Evaluation Scheme & Syllabus

For

B. Tech. IV Year

Agricultural Engineering

ON

CHOICE BASED CREDIT SYSTEM
(CBCS)

[Effective from the Session: 2019-20]
# SEVENTH SEMESTER

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**Deptt. Elective course-3**

1. RAG070 Remote sensing and GIS
2. RAG071 Waste land development
3. RAG072 Watershed Planning and management
4. RAG073 Flood and control measures
5. RAG074A Water quality and management Measures
6. RAG074B Information Technology for land and water management

**Deptt. Elective course-4**

1. RAG075 Ground water well & Pumps
2. RAG076 Human engineering and Safety
3. RAG077 Precision agriculture and system Management
4. RAG078 CAD/CAM computer Graphics
5. RAG079A Testing of Agricultural equipment and Tractors
6. RAG079B Plastic in Agriculture
## EIGHTH SEMESTER

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### Deptt. Elective course-5

1. RAG080  Minor irrigation and command area development
2. RAG081  Management of canal irrigation system
3. RAG082  Reservoir and pond design
4. RAG083  Rural Water Supply and Sanitation
5. RAG084  Landscape irrigation design and management
6. RAG085  Novel Technologies for Food Processing and Shelf Life Extension (NPTEL)

### Deptt. Elective course-6

1. RAG086  Agribusiness Management and Trade
2. RAG087  Bio energy system-design and Application
3. RAG088  Entrepreneurship Development
4. RAG089  Renewal Power Sources
5. RAG090  Renewal energy and Management
6. RAG091  Soil Science and Technology(NPTEL)
SEVENTH SEMESTER

BMSD, Agricultural Structures and Environment control (3-1-0) 4

Unit-I

Unit-II

Unit-III
Planning and layout of farmstead. Scope, importance and need for environmental control, physiological reaction of livestock environmental factors, environmental control systems and their design, control of temperature, humidity and other air constituents by ventilation and other methods, Livestock production facilities, BIS Standards for dairy, piggery, poultry and other farm structures. Design, construction and cost estimation of farm structures; animal shelters, compost pit, fodder silo, fencing and implement sheds, barn for cows, buffalo, poultry, etc.

Unit-IV
Storage of grains, Causes of spoilage, Water activity for low and high moisture food and its limits for storage, Moisture and temperature changes in grain bins; Traditional storage structures and their improvements, Improved storage structures (CAP, hermetic storage, Pusa bin, RCC ring bins), Design consideration for grain storage godowns, Bag storage structures, Shallow and Deep bin, Calculation of pressure in bins, Storage of seeds. Rural living and development, rural roads, their construction cost and repair and maintenance.

Unit-V
Sources of water supply, norms of water supply for human being and animals, drinking water standards and water treatment suitable to rural community. Site and orientation of building in regard to sanitation, community sanitation system; sewage system and its design, cost and maintenance, design of septic tank for small family. Estimation of domestic power requirement, source of power supply and electrification of rural housing.

BMSD, Agricultural Structures and Environment Control Lab (0-0-2) 1

(1) Measurements for environmental parameters and cooling load of a farm building,
(2) Design and layout of a dairy farm.
(3) Design and layout of a poultry house.
(4) Design and layout of a goat house/sheep house.
(5) Design of a farm fencing system
(6) Design of a feed/fodder storage structures,
(7) Design of grain storage structures,
(8) Design and layout of commercial bag and bulk storage facilities,
(9) Study and performance evaluation of different domestic storage structure,
(10) Estimation of a Farm building.
Dairy and Food Engineering (3-0-0) 3

Unit-I
Deterioration in food products and their controls, Physical, chemical and biological methods of food preservation. Nanotechnology: History, fundamental concepts, tools and techniques nanomaterials, applications in food packaging and products, implications, environmental impact of nanomaterials and their potential effects on global economics, regulation of nanotechnology.

Unit-II
Dairy development in India, engineering, thermal and chemical properties of milk and milk products, Process flow charts for product manufacture, Unit operation of various dairy and food processing systems.

