

**DAYALBAGH EDUCATIONAL INSTITUTE
FACULTY OF ENGINEERING
B.TECH. (AGRICULTURAL ENGINEERING)**

SEVENTH SEMESTER

COURSE NUMBER	COURSE TITLE	Credits	End sem. Exam.	Theory / Practical
AEM701	AGRICULTURAL ENGINEERING PROJECT I	3.0	N	P
AEM702	SEMINARS	1.0	N	P
AEM703	FARM BUSINESS MANAGEMENT AND VILLAGE INDUSTRIES	3.0	Y	T
AEM704	PROFESSIONAL ETHICS AND CONCIOUSNESS	2.0	Y	T
AEM705	MINOR PROJECT-I	1.0	N	P
MEM703	REFRIGERATION AND AIR CONDITIONING	3.0	Y	T
MEM704	THERMAL ENGINEERING LAB II	1.0	Y	P
EGC781	CO-OP TRAINING AND EXPERIENTIAL LEARNING	4.0	Y	P
#	STREAM WISE CORE COURSES	7.0	Y	T
*	STREAM WISE OPTIONAL COURSES	3.0	Y	T
TOTAL CREDITS		28.0		

Stream-wise CORE Courses (#):

MAINSTREAM AGRICULTURAL ENGINEERING				
AEM706	WATER HARVESTING AND SOIL CONSERVATION STRUCTURES	3.0	Y	T
AEM707	GROUND WATER WELL AND PUMPS	3.0	Y	T
AEM708	HYDROLOGY LAB	1.0	Y	P
DAIRY ENGINEERING SPECIALIZATION				
AEM709	FOOD QUALITY AND CONTROL	3.0	Y	T
AEM710	DAIRY ENGINEERING	3.0	Y	T
AEM711	DAIRY ENGINEERING LAB	1.0	Y	P
AGRITECH & ENTREPRENEURSHIP SPECIALIZATION				
AEM712	AGRICULTURE MARKETING TRADE & PRICES	3.0	Y	T
AEM713	AI AND MACHINE LEARNING IN AGRICULTURE	3.0	Y	T
AEM714	MODERN AGRITECH LAB	1.0	Y	P

Stream-wise OPTIONAL Courses any one of the following (*):

MAINSTREAM AGRICULTURAL ENGINEERING				
AEM715	BIO ENERGY SYSTEMS	3.0	Y	T
AEM716	SEED PROCESSING TECHNOLOGY	3.0	Y	T
AEM717	DESIGN OF STRUCTURES	3.0	Y	T

AEM718	AGRICULTURE DATA ANALYTICS	3.0	Y	T
AEM719	FARM MACHINERY DESIGN AND PRODUCTION	3.0	Y	T
AEM720	HUMAN ENGINEERING AND SAFETY	3.0	Y	T
MEM728	ADDITIVE MANUFACT. FOR 3D PRINTING	2.0	Y	T
MEM729	ADD. MANUFACT. FOR 3D PRINTING LAB.	1.0	Y	P
DAIRY ENGINEERING SPECIALIZATION				
AEM721	NUTRITIONAL MANAGEMENT IN DAIRY FARM	3.0	Y	T
AEM720	HUMAN ENGINEERING AND SAFETY	3.0	Y	T
MEM728	ADDITIVE MANUFACT. FOR 3D PRINTING	2.0	Y	T
MEM729	ADD. MANUFACT. FOR 3D PRINTING LAB.	1.0	Y	P
AGRITECH & ENTREPRENEURSHIP SPECIALIZATION				
AEM718	AGRICULTURE DATA ANALYTICS	3.0	Y	T
AEM720	HUMAN ENGINEERING AND SAFETY	3.0	Y	T
AEM722	UAV IN AGRICULTURE	3.0	Y	T
AEM723	SENSORS AND MICRO CONTROLLERS	3.0	Y	T
MEM728	ADDITIVE MANUFACT. FOR 3D PRINTING	2.0	Y	T
MEM729	ADD. MANUFACT. FOR 3D PRINTING LAB.	1.0	Y	P

Course Number: AEM701, Course Title: AGRICULTURAL ENGINEERING PROJECT I

Class: B.Tech., Status of Course: HALF COURSE,, Approved since session:

Total Credits:3, Periods (55 mts. Each)/week:6(L:0+T:0+P:6+S:0), Min.pds./sem.: 78

At the final year level the students in a group of 3 or 4 undertake project work in different area of specialisation as Farm machinery and farm power, Soil and water conservation, Irrigation and drainage engineering, applications of renewable energy in agriculture, dairy technology and food engineering, etc. This involves fabrication & testing of software development and their application etc.

Course Number: AEM702, Course Title: SEMINARS

Class: B.Tech., Status of Course: HALF COURSE,, Approved since session:

Total Credits:1, Periods (55 mts. Each)/week:2 (L:0+T:0+P:0+S:2), Min.pds./sem.: 26

Students prepare term papers on topics allotted to them by their respective supervisor. They present it in Seminars.

Course Number: AEM703, Course Title: FARM BUSINESS MANAGEMENT AND VILLAGE INDUSTRIES

Class: B.Tech., Status of Course: Major Course, Approved since session:

Total Credits: 3, Periods (55 mts. each)/week: 3(L:3+T:1+P:0+S:0), Min.pds./sem: 52

UNIT1

Agri-business – scope, characteristics, types, Management – importance, definition, management and administration, Small business – characteristics and stages of growth – management functions – planning, organizing, leading.

UNIT2

Principles, forms of agri-business organizations, Management approaches – Profit Centred Approach, Management by approach and quality circles. Strength, Weakness, Opportunity and Threat (SWOT) Analysis.Agro-inputs and products inventory management – raw material procurement, inventory types and costs.

