Department of Agricultural Meteorology and Physics

M.Sc. Programme

Course No.	*Title of the course*	*Credits*
	1st Semester	
AGM – 501	Fundamentals of Meteorology	3+0
AGM – 502	Fundamentals of Climatology	3+0
AGM – 503	Fundamentals of Agricultural Meteorology	2+1
AGM – 504	Soil Water Balance & Evaporation	2+1
	2nd Semester	
AGM – 551	Weather Modifications For Agriculture	2+0
AGM – 552	Agricultural Climatology	3+1
AGM – 553	Micrometeorology	3+1
AGM – 554	Climate Change and Sustainable Development	2+0
AGM – 555	Weather Forecasting in Agriculture	2+1
	3rd Semester	
AGM – 601	Agro Meteorological Measurements & Instruments	1+2
AGM – 602	Agro Meteorological Aspects of Crop Protection	2+1
AGM- 603	Agro Meteorological Data Management	1+2
AGM- 649	Seminar-I	0+1
	4th Semester	
AGM – 651	Crop Weather Models	2+1
AGM- 652	Climate Risk Management	2+0
AGM- 699	Seminar-II	0+1

Details of Courses

M.Sc. Programme

AGM -501 Fundamental of Meteorology 3+0

UNIT I:Earth and its atmosphere in relation to sun and seasons; solar radiation; heat balance of earth and atmosphere; radiation in the atmosphere-energy balance at different surfaces and significance of different components and their estimation; Angstrom equation and estimation of radiation parameters; nature of radiation, physical and physiological processes important to radiation; laws of radiation: Planck's law, Stefan-Boltzmann's law, Wien's displacement law, Kirchoff's law, Beer's law and Lambert's cosine law; theories of transmissivity; extinction coefficient; length of day; albedo of a surface; atmospheric and astronomical factors affecting depletion of solar radiation received on the earth; selective absorption by constituents of atmosphere; Rayleigh and Mie scattering; direct and diffuse radiation; heat transfer: conduction, convection and radiation; concept of latent and sensible heat; radiant flux and flux density.

UNIT II: Temperature in the atmosphere: distribution of temperature in time and space, variation in temperature with height; subdivisions of the atmosphere: troposphere, stratosphere; atmospheric dynamics-atmospheric motion under balanced forces.

UNIT III: Gas laws; pressure gradient, isobars, hydrostatic equation and its application; coriolis force; geostrophic, gradient and cyclostrophic winds; pressure systems, cyclonic and anticyclone motions, trough, ridge, col, thermal wind, contour charts, variation in pressure with height.

UNIT IV: Concepts of specific heats at constant volume and pressure; first and second laws of thermodynamics and their applications to atmosphere; vertical stability of atmosphere, virtual temperature and potential temperature; moist and dry adiabatic processes; atmospheric stability and DALR and SALR stability criteria for atmosphere-conditional instability and auto convective stability.

UNIT V: Meteorological temperatures: dew point temperature, wet bulb temperature, equivalent temperature and equivalent potential temperature; thermodynamic diagrams and their uses; dynamics of atmosphere and general circulation; equations of motion; turbulence, vorticity and atmospheric waves.

AGM 502 Fundamental as of Climatology 3+0

UNIT I:Air masses and their properties: source regions, processes determining the characteristics of air masses, properties of air masses, classification of air masses, air masses and fronts, important air masses over India; models of secondary circulation in the atmosphere; intratropical convergence zone, mountain and valley breezes, land and sea breezes, sand and dust whirls due to thermal circulation; Fohn and Chinook winds, extra tropical cyclones, tropical cyclones and their structures.

UNIT II:Water vapour or humidity in the atmosphere-various humidity parameters: vapour pressure, specific humidity, relative humidity, mixing ratio, absolute humidity, dew point, wet bulb temperature, saturation deficit, and their interrelationships; psychrometric equation, and stability and instability conditions in the atmosphere; entrophy-tephigram; condensation and precipitation processes-physical basis of atmospheric condensation-growth by coalescence and ice nucleation; lapse rates-ascent of dry and moist air; condensation process-artificial rain making, Bergeron-Findeisen theory; condensation forms-dew, fog, mist, frost, cloud, haze, rain, hail, dust storm and thunderstorms; clouds and their description and classification; evaporation and rainfall; hydrologic cycle.

