

New Scheme Based On AICTE Flexible Curricula

Agriculture Engineering, VII-Semester

AN701- Ground Water, Wells and Pumps

Course Objective: To acquaint and equip the students with the occurrence, development and hydraulics of ground water flow and understand the theories of wells and pumps.

Unit I

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

Unit II

Groundwater hydraulics-steady and unsteady state flow to wells – Dupits theory, determination of aquifer parameters by different methods such as Theis, Jacob and Chow's, Theis recovery method; design of open wells; design of tube well and gravel pack, installation of well screen.

Unit III

Methods of drilling of wells: percussion, rotary, reverse rotary; completion and development of well; well losses and well efficiency, well interference, multiple wells systems, estimation of ground water potential, quality of ground water; artificial groundwater recharge techniques.

Unit IV

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, 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.

Practical:

1. Verification of Darcy's Law
2. Study of different drilling equipments;
3. Sieve analysis for gravel and well screens design;
4. Estimation of specific yield and specific retention;
5. Estimation of aquifer parameters by Theis,
6. Estimation of aquifer parameters – Coopers-Jacob, Chow method
7. Theis Recovery method;
8. Open well design
9. Tube well design
10. Estimating ground water balance;
11. Study of artificial ground water recharge structures;
12. Study of radial flow and mixed flow centrifugal pumps,
13. Multistage centrifugal pumps, turbine, propeller and other pumps;
14. Installation of centrifugal pump;
15. Study of hydraulic ram,
16. Testing of centrifugal pump and study of cavitations;
17. Study and testing of submersible pump.

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Agriculture Engineering, VII-Semester

Course Outcome: The students have knowledge about the theories and application of wells and pumps and the areas of water supply and groundwater development

Suggested Readings:

1. H.M Reghunath 2003. Ground water, Wiley Eastern Ltd.
2. Michael AM, Khepar SD. and SK Sondhi. 2008. Water Well and Pumps, 2nd Edition, Tata McGraw Hill.
3. Michael AM. And Ojha TP. 2014. Principles of Agricultural Engineering Vol-II, 5th Edition. Jain Brothers Publication, New Delhi.
4. Todd David Keith and Larry W. Mays. 2004. Groundwater Hydrology, 3rd Edition, John Wiley & Sons, New York (International Book Distributing Company Lucknow).

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

Agriculture Engineering, VII-Semester

Departmental Elective AN702 (A) Food Packaging Technology

Course Objective: To acquaint and equip the students with different packaging materials, methods of packaging, packaging technology and packaging machineries used in food industry.

Unit I

Factors affecting shelf life of food material during storage, Interactions of spoilage agents with environmental factors as water, oxygen, light, pH, etc. and general principles of control of the spoilage agents; Difference between food infection, food intoxication and allergy. Packaging of foods, requirement, importance and scope, frame work of packaging strategy, environmental considerations, Packaging systems, types: flexible and rigid; retail and bulk; levels of packaging; special solutions and packaging machines, technical packaging systems and data management packaging systems

Unit II

Different types of packaging materials, their key properties and applications, Metal cans, manufacture of two piece and three piece cans, Plastic packaging, different types of polymers used in food packaging and their barrier properties. manufacture of plastic packaging materials, profile extrusion, blown film/ sheet extrusion, blow molding, extrusion blow molding, injection blow molding, stretch blow molding, injection molding. Glass containers, types of glass used in food packaging, manufacture of glass and glass containers, closures for glass containers. Paper and paper board packaging, paper and paper board manufacture process, modification of barrier properties and characteristics of paper/ boards. Relative advantages and disadvantages of different packaging materials; effect of these materials on packed commodities Nutritional labeling on packages.

Unit III

CAS and MAP, shrink and cling packaging, vacuum and gas packaging; Active packaging, Smart packaging, Packaging requirement for raw and processed foods, and their selection of packaging materials, Factors affecting the choice of packaging materials, Disposal and recycle of packaging waste, Printing and labeling, Lamination.

Unit IV

Package testing: Testing methods for flexible materials, rigid materials and semi rigid materials; Tests for paper (thickness, bursting strength, breaking length, stiffness, tear resistance, folding endurance, ply bond test, surface oil absorption test, etc.), plastic film and laminates (thickness, tensile strength, gloss, haze, burning test to identify polymer, etc.), aluminum foil (thickness, pin holes, etc.), glass containers (visual defects, colour, dimensions, impact strength, etc.), metal containers (pressure test, product compatibility, etc.).

