

Semester - VI

Sr. No.	Course Name	Course No.	Credit	L	P	T
1	Agricultural Structures and Environment Control	PFE - 302	3 (2 + 1)	2	1	0

Course content :

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. 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. 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. 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, concept of eco system, 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.

Planning of lectures

S.No.	Topics to be covered in Lecture	Proposed No. of Lectures
1	Planning and layout of farmstead.	1
2	Physiological reactions of livestock to solar radiation and other environmental factors.	2
3	Livestock production facilities, BIS. Standards for dairy, piggery, poultry and other farm structures.	3
4	Design, construction and cost estimation of farm structures; animal shelters, compost pit, fodder silo, fencing and implement sheds, barn for cows, buffalo, poultry, etc.	5
5	Design and construction of rural grain storage system.	3
6	Engineering for rural living and development, rural roads, their construction cost and repair and maintenance.	3
7	Sources of water supply. Norms of water supply for human being and animals, drinking water standards and water treatment suitable to rural community.	3
8	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.	3
9	Estimation of power requirement for domestic and irrigation, source of power supply, use of alternate source of energy, electrification of rural housing.	3
10	Scope, importance and need for environmental control.	2
11	Renewable and non-renewable resources and their equitable use.	1

12	Concept of eco-system, biodiversity of its conservation.	1
13	Environmental pollution and their control, solid waste management system, BOD and COD of food plant waste, primary and secondary treatment of food plant wastes.	4
Total		34
Practicals		
S.No.	Topic	No. of Practical
1	Instruments for measurements of environmental parameters.	1
2	Environmental indices for your city.	1
3	Harmonic analysis for sole-air temperature.	1
4	Reflective and non-reflective air space in buildings.	1
5	Cooling load of a farm building e.g. poultry house.	1
6	Moisture condensation in agricultural buildings.	1
7	Design and layout of a dairy farm.	1
8	Design and layout of a poultry house.	1
9	Design and layout of a sheep/goat house.	1
10	Design of a biogas plant. Design of a farm fencing system	1
11	Design of ventilation system for dairy and poultry house.	1
12	Design of a feed/fodder storage structures	1
13	Familiarization with local grain storage structures	1
14	Design of grain storage structures.	1
15	Cost estimation of a farm buildings	1
Total		15
Reference Books		
<ul style="list-style-type: none"> • Ventilation of Agricultural Structures, By: Hellickson, M.L. and Walker, J.N. • Farm Structures in tropical climates. FAO., By Bengtsson, L.P. • Agricultural buildings and structures. National Food & Energy , By Whitaker, J.H • Farm buildings: From planning to completion, By Phillips, R.E. • Practical farm buildings: A textbook & Handbook, By Boyd, J.S. • Environmental control for animals and plants. ASAE Textbooks., By ALbright, L.D. (• Environmental control systems :Heating, cooling, lighting. , By Moore, F.F. • Elements of bioenvironmental engineering. , By Gaudy, A.F, Gaudy, E. T. • Microbiology for environmental engineers. , By Gaudy F.A., Gaudy, E.T. 		

Sr. No.	Course Name	Course No.	Credit	L	P	T
2	Drying and Storage Engineering	PFE - 304	4 (3 + 1)	3	1	0

Course content :

Moisture content and methods for determination, importance of EMC and methods of its determination, EMC curve and EMC model, principle of drying, theory of diffusion, mechanism of drying- falling rate, constant rate, thin layer, deep bed and their analysis, critical moisture content, drying models, calculation of drying air temperature and air flow rate, air pressure within the grain bed, Shred' s and Hukill' s curve, different methods of drying including puff drying, foam mat drying, freeze drying, etc. Study of different types of dryers- performance, energy utilization pattern and efficiency, study of drying and dehydration of agricultural products. Types and causes of spoilage in storage, conditions for storage of perishable products, functional requirements of storage, control of temperature and relative humidities inside storage, calculation of refrigeration load; modified atmospheric storage and control of its environment, air movement inside the storage, storage of grains: destructive agents, respiration of grains, moisture and temperature changes in stored grains; conditioning of environment inside storage through natural ventilation, mechanical ventilation, artificial drying, grain storage structures such as Bukhari, Morai, Kothar, silo, CAP, warehouse - design and control of environment. Storage of cereal grains and their products, storage of seeds, hermetically sealed and air-cooled storages-refrigerated, controlled atmosphere, modified atmospheric and frozen storages. Storage condition for various fruits and vegetables under cold and CA storage system. Economic, aspects of storage.