UNIT III:Effects of earth's rotation on zonal distribution of radiation, rainfall, temperature and wind; the trade winds, equatorial trough and its movement; the SE Asian monsoon, mechanisms of Indian monsoon, monsoon circulation, monsoon break, role of physiography on rainfall distribution; EL Nino, La Nina and ENSO.

UNIT IV: Weather and climate. Climatic elements and their diurnal, seasonal and annual variation; climatic classification-Koppen, Thornthwaite, Gaussen and Emberger systems, etc.; agroclimatic zones and agro-ecological regions of West Bengal and India; climatology of West Bengal and India-principal weather phenomena occurring in four seasons of West Bengal and India; western disturbances, Nor'wester, heat and cold waves.

AGM 503 Fundamentals of Agricultural Meteorology 2+1

UNIT I:Meaning and scope of agricultural meteorology; components of agricultural meteorology; roles and responsibilities of agricultural meteorologists; importance of meteorological parameters in agriculture; important meteorological processes to agriculture-importance of various micro environment on plant growth and development.

UNIT II:Radiation balance as applied to agriculture-radiation as a forcing function for physical and physiological processes in plants and animals; energy exchange at air-earth interface; energy balance in atmosphere and crop canopy; energy balance over agriculturally important surfaces; evaluation of energy balance components; radiation instruments; advanced techniques for measurement of radiation and energy balance; empirical methods for estimation of short wave, long wave and net radiation; radiation charts-Moller, Elassasser, Kew and Yamamoto charts; radiation interaction with plant environment; spectral properties of vegetation; net radiation profiles and light distribution within plant communities as affected by leaf area index, leaf arrangement and leaf transmissibility; extinction coefficient; meteorological factors in photosynthesis, respiration and net assimilation; radiation utilization during successive stages of plant development and its efficiency; efficiency of solar energy conversion into dry matter production.

UNIT III:Effects of thermal environment on growth and yield of crops; cardinal temperatures, thermoperiodism, photo-nycto temperatures, Vant Hoff's law and phenology of crops; heat unit concepts and related parameters-HTU, PTU, TIR, SMGDD; leaf temperature- transfer processes between leaf surface and adjoining air; latent heat and sensible heat transfer in air-various approaches to evaluate evaporation and sensible heat fluxes, principles of similarity and Bowen ratio concepts; soil temperature and soil heat flux; heat conduction and thermal diffusivity in soil.

Practical: Estimation and measurement of solar and net radiation. Soil heat flux by using of soil heat flux plates. Determination of Bowen ratio. Determination of Bowen ratio. Determination of albedo of bare, irrigated and cropped fields. Measurement of leaf temperature. Instruments for direct measurements of soil heat fluxes and thermal properties of soils. Computation of heat flux from soil temperature profiles. Measurement and evaluation of radiation components. Measurement of wind and temperature profiles near the ground

AGM 504 Soil Water balance and Evapotranspiration 2+1

UNIT I:Energy concept of soil water, hydraulic conductivity and soil water flux; theory on hydraulic conductivity in saturated and unsaturated soils; physical factors concerning water movement in soil; concepts on evaporation, evapotranspiration, potential and actual evapotranspiration.

UNIT II:Theories of evapotranspiration and their comparison; aerodynamic, eddy correlation, energy balance, water balance and other methods, their application under different agroclimatic conditions; concepts of potential, reference and actual evapotranspiration-modified techniques; individual and combined influence of soil, plant and meteorological factors on evapotranspiration; crop coefficient-its concepts and application; water extraction pattern by plant roots.