Unit-III
Principles and equipment related to receiving of milk, pasteurization, sterilization, homogenization, centrifugation and cream separation. Preparation methods and equipment for manufacture of cheese, paneer, butter and ice cream, Filling and packaging of milk and milk products;

Unit-IV
Dairy plant design and layout, Plant utilities; Principles of operation and equipment for thermal processing, Canning, Aseptic processing, Evaporation of food products: principle, types of evaporators, steam economy, multiple effect evaporation, vapour recompression.

Unit-V
Drying of liquid and perishable foods: principles of drying, spray drying, drum drying, freeze drying, Filtration: principle, types of filters; Membrane separation, RO, Nano-filtration, Ultra filtration and Macro-filtration, equipment and applications, Non-thermal and other alternate thermal processing in Food processing.

Dairy and Food Engineering Lab (0-0-2) 1

(1) Study of pasteurizers, Study of sterilizers, Study of homogenizers.
(2) Study of separators, Study of butter churns, Study of evaporators.
(3) Study of milk dryers, Study of freezers, Study of filtration.
(4) Design of food processing plants & preparation of layout.
(5) Visit to multi-product dairy plant, Estimation of steam requirements.
(6) Estimation of refrigeration requirements in dairy & food plant.
(7) Visit to Food industry.

Suggested Reading:
Department Elective Courses -3

Remote Sensing and GIS  (3-0-3)       3

Unit-I
Basic component of remote sensing (RS), advantages and limitations of RS, possible use of RS techniques in assessment and monitoring of land and water resources; electromagnetic spectrum, energy interactions in the atmosphere and with the Earth’s surface; major atmospheric windows.

Unit-II
Principal applications of different wavelength regions; typical spectral reflectance curve for vegetation, soil and water; spectral signatures; different types of sensors and platforms; contrast ratio and possible causes of low contrast; aerial photography; types of aerial photographs, scale of aerial photographs.

Unit- III
Planning aerial photography- end lap and side lap; stereoscopic vision, requirements of stereoscopic photographs; air-photo interpretation- interpretation elements; photogrammetry- measurements on a single vertical aerial photograph, measurements on a stereo-pair- vertical measurements by the parallax method.

Unit- IV
Ground control for aerial photography; satellite remote sensing, multispectral scanner- whiskbroom and push-broom scanner; different types of resolutions; analysis of digital data- image restoration; image enhancement; information extraction, image classification, unsupervised classification, supervised classification, important consideration in the identification of training areas, vegetation indices; microwave remote sensing.

Unit-V
GIS and basic components, different sources of spatial data, basic spatial entities, major components of spatial data, Basic classes of map projections and their properties, Methods of data input into GIS, Data editing, spatial data models and structures, Attribute data management, integrating data (map overlay) in GIS, Application of remote sensing and GIS for the management of land and water resources.

Suggested Reading:

Waste land Development     (3-0-3)        3

Unit-I

Unit-II
Planning of wastelands development - constraints, agro-climatic conditions, development options, contingency plans. Conservation structures - gully stabilization, ravine rehabilitation, sand dune stabilization.
Unit-III

Unit-IV

Unit-V

Suggested Reading:

Watershed Planning and Management (3-0-3) 3

Unit-I
Watershed - introduction and characteristics. Watershed development - problems and prospects, investigation, topographical survey, soil characteristics, vegetative cover, present land use practices and socio-economic factors.

Unit-II
Watershed management - concept, objectives, factors affecting, watershed planning based on land capability classes, hydrologic data for watershed planning, watershed codification, delineation and prioritization of watersheds – sediment yield index. Water budgeting in a watershed.

Unit-III

Unit-IV
Effect of cropping systems, land management and cultural practices on watershed hydrology. Watershed programme - execution, follow-up practices, maintenance, monitoring and evaluation.

Unit-V
Participatory watershed management - role of watershed associations, user groups and self-help groups. Planning and formulation of project proposal for watershed management programme including cost-benefit analysis.

