M. Sc. Meteorology

Syllabus

AFFILIATED COLLEGES

Program Code: ****

2020 – 2021 onwards

BHARATHIAR UNIVERSITY

(A State University, Accredited with "A" Grade by NAAC,
Ranked 13th among Indian Universities by MHRD-NIRF,
World Ranking : Times - 801-1000, Shanghai - 901-1000, URAP - 982)

Coimbatore - 641 046, Tamil Nadu, India

Program Educational Objectives (PEOs)	
The **M Sc in Meteorology** program describe accomplishments that graduates are expected to attain within three to four years after graduation.	
PEO1	To prepare for the role of Meteorologist in the armed forces.
PEO2	Be aware of the benefits and opportunities of open distribution of scientific knowledge, software and data.
PEO3	Be responsible for their own continuing professional development and facilitating the personal development of their colleagues
PEO4	Be resilient to a changing working and resource environment and confident in embracing new challenges.

Program Specific Outcomes (PSOs)	
After the successful completion of I semester program, the students are expected to	
PSO1	Demonstrate systematic understanding of Meteorology
PSO2	Accurately deploy established techniques of analysis and enquiry used in Meteorology and apply the learnt methods and techniques to review, consolidate, extend and apply their knowledge and understanding.
PSO3	Demonstrate knowledge of Meteorological concepts and principles.
PSO4	Critically evaluate arguments, assumptions, abstract concepts and data while taking into account the uncertainty, ambiguity and limits of knowledge of their field of study.

Program Outcomes (POs)	
On successful completion of the **M Sc in Meteorology** program	
PO1	Use conceptual understanding that allows arguments to be devised and sustained and apply the understanding to the solving of problems in Aviation Meteorology
PO2	Critically evaluate arguments, assumptions, abstract concepts and data while taking into account the uncertainty, ambiguity and limits of knowledge of their field of study;
PO3	Communicate information, ideas, problems and solutions about Meteorology to both specialist and non-specialist audiences.
PO4	They should acquire transferable skills relating to the importance of team-work, the management of their own learning, the exercise of initiative and personal responsibility, and the ability to make decisions in complex and unpredictable contexts.
PO5	The application of knowledge based on the use of scientific reasoning to solve problems in atmospheric science, and participation in the analysis, prediction and communication of the impacts of weather and climate on society.
PO6	Be able to develop transparent, robust and well documented scientific software.
PO7	Accurately deploy established techniques of analysis and enquiry used in Meteorology and apply the learnt methods and techniques to review, consolidate, extend and apply their knowledge and understanding.
PO8	Critically evaluate arguments, assumptions, abstract concepts and data while taking into account the uncertainty, ambiguity and limits of knowledge of their field of study;
PO9	Create the synoptic, dynamical and NWP models for forecasting.
PO10	Demonstrate knowledge of Meteorological concepts and principles.

BHARATHIAR UNIVERSITY: COIMBATORE 641 046

M Sc. in Meteorology Curriculum (University Department)

(For the students admitted during the academic year 2020 – 21 onwards)

Course Code	Title of the Course	Credits	Teaching Hours/Week		Maximum Marks		
			Theory	Practical	CIA	ESE	Total
FIRST SEMESTER							
M1	General Meteorology	4	4		25	75	100
M2	Observation & Instruments	4		4	25	75	100
M3	Synoptic Meteorology I	4	4		25	75	100
M4	Physical Meteorology I	4	4		25	75	100
M5	Climatology & Statistics	4	4		25	75	100
M6	Aviation Meteorology I	4	4		25	75	100
M7	Instruments and Observational Practices	4		4	25	75	100
Total		**28**	**20**	**08**	**175**	**525**	**700**
SECOND SEMESTER							
M8	Dynamic Met I	4	4		25	75	100
M9	Synoptic Meteorology II	4	4		25	75	100
M10	Satellite Meteorology I	4	4		25	75	100
M11	Climatology and Statistics II	4	4		25	75	100
M12	Aviation Meteorology II	4	4		25	75	100
M13	Instruments and Observational Practices	4		4	25	75	100
M14	Applied Meteorology & Lab Practices	4		4	25	75	100
	Total	**28**	**20**	**08**	**175**	**525**	**700**
THIRD SEMESTER							
M15	Dynamic Meteorology II	6	6		25	75	100
M16	Satellite Meteorology II	6	6		25	75	100
M17	Physical Meteorology II	6	6		25	75	100
M18	Numerical Weather Prediction	6	6		25	75	100
M19	Aviation Meteorology III	4	4		25	75	100
	Total	**28**	**28**		**125**	**375**	**500**
FOURTH SEMESTER							
M20	Analysis and Prognosis	6		6	25	75	**100**
M21	Project	22		22	100	300	**400**
	Total	**28**		**28**	**125**	**375**	**500**
	Grand Total	**112**	**68**	**44**	**600**	**1800**	**2400**

First Semester

SEMESTER I						
Course code	M1	**GENERAL METEOROLOGY**	**L**	**T**	**P**	**C**
Core		Science of Meteorology	3	1		4
Pre-requisite		Graduation in the field of Science, Engineering, Geography and Computer Application	**Syllabus Version**		20-21	

Course Objectives:

The main objectives of this course are to:

1. To give an overview of science of meteorology.
2. Be aware of the working of world meteorological organization and different met communications/telecommunication network in India.
3. To make aware of effect of physical geography and earth's interior on meteorology.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Remember various components of world meteorological organizations.	K1
2	Understand the met communications, telecommunications network in India and channels used in IAF.	K2
3	Understand the effect of physical geography, motions of the earth and on meteorological process.	K3
4	Apply the knowledge of earth's interior to analyse the meteorological phenomena.	K4
5	Evaluate the measurement of time in prospective of meteorology.	K5

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** – Evaluate

Unit:1	**SCIENCE OF METEOROLOGY- AN OVERVIEW**	**13 hours**

1. Introduction to meteorology.
2. History of meteorology.
3. General circulation.

Unit:2	**METEOROLOGICAL ORGANISATIONS**	**13 hours**

1. World meteorological organization (WMO).
2. Regional met centers.
3. Indian Meteorological Department.
4. Met organization in Indian Air force.

Unit:3	**MOTION OF EARTH AND MEASUREMENT OF TIME**	**13 hours**

1. Introduction.
2. Orbital and rotational characteristics of earth.
3. Conversion of time and sidereal time.

Unit:4	**PHYSICAL GEOGRAPHY AND STRUCTURE OF EARTH**	**13 hours**

1. Insolation.
2. The earth and its interior.
3. Impact of physical geography.

Unit:5	**MET TELECOMMUNICATION**	**12 hours**

1. Global Telecommunication System 2. National Data Exchange Network 3. Meteorological Telecommunications in IAF.		
Unit: 6	**Contemporary Issues**	**2 hours**
Experts lecture, online seminars – webinars		
	Total lecture hours / semester	**66 hours**
Text Book (s)		
1.	WMO Training Manuals.	
2.	Manual of Meteorology for Air Crew - IAF Publication	
3.	General Meteorology – Byers HR.	
Reference Books		
1.	Training Notes. Dept of Meteorology - AFA(Volume – 3)	
2.	Meteorology for Airman in India Part I – I Met D.	
Related online contents		
	www.vayumandal.iaf.in	
	www.afac.iaf.in	
Course Designed By: Wing Commander Anil, Wing Commander (Dr) Anand S Awasthi, Faculty of Meteorology AFAC		
Mapping with Programme Outcomes		

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	M	S	S	S	S	S	S
CO3	S	S	S	S	M	S	S	S	S	S
CO3	S	S	S	S	S	S	M	S	S	S
CO4	S	S	S	S	S	M	S	S	S	S
CO5	S	S	S	S	S	S	S	S	M	S

*S-Strong; M-Medium; L- Low

Course code	M2	OBSERVATION & INSTRUMENTS	L	T	P	C
Core		Surface met observations and codes, measurement of met parameters			4	4
Pre-requisite		Basic knowledge of meteorological parameters	Syllabus Version		20-21	

Course Objectives:

The main objectives of this course are to:

1. To give insight of the procedures of observation in meteorology.
2. Be aware of importance of the correct recording and dissemination of observations.
3. To make them learn the reporting procedures of Met elements using various codes in meteorology.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Remember various codes and reporting procedures.	K1
2	Understand the met parameters and working of Met instruments for recording.	K2
3	Understand the coding and decoding of various codes in Meteorology.	K3
4	Apply the knowledge of Cloud classification for cloud observation.	K4
5	Evaluate the measurement of Met parameter effectively and correctly.	K5

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate

Unit:1	SURFACE MET OBSERVATIONS	13 hours

1. Measurement of Pressure.
2. Measurement of Temperature.
3. Measurement of Surface Wind.
4. Measurement of Humidity.
5. Measurement of Precipitation.
6. Measurement of Visibility.

