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## 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 waterways.
- 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 of 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

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sensing approaches.

- Types of satellite images, fundamentals of satellite image interpretation, techniques 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 water.
- 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 " 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 construction 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 transmission, 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 photo voltaic), 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 - clearing 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 " 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, vacuum and temperature.
- Computers " 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.

  
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