Suggested Reading:
Floods and Control Measures (3-0-0) 3

Unit-I

Unit-II

Unit-III
Gully erosion and its control structures - design and implementation. Ravine control measures. River training works, planning of flood control projects and their economics.

Unit-IV
Earthen embankments - functions, classification - hydraulic fill and rolled fill dams - homogeneous, zoned and diaphragm type, foundation requirements, grouting, seepage through dams, flow net and its properties, seepage pressure, seepage line in composite earth embankments, drainage filters, piping and its causes.

Unit-V
Design and construction of earthen dam, stability of earthen embankments against failure by tension, overturning, sliding etc., stability of slopes - analysis of failure by different methods. Subsurface dams - site selection and constructional features. Check dam - Small earthen embankments - types and design criteria. Subsurface dams - site selection and constructional features.

Suggested Reading:
Water Quality and Management Measures (3-0-0) 3

Unit-I
Natural factors affecting quality of surface water and groundwater, water quality objectives in relation to domestic, industrial and agricultural activities, drinking water quality standards.

Unit-II
Irrigation water quality classification as per USSL and All Indian Coordinated Research Project (AICRP) criteria.

Unit-III
Point and non-point water pollution sources, and water contamination due to inorganic and organic compounds.

Unit-IV
Water contamination related to agricultural chemicals, food industry, hydrocarbon and synthetic organic compounds. Arsenic and fluoride contamination in groundwater and remedial measures.

Unit-V
Water decontamination technologies, cultural and management practices for using poor quality water for irrigation.

Suggested Reading:
FAO. 1996. Control of water pollution from agriculture - FAO irrigation and drainage paper 55

Information Technology for Land and Water Management (3-0-0) 3

Unit-I
Concept of Information Technology (IT) and its application potential. Role of IT in natural resources management. Existing system of information generation and organizations involved in the field of land and water management.

Unit-II

Unit-III
Application of remote sensing, geographic information system (GIS) and GPS. Rational data base management system. Object oriented approaches. Information system, decision support systems and expert systems.

Unit-IV
Agricultural information management systems - use of mathematical models and programmes. Application of decision support systems, multi sensor data loggers and overview of software packages in natural resource management. Video-conferencing of scientific information.
Unit-V
Methods of data input into GIS, Data editing, spatial data models and structures, Attribute data management, integrating data (map overlay) in GIS, Application of remote sensing and GIS for the management of land and water resources.

Suggested Reading::

Department Elective course-4

Ground water well & Pumps (3-1-0) 4

Unit-I
Occurrence and movement of ground water; aquifer and its types; classification of wells, fully penetrating tube wells and open wells, familiarization of various types of bore wells; design of open wells; groundwater exploration techniques.

Unit-II
methods of drilling of wells: percussion, rotary, reverse rotary; design of tube well and gravel pack, installation of well screen, completion and development of well; groundwater hydraulics-determination of aquifer parameters by different method such as Theis, Jacob and Chow’s Theis recovery method; well interference, multiple well systems,

Unit-III
Estimation of ground water potential, quality of ground water; artificial groundwater recharge techniques. Pumping systems: water lifting devices; different types of pumps, classification of pumps, component parts of centrifugal pumps, priming, pump selection, installation and trouble shooting, performance curves, effect of speed on capacity.

Unit-IV
Head and power, effect of change of impeller dimensions on performance characteristics; hydraulic ram, propeller pumps, mixed flow pumps and their performance characteristics; deep well turbine pump and submersible pump.

Suggested Reading:
Human Engineering and Safety


classified

Unit-I

Human factors in system development – concept of systems; basic processes in system development, performance reliability, human performance. Information input process, visual displays, major types and use of displays, auditory and factual displays.

Unit-II


Unit-III

Anthropometry: arrangement and utilization of work space, atmospheric conditions, heat exchange process and performance, air pollution.

Unit-IV

Dangerous machine (Regulation) act, Rehabilitation and compensation to accident victims, Safety gadgets for spraying, threshing, Chaff cutting and tractor & trailer operation etc.

