Course Curriculum of First Semester
as per the ICAR - Sixth Deans' Committee Report for the Academic Programmes in
AGRICULTURAL ENGINEERING

- UG-Certificate in Agricultural Engineering
- UG-Diploma in Agricultural Engineering
- UG-Degree: B.Tech. (Agricultural Engineering)

Mahatma Phule Krishi Vidyapeeth, Rahuri

Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola

Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani

Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli

Maharashtra Agricultural Universities Examination Board, Pune

Compiled & Submitted by

Dr. P.U. Shahare

Associate Dean, College of Agril. Engineering & Technology, Dr.BSKKV, Dapoli.

UG Degree Syllabus State Coordinator

with

UG Degree Syllabus Discipline Coordinators &

DICC - UG Degree Syllabus Core Committee

Submitted to the

Directors of Instruction Coordination Committee

~ w.e.f. AY, 2024-25 ~

Course Layout

B.Tech. (Agricultural Engineering)

Semester: I (New) ***w.e.f.*** **Academic Year: 2024-25**

Sr. No.	Course No.	Course Title	Credit Hrs.	Remark
1.	**CAC-111**	*Deeksharambh* (Induction-cum-Foundation Course)	2(0+2)	NG (2 Weeks)
2.	**AEC-111**	National Service Scheme (NSS-I)/ National Cadet Corps (NCC-I)	1(0+1)	
3.	**MATH-111***	Basic Mathematics*	2(2+0)	NG & Need-based
4.	**AGEN-111**	Crop Production and Protection Technology	4(3+1)	(MDC)
5.	**GAE-111**	Introduction to Agricultural Engineering	4(3+1)	
6.	**SWCE-111**	Surveying and Levelling	3(1+2)	
7.	**FMPE-111**	Workshop Technology and Practice	2(0+2)	
8.	**REE-111**	Basic Electrical Gadgets and Instruments	3(2+1)	
9.	**COMP-111**	Agricultural Informatics and Artificial Intelligence	3(2+1)	
		Total Credits Hrs.	**20(11+9) G 4(2+2) NG**	

CAC: Common Academic Course, **AEC**: Ability Enhancement Course,
MDC: Multidisciplinary Course, **SEC**: Skill Enhancement Course,
G: Gradial, **NG**: Non-Gradial

Note: *MATH-111 for **PCB** student and for **PCM** or **PCMB** student, there is no need to offer any Need-based course.

Currently, during AY 2024-25, **AEC-112** & **MDC-111** are being offered in II-semester as **AEC-122** & **MDC-121**, respectively. However, this layout is subject to change and will be regularized **w.e.f. AY 2025-26**, wherein said courses will be offered in I-semester by shifting any 2 above listed courses to II-semester.

Semester	**:**	**I**	
Course No.	**:**	**CAC-111**	**Credit Hrs. : 2 (0+2) NG/ 2 Weeks**
Course Title	**:**	***Deeksharambh* (Induction-cum-Foundation Course)**	
Non-Gradial Common Academic Course for the said UG degree with the activities to be conducted during initial two weeks.			

Objectives:

(i) To create a platform for students to help for Cultural Integration of students from different backgrounds,

(ii) To know about the operational framework of academic process in the University, instilling life and social skills,

(iii) To create Social awareness, Ethics and Values, Team work, Leadership, Creativity,

(iv) To identify the traditional values and indigenous cultures along with diverse potentialities both in indigenous and developed scenario.

ACTIVITIES

- Introduction/Orientation and Discussions on operational framework of academic process in University/ College, as well as interactions with Academic and Research Managers of the University.
- Interaction with Alumni, Business Leaders, Perspective Employers, Outstanding Achievers in related fields and people with inspiring life experiences.
- Students shall be made aware about the field of food processing, the industry, production, systems, importance of nutrition, packaging, quality issues involved, shelf life and the legal standards available using simple day-to-day example.
- Students shall be exposed to the job opportunities at various levels like production, product development, entrepreneurship opportunities and research opportunities that exist in this area of food processing technology.
- Group activities to identify the strength and weakness of students and to learn from each other's life experiences.
- Activities to enhance Cultural Integration of students from different backgrounds.
- Field visits to the relevant fields/ establishments.
- Sessions on Personality Development (Instilling Life and Social skills, Social awareness, Ethics and Values, Team work, Leadership etc.) and imbibing the Communication skills.

Note: *The details of the relevant activities will be decided by the parent University in line with the above-mentioned broad activities.*

Semester : I		
Course No. : AEC-111	**Credit Hrs. : 1(0+1)**	
Course Title : National Service Scheme (NSS-I) / National Cadet Corps (NCC-I)		
Gradial Common Course across all UG degrees		

Course No.: AEC-111	**Course Title: National Service Scheme-I (NSS-I)**	**Credit Hrs.: 1(0+1)**

SYLLABUS

PRACTICAL

Introduction and Basic Components of NSS

- Orientation: History, Objectives, Principles, Symbol, Badge; Regular Programs under NSS.
- Organizational structure of NSS, Code of conduct for NSS volunteers, Points to be considered by NSS Volunteers' awareness about Health.
- NSS program activities. Concept of regular activities, Special camping, Day camps, Basis of adoption of village/slums, Conducting survey, Analysing Guiding financial patterns of scheme, Youth program/schemes of GOI, Coordination with different agencies and maintenance of diary. Understanding youth. Definition, Profile, Categories, Issues and Challenges of youth; and Opportunities for youth who is agent of the social change.
- Community mobilization. Mapping of community stakeholders, Designing the message as per problems and their culture; Identifying methods of mobilization involving youth-adult partnership. Social harmony and National integration.
- Indian history and culture, role of youth in nation building, Conflict resolution and peace building. Volunteerism and Shramdaan. Indian tradition of volunteerism, its need, importance, motivation and constraints; Shaman as part of volunteerism.
- Citizenship, Constitution, and Human rights. Basic features of constitution of India, Fundamental rights and duties, Human rights, Consumer awareness and rights and Right to information. Family and Society. Concept of family, Community (PRIs and other community-based organizations) and Society.

TEACHING SCHEDULE

PRACTICAL [AEC-111]

Exercise No.	Exercise Topic	Weightage (%)
1	Orientation, History, Objectives, Principles, Symbols, Badge	10
2	Regular Programmes under NSS	10
3	Organisational Structure of NSS	10
4	Code of Conduct of NSS Volunteer	10
5	Points to be considered about NSS Volunteers awareness about Health	5
6	NSS Programme Activities- Concept of Regular activities	5
7	NSS Programme Activities- Special Campaign	5
8	NSS Programme Activities- Day Camps	5
9	NSS Programme Activities- Adoption of village, Conducting survey, Analysing Guiding financial patterns of scheme	5
10	NSS Programme Activities- Youth programs/schemes of GOI, Coordination with different agencies and maintenance of diary. Understanding youth. Definition, Profile, Categories, Issues and Challenges of youth and Opportunities for youth who is agent of the social change.	5
11	Community Mobilization- Mapping of community stakeholders, Designing the message as per problems and their culture; Identifying methods of mobilization involving youth-adult partnership.	5
12	Community Mobilization-Culture, Social harmony and National integration.	5
13	Indian History and Culture- Role of youth in Nation Building	5
14	Volunteerism and Shramdaan: Indian tradition of volunteerism, its need, importance, motivation and constraints; Shaman as part of volunteerism.	5
15	Citizenship, Constitution and Human Rights: Basic features of constitution of India, Fundamental rights and duties, Human rights, Consumer awareness and rights and Right to information.	5
16	Family and Society: Concept of family, Community (PRIs and other community-based organizations) and Society.	5
	Total=	**100**

Course No.: AEC-111	Course Title: National Cadet Corps-I (NCC-I)	Credit Hrs.: 1(0+1)

SYLLABUS

Objective: To integrate and develop qualities of leadership, discipline, character and patriotism and foster the NCC Motto: **"Unity and Discipline"** among the youth.

PRACTICAL

- Aims, Objectives, Organization of NCC and NCC Song. DG's Cardinals of Discipline.
- Drill- aim, General words of command, Attention, Stands-at-ease, Stand-easy and Turning.
- Sizing, Numbering, Forming in three ranks, Open and Close order march and Dressing.
- Saluting at the halt, Getting on parade, Dismissing and Falling-out.
- Marching, Length of pace and time of marching in quick/slow time and halt. Side pace, Pace forward and to the rear. Turning on the march and wheeling. Saluting on the march.
- Marking time, Forward march and halt. Changing step, Formation of squad and squad drill.
- Command and control, Organization, Badges of rank, Honours and Awards.
- Nation Building- Cultural heritage, Religions, Traditions and Customs of India. National integration. Values and ethics, Perception, Communication, Motivation, Decision making, Discipline and duties of good citizens. Leadership traits, Types of leadership. Character/ Personality development. Civil defence organization, Types of emergencies, Fire fighting, Protection. Maintenance of essential services, Disaster management, Aid during development projects.
- Basics of Social Service, Weaker sections of society and their needs, NGO's and their contribution, Contribution of youth towards Social welfare and Family planning.
- Structure and Function of human body, Diet and Exercise, Hygiene and Sanitation. Preventable diseases including AIDS, Safe blood donation, First aid, Physical and mental health. Adventure activities. Basic principles of Ecology, Environmental conservation, Pollution and its control.