Unit:2	CODES	13 hours

1. Synop code.
2. Station model.
3. Surface/ship codes.
4. METAR/SPECI/SPECIAL.

Unit:3	CLOUDS	13 hours

1. Cloud classification.
2. Cloud observation and measurements.

Unit:4	UPPER AIR OBSERVATIONS	13 hours

1. Computation by pilot balloon.
2. Radar-Wind finding.
3. Radiosonde.

Unit:5	MET TELECOMMUNICATION	12 hours

1. Global Telecommunication System
2. National Data Exchange Network
3. Meteorological Telecommunications in IAF.

Unit: 6	Contemporary Issues	2 hours
Experts lecture, online seminars - webinars		
	Total lecture hours /Semester	**66 hours**
Text Book (s)		
1.	WMO Training Manuals.	
2.	Manual of Meteorology for Air Crew - IAF Publication	
3.	General Meteorology – Byers HR.	
Reference Books		
1.	Training Notes. Dept of Meteorology - AFA(Volume – 3)	
2.	Meteorology for Airman in India Part I – I Met D.	
Related online contents		
	www.vayumandal.iaf.in	
	www.afac.iaf.in	
Course Designed By: Wing Commander Anil, Wing Commander (Dr) Anand S Awasthi, Faculty of Meteorology AFAC		
Mapping with Programme Outcomes		

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	S	S	M
CO3	S	S	S	S	M	S	S	S	S	S
CO3	S	S	S	S	S	M	S	S	S	S
CO4	M	S	S	S	S	S	S	S	S	S
CO5	S	S	M	S	S	S	S	S	S	S

*S-Strong; M-Medium; L- Low

Course code	M3	SYNOPTIC METEOROLOGY - I	L	T	P	C
Core		Synoptic meteorology	3	1		4
Pre-requisite		Graduation in the field of Science, Engineering, Geography and Computer Application	Syllabus Version		20-21	

Course Objectives:

The main objectives of this course are to:

1. To give an overview of synoptic meteorology.
2. Be aware of the general circulation and different types of Air Masses.
3. To make aware of Monsoon, extra- tropical and tropical systems.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Remember various components of synoptic meteorology.	K1
2	Understand the air masses and their effect in governing the weather / climate.	K2
3	Understand the evolution and life cycle of Tropical and extra tropical systems.	K2
4	Apply the knowledge of synoptic Met to understand the Monsoon and its semi-permanent features.	K3
5	To understand the structure and genesis of Extra tropical cyclones.	K2

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate

Unit:1	INTRODUCTION TO SYNOPTIC METEROLOGY	13 hours

1. Introduction - Definition.
2. Evolution of synoptic map.
3. Wind system and Scale of atmospheric motion.

Unit:2	Air Masses	13 hours

1. Origin classification, Characteristics features, Movement, properties.
2. Types – Polar, mid latitude, Arctic, Equatorial. Modification.
3. Air Masses over India.
4. Tropical Continental, Tropical Maritime, Equatorial Maritime and Polar air masses over India. Polar Outbreak and cold wave conditions.

Unit:3	FRONTS AND EXTRA TROPICAL CYCLONES	13 hours

1. Definition and characteristics of Cold, Warm and Occluded fronts.
2. Extra tropical Cyclones - Extra Tropical Cyclones, Geographical distribution.
3. Cyclogenesis, Life cycles, Secondaries, Family anticyclones – types.

Unit:4	MONSOON	13 hours

1. Definition, Nature.
2. Mechanics.
3. Areas; Asiatic Monsoon.

Unit:5	INDIAN MONSOON	12 hours

1. SW Monsoon - Period, Pressure and Wind pattern, Areas affected Synoptic systems.
2. NE Monsoon - Period, Pressure and Wind pattern, Areas affected Synoptic systems.

Unit: 6	Contemporary Issues	2 hours
Experts lecture, online seminars - webinars		
	Total lecture hours /Semester	**66 hours**
Text Book (s)		
1.	Training Notes - Dept of Meteorology - AFAC.	
2.	Tropical Meteorology - GC Asnani Vol I & II.	
3.	SW Monsoon - YP Rao. IMD Publication.	
Reference Books		
1.	Compendium of Meteorology – WMO Publication Vol I – Synoptic Met.	
2.	A guide of Tropical forecasting - Maj Aitkinson.	
Related online contents		
	www.vayumandal.iaf.in	
	www.afac.iaf.in	
Course Designed By: Group Captain N Vinod Sankar, Wing Commander Anil, Faculty of Meteorology AFAC		

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	S	S	S	S	S	S	S
CO3	S	S	S	S	M	S	S	S	S	S
CO3	S	S	S	S	S	S	M	S	S	S
CO4	S	S	S	S	S	S	S	S	M	S
CO5	S	S	S	S	M	S	S	S	S	S

*S-Strong; M-Medium; L- Low

Course code	M4	PHYSICAL METEOROLOGY -I	L	T	P	C
Core		Composition of atmosphere, Radiation heat budget	3	1		4
Pre-requisite		Basic knowledge of atmosphere	Syllabus Version		20-21	

Course Objectives:

The main objectives of this course are to:

1. To give insight of the composition of the atmosphere.
2. Be aware of the effects of radiation on the Earth's atmosphere.
3. To make them understand the processes involved in maintaining the heat balance in Earth's atmosphere.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Remember the composition of earth's atmospheres.	K1
2	Understand the difference between solar and terrestrial radiation.	K2
3	Understand the mean heat balance of the earth.	K2
4	Apply the knowledge of Lapse rate to understand the development of clouds.	K4
5	Understand the various optical phenomenons in the atmosphere.	K2

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate

Unit:1	COMPOSITION OF ATMOSPHERE	13 hours

1. Composition of Atmosphere.
2. Different layer of Atmosphere.
3. Spatial distribution of elements of Atmosphere.

Unit:2	RADIATION	13 hours

1. Solar Radiation.
2. Terrestrial Radiation.
3. Diurnal variation.

Unit:3	MEAN HEAT BALANCE	13 hours

1. Water in the atmosphere.
2. Circulation of water in the atmosphere.
3. Humidity and vapour pressure.

Unit:4	STABILITY IN ATMOSPHERE	13 hours

1. Stability and Cloud Development.
2. Lapse Rate, DALR, SALR, ELR.
3. Stability / instability in the atmosphere and Topography.

