

Integral University, Lucknow
Integral Institute of Agricultural Science and Technology
Evaluation Scheme of Undergraduate program
B. Tech. Agricultural Engineering
w.e.f. Session 2018-19
Semester – VI

Course Code	Subject	Periods Per h/week/sem			Evaluation Scheme Theory Mid sem			Evaluation Scheme Practical Examination					End sem Theory Exam	Subject total	Credit	Total Credit Points
								Sessional			End sem exam (Taken by external examiner)	Sub Total (sessional + exam) ^{b+c}				
								CT	TA	Total ^a						
AE325	Agricultural Structures and Environmental Control	2	0	2	10	10	20	5	5	10	20	30	50	100	2:0:1	3
AE326	Ground Water, Wells and Pumps	2	0	2	10	10	20	5	5	10	20	30	50	100	2:0:1	3
AE327	Design of Structures	2	0	2	10	10	20	5	5	10	20	30	50	100	2:0:1	3
ME335	Machine Drawing and Computer Graphics	1	0	4	10	10	20	5	5	10	20	30	50	100	1:0:2	3
AE328	Soil & Water Conservation Structures	2	0	2	10	10	20	5	5	10	20	30	50	100	2:0:1	3
ME334	Refrigeration and Air Conditioning	2	0	2	10	10	20	5	5	10	20	30	50	100	2:0:1	3
BM339	Entrepreneurship Development and Communication Skills	1	0	2	10	10	20	5	5	10	20	30	50	100	1:0:1	2
AE330	Dairy and Food Engineering	2	0	2	10	10	20	5	5	10	20	30	50	100	2:0:1	3
AG316	e-Agriculture	1	0	2	10	10	20	5	5	10	20	30	50	100	1:0:1	2*
	Total															23+2*

Theory mid sem (20 marks) = Mid sem/ makeup (10 marks) + Quiz 1 (2.5 marks) + Quiz 2 (2.5 marks) + Attendance (5 marks), Practical mid sem (10 marks) = CT (5 marks) + TA (2.5 marks) + Attendance (2.5 marks), End sem exam practical (Taken by external examiner) = 20 marks, End sem final theory = 100 marks (40 marks objective type and 60 marks subjective type questions

**Non Gradual Course*

B. Tech. Agricultural Engineering
SEMESTER-VI
Syllabus: Agricultural Structures and Environmental Control
Paper Code: AE325
w.e.f. Session 2018-19

3(2+1)

Unit I: Planning and layout of farmstead. Physiological reactions of livestock to solar radiation and other environmental factors, livestock production facilities, BIS. Standards for dairy, piggery, poultry and other farm structures.

Unit II: Design, construction and cost estimation of farm structures; animal shelters, compost pit, fodder silo, fencing and implement sheds, barn for cows, buffalo, poultry, etc. Design and construction of rural grain storage system engineering for rural living and development, rural roads, their construction cost and repair and maintenance.

Unit III: 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 its design, cost and maintenance, design of septic tank for small family.

Unit IV: Estimation of power requirement for domestic and irrigation, source of power supply, use of alternate source of energy, electrification of rural housing. Scope, importance and need for environmental control, renewable and non-renewable resources and their equitable use.

Unit V: Concept of ecosystem, biodiversity of its conservation, environmental pollution and their control, solid waste management system, BOD and COD of food plant waste, primary and secondary treatment of food plant waste.

Practical: Instruments for measurements of environmental parameters. Environmental indices for your city. Harmonic analysis for sole-air temperature. Reflective and nonreflective air space in buildings. Cooling load of a farm building e.g. poultry house. Moisture condensation in agricultural buildings. Design and layout of a dairy farm. Design and layout of a poultry house. Design and layout of a sheep/goat house. Design of a biogas plant. Design of a farm fencing system. Design of ventilation system for dairy and poultry house. Design of a feed/fodder storage structures. Familiarization with local grain storage structures. Design of grain storage structures. Cost estimation of a farm buildings.

