

Appendix V (N)

Enclosure 1

(Refers to Para 3 of CTESS
Note 850/16 /CTESS
dated 09 Apr 24)

CURRICULUM FRAMEWORK AND COURSE CONTENT FOR OUTCOME BASED EDUCATION

IN

MSc (Naval Weapons)

(Programme No 24 - 8203)



INS DRONACHARYA

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REGULATIONS FOR MSc (NAVAL WEAPONS)

1. **Programme No** : **24 - 8203**
2. **Programme Name** : **MSc (Naval Weapons)**
3. **Programme Name (Naval Equivalent)** : **Long G Course (Indian)**
4. **Approving authority** : **IHQ MoD (Navy)**
5. **Eligibility criteria for admission** :
 - (a) Officers nominated by IHQ MoD (Navy) or HQICG.
 - (b) A Bachelor's degree in Science or BE/BTech, in any discipline, from a recognised university.
6. **Duration** :

Phase 1 - Sem 1 & Sem 2- 48 weeks of Training and On-Job Training

Phase 2 - Sem 3 & Sem 4 – 48 weeks specialisation training at INS Dronacharya.
7. **Attendance requirement** : 85% minimum
8. **Nature** : Full Time contact programme
9. **Approved intake capacity** : As approved by IHQ MoD (Navy)
10. **Examination Pattern** :

Combination of Theory and Practical

Exam paper is set by instructor and vetted by Training Co-ordinator and Training Captain

Written and Practical	- 1760 Marks
Dissertation	- 100 Marks
Oral	- 140 Marks
Total	- 2000 Marks
11. **Minimum Qualifying marks** :

Theory - 55%

Practical - 55%
12. **Grading.**
 - (a) **Grades**. The following are the grades for performance in individual subject.

<u>Ser No</u>	<u>Range of Marks*</u>	<u>Grades</u>	<u>Weightage</u>
1	90 % and above	S - Outstanding	10
2	80 - 90%	A - Excellent	9
3	70 - 80%	B - Very Good	8
4	60 - 70%	C - Good	7
5	55 - 60%	D - Satisfactory	6
6	Below 55%	F - Failed	0

* Note: Upper limit is not included in the class interval.

(b) **Cumulative Grade Point Average.** Overall performance on completion of all phases of training will be indicated by Cumulative Grade Point Average (CGPA) calculated as follows: -

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

Where, G = Grade weightage.

C = Credit value corresponding to the course undergone by the student.

(c) The classification on degree would be as follows: -

<u>Ser No</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 Training Coordinator and Training Captain and re-examination.

(b) Failure in two subjects or in one subject more than once will result in warning by Training Captain and Commanding Officer followed by 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 Subjects and Credit Points.**

<u>Semester III</u>			
<u>Code</u>	<u>Subject</u>	<u>Credits</u>	<u>Marks</u>
24-8203-0101	Principles of Naval Drill	2	100
24-8203-0102	Basic Gunnery	4	200
24-8203-0103	Principals of Ordnance, Armament & Explosive Chemistry	2	100
24-8203-0104	Maritime Law	2	100
24-8203-0105	Guided Weapon Technology	2	100

23-8203-0106	Electronics & Communication	2	100
23-8203-0107	Gunnery Foundation	1	50
24-8203-0108	Design, concept and operation of Super Rapid Gun Mount (SRGM) System	2	100
24-8203-0109	Design, concept and operation of Close-In- Weapon System - AK630	2	100
Sub-Total		19	950
<u>Semester IV</u>			
24-8203-0110	Design, concept and operation of Stabilised Remote Control Gun (SRCG) System	2	100
24-8203-0111	Design, concept and operation of Surface To Surface Missile System –P21/22	1	50
24-8203-0112	Design, concept and operation of Surface To Surface Missile System – BRAHMOS	4	200
24-8203-0113	Design, concept and operation of Surface To Air Missile System – BARAK	4	200
24-8203-0114	Design, concept and operation of Surface To Air Missile System – IGLA	1	50
24-8203-0115	Gunnery Sensor & Fire Control Radars (LYNX U2 & SSR)	2	100
24-8203-0116	Surveillance & Fire Control Systems (AMDR 2D&3D)	1	50
24-8203-0117	Gunnery Tactics	3	150
24-8203-0118	Project Work	1	50
24-8203-0119	Gunnery Board	2	100
Sub-Total		21	1050
Total		40	2000

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

<u>Code</u>	<u>Subject</u>	<u>Hrs/week</u>			<u>Credit</u>	<u>Marks</u>
		<u>L</u>	<u>P</u>	<u>Total</u>		
<u>Semester III</u>						
24-8203-0101	Principles of Naval Drill	1	1	2	2	100
24-8203-0102	Basic Gunnery	1	2	3	4	200
24-8203-0103	Principals of Ordnance, Armament & Explosive Chemistry	4	-	4	2	100
24-8203-0104	Maritime Law	3	1	4	2	100
24-8203-0105	Guided Weapon Technology	4	-	4	2	100
24-8203-0106	Electronics & Communication	3	-	3	2	100
24-8203-0107	Gunnery Foundation	2	-	2	1	50
24-8203-0108	Design, concept of Super Rapid Gun Mount (SRGM) System	2	3	5	2	100
24-8203-0109	Design, concept of CIWS - AK630	1	2	3	2	100
	Sub Total (A)			30	19	950

<u>Semester IV</u>						
24-8203-0110	Design, concept and operation of Stabilised Remote Control Gun (SRCG) System	2	2	4	2	100
24-8203-0111	Design, concept and operation of Surface To Surface Missile System – P21/22	2	2	4	2	100
24-8203-0112	Design, concept and operation of Surface To Surface Missile System – BRAHMOS	3	2	5	4	200
24-8203-0113	Design, concept and operation of Surface To Air Missile System – BARAK	3	2	5	4	200
24-8203-0114	Design, concept and operation of Surface To Air Missile System – IGLA	1	1	2	1	50
24-8203-0115	Gunnery Sensor & Fire Control Radars (LYNX U2 & SSR)	2	2	4	2	100
24-8203-0116	Surveillance & Fire Control Systems (AMDR 2D&3D)	2	1	3	1	50
24-8203-0117	Gunnery Tactics	3	0	3	2	100

24-8203-0118	Project Work	0	0	0	1	50
24-8203-0119	Gunnery Board	0	0	0	2	100
	Sub Total (B)			30	21	1050
	Total (A+B)			34	40	2000

Total Credits : **40**

Total Exam Marks : **2000**

SYLLABI FOR PROGRAMME 24-8209 - MSC (NAVAL WEAPONS) REGULAR

VISION

To meet global standards as a centre of excellence across the spectrum of naval surface warfare and impart robust combat oriented training in all aspects of tactics and weapon employment in order to arm officers and sailors to win the war at sea.

MISSION

As the premier establishment of the Indian Navy for Gunnery and Missile training, INS Dronacharya seeks to continuously evolve to keep pace with developing technologies in the field of Gunnery and Missile warfare, thus emerging as a Centre of Excellence for the same. This unit strives to impart robust, practical oriented Gunnery and Missile training, with an aim to arm trainees with in-depth professional knowledge and thorough job competence, so as to be fully capable of effectively discharging assigned gunnery duties.

PROGRAMME EDUCATIONAL OBJECTIVES (PEO)

PEO 1. The trainees will be provided with scholastic atmosphere to acquire advance level knowledge to carry out duties of Explosive Accounting Officer wherein the officer will be able to account and maintain the requisite standards and amount of ammunition as required.

PEO 2. The trainees will be able to effectively implement the Fire Control Systems which will enable them to effectively exploit the guns and missiles onboard ships to maximize the effects on targets.

PEO 3. To trainees will be provided with a thorough understanding on maintenance and repair of ships' gunnery equipment which will enable them to carry out O level maintenance as per OEM specifications.

PEO 4. The trainees will be proficient in analysing the operational and tactical implementation of Surface to Air Missile and Surface to Surface Missile for pre and post firing analysis of the missile systems enabling them to generate CAASP for effective employment of weapon systems.

PROGRAMME OUTCOME (PO)

PO 1. The trainees will be able to impart training to officers and sailors posted on their ships and establishments for gunnery duties and in particular for the drill, discipline and smartness at gunnery quarters.

