

**CURRICULUM FRAMEWORK AND COURSE CONTENT
FOR OUTCOME BASED EDUCATION**

IN

MSc in Underwater Science and Technology
(Programme No 24 - 8803)

Conducted By



TO SEEK TO CLASSIFY TO DESTROY

ASW SCHOOL

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REGULATIONS FOR MSc (UNDERWATER SCIENCE AND TECHNOLOGY)

1. **Programme No** : 24 - 8803
2. **Programme Name** : MSc in Underwater Science and Technology
Sensor
3. **Programme Name (Naval Equivalent)** : Long ASW (Indian)
4. **Approving authority** : IHQ MoD(Navy)
5. **Eligibility criteria for admission** : (a) Officer Nominated by IHQ MoD(Navy) or HQ ICG

(b) A Bachelor's Degree in Science or BE/ BTech, in any discipline, from a recognized university.
6. **Duration** : Phase I
(a) Semesters I & II - 48 weeks of Technical Training and OJT

Phase II
(b) Semesters III & IV - 48 weeks Specialisation Training at ASW School
7. **Attendance requirement** : 85% minimum
8. **Nature** : Full Time Contact Programme
9. **Approved intake capacity** : As approved by IHQ MoD(Navy)
10. **Examination Pattern** : The examination paper setter will be an officer/ sailor other than the subject instructor, nominated by the Chief Instructor.
11. **Minimum qualifying marks** : Theory 55% and Practical 70 %
12. **Grading.**

(a) The grading of the students is based on the final result, which is as follows:-

Range of Marks	Grades	Weightage
90% of above	S - Outstanding	10
80 – 90 %	A - Excellent	09
70 – 80 %	B - Very Good	08
60 – 70 %	C - Good	07
55 - 60 %	D – Satisfactory	06
Below 55 %	F – Failed	00

* Where (X – Y %) means X is included and Y is excluded.

(b) **Cumulative Grade Point Average (CGPA).** Overall performance at the end of the course is indicated by Cumulative Grade Point Average (CGPA) calculated as follows for all subject: -

$$\text{CGPA} = \frac{(G_1C_1 + G_2C_2 + G_3C_3 + \dots + G_nC_n)}{(C_1 + C_2 + C_3 + \dots + C_n)}$$

Where, G = Grade weightage.

C = Credit value corresponding to the subject.

(c) **Classification.** The classification of MSc in Underwater Science and Technology will be given as follows: -

<u>Ser</u>	<u>Classification</u>	<u>CGPA</u>
1.	First Class with distinction	8 and above
2.	First Class	7 < 8
3.	Second Class	6 < 7

13. **Failure in Examinations.**

(a) Failure in one subject will result in warning by Chief Instructor and re-examination.

(b) Failure in two subjects or in one subject more than once will result in warning by Officer-in-Charge and re-examination.

(c) Failure in three or more subjects or in re-examination will be considered as failure in the whole course and trainee will be withdrawn from the course.

14. **Synopsis of the Subjects and Credit Points.**

<u>Subject Code</u>	<u>Subject</u>	<u>Credit</u>
<u>SEMESTER III</u>		
24-8803-1001	Underwater Acoustics	3
24-8803-1002	Sonar Theory I	2
24-8803-1003	Sonar Theory II	3
24-8803-1004	Sonar Theory III	3
24-8803-1005	Naval Weapon Systems	3
24-8803-1006	Equipment Group I	2
24-8803-1007	Equipment Group II	2
24-8803-1008	Equipment Group III	1
24-8803-1009	Applied Mathematics	1
	Total	20
<u>SEMESTER IV</u>		
24-8803-1010	Torpedo A244S	2
24-8803-1011	Torpedo CET 65E	2
24-8803-1012	Mine Warfare	2
24-8803-1013	Rocket Launcher RBU 6000 and Fire Control System (FCS)	2
24-8803-1014	Tactics I	4

<u>Subject Code</u>	<u>Subject</u>	<u>Credit</u>
24-8803-1015	Tactics II	4
24-8803-1016	Project	2
24-8803-1017	Oral Board	4
Total		22
Grand Total		42

SCHEME OF INSTRUCTIONS (SOI) AND SCHEME OF EXAMINATIONS (SOE)

CODE	SUBJECT	HOURS/ WEEK				CREDI	MARKS		
		L	T	P	TOTAL	I	TH	PR	TOTAL
	Semester III								
24-8803-1001	Underwater Acoustics	2	-	1	3	3	50	10	60
24-8803-1002	Sonar Theory I	2	-	1	3	2	40	10	50
24-8803-1003	Sonar Theory II	3	-	1	4	3	40	40	80
24-8803-1004	Sonar Theory III	3	-	2	5	3	70	20	90
24-8803-1005	Naval Weapon Systems	4	-	1	5	3	125	20	145
24-8803-1006	Equipment Group I	2	-	1	3	2	60	20	80
24-8803-1007	Equipment Group II	2	-	1	3	2	40	10	50
24-8803-1008	Equipment Group III	2	-	1	3	1	60	20	80
24-8803-1009	Applied Mathematics	1	-		1	1	45	10	55
	Total				30	20	530	160	690
	Semester IV								
24-8803-1010	Torpedo A244S	3	-	1	4	2	70	30	100
24-8803-1011	Torpedo CET 65E	3	-	1	4	2	70	30	100
24-8803-1012	Mine Warfare	3	-	1	4	2	70	30	100
24-8803-1013	Rocket Launcher RBU 6000 and Fire Control System (FCS)	3	-	2	5	2	90	60	150
24-8803-1014	Tactics I	4	-	1	5	4	200	0	200
24-8803-1015	Tactics II	4	-	1	5	4	200	0	200
24-8803-1016	Project	1	1	-	2	2	200	0	200
24-8803-1017	Oral Board	1	-	-	1	4	210	-	210
	Total				30	22	1110	150	1250
	Grand Total				60	42	1640	310	1940

Total Credits: **42**Total Exam Marks: **1940**

SYLLABI FOR PROGRAMME 24 - 8803

MSc IN UNDERWATER SCIENCE AND TECHNOLOGY

VISION

Practicalisation of training, building up of new resources, maximising of the existing resources, impetus on safety related training and maximise fleet exposure opportunities of trainees. The School aims to provide the right balance of theoretical and practical training to the entire spectrum of ASW trainees. The emphasis of training has been directed towards preparing them for the immediate next job, while broadening their horizon for future responsibilities. The School shall, through professional research, contribute towards development of ASW Tactics and Doctrine and also advice higher command formations on ASW, Mine Warfare and Underwater Domain Awareness.

MISSION

The School is responsible for producing 'Fleet-ready' officers and sailors and act as a repository of knowledge on all aspects of ASW, Mine Warfare and Underwater Domain Awareness. Its mandate is to actively contribute to the advancement of ASW tactical thinking and doctrine through rigorous professional research.

PROGRAMME EDUCATIONAL OBJECTIVES (PEO)

PE01: To provide trainees with an academic setting that nurtures learning and empowers them to excel in the naval profession, mastering the necessary skills for successful operations in Anti-Submarine Warfare.