TEACHING SCHEDULE

PRACTICAL [AEC-111]

Exercise No.	Exercise Topic	Exercise Sub-topics/ Titles	Weightage (%)
1-2	Introduction to NCC	Aims, Objectives, NCC Organizational structure, NCC Song, DG's Cardinals of Discipline.	4
3-5	Drill Basics	Aim of drill, General words of command, Positions of attention, Stand-at-ease and Stand-easy, Turning.	8
6-8	Formation Drills	Sizing, Numbering, Forming in three ranks, Open and Close order march and Dressing.	8
9-11	Saluting Drills and Parade Movements	Saluting at halt, Getting on parade, Dismissing and Falling-out.	8
12-14	Marching Techniques	Length of pace and time of marching in Quick/slow march, Side pace, Forward/rear pace, Turning on the march, Wheeling and Saluting on the march	10
15-17	Squad Formation and Control	Marking time, Forward march, Halt, Changing step, Formation of squad and Squad drill.	10
18-19	Command and Control in NCC	Organization, Badges of rank, Honours and Awards.	4
20-22	Nation Building and Citizenship; Leadership	Cultural heritage, Religions, Traditions, Customs of India, National integration, Values and Ethics, Communication, Leadership traits, Discipline and Motivation, Character/ Personality Development.	12
23-24	Civil Defence and Emergency Management	Types of emergencies, Fire fighting techniques, Maintenance of essential services, Disaster management and Aid during development projects, Civil Defence Organizations.	10
25-26	Social Service and Youth Welfare	Weaker sections of society, Role of NGOs, Youth participation in Social welfare and Family planning	8
27-29	Health, Hygiene and First Aid	Human body structure, Diet, Hygiene, Preventable diseases (including AIDS), Safe blood donation, First aid practices, Mental and Physical health.	10
30-32	Environment and Ecology	Basic Principles of Ecology, Environmental conservation, Pollution and its control, Adventure activities.	8
		Total =	**100**

Semester	**:**	**I**	
Course No.	**:**	**MATH-111***	**Credit Hrs. : 2(2+0) Need-based; G/NG**
Course Title	**:**	**Basic Mathematics**	
***Gradial** Need-based Common Course for **B.Tech. (Biotechnology)**; ***Non-Gradial** Need-based Common Course for **B.Tech. (Agril. Engg.)** & **B.Tech. (Food Technology)**			

SYLLABUS

Objectives:

(i) To study the basic principles and functions in mathematics like limits and continuity,

(ii) To study differentiation and integration,

(iii) To study matrices and determinants.

THEORY

Functions:

Function and types of functions, Limit: Introduction, left-handed and right-handed limits, Algebra of limits, Standard limits. Continuity: Definition of continuity, continuity of algebraic functions. Continuity of trigonometric and exponential functions.

Differentiation:

Differentiation by the first principle, Rules of Differentiation: sum, difference, product and quotient formulae, differentiation using the chain rule, differentiation of functions in parametric and implicit form, logarithmic differentiation, geometrical interpretation of derivative. Successive differentiation, maxima and minima.

Integration:

Definition of indefinite integrals, Integrals of elementary functions (Formulae only), Theorems of integration (without proof), Integration by substitution, integration by partial fractions, integration by parts, Definition of definite Integral with examples, properties of definite integral (without proof).

Matrices and Determinants:

Definition of determinants, example up to Third order determinant, properties of determinant (statements only), Definition of matrix, types of matrices, Algebra of Matrix (addition, subtraction and multiplication), inverse of matrix, Solution of linear equations by Crammer's rule.

TEACHING SCHEDULE

THEORY [MATH-111]

Lecture No.	Topic	Subtopics/ Key Points	Weightage (%)
1-5	**Functions:**	Definition of Function, Types of functions	15
		Some Basic Functions: Definition and Properties of: Constant Function, Identity Function, Power Function. Polynomial Function, Linear, quadratic and cubic function, Radical Function, Rational Function. Exponential, Logarithmic and Trigonometric Function	
	Limit:	Introduction, Definition of Limit, left-handed and right-handed limits, Algebra of limits	
		Standard limits: Method of Factorization, Rationalization, Limit of Trigonometric, Exponential Logarithmic and Functions. Limit of Infinity	
	Continuity:	Definition of continuity, Continuity of algebraic functions, Continuity of trigonometric and exponential functions.	
6 -15	**Differentiation:**	Definition, Differentiation by the first principle, Derivative of Some standard functions (Formulae only), Rules of Differentiation (Sum, Difference, Product and quotient without proof), Differentiation using the chain rule, Differentiation of functions in parametric and implicit form, Logarithmic Differentiation, Successive differentiation, Maxima and minima	30
16 -25	**Indefinite and Definite Integration**:	Definition of indefinite Integral, Integrals elementary functions (Formulae only) Theorems of integration (without proof) Methods of Integration: Integration by Substitution, Integration by parts, Integration by partial fractions Some special integrals formulae only. Definition of definite Integral with examples Properties of definite integral (Without proof)	30
26 -32	**Determinants and Matrices:**	Definition of determinants, Expansion up to third order determinant, Properties of determinant (statements only) Definition of matrix, Order of Matrix, Types of matrices, Algebra of Matrices, Inverse of matrix by elementary transformations, Solution of linear equations by Crammer's rule	25
		Total=	**100**

Suggested Readings:

1. NCERT, 2012, Mathematics of Class XII, NCERT, India.
2. A Textbook of Mathematics XI and XII (Part I and II) Maharashtra State Board of Secondary and Higher Secondary Education, Pune.
3. Sharma RD, 2014, Mathematics of Class XII, Dhanpat Rai Publisher.

Semester	**:**	**I**			
Course No.	**:**	**AGEN-111**	**Credit Hrs.**	**:**	**4(3+1)**
Course Title	**:**	**Crop Production and Protection Technologies**			

SYLLABUS

Objectives:

(i) To enable the students to have basic idea on crop production and protection practices to understand the domain of agricultural sciences,

(ii) To impart the basic knowledge of the different types of machineries/equipments that can be adopted for the said operations.

THEORY

AGRONOMY:

Introduction and scope of Agronomy; Classification of crops; Effect of different weather parameters on crop growth and development; Principles of tillage, tilth and its characteristics; Crop seasons; Time and method of sowing of major field crops, seed rate for important crops; Methods and time of application of manures and fertilizers, fertigation; Basic principles of natural farming, organic farming and sustainable agriculture; Soil-water-plant relationship, crop coefficients, water requirement of crops and critical stages for irrigation; Weeds and their management in crops; Crop rotation, cropping systems, cropping scheme, relay cropping, mixed cropping and intercropping.

SOIL SCIENCE:

Soil forming processes; Classification and composition of soil, Soil taxonomy orders; Important soil physical properties and their importance; Soil particle distribution; Soil inorganic colloids – their composition, properties and origin of charge; Ion exchange in soil and nutrient availability; Soil organic matter– its composition and decomposition, effect on soil fertility; Soil reaction – acidic, saline and sodic soils; Quality of irrigation water; Essential plants nutrients- their functions and deficiency symptoms in plants; Important inorganic fertilizers and their reactions in soils; Gypsum requirement for reclamation of sodic soils and neutralizing RSC; Liquid fertilizers and their solubility and compatibility.

HORTICULTURE:

Types of Horticultural crops; Sowing and planting times and methods; Seed rate and seed treatment for vegetable crops; Macro- and micro- propagation methods; Types of plant growing structures; Pruning and training; Water requirements and critical stages; Management of orchard; Major pests and diseases of horticultural crops and their management.

PRACTICAL

AGRONOMY: Identification of crops and their varieties, seeds and weeds; Study of different fertilizer application methods and weed control methods; Judging the maturity time for harvesting of crop; Study of seed viability and germination test.

SOIL SCIENCE: Identification of rocks and minerals; Examination of soil profile in the field; Determination of bulk density, particle density and porosity of soil; Determination of organic carbon of soil; Identification of nutrient deficiency symptoms of crops in the field; Determination of gypsum requirement of sodic soils.

HORTICULTURE: Identification and description of important fruits, flowers and vegetables crops; Study of different garden tools; Preparation of nursery bed; Practices of pruning and training in some important fruit crops; Study of cultural operations for vegetable crops (sowing, fertilizer application, mulching, irrigation and weed control); Seed extraction techniques; Visit to commercial greenhouse/ polyhouse.

