Annexure I

FACULTY OF AGRICULTURE

Undergraduate Course Curriculum

I Semester			
S. No.	**Course No.**	**Course Title**	**Credit Hours**
1	FC - I	Deekshaarambh (Induction cum Foundation course)	2 (0+2) 2 week(NG) Non-gradial
2	SEC - (1-17)	Skill Enhancement course (1-17)*	2(0+2)
3	SEC - (1-17)	Skill Enhancement course (1-17)*	2(0+2)
4	AEC - I	Communication Skills	2(1+1)
5	AGRON 1.1	Fundamentals of Agronomy	3(2+1)
6	SOIL 1.1	Fundamentals of Soil Science	3(2+1)
7	HORT 1.1	Fundamentals of Horticulture	3(2+1)
8	ENT 1.1	Fundamentals of Entomology	3(2+1)
9	EXTN 1.1	Rural Sociology and Educational Psychology	2(2+0)
10	AEC - IV	National Service Scheme - I (NSS - I)	1(0+1)
11	AEC - V	National Cadet Corps - I (NCC - I)	1(0+1)
12	MATHS 1.1	Introductory mathematics	1(1+0) Non-gradial
Note: ***Students may opt for either NSS or NCC in a semester***			

II Semester			
1	SEC - (1-17)	Skill Enhancement course (1-17)*	2(0+2)
2	SEC - (1-17)	Skill Enhancement course (1-17)*	2(0+2)
3	AEC - II	Personality Development	2(1+1)
4	VAC - I	Environmental Studies and Disaster Management	3(2+1)
5	SOIL 2.2	Soil Fertility Management	3(2+1)
6	MDC - I	Farming based livelihood Systems	3(2+1)
7	AH 2.1	Livestock and Poultry Management	2(1+1)
8	PL. PATH 2.1	Fundamentals of Plant Pathology	3(2+1)
9	AEC - VI	National Service Scheme - II (NSS - II)	1(0+1)
10	AEC - VII	National Cadet Corps - II (NCC - II)	1(0+1)
Note: ***Students may opt for either NSS or NCC in a semester***			
III semester			
1	SEC - (1-17)	Skill Enhancement course (1-17)*	2(0+2)
2	MDC - II	Entrepreneurship Development and Business Communication	3(2+1)
3	AEC - III	Physical Education, First Aid and Yoga Practices	2(0+2)
4	GPB 3.1	Principles of Genetics	3(2+1)
5	AGRON 3.2	Crop Production Technology-I (*Kharif* crops)	3(1+2)
6	HORT 3.2	Production Technology of Fruit and Plantation Crops	2(1+1)
7	EXTN 3.2	Fundamentals of Extension Education	2(1+1)
8	NEMA 3.1	Fundamentals of Nematology	2(1+1)
9	AGRON 3.3	Principles and Practices of Natural Farming	2(1+1)
10	AEC – VIII	National Service Scheme - III (NSS - III) (Non-gradial)	1(0+1)
11	AEC - IX	National Cadet Corps - III (NCC - III) (Non-gradial)	1(0+1)
Note: ***Students may opt for either NSS or NCC in a semester***			

IV semester			
1	SEC - (1-17)	Skill Enhancement course (1-17)*	2(0+2)
2	VAC - II	Agriculture informatics and Artificial Intelligence	3(2+1)
3	HORT 4.3	Production Technology of Vegetables and Spices	2(1+1)
4	AG. ECON 4.1	Principles of Agricultural Economics and Farm Management	2(2+0)
5	AGRON 4.4	Crop Production Technology - II (*Rabi* Crops)	3(1+2)
6	AG. ENGG 4.1	Farm Machinery and Power	2(1+1)
7	AGRON 4.5	Water Management	2(1+1)
8	SOIL 4.3	Problematic Soils and their management	2(1+1)
9	GPB 4.2	Basics of Plant Breeding	3(2+1)
10	AEC - X	National Service Scheme - IV (NSS - IV) (Non-gradial)	1(0+1)
11	AEC - XI	National Cadet Corps - IV (NCC - IV) (Non-gradial)	1(0+1)
Note: ***Students may opt for either NSS or NCC in a semester***			
V semester			
1	MDC - III	Agricultural Marketing and Trade	3(2+1)
2	AG. MET 5.1	Introductionto Agro-meteorology	2(1+1)
3	CR. PHY 5.1	Fundamentals of Crop Physiology	3(2+1)
4	ENT 5.2	Pest Management in Crops and Stored Grains	3(2+1)
5	PL. PATH 5.2	Diseases of Field & Horticultural Crops & their Management	3(2+1)
6	GPB 5.3	Crop Improvement - I (*Kharif* Crops)	2(1+1)
7	AGRON 5.6	Weed Management	2(1+1)
8	AG. ENGG 5.2	Renewable energy in Agriculture and Allied Sector	2(1+1)
9	AGRON 5.7	Introductory Agroforestry	2(1+1)
VI semester			
1	AG. BIOTECH 6.1	Fundamentals of Agri. Biotechnology	3(2+1)
2	AG. STAT 6.1	Basic and Applied Agril. Statistics	3(2+1)
3	GPB 6.4	Crop Improvement (*Rabi* Crops) - II	2(1+1)
4	HORT 6.4	Ornamental Crops, MAPs and Landscaping	2(1+1)
5	AGRON 6.8	Dry land agriculture / Rainfed agriculture and watershed management	2(1+1)
6	BIOCHEM 6.1	Essentials of Plant Biochemistry	3(2+1)
7	PL. PATH 6.3	Agricultural Microbiology and Phyto-remediation	2(1+1)
8	AG. ECON 6.2	Agricultural Finance & Cooperation	2(1+1)
9	GPB 6.5	Fundamentals of Seed Science & Technology	2(1+1)