Unit-V

Familiarization with tractor as a spring-mass system. Ergonomic considerations and operational safety. Introduction to tractor testing. Deciphering the engine test codes.

Suggested Reading:


Precision Agricultural and System Management


classified

Unit-I

Precision Agriculture – need and functional requirements. Familiarization with issues relating to natural resources. Familiarization with equipment for precision agriculture including sowing and planting machines.

Unit-II

power sprayers, land clearing machines, laser guided land levellers, straw-chopper, straw-balers, grain combines, etc. Introduction to GIS based precision agriculture and its applications.

Unit-III

Introduction to sensors and application of sensors for data generation. Database management. System concept. System approach in farm machinery management, problems on machinery selection, maintenance and scheduling of operations.

Unit-IV

Application to PERT and CPM for machinery system management. Protected cultivation.
Unit-V
Introduction, History, origin, development, National and International Scenario, components of green house, perspective, Types of green houses, polyhouses /shed nets.

Suggested Reading:
Dutta SK. Soil Conservation and land management.
Sigma and Jagmohan. Earth Moving Machinery.
Wood and Stuart. Earth Moving Machinery.
DeMess MN. Fundamentals of Geographic Information System.
Hunt Donnell. Farm Power and Machinery Management.
Sharma DN and S Mukesh. Farm Power and Machinery Management Vol I.

UNIT-I

Unit-II
Speech control devices and Touch, panels, Graphics display devices-Cathode Ray Tube, Random & Raster scan display, Colour CRT monitors, Direct View Storage Tubes, Flat Panel display, Hard copy printers and plotters

Unit-III

Unit-IV
Output primitives- Bresenham’s line drawing algorithm and Bresenham’s circle generating algorithm.

Unit-V
Implementation of CAD in - CAM - CIM - RPT, kinematic analysis, Manufacturability analysis, simulation and Animation – Types – Techniques.

Suggested Reading:

Test of Agricultural Machinery and Tractors (3-1-0) 4

UNIT- I
Basic objectives of testing of agricultural equipment; concept and importance. Different terminology used in testing of agricultural equipment, I.C engines and tractors. Different types of transducer and their uses, instrumentation for draft, slip, sinkage, soil resistance, sound and vibration. Hardness of material. Test codes: Nebraska, OECD, RNAM,BS,ISO,BIS etc. Testing of primary and secondary tillage tools, sowing/planting equipment, weeding tools,

UNIT- II
Harvesting machinery, power threshers, combine harvesters, sprayers, dusters etc. as per BIS standard. Testing of I.C. engines and tractors as per BIS test codes. Basic objectives of testing agricultural equipment: Concept and importance. Different terminology used in testing of agricultural equipment, I.C. engines and tractors. Different types of transducers and their uses, instrumentation for draft, slip, sinkage, soil resistance, sound and vibration measuring instruments. Hardness measuring instruments.
UNIT- III
Test codes: Nebraska, OECD, RNAM, BS, ISO, BIS etc., basis difference. Test codes and procedure for primary tillage tool as per BIS test code. Test code and procedure for testing of secondary as per BIS test code. Test code and procedure for testing of ferti-seed drill as per BIS test code.

UNIT- IV
Test code and procedure for testing of weeding tools as per BIS test code. Test code and procedure for testing of a harvesting machine as per BIS test code. Test code and procedure for testing of a power thresher as per BIS test code. Test code and procedure for testing of a combine harvester as per BIS test code.

UNIT- V
Test procedure of a power sprayer as per BIS test code. Test code and procedure of a agricultural tractor as per BIS test code. Test code and procedure of an I.C engine as per BIS test code.

Plastic in Agriculture (3-1-0)  4

Unit-I
Introduction of plasticulture - types and quality of plastics used in soil and water conservation, production agriculture and post harvest management. Quality control measures. Present status and future prospective of plasticulture in India.