UNIT3

Marketing management – Marketing environment, marketing mix – Input marketing promotion activities.product pricing methods, Agricultural input marketing firms.Financial management. Acquiring capital – budget analysis.Agricultural inputs retailing, types of distribution channels – Return on Investment

UNIT4

Village industries for prosperity of rural poor. Work of different agencies-KVIC, handicraft & other boards. Small scale industries. Definition. Resource based and demand based industries. Market survey and analysis. Process flow chart. Quality standards & control.

UNIT5

Cost of project. Fixed and working capital requirement. Cost of production and profitability. Break even analysis. Cash flow analysis.Role of Govt. Agencies. Incentives. Backward areas. Reserved items. DIC. SISI. SIDO. National bed banks etc. Agriculture policies, Taxation system in agriculture.

SUGGESTED READINGS

Himanshu, "Agri Business Management – Problems and prospects", Ritu Publications, Jaipur, 2005

Smita Diwase, "Indian Agriculture and Agribusiness Management", Krishi Resource Management Network, Pune, 2004

Course No: AEM704, Course Title: PROFESSIONAL ETHICS AND CONCIOUSNESS

Class: B.Tech., Status of Course: Major Course, Approved since session:

Total Credits: 2, Periods (55 mts. each)/week: 2(L:2+T:1+P:0+S:0), Min.pds./sem: 39

UNIT1

Moral values and ethics: Integrity, work ethic, service learning; civic virtues like caring, sharing, honesty, courage, valuing time, cooperation, commitment, empathy, self-confidence, spirituality and stress management

UNIT2

Variety of moral issues, types of inquiry, moral dilemma, Moral Autonomy: Kohl Berg theory, Gillian's theory, consensus and controversy, theories about right action, customs and religion, uses of ethical theories, engineers as responsible experimenters, a balanced outlook on law.

UNIT3

Safety and risk: assessment of safety and risk, risk benefit analysis and reducing risk, respect for authority, collective bargaining, confidentiality, conflict of interest, occupational crime.

RIGHTS: Professional rights, employee rights, intellectual property rights(ITR), discrimination.

UNIT4

Multinational Corporations, environmental ethics, computer ethics, weapon development, engineer as manager, consulting engineers and advisors, moral leadership, corporate social responsibility

UNIT5

Basics of consciousness, different levels of consciousness, mystery of consciousness, requirement for creating consciousness system, consciousness and contemporary system theory, machine consciousness, neuro biological concepts in consciousness, aim of life and the concept of pleasure and pain, brain-mined relationship for consciousness.

SUGGESTED READING:

Mike W, Martin and Roland Schinzinger, Ethics in engineering, Tata Mc Graw Hill, New Delhi, 2003

Govind Rajan M, Natrajan S, Senthil Kumar VS, Engineering ethics, Prentice Hall of India, New Delhi, 2004

Deborah G, Thomson, Ethical issues in engineering, PHI, 1991

John Rowan and Samuel Zinaich Jr., Ethics for profession, Wordsworth, US.

Course Number: MEM703, Course Title: REFRIGERATION AND AIR CONDITIONING

Class: B.Tech., Status of Course: MAJOR COURSE, Approved since session: 2013-14

Total Credits:3, Periods (55 mts. each)/week:3(L:3+T:1+P:0+S:0), Min.pds./sem.: 52

UNIT 1

Introduction. Methods of Refrigeration (change in phase, expansion of liquids, adiabatic expansion of a gas, thermoelectric cooling, adiabatic demagnetization, ice refrigeration, evaporative refrigeration, steam jet refrigeration). Carnot refrigeration cycle, COP, concept of heat pump, Unit of refrigeration Capacity. Applications of refrigeration.

Air refrigeration: Air refrigeration cycle. Bell Coleman air refrigerator, Advantages of using air refrigeration in Aircraft. Simple, Bootstrap, Regenerative and reduced ambient type systems. Performance of air refrigeration systems, Comparison of different air cooling systems for aircraft.

UNIT 2

Simple vapour compression refrigeration system, different compression processes (wet, dry and saturated compression, super heated compression), Coefficient of performance with and without superheating and under-cooling. Compressor volumetric efficiency. Application of T-S diagram and P-H charts. Effects of operating conditions on the performance of the system. Advantages and disadvantages of vapour compression system over air refrigeration system. Important refrigerants, nomenclature and their properties. Insulating materials and their properties and applications. Leak detection. Charging of refrigerants.

UNIT 3

Methods of improving COP, flash chamber, flash inter cooler, Compound vapour compression system with and without inter-cooling for single and multi evaporators. Cascading. Manufacturing of dry ice. Refrigeration equipment-expansion/throttling devices. Refrigeration load calculations.

Absorption system: Simple and improved absorption systems. COP of absorption system, Electrolux system, Lithium bromide water absorption system.

UNIT 4

Psychrometric properties of air. Adiabatic saturation temperature. Psychrometric charts. Locating state points. Process of heating, cooling, humidification and de-humidification on charts. Chemical de-humidification. Air conditioning: Factors affecting air conditioning systems. Industrial and comfort air conditioning. Human requirements of Comfort. Comfort charts. Ventilation requirements. Applications of air conditioning, Automotive Air-Conditioning.

UNIT 5

Air conditioning equipments and system layout. Distribution of air through ducts, grills, filters, etc. Simple automatic system for temperature and humidity using face and bypass damper and reheat method.

INDUSTRIAL AND COMMERCIAL APPLICATION: Transport air conditioning, evaporative condensers, cooling towers, heat pumps.

