent, the former Prime Minister Nawaz Sharief later disclosed that Pakistan was left with just six days of fuel (POL) to sustain itself if a full-fledged war broke out.

SECTION -11 (SD/SW)

NAVAL CAMPAIGN (PEARL HARBOUR, FALKLAND WAR,

BATTLE OF ATLANTIC/ FLEET PFR, IFR)

Period	-	2
Type	-	PRAC
Term	-	01 each for II & III

Trg Aids

1. Blackboard, chalk, white board marker, projector and pointer & Video clips

Time Plan.

- | | | | | |
|----|-----|----------------------------------|---|---------|
| 2. | (a) | Intro | - | 05 Mins |
| | (b) | Pearl Harbour, | - | 10 Mins |
| | (c) | Falkland war, Battle of Atlantic | - | 10 Mins |
| | (d) | PFR, IFR | - | 10 Mins |
| | (e) | Conclusion | - | 05 Mins |

40 Mins

3. **Introduction.** During First and Second World War, there were many Naval Campaigns which turned the tide of war and considered to be the turning points. Let us look at some of the famous naval battles.

Pearl Harbor

4. The Battle of Pearl Harbour was a surprise military strike conducted by the Imperial Japanese Navy against the United States naval base at Pearl Harbour, Hawaii, on the morning of December 7, 1941 (December 8 in Japan). The attack was intended as a preventive action in order to keep the U.S. Pacific Fleet from interfering

with military actions the Empire of Japan was planning in Southeast Asia against overseas territories of the United Kingdom, the Netherlands, and the United States.

5. The base was attacked by 353 Japanese fighters, bombers and torpedo planes in two waves, launched from six aircraft carriers. All eight U.S. Navy battleships were damaged, with four being sunk. Of these eight damaged, two were raised, and with four repaired, six battleships returned to service later in the war. The Japanese also sank or damaged three cruisers, three destroyers, an anti-aircraft training ship and one minelayer. 188 U.S. aircraft were destroyed; 2,402 Americans were killed and 1,282 wounded. Important base installations such as the power station, shipyard, maintenance, and fuel and torpedo storage facilities, as well as the submarine piers and headquarters building (also home of the intelligence section) were not attacked. Japanese losses were light: 29 aircraft and five midget submarines lost, and 65 servicemen killed or wounded. One Japanese sailor was captured.

6. The attack came as a profound shock to the American people and led directly to the American entry into World War II in both the Pacific and European theaters. The following day (December 8), the United States declared war on Japan. Domestic support for non-interventionism, which had been strong, disappeared. Clandestine support of Britain (for example the Neutrality Patrol) was replaced by active alliance. Subsequent operations by the U.S. prompted Germany and Italy to declare war on the U.S. on December 11, which was reciprocated by the U.S. the same day. There were numerous historical precedents for unannounced military action by Japan. However, the lack of any formal warning, particularly while negotiations were still apparently ongoing, led President Franklin D. Roosevelt to proclaim December 7, 1941, "a date which will live in infamy". Thus Japan had achieved total "Surprise" by attacking Pearl Harbour. (Show Movie)

Falklands War

7. The Falklands War (Spanish: *Guerra de las Malvinas* or *Guerra del Atlántico Sur*), also known as the Falklands Conflict or Falklands Crisis, was a 1982 war between Argentina and the United Kingdom. The conflict resulted from the long-standing dispute over the sovereignty of the Falkland Islands and South Georgia and the South Sandwich Islands, which lie in the South Atlantic, east of Argentina.

8. The Falklands War began on Friday 2 April 1982, when Argentine forces invaded and occupied the Falkland Islands and South Georgia. The British government dispatched a naval task force to engage the Argentine Navy and Air Force, and retake the islands by amphibious assault. The resulting conflict lasted 74 days and ended with the Argentine surrender on 14 June 1982, which returned the islands to British control. During the conflict, 649 Argentine military personnel, 255 British military personnel and 3 Falkland Islanders died.

9. The conflict was the result of a protracted historical confrontation regarding the sovereignty of the islands. Argentina has asserted that the Falkland Islands have been Argentinian territory since the 19th century and till to date and showed no sign of relinquishing the claim. The claim was added to the Argentine constitution after its reformation in 1994. As such, the Argentine government characterised their initial invasion as the re-occupation of their own territory, whilst the British government saw it as an invasion of a British dependent territory. However, neither state officially declared war and hostilities were almost exclusively limited to the territories under dispute and the local area of the South Atlantic.

10. The conflict had a strong impact in both countries. Patriotic sentiment ran high in Argentina, but the outcome prompted large protests against the ruling military government, which hastened its downfall. In the United Kingdom, Prime Minister Margaret Thatcher's government was bolstered by the successful outcome. Relations between the United Kingdom and Argentina were restored in 1989 following a meeting in Madrid, at which the two Governments issued a joint statement. (Show Movie Clip)

Battle of Atlantic

11. The Battle of the Atlantic was the longest continuous military campaign in World War II, running from 1939 to the defeat of Germany in 1945. At its core was the Allied naval blockade of Germany, announced the day after the declaration of war, and Germany's subsequent counter-blockade. It was at its height from mid-1940 through to the end of 1943. The Battle of the Atlantic pitted U-boats and other warships of the *Kriegsmarine* (German Navy) and aircraft of the *Luftwaffe* (German Air Force) against Allied merchant shipping. The convoys, coming mainly from North America and mainly going to the United Kingdom and the Soviet Union, were protected for the most part by the British and Canadian navies and air forces. These forces were aided by ships and aircraft of the United States from September 13, 1941. The Germans were

joined by submarines of the Italian Royal Navy (*Regia Marina*) after their Axis ally Italy entered the war on June 10, 1940.

12. As an island nation, the United Kingdom was highly dependent on imported goods. Britain required more than a million tons of imported material per week in order to be able to survive and fight. In essence, the Battle of the Atlantic was a tonnage war: The Allied struggle to supply Britain and the Axis attempt to stem the flow of merchant shipping which enabled Britain to keep fighting. From 1942 onwards, the Germans also sought to prevent the build-up of Allied supplies and equipment in the British Isles in preparation for the invasion of occupied Europe. The defeat of the U-boat threat was a pre-requisite for pushing back the Germans. Winston Churchill was later to state:

13. The Battle of the Atlantic was the dominating factor all through the war. Never for one moment could we forget that everything happening elsewhere, on land, at sea or in the air depended ultimately on its outcome. The outcome of the battle was a strategic victory for the Allies—the German blockade failed—but at great cost: 3,500 merchant ships and 175 warships were sunk for the loss of 783 U-boats.

14. The name 'Battle of the Atlantic' was coined by Winston Churchill in February 1941. It has been called the "longest, largest, and most complex" naval battle in history. The campaign began immediately after the European war began and lasted six years. It involved thousands of ships in more than 100 convoy battles and perhaps 1,000 single-ship encounters, in a theatre covering thousands of square miles of ocean. The situation changed constantly, with one side or the other gaining advantage, as new weapons, tactics, counter-measures, and equipment were developed by both sides. The Allies gradually gained the upper hand, overcoming German surface raiders by the end of 1942 and defeating the U-boats by mid-1943, though losses to U-boats continued to war's end. (Show Slides)

15. **President Fleet Review (PFR)**. The President of India is entitled to inspect his/her fleet, as he/she is the supreme commander of the Indian Armed Forces. The first President's fleet review by India was hosted by Dr. Rajendra Prasad on 10 October 1953. President's reviews usually take place once in the President's term. In all, ten fleet reviews have taken place, including in February 2006, when former President Dr. APJ Abdul Kalam took the review. The latest, on 20 December 2011, when President Smt Pratibha Patil set sail in a warship INS Subhadra to take the 10th Fleet Review.

16. **Maritime Show.** The Presidents Review is an impressive ceremony, second only to the Republic Day Parade. Naval ships and ships from maritime organisations like the Coast Guard, the Merchant Navy, the National Institute of Oceanography, the Oil and Natural Gas Commission, Training Ship Rajendra and Naval Yard Craft are anchored precisely in neat lines and dressed overall. Thus all stake holders in the maritime domain gather representing a total Maritime Show.

17. The President embarks in a naval ship nominated as the President Yacht, which files the President's Colours. After receiving a 21-gun salute, the President reviews the Fleet by cruising past each line of Ships. Each ship's side is manned by her ship's company in white ceremonial uniform. As the President passes by, each Ships' company, in unison take off their caps in salutation and give three resounding 'Jais'. The fixed and rotary wings a/c squadrons also fly pass and carry out aerial aerobatics in the sky.

18. At sunset, all ships at the anchorage participate in a fireworks display. As darkness descends, all ships, in unison, switch on their garlands of lights, which accentuate their silhouettes.

19. No Fleet Review was held for President Neelam Sanjiva Reddy during his tenure from 25 Jul 1977 to 24 Jul 1982.

20. **International Fleet Review (IFR).** The Indian Navy also conducted an International fleet review named *Bridges of Friendship* in February 2001 in Mumbai. Many ships of friendly Navies from all around the world participated, including two from the U.S. Navy. The aim of IFR is to showcase India's Maritime assets and naval power in the international arena.

21. **Conclusion.** Study of Naval Battles reveals that strategy and tactics have to be supported by logistics as the arena is vast. Navies have to be supported across oceans and for long periods of time. Also, real time communication is of extreme importance. Fleet is reviewed by the President, who is the supreme Commander of the Armed Forces, once in his/her tenure.

CHAPTER-II

NAVAL WARFARE AND ITS COMPONENTS (NW)

SECTION-1(SD/SW)

INTRODUCTION TO ANTI-SUBMARINE WARFARE & FLEET OPERATION

Period - 02

Type - LEC

Term - II

.....

Training Aids

1. Blackboard, chalk, White board, Marker, Pointer & Projector

Time Plan

- | | | | | |
|----|-----|------------------------|---|---------|
| 2. | (a) | Introduction | - | 05 min |
| | (b) | Anti-submarine warfare | - | 10 min |
| | (c) | Weapons and sensors | - | 20 min |
| | (d) | Conclusion | - | 05 Mins |
| | | | | ----- |
| | | | | 40 Mins |
| | | | | ----- |

3. **Introduction.** In its early years, this Branch of Naval warfare was referred to as '***Torpedo & Anti- Submarine Warfare***'. Today this is now termed as '***Undersea Warfare***'- the cat and mouse game, with the participants playing the rules of both the hunter and the hunted. From these facts it is easy to understand the great importance of Anti-submarine warfare in Naval Warfare.

4. **Sonar.** A system for detection of the submerged objects using sound pulses is called sonar. The purpose of it is to detect, classify and locate an underwater target.

5. **Components of Sonar.** The major components of sonar are mentioned below:-

- (a) Transducer.
- (b) Transmit/ Receive switch.
- (c) Transmitter.
- (d) Receiver.
- (e) Display.
- (f) Head phone.

6. **Types of Sonar.** Sonars, the world over, use different methods for transmission of sound energy, reception & processing of returning sound energy. Sonars are broadly classified depending on the type of method for search and detection of underwater target as follows:-

- (a) **Step search Sonar.** When the search underwater is all around the platform in limited steps, similar to search light system.
- (b) **Panaromic Sonar.** In this, ripple beams are formed to search the 360 deg arc around the platform.
- (c) **The Convergence zone Sonar.** These Sonars use the convergent zones which may exist in certain waters to enhance the detection range.
- (d) **Bottom bounce Sonar.** Which are used when bottom bounce condition in certain water (depending on the sea water)
- (e) **Towed Arrays.** These are small linear array which is streamed behind the ship. It receives noise radiated by ships and submarines underwater. Towed arrays operate in very low Frequency region and achieve long range detection of targets.

7. **Classification of Sonars.** Sonars are classified as Hull Mounted or Variable Depth Sonar (VDS) based on way it is out-fitted on a Ship.

- (a) **Hull Mounted.** The hull mounted sonar has a transducer enclosed in a dome. Thus the dome is kept at a constant depth in the water when the sonar is operating.

(b) **Variable Depth Sonar (VDS)**. The VDS has a transducer which may be lowered at different depths to optimize to sonar performance in varying hydrological conditions such as:-

- (i) Towed array.
- (ii) Dunking sonars
- (iii) Sonobuoys

8. **Modes of Sonar**

(a) **Active Sonar**. This system is based on the echo ranging principle where acoustic signal is radiated and returning echoes from the targets are received.

(b) **Passive Sonar**. The passive sonar does not put any energy in to water but listen to the sound produced by ships and submarine.

9. **MISCELLANEOUS SENSORS.**

(a) **Sonobuoys.** For underwater detections, these are smaller sonar sets dropped by aircrafts, which detect submarines by sonar and relay information to the aircraft by radio. They can be active or passive. Passive buoys have the advantage of concealing their presence from submarines.

(b) **Magnetic Anomaly Detection (MAD).** To detect minute changes in the earth's magnetic field caused by the presence of a submarine. The range is limited and depends on aircraft's flying height. It is used mainly to confirm the presence of a contact and is very limited.

(c) **Exhaust Trail Indicator (ETI).** To detect diesel fumes thereby indicating presence of a diesel powered submarine. It is not very accurate and in today's context is very limited.

10. **ASW Weapons.** The following are the types of ASW weapons fitted on major IN surface platforms of Indian Navy:-

- (a) Torpedoes (A 244S, CET 53M, CET 53-65KE, CET 65E, AND SUT)
- (b) Rockets. (SR 375, RGB 60, RGB 12)
- (c) Depth Charge Mk 7*/11.
- (d) Mines. (MR 80, PBGM, PBMM AND PBEM (exercise version)).
- (e) PLAB Bombs.

(f) APR 2E (UW Missiles).

11. **Types of Attack.** The underwater saboteurs can use any of the following means to carry out attack on ships in harbour.

- (a) Midget attack.
- (b) Chariot attack.
- (c) Swimmer attack.
- (d) Drifting charges.

12. **Launching Platforms.** The vessel from which a weapon is fired is called a launching platform. The launching platforms for the different weapons are as follows:-

- (a) **Torpedo.** A Torpedo can be fired from a ship, submarine or an aircraft. Depending on the depth of the submarine or the depth below the waterline of a target ship. It is essential that prior to launch the depth has to be set on the Torpedo. The torpedo should also be able to correct itself at the running depth from external forces during its run.
- (b) **Rocket.** A rocket has got its own propellant in the form of a booster which takes the rocket to its required range. The range is achieved elevating the angle of the launcher the maximum range is achieved at 45 degrees elevation of the launcher.
- (c) **Depth Charges.** Depth charges are depth bombs, which explodes on hydrostatic principle. It is one of the fool Proof Weapon systems, which can be effectively used as deterrent against submarines.

13. **The Sonars & Weapons Indian Naval Ships:**

- (a) **Aircraft Carrier** 1 x Graseby Type 184M hull-mounted
- (b) **Delhi Class Sonar;** 1 x Bharat APSOH (Advanced Panoramic Sonar Hull) hull-mounted,
2 x RBU-6000 Anti-submarine mortars.
5 x 10-21 inch torpedo tubes
- (c) **Rajput Class Sonar;** 1 x hull mounted Vycheda MG-311 (NATO: Wolf Paw) sonar.
1 x Vyega MG-325 (NATO: Mare Tail) variable depth sonar

1 x 533 mm PTA 533 quintuple torpedo tube launcher.

2 x RBU-6000 anti- submarine mortars.

(d) **Shivalik Class** 1 x BEL APARNA

HUMSA (Hull Mounted Sonar Array).

ATAS/Thales Sintra towed array systems.

2 x 2 DTA-53-956 torpedo launchers.

2 x RBU-6000 (RPK-8) rocket launchers

(e) **Talwar Class** BEL APSOH (Advanced Panoramic Sonar Hull) hull-mounted sonar

1 x RBU-6000 ASW launcher with 212mm 90R anti-submarine missile.

RGB-60 depth charges.

(f) **Barhmaputra Class** 1 x Bharat HUMSA sonar.

1 x Thales Sintra sonar

6 x 324mm ILAS 3 (2 x triple tubes) with Whitehead A244S anti-submarine torpedoes

(g) **Godavari Class** Bharat APSOH hull mounted sonar.

Fathoms Oceanic VDS and Type 162M sonar

6 x 324mm ILAS 3 torpedo tubes with Whitehead A244S

NST 58 anti-submarine torpedoes

(h) **Abhay Class** 1 x Rat Tail VDS sonar

4 x 533mm torpedo tubes, SET-65E anti-submarine torpedoes.

2 x RBU 1200 five-tubed rocket launcher

(j) **Pondicherry Class** MG-69/79 High frequency, hull mounted, active mine detection

2 x RBU 1200 5-tubed ASW rocket

10 mines

14. **Fleet Operations.** Ships operate as a Fleet during operations. The Main Body comprises the high-value ships like the Tanker and Aircraft Carrier. They are protected by a screen comprising anti-ship and anti-submarine ships. In addition, ships are placed ahead of the formation as Pickets

15. **Conclusion.** Anti submarine warfare is a special operation to detect and engage a submarine. This involved special types of ships termed “Anti-Submarine Role Ships”

which are fitted with sonars and anti-submarine weapons. Ships fitted with both anti-ship and anti-submarine weapons are called Multi-purpose ships.

SECTION-2(SD/SW)

ROLE OF AVIATION - NAVAL AIRCRAFT & HELICOPTERS

Period	-	02
Type	-	LEC
Term	-	III

Training Aids

1. Blackboard, chalk, White board, Marker, Pointer & Projector

Time Plan

2.	(a)	Introduction	-	05 min
	(b)	Role of Naval Aviation	-	15 min
	(c)	Types of Aircraft	-	15 min
	(d)	Conclusion	-	05 Mins

				40 Mins

3. **Introduction.** Indian Navy operates as a three dimensional navy with a responsibility to keep our maritime areas of interest safe and secure from underwater, surface and aerial threats. Naval aviation is one of the three dimensions responsible for keeping our national assets safe from air threat.

4. **Role of Naval Aviation.** Induction of air element in naval warfare has enhanced the reach of our forces to counter threat at longer ranges away from our coast. One of the primary role is to maintain surveillance at all times. Aerial surveillance is the fastest means with extended coverage which is achieved with LRMP aircraft. These aircraft can also carry out attack on surface, ships or submarines when detected. The fighter aircraft

which operate from the aircraft carrier prevents strike by hostile aircraft on our surface ships or coastal assets. Helicopters embark on other ships of the fleet also support the fleet against submarines which are a threat to the fleet at sea and also enemy surface ships operating beyond the detection ranges of our ships.