PE02: To provide a thorough knowledge of various weapons and sensors, enabling trainees to operate them in various diverse environment to undertake operations and consequently building a successful career in Anti-Submarine Warfare, staying abreast of technological advancements in the field.

PE03: To provide trainees with comprehensive knowledge of underwater operations and the technical expertise necessary to address field challenges, enabling them to fulfill the responsibilities while undertaking the role of Command/Anti-Submarine Warfare Officer (ASWO) when implementing operational tactics.

PE04: To engage trainees in continuous professional development, staying abreast of advancements in submarine warfare tactics, strategies and technologies to ensure readiness for evolving operational challenges.

PROGRAMME OUTCOMES (PO)

PO1: To suitably comprehend the principles of underwater acoustics and applications of sonar towards effective utilisation of ASW sensors and weapons under varying operating conditions.

PO2: To be able to exploit the sensors and weapon systems by operators on various ASW platforms.

PO3: To effectively apply concepts of various underwater detection and tracking systems, decoy systems, advanced torpedo defense systems and mine warfare onboard ships.

PO4: To analyse a tactical scenario and advise Command in conduct of coordinated operations.

PO5: Function effectively as an ASWO, and as a leader in diverse teams with varying platforms, and in multi-disciplinary settings.

24-8803-1001 UNDERWATER ACOUSTICS

Course Description. This course covers concepts of underwater acoustics and principles of sound systems in water

24-8803-1001	Under Water Acoustics	Category	L	T	P	Credit
		-	2	-	1	3

Pre-requisites. Basic concepts of characteristics of sound, sound propagation and velocity of sound.

Course Objectives. To be able to apply concepts of underwater sound towards exploitation of various ASW sensors.

Course Outcome. After completion of the course, trainee will be able to:-

CO 1	Analyse the propagation of sound wave as per existing hydrological conditions
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Mapping of course outcomes with program outcomes: Level-Low (1), medium (2) and high (3)

	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	3	3	2	3	3

Distribution of Marks.

Total Marks	ESE	ESE Duration
60	60	3 hours

End Semester Examination Pattern.

End Semester Examination Pattern: Consists of three parts; Part A, B and C. Part A contains 30 questions (10 – fill in the blanks, 10 – choose the correct answer and 10 short answer) from each module, each question will be of one mark. Part B contains 08 questions from each module, 04 Three-mark question and 04 Two-mark question each. Each question can have maximum 2 subdivisions. Part C consists of practical viva comprising of 10 marks.

Module 1

- Utility of acoustic energy in naval operations such as Anti-Submarine Warfare, Mine Warfare, Submarine Operations, Ocean Surveillance, Underwater Communication etc.
- The physical properties of acoustic wave's intensity – acoustic impedance, acoustic energy power
- Units – decibel notations, standard reference pressure used in U/W sound.

Module 2

- Existence of Acoustic Path, Background Signal and Signal to Back Ground Noise ratio

2. Derivation of Sonar Equation in logical steps, Active and Passive Sonar Equation, definitions of various Sonar Parameters, limitation of Sonar Equation, Figure of Merit

Module 3

1. Velocity of sound in the sea, variation of the profile with latitude, season and time of day, deep sea velocity profile
2. Various acoustic paths, sound propagation in positive, negative and isothermal gradient, sound channel propagation
3. Mixed layer sound channel, deep sound channel and shallow water sound channel, bottom bounce paths, convergence zones, various paths

Module 4

1. Source of Ambient Noise, Source and path of Self Noise, Self-Noise Measurement, Flow Noise
2. Source of Radiated Noise, Machinery Noise, Propeller Noise, variation with speed and frequency
3. Types of causes of losses of sound energy in sea - Spreading Losses (spherical and cylindrical) Absorption Loss, causes of variation with frequency, temperature and depth, Theory of Reverberation, types of Reverberation.

Module 5

1. The concept of geometry of Target Strength, Variation of Target Strength of a submarine with aspects, Pulse length, depth and range.
2. Doppler Effect, Doppler Shift, cause of Doppler shift, Echo Pitch, Echo Duration
3. Transducers, Constructions, types of materials used in construction of transducers e.g. Piezo-electric, directional properties of transducer
4. Definition of Directivity Index (array gain) and Detection Threshold, receiver operating curves and advantages of an array over a single hydrophone

References.

1. Principles of Underwater Sound by RJ Urick, Third Edition, published by Peninsula publishing 2013.
2. An introduction to underwater acoustics – Principles and applications by Xavier Lurton, first edition, published by Springer, 2016
3. Sonar for Practicing Engineers by A.D Waite, third edition, published by Wiley, 2002
4. Mechanics of Underwater Noise by Donald Ross, Third Edition published by Peninsula Publishing Los Altos, California 1984
5. An Introduction to underwater acoustics by Dr Xavier Lurton published by Springer Praxis Books in 2002

24-8803-1002 SONAR THEORY I

Course Description. This course covers concepts of Basic Sonar Theory

24-8803-1002	Sonar Theory I	Category	L	T	P	Credit
		-	2	-	1	2

Pre-requisites. Basic knowledge on the operation of Sonar Systems

Course Objectives. (i) To be conversant on operations including waveforms of sonar
(ii) To be conversant with exploitation of various sonar systems.

Course Outcome. After completion of the course, the student will be able to

CO 1	Acquire knowledge and operate sonar for detection of target
CO2	To be able to control operations of Sonar through various modes

Mapping of course outcomes with program outcomes: Level-Low (1), medium (2) and high (3)

	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	3	3	1		3
CO 2	3	3			3

Distribution of Marks.

Total Marks	ESE	ESE Duration
50	50	2 hours

End Semester Examination Pattern.

End Semester Examination Pattern: Consists of three parts; Part A, B and C. Part A contains 20 questions (05 – fill in the blank, 05 – choose the correct answer, 05 – Match the following and 05– true or false) from each module, each question will be of one mark. Part B contains questions- 02 five-mark questions, 02 Three-mark question and 02 Two-marks question each. Part C contains practical examination on equipment handling for 10 marks.

Module 1

1. Introduction to SONAR and Components of a Sonar System.
2. Typical Layout of sonar and its associated fitting
3. Classification of sonars: MF, LOW Frequency Bi Static, Multi Static, Parametric, Side Scan and High-Definition Mine Hunting.
4. Concept of Beam Forming.
5. System block diagram and major sub systems.
6. Types of Wave forms, types of transmission and display.

Module 2

1. Various Display characteristics.
2. Initial search and track active targets.
3. Initial search and track passive targets.
4. Mine detection and tracking of torpedo HE.

References.