PO 2. The trainee will be able to effectively supervise juniors under his leadership for custody, maintenance, examination, embarkation, disembarkation, handling, fuzing and preparation for service of all explosives and missiles in ships and naval establishments.

PO 3. The trainee will be able to undertake handling of small arms, organise Landing Party and perform Range Officer Duties.

PO 4. The trainee will be educated on maritime laws and regulation and will be provided with practical training to organise, conduct and command a VBSS (Visit, Board, Search & Seizure) team.

PO 5. The trainee will be able to implement the best adjustments to Fire Control Systems for the mutual alignment of gunnery direction radar, gunnery control radar, director sight, gun sight and gun bore systems and guided missile radar and systems.

PO 6. The trainee will be able to functionally and tactically exploit the gunnery weapons, missiles and sensors for effective combat operations during operational exercises and war.

PO 7. The trainee will be able to advise the Command on the tactics to employ to obtain the best results from the ship's gunnery weapons & missiles.

24-8203-0101 – PRINCIPLES OF NAVAL DRILL

1. **Course Description.** The curriculum of this course is designed to train the trainees for conduct of naval parade & ceremonials in naval ships and establishments at various occasions.
2. **Pre-Requisites.** Officers should have served onboard IN/ICG Ships and establishments.
3. **Distribution of Marks.**

<u>Code</u>	<u>Subject</u>	<u>Hrs/week</u>			<u>Credits</u>	<u>Marks</u>
		<u>L</u>	<u>P</u>	<u>Total</u>		
24-8203-0101	Principles of Naval Drill	1	1	2	2	100
	Total			2	2	100

4. **Course Outcome.** After completion of the course the trainees will be able to: -

<u>CO 1</u>	Supervise and conduct drill in naval ships and establishments at various occasions.
<u>CO 2</u>	Advise the command/seniors on ceremonials including commissioning, decommissioning, award of Colours, investiture ceremonies etc pertaining to Indian Navy.

5. **Mapping of Course Outcomes with Program Outcomes.**
Level – Low (1), Medium (2) and High (3)

	<u>PO 1</u>	<u>PO 2</u>	<u>PO 3</u>	<u>PO 4</u>	<u>PO 5</u>	<u>PO 6</u>	<u>PO 7</u>
CO 1	3						
CO 2	3						

6. **Course Content.**
 - (a) **Module I.** Standing drill, Squad drill, sword drill, Parade Commander drill, Platoon commander drill, conduct of divisions, conduct of presidents colours, conduct of Republic Day/ Independence Day parade.
 - (b) **Module II.** Power of Command- Duties of Parade commander, OOGI, Platoon Commander, Conduct Ceremonial parades ashore, Conduct of ceremonial parade division at afloat, Guard of honor, Colour guard, entering/leaving, Conduct of Naval ceremonials – Man and cheer ship, pulling out ceremony, wreath laying
 - (c) **Module III.** Conduct and ceremonial parade & divisions – Nishan Guard, Conduct of Naval ceremonial – Call on and return call, Conduct of funeral – Afloat and ashore, Commissioning/Decommissioning of warships.
7. **Reference.** INBR (Indian Naval Book of Reference) 1834 on Indian Naval drills, parades and ceremonials approved by Naval Headquarters, New Delhi in 2001

24-8203-0102 - BASIC GUNNERY

1. **Course Description.** The curriculum of this course is designed to provide trainees understanding on general gunnery aspects, duties of the armament responsible officer and the basic working principles of the weapon systems deployed on naval ships & submarines.
2. **Pre-Requisites.** Officers should have served onboard IN/ICG Ships and establishments.
3. **Distribution of Marks.**

<u>Code</u>	<u>Subject</u>	<u>Hrs/week</u>			<u>Credits</u>	<u>Marks</u>
		<u>L</u>	<u>P</u>	<u>Total</u>		
24-8203-0102	Small Arms	.5	1.5	2	2	100
	Landing Party	-	.5	.5	1	50
	Range Officer Duties	.5	-	.5	1	50
	Total			3	4	200

4. **Course Outcome:** After completion of the course the trainees will be able to: -

<u>CO 1</u>	Perform, supervise and train officers and sailors on assembling, disassembling, maintenance and firing of the small arms onboard ships and establishment. The trainee will also be familiar with safety procedures regarding handling and stowage of the small arms.
<u>CO 2</u>	Organise, train and command ship's sentries and Landing Party.
<u>CO 3</u>	Perform range officer duties to ensure safety of men & arms on firing range.

5. **Mapping of Course Outcomes with Program Outcomes.**
Level – Low (1), Medium (2) and High (3)

	<u>PO 1</u>	<u>PO 2</u>	<u>PO 3</u>	<u>PO 4</u>	<u>PO 5</u>	<u>PO 6</u>	<u>PO 7</u>
<u>CO 1</u>			3				
<u>CO 2</u>			3				
<u>CO 3</u>			3				

6. **Course Content.**

(a) **Module I.** Rifle 5.56mm INSAS, Rifle 9mm Carbine, Rifle 7.62mm LMG, Rifle 12.7mm HMG operation, safety and maintenance actions for handling small arms. Duties of Range Officer, identifications of targets, practical firings at classification range/short range.

(b) **Module II.** Field Craft. Camouflage, concealment, field movement, formation and signal, Organisation and composition of Landing Party up to company level, Arms, ammunition and equipment carried by each individual, Aid to civil power, concept and responsibilities document, aid and equipment required, Function of Landing Party and order of dress.

(c) **Module III.** Ranges, Targets and safety precautions at range. Types and construction of range, Classification, short, Pistol, and miniature range, Types and characteristics, marking of Snap, CQB, Fig 11, Fig 12, Fig 11 Combat, A, B and C type targets, Ammunition warning to all personnel, live/empty cases mixing, ear

defenders, loading of weapons, danger flags, night firing lamp and inspection of targets

(d) **Module IV**. Sentries. Rig, items to be carried, safety precautions and Rules of engagement, Quick Reaction Team. Organisation, composition and procedure, challenging procedure, factors effecting challenging, Action on failure to obey the challenge, Positioning of sentries and Personal protection measures for sentries.

(e) **Module V**. Practical firing of 5.56 mm INSAS/9mm Pistol/5.56 mm LMG and HMG at Classification range/Short range.

7. **Reference**. Technical manual of Small arms (Rifle 5.56mm INSAS, Rifle 9mm Carbine, Rifle 7.62mm LMG, Rifle 12.7mm HMG)

24-8203-0103 – PRINCIPALS OF ORDNANCE, ARMAMENT AND EXPLOSIVE CHEMISTRY

1. **Course Description.** This course specifically covers modules pertaining to Ordnance and ammunition which will enable a trainee to facilitate safe stowage, handling and exploitation of the ammunition.
2. **Pre-Requisites.** Officers should have knowledge about basic concepts of chemistry to understand reactions.
3. **Distribution of Marks.**

<u>Code</u>	<u>Subject</u>	<u>Hrs/week</u>			<u>Credits</u>	<u>Marks</u>
		<u>L</u>	<u>P</u>	<u>Total</u>		
24-8203-0103	Explosive Chemistry	2	-	2	1	50
	Ordnance & Ammunition	2	-	2	1	50
	Total			4	2	100

4. **Course Outcome:** After completion of the course the trainees will be able to: -

<u>CO 1</u>	Explain types of explosives, various HE fillings in use, Pyrotechnic and its compositions and train including the characteristics of military explosives.
<u>CO 2</u>	Apply knowledge of composition of explosives for exploitation onboard.
<u>CO 3</u>	Facilitate safe stowage of Ordnance & ammunition onboard Ships.
<u>CO 4</u>	Conversant with principles of naval weapon systems and NAD organisation.

5. **Mapping of Course Outcomes with Program Outcomes.**
Level – Low (1), Medium (2) and High (3)

	<u>PO 1</u>	<u>PO 2</u>	<u>PO 3</u>	<u>PO 4</u>	<u>PO 5</u>	<u>PO 6</u>	<u>PO 7</u>
CO 1	3						
CO 2		3					
CO 3		2					
CO 4		2					

6. **Course Content:**

- (a) **Module I.** Ballistics: Definitions, Internal Ballistics: and External Ballistics of projectile motion, Summary of Events inside and outside the barrel, Various Forces and Factors involved. Stability criteria.
- (b) **Module II.** Introduction to Gun Design and Construction, Various types of Ordnance / Delivery systems. General description of gun mounts. Barrel and breech mechanism and other assemblies. Various methods of barrel construction, barrel wear.
- (c) **Module III.** Introduction to Types of ammunition. Classification of Gun Ammunition, Complete round/Cartridge, Brief description of cartridge case system,

manufacture and types, Various Charges in Service, Components of In-Service cartridges.

