Course Name: Fundamentals of Meteorology
Course No.: AGM- 501
Credit Hours: 3(2 + 1)

Objectives: To impart theoretical and practical knowledge of physical processes occurring in atmosphere and techniques used in meteorology.

Theory Syllabus:

UNIT I

Solar radiation and laws of radiation; greenhouse effect, albedo, and heat balance of the earth and atmosphere; variation in pressure and temperature with height, potential temperature, pressure gradient, cyclonic and anticyclonic motions; geostropic and gradient winds; equations of motion; general circulation, turbulence, vorticity, atmospheric waves.

UNIT II

Gas laws, laws of thermodynamics and their application to atmosphere; water vapour in the atmosphere, various humidity parameters and their interrelationships; vapour pressure, psychrometric equation, saturation deficit, Lapse rates-ascent of dry and moist air, stability and instability conditions in the atmosphere.

UNIT III

Agromet observatory and analysis of weather data; Condensation; clouds and their classification; evaporation and rainfall; the hydrological cycle; precipitation processes, artificial rainmaking, thunderstorms and dust storm; haze, mist, fog, and dew; air masses and fronts; tropical and extra-tropical cyclones.

UNIT IV

Effect of Earth's rotation on zonal distribution of radiation, rainfall, temperature, and wind; the trade winds, equatorial trough and its movement;

UNIT V

Monsoon and its origin; Indian monsoon and its seasonal aspects: Onset, advancement and retreat of monsoon in different parts of India, Walker and Hadley cell, El Nino, La Nina, Southern Oscillation Index and their impact on monsoon.

Practical Syllabus:

- Agromet observatory- different classes of observatories (A, B, C)
- Site selection and installation procedures for meteorological instruments
- Measurement of weather parameters.
- Reading and recording, calculation of daily, weekly, monthly means.
- Totals of weather data.
- Weather chart preparation and identification of low pressure systems and ridges.
- Statistical technique for computation of climatic normals, moving average, etc.

Resources (books, journals, documents, websites)

- Ahrens. 2008. Meteorology today. Wadsworth Publishing Co Inc; 9th Edition
- Barry RG & Richard JC. 2003. Atmosphere, Weather and Climate. Tailor &Fransics Group.
- Bishnoi OP. 2007. Principles of Agricultural Meteorology. Oxford Book Co.
- Ghadekar, S.R. 2001. Meteorology. Agromet Publishers (Nagpur)
- Ghadekar, S.R. 2002. Practical Meteorology. Agromet Publishers (Nagpur) Mcllveen R. 1992. Fundamentals of Weather and Climate. Chapman & Hall.
- Petterson S. 1958. Introduction to Meteorology. McGraw Hill.
- Trewartha Glenn T. 1954. An Introduction to Climate. McGraw Hill.
- Varshneya MC & Pillai PB. 2003. Text Book of Agricultural Meteorology. ICAR.

Course Name: Fundamentals of Agricultural Meteorology
Course No.: AGM- 502
Credit Hours: 3(2 + 1)

Objectives: To impart the theoretical and practical knowledge of physical processes occurring in relation to plant and atmosphere with advanced techniques.

Theory Syllabus:

UNIT I

Meaning and scope of agricultural meteorology; components of agricultural meteorology; role and responsibilities of agricultural meteorologists.

UNIT II

Importance of meteorological parameters in agriculture; efficiency of solar energy conversion into dry matter production; meteorological factors in photosynthesis, respiration and net assimilation; basic principles of water balance in ecosystems; soil water balance models and water production functions.

UNIT III

Crop weather calendars; weather forecasts for agriculture at short, medium and long range levels; agromet advisories, preparation, dissemination and economic impact analysis; use of satellite imageries in weather forecasting; synoptic charts and synoptic approach to weather forecasting.

UNIT IV

Concept, definition, types of drought and their causes; prediction of drought; crop water stress index, crop stress detection; air pollution and its influence on vegetation, meteorological aspects of forest fires and their control

UNIT V

Climatic change, green house effect, CO_2 increase, global warming and their impact on agriculture; climate classification, agro-climatic zones and agro-ecological regions of India.