Course Outcome: To acquaint and equip the students with different packaging materials, methods of packaging, packaging technology and packaging machineries used in food industry.

Suggested Readings

1. Coles, R., McDowell, D., Kirwan, M .J. (2003). Food Packaging Technology. Blackwell Publishing Co.
2. Gosby, N.T. (2001). Food Packaging Materials. Applied Science Publication
3. John, P.J. (2008). A Handbook on Food Packaging Narendra Publishing House,
4. Mahadevia, M., Gowramma, R.V. (2007). Food Packaging Materials. Tata McGraw Hill
5. Robertson, G. L. (2001). Food Packaging and Shelf life: A Practical Guide. Narendra Publishing House.
6. Robertson, G. L. (2005). Food Packaging: Principles and Practice. Second Edition. Taylor and Francis Pub.

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New Scheme Based On AICTE Flexible Curricula

Agriculture Engineering, VII-Semester

Departmental Elective AN702 (B) Farm Machinery Design

UNIT I

Farm machinery design - modern trends - tasks and requirements - economic considerations - durability, reliability and rigidity. Physico mechanical properties of soils - technological process of ploughing - wedge theory - working process of mould board plough - determination of basic parameters - Design of coulters - shares - mould boards.

UNIT II

Machines and implements for surface and inter row tillage - peg toothed harrow - disk harrows - rotary hoes - graders - rollers - cultivators - design of V shaped sweeps - rigidity of working tools. Rotary machines - trajectory of motion of rotary tiller tynes - forces acting - power requirement. Machines with working tools executing an oscillatory motion.

UNIT III

Design considerations for Grain hoppers – seed metering mechanism – furrow openers and seed tubes. Machines for fertilizer application – discs type broadcasters. Organic fertilizer application - Properties of organic manure – spreading machines.

UNIT IV

Liquid fertilizer distributors. Planting and transplanting – paddy transplanters – potato planters. Hydraulic nozzles. Power operated hydraulic sprayer design principles. Controlled droplet application. Spray drift and its mitigation. Use of drones for spraying – design of spray generation and application issues.

UNIT V

Crop harvesting- plant properties- physical and mechanical properties of plant stem -plant bending modeling. Harvesters, basic principles of design and its sub-systems. Cereal threshing and separation- design of tangential and axial threshing units. Performance indices of threshing units. Factors influencing the threshing process and power requirement. Separation process and design of straw walker. Cleaning unit process and operation. Grain pan- chaffer and bottom sieve.

Suggested Readings

1. Bosoi, E.S., O.V.Verniaev, I.I. Smirnov and E.G. Sultan-Shakh. (1990). Theory, construction and calculations of Agricultural Machinery - Vol.I. Oxonian Press Pvt. Ltd. No.56, Connaught Circle, New Delhi.
2. William. R.Gill and Glen E.Vanden Berg.. Soil dynamics in tillage and traction. Sup dt. of documents, U.S. Govt. Printing Office, Washington, D.C. 20402.
3. Bernacki, C., J.Haman and Cz.Kanafajski (1972). Agricultural Machines, Theory and Construction. Vol - I. U.S. Dept. of Commerce, National Technical Information Service, Springfield, Virginia.22151.
4. Yatsuk, E.P. (1981). Rotary soil working machines construction, calculation and design. American Publishing Co. Pvt.Ltd, New Delhi.
5. Varshney AC et al. 2004. Data book for Agricultural Machinery Design. ICAR - Central Institute of Agricultural Engineering, Berasia Road, Bhopal.

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

Agriculture Engineering, VII-Semester

Departmental Elective AN702 (C) Dairy and Food Engineering

Course Objective: To disseminate the knowledge of properties of products, unit operations and packaging involved in dairy and food engineering.

Unit I

Deterioration in food products and their controls, Physical, chemical and biological methods of food preservation. 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. Principles and equipment related to receiving of milk

Unit II

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; Aseptic processing.

Unit III

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

Unit IV

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, Nanotechnology: fundamental concepts.

Course Outcome: Student get knowledge about products properties, dairy plant's design and operations and packaging involved in dairy and food engineering.

Suggested Readings

1. Ahmed, T. 1997. Dairy Plant Engineering and Management. 4th Ed. Kitab Mahal.
2. McCabe, W.L. and Smith, J. C. 1999. Unit Operations of Chemical Engineering. McGraw Hill.
3. Rao, D.G. 2010. Fundamentals of Food Engineering. PHI learning Pvt. Ltd. New Delhi.
4. Singh, R.P. & Heldman, D.R. 1993. Introduction to Food Engineering. Academic Press.
5. Toledo, R. T. 1997. Fundamentals of Food Process Engineering. CBS Publisher.
6. Tufail Ahmed, -Dairy Plant Engineering and Management, CBS Publishers and Distributors, New Delhi, 2001.