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.
4. Venugopal Rao, P. Text Book of Environmental Engineering, Prentice Hall of India, New Delhi.
5. Garg, S.K. Water Supply Engineering, Khanna Publishers, New Delhi-6.
6. Dutta, B.N. Estimating and Costing in Civil Engineering, Dutta & CO, Lucknow.
7. Khanna, P.N. Indian Practical Civil Engineer' s Hand Book, Engineer' s Publishers, New Delhi.
8. Sahay, K.M. and Singh, K.K. Unit Operations of Agricultural Processing, Vikas publishing pvt. Ltd, Noida.
9. Banerjee, G.C. A Text Book of Animal Husbandry, Oxford IBH Publishing Co, New Delhi.

B. Tech. Agricultural Engineering
SEMESTER-VI
Syllabus: Groundwater, Wells and Pumps
Paper Code: AE326
w.e.f. Session 2018-19

3(2+1)

Unit I: Occurrence and movement of ground water, aquifer and its types, classification of wells, steady and transient flow into partially, fully and non-penetrating and open wells, familiarization of various types of bore wells common in the state.

Unit II: Design of open well, groundwater exploration techniques, methods of drilling of wells, percussion, rotary, reverse, rotary, design of assembly 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 etc. Theis recovery method, well interference, multiple well systems, surface and subsurface exploitation and estimation of ground water potential, quality of ground water.

Unit III: Artificial groundwater recharge planning, modelling, ground water project formulation. Pumping Systems: Water lifting devices; different types of pumping machinery, classification of pumps, component parts of centrifugal pumps; pump selection, installation and troubleshooting; design of centrifugal pumps, performance curves, effect of speed on head capacity, power capacity and efficiency curves.

Unit III: Effect of change of impeller dimensions on performance characteristics; hydraulic ram, propeller pumps, mixed flow pumps and their performance characteristics; priming, self-priming devices, rotodynamic pumps for special purposes such as deep well turbine pump and submersible pump.

Practical: Verification of Darcy' s Law; Study of different drilling equipments; Sieve analysis for gravel and well screens design; Estimation of specific yield and specific retention; Testing of well screen; Drilling of a tube well; Measurement of water level and drawdown in pumped wells; Estimation of aquifer parameters by Thies method, Coopers- Jacob method , Chow method, Theis Recovery method; Well design under confined and unconfined conditions, well losses and well efficiency; Estimating ground water balance; Study of artificial ground water recharge structures; Study of radial flow and mixed flow centrifugal pumps, multistage centrifugal pumps, turbine, propeller and other pumps; Installation of centrifugal pump; Testing of centrifugal pump and study of cavitations; Study of performance characteristics of hydraulic ram; Study and testing of submersible pump.

Suggested Readings:

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

B. Tech. Agricultural Engineering
SEMESTER-VI
Syllabus: Design of Structures
Paper Code: AE327
w.e.f. Session 2018-19

3(2+1)

Unit I: Loads and use of BIS Codes. Design of connections. Design of structural steel members in tension, compression and bending.

Unit II: Design of steel roof truss. Analysis and design of singly and doubly reinforced sections, Shear, Bond and Torsion.

Unit III: Design of Flanged Beams, Slabs, Columns, Foundations, Retaining walls and Silos.

Practical: Design and drawing of steel roof truss; Design and drawing of RCC building; Design and drawing of Retaining wall.

Suggested Readings

1. Junarkar, S.B. 2001. Mechanics of Structures Vol. I Charotar Publishing Home, Anand.
2. Khurmi R. S. 2001. Strength of materials. S. Chand & Company Ltd., 7361, Ram Nagar, New Delhi - 110055.
3. Kumar Sushil 2003. Treasure of R.C.C. Design. R.K. Jain. 1705-A, Nai Sarak , Delhi-110006, P.B.1074.

B. Tech. Agricultural Engineering
SEMESTER-VI
Syllabus: Machine Drawing and Computer Graphics
Paper Code: ME335
w.e.f. Session 2018-19

3(1+2)

Unit I: First and third angle methods of projection. Preparation of working drawing from models and isometric views. Drawing of missing views. Different methods of dimensioning. Concept of sectioning. Revolved and oblique section.

Unit II: Sectional drawing of simple machine parts. Types of rivet heads and riveted joints. Processes for producing leak proof joints. Symbols for different types of welded joints. Nomenclature, thread profiles, multi-start threads, left and right hand thread. Square headed and hexagonal nuts and bolts. Conventional representation of threads.

