Department of Agricultural Engineering
SAS:NU, Medziphema Campus

Semester-wise Course allocation to **Agricultural Engineering Discipline** for B.Sc. (Hons) Agriculture

(As per ICAR Fifth Deans' Committee)

Sl.No.	Course No.	Course Title	Credit Hours	Semester
(A) Essential Courses				
1.	AGE-102	Introductory Soil and Water Conservation Engineering	**2(1+1)**	**II**
2.	AGE-201	Farm Machinery and Power	**2(1+1)**	**III**
3.	AGE-202	Renewable Energy and Green Technology	**2(1+1)**	**IV**
4.	AGE-302	Protected Cultivation and Secondary Agriculture	**2(1+1)**	**VI**
(B) Elective Courses				
5.	AGE-204	Fundamental of Irrigation Engineering	**3 (2+1)**	**IV**
6.	AGE-301	System Simulation and Agro-advisory	**3(2+1)**	**V**
7.	AGE-304	Remote Sensing and GIS application in Watershed Management	**3(2+1)**	**VI**
(c) Remedial Course				
8.	AGE MAT-101	Elementary Mathematics	**2(2+0)**	**I**

Department of Agricultural Engineering

Syllabus of core courses

SI	Course No	Title	Credit hours
1.	MAT-101	Elementary Mathematics	2(2+0)

Theory

Cartesian Coordinates: Distance formula, section formula (internal and external division), Change of axes (only origin changed).

Straight lines: Equation of co-ordinate axes, Equation of lines parallel to axes, Slope-intercept form of equation of line, Slope-point form of equation of line, Two point form of equation of line, Intercept form of equation of line, Normal form of equation of line, General form of equation of line, Point of intersection of two st. lines, Angles between two st. lines, Parallel lines, Perpendicular lines, Angle of bisectors between two lines, Area of triangle and quadrilateral.

Circle: Equation of circle whose centre and radius is known, General equation of a circle, (Derivation of formulas are not required only explanation and some problems sould be done based on these formulas)

Differential Calculus : Concept of function, limit and continuity, Simple problems on limit, Simple problems on continuity, Differentiation of x^n , e^x from first principle, Derivatives of sum, difference, product and quotient of two functions, Differentiation of functions of functions (Simple problem based on it), Logarithmic differentiation (Simple problem based on it), Differentiation by substitution method and simple problems based on it, Maxima and Minima of the functions of the form y=f (x) (Simple problems based on it).

Integral Calculus: Integration of simple functions, Integration of Product of two functions, Integration by substitution method, Definite Integral (simple problems based on it), Area under simple well-known curves (simple problems based on it).

Matrices and Determinants: Evaluation of determinant and Properties of determinants up to 3rd order, Definition of Matrices, Addition, Subtraction, Multiplication, Transpose and Inverse up to 3rd order.

SI	Course No	Title	Credit hours
2.	**AGE-102**	**Introductory Soil and Water Conservation Engineering**	**2(1+1)**

Theory:

Definition, types and causes of soil erosion; Runoff, factors effecting runoff, Rainfall-runoff relationship, computation of runoff by Rational method and Curve number method, Water erosion: forms of water erosion, gully classification; Soil loss estimation by Universal Loss Soil Equation. Principles of erosion control: contour cultivation and strip cropping. Contour bund, graded bund and bench terracing, grassed water ways and their design. Wind erosion: mechanics of wind erosion and its control measures. Extent of soil erosion and status of soil and water conservation programme in North East Region of the country.

Practical

1. Average depth of rainfall over an area by (a) Arithmetic mean method (b) Thiessen polygon methods of leveling equipments
2. Calculation of rainfall intensity
3. Preparation of rainfall frequency curve and determination of rainfall for given recurrence interval and probability
4. Chain Surveying
5. Differential leveling
6. Profile leveling
7. Determination of slope
8. Contour plotting
9. Measurement of infiltration rate
10. Runoff measurement using current meter and flume
11. Soil loss from a runoff plot by multislot-divisor

SI	Course No	Title	Credit hours
3.	**AGE-201**	**Farm Machinery and Power**	**2(1+1)**

Theory:

Sources of Farm Power , I.C. engines, working principles of I. C. engines, comparison of two stroke and four stroke cycle engines , functions of different components of I.C. engine, I.C. engine terminology- bore stroke ratio, TDC and BDC, Piston displacement, Piston speed, Swept volume, clearance volume, compression ratio, IHP, BHP,FHP, DBHP, Mechanical Efficiency, Thermal Efficiency, Firing Interval; Firing Order Introduction of different systems of I.C. engines- Air intake and exhaust system, fuel

system, cooling and lubrication system, Introduction of hydraulic control system and power transmission system of a tractor, PTO shaft.