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New Scheme Based On AICTE Flexible Curricula

Agriculture Engineering, VII-Semester

Departmental Elective AN702 (D) Testing of Farm Machinery

UNIT I

Importance and significance of testing and types of testing. Test equipment, usage and limitations. Test procedures and various test codes: National and International.

UNIT II

Laboratory and field testing of tillage and sowing machinery: laser land leveler, m.b. Plough, disc plough, rotavator, cultivator, disc harrow, seed cum fertilizer drill & planter.

UNIT III

Laboratory and field testing of manual & power operated intercultural machinery and plant protection machine. Laboratory and field testing of reaper, thresher and chaff cutter.

UNIT IV

Laboratory and field testing of tractor, straw combine & combine harvester.

UNIT V

Review and interpretation of test reports. Importance and need of standardization of components of agricultural equipment.

Suggested Readings

1. Barger EL, Liljedahl JB & McKibben EC. 1967. Tractors and their Power Units. Wiley Eastern.
2. Indian Standard Codes for Agril. Implements. Published by BIS, New Delhi.
3. Inns FM. 1986. Selection, Testing and Evaluation of Agricultural Machines and Equipment. FAO Service Bull. No.115.
4. Mehta ML, Verma SR, Rajan Pardeep and Singh S K. 2019. Testing and Evaluation of Agricultural Machinery. Daya Publishing House, Delhi.
5. Nebraska Tractor Test Code for Testing Tractor, Nebraska, USA.
6. Smith DW, Sims BG & O'Neill D H. 2001. Testing and Evaluation of Agricultural Machinery and Equipment - Principle and Practice. FAO Agricultural Services Bull. 110.

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New Scheme Based On AICTE Flexible Curricula

Agriculture Engineering, VII-Semester

Departmental Elective AN703 (A) Experimental design & statistical methods in Agriculture

UNIT I

Need for designing of experiments, characteristics of a good design. Basic principles of designs- randomization, replication and local control. Uniformity trials, size and shape of plots and blocks;

UNIT II

Analysis of variance; Completely randomized design, randomized block design and Latin square design. Factorial experiments, (symmetrical as well as asymmetrical). Orthogonality and partitioning of degrees of freedom.

UNIT III

Confounding in symmetrical factorial experiments, Factorial experiments with control treatment. Split plot and strip plot designs;

UNIT IV

Analysis of covariance and missing plot techniques in randomized block and Latin square designs; Transformations, crossover designs, balanced incomplete block design, resolvable designs and their applications

UNIT V

Lattice design, alpha design - concepts, randomisation procedure, analysis and interpretation of results. Response surfaces. Experiments with mixtures. Bioassays - direct and indirect, indirect assays based on quantal dose response, parallel line and slope ratio assays potency estimation.

Suggested Reading:

1. Cochran WG & Cox GM. 1957. Experimental Designs. 2nd Ed. John Wiley.
2. Dean AM & Voss D. 1999. Design and Analysis of Experiments. Springer.
3. Federer WT. 1985. Experimental Designs. MacMillan.
4. Fisher RA. 1953. Design and Analysis of Experiments.
5. Oliver & Boyd. Nigam AK & Gupta VK. 1979. Handbook on Analysis of Agricultural Experiments. IASRI Publ. Pearce SC. 1983. The Agricultural Field Experiment: A Statistical Examination of Theory & Practice. John Wiley.

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Agriculture Engineering, VII-Semester

Open Elective AN703 (B) ICT in Agriculture

UNIT I

Introduction & scope of ICT in Agriculture, Need for ICT in Agricultural Extension. National Policies on ICT in Agricultural Extension. Role of communications in ICT:

UNIT II

Concept, elements & their characteristics. Message: meaning, dimensions of a message characteristics of a good message, message treatment and effectiveness, distortion of message. Methods of communication: meaning and function. Forms of communication. Role of Mass Media in dissemination of farm technology.