Practical syllabus:

- Preparation of crop weather calendars
- Development of simple regression models for weather, pest and disease relation in different crops.
- Preparation of weather based agro-advisories
- Use of automated weather station (AWS)

Resources (books, journals, documents, websites)

- Bishnoi OP. 2007. Principles of Agricultural Meteorology. Oxford Book Co.
- Kakde JR. 1985. Agricultural Climatology. Metropolitan Book Co.

- Mahi and Kingra. 2014. Fundamentals of agrometeorology. Kalyani publishers.
- Mavi, H.S. and Tupper. 2004. Principles and applications of climate studies in agriculture. CRC Press
- Varshneya MC & Pillai PB. 2003. Text Book of Agricultural Meteorology. ICAR.

Course Name: Crop-weather relationships
Course No.: AGM-503
Credit Hours: 2(2 + 0)

Objectives: To study and understand the role of weather on crop growth and development.

Theory Syllabus:

UNIT I

Understanding the influence of weather elements on crop growth, impact of climatic variability and extremes on crop production, climatic normals for crop production.

UNIT II

Climatic requirements of major crops, temperature effect on crop growth, radiation impact and radiation utilization efficiency, humidity effect on crop performance, effect of soil temperature on seed germination and root growth, wind variation and crop growth.

UNIT III

Meteorological indices to predict crop production, Interpretation of weather forecasts for various agricultural operations towards improved productivity, crop-weather relationship in dryland areas. Crop weather relationship of major horticultural crops of the region and agroforestry system.

UNIT IV

Rhizosphere and microorganisms in relation to weather, fertilizer and water use efficiency in relation to weather

Teaching methods/activities: Classroom teaching

Course Name: Agro-Meteorological Measurements and Instrumentation
Course No.: AGM- 504
Credit Hours: 3(1+2)

Objectives: To impart the theoretical and practical knowledge of instruments/equipments used for measurement of agro-meteorological variables.

Theory Syllabus:

UNIT I

Fundamentals of measurement techniques; theory and working principles of barometer, thermometer, psychrometer, hair hygrometer, thermos-hygrograph; exposure and operation of meteorological instruments/ equipments in Agromet observatories.

UNIT II

Radiation and temperature measuring instruments: working principles of albedometer, photometer, spectro-radiometer, sunshine recorder, dew recorder, quantum radiation sensors, pressure bomb apparatus, thermographs, and infra-red thermometer.

UNIT III

Precipitation and dew instruments: working principles of rain gauge, self-recording rain gauge, Duvdevani dew gauges. Wind instruments: working principles of anemometer, wind vane, anemograph.

UNIT IV

Evapotranspiration and photosynthesis instruments: working principles of lysimeters, open pan evaporimeters, porometer, photosynthesis system, leaf area meter.

UNIT V

Boundary layer fluxes, Flux tower, soil heat flux plates, instruments to measure soil moisture and soil temperature.

UNIT VI

Automatic weather station – data logger and sensors, nano-sensors for measurement of weather variables; computation and interpretation of data.

Practical

- Working with the above instruments in the meteorological observatory, fields and laboratory, Recording observations of relevant parameters
- Computation and interpretation of the data
- Analysis of AWS data

Course Name: Crop Micrometeorology
Course No.: AGM- 505
Credit Hours: 3(2 + 1)

Objectives: To impart the theoretical and practical knowledge of physical processes occurring in lower atmosphere and within crop canopy concerning crop growth

Theory Syllabus:

UNIT I
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 II
Molecular and eddy transport of heat, water vapour and momentum, frictional effects, eddy diffusion, mixing; zero plane displacement, temperature instability, eddy covariance technique, 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, Raymonds analogy, Exchange coefficients.