5. **Types of Aircraft.** There are three types of aircraft in the navy

(a) **Fixed Wing aircraft** includes long and medium range maritime petrol aircraft , fighters and trainers.

(i) LRMP – IL 38 and TU 142M

(ii) MRMP – Dornier

(iii) Fighters – Sea Harrier, MIG 29K

(iv) Trainer – Kiran

(b) **Rotary Wing aircraft** are helicopters based on surface ships. They include

(i) Sea King & UH3H – for antiship, anti surface and commando drop

(ii) Kamov – anti submarine and electronic surveillance

(iii) Chetak – anti submarine and search and rescue

(c) **Unmanned aerial vehicle (UAV)** are pilotless aircraft fully controlled from a base and is used mainly for surveillance. They are

(i) Searcher

(ii) Heron

6. **Conclusion.** The war at sea is complex and involves several units by way of ships, submarines and aircraft. Hence ships operating at sea have to be fully prepared to counter all these threats. One of the most effective resources is the presence of aircraft and helicopters at sea from ship based on the aircraft carrier and surface ships which can be launched at short notice and can cover extensive ranges over the sea to detect threats and also neutralize them.

SECTION-3 (SD/SW)

TYPES OF SUBMARINES AND ITS ROLE - ASW WEAPON AND SENSORS

Period	-	01
Type	-	LEC
Term	-	III

Training Aids

1. Blackboard, chalk, White board, Marker, Pointer & Projector

Time Plan

2.	(a)	Introduction	-	05 min
	(b)	Types of Submarine and role	-	15 min
	(c)	Weapons and Sensors	-	15 min
	(d)	Conclusion	-	05 Mins

				40 Mins

3. **Introduction**. It was Leonardo Da Vinci who conceived the idea of a submersible. This was recorded in 1864 during the American civil war. Since then, the development of submarine as a weapon of war has been unique in the annals of Naval warfare. India has a large submarine fleet which can be deployed in offensive role to attack enemy warships and merchant shipping and to safeguard our assets.

4. **Buoyancy and Floatation**. A Submarine consists of a tubular hull, called a pressure hull. In order to float and stabilize this huge metal structure, the submarine is fitted with main ballast tanks. These are external to the pressure hull, and when on the

surface are full of air to give the submarine a positive buoyancy. The tanks are opened to the sea at the bottom through small circular openings which result in flooding. To dive a submarine, the main vents are opened to allow air to escape and with it the sea water. (This essentially trims the submarines 'by the bow'.) This reduces the buoyancy, inducing neutral buoyancy causing the submarine to dive. Similarly if diving stations, are 'piped', a number of them moving aft from living quarters to the control room) water is pumped from aft to forward to maintain the trim.

5. **Types of submarine:** There are two types of submarine these are:-

(a) **Conventional Submarines**. These are propelled by diesel engines or electric motors. The diesel engine is used to propel the submarine and charge its batteries, when the submarine is at the surface or on '***snort***' (*at periscope depth*). The electric motor is used to propel the submarine when it is dived. The conventional submarine usually has a displacement between 5000 to 6000 tonnes.

(b) **Nuclear Submarines**: These are powered by nuclear reactors and therefore remain underwater for longer duration. They are also capable of higher speeds than conventional submarine. They usually carry strategic weapons like submarine launched ballistic missile (SLBM), with nuclear warheads. The nuclear submarine has much larger displacement than conventional Submarines. They can maintain submerged operating speed of 20 knots or more.

6. **Special purpose Submarines:**

(a) **Coastal or Snort Submarine**. These Submarines have characteristics similar to those of the World War -II U-Boats but are of small size (usually 350 to 700 tonnes) and with limited endurance.

(b) **Midgets**. Midgets are very small submarines which carry a small crew of five or six men in a pressure hull. They have endurance at sea of 5 – 7 days. However, full operation efficiency is unlikely to be maintained for longer than 48 hours and submerged endurance is limited.

(c) **Pigmyes or Chariots**. These are small crafts without a pressure hull, and are propelled by electric motors, and their batteries can be only recharged from ashore / a submarine tender ship.

7. **Advantages of Submarine**

(a) **Conventional Submarine.**

- (i) Conventional Submarines can operate in shallow water.
- (ii) Are difficult to detect as they are small in size.
- (iv) Economically cheaper.
- (v) No radiation effect.

(b) **Nuclear Submarine.**

- (i) It can remain dived for longer period.
- (ii) More endurance.
- (iii) More speed and accuracy.

8. **Disadvantages of Submarine**

(a) **Conventional Submarine.**

- (i) Less Endurance.
- (ii) Less Speed.
- (iii) Has to surface for battery charging.
- (iv) Can't carry nuclear weapon with war head.

(b) **Nuclear Submarine.**

- (i) Higher noise radiation.
- (ii) Expensive.
- (iii) Cannot be used as small unit.
- (iv) Cannot be deployed in shallow waters.

9. **Role of Submarines.**

- (a) Deterrence to enemy shipping.
- (b) Clandestine Operations in support of small units.
- (c) Cargo carrying.

- (d) Reconnaissance including photography of enemy ports and survey of beaches.
- (e) Landing and recovery of agents and Saboteurs.
- (f) Mine Laying.
- (g) Launching strategic missiles.

10. **Sensors**

- (a) **Periscope**. Submarines are usually fitted with two periscopes. The larger one is used for reconnaissance and aerial search, and the smaller one for visual confirmation of a target, prior torpedo launch. The periscope is used for observation as well as for detection. If targets approximate bearing is known a check observation can be made in few seconds. A careful examination of the horizon takes considerable time and is usually conducted by sector searches. On a clear day, the submarine can sight a convoy at a range of 10 miles, escorting ships at about 7 miles, aircrafts at 8-9 miles.
- (b) **Radar**. Most submarines are fitted with surface search and air search radar, one or both can be used when submerged at periscope depth. Some submarines have fire control radar antenna fitted to the search periscope. The range of detection by surface search radar is limited by its low height above the sea level.
- (c) **Sonar**. Most submarines are fitted with an array type of sonar which provides a purely passive method of long range detection of noises of suitable intensity and frequency. Under ideal conditions the range may be greater than average value of 15 to 30 nautical miles.
- (d) **Wireless/EW Equipment**. Submarines are fitted with suitable communication equipments for communication with surface ships and bases ashore. Submarines can receive VLF transmission on very low frequencies with their aerial 30 feet below the surface, even when operating as much as 3000 nautical miles of transmitting station.
- (e) **Bathy Thermograp**. Submarines are provided with sound velocity recorder to asses estimated sonar range, shadow zones and best operating depths.

11. **Weapons of Submarines.**

(a) **Torpedoes.** Submarines have always been designed to carry a large number of torpedoes tubes. A tube assembly is accommodated in the submarines fore and aft ends. The tubes are arranged parallel to each other and discharged by 'swim out'. The submarines may carry either passive/active/wire guided torpedoes. The following types of torpedoes are carried by submarines.

- (i) Passive.
- (ii) Active.
- (iii) Active.
- (iv) Wake homing torpedoes.
- (v) Wire Guided.

(b) **Missiles.** Some submarines are capable of firing tactical/cruise missiles. To permit launching without surfacing these missiles need to be of ballistic types. Some of the IN submarines have the capability of launching KLUB missiles.

(c) **Mine.** Submarines are capable of carrying and launching mines through the torpedo tubes. Since the torpedo being an important defensive weapon the submarines rarely proceed on operations with full load of mines at the expense of its torpedo carrying capacity. IN submarines are capable of laying MR 80, MRP, PBGM and PBEM mines.

12. **Sources to Detect Enemy Submarine at Sea.**

- (a) Sonar.
- (b) Radar.
- (c) EW Interception.
- (d) Aircraft.
- (e) Visual Lookout.
- (f) Visual sighting of Submarine or its periscope by merchant ships and fishing craft.

13. **Endurance of Submarine**. The endurance at Sea depends on several factors.

Some of these are:-

- (a) Fuel Carrying capacity.
- (b) Distance from Base (Time on Patrol).
- (c) Weather Conditions.
- (d) Snorting Time.
- (e) Time on Surface.
- (f) Time out of Dock.
- (g) Speeds Used (when submerged)

14. **Conclusion**. Submarines are very versatile platforms which use the principle of stealth to penetrate deep into enemy waters and carry out reconnaissance or offensive action against enemy shipping. They are fitted with weapons and sensors for detection and engagement. Conventional submarines are limited in their operations as they have to charge batteries whilst snorting and can be detected by ships or aircrafts.

SECTION-4 (SD/SW)

ELEMENTARY KNOWLEDGE OF GUNS & MISSILES

TYPES OF MISSILES & GUNS

Period	-	02
Type	-	LEC
Term	-	II

Training Aids

1. Blackboard, chalk, White board, Marker, Pointer & Projector

Time Plan

2.	(a)	Introduction	-	05 min
	(b)	Gunnery	-	15 min
	(c)	Missiles	-	15 min
	(d)	Conclusion	-	05 Mins

				40 Mins

3. **Introduction**. In the days of Sailing Ships, Warships were fitted with guns on the weather deck, on either side of the Ship, to keep clear of the ship's sails. With the advent of coal-fired ships, guns were optimally positioned to obtain optimal safe '*firing-arcs*'. In the initial period, guns were limited in size and firing range. With improved knowledge of metallurgy, priming and fusing, the size and range of Guns/Cannons increased exponentially. Despite the advent of the missile age and the rapid strides made in guided weapon technology, relevance of Surface guns, to a nation's Fleet remains a vital component. Nature of Conflict at Sea, between Navies, in the present

geo-political environment, is pre-dominantly of a “Low-Intensity” nature. Naval Guns provide a Fleet Commander, an instrument which is not only “flexible” but can be scaled-up or down, as appropriate, to a developing situation. Awareness of Gunnery to Naval Wing cadets has been packaged in a set of two-lectures, the first covers Guns and the second, Missiles.

4. **Close-in Weapon System (CIWS)**. These are guns which provide for action against targets, which are within visual range, at sea, typically 2 to 8 Nautical miles. These guns have a very high rate of fire, most are auto-controlled from a remote position. Common CIWS in the inventory of the Indian Navy are:-

- (a) 12.7MM HMG.
- (b) AK 630.
- (c) AK 230.
- (d) CRN-91 30 MM Medak.
- (e) 40 / 60 Bofors Gun.

5. **Medium Range Guns (MRG)**. Medium range Guns are those Gun systems, which have a MER in excess of the Visual range. Typically the range is 10 to 15 nautical miles. The guns are associated with a Gunnery Radar and a weapon control system (WCS). Together they identify and acquire the target, and direct the best suited Gun on a Ship to engage. The common CIWS in the inventory of the Indian Navy are:-

- (a) AK 100.
- (b) AK 176.
- (c) 76 MM OTO Melera Gun.
- (d) 4.5 Inch Gun.

6. **Guns fitted on surface platforms**

- | | | | |
|-----|------------------|---|--------------------|
| (a) | Aircraft carrier | - | 40 MM (2 Nos) |
| (b) | Delhi class | - | AK 100 (1 No) |
| | | | 30 MM (4 Nos) |
| (c) | Rajput class | - | AK 176 (1 No) |
| | | | 30 MM (4 Nos) |
| (d) | Shivalik class | - | 3' Oto-Breda Gun-1 |
| (e) | Talwar class | - | AK 100 (1 Nos) |

			Kashtan (2 Nos)
(f)	Khukri class	-	AK 176 (1 No) 30 MM (2 Nos)
(g)	Veer class	-	AK 176 (1 No) 30 MM (2 Nos)

7. **Organisation of Gunnery Dept.**

- (a) EXO
- (b) Gunnery Officer (GO)
- (c) GO II/III/IV
- (d) COT/GI

8. **Command and Control Orders.** Should be :-

- (a) As brief as possible.
- (b) Easy to understand.
- (c) Relatively simple to carry out.

9. **Types of orders and reports**

- (a) **The preliminary command orders** cover the following aspects:-

- (i) The degree of readiness.
- (ii) The state of preparedness.
- (iii) Policy orders.

- (b) **Action Command Orders**

- (i) To confirm or if necessary, change the type of engagement or target given in the policy.
- (ii) To initiate an engagement using deliberate or alarm procedure.
- (iii) To interrupt an engagement, e.g. by ordering Check-Check-Check.
- (iv) To terminate an engagement, e.g. by Stop Loading - Stop Loading - Stop Loading or Cease firing

10. **Stowage of Ammunition.**

- (a) **Magazine.** A compartment or locker specially designed to be safe for the permanent or temporary stowage of any of the explosives.
- (b) **Locker.** The suffix 'locker' indicates that the particular magazine is free standing or recessed into the ships structure but its boundaries are not part of ship's structure and it is surrounded by an air gap.
- (c) **Ready Use.** The term "Ready Use' is used to indicate that boxed or unboxed explosives stores may only be stowed temporarily in that the particular magazine or locker.

11. **Gunnery Terminology**

- (a) **Armour Piercing Projectiles (AP).** Projectiles specially designed to pierce armour.
- (b) **Caliber.** The nominal diameter of the bore of a gun barrel measured across the bore.
- (c) **Effective Range.** The range within which accurate and lethal fire can be accomplished with a particular weapon, ammunition and sighting instruments in use.
- (d) **Fixed Ammunition.** A round of ammunition in which the projectile is secured with a cartridge case.
- (e) **Hang Fire.** When the time interval between the firing of a cartridge cap and the initiation of the propellant is excessive
- (f) **'Hot Guns'**. It is the condition of the gun when it becomes hot after firing certain number of rounds continuously resulting in cook off. The rate of fire and the number of rounds required to bring the gun condition varies from gun to gun.

12. **Responsibility of Gunnery Officer.** The Gunnery Officer is:-

- (a) Responsible for all explosives and explosive stores committed under his responsibility
- (b) To ensure safety or other regulations for explosives in his custody are drawn to the attention of the officers outside his department.

- (c) To inform OOW/ Duty Officer is informed before weapons or explosives are exposed on deck which requires Radio/ Radar restrictions transmission.
- (d) To ensure explosives Log is up to date with regard to the explosives under his charge.

13 **Watch and Quarter Bill.** It is prepared by each department of the ship and displayed within the department. This is prepared by the senior most Gunnery sailor of the department. It indicates various quarters that is prepared and needs to be manned by a personnel during different states of readiness. It is prominently displayed, usually in the main alley-way of the Ship, on a White board. It carries the following information:-
SNO, NAME, RANK, PART II 'Q', ACTION STATION, DEFENCE STATION, CRUISING STATION, ACTION MESSING, AND BOAT STATION.

14. **Watch and Station Bill.** Watch and Station bill is a record in which the information about the departmental organisation according to requirement of manning various stations in the ship at various states of readiness. This will be prepared by the Gunnery Officer after receiving data from other departments. The consolidated list will be displayed at a prominent location, below decks, as the ship's watch and station bill. It is customary that this is updated, each time prior putting out to sea.

Missiles

15 **Background.** Naval Gunnery has been a vital component of a Nation's Navy, since centuries. With technological advances, Radar systems were increasingly able to detect targets, in particular air-borne targets at extended ranges. Guns have an intrinsic limitation of range and its explosive payload. Even the 10-inch Guns of the famous German dreadnought Bismarck. Had a range under 25 Nautical miles. This paved the way to developments in missile technology. The Germans started a programme to develop missile based defense systems, originally called "anti-ballistic missile (ABM)" systems. The German V-2 short-range ballistic missile, launched against London and Antwerp by the Germans in the closing months of World War II, made it clear that long range missiles were the weapons of the 20th century. By 1950s, the technology was available to develop long-range missiles with accurate self- contained guidance systems and nuclear warheads. Parallely, there was progress being made to

develop weapons to counter this threat, in the development of Surface-to-Air (SAM) missile systems to intercept missile threats.

16. **Surface to Surface Missile (SSM).** The following SSM missiles are fitted onboard ships of the Indian Navy:

- (a) Klub Vertical launch system (VLS)
- (b) BrahMos Supersonic Missile.
- (c) Uran-E.
- (d) KH-35 Switchblade (SS-N-25).
- (e) SS-N-25.
- (f) P 20.
- (g) Dhanush.

17. **Surface to Air Missile (SAM).** The following SAM missiles are fitted onboard ships Indian Navy:

- (a) Barak Vertical launch (VL).
- (b) Shtil Missile.
- (c) SA-N-7 Missile.
- (d) Kashtan .
- (e) Igla 1E.
- (f) Strela - 2M.

18. **Missiles fitted on IN surface platforms**

(a) Aircraft Carrier	Barak VL	SAM 16
(b) Delhi Class	16 x SS-N-25	SSM
	1 x Barak	SAM
	2 x Shtil	SAM
(c) <u>Rajput Class</u>	BrahMos	SSM
(d) Shivalik Class	8 x Klub VLS	
(e) Khukri Class	P 20 SSM	

19. **Function of various missiles and their range**

- (a) **Ballistic Missile.** A ballistic missile is a missile that follows a sub-orbital ballistic flight path with the objective of delivering one or more warheads to a

predetermined target. To date, ballistic missiles have been propelled during powered flight by chemical rocket engines of various types.

(b) **Cruise missile**. A cruise missile is a guided missile. The major portion of whose flight path to its target (a land-based or sea-based target) is conducted at approximately constant velocity; that relies on the dynamic reaction of air for lift, and upon propulsion forces to balance drag. Cruise missiles are designed to deliver a large warhead over long distances with high accuracy. Modern cruise missiles can travel at supersonic or high subsonic speeds, are self-navigating, and can fly on a non-ballistic, extremely low altitude trajectory. They are distinct from unmanned aerial vehicles (UAV) in that they are used only as weapons and not for reconnaissance. In a cruise missile, the warhead is integrated into the vehicle and the vehicle is always sacrificed in the mission.

(c) **Guided Missile**. Projectile provided with means for altering its direction after it leaves its launching device. Almost all modern missiles are propelled by rockets or jet engines and have guidance mechanisms, usually including sensors, to help the missile find its target. Heat-seeking missiles, for example, carry infrared sensors that allow them to home in on the exhaust of jet engines.