Unit III: Different types of lock nuts, studs, machine screws, cap screws and wood screws. Foundation bolts. Design process, application of computers for design, definition of CAD, benefits of CAD, CAD system components. Computer hardware for CAD. Display, input and output devices. Graphic primitives, display file, frame buffer, display control, display processors, Line generation, graphics software.

Unit IV: Points and lines, Polygons, filling of polygons. Text primitive. Other primitives. Windowing and clipping, view port. Homogeneous coordinates. Transformations. Planar and space curves design. Analytical and synthetic approaches. Parametric and implicit equations. B-spline and Beizer curves. Geometric modeling techniques. Wire frames. Introduction to solid modeling. Introduction to numerical control.

Unit V: Basic components of NC system, NC coordinates and motion control systems. Computer numerical control, direct numerical control, combined CNC/DNC. NC machine tools and control units. Tooling for NC machines, part programming, punched tape, tape coding and format, manual and computer assisted part programming.

Practical: Preparation of manual drawings with dimensions from Models and Isometric drawings of objects and machine components; Preparation of sectional drawings of simple machine parts; Drawing of riveted joints and thread fasteners; Demonstration on computer graphics and computer aided drafting use of standard software; Practice in the use of basic and drawing commands on auto cad; Generating simple 2-D drawings with dimensioning using autocad; Practice in the use of modify and rebelling commands; Practice in graphics mathematics, curve fitting and transformations; Demonstration on CNC machine

Suggested Readings

1. Ibrahim Zeid. 2004. Mastering CAD/CAM. McGraw-Hill Book Co., NY, USA.
2. Kunwoo Lee. 1999. Principles of CAD/CAM/CAE Systems. Prentice-Hall, USA.
3. N.D. Bhat and V.M. Panchal. 1995. Machine Drawing. Charotar Publishing House, Anand.
4. N.D. Bhat. 1995. Elementary Engineering Drawing. Charotar Publishing House, Anand.

B. Tech. Agricultural Engineering
SEMESTER-VI
Syllabus: Soil and Water Conservation Structures
Paper Code: AE328
w.e.f. Session 2018-19

3(1+2)

Unit I: Introduction; classification of structures, functional requirements of soil erosion control structures; flow in open channels-types of flow, state of flow, regimes of flow, energy and momentum principles, specific energy and specific force; hydraulic jump and its application, type of hydraulic jump, energy dissipation due to jump, jump efficiency, relative loss of energy.

Unit II: Runoff measuring structures-par shall flume, H - flume and weirs; straight drop spillway - general description, functional use, advantages and disadvantages, structural parts and functions; components of spillway, hydrologic and hydraulic design, free board and wave free board, aeration of weirs, concept of free and submerged flow, structural design of a drop spillway-loads on headwall, variables affecting equivalent fluid pressure.

Unit III: Determination of saturation line for different flow conditions, seepage under the structure, equivalent fluid pressure of triangular load diagram for various flow conditions, creep line theory, uplift pressure estimation, safety against sliding, overturning, crushing and tension; chute spillway general description and its components, hydraulic design, energy dissipaters.

Unit IV: Design criteria of a SAF stilling basin and its limitations, drop inlet spillway- general description, functional use, design criteria; design of diversions; small earth embankments-their types and design principles, farm ponds and reservoirs, cost estimation of structures.

Practical: Design of H-flume; Design of Parshall flume; Construction of specific energy and specific force diagram; Measurement of hydraulic jump parameters and amount of energy dissipation; Hydraulic design of a straight drop spillway; Determination of uplift force and construction of uplift pressure diagram; Determination of loads on headwall and construction of triangular load diagram; Stability analysis of a straight drop spillway; Hydraulic design of a chute spillway; Design of a SAF energy dissipater; Design of small earth embankments and water harvesting structures; Cost estimation of structures.

Suggested Readings

1. Mahnot, S.C. 2014. Soil and Water Conservation and Watershed Management. International Books and Periodicals Supply Service, New Delhi.
2. Mal, B.C. 2014. Introduction to Soil and Water Conservation Engineering. 2014. Kalyani Publishers.
3. Michael, A.M. and T.P. Ojha. 2003. Principles of Agricultural Engineering. Volume II. 4th Edition, Jain Brothers, New Delhi.
4. Murthy, V.V.N. 2002. Land and Water Management Engineering. 4th Edition, Kalyani Publishers, New Delhi.
5. Norman Hudson. 1985. Soil Conservation. Cornell University Press, Ithaca, New York, USA.