SUGGESTED READING:

S Domkundwar & SC Arora: A COURSE IN REFRIGERATION & AIR CONDITIONING

Stoecker: REFRIGERATION AND AIR CONDITIONING

Manohar Lal: REFRIGERATION AND AIR CONDITIONING

Sparks & Dillo: MECHANICAL REFRIGERATION

CP Arora: REFRIGERATION AND AIR CONDITIONING

Course Number: MEM704, Course Title: THERMAL ENGINEERING LAB II

Class: B.Tech., Status of Course: MAJOR COURSE, Approved since session: 2000-01

Total Credits:1, Periods (55 mts. each)/week:2(L:0+T:0+P:1+S:1), Min.pds./sem.: 26

1. Study of Heat pump.
2. Study of refrigerators sealed unit and open unit.
3. Study of AC tutor
4. To determine COP of house hold refrigerator.
5. To determine COP of AC tutor.
6. Study of ice plant and cold storage.
7. Study of cooling tower.

Course Number: EGC781, Course Title: CO-OP TRAINING AND EXPERIENTIAL LEARNING

Class: B.Tech., Status of Course: CORE COURSE, Approved since session: 2000-01

Total Credits:4

The students are expected to undergo practical training in different industries allotted to them at different places, in order to acquaint themselves to various shop floor activities, industrial environment, problems faced in industries. They are required to submit a report on the training and the evaluation through internal and external viva voce.

Course Number: AEM705, Course Title: MINOR PROJECT-I

Class: B.Tech., Status of Course: CORE COURSE, Approved since session: 2000-01

Total Credits:1, Periods (55 mts. Each)/week:2 (L:0+T:0+P:2+S:0), Min.pds./sem.: 26

In order to implement the knowledge gained through various courses, the students undertake project related to demonstration of agriculture technologies, development of prototypes, establishment of small scale industries etc.

1. Exposure to agritech startups, listing the startups and case studies
2. To increase the farm productivity that will increase the farms income
3. Make innovative farm equipments for small and medium farmer
4. To develop cost effective storage system for vegetables and fruits at small scale
5. Visit to IARI/ICAR/some reputed agricultural facilities

Course Number: AEM706, Course Title: Water Harvesting and Soil Conservation Structures

Class: B.Tech., Status of Course: Major Course, Approved since session:

Total Credits: 3, Periods (55 mts. each)/week: 3(L:3+T:1+P:0+S:0), Min.pds./sem: 52

Unit 1

Water harvesting -principles, importance and issues. Water harvesting techniques - classification based on source, storage and use. Runoff harvesting – short-term and long-term techniques. Short-term harvesting techniques - terracing and bunding, rock and ground catchments.

Unit 2

Long-term harvesting techniques - purpose and design criteria. Structures - farm ponds - dug-out and embankment reservoir types, tanks and subsurface dykes. Farm pond -

components, site selection, design criteria, capacity, embankment, mechanical and emergency spillways, cost estimation and construction. Percolation pond - site selection, design and construction details. Design considerations of nala bunds.

Unit 3

Soil erosion control structures - introduction, classification and functional requirements. Permanent structures for soil conservation and gully control - check dams, drop, chute and drop inlet spillways - design requirements, planning for design, design procedures - hydrologic, hydraulic and structural design and stability analysis.

Unit 4

Hydraulic jump and its application. Drop spillway - applicability, types - straight drop, box-type inlet spillways - description, functional use, advantages and disadvantages, straight apron and stilling basin outlet, structural components and functions. Loads on head wall, variables affecting equivalent fluid pressure, triangular load diagram for various flow conditions, creep line theory, uplift pressure estimation, safety against sliding, overturning, crushing and tension.

Unit 5

Chute spillway - description, components, energy dissipaters, design criteria of Saint Antony Falls (SAF) stilling basin and its limitations. Drop inlet spillway - description, functional use and design criteria.

Suggested Readings

- Singh Gurmel, C. Venkataraman, G. Sastry and B.P. Joshi. 1996. Manual of Soil and Water Conservation Practices. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
- Michael A.M. and T.P. Ojha. 2003. Principles of Agricultural Engineering. Volume II. 4th Edition, Jain Brothers, New Delhi.
- Murthy, V.V.N. 2002. Land and Water Management Engineering. 4th Edition, Kalyani Publishers, New Delhi.
- Schwab, G.O., D.D. Fangmeier, W.J. Elliot, R.K. Frevert. 1993. Soil and Water Conservation Engineering. 4th Edition, John Wiley and Sons Inc. New York.
- Suresh R. 2014. Soil and Water Conservation Engineering. Standard Publisher Distributors, New Delhi.
- Samra, J.S., V.N. Sharda and A.K. Sikka. 2002. Water Harvesting and Recycling: Indian Experiences. CSWCR&TI, Dehradun, Allied Printers, Dehradun.
- Theib Y. Oweis, Dieter Prinz and Ahmed Y. Hachum. 2012. Rainwater Harvesting for Agriculture in the Dry Areas. CRC Press, Taylor and Francis Group, London.
- Studer Rima Mekdaschi and Hanspeter Liniger. 2013. Water Harvesting - Guidelines to Good Practice. Centre for Development and Environment, University of Bern, Switzerland.

Course Number: AEM707, Course Title: Groundwater, Wells and Pumps

Class: B.Tech., Status of Course: Major Course, Approved since session:

Total Credits: 3, Periods (55 mts. each)/week: 3(L:3+T:1+P:0+S:0), Min.pds./sem: 52

Unit1

Occurrence and movement of ground water; aquifer and its types; classification of wells, fully penetrating tubewells and open wells, familiarization of various types of bore wells; design of open wells;

Unit2

Groundwater exploration techniques; methods of drilling of wells: percussion, rotary, reverse rotary; design of tubewell and gravel pack, installation of well screen, completion and development of well;

Unit3

Groundwater hydraulics-determination of aquifer parameters by different method such as Theis, Jacob and Chow's, Theis recovery method; well interference, multiple well systems, estimation of ground water potential, quality of ground water; Artificial groundwater recharge techniques;

Unit4

Pumping systems: waterlifting 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;

Unit5

hydraulic ram, propeller pumps, mixed flow pumps and their performance characteristics; deep well turbine pump and submersible pump.