Unit:5	OPTICAL PHENOMENA	12 hours

1. Rainbow, Mirage.
2. Halo, Corona.
3. Twinkling and Aurora.

Unit: 6	Contemporary Issues	2 hours
	Experts lecture, online seminars - webinars	
	Total lecture hours /Semester	66 hours

Text Book (s)	
1.	Training Notes. Dept of Meteorology - AFAC
2.	Physical Meteorology - Johnson.
3.	Meteorology- Understanding the atmosphere- S A Ackerman, John A Knox
Reference Books	
1.	Dynamical and Physical Met - Haltiner and Martin.
2.	Theoretical Meteorology – Hess
Related online contents	
	www.vayumandal.iaf.in
	www.afac.iaf.in

Course Designed By: Group Captain N Vinod Sankar, Wing Commander Anil, Faculty of Meteorology AFAC

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	M	S	S
CO3	S	S	S	M	S	S	S	S	S	S
CO3	M	S	S	S	S	S	S	S	S	S
CO4	S	M	S	S	S	S	S	S	S	S
CO5	S	S	S	S	S	S	M	S	S	S

*S-Strong; M-Medium; L- Low

Course code	M5	CLIMATOLOGY & STATISTICS	L	T	P	C
Core		Climatology and statistical method	3	1		4
Pre-requisite		Graduation in the field of Science, Engineering, Geography and Computer Application	Syllabus Version		20-21	

Course Objectives:

The main objectives of this course are to:

1. To give an overview of world climatology.
2. Be aware of the various statistical methods required for the formulation of world and Indian climatology.
3. To make aware of storm track Atlas.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Remember the world and Indian climatology.	K1
2	Understand the role of statistics in climatology.	K2
3	Understand the utilization of climatology as a tool for forecasting.	K2
4	Apply the various statistical methods for the formulation of climatology.	K4
5	Evaluate the measurement of climatic change with respect to time.	K5

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate

Unit:1	SCOPE OF CLIMATOLOGY	13 hours

1. Introduction to Climatology.
2. Climate control.
3. Climate variability.

Unit:2	CLIMATE CLASSIFICATION	13 hours

1. Climatic Classification.
2. World climatology.
3. Indian climatology.

Unit:3	CLIMATOLOGY OF TROPICAL/EXTRA TROPICAL STORMS	13 hours

1. Climatology of tropical storms over Indian Sea.
2. Climatology of extra tropical storms.

Unit:4	STATISTICS	13 hours

1. Statistics and its applicability in atmospheric science.
2. Collection and presentation of data.
3. Meteorological diagrams.

Unit:5	STATISTICAL METHODS	12 hours

1. Perfect prognosis methods (PPM)
2. Model output statistics (MOS)
3. Classical method.

Unit: 6	Contemporary Issues	2 hours
Experts lecture, online seminars - webinars		
	Total lecture hours /Semester	**66 hours**
Text Book (s)		
1.	WMO compendium of climatology.	
2.	An introduction to climate - Trewertha	
3.	Training notes Dept of Met, AFAC – Vol I	
Reference Books		
1.	Statistical methods – S P Gupta	
2.	Storm tracks atlas – India Met Dept publications.	
Related online contents		
	www.vayumandal.iaf.in	
	www.afac.iaf.in	
Course Designed By: Wing Commander (Dr) Anand S Awasthi, Wing Commander Anil, Faculty of Meteorology AFAC		
Mapping with Programme Outcomes		

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	M	S	S	S	S
CO3	S	S	S	M	S	S	S	S	S	S
CO3	S	S	S	S	S	S	S	M	S	S
CO4	S	S	S	S	S	S	M	S	S	S
CO5	S	S	S	S	S	S	S	S	S	M

*S-Strong; M-Medium; L- Low

Course code	M6	AVIATION METEOROLOGY	L	T	P	C
Core		Aviation weather codes and hazards	3	1		4
Pre-requisite		Basic knowledge of meteorological parameters	Syllabus Version		20-21	

Course Objectives:

The main objectives of this course are to:

1. To give insight of the procedures of observation and reporting in aviation meteorology.
2. Be aware of importance of the correct recording and dissemination of observations and weather codes.
3. To be aware of various aviation weather hazards in air and at ground.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Remember various aviation weather codes and their reporting procedures.	K1
2	Understand the procedure of measurement of various met parameters.	K2
3	Understand the coding and decoding of various aviation weather codes.	K2
4	Understand the various aviation weather hazards and their impact on flying occasions.	K2
5	Analyse the risk factors involved in particular type of aviation weather hazard.	K4

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate

Unit:1	**AVIATION WEATHER CODES**	**13 hours**

1. Aviation weather codes - 2004.
2. METAR, TREND AND TAF.

Unit:2	**MEASUREMENT OF PRESSURE**	**13 hours**

1. Pressure measurement.
2. Recording and coding procedure.

Unit:3	**MEASUREMENT OF VISIBILITY**	**13 hours**

1. Visibility measurement for aviation.
2. Recording and coding procedure.

Unit:4	**MEASUREMENT OF WINDS**	**13 hours**

1. Measurement of surface wind.
2. Recording and coding procedure.

Unit:5	**AERONAUTICAL DATA**	**12 hours**

1. Communication network for exchange of aeronautical data.
2. Air report(AIRREP)

Unit: 6	**Contemporary Issues**	**2 hours**
	Experts lecture, online seminars - webinars	
	Total lecture hours /Semester	**66 hours**

Text Book (s)

1.	Meteorology for Air Crew – IAP 3201
2.	Procedure for meteorological services in IAF 2002 Edition.
3.	Aviation weather codes - 2004

Reference Books	
1.	Manual on meteorological services for aviation in India .Edition 2005.
Related online contents	
	www.vayumandal.iaf.in
	www.afac.iaf.in

Course Designed By: Wing Commander (Dr) Anand S Awasthi, Wing Commander Anil, Faculty of Meteorology AFAC

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	M	S	S	S	S	S
CO3	S	S	S	S	S	S	S	S	S	M
CO3	M	S	S	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	M	S	S	S
CO5	S	S	S	S	S	M	S	S	S	S

*S-Strong; M-Medium; L- Low

Course code	M7	INSTRUMENTS AND OBSERVATIONAL PRACTICES	L	T	P	C
Core		Observations, plotting surface and upper air charts, Installation of met equipments.			4	4
Pre-requisite		Graduation in the field of Science, Engineering, Geography and Computer Application	Syllabus Version		20-21	

Course Objectives:

The main objectives of this course are to:

1. To give insight of the procedures of measurement of surface and upper air observations.
2. To make learn the plotting of surface and upper air charts.
3. To make them understand the installation, maintenance and inspection of met instruments.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Remember the procedure of observations.	K1
2	Understand the procedure of upper wind measurement and plotting.	K2
3	Apply the knowledge of pilot balloon observations for the computation of upper air winds.	K3
4	Apply the knowledge of met instruments for their installation, maintenance and inspection of met instruments.	K3
5	To evaluate the inspection schedule and standardization of met equipments.	K5

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate

Unit:1	MEASUREMENTS	13 hours

1. Surface observation.
2. Cloud observation.

Unit:2	PLOTTING	13 hours

1. Surface charts.
2. Upper air charts.

Unit:3	UPPER WIND MEASUREMENT	13 hours

1. Pilot balloon.
2. Radiosonde.

Unit:4	MET EQUIPMENT	13 hours

1. Installation procedure (Automatic weather station and Lightning Detection system).
2. Maintenance procedure (Automatic weather station and Lightning Detection system).

Unit:5	STANDARDISATION	12 hours

1. Inspection of individual instruments.
2. Calibration of individual instruments.
3. Standardisation of individual instruments.