UNIT III
Micrometeorology of plant canopies; distribution of temperature, humidity, vapour pressure, wind and carbon dioxide; modification of microclimate due to cultural practices, intercropping; radiation distribution and utilization by plant communities, leaf temperature and its biological effects; influence of topography on microclimate; shelter belts and wind breaks, microclimate in low plant area of meadows and grain fields, microclimate within forests, glass house and plastic house climates; instruments and measuring techniques in micrometeorology.

UNIT IV
Effects of ambient weather conditions on growth, development and yield of crops; measurement of global and diffuse radiation; measurement of albedo over natural surfaces and cropped surfaces; net radiation measurement at different levels; PAR distribution in plant canopies and interception; wind, temperature and humidity profiles in (a) short crops and (b) tall crops; energy balance over crops and LAI and biomass estimation; remote sensing and its application in relation to micrometeorology.

Practical

- Micrometeorological measurements in crop canopies
- Quantification of crop microclimate
- Determination of ET and its computation by different methods.

Resources (books, journals, documents, websites)

- Arya S Pal. 1988. Introduction to Micrometeorology. Academic Press. Bishnoi OP. 2007. Principles of Agricultural Meteorology. Oxford Book Co.
- Chang, Jen-Hu. 1968. Climate and Agriculture: An Ecological Survey. Aldine Publishing Company.
- Gates DM. 1968. Energy Exchange in the Biosphere. UNESCO.
- Goudriaan J. 1983. Crop Micrometeorology: A Simulation Study. Scientific Publ.

- Grace J. 1983. Plant Atmospheric Relationships: Outline Studies in Ecology. Chapman & Hall.
- Gupta PL & Rao VUM. 2000. Practical Manual on Micrometeorology. Dept. of Agril. Meteorology, CCS HAU Hisar, India.
- Jones HG. 1992. Plants and Microclimate. Cambridge Univ. Press. Munn RE. 1970. Biometeorological Methods. Academic Press.
- Monteith and Unsworth. 2013. Principles of Environmental Physics. Elsevier.
- Rosenberg NJ. 1974. Microclimate – The biological Environmet. John Wiley & Sons. Sellers W. 1967. Physical Climatology. The University of Chicago Press.

Course Name: Evapotranspiration and Soil Water Balance
Course No.: AGM- 506
Credit Hours: 3(2 + 1)

Objectives: To impart the theoretical and practical knowledge of ET estimation and determination of the components of soil water balance

Theory Syllabus:

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.

UNIT III

Influence of microclimatic and cultural factors on soil water balance; 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.

UNIT IV

Yield functions; water use efficiency and scheduling of irrigation based on evapotranspiration; dry matter yield ET functions; radiation instruments; advanced techniques for measurement of radiation and energy balance; estimation of evapotranspiration through remote sensing.

Practical

- Measurement of various components of soil water balance
- Evaluation of hydraulic conductivity vs. soil moisture relationship by water balance approach
- Computation and comparison of evapotranspiration by different methods - energy balance method, aerodynamic method, Penman method, remote sensing and other methods
- Soil moisture retention characteristics by pressure plate method.

Resources (books, journals, documents, websites)

- Bishnoi OP. 2007. Principles of Agricultural Meteorology. Oxford Book Co.
- Burman R &Pochop LO. 1994. Evaporation, Evapotranspiration and Climatic Data. Elsevier.
- Grace J.1983. Plant Atmospheric Relationships: Outline Studies in Ecology. Chapman & Hall.
- Mavi HS & Graeme J Tupper 2004. Agrometeorology: Principles and Applications of Climate Studies in Agriculture. The Haworth Press.
- Murthy VRK. 2002. Basic Principles of Agricultural Meteorology. BS Publ.

- Ram Niwas, Diwan Singh & Rao VUM. 2000. Pratical Manual on Evapotranspiration. Dept. of Agril.Meteorology, CCS HAU Hisar.
- Rosenberg NJ, Blad BL &Verma SB.1983. Microclimate –The Biological Environment. John Wiley & Sons.
- Subramaniam, V.P. (1982). Water balance and its application. Andhra University Press, Waltair, India.

