60 AGRICULTURAL METEOROLOGY

Unit 1 : General Meteorology

Scope and importance of meteorology; Layers of atmosphere and their characters; Laws of radiation: Planck's law, Stephan-Boatman law, Wein's displacement law; Kirchoff's law, Beer's law and Lambert's, Cosine law, Solar constant, length of day;Atmospheric and astronomical factors affecting depiction of solar radiation; Ozone hole; Direct and diffuse radiation; Albedo, Heat transfer, convection, conduction and radiation; Concepts of latent and sensible heat; temperature inversion Radiant flux and flux density; Atmospheric motion balanced forces; Gas laws, pressure gradient, isobars, hydraulic equation and its application; Carioles force, geotropic, gradient and cyclostrophic winds; three dimensional wind circulation; Pressure systems; Cyclones and anticyclonic motions: trough, ridge and col; Thermal wind; Contour charts, Concepts of specific heat at constant volume and pressure; First and second laws of thermodynamics, vapor pressure, specific humidity, relative humidity, mixing ratio, absolute humidity and dew point temperature; Vapour pressure deficit; Psychometric equation, entropy, T-phi gram; Vertical stability of atmosphere, virtual temperature and potential temperature; Moist and dry adiabatic processes; Clouds their description and classification; Condensation process-artificial rain making; Bergeron-Findeison theory; coalescence theory; Forms and types of precipitation Dew, frost, fog, mist, haze thunderstorm and hail; Air masses and fronts; Extra tropical cyclones; Land and sea breeze; Mountain and valley winds; Wind rose, Tropical cyclones and their structures; Extreme events, Tornados, water spout, thunder storm, dust storm, Avalanche, blizzard etc., Weather variables and their measurements; Different types of observatories and instruments; Units for measurements of momentum, force work, power, surface tension, pressure, temperature; Thermal - conductivity and diffusivity, resistance, radiation light intensity and water vapour.

Unit 2 : General Climatology

Elements of weather and climate; Climatic controls, factors affecting climate Seasonal distribution of radiation, rainfall. temperature sunshine, wind pressure over India; Climatic classification - Koppen and Thornthwaite; Hargreaves and Trolls classification; Climatology principles of weather phenomena occurring in four main seasons of India; Mechanism of Indian monsoons; Climatic variability,recent trends, Mitigation and adaptation strategies, factor affecting rainfall distribution, cyclones and cyclonic tracks over the Indian region; North western disturbances and monsoon breaks; Drought climatology, rainfall and its variability, atmospheric and agricultural droughts intensity, duration, beginning and end of drought and wet spells; Moisture availability indices; Heat and cold waves; Continental, polar maritime and monsoon climates, El-Niño, La Nino and their impact on Indian rainfall systems.

Unit 3 : Agricultural Climatology

Meaning and scope; Effect of thermal environment, Diurnal variation; on growth and yield of crops; Cardinal temperatures; Thermoperiodism, photoperiodism; Vont Hoff's law, phenology of crops; Heat unit concept, thermal time and thermal use-efficiency and their applications; Length of growing period determination. contingency planning far different weather aberrations, and

extreme weather events; Meteorological factors associated with incidence and development of crop pests and disease, pest and disease out breaks etc.; Effect of climate on humans and animals, warm and cold season indices for comfort zones, role of weather in animal disease and protection against weather hazards.

Unit 4 : Micrometeorology

Concept of micro, meso and macro meteorology; Micrometeorological processes near bare ground and crop surfaces; Shearing stress, molecular and eddy diffusion, forced and tree convection; Boundary layer, frictional velocity, roughness length and zero plane displacement; Micrometeorology of crops, rice and wheat; Day and night radiation, humidity, temperature, wind and CO2 profiles in crop canopies; Richardson number, Reynolds analogy, exchange coefficients, fluxes of momentum, water vapors, CO2 and heat; Inversion and its effect on smoke plume distribution; Windbreaks and shelterbelts, different methods on modification of field microclimate; Frost protection, hail suppression spectral properties of vegetation; Light interception by crop canopies as influenced by leaf area index, leaf arrangement and leaf transmissibility, extinction coefficient and radiation use–efficiency; Microclimate of field crops, forest and orchards etc.

Unit 5 : Evapotranspiration

Hydrological cycle and concept of water balance, concepts of evaporation. evapotranspiration, potential and actual evapotranspiration, consumptive use, different approaches of ET determination direct and empirical methods, energy balance and Bowen's ratio methods, water balance single and multilayered soil methods, aerodynamic, eddy correlation and combination approaches, field lysimetric approaches and canopy temperature based methods; Advantages and limitations of different methods; Water use and water use-efficiency, dry matter production and crop yield functions; Irrigation scheduling based on ET; Advective energy determination and its effect on water use by crops; Physiological variation in relation to crop growth and development.

Unit 6 : Crop Weather Modeling

Concepts of mechanistic and deterministic models; General features of dynamical and statistical modeling techniques; Crop weather models and their use in crop yield assessments; Crop weather analysis models, empirical, statistical models, and differentcrop growth simulation models for yield assessment; concepts for crop growth and yield; Advantages and limitations of modeling, climatic change, greenhouse effect, CO2 increase, global warming and their impact on agriculture.

Unit 7 : Weather Forecasting for Agriculture

Methods and types of weather forecasting,: Short, medium and long range weather forecasting; Crop and pest weather calendars Monsoon onset and rainfall forecasts; Weather forecasting and agro-advisories; Use of satellite cloud imageries in weather forecasting; Synoptic charts and synoptic approach to weather forecasting, use of medium, long range and vegetative indices based agro meteorology forecasts for monitoring crop prospects and crop yield forecasts; Meteorological satellites for weather forecasts; Forecast of Indian monsoon rainfall; Early warning systems for agriculture operation forecasts.