1. Sonar for Practicing Engineers by A.D Waite, third edition, published by Wiley, 2002
2. Sonar system Design by SP Pillai, first edition, published by Defence research and development organization, 2013
3. Introduction to theory & design of sonar transducer by Oscar Bryan Wilson 1998 publishing by peninsula publishers USA, first edition
4. Sonar and Underwater Acoustics by Jean-Paul Marage and Yvon Mori, 1st edition, ISTE Ltd and John Wiley & Sons Inc Publisher, 2010
5. Transducers and Arrays for Underwater Sound by Charles H Sherman and John L Butler, Springer publishers, 1st edition, 2011
6. Technical Specification docket for HUMSA NG, HUMSA UG, ATAS

24-8803-1003 SONAR THEORY II

Course Description. This course covers concepts of Sonar HUMSA NG and UG.

24-8803-1003	Sonar Theory II	Category	L	T	P	Credit
		-	3	-	1	3

Pre-requisites. Basic knowledge on the operation of Sonar Systems

Course Objectives. (i) To operate sonar as per the hydrological conditions
(ii) To be conversant with exploitation of sonar systems.

Course Outcome. After completion of the course, the student will be able to

CO 1	Acquire knowledge and operate sonar for detection of target
CO2	To be able to control operations of Sonar through active and passive operator

Mapping of course outcomes with program outcomes: Level-Low (1), medium (2) and high (3)

	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	3	3	1		3
CO 2	3	3			3

Distribution of Marks.

Total Marks	ESE	ESE Duration
80	80	3 hours

End Semester Examination Pattern.

End Semester Examination Pattern: Consists will be three parts; Part A, B and Part C. Part A 20 contains questions (10 – fill in the blank, 05 – choose the correct answer, and 05 – true or false) from each module, each question will be of one mark. Part B contains - 02 Five-mark question, 02 Three-mark question and 02 Two-mark question each. Part C contains practical examination on equipment handling for 40 marks.

Module 1

1. Sonar HUMSA NG
 - (a) Location of major units and sub units and their functions
 - (b) system operation, Generic Settings, Active Transmitter
 - (c) Functional features
 - (d) signal processing
 - (e) Tactical use of display formats
 - (f) Transmission Waveforms, Modes of Transmission and exploitation commensuration with environment

2. Tactical Operation of sonar
 - (a) practical utility of shifting between modes, Bistatic/ multistatic operations
 - (b) Safety precautions prior operation of sonar
 - (c) Sea and action drills

Module 2

1. Sonar HUMSA UG
 - (a) Location of major units and sub units and their functions
 - (b) system operation,
 - (c) operator console,
 - (d) signal processing
 - (e) Tactical use of display formats
 - (f) Duties of Sonar Controller

2. Tactical Operation of sonar
 - (a) practical utility of shifting between modes
 - (b) Safety precautions prior operation of sonar
 - (c) Sea and action drills

References.

1. Sonar for Practicing Engineers by A.D Waite, third edition, published by Wiley, 2002
2. Sonar system Design by SP Pillai, first edition, published by Defence research and development organization, 2013
3. Introduction to theory & design of sonar transducer by Oscar Bryan Wilson 1998 publishing by peninsula publishers USA, first edition

4. Sonar and Underwater Acoustics by Jean-Paul Marage and Yvon Mori, 1st edition, ISTE Ltd and John Wiley & Sons Inc Publisher, 2010
5. Transducers and Arrays for Underwater Sound by Charles H Sherman and John L Butler, Springer publishers, 1st edition, 2011
6. Technical Specification docket for HUMSA NG, HUMSA UG, ATAS

24-8803-1004 SONAR THEORY III

Course Description. This course covers concepts of Sonar systems

24-8803-1004	Sonar Theory III	Category	L	T	P	Credit
		-	3	-	2	3

Pre-requisites. Basic knowledge on the operation of Sonar systems

Course Objectives.

- (i) To analyse concepts of spectrum processing of underwater acoustics and harmonics in LOFAR
- (ii) To be conversant with exploitation of LOFAR systems.
- (iii) To be conversant with exploitation of ATAS System onboard.

Course Outcome. After completion of the course, the student will be able to:-

CO 1	To be able to analyse various machinery noise using low frequency propagation and its interaction with medium
CO 2	To be able to exploit the operations of Sonar in various mode
CO 3	Acquire knowledge and operate ATAS for detection of target
CO 4	To be able to control operations of ATAS streaming and recovery operations with observance of safety onboard

Mapping of course outcomes with program outcomes: Level-Low (1), medium (2) and high (3)

	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	3	3	1	2	3
CO 2	3	3	1	2	3
CO 3	3	3	1	2	3
CO 4	3	3	2	2	3

Distribution of Marks.

Total Marks	ESE	ESE Duration
90	90	3 hours

End Semester Examination Pattern.

End Semester Examination Pattern: Consists of three parts: Part A, B and Part C. Part A contains 20 questions (05 – fill in the blank, 05 – choose the correct answer, 05 – Match the following and 05– true or false)) from each module, each question will be of one mark. Part B contains questions-06, Five-mark question, 04 Three-mark question and 04 Two-mark question each. Students should answer all questions. Part C contains practical examination on equipment handling and viva voce for 20 marks.

Module 1

Low Frequency Analysis and Ranging (LOFAR)

- (a) Low frequency propagation and its characteristics. Functional features
- (b) Components of radiated noise, In hull and out hull noise and transmission characteristics, Machinery Noise, Propeller Noise
- (c) Pattern recognition, spectrum predominance
- (d) Calculation and Solving LOFAR grams using Signature analysis, Interpretation of Lofargrams

Module 2

Active Towed Array Sonar (ATAS)

- (a) components and their purpose
- (b) basic operating principles
- (c) Introduction to lowering and hoisting system and operation of the system
- (d) Safety precautions prior operating ATAS

References.

1. Sonar for Practicing Engineers by A.D Waite, third edition, published by Wiley, 2002
2. Sonar system Design by SP Pillai, first edition, published by Defence research and development organization, 2013
3. Introduction to theory & design of sonar transducer by Oscar Bryan Wilson 1998 publishing by peninsula publishers USA, first edition
4. Sonar and Underwater Acoustics by Jean-Paul Marage and Yvon Mori, 1st edition, ISTE Ltd and John Wiley & Sons Inc Publisher, 2010
5. Transducers and Arrays for Underwater Sound by Charles H Sherman and John L Butler, Springer publishers, 1st edition, 2011

24-8803-1005 NAVAL WEAPON SYSTEMS

Course Description. This course covers concepts of underwater weapon DC Mk II, Seaward Defense, General ASW, Towed Decoys and Demolition.

24-8803-1005	Naval Weapon Systems	Category	L	T	P	Credit
		-	4	-	1	3

Pre-requisites. Basic knowledge on seaward defense organization.