Course Name: Crop Weather Models
Course No.: AGM- 507
Credit Hours: 3(1+2)

Objectives: To impart the theoretical and practical knowledge of various models for estimation of crop weather responses.

Theory Syllabus:

UNIT I

Principles of crop production; effect of weather elements on crop responses; impact of natural and induced variability of climate on crop production.

UNIT II

Introduction and application to crop modeling, types of models, Empirical and statistical crop weather models their application with examples; concept of crop growth model in relation to weather, soil, plant and other environmental related parameters and remote sensing inputs; growth and yield prediction models;

UNIT III

Dynamic crop simulation models, e. g. DSSAT, Info Crop, APSIM, CropSyst, etc.; optimization, calibration and validation of models. Weather data and physiology-based approaches to modeling of crop growth and yield; forecasting of pests and diseases; stochastic models; advantages and limitation of modeling.

Practical

• Working with statistical and simulation models, DSSAT models, InfoCrop, Oryza, etc.

Course Name: Applied Agriculture Climatology
Course No: AGM 508
Credit Hours: 3(1+2)

Objectives: To impart the theoretical and practical knowledge of computation of different bio-parameters and their applications in the agriculture.

Theory Syllabus:

UNIT I

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 II

Precipitation indices; Climatic water budget: potential and actual evapotranspiration and their computation; measurement of precipitation, 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

Thermal indices and phenology: cardinal temperatures; heat unit and growing degree day concepts for crop phenology, crop growth and development; insect-pest development; crop weather calendars; agroclimatic requirement of crops.

UNIT IV

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

Practical

- Use of statistical approaches in data analysis
- Preparation of climatic water budget
- Estimation of agro-meteorological variables using historical records
- Degree day concept and phenology forecasting and preparation of crop calendar
- 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.

Course Name: Weather Forecasting
Course No.: AGM- 509
Credit Hours: 3(2 + 1)

Objectives: To impart theoretical and practical knowledge of forecasting techniques used for weather prediction and preparation of agro-advisories.

Theory Syllabus:

UNIT I

Weather forecasting system: definition, scope and importance; 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; weather forecasting network.

UNIT II

Approaches for weather forecasts: methods of weather forecasts - synoptic, numerical prediction, statistical, analogue, persistence and climatological approach, nanotechnological 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.

UNIT IV

Modification of weather hazards: weather modification for agriculture; scientific advances in artificial rain making, hail suppression, dissipation of fog and stratus clouds, modification of severe storms and electric behavior of clouds.

UNIT V

Weather based advisories: interpretation of weather forecasts for soil moisture, farm operations, pest and disease development and epidemics, crops and livestock production; preparation of weather-based advisories and dissemination.

Practical

- Exercise on weather forecasting for various applications
- Preparation of weather-based agro-advisories based on weather forecast using various approaches and synoptic charts.

Course Name: RS and GIS Applications in Agricultural Meteorology
Course No.: AGM- 510
Credit Hours: 3(2 + 1)

Objectives: To impart the theoretical and practical knowledge of remote sensing principles and their use to estimate of agro-meteorological variables.

Theory Syllabus:

UNIT I

Basic components of remote sensing- signals, sensors and sensing systems; active and passive remote sensing.

UNIT II

Characteristics of electromagnetic radiation and its interaction with matter; spectral features of earth's surface features; remote sensors in visible, infrared and microwave regions.

UNIT III

Imaging and non-imaging systems; framing and scanning systems; resolution of sensors; sensor platforms, their launching and maintenance. Drone technology.

UNIT IV

Data acquisition system, data preprocessing, storage and dissemination; digital image processing and information extraction.

UNIT V

Microwave remote sensing; visual and digital image interpretation; introduction to GIS and GPS.

UNIT VI

Digital techniques for crop discrimination and identification; crop stress detection - soil moisture assessment, inventory of ground water and satellite measurement of surface soil moisture and temperature; drought monitoring, monitoring of crop disease and pest infestation. Use of satellite data in weather forecasting.