(d) **Module IV.** Projectile: Introduction, Definitions, Basics of projectile / shell design, Stability Forces acting, Functions of Bourrelet, Types of Projectile, Filling of HE Shell, Driving Band: Introduction, Material, Design and Types.

(e) **Module V.** Identification of In-service Ammunition (30 mm and above) Fuzes: Functions, Design Principles, Classifications, Components, Arming Mechanisms/ Safety and Arming devices, Mechanical and Electronic Fuzes, Working of In-service Fuzes (AK 630, 40/60, 76.2 mm, 76/62 mm, 100 mm, Kavach, 127 mm, 140 mm)

(f) **Module VI.** Introduction to primer/ detonators. Constructional detail, various types. Percussion, electric combinations and conducting compositions type.

(g) **Module VII.** Proof of Ammunitions: Propellant, Primer, Fuze, Cartridge Case, shell and complete round proof. Various types of failures / defects encountered. Assessment of charge Mass. Ammunition Preparation, Marking and Storage, Safety Class Division: Magazines traverses, Safety class divisions and groups

(h) **Module VIII.** Concept of Rail Gun, Coil Guns and other hyper velocity projectile delivery systems. Extended range guided munitions and precision guided munitions, Latest trends in munitions.

(i) **Module IX.** Introduction to explosives and military explosives, classifications, functional performance parameters like sensitivity, power, FOI, brisance, stability, density. Introduction to explosion, detonation, deflagration, oxygen balance, relative strength, heat of explosion, group of explosives, primers and their classification, construction and action.

(j) **Module X.** Low explosives, Pt/Tt curves, propellant performance parameters of burn time, thrust, impulse, Isp etc, gun propellant in use with naval ammunition, high explosives: intermediaries and HE compositions in use, comparison performance parameters of low, intermediary and high explosives, exudation of TNT, Pyrotechnic and its compositions

7. **References.**

(a) INBR 1862/2019 Indian Naval Magazine explosive regulation Part 1 approved by Naval Headquarters, New Delhi in 2019.

(b) INBR 1977, Handbook of Conventional ammunition, Part I and II approved by Naval Headquarters, New Delhi in 2015

(c) INBR 1978, Naval armament technology A perspective, approved by Naval Headquarters, New Delhi in 2010

(d) Principles of Naval weapon system by Craige Payne, second edition published by Naval Institute Press, 2010

24-8203-0104 – MARITIME LAW

1. **Course Description.** This course is designed to introduce the aspects pertaining to International Maritime Laws and VBSS (Visit Board, Search & Seizure) procedure.
2. **Pre-Requisites.** Officers should be aware of the fundamentals of international maritime law.
3. **Distribution of Marks.**

<u>Code</u>	<u>Subject</u>	<u>Hrs/week</u>			<u>Credits</u>	<u>Marks</u>
		<u>L</u>	<u>P</u>	<u>Total</u>		
24-8203-0104	Maritime Law	1	0	1	.5	25
	VBSS (Visit Board, Search & Seizure)	1	1	2	1	50
	FPM	1	0	1	.5	25
	Total			4	2	100

4. **Course Outcome.** After completion of the course the trainees will be: -

<u>CO 1</u>	Conversant with the legal aspects of MIO (Maritime Interception Operations) and LEO (Let Export Order) with reference to UNCLOS (United Nations Convention on the Law of the sea) and laws of armed conflict.
<u>CO 2</u>	Able to organise, conduct and command the ships VBSS team and supervise a VBSS operation independently.
<u>CO 3</u>	To be conversant with basics of asymmetric attack and actions to counter the same

5. **Mapping of Course Outcomes with Program Outcomes.**
Level – Low (1), Medium (2) and High (3)

	<u>PO 1</u>	<u>PO 2</u>	<u>PO 3</u>	<u>PO 4</u>	<u>PO 5</u>	<u>PO 6</u>	<u>PO 7</u>
CO 1				3			
CO 2			3	3			
CO 3			2	3			

6. **Course Content.**

(a) **Module I.** Legal aspects of MIO, LEO, MZI act, UNCLOS and law of armed conflict. Basic introduction of the laws of armed conflict and UNCLOS and their relevance in real time Ops.

(b) **Module II.** Composition of VBSS team as per class of ship. Role and duties of each component of the team. Guidelines for Evidence collection, Tagging & documentation.

(c) **Module III.** Introduction of general organisation onboard a merchant vessel. Classification of merchant vessels as per role and tonnage. Standard layout of compartments onboard various type of merchant vessels. Various documents

and certificates used onboard merchant vessels. Procedure for interrogation of suspect vessels on MMB. Sequence of action in each phase. Introduction to salient aspects to be included as part of briefing to command and boarding team on the conduct of VBSS Operations.

(d) **Module IV.** Types of asymmetric attack, Countermeasures against asymmetric threats, Organisation and Command & Control for FPM, Rules of Engagement, INEXREM exercises for FPM.

7. **References.**

(a) INBR 1700, Indian Navy *VBSS guidebook approved by Naval Headquarters, New Delhi in 2021

(b) United Nation Convention on Law of the Sea, an International agreement. Depository- Secretary-General of the United Nations signed on and adopted in 1982.

(c) INBR 1651, Indian Navy "Defence Against Asymmetric Warfare", 2010

24-8203-0105 - GUIDED WEAPON TECHNOLOGY

1. **Course Description.** This course will cover the aspects of missile guidance and control systems in the weapon and missile installed on naval platforms.
2. **Pre-Requisites.** Should have a clear understanding about the basic concepts in physics.
3. **Distribution of Marks.**

<u>Code</u>	<u>Subject</u>	<u>Hrs/week</u>			<u>Credits</u>	<u>Marks</u>
		<u>L</u>	<u>P</u>	<u>Total</u>		
24-8203-0105	Guided Weapon Information Capsule	2	0	2	1	50
	Missile Decoys	1	0	1	.5	25
	Introduction To Modern SSMS And SAMS	1	0	1	.5	25
Total				4	2	100

4. **Course Outcome.** After completion of the course the students will be able to: -

CO 1	Apply basic knowledge on missile guidance techniques, missile control systems and missile kinematics so as to understand design and development concepts and various missile systems.
CO 2	Calculate and apply non-standard ballistic settings on Fire Control Computer.
CO 3	Apply basic knowledge on concept and working of various types of anti-ship missile decoys, apply thorough knowledge on components, Elevation and other mechanism, electrical equipment, firing circuit, stowage of ammunition, allowance of ammunition, and Exploitation of Chaff in different modes
CO 4	To check existing knowledge of class on the subject, To have basic knowledge of PN SSM/ AShMs, To have basic knowledge of PN surface to air missiles, To have basic knowledge of PLA (N) SSMs/AShMs, To have basic knowledge of PLA (N) surface to air missiles

5. **Mapping of Course Outcomes with Program Outcomes.** Level – Low (1), medium (2) and high (3)

	<u>PO 1</u>	<u>PO 2</u>	<u>PO 3</u>	<u>PO 4</u>	<u>PO 5</u>	<u>PO 6</u>	<u>PO 7</u>
CO 1					3		
CO 2					3		
CO 3						3	
CO 4							2

6. Course Content.

(a) **Module I.** Missile Instruments Introduction, elementary theory of gyroscopes, frees gyro, rate gyro, accelerometers, resolvers and altimeter. Auto Pilot Introduction, parameters of auto pilot design, autopilot and changing environment, vertical launch autopilots. Introduction to Missile Kinematics. Missile Trajectories Constant bearing course, pure pursuit course, deviated pursuit course, proportional navigation course.

(b) **Module II.** Introduction, phases of guidance, types of guidance systems, principles of inertial guidance, beam rider guidance, fundamental and basic principles, typical beam rider receiver, laser range finders, laser designators and receiver, homing guidance, active/passive homing system, comparison of active and semi-active homing, homing heads and their stabilisation. IR detectors, Infra-red passive homing systems.