UNIT III:Climatic and water budgeting approach; evapotranspiration models: aerodynamic approaches such as Dalton's equation, Thornthwaite-Holtzman equation, Pasquill's approach, eddy correlation, energy balance methods, Bowen ratio approach, combination of approaches of Penman, Slatyer and Mcilroy, Van Bavel, Monteith and Tanner and empirical formulae of Thornthwaite, Blaney-Criddle, Makkink, Turc, Budyco, Papadakis; advantages and limitations of different methods.

UNIT IV:Basic principles of water balance in ecosystems; soil water balance models of Thornthwaite and Mather, Shaw, Robertson and Baier, linear models, log and exponential models of soil moisture decay curves; calculation of water surplus and deficit; advection and its effect on water use by crops; water and yield relationships; water production function; yield functions; relationships between water use and dry matter production; dry matter yield ET functions.

UNIT V:Consumptive use, water use and water use efficiency; influence of microclimatic, plant, soil and cultural factors on ET by crops; techniques of lysimetry in measuring actual evapotranspiration; water use efficiency and scheduling of irrigation based on evapotranspiration; water use efficiency and antitranspirants, computation of Kc values and their use; irrigation scheduling based on climatological approaches.

Practical: Estimation of evaporation, evapotranspiration and crop coefficient. Determination and use of crop factors in evapotranspiration studies. Evaluation of hydraulic conductivity vs. soil moisture relationship by water balance approach. Determination of indices of moisture adequacy and length of growing period in different soil climatic zones. Determination of aridity indices and water requirement satisfaction index by different methods for appraisal of water stress of crops, water use and yield production functions. Soil moisture measurement by different methods. Measurement of soil matric potential by tensiometric studies. Computation and comparison of evapotranspiration by different

methods-energy balance method, aerodynamic method, Penman method, and other methods. Soil moisture retention characteristics by pressure plate method.

AGM 551 Weather Modifications for Agriculture 2+0

UNIT I: Definition and scope; historical reviews of weather modification, present status of weather modification for agriculture; atmospheric composition and green house effect.

UNITII: Theories of weather modification; modification of macroclimate: scientific advances in clouds and electrical behavior of clouds; modification of frost intensity and severe storms; wind barriers, protection of plants against climatic hazards; air and water pollution; meteorological conditions in artificial and controlled climates - green, plastic, glass and animal houses etc.; modification of weather hazards; weather modification for agriculture; modification of clouds and cloud systems: cloud seeding, artificial rain making and hail suppression; dissipation of fog and stratus clouds; modification of severe storms and electric behavior of clouds.

UNIT III: Modification of microclimate; inadvertent and advertent modification of climate; modification of fluxes at the top of the crop surface: man-made fog, wind machines, light control, photoperiod control, prevention of fog, frost protection-radiation control, soil heat control, latent heat control, sensible heat control and direct heating; modification of advective fluxes: windbreak and shelter effects and their effect on modification on climate: wind and turbulence effects, energy and water balances and climatic effects and applications; shelter effect-radiation balance, air and humidity, site selection, shape of plant beds; modification of fluxes at the crop surface: albedo modification, geometry control; sprinkling for heat stress reduction, sprinkling and irrigation for frost and cold protection, direct heating for frost protection, mulching: soil moisture and temperature control-pulverized soil, straw mulch, plastic mulch, asphalt or petroleum mulch, antitranspirants; modification of solar radiation and evaporation; modification of cold weather-warming irrigation water, frost prevention, modification of advected cold wind.

UNIT IV: Modification of microclimate due to cultural practices, intercropping; influence of topography on microclimate; microclimates within forest and climatic influences of forest, influence of forest on precipitation; microclimatology and topoclimatology; microclimates of low plant cover; microclimate of meadows and grain fields; influences of kind, colour and condition of soil on microclimates.

AGM 552 Agricultural Climatology 3+1

UNIT I:Phenology and seasonal changes of weather conditions; crop climatology-thermoperiodism, photoperiodism, heat unit concepts and its applications; thermal indices and phenology: cardinal temperatures; heat unit and growing degree day concepts for crop phenology, crop growth and development; insect-pest development; agroclimatic requirement of crops.