Unit: 6	Contemporary Issues	2 hours
Experts lecture, online seminars - webinars		
	Total lecture hours /Semester	**66 hours**
Text Book (s)		
1.	Training Notes- Dept of Meteorology – AFAC , Vol - I.	
2.	Manual meteorology for air crew: IAP 3201.	
3.	Manual meteorology for air crew: IAP 3202.	
Reference Books		
1.	Technical manual of individual instruments.	
2.	Guide to Met instruments and methods of observation - WMO.	
Related online contents		
	www.vayumandal.iaf.in	
	www.afac.iaf.in	
Course Designed By: Wing Commander Anil, Wing Commander RP Patil, Faculty of Meteorology AFAC		

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	M	S	S	S	S
CO3	S	S	S	S	S	S	S	M	S	S
CO3	S	S	S	S	S	S	S	S	S	M
CO4	S	S	S	S	S	M	S	S	S	S
CO5	S	S	S	S	S	M	S	S	S	S

*S-Strong; M-Medium; L- Low

Second Semester

SEMESTER - II						
Course code	M8	**DYNAMIC MET -I**	**L**	**T**	**P**	**C**
Core		Dynamics, kinematics and mathematics	3	1		4
Pre-requisite		Graduation in the field of Science, Engineering, Geography and Computer Application	**Syllabus Version**		20-21	

Course Objectives:

The main objectives of this course are to:

1. To give insight of the mathematics and kinematics involved in atmospheric flow.
2. Be aware of the dynamics of atmospheric flow.
3. To make them understand the equation of motion and continuity.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Remember the equation of motion and continuity.	K1
2	Understand the difference between the different kinds of flow.	K2
3	Apply the knowledge of kinematics and dynamics to find out the areas of convergence and divergence.	K3
4	Analyse the horizontal and vertical variations of wind flow.	K4
5	Understand the Ageo- strophic flow.	K2

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate

Unit:1	**KINEMATICS**	**13 hours**

1. Kinematics of fluid flow.
2. Kinematics of pressure system.
3. The Bjerknes Holmboe theory.

Unit:2	**EQUATION OF MOTION**	**13 hours**

1. Newton law of motion.
2. Equation of motion in rotating coordinate system.
3. Equation of motion in spherical polar coordinate system.

Unit:3	**HORIZONTAL BALANCE FLOW**	**13 hours**

1. Classification of flow patterns.
2. Ageostrophic wind.

Unit:4	**VERTICAL VARIATION OF WIND**	**13 hours**

1. Thermal wind and thermal advection.
2. Thermal wind and relative stability.
3. Application of thermal wind.
4. Barotrophic and Baroclinic atmosphere.

Unit:5	EQUATION OF CONTINUITY	12 hours
1. Mass divergence form. 2. Velocity divergence form.		
Unit: 6	**Contemporary Issues**	**2 hours**
Experts lecture, online seminars - webinars		
	Total lecture hours /Semester	**66 hours**
Text Book (s)		
1.	Dynamic Meteorology – Dept of Met –Vol I	
2.	An introduction to Dynamic meteorology – JR Holton.	
3.	Dynamic and Physical meteorology – Haltiner & Martin	
Reference Books		
1.	Weather analysis and forecasting – S Petterson.	
2.	Compendium of Meteorology Vol I – WMO publication	
3.	Elements of Dynamic Meteorology - Gordon	
Related online contents		
	www.vayumandal.iaf.in	
	www.afac.iaf.in	
Course Designed By: Group Captain N Vinod Sankar, Wing Commander RP Patil, Faculty of Meteorology AFAC		

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	M	S	S	S	S
CO3	S	S	S	S	S	S	S	S	S	M
CO3	S	S	S	S	M	S	S	S	S	S
CO4	S	S	S	S	S	S	S	M	S	S
CO5	S	S	S	M	S	S	S	S	S	S

*S-Strong; M-Medium; L- Low

Course code	M9	SYNOPTIC METEOROLOGY II	L	T	P	C
Core		General circulation, Tropical Meteorology and ITCZ	3	1		4
Pre-requisite		Graduation in the field of Science, Engineering, Geography and Computer Application	Syllabus Version		20-21	

Course Objectives:

The main objectives of this course are to:

1. To give an overview of synoptic meteorology.
2. Be aware of the general circulation and different types of Circulation models.
3. To make aware of ITCZ.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Understand the concept of synoptic meteorology.	K2
2	Understand the general circulation.	K2
3	Apply the knowledge to differentiate between different models of general circulation.	K3
4	Apply the knowledge of Tropical Meteorology to understand ITCZ.	K3
5	Analyse the movement and structure of ITCZ.	K4

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate

Unit:1	GENERAL CIRCULATION	13 hours

1. Scales of atmospheric motion.
2. Longitudinally averaged and varying flow.
3. Meridional Distribution of temperature and winds.

Unit:2	CONSTRAINTS ON THEORIES OF GENERAL CIRCULATION	13 hours

1. Law of conservation of heat.
2. Law of conservation of angular momentum.
3. Law of conservation of mass.
4. Law of conservation of moisture.

Unit:3	MODELS OF GENERAL CIRCULATION	13 hours

2. The classical model.
2. Fletcher model of general circulation.
3. Asnani model of general circulation.

Unit:4	TROPICAL METEOROLOGY	13 hours

1. Introduction to Tropical meteorology.
2. Tropical systems.
3. Interaction between mid – latitude and tropical systems.

Unit:5	ITCZ	12 hours
1. Inter Tropical Convergence Zone (ITCZ). 2. Structure and movement of ITCZ. 3. Weather associated with ITCZ.		
Unit: 6	**Contemporary Issues**	**2 hours**
Experts lecture, online seminars - webinars		
	Total lecture hours /Semester	**66 hours**
Text Book (s)		
1.	Synoptic Met – Dept of Met –AFAC, Vol -II.	
2.	Tropical Meteorology – GC Asnani Vol I &II	
3.	Mesoscale atmospheric circulation – BW Aitkinson.	
Reference Books		
1.	Compendium of meteorology – WMO publication Vol I – Synoptic Met	
2.	Tropical Meteorology - Reihl.	
Related online contents		
	www.vayumandal.iaf.in	
	www.afac.iaf.in	
Course Designed By: Group Captain N Vinod Sankar, Wing Commander Anil, Faculty of Meteorology AFAC		

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	M	S	S	S	S	S
CO3	S	S	S	S	S	S	S	S	S	M
CO3	M	S	S	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	M	S	S	S
CO5	S	S	S	S	S	M	S	S	S	S

*S-Strong; M-Medium; L- Low

Course code	M10	SATELLITE METEOROLOGY	L	T	P	C
Core		Remote sensing, radiation laws and interpretation of cloud images	3	1		4
Pre-requisite		Basic fundamentals of radiations and radiometry.	Syllabus Version		20-21	

Course Objectives:

The main objectives of this course are to:

1. To give insight of the procedures of radiometry.
2. Be aware of importance of satellite cloud imageries.
3. To make them learn the procedure of interpretation of satellite imageries.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Remember various imageries and products of Meteorological satellite.	K1
2	Understand the principle behind the interpretation of different satellite imageries.	K2
3	Understand the fundamentals of remote sensing.	K2
4	Apply the knowledge of Cloud interpretation for cloud classification.	K3
5	Analyse the structure and type of clouds by interpretation of satellite imagery.	K4

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate

Unit:1	INTRODUCTION TO REMOTE SENSING	18 hours

1. Evolution of satellite Meteorology.
2. Types of Meteorological satellite.
3. Orbits for Meteorological satellite.
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Unit:2	RADIATIONS	18 hours

1. Atmospheric radiations.
2. Radiation laws.
3. Electromagnetic energy.

Unit:3	FUNDAMENTALS OF RADIOMETRY	18 hours

1. Absorption and emission by the atmosphere.
2. General characteristics of visible imagery.
3. General characteristics of infra-red imagery.
4. General characteristics of water vapour imagery.

Unit:4	SATELLITE CLOUD IMAGERIES	18 hours

1. Interpretation of satellite cloud imageries.
2. Processing of satellite cloud imageries.
3. Limitations in the interpretation of satellite cloud imageries.

Unit:5	CLASSIFICATION OF CLOUDS	17 hours

1. Atlas of cloud types, cloud formations and underlying surfaces.
2. Meso-scale cloud patterns and forms.
3. Sub synoptic cloud patterns.