(c) **Module III.** Fundamentals of Jet propulsion. Thermodynamics of nozzle flow. Solid, liquid propellants and systems. Air breathing engines. Types of Sustainers engines including RAMJET, SCRAMJET, Cryogenic based sustainers and their applications in Naval system.

(d) **Module IV.** Introduction to concept of anti-ship missile decoys, Modern active/passive onboard and offboard missile decoys and their working principle, TTD, Purpose, Launcher Parts Fire control panel, Elevation and Training Mechanism, Electrical Equipment, Firing circuit, Block Diagram of Firing circuit, Firing Circuit checks, Ammunition, Type of Ammunition, Packing of Ammunition, Stowage capacity of magazine, Fuse setting operation, Annual practice allowance, Preparation for Sea & Action, Preparation for firing, Firing procedure, Procedure of loading/Unloading of projectile, trouble shooting, Misfire drill, Chaff exploitation as per Chaff Exploitation Doctrine.

(e) **Module V.** **Snap Test.** Conduct of snap test (objective) covering SSMs, SAMs, onboard ships of PN and PLA (N),

- Advantages/ Limitations over SSMs of IN
- (i) **LY 80, FM 90, LY 60**
- (ii) **Zarb, Harba, C802, Exocet, YJ-12, Atmaca,**
 - Ships fitted on
 - Technical data
 - Propulsion
 - Payload
 - Guidance
 - Basic flight trajectory
 - Weapon/Fire Control System

- Ships fitted on
- Technical data
- Propulsion
- Payload
- Guidance
- Basic flight trajectory
- Weapon/Fire Control System
- Advantages/ Limitations over SAMs of IN

(iii) **C 701, HY 2, YJ 18, YJ 62**

- Ships fitted on
- Technical data
- Propulsion
- Payload
- Guidance
- Basic flight trajectory
- Weapon/Fire Control System
- Advantages/ Limitations over SSMs of IN

(iv) **HHQ, HHQ 7/7A, HHQ 9/9A, HHQ 16**

- Ships fitted on
- Technical data
- Propulsion
- Payload
- Guidance
- Basic flight trajectory
- Weapon/Fire Control System
- Advantages/ Limitations over SAMs of IN

7. **References.**

- (a) Principles of Naval weapon system by Craige Payne, Second edition published by Naval Institute Press, 2010
- (b) Guided weapons – Land warfare: Brassey's New battlefield weapon systems and technology series into 21st century by Ken Rouse J, Fourth edition published by Brassey's 2000
- (c) Military Ballistics - Land warfare: Brassey's New battlefield weapon systems and technology series into 21st century by CL Farrar, Vol 13 published by Brassey's 1999
- (d) Fundamentals of Guided Missiles by SR Mohan, First edition published by DRDO 2016
- (e) Guided Weapons System Design by R Balakrishnan, First edition published by DRDO 1998

24-8203-0106 – ELECTRONICS & COMMUNICATION

1. **Course Description.** This course is designed to provide the trainees an overview on fiber optics and laser technology used in weapons, electronics and radar for weapons & sensors and networking fundamentals.
2. **Pre-Requisites.** Officers should have senior secondary level knowledge in Physics.
3. **Distribution of Marks.**

<u>Code</u>	<u>Subject</u>	<u>Hrs/week</u>			<u>Credits</u>	<u>Marks</u>
		<u>L</u>	<u>P</u>	<u>Total</u>		
24-8203-0106	Electronics And Radar	1	0	1	1	50
	Networking Fundamentals	1	0	1	.5	25
	Fiber Optics & Laser	1	0	1	.5	25
	Total			3	2	100

4. **Course Outcome.** After completion of the course the students will be able to: -

CO 1	Apply basic knowledge of electronics, laser, optics and radar so as to understand the functioning of various fire control, air/surface surveillance systems and professional tasking.
CO 2	Apply basic knowledge of network fundamentals to understand the concepts of Network Centric Equipment and operating Systems during network centric warfare.
CO 3	Understand the principles of Lasers, its military applications and be conversant with the principle of Thermal Imaging and its applications.

5. **Mapping of Course Outcomes with Program Outcomes.**
Level – Low (1), medium (2) and high (3)

	<u>PO 1</u>	<u>PO 2</u>	<u>PO 3</u>	<u>PO 4</u>	<u>PO 5</u>	<u>PO 6</u>	<u>PO 7</u>
CO 1					3	2	
CO 2						2	3
CO3					2	2	

6. **Course Content.**

(a) **Module I.** MTI, external coherence, Doppler effect, factors effecting radar performance, duct propagation, types of gunnery radars, frequency selection surveillance tracking, TWS, fire control missile guidance radar, altimeter, AEW, pulses Doppler, CW radar, pulse compression technique, phase array multiplication radar, millimetric wave Radar, beam switching sequential lobbing, monopulse and LORO techniques, IR laser tracking methods. ESM range advantage, RX sensitivity/freq band. Consideration for jamming its effects, types of jamming noise swept, RGPO DECM VGPO main/slide lobe jamming its cancellation. Chaff and its characteristics bloom time, persistence time, ECCM.

(b) **Module II.** Introduction, Applications, Classifications Network Security, OSI Model, TCP/IT model, Practical on Installing, Configuring and Network Management. Information Security: Various IT and INFOSEC policies in force, Networking infrastructure in the *IN*.

(c) **Module III.** Introduction to Fibre Optics and working principle of Optical Fibres, Military applications of Optical Fibres, Principles of Laser, Directed Energy Weapons, Defensive Countermeasures, Target Designators, Disorientation, Guidance, Fire Arms (Laser Sight, Eye Targeted Lasers, Holographic Weapon Sight), Principles of Thermal Imaging, Military applications of Thermal Imaging – FLIR, Motion Detection.

7. **References.**

(a) Radar Handbook – Merrill I Skolnik, Third edition by McGraw-Hill Education, 2008.

(b) Data Communication and Networking by Behrouz A Forouzan, Fourth Edition published by Mc Graw Hill Education, 2017.

(c) Fibre optics and Laser Instruments by N Nagaraj, S Renuka published by Anuradha Publication, 2010

24-8203-0107 - GUNNERY FOUNDATION

1. **Course Description.** The course is designed to provide the trainees with an overview on gunnery concepts like stabilisation & probability for effective delivery of ordnance on target.
2. **Pre-Requisites.** Officers should have senior-secondary level knowledge of physics and maths.
3. **Distribution of Marks.**

<u>Code</u>	<u>Subject</u>	<u>Hrs/week</u>			<u>Credits</u>	<u>Marks</u>
		<u>L</u>	<u>P</u>	<u>Total</u>		
24-8203-0107	Gunnery Theory	1	0	1	.5	25
	Mathematical Ground Work	1	0	1	.5	25
	Total			2	1	50

4. **Course Outcome.** After completion of the course the trainee will be: -

CO 1	Conversant with Reference frame & Coordinate system, theory of stabilisation, theory of Tracking and theory of Prediction, this will enable them to apply the concept for effective delivery of ordnance on target.
CO 2	Conversant with mathematical concepts involved in Operational Research and System Analysis.

5. **Mapping of Course Outcomes with Program Outcomes.**
Level – Low (1), Medium (2) and High (3)

	<u>PO 1</u>	<u>PO 2</u>	<u>PO 3</u>	<u>PO 4</u>	<u>PO 5</u>	<u>PO 6</u>	<u>PO 7</u>
CO 1					2	3	3
CO 2					2		

6. **Course Content.**

(a) **Module I.** Introduction to Weapon Station Reference Frames, Reference Frame Rotation and Reference Frame Translation along with its utilities in Navy, Introduction to Co-ordinate systems (Spherical, Polar, Cylindrical and Cartesian) and Conversion from one to another, Introduction to angles between lines and planes, spherical planes, Introduction to Angular Movement of Ship, Vertical Stabilisation – Roll, Pitch, Level, Cross Level and Slope Angles, Azimuth Stabilisation – Yaw, Normal Gimballed Gyro, Double Gimballed Gyro, Stabilisation problem with Two Axis, Three Axis and Four Axis Mountings, Line Stabilisation.

(b) **Module II.** Working principle of Weapon Gyro, Determination of Target Position and Movement, Measurement of Target Coordinates, Rate aided operations, Regenerative Operations, Second Derivative Operation, Radar Servo Tracking System and Range Tracking, Prediction Assumptions, Calculation of Time

of Flight and Tangent Elevation, Corrections for change in Muzzle Velocity, Ballistic Coefficient, Drift, Own Speed, Effect of Wind on Shell Motion.