UNIT II:Hydrological cycle: precipitation intensity, evaporation, infiltration, runoff, soil storage and hydrological balance; climatic water budgeting techniques and its applications in evaluation of moisture availability periods within crop growing seasons; planning of multiple cropping pattern for different soil climatic zones on India; potential and actual evapotranspiration and their computation; calculation of water surplus and deficit; computation of daily and monthly water budget and their applications; assessment of dry and wet spells, available soil moisture, moisture adequacy index and their applications.

UNIT III: Influence of agro meteorological factors on incidence of pests and diseases and timing and effectiveness of control measures; special weather forecast: frost, insect, pest and disease, drought, high winds, heat waves, rainfall and monsoon onsets; crop protection from weather hazards: protection from frosts, forest fire, meteorological aspects of forest fires and their control, drought, flood, wind breaks and shelter belts; principles of cloud seeding; insect-pest development.

UNIT IV:Weather forecasting: importance, types, tools and modern techniques of weather forecasting; crop weather charts, calendars and diagrams; weather forecasting and agroadvisories; crop weather calendar; general forecasting: short, medium and long range forecasting for agriculture; use of satellite cloud imageries and synoptic approach to weather forecasting.

UNIT V: Bioclimatic concepts: evaluation of human comfort, comfort indices (temperature, humidity index and wind chill) and clothing insulation; climate, housing and site orientation; climatic normal for animal production.

Practical: Calculation of heat units for different crops. Water balance computation by book keeping method and evaluation of growing period for multiple cropping. Assured rainfall analysis. Computation of moisture availability indices by Hargreave's method. Preparation of crop weather calendars for major crops. Preparation of agro advisories based on medium range weather forecasts. Determination of onset and withdrawal of monsoon in west Bengal. Estimation of agro-meteorological variables using historical records. Evaluation of radiation, wind and shading effects in site selection and orientation. Study of

weather-pest and disease interactions, calculation of continentality factors; calculation of comfort indices and preparation of climograph.

AGM 553 Micrometeorology 3+1

UNIT I:Meaning and scope of micrometeorology; concepts of micro, meso and macro meteorology; independent and dependent microclimate; importance of lower regions of atmosphere; micrometeorological processes near bare ground and crop surfaces; atmosphere near the ground; distribution of important meteorological parameters in the boundary layers.

UNIT II: Properties of atmosphere near the earth's surface; exchange of mass momentum and energy between surface and overlaying atmosphere, exchange coefficient, similarity hypothesis, shearing stress, forced and free convection**.**

UNIT III: Atmospheric diffusion; fluxes of different gases from vegetation and their influence in global climate change; molecular and eddy transport of heat, water vapour and momentum, frictional effects, eddy diffusion, mixing; boundary layer, friction velocity, roughness length and zero-plane displacement; temperature instability, air pollution; microclimate near the bare ground, unstable and inversion layers, variation in microclimate under irrigated and rainfed conditions, soil moisture and temperature variation with depth; Richardson number, laminar and turbulent conditions, Reynold's analogy, exchange coefficient relationships application of turbulent transfer processes to agricultural phenomenon such as photosynthesis under field condition; wind profile near the ground; remote sensing in relation to micrometeorology.

UNIT IV: Micrometeorology of plant canopies; distribution of temperature, humidity, vapour pressure, wind and carbon dioxide profiles in the crop canopies; fluxes of water vapour, CO_2, and heat inversion and its effect on smoke plume distribution; instruments and measuring techniques in micrometeorology.

UNIT V: Spectral properties of vegetation: light interception by crop canopies as influenced by leaf area index, leaf arrangement and leaf transmissibility, extinction coefficient; effects of ambient weather conditions on growth, development and yield of crops; measurement of global and diffuse radiation; measurement of albedo over natural and cropped surfaces; net radiation measurement at different levels; PAR distribution in plant canopies and interception; wind, temperature and humidity profiles in short crops and tall crops; energy balance over crops and LAI and biomass estimation; radiation

distribution and utilization by plant communities, leaf temperature and its biological effects; influences of slopes and topography on insolation, temperature and wind.

