APPENDIX VIII

Enclosure to SNOM letter
815/91/3 dated 21 Dec 23

CURRICULUM FRAMEWORK AND COURSE CONTENT FOR OUTCOME BASED EDUCATION

IN

M.Sc., Applied Meteorology
(Programme No. 23-4209)

Conducted by

SCHOOL OF NAVAL OCEANOLOGY AND METEOROLOGY (SNOM)

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REGULATIONS FOR MSC IN APPLIED METEOROLOGY

1.	Programme No	23-4209.
2.	Programme Name Civil Equal	M.Sc., in Applied Meteorology.
3.	Programme Code Naval Equivalent	Long Meteorology Course.
4.	Approving Authority	Naval Headquarters (NHQ), Ministry of Defence (Navy).
5.	Eligibility Criteria for Admission	(a) Officers nominated by Naval Headquarters (NHQ). (b) M.Sc., degree in P/ C/ M or B.Sc., degree with P/C/M or B.E./ B.Tech/ BSc (Engg) from any recognised university.
6.	Duration	**Semester I & II** (a) 26 weeks of Naval Orientation Training course at Indian Naval Academy. (b) 18 weeks of Training Technology course at Naval Institute of Education Training Technology and Leadership course at CELABS. (c) 04 weeks of ship attachment. (d) 04 weeks of Division and Managements (D & M) course. (e) 02 weeks of Nuclear Biological Chemical and Damage Control (NBCD) course. **Semester III & IV** (a) 35 weeks training in Meteorological subjects at School of Naval Oceanology and Meteorology (SNOM), Kochi. (b) 17 weeks project work cum On-Job-Training at their place of posting.

7.	Attendance requirement	Minimum 80%.
8.	Nature	Full time.
9.	Approved intake capacity	As approved by Integrated Headquarters Ministry of Defence (Navy).
10.	Examination Pattern	Exam paper setter will be other than the subject instructor as nominated by Chief Instructor.

11. **Grading**.

(a) **Grades**. The following are the grades for performance in individual subject: -

Range of Marks	Grades	Weightage
90% and above	'S' - Outstanding	10
80 – 90 %	'A' - Excellent	9
70 – 80 %	'B' - Very Good	8
60 – 70 %	'C' - Good	7
50 – 60 %	'D' - Satisfactory	6
Below 50%	'F' - Failure	0

Where (X-Y) means X is included and Y is excluded

(b) **Grade Point Average**. Performance at the end of the Semester is indicated by Grade Point Average (GPA) calculated as follows for all subjects in the Semester:-

$$GPA = \frac{G_1C_1 + G_2C_2 + G_3C_3 + \ldots\ldots GnCn}{C_1 + C_2 + C_3 + \ldots\ldots Cn}$$

(G = grade weightage and (C = corresponding subject Credit).

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

$$CGPA = \frac{C_{III}(GPA_{III}) + C_{IV}(GPA_{IV})}{C_{III} + C_{IV}}$$

(C_{III} and C_{IV} credit for Semester III and IV and GPA_{III} and GPA_{IV} grade point average for Semester III and Semester IV)

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

Classification	CGPA
First Class with distinction	8 and above

Classification	CGPA
First Class	6.5 and above
Second Class	6 and above

(e) Details of the course and credit points are as follows:-

Semester I

Course Code	Paper	C/E	Credit
23-4209-0101	Leadership, Naval Value System and Divisional Duties	C	3
23-4209-0102	Naval Orientation and Naval Organisation	C	3
23-4209-0103	Seamanship (Rigging and Boat Work)	C	2
23-4209-0104	Seamanship (Anchor Work and Survival and Safety)	C	2
23-4209-0105	General Navigation	C	2
23-4209-0106	Chart Work and Rules of the Road	C	2
23-4209-0107	Naval discipline, security and watch keeping	C	2
23-4209-0108	Naval communication and ceremonials	C	2
23-4209-0109	Naval science and technology	E	1
23-4209-0110	Indian naval history	E	1
		C+E	19