(c) **Module III.** Introduction to Operational Research and System Analysis, Basics of Probability Theory for ORSA, Basic of Statistics for ORSA, Basics of Linear programming for ORSA.

7. **References.**

- (a) Control System Engineering, Norman Nise, 1992
- (b) Schaum's Outline of Feedback & Control System, Joseph J. DiStefano, 2013
- (c) Essential Stability Theory, Cambridge Core

24-8203-0108 – DESIGN, CONCEPT AND OPERATION OF SUPER RAPID GUN MOUNT (SRGM) SYSTEM

1. **Course Description.** The course is designed to provide practical and theoretical knowledge on Anti-missile gun- Super Rapid Gun Mount (SRGM) installed on naval platforms.
2. **Pre-Requisites.** Officers should have undergone ab initio training.
3. **Distribution of Marks.**

Code	Subject	Hrs/week			Credits	Marks
		L	P	Total		
24-8203-0108	SRGM – Technical Details	.5	0	.5	.5	25
	SRGM – Gun Mount	.5	2	2.5	1	100
	SRGM – Tactical Exploitation	1	1	2	.5	25
	Total			5	2	100

4. **Course Outcome:** After completion of the course the trainee will be: -

CO 1	Able to understand capabilities, tactical utilisation and limitation of 72/62 SRGM.
CO 2	Conversant with the components, layout, mechanical construction and operational functional diagram.
CO 3	Undertake loading/unloading and misfire drills and to carry out pre firing and post firing checks.
CO 4	Understand proximity switches, their functions and interactions during gun mount operation and firing so as to be able to analyse stoppages and failures.

5. **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	PO 6	PO 7
CO 1					2	3	2
CO 2					3	3	3
CO 3					2	3	2
CO 4					3	2	2

6. **Course Content.**

(a) **Module I.** Purpose, Technical data, capabilities and limitation, Type of ammunition, Layout of system and manning, Overall operation of the gun mount, Various methods of training fire control system and sight. Intercommunication between compartments of the system. Air-conditioning and ventilation arrangement in the barbette and Firefighting arrangement in barbette and magazine. Operation of ammunition hoist.

(b) **Module II.** Gun mount assembly, COT console, Cooling system, Local stabilization unit, Hydraulic system, Manual operation of GM, Description of the gun mount, Training (Upper shank, lower shank, Reduction gear box, Tr bearing and Trg lock), Elevation Cradle, Balancer, upper compensation cylinder, lower compensation cylinder, Reduction gear box, Elevating arc, hydraulic limit stop buffer, elevating lock

(c) **Module III.** Feeding, loading and case ejection system, revolving mechanism, hand crank, interlocks, round retainer and supports screw feeder hoist, rocking arms, Hydraulic system, Loading/unloading, misfire drill, preparation for firing, post firing routines and securing of mounting post firing, maintenance schedule.

(d) **Module IV.** Proximity switches, their functions and interactions during gun mount operation , analyse of stoppages and failures

7. **Reference.** Technical Documents Operating Instructions SRGM approved by Naval Headquarters, New Delhi

24-8203-0109 – DESIGN, CONCEPT AND OPERATION OF CLOSE-IN- WEAPON SYSTEM - AK630

1. **Course Description.** The course is designed to provide practical and theoretical knowledge on Close-in- Weapon System AK630 installed on naval platforms.
2. **Pre-Requisites.** Officers should have undergone ab initio training.
3. **Distribution of Marks.**

<u>Code</u>	<u>Subject</u>	<u>Hrs/week</u>			<u>Credits</u>	<u>Marks</u>
		<u>L</u>	<u>P</u>	<u>Total</u>		
24-8203-0109	AK630 – Technical Details & Tactical Exploitation	.5	1	1.5	.5	50
	AK630 – Gun Mount	.5	1	1.5	1	50
	Total			3	2	100

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

CO 1	Functionally and tactically exploit AK630 for combat operations.
CO 2	Conversant with the components, layout, mechanical construction and operational functional diagram.
CO 3	Undertake loading/unloading and misfire drills and to carry out pre firing and post firing checks.

5. **Mapping of Course Outcomes with Program Outcomes.**

Level – Low (1), medium (2) and high (3)

	<u>PO 1</u>	<u>PO 2</u>	<u>PO 3</u>	<u>PO 4</u>	<u>PO 5</u>	<u>PO 6</u>	<u>PO 7</u>
CO 1					2	2	3
CO 2					3	2	2
CO 3					2	3	2

6. **Course Content.**

(a) **Module I.** Introduction to System including Technical Data, Barbette & Mounting Layout, AO 18, Breech Block, Cradle & Cooling System, Electrical & Hydraulic Systems of AK 630 GM

(b) **Module II.** Pneumatic Systems of AK 630 and Charging of Air Bottles, Firing operation of the gun, Modes of Fire, Command & Control orders, MAINTOPS Routines, Gun trials & Series Inspection, Incident Study and Analysis related to AK 630GM, Live Firing of AK 630.

(c) **Module III.** Introduction, Technical Description, Main functions, System Component, Below Deck and above deck components, Pedestal Architecture, Weapon Overview and common terms, Pedestal Movement, Auxiliary Operation, Drift Cancellation Process, Human Machine Interface (HMI), Screen Key Controls,

(d) FCS/ Battle Screen including various indications and action buttons, Setting tab of Battle, Ammunition, Camera, Environment, utility and sight, Operation of SCP, switches logic, Main assemblies/ groups, internal parts of gun and their functions.

(e) **Module IV.** Stripping/ Assembling of gun, loading and firing mechanism of gun, mounting of gun on the cradle, Loading/ unloading of ammunition, identification of types of ammunition, Preventive maintenance schedules including pre and post firing routines, Corrective maintenance schedule, Functionality test, Nitrogen purging procedure, Boresight camera calibration procedure and Gun jump calibration during weapon alignment, Stripping/ Assembling of gun, belting/ unbolting, Safe practices during operation or maintenance of the system including misfire drill and stoppages.

7. **Reference.** Technical Documents Operating Instructions AK 630 approved by Naval Headquarters, New Delhi

24-8203-0110 – DESIGN, CONCEPT AND OPERATION OF STABILISED REMOTE CONTROL GUN (SRCG) SYSTEM

1. **Course Description.** The course is designed to provide practical and theoretical knowledge on Stabilised Remote Control Gun (SRCG) installed on naval platforms.
2. **Pre-Requisites.** Officers should be well versed with the operation of small arms.
3. **Distribution of Marks.**

<u>Code</u>	<u>Subject</u>	<u>Hrs/week</u>			<u>Credits</u>	<u>Marks</u>
		<u>L</u>	<u>P</u>	<u>Total</u>		
24-8203-0110	SRCG – Technical & Exploitation Details	1	0	1	1	50
	SRCG – Practical & Firing	1	2	3	1	50
	Total			4	2	100

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

CO 1	Functionally and tactically exploit SRCG for combat operations.
CO 2	Exploit capabilities of the system and understand maintenance concept of the entire system for safe operation and evaluate the trainees.