Suggested Readings

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

Course No: AEM708, Course Title: Hydrology Lab

Class: B.Tech., Status of Course: Major Course, Approved since session:

Total Credits: 1, Periods (55 mts. each)/week: 2(L:0+T:0+P:2+S:0), Min.pds./sem:26

1. Visit to meteorological observatory, prepare the layout and study different instruments
2. Measurement of rainfall by recording and non-recording type rain gauges,
3. Sieve analysis for gravel and well screens design;
4. Study of artificial ground water recharge structures;
5. Testing of centrifugal pump and study of cavitations;
6. study and testing of hydraulic ram;
7. In-situ measurement of hydraulic conductivity by single auger hole and inverse auger hole method
8. Design of surface drainage system and cost analysis
9. Preparation of contour map and isobath map
10. Delineation of watershed and determination of watershed characteristics

Course No: AEM709, Course Title: FOOD QUALITY AND CONTROL

Class: B.Tech., Status of Course: Major Course, Approved since session:

Total Credits: 3, Periods (55 mts. each)/week: 3(L:3+T:1+P:0+S:0), Min.pds./sem: 52

Unit1

Basics of Food Science and Food Analysis, Concept, objectives and need of food quality. Measurement of colour, flavour, consistency, viscosity, texture and their relationship with food quality and composition.

Unit2

Sampling; purpose, sampling techniques, sampling procedures for liquid, powdered and granular materials, Quality control, Quality control tools, Statistical quality control, Sensory evaluation methods

Unit3

panel selection methods, Interpretation of sensory results. Instrumental method for testing quality. Food adulteration and food safety. TQM and TQC, consumer preferences and acceptance,

Unit4

Food Safety Management Systems GAP, GHP, GMP, Hazards and HACCP (Hazard analysis and critical control point), Sanitation in food industry (SSOP),

Unit5

Food Laws and Regulations in India, FSSAI, Food grades and standards BIS, AGMARK, PFA, FPO, ISO 9000, 22000 Series. CAC (Codex Alimentarius Commission), Traceability and Quality Assurance system in a process plant, Bio safety and Bioterrorism.

Suggested Readings

Ranganna S. Hand book of Analysis and Quality Control for Fruit and Vegetable Products.
Srilakshmi B, Food Science.
Sharma Avanthi. A text book of Food Science and Technology.
Mudambi Sumati R, Rao Shalini M and Rajagopal M.V. Food Science.
Potter NN and Hotchkiss JH, Food Science.
Dev Raj, Rakesh Sharma and Joshi V.K, Quality for Value Addition in Food Processing.
The Food Safety and Standards Act along with Rules & Regulations. Commercial Law Publishers (India) Pvt. Ltd.

Course Number: AEM710, Course Title: DAIRY ENGINEERING

Class: B.Tech., Status of Course: Major Course, Approved since session:

Total Credits: 3, Periods (55 mts. each)/week: 3(L:3+T:1+P:0+S:0), Min.pds./sem: 52

Unit1

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. (Practicals) Visit to multi-product dairy plant.

Unit2

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, pasteurization, sterilization, homogenization, centrifugation and cream separation.(Practicals) Study of pasteurizers, Study of sterilizers, Study of homogenizers.

Unit3

Preparation methods and equipment for manufacture of cheese, paneer, butter and ice cream, Filling and packaging of milk and milk products.Dairy plant design and layout, Plant utilities.(Practicals) Study of separators, Study of butter churns, Visit to Food industry, Estimation of refrigeration requirements in dairy & food plant.

Unit4

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.Drying of liquid and perishable foods: principles of drying, spray drying, drum drying, freeze drying. (Practicals) Study of evaporators,Study of milk dryers, Study of freezers, Estimation of steam requirements.

Unit5

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. (Practicals) Study of filtration, Design of food processing plants & preparation of layout

Suggested Readings

Ahmed, T. 1997. Dairy Plant Engineering and Management. 4th Ed. Kitab Mahal.
McCabe W.L. and Smith J. C. 1999. Unit Operations of Chemical Engineering. McGrawHill.
RaoD.G. Fundamentals of Food Engineering. PHI learning Pvt. Ltd. New Delhi.
Singh R.P. & Heldman D.R. 1993. Introduction to Food Engineering. Academic Press.
Toledo R. T. 1997. Fundamentals of Food Process Engineering. CBS Publisher.

Course No: AEM711, Course Title: DAIRY ENGINEERING LAB

Class: B.Tech., Status of Course: Major Course, Approved since session:

Total Credits: 1, Periods (55 mts. each)/week: 2(L:0+T:0+P:2+S:0), Min.pds./sem:26

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

Course Number: AEM712, Course Title: AGRICULTURE MARKETING TRADE & PRICES

Class: B.Tech., Status of Course: Major Course, Approved since session:

Total Credits: 3, Periods (55 mts. each)/week: 3(L:3+T:1+P:0+S:0), Min.pds./sem: 52

UNIT 1

Agricultural Marketing: Concepts and definitions of market, marketing, agricultural marketing, market structure, Market segmentation, classification and characteristics of agricultural markets, Nature and determinants of demand and supply of farm products, Producer's surplus – meaning and its types, marketable and marketed surplus, factors affecting marketable surplus of agricl.-commodities

UNIT 2

Product life cycle (PLC) and competitive strategies: Meaning and stages in PLC; characteristics of PLC; strategies in different stages of PLC, Pricing and promotion strategies: pricing considerations and approaches – cost based and competition based pricing, Market promotion – advertising, personal selling, sales promotion and publicity – their meaning and merits & demerits, Marketing process-concentration, dispersion and equalization

