

SYLLABUS M.PHIL : METEOROLOGY



**AIR FORCE ADMINISTRATIVE COLLEGE
COIMBATORE
641 018**

BHARATHIAR UNIVERSITY

M PHIL : PART I (METEOROLOGY)

**PAPER I : TEACHING TECHNIQUES / PEDAGOGICAL TECHNIQUES
IN HIGHER EDUCATION**

UNIT - I : Higher Education and Learning

Historical Perspectives ... Objectives and Role of Higher Education ... Learning and Learning Hierarchy ... Information Processing ... Learning Events and outcomes ... Motivation.

UNIT – II : Teaching technology: Designs

Teaching Technology: Meaning, concept and scope ... Instructional Designs: Objective based, Skill based, Competency based, Learning style based and Model based.

UNIT – III : Methods and Technique of teaching

Large Group Techniques: Lecture, Modified Lecture, Seminar, Symposium, Panel Discussion, Team Teaching, Project Approach and Workshop ... Small Group Techniques: Group Discussion, Simulation, Role Playing, Buzz Technique, Brain storming, Case Discussion and Assignment ... System Approach in education.

Unit – IV : Measurement and Evaluation in Education

Educational Evaluation: A Conceptual Framework ... Methods of Evaluation ... Self Evaluation and Student Evaluation in Higher Education ... Question Banking ... Diagnostic Testing and Remedial Teaching.

UNIT – V : Electronic Media in Education

Instructional Media: Concept, Selection, Use and Variety ... e- Learning Resources: e- Learning e- books, e- journals, etc ... Web based Learning: Access and Teaching Issues.

Text Books:

For Unit I – IV-

Vedanayagam, E. G. (1989) Teaching Technology for Collage Teachers. New Delhi: Sterling Publishers (P) Ltd.

For Unit V-

Rajasekar S (2005). Computer Education and Educational Computing. Hyderabad: Neelkamal Publications.

Books for References:

Kumar KL (1997) Education Technology, New Delhi: New Age International (P) Ltd.

Sampathkum K. Paneerselvam A. and Santhanam S. (1990) Introduction to Educational Technology, New Delhi: Sterling Publishers (Pvt) Ltd. **Tony Bates AW. (2005) Technology**

e- Learning and Disyance Education, New York: Routledge.

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M PHIL : PART I (METEOROLOGY)

PAPER II : RESEARCH METHODOLOGY

Unit I: Research (Scope & Characteristics) and Essentials of Thesis Writing

Meaning and function of research; Identification of the research problem; Qualities of a research worker; Guidance in research; Investigation; Results and discussions; Attending a scientific seminar/conference; Relevant reference material.

Assignment and Thesis at the tertiary level: Writing at the tertiary level, Planning the assignment, Planning the thesis, Scholarly writing, Writing thesis or assignment, General format. Page and Chapter format, Use of quotations, Footnotes, Tables and figures, Referencing, Appendices, Revising the Assignment or Thesis. Editing and evaluating the final product.

Unit II: Statistical Methods and Numerical Analysis

Central tendency and dispersion; Theoretical distributions: Binomial, Poisson and Normal distributions; Test of Hypothesis: T – test and Chi square test; Curve fitting; Correlation and regression.

Solution of Algebraic Equations (Non-linear Equations): Newton–Raphson method, Convergence criteria, Generalized Newton’s method; Solution of systems of non–linear equation by Newton–Raphson method; Numerical solution of partial differential equation: Solution by Taylor’s series, Euler’s method, Modified Euler’s method, Runge-Kutta method

Unit III: Dynamic Met

Scale analysis; Equation of motion; Continuity equation; Vorticity equation: Vorticity theorem and its applications; Quasi-Geostrophic theory: Omega equation, Tendency equation; Atmospheric waves: Perturbation theory, Rossby wave, Baroclinic wave; Baroclinic & Barotropic instability; Atmospheric turbulence: Prandtl’s layer, Ekman layer; Secondary circulations, Transport of momentum, Heat and water vapour in PBL.

Unit IV : Cloud Physics & Satellite Meteorology

General aspects of cloud and precipitation processes; Nucleation of liquid water ice in water vapour: Growth processes of droplets, principle and uses of Radar in cloud physics.

Characteristic features of satellite imageries: Different type of satellite images *viz.* Visible, IR, Water Vapour, Microwave, Image enhancement techniques, Cloud features associated with jet stream, Western disturbances and tropical cyclones.

Unit V: Climatology

Temperature and wind microclimates: Heat island, Climate variation in wind at different seasons; Synoptic climatology: Theory of climatic changes, Regional and hemispherical models; Applied climatology; Methods of studies in climatological analysis.