Unit: 6	Contemporary Issues	2 hours
Experts lecture, online seminars - webinars		
	Total lecture hours /Semester	**91 hours**
Text Book (s)		
1.	Satellite Met – Dept of Met –AFAC, Vol -I.	
2.	Images in weather forecasting – Badder MJ., et.al.	
3.	Satellite Meteorology an introduction – Stanley Q Kidder & Thomas H Vondar Haar.	
Reference Books		
1.	The use of satellite pictures in weather analysis and forecasting: WMO technical note No.124	
2.	Fundamental of remote sensing – George Joseph.	
3.	Satellite Meteorology – RR Kelkar	
Related online contents		
	www.vayumandal.iaf.in	
	www.afac.iaf.in	
Course Designed By: Wing Commander Anil, Wing Commander (Dr) Anand S Awasthi, Faculty of Meteorology AFAC		
Mapping with Programme Outcomes		

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	M	S	S	S	S	S
CO3	S	S	S	S	S	S	S	S	S	M
CO3	M	S	S	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	M	S	S	S
CO5	S	S	S	S	S	M	S	S	S	S

*S-Strong; M-Medium; L- Low

Course code	M11	CLIMATOLOGY AND STATISTICS II	L	T	P	C
Core		Physical Climatology, Regional climatology ,Local climatology and theoretical distribution	3	1		4
Pre-requisite		Graduation in the field of Science, Engineering, Geography and Computer Application	Syllabus Version		20-21	

Course Objectives:

The main objectives of this course are to:

1. To give an overview on physical climatology.
2. Be aware of large scale effects of surface boundary on climatology.
3. To make aware different types of climatology and statistical analysis.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Remember the local and regional climatology.	K1
2	Understand the large scale effects of surface boundary on climatology.	K2
3	Understand the theory of probability and their role in calculation of climatology.	K2
4	Apply the knowledge of theoretical distribution to understand the climatology of an area.	K3
5	Evaluate the correlation and regression between different Met parameters.	K5

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate

Unit:1	PHYSICAL CLIMATOLOGY	18 hours

1. Introduction to physical climatology.
2. Local climatology and regional climatology.

Unit:2	THEORY OF PROBABILITY	18 hours

1. Discrete and continuous distribution.
2. Binomial distribution.
3. Poisson distribution.
4. Gaussian/normal distribution.

Unit:3	CORRELATION ANALYSIS	18 hours

1. Meaning and significance.
2. Background error correlations.
3. Karl Pierson's Correlation coefficient.

Unit:4	REGRESSION ANALYSIS	18 hours

1. Important characteristics of regression analysis.
2. Regression equation for straight line.
3. Regression equation for parabola.
4. Standard Error of Estimate (SEE).

Unit:5	REGRESSION EQUATION FOR TWO OR MORE VARIABLES	17 hours
1. Curve fitting. 2. Interpolation. 3. Interpolants. 4. Linear and Quadrant interpolation.		
Unit: 6	**Contemporary Issues**	**2 hours**
Experts lecture, online seminars – webinars		
	Total lecture hours /Semester	**91 hours**
Text Book (s)		
1.	Training Notes. Dept of Meteorology – AFAC, Vol II	
2.	Climatology of south Asia – GB Pant and K Rupa Kumar	
3.	Statistical methods – SP Gupta.	
Reference Books		
1.	WMO Compendium on climatology.	
2.	Statistical methods in the atmospheric sciences – Wilks Daniel S.	
Related online contents		
	www.vayumandal.iaf.in	
	www.afac.iaf.in	
Course Designed By: Wing Commander (Dr) Anand S Awasthi, Wing Commander Anil, Faculty of Meteorology AFAC		
Mapping with Programme Outcomes		

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	M	S	S	S	S	S
CO3	S	S	S	S	S	S	S	S	S	M
CO3	M	S	S	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	M	S	S	S
CO5	S	S	S	S	S	M	S	S	S	S

*S-Strong; M-Medium; L- Low

Course code	M12	AVAITION METEOROLOGY – II	L	T	P	C
Core		Altimetry, Current weather observations, Aircraft Observations and Reporting, Aviation Forecast, warnings and Thunderstorms.	3	1		4
Pre-requisite		Basic knowledge of aviation meteorology.	Syllabus Version		20-21	

Course Objectives:

The main objectives of this course are to:

1. To give insight altimetry, aviation forecast and warnings.
2. Be aware of the importance of accurate and timely issue of weather warnings.
3. To be aware of Thunderstorms and its effect on air operations.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Remember the criteria's of weather warnings.	K1
2	Understand the aviation forecast and its role in making safe air operations.	K2
3	Understand the importance of Aircraft observations and reporting.	K2
4	Apply the knowledge of altimetry to avoid erroneous observations.	K3
5	Analyse the aviation weather hazards associated with thunderstorm on air operations.	K4

K1 – Remember; **K2** – Understand; **K3** – Apply; **K4** – Analyze; **K5** – Evaluate

Unit:1	ALTIMETRY	18 hours

1. D value, pressure altimeter.
2. Instrumental errors and error due to pressure & temperature variation.
3. Pressure altitude and altimeter correction.
4. Altimeter settings.

Unit:2	CURRENT WEATHER OBSERVATIONS	18 hours

1. Ground station observations.
2. Aircraft observations and reporting.
3. Categories of observations and reports.

Unit:3	AVIATION FORECAST	18 hours

1. Local/area forecast.
2. Landing and takeoff type forecast.
3. Terminal aerodrome forecast.
4. Route forecast.

Unit:4	WARNINGS	18 hours

1. Cautionary Met reports.
2. Weather/gale warnings.

3. Sector warnings.		
Unit:5	**THUNDERSTORM**	**17 hours**
1. Life cycle of thunderstorms. 2. Types of Thunderstorms. 3. Aviation weather hazards.		
Unit: 6	**Contemporary Issues**	**2 hours**
Experts lecture, online seminars – webinars		
	Total lecture hours /Semester	**91 hours**
Text Book (s)		
1.	Meteorology for Air Crew – IAP 3201	
2.	Procedure for IAF meteorological services - IAP 3202	
3.	Aviation weather codes – 2004	
Reference Books		
1.	ICAO publication – Annex 3.	
2.	Aviation meteorology – HMSO publication 1960	
Related online contents		
	www.vayumandal.iaf.in	
	www.afac.iaf.in	
Course Designed By: Wing Commander (Dr) Anand S Awasthi, Wing Commander RP Patil, Faculty of Meteorology AFAC		
Mapping with Programme Outcomes		

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	M	S	S	S	S	S
CO3	S	S	S	S	S	S	S	S	S	M
CO3	M	S	S	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	M	S	S	S
CO5	S	S	S	S	S	M	S	S	S	S

*S-Strong; M-Medium; L- Low

Course code	M13	INSTRUMENTS AND OBSERVATIONAL PRACTICES	L	T	P	C
Core		Observations, plotting surface and upper air charts, Installation of met equipments.			4	4
Pre-requisite		Graduation in the field of Science, Engineering, Geography and Computer Application.	Syllabus Version		20-21	

Course Objectives:

The main objectives of this course are to:

1. To give insight of the procedures of measurement of surface and upper air observations.
2. To make learn the plotting of surface and upper air charts.
3. To make them understand the installation, maintenance and inspection of met instruments.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Remember the procedure of observations.	K1
2	Understand the procedure of upper wind measurement and plotting.	K2
3	Apply the knowledge of pilot balloon observations for the computation of upper air winds.	K3
4	Apply the knowledge of met instruments for their installation, maintenance and inspection of met instruments.	K3
5	To evaluate the inspection schedule and standardization of met equipments.	K5

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate

Unit:1	MEASUREMENTS	18 hours

1. Surface observation.
2. Cloud observation.

Unit:2	PLOTTING	18 hours

1. Surface charts.
2. Upper air charts.

Unit:3	UPPERWIND MEASUREMENT	18 hours

1. Pilot balloon.
2. Radiosonde.

Unit:4	MET EQUIPMENT	18 hours
1. Installation procedure (Multi spectral microwave radiometer and High resolution picture transmission) 2. Maintenance procedure (Multi spectral microwave radiometer and High resolution picture transmission)		
Unit:5	**STANDARDISATION**	**17 hours**
1. Inspection of individual instruments. 2. Calibration of individual instruments. 3. Standardisation of individual instruments.		
Unit: 6	**Contemporary Issues**	**2 hours**
Experts lecture, online seminars - webinars		
	Total Lecture Hours /Semester	**91 hours**
Text Book (s)		
1.	Training Notes-Dept of Meteorology – AFAC , Vol - I.	
2.	Manual meteorology for air crew: IAP 3201.	
3.	Manual meteorology for air crew: IAP 3202.	
Reference Books		
1.	Technical manual of individual instruments.	
2.	Guide to Met instruments and methods of observation - WMO.	
Related online contents		
	www.vayumandal.iaf.in	
	www.afac.iaf.in	
Course Designed By:, Wing Commander RP Patil, Wing Commander (Dr) Anand S Awasthi, Wing Commander Anil, Faculty of Meteorology AFAC		