Suggested Readings [AGEN-111]:

1. Ahamad S, Anwar Ali and Sharma P K (Eds.). 2018. Plant Disease Management in Horticultural Crops. Daya Publishing House, Delhi.
2. Biswas T D and Mukharjee S K. 1987. A Textbook of Soil Science. Tata McGraw-Hill publishing Co. Ltd.
3. Brady N C and Ray R Weill. 2002. The Nature and Properties of Soil. Pearson Education Inc. New Delhi.
4. Chadha K L. 2003. Handbook of Horticulture. ICAR Publication, New Delhi.
5. Das D K. 2020. Introductory to Soil Science. Kalyani publication, Ludhiana.
6. Dey G C. 2013. Fundamentals of Agronomy. Jain Book Depot.
7. Ghildyal B P and Tripathy R P. 1987. Soil Physics. Wiley Eastern Ltd., New Delhi.
8. Hillel D. 1982. Introduction to Soil Physics. Academic Press, New York.
9. Indian Society of Soil Science. 2002. Fundamentals of Soil Science. ISSC, IARI, New Delhi.
10. Janick J. 1979. Horticultural Science. Surjeet Publications, Delhi.
11. Kumar N. 2017. Introduction to Horticulture. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
12. Muthukrishnan N, Ganapathy N, Nalini R and Rajendran R. 2005. Pest Management in Horticultural Crops. New Madura Publishers, Madurai, Tamil Nadu.
13. Reddy S R. 2020. Principles of Agronomy. Kalyani Publisher.
14. Reddy Yellamanda T and Reddy Shankar G H. 1995. Principles of Agronomy. Kalyani Publishers, Ludhiana.
15. Sehgal J L. 1996. Soil Pedology. Kalyani Publication, Ludhiana.
16. Singh Jitendra. 2018. Fundamentals of Horticulture. Kalyani Publishers, Ludhiana.
17. Singh S S and Singh R. 2013. Principles and Practices of Agronomy. Kalyani Publisher.
18. Sudheer K P and Indira V. 2016. Post-harvest Technology of Horticultural Crops. New India Publishing Agency, New Delhi.

TEACHING SCHEDULE

THEORY [AGEN-111]

Lecture No.	Topic with Sub-topics	Weightage (%)
AGRONOMY		
1	Introduction and scope of Agronomy	2
2	Classification of crops (with e.g.)	2
3	Effect of different weather parameters on crop growth and development	2
4	Principles of tillage, tilth and its characteristics	2
5	Crop seasons	2
6	Time and methods of sowing of major field crops, Seed rate for important crops	2
7-8	Methods and time of application of manures and fertilizers, Fertigation	3
9-10	Basic principles of Natural farming, Organic farming and Sustainable Agriculture	4
11-12	Soil-Water-Plant relationship, Crop coefficients, Water requirement of crops and Critical stages for irrigation	4
13-14	Weeds and their management in crops	4
15-16	Crop rotation, Cropping systems, Cropping schemes, Relay cropping, Mixed cropping and Intercropping	4
	Sub-Total =	**33**
SOIL SCIENCE		
17	Soil forming processes	2
18	Classification and composition of soil, Soil taxonomy orders	2
19-20	Important soil physical properties and their importance; Soil particle distribution	4
21	Soil inorganic colloids– their composition, properties and origin of charge	2
22	Ion exchange in soil and nutrient availability	2
23-24	Soil organic matter– its composition and decomposition, effect on soil fertility	4
25-26	Soil reaction – acidic, saline and sodic soils	4
27	Quality of irrigation water	2
28	Essential plants nutrients- their functions and deficiency symptoms in plants	4
29-30	Important inorganic fertilizers and their reactions in soils	4
31	Gypsum requirement for reclamation of sodic soils and neutralizing RSC	2
32	Liquid fertilizers and their solubility and compatibility	2
	Sub-Total =	**34**

Continued…

HORTICULTURE		
33-34	Types of horticultural crops (with e.g.)	4
35	Sowing and planting time and methods	4
36	Seed rate and seed treatment for major/ important vegetable crops	3
37-38	Macro- and micro-propagation methods	5
39-40	Types of plant growing structures	4
41-42	Pruning and training	4
43	Water requirements and critical stages	2
44-45	Management of orchard	3
46-48	Major pests and diseases of horticultural crops and their management	4
	Sub-Total =	**33**
	Total =	**100**

PRACTICAL [AGEN-111]

Exercise No.	Exercise Title
AGRONOMY	
1-2	Identification of crops and their varieties, seeds and weeds
3	Study of different fertilizer application methods and weed control methods
4	Judging the maturity time for harvesting of crop
5	Study of seed viability and germination test
SOIL SCIENCE	
6	Identification of rocks and minerals; Examination of soil profile in the field
7	Determination of bulk density, particle density and porosity of soil
8	Determination of organic carbon of soil
9	Identification of nutrient deficiency symptoms of crops in the field
10	Determination of gypsum requirement of sodic soils
HORTICULTURE	
11	Identification and description of important fruits, flowers and vegetables crops
12	Study of different garden tools
13	Preparation of nursery bed; Study of cultural operations for vegetable crops (sowing, fertilizer application, mulching, irrigation and weed control)
14	Practices of pruning and training in some important fruit crops
15	Seed extraction techniques
16	Visit to commercial greenhouse/ polyhouse

Semester	**:**	**I**		
Course No.	**:**	**GAE-111**	**Credit Hrs.**	**: 4 (3+1)**
Course Title	**:**	**Introduction to Agricultural Engineering**		

SYLLABUS

Objectives: To enable the students to have basic idea on different agricultural engineering applications of machinery for different farm operations, post-harvest, technologies on renewable energy, soil and water conservation, irrigation and farm structure and allied areas.

THEORY

FARM MACHINERY AND POWER ENGINEERING:

Importance of Agricultural Mechanization for today's Agriculture; Different sectors of Farm Machinery for employment for Agricultural Engineers; Scope of research and higher studies in Farm Machinery and Power in India and abroad; Farm mechanization needs and strategy, Classification of farm machinery on the basis of unit operations; Principles of selection of machinery for different sizes of land and matching power sources; Different types of equipment for tillage, sowing, planting and transplanting, fertilizer application, weed control, plant protection; Harvesting and threshing equipment for rice, wheat, maize, cotton, sugarcane, fruits, tuber crops and other locally important crops; Functions and capabilities of tractor and power tillers; Introduction to the IC engine systems, fuel and air supply systems, cooling and lubricating systems, and electrical systems in a tractor; Basic parts of a power tiller; Hitching system.

RENEWABLE ENERGY ENGINEERING:

Introduction to Renewable Energy Engineering for today's Agriculture; Different sectors of employment in Renewable Energy Engineering; Scope of research and higher studies in renewable energy Engineering in India and abroad. Types of Solar energy collectors; Application of Solar energy: Solar water heating system and Solar dryer; Solar photovoltaic system: components and applications; Wind energy: Working principle of WECS, Types and components of WECS; Biogas production and types of biogas plants.

SOIL AND WATER CONSERVATION ENGINEERING:

Importance of Soil and Water Conservation Engineering for today's Agriculture; Different sectors of employment in Soil and Water Conservation Engineering; Scope of research and higher studies in Soil and Water Conservation Engineering in India and abroad. Different agronomical measures for control of water erosion, mixed cropping, crop rotation, tillage practices, mulching; Different engineering measures, gully control measures; Use of topographical survey and contour maps; Different types of water harvesting structures.

IRRIGATION AND DRAINAGE ENGINEERING:

Importance of Irrigation and Drainage Engineering for today's Agriculture; Different sectors of employment in Irrigation and Drainage Engineering; Scope of research and higher studies in Irrigation and Drainage Engineering in India and abroad. Introduction to soil-plant-water relationship; Equipment for measurement of irrigation water viz., weirs, notches, orifices and mouth pieces; Introduction to different surface irrigation methods as border, furrow and check basin, sprinkler, drip irrigation and their different components; Underground water conveyance methods in pipes; Introduction to planning of drainage systems; Introduction to centrifugal pumps and different components.

FARM STRUCTURE ENGINEERING:

Importance of Farm Structural Engineering for today's Agriculture, Scope of research and higher studies in Farm Structural Engineering and Environment management in India and abroad. Different types of Agriculture structures, Introduction to planning layout of farmsteads, animal houses, poultry houses; Different types of grain storage structures; Greenhouse and its different parts, Low cost protected structures.

PROCESS AND FOOD ENGINEERING:

Importance of Process and Food Engineering for today's Agriculture; Different sectors of employment in Process and Food Engineering; Scope of research and higher studies Process and Food Engineering in India and abroad. Classification of different types of agricultural commodities as durables, perishables etc.; Moisture content and its importance in grain storage: common reasons of food spoilage, food preservation methods; Different primary operations and their necessity; Methods and equipments used for cleaning, washing, sorting, grading, peeling, size reduction; Different types of traditional and modern storage structures, Storage of perishables commodities; Different types of packaging materials and their suitability for various food products; Basic principles of value addition of food as drying and dehydration, evaporation, thermal processing, refrigerated and frozen storage, Chemical preservation and other novel methods.

PRACTICAL

Study of various implements (tillage, sowing, planting, weeding, fertilizer application); Study of farm implements (pesticide application, harvesting and threshing); Study of various components of tractor and matching implements; Study of various components of power tiller and matching implements. Study of biogas plants and operational parameters, Study of solar energy application systems. Visit to a watershed, Study on various components of sprinkler and drip irrigation. Study on various components centrifugal pump. Visit to a greenhouse with modern irrigation system. Study of various post-harvest operations, study of different food processing equipments, value addition of common crops. Visit to implement manufacturing unit, Visit to mechanized farm, Visit to food processing industry.