5. **Mapping of Course Outcomes with Program Outcomes.**
Level – Low (1), medium (2) and high (3)

	<u>PO 1</u>	<u>PO 2</u>	<u>PO 3</u>	<u>PO 4</u>	<u>PO 5</u>	<u>PO 6</u>	<u>PO 7</u>
CO 1					3	3	3
CO 2					3	2	2

6. **Course Content.**

- (a) **Module I.** Introduction, Technical Description, Main functions, System Component, Below Deck and above deck components, Pedestal Architecture, Weapon Overview and common terms, Pedestal Movement, Auxiliary Operation
- (b) **Module II.** Drift Cancellation Process, Human Machine Interface (HMI), Screen Key Controls, FCS/ Battle Screen including various indications and action buttons, Setting tab of Battle, Ammunition, Camera, Environment, utility and sight
- (c) **Module III.** Operation of SCP, switches logic, Main assemblies/ groups, internal parts of gun and their functions. Stripping/ Assembling of gun, loading and firing mechanism of gun, mounting of gun on the cradle

(d) **Module IV.** Loading/ unloading of ammunition, identification of types of ammunition, Preventive maintenance schedules including pre and post firing routines, Corrective maintenance schedule, Functionality test, Nitrogen purging procedure

(e) **Module V.** Boresight camera calibration procedure and Gun jump calibration during weapon alignment, Stripping/ Assembling of gun, belting/ unbolting, Safe practices during operation or maintenance of the system including misfire drill and stoppages, Examination

7. **Reference.** Technical Documents Operating Instructions of SRCG approved by Naval Headquarters, New Delhi

**24-8203-0111 – DESIGN, CONCEPT AND OPERATION OF SURFACE TO SURFACE
MISSILE SYSTEM –P21/22**

1. **Course Description.** The course is designed to provide practical and theoretical knowledge on P21/22 SSM installed on naval platforms.
2. **Pre-Requisites.** Officers should have an understanding of explosive chemistry and physics.
3. **Distribution of Marks.**

<u>Code</u>	<u>Subject</u>	<u>Hrs/week</u>			<u>Credits</u>	<u>Marks</u>
		<u>L</u>	<u>P</u>	<u>Total</u>		
24-8203-0111	P21/22 – Technical Details & Circuit Diagram	.5	0	.5	.5	25
	P21/22 – Simulator & Firing Practicals	.5	1	1.5	.5	25
	Total			2	1	50

4. **Course Outcome:** After completion of the course the trainee will be: -

CO 1	Conversant with P21/22 complex, trajectory and sub-systems and functional knowledge of missile propulsion system.
CO 2	Able to understand SSM loader and will be conversant with Embarkation/ Disembarkation procedure of the missile.
CO 3	Functionally and tactically exploit missile P 21-22 (Surface to Surface Missile) for combat operations.
CO 4	Able to prepare system and crew for CIT checks, undertake Practice missile firing as per firing order, have knowledge to undertake basic analysis and prepare WAU report.

5. **Mapping of Course Outcomes with Program Outcomes.**

Level – Low (1), medium (2) and high (3)

	<u>PO 1</u>	<u>PO 2</u>	<u>PO 3</u>	<u>PO 4</u>	<u>PO 5</u>	<u>PO 6</u>	<u>PO 7</u>
CO 1					2	2	3
CO 2					3	3	2
CO 3					2	3	2
CO 4					3	2	2

6. **Course Content.**

(a) **Module I.** Introduction, Booster, Propellant and Air System, Sustainer Engine, Electric Equipment, Warhead and Fuze Assembly, Radar Homing Head (DCM-AE), IR Homing Head (FAD Module), Container, Electrical Connectors, Sprinkling System (KARAT-M), Loader (KT-97BE), Loading/Unloading, Modes of Operations, Fire Control System (Korall-NKE), Computer (IK, Data entry device (83K), Missile Officer's Panel (101), Firing Circuit Diagrams, Modes of firing Harbour drills, CIT preparation, Practice missile firing, Maintenance.

(b) **Module II.** General Information-Missile- Introduction, Technical Specifications, Configuration of missile, Flight Trajectory, Brief Description of hardware components, Design of Missile Hardware Structure- Hardware structure,

Transportation cum Launch Canister (TLC), Nose Cap, Internal Nose Cap ,airframe, F1 section body, F2 section body, Instrument frame of F1/F2 section, Wing, Fin Assembly, Sustainer- Function and area of application, Structure of supersonic Ramjet, Fuel system of Ramjet, Starting system, turbo hydraulic pump set, electrical equipment of sustainer, Telemetry sensor, Combined Pneumatic and Hydraulic System (CPHS)- Function and structure

(c) **Module III.** Basic parameters and technical descriptions, serviceability, structure, operation of CPHS, control surface unfolding system, Booster- function and structure, Technical characteristics of booster stage, Docking of booster stage to sustainer, operation of booster stage, Front Docking Unit(FDU), Instrument bay pressurisation system, Pyro Device- Types and function, design and operation, Launch Gas Generator, solid propellant motor system of nose cap, initiation system.

(d) **Module IV.** Electrical equipment- function and structure, Power and command distribution unit, Pyro control unit, Onboard power supply source, Armament- Structure and function, Warhead CK 317, Action of Warhead, Fuze CK 318, Impact sensor system CK319, Onboard Control system Equipment-Function, Basic technical data, Composition of Onboard Control system equipment, seeker K-312, Angular Velocity sensor K 314-47, Information Converter CK 314-43, servo Amplifier CK 314-42, Radio Altimeter K-313, Inertial Navigation system, Onboard Digital computer, Detection and homing system-seeker-Function

7. **Reference.** Technical Documents Operating Instructions of P21 approved by Naval Headquarters, New Delhi

**24-8203-0112 – DESIGN, CONCEPT AND OPERATION OF SURFACE TO SURFACE
MISSILE SYSTEM – BRAHMOS**

1. **Course Description.** The course is designed to provide practical and theoretical knowledge on BRAHMOS SSM installed on naval platforms.
2. **Pre-Requisites.** Officers should have an understanding of explosive chemistry and physics.
3. **Distribution of Marks.**

<u>Code</u>	<u>Subject</u>	<u>Hrs/week</u>			<u>Credits</u>	<u>Marks</u>
		<u>L</u>	<u>P</u>	<u>Total</u>		
24-8203-0112	BRAHMOS – Technical Details	1	0	1	1	50
	BRAHMOS – Simulator & Firing Practical	1	1	2	1	50
	BRAHMOS – Tactical Exploitation	1	1	2	2	100
	Total			5	4	200

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

CO 1	Understand the basic structure of BrahMos missile and will be conversant with the technical data & components of BrahMos missile.
CO 2	Understand the BrahMos missile Flight and target detection components and will possess functional and operational knowledge of BrahMos FCS.
CO 3	Undertake combat & tactical exploration of missile system.

5. **Mapping of Course Outcomes with Program Outcomes.**

Level – Low (1), medium (2) and high (3)

	<u>PO 1</u>	<u>PO 2</u>	<u>PO 3</u>	<u>PO 4</u>	<u>PO 5</u>	<u>PO 6</u>	<u>PO 7</u>
CO 1					2	2	3
CO 2					3	3	2
CO 3					2	3	3

6. **Course Content.**

(a) **Module I.** General Information-Missile- Introduction, Technical Specifications, Configuration of missile, Flight Trajectory, Brief Description of hardware components, Design of Missile Hardware Structure- Hardware structure, Transportation cum Launch Canister (TLC), Nose Cap, Internal Nose Cap, airframe, F1 section body, F2 section body, Instrument frame of F1/F2 section, Wing.

(b) **Module II.** Fin Assembly, Sustainer- Function and area of application, Structure of supersonic Ramjet, Fuel system of Ramjet, Starting system, turbo hydraulic pump set, electrical equipment of sustainer, Telemetry sensor, Combined Pneumatic and Hydraulic System (CPHS)- Function and structure, Basic parameters and technical descriptions, serviceability, structure, operation of CPHS, control surface unfolding system, Booster- function and structure.

(c) **Module II.** Technical characteristics of booster stage, Docking of booster stage to sustainer, operation of booster stage, Front Docking Unit(FDU), Instrument bay pressurisation system, Pyro Device- Types and function, design and operation, Launch Gas Generator, solid propellant motor system of nose cap, initiation system, Electrical equipment- function and structure, Power and command distribution unit, Pyro control unit, Onboard power supply source, Armament- Structure and function, Warhead CK 317, Action of Warhead, Fuze CK 318, Impact sensor system CK319, Onboard Control system Equipment-Function, Basic technical data.

(d) **Module III.** Composition of Onboard Control system equipment, seeker K-312, Angular Velocity Sensor K 314-47, Information Converter CK 314-43, servo Amplifier CK 314-42, Radio Altimeter K-313, Inertial Navigation system, Onboard Digital computer, Detection and homing System-Seeker-Function

(e) **Module IV.** Technical specification, functional configuration, operational modes, structure of seeker, system checks of the seeker, Interface with control and guidance system, Radio Altimeter- Function and structure, Technical specification, functional configuration, operational modes, structure of seeker, system checks of the seeker, interface with control and guidance system, Inertial Navigation System- function, output parameter , characteristics, Flight sequence- flight sequence, Pre-Launch Preparation, Brahmos FCS.

7. **Reference.** Technical Documents and Operating Instructions of P21 approved by Naval Headquarters, New Delhi.