Planning of lectures

S.No.	Topics to be covered in Lecture	Proposed No. of Lectures
1	Moisture content and methods for determination.	2
2	Importance of EMC and methods of its determination, EMC curve and EMC model.	3
3	Principle of drying, theory of diffusion, mechanism of drying- falling rate, constant rate, thin layer, deep bed and their analysis, critical moisture content, drying models, calculation of drying air temperature and air flow rate.	6
4	Air pressure within the grain bed, Shred's and Hukill's curve.	2
5	Different methods of drying including puff drying, foam mat drying, freeze drying, etc.	2
6	Study of different types of dryers- performance, energy utilization pattern and efficiency.	4
7	Study of drying and dehydration of agricultural products.	2
8	Types and causes of spoilage in storage.	2
9	Storage of perishable products, functional requirements of storage, control of temperature and relative humidity inside storage.	3
10	Calculation of refrigeration load.	2
11	Conditions for modified atmospheric storage and control of its environment.	2
12	Storage of grains: destructive agents, respiration of grains, moisture and temperature changes in stored grains air movement inside the storage, conditioning of environment inside storage through natural ventilation,	5

	mechanical ventilation, artificial drying.	
13	Grain storage structures such as Bukhari, Morai, Kothar, silo, CAP, warehouse - design and control of environment.	4
14	Storage of cereal grains and their products, storage of seeds, hermetically sealed and air-cooled storages-refrigerated, controlled atmosphere, modified atmospheric and frozen storages.	4
15	Storage condition for various fruits and vegetables under cold and CA storage system.	3
16	Economic, aspects of storage.	2
Total		48
Practicals		
S.No.	Topic	No. of Practicals
1	Study of mechanics of bulk solids affecting cleaning, drying and storage of grains.	1
2	Measurement of moisture content during drying and aeration.	1
3	Measurement of relative humidity during drying and aeration using different techniques.	1
4	Measurement of air velocity during drying and aeration.	1
5	Drying characteristic and determination of drying constant.	2
6	Determination of EMC and ERH.	1
7	Study of various types of dryers.	1
8	To study the effect of relative humidity and temperature on grains stored in gunny bags.	1
9	Design and layout of commercial bag storage facilities.	2
10	Design and layout of commercial bulk storage facilities.	2
11	Study of different domestic storage structures.	1
12	Visits to commercial handling and storage facilities for grains.	2
Total		15
Reference Books		
<ul style="list-style-type: none"> • Drying and storage of grains and oilseeds, By: Brooker D. B. F. W. Bakkee-Arkema and C. W. Hall. • Unit operations of Agricultural Processing, By: Sahay, K. M. & K.K. Singh. • Post harvest technology of cereals, pulses and oilseeds, By: Chakraverty, A. • Handling and storage of food grains in tropical and subtropical area~, By: FAO Pub. • Preservation and storage of grains, seeds and their by-products, By: Multon, J. L. • Grain storage Engineering and Technology, By Vijayaraghavan, S. • Dehydration of foods C.V-, By :Barbosa -ca,novas and H, Vega;. Mercado. • Applied numerical methods for food and Agricultural engineers. , By :Chandra P. K, Singh R.P 		

Sr. No.	Course Name	Course No.	Credit	L	P	T
3	Design of Structures	RE - 302	3 (2 + 1)	2	1	0
Course content :						
Loads and use of BIS Codes. Design of connections. Design of structural steel members in tension, compression and bending. Design of steel roof truss. Analysis and design of singly and doubly reinforced sections, Shear, Bond and Torsion. Design of Flanged Beams, Slabs, Columns, Foundations, Retaining walls and Silos.						
Planning of lectures						
S.No.	Topics to be covered in Lecture					Proposed No. of Lectures
1	Loads and use of I. S. Codes.					3
2	Design of connections.					3
3	Design of structural steel members in tension,					3
4	compression and bending.					4
5	Design of steel roof truss.					3
6	Analysis and Design of singly and doubly reinforced sections, Shear, Bond and Torsion.					5
7	Design of Flanged Beams, Slabs,					4
8	Design of Flanged, Columns, Foundations,					3
9	Design of Flanged Retaining walls and Silos					4
Total					32	
Practicals						
S.No.	Topic					No. of Practicals
1	Design and drawing of steel roof truss					5
2	Design and drawing of RCC building					5
3	Design and drawing of Retaining wall					4
Total					14	
Reference Books						
<ul style="list-style-type: none"> • Design of steel structures Vol. I , By: Ram Chandra, • Steel structures , By: Vazirani and Ratwani, • Design of steel structures, By: Ramamrutham, • Concrete structures , By: Vazirani & Ratwani, • Plain and Reinforced concrete Vol. I , By: Jaikrishna and O. P. Jain • Design of Plane and reinforced concrete structures , By: S. Ramamrutham • IS: 800-1984 Code of Practice for General Construction in steel • Indian Standard Code of Practice for use of structural steel in General Building Construction • ISI Handbook for Structural Engineers. Structural Steel Section • IS 456:2000 Indian Standard Code of Practice for Plain and Reinforced Concrete. 						