VII semester		
5 (Five) Elective Courses(major or minor) each of 4(3+1) credits for B.Sc. (Hons) Agriculture degree		**20(15+5)**
VIII semester		
1	Student Ready(RAWE /Industrial Attachment/ Experiential learning / Hands on training / Project work/ Internship)	20
Note: * Will be decided by the respective colleges/University ** Students needs to complete 10 credits online courses		

Skill Enhancement Courses(SECs)		
SEC – 1	Biofertilizer and biopesticide production	2(0+2)
SEC – 2	Production Technology of Bioagents	2(0+2)
SEC – 3	Seed Production and Testing Technology	2(0+2)
SEC – 4	Mushroom Production Technology	2(0+2)
SEC – 5	Soil, Plant and Water Testing	2(0+2)
SEC – 6	Post-harvest processing technology	2(0+2)
SEC – 7	Beneficial insect farming	2(0+2)
SEC – 8	Plantation Crop Production and Processing	2(0+2)
SEC – 9	Poultry Production Technology	2(0+2)
SEC – 10	Piggery Production Technology	2(0+2)
SEC – 11	Commercial Horticulture	2(0+2)
SEC – 12	Floriculture and Landscaping	2(0+2)
SEC – 13	Food Processing	2(0+2)
SEC – 14	Agriculture Waste Management	2(0+2)
SEC – 15	Organic Production Technology	2(0+2)
SEC – 16	Commercial Sericulture	2(0+2)
SEC – 17	Video Production	2(0+2)

Department wise courses

Course Code	Course title	Credit Hours	Total
Agronomy			
AGRON 1.1	Fundamentals of Agronomy	3(2+1)	**22(13+9)**
MDC - I	Farming based livelihood systems	3(2+1)	
AGRON 3.2	Crop Production Technology- I (*Kharif* Crops)	3(1+2)	
AGRON 3.3	Principles and Practices of Natural Farming	2(1+1)	
AGRON 4.4	Crop Production Technology – II (*Rabi* Crops)	3(1+2)	
AGRON 4.5	Water Management	2(1+1)	
AGRON 5.6	Weed Management	2(1+1)	
AGRON 5.7	Introductory Agroforestry	2(1+1)	
AGRON 6.8	Dry land agriculture/ Rainfed agriculture and watershed management	2(1+1)	
Soil Science			
SOIL 1.1	Fundamentals of Soil Science	3(2+1)	**8(5+3)**
SOIL 2.2	Soil Fertility Management	3(2+1)	
SOIL 4.3	Problematic Soils and their management	2(1+1)	
Horticulture			
HORT 1.1	Fundamentals of Horticulture	3(2+1)	**9(5+4)**
HORT 3.2	Production Technology of Fruit and Plantation Crops	2(1+1)	
HORT 4.3	Production Technology of Vegetables and Spices	2(1+1)	
HORT 6.4	Ornamental Crops, MAPs, and Landscaping	2(1+1)	
Genetics and Plant Breeding			
GPB 3.1	Principles of Genetics	3(2+1)	**12(7+5)**
GPB 4.2	Basics of Plant Breeding	3(2+1)	
GPB 5.3	Crop Improvement (*Kharif* Crops) - I	2(1+1)	
GPB 6.4	Crop Improvement (*Rabi* Crops) - II	2(1+1)	
GPB 6.5	Fundamentals of Seed Science and Technology	2(1+1)	
Entomology			
ENT 1.1	Fundamentals of Entomology	3(2+1)	**6(4+2)**
ENT 5.2	Pest management in Crops and Stored Grains	3(2+1)	
Plant Pathology			
PL. PATH 2.1	Fundamentals of Plant Pathology	3(2+1)	**8(5+3)**
PL. PATH 5.2	Diseases of Field & Horticultural Crops & their Management	3(2+1)	
PL. PATH 6.3	Agricultural Microbiology and Phyto-remediation	2(1+1)	