- Course Objectives.**
- (i) To be able to exploit the concepts of underwater weapon DC Mk 11 and principles of towed decoy PNM during coordinated exercise.
 - (ii) To be able to perform and supervise actions during seaward defense and be able to be conversant with survey/demand procedures of Naval/armament stores and their stowage
 - (iii) To acquire functional knowledge of theory of demolition and underwater explosives

Course Outcome. After completion of the course, the student will be able to

CO 1	Prepare DC Mk 11 for deployment
CO 2	Deploy towed decoy under various tactical scenarios
CO 3	Perform duties of Officer of the day and ensure security of ship
CO 4	Early detection, localization and identification of target
CO 5	To Identify and exploit the use of naval explosives underwater
CO 6	Operate and supervise the conduct of demolition exercises underwater

Mapping of course outcomes with program outcomes: Level-Low (1), medium (2) and high (3)

	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	3	3	2	3	3
CO 2	3	2	2	2	2
CO 3	3	3	1	3	2
CO 4	3	3	1	3	3
CO 5	3	3	1		2
CO 6	3	3	2	1	2

Distribution of Marks.

Total Marks	ESE	ESE Duration
145	145	3 hours

End Semester Examination Pattern.

End Semester Examination Pattern: Consists of 3 parts; Part A, B and C. Part A contains 35 questions (10 – fill in the blank, 10 – choose the correct answer, 05 – Match the following and 10– true or false) from each module, each question will be of one mark. Part B contains; 10 five-mark questions, 06 Three-mark question and 06 Two-mark question each and 10 one-mark question. Each question can have maximum 2 sub-divisions. Part C contains practical examination on equipment handling for 20 marks.

Module 1

1. DC Mk II-
 - (a) Preparation of DC Mk 11 system,
 - (b) Parts and function of system
 - (c) Exploitation of system
 - (d) Tactical deployment during exercise
 - (e) Safety precautions to be followed
2. Towed Decoy PNM
 - (a) Parts and Use of towed decoy
 - (b) Procedure for deployment
 - (c) Maintenance of PNM

Module 2

1. Aim / principles of Seaward Defense
 - (a) Water borne attacks
 - (b) Components of Harbor security
 - (c) Introduction to references for Seaward defense

2. Conduct of Higher Security state
 - (a) Types of threat
 - (b) Types of underwater saboteurs
 - (c) Defensive measures
 - (d) Safety precautions
 - (e) Positioning of lookouts and sentries
 - (f) Signals used during exercise

3. Roles / functions of ASW Department onboard
 - (a) Duties/ responsibilities of ASW sailors as PO US I.
 - (b) Maintaining of books and records
 - (c) Function of Naval organization
 - (d) Underwater signature management

Module 3

1. Naval Stores
 - (a) Types of Naval Stores
 - (b) Demanding accounting procedure
 - (c) Material organization
 - (d) Ledger Muster

2. Naval Armament Stores
 - (a) Types of Naval Armament Stores
 - (b) Demanding /accounting/ stowage procedure
 - (c) Magazine and Keyboard organization
 - (d) Safety precautions

Module 4

1. Demolition, Combustion, Explosion and Detonation; Classes of Explosives, Low Explosive, High Explosive and Primary Explosives.

2. Initiation of Explosive, Partial Detonation, Sympathetic Detonation, Hot Spot theory, velocities of Detonation, burning of Explosive, Brilliance, Tampering and Initiation Train; Effect of addition of Non-Explosive Ignition; Simple explosives, TNT, CE, RDX, PETN, Amatol, fuse TNT/AL RDX/TNT Topre, MDX RDX/W AX/AL and Plastic explosive-PE 3A.

References.

1. Integrated Headquarters, Ministry of Defence (Navy), Doctrine on Coastal Security, Naval Operational Publication, 2017
2. BR 338(I), Handbook of Demolition and Explosives
3. INBR 1862/2019 Handbook for Indian Naval Magazine and Explosives Regulation

24-8803-1006 EQUIPMENT GROUP I

Course Description. This course covers concepts of electrical equipment for maintenance of Sonar/ ASW Equipment onboard which includes- Expendable bathy thermograph (XBT), Underwater acoustics Communication system (UWACS), Self-Propelled Underwater Re-usable Target (SPURT), Major firefighting System (MFFS) and application of computer

24-8803-1006	Equipment Group I	Category	L	T	P	Credit
		-	2	-	1	2

Pre-requisites. Technical specification, Calibration checks, Deployment of XBT probe

Course Objectives. To be able to carry out effective operation/ supervision of exploitation of underwater equipment's and its associated software.

Course Outcome. After completion of the course, the student will be able to

CO 1	Calculate Sonar Range using PROSPER and PROBS and use PROSIM software
CO2	To deploy and exploit SPURT, MFFS
CO3	To ensure data security in naval environment

Mapping of course outcomes with program outcomes: Level-Low (1), medium (2) and high (3)

	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	2	2	2	2	2

Distribution of Marks.

Total Marks	ESE	ESE Duration
80	80	3 hours

End Semester Examination Pattern.

End Semester Examination Pattern: Consists of 3 parts; Part A, B and C. Part A contains 20 questions (10 – fill in the blank, 10 – choose the correct answer) from each module, each question will be of one mark. Part B contains; 04 Five-mark question 04 three mark and 04 two-mark questions from module. Students should answer all questions. Part B contains practical examination on equipment handling for 20 marks.

Module 1

1. Operation of XBT System
 - (a) Sequence of operation,
 - (b) calibration checks,
 - (c) Requirements of operation and maintenance by operator

2. Analysis of Temperature Profile
 - (a) Parameters of PROSPER software
 - (b) Application of Sonar Tote
 - (c) Target profiling
 - (d) Predicted / Estimated Sonar Range and Ray trace plot
 - (e) Record keeping and sending of Bathy returns

Module 2

3G UWACS and UWACS TRITON

- (a) Modes of operation, difference between Keltron UWT, 3G UWACS and UWACS Triton
- (b) Switching ON procedure, Function of keys and communication procedure in various modes
- (c) Safety precautions while transmitting on UWT
- (d) Sea and action drills

Module 3

1. Self-Propelled Underwater Reusable Target (SPURT)
 - (a) Parts of SPURT
 - (b) Preparation onboard prior deployment at sea
 - (c) Lowering and recovery procedure
 - (d) Technical description and capability/limitation of SPURT
 - (e) Pre deployment checks and Operating procedure for SPURT

2. ASW Wave Glider/ UUVs/ AUVs
 - (a) Operation of Wave Glider, monitoring system, record the data
 - (b) classify the data and analysis the LOFAR Gram
 - (c) recovery procedure
 - (d) Post recovery routine and routine checks of Glider in Harbour.

Module 5

Major Fire fighting system (MFFS)

- (a) Parts of MFFS
- (b) Use of MFFS
- (c) Technical description and capability/limitation
- (d) Checks and Operating procedure

Module 6

Naval Network Security

- (a) Overview of network security
- (b) Awareness regarding IT/Infosec policies in IN.
- (c) Use of internet in Naval environment and sensitization regarding social media and risks posed by them.
- (d) Handling security issues, user notifications, vulnerability fixing, security measures for safe disposal.

References.