Sr. No.	Course Name	Course No.	Credit	L	P	T
4	Drainage Engineering	SWE - 302	2 (1 + 1)	1	1	0
Course content :						
Drainage, objectives of drainage, familiarization with the drainage problems of the state, Surface drainage, drainage coefficient, types of surface drainage, design of open channel, sub-surface drainage purpose and benefits, investigations of design parameters, hydraulic conductivity, drainable porosity, water table etc., types and use of subsurface drainage system, Design of surface drains, interceptor and relief drains. Derivation of ellipse (Hooghoudt' s) and Ernst' s drain spacing equations. Design of subsurface drainage system. Drainage materials, drainage pipes, drain envelope. Layout, construction and installation of drains. Drainage structures. Vertical drainage. Bio-drainage. Tile Drains. Drainage of irrigated and humid areas. Salt balance, reclamation of saline and alkaline soils. Leaching requirements, conjunctive use of fresh and saline waters. Economic aspects of drainage.						
Planning of lectures						
S.No.	Topics to be covered in Lecture					Proposed No. of Lectures
1	Drainage, objectives of drainage, familiarization with the drainage problems of the State					1
2	Surface drainage, drainage coefficient, types of surface drainage, design of open channel.					2
3	Sub-surface drainage purpose and benefits, investigations of design parameters, hydraulic conductivity, drainable porosity, water table etc.					2
4	Types and use of subsurface drainage system,					1
5	Design of surface drains, interceptor and relief drains					2
6	Derivation of ellipse (Hooghoudt's) and Ernst's drain spacing equations					1
7	Design of subsurface drainage system.					1
8	Drainage materials, drainage pipes, drain envelope					1
9	Layout, construction and installation of drains					1
10	Drainage structures, Vertical drainage, Bio-drainage, Tile Drains					1
11	Drainage of irrigated and humid areas					1
12	Salt balance, reclamation of saline and alkaline soils. Leaching requirements,					1
13	Conjunctive use of fresh and saline waters.					1
14	Economic aspects of drainage					1
Total					17	
Practicals						
S.No.	Topic					No. of Practicals
1	In-situ measurement of hydraulic conductivity					1
2	Determination of drainage coefficients					1
3	Installation of piezometer and observation well					1
4	Preparation of iso-bath and isobar maps					1
5	Measurement of hydraulic conductivity and drainable porosity					1
6	Design of surface drainage systems					3

7	Design of subsurface drainage systems	3
8	Determination of chemical properties of soil and water	1
9	Fabrication of drainage tiles	1
10	Testing of drainage tiles	1
11	Determination of gypsum requirement for land reclamation	1
12	Installation of sub-surface drainage system	1
13	Cost analysis of surface and sub-surface drainage system	1
Total		17

Reference Books

- Land and water management; Principles and Practices, By: V V N, Murthy
- Horizontal Drainage System design, By: Dr Cheddi Lal
- Principles of Agricultural Engineering Vol-II,, By: A M Michael & T P Ojha

Sr. No.	Course Name	Course No.	Credit	L	P	T
5	Soil and Water Conservation Structures	SWE - 304	3 (2 + 1)	2	1	0

Course content :

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; runoff measuring structures-parshall 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, 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, 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.

Planning of lectures

S.No.	Topics to be covered in Lecture	Proposed No. of Lectures
1	Introduction and classification of structures	1
2	Functional requirements of soil erosion control structures;	1
3	Flow in open channels-types of flow, state of flow, regimes of flow, energy and momentum	2
4	Principles, specific energy and specific force; hydraulic jump and Its application,	1
5	Type of hydraulic jump, energy dissipation due to jump, jump efficiency, relative loss of energy;	1
6	Runoff measuring structures-parshall flume..- H - flume and weirs;	2
7	Straight drop spillway - general description, functional use, advantages and disadvantages, Structural parts and functions; components of spillway, Hydrologic and hydraulic design of drop structure	4