Practical: Micrometeorological measurements in crop canopies and to fit the observed parameters in aerodynamic and energy balance equation. Determination of roughness parameters and zero-plane displacement. Determination of Reynold's and Richardson's Number to understand stability conditions of the atmosphere. Methods of measuring energy transfer. Use of micrometeorological instruments like pyranometer, albedometer, net radiometer, pyrheliometer, pyrgeometer, quantum sensor, psychrometer etc. Profile measurement of different micrometeorological parameters in crop and soil. Quantification of crop microclimate.

AGM 554 Climate and Sustainable Development 2+0

UNIT I: Climate change and global warming: definitions of terms; causes of climate change and global warming; greenhouse gases, ozone depletion; past records, present trends, extreme weather events and future projections; astronomical predictions: lunar cycle, sunspot cycle, soil-lunar tides, Chandlers compensation, blocking highs; case studies on various climatic projections and consequences thereof in relation to agriculture.

UNIT II: Impacts of climate change on various systems: impacts resulting from projected changes on agriculture and food security; hydrology and water resources; terrestrial and freshwater ecosystems; coastal zones and marine ecosystems; human health; human settlements, energy, and industry; insurance and other financial services; climate change and crop diversification, loss of biodiversity, microbes and pest dynamics; climate change and storage, climate change and weed management; advance methodology of assessing the impact of climate change on crops.

UNIT III: Sensitivity, adaptation and vulnerability: system's sensitivity, adaptive capacity and vulnerability to climate change and extreme weather events; regional scenarios of climate change and variability.

UNIT IV: Mitigation strategies for sustainable development: international policies, protocols, treaties for reduction in greenhouse gases and carbon emissions; carbon sequestration; carbon credit; clean development mechanism (CDM) and land use, land use change and forestry mechanism, alternate energy sources etc.

UNIT V:Agricultural food security: reduction in carbon and GHG emission; fuel conservation and reduction in energy use, conservation tillage, bio-fuels for fossil fuels, reduction in machinery use etc;

increasing carbon sinks; resource conservation technologies, mixed rotations of cover and green manure crops, minimization of summer fallow and no ground cover periods etc.

AGM 555 Weather Forcasting for Agriculture 2+1

UNIT I: Weather forecasting system: definition, scope and importance; historical background; observational network of weather forecasting; weather forecasting network in India; benefits of weather forecasting to agriculture; forecasting problems; classified terminology of weather parameters used in weather forecasts and their interpretation; elements of agricultural weather forecasts; types of forecasting: short, medium and long-range; study of synoptic charts with special reference to location of highs and lows, jet streams, synoptic features and weather anomalies and zones of thermal advection and interpretation of satellite pictures of clouds in visible and infra-red range.

UNIT II: Approaches for weather forecasts: methods of weather forecasts - synoptic, numerical prediction, statistical, analogue, persistence and climatological approach, nano-technological approach, Indigenous Technical Knowledge (ITK) base- signals from flora, fauna, insects, birds, animals behavior; various methods of verification of location-specific weather forecast.

UNIT III: Special forecasts: special forecasts for natural calamities such as drought, floods, high winds, cold (frost) and heat waves, hail storms, cyclones and protection measures against such hazards; weather based advisories: concept of agrometeorological advisory; interpretation of weather forecasts for soil moisture, farm operations, pest and disease development and epidemics, crops and livestock production; preparation of weather-based advisories for farmers and dissemination; verification of weather forecasts.

Practical: Exercise on weather forecasting for various applications. Preparation of weather-based agro-advisories based on weather forecast using various approaches and synoptic charts. Preparation of crop-weather calendar for principal crops. Preparation of pest -weather calendar for principal insect pests.Preparation of disease-weather calendar for principal diseases. Preparation of agro meteorological advisory services (AAS) bulletin for farmers. Verification of medium range weather forecasts and analysis of feedback from farmers receiving AAS bulletins.