1. Sea surface Temperature edited by Jorge Vazquez- Cuervo and Xiaofeng Li published by MDPI, Switzerland, 2018
2. Bathymetry and its applications by Philippe Blondel published by INTECH in 2012
3. Data and Computer Communications by William Stallings, Eighth Edition, Pearson Education Publishers, 2007
4. Fundamentals of Computers by E Balagurusamy, 2nd edition, published by Mc Graw Hill Education, 2009
5. Computer Networking with Internet Protocols and Technology by William Stalling, 1st edition, Pearson Education India, 2003
6. Fundamentals of Computers by V Rajaraman and Neeharika Adabala, 6th Edition, Prentice - Hall of India Pvt Ltd, New Delhi, 2014

24-8803-1007 EQUIPMENT GROUP II

Course Description. This course covers concepts of Decoy/ Sonar health check systems

24-8803-1007	Equipment Group II	Category	L	T	P	Credit
		-	2	-	1	2

Pre-requisites. Nil

- Course Objectives.**
- (i) To be able to control the operation of the Torpedo Decoy System ATDS
 - (ii) To be able to operate, maintain and to supervise the operation of varunastra and Mk 54 torpedo
 - (iii) Apply concepts of seamanship

Course Outcome. After completion of the course, the student will be able to

CO 1	Acquire knowledge on the Torpedo decoy systems and operate Advanced Torpedo Defense Systems (ATDS)
CO2	Operate and supervise the operation of Varunastra and Mk 54 torpedo
CO3	Supervise seamanship evolutions

Mapping of course outcomes with program outcomes: Level-Low (1), medium (2) and high (3)

	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	3	3	1		2
CO2	3	3	2	1	2

Distribution of Marks.

Total Marks	ESE	ESE Duration
50	50	3 hours

End Semester Examination Pattern.

End Semester Examination Pattern: Consists of 3 parts; Part A, B and C. Part A contains 10 questions (05 – fill in the blank, 05 – choose the correct answer) from each module, each question will be of one mark. Part B contains; 02 five marks questions, 04 Three-mark question and 04 Two-mark question each. Each question can have maximum 2 sub-divisions. Students should answer all questions. Part C will have practical viva comprising of 10 marks.

Module 1

MK 54

- (a) Components of MK 54
- (b) Technical details and operational limitations
- (c) Safety precautions whilst launching and recovering
- (d) Logic Operation

Module 2

Advanced torpedo Defence systems (ATDS) - MAREECH/ Torpedo Decoy

- (e) Components of ATDS
- (f) Technical details and operational limitations
- (g) Safety precautions whilst streaming and recovering ATDS, Pipe Noise Maker(PNM)

Module 3

Varunastra torpedo A244S

- (a) Exploder mechanism, description, function and Circuit diagram
- (b) Pre-settable data on the torpedo and Transmission configuration
- (c) Reception beam, Search pattern, Attack phase, Acquisition criteria, Lost contact procedure and re-attack

Module 4

Seamanship phase

- (a) Introduction to seamanship
- (b) Safety precautions
- (c) Seamanship evolutions

References.

1. Time Frequency Signal Analysis and Processing by Boualem Boashash, 2nd Edition published by Academic Press, 2015
2. Handbook on ATDS
3. Introduction to theory & design of sonar transducer by Oscar Bryan Wilson 1998 publishing by peninsula publishers USA, first edition
4. Digital Principles and Applications by A P Molvino and Donald P Leach Fourth Edition published by Tata Mcgraw Hill sixteenth reprint 1999
5. INBR (Indian Naval Book of Reference) 1424, The Operational Manual for GI 738

8803-1008 EQUIPMENT GROUP III

Course Description. This course covers concepts of digital electronics for maintenance of Sonar/ ASW Equipment onboard, Underwater Telephony, principles of sonobuoys and of underwater weapon guidance control propulsion and launching system (PUWW).

24-8803-1008	Equipment Group III	Category	L	T	P	Credit
		-	2	-	1	1

Pre-requisites. Basic knowledge of the principles of digital electronics, principles and functioning of basic sonar.

Course Objectives.

- (i) Impart theoretical and practical knowledge on system maintenance
- (ii) Able to comprehend operation of common test equipment onboard
- (iii) To be able to handle various electrical equipment and follow electrical engineering practice.
- (iv) To be able to operate/supervise the operation of underwater telephone (UWT)
- (v) To analyse the deployment of sonobuoys in tactical scenarios

Course Outcome. After completion of the course, the student will be able to

CO 1	Comprehend the maintenance routine of Sonar
CO 2	Advise crew during the use of equipment for Sonar Parameter checks.
CO 3	follow safe electrical engineering practice onboard
CO 4	Analyse the use of equipment for Sonar Parameter checks.
CO 5	To be able to carry out and supervise the operations on sonobuoy
CO 6	To be able to operate and supervise the operation of UWT KELTRON

Mapping of course outcomes with program outcomes: Level-Low (1), medium (2) and high (3)

	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	3	3	2	1	1
CO 2	3	1			1
CO 3	3	1			1
CO 4	3	2	1		1
CO 5	3	3	1	2	1
CO 6	3	2	2	2	3

Distribution of Marks.

Total Marks	ESE	ESE Duration
80	80	3 hours

End Semester Examination Pattern.

End Semester Examination Pattern: Consists of 3 parts; Part A, B and C. Part A contains 20 questions (10 – fill in the blank, 10 – choose the correct answer) from each module, each question will be of one mark. Part B contains; 04 questions five-mark question, 04 three mark questions and

04 two-mark question each. Students should answer all questions. Part C contains practical examination on equipment handling for 20 marks.

Module 1

1. Calculation of Binary, octal, hexadecimal, binary addition subtraction, positive logic, negative logic need for BCD encode/ decoding, parity cycle code. Application of Logic Gates
2. Use of Multi vibrator, mono shot, bi-stable, a-stable RS Flipflop, latches, propagation delay time, set up time, hold time race problem, master slave set up time, hold time race problem, master slave Flipflop, clock system. Concept of timers and counters. Types of memories. Analog to digital conversion and digital to Analog conversion. Linear frequency modulation. Application of Step frequency modulation, hyperbolic frequency modulation. Concepts of Detection problem, various functions and their definitions. Types of modulation in sound waves used for under water transmission.

Module 2

1. Introduction to torpedo propulsion, Close looped cycles and open loop cycles for underwater Propulsion, U/W propulsion technologies around the world. Theory of super cavitation.
2. Sensors, signal processing and algorithms for detecting classifying and tracking targets, Safeties involving warheads and firing. Challenges in u/w homing and guidance.

Module 3

1. Introduction to Sonobuoys; Capabilities of Sonobuoys; Various types of Sonobuoys.
2. Functional features; Operational features; General description of Sonobuoys used by world navies and their tactical exploitation.

Module 4

UWT- KELTRON; Modes of operation; Switching ON procedure; Function of keys and communication procedure in various modes; Safety precautions while transmitting on UWT.

References.