B. Tech. Agricultural Engineering
SEMESTER-VI
Syllabus: Refrigeration and Air Conditioning
Paper Code: ME334
w.e.f. Session 2018-19

3(2+1)

Unit I: Definition of refrigeration and air conditioning, necessity of refrigeration and air conditioning. History of refrigerants, Refrigerants, definition, classification, nomenclature, methane and ethane series. Desirable properties of refrigerants- physical, chemical, safety, thermodynamic and economical. Azeotropes.

Unit II: Components of vapour compression refrigeration system, evaporator, compressor, condenser and expansion valve. Ice manufacture, principles of ice production, different systems. Treatment of water for making ice, Brines, Freezing tanks, ice cans, air agitation, quality of ice.

Unit III: Applications of refrigeration in different food products - fruit and vegetable products, meat products, fish, poultry products, dairy products etc. Food Freezing: Freezing systems: indirect contact systems, plate freezers, air blast freezers, and freezers for liquid foods.

Unit IV: Direct contact systems, air blast immersion, frozen food properties, density, thermal conductivity enthalpy, apparent specific heat and thermal diffusivity, freezing time, factors influencing freezing time, freezing rate, thawing time. Frozen food storage: Quality changes in foods during frozen storage.

Practical

Standard refrigeration symbols. To study vapour compression refrigeration system. Solving problems on cooling load calculations/Refrigeration load. To study the properties and performance characteristics of some commonly used refrigerants. To study the components of the refrigeration system. Freezing of foods by different methods. Determination of freezing time of a food material.

Suggested Readings

1. William C. Whitman, William M. Johnson, John A. Tomczyk and Eugene Silberstein. 2009.
2. Refrigeration & Air Conditioning Technology, 6th Ed. Delmar, Cengage Learning, NY, USA.
3. C.P. Arora. 2000. Refrigeration and Air Conditioning, 2nd Ed. Tata McGraw-Hill Publishing Co. Ltd., New Delhi.
4. W.F. Stoecker and J.W. Jones.1982. Refrigeration and Air Conditioning, 2nd Ed. McGraw-Hill Book Co., New York, USA.

B. Tech. Agricultural Engineering
SEMESTER-VI

Syllabus: Entrepreneurship Development and Communication Skills

Paper Code: BM339

w.e.f. Session 2018-19

3(2+1)

Unit I: Basic Entrepreneurship Development: Assessing overall business environment in the Indian economy. Overview of Indian social, political and economic systems and their implications for decision making by individual entrepreneurs. Globalization and the emerging business /entrepreneurial environment.

Unit II: Concept of entrepreneurship; entrepreneurial and managerial characteristics; managing an enterprise; motivation and entrepreneurship development; importance of planning, monitoring, evaluation and follow up; managing competition; entrepreneurship development programs; SWOT analysis, Generation, incubation and commercialization of ideas and innovations. Government schemes and incentives for promotion of entrepreneurship.

Unit III: Government policy on Small and Medium Enterprises (SMEs) / SSIs. Export and Import Policies relevant to fisheries sector. Venture capital. Contract farming and joint ventures, public-private partnerships. Overview of fisheries inputs industry. Characteristics of Indian fisheries processing and export industry.

Unit IV: Social Responsibility of Business. Communication Skills: Structural and functional grammar; meaning and process of communication, verbal and non-verbal communication; listening and note taking, writing skills, oral presentation skills; field diary and lab record; indexing, footnote and bibliographic procedures. Reading and comprehension of general and technical articles, precis writing, summarizing, abstracting; individual and group presentations, impromptu presentation, public speaking; Group discussion. Organizing seminars and conferences.

Practical: Listening and note taking, writing skills, oral presentation skills; field diary and lab record; indexing, footnote and bibliographic procedures. Reading and comprehension of general and technical articles, precis writing, summarizing, abstracting; individual and group presentations.

