

ANNEXURE - I

Agrometeorology

CORE COURSES					
Course Code	Title of the Course	L	T	P	Credit
Semester -I					
AGM- 601	General Meteorology-I	3	0	0	3
AGM- 602	Agrometeorology-I	2	0	2	3
AGM- 603	Methods in Climatology	2	0	2	3
AGM- 604	Meteorological Instruments	2	0	2	3
MAS- 714	Statistics -I	2	0	2	3
COMP-609	Computer Orientation	2	0	2	3
Semester -II					
AGM- 605	General Meteorology-II	3	0	0	3
AGM- 606	Agrometeorology-II	2	0	2	3
AGM- 607	Climatology	2	0	0	2
AGM- 608	Air Pollution Meteorology	2	0	2	3
AGM- 609	Hydrometeorology	2	0	2	3
MAS- 715	Statistics -II	2	0	2	3
AGM- 780	Seminar -I	0	0	2	1
Semester -III					
AGM- 610	Applied Agro-Climatology	2	0	1	3
AGM- 611	Micrometeorology	2	0	2	3
AGM- 612	Farm House Meteorology	1	0	0	1
AGM- 613	Animal Climatology	2	0	0	2
AGM- 614	Environmental Physics	3	0	0	3
AGM- 615	Agroclimatology	3	0	0	3
AGM- 880	Seminar -II	0	0	2	1
Semester -IV					
AGM- 899	Dissertation	0	0	30	15

AGROMETEOROLOGY

AGM- 601

General Meteorology-I

(2+1)

Earth and its atmosphere in relation to sun. Radiation in the atmosphere; physical and physiological processes important to radiation. Laws of radiation and green-house effect. Heat balance of the atmosphere. Terrestrial radiation absorption by ozone, carbondioxide, water vapour and clouds. Heat transfer processes.

Temperature in the atmosphere; Distribution of temperature in time and space, subdivisions of the atmosphere-troposphere, stratosphere, thermosphere. Thermodynamics in the atmosphere; Adiabatic process, relation between temperature and pressure in dry air-hydrostatic equation atmospheric stability and stability criteria for the atmosphere. Meteorological temperatures, thermodynamic diagrams and their uses.

Dynamics of the atmosphere and general circulation. Influence of land masses and oceans on the circulation pattern.

AGM- 602

Agrometeorology-I

(2+ 1)

Important meteorological processes to agriculture; Importance of various micro-environment on plant growth and development; Meaning and scope of agrometeorology. Radiation balance as applied to agriculture; Energy balance over agriculturally important surfaces. Evaluation of energy balance components; Radiation instruments, empirical methods for estimation of short-wave, long-wave and net radiation; Radiation charts-Moller, Ellassasser, Kew and Yamamoto charts. Net radiation profiles and light distribution within the plant communities. Radiation utilisation during successive stages of plant development and its efficiency.

Thermal effects of environment on growth and development of plants; Cardinal temperatures; Thermoperiodism; Phenology and tolerance; Heat unit concept; Photoperiodism; Leaf temperatures. Transfer process between leaf surface and adjoining air. Latent heat and sensible heat transfer in air; various approaches to evaluate evaporation and sensible heat fluxes; Principle of similarity and Bowen Ratio concept. Conduction of heat in soil, heat capacity and thermal conductivity of soil-their dependence on texture, structure and moisture content of soil. Fourier heat conduction equation. Diurnal and annual variation of soil temperature. Computation of heat flux from soil temperature profiles; Instruments for direct measurement of soil heat flux and thermal properties of soil.

AGM- 603

Methods in Climatology

(2+ 1)

Statistical methods in climatological studies. Uses of measures of central tendency, measures of dispersion statistical distributions commonly occurring in climatology-Normal, Gamma, Exponential, Logarithmic, Lognormal, Binomial, Poisson and X^2 distributions. Graphs and maps for representating agro-meteorological data. Special statistical methods of importance in climatology. Orthogonal polynomials; Time series; extreme value theory; Harmonic analysis, Statistical processes; Power spectrum analysis; Game theory; theory of decision making.