20. **Range of Missiles**

(a) **Ballistic missile**. Ballistic missiles travel in a high trajectory, motor burns out partly through flight.

(b) **Tactical ballistic missile**. Range between about 150 km and 300 km.

(c) **Battlefield range ballistic missile (BRBM)**. Range less than 200 km.

(d) **Theatre ballistic missile (TBM)**. Range between 300 km and 3500 km.

(e) **Short-range ballistic missile (SRBM)**. Range 1000 km or less.

(f) **Medium-range ballistic missile (MRBM)**. Range between 1000 km and 3500 km.

(g) **Long-range ballistic missile (LRBM)**. Range between 3500 km and 5500 km.

(h) **Intercontinental ballistic missile (ICBM)**. Range greater than 5500 km.

(j) **Submarine-launched ballistic missile (SLBM)**. Launched from ballistic missile submarines (SSBNs), all current designs have intercontinental range.

(k) **Cruise missiles**. Cruise missiles travel low over the ground, motor burns during entire flight, typical range 2,500 km (1,500 NM)

(l) **Anti-ship missiles**. Anti-ship missiles, also called '*Sea-Skimmers*' travel low over sea, and 'pop-up', when very close to the target.

21. **Conclusion**. Guns were used onboard ships extensively during World War II. Thereafter, missiles have been introduced in the Navy. The most celebrated Missile action, carried out by Ships of the Indian Navy, was the Attack on Karachi Harbour. On 04 Dec 1971, a squadron of four OSA-M class missile boats launched a salvo of P-21 SSMs on the oil farm at Keamari, near Karachi harbour, besides striking several Warships and Merchantmen in harbour. The Operation was codenamed '***OP-TRIDENT***'. Guns are however, still used for anti-ship as well as Naval Gunfire Support to land units.

CHAPTER-III

NAVAL COMMUNICATION

SECTION-1 (SD/SW)

INTRODUCTION TO NAVAL MODERN COMMUNICATION,

PURPOSE AND PRINCIPLES

Period	-	02
Type	-	LEC
Term	-	1

Training Aids

1. Pointer, Blackboard, chalk, white board, Marker

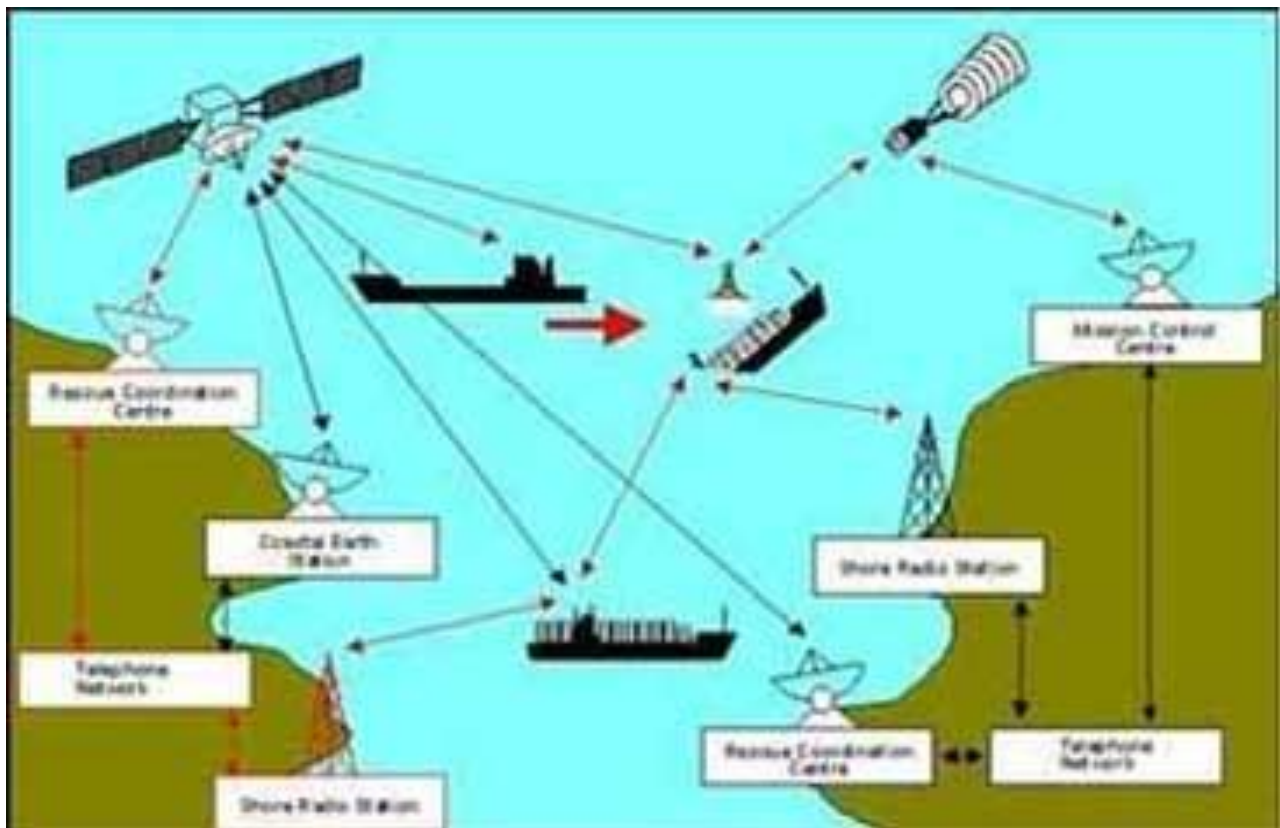
Time Plan

2.	(a)	Introduction	-	10 Min
	(b)	Purpose& Principle	-	20 Min
	(c)	Communication Department	-	10 Min
	(c)	Conclusion	-	05 Min

				40 Min

3. **Introduction.** Communication is the exchange of thought, idea, information and data. In Navy communication are the means whereby command is exercised or executed. In communication the message passed should be clear, brief and understandable between the sender and receiver. Orders and information must be passed rapidly, accurately and where possible, securely between ships, aircrafts and shore establishments. An efficient system of communication is vital for fighting efficiency of a modern fleet. The Signal Communication Officer (SCO) is the overall in charge of the communication department onboard a ship.

4. **Purpose & Principles.** In the modern world, most nations attempt to minimize the risk of war caused by miscommunication or inadequate communication by pushing the limits of communication technology and systems. As a result Naval Communication is more intense, complicated and often motivates the development of advanced technology for ships, submarines, aircraft as well as computers. Main aim is to achieve an uninterrupted and jamming less communication with full network centricity to achieve Maritime Domain Awareness (MDA). Naval Communication has undergone a sea change. Satellite Communication between ships, submarines, aircrafts as well as shore establishment have become faster and reliable using various types of secure modems. Effective and secure communication links have always been a fundamental requirement for navies with modern fleets relying heavily on radio and satellite technology. Rukmani, LINK II, MSS, SB (Satellite Broadcast) are the modern advanced communication equipments.



5. **Duties of Various Communication Sub-departments.** Further communication department is divided into three sub departments viz. Tactical, Radio and Special. The responsibility of each of three sub departments is given below:-

(a) **Tactical** Fleet work, Visual Signalling, cryptography (offline) and traffic handling.

(b) **Radio** Radio telegraphy, automatic telegraphy, radio telephony, cryptography (online) and traffic handling.

(c) **Special** Electronic warfare and traffic handling.

6. **Conclusion.** Naval communication is essential for exchange of information from shore to sea, sea to sea and sea to shore. During war, important messages are passed which need to be received clearly, understood so that they can be acted upon to achieve the desired result. All cadets should be aware about the functioning of Naval communication.

SECTION -2 (SD/SW)**SEMAPHORE**

Period	-	03
Type	-	PRACT
Term	-	I(1 Prac) & II (2 Prac)

Training Aids

1. Pointer, Blackboard, chalk, white board, Marker, Semaphore Flags

Time Plan

2.	(a)	Introduction	-	05 Min
	(b)	Semaphore	-	30 Min
	(c)	Conclusion	-	05 Mins

				40 Mins

3. **Introduction.** Semaphore is a visual means of communication which provides a rapid means for passing messages over short distances during daylight.

4. **Semaphore.** The different semaphore signs are made by moving one or two hand flags so that they form various angles with the perpendicular. It is essential that each angle be formed correctly, as good communication depends upon accuracy in this respect

5. **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 spelt 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 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 follows) |

6. **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:

- | | | | |
|-----|-------------------|-----|-----------------------|
| BT | - Break | MIM | - Comma |
| KN | - (Open Brackets | KK | -) Close Brackets |
| AAA | - Full Stop | XE | - Slant |
| DU | - Hyphen | B | - More to follow |
| C | - Correct | WA | - Word After |
| WB | - Word before | AR | - End of transmission |
| II | - Seperative Sign | AS | - Wait |

7. **Learning Semaphore.** How to Remember

- | | | |
|------------------------|---|---|
| 1 st Circle | : | A to G (Single arm signs) |
| 2 nd Circle | : | H to N (omitting J, Right hand at A position) |
| 3 rd Circle | : | O to S (Rt hand at B Position) |
| 4 th Circle | : | T, U, Y (Rt hand at C position) |
| 5 th Circle | : | J, V (Right hand at D position) |
| To complete | : | W, X, Z |

8. **Conclusion.** All cadets should be trained in Semaphore skills which is highly essential on board ships to communicate with other ships at sea. Semaphore is the most important skill in Indian Naval Communication. It will develop a good sense of concentration.

SECTION -3 (SD/SW)**PHONETIC ALPHABETS**

Period	-	1
Type	-	LEC
Term	-	1

-

Training Aids

1. Pointer, Blackboard, chalk, white board, Marker

Time Plan

2.	(a)	Introduction	-	05 Min
	(b)	Phonetic alphabets	-	30 Min
	(c)	Conclusion	-	05 Mins

				40 Mins

3. **Introduction.** Some of the alphabets sound very similar especially on radio circuits which cause confusion to the receiving operator, to avoid this standard phonetics are used.

4. **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. In order to eliminate the ambiguity phonetic alphabets are used.

5. The Phonetic alphabets are given below:

A –	Alfa	J - Juliet	S - Sierra
B –	Bravo	K – Kilo	T - Tango
C –	Charlie	L – Lima	U - Uniform
D -	Delta	M – Mike	V - Victor
E –	Echo	N – November	W - Whiskey
F -	Foxtrot	O – Oscar	X – X ray
G -	Golf	P – Papa	Y - Yankee
H –	Hotel	Q – Quebec	Z - Zulu
I –	India	R – Romeo	

6. **Conclusion**. It is the duty of every cadet to communicate in phonetics especially while receiving a semaphore so as the writer could frame the message without any ambiguity. They must also use phonetics while communicating on radio telephone circuits.

SECTION -4 (SD/SW)**RADIO TELEPHONY PROCEDURE**

Period	-	1
Type	-	LEC/PRACT
Term	-	1
-		

Training Aids

1. Pointer, Blackboard, chalk, white board, Marker

Time Plan

2.	(a)	Introduction	-	05 Min
	(b)	RT Procedure	-	15 Min
	(c)	RT Practical	-	15 Min
	(d)	Conclusion	-	05 Mins

				40 Mins

3. **Introduction.** When signaling by voice, greatest care is to be taken that the message is kept short and to the point. Voice procedure is simple and easily understood

4. **RT Procedure.** When signaling by voice greatest care is to be taken that the message is kept short and to the point. The tendency to carry on a telephone conversation is to be avoided. Voice procedure is simple and easily understood. It is most important that this procedure is used at all times and the instruction in its use is given to all officers and ratings who may have to pass messages by radio telephone. Messages transmitted by voice are not invariably written down, but whenever practical a short note of their purpose should be made. Speech should be clear and slow with

natural emphasis on each word. Messages should normally be spoken in natural phrases and not word by word. The phonetic alphabet and pronunciation of figures are to be used when applicable

5. **RT Practical.** Voice procedure should generally be clear to the receiving operator. All the difficult words are to be spelt out. An example of a voice procedure is given below:

Collective DE (This is) Ctrl = Radio Check = K (over)

DE A1 (Alfa One) = Roger = K

DE Ctrl = Roger out.

Time Check: Collective DE Ctrl = When I Say time it will be exactly 1030... 15 seconds... 10 seconds. 5 4 3 2 1 Time 1030 = A1 K

Note: While calling collective we have to control one addressee

6. **Conclusion.** The Naval communication has a unique method of Radio Telephony. It is the duty of every cadet to learn simple voice procedures as used in Navy. Messages should be spoken in natural phrase and not word by word. The phonetic alphabet and pronunciation of figures are to be used wherever applicable.

SECTION -5 (SD/SW)

WEARING NATIONAL FLAG, ENSIGN AND ADMIRAL'S FLAG

Period	-	1
Type	-	LEC
Term	-	III

Training Aids

1. Pointer, Blackboard, chalk, white board, Marker

Time Plan

2.	(a)	Introduction	-	05 Min
	(b)	Wearing of Flags	-	15 Min
	(c)	Ceremonies	-	15 Min
	(d)	Conclusion	-	05 Mins

				40 Mins

3. **Introduction.** National flag is flown on the jack staff and Naval Ensign on Ensign staff between colours and sunset.
4. **Wearing of National Flag & Naval Ensign.** National Flag is worn on the Jack staff and Naval Ensign on the Ensign staff between colours and sunset in harbour only. Naval Ensign is flown all the time whilst at sea.
5. **Naval Ensigns.** Naval Ensigns are worn by boats on the following occasions:-
 - (a) When the Flag of the President or any other dignitary is also worn

- (b) When IN ships are dressed overall
- (c) When in a foreign Port by day and night
- (d) When carrying a corpse
- (e) When going alongside a foreign warship by day or night

6. **National Flags.** National Flag is flown on the Jackstaff between colours to sunset in harbour only. It is flown at sea only on the following occasions:-

- (a) When the President is embarked
- (b) When escorting the Presidents ship
- (c) When engaged in a war

7. Colours is the term which indicates collectively the National flag and Naval Ensign. Colours ceremony is the hoisting of colours in commissioned ships and establishments at 0800 Hrs daily, unless some other time is promulgated by higher authorities.

8. Sunset is similar to the colour ceremony and is not carried out at a fixed time, but at the time of sunset every evening. Instead of hoisting the colours they are hauled down. When a Merchant ship passes a warship either at sea or in harbour, she dips her ensign as a part of courtesy and the warship acknowledges it by dipping her ensign and hoisting her before the merchant ship does .

9. **Ceremonials.** The ceremony of decorating a ship from foxle to quarter deck by signal flags is known as “**Dressing ship**”. A line with flags and pennants hanged alternatively is connected from jackstaff on the foxle to mainmast and from mainmast to quarter deck. Dressing ship is carried out on the followings occasions:-

- (a) Independence day (15 Aug)
- (b) Republic day (26 Jan)
- (c) Coastguard day (1 Feb)
- (d) National Maritime day

(e) Navy Day (4 Dec)

10. **Conclusion.** All cadets should be aware of the ceremonies of the Indian Navy and this will help develop good mark of respect towards the nation and the flag. They must involve themselves in respecting the flags and educate others about the value of flags.

CHAPTER-IV

NAVIGATION

SECTION-1(SD/SW)

NAVIGATION OF SHIP - BASIC REQUIREMENTS

Period	-	02
Type	-	PRAC
Term	-	II

Training Aids

1. Blackboard, chalk, White board, Marker, Pointer & Projector, Charts

Time Plan

2.	(a)	Introduction	-	05 min
	(b)	Basics of Navigation	-	10 min
	(c)	Navigation Terminology	-	20 min
	(d)	Conclusion	-	05 Mins

				40 Mins

3. **Introduction.** Navigation is the process of planning and carrying out the movement of all modes of transport from one place to another by sea, air, land or space. The navigation of ship and all under water crafts is called marine navigation. This requires a high degree of precision in planning and execution. The world wide satellite system can tell the position of the ship with an accuracy of 100 meters.

4. **Various navigational terms.**

- (a) **East and West.** The direction towards which the earth rotates is called east opposite direction is west.
- (b) **Great circle.** When a plane passes through the centre of the earth the resulting section is known as a great circle.
- (c) **Meridians.** These are the semi great circles, joining the poles and are perpendicular to the equator.
- (d) **Latitude.** The Latitude of a place is the angle, which is perpendicular to the earth surface at the place, makes with the plane of the equator, it is measured 0 to 90 north or south of the equator.
- (e) **Longitude.** The longitude of a place is the angle between the plane of the Prime Meridian and the meridian of the place measured from 0 to 180 east or west of Greenwich.
- (f) **The Sea Mile.** The Sea mile is the length of arc (1') measured along the meridian in the latitude of the position. The length of the sea mile is shortest at the equator (1842.9 mtrs) and the longest at the poles (1861.6 m) with a mean value of between 1843 meters and 1862 meters according to latitude. A cable is approximately 200 yards. This is a convenient measure frequently used at sea for navigational purpose.
- (g) **Geographical Mile.** The Geographical mile is the length of 1' of arc measured along the equator (i.e. 1' of longitude). As the equator is a circle the length of the geographical mile is the same at all parts of the equator and is equal to $(a \sin 1' \text{ of arc})$. Its value is 1855.4 meters.
- (h) **International Nautical Mile.** This is standard fixed length of 1852 meters. Its correct abbreviation is **nm**. The distances given in admiralty distance tables and in ocean passage of the worlds are in international nautical mile.
- (j) **Knot.** It is convenient to have a fixed or standard unit for measuring speed in navigation. This unit is international nautical mile (1852 meters) per hour and is called a knot abbreviated to **kn**.

5. **Charts and information available on chart.** To a navigator, the most useful chart is the one which can show the track of his ship by drawing one or a series of

straight lines between his starting point and destination, and the course he must steer in order to arrive there.

6. **Instrument and equipment used in navigation**

(a) **Radar**. Radio aided Direction and ranging i.e. with the help of radio waves, the direction and range of objects are obtained.

(b) **Sextant**. It is an instrument by which a ship's position can be determined by taking the sight of heavenly bodies such as sun, stars, etc.

(c) **Compass**. It is used to find the direction of the ship at sea. There are mainly two types of compass magnetic and gyro. The navigational compass is an instrument that gives the necessary datum line from which courses and bearings can be measured. Compass helps us to find the direction of the ship at sea.