TEACHING SCHEDULE

THEORY [GAE-111]

Lecture No.	Topic	Sub-topics/ Key Points	Weightage (%)
FARM MACHINERY AND POWER ENGINEERING			
1	Importance of Agricultural Mechanization	Importance of Agricultural Machinery for today's Agriculture; Different sectors of Farm Machinery for employment for Agricultural Engineers; Scope of research and higher studies in Farm Machinery and Power in India and abroad	5
2	Farm Mechanization	Farm mechanization advantages, strategy, Classification of farm machinery on the basis of unit operations; Selection of machinery for different sizes of land and matching power sources	
3	Tillage	Tillage: Types, Tillage machinery, Introduction to M.B. plough, disc plough, subsoiler, harrows, cultivators	5
4	Planting	Seed drill, planters, zero till drill, calibration, rice and vegetable transplanter	
5	Intercultural Equipments	Fertilizer applicators, types of weeders, uses, intercultural equipments	
6	Spraying Equipments	Sprayers: Manual and battery-operated knapsack sprayer, mist blowers, boom sprayer	5
7	Harvesting Equipments	Introduction to harvesting machines for rice, wheat, maize, cotton, sugarcane, fruit crop, tuber crop, sugarcane	
8	Threshing Equipments	Introduction to thresher for rice, wheat, maize; Combine harvester	
9	Engine	Introduction to the IC engine: C.I. and S.I. engines, their working principles, engine components their functions, valve operating mechanism, firing order in multi cylinder engine and trouble shooting	5
10	Engine System	Intake, exhaust system: types of air cleaner, their working, exhaust system Fuel supply system: in tractor, components their functions, carburetor, components, working principle, trouble shooting	

Continued…

11	Tractor systems	Cooling system: types, components and functions. Lubrication system: types, combination of splash and pressure system, components and function trouble shooting. Electrical system of tractor: Battery, electrolyte, charging, discharging system: components and functions	5
12	Tractor and Power tiller	Functions and capabilities of tractor and power tiller, Basic parts of a power tiller; Tractor hitching system	
		Sub-Total =	**25**
RENEWABLE ENERGY ENGINEERING			
13	Introduction to Renewable Energy Sources	Importance of renewable energy for today's agriculture; Different sectors of renewable energy for employment for Agricultural Engineers; Scope of research and higher studies in renewable energy in India and abroad. Definition, Classification, Types, Advantages/limitations and prospectus of renewable energy sources. Comparison between Conventional (Commercial) and Non-conventional energy (Renewable energy) sources.	5
14	Solar Energy Collector	Working principal and function of solar collector. Types and Application of solar collectors; Advantages and disadvantages of different solar collectors over each other.	
15	Application of Solar energy	Generalized classifications of solar energy applications; Solar Water Heating System: Working Principle, types, advantages and uses. Solar Drying System: Working principle, Types, advantages and uses.	
16	Solar Photovoltaics Systems	Definition and Principles of photovoltaic effect, Solar cell and semiconductor junction, Basic photovoltaics system for power generation; Applications, advantages and disadvantages of solar photovoltaic system	3
17	Wind Energy Systems	Basic components of wind energy conversion system, Types of wind energy machines; Applications, advantages and disadvantages of wind energy system	

Continued…

18	Biogas Production and Types	Working, Components, Classification and Types of Biogas plants Comparison of floating gas and fixed dome, Applications of biogas system, Factors affecting biogas generation	2
		Sub-Total =	**10**
SOIL AND WATER CONSERVATION ENGINEERING			
19	Importance of Soil and Water Conservation for today's Agriculture	Principles, Benefits, Problems by erosion, causes of erosion, Different sectors of employment in SWCE, Scope of research and higher studies in SWCE in India and Abroad	4
20	Agronomical Measures for Control of Water Erosion	Mixed cropping, crop rotation, tillage practices, mulching	
21	Different Engineering Measures; Temporary Gully Control Measures	Single row brusho wood dam, Double row brusho wood dam, Loose rock fill dam, log check dam, netting dam	3
22	Permanent Gully Control Structures	Drop inlet spillway, chute spillway and straight drop spillway (functional uses, adaptability, advantages, limitations of all)	3
23	Survey and Maps	Contour lines, Characteristics of contour lines, use of contour maps and topographical maps	2
24	Different Types of Water Harvesting Structures	Roof harvesting, Runoff harvesting (short term and long-term storage), flood water harvesting.	3
		Total =	**15**
IRRIGATION AND DRAINAGE ENGINEERING			
25	Importance and Scope	Importance of Irrigation and Drainage Engineering for today's Agriculture; Different sectors of employment in Irrigation and Drainage Engineering; Scope of research and higher studies in Irrigation and Drainage Engineering in India and abroad.	5
	Introduction to Soil-Plant-Water Relationship	Soil-Plant-Water Relationship: Relevant Terms/Definitions	
	Water Relations of Soil	Kinds of soil water, Movement of water into soils, Infiltration, Evaporation and Transpiration (Definitions only)	
26	Measurement of Irrigation Water	Units of measurement of water, Methods of water measurement, Weir and notches (Rectangular, Cipoletti weir, V-notch weir, Orifices, Parshall flume) Mouthpieces	

Continued…

27	Surface Irrigation Methods	Methods of irrigation- Border irrigation: Basic details only Check basin irrigation: Basic details only Furrow irrigation: Basic details only	5
28	Sprinkler, Drip irrigation and their Different Components	Sprinkler irrigation system: Basics, adaptability, limitations, Types of sprinkler systems: Components of sprinkler system (*List of components and their functions only*) Drip irrigation system: Basics, Advantages of drip system; Components of drip systems (*List of components and their functions only*)	
29	Underground Water Conveyance Methods in Pipes	Basics, Pipes for underground water distribution systems, Discharge capacity of pipelines	5
30	Introduction to Planning of Drainage Systems	Basics of Drainage- Definitions, Water logging- Definition, Causes of water logging, Benefits of Drainage, Drainage coefficient and Subsurface drainage.	
31	Introduction to Centrifugal Pumps and Different Components	Basics, Principle of operation of Centrifugal pumps, Centrifugal pump classification, components of centrifugal pump	
		Total =	**15**
FARM STRUCTURE ENGINEERING			
32	Importance	Importance of Farm Structural Engineering for today's Agriculture, Scope of research and higher studies in Farm Structural Engineering and Environment management in India and abroad	3
	Farmstead Planning	Introduction, location, size and arrangement, Defects in traditional houses, Rooms of improved farm house.	
33	Dairy barn and Poultry housing	Types of Dairy barns, Types of poultry houses with drawings	2.5
34	Grain Storage Structures	Grain storage methods, requirements of good storage structures, indigenous storage structures- Bukhari, Morai and Kothar structure, Grain bins- cylindrical, Rectangular and Pusa bin.	2
35	Protected Structures	Factors affecting plant growth, Greenhouse effect, Orientation of Greenhouse, Classification of Greenhouse based on shape. Greenhouse, Shade-net house and Low cost protected structures with drawings.	2.5
		Total =	**10**

Continued…

AGRICULTURAL PROCESS ENGINEERING			
36	Importance	Importance of Agricultural Processing, Different employment sectors for processing and Food Engineers, Scope of research and higher studies in processing and Food Engineering in India and abroad.	5
37	Agricultural Commodities	Its classification as durables, perishables, etc. Common reasons of spoilage and different preservation methods	
38	Unit Operations	Cleaning, sorting, grading	
39	Grain Processing Equipments	Air screen cleaner, Specific gravity separator, Indented cylinder and Disk separator, Spiral separator	5
40	Unit Operation of Fruit and Vegetable Processing	Methods of sorting, grading, washing, peeling of fruits and vegetables	
41	Size Reduction	Method and Equipment	5
42	Moisture content and its Representation	Wet and dry basis moisture content; Numerical only on conversion of wet and dry basis	
43-44	Drying and Dehydration	Principles of drying, importance and advantages of drying, different methods of drying	5
45	Thermal Processing	Sterilization, pasteurization, blanching and evaporation	5
46	Storage	Storage of perishables, air tight storage	
47	Packaging	Different types of packaging materials	
48	Novel Processing	Different novel processing techniques (in brief)	
		Sub-Total =	**25**
		Total =	**100**

TEACHING SCHEDULE

PRACTICAL [GAE 111]

Exercise No.	Exercise Title
FARM MACHINERY AND POWER ENGINEERING	
1	Study of tillage, sowing and planting equipments
2	Study of weeding, fertilizer application, pesticide application equipments
3	Study of harvesting and threshing equipments
4	Study of matching implements of tractor and power tiller
5	Study of various components of tractor and power tiller
6	Study of intake exhaust, lubrication and cooling systems
7	Study of fuel, ignition system and electrical system of tractor
RENEWABLE ENERGY ENGINEERING	
8	Study of various types of biogas plants and operating parameters.
9	Study of various applications of solar energy systems.
SOIL AND WATER CONSERVATION ENGINEERING	
10	Study of various Soil and Water Conservation measures
IRRIGATION AND DRAINAGE ENGINEERING	
11	Study on various components of sprinkler and drip irrigation
12	Study on various components centrifugal pump
PROCESSING AND FOOD ENGINEERING	
13	Determination of moisture content of agricultural produce
14	Value addition of horticultural crops
15	Value addition of food grains
Common for all above Departments*	
16	Visit to implement manufacturing unit, mechanised farm, Visit to watershed, Visit to a greenhouse with modern irrigation system, Visit to a food processing industry.

Suggested Readings [GAE 111]:

FARM MACHINERY AND POWER ENGINEERING

1. Jain S C and Philip G 2009. Farm Machinery: An Approach. Second Ed. Standard Publisher and distributor, New Delhi
2. Michel A.M. and Ojha T.P. 2003. Principles of Agricultural Engineering-I, Jain Brothers, New Delhi
3. Nakra C.P 1980. 1980. Farm Machines and Equipments, Dhanpat Rai Publishing Company Pvt Ltd. New Delhi.