UNIT VII

Soil resource inventory; land use/land cover mapping and planning; integrated watershed development; crop yield modeling and crop production forecasting.

Practical

- Acquisition of maps
- Field data collection
- Map and imagery scales
- S/W and H/W requirements and specifications for remote sensing
- Data products, their specifications, media types, data inputs, transformation, display types, image enhancement
- Image classification methods
- Evaluation of classification errors
- Crop discrimination and acreage estimations

- Differentiation of different degraded soils
- Time domain reflectometry
- Use of spectrometer and computation of vegetation indices
- Demonstration of case studies
- Hands on training

Course Name: Strategic Use of Climatic Information
Course No: AGM 511
Credit hour: (2+1)

Objective: To impart the theoretical and practical knowledge of climatic hazards and their mitigations.

Theory Syllabus:

UNIT I

Increasing awareness on potential climate hazards and mitigations: history of climate related disasters in the concerned continent/region/country/sub-region and their documented or remembered impacts; Climatic hazards and extreme weather events (Cyclone, Hailstorm, drought, flood, etc.), Impact of climatic hazard on agricultural production; efforts made in mitigating impacts of (future) disasters (prevention); trends discernible in occurrence and character of disasters, if any.

UNIT II

Selection of appropriate land use and cropping patterns: types and drivers of agricultural land use and cropping patterns based on climatic situation; history of present land use and cropping patterns in the sub-region concerned as related to environmental issues; successes and difficulties experienced by farmers with present land use and cropping patterns; outlook for present land use and cropping patterns and possible alternatives from an environmental point of view.

UNIT III

Adoption of preparedness strategies: priority settings for preparedness strategies in agricultural production; preparedness for meteorological disasters in development planning; permanent adaptation strategies that reduce the vulnerabilities to hazards; preparedness as a coping strategy.

UNIT IV

Making more efficient use of agricultural inputs: agro-meteorological aspects of agricultural production inputs and their history; determination of input efficiencies based on weather conditions; other factors determining inputs and input efficiency; actual use of inputs in main land use and cropping patterns of the region.

UNIT V

Adoption of microclimate modification techniques: review of microclimate management and manipulation methods; history of microclimate modification techniques practiced in the continent/country/sub-region concerned; possible improvements in adoption of microclimate modification techniques, given increasing climate variability and climate change; local trends in adoption of such techniques.

UNIT VI

Protection measures against extreme climate: history of protection measures against extreme climate in the continent/region/country/sub region concerned; successes and difficulties experienced by farmers with present protection measures; outlook for present protection measures and possible alternatives; trends in protection methods against extreme climate.

Practical

- Outlook for present land use and cropping patterns and possible alternatives from environmental point of view

- Recent trends in land use and cropping patterns.
- Agro-meteorological services to increase farmers design abilities of land use and cropping patterns.
- Systematic and standardized data collection on protection measures against extreme climate.

Course Name: Weather and Climate Risk Management
Course No: AGM 512
Credit Hours: 2(2+0)

Objectives: To impart the theoretical and practical knowledge of weather modification techniques with risk management strategies

Theory Syllabus:

UNIT I

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 II

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; preparedness for weather and climate risks.

UNIT III

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 IV

Theories of weather modification; scientific advances in clouds and electrical behavior of clouds; hails suppression, dissipation of fog, modification of frost intensity and severe storms; shelter belts and wind breaks, mulches and anti-transpirants; protection of plants against climatic hazards; air and water pollution; meteorological conditions in artificial and controlled climates - green, plastic, glass and animal houses etc.

UNIT V

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

UNIT VI

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 VII

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; application of methods that permit the incorporation of seasonal and long-term forecasts into the risk assessment models.

Course Name: Aerobiometeorology
Course No: AGM 513
Credit Hours: 2+1

Objectives: To impart theoretical knowledge on insect, pest and plant biometeorology.