Note:- One Elective is to be selected in the semester

Semester II

Course Code	Paper	C/E	Credit
23-4209-0201	Education Management	C	3

23-4209-0202	Concepts in Education and Learning	C	3
23-4209-0203	Training Methodology	C	3
23-4209-0204	Design and Development of Learning Process	C	3
23-4209-0205	Divisions and Management	E	2
23-4209-0206	Nuclear Biological and Chemical Defence	E	2
23-4209-0207	Ship Attachment	C	3
		C+E	17
Note:- One Elective is to be selected in the semester			

Semester III

Course Code	Paper	C/E	Credit
23-4209-0301	Meteorological Observational Systems	C	3
23-4209-0302	Dynamic Meteorology	C	3
23-4209-0303	Physical Meteorology	C	3
23-4209-0304	Synoptic and Aviation Meteorology	C	3
23-4209-0305	Statistics	E	2
23-4209-0306	Computer Programming and Applications	C	3
23-4209-0307	Advanced Mathematics	E	2
23-4209-0308	Disaster Management	E	2
23-4209-0309	Satellite & Radar Meteorology	C	3
23-4209-0310	Practical	C	2
23-4209-0311	Viva-Voce	C	2
		C + E	22 + 02 = 24
Note:- One Elective is to be selected in the semester			

SEMESTER IV

Course Code	Paper	C/E	Credit

23-4209-0401	Geophysical Fluid Dynamics	C	3
23-4209-0402	Numerical Weather Prediction	C	3
23-4209-0403	Advanced Physical Meteorology & Hydrometeorology	E	2
23-4209-0404	Climate Science	C	3
23-4209-0405	Model Output Diagnostics	C	2
23-4209-0406	Physical Oceanography	C	2
23-4209-0407	Air – Sea Interaction	E	2
23-4209-0408	Middle Atmosphere	E	2
23-4209-0409	Practical	C	2
23-4209-0410	Viva-Voce	C	2
23-4209-0411	Project work	C	3
23-4209-0412	MOOC	E	2
	C + E	22 + 02 = 22	
Note:- One Elective is to be selected in the semester			
Accumulated minimum credits required for successful completion of the program is: **82**			

12. **Minimum Qualifying Marks**. **50%.**

13. **Failure in Examinations**. As per Training Directive issued by Headquarters Southern Naval Command (HQSNC). Gist are as follows:-

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

(b) Failure in two subjects will result in warning by Officer-in-Charge and re-examination.

(c) Failure in three or more subjects or failure in the same subject twice will be considered as failure in the whole course and trainee will be required to undergo the course again.

(d) In case a trainee fails in one or two subjects / is absent on medical grounds or due to participation in sports, he may be retained in the establishment for a duration of two weeks for additional coaching and re-examination on approval by HQSNC.

(e) Marks obtained in re-examination will be restricted to minimum passing marks for that subject.

SCHEME OF INSTRUCTIONS (SOI) & SCHEME OF EXAMINATION (SOE)

MSC IN APPLIED METEOROLOGY (PROGRAMME 23-4209)

SEMESTER I

Code	Subject	Hours/ Week				Credit	C/ E	Marks		
		L	T	P	Total			CA	ESE	Total
23-4209-0101	Leadership, Naval Value System and Divisional Duties	3	2	-	5	3	C	50	50	100
23-4209-0102	Naval Orientation and Naval Organisation	4	1	-	5	3	C	50	50	100
23-4209-0103	Seamanship (Rigging and Boat Work)	2	-	2	4	2	C	50	50	100
23-4209-0104	Seamanship (Anchor Work and Survival and Safety)	2	-	2	4	2	C	50	50	100
23-4209-0105	General Navigation	2	1	1	4	2	C	50	50	100
23-4209-0106	Chart Work and Rules of the Road	1	-	2	3	2	C	50	50	100
23-4209-0107	Naval Discipline, Security and Watch Keeping	2	1	1	4	2	C	50	50	100
23-4209-0108	Naval Communications and Ceremonials	2	1	-	3	2	C	50	50	100
23-4209-0109	Naval Science and Technology	1	1	-	2	1	E	50	50	100
23-4209-0110	Indian Naval History	1	1	-	2	1	E	50	50	100
	Total	**19**	**7**	**8**	**34**	**19**	**-**	**450**	**450**	**900**

