SYLLABUS FOR AGRICULTURAL ENGINEERING (AG)

Engineering Mathematics

Algebra:

Matrices and Determinants, Systems of linear equations, Eigen values and eigen vectors.

Calculus:

Limit, continuity and differentiability; Partial Derivatives; Maxima and minima; Sequences and series; Test for convergence; Fourier series.

Vector Calculus:

Gradient; Divergence and Curl; Line; surface and volume integrals; Stokes, Gauss and Green's theorems.

Differential Equations:

Linear and non-linear first order ODEs; Higher order linear ODEs with constant coefficients; Cauchy's and Euler's equations; Laplace transforms; PDEs - Laplace, heat and wave equations.

Probability and Statistics:

Mean, median, mode and standard deviation; Random variables; Poisson, normal and binomial distributions; Correlation and regression analysis.

Numerical Methods:

Solutions of linear and non-linear algebraic equations; integration of trapezoidal and Simpson's rule; single and multi-step methods for differential equations.

Farm Machinery and Power

Sources of power on the farm-human, animal, mechanical, electrical, wind, solar and biomass; bio-fuels; design and selection of machine elements - gears, pulleys, chains and sprockets and belts; overload safety devices used in farm machinery; measurement of force, torque, speed, displacement and acceleration on machine elements.

Soil tillage; forces acting on a tillage tool; hitch systems and hitching of tillage implements; mechanics of animal traction; functional requirements, principles of working, construction and operation of manual, animal and power operated equipment for tillage, sowing, planting, fertilizer application, inter-cultivation, spraying, mowing, chaff cutting, harvesting, threshing and transport; testing of agricultural machinery and equipment; calculation of performance parameters -field capacity, efficiency, application rate and losses; cost analysis of implements and tractors

Thermodynamic principles of I.C. engines; I.C. engine cycles; engine components; fuels and combustion; lubricants and their properties; I.C. engine systems - fuel, cooling, lubrication, ignition, electrical, intake and exhaust; selection, operation, maintenance and repair of I.C. engines; power efficiencies and measurement; calculation of power, torque, fuel consumption, heat load and power losses.

Tractors and power tillers - type, selection, maintenance and repair; tractor clutches and brakes; power transmission systems - gear trains, differential, final drives and power take-off; mechanics of tractor chassis; traction theory; three point hitches- free link and restrained link operations; mechanical steering and hydraulic control systems used in tractors; human engineering and safety in tractor design; tractor tests and performance.

Soil and Water Conservation Engineering

Ideal and real fluids, properties of fluids; hydrostatic pressure and its measurement; hydrostatic forces on plane and curved surface; continuity equation; Bernoulli's theorem; laminar and turbulent flow in pipes, Darcy- Weisbach and Hazen-Williams equations, Moody's diagram; flow through orifices and notches; flow in open channels.

Engineering properties of soils; fundamental definitions and relationships; index properties of soils; permeability and seepage analysis; shear strength, Mohr's circle of stress, active and passive earth pressures; stability of slopes.

Hydrological cycle; meteorological parameters and their measurement, analysis of precipitation data; abstraction from precipitation; runoff; hydrograph analysis, unit hydrograph theory and application; stream flow measurement; flood routing, hydrological reservoir and channel routing.

Measurement of distance and area; chain surveying, methods of traversing; measurement of angles and bearings, plane table surveying; types of levelling; contouring; instruments for surveying and levelling; computation of earth work.

Mechanics of soil erosion, soil erosion types; wind and water erosion; factors affecting erosion; soil loss estimation; biological and engineering measures to control erosion; terraces and bunds; vegetative waterways; gully control structures, drop, drop inlet and chute spillways; earthen dams; water harvesting structures, farm ponds, watershed management.

Soil-water-plant relationship, water requirement of crops; consumptive use and evapotranspiration; irrigation scheduling; irrigation efficiencies; design of irrigation channels; measurement of soil moisture, irrigation water and infiltration; surface, sprinkler and drip methods of irrigation; design and evaluation of irrigation methods.

Drainage coefficient; planning, design and layout of surface and sub-surface drainage systems; leaching requirement and salinity control; irrigation and drainage water quality.

Groundwater occurrence confined and unconfined aquifers, evaluation of aquifer properties; well hydraulics; groundwater recharge.

Classification of pumps; pump characteristics; pump selection and installation.

Agricultural Processing and Food Engineering

Steady state heat transfer in conduction, convection and radiation; transient heat transfer in simple geometry; condensation and boiling heat transfer; working principles of heat exchangers; diffusive and convective mass transfer; simultaneous heat and mass transfer in agricultural processing operations.

Material and energy balances in food processing systems; water activity, sorption and desorption isotherms; centrifugal separation of solids, liquids and gases; kinetics of microbial death - pasteurization and sterilization of liquid foods; preservation of food by cooling and freezing; refrigeration and cold storage basics and applications; psychrometry - properties of air-vapour mixture; concentration and drying of liquid foods - evaporators, tray, drum and spray dryers.

Mechanics and energy requirement in size reduction of granular solids; particle size analysis for comminuted solids; size separation by screening; fluidization of granular solids-pneumatic, bucket, screw and belt conveying; cleaning and grading; Effectiveness of grain cleaners.

Hydrothermal treatment, drying and milling of cereals, pulses and oilseeds; Processing of seeds, spices, fruits and vegetables; By-product utilization from processing industries.

Controlled and modified atmosphere storage; Perishable food storage, godowns, bins and grain silos.