Suggested Readings

1. Chole, R. R. *et al.*, 2012, *Entrepreneurship Development and Communication skills*, Scientific publishers, Jodhpur.
2. Gittiner, J P., 1982, *Economic Analysis of Agricultural Projects*, The John Hopkins University Press Baltimore, USA.
3. Hopkins J A and Baker C B Danville, *Financial Management in Agriculture*, 6th ed Barry P J, IL Interstate Publishers.
4. Kotler Philip and Armstrong, *Principles of Marketing*. Prentice-Hall.
5. Pandey U. K., *An Introduction to Agricultural Finance*.
6. Dr.A.K.Singh,2009.Entrepreneurship Development and Management. Lakshmi Publications Ltd.,
7. S. Anil Kumar, S.C Poornima, M.K. Abraham and K. Jayashree, 2008; Entrepreneurship Development. New Age International Publishers

B. Tech. Agricultural Engineering
SEMESTER-VI
Syllabus: Dairy and Food Engineering
Paper Code: AE330
w.e.f. Session 2018-19

Theory

3(2+1)

Unit I: Planning Dairy development in India. Engineering, thermal and chemical properties of milk and milk products,

Unit II: Unit operation of various dairy and food processing systems, process flow charts for product manufacture, working principles of equipment for receiving, pasteurization sterilization, homogenisation, filling & packaging, butter manufacture.

Unit III: Dairy plant design and layout, composition and proximate analysis of food products. Deterioration in products and their controls.

Unit IV: Physical, chemical and biological methods of food preservation, changes undergone by the food components during processing, evaporation, drying, freezing juice extraction, filtration, membrane separation, thermal processing, plant utilities requirement.

Practical: Listening Study of a composite pilot milk processing plant & equipments; Study of pasteurizers; Study of sterilizers; Study of homogenisers; Study of separators; Study of butter churners; Study of evaporators; Study of milk dryers; Study of freezers; Design of food processing plants & preparation of layout; Visit to multiproduct dairy product; Determination of physical properties of food products; Estimation of steam requirements; Estimation of refrigeration requirements in dairy & food plant; Visit to Food industry.

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. 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.

B. Tech. Agricultural Engineering
SEMESTER-VI
Syllabus: e-Agriculture
Paper Code: AG316
w.e.f. Session 2018-19

2(1+1)

UNIT I: Introduction of e-Agriculture, Biological databases: Primary, Secondary and Composite databases, Need of Biological databases in Agricultural Sciences

UNIT II: Adopter categories and their characteristics. Basic Introduction to National Center for Biotechnology Information (NCBI), AgriCola, CENTRE FOR AGRICULTURAL INFORMATICS & E-GOVERNANCE RESEARCH STUDIES

UNIT III: Digital Networks for Farmers (DNF): A National Outlook (VISTARNET–Agricultural Extension Information System Network, APHNET–Animal production and Health Informatics Network FISHNET–Fisheries Informatics Network, AGMARKNET, ARISNET–Agricultural Research Information System Network, SEEDNET– Seed Informatics Network, HORTNET– Horticultural Informatics Network, PPIN–Plant Protection Informatics Network, Future technologies and ICT applications to Enhance Food Security – A Global Outlook,

UNIT IV: Education – Meaning, Definition, Types – Formal Informal and Non-formal education, Communication, individual contact methods- Meaning, Objectives, Steps. Group contact methods, Mass contact Methods –Innovative Information sources – Internet, Cyber Cafes, Video and tele conferences, Kisan call centers, e-chaupal, Consultancy clinics, EEI.

Practicals: Usage of agriculture and biological database, NAL Online Catalog – AGRICOLA, Briefing about retrieval of scientific articles from PubMed database, Innovative Information sources

Suggested Readings:

1. Absolute beginners guide to Computer Basics by Michael Miller, Que Publishing; 5 edition
2. BIOS Instant Notes in Bioinformatics by Charlie Hodgman, Andrew French, David Westhead, Taylor & Francis publishing; 2 edition.
3. Introduction to Bioinformatics by Teresa Attwood, David Parry-Smith 1st edition; Prentice Hall publications
4. Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins by Andreas D. Baxevanis and B. F. Francis Ouellette (Eds), 2nd Edition; Willey & Sons publications.
5. Bioinformatics: Sequence, Structure, and Databanks: A Practical Approach by Des Higgins, Willie Taylor; OUP.