AGM 601 Agro Meteorological Measurements and Instrumentations 1+2

UNIT I: Agromet observatory: site selection, layout, kinds, instruments, order of observations, times of observations in IST and LMT, exposure, operation, care, maintenance, calibration, detection of defects

and rectification; working principles of thermometers, grass minimum thermometer, open pan evaporimeter, soil thermometers, sunshine recorder, anemometer, anemograph, wind vane Duvdevani dew gauge, dew recorder; wind speed estimation by Beaufort Scale; routine measurements, computation and interpretation of all meteorological elements.

UNIT II: Fundamentals of measurement techniques; theory and working principles of radiation instruments: pyranometer, albedometer, photometer, spectro-radiometer, quantum radiation sensors, infrared thermometer, net radiometer, pressure bomb apparatus, porometer, photosynthesis system, leaf area meter, etc along with their descriptions, measurements, care, maintenance, calibration, detection of flaws and their repairs; soil heat flux plates; instruments for measuring soil moisture. Automatic weather stations: data logger and sensors, computation and interpretation of data.

UNIT III: Theory and working principles of psychrometers, hair hygrograph, thermograph, self recording rain gauge, lysimeter, pyranograph, anemograph, barometer, barograph, etc along with their exposure, operation, measurements and interpretation.

Practical: Working with the above instruments in the meteorological observatory and taking routine observations of relevant parameters and their interpretation. Computation of derived parameters and interpretation. Calibration of thermometer and to find out its correction factor. To study the lag coefficient of a thermometer. To prepare a thermocouple and to calibrate it.To get acquaintance with instruments in automatic weather station. Use of micrometeorological instruments: pyranometer, albedometer, net radiometer, pyrheliometer, pyrgeometer, heat flux plates, quantum sensor and luxmeter in the crop field. Use of psychrometers, hair hygrograph, thermograph, self recording rain gauge and lysimeter. Basic concepts of data logging, and introduction and use data loggers, and programming of data loggers.

AGM 602 Agro Meteorological Aspects of Crop Protection 2+1

UNIT I: Meteorological factors associated with incidence and development of crop pests and diseases such as rust diseases, potato blight, apple scab, ground nut red hairy caterpillar and other major pests and diseases of West Bengal.

UNIT II: Meteorological aspects of protection against plant diseases, weeds and insect pests with special reference to locust and other insect pests with long range migration. Locust meteorology.

UNIT III: Application of weather forecast and weather advisories to operational crop protection. Preparation and dissemination of weather based information and warning of pest and disease control. Economic importance of agro meteorological input to operational crop protection.

UNIT IV: Aerobiometeorology-its role in integrated disease and pest management, insect movement in atmosphere-effect of temperature, humidity, wind and rain on the dispersal, immigration and emigration of pests and pathogens.

UNIT V: Role of agrometeorology in forecasting disease and pest outbreak. Climatological models for forecasting of pests and diseases. Meteorological data requirement for crop protection.

Practical: Effects of meteorological factors on growth and development of pests and diseases. Sampling, measurement and population studies. Analysis and modeling of pest and disease-operational graphical models for monitoring of pest and disease development using routine weather observation. Weather based modeling of pests outbreak and recommendations. Weather based modeling of disease outbreak and their recommendations.

AGM 603 Agro Meteorological Data Management 1+2

UNIT I:Data and information; types of data; climate, soil and crop data; Importance of database management; data requirements; data collection and recording (Automatic and manual).

UNIT II: Data structure/format; quality control of data; techniques of climatic data generation; missing data; introduction to different software for database management.

UNIT III:Processing and analysis of data and data products; value addition of data and data products; data users, public, commercial, academic or research.

UNIT IV:Availability, accessibility and security of data; evaluating the cost of data; e-management of data.

UNIT V: Climatic statistics: measures of central tendency and variability, skewness, kurtosis, homogeneity, correlation, regression and moving averages; probability analysis using normal, binomial, Markov-chain and incomplete gamma distribution; parametric and non parametric tests; assessment of frequency of disastrous events.