RENEWABLE ENERGY ENGINEERING

1. Rai G.D.2017. Non-Conventional Energy Sources, Khanna Publishers, New Delhi.
2. Rai G.D.2014. Solar Energy Utilization, Khanna Publishers, New Delhi.
3. Rathore N. S., Panwar N.L. & Kurchaniya A. K. 2008. Renewable Energy-Theory and Practices, Himanshu Publications, Udaipur.
4. Kalbande S. R., Bhale V. M. & Sedani S.R. 2022. Renewable Energy Technologies, Narendra Publications, New Delhi.

SOIL AND WATER CONSERVATION ENGINEERING

1. Michael, A.M. and T.P. Ojha 2020. Principles of Agricultural Engineering. Volume II. 5th Edition, Jain Brothers, New Delhi.
2. Suresh, R. 2020. Soil and Water Conservation Engineering. Standard Publ. Distributors, New Delhi.
3. Suresh, R. 2009. Soil and Water Conservation Engineering. Standard Publ. Distributors, New Delhi.

IRRIGATION AND DRAINAGE ENGINEERING

1. Irrigation: Theory and Practice (2nd Edition) by A.M. Michael,Vikas Publishing House, New Delhi.
2. Principles of Agricultural Engineering- Vol.-II (3rd Edition), A.M. Michael and T.P. Ojha published by Jain Brothers, New Delhi.
3. Fluid Mechanics and Hydraulic Machines by R.K. Bansal, Laxmi Publication New Delhi.

FARM STRUCTURE ENGINEERING

1. Principles of Agricultural Engineering, Volume-I by T.P. Ojha and A.M. Michael, Jain Brothers, New Delhi -110 005 (Fourth Edition, 2003).
2. Greenhouse Technology and Applications by Vilas M. Salokhe and Ajay K. Sharma. Agrotech Publishing Academy, Udaipur (Raj.), First Edition (2006).

PROCESS AND FOOD ENGINEERING

1. Chakraverty, A. Post Harvest Technology of Cereals, Pulses and Oilseeds Oxford & IBH Publishing Pvt Ltd 66, Janpath, New Delhi 110001.
2. Sahay K.M .and K.K. Singh, Unit operations of Agricultural Processing-2022 Vikas Publishing house, Pvt. Ltd.576, Masjid Road, Jangpura, New Delhi 110014.
3. Girdharilal, G.S. Siddappa and G.L. Tandon, Preservation of Fruits and Vegetables Indian Council of Agricultural Research, New Delhi.
4. Akash Pare and B L. Mandhyan, Food Process Engineering and Technology Nipa GenX Electronic Resources and Solutions Pvt Ltd, Pritam Pura New Delhi.
5. I.S. Singh, Post-Harvest Handling and Processing of Fruits and Vegetables, Westville Publishing houses, New Delhi.

Semester	**:**	**I**		
Course No.	**:**	**SWCE-111**	**Credit Hrs.**	**: 3(1+2)**
Course Title	**:**	**Surveying and Levelling**		

SYLLABUS

Objectives: To enable the students to conduct the survey work for any area and also to prepare layout of engineering structures.

THEORY

Surveying: Introduction, classification and basic principles; Linear measurements, chain surveying, cross staff survey, compass survey, planimeter; Errors in measurements, their elimination and correction; Plane table surveying, methods, advantages and disadvantages. Levelling, levelling difficulties and error in levelling, contouring, computation of area and volume; Theodolite traversing, introduction to setting of curves; Total station; Introduction to GPS survey, Remote Sensing and GIS use in survey.

PRACTICAL

Linear measurements using different instruments; Reconnaissance survey in the field; Use of field book; Study on various types of chain used in chain survey and its components; Study of errors in chain surveying; Use of ranging rods and ranging in the field; Obstacles during chaining; Offsets in chain survey; Cross Staff; Survey of an area; Preparation of map; Study on various types of compass; Compass survey of an area; Plotting of compass survey; Plane table surveying and different methods; Study on various types of levels and its components; Setting up of dumpy level in the field; Computation of various methods for RL; Study on Levelling, L section and X sections and its plotting; Measurement of slope in the field; Study on contour and its characteristics; Contour survey of an area and preparation of contour map; Introduction of software in drawing contour; Theodolite surveying; Ranging by Theodolite; Height of object by using Theodolite; Setting out curves by Theodolite; Use of minor instruments; Use of total station, Use of modern computers for surveying.

Suggested Readings [SWCE-111]:

1. Kanetkar T.P. and S.V. Kulkarni, Surveying and Levelling, Part 1, 24th edition, reprint, 2017.
2. Remote Sensing and GIS by M. Anji Reddy.
3. Kanetkar T.P. and S.V. Kulkarni Surveying and Levelling, Part 2, 21st edition, reprint 1983.
4. Agor R.A Textbook of Surveying & Levelling. Khanna Publishers, New Delhi.
5. Arora K R. 1990. Surveying (Vol.I), Standard Book House, Delhi.
6. Kanetkar T P. 1993. Surveying and Levelling. Pune Vidyarthi Griha, Prakashan, Pune.
7. Punmia B C. 1987. Surveying (Vol.I). Laxmi Publications, New Delhi.

TEACHING SCHEDULE

THEORY [SWCE-111]

Lecture No.	Topic	Sub-topics/ Key Points	Weightage (%)
1-4	Surveying	Definitions, Object of Survey, Primary Divisions of Survey, Classification and use of survey	30
		Principle of surveying, Measurement, Units of measurements, Methods of locating points, Precision in surveying, Works of the surveyor.	
		Reconnaissance survey in the field; Principles of Chain Surveying, Triangulation survey, offsets in chain survey, ranging and types of ranging	
		Chaining, Type of chains used in chain survey and its components, Errors in lengths due to incorrect chain, Numerical on chain and tape corrections	
5	Computation of area and volume	Computation of areas, Computation of earth work volume, Prizmoidal formula and Numerical, Planimeter	
6	Instruments for setting right angles	Instruments for setting right angles, Cross staff, Prism square and optical square, Obstacles during chaining, Numerical	
7-8	Compass survey	Types and Methods of Traverse survey, Prismatic Compass, Surveyor Compass, Bearing of line, and computation of angles.	25
		Local attraction and numerical, Magnetic declinations, Dip of needles, Plotting of traverse survey, Errors and limitation of compass survey.	
9-10	Plane Table Surveying	Plane Tabling, Instruments and Accessories. Advantages and Disadvantages, setting and orienting tables,	
		Methods of Plane tabling, Radiation, Intersection, Traversing and Resection, Errors in Plane Tabling	
11-13	Levelling	Terms used in Levelling, Types of levels, Levelling staffs, Focusing, Bench Marks, Adjustment of Level.	25
		Principles of levelling, Reduction of levels, Booking of staff reading, Numerical.	
		Classification of levelling, Differential, Profile, Cross sectioning, effect of curvature and refraction, check levelling, Reciprocal and precise levelling.	
14	Contouring	Contouring, Characteristics of contours Use of contours, Locating the contours, Interpolation of contours.	20
15	Theodolite Traversing	Theodolites, Traversing, Measurement of horizontal and vertical angle, Introduction to setting of curves, Total Survey Stations	
16	GPS, RS & GIS use in survey	Introduction to GPS, Remote Sensing and GIS use in survey	
		Total=	**100**

TEACHING SCHEDULE

PRACTICAL [SWCE-111]

Exercise No.	Exercise Title
1	Reconnaissance survey in the field, introduction to different linear measuring instruments and Use of Field Book
2	Study on various types of chain used in chain survey and its components
3	Study of errors in chain survey
4	Study of direct ranging of survey line and Offsets in chain survey
5	Study of indirect ranging of survey line
6	Study on various obstacles or obstructions in Chaining
7	Chain survey of an area by Triangulation using cross staff
8	Plotting of chain survey and computation of area
9	Study of Prismatic Compass and surveyor compass,
10	Open traverses survey of Road or Stream and Plotting
11	Closed Traverse survey of field / building and Plotting
12	Plane Table survey by Radiation Methods
13	Plane Table survey by Intersection Methods
14	Plane Table survey by Traversing Methods
15	Study of different levels, levelling staff and their adjustment
16	To study booking of staff reading to determine the reduced level
17	To study the simple and differential levelling to determine reduced levels
18	To study the profile levelling and determine reduced levelling
19	To study the plotting of profile levelling and compute cutting and filling
20	To study the contour survey of field
21	Plotting of contours, interpolation of contours and determine the slope of field
22	Study the software for drawing of contours
23	Cross sectioning of gully or nala and plotting
24	L-section of a gully or nala and plotting
25	To study the Theodolite, Measurement of vertical and horizontal angle by Theodolite
26	Determine the height of object with Theodolite
27	Setting of curves with Theodolite
28	Study of Total Survey Station and height of object with Total Survey Station
29	Study of Minor Instruments (Abney level, hand level, Box sextant and Clinometers)
30	Study of Planimeter and measurement of area from map
31	Study of GPS and Measuring area with GPS
32	Study of DEM and preparation of contour map in GIS

Semester	**:**	**I**			
Course No.	**:**	**FMPE-111**	**Credit Hrs.**	**:**	**2(0+2)**
Course Title	**:**	**Workshop Technology and Practice**			

SYLLABUS

Objectives: To expose the students to the basic manufacturing processes involved for production of different machine elements and to facilitate hands-on experience of using these machines.