References

1. Hand Book of Methodology of Research – Rajammal, P Devadas and K Kulandaivel, Sri Ramakrishna Mission Vidyalaya Press, Coimbatore-20 (1976).
2. Higher Mathematics for Engineers and Physicists – II Edition – Mc Graw Hill, 1941, Ivan S Sokolnikoff & Elizabeth S Sokolnikoff
3. Thesis and Assignment writing – Janathan Anderson et al – Wiley Eastern Ltd., 1977.
4. Science of Educational Research, Von Nostrand Rainhold & Co., New York – George J Mowly, Chapter 8 – 12.
5. Statistics – Murray R Spiegel
6. Statistics – Theory, Methods & Application, Sancheti & J Kapoor
7. Applied Statistics in Atmospheric Science – Essen anger
8. Synoptic Climatology – Barry & Perry
9. Hand Book of Statistical Methods in Meteorology, CEP Brooks DSc, N Carruthers B SCOP, London, Her Majesty's Stationary Office, London.
10. A short course in Cloud Physics – RR Rogers & MK Yau.
11. An introduction to Dynamic Meteorology – James R Holton.
12. Dynamical Physical Meteorology – George A Holton & Frank L Martin.
13. Elements of Dynamic Meteorology – AH Gordon
14. Introduction to Theoretical Meteorology – Saymour L Hess
15. principles of Kinematics and Dynamics Vol I & II – Howard B Bluestein.
16. Compedium of Meteorology, Vol I, Part I – Aksel Wiin-Neilsen.
17. Images in weather forecasting – MJ Bader, GS Forbes, JR Grant, RBE Lilley and MJ Waters.
18. WMO Tech Notes 124 – The use of satellite pictures in weather analysis and forecasting.
19. Satellite Meteorology an introduction – Stanley Q Kidder and Thomas H Vonder Haar
20. Climates of South East Asia – GB Pant & Rupa Kumar.
21. Physical Climatology – Setters.

PAPER III – SYNOPTIC METEOROLOGY **(SPECIAL PAPER)**

Unit I: Extra Tropical Met

Waves in the atmosphere: Types and their differences, Methods of forecast of movement and intensity; Zonal Index: Definition, Computation, Blocking, Circulation patterns, Role of zonal index in medium range weather forecasting and its influence over Indian region; Barotropicity and Baroclinicity: Barotropic Instability, Baroclinic Instability, The distribution, Their roles in development of weather; Cut-off low: Genesis, Structure, Movement, Weather; Blocking High: Concept, Characteristics, Formation, Movement, Model, Role of ocean, Effects on Indian weather; Western Disturbances; Formation, Movement, Intensity, Weather, Induced systems, Role of upper tropospheric features in development of Western Disturbances.

Unit II : Tropical Met

Scale analysis in tropics; Equation of motion, Continuity Equation, Vorticity Equation; Pressure wind Relationship: Geostrophic hypothesis, Wind & pressure field near Equator; Tropical general circulation: Hadley cell, Asnani model, ITCZ, Walker circulation, ENSO phenomena; CISK: Concept, Ekman CISK and Wave CISK, Application of CISK in the synoptic development in the tropics; Cumulus dynamics: Instabilities of various kinds, Energetics of cumulus cloud, Local severe storms; Tropical storms: Formation, Structure, Movement, Forecasting of Movement and Intensity; Long range, medium range & short range forecasting techniques in other tropical systems (Easterly wave, LL Easterlies etc.); Middle and upper Tropospheric Vortices: Formation, Structure and Movement.

Unit III: Monsoon Meteorology

Monsoon regions in tropics: Summer and winter circulation monsoon over India; General monsoon circulation (Balance of Mass, Radiation, Angular momentum, Flow across Equator, Global Relationship); Onset and withdrawal features; Semi-permanent systems; Monsoon depressions; Other synoptic systems; Orographic effects; Oceanic features; Numerical modelling of monsoon; Long range forecasting of monsoon rainfall.

Unit IV: General Circulation Studies

General Circulation features viz. temperature & wind: Basics, Energetics, Energy conversions, Available potential Energy concept, Global aspects of atmospheric energy, Mid- latitude and tropical energy aspects; Heat Balance of earth-atmosphere system; The maintenance of Angular Momentum: Dynamic influence of mountains and friction; Seasonal and zonal variations of the mean atmosphere structure and flow patterns; Large numerical models.

Unit V: Meteorological Prognosis

Mid-latitude systems: Long waves & short waves, Western disturbances, Induced systems; General techniques of prognosis: Prognosis of tropical systems, Tropical storms, Tropical systems, Monsoon systems; Objective techniques: Technique of selecting parameters, Regression methods.