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	M	S	S	S	S	S
CO3	S	S	S	S	S	S	S	S	S	M
CO3	M	S	S	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	M	S	S	S
CO5	S	S	S	S	S	M	S	S	S	S

*S-Strong; M-Medium; L- Low

Course code	M14	APPLIED METEOROLOGY AND LAB PRACTICES	L	T	P	C
Core		Daily map discussion, satellite interpretation, installation and running of NWP model			4	4
Pre-requisite		Basic knowledge of meteorology	Syllabus Version		20-21	

Course Objectives:

The main objectives of this course are to:

1. To give hands on practice for the installation and running of NWP model.
2. Be aware of the procedure of conducting daily map discussion and satellite interpretation.
3. To built an ability for the installation of various modern met equipments.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Remember the procedure of downloading satellite images and their interpretation.	K1
2	Remember the installation procedure of modern met equipments.	K1
3	Remember the installation, running and troubleshooting of NWP models.	K1
4	Understand the various parameterisations scheme used in NWP models.	K2
5	Analyse the forecast given by NWP models.	K4

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate

Unit:1	MODEL METEORLOGICAL EQUIPMENT	13 hours

1. Automatic weather station (AWS)
2. Multi spectral microwave radiometer (MWR)
3. High resolution picture transmission (HRPT)
4. Lightning detector system (LDS)

Unit:2	MAINTENANCE	13 hours

1. First line maintenance.
2 .Fault reporting and troubleshooting of the equipments.

Unit:3	METEOROLOGICAL PARAMETERS	13 hours

1. Calculation of meteorological parameters using meteorological software.
   (a) TECAN
   (b) GrADS

Unit:4	POLICIES ON EQUIPMENT,PUBLICATION	13 hours

1. 01/10 Technical circular: AWS &CEILOMETER
2. 02/15 Technical circular: MWR
3. 03/15 Technical circular: LDS

Unit: 5	ADMINISTRATION METEOROLOGICAL OFFICE IAF	12 hours

1. Air force Met services, Command Met section and Unit Met section.
2. Met publication and inventory, Management of Met library.
3. Write-off and loss of Met publications.

Unit: 6	Contemporary Issues	2 hours
Experts lecture, online seminars - webinars		
	Total lecture hours /Semester	**66 hours**
Text Book (s)		
1.	Manuals of AWS, LDS, HRPT and MWR.	
2.	Procedure for meteorological services in IAF 2002 Edition.	
Reference Books		
1.	Policy Letter and Met services instructions by Air Headquarters: IAF.	
Related online contents		
	www.vayumandal.iaf.in	
	www.afac.iaf.in	
Course Designed By: Group Captain N Vinod Sankar, Wing Commander Anil, Faculty of Meteorology AFAC		

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	M	S	S	S	S	S
CO3	S	S	S	S	S	S	S	S	S	M
CO3	M	S	S	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	M	S	S	S
CO5	S	S	S	S	S	M	S	S	S	S

*S-Strong; M-Medium; L- Low

Third Semester

SEMESTER III						
Course code	M15	**DYNAMIC MET II**	**L**	**T**	**P**	**C**
Core		Vorticity theorem , Development theorem ,Quasi- geostrophic theory, Atmospheric waves and Cumulus dynamics.	4	2		6
Pre-requisite		Graduation in the field of Science, Engineering, Geography and Computer Application	**Syllabus Version**		20-21	

Course Objectives:

The main objectives of this course are to:

1. To give insight of the intensification and development of extra-tropical systems.
2. To make learn the role of dynamics in development of systems.
3. To make them understand the cumulus dynamics.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Remember the role of vorticity to find the areas of convergence and divergence in a system.	K1
2	Understand the role of vorticity in development of synoptic scale weather system, especially in Met latitude westerly flow region.	K2
3	Apply the knowledge of Quasi-geostrophic models to treat the atmosphere in more realistic manner.	K3
4	Apply the knowledge of dynamic equations for cumulus convection.	K3
5	To understand the significance / importance of Planetary Boundary Layer (PBL).	K5

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate

Unit:1	**VORTICITY AND VORTICTY THEOREM**	**18 hours**

1. Circulation and vorticity.
2. Relation between circulation and vorticity.
3. Vorticity theorem in pressure coordinate system.
4. Applications of simplified vorticity theorem.

Unit:2	**DEVELOPMENT THEORY**	**18 hours**

1. Sutcliffe's Development Theory.
2. Pettersson's Development Theory.

Unit:3	**QUASI-GEOSTROPHIC THEORY**	**18 hours**

1. Quasi-geostrophic models: Barotropic Model.
2. Quasi-geostrophic models: Equivalent Barotropic Model.
3. Quasi-geostrophic models: Baroclinic Model.

Unit:4	**TROPICAL CONVECTION AND CUMULUS DYNAMICS**	**18 hours**

1. Tropical Motion Systems.
2. Scale analysis of tropical systems.
3. Dynamic Equation for Cumulus Convection.

Unit:5	**CONVECTIVE CLOUDS**	**17 hours**

1. Convective Available Potential Energy (CAPE) and Convective Inhibition (CIN).
2. Importance of vertical wind shear.

3. Development and Dynamical Consequences of rotation in super cells.		
Unit: 6	**Contemporary Issues**	**2 hours**
Experts lecture, online seminars - webinars		
	Total lecture hours /Semester	**91 hours**
Text Book (s)		
1.	Dynamic Meteorology – Faculty of Met –Vol II	
2.	An introduction to Dynamic meteorology – JR Holton.	
3.	Dynamic and Physical meteorology – Haltiner & Martin	
Reference Books		
1.	Weather analysis and forecasting – S Petterson.	
2.	Compendium of Meteorology Vol I – WMO publication	
3.	Elements of Dynamic Meteorology - Gordon	
Related online contents		
	www.vayumandal.iaf.in	
	www.afac.iaf.in	
Course Designed By: Wing Commander RP Patil, Wing Commander Anil, Faculty of Meteorology AFAC		

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**	**S**
CO3	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**M**
CO3	**M**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**
CO4	**S**	**S**	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**
CO5	**S**	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**

*S-Strong; M-Medium; L- Low

SEMESTER - III						
Course code	M16	**SATELLITE METEOROLOGY -II**	**L**	**T**	**P**	**C**
Core		Estimation of meteorological parameters, cloud systems and Topographically induced cloud patterns	4	2		6
Pre-requisite		Basic knowledge of satellite meteorology.	**Syllabus Version**		20-21	

Course Objectives:

The main objectives of this course are to:

1. To give insight about the retrievals of Met parameters.
2. Be aware of the importance of the various active and passive sensors onboard of the Met satellites.
3. To be aware of patterns associated with clouds seen in satellite images.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Remember the different types of Met sensors onboard on Met satellite.	K1
2	Understand the principle behind atmospheric sounding.	K2
3	Understand the importance of retrievals of Met parameters.	K2
4	Apply the knowledge of satellite meteorology for identification of clouds.	K3
5	Analyse and locate jet streams from satellite imageries.	K4

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate

Unit:1	**RETREIVAL OF METEOROLOGICAL PARAMETERS**	**18 hours**

1. Sounding theories and retrieval methods.
2. Operational retrievals.
3. Future developments in satellite soundings.

Unit:2	**IDENTIFICATION OF WEATHER FEATURES**	**18 hours**

1. Cloud types.
2. Meso-scale, Sub-synoptic scale and Synoptic scale cloud patterns.
3. Jet stream associated with large amplitude trough.

