**UPSC IFS Agricultural Engineering Syllabus**

### Paper - I

**Section A**

* **Soil and Water Conservation:**
* Scope of soil and water conservation.
* Mechanics and types of erosion, their causes.
* Rainfall, runoff and sedimentation relationships and their measurement.
* Soil erosion control measures - biological and engineering including stream bank protection-vegetative barriers, contour bunds, contour trenches, contour stone walls, contour ditches, terraces, outlets and grassed waterwyas.
* Gully control structures - temporary and permanent - design of permanent soil conservation structures such as chute, drop and drop inlet spillways.
* Design of farm ponds and percolation ponds.
* Principles of flood control-flood routing.
* Watershed Management - investigation, planning and implementation - selection of priority areas and water shed work plan, water harvesting and moisture conservation.
* Land development - levelling, estimation of earth volumes and costing.
* Wind Erosion process - design fo shelter belts and wind brakes and their management.
* Forest (Conservation) Act

**Aerial Photography and Remote Sensing:**

* Basic characteristics of photographic images, interpretation keys, equipment for interpretation, imagery interpretation for land use, geology, soil and forestry.
* Remote sensing - merits and demerits of conventional and remote sensing approaches.
* Types of satellite images, fundamentals of satellite image interpretation, teachniques of visual and digital interpretations for soil, water and land use management.
* Use of GIS in planning and development of watersheds, forests including forest cover, water resources etc.

**Section B:**

**Irrigation and Drainage:**

* Sources of water for irrigation.
* Planning and design of minor irrigation projects.
* Techniques of measuring soil moisture - laboratory and in situ, Soil-water plant relationships.
* Water requirement of crops.
* Planning conjunctive use of surface and ground weater.
* Measurement of irrigation water, measuring devices - orifices, weirs and flumes. Methods of irrigation - surface, sprinkler and drip, fertigation.
* Irrigation efficiencies and their estimation.
* Design and construction of canals, field channels, underground pipelines, head-gates, diversion boxes and structures for road crossing.
* Occurrence of ground water, hydraulics of wells, types of wells (tube wells and open wells) and their construction.
* Well development and testing.
* Pumps-types, selection and installation. Rehabilitation of sick and failed wells.
* Drainage causes of waterlogging and salt problem.
* Methods of drainage of irrigated and unirrigated lands, design of surface, sub-surface and vertical drainage systems.
* Improvement and utilization of poor quality water.
* Reclamation of saline and alkali soils.
* Economics of irrigation and drainage systems.
* Use of waste water for irrigation â€” standards of waste water for sustained irrigation, feasibility and economics.

**Agricultural Structures:**

* Site selection, design and construction of farmstead - farm house, cattle shed, dairy bam, poultry shed, hog housing, machinery and implement shed, storage structures for food grains, feed and forage.
* Design and consturction of fences and farm roads. Structures for plant environment - green houses, poly houses and shade houses.
* Common building materials used in construction - timber, brick, stone, tiles, concrete etc and their properties.
* Water supply, drainage and sanitation system.

### Paper – II

**Section A**

**Farm Power and Machinery:**

* Agricultural mechanization and its scope. Sources of farm power - animate and electro-mechanical.
* Thermodynamics, construction and working of internal combustion engines.
* Fuel, ignition, lubrication, cooling and governing system of IC engines.
* Different types of tractors and power tillers. Power tramsmission, ground drive, power take off (p.t.o.) and control systems.
* Operation and maintenance of farm machinery for primary and secondary tillage.
* Traction theory.
* Sowing transplanting and interculture implements and tools.
* Plant protection equipment - spraying and dusting.
* Harvesting, threshing and combining equipment.
* Machinery for earth moving and land development - methods and cost estimation.
* Ergonomics of man-machine system.
* Machinery for horticulture and agro-forestry, feeds and forages.
* Haulage of agricultural and forest produce.

**Agro-energy:**

* Energy requirements of agricultural operations and agro-processing.
* Selection, installation, safety and maintenance of electric motors for agricultural applications.
* Solar (thermal and photovoltoic), wind and bio-gas energy and their utilization in agriculture.
* Gasification of biomass for running IC engines and for electric power generation.
* Energy efficient cooking stoves and alternate cooking fuels.
* Distribution of electricity for agricultural and agro-industrial applications.

**Section B:**

**Agricultural Process Engineering:**

* Post harvest technology of crops and its scope.
* Engineering properties of agricultural produces and by-products.
* Unit operations - clearning grading, size reduction, densification, concentration, drying/dehydration, evaporation, filtration, freezing and packaging of agricultural produces and by-products.
* Material handling equipment - belt and screw conveyors, bucket elevators, their capacity and power requirement.
* Processing of milk and dairy products - homogenization, cream separation, pasteurization, sterilization, spray and roller drying, butter making, ice cream, cheese and shrikhand manufacture.
* Waste and by-product utilization - rice husk, rice bran, sugarcane bagasse, plant residues and coir pith.

**Instrumentation and computer applications in Agricultural Engineering:**

* Electronic devices and their characteristics - rectifiers, amplifiers, oscillators, multivibrators.
* Digital circuits â€” sequential and combinational system.
* Application of microprocessors in data acquisition and control of agricultural engineering processes- measurement systems for level, flow, strain, force, torque, power, pressure, vaccum and temperature.
* Computers â€” introduction, input/output devices, central processing unit, memory devices, operating systems, processors, keyboards and printers.
* Algorithms, flowchart specification, programme translation and problem analysis in Agricultural Engineering. Multimedia and Audio-Visual aids.