References

1. Synoptic – Dynamic Meteorology in middle latitudes Vol – I & II - By Howard B Blucstein.
2. SW Monsoon: MET Monograph- Synoptic MET 1/1976 - YP Rao
3. Structure of an Arabian Sea summer Monsoon System - YP Rao & BW Desai
4. Prognosis of Weather Forecasting - CS Ramage
5. Monsoon Meteorology - CS Ramage
6. Tropical meteorology Vol – I, II & III - GS Asnani

PAPER III – AVIATION MET
(SPECIAL PAPER)

Unit I: Aviation Met – I

Importance; Met elements; Organisation: WMO, ICAO, DGCA, IMD, IAF Met; Current Weather Reports; Altimetry; Aviation Forecasts: Cautionary Met Reports, Weather Warnings; Flight Procedures/Briefing; PANSMET; Aviation Codes; Forecasts/Briefings.

Unit II: Aviation Met – II

Aerodromes: Aerodromes Services (Met Related), Operation of aircraft, Aeronautical information services, Aeronautical telecommunications, Regulatory documents; Requirements of military aviation; Meteorological aspects of flight planning; Pressure pattern, Flying–Air traffic services.

Unit III: Special Aviation Phenomena

Low level wind shear; Microburst; Thunderstorm hazards; Aircraft icing; Turbulence, CAT, Mountain Waves, Gravity waves; Surface and slant visibility; Weather radars; Nowcasting techniques: Very short range forecasting, Objective techniques in local forecasting.

Unit IV: Prediction Models and Tools

Prediction of mesoscale systems by statistical and probability models; Techniques of selecting predictors; Regression & use of numerically predicted flow patterns; Formation of stochastic model based on primitive equation; Prediction of mountain/valley weather; Marine weather, Local severe weather; Local weather features.

Unit V: Synoptic Model

Applications of waves in the atmosphere; Zonal index; Barotropicity and baroclinicity; Blocking high; Western disturbances; Lee cyclogenesis; Tropical storms; Tropical Systems; Monsoon Circulation: Semi-permanent monsoon systems, Monsoon depression, Other synoptic systems.

References

1. Hand Book of Aviation Meteorology HMSO Publication 1960.
2. Meteorology for Aircrew 3201.
3. IAP 3202.
4. First International Conference on Aviation weather System – Montreal 1981.
5. Aeronautical Meteorology WMO TN 95.
6. Instructions for Aviation Services in India – IMD Publication.
7. Nowcasting by KA Browning, WMO Tech Notes on CAT, Mountain Waves.
8. WMO Tech Notes on CAT, Mountain Waves.
9. Aeronautical Met – WMO TN 95.
10. Procedures for Air Navigation Services Met Procedure.
11. Memorandum on ICAO (1955 Edition) Publications.
12. Dynamic Meteorology by Holton.
13. Monsoon by YP Rao.
14. WMO Compendium by WMO.
15. Atmospheric Circulation System - by Newton and Palmen.
16. Thunderstorm Morphology & Dynamics – By Kessler.
17. Indian and other journals on Meteorology.

PAPER III – NUMERICAL WEATHER PREDICTION
(SPECIAL PAPER)

Unit I: Introduction

Historical Background; Filtering problem; Finite difference techniques; Explicit and implicit schemes; Semi implicit schemes; CFL criterion and stability analysis; Staggered grid; Nonlinear instability and aliasing.

Unit II: Hierarchy Of Numerical Models

Barotropic Model: Equivalent barotropic model, Two-level baroclinic model; Shallow water equation model; Primitive equation models; Boundary conditions and time integration.

Unit III: Parameterization of Sub Grid Scale Processes

Boundary layer parameterization: Cumulus convection, Radiation parameterization.

Unit IV: Objective Analyses and Initialization

Basic Concepts; Ponofskys methods; Cressmans method; Optimum interpolation technique. Static, dynamic and normal mode initialization.

Unit V: Spectral and Finite Elements Models

Introduction; Galerkin methods; Transform method; Spectral model of shallow water equations; Overview of primitive equation; Multilayer spectral models; Finite element method.

References

1. Numerical Weather Prediction – 63028 – GJ Haltiner.
2. Numerical Weather Prediction Model Tech Report No 2 - Mohanty, Paliwal, Tyagi, Madan & Sareen.
3. An Introduction to Numerical Weather Prediction Technique – TN Krishna Murthy.
4. Introduction to NWP – GC Asnani.
5. Basic Concepts in NWP Model – RK Dutta.
6. Numerical Prediction and Dynamic Meteorology – Haltiner & Williams.