Extension Education			
EXTN 1.1	Rural Sociology and Educational Psychology	2(2+0)	**8(5+3)**
EXTN 3.2	Fundamentals of Extension Education	2(1+1)	
AEC - I	Communication skills	2(1+1)	
AEC - II	Personality development	2(1+1)	
Agricultural Meteorology			
VAC – I	Environmental Studies and Disaster management	3(2+1)	**5(3+2)**
AG. MET 5.1	Introduction to Agro-meteorology	2(1+1)	
Agricultural Economics			
AG. ECON 4.1	Principles of Agricultural Economics and Farm Management	2(2+0)	**9(6+3)**
MDC - II	Entrepreneurship Development and Business Communication	3(2+1)	
MDC - III	Agricultural Marketing and Trade	3(2+1)	
AG. ECON 6.2	Agricultural Finance & Cooperation	2(1+1)	
Agricultural Statistics			**6(4+2)**
VAC - II	Agriculture informatics and Artificial Intelligence	3(2+1)	
AG. STAT 6.1	Basic and Applied Agril. Statistics	3(2+1)	
MATHS 1.1	Introductory Mathematics	1(1+0)	Nongradial
Agricultural Engineering			
AG. ENGG 4.1	Farm Machinery and Power	2(1+1)	**4(2+2)**
AG. ENGG 5.2	Renewable energy in Agriculture and Allied Sector	2(1+1)	
Nematology			
NEMA 3.1	Fundamentals of Nematology	2(1+1)	**2(1+1)**
Biochemistry			
BIOCHEM 6.1	Essentials of Plant Biochemistry	3(2+1)	**3(2+1)**
Crop Physiology			
CR. PHY 5.1	Fundamentals of Crop Physiology	3(2+1)	**3(2+1)**
Animal Husbandry			
AH 2.1	Livestock and poultry Management	2(1+1)	**2(1+1)**
Agricultural Bio-technology			
AG. BIOTECH 6.1	Fundamentals of Agri Biotechnology	3(2+1)	**3(2+1)**
Students' Welfare			
AEC - IV	National Cadet Corps (NCC)	1(0+1)	**1(0+1)**
AEC - V	National Service Scheme (NSS)	1(0+1)	**1(0+1)**
AEC - VI	National Cadet Corps (NCC)	1(0+1)	**1(0+1)**
AEC - VII	National Service Scheme (NSS)	1(0+1)	**1(0+1)**
AEC - VIII	National Service Scheme - III (NSS - III) (Non-gradial)	1(0+1)	1(0+1)

AEC - IX	National Cadet Corps - III (NCC - III) (Non-gradial)	1(0+1)	1(0+1)
AEC - X	National Service Scheme - IV (NSS - IV) (Non-gradial)	1(0+1)	1(0+1)
AEC - XI	National Cadet Corps - IV (NCC - IV) (Non-gradial)	1(0+1)	1(0+1)
AEC – III	Physical Education, First Aid and Yoga Practices	2(0+2)	**2(0+2)**
ST	Study Tour	2(0+2)	**2(0+2) Non gradial**