Persistence-its measurement, and evaluation model, Conditional probabilities; Random and Markov model, Application of Random and Markov model for various agrometeorological phenomena. Climatic indices. Graphical methods of objective forecasting

AGM- 604 Meteorological Instruments. (2+ 1)

Theory of measurement of meteorological parameters. Elementary principles (theory) behind measurement of radiation, temperature, pressure, humidity, wind, evaporation, condensation and precipitation. Meteorological instruments for agrometeorological observatories. Self recording & nonrecording instruments.

Meteorological instruments used for routine observation at agrometeorological observatories-their description, care, maintenance, calibration, detection of faults and repairs. Special meteorological instruments for micrometeorological work. Theory behind the design of these instruments their characteristics and limitations.

Lysimeters. Infrared thermometer. Multichannel potentiometric recorder.

AGM- 605 General Meteorology-II (2+1)

Air masses and their structure; properties of air masses, classification of air masses. Important air masses of India. Models of secondary circulation in the atmosphere. Fronts; Cyclones and anticyclones, troughs and ridges in upper air, tropical cyclones; monsoon circulation, mountain and valley breezes, land and dust whirls due to thermal circulation. Various humidity parameters and their inter-relationships; psychrometry-theory of dry and wet bulb psychrometry (Norman's Theorem).

Condensation and precipitation in the atmosphere; condensation forms clouds and cloud classification,

Elementary aspects of weather Forecasting. Observational network; preparation of surface and upper air synoptic chart and their analysis; Techniques for short range, medium range and long range forecasting.

Climatic classification; various criteria for classification of climate. Geographic distribution of various climatic types. Principal weather phenomena occurring in four main seasons in India. Mechanism of Indian monsoon and general distribution of precipitation during South-West and North-East monsoon; Spatial interrelationships between synoptic features and precipitation distribution during monsoon.

AGM- 606 Agrometeorology-II (2+ 1)

Evaporation and evapotranspiration; Theory of evaporation; Individual and combined influences of soil, plant and meteorological factors on evapotranspiration, methods of measuring evapotranspiration, pan evaporimeter, atmometer, drainage and weighing type lysimeters, hydraulic type lysimeter with a manometer. Estimation of evapotranspiration. Concepts of potential and actual evapotranspiration. Aerodynamic approaches such as Dalton's equation, Thornthwaite Holtzman equation, Pasquill's approach; eddy correlation method.

Energy balance methods-Bowen Ratio approach, combination approaches of Penman, Slatyer and Malory, van Bavel, Monteith and Tanner. Empirical formulae of Thornthwaite, Balaney-Criddle, Makkink, Turc, Budyko, Papadakis etc. Water balance and physical factors concerning water movement in soil.

Evaluation and insitu measurements of various components of hydrologic cycle. Soil moisture measurements by gravimetric sampling, conductivity units, tensiometers and neutron dispersion technique. Concept of hydraulic conductivity in saturated and unsaturated soils, evaluation of soil moisture fluxes and drainage components; water extraction pattern by plant roots. Climatic water budgeting approach.

Soil moisture budget models of Thornthwaite and Mather, Shaw, Robertson and Baier. Linear model, log and exponential models of soil moisture decay curves. Water and yield relationships, Consumptive use; water use efficiency, relationship between

Profiles of temperature, humidity and wind under different stability conditions. Laminar and turbulent conditions; Reynold and Richardson number. Turbulent transfer of mass, momentum and energy. Concepts of exchange co-efficient, exchange coefficient relationships. Application of turbulent transfer processes to agricultural phenomena such as photosynthesis under field conditions.

Microclimatology and Topoclimatology. Microclimates in low plant cover, microclimates of meadows and grain fields, microclimates within forests and climatic influences of forests. Influence of kind, colour and condition of soil on microclimates. Influences of slopes and topography on insolation, temperature and winds. Atmospheric diffusion.

AGM- 612 Farm House Meteorology (1 +0)

Meteorological conditions prevailing in glass-house, green house, animal house, poultry house and grain storage barns.

Heating, cooling and ventilation of these structures as governed by meteorological factors.