UNIT 3

Marketing functions; Exchange functions – buying and selling Physical functions – storage, transport and processing, Facilitating functions – packaging, branding, grading, quality control and labeling (Agmark), Types and importance of agencies involved in agricultural marketing, Meaning and definition of marketing channel; number of channel levels; marketing channels for different farm products,

UNIT 4

Price spread: Meaning, definition and types of market integration, Marketing efficiency; marketing costs, margins and price spread, Factors affecting cost of marketing; reasons for higher marketing costs of farm commodities; ways of reducing marketing costs, Public sector institutions- CWC, SWC, FCI, CACP & DMI - their objectives and functions; cooperative marketing in India, Types of risk in marketing; speculation & hedging; an overview of futures trading

UNIT 5

Meaning and functions of price; administered prices; need for agricultural price policy, Concept of International Trade and its need, theories of absolute and comparative advantage , Present status and prospects of international trade in agricommodities; GATT and WTO, Agreement on Agriculture (AoA) and its implications on Indian agriculture; IPR

SUGGESTED READINGS

1. Agricultural Marketing in India by S.S. Acharya & N.L. Agarwal, Oxford & IBH Publishing Co. Pvt. Ltd, New Delhi.
2. Marketing Management: A South Asian Perspective by Philip Kotler, Kevin Lane Keller, Abraham Koshy & Mithileshwar Jha, Dorling Kindersley (India) Pvt. Ltd. Licensees of Pearson Education in South Asia.
3. Agricultural Economics by Subba Reddy, P. Raghu Ram, T.V. Neelkanta Sastry & I. Bhavani Devi, Second Edition, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.

2.

Course Number: AEM713, Course Title: AI AND MACHINE LEARNING IN AGRICULTURE

Class: B.Tech., Status of Course: Major Course, Approved since session:

Total Credits: 3, Periods (55 mts. each)/week: 3(L:3+T:1+P:0+S:0), Min.pds./sem: 52

UNIT 1

Introduction to Artificial Intelligence, Foundations and History of Artificial Intelligence, Applications of Artificial Intelligence, Intelligent Agents, Structure of Intelligent Agents. Computer vision, Natural Language Possessing.

UNIT 2

Searching for solutions, Uniformed search strategies, Informed search strategies, Local search algorithms and optimistic problems, Adversarial Search, Search for games, Alpha - Beta pruning.

UNIT 3

Propositional logic, Theory of first order logic, Inference in First order logic, Forward & Backward chaining, Resolution, Probabilistic reasoning, Utility theory, Hidden Markov Models (HMM), Bayesian Networks.

UNIT 4

Introduction to machine learning, Types of learning, Need and Applications of machine learning, Machine learning Versus Artificial Intelligence, Challenges of machine learning, Basic Components of learning, Hypothesis space, Dimensionality Reduction: Introduction, Feature selection, Feature Extraction, Need of dimensionality reduction, Principal Component Analysis. UNIT 5

Supervised and unsupervised learning, Decision trees, Statistical learning models, Learning with complete data - Naive Bayes models, Learning with hidden data - EM algorithm, Reinforcement learning.

SUGGESTED READINGS:

1. Stuart Russell, Peter Norvig, "Artificial Intelligence – A Modern Approach", Pearson Education
2. Elaine Rich and Kevin Knight, "Artificial Intelligence", McGraw-Hill
3. E Charniak and D McDermott, "Introduction to Artificial Intelligence", Pearson Education
4. Dan W. Patterson, "Artificial Intelligence and Expert Systems", Prentice Hall of India,
5. Tom Mitchell, MACHINE LEARNING, First Edition
6. EthemAlpaydin, INTRODUCTION TO MACHINE LEARNING, Fourth Edition
7. Simon Rogers, Mark Girolami, A FIRST COURSE IN MACHINE LEARNING, Second Edition

Course No: AEM714, Course Title: MODERN AGRITECH LAB

Class: B.Tech., Status of Course: Major Course, Approved since session:

Total Credits: 1, Periods (55 mts. each)/week: 2(L:0+T:0+P:2+S:0), Min.pds./sem:26

Some of the below experiments will be conducted by the students to learn AI, Machine learning and UAV:

1. Carry out real-time data collection and processing through UAV
2. Installs and troubleshoots the components of drones/UAV equipped with appropriate cameras, sensors (Optical Sensors etc.) and integrating modules for crop monitoring & spraying, soil & field analysis, plant counting and yield prediction, plant height measurement, canopy cover mapping and so on.
3. To conduct any of the following experiments to learn AI:
 - Implementation of logic gates using McCulloch-Pitts model
 - Implementation of Rosenblatt's perceptron models
 - Hebs rule, Delta Rule, Effect of Different activation functions
 - Implementation of Single Layer and Multi Layer Perceptron models
 - Back propagation, Art-1, Art-2 Implementation
 - Implementation of Fuzzy operations and relations
 - Implementation of Fuzzy Controller
 - Implementation of Genetic Algorithm
4. Basic Introduction to machine learning and implementation of some of the below experiments:
 - Study of machine learning library in Keras.
 - Write a python code to implement K-nearest neighbourhood program for the given dataset.
 - Write a python code to implement decision tree for a given dataset.
 - Write a python code to apply Naive Bayesian algorithm to classify a dataset from UCI/Kaggle.
 - Write a program to implement perceptron. Test for OR Gate, AND Gate and XOR Gate.
 - Implement Neural networks using Keras. Test to classify disease infested crop data into severe and moderate (use diseased crop data set) and obtain its accuracy level.
 - Study of Linear Regression with Excel.
 - Write a python code for prediction using linear regression model. Test with suitable dataset.
 - Write a python program to build an email spam classifier using support vector machines for the Spam base dataset from UCI machine learning repository.
 - Write a python program to perform clustering using python. Test with suitable dataset.
 - Study of WEKA tool for Preprocessing and Visualization.
 - Use WEKA tool for Classification and Clustering.