Theory Syllabus:

UNIT I

Definition and structure of Aerobiometeorology, role of Agrometeorology and Biogeography in forecasting pests and disease outbreak, insect movement in the atmosphere, intensification, Effect of weather & climate parameters on reproduction, growth, development, movements, food, habitat and dispersal of pests and diseases. Influence of weather & climate on Migratory pests (Desert locust, BPH etc.).

UNIT II

Benevolent and malevolent weather conditions for salient pests & diseases of the concerned agro-climatic zones. Effects of sudden weather changes and extreme weather conditions on population built-up of the pest, heat stress and heat related mortality, climate change impact on pest and diseases.

UNIT III

Biometeorology in integrated pest and disease management programme, modification of plant canopy and its impact of plant diseases, management of segments of disease triangle: environment manipulation and host manipulation, weather based forewarning system for pest and diseases.

UNIT IV

Soil borne pathogens, their biology, management and challenges, soil borne diseases and their control, abiotic factor in soil borne disease management, Managing of pests & diseases in controlled environment, Environmental management for pest and disease.

Practical

- Identification of different pests
- Pest population, observations and their index calculation
- Identification of various diseases
- Disease initiation and their intensity, percent disease index
- Relation between weather parameters and pests and disease

PGS 501: LIBRARY AND INFORMATION SERVICES (1+0)

Objective

To equip the library users with skills to trace information from libraries efficiently, to apprise them of information and knowledge resources, to carry out literature survey, to formulate information search strategies, and to use modern tools (Internet, OPAC, search engines etc.) of information search.

Theory

Introduction to library and its services; Role of libraries in education, research and technology transfer; Classification systems and organization of library; Sources of information- Primary Sources, Secondary Sources and Tertiary Sources; Intricacies of abstracting and indexing services (Science Citation Index, Biological Abstracts, Chemical Abstracts, CABI Abstracts, etc.); Tracing information from reference sources; Literature survey; Citation techniques/Preparation of bibliography; Use of CD-ROM Databases, Online Public Access Catalogue and other computerized library services; Use of Internet including search engines and its resources; e- resources access methods.

PGS 502: TECHNICAL WRITING AND COMMUNICATIONS SKILLS (0+1)

Objective

- To equip the students/scholars with skills to write dissertations, research papers, etc.
- To equip the students/scholars with skills to communicate and articulate in English (verbal as well as writing).

Practical

- ***Technical Writing*** - Various forms of scientific writings- theses, technical papers, reviews, manuals, etc; Various parts of thesis and research communications (title page, authorship contents page, preface, introduction, review of literature, material and methods, experimental results and discussion); Writing of abstracts, summaries, précis, citations etc.; commonly used abbreviations in the theses and research communications; illustrations, photographs and drawings with suitable captions; pagination, numbering of tables and illustrations; Writing of numbers and dates in scientific write-ups; Editing and proof-reading; Writing of a review article.
- ***Communication Skills*** - Grammar (Tenses, parts of speech, clauses, punctuation marks); Error analysis (Common errors); Concord; Collocation; Phonetic symbols and transcription; Accentual pattern: Weak forms in connected speech: Participation in group discussion: Facing an interview; presentation of scientific papers.

PGS-503: Intellectual Property and Its Management in Agriculture (1+0)

Objective

The main objective of this course is to equip students and stakeholders with knowledge of intellectual property rights (IPR) related protection systems, their significance and use of IPR as a tool for wealth and value creation in a knowledge-based economy.

Theory

Historical perspectives and need for the introduction of Intellectual Property Right regime; TRIPs and various provisions in TRIPS Agreement; Intellectual Property and Intellectual Property Rights (IPR), benefits of securing IPRs; Indian Legislations for the protection of various types of Intellectual Properties; Fundamentals of patents, copyrights, geographical indications, designs and layout, trade secrets and traditional knowledge, trademarks, protection of plant varieties and farmers‘ rights and bio-diversity protection; Protectable subject matters, protection in biotechnology, protection of other biological materials, ownership and period of protection; National Biodiversity protection initiatives; Convention on Biological Diversity; International Treaty on Plant Genetic Resources for Food and Agriculture; Licensing of technologies, Material transfer agreements, Research collaboration Agreement, License Agreement.