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DEPARTMENT WISE DETAILED COURSE SYLLEBUS FOR DIFFERENT COURSES

1. AGRONOMY	
1.	**AGRON 1.1 Fundamentals of Agronomy 3(2+1)**
	Theory:
	Agronomy and its scope: Definition, meaning and scope of Agronomy; art, science and business of crop production, relation of Agronomy with other disciplines of Agricultural Science, fields crops and classification, importance, ecology and ecosystem. Seeds and sowing: Definitions of crops, variety and seed. Factors affecting crop stands establishment: good quality seed, proper tillage, time of sowing seed rate, depth and method of sowing: broadcasting, drilling, dibbling, transplanting etc. Tillage and tilth: Definition, objectives, types, advantages and disadvantages of tillage including conservation tillage. Crop density and geometry: plant geometry and planting geometry, its effect on growth, yield. Crop nutrition: Definition of essential nutrients, criteria of essentiality, functional elements, classification of essential nutrients, role of macro and micro nutrients. Nutrient absorption, active and passive absorption of nutrients, forms of plant nutrients absorbed by plants, Combined /uncombined forms. Manures and fertilizers, nutrient use efficiency: Sources of nutrients: Inorganic (fertilizers), organic (manures) and bio-fertilizers; their classification and characteristics, method of preparation and role of organic manures in crop production. Integrated Nutrient Management (INM): Meaning, different approaches and advantages of INM. Green manure- role in crop production: Definition, objectives types of green manuring, desirable characteristics, advantages and limitations of green manuring. Water management: Water resources of the world, India and the state; Soil Moisture constants: gravitational water, capillary water, hygroscopic water, Soil moisture constants. Weeds: Definition, Importance and basics of classification of weeds and their control. Agroclimatic zones of India and the state, cropping systems: Factors affecting cropping systems, major cropping patterns and systems in the country. Sustainable crop production: Definition, importance and practices, natural resources and conservation pollution and pollutants, Allelopathy: Meaning and importance in crop production, Growth and development of crops: Definition, Meaning and factors affecting growth and development.
	Practical:
	A visit to Instructional Crop farm and study on field crops, Identification of crops, seeds, fertilizers, pesticides, Crops and cropping systems in different Agro-climatic zones of the state, Study of some preparatory tillage implements, Study of inter tillage implements, Practice of ploughing / puddling, Study and practice of inter cultivation in field crops, Numerical exercises on calculation of seed, plant population and fertilizer requirement, Study of yield contributing characters and yield estimation of crops, Identification of weeds in different crops, Seed germination and viability test of seed, Practice on time and method of application of manures and fertilizers.
2.	**MDC - I Farming based livelihood systems 3(2+1)**
	Theory:
	Theory: Status of agriculture in India and different states, Income of farmers and rural people in India, Livelihood-Definition, concept and livelihood pattern in urban and rural areas, Different indicators to study livelihood systems. Agricultural livelihood systems (ALS): Meaning, approach, approaches and framework, Definition of farming systems and farming based livelihood systems Prevalent Farming systems in India contributing to livelihood. Types of traditional and modern farming systems. Components of farming system/ farming-based livelihood systems- Crops and cropping systems, Livestock (Dairy, Piggery, Goatry, Poultry, Duckry etc.), Horticultural crops, Agro--forestry systems, Aqua culture Duck/Poultry cum Fish, Dairy cum Fish, Piggery cum Fish etc., Small-, medium- and large- enterprises including value

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	chains and secondary enterprises as livelihood components for farmers, Factors affecting integration of various enterprises of farming for livelihood. Feasibility of different farming systems for different agro-climatic zones, Commercial farming-based livelihood models by NABARD, ICAR and other organizations across the country, Case studies on different livelihood enterprises associated with the farming. Risk and success factors in farming-based livelihood systems, Schemes and programs by Central and State Government, Public and Private organizations involved in promotion of farming-based livelihood opportunities. Role of farming-based livelihood enterprises in 21st Century in view of circular economy, green economy, climate change, digitalization and changing life style.
	Practical:
	Survey of farming systems and agricultural based livelihood enterprises, Study of components of important farming based livelihood models/ systems in different agro-climatic zones, Study of production and profitability of crop based, livestock based, processing based and integrated farming based livelihood models, Field visit of innovative farming system models. Visit of Agri-based enterprises and their functional aspects for integration of production, processing and distribution sectors and Study of agri-enterprises involved in industry and service sectors (Value Chain Models), Learning about concept of project formulation on farming-based livelihood systems along with cost and profit analysis, Case study of Start-Ups in agri-sectors.
3.	**AGRON 3.2 Crop Production Technology- I (*Kharif* Crops) 3(1+2)**
	Theory:
	Theory: Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of Kharif crops. Cereals- rice, maize, sorghum, pearl millet, finger millet and other minor millets, pulses- pigeonpea, mungbean and urdbean and cluster bean; oilseeds groundnut, soybean, sesame, castor; fibre crops- cotton and jute; forage crops- sorghum, cowpea, and napier hybrid and fodder maize **;**Cash crop -Bidi tobacco; Green manure crops -Sunnhemp and Dhaincha
	Practical:
	Practical: Rice nursery preparation, transplanting of rice, sowing of soybean, pigeon pea and mungbean, maize, groundnut and cotton, effect of seed size on germination and seedling vigour of Kharif crops, effect of sowing depth on germination of Kharif crops, identification of weeds in Kharif crops, top dressing and foliar feeding of nutrients, study of yield contributing characters and yield calculation of Kharif crops, study of crop varieties and important agronomic experiments at experiential farm, recording biometric observations, Study of forage experiments, morphological description of Kharif crops, silage and hay making, visit to research centres of related crops.
4.	**AGRON 3.3 Principles and Practices of Natural Farming 2(1+1)**
	Theory:
	Indian Heritage of Ancient Agriculture, History of Natural Farming, Importance of natural farming in view of climate change, soil health, water use carbon sequestration, biodiversity conservation, food security and nutritional security, and sustainable development goals (SDGs), Concept of natural farming; Definition of natural farming; Objective of natural farming, Essential characteristics and Principles of natural farming; Scope and importance of natural farming. Main Pillars of natural farming; Methods/ types/schools of natural farming. Characteristics and design of a natural farm, Concept of ecological balance, ecological engineering and community responsibility in natural versus other farming systems, Introduction to concept of ecological, water, carbon and nitrogen foot prints, Concept and evaluation of ecosystem services, integration of crops, trees and animals, cropping system approaches, Biodiversity, indigenous seed production, farm waste recycling, water conservation and renewable energy use approaches on a natural farm, Rearing practices for animals under natural farming, Nutrient management in natural farming and their sources, Insect, pest, disease and weed management under natural farming; Mechanization in natural farming, Processing, labelling, economic considerations and viability, certification and standards in natural farming,