1. Electronics Devices and Circuit Theory by Robert L Boylestad and Louis Nashelsky Fourth Edition Published by Pearson in 1987
2. Digital Principles and Applications by A P Molvino and Donald P Leach Fourth Edition published by Tata Mcgraw Hill sixteenth reprint 1999
3. Electronics Instrumentation by HS Kalsi, 2nd edition published by Tata Mc Graw hill, 2015
4. Introduction to Naval Engineering by David A Blank, Arthur E Block and David J Richardson Second Edition published by Naval Institute Press, Annapoils, Maryland 1983
5. Electrical equipment Handbook by Philip Kiameh published by Mc Graw Hill Education in May 2003
6. INBR (Indian Naval Book of Reference) 1806- Guide to Cyber Forensics of Digital Artefacts

7. Headquarters Integrated Defence Staff, Cyber Security Policy – 202
Torpedoes and Torpedo Warfare by Charles William Sleeman, first edition, published by Wentworth Press, 2016
8. Torpedo by Katherine C Epstein, First edition, published by Harvard University press, 2014
9. The Underwater Handbook by Charles W Shilling, Margaret F Werts and Nancy R Schandelmeier, 1976th edition, published by Springer, 1977
10. Marine Propellers and Propulsion by John Carlton, Fourth Edition, Published by Butterworth-Heinemann, 2018
11. Sensors Handbook, Sabaree Solomon, 2nd edition published by McGraw Hill, 1998
12. Sonar system Design by SP Pillai, first edition, published by Defence research and development organization, 2013
13. Introduction to theory & design of sonar transducer by Oscar Bryan Wilson 1998 publishing by peninsula publishers USA, first edition
14. INBR 2651 User Handbook Keltron on Underwater telephone
15. Principles of Naval Weapon Systems by Craig Payne, Second edition, published by Naval Institute Press, 2010

24-8803-1009 – APPLIED MATHEMATICS

Course Description. This course covers concepts of Statistics and probability and its use in naval operations and analysis

24-8803-1010	Applied Mathematics	Category	L	T	P	Credit
		-	1	-	-	1

Pre-requisites. Basic working knowledge in solving statics and probability problems

Course Objectives. (i) To acquire functional knowledge of statics and probability to interpret situational plans during operations
(ii) To apply concepts of Operational analysis and undertake conditional study

Course Outcome. After completion of the course, the student will be able to

CO 1	To interpret search plans using basic probability theory
CO2	To apply, simulate and model various situations and tactical conditions

Mapping of course outcomes with program outcomes: Level-Low (1), medium (2) and high (3)

	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	3	3	1		2
CO2	3	3	2	1	2

Distribution of Marks.

Total	ESE	ESE
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Marks		Duration
55	55	2 hours

End Semester Examination Pattern.

End Semester Examination Pattern: There will be three parts; Part A, B and C. Part A contains 15 questions (05– fill in the blank, 05 – choose the correct answer and 05 short answer) from each module, each question will be of one mark. Part B contains 08 questions; 04 Three-mark question and 04 Two-mark question each. Each question can have maximum 2 sub-divisions. Part C will have practical comprising of 10 marks.

Module 1

1. Calculating Dispersion, standard deviation, significance of standard deviation, Descriptive statistics
2. Joint, Marginal and conditional probability, Bayes Theorem, Discrete and continuous probability, testing of hypothesis

Module 2

1. Linear programming, optimization; Theory of simplex method, slack surplus variables, optimality condition, extreme points and basic feasible solutions
2. Introduction to game theory, two person zero sum games- saddle points, mixed strategies, symmetric games, matrix games, non zero sum games
3. Simulation and queuing systems, forecasting techniques, Regression analysis and applications in ASW operations

References.

1. Introduction to Probability and statistics by Seymour Lipschuz and John Schiller published by McGraw Hill Education, 2011
2. An Introduction to Probability Theory and its applications by William Feller, third edition, published by Wiley, 1968
3. Probability and Statistics by Morris H. DeGroot, fourth edition, published by Pearson, 2010
4. Mathematical Fundamentals by Gupta and Vashishtha By Krishna Prakashan Mandir Meerut, Third Edition, 1998.
5. Probability Theory by Jim Pitman published by Narosa Publishing House, 1996
6. Theory of Ordinary Differential Equations by Earl A Coddington and Normal Levinson THM fifth Edition published by McGraw Hill New York, 1998
7. Statistics A Beginners Text VOI I by BR Bhat , KS Mahava Rao and T Srivenkataramana Volume I published by New Age International Publishers, 1990
8. Probability Theory: The logic of Science by Edwin T Jaynes edited by G. Larry Bretthorst published by Cambridge University Press, 2003
9. Testing Statistical Hypotheses, Second edition by EL Lehmann and Joseph P Romano published by Springer, 1998
10. An Introduction to Multivariate Statistical Analysis, Third Edition by T W Anderson published by Wiley- Interscience, 2003

24-8803-1010 – TORPEDO A244S

Course Description. This course covers concepts of A244S Torpedo and its deployment

24-8803-1010	Torpedo A244S	Category	L	T	P	Credit
		-	3	-	1	2

Pre-requisites. Basic working knowledge in Torpedo and principles of its operation

Course Objectives. (i) To acquire functional knowledge of A244S torpedo

Course Outcome. After completion of the course, the student will be able to

CO 1	To control deployment and supervise maintenance of torpedo A244S and its system
CO2	To acquire knowledge on the safety and maintenance of torpedo tubes

Mapping of course outcomes with program outcomes: Level-Low (1), medium (2) and high (3)

	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	3	3	3	3	2
CO2	3	3	2	3	2

Distribution of Marks.

Total Marks	ESE	ESE Duration
100	100	3 hours

End Semester Examination Pattern.

End Semester Examination Pattern: Consists of three parts; Part A, B and C. Part A contains 30 questions (10 – fill in the blank, 10 – choose the correct answer and 10 short answer) from each module, each question will be of one mark. Part B contains 08 questions; 04 five-mark question 04 Three-mark question and 04 Two-mark question each. Each question can have maximum 2 subdivisions. Part C will have practical comprising of 30 marks.

Module 1

1. Parts of A244s and its Operational Capabilities
2. Reception beam, Search pattern, Attack phase, Acquisition criteria, Lost contact procedure and re-attack
3. Preparation onboard ship and recovery first aid routines- FIAM gear, air launch/ tube launch
4. Loading and unloading procedures for torpedoes in tubes.
5. Ship borne pre-setter, portable pre-setter and simulator.

References.

1. Torpedoes and Torpedo Warfare by Charles William Sleeman, first edition, published by Wentworth Press, 2016
2. Torpedo by Katherine C Epstein, First edition, published by Harvard University press, 2014
3. Weapon System Safety Guidelines Handbook
4. Docket on A244S, TTL and SPS
5. Submarines and Deep Sea Vehicles by Jeffrey Tall, 2002 edition, published by Thunder BayPr
6. Sonar-Sensors & Systems(ICONs-2002) by HRS Sastry, DD Ebenezer and TVS Sundaram, organized by NPOL, Published by Allied Publishers Pvt Ltd, 2002

24-8803-1011 - TORPEDO CET 65E

Course Description: This course covers concepts of CET 65E Torpedo and its deployment

24-8803-1011	Torpedo CET 65E	Category	L	T	P	Credit
		-	3	-	1	2

Pre-requisites. Basic working knowledge of Torpedo and principles of operation.