Unit:3	**OUTFLOW BOUNDARY AND ORGANISED MESO-SCALE SYSTEM**	**18 hours**

1. Convective storm out flow and ARC clouds.
2. Meso-scale convective systems.
3. Meso-scale convective complexes.

Unit:4	**CONVECTION ASSOCIATED WITH SEA AND LAND BREEZE**	**18 hours**

1. Convection associated with sea breeze.
2. Convection associated with land breeze.

Unit:5	GLOBAL MET SATELLITE OBSERVATION SYSTEM	17 hours
1. Operational geostationary satellite. 2. Meteorological polar orbital satellite. 3. GPM (Global precipitation measurement) core observatory, The A-Train.		
Unit: 6	**Contemporary Issues**	**2 hours**
Experts lecture, online seminars - webinars		
	Total lecture hours /Semester	**91 hours**
Text Book (s)		
1.	Satellite meteorology Vol II – Met Dept- AFAC	
2.	Images in weather forecasting – Badder MJ., et.al.	
3.	Fundamental of remote sensing – George Joseph	
Reference Books		
1.	Satellite meteorology an introduction – Stanley Q Kidder & Thomas H Vondar Haar.	
2.	The use of satellite pictures in weather analysis and forecasting : WMO	
Related online contents		
	www.vayumandal.iaf.in	
	www.afac.iaf.in	
Course Designed By: Wing Commander Anil, Wing Commander (Dr) Anand S Awasthi, Faculty of Meteorology AFAC		

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	M	S	S	S	S	S
CO3	S	S	S	S	S	S	S	S	S	M
CO3	M	S	S	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	M	S	S	S
CO5	S	S	S	S	S	M	S	S	S	S

*S-Strong; M-Medium; L- Low

Course code	M17	PHYSICAL METEOROLOGY II	L	T	P	C
Core		Atmospheric stability, cloud physics, Atmospheric electricity, radar meteorology, Ocean-Atmospheric system and Seismology.	4	2		6
Pre-requisite		Basic knowledge of Physical meteorology.	Syllabus Version		20-21	

Course Objectives:

The main objectives of this course are to:

1. To give an overview of atmospheric stability.
2. Be aware of the working principles of weather radar meteorology.
3. To make aware of atmospheric electricity and Seismology.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Remember various types of atmospheric stability.	K1
2	Understand the cloud physics.	K2
3	Understand the effect of atmospheric electricity.	K2
4	Apply the knowledge of radar meteorology for tracking and prediction of weather.	K3
5	Analyse the effect of ocean and atmospheric interaction.	K4

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** – Evaluate

Unit:1	ATMOSPHERIC STABILITY	18 hours

1. Thermodynamics of dry air.
2. Vapour pressure, relative humidity, perceptible water, dew point and wet bulb temperature.
3. Virtual temperature, potential temperature, equivalent temperature and equivalent potential temperature.
4. Latent instability and convective instability.

Unit:2	CLOUD PHYSICS	18 hours

1. Sources and sinks of atmospheric aerosols.
2. Formation of cloud droplets.
3. Formation of warm clouds.
4. Formation of cool clouds.

Unit:3	ATMOSPHERIC ELECTRICITY	18 hours

3. Historical prospective of electricity.
2. Fair weather electric field of atmospheric.
3. Thunderstorm electricity.

Unit:4	PHYSICAL OCEANOGRAPHY AND SEISMOLOGY	18 hours

1. Ocean circulation and currents.
2. Introduction to seismology.
3. Earthquake waves and Tsunami.

Unit:5	RADAR METEOROLOGY	17 hours
1. Basic theory of convectional weather radars. 2. Interpretation of Doppler weather radar products. 3. Application of weather radar and weather forecasting.		
Unit: 6	**Contemporary Issues**	**2 hours**
Experts lecture, online seminars – webinars		
	Total lecture hours /Semester	**91 hours**
Text Book (s)		
1.	Physical meteorology Vol II - Dept Met – AFAC	
2.	Cloud physics - Rogers	
3.	Radar meteorology - Batten	
Reference Books		
1.	Physical meteorology - Johnson	
2.	Upper atmosphere and waves – Tom Beer	
Related online contents		
	www.vayumandal.iaf.in	
	www.afac.iaf.in	
Course Designed By: Group Captain N Vinod Sankar, Wing Commander Anil, Faculty of Meteorology AFAC		
Mapping with Programme Outcomes		

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	M	S	S	S	S	S
CO3	S	S	S	S	S	S	S	S	S	M
CO3	M	S	S	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	M	S	S	S
CO5	S	S	S	S	S	M	S	S	S	S

*S-Strong; M-Medium; L- Low

Course code	M18	NUMERICAL WEATHER PREDICTION	L	T	P	C
Core		NWP model structure, dynamics in NWP model, parametraisiation and processes in NWP models, data assimilation and model assessment tools.	4	2		6
Pre-requisite		Graduation in the field of Science, Engineering, Geography and Computer Application	Syllabus Version		20-21	

Course Objectives:

The main objectives of this course are to:

1. To give insight of numerical weather prediction models.
2. Be aware of importance of the NWP in short, medium and long term forecasting.
3. To make them learn the installation and running of NWP models.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Remember various NWP models.	K1
2	Understand the requirement of NWP in forecasting.	K2
3	Understand the coding and processes involved in NWP.	K2
4	Apply the knowledge of parameterization for changing the NWP schemes.	K3
5	Evaluate and measure the errors in NWP models forecast with the help of model assessment tools.	K5

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate

Unit:1	MODEL STRUCTURE	18 hours

1. Components of NWP models.
2. Types of NWP models.
3. Dynamics in NWP models.

Unit:2	RESOLUTION	18 hours

1. Vertical resolution.
2. Vertical coordinates.
3. Horizontal resolution.

Unit:3	PARAMETRAISIATION AND PROCESSES IN NWP MODELS	18 hours

1. Physical processes in nature.
2. Parameterising physical processes.
3. Model simulation of PBL.

Unit:4	VISUALISATION SOFTWARE	18 hours

1. Post-processing process.

2. Overview of Grid Analysis and Display System.		
Unit:5	**APPLICATION AND LIMITATION OF NWP PRODUCTS**	**17 hours**
1. Global forecast system (GFS). 2. Operational impacts. 3. Boundary conditions for atmospheric models. 4. Quality control and data preparation.		
Unit: 6	**Contemporary Issues**	**2 hours**
Experts lecture, online seminars - webinars		
	Total lecture hours /Semester	**91 hours**
Text Book (s)		
1.	Numerical weather prediction Vol I - Met Dept – AFAC	
2.	Numerical weather prediction Vol II - Met Dept – AFAC	
3.	Numerical weather prediction - Haltiner GJ	
Reference Books		
1.	Numerical weather prediction and dynamic meteorology – Haltiner and Williams	
2.	An introduction to Numerical weather prediction techniques – Krishnamurthy TN and Bounoua L.	
Related online contents		
	www.vayumandal.iaf.in	
	www.afac.iaf.in	
Course Designed By: Wing Commander (Dr) Anand S Awasthi, Wing Commander Anil, Faculty of Meteorology AFAC		
Mapping with Programme Outcomes		

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	M	S	S	S	S	S
CO3	S	S	S	S	S	S	S	S	S	M
CO3	M	S	S	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	M	S	S	S
CO5	S	S	S	S	S	M	S	S	S	S

*S-Strong; M-Medium; L- Low

Course code	M19	**AVIATION METEOROLOGY - III**	**L**	**T**	**P**	**C**
Core		Flight procedures/briefings, Operations of aircraft, Special weather phenomena, Special aviation observations and Aeronautical Climatology	4	2		6
Pre-requisite		Basic knowledge of aviation meteorology	**Syllabus Version**		20-21	

Course Objectives:

The main objectives of this course are to:

1. To give insight of the procedures of observation and reporting in aviation meteorology.
2. Be aware of importance of the flight procedures and briefings.
3. To be aware of various special aviation observations and their impact on air operations.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Remember various flight briefings and flight procedures.	K1
2	Understand the role of accurate briefings in air operations.	K2
3	Understand the use of Aircraft observations and reporting in briefings.	K2
4	Apply the knowledge of aeronautical meteorology in air operations.	K3
5	Evaluate the aviation weather hazards associated with special weather phenomena.	K5

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate

Unit:1	**FLIGHT PROCEDURE / BREIFINGS**	**18 hours**

1. Pre-flight information.
2. Met briefing for cross country flights.
3. Briefing for VIP/VVIP flights.

Unit:2	**OPERATIONS OF AIRCRAFT**	**18 hours**

1. Introduction to aircraft operation.
2. Importance of various meteorological elements in aviation.
3. Importance of weather in various types of air operations.