Unit-II

Unit-III

Unit-IV

Unit-V
Plastics for aquacultural engineering and animal husbandry - animal shelters, vermi-beds and inland fisheries. Silage film technique for fodder preservation. Agencies involved in the promotion of plasticulture in agriculture at national and state level. Human resource development in plasticulture applications.

Suggested Reading:
EIGHTH SEMESTER

Department Elective Course- 5

Minor Irrigation and Command Area Development (3-1-0) Unit-I

Factors affecting performance of irrigation projects; types of minor irrigation systems in India; lift irrigation systems: feasibility, type of pumping stations and their site selection.

Unit-II
Design of lift irrigation systems; tank Irrigation: grouping of tanks, storage capacity, supply works and sluices.

Unit-III
Command area development (CAD) programme- components, need, scope, and development approaches, historical perspective, command area development authorities- functions and responsibilities; on farm development works.

Unit-IV
Reclamation works, use of remote sensing techniques for CAD works; water productivity: concepts and measures for enhancing water productivity; Farmers’ participation in command area development.

Suggested Reading:

Management of Canal Irrigation System (3-1-0) 3 Unit-I

Purpose benefits and ill effects of irrigation; typical network of canal irrigation system and its different physical components; canal classification based on source of water, financial output, purpose, discharge and alignment; canal alignment: general considerations for alignment; performance indicators for canal irrigation system evaluation.

Unit-II
Estimation of water requirements for canal command areas and determination of canal capacity; water duty and delta, relationship between duty, base period and delta, factors affecting duty and method of improving duty.

Unit-III
Silt theory: Kennedy’s theory, design of channels by Kennedy’s theory, Lacey’s regime theory and basic regime equations, design of channels by Lacey’s theory, maintenance of unlined irrigation canals, measurement of discharge in canals, rostering (canal running schedule) and warabandhi.

Unit-IV
Necessity of canal lining: advantages and disadvantages, types of canal lining and desirable characteristics for the suitability of lining materials; design of lined canals; functions of distributaries head and cross regulators. Canal falls, their necessity and factors affecting canal fall; sources of surplus water in canals and types of canal escapes; requirements of a good canal outlet and types of outlet.
Suggested Reading:

Reservoir and pond design (3-1-0) 4 Units

UNIT- I
Earthen embankments - functions, advantages and disadvantages, classification – hydraulic fill and rolled fill dams - homogeneous, zoned and diaphragm type;

UNIT- II
Foundation requirements, grouting, seepage through dams - estimation of seepage discharge, location of seepage/phreatic line by graphical and analytical methods,

UNIT- III
Flow-net and its properties, seepage pressure, seepage line in composite earth embankments, drainage filters, piping and its causes;

UNIT- IV
Design and construction of earthen dam, stability of earthen embankments against failure by tension, overturning, sliding etc; stability of slopes - analysis of failure by slice method; Types of reservoirs and farm ponds, design and estimation of earth work; cost analysis.

Rural Water Supply and Sanitation (3-1-0) 4 Units

UNIT- I
Introduction and scope of the subject, types of roads planning of rural roads, geometric design of roads,

UNIT- II
Pavement design, material for construction of roads, source and characteristics of water supply,

UNIT- III
Estimation of quantity for rural water supply, layout of distribution system intake works,

UNIT- IV
Capacity requirement of storage of water, water treatment methods, pipe network analysis,

UNIT- V
Estimation and design of sewage systems, septic tanks.

Landscape Irrigation Design and Management (3-1-0) 4 Units

UNIT- I
Conventional method of landscape irrigation- hose irrigation system, quick release coupling system and portable sprinkler with hose pipes; Modern methods of landscape irrigation- pop-up sprinklers, spray pop-up sprinkler, shrub adopter, drip irrigation and bubblers;

UNIT- II
Merits and demerits of conventional and modern irrigation systems, types of landscapes and suitability of different irrigation methods, water requirement for different landscapes,

UNIT- III
Segments of landscape irrigation systems, Main components of modern landscape irrigation systems and their selection criteria; Types of pipes, pressure ratings, sizing and selection criteria.