PRACTICAL

Introduction about different shops in the workshop; Safety and precautions to be taken in the workshop; Study of different tools used for fitting and different fitting operations; Study of various measuring instruments used for fitting; Exercise in fitting: sawing, filing and right angle fitting of MS flat; Working with complex fitting jobs: operations of drilling, reaming, and threading and with tap dies; Preparation of a paper weight; Study of various carpentry tools, types of wood and their characteristics and working with carpentry tools; Preparation of simple joints in carpentry: cross half lap joint or T-half joint, Mortise and Tenon joint in carpentry; Preparation of dovetail joint in carpentry; Study of welding, types of welding, oxyacetylene gas welding, types of flames, welding techniques and equipment used for gas welding, working with welding equipment; Working with electric arc welding; Equipment and tools, safety and precautions taken in arc welding; Preparation of Butt joint and lap joint with ARC welding; Preparation of Lap and Butt joints using gas welding; Working on a lathe machine and study of different tools used in lathe machine; Exercise on simple turning, step turning in lathe machine; Preparation of job on taper turning, drilling, knurling and threading in lathe machine; Working with different machines in machine shop such as shaper ,milling machine, etc. and with different tools used in machine shop; Exercise on bending, shaping etc.; Exercise on Drawing, Punching, Riveting; Making different types of sheet metal joints using G.I. sheets; Practice job on shaper; Changing a round MS rod into square section with a shaper; Exercise on a milling machine such as making a slot, gear tooth forming and indexing.

Suggested Readings [FMPE-111]:

1. Chapman W.A.J. 2018. Workshop Technology (Vol. I and II), Arnold Publishers (India) Pvt Ltd. New Delhi.
2. Hajra Choudhari, S. K. Roy N, Hajra Choudhary A.K. 2017. Elements of Workshop Technology (Vol. I and II), Media Promoters and Publishers Pvt Ltd, Mumbai
3. Khurmi R.S and Gupta J.K. 2018 A Textbook of Workshop Technology. S. Chand and Company Ltd., New Delhi.
4. Raghuwanshi B.S. 2016. A Course on Workshop Technology (Vol. I and II), Dhanpat Rai and Sons, New Delhi.

TEACHING SCHEDULE

PRACTICAL [FMPE-111]

Exercise No.	Exercise Title
1	Introduction about different shops in the manufacturing workshop, study of safety tools and safety precautions/measures
2	Exercise in fitting shop: sawing, filing
3	Exercise in fitting shop: right-angle fitting of MS flat
4	Exercise on operations of drilling, reaming
5	Exercise on operations of threading and with tap dies
6	Preparation of a paper weight
7	Preparation of cross half lap joint or T-half joint in carpentry
8	Preparation of Mortise and Tenon joint in carpentry
9	Preparation of dovetail joint in carpentry
10	Preparation of Butt joint with ARC welding
11	Preparation of Lap joint with ARC welding
12	Preparation of Butt joint using gas welding
13	Preparation of Lap joint using gas welding
14	Introduction and demonstration on a lathe machine
15	Exercise on simple turning in lathe machine
16	Exercise on step turning in lathe machine
17	Preparation of job on taper turning in lathe machine
18	Preparation of job on drilling in lathe machine
19	Preparation of job on knurling in lathe machine
20	Preparation of job on threading in lathe machine
21	Introduction and demonstration on shaper machine
22	Introduction and demonstration on milling machine
23	Exercise on Bending
24	Exercise on Shaping
25	Exercise on Drawing
26	Exercise on Punching
27	Exercise on Riveting
28	Making different types of sheet metal joints using G.I. sheets
29	Exercise on changing a round MS rod into square section with a shaper
30	Introduction and demonstration of a slot making with milling machine
31	Introduction and demonstration of a gear tooth forming
32	Introduction and demonstration of indexing mechanisms.

Semester	**:**	**I**			
Course No.	**:**	**REE-111**	**Credit Hrs.**	**:**	**3(2+1)**
Course Title	**:**	**Basic Electrical Gadgets and Instruments**			

SYLLABUS

Objectives:

(i) To enable the students to take up repair and maintenance of different common electrical gadgets.

(ii) To acquire the basic knowledge of instruments used for scientific measurements.

THEORY

Introduction to different electrical appliances used in agricultural buildings, structures and farm operations; Difference between AC and DC supply system; Introduction to AC fundamentals; AC through series RL, RC, and RLC circuits, parallel AC circuit, series and parallel resonance; Q-factor and bandwidth. Three-phase AC circuit: Concept of balanced three-phase AC circuits, line and phase quantity in star and delta network, power in three-phase circuit, various methods of three phase power measurement like (one wattmeter and two-wattmeter method). Diode and its applications: Rectifier, Clipper, Clamper, voltage multiplier and capacitive filter zener diode as voltage regulator. Transistor and its applications: Bipolar junction transistor, operating point. Various biasing methods, fixed, self-biasing and potential divider biasing method; OP-AMP, Ideal OP-AMP characteristics, Linear and non-linear applications of OP-AMP (adder, subtractor, integrator, active rectifier, comparator). Introduction to digital electronics and logic gates: Basic theorem of Boolean algebra, Combinational logic circuits (basic gates, SOP rule and K-map), binary adder. Principles of general instruments, measurement of displacement, temperature, velocity, force and pressure using different instruments like, strain gauges, load cell, thermistors, thermocouples, pyrometer, linear variable differential transformer (LVDT), capacitive transducers, RTD, instruments for measurement of speed, wind velocity, solar radiation, anemometer, multimeter etc.

PRACTICAL

BASIC ELECTRICAL AND ELECTRONICS GADGETS

To prepare an electrical switch board to control two light points, one plug point, one fan point and fuse (House wiring); To prepare an electrical switch board to control two light points using two two-way switch (staircase wiring); To connect and test a fluorescent lamp; To find faults and repair home appliances such as heater, electric iron, fans and mixer-grinder, etc.; To find faults and repair UPS; To measure the power requirement and power factor in a AC single phase series RLC circuit; To measure energy of a single phase AC circuit with the help of ammeter, voltmeter and power factor meter and energy meter; To measure the power consumption in a three-phase circuit using two-wattmeter method.

INSTRUMENTATION

To prepare a DC power supply unit using diode and filter circuit; To study the Zener diode as voltage regulator circuit; To study transistor characteristics in CE configurations; To verify different logic gates; To measure unknown resistance using Wheatstone bridge; To measure the displacement and to determine the characteristics of LVDT; To measure the displacement using LVDT and potentiometer; To measure the pressure using strain gauge and Bourden tube; To measure the temperature using RTD, thermistors and thermocouple and study their characteristics; To measure the speed, wind velocity, solar radiation etc., using different measuring tools like tachometer, anemometer, pyranometer, multimeter, etc.; To acquaint with different other types of instruments used in agriculture and food processing application

TEACHING SCHEDULE

THEORY [REE-111]

Lecture No.	Topic	Sub-topics/Key Points	Weightage (%)
1	Introduction to different Electrical Appliances used in Agricultural Buildings Structures and Farm Operations. Difference between AC and DC Supply systems.	Brief Introduction of electrical appliances used in: Electrified Dairy Farm, Electrified Fruit and Vegetable Farm, Electrified Livestock Farm, Electrified Poultry Farm, Electrified General Farm, Electrified Farm Shop, Definitions and Concepts of Time period, Frequency, Magnitude, Waveform to differentiate A.C. and D.C.	5
2-4	Introduction to AC Fundamentals	Generation of Alternating Voltages and Current Equation of Alternating Voltages and Current Cycle, Time Period, Frequency, Amplitude Different Forms of E.M.F equation Phase and Phase Difference, Root Mean-Square (R.M.S) Value and its Analytical Derivation Average Value and its Analytical Derivation Form, Crest or Peak or Amplitude Factor A.C Through Pure Ohmic Resistance, Pure Inductance and Pure Capacitance Alone.	10
5-6	AC through series RL, RC and RLC Circuits	A.C. Through Resistance and Inductance. Definition and Concept of Power Factor, Active Power, Reactive Power and Apparent Power. A.C. through Resistance and Capacitance A.C. through Resistance Inductance and Capacitance. Examples on A.C. through Resistance and Inductance.	
7	Parallel AC Circuit	Solving Parallel Circuit by Vector or Phasor Method	5
	Series and Parallel Resonance	Resonance in R-L-C series Circuit and in Parallel Circuit.	
	Q-factor and Bandwidth	Brief concept Q factor and Bandwidth	