Primary and secondary tillage implement-Deshi plough, M.B plough, Disc plough, Sub soiler, Rotavator, Disc harrow, Patela harrow, implements for intercultural operations-cultivator, hand hoes, Introduction of sowing and planting equipment, paddy transplanter, Implements for hill agriculture, Draft, Field capacity and Field efficiency of an implement, Introduction of Plant protection equipment, Introduction of harvesting and threshing equipment.

Practical:

1. Identification of different components of I.C. engine.
2. Familiarization with air intake and exhaust, and fuel system of engine.
3. Familiarization with lubrication and cooling system of engine.
4. Familiarization with clutch, transmission, differential and final drive of a tractor
5. Familiarization with hydraulic control system and hitching system of tractor.
6. Cost analysis of tractor power and attached implement
7. Operation of tractor and tractor drawn implements
8. Operation of power tiller
9. Use of implements for hill agriculture
10. Identification of different parts of mould plough, disc plough, disc harrow and cultivator.
11. Calibration of seed drill and planters
12. Familiarization with paddy transplanter and preparation of mat type of seedling
13. Familiarization with different types of sprayers and dusters
14. Familiarization with harvesting, threshing and cleaning machinery and equipments.

SI	Course No	Title	Credit hours
4.	**AGE-202**	**Renewable Energy and Green Technology**	**2(1+1)**

Theory:

Classification of energy sources, contribution of different energy sources in agricultural sector, Biomass utilization, Biogas- raw materials for biogas generation, types of biogas plants, construction details of KVIC, Janata and Deenbandhu types of biogas plant, factors affecting production of biogas, gasifires-types of gasifires, bio-diesel-characteristics of bio-diesel, production of bio-diesel from vegetable oils, bio-ethanol and its production from agricultural produce, briquette, utilization as bio energy resource.

Solar energy-Flat plate collector and concentrating collector, Solar energy gadgets- solar cooker, solar water heater, solar dryer, solar pond, solar distillation, solar photovoltaic system and their application, Wind energy- types and application of wind mill, hydro-power.

Practical:

1. Design of KVIC type of biogas plant
2. Construction of working model of biogas plant
3. Care and maintenance of biogas plant
4. Visit to biogas plant
5. Visit to gasifier plant
6. Production process of biodiesel
7. Preparation of Beehive Briquettes using a Briquetting Mould
8. Study on solar cooker, solar water heater, solar lantern, solar street light and solar pumping system
9. Construction of working model of solar dryer and solar tunnel dryer

SI	Course No	Title	Credit hours
5.	**AGE-302**	**Protected Cultivation and Secondary Agriculture**	**2(1+1)**

Theory:

Concept of green house and introduction of green house technology, Types of Green Houses- greenhouses based on shape, utility, construction, covering materials and cost, active and passive green houses, Plant response to green house environment- light, temperature, relative humidity, ventilation and carbon dioxide and environmental requirement of agriculture and horticulture crops inside green houses. Constructional details of green house, materials of construction for traditional and low-cost green houses, design criteria of green house for cooling and heating purposes, green house equipments, natural ventilation, forced ventilation, summer cooling and winter cooling, hot air green house heating systems, green house drying, Irrigation systems used in greenhouses- Manual irrigation, drip irrigation, fertigation. Use of polyhouse and shade nets.

Important engineering properties such as physical, thermal and aero & hydrodynamic properties of cereals, pulses and oilseed, Drying: moisture measurement, EMC, drying theory-thin layer and deep bed drying, various drying method, commercial grain dryer (deep bed dryer, flat bed dryer, tray dryer, fluidized bed dryer, recirculatory dryer and solar dryer).