SEMESTER II

Code	Subject	Hours/ Week				Credit	C/E	Marks		
		L	T	P	Total			CA	ESE	Total
23-4209-0201	Education Management	4	2	-	6	C	3	50	50	100
23-4209-0202	Concepts in Education and Learning	4	2	-	6	C	3	50	50	100
23-4209-0203	Training Methodology	4	2	-	6	C	3	50	50	100
23-4209-0204	Design and Development of Learning Process	4	2	-	6	C	3	50	50	100
23-4209-0205	Divisions and Management	2	2	-	4	E	2	50	50	100
23-4209-0206	Nuclear Biological and Chemical Defence	2	2	-	4	E	2	50	50	100
23-4209-0207	Ship Attachment	-	-	6	6	C	3	100	-	100
	Total	**18**	**10**	**6**	**34**	**NA**	**17**	**350**	**250**	**600**

SEMESTER III

Code	Subject	Hours/ Week				Credit	C/E	Marks		
		L	T	P	Total			CA	ESE	Total
23-4209-0301	Meteorological Observational Systems	3	1	1	5	3	C	50	50	100
23-4209-0302	Dynamic Meteorology	3	1	1	5	3	C	50	50	100
23-4209-0303	Physical Meteorology	2	1	2	5	3	C	50	50	100
23-4209-0304	Synoptic and Aviation Meteorology	2	1	2	5	3	C	50	50	100
23-4209-0305	Statistics	2	-	-	2	2	E	50	50	100
23-4209-0306	Computer Programming and Applications	1	2	2	5	3	C	50	50	100
23-4209-0307	Advanced Mathematics	2	-	-	2	2	E	50	50	100
23-4209-0308	Disaster Management	2	-	-	2	2	E	50	50	100
23-4209-0309	Satellite & Radar Meteorology	4	-	1	5	3	C	50	50	100
23-4209-0310.	Practical	-	-	2	2	2	C	100	-	100
23-4209-0311	Viva-Voce	-	-	-	-	2	C	-	100	100
	Total	**17**	**6**	**11**	**34**	**24**	**-**	**450**	**450**	**900**

*__Note__: **CA** (Continuous Assessment), **ESE** (End Semester Examination)

SEMESTER IV

Code	Subject	Hours/ Week				Credit	C/ E	Marks		
		L	T	P	Total			CA	ESA	Total
23-4209-0401	Geophysical Fluid Dynamics	4	1	1	6	3	C	50	50	100
23-4209-0402	Numerical Weather Prediction	4	1	1	6	3	C	50	50	100
23-4209-0403	Advanced Physical Meteorology	1	1	1	3	2	E	50	50	100
23-4209-0404	Climate Science	3	1	1	5	3	C	50	50	100
23-4209-0405	Model Output Diagnostics	1	1	1	3	2	C	50	50	100
23-4209-0406	Physical Oceanography	2	-	1	3	2	C	50	50	100
23-4209-0407	Air–Sea Interaction	1	1	1	3	2	E	50	50	100
23-4209-0408	Middle Atmosphere	1	1	1	3	2	E	50	50	100
23-4209-0409	Practical			3	3	2	C	100	-	100
23-4209-0410	Viva-Voce	-	-	-	-	2	C	-	100	100
23-4209-0411	Project Work	1	1	3	5	3	C	-	100	100
23-4209-0411	MOOC	-	-	-	-	-	E	-	-	-
	Total	**16**	**6**	**12**	**34**	**22**		**400**	**500**	**900**

*Note: CA (Continuous Assessment), ESE (End Semester Examination)

Total Credits : **82**

SYLLABI FOR PROGRAMME 23-4209

MSC IN APPLIED METEOROLOGY

VISION STATEMENT

To provide the best quality METOC (Meteorology and Oceanography) training by enhancing the training capabilities of the school keeping pace with the changing times so as to evolve as a "***Centre of Excellence***" in the Indian Navy for training in the field of Earth Sciences.