Unit:3	**SPECIAL WEATHER PHENOMENA**	**18 hours**

1. Thunderstorms.
2. Dust storms.
3. Clear Air Turbulence (CAT).

Unit:4	**AVIATION WEATHER FORECASTS**	**18 hours**

1. Terminal Aerodrome Forecast.
2. Local and Area forecast.
3. Route forecast.
4. Landing and Takeoff forecast.

Unit:5	**AIR TRAFFIC SERVICES**	**17 hours**

1. Evolution of air traffic services. 2. Operation of air traffic control services.		
Unit: 6	**Contemporary Issues**	**2 hours**
Experts lecture, online seminars - webinars		
	Total lecture hours /Semester	**91 hours**
Text Book (s)		
1.	Meteorology for Air Crew – IAP 3201	
2.	Procedure for IAF meteorological services - IAP 3202	
3.	Aviation weather codes - 2004	
Reference Books		
1.	ICAO publication – Annex 3.	
2.	Aviation meteorology – HMSO publication 1960	
Related online contents		
	www.vayumandal.iaf.in	
	www.afac.iaf.in	
Course Designed By: Wing Commander (Dr) Anand S Awasthi, Wing Commander Anil, Faculty of Meteorology AFAC		

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	S	S	S
CO3	S	S	S	S	M	S	S	S	S	S
CO3	S	S	S	S	S	S	M	S	S	S
CO4	S	S	S	M	S	S	S	S	S	S
CO5	S	S	S	S	S	S	S	S	S	S

*S-Strong; M-Medium; L- Low

Fourth Semester

SEMESTER IV						
Course code	M20	**ANALYSIS AND PROGNOSIS**	**L**	**T**	**P**	**C**
Core		Analysis and prognosis of charts			6	6
Pre-requisite		Basic knowledge of Aviation meteorology	**Syllabus Version**		20-21	

Course Objectives:

The main objectives of this course are to:

1. To give hands on training for plotting of charts.
2. To enhance the skill of analysis of charts.
3. To make students understand the process of prognosis of the systems analysed on surface and upper air charts.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Plot the surface and upper air charts.	K3
2	Analyse the surface and upper air charts.	K4
3	Prognosticate the systems on analysed surface and upper air charts.	K3
4	Apply the knowledge of prognosticated systems for weather forecasting.	K3
5	Understand the various limitations of analysis of charts.	K2

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate

Unit:1	**SURFACE CHARTS**	**18 hours**

1. Plotting.
2. Analysis.
3. Prognosis.

Unit:2	**UPPER AIR CHARTS**	**18 hours**

1. Plotting.
2. Analysis.
3. Prognosis.

Unit:3	**AUXILARY CHARTS**	**18 hours**

1. Plotting.
2. Analysis.
3. Prognosis.

Unit:4	**SATELLITE INTERPRETATION**	**18 hours**

1. Image and products downloading.
2. Area selection.
3. Use of RAPID software.

Unit:5	SCIENTIFIC REVEIW	17 hours
1. Selection of scientific papers. 2. Presentations. 3. Critical appreciation.		
Unit: 6	**Contemporary Issues**	**2 hours**
Experts lecture, online seminars - webinars		
	Total lecture hours /Semester	**91 hours**
Text Book (s)		
1.	Analysis and Prognosis - Dept of Meteorology - AFAC	
Reference Books		
1.	Weather analysis and forecasting – S Petterssen (Vol I)	
2.	Images in weather forecasting – Bader et.al.	
Related online contents		
	www.vayumandal.iaf.in	
	www.afac.iaf.in	
Course Designed By: Group Captain N Vinod Sankar, Wing Commander Anil, Faculty of Meteorology AFAC		

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	M	S	S	S	S	S
CO3	S	S	S	S	S	S	S	S	S	M
CO3	M	S	S	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	M	S	S	S
CO5	S	S	S	S	S	M	S	S	S	S

*S-Strong; M-Medium; L- Low

Course code	M21	PROJECT WORK	L	T	P	C
Core		Dynamic meteorology ,synoptic meteorology, physical meteorology , climatology, aviation meteorology and NWP			22	22
Pre-requisite		Graduation in the field of Science, Engineering, Geography and Computer Application	Syllabus Version		20-21	

Course Objectives:

The main objectives of this course are to:

1. To give an overview of research in meteorology.
2. Be aware of the various statistical methods required for the formulation of world and Indian climatology.
3. To inculcate the habit of research in the field of meteorology.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Remember the research methodology.	K1
2	Understand the role of research work in meteorology.	K2
3	Understand the utilization of research outcomes as a tool for forecasting.	K2
4	Apply the various research methods for the finding new elements/ parameters for weather forecasting in meteorology.	K3
5	Evaluate the measurement of climatic change with respect to time.	K5

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate

Unit:1	PROJECT WORK	357 hours
	Total lecture hours /Semester	357 hours

Course Designed By : Group Captain N Vinod Sankar, Wing Commander (Dr) Anand S Awasthi, Wing Commander Anil, Faculty of Meteorology AFAC

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	M	S	S	S	S	S
CO3	S	S	S	S	S	S	S	S	S	M
CO3	M	S	S	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	M	S	S	S
CO5	S	S	S	S	S	M	S	S	S	S

*S-Strong; M-Medium; L- Low

Annexure

M Sc. (Meteorology)

Syllabus
(With effect from July 2021)

Program Code : M. Sc.(Meteorology)

FACULTY OF METEOROLOGY
AIR FORCE ADMINISTRATIVE COLLEGE
Bharathiar University
(A State University, Accredited with "A"Grade by NAAC and 13th Rank among Indian Universities by MHRD-NIRF)
Coimbatore 641 046, INDIA

BHARATHIAR UNIVERSITY: COIMBATORE 641046
FACULTY OF METEOROLOGY

MISSION

GYANAM VISHWASAM KARANAM

Details for the Certificate Course

1	**Name of the Course**	M. Sc. in Meteorology
2	**Name of the Department**	Air Force Administrative College, Coimbatore
3	**Name of the Faculty Member**	Gp Capt N Vinod Sankar Wg Cdr Reshma P Patil Wg Cdr (Dr) Anand S Awasthi Wg Cdr Anil
4	**Inter/Intra Department**	Faculty of Meteorology
5	**Objectives of the Course**	To prepare for the role of Aviation Meteorologist in the armed forces.
6	**Topics to be Covered**	General Meteorology, Observation and Instrument, Synoptic Meteorology , Physical Meteorology, Climatology and Statistics, Aviation Meteorology, Dynamic Meteorology, Numerical Weather Prediction, and Satellite Meteorology, Analysis and Prognosis
7	**Duration of the Course**	2 year
8	**Eligibility**	Graduation in the field of Science, Engineering, Geography and Computer Application.
9	**Registration**	Max 18
10	**Description of the Course**	Master of Science in Meteorology
11	**Job Opportunities**	Aviation Forecasting
12	**Number of Candidates**	Max 18
13	**Course Fee**	As per Bharathiar University