Continued…

8-10	Three-phase AC Circuit	Concept of balanced three-phase AC circuits Generation of Poly phase Voltage. Phase sequence. Interconnection of Three Phases,	10
	Line and Phase Quantity in Star and Delta Network	Star or Wye Connection, Voltages and Currents in Star or Wye Connection, Delta or Mesh Connections; Voltages and Currents in delta or Mesh Connection	
11	Power in Three-phase Circuit	Power Measurement in 3-Phase Circuits, Three wattmeter Method, Two wattmeter Method (Balanced or Unbalanced Load), One Wattmeter Method.	5
12-16	Diode and its Applications	Principal, Types and Uses of Rectifier and Capacitive filter. Principal, Types and Uses of Clipper, Clamper, Voltage multiplier and Zener diode as Voltage regulator	5 5
17-19	Transistor and its Applications	Working principle of : Bi-polar junction Transistor with CE, CB, CC Operating point; Various biasing methods (viz., fixed, self and potential divider biasing methods).	10
20-22	Operational Amplifier (OP-AMP) and its Application	Basic concept of OP-AMP and its Ideal Characteristics; Linear and Non-linear applications of OP-AMP (adder, subtractor, integrator, active rectifier, comparator)	10
23-25	Introduction to Digital Electronics	Concept and Working of Logic gates. Basic theorem of Boolean Algebra. Combinational Logic circuits (Basic gates, Introduction to K-Map binary adder and SOP rule)	10
26-32	Measuring Instrumentation (Transducer and Sensors)	Principles of General instrumentation system with Block diagram; Electrical measurement of: Displacement [like, Linear variable differential transformer (LVDT), Capacitive transducers, Strain gauge]	10
		Temperature (Thermistors, Thermocouples, RTD, Pyrometer); Force (Strain gauge, Pressuductor load cell)	5
		Pressure (Strain gauges, Load cell, Capacitive, Potentiometric); Speed (Resonance tachometer, Eddy current Tachometer)	5
		Wind velocity (Anemometer); Solar radiation (Pyranometer).	5
		Total	**100**

TEACHING SCHEDULE

PRACTICAL [REE-111]

Exercise No.	Exercise Title
1	To prepare an electrical switch board to control two light points, one plug point, one fan point and fuse (House wiring).
2	To prepare an electrical switch board to control two light points using two two-way switch (Staircase wiring).
3	To connect and test a fluorescent lamp.
4	To find faults and repair home appliances such as heater, electric iron, fans and mixer-grinder and UPS etc.
5	To measure the power requirement and power factor in an AC single phase series RLC circuit.
6	To measure energy of a single-phase AC circuit with the help of ammeter, voltmeter and power factor meter and energy meter.
7	To measure the power consumption in a three-phase circuit using two-wattmeter method.
8	To prepare a DC power supply unit using diode and filter circuit.
9	To study the Zener diode as voltage regulator.
10	To study transistor characteristics in CE configurations.
11	To verify different logic gates.
12	To measure unknown resistance using Wheatstone bridge.
13	To measure the displacement and to determine the characteristics of LVDT and Potentiometer.
14	To measure the pressure using strain gauge and Bourden tube.
15	To measure the temperature using RTD, thermistors and thermocouple and study their characteristics.
16	To measure the speed, wind velocity, solar radiation etc., using different measuring tools like tachometer, anemometer, pyranometer, multimeter etc.

Suggested Readings [REE-111]:

1. Boylestad R L and Nashelsky L N. 2011. Electronic Device and Circuit Theory. Pearson.
2. Ghosh S. 2007. Fundamentals of Electrical & Electronics Engineering, 2nd Ed PHI Learning, New Delhi.
3. Metha V K and Metha R. 2012. Basic Electrical Engineering, Fifth edition. S Chand & Co., New Delhi.
4. Metha V K and Metha R. 2012. Principle of Electronics, Fifth edition. S Chand & Co., New Delhi.
5. Rajput R K. 2007. Basic Electrical and Electronics Engineering. Laxmi Publications, New Delhi.
6. Theraja B L and Theraja A K. 2005. A Text Book of Electrical Technology Vol. I. and II, S Chand & Co., New Delhi.
7. Robert H. Brown, Farm Electrification. Allied Pacific Private Limited Bombay, Indian Edition.
8. Singh S K, Industrial Instrumentation and control, third edition, published by Tata McGraw-Hill Companies.

Semester	**:**	**I**		
Course No.	**:**	**COMP-111**	**Credit Hrs.**	**: 3(2+1)**
Course Title	**:**	**Agricultural Informatics and Artificial Intelligence**		

SYLLABUS

Objectives:

(i) To acquaint students with the basics of computer applications in Agriculture, multimedia, database management, application of mobile apps and decision-making processes etc.,

(ii) To provide basic knowledge of computer with applications in Agriculture,

(iii) To make the students familiar with Agricultural-Informatics, its components and applications in Agriculture and Artificial Intelligence.

THEORY

Introduction to Computers, Anatomy of Computers, Memory Concepts, Units of Memory, Operating System: Definition and types, Applications of MS-Office for creating, Editing and Formatting a document, Data presentation, Tabulation and graph creation, Statistical analysis, Mathematical expressions, Database, concepts and types, creating database, Uses of DBMS in Agriculture, Internet and World Wide Web (WWW): Concepts and components. Computer programming: General concepts, Introduction to Visual Basic, Java, Fortran, C/C++, etc. concepts and standard input/output operations. e-Agriculture, Concepts, design and development; Application of innovative ways to use information and communication technologies (IT) in Agriculture, Computer Models in Agriculture: Statistical, weather analysis and crop simulation models, concepts, structure, input-output files, limitation, advantages and application of models for understanding plant processes, sensitivity, verification, calibration and validation, IT applications for computation of water and nutrient requirement of crops, Computer-controlled devices (automated systems) for Agri-input management, Smartphone mobile apps in agriculture for farm advice: Market price, postharvest management etc. Geospatial technology: Concepts, techniques, components and uses for generating valuable agri-information, Decision support systems: Concepts, components and applications in Agriculture. Agriculture Expert System, Soil Information Systems etc. for supporting farm decisions. Preparation of contingent crop planning and crop calendars using IT tools, Digital India and schemes to promote digitalization of agriculture in India. Introduction to artificial intelligence, background and applications, Turing test. Control strategies, Breadth-first search, Depth-first search, Heuristics search techniques: Best-first search, A*algorithm, IoT and Big Data; Use of AI in Agriculture for autonomous crop management, and health, monitoring livestock health, intelligent pesticide application, yield mapping and predictive analysis, automatic weeding and harvesting, sorting of produce, and other food processing applications; Concepts of Smart Agriculture, Use of AI in food and nutrition science etc.

PRACTICAL

Study of computer components, accessories, practice of important DoS Commands, Introduction of different operating systems such as Windows, Unix/ Linux, creating files and folders, File Management. Use of MS-WORD and MS PowerPoint for creating, editing and presenting a scientific document, MS- EXCEL - Creating a spreadsheet, Use of statistical tools, Writing expressions, Creating graphs, Analysis of scientific data, Handling macros. MS-ACCESS: Creating Database, preparing queries and reports, Demonstration of Agri- information system, Introduction to World Wide Web (WWW) and its components, Introduction of programming languages such as Visual Basic, Java, Fortran, C, C++, Hands on practice on Crop Simulation Models (CSM), DSSAT/Crop-Info/Crop Syst/ Wofost, Preparation of inputs file for CSM and study of model outputs, computation of water and nutrient requirements of crop using CSM and IT tools, Use of smart phones and other devices in agro-advisory and dissemination of market information, Introduction of Geospatial Technology, Hands on practice on preparation of Decision Support System, Preparation of contingent crop planning, India Digital Ecosystem of Agriculture (IDEA).

TEACHING SCHEDULE

THEORY [COMP-111]

Lecture No.	Topic	Sub-topics/ Key Points	Weightage (%)
1-3	**Introduction to Computers, Anatomy of Computers** **Memory Concepts:** **Operating System:**	Definitions Characteristics of Computer Components of Computer CPU: CU, ALU, MU Input Devices; Output Devices; Units of Memory: bit to TB, Types: Primary, Secondary Definitions and Types: Single user, Multiuser and features. OS Special Types (Brief Overview): Batch, Real-Time, Time Sharing, Distributed, Network OS. Functions of operating system	7
4-6	**Applications of MS-Office**	MS Word: Creating a New Document formatting option features Insertion of Table MS Excel: creating work sheet and graph, Functions for Data Analysis: AVERAGE, COUNT, SUM, MIN, MAX, MEDIAN, MODE, STDEV, STDEVP, VAR, VARP, CORREL, PERCENTILE Mathematical functions in excel: SUM, AVERAGE, AVERAGEIF, COUNT, COUNTIF, MOD, ROUND	7
7-9	**Database and DBMS**	Database, concepts and types, creating database, Uses of DBMS in Agriculture. Database concepts Database- Definition: Characteristics of Database Structure of Database Management System Tables: Concept of view, Primary key, Foreign key Creating database: SQL query: Create, Insert, Select, Delete, Update. Form: Steps for Creating Forms, Entering Data in forms Report using MS-ACCESS: Steps for Creating Reports, Printing reports.	7

