

# **Gate Syllabus for Agricultural Engineering 2014-15**

**General Aptitude(GA)**-Multiple Choice test.

- **This Paper Consists of Verbal Ability:** English grammar, verbal analogies, instructions, critical reasoning and verbal deduction, Sentence completion, Word groups.

**ENGINEERING MATHEMATICS-** Mathematical branch that includes mathematical methods and techniques that are generally employed in Industry and engineering

- **Linear Algebra: Branch of mathematics which does study of operation and applying it to find an answer equations.** It include topics-Determinants and Matrices, Systems of linear equations, Eigen vectors and eigen values.
- **Calculus: Mathematical study of change.** It include topics-Continuity, Limit and differentiability; Partial Derivatives; Minima and maxima; Series and sequence; Test for convergence; Fourier series.
- **Vector Calculus:** It include topics- Gradient; Curl and Divergence; surface, line and volume integrals; Stokes, Green and Gauss theorems.
- **Differential Equations: Deals with rate of change and slope of curves.** It includes non-Linear and linear first order ODEs; Higher order linear ODEs with constant coefficients; Euler's and Cauchy's equations; Laplace transforms; PDEs -Laplace, wave and heat equations.
- **Probability and Statistics: Probability is the way to roughly judge the occurrence of a thing or to what extent a statement is true.** It includes-median, mean, mode and standard deviation; Random variables; Poisson, binomial and normal distributions; Correlation and regression analysis.
- **Numerical Methods: It consists of set of rules which uses numerical approximation to find an answer to the problems of mathematical analysis.** It includes- Solutions of non- linear and linear algebraic equations; integration of simpson's and trapezoidal rule; single and multi-step methods for differential equations.

**FARM MACHINERY AND POWER-**This field applies mechanical, biological, physical and electronic principles to find an answer to real life problems.

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

measurement of force, speed, torque, 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; principles of working, functional requirements, construction and operation of manual, animal and power operated equipment for tillage, planting, sowing, fertilizer application, inter-cultivation, mowing, spraying, harvesting, chaff cutting, threshing and transport; testing of agricultural machinery and equipment; calculation of performance parameters - field capacity, application rate, efficiency and losses; cost analysis of tractors and implements.
- Thermodynamic principles of I.C. engines; I.C. engine cycles; engine components; fuels and combustion; lubricants and their properties; I.C. engine systems – cooling, fuel, lubrication, ignition, electrical, exhaust and intake; selection, operation, maintenance and repair of I.C. engines; power efficiencies and measurement; calculation of torque, power, fuel consumption, power losses and heat load.
- Tractors and power tillers – selection, type, maintenance and repair; tractor brakes and clutches; power transmission systems – gear trains, final drives, differential and power take-off; mechanics of tractor chassis; traction theory; three point hitches-restrained link and free 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-It applies engineering principles and its practices for development and plan of systems for natural resources.**

- Real and ideal fluids, properties of fluids; hydrostatic pressure and its measurement; hydrostatic forces on curved and plane surface; continuity equation; Bernoulli's theorem; turbulent and laminar 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; hydrograph analysis, runoff; unit hydrograph theory and application; stream flow measurement; hydrological reservoir and channel routing, flood routing.
- Measurement of distance and area; methods of traversing; chain surveying; measurement of angles and bearings, plane table surveying; types of levelling; contouring; instruments for levelling and surveying; 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; bunds and terraces; vegetative waterways; drop, drop inlet, gully control

structures and chute spillways; earthen dams; water harvesting structures, watershed management, farm ponds.

- Soil-water-plant relationship, water requirement of crops; consumptive use and evapotranspiration; irrigation scheduling; irrigation efficiencies; measurement of soil moisture, design of irrigation channels, 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; irrigation and drainage water quality; leaching requirement and salinity control
- Groundwater occurrence unconfined and confined aquifers, well hydraulics; groundwater recharge; evaluation of aquifer properties
- Classification of pumps; pump characteristics; pump selection and installation.

### **AGRICULTURAL PROCESSING AND FOOD ENGINEERING-Agricultural**

**processing is that branch of knowledge which make use of engineering science and technology to agricultural production and processing. Food engineering is a applied physical science branch that merge microbiology, science and engineering education for food and related industries**

- Steady state heat transfer in conduction, radiation and convection; transient heat transfer in simple geometry; working principles of heat exchangers; condensation and boiling heat transfer; diffusive and convective mass transfer; simultaneous heat and mass transfer in agricultural processing operations.
- Material and energy balances in food processing systems; water activity, desorption and sorption isotherms; centrifugal separation of liquids, solids 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; concentration and drying of liquid foods – evaporators, tray, drum and spray dryers, psychrometry – properties of air-vapour mixture;
- Mechanics and energy requirement in size reduction of granular solids; particle size analysis for comminuted solids; fluidization of granular solids-pneumatic, size separation by screening, bucket, screw and belt conveying; grading and cleaning; Effectiveness of grain cleaners.
- Hydrothermal treatment, drying and milling of pulses, cereals and oilseeds; Processing of seeds, spices, vegetables and fruits; By-product utilization from processing industries.
- Controlled and modified atmosphere storage; Perishable food storage, godowns, bins and grain silos.