(d) **Echo Sounder**. It is an instrument by which depth of the water can be measured below the keel of the ship. This helps us to prevent the ship from grounding.

(e) **Log**. Used for finding the speed and distance travelled through water

(f) **Plotting Table**. Used for plotting position and track of the ship

(g) **Charts**. Used for plotting the ships position, course etc.

7. **Conclusion**. Navigation is the science of taking a ship from one place to the other by the safest and shortest route. The navigator has to be familiar with charts, meteorological conditions and methods & equipment to determine his position at any given time and calculate the correct course.

SECTION-2(SD/SW)**TYPES OF COMPASS**

Period	-	01
Type	-	LEC
Term	-	II

Training Aids

1. Blackboard, chalk, White board, Marker, Pointer & Projector

Time Plan

2.	(a)	Introduction	-	05 min
	(b)	Types of Compass	-	15 min
	(c)	True and Magnetic North	-	15 min
	(d)	Conclusion	-	05 Mins

				40 Mins

3. **Introduction.** The navigational compass is an instrument that gives the necessary datum line from which courses and bearings can be measured. Compass helps us to find the direction of the ship at sea.

4. **Types of compass** Magnetic compass and Gyro compass.

(a) **Magnetic compass.** It is a magnet freely suspended in a horizontal plane which settles with one end pointing approximately to the true north. The reading obtained does not give us the true north due to various external factors such as

earth's magnetism and ships magnetic property. The north direction obtained is called the compass north.

(b) **Gyro Compass**. This instrument is a rapidly spinning wheel or gyroscope, the axis of which is made to point along the meridian towards true north. Courses and bearings, which are measured using a gyrocompass, are true provided there is no error in the compass. It is measured clockwise from 000 to 360.

5. **True north/ Magnetic north, Compass Terminology**. Direction between two points is the angle between the meridian and the great circle formed by them. In order to proceed in a particular direction it is important to have a reference. The most convenient reference is the meridian passing through the ship's position because any meridian lies in the north south direction. The bearing measured from this reference is called true bearing. Compass is used to find out the direction of the ship at sea. Various terms are:

(a) **True North**. True North is the Northerly direction of the meridian and is the reference from which true bearings and courses are measured. The Geographical North is True North.

(b) **True Bearing**. A true bearing of an object is the angle between the meridian and direction of the object.

(c) **Compass North**. When we take the magnetic compass onboard a ship it is not only affected by earth magnetic force but also by the ship's inherent magnetism and the north shown by compass is known as Compass North.

(d) **Gyro North**. The direction north indicated by Gyro compass is known as Gyro North which is also the true north.

(e) **Variation**. The angle between the true meridian and the magnetic meridian at any place is called the variation at that place. It is expressed in degrees and minutes. On ordinary charts the variation is given for a certain year,

together with a note of any annual change, which it is undergoing. The navigator must always allow for this change.

(f) **Deviation**. The angle between the magnetic meridian and the direction in which the magnetic needle actually points is called deviation. If the compass north lies to the east of the magnetic meridian, the deviation is said to be easterly; if west it is said to be westerly.

6. **Conclusion**. The compass is used for indicating direction, based on which the Navigator plans his course. The navigator must know the deviation and variation to find the direction accurately.

SECTION-3(SD/SW)**SIMPLE CHART WORK**

Period	-	01
Type	-	PRAC
Term	-	II

Training Aids

1. Blackboard, chalk, White board, Marker, Pointer & Projector, Chart

Time Plan

2.	(a)	Introduction	-	05 min
	(b)	Types of Charts	-	15 min
	(c)	Information on Charts	-	15 min
	(d)	Conclusion	-	05 Mins

				40 Mins

3. **Introduction.** To a navigator, the most useful chart is the one which can show the track of his ship by drawing one or a series of straight lines between his starting point and destination, and the steady course he must steer in order to arrive there.

4. **Chart Projections.**

- (a) **Mercator Projection.** The main properties of a Mercator Chart are:-
- (i) A Rhumb line on the Earth appears as straight lines on the chart.
 - (ii) The Equator appears as a straight line.
 - (iii) The parallel of latitudes appear as a straight line.
 - (iv) All Meridians appears as straight line perpendicular to the equator.
- (b) **Gnomonic Projection.** In order to assist the navigator in finding the great circle track between two places, charts are constructed so that any straight line drawn on them shall represent a great circle. These charts are known as Gnomonic charts and they are formed by projecting the Earth's surface from the Earth's centre on to the tangent plane at any convenient point. It is so constructed that:-
- (i) Great circles appear as straight line and rhomb line appears curved.
 - (ii) Meridian is curved converging to the poles
 - (iii) Parallel of latitude is also curved

5. **Chart Scales.** Charts are generally published in three different scales, they are:-

- (a) **Small scale charts.** These are charts covering a very vast area and the information such as sounding, lights etc. are not given in detail. These charts are generally used for passage planning and never should be used for navigation.
- (b) **Medium scale charts.** These charts are used for passage. The information for navigation including dangers is clearly shown on these charts. These charts cover a general area of about 50 – 70 NM.
- (c) **Large scale charts.** These charts are generally of harbours and their approaches. These charts contain all information's required for precise navigation. These charts cover an area of 5 – 7 NM.

6. **Fixing a Ship.** When it is not possible to obtain the ship's actual position by fixing, a position may be worked up based upon the most recent fix.

(a) **Dead Reckoning (DR).** It is the expression used to describe that position obtained from the true course steered by the ship and her speed through the water and from no other factors. The Dead Reckoning position is represented by the symbol \blacktriangle .

(b) **Estimated Position (EP).** This position is the most accurate that the navigator can obtain by calculation and estimation only. It is derived from DR position adjusted for the estimated effects of leeway, tidal stream, current and surface drift. The EP must always remain an approximate position, because these four variable factors are difficult to determine exactly, although experience helps long way to estimate the effect as accurately as possible. It is indicated by triangles and four-figure time.

Step One. Plot the course steered and the speed thorough the water, thus arriving at the Dead Reckoning (DR) position.

Step Two. Plot on from the Dead Reckoning position the effect of:-

- (i) Leeway
- (ii) Tidal stream
- (iii) Current
- (iv) Surface drif

Thus arriving at the Estimated Position (EP).

7. **Arrow on tracks.**

- (a) A single arrow denotes course steered, water track, leeway vector.
- (b) A double arrow denotes ship's ground track.
- (c) A triple arrow denotes tidal stream, current, surface drift and drift.

8. **The various types of charts are:-**

- (a) Navigational Chart
- (b) Ship`s boat charts
- (c) Routing charts
- (d) Magnetic charts
- (e) Ocean sounding charts
- (f) LD charts (lattice Decca)
- (g) Astronomical charts and diagrams

9. **Various information shown on charts are:-**

- (a) Number of chart
- (b) Title of the chart
- (c) Survey data
- (d) A source data diagram
- (e) Date of publication
- (f) New edition
- (g) Date of printing
- (h) Chart dimension
- (j) Scale of the chart
- (k) Abbreviations & symbol
- (l) Heights
- (m) Drying heights
- (n) Tidal stream information

10. **Conclusion.** Charts are used to plot ships course and also for planning passage from one place to another. Large Scale Charts cover small area whereas Small Scale charts cover large areas. A lot of information is given on the charts which are used for accurately positioning the ship.

SECTION-4(SD/SW)**ELECTRONIC AIDS FOR NAVIGATION**

Period	-	02
Type	-	LEC
Term	-	III

Training Aids

1. Blackboard, chalk, White board, Marker, Pointer & Projector

Time Plan

2.	(a)	Introduction	-	05 min
	(b)	Purpose of Nav aids	-	15 min
	(c)	Types of Nav aids	-	15 min
	(d)	Conclusion	-	05 Mins

				40 Mins

3. **Introduction.** The ancient Navigator had to rely on visual lookouts to aid his passage by hailing presence of land or other objects. Today's Navigator has a lot of electronic aids which help him in finding his position as well as the surroundings, even in conditions of low visibility.

4. **RADAR.** Radio aided Direction and ranging i.e. with the help of radio waves, the direction and range of objects are obtained. The radar plays a very important role in Navigation and Directions.

5. Three types of Radars used in Navy.
 - (a) Air warning Radar to detect approaching enemy aircrafts.
 - (b) Radar to detect surface crafts and ships
 - (c) Radar used for navigation, for controlling Guns, missiles and helicopters

6. **RACON**. Radar responders, or radar transponder beacons, are receiver/transmitter transponder devices used as a navigation aid, identifying landmarks or buoys on a ship board marine radar display. A RACON responds to a received radar pulse by transmitting an identifiable mark back to the radar set. The displayed responds has a length on the radar display corresponding to a few nautical miles, encoded as a Morse character beginning with a dash for identification.

7. **Other Aids**. RAMARKS are radar beacons, which transmit independently without having to be triggered by the ships RADAR. A RAMARK response on a radar display gives no indication of distance, but instead extends from the ships position to the circumference of the display. Various types of Navigational aids are as follows:-
 - (a) **Log**: - It is used for calculating the speed and distance travelled through water.
 - (b) **Echo Sounder**: -It is an instrument by which depth of the water can be measured below the keel of the ship. This helps us to prevent the ship from grounding.
 - (c) **Anemometer**: - It is used to find the relative wind speed at sea. The modern anemometer gives both relative and true wind speed.

8. **Global positioning system (GPS)** is one of the most important modern Navigational Aid. These help us to locate our position to the accuracy of a few hundred meters. All sea going vessels are suppose to have GPS fitted onboard for navigation. Modern navies even use GPS for accurate launching of ballistic and continental missiles. GPS functions using 14 satellites located at different places in the space. An user gets feed from the various satellites in his range and then gives the position after inter relating all the feeds. This is not fully accurate and must not be fully dependant for

navigation. We must also do plotting to cross check the position given to us by GPS for errors.

9. **Conclusion.** Use of electronic aids has enhanced the accuracy of Navigation. A Navigator has to be conversant with the operation of all electronic aids available on the ship.

SECTION-5(SD/SW)**TIDES**

Period	-	01
Type	-	LEC
Term	-	II

Training Aids

1. Blackboard, chalk, White board, Marker, Pointer & Projector

Time Plan

2.	(a)	Introduction	-	05 min
	(b)	Characteristics of tides	-	10 min
	(c)	Terminology	-	20 min
	(d)	Conclusion	-	05 Mins

				40 Mins

3. **Introduction.** The vertical rise and fall of sea water because of gravitational pull exerted between the earth and moon and to lesser extent by sun is called tide.

4. **Terminology.**

(a) **High water.** The highest level reached during one tidal oscillation. It is Specified by the time and height above chart datum prevailing at that instant.

- (b) **Low water**. It is the lowest level reached by sea waves during one tidal oscillation and is specified by time and height.
- (c) **Range of tides**. The difference between the levels of successive high and low water.
- (d) **Height of tide**. The vertical distance between the level of the sea at a instant with reference to chart datum.
- (e) **Slack water**. This is the instant preceeding and succeeding maximum rate, when the tidal stream is at its weakest in strength
- (f) **Maximum rate**. This is the greatest rate of tidal stream reached in each two more or less opposing direction in one oscillation.
- (g) **Chart datum**. This is a low water horizontal plane below which tide seldom falls. Based near to lat level, this is specified with reference to a bench mark level or ground in the harbours.
- (h) **Tidal stream**. Periodical horizontal oscillations of the sea under the effect of sun and moon's influence.
- (j) **HAT & LAT**. These are the levels of highest and lowest tides that is possible to predict at standard ports. Unpredictable metrological conditions may increase or decrease these values
- (k) **Mean level**. The average levels of the sea is as calculated from a long series of observations is known as mean level also known as mean sea level.
- (l) **Spring tides**. The range of the semi-diurnal tides varies mainly with the phases of moon; from new moon to full moon and vice versa. Springs are those semidiurnal tides of greatest range, which occur in each of these periods of semi-lunation (about 14 ½ days)

(m) **Neap tides**. Those semi-diurnal tides with least range, which occur in each period of semi lunation from new moon to full moon and vice versa.

5. **Currents**. These are horizontal movements of water due to causes other than the tide raising forces of the moon and sun. They have progressive or fluctuating movement's seasonal character as opposed to periodical. Some currents are more or less regular and some entirely random and unpredictable.

Currents are caused by the following factors:-

(a) Meteorological factors like prevailing winds change in temperature and pressure above the surface of water

(b) Oceanographic factors like differing salinity, changing temperature and pressure conditions prevailing over the oceans.

(c) Topographical factors such as irregularities in the sea bed

6. **Conclusion**. Tides play a significant role in the entry and exit of a ship from a harbour. Knowledge of effects of tides and currents is essential to accurately navigate a ship.

SECTION-6(SD/SW)**CLOUDS**

Period	-	01
Type	-	LEC
Term	-	III

Training Aids

1. Blackboard, chalk, White board, Marker, Pointer & Projector

Time Plan

2.	(a)	Introduction	-	05 min
	(b)	Characteristics of clouds	-	10 min
	(c)	Types of clouds	-	20 min
	(d)	Conclusion	-	05 Mins

				40 Mins

3. **Introduction.** Clouds are formed due to the condensation of the water which evaporates from the various sources of water on the earth's surface. They are formed at very high altitude and descend over a period of time due to the density of the cloud and come down as rain.

4. **Types of Clouds:**

(a) **High Clouds.** High-level clouds form above 20,000 feet (6,000 meters) and since the temperatures are so cold at such high elevations, these clouds are primarily composed of ice crystals. High-level clouds are typically thin and white in appearance, but can appear in a magnificent array of colours when the sun is low on the horizon.

(b) **Medium Clouds**. The bases of mid-level clouds typically appear between 6,500 to 20,000 feet (2,000 to 6,000 meters). Because of their lower altitudes, they are composed primarily of water droplets; however, they can also compose of ice crystals when temperatures are cold enough.

(c) **Low Clouds**. Low clouds are mostly composed of water droplets since their bases generally lie below 6,500 feet (2,000 meters). However, when temperatures are cold enough, these clouds may also contain ice particles and snow.

(d) **Clouds with Vertical Displacement**. Probably the most familiar of the classified clouds is the cumulus cloud. Generated most commonly through either thermal convection or frontal lifting, these clouds can grow to heights in excess of 39,000 feet (12,000 meters), releasing incredible amounts of energy through the condensation of water vapor within the cloud itself.

5. **Conclusion**. Clouds are categorised by their altitude and extent. Knowledge of clouds is essential to predict changes in weather. This effects various Naval operations like flying and Radar operations .

SECTION-7(SD/SW)**INTRODUCTION TO ASTRONOMY**

Period	-	01
Type	-	LEC
Term	-	II

Training Aids

1. Blackboard, chalk, White board, Marker, Pointer & Projector

Time Plan

2.	(a)	Introduction	-	05 min
	(b)	Astronomy & Navigation	-	30 min
	(d)	Conclusion	-	05 Mins

				40 Mins

3. **Introduction.** Astro navigation is the science of using celestial bodies, such as stars and planets, to navigate one's place on Earth. Historically used to navigate the oceans, and still considered a necessary skill for mariners, astro navigation has been replaced by GPS, radar systems and radio communications in recent times, making astro navigation seem somewhat obsolete. All Navies still include astronomical navigation questions on its mariner certification examinations, and many study the ancient art now for fun rather than necessity. Astro navigation is not easy. It involves mathematical formulas and committed study to produce results

4. **Astro-navigation.** It is the science of using celestial bodies, such as stars and planets, to find one's position on Earth. Astronomical navigation has been replaced by GPS, radar systems and radio communications in recent times, making astronomical navigation seems somewhat obsolete.

5. **Sextant.** The sextant is a modern marvel when compared to other celestial navigation devices. It uses two mirrors so the instrument is aimed at the horizon, and

the user only has to look in one place. The user would align the celestial body they were using with the horizon, by adjusting the sextant's moving parts. Various dials and notches on the device would then be used to determine the position of the user on the globe.

6. **Conclusion.** Although the navigator has a variety of electronic equipment at his disposal, the same are prone to failure or inaccuracies. Use of satellites maybe restricted during wartime or hostilities and the navigator may have to fall back on the most ancient and reliable method of position-finding, ie use of Astronomical bodies.

CHAPTER-V

SEAMANSHIP

SECTION-1(SD/SW)**ANCHORWORK- PARTS OF ANCHOR AND CABLE**

Period - 01

Type - PRAC

Term - I

-

Training Aids

1. Anchor and Cable

Time Plan

2.	(a)	Introduction	-	05 min
	(b)	Parts of Anchor	-	15 min
	(c)	Parts of Cable	-	15 min
	(d)	Conclusion	-	05 Mins

				40 Mins

3. **Introduction.** Anchor is a hook, attached to a length of chain or rope called a cable, by which a ship or a boat can be held temporarily to the sea bed in comparatively shallow water.

4. **Parts of an anchor**

- (a) Anchor Ring
- (b) Anchor Shackle
- (c) Shank
- (d) Fluke
- (e) Pea or bill

5. **Parts of Cable**

- (a) Lugged Anchor Shackle
- (b) Lugless Joining Shackle
- (c) Securing to Buoy Shackle
- (d) Bottle Screw Slip
- (e) Blake Slip
- (f) Cup Swivel
- (g) Box Swivel
- (h) Adoptor Piece

6. **Identification of cable**

- (a) The shackle and joining shackle are marked from outer end to its inner end.
- (b) Every joining shackle except one between two half shackles, is painted white.
- (c) One link on each side of a joining shackle is also painted white and marked with a number of turns of seizing wire around the stud corresponding to the number of the joining shackle.

7. **Conclusion.** Anchor and cable are used to hold a ships 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.

SECTION-2(SD/SW)**ANCHORWORK- PURPOSE OF ANCHOR AND HOLDING GROUND**

Period	-	01
Type	-	PRAC
Term	-	II

Training Aids

1. Anchor and Cable

Time Plan

2.	(a)	Introduction	-	05 min
	(b)	Purpose of Anchor	-	15 min
	(c)	Holding Ground	-	15 min
	(d)	Conclusion	-	05 Mins

				40 Mins

3. **Introduction.** Anchor and cable are used to hold a ships position in water. The cable is designed to act as a spring with the anchor holding it secured to the bottom of the sea.