8	Structural design of a drop spillway-loads on headwall, variables affecting equivalent fluid pressure,	2
9	Determination of saturation line for different flow conditions, seepage under the structure	1
10	Free board and wave free board, aeration of weirs, concept of free and submerged flow,	1
11	Equivalent fluid pressure of triangular load diagram for various flow conditions,	1
12	Creep line theory, uplift pressure estimation,	2
13	Safety against sliding, over turning, crushing and tension;	1
14	Chute spillway, general description and its components, hydraulic design, energy dissipaters, design criteria of a SAF stilling basin and its limitations,	4
15	Drop inlet spillway- general description, functional use, design criteria;	3
16	Design of diversions;	1
17	Small earth embankments-their types and design	2
18	Principles, farm ponds and reservoirs	2
19	Cost estimation of structures	2
Total		34
Practicals		
S.No.	Topic	No. of Practicals
1	Design of H-flume	1
2	Design of Parshall flume	1
3	Construction of specific energy and specific force diagram	1
4	Measurement of hydraulic jump parameters and amount of energy dissipation	1
5	Hydrologic and hydraulic design of a straight drop spillway	1
6	Determination of uplift force and construction of uplift pressure diagram	1
7	Determination of loads on headwall and construction triangular load diagram	1
8	Stability analysis of a straight drop spillway	1
9	Design of drop inlet spillway	1
10	Hydraulic design of a chute spillway;	1
11	Design of small earth embankments	1
12	Design of a SAF energy dissipater	1
13	Design of water harvesting structures;	3
14	Cost estimation of structures.	1
15	Visit to watershed	1
Total		17
Reference Books		
<ul style="list-style-type: none"> • Land and water management; Principles and Practices, By V V N Murthy • Soil and water Conservation Engineering , By R Suresh, 		

Sr. No.	Course Name	Course No.	Credit	L	P	T
6	Refrigeration and Air Conditioning	FMP- 302	3 (2 + 1)	2	1	0
Course content :						
Principles of refrigeration, second law of thermodynamics applied to refrigeration, carnot-cycle, reversed carnot cycle, coefficient of performance, unit of refrigeration. Refrigeration in food industry, types of refrigeration system, mechanical vapour compression, vapour absorption system, components of mechanical refrigeration, refrigerant, desirable properties of ideal refrigerant, Centrifugal and steam jet refrigeration systems, thermoelectric refrigeration systems, vortex tube and other refrigeration systems, ultra low temperature refrigeration, cold storages, insulation material, design of cold storages, defrosting. Thermodynamic properties of moist air, perfect gas relationship for approximate calculation, adiabatic saturation process, wet bulb temperature and its measurement, psychometric chart and its use, elementary psychometric process. Air conditioning – principles- Type and functions of air conditioning, physiological principles in air conditioning, air distribution and duct design methods, fundamentals of design of complete air conditioning systems – humidifiers and dehumidifiers – cooling and calculations, types of air conditioners – applications.						
Planning of lectures						
S.No.	Topics to be covered in Lecture					Proposed No. of Lectures
1	Principles of refrigeration, types of refrigeration system, mechanical vapour compression, vapour absorption system, components of mechanical refrigeration.					5
2	Second law of thermodynamics applied to refrigeration, carnot cycle, reversed carnot cycle, coefficient of performance, and unit of refrigeration.					5
3	Refrigerant, desirable properties of ideal refrigerant.					2
4	Centrifugal and steam jet refrigeration systems, thermoelectric refrigeration systems, vortex tube and other refrigeration systems.					4
5	Ultra low temperature refrigeration, cold storages, insulation material, design of cold storages, defrosting.					3
6	Thermodynamic properties of moist air, perfect gas relationship for approximate calculation, adiabatic saturation process, wet bulb temperature and its measurement, psychometric chart and its use, elementary psychometric process.					5
7	Air conditioning – principles- Type and functions of air conditioning, physiological principles in air conditioning, air distribution and duct design methods, fundamentals of design of complete air conditioning systems, types of air conditioners - applications.					5
8	Humidifiers and dehumidifiers.					2
9	Cooling load calculations.					2
10	Moisture content and methods for determination.					1
Total					34	
Practicals						
S.No.	Topic					No. of Practicals
1	Study of vapour compression and vapour absorption systems.					1
2	Study of Electrolux refrigerator.					1
3	Solving problems on refrigeration on vapour absorption system.					1