Course Objectives. (i) To acquire functional knowledge of CET 65E torpedo

Course Outcome. After completion of the course, the student will be able to

CO 1	To control deployment and supervise maintenance of torpedo CET65E and its system
CO2	To acquire knowledge on the safety and maintenance of torpedo tube QTTM

Mapping of course outcomes with program outcomes: Level-Low (1), medium (2) and high (3)

	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	3	3	3	3	2
CO2	3	3	2	3	2

Distribution of Marks.

Total Marks	ESE	ESE Duration
100	100	3 hours

End Semester Examination Pattern.

End Semester Examination Pattern: Consists of three parts; Part A, B and C. Part A contains 30 questions (10 – fill in the blank, 10 – choose the correct answer and 10 short answer) from each module, each question will be of one mark. Part B contains 08 questions; 04 five-mark question 04

Three-mark question and 04 Two-mark question each. Each question can have maximum 2 subdivisions. Part C will have practical comprising of 30 marks.

Module

1. Parts of CET65E and its Operational Capabilities
2. Reception beam, Search pattern, Attack phase, Acquisition criteria, Lost contact procedure and re-attack
3. Preparation onboard ship and recovery first aid routines- tube launch
4. Loading and unloading procedures for torpedoes in tubes.
5. Safety precautions

References.

1. Torpedoes and Torpedo Warfare by Charles William Sleeman, first edition, published by Wentworth Press, 2016
2. Torpedo by Katherine C Epstein, First edition, published by Harvard University press, 2014
3. Weapon System Safety Guidelines Handbook
4. Docket on A244S, TTL and SPS
5. Submarines and Deep Sea Vehicles by Jeffrey Tall, 2002 edition, published by Thunder BayPr
6. Sonar-Sensors & Systems(ICONs-2002) by HRS Sastry, DD Ebenezer and TVS Sundaram, organized by NPOL, Published by Allied Publishers Pvt Ltd, 2002

24-8803-1012 MINE WARFARE

Course Description. This course covers concepts of Mine Warfare

24-8803-1012	Mine Warfare	Category	L	T	P	Credit
		-	3	-	1	2

Pre-requisites. Knowledge on basic Mine warfare

Course Objectives. To be conversant with mine warfare and coordinate MCM operations.

Course Outcome. After completion of the course, the student will be able to:-

CO 1	To be able to lay down principles of mine warfare
CO2	To advice command on material and tactical aspects of mine warfare

Mapping of course outcomes with program outcomes: Level-Low (1), medium (2) and high (3)

	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	3	3	1	3	1
CO2	3	1	1	1	2

Distribution of Marks.

Total Marks	ESE	ESE Duration
100	100	3 hours

End Semester Examination Pattern.

End Semester Examination Pattern: Consists of three parts; Part A, B and C. Part A contains 30 questions (10 – fill in the blank, 10 – choose the correct answer and 10 short answer) from each module, each question will be of one mark. Part B contains 08 questions; 04 five-mark question 04 Three-mark question and 04 Two-mark question each. Each question can have maximum 2 subdivisions. Part C will have practical comprising of 30 marks.

Module 1

Principles of Mine Warfare

- (a) Types and Characteristics of mines
- (b) Types of Mine Layers
- (c) Types of Mine Fields

Module 2

Principles of Mine counter measures

- (a) Types of mine counter measure operations
- (b) Safety aspects for mined waters
- (c) Mine and MCM Capabilities of Navy

References.

1. Naval Mine Warfare by Louis Gerken published by Armer Scientific Corp, First Edition printed in USA, 1989
4. INBR (Indian Naval Book of Reference)1836- Mine Counter Measure Doctrine
5. INBR (Indian Naval Book of Reference)1463- Mine and mining stores, Mine sweeping manual published in 1953
6. BR (Book of Reference) 2751/69/MOD – Handbook for mine disposal weapons published in 1969 by Ministry of Defence, Director General Weapons

24-8803-1013- ROCKET LAUNCHER RBU 6000 AND FIRE CONTROL SYSTEM (FCS)

Course Description. This course covers concepts of RBU6000, exploitation of RGB 60 rocket and Fire Control Systems

24-8803-1013	Rocket Launcher RBU 6000 and Fire Control System (FCS)	Category	L	T	P	Credit
		-	3	-	2	2

Pre-requisites. Basic working knowledge in rockets and principles of operation

Course Objectives (i) To acquire functional knowledge of RBU6000
(ii) To exploit the features of RGB 60 rocket
(iii) To carry out operation of ASW Fire Control Systems (FCS)

Course Outcome. After completion of the course, the student will be able to

CO 1	To conduct deployment and supervise maintenance of RBU 6000 and its system
CO 2	To acquire knowledge on the safety and maintenance of rocket launcher
CO 3	To be able to carry out and supervise the operations on anti-submarine computer PURGA, IAC Mod '0' 'C'

Mapping of course outcomes with program outcomes: Level-Low (1), medium (2) and high (3)

	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	3	3	3	3	2
CO 2	3	3	2	3	2
CO 3	3	3	1	2	1

Distribution of Marks.

Total Marks	ESE	ESE Duration
150	150	3 hours

End Semester Examination Pattern.

End Semester Examination Pattern: Consists of three parts; Part A, B and C. Part A contains 30 questions (10 – fill in the blank, 10 – choose the correct answer and 10 short answer) from each module, each question will be of one mark. Part B contains 08 questions; 04 five-mark question, 04 three-mark question and 04 two-mark question each. Each question can have maximum 2 subdivisions. Part C will have practical comprising of 50 marks

Module 1

1. Parts of RBU and its operational capabilities
2. Operation of A/S r/l RBU 6000
3. Loading, operation and safety precautions.

4. A/S rocket technical data, construction, function of propellant, fuzing/ defuzing of rocket
2. Safety precautions while handling rockets and pistols.

Module 2

1. Fire Control Systems (FCS)
 - (a) Composition of Fire Control System with Class of Ships
 - (b) Selection and operation of all pages/ display
 - (c) Firing Procedure Main/Reserve Mode
 - (d) Safety precautions, routine and maintenance
 - (e) Sea and Action drills
2. IAC Mod '0' and IAC Mod 'C'
 - (a) Introduction and purpose
 - (b) Differentiate between IAC MOD '0' and MOD 'C'
 - (c) Modes of firing, Various data input for RL and torpedo firing
 - (d) Practice of command-and-control order

References.