UNIT VI: Probabilities of monthly and weekly rainfall; frequency and probability of dry and wet spells; onset and end of rainy seasons based on backward and forward accumulation of rainfall; relationship

between bright sun shine hours and global radiation; calculation of length of growing season, surplus and deficit by Thornthwaite and Mather (1955) water balance method; calculation of water requirement, deficit and water requirement satisfaction index by FAO method.

Practical: Types of instruments and data recording. WS data retrieval, storage and transfer. Exposure to different software for Agromet data analysis; exposure to Statistical software.Temporal and spatial analysis of data; exposure to GIS. Value addition to data. Introduction to internet protocols. Uploading and downloading data, password and security of data. E-management of data. Application of data management tools in agro climatic analysis.

AGM 651 Crop Weather Models 2+1

UNIT I: Principles of crop production; evaluation of crop responses to weather elements; impact of natural and induced variability of climate on crop production.

UNIT II: Introduction and application of crop modeling, types of models, concepts of mechanistic and deterministic models; empirical and statistical crop weather models and their application with examples; regression models-incorporating weather, soil, plant and other environmental related parameters and remote sensing inputs; growth and yield prediction models; general features of dynamic and statistical modeling techniques; measures of central tendency and dispersion, correlation, regression moving average, probability and their distribution function; weather data and physiology-based approaches to modeling of crop growth and yield; stochastic models; advantages and limitation of modeling.

UNIT III: Crop simulation models, e.g. CERES, WOFOST, SPAW, RESCAP, WTGROW, ect; use of crop simulation model in determining climatic change, green house effect, CO_2 increase, global warming and their impact on agriculture; verification, calibration and validation of models.

Practical: Working with statistical and simulation models, DSSAT models, BRASSICA, RESCAP etc.To develop linear regression models involving weather data and yield of principal crops.To develop nonlinear regression models involving weather data and yield of principal crops.To determine the impact of elevated CO_2 scenarios on principal crops.To determine the impact of elevated temperature scenarios on principal crops. To develop relationships between PAR and photosynthetic rate.

AGM 652 Climate Risk Management 2+0

UNIT I:Risks in agricultural production, history of weather and climate as accepted risk factors in agriculture in the continent/region/country/sub-region concerned and the related documented risk concepts; history and trends of defense strategies towards such risks in the same continent region/country/sub-region; preparedness for weather and climate risks.

UNIT II: Risks of droughts; monitoring, prediction and prevention of drought; drought proofing and management; modern tools including remote sensing and GIS in monitoring and combating droughts.

UNIT III: Risk characterization - definitions and classification of risks; characterization of weather and climate related risks in agriculture; water related risks; radiation/heat related risks; air and its movement related risks; biomass related risks; social and economic risk factors related to weather and climate.

UNIT IV: Approaches and tools to deal with risks - history of methods for weather and climate related risk assessments in the continent/region/country/subregion concerned and their documented evidence of application to agricultural/farming systems; strategies dealing with risks- mitigating practices before occurrence; preparedness for the inevitable; contingency planning and responses; disaster risk mainstreaming.

UNIT V: Perspectives for farm applications - farm applications not yet dealt with, such as making risk information products more client friendly and transfer of risk information products to primary and secondary users of such information; heterogeneity of rural people in education, income, occupation and information demands and consequences for risk information products and their transfer; livelihood-focused support, participation and community perspectives; challenges for developing coping strategies including transferring risks through insurance schemes.

UNIT VI: Challenges to coping strategies - combining challenges to disaster risk mainstreaming, mitigation practices, contingency planning and responses, basic preparedness; preparedness approaches reducing emergency relief necessities; the role that insurances can play in risk spreading and transfer; quantification of risk in agricultural systems associated with weather and climate; methods for risk assessment and application to agricultural systems of local and regional interest; application of risk management approaches to problems associated with weather and climate problems; application of methods that permit the incorporation of seasonal and long-term forecasts into the risk assessment models.