4. **Purpose of anchor.** Anchor is a hook, attached to a length of chain or rope called a cable, by which a ship or a boat can be held temporarily to the sea bed in comparatively shallow water.

5. **Types of anchor**

- (a) Admiralty pattern anchor
- (b) Admiralty standard stockless
- (c) Admiralty class (AC) -12,14
- (d) AC 16A & 17
- (e) Stocked close – Stowing (Danforth)
- (f) Chattam Quick Release (CQR)

6. **Holding ground**

- (a) An anchor beds itself in the bottom
- (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 in
- (e) After a further amount of dragging the anchor embeds itself completely until it holds

7. **Conclusion.** Anchor and cable are used to hold a ships position in water. The cable is designed to act as a spring with the anchor holding it secured to the bottom of the sea.

SECTION-3 (SD/SW)

RIGGING- TYPES OF ROPES

Period	-	01
Type	-	LEC
Term	-	I

Training Aids

1. Blackboard, chalk, White board, Marker, Rope, Pointer & Projector

Time Plan

2.	(a)	Introduction	-	05 min
	(b)	Types of Rope	-	15 min
	(c)	Breaking strength/ Maintenance	-	15 min
	(d)	Conclusion	-	05 Mins

				40 Mins

3. **Introduction.** Ropes are used extensively onboard ships. Different ropes are used for different purpose. Knowledge of ropes is essential for every seaman.

4. **Three types of Ropes**

- (a) Natural fibre ropes
- (b) Man made ropes
- (c) Steel wire ropes

5. **Types of Natural Fiber Ropes**

- (a) Sisal
- (b) Manila
- (c) Coir
- (d) Hemp

6. **Types of Manmade Fiber Ropes**

- (a) Polyamide, Polyester, Polyethylene
- (b) Polyethylene Parafil Aramid

7. **Types of Steel Wire Ropes**

- (a) Steel wire rope
- (b) Flexible steel wire rope
- (c) Extra flexible steel wire rope
- (d) Mild steel wire rope

8. **Breaking Strength**. A method of finding the approximate breaking strength of natural fibre cordage ropes is as follows:-

$$bs = d^2/200 \text{ tonnes}$$

Where, bs - breaking strength

d - diameter in mm

9. **Stowing**. NFC should not be stowed away while it is wet. If it is unavoidable, the rope must be brought out and dried at the first opportunity. Before estimating the strength of such a rope it should be examined for damage, chafe, rot and fatigue. Rot can be detected by the smell of the rope and by opening out the strands and examining their inner surfaces

10. **Maintenance and securing of rope**

- (a) Exposure to sun light
- (b) Exposure to chemical
- (c) Handling
- (d) Stowage
- (e) Wear
- (f) Crowsfooting
- (g) Chafing
- (h) Stretching
- (i) Rust
- (j) Heat
- (k) Icing
- (l) Oil and grease

11. **Conclusion.** Ropes are extremely useful for securing items at sea. They require regular maintenance and have to be stowed in a proper manner to prevent deterioration and thereby losing their strength.

SECTION-4(SD/SW)**RIGGING- BENDS AND HITCHES**

Period	-	01
Type	-	PRAC
Term	-	I

Training Aids

1. Ropes

Time Plan

2.	(a)	Introduction	-	05 min
	(b)	Demo	-	15 min
	(c)	Practice	-	15 min
	(d)	Conclusion	-	05 Mins

				40 Mins

3. **Introduction.** Ropes can be secured to each other or items and fittings by means of bends and hitches. Each bend or hitch is used for a specific purpose and cannot be interchanged.

4. **Types**

- (a) **Bend** - Temporary joining of two ropes together.
- (b) **Hitch** - Joining a rope to a spar or structure or a ring.
- (c) **Knots** - Made within the strands of a rope.

5. **Types of Knots**

- (a) **Reef knot** .It is used to join two ropes of equal size.
- (b) **Clove hitch**. A Clove hitch is useful for tying a line to a post, even when the end of the line is not available
- (c) **Rolling hitch**. This hitch 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
- (d) **Timber hitch**. This hitch is used to secure a rope's end to a spar or bale
- (e) **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 round a man's waist
- (f) **Round Turn and two half hitch** .This combination is used to secure a heavy load to a spar, ring or a shackle
- (g) **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 being placed under his arms and the long one under his buttocks

6. **Element of bend and hitches**

- (a) A Bight
- (b) Round turn
- (c) A Half hitch
- (d) A Twist
- (e) An Over hand knot

7. **Conclusion**. Ropes are extremely useful for securing items at sea. They require regular maintenance and have to be stowed in a proper manner to prevent deterioration and thereby losing their strength.

SECTION-5 (SD/SW)**RIGGING- INTRODUCTION TO SHACKLES & BLOCKS**

Period - 01

Type - PRAC

Term - I

Training Aids

1. Shackles

Time Plan

2.	(a)	Introduction	-	05 min
	(b)	Shackles	-	15 min
	(c)	Hooks and Blocks	-	15 min
	(d)	Conclusion	-	05 Mins

				40 Mins

3. **Introduction.** Heavy items are required to be lifted by ropes. However, a lot of personnel would be required to lift heavy weights. This can be reduced considerably by the use of blocks, which greatly reduces the effort.

4. **Shackles.** Rigging shackles are coupling links used for joining ropes, webbing, chain together or to some fitting usually forged from carbon – magnesium steel.

5. **Types of Shackle:**

- (a) Screw shackle
- (b) Forelock shackle
- (c) Clenched shackle
- (d) Joining shackle
- (e) Joggle Shackle
- (f) Feathered Shackle

6. **Hooks.** Hooks are used at sea for lifting purpose and are much weaker than shackles of similar size. They are usually made of galvanised mild steel .

7. **Types of Hooks:**

- (a) Spring hook
- (b) Tackle open hook
- (c) Swivel spring hook
- (d) Release hook
- (e) Recovery hook
- (f) 'S' hook or awning hook
- (g) RFD automatic release hook

8. **Block.** Block is a portable pulley, made of metal, metal and synthetic-resin bonded fibre (SRBF) or in some cases wood and metal.

9. **Types of Block:**

- (a) Synthetic resin-bonded fibre (SRBF) Block
- (b) Metal block
- (c) Wooden block

10. **Derrick.** A derrick is a spar, made of wood or steel, rigged as a swinging boom and used for hoisting boats, stores, cargo, ammunition or gear in and out of a ship

11. **Coiling down.** Cordage is very resilient and will absorb a number of turns in its length without becoming snarled if the length is sufficient and the turns correspond with

the lay of the rope. Rope of right hand lay is always coiled downright handed, and rope of left-hand lay is always coiled down left handed

12. **Splicing**. Splicing is a method of joining the ends of two ropes together or making an eye at the end of a rope, by interlocking the strands. All splices reduce the strength of a rope by $1/8^{\text{th}}$.

13. **Types of Splice:-**

- (a) Back splice
- (b) Eye splice
- (c) Short splice
- (d) Long splice
- (e) Cut splice
- (f) Chain splice

14. **Conclusion**. Every seamanship evolution onboard involves the use of blocks, hooks and shackles. Knowledge of the various types of shackles and their uses as well as lifting abilities is essential for every seaman.

SECTION-6(SD/SW)**BOATWORK- PARTS OF BOAT**

Period - 01

Type - PRAC

Term - I

Training Aids

1. 27 Foot Drop Keel Whaler & Oar

Time Plan

2. (a) Introduction - 05 min
 - (b) Parts of Whaler - 20 min
 - (c) Parts of oar - 10 min
 - (d) Conclusion - 05 Mins
-
- 40 Mins
-

3. **Introduction.** Ships seldom come alongside. The men move from ship to shore by using their boats, when the ships are at anchorage. Boats can be maneuvered by using oars and sails. Whaler is a commonly used boat in the navy.

4. **Parts of Whaler** Apron, Back board, Badge block, Benches, Bilge, Bilge rails, Bottom board, Bow, Canopy, Capping, Drop keel, Cleats, Crutches, Deck Eyes, Floors, Floor board, Garboard strake, Grating, Gudgeon & pintails, Gunwale, Hog, Keel, Keelson, Mast step & clamp, Pillars, Planking, Plug, Ringbolts, Rowlocks, Rubbers, Rudder, Stem, Stern post, Stern sheet, Stretcher, Tabernacle, Thwarts, Timbers, Wash strake,

5. **Parts of Oar** Copper bands, leather, grip, blade, shaft and loom.

6. **Conclusion**. Knowledge of various parts of the boat and oar is very essential while putting the boat to use at sea.

SECTION-7(SD/SW)**BOATWORK- BOAT PULLING INSTRUCTIONS**

Period - 01

Type - PRAC

Term - I

Training Aids

1. 27 Foot Drop Keel Whaler

Time Plan

2. (a) Introduction - 05 min
 - (b) Pulling instructions - 20 min
 - (c) Steering instructions - 10 min
 - (d) Conclusion - 05 Mins
-
- 40 Mins
-

3. **Introduction.** The boat can move very swiftly if the pulling is synchronized. The coxswain is responsible for ensuring that the crew pulls steadily and together. He is also responsible for steering the boat correctly.

4. **Pulling orders**

- (a) **Ship your oars.** This is the order to place the oars in the crutches and ready for pulling

- (b) **Shove off**. This is the order to shove the boat off with looms of the oars from the ship or landing place alongside which she is lying or from bottom of the boat if grounded
- (c) **Give way together**. This is the order to start pulling and it is obeyed together by the whole crew
- (d) **Oars**. This is an order to cease pulling
- (e) **Hold water**. This is the order to reduce or stop the way of the boat by holding the oars at right angles to the boat and with their blades in water
- (f) **Stroke together**. This is the order for all to give one stroke together
- (g) **Back together**. This is the order to back water together by pushing on the looms of the oars instead of pulling
- (h) **Easy all**. This is the order to pull less vigorously so that the speed of the boat will be reduced. If the boat is being turned the order easy port or easy starboard may be given.
- (i) **Mind your oars**. This is the warning to the crew to keep the blades of their oar clear from obstructions
- (j) **Eyes in the boat**. This is an order to the crew to keep their gaze from wondering aboard and to pay attention to their duties.
- (k) **Bow**. This is an order to the bow man to boat his oar and be ready to fend off the bows of boat with his boat hook
- (l) **Boat your oars**. This is the order to unship the oars from crutches and lay them fore and aft in the boat on their respective sides.

5. **Various essentials in a pulling boat**. Plug, Oars, Crutches, Stretches, Rudder, Tiller or yoke, Painter, Towing bollard, Special gear.

6. **Steering/Manning of boat under oars**

Port side – 03 Persons (oars on stbd)

Stbd side – 02 persons (oars on Port)

- If port side crew pull, the boat turns port side
- If stbd side crew pull, the boat turns stbd side
- All crew will face towards coxswain and coxswain faces towards head

7. **Instructions/ precautions while pulling**

- (a) Ensure the boat is clear of water
- (b) Adequate number of oars & crutches along with spare
- (c) Life jacket for all the crew
- (d) Check the boat plug
- (e) First aid kit

8. **Instruction on Boat pulling**. When a pulling boat is under way any order to the oarsman except hold water is obeyed on completing one full stroke after the order is given. All such orders should be given at the moment when the blades of the oars are in water.

- (a) Availability of loud hailer, drinking water, sufficient ropes, bailer, anchor, life buoy and boat hook
- (b) Only swimmers and physically fit should participate
- (c) Knowledge of local weather and tidal conditions
- (d) Rudder, tiller & towing bollard should be properly secured

9. **Conclusion**. The whaler carries a coxswain and a crew of 5 pullers. The pulling is to be synchronized by the coxswain with the help of orders. All seaman and pullers are required to know the orders for pulling.

SECTION-8 (SD/SW)**BOATWORK- STEERING OF BOAT**

Period - 02

Type - PRAC

Term - I

.....

Training Aids

1. 27 Foot Drop Keel Whaler

Time Plan

2.	(a)	Introduction	-	05 min
	(b)	Steering orders	-	15 min
	(c)	Precautions	-	15 min
	(d)	Conclusion	-	05 Mins

				40 Mins

(Practical demo to be conducted by PI Staff)

SECTION-9(SD/SW)**BOATWORK- RIGGING OF SAILS IN BOATS**

Period - 02

Type - PRAC

Term - II

.....

Training Aids

1. 27 Foot Drop Keel Whaler

Time Plan

2.
 - (a) Introduction - 05 min
 - (b) Parts of Sail - 15 min
 - (c) Rigging of Sail - 15 min
 - (d) Conclusion - 05 Mins

40 Mins

3. **Introduction.** Whalers and Enterprise class boats are commonly used in the Navy as sailing boats. Enterprise class boats are meant only for sailing with a crew of two.

4. **Part of sail**

- (a) **Head** Upper side of lug sail
- (b) **Foot** Lower side of any sail
- (c) **Luff** The forward edge of sail
- (d) **Leach** The after edge of a sail
- (e) **Peak** After upper corner of a lug sail

- (f) **Tack** Lower fwd corner of a sail
- (g) **Clew** Lower after corner of a sail
- (h) **Throat** Forward upper corner of a sail

5. **Three types of sail**

- (a) **Fore sail** The sail set immediately before the fore mast
- (b) **Main sail** The sail set on the main mast
- (c) **Mizzen sail** The sail set on the mizzen mast

6. **Conclusion.** The sails have many parts which have typical terminology. Cadets are required to know the terms and understand the uses. Sailing requires both knowledge and skill.

SECTION-10 (SD/SW)**BOATWORK- ELEMENTARY SAILING**

Period	-	02
Type	-	1 LEC, 1 PRAC
Term	-	II

Training Aids

1. Blackboard, chalk, White board, Marker, Boat, Enterprise sailing boat, Pointer & Projector

Time Plan

2.	(a)	Introduction	-	05 min
	(b)	Sailing Terms	-	15 min
	(c)	Sailing Rules	-	15 min
	(d)	Conclusion	-	05 Mins

				40 Mins

3. **Introduction**. Enterprise class boats are a very suitable platform for learning sailing. Cadets are required to know the terms and understand the uses. Sailing requires both knowledge and skill. A clear understanding of the orders is essential for sailing. Rules are to be understood and strictly adhered in races.

4. **Term used in sailing**

- (a) **Close-hauled**. A boat is close-hauled or sailing by, or the wind, when her sheets are hauled close aft and all her sails are drawing and she is sailing as close as possible to the direction from which the wind is blowing
- (b) **Reaching**. A boat is reaching when she is sailing free with the wind abeam or before the beam.
- (c) **Running**. A boat is running when she is sailing with the wind abaft the beam.
- (d) **Sailing free**. A boat is sailing free whenever her sails are filled and she is not sailing close-hauled, i.e. When sailing so that she is free to manoeuvre on either side of her course without having to go about (see tacking)
- (e) **Wearing/ gybing**. This is altering course away from the wind until the boat is on her new course or begins to gybe.
- (f) **Beating**. When the destination of sailing boat lies directly upwind she beats to windward by sailing close-hauled in a series of alternate tacks
- (g) **To luff**. This is altering course to bring the boat's head closer to the wind.
- (h) **In irons**. A boat is in irons when she fails to go about from one tack to the other and lies head to wind unable to pay off on either tack
- (i) **Port and Starboard tacks**. A boat is on the port tack when she is closed hauled with the wind on her port side, and on the starboard tack when she is close hauled with the wind on her starboard side.

5. **Elementary sailing rules**. Sailing rules are commonly known as "*rules of the road*"

There are three common rules applicable to a sailing vessel:-

- Rule 1** A sail boat running free must keep clear of one close hauled.
- Rule 2** A sail boat close hauled on the port tack must keep clear of a sailboat close hauled on the starboard tack.
- Rule 3** When both boats are running free on opposite tacks the vessel with the wind on the port side must keep clear.
- Rule 4** When both boats are running free on the same tack the boat to windward must keep clear

6. **Conclusion.** Sailing requires both knowledge and skill. A clear understanding of the orders are essential for sailing. Rules are to be understood and strictly adhered in races.

SECTION-11(SD/SW)**BOATWORK- WHALER SAILING**

Period	-	01
Type	-	PRAC
Term	-	III

Training Aids

1. 27 Foot Drop Keel Whaler

Time Plan

2.	(a)	Introduction	-	05 min
	(b)	Rigging of Whaler	-	15 min
	(c)	Sailing rules	-	15 min
	(d)	Conclusion	-	05 Mins

				40 Mins

(Practical Demo to be carried out by PI Staff)

SECTION-12(SD/SW)**BOATWORK- POWER BOATS**

Period	-	01
Type	-	LEC
Term	-	II

Training Aids

1. Blackboard, chalk, White board, Marker, Boat, Pointer & Projector

Time Plan

2.	(a)	Introduction	-	05 min
	(b)	Types of Boats	-	15 min
	(c)	Anchoring and Securing	-	15 min
	(d)	Conclusion	-	05 Mins

				40 Mins

3. **Introduction.** Power boats are driven by internal combustion engines and therefore known as Motor boats. They may be classified as inboard or outboard according to the position of the motor. They may also be classified according to speed (fast, medium or slow speed)

4. **Types of power boats**

- (a) Gemini crafts
- (b) RIBs
- (c) GRP Motor Boats

5. **Anchoring a boat**

- (a) The length of the cable is normally four time the depth of water
- (b) The inboard end of the cable is secured to a towing bollard by taking four turns around the bollard and then seizing the inboard part to the out board part
- (c) If a boat snatches at her cable in a heavy sea, pay out as much as cable as possible

6. **Securing of boat**

- (a) Heavier boats will be secured alongside
- (b) When marking fast to the lower boom, a pulling boat is secured to the quarter lizard the inner being kept for power boat
- (c) The painter should be rove through the eye of the lizard then back through the thimble of the painter and then secured with a double sheet bend round both parts
- (d) The scope of the painter should be adjusted so that the boat rise easily with out yawing or snatching
- (e) Along side jetty or anchor boat
- (f) To a boom
- (g) To an accommodation ladder
- (h) To a buoy

7. **Towing a boat**

- (a) A lightly laden boat may be towed in calm weather by her painter which should be made fast with two or three turns around her towing bollard

- (b) If no bollard is provided a wooden bar should be passed through the bight of the painter and placed under the two fore most thwarts
- (c) A boat should never be towed direct from her stem ringbolt because it puts an unfair strain on the ringbolt and stem

8. **Conclusion.** Power boats are used extensively for conveying Captain, officers, crew and stores from ship to shore and back. They are required to be secured properly and can be towed for long durations, with due precaution.