1. Rocket Launcher RBU 6000 Operating/Maintenance Instructions
2. Electrical Servo Drive Technical/Instructions/Descriptions on maintenance and care
3. RGB 60 Description and Handling Instructions Main Hoist and Small Hoist ML 36 Albums of Drawings
4. Principles of Naval Weapon Systems by DAVID R, Third Edition published by Naval Institute Press, Annapolis, Maryland 1985
5. Naval Operations Analysis, Third Edition by Daniel H Wagner, W Charles and Thomas J Sanders Naval Institute Press USA ,2002
6. Introduction to Torpedo Technology by Rear Admiral NK Ramanarasaiah (Retd), VSM ,DRDO, New Delhi, 1993

24-8803-1014 TACTICS I

Course Description. This course covers concepts of Seaward Defense

24-8803-1014	Tactics I	Category	L	T	P	Credit
		-	4	-	1	4

Pre-requisites. Nil

Course Objectives. To be able to comprehend ASW Tactics and carryout duties of anti-submarine warfare officer (ASWO) to conduct Anti-submarine operations

Course Outcome. After completion of the course, the student will be able to

CO 1	Conduct anti-submarine operations as anti-submarine warfare officer
CO2	Acquire knowledge on ASW operations, Sub surface domain awareness, attack plans and evasion by surface force.

Mapping of course outcomes with program outcomes: Level-Low (1), medium (2) and high (3)

	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	3	3	1	2	2
CO 2	3	2	1	3	3

Distribution of Marks.

Total Marks	ESE	ESE Duration
200	200	3 hours

End Semester Examination Pattern.

End Semester Examination Pattern: Consists of two parts; Part A and B. Part A contains 40 questions (10 – fill in the blank, 10 – choose the correct answer 10 true and false and 10 short answer) from each module, each question will be of one mark. Part B contains 20 five-mark question, 10 Three-mark question and 15 Two-mark question each. Each question can have maximum 2 sub-divisions.

Module 1

Surface Operations

- (a) Urgent attack, deliberate attack, Defensive measures
- (b) Officer of tactical Command, Scene of action commander, Positioning of lookouts and sentries

Module 2

Screens

- (a) Introduction to concepts of TDZ, MDZ, WDZ
- (b) Evasive steering
- (c) Datum
- (d) Introduction to CLASP A and B and evasion course by surface forces
- (e) Introduction to basics of screening.

Module 3

Air operations.

- (a) Types of ASW aircraft
- (b) Close support, distant support
- (c) Safety precautions
- (d) Airplans, conduct of ASW Air ops

Module 4

1. Submarine Operations
 - (a) Actions on SUBMISS/ SUBSUNK
 - (b) Safety of Submarine
 - (c) Submiss/Subsunk organization, onboard sonar silence period
 - (d) Identification of Submarine accident.
 - (e) Communication with Submarine during ASW exercises
2. Operations room organization
 - (a) Classification procedure
 - (b) Antisubmarine action plot
 - (c) Maintenance of various boards

Module 5

Coordinated operations.

- (a) Phases of coordinated ops
- (b) Actions on gaining contact
- (c) Flow chart of action

References.

1. INMI (Indian Naval Maneuvering Instructions)
2. INCB (Indian Naval Charge Book) 38
3. MXP (Multinational Exercise Publication) 2 C and MXP 1 D

24-8803-1015 TACTICS II

Course Description. This course aims to assess the assimilation of knowledge by the trainee.

24-8803-1015	Tactics II	Category	L	T	P	Credit
		-	4	-	1	4

Pre-requisites. Concept of Operations, tactics and warfare planning

Course Objectives. To be able to comprehend Tactical scenarios and carryout planning for coordinated operations

Course Outcome. After completion of the course, the student will be able to

CO 1	Analyse, interprets and effectively undertake tactical scenarios onboard
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Mapping of course outcomes with program outcomes: Level-Low (1), medium (2) and high (3)

	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	3	3	1	2	2

Distribution of Marks.

Total Marks	ESE	ESE Duration
200	200	3 hours

End Semester Examination Pattern.

End Semester Examination Pattern: It will be conducted in two phases: theory based and practical with scenario based questions on tactical operations.

Module

Scenario based testing held at Maritime Warfare Centre on execution of operations which includes-

- (a) Tactical scenario-based deductions and coordinated Operation
- (b) Command planning
- (c) Simulator handling
- (d) Wargaming
- (e) Safety precautions whilst handling of equipment and operating at sea
- (f) Rules and regulations of safe navigation

References.

1. INMI (Indian Naval Maneuvering Instructions)
2. INCB (Indian Naval Charge Book) 38
3. MXP (Multinational Exercise Publication) 2 C and MXP 1 D
4. INBR 8

24-8803-1016 – PROJECT

Course Description. This course aims to assess the assimilation of knowledge by the trainee by undertaking a project on ASW based systems

24-8803-1016	Project	Category	L	T	P	Credit
		-	1	1	-	2

Pre-requisites. Should have undertaken course instruction on Sonar Systems/ functioning of ASW sensors and weapons

Course Objectives. To undertake a comprehensive study on ASW based systems

Course Outcome. After completion of the course, the student will be able to

CO 1	To apply concepts of ASW warfare to tactical scenarios
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Mapping of course outcomes with program outcomes: Level-Low (1), medium (2) and high (3)

	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	3	3	1	2	2

Distribution of Marks.

Total Marks	ESE	ESE Duration
200	200	2 hours

End Semester Examination Pattern.

End Semester Examination Pattern: It will be conducted as presentation along with viva with scenario-based questions covering aspects of ASW operation as per topic provided by the nominating authority at ASW School.

Module

Topics as relevant to ASW will be assigned by ASW School

- (a) Research the subject topic assigned.
- (b) Preparation of written report and presentation of findings to a professional audience.

Officers work results in developing ideas, concepts and procedures, which may assist in improving tactical, conceptual and strategic aspects of ASW Operations.

24-8803-1017 - ORAL BOARD

Course Description. This course aims to assess the assimilation of knowledge by the trainee.

24-8803-1017	Oral Board	Category	L	T	P	Credit
		-	1	-	-	4

Pre-requisites. Should be a full time trainee for the Long Course and have qualified in all subjects.

Course Objectives. To perform the duties of ASWO

Course Outcome. After completion of the course, the student will be able to

CO 1	Analyse a prevailing situation at sea and take appropriate measures to counter the threat from the perspective of ASW and mine countermeasures operations.
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Mapping of course outcomes with program outcomes: Level-Low (1), medium (2) and high (3)

	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	3	3	1	2	2

Distribution of Marks.

Total Marks	ESE	ESE Duration
210	210	3 hours

End Semester Examination Pattern.

End Semester Examination Pattern: It will be conducted in two phases: theory based and practical with scenario-based questions on sonar operations.

Module

Scenario based testing on equipment handling which includes-

- (a) Tactical scenario-based deductions and Operation of sonar and sonar controller
- (b) Command and control orders
- (c) Simulator handling
- (d) Safety precautions whilst handling of equipment

References.

1. INMI (Indian Naval Maneuvering Instructions)
2. INCB (Indian Naval Charge Book) 38
3. MXP (Multinational Exercise Publication) 2 C and MXP 1 D
4. INBR 8 (Indian Maritime Doctrine)
5. INTI (Indian Naval Tactical Instructions)