UNIT- IV
Automation system for landscape irrigation—main components, types of controllers and their application, Design of modern landscape irrigation systems, operation and maintenance of landscape irrigation systems.

**Suggested Reading:**

**noc19-ar01** Novel Technologies for Food Processing and Shelf Life
(Note- As per NPTEL course content)

# Department Elective course-6

## Agribusiness Management and Trade

**Unit-I**
Management concepts and principles, process of management, functions of management,

**Unit-II**
Concept of agribusiness and application of management principles to agribusiness, production, consumption, and marketing of agricultural products,

**Unit-III**
Agricultural processing, meaning and theories of international trade,

**Unit-IV**
WTO provisions for trade in agricultural and food commodities, India’s contribution to international trade in food and agri–commodities

## Bio Energy System – Design and Application

**Unit-I**

**Unit-II**

**Unit-III**

**Unit-IV**

**Suggested Reading:**
British BioGen. 1997, Anaerobic digestion of farm and food processing practices- Good practice guidelines, London,
Entrepreneurship Development

Unit-I

Unit-II

Unit-III
Agreements on agriculture (AOA) – Domestic supply, market access, export subsidies agreements on sanitary and phyto-sanitary (SPS) measures, Trade related intellectual property rights (TRIPS). Development (ED): Concept of entrepreneur and entrepreneurship Assessing overall business environment in Indian economy– Entrepreneurial and managerial characteristics- Entrepreneurship development Programmes (EDP)- Generation incubation and commercialization of ideas and innovations- Motivation and entrepreneurship development.

Unit-IV
Globalization and the emerging business entrepreneurial environment- Managing an enterprise: Importance of planning, budgeting, monitoring evaluation and follow-up managing competition. Role of ED in economic development of a country- Overview of Indian social.

Unit-V
Political systems and their implications for decision making by individual entrepreneurs- Economic system and its implications for decision making by individual entrepreneurs- Social responsibility of business. Morals and ethics in enterprise management- SWOT analysis- Government schemes and incentives for promotion of entrepreneurship.

Government policy on small and medium enterprises (SMEs)/SSIs/MSME sectors- Venture capital (VC), contract farming (CF) and joint ventures (JV), public-private partnerships (PPP) - Overview of agricultural engineering industry, characteristics of Indian farm machinery industry.

Suggested Reading:

Renewable Power Source

Unit-I
Energy consumption pattern & energy resources in India. Renewable energy options, potential and utilization. Biogas technology and mechanisms, generation of power from biogas, Power generation
from urban, municipal and industrial waste. Design & use of different commercial sized biogas plant.

**Unit-II**
Solar thermal and photovoltaic Systems for power generation. Central receiver (Chimney) and distributed type solar power plant, OTEC, MHD, hydrogen and fuel cell technology. Wind farms. Aero-generators. Wind power generation system.

**Unit-III**

**Unit-IV**

Biomass gasification, Types of gasifier, various types of biomass cook stoves for rural energy needs. Biogas: types of biogas plants, biogas generation, factors affecting biogas generation and usages, design consideration, advantages and disadvantages of biogas spent slurry.

**Suggested Reading:**

**Renewal Energy and Management** (3-0-0) 3Units

**Unit-I**
Concept and limitation of Renewable Energy Sources (RES), Criteria for assessing the potential of RES, Classification of RES, Solar, Wind, Geothermal, Biomass, Ocean energy sources, Comparison of renewable energy sources with non renewable sources.

**Unit-II**

**Unit-III**

**Unit-IV**
Bio-energy: Pyrolysis of Biomass to produce solid, liquid and gaseous fuels. Biomass gasification, Types of gasifier, various types of biomass cook stoves for rural energy needs. Biogas: types of biogas plants, biogas generation, factors affecting biogas generation and usages, design consideration, advantages and disadvantages of biogas spent slurry.
Energy consumption pattern & energy resources in India. Renewable energy options, potential and utilization. Biogas technology and mechanisms, generation of power from biogas, Power generation from urban, municipal and industrial waste.

**Suggested Reading:**