Course No: AEM715, Course Title: BIO ENERGY SYSTEMS

Class: B.Tech., Status of Course: Major Course, Approved since session:

Total Credits: 3, Periods (55 mts. each)/week: 3(L:3+T:1+P:0+S:0), Min.pds./sem: 52

UNIT1

Fermentation processes and its general requirements, An overview of aerobic and anaerobic fermentation processes and their industrial application. Heat transfer processes in anaerobic digestion systems, land fill gas technology and potential.

UNIT2

Biomass Production: Wastelands,classification and their use through energy plantation,selection of species, methods of fieldpreparation and transplanting. Harvesting of biomass and coppicing characteristics.

UNIT3

Biomasspreparation techniques for harnessing (size reduction, densification and drying). Thermochemicaldegradation. History of small gas producer engine system. Chemistry of gasification.

UNIT4

Gas producer - type, operating principle. Gasifier fuels, properties, preparation, conditioning of producer gas. Application, shaft power generation, thermal application and economics.

UNIT5

Trans-esterification for biodiesel production. A range of bio-hydrogen production routes. Environmental aspect of bio-energy, assessment of greenhouse gas mitigation potential.

Suggested Readings

British BioGen 1997, Anaerobic digestion of farm and food processing practices- Good practice guidelines, London, available on www.britishbiogen.co.uk.

Butler, S. 2005. Renewable Energy Academy: Training wood energy professionals.

Centre for biomass energy. 1998. Straw for energy production; Technology- Environment- Ecology. Available: www.ens.dk.

Course No: AEM716, Course Title: SEED PROCESSING TECHNOLOGY

Class: B.Tech., Status of Course: Major Course, Approved since session:

Total Credits: 3, Periods (55 mts. each)/week: 3(L:3+T:1+P:0+S:0), Min.pds./sem: 52

UNIT 1

Definition and characteristics of seed and how it differs from grain; Propagation of crop plants through true seed and vegetative means; Features of good quality seed; Importance of seed in successful crop production; Floral biology: self and cross pollination; Methods of genetic improvement of crop plants such as selection, hybridization, mutation and polyploidy; Seed legislations promulgated in India from 1996 to date and the purpose of each of these legislations.

UNIT 2

Multiplication of seed and seed material: systems of seed multiplication, classes of seed, multiplication models, multiplication ratio, field selection, planting ratio, isolation needs and roughing; Harvest and extraction of seed; Methods of hybrid seed production; Genetic deterioration during crop production cycles; Seed certification process: legal basis, pre-requisites for applicability, detailed description of the specific steps of the certification process (with particular emphasis on field inspection).

UNIT 3

Components of seed processing in a broader sense; Steps in seed processing in its narrower sense: preliminary cleaning, basic cleaning and grading, and equipment used in each of the steps; Seed treatment; Seed drying; Seed sampling; Seed testing: details of specific tests conducted for different purposes (service, certification and seed law enforcement); Standards prescribed for different crops.

UNIT 4

Types of organizations involved in seed production (public, quasi-governmental, private and cooperative), and their objectives and features; Organizational set up of a seed company; Steps involved in planning and developing a seed programme; Seed marketing activities and

analysis of seed demand and supply; Opportunities for Indian seed companies to have a greater share of world seed market; Visit to seed organizations; Preparing seed projects to obtain credit; Export procedures and formalities; Seed/plant quarantine method.

UNIT 5

Principles and special techniques used for seed production in important horticultural crops by selecting representatives of vegetable / flower / fruit / spice / condiment / plantation crops.

SUGGESTED READINGS

Singh, S.P., Commercial Vegetable Seed Production, Kalyani Publishers, Chennai, 2001

Agarwal, R.L., Seed Technology, Oxford IBH Publishing.Co., New Delhi, 1995

Course No: AEM717, Course Title: DESIGN OF STRUCTURES

Class: B.Tech., Status of Course: Major Course, Approved since session:

Total Credits: 3, Periods (55 mts. each)/week: 3(L:3+T:1+P:0+S:0), Min.pds./sem: 52

Unit1

Loads and use of BIS Codes. Design of connections.Design and drawing of single reinforced beam, double reinforced beam.

Unit2

Design of structural steel members intension, compression and bending. Design and drawing of one way, two way slabs

Unit3

Design of steel roof truss. Design and drawingof steel roof truss

Unit4

Analysis and design of singlyand doubly reinforced sections, Shear, Bond and Torsion.

Design and drawing ofRCC building;

Unit5

Design of Flanged Beams, Slabs,Columns, Foundations, Retaining walls and Silos.Design and drawing of Retaining wall. To measure workability of cement byslump test

Suggested Readings

Junarkar, S.B. 2001. Mechanics of Structures Vol. I Charotar Publishing Home, Anand.

Khurmi R. S. 2001. Strength of materials. S. Chand & Company Ltd., Ram Nagar, New Delhi

Kumar Sushil 2003. Treasure of R.C.C. Design. R.K. Jain. 1705-A, Nai Sarak , Delhi-110006,

Course No: AEM718, Course Title: AGRICULTURE DATA ANALYTICS

Class: B.Tech., Status of Course: Major Course, Approved since session:

Total Credits: 3, Periods (55 mts. each)/week: 3(L:3+T:1+P:0+S:0), Min.pds./sem: 52

UNIT 1

Precision agriculture technologies, prescriptive agriculture services, public and private data

UNIT 2

Agriculture gateway glossary:ISO 11783, shapefiles, KMZs, GeoTIFFs, CSV, TXT, yld etc, machinery and agronomic data

UNIT 3

Structure and data elements within files, obtaining meaningful data layers, organizing and managing data using today's technologies (cloud etc.), data accuracy, precision, errors, cleaning

UNIT 4

Data visualization, identifying outliers: using algorithms to scrub data, identifying rrsearch topics and appropriate analytical techniques

UNIT 5

Spatial data analysis techniques-geostatistics, kriging

SUGGESTED READINGS

Fischer, M.M., and A. Getis. 2010. Handbook of Applied Spatial Analysis; Software Tools, Methods and Application s. Springer-Verlag Berlin Heidelbergh.