**24-8203-0113 – DESIGN, CONCEPT AND OPERATION OF SURFACE TO AIR
MISSILE SYSTEM – BARAK**

1. **Course Description.** The course is designed to provide practical and theoretical knowledge on SAM system BARAK installed on naval platforms.
2. **Pre-Requisites.** Officers should have an understanding of explosive chemistry and physics.
3. **Distribution of Marks.**

<u>Code</u>	<u>Subject</u>	<u>Hrs/week</u>			<u>Credits</u>	<u>Marks</u>
		<u>L</u>	<u>P</u>	<u>Total</u>		
24-8203-0113	BARAK – Technical Details	1	0	1	1	50
	BARAK – Simulator & Firing Practical	1	1	2	2	100
	BARAK – Tactical Exploitation	1	1	2	1	50
	Total			5	4	200

4. **Course Outcome:** After completion of the course the trainee will be: -

CO 1	Conversant with the technical data & composition of system for tactical exploitation.
CO 2	Able to exploit BWCS Operational Process for threat evaluation and resource allocation.
CO 3	Able to practically exploit BWCS operating functions, transmitter channel and receiver channel.
CO 4	Able to perform system drills and analysis of previous firings.

5. **Mapping of Course Outcomes with Program Outcomes.**

Level – Low (1), medium (2) and high (3)

	<u>PO 1</u>	<u>PO 2</u>	<u>PO 3</u>	<u>PO 4</u>	<u>PO 5</u>	<u>PO 6</u>	<u>PO 7</u>
CO 1					2	2	3
CO 2					3	3	3
CO 3					2	3	3
CO 4					3	3	3

6. **Course Content.**

(a) **Module I.** System Overview, BWCS Layout Description, FCS & INS - Technical Overview Units and Performances Description- FCS Interfaces, Major Block Level System description, Units and Sub Units Description, System Configurations, FCR, Technical Overview, units and performance description, FCR Interface with FCS, FCR main tasks.

(b) **Module II.** Main features, specification, System Op Modes, Missilery Engagement Modes, Simulation Mode, Maintenance Mode, TERA Functions, TERA parameters, TERA modes, FCR – Logic Modes, BLCU – Logic, Modes, FCC-controls and indications, MU controls and indications, BLCU controls and indications, BARAK canister –controls and indications, FCC means of operation, FCC –upper monitor display, lower monitor display, Display forms, General

description, System activation/ shutdown, control functions, engagement management, FCR Operating parameters, tactical functions graphic tools, simulation modes, maintenance mode FCR frequency setting, Recording Unit (RECU).

(c) **Module III.** Technical overview, Operating Procedure, Recording procedures, Data Format for firing analysis as per AMBAR, FCR main Task, Main Features, Specifications, Interfaces, Pictorial Diagram Antenna System, Transmitter and Processor rack(TPR), TWT Transmitter, Anti condensation Unit, Servo Unit Rack, Man aloft switch, Block Diagram of X band Tx channel, Block Diagram of Ka band Tx channel, Rx channel general Block Diagram, RSPU interconnections, Rx channel signal processing, Antenna assembly General View of AE, Block Diagram, Main Antenna, Feed, Reflectors, Narrow capture AE, Wide Capture AE, Side Lobe AE, IMU, TTD of BCM, Parts of BCM and their functions

(d) **Module IV.** General safety regulations for Missile Handling activities, Safety regulations for BCM loading/ unloading onboard ship, Incidents/Accidents, Safety regulations for BCM unloading after launch failure, Safety regulations, unloading after Hang fire, Emergency procedures in case of fire, Safety regulations for handling a dropped BCM, Humidity Check, Visual inspection and corrections, pressure check and Nitrogen filling, Pressure check, Nitrogen filling procedure using portable filling Device, built-in –test using FCS, PLCC-BCM-FCR communication checkout procedure using PCCA.

(e) **Module V.** Preparation/selection of articles for firing, 1 General Description of VLU, MSU connection to VLU, Functional and Physical Description of VLU, Upper Plate Assembly-Location and Function, Central Structure –Location and function, Hangfire Funnel –Location and function, Hangfire Chamber-Location and function, VLU –Physical Characteristics, Safety Precautions to be followed for maintenance of VLU, Periodic Maintenance Activities, Pre and Post sailing Inspections, Canister handling after Missile launch, After docking service, Quarterly service, Funnel Cover Replacement and installation, Undertake firing drills/ PMF in TERA On and Off Mode on emulator.

7. **Reference.** Technical Documents and Operating Instructions of BARAK approved by Naval Headquarters, New Delhi.

**24-8203-0114 – DESIGN, CONCEPT AND OPERATION OF SURFACE TO AIR
MISSILE SYSTEM – IGLA**

1. **Course Description.** The course is designed to provide practical and theoretical knowledge on IGLA system installed on naval platforms.
2. **Pre-Requisites.** Officers should have an understanding of explosive chemistry and physics.
3. **Distribution of Marks.**

<u>Code</u>	<u>Subject</u>	<u>Hrs/week</u>			<u>Credits</u>	<u>Marks</u>
		<u>L</u>	<u>P</u>	<u>Total</u>		
24-8203-0114	IGLA – Technical Details & Exploitation	1	0	1	.5	25
	IGLA – Simulator Training	0	1	1	.5	25
	Total			2	1	50

4. **Course Outcome:** After completion of the course the trainee will be: -

CO 1	Conversant with capabilities, limitations, technical utilisation and stowage conditions of IGLA SAM for implementation onboard Ships.
CO 2	Conversant with the launching conditions, acceptance, stowage, care and maintenance of IGLA SAM.
CO 3	Conversant with the Tactical exploitation of IGLA SAM.

5. **Mapping of Course Outcomes with Program Outcomes.**

Level – Low (1), medium (2) and high (3)

	<u>PO 1</u>	<u>PO 2</u>	<u>PO 3</u>	<u>PO 4</u>	<u>PO 5</u>	<u>PO 6</u>	<u>PO 7</u>
CO 1					2	3	3
CO 2					3	3	
CO 3					2	3	3

6. **Course Content.**

(a) **Module I.** Introduction to IGLA SAM, Purpose, Composition, Technical data, Stowage conditions on board.

(b) **Module II.** Parts of SAM, SAM, launching tube, Launching mechanism, Combat employment & operation, Launching conditions & procedure, Misfire drill, Acceptance of missile, Care and maintenance of the SAM/ magazine stowage.

7. **Reference.** Technical Documents and Operating Instructions of IGLA approved by Naval Headquarters, New Delhi.

24-8203-0115 – GUNNERY SENSOR & FIRE CONTROL RADARS (LYNX U2 & SSR)

1. **Course Description.** The course is designed to provide practical and theoretical knowledge on Fire Control Radars installed on naval platforms.
2. **Pre-Requisites.** Officers should have adequate knowledge about the operation of radars.
3. **Distribution of Marks.**

<u>Code</u>	<u>Subject</u>	<u>Hrs/week</u>			<u>Credits</u>	<u>Marks</u>
		<u>L</u>	<u>P</u>	<u>Total</u>		
24-8203-0115	LYNX U2	1	1	2	1	50
	SSR	1	1	2	1	50
	Total			4	2	100

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

CO 1	Optimally utilize the LYNX fire control radar for combat exploitations.
CO 2	Conversant with the basics data and components of active channel of the system, radar devices, understand tactical exploitation

5. **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	PO 6	PO 7
CO 1					3	3	
CO 2					2	3	3

6. **Course Content.**

(a) **Module I.** Basic components of LYNX FCR, Technical Specifications, Switching on/off procedures, Controls and Indicators, Operational Functions, Secondary and ancillary functions, Visual sight operation, TDS operation. Practical for target detection, passing of target information, final hit data, projectile information.

(b) **Module II.** Various Functions and Operation/Exploitation of DRES including Mobile Operator Panel, Various Functions and Operation/Exploitation of TDS: Kolanka Sight, TDS Graticule for AK 630, TDS Graticule for SRGM, Gun Casualty Panel, Primary Operational Functions: Alert, Surveillance, Designation and Acquisition of Target, Tracking of Target, Engagement of Target, Assessment of Battle Damage

(c) **Module III.** Secondary Operational Functions (PAC Firings and Corrections, Shot Corrections) and Ancillary Functions (BITE, Alignment, Simulation), Controls, indications and Operations for SRGM firing, Controls, indications and Operations for AK 176 firing, Controls, indications and Operations for AK 630 firing

(d) **Module IV.** Basic data and Components of Active Channel, Introduction, Functions, Modes of Operation, TTD, MFC and RSAP, Combat Exploitation.