AGM- 613 Animal climatology. (2+0)

Thermal balance in animals. Energy exchange processes at the skin of the animals and the need for the maintenance of thermal balance in the animals. Direct and indirect effects of weather on animals.

The effect of weather conditions on animal production, loss of water from the body, growth rate and body weight, reproduction, grazing habits and food intake, milk production, sun burn and photosensitive disorders.

AGM- 614. Environmental Physics. (3+0)

Thermodynamics of the atmosphere. Physics of radiation-origin and nature of radiation, radiation laws and their application in agricultural meteorology; radiation geometry in cartesian, spherical and cylindrical coordinate systems, conservation principle for radiant energy.

Physics of transport phenomena-heat transport in soil, liquid and gas, 'thermal conduction, soil temperature and ground heat flux, diffusion and thermal conductivity. Fluid motion, laminar and turbulent transfer, fluctuation theory for turbulent transfer of momentum, heat and water vapour. Physics of condensation and precipitation. Physics of evaporation-aerodynamic approach, energy balance approach and combination approach for evaporation estimates.

Physics of soil water system-the concept of potential as applied to soil water system, total potential and components. Movement of water in soil, fundamental equation, hydraulic conductivity, infiltration, field drainage and water vapour movement in soil. Physics of crop water use - A physical introduction to plant-water system and relationships, water transport through soil-plant atmosphere system, measurement of crops water use in terms of water conservation equation.

Micrometeorology of crops-measurment and interpretation of fluxes above crop canopy, microclimate of crops, a measurement of canopy fluxes and application.

AGM- 615 Agroclimatology (3+0)

Microclimate as an aspect of general plant environment. Heat economy of plants and plant temperatures, radiation and temperature and humidity and wind relationship in

a differential plant cover, causes of temperature inversion and its effects. Temperature, wind and humidity inter relationships, crop adaptation and microclimate, weather and diseases of crops, weather and crop pests. Microclimate and phenology, importance of microclimate studies in ecological research. Crop weather observation and their importance in predicting epidemics of adverse weather. Organisation of meteorological observatories of the world in general and of India in particular and weather forecasting. Understanding of crop weather relationship and control of plant climate.

BASIC SUPPORTING COURSES

MAS 714 STATISTICS – 1 Cr. 3(2+1)

Theory

Analysis of variance: Definition and assumptions, one way classification, two way classification. Sampling Techniques: Simple random sampling, stratified random sampling, systematic sampling. Design Experiments: Randomized Block design, Latin Square design, Factorial design (2^2 , 2^3 , 3^2 , 3^3 factorials), Some P x Q experiments, Split Plot Experiments. Balanced Incomplete Block design

Practical

Analysis of variance, Randomized Block Design.

Theory

	Content	Lecture
•	Analysis of variance	2
•	Definition and assumptions,	2
•	one way classification,	2
•	two way classification.	2
•	Sampling Techniques	2
•	Simple random sampling	2
•	stratified random sampling	2
•	systematic sampling.	2
•	Design Experiments	2
•	Randomized Block design	2
•	Latin Square design	2
•	Factorial design (2^2 , 2^3 , 3^2 , 3^3 factorials)	3
•	Some P x Q experiments	3
•	Split Plot Experiments	3
•	Balanced Incomplete Block design	3

Practical

	Content	Lecture
•	Analysis of variance	6
•	Randomized Block Design	11

References

1. Bernard Ostle and R.W.Mensing, Statistics in Research.
2. C.H. Goulden, Method of Statistical Analysis.
3. G.W. Snedecor and W.G. Cochran, Statistical Methods.

4. R.G. Steel and J.H. Torrie, Principles and Procedures of Statistics (with special reference to Biological Sciences)
5. R.Rangaswamy, A Text Book of Agricultural Statistics.
6. Chandel S.R.S, A Text Book of Agricultural Statistics.
7. W.G. Cochran and G.M.Cox, Experimental Designs.