CHAPTER-VI

FIRE FIGHTING FLOODING

AND

DAMAGE CONTROL

SECTION -1 (SD/SW)**FIRE FIGHTING, FLOODING AND DAMAGE CONTROL**

Period	-	2
Type	-	LEC
Term	-	3

Training Aids

1. Computer slides, Pointer, Blackboard, chalk, white board, Marker

Time Plan

2.
 - (a) Introduction - 05 Min
 - (b) Types of Fire - 05 Min
 - (c) Types of Extinguishers - 10 Min
 - (d) Fire Triangle - 05 Mins
 - (e) Methods of Fire fighting - 10 Mins
 - (d) Conclusion - 05 Mins

40 Mins

3. **Introduction**. Fire can be caused due to various reasons. Prevention is the best way to fight fire. Early detection and knowledge of the types of fire and various methods to fight fire will enable containing the damage. Everyday Hazards of fire are as follows:-:

- (a) Carelessness with naked lights and cigarettes left about.
- (b) Paint and oil splashes in contact with heat.
- (c) Cooking oil in the galley, if left unattended on the cooking range for a long time.
- (d) Private electrical equipment not checked, safe and used without proper plugs.
- (e) Smoking in unauthorized area and on bed.
- (f) Electric iron and soldering iron not switched off or not in use and closed.
- (g) Highly flammable materials not stowed safely.
- (h) Keeping power supply 'ON' when compartment is not in use and closed.

4. **Types Of Fire**

Fire depends on three things being present together.

- (a) Fuel or inflammable materials (Oil, paints, wood, paper etc.)
- (b) Heat
- (c) Oxygen

5. **Classification of fire.** There are five different types of fire. These are:-

<u>Class</u>		<u>Type</u>
A	-	General Fire
B	-	Oil Fire
C	-	Gaseous Fire
D	-	Metallic Fire
E	-	Electric Fire

6. **Types Of Fire Fighting Extinguishers Used In Navy.** First Aid Fire Fighting Equipments:

(a) **9 Ltrs AFFF Extinguisher.** AFFF stands for 'Aqueous Film Forming Foam'. It is a new type of fire extinguisher which is painted bright red and is supplied to ship in lieu of water type and foam type extinguishers. It can extinguish both general and oil fire. It can also be used against electrical fires of normal ships voltage provided the nozzle is kept 1.8 metres away from the electrical fire and ships supply should be 440 V and below. Duration of the extinguisher is 60 to 90 seconds.



(b) **2 Kg CO2 Extinguisher.** This extinguisher is painted black and contains CO2 gas under pressure. It is operated by aiming the discharge horn at the base of the fire and removing the safety pin and opening the regulator. This extinguisher is used against electrical fire.



(c) **10 Kg Dry Chemical Powder Extinguisher.** It is used on metallic and oil fires. It consists of 10 kg dry chemical powder attached with a CO2 cartridge fitted inside with a cap. It is painted blue in colour.

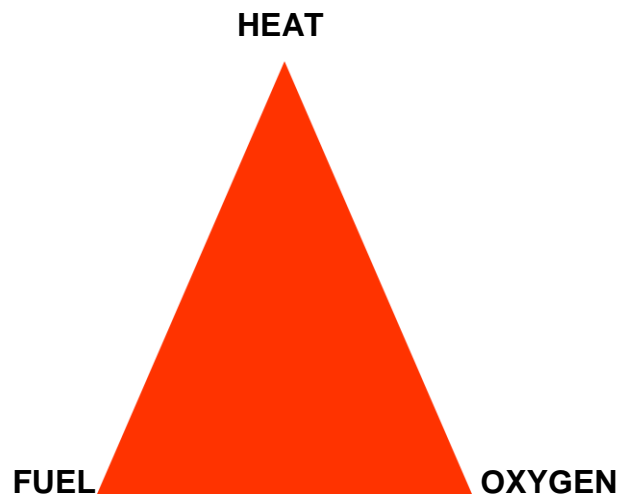
(d) **PD 12 Dry Chemical Powder Extinguisher.** It is painted blue and is used on helo/flight deck of ship. It consists of 28 lbs dry chemical powder and is attached with CO2 cylinder, which is outside the extinguisher.

(e) **PD 25 Dry Powder type Extinguisher.** Dry chemical powder extinguisher painted blue and is used on helo/flight deck of ship. It consists of 25 lbs dry chemical powder and a CO2 cartridge which is attached inside the extinguisher.



(f) **Trolley Mounted Fire Extinguisher.**

- (i) 75 Kg dry chemical powder
- (ii) Twin CO2 6.5 Kg
- (iii) 45 ltrs foam.

7. **Fire Triangle**8. **Principles of Fire Fighting**

- (a) **Cooling**. This is done by bringing down the temperature or removing the heat. The best agent of cooling is water, which is freely available in ships for fighting the fire. Water must be applied to burning materials and not to the flames.
- (b) **Starving**. It is to remove all inflammable materials in the vicinity of fire so that fire does not spread further and is automatically put off.
- (c) **Smothering**. It is a process of cutting off air supply which helps fire. This is achieved by means of a first – aid fire fighting equipments, CO2 Smothering system, main foam appliances etc. This is also achieved by means of closing all port holes, hatches, ventilation fans etc.

- 9. **FF Methods & Tactics.** On slightest suspicion of trapped personnel in a smoke filled section, search should be started immediately. The search team must:-

- (a) Be well briefed.
- (b) Have well defined search area.

10. **Search and Rescue**

Search party: - The minimum composition of 2+1 searchers must operate in pairs because

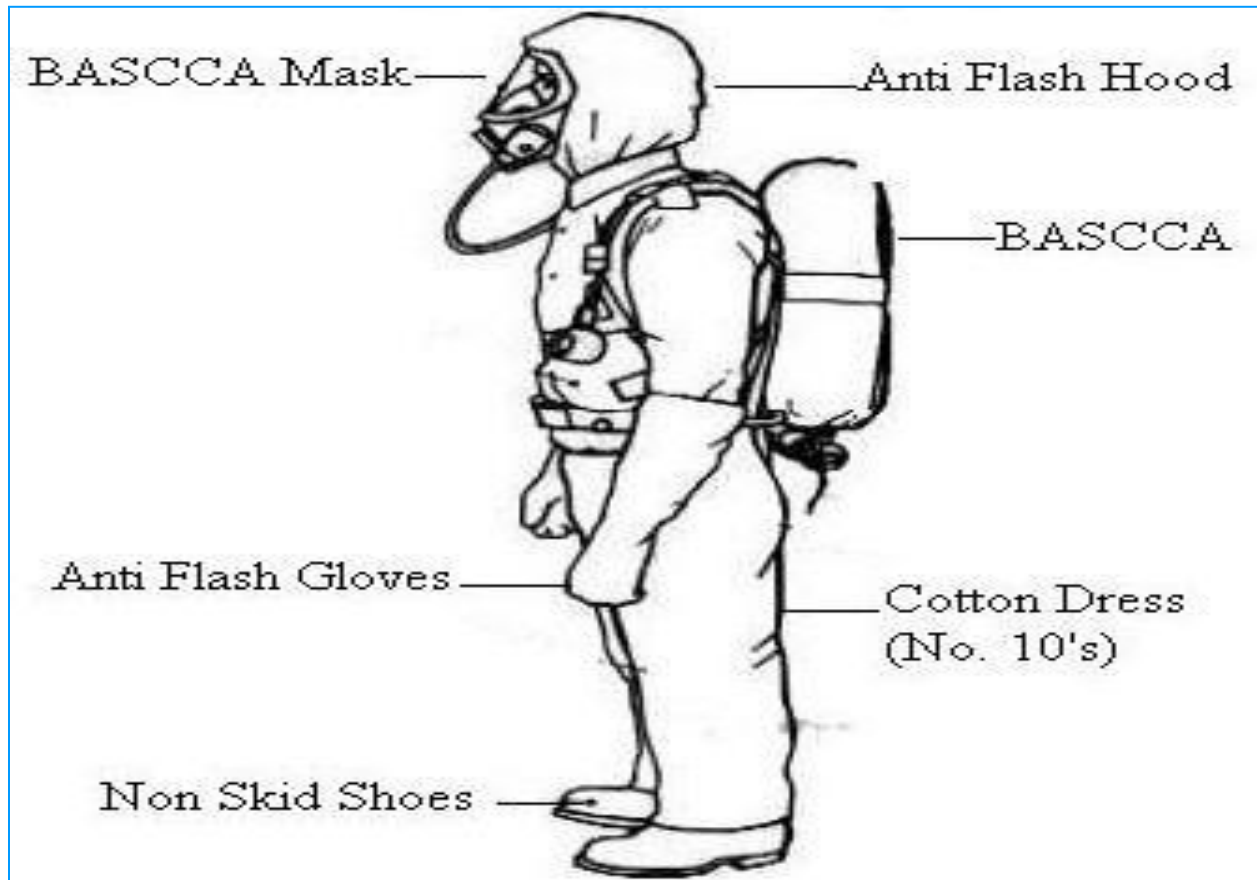
- (a) A partner boosts morale
- (b) In case of trouble, searchers can help each other.
- (c) Better effort available for clearing obstructions.
- (d) Easy transportation of casualties.
- (e) Each of the searchers dons BA sets, and carry extension equipment and run guide line. At each flat, office, mess decks etc. One of the search team members must remain at entrance while the other makes his way into the space and feels his way around as close to the perimeter as possible (a casualty may crawl to a bulkhead and collapse there). The search must be made cautiously and thoroughly at the following locations:-:
 - (i) Fully at deck level.
 - (ii) Under tables, desks, chairs and benches.
 - (iii) Under bed clothes.
 - (iv) In cupboards, wardrobes and chests etc.
 - (v) Behind and beneath ladders.
 - (vi) Behind open doors behind fitted furniture, lockers etc.

11. **First Report and Action**

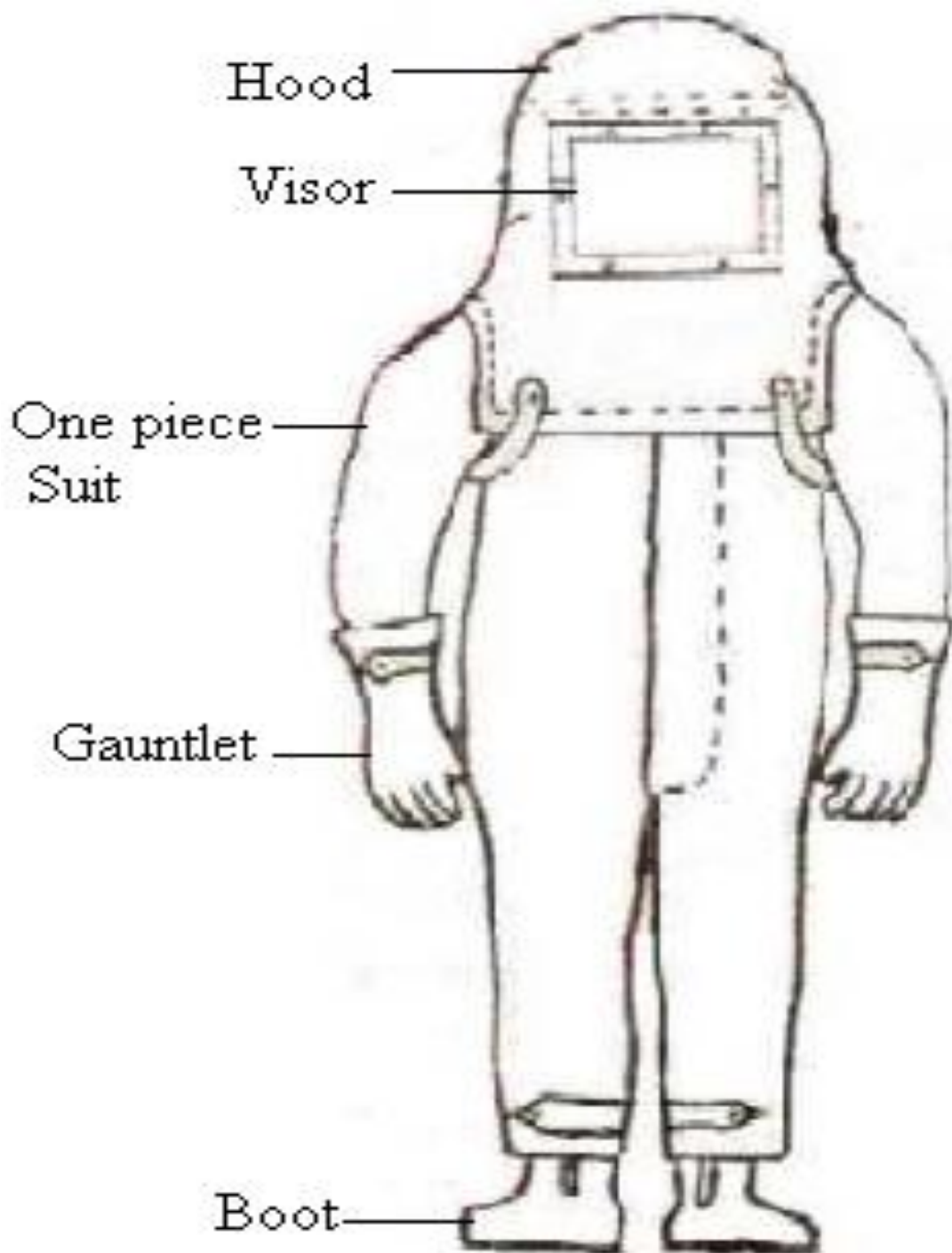
- (a) **If smoke is seen to be issuing from beneath a closed door.** Suspect fire but do not open the door, because, if the door is opened the fire might flare up fiercely and spread rapidly. Raise the alarm "fire fire fire" and inform the command by the quickest method. Pass clear and accurate message and return to the scene of the incident.
- (b) **If the door is open or the fire is not behind the door.** If fire is discovered in an open compartment, raise the alarm by shouting "fire fire fire" and try to extinguish it with the equipment in hand. Inform command by quickest method. If the finder is doubtful of his ability to extinguish the fire, he should shut all

openings to the compartment (if practicable), ensure command is informed and report to the person who arrives to take charge of the incident.

12. **Basic Firefighting Rig with BASCCA set**



13. **Full Firefighting Rig**

14. ALUMINISED FIRE PROXIMITY SUIT

15. **Conclusion**. Fire depends on three things being present together. Firstly Fuel or inflammable material ,secondly Heat and thirdly Oxygen. Fire fighting is everybody's business and all personnel on board a ship should be alert to prevent and put out a fire.

SECTION -2 (SD/SW)**CAUSES OF DAMAGE, FLOODING AND DAMAGE CONTROL**

Period	-	2
Type	-	LEC
Term	-	2

Training Aids

1. Computer slides, Pointer, Blackboard, chalk, white board, Marker

Time Plan

2.
 - (a) Introduction - 05 Min
 - (b) Causes of Damage - 15 Min
 - (c) Flooding and Damage Control - 15 Min
 - (d) Conclusion - 05 Mins

40 Mins

3. **Introduction.** Damage control is a term used in the navies for the emergency control of situations that may hazard the sinking of a ship. Damage and flooding in a ship can occur due to collision, grounding, weapon explosion enemy attack etc. There is a prime need to contain flooding and damage in the smallest possible limit and to this end flooding boundaries must be established as quickly as possible. Resistance of flooding of ships compartment/spaces depends on watertight integrity.

4. **Causes of Damage.** Damage and flooding in a ship can occur due to collision, grounding, weapon explosion enemy attack etc. There is a prime need to contain flooding and damage in the smallest possible limit and to this end flooding boundaries

must be established as quickly as possible. It is also used in other contexts as explained below. Examples are:

- (a) rupture of a pipe or hull especially below the waterline and
- (b) damage from grounding (running aground) or hard berthing against a wharf.
- (c) temporary fixing of bomb or explosive damage.

5. **Zone of Damage.**

Damage to a ship can be divided into three zones.

- (a) **Primary Zone.** This is in the immediate vicinity of the cause of damage explosion, collision grounding and, particularly in the case of explosion will be the zone of complete destruction. That part of the primary zone below the waterline will probably be completely loaded and nothing can be done except to try to contain the flood water within its original boundary.
- (b) **Secondary Zone.** It is unlikely that this zone will flood immediately but slow and progressive flooding is probable cause of damage to hull and bulkheads/decks surrounding the primary zone. It is in the secondary zone that the work of the NBCD parties principally lies.
- (c) **Remote Zone.** Accidents involving collision grounding and particularly explosion will cause a shock wave to travel through the ship's structure and may cause a violent whip, with resultant damage and fire.

6. **GENERAL LEAK STOPPING DEVICE**

- | | |
|----------------------------|---|
| (a) Wooden shores | (b) Wooden plugs |
| (c) Wooden wedges | (d) Splinter Box |
| (e) Stopper plates | (f) Pad pieces |
| (g) Quick hardening cement | (h) Oakum |
| (j) 3 leg stopper plate | (k) Metallic (Telescopic) adjustable shores |
| (l) Grid shores | (m) Dog nails |
| (n) Blank flanges | (p) Multi purpose band |
| (q) Jubilee clips | (r) Fixed shores (beam shoring) |

7. **Watertight Risk Markings.** The area susceptible to immediate flooding or damage is marked as 'red zone' which extends from the keel to somewhere above the deep waterline, rising higher at the ends and in a broad ship at the side. Openings to all compartments within the red zone are subject to immediate risk during flooding. All such openings are known as 'red opening' and are marked in 'red' on a door or hatch by red triangle across the upper corner farthest from hinges and on valve/scuttle by a red disk.

8. **Control Markings.** Control markings are used to control the Opening of doors, hatches and certain other openings in accordance with the condition in force. Those which control the water tight conditions are called 'Watertight Control Markings' and are painted black in colour on doors and hatches. This is to maintain the water tight integrity in case of flooding for isolating that particular compartment which is flooded.