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	marketing and export potential of natural farming produce and products. Initiatives taken by Government (central/state), NGOs and other organizations for promotion of natural farming and chemical free agriculture, Case studies and success stories in natural farming and chemical free traditional farming, Entrepreneurship opportunities in natural farming.
	Practical:
	Visit of natural farm and chemical free traditional farms to study the various components and operations of natural farming principles at the farm; Indigenous technical knowledge (ITK) for seed, tillage, water, nutrient, insect-pest, disease and weed management; On-farm inputs preparation methods and protocols, Studies in green manuring in-situ and green leaf manuring, Studies on different types of botanicals and animal urine and dung based non-aerated and aerated inputs for plant growth, nutrient, insect and pest and disease management; Weed management practices in natural farming; Techniques of Indigenous seed production- storage and marketing, Partial and complete nutrient and financial budgeting in natural farming; farming; Evaluation of ecosystem services in natural farming (Crop, Field and System).
5.	**AGRON 4.4 Crop Production Technology – II (*Rabi* Crops) 3(1+2)**
	Theory:
	Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of Rabi crops. Cereals- wheat and barley. Pulses chickpea, lentil, peas. Rabi redgram and, rajmash. Oilseed- rapeseed, mustard, sunflower, safflower; and linseed. Sugar crops-sugarcane and sugar beet. Medicinal and aromatic crops- mentha, lemon grass and citronella. Forage crops –barseem, lucerne and oat; potato, quinoa, tobacco.
	Practical:
	Identification of rabi crops and seeds; Sowing methods of wheat and sugarcane; identification of weeds in rabi season crops; study of morphological characteristics of rabi crops; study of yield contributing characters of rabi season crops; yield and juice quality analysis of sugarcane; oil extraction of medicinal crops; Numerical exercises on fertilizer, seed requirement and plant population; Visit to important agronomic experiments, forage experiments and research stations of related crops
6.	**AGRON 4.5 Water Management 2(1+1)**
	Theory:
	Irrigation: definition and objectives; Importance: Function of water for plant growth, water resources and irrigation development for different crops in India; Soil plant water relationships; Available and unavailable soil moisture, distribution of soil moisture, water budgeting, rooting characteristics, moisture extraction pattern, effect of moisture stress on crop growth. Methods of soil moisture estimation, evapotranspiration and crop water requirement; effective rainfall, different approaches of scheduling of irrigation; Methods of irrigation: surface and sub-surface, pressurized methods, *viz.,* sprinkler and drip irrigation, their suitability, merits and limitations, fertigation, economic use of irrigation water; Layout of different irrigation systems, Irrigation efficiency and water use efficiency, conjunctive use of water, irrigation water quality and its management. Water management of different crops (rice, wheat, maize, groundnut, sugarcane, mango, banana and tomato); quality of irrigation water, irrigation management practices for different soils and crops, drip, sprinkler. Layout of underground pipeline system,
	Practical:
	Determination of bulk density by field method; Determination of soil moisture content by gravimetric method, tensiometer, electrical resistance block and neutron moisture meter; Determination of field capacity by field method; Determination of permanent wilting point; Measurement of irrigation water by using water measuring devices *viz.*, flumes, weirs, notches, orifices; Calculation of irrigation water requirement (Problems); Determination of infiltration rate; Demonstration of furrow method of irrigation; Demonstration of check basin and basin method of irrigation; Visit to farmers' field and cost estimation of drip irrigation system; Demonstration of filter cleaning, fertigation, injection and flushing of laterals; layout for different methods of irrigation, Erection and operation of sprinkler irrigation system;