Continued…

10	**Internet and World Wide Web (www)**	Concepts and components Internet: Introduction Definition of LAN, WAN, MAN and Internet Internet Service Provider (ISP) World Wide Web; Hypertext Web Browser Web Page and Websites E-Mail: Creating Email, Email Addresses, Using Email, Sending the message, CC and BCC; Search Engine	7
11-12	**Computer Programming**	General concepts, Introduction to Visual basic, java, FORTRAN, C, C++ etc.: concepts and standard input/output operations. C 'language - character set, data type, concepts and standard input/output – scanf( ), printf( ) operations Assignment - any five C simple language program	7
13-14	**e-Agriculture**	Concepts, Importance of IT in e-Agril., AGRINET: Introduction, Objectives. Advantages and Challenges in Agriculture.	7
15-16	**Crop Simulation Models**	Crop Simulation Models Definition, Concept: Requirement of Good Modeling. Input-output files, limitation, advantages Types: Statistical Models, weather analysis Dynamic Models, Mechanistic Models, Functional Models and Crop Modeling. Classifications of Models based on their Applications: Primary Model, Comprehensive Model, Summary of Model, Characteristics of Models, Uses of Models	7
17-19	**IOT and IT Applications in Agriculture**	IoT Definition, Challenges and Benefits of IOT in Agriculture Use of IoT Applications in Agriculture: Precision Farming, Agricultural Drones, Smart Greenhouses. IT Applications in Agriculture for Computation of Water and Nutrient Requirement of Crop. Role of IT Application in water and nutrient requirement. Brief introduction of: Computation of water and nutrient requirement using weather parameters. Advantages	7

Continued…

COMP-111…

20-21	**Computer-controlled Devices (Automated systems), Smartphone Apps and GPS**	Computer-controlled devices (automated systems) for Agri-input management- Examples of Automation Devices: Robotics Application in Planting, Drones for Irrigation, Harvest Automation Tools, Automated Tractors etc. AWS - Automatic Weather Station. AIS - Automatic Irrigation System. Smartphone Mobile Apps in Agriculture: Introduction- Irrigation Systems, Fertilizer Application, Pest and Disease Management Seeding and Planting, Harvesting Systems Weather Forecasting, Soil Testing and Analysis, Crop Management, Market Prices Farm Management, Financial and Insurance Services; Introduction and Uses to Geospatial Technology.	7
22-23	**Decision Support System (DSS)**	Decision support systems (DSS) Introduction, Concepts, Components, Types and Applications in Agriculture.	7
24-25	**Agriculture Expert System (AES)**	Introduction, Concepts, Components and Applications in Agriculture.	7
26-27	**Contingent / Crop Planning Calendars using IT Tools**	Introduction, Definition, Benefits, Steps to Prepare Contingent Crop Planning using IT Tools.	7
28-30	**Introduction and Uses to Artificial Intelligence and Overview**	Introduction and its uses to Artificial Intelligence and Overview and Examples of AI in Agriculture - Turing test. Control strategies, Breadth-first search, Depth-first search, Heuristics search techniques: Best-first search, A* algorithm, IoT and Big Data; (Autonomous crop management and health, monitoring livestock health, intelligent pesticide application, yield mapping and predictive analysis, automatic weeding and harvesting, sorting of produce and other food processing applications).	8
31-32	**Digital India and Schemes to promote Digitalization of Agriculture in India**	Digital India and Schemes to promote Digitalization of Agriculture in India: Digital Agriculture in India: Status, Challenge, Digital India and Initiatives in Agriculture Sector. Digital Agriculture or NeGP-A 2.0	8
		Total	**100**

TEACHING SCHEDULE

PRACTICAL [COMP-111]

Exercise No.	Exercise Title
1-2	Study of computer components, accessories, practice of important DOS command Introduction to different Operating systems such as Windows, Unix/ Linux Creating files and folders, Files Management.
3-4	Use of MS-WORD, creating files and folders, files management and MS-POWERPOINT Presentation for creating, editing and presenting scientific documents. MS-EXCEL- Mathematical calculations, Preparation of Spread sheets. Use of statistical tools, Writing expressions, Creating graphs, Analysis of scientific data Handling Macros, MS-EXCEL chart-Line, XY, Bar and Pie
5-6	MS-ACCESS- Creating Database, Preparing queries and reports.
7-8	Program in C-Language: a) Program to enter name and print name. b) Program to calculate sum and subtraction of numbers. c) Program to calculate Area of Circle. d) Program to calculate Area of Triangle e) Program to calculate Area of Rectangle.
9	Introduction to Internet, World Wide Web (WWW).
10-11	Hands-on Practice on Crop Simulation Model (CSM)(:- CROPWAT 8.0.
12-13	Use of Smartphone Apps (Developed by SAU).
14-15	Hands-on Practice on Decision Support System (DSS).
16	Introduction to India Digital Ecosystem of Agriculture (IDEA).

Suggested Readings [COMP-111]:

1. Fundamentals of Computer by V. Rajaraman.
2. Introduction to Information Technology by Pearson.
3. Introduction to Database Management System by C. J. Date.
4. Concepts and Techniques of Programming in C by Dhabal Prasad Sethi and Manoranjan, Wiley India.
5. Introductory A g r i Informatics by Mahapatra, Subrat K et al, Jain Brothers Publication.
6. Russell, Stuart, Artificial Intelligence: A Modern Approach, Pearson Edition 2013.
7. Nilson N.J. 2001. Principles of Artificial Intelligence. Narosa.
8. Agricultural Informatics and Artificial Intelligence for B Tech (Agricultural Technology) by Prashant Publication.

Online resources: ***(COMP-111)***

- https://en.wikipedia.org/wiki/Computer
- https://www.javatpoint.com/computer
- https://iasri.icar.gov.in/
- https://www.nrsc.gov.in/EO_Agr_Objective?language_content_entity=en
- https://www.agrimoon.com
- https://www.agriinfo.in
- https://eagri.org
- https://www.agriglance.com
- https://agritech.tnau.ac.in
- https://loksabhadocs.nic.in/Refinput/New_Reference_Notes/English/Agriculture_and_Digital_India.pdf
- https://www.investindia.gov.in/team-india-blogs/digitalisation-agriculture-india
- http://courseware.cutm.ac.in/wp-content/uploads/2020/06/Session-11-Preparation-of-Contingent-Crop-Planning-and-Crop-Calendars-Using-IT-Tools.pdf
- https://optimizeias.com/indias-digital-ecosystem-for-agriculture/
- https://www.igi-global.com/chapter/introduction-to-agricultural-information-systems/266572#:~:text=Agricultural%20Information%20Systems%3A%20Information%20system,knowledge%20utilization%20by%20agricultural%20producers.
- https://cropcalendar.apps.fao.org/#/home
- http://www.irdindia.in/journal_ijrdmr/pdf/vol4_iss1/7.pdf
- https://learn.microsoft.com/en-us/office365/servicedescriptions/office-applications-service-description/office-applications
- https://ebooks.inflibnet.ac.in/hsp16/chapter/application-of-software-in-statisticalanalysis-i-microsoft-excel/
- http://eagri.org/eagri50/STAM102/index.html
- https://edu.gcfglobal.org/en/internetbasics/using-a-web-browser/1/
- https://www.javatpoint.com/what-is-world-wide-web
- https://www.mdpi.com/journal/agriculture/special_issues/Decision_Support_Systems_Application
- https://apps.gov.in/ministry/ministry-agriculture
- http://courseware.cutm.ac.in/wp-content/uploads/2020/06/Session-11-Preparation-of-Contingent-Crop-Planning-and-Crop-Calendars-Using-IT-Tools.pdf
- https://apps.mgov.gov.in/apps_by_category;jsessionid=8206D0DAE69F48FB50962462A8922C23?name=Agriculture

Tools available for Student for Academic Purpose only: (COMP-111)

1. DSSAT (Decision Support System for Agrotechnology Transfer)
   - Purpose: A comprehensive crop modeling tool.
   - Use: Simulates plant growth, development, and yield for various crops under different management and environmental conditions.
   - Download: https://dssat.net/
2. APSIM (Agricultural Production Systems Simulator)
   - Purpose: A powerful plant simulation tool.
   - Use: Models the effects of environmental variables like soil, climate, and management strategies on plant growth and crop yield.
   - Download: https://www.apsim.info/
3. Open Sim Root
   - Purpose: A root growth modeling software.
   - Use: Helps understand plant root growth processes, interactions with soil, and how they respond to environmental conditions.
   - Download: Available as open-source software via research platforms like Git Hub. https://gitlab.com/rootmodels/OpenSimRoot
4. Virtual Plant
   - Purpose: A tool for visualizing and modeling plant metabolic and regulatory networks.
   - Use: Helps in understanding complex plant processes such as gene regulation, metabolic pathways, and how they respond to environmental conditions.
     Download: https://sourceforge.net/projects/virtualplant/
5. R Studio (with Bioconductor and Plant Modeling Libraries)
   - Purpose: A programming environment for statistical computing.
   - Use: Using plant modeling libraries like plant and photosynthesis, researchers can model plant growth, carbon assimilation, and nutrient cycling.
   - Download: https://posit.co/downloads/
6. WOFOST (World Food Studies)
   - Purpose: A plant process and crop growth simulation model developed by the FAO.
   - Use: Helps in understanding crop development, photosynthesis, and biomass accumulation under different environmental and management conditions.
   - Download: https://www.wur.nl/en/research-results/research-institutes/environmental-research/facilities-tools/software-models-and-databases/wofost/downloads-wofost.htm
7. Green Lab
   - Purpose: A plant growth model focused on plant architecture and functional growth processes.
   - Use: Simulates plant organ development and growth processes, integrating functional and structural aspects of plant behavior.
   - Download: https://greenlab.cirad.fr/GLUVED/html/P3_Tools/Tool_simul_003.html