Sl. No.	Condition	Position of Doors/Hatches	Rules
01.	X Ray	X closed, Y and Z open	X opening are to be opened only with permission of DCHQ or OOW.
02.	Yankee	X and Y doors are closed Z remains open	X and Y opening are closed. For X rules as for X-ray, Y can be opened for passage but to be shut immediately.
03.	Zulu	X, Y and Z all are closed.	X, Y, Z closed, for X and Y rules as for Yankey. Z openings may be opened for passage but immediately to be closed.

9. **Conclusion.** Damage can take place due to collision, grounding of enemy action. The ship has to be maintained at all times in a condition where it can contain the damage and continue with its task. Watertight integrity determines the resistance of flooding of ships Compartment/spaces. Risk and Control markings are for maintaining watertight as well as gaslight integrity on board ships.

CHAPTER-VII

SHIP AND BOAT MODELLING

SECTION -1 (SD/SW)**PRINCIPLES OF SHIP MODELLING**

Period	-	1
Type	-	LEC
Term	-	I

Trg Aids

1. Blackboard, chalk, white board marker, projector and pointer.

Time Plan.

2.	(a)	Introduction	-	05 Mins
	(b)	History	-	10 Mins
	(c)	Principles of SM	-	20 Mins
	(d)	Conclusion	-	05 Mins

				40 Mins

3. **Introduction.** Ship Modeling is a creative activity wherein the cadets are taught to make models of boats, yachts and various ships of the Indian and international navies. It is an important part of naval training for a NCC Cadet. It can also be taken up as a hobby. It makes a cadet observant, cool headed and applies scientific knowledge to excel in this discipline.

4. **History.** Ancient ship and Boat models have been discovered throughout the Mediterranean, especially from ancient Greece, Egypt and Phoenicia. These models provide archaeologists with valuable information regarding seafaring technology and the sociological and economic importance of seafaring. Ships made far-flung travel and trade more comfortable and economical, and they added a whole new facet to warfare. Thus, ships carried a great deal of significance to the people of the ancient world, and

this is expressed partly through the creation of boat and ship models. Ship models are helpful to archaeologists in that they allow archaeologists to make estimates regarding the size of the vessel would be in the real life. While this technique makes the assumption that artists scaled the models appropriately, it is useful to get some sense of how large these ships and boats may have been in real life. Archaeologists are able to calculate these estimates of size by employing a series of assumptions about the distance between rowers and a maximum draft of the vessels. Until the early 18th century, virtually all European small craft and many larger vessels were built without formal plans being drawn. A builder would construct models to show prospective customers how the full size ship would appear and to illustrate advanced building techniques. Ship models constructed for the British Navy were referred to as *Admiralty* models and were principally constructed during the 18th and 19th century to depict proposed warship design. In the early part of 20th Century, amateur Ship Model Kits became available. Early 20th Century models comprise a combination of wooden hulls and cast lead for anchors, deadeyes and rigging blocks. These materials gradually gave way to plastic precast sets.

5. **Principles of Ship Modelling.** It is not difficult for a beginner to make the desired models, provided he has patience and some attitude for this sort of work. It is possible for any reasonably “handy” person to produce a good model, provided he is prepared to give time and follows the instructions carefully:

- (a) In the first stage cadets are taught to build elementary solid models for which the parts are provided in the kit and they are only to assemble them with the help of a sequential drawing supplied with the kit.
- (b) To make the desired model he has to have the patience and some aptitude for this sort of work. It is possible for any reasonably “handy” person to produce a good model, provided he is prepared to give time and follows the instructions carefully.
- (c) In the second stage cadets are required to build powered models and sailing yachts out of kits which contains pre-cut parts, marine fittings and construction plan. These steps are followed to enable the ship modeler to finally

construct advanced models from full scale plans using only readily available materials.

6. **Reading a Drawing.** An important aspect in shipmodelling is the ability to read a drawing. Generally a drawing is supplied with the kit known as a constructional chart assemble plan or blue print and comprises of two aspects that are:-

- (a) **The top view or 'plan'.** From the plan, length and breadth of the superstructure fitting can be measured.
- (b) **The side view or 'elevation'.** From this view length, height and the actual thickness of the various parts of the superstructure are measured.

7. In the case of a yacht, the drawing comprises of two figures i.e. the hull plan and the sail plan. These plans may however differ from yacht to yacht and from manufacturer to manufacturer.

8. When building a model, it is best to get the full sized plans, if possible, as this minimizes the chances of error, especially when enlarging from a small scale plan since the error gets multiplied by the scale.

9. **Types of joints used in Carpentry.** The following joints are generally used in carpentry:-

- (a) Lap joint. (full lap and half lap)
- (b) Halving joint. (angle halving joint. Dovetail halving joint and cross halving joint).
- (c) Mortice and tenon joints.
- (d) Bridle joints.
- (e) Tongue and grooves joints.

Further details will be explained by the instructor in the class

10. **Conclusion.** Ship Modeling is an ancient art and archaeological evidences found in various civilisation are testimony to the same. Cadets with requisite aptitude must develop their skills in order to excel in this particular discipline of training. This can be taken up as hobby. Cadets with strong aptitude may also opt for Naval Architect branch when eligible for higher studies.

SECTION -2 (SD/SW)**MAINTENANCE AND CARE OF TOOLS**

Period	-	01
Type	-	LEC/ PRAC
Term	-	I

Trg Aids

1. Blackboard, chalk, white board marker and projector and pointer.

Time Plan.

2.	(a)	Intro	-	05 Mins
	(b)	Types of Tools	-	15 Mins
	(c)	Care and Maintenance of Tools	-	15 Mins
	(d)	Conclusion	-	05 Mins

				40 Mins

3. **Introduction.** It is impossible to list all the tools that may be required to build a model. The number of tools will vary with type of model under construction. Some people can do it all with an old razor blade and a sheet of sand paper, while others need a complete carpenter's tool kit, power tools besides. The number of tools required for modeling will vary considerably with the individual as well as with the type of model under construction. A list of the minimum requirement of tools necessary for effective modeling is given below:-

4. **Type.**

- (a) **Measuring and Testing tools.** Tape, Chain measure, foot rule, tri square, sliding level, marking gauge and compass etc.
- (b) **Planes.** Jack plane, smoothing plane, compass plane, adjustable compass plane and spoke shave etc.
- (c) **Chisels.** Gouging Chisel, mortise Chisel and flat Chisel of various sizes.
- (d) **Cutting Tools.** Hand saw, fret saw, hack saw and various types of multi craft knives.
- (e) **Boring Tools.** Hand drill, gimlet and augur etc.
- (f) **Vice and Clamps.** Bench vice, hand vice and clamps of various sizes.
- (g) **Files.** Rasp rough, rough flat, half round, round triangular, knife edge, square and diamond etc.
- (h) **Miscellaneous tools.** Hammer, Spanners, nose pliers, cutting pliers, scissors, screw drivers, set squares, soldering irons and drill bits of various sizes etc.

5. **Wood.** With regard to actual selection of wood, there are several suitable Varieties of wood like Douglas fir silver spruce, yellow pine, red cedar, hickory, maple, African white wood mahogany and teak. Balsa is the most perfectly suited wood for modeling, especially if the model is designed to take its characteristics in to account. It is essential to ensure that this wood is well scaled, since any absorption of water creates considerable swelling which can peel away the paint work. This wood is particularly useful in block form. When using the wood for modeling it should always be remembered that it must not be kiln dried, because it does not produce the same result as natural seasoning.

6. **Adhesives.** One of the most important materials used in model building is adhesives and it need hardly be said that whatever the adhesive used, it must be water proof. For most purposes Nitro Cellulose cement is suitable especially for work with balsa wood. A wide variety of adhesives are now available in the market and there are

several specialized products for boat building. The first essential requirement is its insolubility in water, which rules out such products as animal glue. Harder wood other than balsa needs slow drying resin based adhesive. For very high adhesion with difficult materials, such as metal to wood joints etc., epoxy resins such as Araldite are extremely useful but, these are relatively expensive to use in large quantities. Quick drying adhesives are useful for obtaining reasonably quick results but do not hold well for longer durations.

7. **Care of Tools**. Various tools enumerated above require to be maintained by the cadets. After using a tool, same must be stowed properly, so that it is available for employment later use. Tools must be cleaned using hand brush/ cloth and painted whenever required. Tools are to be guarded against rusts and damages. When not used for prolonged period, tools must be neatly arranged in the tool cupboard / box. For ease of mustering a list of tools must be maintained in the cupboard or separately.

8. **Conclusion**. Besides kit and consumable required as material for modeling, it is tools that give shape to the model. Care of tools is an important part of training for ship modelers.

SM-3 (SD/SW)**TYPES OF MODELS**

Period	-	01
Type	-	LEC/ PRAC
Term	-	II

Trg Aids

1. Blackboard, chalk, white board marker and projector and pointer.

Time Plan.

2.	(a)	Intro	-	05 Mins
	(b)	Types of Model	-	15 Mins
	(c)	Explanation with Model	-	15 Mins
	(d)	Conclusion	-	05 Mins

				40 Mins

3. **Introduction** Models are of different types like Solid Model, Working Model or a Sailing Model

4. **Solid Model**. A solid model is one made with solid block of wood including the appendages and additional parts attached post preparation of the basic structure. The solid models are basically scaled to originally planned ship for purposes of show and testing / trials.

5. **Working Model**. Working Model for the boat is a scaled model with all parts moving with mechanical or electrical support. The working model is designed to project the actual working of the boat.

6. **Sailing Model**. Sailing models are generally scaled models with sails and motor fitted for control of the sail model remotely.

STABLIZING OF MODELS

7. One of the big advantages in ship modelling is that almost anything will float, and with sufficient power it can be propelled through the water. This provides satisfaction to the casual model maker.
8. A model's first contact with the water usually comes some time before the last coat of paint is dry and the last details are fitted, however, it is far more practical to test the model during construction, since alteration of subsequent position of components becomes a major operation. The time for this is normally after the initial two or three coats of paints and, if possible, before permanent attachment of the deck and superstructure.
9. Mark the water line at stem and stern with pencil marks, and place components, or equivalent weights in correct position and check that the hull floats true. If after completion, ballast is required to bring the model down to her marks or to correct trim, determine the required amount and its position by stacking cut chunks, flakes and shots of lead in place, then melt the lead in to a convenient block and place or screw, to the hull bottom as low as possible.
10. But for other types of hull like planked hull or hard chine hulls, where the bulkheads are used for making watertight compartments and are glued with the keel, this process should be carried out in the manner explained. After stacking the flakes or shots in the correct position between the bulkheads, melt the lead and make the blocks according to the space available and then place/ glue them as near as possible to the keel.
11. (Practical Demo with models is essential to cover this Topic)

SECTION -4 (SD/SW)

CALCULATIONS OF SAIL AREA OF A MODEL

Period	-	02
Type	-	PRAC
Term	-	III

-

Training Aids

1. Blackboard, chalk, white board marker and projector and pointer, Sail.

Time Plan.

2.	(a)	Intro	-	05 Mins
	(b)	Sail Plan	-	15 Mins
	(c)	Practical Demo	-	15 Mins
	(d)	Conclusion	-	05 Mins

				40 Mins

3. **Introduction.** The Sailing Model's correctness is judged in competitions by racing them against each other. Thus, it is essential to calculate the sail area of the model.

4. **CALCULATION OF SAIL AREA FOR A MODEL.** Although model yachts can be of different rigs, experience has proved that the most practical and efficient is the Bermuda rig. This is the simplest rig possible as it consists of a triangular (Bermudian or lego-mutton) main sail and single head salt (jib). Hence all modern racing models without exception, rigged this way, it will facilitate the subject, if we use the proper and correct names/ terms for the different parts of the sail.

5. **Sail Plan.** If you refer to the sail plan, it will be seen that there are two triangular sails. The front one is the Jib, and after one the Main sail. Each sail has three sides-

the luff (fore side) the leach (after side) and the foot. The top corner is the head, the front corner is the tack, and after corner the clew. This applies to both jib and main sail.

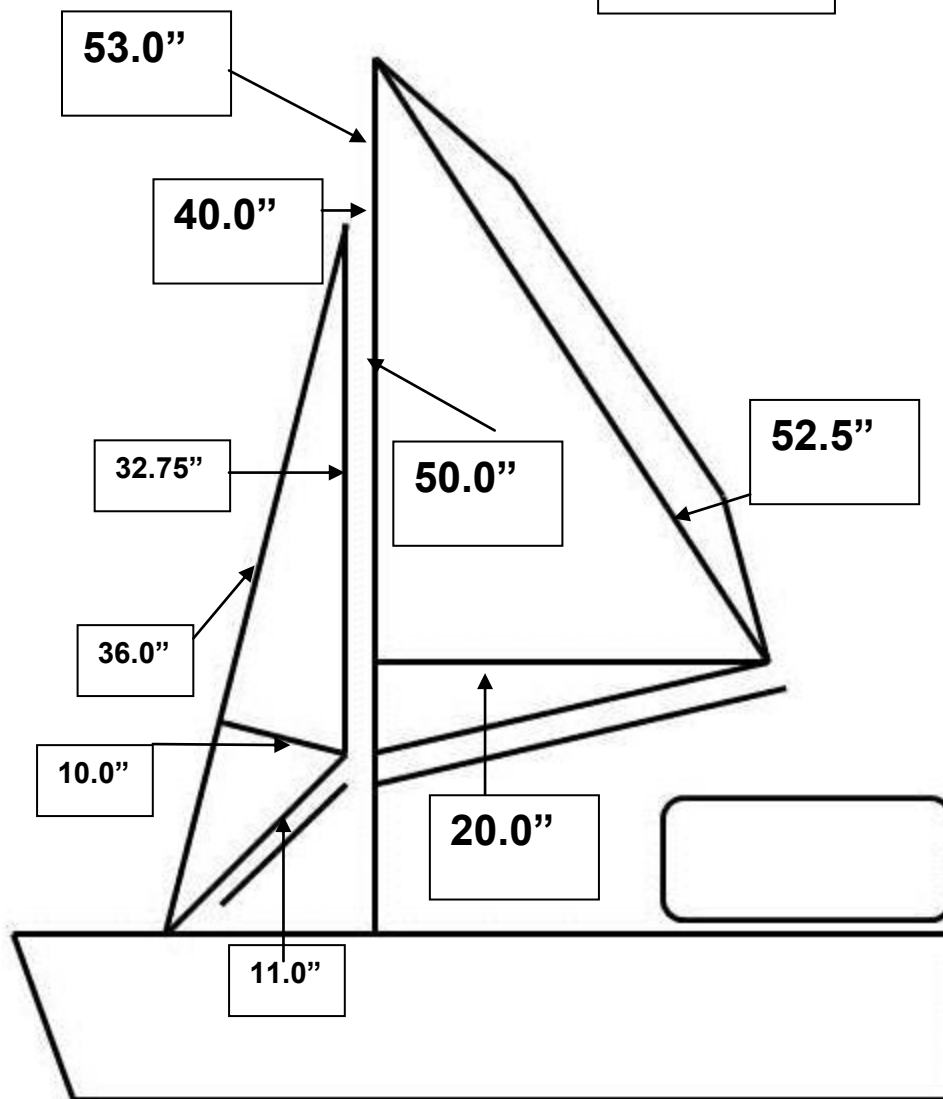
Actual sail area is measured as follow:-

(a) **Main Sail**. The luff (forward side of sail) is measured from tack (bottom forward corner of sail) to underside of the head. The diagonal is a line taken from the clew (bottom after corner of sail) to the luff and perpendicular to it. The area of the sail is calculated by multiplying the luff by the diagonal and dividing by two (Figure VIII-1).

(b) **Jib**. The luff is measured from tack to underside of head to the eye in the head (top corner of sail). The diagonal is measured like in the main sail. The area of the jig is then calculated by multiplying the luff by the diagonal and dividing by two (figure VIII-i)

6. The measured area of the sail plan is the area of the main sail plus area of jib. There is no limit on the height of the rig in this class but the height of the jibstay above the deck must not exceed 80% of the height of the main sail head above deck. For example take a sail plan of 36" model yacht and measure it as under:-

	<u>Jib</u>	<u>Main Sail</u>
Luff	36.0"	50.0"
Leach	32.75"	52.5"
Foot	10.00"	20.00"
Foreside Mast	12 5/8" bow.	
Jib	$\frac{36 \times 10}{2} = 180$	
Main Sail	$\frac{50 \times 20}{2} = 500$	
	680 Sq . Inches.	

36" Class

7. (Practical Demo with Sail is essential to impart this topic).

SECTION-5 (SD/SW)**INTRODUCTION TO SHIP MODEL COMPETITION**

Period	-	01
Type	-	LEC
Term	-	II

Training Aids

1. Blackboard, chalk, white board marker and projector and pointer.

Time Plan.

2.	(a)	Intro	-	05 Mins
	(b)	Ship Modelling Competitions	-	20 Mins
	(c)	Criteria for Evaluation	-	10 Mins
	(d)	Conclusion	-	05 Mins

				40 Mins

3. **Introduction.** SM Competitions are held between Dtes. as part of RD Banner Competitions. This lecture is aimed at apprising cadets on various types of competitions held and criteria for judging models.

4. **Competitions.** SM competitions are held during following camps :-

- (a) RDC
- (b) NSC
- (c) ATC SW

5. **Types of Models:-**

- (a) Camp Model
- (b) Dte. Model
- (c) VIP Model

6. **Camp Model.** Camp Models are made during a particular camp within a specified period as per admin instructions/ ADJI of respective Camps. The type of model is usually power model.

7. **Dte. Model.** These models are made during preparatory camps prior to actual camp where competitions are held. The types of model are usually sailing, RC and Open Class.

8. **VIP Model.** Solid Model made prior to the camp which may carry specific marks towards RD Banner Competition.

9. **Criteria for Evaluation.** The criteria for marking a particular model would depend on type of model as follows:-

- (a) **Static.**
 - (i) Proximity to the drawing
 - (ii) Model Dimension to the scale
 - (iii) Fittings
 - (iv) Elegance

- (b) **Stability.**
 - (i) Draught and Trim
 - (ii) List
 - (iii) Righting Moment

(c) **Performance.** Power/RC/ Sail model are assessed for operational performance through a straight run and or turning circle.

(i) **Straight Run.** The Model is made to run to a Centre Mark at the middle of the tank from the opposite side. Graduations of 6" are made on either side of the centre mark representing loss of one mark each.