UNIT III

Modern communication media: electronic video, tele text, tele conference, computer assisted instruction. Telephone/Mobile Technology: Farmer Call Centre, SMS Broadcast Service, m-krishi. ICT initiatives of NGOs and Private Companies. ICT initiatives by ICAR and SAUs, Value Added Services,

UNIT IV

Fisher Friend Project, SMS Services to farmers by Department of Agriculture. Practices of ICT for Agricultural Extension: aAQUA, Digital Green, e -Agrik (e-Agriculture), e- Sagu (e-cultivation), KISSAN (Karshaka Information Systems Service and Networking), Solutions through Information, VASAT - Virtual Academy for the Semi-Arid Tropics, Touch Screen Kiosk, e-Extension (e-Soil Health Card Program) Village.

UNIT V

Village Knowledge Centre (VRC/VRC/CIC): Introduction, concept, process for setting VRC. Warana Wired Village Project, Web Portals: AGRISNET, DACNET, In DG, DEAL, i -KISAN, e- Krishi, ASHA, IFFCO- Agri-Portal, Agriwatch Portal, i-Shakti. ICTs for market information and Agri- Business: AGMARKNET, e-KRISHI VIPNAN, ICT-e-CHOPAL, EID Garry India griline.

Suggested Reading:

1. G.L. Ray, 2006. Extension communication and management. Kalyani Publ.
2. A.S. Sandhu, 2004. Text book on Agricultural communication process and methods. Oxford & TBH.
3. R Saravanan, C Kathiresan & T Indra Devi, 2011. Information & communication technology for agriculture and rural development. New India Publ. Agency

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

Agriculture Engineering, VII-Semester

Open Elective AN703 (C) AI & IOT Applications in Agriculture

UNIT I

Foundation and history of artificial intelligent, problems and techniques – AI programming languages, introduction to LISP and PROLOG- problem spaces and searches, blind search strategies, Breadth first - Depth first- heuristic search techniques Hill climbing; best first -A* algorithm AO* algorithm- game tree.

UNIT II

Min max algorithms, game playing- alpha beta pruning. Knowledge representation issues, predicate logic - logic programming, semantic nets- frames and inheritance, constraint propagation, representing knowledge using rules, rules based deduction systems. Reasoning under uncertainty, review of probability.

UNIT III

Baye's probabilistic interferences and Dempstershafer theory, Heuristic methods, symbolic reasoning under uncertainty, Statistical reasoning, Fuzzy reasoning, Temporal reasoning, Non monotonic reasoning. Planning and planning in situational calculus, representation for planning, partial order planning algorithm, learning from examples, discovery as learning, learning by analogy, explanation based learning, neural nets, genetic algorithms.

UNIT IV

Principles of Natural language processing, rule based systems architecture, Expert systems, knowledge acquisition concepts, AI application to robotics, and current trends in intelligent systems. Defining IoT, Characteristics of IoT, Physical design of IoT, Logical design of IoT, Functional blocks of IoT.

UNIT V

Communication models & APIs .Machine to Machine, Difference between IoT and M2M, Software define Network. Wireless medium access issues, MAC protocol survey, Survey routing protocols, Sensor deployment & Node discovery, Data aggregation & dissemination IoT applications in managing crop and environmental parameters.

Suggested Readings:

1. Russell, S. and P. Norvig. 1998. Artificial Intelligence: A Modern Approach. Prentice Hall.
2. Rich, Elain and Kevin Knight. 1991. Artificial Intelligence. TMH.
3. Patrick Henry Winston. 1992. Artificial intelligence. Addition Wesley 3 rd Ed.
4. Nilson Nils J. Principles of Artificial Intelligence. Norsa Publishing House.
5. Vijay Madiseti, Arshdeep Bahga, "Internet of Things: A Hands -On Approach"
6. Waltenegus Dargie, Christian Poellabauer, "Fundamentals of Wireless Sensor Networks: Theory and Practice"

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

Agriculture Engineering, VII-Semester

Open Elective AN703 (D) Farm Tractor

Course Objective: To equip the student with sufficient knowledge about tractor and its various systems, their principles of operation and types, components etc.; and to introduce the ergonomic and safety considerations in tractors; and tractor testing

UNIT I

Introduction to Tractors - Review of engine parts and their functions- Introduction to transmission system in a tractor – components – functioning

UNIT II

Study of clutch – need, types, functional requirements, construction and principle of operation; Familiarization with single plate, multi-plate, centrifugal and dual clutch systems; Study of Gear Box – gear terminology – types of gears - principle of operation; Gear box types - functional requirements; Calculation for speed ratio; Study of differential system – need, functional components, construction; Calculation for speed reduction; Study of final drive – need, types ; Study of brake system – types, principle of operation, construction; Calculation for braking torque; Study of steering system – requirements, functional components; Steering geometry characteristics Calculation for turning radius; Familiarization with Ackerman steering - Steering systems in track type tractors; Introduction to hydraulic system - principle of operation; Types of hydraulic system, main functional components, functional requirements; Familiarization with the hydraulic system adjustments and ADDC; Introduction to tractor power outlets – PTO, PTO standards, types and functions; Study of power tiller transmission system and clutches – components and functions.