Price, M.H. 2016. Mastering ArcGIS. McGraw Hill Education: New York, New York. 7th Ed. Crawley, M.J. 2013.

The R Book. John Wiley and Sons, Ltd.: Chinster, Wset Sussex, United Kingdom. 2nd Ed.

Course No: AEM719, Course Title: FARM MACHINERY DESIGN AND PRODUCTION

Class: B.Tech., Status of Course: Major Course, Approved since session:

Total Credits: 3, Periods (55 mts. each)/week: 3(L:3+T:1+P:0+S:0), Min.pds./sem: 52

Unit 1

Introduction to design parameters of Agricultural Machines and design procedure, Characteristics of farm Machinery Design, Research and Development Aspect of farm Machinery.

Unit 2

Design of standard power transmission components used in Agricultural Machines, mechanical and hydraulic units, Design of bearings, Introduction to safety in power transmission, Application of design principles to the system of selected farm Machineries

Unit3

Critical Appraisal in Production of Agricultural Machines, Advances in materials used for Ag Machinery, Cutting tools including CNC tools and finished tools, Advance manufacturing techniques like powder metallurgy, EDM, carburising etc

Unit 4

Limits, Fits and tolerances, Jigs and fixtures

Unit 5

Layout Planning of a small scale industry, Quality production management, Problems on economics of Process Selection and reliability; Case study for manufacturing a simple Agriculture machinery

SUGGESTED READINGS

Raymond N Y, EEzzat A F and Nicolas Skiadas.(1984), Vehicle Traction Mechanics,Elsevier Science Publishers B V, New York.

Sharma, D N and Mukesh, S.(2010), Design of Agricultural Tractor- Principles andproblems,Jain brothers, New Delhi.

William R G and Vanden Berg G E. (1968), Soil Dynamics in Tillage and Traction,Agricultural Research Service, USA.

Course No: AEM720, Course Title: HUMAN ENGINEERING AND SAFETY

Class: B.Tech., Status of Course: Major Course, Approved since session:

Total Credits: 3, Periods (55 mts. each)/week: 3(L:3+T:1+P:0+S:0), Min.pds./sem: 52

Unit1

Human factors in system development - concept of systems; basic processes in systemdevelopment, performance reliability, human performance.

Unit2

Information input process, visualdisplays, major types and use of displays, auditory and factual displays. Speechcommunications.

Unit3

Biomechanics of motion, types of movements, Range of movements,strength and endurance, speed and accuracy, human control of systems.

Unit4

Human motoractivities, controls, tools and related devices. Anthropometry: arrangement and utilization ofwork space, atmospheric conditions, heat exchange process andperformance, air pollution.

Unit5

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

Suggested Readings

Chapanis A. 1996. Human Factors in System Engineering. John Wiley & Sons, New York.

Dul J. and Weerdmeester B.1993. Ergonomics for Beginners. A Quick Reference Guide.Taylor and Francis, London.

Mathews J. and Knight A. A. 1971. Ergonomics in Agricultural Equipment Design. NationalInstitute of Agricultural Engineering.

Astrand P. And and Rodahl K. 1977. Textbook of Work Physiology. Mc Hill Corporation, NewYork.

Mark S. Sanders and Ernest James McCormick. 1993. Human Factors in Engineering and Design Mc Hill corporation, New York.

Keegan J J, Radke AO. 1964. Designing vehicle seats for greater comfort. SAE Journal;72:50~5.

Yadav R, Tewari V.K. 1998. Tractor operator workplace design-a review. Journal of Terramechanics 35: 41-53.

Course Number: MEM728, Course Title: ADDITIVE MANUFACTURING FOR 3D PRINTING

Class: B.Tech., Status of Course: MAJOR COURSE, Approved since session: 2015-16
Total Credits:2, Periods (55 mts. each)/ week:2(L-2+T-0+P:0+S-0), Min.pds./sem.: 26
UNIT 1

History and Technology background. Design principles for Additive Manufacturing. Technology impact on society and novel applications.

UNIT 2

Solid-Based Processes- Fused Deposition Modelling (FDM) and Polyjet; Light-Based Processes- Polyjet; Powder-Based Processes-Selective Laser Sintering (SLS), Liquid-Based Processes- Stereolithography (SLA).

UNIT 3

Rate, dimensions, cost and flexibility. Control of mechanical, thermal, and other functional properties. Materials for AM & issues. Design rules for AM; Process and quality control in additive manufacturing: Accuracy, repeatability, Fabrication speed.

UNIT 4

AM Process Chain; Application Workflow; 3D modeling; STL Data Structure, Error and Repair; process planning, and measurement. CAD systems for additive manufacturing. 3D content creating: Scanning. Post processing for additive manufacturing.

UNIT 5

Applications, including examples from aerospace, biomedical, architecture, energy, consumer devices and others. Future trends and implications of additive manufacturing. Emerging materials.

SUGGESTED READINGS:

Gebhardt: UNDERSTANDING ADDITIVE MANUFACTURING, Hanser.

Lipson & Kurman: FABRICATED: THE NEW WORLD OF 3D PRINTING, Wiley.