	Measurement of emitter discharge rate, wetted diameter and calculation of emitter discharge variability; Visit to irrigation research centre/ station and visit to command area.
7.	**AGRON 5.6 Weed Management 2(1+1)**
	Theory:
	Introduction to weeds, characteristics of weeds, their harmful and beneficial effects on ecosystem. Classification, reproduction and dissemination of weeds, crop-weed completion, factors of competition, factors affecting growth and development. Weed flora shifts. Concepts of weed management: physical, cultural, chemical and biological; principles and methods, integrated weed management. Robotic weed control, weed management in organic/ natural farming. Herbicide classification and properties of important herbicides, concept of adjuvants, surfactants, herbicide formulation and their use, Nano herbicides, precision weed management; Mode of action of herbicides and selectivity phenomenon. Concept of herbicide mixture and utility in agriculture, Herbicide compatibility with agro-chemicals and their application, Herbicide resistance and its management. Weed management in different field and horticultural crops, weed management in cropping systems.
	Practical:
	Weed identification, Biology of important weeds. Techniques of weed preservation. Study weeds in different situations, Study of herbicide formulations and mixture of herbicide. Study methods of herbicide application, Herbicide application equipment their parts, use, maintenance and calibration. Weed control implements, Calculation of herbicide doses and requirement, weed control efficiency and weed index, Phytotoxicity of herbicides, Weed management in fallow lands, Management of problem and parasitic weeds.
8.	**AGRON 5.7 Introductory Agroforestry 2(1+1)**
	Agro-forestry**:** Definition and scope of Agroforestry system, Type of Agroforestry system, potential of Agroforestry in India, Prevailing agroforestry system in India, MPTS- definition, role of MPTS in agroforestry system, its selection for different agroforestry system, MPTS of NE India, Ecological aspects of Agroforestry system, tree -crop interaction – competition, nutrient recycling, Traditional Agroforestry as a viable choice to conserve Agro biodiversity in India. Management of Agro-forestry system**,** Role of agroforestry in soil and water conservation, windbreak, shelterbelt–definition, objectives., Socio- economic aspects of Agroforestry system, Design and Diagnostic study of agroforetry system, Silviculture**:** Defination and scope of silviculture system, Propagation of tree species**,** Regeneration by seed, coppice, root suckers, Transplanting, stamp, branch cutting, rhizomes, Nursery bed preparation and management, Cultural practices for bare root and seedling, field handling of nursery stock, Management of tree species**,** Silviculture of important tree species, choice of species- site factors, root, crown and bole characteristics, phenology ,nutritional and water requirement, ground operation, tending, harvesting utility etc.
	Practical:
	Study of tree growth measurement, Study of environmental parameters affecting AF System. Plant propagation methods, Pre-sowing seed treatment, preparation of nursery bed exercise, practicing students experience in vegetation, aforestation method, practical training, pruning, coppicing, pollarding etc. natural and artificial regeneration. Design and diagnostic survey of agro-forestry system. Evaluation of agro-forestry system in different agro climatic zones. Exposure Visit to prevailing agroforestry systems of the state and related important institutions.
9.	**AGRON 6.8 Dry land agriculture/ Rainfed agriculture and watershed management 2(1+1)**
	Theory:
	Dryland/Rainfed agriculture: Introduction, types and characteristics; History of dry land/rainfed agriculture in India; Problems and prospects of dry land/rainfed agriculture in India ; Soil and climatic conditions prevalent in dry land/rainfed areas; Soil and water conservation techniques, Drought: types, effect of water deficit on physiological/morphological characteristics of the

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	plants, Crop adaptation and mitigation to drought; Water harvesting: importance, its techniques, Efficient utilization of water through soil and crop management practices, Crops and cropping systems in dry land/rainfed areas; Management of crops in dry land/rainfed areas, Contingent crop planning for aberrant weather conditions, Concept, history, objective, principles and components of watershed management, factors affecting watershed management.
	Practical:
	Studies on climate classification, studies on rainfall pattern in rainfed areas of the country and pattern of onset and withdrawal of monsoons. Studies on cropping pattern of different rainfed areas in the country and demarcation of rainfed area on map of India. Interpretation of meteorological data and scheduling of supplemental irrigation on the basis of evapo-transpiration demand of crops. Critical analysis of rainfall and possible drought period in the country. Effective rainfall and its calculation. Studies on cultural practices for mitigating moisture stress including mechanical and agronomic measure. Soil moisture determination under different land situations, Importance of seed priming to mitigate drought. Assessment of meteorological drought. Characterization and delineation of model watershed. Field demonstration on soil & moisture conservation measures. Field demonstration on construction of water harvesting structures. Visit to rainfed research station/watershed.