(ii) **RC Model.** It is made to do a run between marker buoys in fixed pattern. Accuracy is measured by not touching the sides or buoys and speed of the model taking minimal time.

(ii) **Sailing Model.** All models are made to do a run from one side of the tank to the other powered by sails alone. The model taking minimal time is judged first and timing is taken from that model.

10. **Conclusion.** Ship and Boat Modeling by cadets requires application of skills, patience and attitude for perfection. Various competitions are held during Annual Camps in order to evaluate the degree of excellence achieved by cadets in an objective manner.

SECTION-6 (SD/SW)**CARE AND HANDLING OF POWER TOOLS USED**

Period	-	01
Type	-	LEC/PRAC
Term	-	II

Trg Aids

1. Blackboard, chalk, white board marker and projector and pointer & Tools

Time Plan.

2.	(a)	Introduction	-	05 Mins
	(b)	Maintenance & care of Tools	-	30 Mins
	(c)	Conclusion	-	05 Mins

				40 Mins

3. **Introduction.** Besides carpentry tools, Power tools are also used for Ship Modeling. Power tools such as jigsaw Machine, drilling, grinding, buffing set, lathe set, wood turning set, saw and groover set, sanding and polishing set etc. are expected to produce accurate work pieces not only when the machine is new but throughout its working life. For this reason the wear of the machine must not exceed certain limits, it must be watched and parts which are faulty due to wear or other damage must be replaced or repaired without delay. Therefore, repair and maintenance work must be carried out in accordance with preventive maintenance schedules.

4. **Maintenance and care of Power Tools used in Modelling:-**

- (a) Polythene/ canvas dust covers are to be used to cover the machines and equipment when not in use to protect them against dust and moisture.

(b) The user should be instructed to clean the machine after use with a hand brush. Slide ways are to be oiled to avoid condensation of moisture and then to cover the machine with dust cover.

(c) Each machine must have its tool cup-board for keeping all the accessories required for use.

(d) Cadets should be taught the use of the various controls and the correct manipulation of the machine before the commencement of any skill training of the machine.

(e) A check list/ store list showing all the items kept in the tool cup-board is to be displayed in a prominent place inside the cup-board.

5. **Conclusion.** Power tools used in ship modelling are for better finish, speed of execution and mass production. However, the machines needs to be kept operational and cadets must be trained to handle them with confidence for optimal exploitation, otherwise mishandling causing accidents leading to loss of material or injury.

SECTION-7 (SD/SW)**REPAIRING OF SHIP MODELS**

Period	-	01
Type	-	LEC/PRAC
Term	-	III

Training Aids

1. Blackboard, chalk, white board marker and projector and pointer.

Time Plan.

2.	(a)	Introduction	-	05 Mins
	(b)	Repairing	-	15 Mins
	(c)	Stabilising	-	15 Mins
	(d)	Conclusion	-	05 Mins

				40 Mins

3. **Introduction.** Any type of model may be damaged, requiring repair. Also all working model are to be stabilised to give optimum performance.

4. **Repairing.** If a model is damaged while carrying from one place to another or to repair damaged model, stores required for repairs are:-

- (a) Balsa wood Sheets, strips
- (b) M Seal, Pins, feviquick
- (c) Paints

STABILISING.

5. One of the big advantages in ship modelling is that almost anything will float, and with sufficient power it can be propelled through the water. This provides satisfaction to the casual model maker.

6. A model's first contact with the water usually comes some time before the last coat of paint is dry and the last details are fitted, however, it is far more practical to test the model during construction, since alteration of subsequent position of components becomes a major operation. The time for this is normally after the initial two to three coats of paint and if possible, before permanent attachment of the deck and superstructure.

7. Mark the water line at stem and stern with pencil marks and place components, or equivalent weights, in correct position and check that the hull floats true. If after completion, ballast is required to bring the model down to her marks or to correct trim, determine the required amount and its position by stacking cut chunks, flakes and shots of lead in peace, then melt the lead in to a convenient block and place or screw, to the hull bottom as low as possible.

8. But for other types of hulls like planked hull or chine hulls, where the bulkheads are used for making watertight compartments and are glued with the keel, this process should be carried out in the manner explained after stacking the flakes or shots in the correct position between the bulkheads, melt the lead and make the blocks according to the space available and then place / glue them as near as possible to the keel.

FITTING, PAINTING AND FINISHING MODELS

9. **Fitting of Models.** There are a large number of fittings on any ship/boat model. By far the best way is to study first hand a ship of the same type as the model or observe the details from photographs. The following are the main fittings generally found in a ship:-

Davits, Search Lights, Mast, Anchor, Fair Leads, Rigging Blocks, Cleats, Bollards, Stag Horns, Steering Wheel, Port Holes, Ventilators Capstan etc.

Painting and Finishing a Model.

10. It is not enough merely to slap a coat of paint on the job, especially when so many hours have been put in to the earlier work. Although the temptation to get the model floating is very strong, an extra hour or two spent in a careful paint finish will more than repay in satisfaction during the models life.

11. The secret of good painting is good surface preparation alongwith the use of good tools and good quality materials. Thoroughness is essential, especially in painting the interior of the model .Small internal areas of the model which are unpainted can lead to water ingress which can lead to deterioration of the model.

12. Thus it is necessary to study the various phases of construction to decide what parts must be painted before the next step renders it inaccessible. The usual colour for the inside of a boat is white, though some builders prefer plain varnish or clear lacquer. In either case the first coat should be well thinned and applied freely, though not freely enough for it to run down and pool in the corners of the structure. After this coat, two full strength coats should be applied, allowing plenty of time for them to harden. A meticulous modeler will carefully rub down and finish at least those parts which will be visible when the model's hatches are removed.

13. It should always be determined beforehand which kind of paint is going to be used for painting the model. If nitro cellulose (NC) based lacquer is to be applied then obtain a smooth surface by using NC based primer surface only. If any gap is to be filled, it should be done only after applying a thin first coat of primer and that too with NC based putty. When the putty is well dried, it should be rubbed down with Carborandum Paper. The rubbing is to be done, using the kerosene oil because there is every possibility of the wood swelling it, water is used while rubbing. It must be remembered that with each coat of primer, rubbing is required.

14. If the painting is to be done by brush, a thin coat of lacquer is advisable every time to obtain good results. Further details of this will be given by the instructor in class.

15. **Conclusion.** A model has to be stabilized before it is put in water. The trim and heel are checked before as it forms an important part of the competition. Models have to be repaired regularly and cadets have to be conversant with the tools and procedures as well as care and maintenance of tools and models. Models have to be packed carefully before transportation.

SECTION-8 (SD/SW)**HANDLING AND OPERATION OF REMOTE CONTROL MODELS**

Period	-	02
Type	-	LEC/PRAC
Term	-	III

Training Aids

1. Remote Control Receiver & Transmitter

Time Plan.

2.	(a)	Introduction	-	05 Mins
	(b)	Handling	-	15 Mins
	(c)	RC equipment	-	15 Mins
	(d)	Conclusion	-	05 Mins

				40 Mins

3. **Introduction.** The models requiring control remotely need to maintain the basic principles of watertight integrity, stability and the right amount of buoyancy. The remote control models are generally made from strips of balsa wood or any other light weight wood which is easy to cut, bend and shape into. The model is generally made with wooden strips cut in such a way to maintain symmetry in design of the model. The strips form various strakes of the hull and full pieces of strips are used to cover the hull to form the decks. The design is more or less like that of an original ship with bulkheads and supporting structures being included to maintain the integrity of the model while keeping it watertight and balanced. The model is prepared in such a way that the motor is placed in the lower part of the hull and connected to the propeller through the aft part of the hull pierced and covered well to only allow the propeller to operate without any ingress of water. The packing is done using steel bearings, rubber washers or oakum. The receiver for the motor is placed above the main deck for proper reception at all

times and connected to the motor using small wire or PCB. The transmitter is used to operate the model in such a way as to rotate it 360° and move forward or back.

4. **Handling and operation of a Remote Control Model.** A model 40 to 50 cm length and minimum 6cm width is required for RC operation. While Operating the model, check that water leakage is not there. To operate the RC model the following items are required:-

- (a) Remote Control
- (b) Good Model as specified above
- (c) Water Tank

5. **Remote Control.** Remote Control has the following important items:-

- (a) **Transmitter.** It operates the model in the ahead and astern direction and rotational direction of 360°. This will run with 12 V DC(8 Battery Cells of 1.5 V)
- (b) **Receiver.** It is fitted in model to receive the orders from transmitter and works as ordered. Receivers runs with the help of 6V DC(4 Cells 1.5V)
- (c) **Servers.** It operates with the help of receivers as per order passed by the transmitter and it will run as per the orders of receiver.

6. **Water Tank.** To operate RC model, a water tank of size 15'x 10'x 2'(15'long, 10'width and 2'height) is required. Tank will be filled with water up to one feet to operate the model with the help of remote control.

7. **Conclusion.** An RC model is performance oriented model when the finished model can carry out manoeuvres as required for the competition. Besides construction of RC model, with regards to its stability and water tightness, the cadets need to have hands on experience to operate the model using remote control in order to excel.

SECTION-9 (SD/SW)
PRACTICAL TRAINING

Period	-	09
Type	-	PRAC
Term	-	III

PRACTICAL TRAINING TO BE IMPARTED BY THE SMI.

CHAPTER-VIII

SEARCH AND RESCUE

SECTION -1 (SD/SW)**SAR ORGANISATION IN THE INDIAN OCEAN**

Period	-	01
Type	-	LEC
Term	-	I

Trg Aids

1. Blackboard, chalk, white board marker and projector and pointer.

Time Plan.

- | | | | | |
|----|-----|--------------------------------------|---|---------|
| 2. | (a) | Intro | - | 05 Mins |
| | (b) | Types of SAR | - | 15 Mins |
| | (c) | SAR Organisation in the Indian Ocean | - | 15 Mins |
| | (d) | Conclusion | - | 05 Mins |

40 Mins

3. **Introduction.** Communal riots, piracy, industrial disharmonies, war etc are the few examples of **man made disasters**, whereas flood, drought, earthquake, tsunami etc are some of the **natural disasters**. During all these calamities and disasters the loss of human life, animal life, material, property etc cannot be over ruled. In order to help the people affected and minimize said losses and the concept of Search & Rescue arises. SAR basically is an operation to locate those people who are in distress during the disasters or in imminent danger and provide them all the possible help and aid

- 4, **Types of Search and rescue.** Depending upon the nature and place of disaster, types of SAR vary to meet aviation disasters, maritime disasters and land disasters.

5. **Industrial Convention on Maritime Search and Rescue.**

- (a) Decisions taken on convention
- (b) Establishment of GMDSS
- (c) Division of world oceans into 13
- (d) SAR areas

6. **SAR Organization in Indian Ocean.** Indian Ocean area is one of those thirteen SAR areas in the world oceans, identified during 1979 convention. This area provides SAR cover to ships and other crafts in the Indian Ocean area. The said area has the following agencies to coordinate the SAR operation:

- (a) Coastal Radio Station
- (b) Coastal Surveillance Organization
- (c) Coastal Maritime SAR system
- (d) Vessel Traffic Service providers
- (f) Port and Harbors etc.

7. **Conclusion.** The Indian Ocean region is of Strategic Importance for the Navy and it is very essential to provide SAR services in this region. A number of agencies are involved in the SAR cover.

SECTION -2 (SD/SW)**ROLE OF INDIAN COAST GUARD**

Period	-	01
Type	-	LEC
Term	-	III

Trg Aids

1. Blackboard, chalk, white board marker and projector and pointer.

Time Plan.

2.

(a)	Intro	-	05 Mins
(b)	Role of Coast Guard	-	15 Mins
(c)	Extent of SAR cover	-	15 Mins
(d)	Conclusion	-	05 Mins

40 Mins

3. **Introduction.** In order to help the people affected and minimize said losses and the concept of Search & Rescue arises. SAR basically is an operation to locate those people who are in distress during the disasters or in imminent danger and provide them all the possible help and aid. Indian Coast Guard was established on 18 Aug 1978 and operates under the Department of Defence of the Union ministry of Defence. The Coast Guard works in close cooperation with the Indian Navy, Department of fisheries and Department of Revenue (customs) and the Central and State Police Forces.

4. **Coast Guard has following mission.**

- (a) National Defence during hostilities and peace.
- (b) Safety and protection of artificial lands, offshore terminals and other installations.
- (c) Protection and assistance to fishermen and mariners at sea.
- (d) Coastal security.
- (e) Law Enforcement in territorial & international water..
- (f) Preservation and protection of marine ecology.
- (g) Ant smuggling and other customs & preventive operations.
- (h) Scientific data collection and support.

5. **Role of Indian Coast Guard in Search and Rescue.** The Indian Coast Guard is responsible for coordinating SAR operation in the Indian Maritime Search & Rescue Region (IMSRR), The Indian SRR is sub divided into four sub region each with an assigned MRCC at Mumbai, Chennai, Port Blair and Porbandar. Coast Guard is basically an agency to provide SAR cover to ships and other crafts sailing in the sea around Indian peninsula. Director General Coast Guard is the National Maritime SAR Coordinating Authority (NMSARCA). Under NMSARCA, the Indian Search and Rescue region of India is divided into three SAR areas with MRCC's located at Mumbai, Chennai and Portblair. The Indian Coast Guard is designated as a nodal agency for Maritime Search and Rescue in Indian Search and Rescue region.

6. **The various field which are covered by SAR operation of Indian Coast Guard include** help and aid to fisherman in a distress, medical help, Antipiracy operation, aids to ships during fire, flood, tsunami, pirate attacks, drowning, requirement of towing the vessel, communication failure, machinery breakdown, search of missing crew, boats, machinery and material, disembarking of rescued crew, help to vessels drifting, meet fuel starvation, help during sinking of crafts, boats etc, medical evacuation, providing international cooperation to foreign vessel, ships, prevention of oil spills, providing distress alerts to fisherman and local public etc.

7. **Conclusion.** The Indian Ocean region is of Strategic Importance for the Navy and it is very essential to provide SAR services in this region. A number of agencies are

involved in the SRA cover. Coast Guard is basically an agency to provide SAR cover to ships and other crafts sailing in the sea around the Indian peninsula.

CHAPTER-IX

SWIMMING

SECTION -1 (SD/SW)**SWIMMING- FLOATING AND BREATHING TECHNIQUES**

Period	-	03
Type	-	PRAC
Term	-	III

Training Aids

1. Blackboard, chalk, white board marker and projector and pointer, Swimming pool.

Time Plan.

2.	(a)	Introduction	-	05 Mins
	(b)	Basics of Swimming gear	-	15 Mins
	(c)	Styles of Swimming	-	15 Mins
	(d)	Conclusion	-	05 Mins

				40 Mins

3. **Introduction.** Swimming is the self propulsion of a person through water for survival, recreation, sports, exercises or other reasons. Floating at the time of emergency, evacuation or any accident .The technique of floating keeps you surviving till help and assistance reaches you.

4. **Swimming Gears.** The following are few of the gears used by a swimmer:-

- (a) Swim suit
- (b) Swim cap
- (c) Goggles

- (d) Swim fins
- (e) Drag Suit
- (f) Paddlers
- (g) Kick Board

5. Various styles of Swimming

(a) **Front Crawl (Free Style)**. This style is swum with head facing down own facing, with scissors kick, flutter kick and up and down leg kicks . One arm always rests at the front while other arms, performs a cycles back towards sky.

(b) **Breast stroke**. Performed face down in the water without rotating the torso. The arms stay in the water and move synchronously while the legs perform a frog kick, The head is kept elevated out of the water throughout the stroke.

(c) **Butterfly**. Like a breast stroke it is performed face down in water the legs perform a dolphin kick while the arms move in a forward circle at the same time.

(d) **Dog Paddle**. Performed face over water and paddling with alternate hands often with the nose and mouth above the water.

(e) **Back Stroke**. This style is also known as back crawl. In this style the chest is facing the sky and one is lying on the back. Both arms move synchronized with a small synchronized kick.

Note. In addition to above swimming styles, there are few more styles namely snorkeling, fin swimming, sidestroke, combat side stroke etc.

6. Tips in swimming

- (a) Swimmer must focus on exhalation and not on inhalation. The exhalation must be done under water.
- (b) When you are not breathing, you should keep your head still.

- (c) When you move through water you create a 'bow wave' with your head and body.
- (d) Do not lift your head while swimming.
- (e) Do not over rotate your head. You should rotate up to the extent when you see your sides.
- (f) Rotate the body till the extent you feel comfortable. This helps to your breathing.
- (g) Once you are comfortable keeping your face/ head in the water while swimming you need to figure out how and when to breath.
- (h) When you breath in, your mouth should be out of water.
- (j) The mouth should be closed while the face is in the water. As the face is inside the water a small amount of air should be released so as to avoid water entering the nose.
- (k) When the face turns side ways after being lifted out of water one should exhale as much as possible with the help of nose and mouth.

7. **Precaution while Swimming.**

- (a) Never swim alone.
- (b) Know the depth of the water.
- (c) A strict discipline must be followed in the pool.
- (d) Never dive in the shallow end of the pool.
- (e) Wear proper kit while swimming.
- (f) You should know your limits.
- (g) Don't drink more water when you go for swimming.
- (h) Proper floatation devices must be standby/ ready when you are swimming.
- (j) Follow all instruction& safety precaution promulgated by the authorities.

- (k) Swim always with in designated areas.
- (l) All precaution must be taken to keep the water clean & hygienic.
- (m) All possible medical care must be taken to protect yourself for various infection due to water of swimming pool.

8. **Conclusion.** Swimming is an important activity for any individual not only as a sports and entertainment but also as a survival technique. It requires a balanced coordination of your breathing, mental and physical movements, strength and stamina to make you a good swimmer.

SECTION -2 (SD/SW)**SWIMMING- FLOATATION FOR 3 MINS AND SWIMMING FOR 50 m**

Period	-	06
Type	-	PRAC
Term	-	2 EACH IN I, II AND III

Trg Aids

1. Swimming Pool.

Time Plan.

2.	(a)	Warm up	-	05 Mins
	(b)	Swimming for 50 M	-	15 Mins
	(c)	Floating for 3 mins	-	15 Mins
	(d)	Debrief	-	05 Mins

				40 Mins

(PRACTICAL CLASSES AT SWIMMING POOL WITH PROPER COSTUMES)