UNIT III

Introduction to traction - Traction terminology; Theoretical calculation of shear force and rolling resistance on traction device; Study of wheels and tyres – Solid tyres and pneumatic tyres; Tyre construction and tyre specifications; Study of traction aids; Study of tractor mechanics – forces acting on the tractor; Determination of CG of a tractor; Weight transfer in a tractor; Determination and importance of moment of inertia of a tractor; Study of tractor static equilibrium, tractor stability especially at turns; Determination of maximum drawbar pull; Familiarization with tractor as a spring- mass system

UNIT IV

Ergonomic considerations and operational safety; Introduction to tractor testing - Deciphering the test codes.

Course Outcomes: Student have knowledge about tractor and their principles of operation and types, components etc., concept of traction and mechanics of tractor and have basic knowledge about the ergonomic and safety considerations in tractors; and tractor testing

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Agriculture Engineering, VII-Semester

Suggested Readings

1. Jain, S. C., and Rai, C. R. 2013. Farm Tractor Maintenance and Repair. Standard Publishers Distributors, Delhi
2. Kirpal Singh. 2013. Automobile Engineering Vol. I. Standard Publishers Distributors, Delhi
Liljedahl, J. B., Turnquist, P. K., Smith, D. W., and Hokey, M. 2004. Tractors and Their Power Units. CBS Publishers and Distributors Pvt. Ltd, New Delhi
3. Relevant BIS Test Codes for Tractors.
4. Singh, S., and Verma, S. R. 2009. Farm Machinery Maintenance and Management. Indian Council of Agricultural Research, New Delhi

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**Agriculture Engineering, VII-Semester
AN704 Agriculture Structures Lab**

Practical:

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. Cost estimation of a Farm building.

Suggested Readings:

1. Pandey, P.H. Principles and practices of Agricultural Structures and Environmental Control, Kalyani Publishers, Ludhiana.
2. Ojha, T.P and Michael, A.M. Principles of Agricultural Engineering, Vol. I, Jain Brothers, Karol Bag, New Delhi.
3. Nathanson, J.A. Basic Environmental Technology, Prentice Hall of India, New Delhi. Venugopal Rao, P. Text Book of Environmental Engineering, Prentice Hall of India, New Delhi.
4. Garg, S.K. Water Supply Engineering, Khanna Publishers, New Delhi-6.
5. Dutta, B.N. Estimating and Costing in Civil Engineering, Dutta & CO, Lucknow. Khanna, P.N. Indian Practical Civil Engineer's Hand Book, Engineer's Publishers, New Delhi.
6. Sahay, K.M. and Singh, K.K. Unit Operations of Agricultural Processing, Vikas publishing pvt. Ltd, Noida.
7. Banerjee, G.C. A Text Book of Animal Husbandry, Oxford IBH Publishing Co, New Delhi.

Practical:

1. Study/visit to a functional green house
2. Planning and layout of green house & associated utilities
3. Material selection for the construction of green house
4. Measurement of temp. using thermistor & thermocouples inside the green house
5. Measurement of humidity, solar radiations & air velocity using various methods
6. Application of psychometric charts
7. Greenhouse irrigation design
8. Estimation of cooling requirements in a green house
9. Estimation of ventilation requirements
10. Thermal performance of green house
11. Application of data loggers for simultaneous estimation & control of different parameters like temp., RH, solar radiations etc.
12. Calculations of environment indices inside a green house
13. Fertigation calculations for greenhouse
14. Structural analysis of green house
15. Economic analysis of green house
16. Visit to a commercial green house

Suggested Readings:

1. Manohar, K.R. and Iga Thinathane. C. Greenhouse technology and management.
2. B.S.Publications, Hyderabad.
3. Nelson, P.V. Greenhouse operation and maintenance. Publisher: Prentice Hall, 2011. ISBN 10: 0132439360 ISBN 13: 9780132439367.
4. Prasad and Kumar. 2012. Greenhouse management for horticulture crops. Agrobios (India), Jodhpur
5. Salokhe, V.M. and Sharma, A.K. 2012.Greenhouse technology and applications. Geeta Somani Agrotech publishing Academy, Udaipur.