2.	**SOIL SCIENCE**
1.	**SOIL 1.1 Fundamentals of Soil Science 3(2+1)**
	Theory:
	Soil: Pedological and edaphalogical concepts. Rocks and minerals, weathering, Silicate clays: constitution and properties, sources of charge, ion exchange, cation and anion exchange capacity and base saturation (after buffering capacity), Soil formation, Soil organic matter, Pedogenic processes, Soil colloids: inorganic and organic, Properties of soil colloids and Ion exchange in soils, Soil profile, soil texture, soil structure. Bulk density and particle density, soil consistency, soil temperature, soil air, soil water. Soil reaction and buffering capacity. Soil taxonomy, keys to soil orders. Soils of India.
	Practical:
	Study of general properties of minerals, study of minerals-silicate and non-silicate minerals, study of rocks-igneous, sedimentary and metamorphic rocks; study of a soil profile, collection and processing of soil for analysis, study of soil texture-feel method, mechanical analysis, determination particle density and soil porosity, determination of soil colour, study of soil structure and aggregate analysis, determination of soil moisture, determination of soil moisture constants, field capacity, water holding capacity. Study of infiltration rate of soil, determination of pH and Electrical conductivity of soil.
2.	**SOIL 2.2 Soil Fertility Management 3(2+1)**
	Theory:
	History of soil fertility and plant nutrition. criteria of essentiality. role, deficiency and toxicity symptoms of essential plant nutrients, Mechanisms of nutrient transport to plants, factors affecting nutrient availability to plants. Chemistry of macro and micronutrients. Soil fertility evaluation, Soil testing. Critical levels of different nutrients in soil. Forms of nutrients in soil, plant analysis, rapid plant tissue tests. Indicator plants. Introduction and importance of manures and fertilizers. Fertilizer recommendation approaches. Integrated nutrient management. Chemical fertilizers: classification, composition and properties of major fertilizers, secondary and micronutrient fertilizers, Complex fertilizers, Customized fertilizers, water soluble fertilizers nano fertilizers Soil amendments, Fertilizer Storage, Fertilizer Control Order. Methods of fertilizer recommendations to crops. Factor influencing nutrient use efficiency (NUE), methods of application under rainfed and irrigated conditions. STCR/RTNM/ IPNS,

	Carbon sequestration and Carbon Trading, Preparation and properties of major manures (FYM, Compost, Vermicompost, Green manuring, Oilcakes).
	Practical:
	Introduction of analytical instruments and their principles, calibration and applications of Colorimetry and flame photometry; Estimation of alkaline hydrolysable N in soils; Estimation of soil extractable P in soils; Estimation of exchangeable K in soils; Estimation of exchangeable Ca and Mg in soils; Estimation of soil extractable S in soils; Estimation of DTPA extractable Zn in soils; Estimation of N in plants; Estimation of P in plants; Estimation of K in plants; Estimation of S in plants.
3.	**SOIL 4.3 Problematic Soils and their management 2(1+1)**
	Theory:
	Soil quality and health, Distribution of Waste land and problem soils in India, Categorization of Problem soils based on properties. Reclamation and management of Acid soils, Saline, Sodic soils, Acid Sulphate soils, Eroded and Compacted soils, polluted soils. Contaminated soils (Pesticide contamination, Heavy metal contamination), Mined soils (Coal mined, Oil mined), Management of Riverine soils, Waterlogged soils, Irrigation water – quality and standards, utilization of saline water in agriculture. Use of Remote sensing and GIS in diagnosis and management of problem soils. Irrigation and water quality. Multipurpose tree (MPT) species, bio remediation through MPTs of soils, land capability and classification, land suitability classification.
	Practical:
	Determination of pHs and EC of saturation extract of problematic soil. Determination of redox potential in soil, Estimation of water soluble and exchangeable cations in soil and computation of SAR and ESP and characterization of problematic soil. Determination of Gypsum requirement of alkali / sodic soil. Determination of lime requirement of acidic soil. Determination of Quality of irrigation water (pH, EC, Ca, Mg, Na, CO_3, HCO_3, Cl, SAR and RSC), Determination of nitrate (NO3-) from irrigation water, Determination of dissolved oxygen and free carbon dioxide levels in water samples.

3. HORTICULTURE	
1.	**HORT 1.1 Fundamentals of Horticulture 3(2+1)**
	Theory:
	Horticulture: Its different branches, importance and scope, Horticulture and botanical classification, soil and climate for horticultural crops. Plant propagation: methods and propagation structures, seed dormancy and seed germination, Merits and demerits of sexual and asexual propagation Stock-scion relationship. Principles of orchard establishment, principles and methods of training and pruning of fruit crops, Juvenility and flower bud differentiation, unfruitfulness in horticultural crops, pollination, pollinizers and pollinators, fertilization and parthenocarpy, importance of bio regulators in horticultural crops, irrigation and its methods, Fertilizer application in horticultural crops.
	Practical:
	Identification and nomenclature of fruit, Layout of an orchard, pit making and system of planting, Nursery raising techniques of fruit crops, Understanding of plant propagation structures, Propagation through seeds and plant parts, Propagation techniques for horticultural crops, Container, potting mixture, potting and repotting, Training and pruning methods on fruit crops, Preparation of fertilizer mixture and application, Preparation and application of PGR,