7. **References.**

(a) Technical Documents and Operating Instructions of SSR approved by Naval Headquarters, New Delhi.

(b) Technical Documents and Operating Instructions LYNX approved by Naval Headquarters, New Delhi.

24-8203-0116 – SURVEILLANCE & FIRE CONTROL SYSTEMS (AMDR 2D&3D)

1. **Course Description.** The course is designed to provide practical and theoretical knowledge on major gunnery sensors systems installed on naval platforms.
2. **Pre-Requisites.** Officers should have adequate knowledge about the functioning of radars.
3. **Distribution of Marks.**

<u>Code</u>	<u>Subject</u>	<u>Hrs/week</u>			<u>Credits</u>	<u>Marks</u>
		<u>L</u>	<u>P</u>	<u>Total</u>		
24-8203-0116	AMDR 2D&3D	2	1	3	1	50
	Total			3	1	50

4. **Course Outcome:** After completion of the course the trainee will be: -

CO 1	Conversant with the AMDR general description, the basic system specifications.
CO 2	AMDR system block diagram, AMDR modes of operation, power supply requirement of AMDR system, AMDR System performance.

5. **Mapping of Course Outcomes with Program Outcomes:**
Level – Low (1), medium (2) and high (3)

	<u>PO 1</u>	<u>PO 2</u>	<u>PO 3</u>	<u>PO 4</u>	<u>PO 5</u>	<u>PO 6</u>	<u>PO 7</u>
CO 1					3	3	
CO 2					2	3	2

6. **Course Content.**

(a) **Module I.** System main features, Antenna main features, ECCM features, basic parameters (System), basic parameters (Antenna), basic parameters (Transmitter), Receiver specifications, Signal Processing specifications, Basic block Diagram, Cooling Unit.

(b) **Module II.** TX Block Diagram, Receiver Processor Block Diagram, Antenna Control Box, Remote Control Unit, Antenna, Operational Mode, Maintenance Mode, LRS Mode, TA Mode, TAWS Mode, Power supplies required for the system, PDD, Conversion machinery, Operational Performance, Exploitation onboard ships.

7. **Reference.** Technical Documents and Operating Instructions LYNX approved by Naval Headquarters, New Delhi.

24-8203-0117 - GUNNERY TACTICS

Course Description. The course is designed to provide knowledge of Gunnery Tactics for operational exploitation for operational exploitation of naval platforms..

1. **Pre-Requisites.** Officers should have served onboard Indian Naval ships and establishments.

<u>Code</u>	<u>Subject</u>	<u>Hrs/week</u>			<u>Credit</u>	<u>Mark</u>
		<u>L</u>	<u>P</u>	<u>Total</u>		<u>s</u>
24-8203-0117	Operational Efficiency	1.25	0	1.25	.5	20
	Fighting Efficiency	1.5	0	1.5	1	50
	Equipment Efficiency	.25	0	.25	.25	10
	MWC Tactics phase. (ND School, ASW School, Signal School, NODPAC, Seamanship school, NIAT	2	0	2	1.25	70
	Total			5	3	150

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

CO 1	Administer functioning of Gunnery department, to analyse various gunnery shoots as per extant policies and have thorough knowledge of targets used in IN for missile and gun shoot.
CO 2	Tactically exploit laid down principles of General, surface tactics.
CO 3	Ensure optimum efficiency of gunnery weapons and sensors.
CO 4	Apply the basic knowledge of Navigation Direction, Communication networks, Electronic warfare, ASW aspects for conduct of effective Gunnery warfare at sea.

3. **Mapping of Course Outcomes with Program Outcomes.**

Level – Low (1), medium (2) and high (3)

	<u>PO 1</u>	<u>PO 2</u>	<u>PO 3</u>	<u>PO 4</u>	<u>PO 5</u>	<u>PO 6</u>	<u>PO 7</u>
CO 1					2	3	
CO 2					3	2	3
CO 3					3	3	
CO 4							3

4. **Course Content.**

(a) **Module I.** Training principles, pre-commission, working up and communication of training for user skills, preparation before practice gunnery firings. Safety rules: AA and NGS practices, NGS: Classification of target, firing procedures. The standard format and salient points for the preparation of firing order including distribution (home assignment). Procedure for conducting various AA/SU/FPX/VBX non firing exercise. Drafting of FAAWC and SAG CDR policy and conduct of drills. Safety precautions, safety rules to be observed during various gunnery practices.

The standard format of salient points for the preparation of a firing order including its distribution.

(b) **Module II.** Principles of war, sea control/ denial, blockade, territorial waters, EEZ and continental shelf. Surface gunnery fighting range and bearing of targets, formation and ship handling effect of weather. Ammunition expenditure and type of SU action., Amphibious warfare, Over the Horizon targeting, AMD employment of soft kill and hard kill measures.

(c) **Module III.** To coordinate care and maintenance, testing and tuning, weapon alignment and HATS and SATS of sensor and weapons. To be conversant with various organisations responsible for testing and tuning and confirming the proper functioning of equipment and gun. To be conversant with the organisations for ensuring constant checks and maintenance of gunnery equipment

(d) **Module IV.** Electronic warfare, Radio Organisation, RT communication, Under water acoustics, Mines, UW sensors, basics of ASW tactics, Introduction to air weapons, Targeting philosophy, GPS, Coastal Navigation, Action Information Organisation. Basics of Helo control.

5. **References.**

(a) INBR 45 (1 & 2), Admiralty manual of navigation, Lords commissioners of Admiralty, approved by Naval Headquarters, New Delhi in 1967

(b) Joint Services Communication Publication (JSCP) - II, Handbook on brevity code

(c) Principles of underwater sound by Robert J Urick published by Peninsula publishing, 1983

(d) Sonar for Practising Engineers by AD Waite, Third edition published by John Wiley & Sons inc 2002

24-8203-0118 - PROJECT WORK

1. **Course Description.** The course is designed to enable trainees to undertake thorough study/ research of gunnery related topics.

2. **Pre-Requisites.** Officers should have a very clear understanding about the concepts of naval gunnery.

<u>Code</u>	<u>Subject</u>	<u>Hrs/week</u>			<u>Credit</u>	<u>Marks</u>
		<u>L</u>	<u>P</u>	<u>Total</u>		<u>Total</u>
24-8203-0118	Project Work	0	0	0	1	50
	Total			0	1	50

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

CO 1	Appreciate developments in the field of naval gunnery and contribute to
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	developments in the field of naval gunnery in Indian Navy.
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4. **Mapping of Course Outcomes with Program Outcomes.**

Level – Low (1), medium (2) and high (3)

	<u>PO 1</u>	<u>PO 2</u>	<u>PO 3</u>	<u>PO 4</u>	<u>PO 5</u>	<u>PO 6</u>	<u>PO 7</u>
<u>CO 1</u>					2	2	

5. **Course Content.** Trainees will be required to undertake research on gunnery related topics as decided by Training Captain.

6. **Reference.** NA

24-8203-0119 – GUNNERY BOARD

1. **Course Description.** The course is designed to assess the knowledge gained by trainees.

2. **Pre-Requisites.** Assimilation of all the courses covered during the curriculum.

<u>Code</u>	<u>Subject</u>	<u>Hrs/week</u>			<u>Credit</u>	<u>Marks</u>
		<u>L</u>	<u>P</u>	<u>Total</u>		<u>Total</u>
24-8203-0119	Gunnery Board	0	0	0	2	100
	<u>Total</u>			0	2	100

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

<u>CO 1</u>	Have a sound knowledge of the essentials of time tested naval gunnery practices, Weapon Systems on board ships and also ashore, and, gunnery tactics, to function effectively as the Gunnery Officer in a naval unit.
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4. **Mapping of Course Outcomes with Program Outcomes.**

Level – Low (1), medium (2) and high (3)

	<u>PO 1</u>	<u>PO 2</u>	<u>PO 3</u>	<u>PO 4</u>	<u>PO 5</u>	<u>PO 6</u>	<u>PO 7</u>
<u>CO 1</u>	3	3	3	3	3	3	3

5. **Course Content.** The entire spectrum of topics covered during the curriculum of the specialist training.

6. **Reference.** NA