MAS 715 STATISTICS – II (Regression, Correlation) Cr. 3(2+1)

Theory

Statistical Methods: Measures of Skewness and Kurtosis, standard error of mean, Coefficient of variation. Theory of Probability : Definitions, Additions and Multiplication rules of Probability, Conditional Probability. Probability distributions: Normal, Binomial and Poisson distributions. Correlation and Regression : Simple correlation, Rank correlation, Regression Coefficient, Multiple and Partial Correlation, Regression lines between two variables, Multiple Regression. Tests of Significance: X^2 - test, t - test one sample, two sample t – tests, paired t-test, F – test, Fisher’s 2 – transformation

Practical

Coefficient of variation, SE of mean, Skewness and Kurtosis. Fitting of Normal, Binomial and Poisson distribution. Simple Correlation, Multiple and Partial Correlation with three variables only. Regression lines between two variables. X^2 , t and F – tests

Theory

Content	Lecture
• Statistical Methods: Measures of Skewness and Kurtosis	2
• standard error of mean	2
• Coefficient of variation	2
• Theory of Probability : Definitions	2
• Additions and Multiplication rules of Probability	2
• Conditional Probability	2
• Probability distributions: Normal, Binomial and Poisson distributions	2
• Correlation and Regression : Simple correlation	2
• Rank correlation	2
• Regression Coefficient	2
• Multiple and Partial Correlation	3
• Regression lines between two variables	3
• Multiple Regression	3
• Tests of Significance: X^2 - test	3
• t - test one sample	2
• two sample t – tests	2
• paired t-test, F – test	2
• Fisher’s 2 – transformation	2

Practical

	Content	Lecture
•	Coefficient of variation	2
•	SE of mean	1
•	Skewness and Kurtosis	2
•	Fitting of Normal	2
•	Binomial and Poisson distribution	2
•	Simple Correlation	2
•	Multiple and Partial Correlation with three variables only	2
•	Regression lines between two variables	2
•	X^2 , t and F – tests	2

Reference

1. C.H. Goulden, Method of Statistical Analysis.
2. Bernard Ostle and R.W.Mensing, Statistics in Research.
3. R.Rangaswamy, A Text Book of Agricultural Statistics.
4. Chandel S.R.S, A Text Book of Agricultural Statistics.
5. W.G. Cochran and G.M.Cox, Experimental Designs.

COMP 609 COMPUTER ORIENTATION Cr. 3(2+1)

Theory

Introduction to multi programming and time sharing computers - Login and creation of files - Introduction to structured programming with reference to BASIC - Variables and constants, complex, double precision, logical, character - Arithmetic expressions, arrays, control statements (DO, IF, Computed GOTO) - Functions and subroutines - I/O statements - Elementary programming of algorithms.

Practical

Loading Windows and other features in Windows. MS Word – creation, editing of a document. Using features like underlining, bold, italics, spell check etc. and printing. Creation of excel sheet and processing for statistical analysis. Creation of a database in access - Mstat – creation of a data file. Internet – getting connected and email Internet – retrieval of information.

Theory

	Content	Lecture
•	Introduction to multi programming and time sharing computers	3
•	Login and creation of files	3
•	Introduction to structured programming with reference to BASIC	4
•	Variables and constants	3
•	Complex, double precision	3
•	Logical, character	3
•	Arithmetic expressions	3
•	Arrays, control statements (DO, IF, Computed GOTO)	4
•	Functions and subroutines - I/O statements	4

- Elementary programming of algorithms 4

Practical

Content	Lecture
• Loading Windows and other features in Windows	3
• MS Word – creation, editing of a document	2
• Using features like underlining, bold, italics, spell check etc. and printing	3
• Creation of excel sheet and processing for statistical analysis	2
• Creation of a database in access - Mstat – creation of a data file	3
• Internet – getting connected and email Internet – retrieval of information	3

References

1. Chris Lewis, Essential Tips: Using the Internet
2. Gene Weisskopf, ABCs of Excel 97
3. Kenneth N.Berk, Introductory Statistics with Systat
4. Kris N, Advanced Data Analysis with Systat
5. Mark Wallace, Things to do on the Internet
6. Ron Mansfield, The Compact Guide to Microsoft Office