MISSION STATEMENT

To explore, exploit and expand the training domains in the fields of Atmospheric and Ocean Science by incorporating the latest developments in the relevant/ associated fields making every trainee fully aware of the impact and the influence of weather elements thereby empower them to accomplish their tasks with professionalism and finesse to support Naval Operations.

In doing so, the centre will strive hard to provide state of the art METOC (Meteorology and Oceanography) training facilities to each and every trainee through continuous evolution and enhancement of curriculum, infrastructure, trainer capabilities & involvement, commitment to offer selfless service with a firm focus on the overall achievement of the Training Command's objectives and Indian Navy's core values.

PROGRAMME EDUCATIONAL OBJECTIVES (PEO)

PE01. Undertake METOC duties at Naval Met offices and provide necessary METOC information, reports, warnings and input to decision makers at Command, Fleet and Area HQ level.

PE02. Carryout research work in the field of Meteorology and exploit Numerical Weather Forecasting Models to aid naval operations.

PE03. Utilise Meteorological and Oceanographic equipment, instruments, tools and other hardware & software resources effectively towards rendering Meteorological support for naval operations.

PROGRAMME OUTCOME (PO)

PO1. **Meteorological Watch Keeping**. Undertake meteorological watch keeping duties at Naval Air Stations in consonance with relevant NOs/ INBR/ SOPs/ Circulars.

PO2. **Meteorological Briefings**. Conduct online, offline and documented briefings for providing necessary meteorological information, warnings and input to decision makers at Command, Fleet and Area HQ level.

PO3. **Meteorological Forecasting Section**. Supervise overall functioning of meteorological forecasting section of Naval Air Stations, afloat units and Command Meteorological Offices.

PO4. **Meteorological Instruments**. Exploitation of meteorological instruments, equipment, observatory and supervision of 'O' level maintenance, calibration and servicing of associated hardware.

PO5. **Oceanographic Duties**. Carryout basic oceanographic duties viz., undertaking ocean observations, analysis of ocean forecast data and exploitation of ocean Data visualization tools.

PO6. **Meteorological Data handling**. Exploitation of meteorological software/ resources and meteorological data handling.

PO7. **Numerical Weather Prediction (NWP)**. Running of Numerical Weather Prediction models to generate customised forecast products to cater for operations specific to Navy.

PO8. **Meteorological Case Study**. Carryout research-oriented case studies including severe weather event analysis

PO9. **Functioning of Met and Oceanography Office**. Undertake METOC staff work and office administration.

BLOOM'S CATEGORY AS[illegible]T FOR COURSE OUTCOME

Level	Description	Sample
Remember	Recognise student's ability to use rote memorization and recall certain facts	Define, cite, name, recall, list, state, write
Understand	Involve students' ability to read course content, understand and interpret important information put other's idea in to their own words	Describe, explain, identify, summarise, discuss, outline
Apply	Students take new concepts and apply them to another situation	Demonstrate, illustrate, interpret, solve, use, examine
Analyse	Students have the ability to take new information and break it down into parts to differentiate between them	Compare, contrast, distinguish, examine, identify, categorise, investigate
Evaluate	Involve ability to look at someone's idea or principles and the worth of the work and the of the conclusions	Appraise, defend, support, value, justify, assess, inspect, recommend
Create	Students are able various pieces of information and from a whole creating a pattern where one did not previously exist	Assemble, construct, design, develop, create, plan, invent, synthesise

Clarification on Terminologies Used in Syllabus

Continuous Internal Evaluation (CIE) Pattern. The trainees would be constantly assessed during the course duration. For each subject, continuous assessment would be divided into two parts. Details are as follows: -

(a) **Continuous Assessment (CA)**. As part of continuous assessment, trainees would be provided scientific papers for review, presentations on various topics, assignments, quiz etc.

(b) **Internal Test (IT)**. One internal test for 20 marks would be conducted on completion of the subject.