Gibson, Rosen, Stucker: ADDITIVE MANUFACTURING TECHNOLOGIES: RAPID PROTOTYPING TO DIRECT DIGITAL MANUFACTURING. Springer.

Hopkinson, Hague, Dickens: RAPID MANUFACTURING: AN INDUSTRIAL REVOLUTION FOR THE DIGITAL AGE. Wiley.

Gibson: ADVANCED MANUFACTURING TECHNOLOGIES FOR MEDICAL APPLICATIONS. Wiley.

NSF Report: FRONTIERS OF ADDITIVE MANUFACTURING RESEARCH AND EDUCATION AN NSF ADDITIVE MANUFACTURING WORKSHOP REPORT, 2013

Course Number: MEM729, Course Title: ADDITIVE MANUFACTURING LAB.

Class: B.Tech., Status of Course: MAJOR COURSE, Approved since session: 2015-16
Total Credits:1, Periods (55 mts. each)/ week:2(L-0+T-0+P:2+S-0), Min.pds./sem.: 26
EXPERIMENTS:

1. Anatomy of 3d Printer
2. Assembly of 3D Printer
3. Fused deposition Modeling (FDM)
4. Polyjet Modeling
5. 3D Scanning exercise
6. Design and printing exercise

Course Number: AEM721, Course Title: NUTRITIONAL MANAGEMENT IN DAIRY FARM

Class: B.Tech., Status of Course: Major Course, Approved since session:
Total Credits: 3, Periods (55 mts. each)/week: 3(L:3+T:1+P:0+S:0), Min.pds./sem: 52
UNIT 1

The essentials in the proper feeding of Dairy cattle, Energy requirements for maintenance and Production

UNIT 2

Digestive system of cattle Dairy Cattle

UNIT 3

Nutritional Requirements of Dairy Cattle (young calves, Calves, Heifers, Pregnant heifers, lactating cattle, Dried cattle)

UNIT 4

Forages - Brief description of fodder crops.Grains - Proteins - Lipids - Minerals and vitamins
- Water

UNIT 5

Total Mix Ration system, Component-fed Rations, Pasture-based Feeding Systems, Characteristics of a good Dairy ration, Economic Supply of nutrients

SUGGESTED READINGS:

I C A R Hand book of Animal Husbandry

Mahendra Singh and Jancy Gupta Buffalo Dairy Husbandry Practices NDRI Karnal

Anjali Agrawal and R.C.Upadhyay Important Micronutrients and Supplementation in Transition Dairy Cows NDRI Karnal

Course Number: AEM722, Course Title: UAV IN AGRICULTURE

Class: B.Tech., Status of Course: Major Course, Approved since session:

Total Credits: 3, Periods (55 mts. each)/week: 3(L:3+T:1+P:0+S:0), Min.pds./sem: 52

UNIT 1

Overview of Remote sensing and UAV, Types of UAV: fixed vane and quad-copter, Sensor used in UAV

UNIT 2

Usage of UAV in agriculture for crop health assessment, irrigation, nutrient management, crop monitoring, crop spraying, planting and soil & field analysis, drainage mapping , use of thermal camera in smart farming.

UNIT 3

GIS techniques to extract geospatial data from UAV, Data Pre-processing, Video Image Processing, Image processing and color indices calculation, Data processing methods

UNIT 4

Safe operation of UAVs in manual and programmed flight mode, legal regulations on use of UAVs, Current and futures issues of drones

UNIT 5

Case studies related to application of UAV in agriculture

SUGGESTED READING

Warner, E. S., Graham, R. W., Read, R. E., 1996. Small format AERIAL PHOTOGRAPHY. Whittles Publishing. Malta
Krishna, K. R., 2021, Agricultural drones: a peaceful pursuit, Apple academic press

Course Number: AEM723, Course Title: SENSORS AND MICRO CONTROLLERS

Class: B.Tech., Status of Course: Major Course, Approved since session:

Total Credits: 3, Periods (55 mts. each)/week: 3(L:3+T:1+P:0+S:0), Min.pds./sem: 52

UNIT 1

Review: Active passive components. Discrete components circuits, Semiconductors, Semiconductor diodes: characteristics, diode equation, rectifier and other application, Zener diodes, Breakdown mechanisms, use as a voltage regulator, regulated power supply. Transistors: pnp, npn transistors and their characteristics, current relationships, applications as an amplifier.

UNIT 2

Operational Amplifiers: Ideal operational amplifier characteristics, concept of feedback, open/closed loop gain, inverting, non-inverting amplifier, Zero crossing detector, Applications: summer, integrator, differentiator and other mathematical operations, active filters.

UNIT 3

Terminology, Sensor types and selection, motion sensor, infrared (IR) sensors, microphones, cameras, GPS, accelerometers, ultrasonic sensor, torque sensors, gyroscope sensors, optical sensors, tactile sensors, MEMS sensors

UNIT 4

Microcontroller and their working, elements and features of microcontroller, types of microcontroller, Application of microcontroller

UNIT 5

Instrumentation process steps and real-world applications, control system architecture – feed forward and feedback. Data Acquisition Hardware, Digital-to-Analog Converter, DAC Operation, Analog-to-Digital Converter- Successive Approximation ADC, Delta-Sigma ADC, ADC Performance Characteristics.

SUGGESTED READINGS:

Malvino, A.P. and Leach, D., : DIGITAL PRINCIPLES AND APPLICATIONS

Jain RP: MODERN DIGITAL THEORY

Boylestad & Nashelsky : ELECTRONIC DEVICES AND CIRCUIT THEORY

Millman & Halkias: INTEGRATED ELECTRONICS

Clarence W. de Silva : SENSORS AND ACTUATORS: ENGINEERING SYSTEM INSTRUMENTATION, SECOND EDITION