PGS 504: BASIC CONCEPTS IN LABORATORY TECHNIQUES 1(0+1)

Objective

To acquaint the students about the basics of commonly used techniques in laboratory.

Practical

Safety measures while in Lab; Handling of chemical substances; Use of burettes, pipettes, measuring cylinders, flasks, separatory funnel, condensers, micropipettes and vaccupets; washing, drying and sterilization of glassware; Drying of solvents/chemicals. Weighing and preparation of solutions of different strengths and their dilution; Handling techniques of solutions; Preparation of different agro-chemical doses in field and pot applications; Preparation of solutions of acids; Neutralisation of acid and bases; Preparation of buffers of different strengths and pH values. Use and handling of microscope, laminar flow, vacuum pumps, viscometer, thermometer, magnetic stirrer, micro-ovens, incubators, sand bath, water bath, oil bath; Electric wiring and earthing. Preparation of media and methods of sterilization; Seed viability testing, testing of pollen viability; Tissue culture of crop plants; Description of flowering plants in botanical terms in relation to taxonomy

Suggested Readings

- Furr AK. 2000. *CRC Hand Book of Laboratory Safety*. CRC Press.
- Gabb MH &Latchem WE. 1968. *A Handbook of Laboratory Solutions*. Chemical Publ. Co.

PGS 505: Agricultural Research Ethics and Rural Development Programme (1+0)

Objective

To enlighten the students about the organization and functioning of agricultural research systems at national and international levels, research ethics, and rural development programmes and policies of Government.

Theory

UNIT I

History of agriculture in brief; Global agricultural research system: need, scope, opportunities; Role in promoting food security, reducing poverty and protecting the environment; National Agricultural Research Systems (NARS) and Regional Agricultural Research Institutions; Consultative Group on International Agricultural Research (CGIAR): International Agricultural Research Centres (IARC), partnership with NARS, role as a partner in the global agricultural research system, strengthening capacities at national and regional levels; International fellowships for scientific mobility.

UNIT II

Research ethics: research integrity, research safety in laboratories, welfare of animals used in research, computer ethics, standards and problems in research ethics.

UNIT III

Concept and connotations of rural development, rural development policies and strategies. Rural development programmes: Community Development Programme, Intensive Agricultural District Programme, and Special group – Area Specific Programme, Integrated Rural Development Programme (IRDP) Panchayati Raj Institutions, Co-operatives, and Voluntary Agencies/Non R Governmental Organisations. Critical evaluation of rural development policies and programmes. Constraints in implementation of rural policies and programmes.

PGS 506: Disaster Management (1+0)

Objectives

To introduce learners to the key concepts and practices of natural disaster management; to equip them to conduct thorough assessment of hazards, and risks vulnerability; and capacity building.

Theory

UNIT I

Natural Disasters- Meaning and nature of natural disasters, their types and effects. Floods, Drought, Cyclone, Earthquakes, Landslides, Avalanches, Volcanic eruptions, Heat and cold Waves, Climatic Change: Global warming, Sea Level rise, Ozone Depletion

UNIT II

Man Made Disasters- Nuclear disasters, chemical disasters, biological disasters, building fire, coal fire, forest fire. Oil fire, air pollution, water pollution, deforestation, Industrial wastewater pollution, road accidents, rail accidents, air accidents, sea accidents.

UNIT III

Disaster Management- Efforts to mitigate natural disasters at national and global levels. International Strategy for Disaster reduction. Concept of disaster management, national disaster management framework; financial arrangements; role of NGOs, Community-based organizations, and media. Central, State, District and local Administration; Armed forces in Disaster response; Disaster response: Police and other organizations.