Practical:

1. Visit of green houses for the study of green house equipments and preparation of detail report of the visit
2. Construction of models of different types of green houses

3. Measurement of light intensity and CO_2 inside and outside green house
4. Calculation for light, carbon dioxide and irrigation requirement in a green house
5. Operation of drip irrigation and fertigation in a green house
6. Determination of the rate of air exchange in an active summer and winter cooling system.
7. Cost estimation and economic analysis.
8. Visit to various Post Harvest Processing industries (Rice mill, oil mill, floor mill, tea estate and factory, etc.)
9. Determination of moisture content of various grains by oven drying & infrared moisture methods.
10. Determination of Moisture content of various grains by moisture meter.

Syllabus of elective courses

SI	Course No	Title	Credit hours
1.	AGE-204	Fundamental of Irrigation Engineering	3(2+1)

Theory:

Irrigation, purpose of irrigation, sources of irrigation water, Measurement of irrigation water, weir, flumes and orifices and other methods; water conveyance, design of irrigation field channels, underground pipe conveyance system, irrigation structures, channel lining; infiltration, evapotranspiration, depth of irrigation, frequency of irrigation, surface irrigation methods of water application, border, check basin, furrow and contour irrigation; irrigation efficiencies; sprinkler and drip irrigation method, merits, demerits, selection and design; Participatory irrigation management.

Practical:

(1) Measurement of irrigation water using various irrigation measurement devices:
- (a) Weirs- Rectangular, Trapezoidal and Triangular
- (b) Flumes
- (c) Orifices

(2) Measurement of infiltration rate using double ring infiltrometer
(3) Computation of evaporation and transpiration;
(4) Estimation of irrigation efficiency
(5) Measurement of uniformity coefficient of sprinkler irrigation method
(6) Measurement of uniformity coefficient of drip irrigation method
(7) Field problems and remedial measures for sprinkler and drip irrigation method

SI	Course No	Title	Credit hours
2.	AGE-301	System Simulation and Agro-advisory	3(2+1)

Theory:

System approach for representing soil-plant-atmospheric continuum, system boundaries, Crop models- concepts, types of crop models, data requirements, relational diagrams, Evaluation of crop responses to weather elements; Elementary crop growth models; calibration, validation, and sensitivity analysis, Potential and achievable crop production-concept and modelling techniques for their estimation. Crop production in moisture and nutrients limited conditions; components of soil water and nutrients balance. Weather forecasting, types, methods, tools and techniques, forecast verification; ITK for weather forecast and its validity; Crop-Weather Calendars.

Practical:

1. Preparation of crop weather calendars.
2. Preparation of agro-advisories based on weather forecast using various approaches and synoptic charts.
3. Working with statistical and simulation models for crop growth.
4. Potential and achievable production; yield forecasting,
5. Simulation with limitations of water and nutrient management options.
6. Sensitivity analysis of varying weather and crop management practices.
7. Use of statistical approaches in data analysis and preparation of historical, past and present meteorological data for medium range weather forecast.
8. Feedback from farmers about the agro-advisory

SI	Course No	Title	Credit hours
3.	AGE-304	Remote Sensing and GIS Application in Watershed Management	3(2+1)

Remote Sensing: image interpretation, basic principles of image interpretation, digital image processing, GIS: definition, basic components, and standard GIS packages; data-entry, storage and maintenance; data types-spatial and non-spatial data, - point line polygon, vector-raster

Concept of watershed, watershed management and watershed modeling, types of watershed models, theoretical background of some widely used GIS based watershed simulation models-SWAT and WEPP, Watershed characterization by using topographic maps as well as digital elevation models; Delineation of watershed, and measurement of area under different vegetative and topographic conditions.

Practical:

(1) Familiarization with remote sensing and GIS hardware
(2) Interpretation of satellite imagery;
(3) Basic GIS operations such as image display; georeferencing, mosaicing etc.
(4) Study the various features of GIS software package;
(5) Scanning and digitization of maps
(6) Study of topographic maps including contour lines
(7) Delineation of watershed and sub-watershed using GIS and DEM
(8) Preparation of watershed development plan using RS and GIS
(10) GIS supported case studies in watershed management.