4	Experiments with the refrigeration tutor to study various components of refrigeration.	1
5	Determination of the coefficient of performance of the refrigeration tutor.	1
6	Experiment on humidifier for the determination of humidifying efficiency.	1
7	Experiment on dehumidifier for the determination of dehumidifying efficiency.	1
8	Experiment on the cooling efficiency of a domestic refrigerator.	1
9	Experiments on working details of a cold storage plant and air conditioning unit.	1
10	Experiments with air conditioning tutor to study various components.	1
11	Determination of the coefficient of performance of air conditioning tutor.	1
12	Estimation of refrigeration load.	1
13	Estimation of cooling load for air conditioner.	1
14	Estimation of humidification and dehumidification load.	1
15	Design of complete cold storage system.	1
	Total	15
Reference Books		
<ul style="list-style-type: none"> • Refrigeration & Air conditioning , By: R.S. Khurmi & J.K. Gupta • Principles of refrigeration , By: Roy J. Dossat • Refrigeration & Air conditioning , By: Dom Kululwar • Refrigeration & Air condition , By: Jain V.K. • A text book of Refrigeration and Air Conditioning, By: Gupta, R. K. & Jain. • Food preservation by Refrigeration , By: Lorentze 		

Sr. No.	Course Name	Course No.	Credit	L	P	T
7	Entrepreneurship Development and Communication Skills	AEE - 302	3 (2 + 1)	2	0	1
<p>Course content :</p> <p>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. Globalisation and the emerging business / entrepreneurial environment. 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. Government policy on Small and Medium Enterprises (SMEs) / SSIs. Export and Import Policies relevant to horticulture sector. Venture capital. Contract farming and joint ventures, public-private partnerships. Characteristics of Indian farm machinery industry. Social Responsibility of Business.</p> <p>Communication Skills: Structural and functional grammar; meaning and process of communication, verbal and nonverbal 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, précis writing, summarizing, abstracting; individual and group presentations, impromptu presentation, public speaking; Group discussion. Organizing seminars and conferences.</p>						

Planning of lectures		
S.No.	Topics to be covered in Lecture	Proposed No. of Lectures
1	Assessing overall business environment in the Indian economy	2
2	Overview of Indian social, political and economic systems and their implications for decision making by individual entrepreneurs	2
3	Globalization and the emerging business / entrepreneurial environment	2
4	Concept of entrepreneurship; entrepreneurial and managerial characteristics; managing an enterprise; motivation and entrepreneurship development; importance of planning, monitoring, evaluation and follow up	4
5	Managing competition; entrepreneurship development programs; SWOT analysis; Generation, incubation and commercialization of ideas and innovations	2
6	Government schemes and incentives for promotion of entrepreneurship	2
7	Government policy on Small and Medium Enterprises (SMEs) / SSIs; Export and Import Policies relevant to horticulture sector	2
8	Venture capital; Contract farming and joint ventures, public-private partnerships; Characteristics of Indian farm machinery industry; Social Responsibility of Business.	2
9	Structural and functional grammar; meaning and process of communication, verbal and nonverbal communication; listening and note taking, writing skills, oral presentation skills.	4
10	Field diary and lab record; indexing, footnote and bibliographic procedures	3
11	Reading and comprehension of general and technical articles, précis writing, summarizing, abstracting;	3
12	Individual and group presentations, impromptu presentation, public speaking Group discussion; Organizing seminars and conferences	3
Total		32
Tutorials		
S.No.	Topic	No. of Tutorials
1	Listening and note taking	2
2	Writing skills	1
3	Oral presentation skills	2
4	Field diary and lab record	2
5	Indexing, footnote and bibliographic procedures.	2
6	Reading and comprehension of general and technical articles.	2
7	Précis writing, summarizing, abstracting	1
8	Individual and group presentations.	4
Total		16

Reference Books

- Extension Communication and Management , By: G. L. Ray
- Communication and Instructional Technology, By: Indu Grover, Shusma Kaushik, Lali Yadav, Deepak Grover & Shashikanta Verma
- Extension Management, By: Indu Grover, Lali Yadav & Deepak Grover
- Communication Through Farm Literature, By: G.K.
- Agricultural Extension , By: A.W. Van den Ban & H.S .Hawkins
- Education And Communication For Development , By: O.P.
- Trainers Manual on Developing Entrepreneurial Motivation, By: Akhouri, M.M.P., Mishra, S.P. and Sengupta, Rita
- Entrepreneurship, Playing to Win, By: Betty Gordan B
- The Entrepreneurs Handbook Vol.1 & 2 , By: Mancuso,
- Development of an Entrepreneur : A Behaviouristic Model, Technical paper No. 51, (Mimeographed), Ahmedabad, Indian Institute of Management , By: Rao, T.V.(1974)
- Teaching Oral Communication , By: Donn Byrne
- Communicative Language Teaching-An Introduction , By: Francoise Grellet
- Developing Reading Skills , By: Janice Yalden
- React-Interact Situation for Communications , By: Penny Ur and Andrew Wright