	Layout of different irrigation systems, Maturity studies, harvesting, grading, packaging and storage.
2.	**HORT 3.2 Production Technology of Fruit and Plantation Crops 2(1+1)**
	Theory:
	Production status of fruit and plantation crops: Importance and scope of fruit and plantation crop industry in India; nutritional value of fruit crops; classification of fruit crops; area, production, productivity and export potential of fruit and plantation crops. Crop production techniques in tropical, sub-tropical and temperate fruit crops: Climate and soil requirements, varieties, propagation and use of rootstocks, planting density and systems of planting: High density and ultra-high density planting, cropping systems, after care – training and pruning; water, nutrient and weed management, fertigation, special horticultural techniques, plant growth regulation, important disorders, maturity indices and harvest, value addition. Fruit crops: mango, banana, papaya, guava, sapota, citrus, grape, litchi, pineapple, pomegranate, apple, pear, peach, strawberry, nut crops Jackfruit and minor fruits- date, ber, apple, plantation crops-coconut, arecanut, cashew, tea, coffee and rubber. Crop production techniques in palms and plantation crops: Climate and soil requirements, varieties, propagation, nursery management, planting and planting systems, cropping systems, after care, training and pruning for plantation crops, water, nutrient and weed management, intercropping, multi-tier cropping system, mulching, special horticultural practices, maturity indices, harvest and yield, pests and diseases, processing- value addition Palms: Coconut, Arecanut, Oil palm and Palmyrah, Plantation crops: Tea, Coffee, Cocoa, Cashewnut, Rubber.
	Practical:
	Propagation techniques, selection of planting material, varieties, important cultural practices for mango, banana, papaya, guava, sapota, grapes, Citrus (mandarin and acid lime), pomegranate, jackfruit, preparation and application of PGR's for propagation, Micro propagation, protocol for mass multiplication and hardening of fruit crops, Identification and description of varieties, mother palm and seed nut selection, nursery practices, seedling selection, fertilizers application, nutritional disorders, pests and diseases of Coconut, Arecanut and cocoa, Tea and coffee, Rubber and cashew, Visit to commercial orchard and plantation industries.
3.	**HORT 4.3 Production Technology of Vegetables and Spices 2(1+1)**
	Theory:
	Importance of vegetables and spices in human nutrition and national economy, kitchen gardening, brief about origin, area, climate, soil, improved varieties and cultivation practices such as time of sowing, transplanting techniques, planting distance, fertilizer requirements, irrigation, weed management, harvesting and yield, physiological disorders of important vegetable and spices (tomato, okra, brinjal, chili, capsicum, cucumber, bitter gourd , bottle gourd, sweet potato, cassava and moringa, pumpkin, French bean, peas; cole crops such as cabbage, cauliflower, knol-khol; bulb crops such as onion, garlic; root crops such as carrot, radish, beetroot; tuber crops such as potato; leafy vegetables such as amaranth, palak, perennial vegetables, spice crops like turmeric, zinger, garlic, coriander, cumin, black pepper, cardamom, fenugreek, fennel, clove, nutmeg, cinnamon, curry leaf, tamarind and herbal spices).
	Practical:
	Identification of vegetables and spice crops and their seeds. Description of varieties. Propagation methods - rapid multiplication techniques - seed collection and extraction. Nursery raising. Direct seed sowing and transplanting. Study of morphological characters of different vegetables and spices. Fertilizers applications. Harvesting and post-harvest practices, Economics of vegetables and spices cultivation, visit to spice gardens.
4.	**HORT 6.4 Ornamental Crops, MAPs, and Landscaping 2(1+1)**
	Theory:
	Production technology of ashwagandha, costus, isabgol and geranium; Production technology of mint, aloe and ocimum, Coleus, Glory lily, Periwinkle etc.; Production technology of plants like lemongrass, citronella, vetiver and palmarosa etc., Importance and scope of ornamental

	crops; Importance and scope of medicinal and aromatic plants and landscaping; Principles of landscaping; Landscape uses of trees, shrubs and climbers, Production technology of important cut flowers like rose, gerbera and orchids; Production technology of gladiolus, tuberose and lilium; Production technology of chrysanthemum and carnation; Package of practices for loose flowers like marigold and jasmine under open conditions; Brief concept of Home landscaping, Carpet bedding, Topiary, Bonsai, Lawn, flower arrangement, Herbaceous Border, Hedge, Edge, arch, pergola, flower bed, shrubbery, annual mixed border, mixed border, garden wall, fencing, drives and path, steps, terraces etc.; Processing and value addition imp ornamental crops; Processing and value addition of MAPs produce.
	Practical:
	Identification MAPs and Ornamental plants (trees, shrubs, climbers, seasonal flower and house plants). Propagation of MAP, Bed preparation and planting of MAP; Nursery bed preparation and sowing of seasonal flower seeds; Propagation of ornamental plants by terminal/herbaceous cuttings; Propagation of Anthurium and orchids; Propagation of bougainvillea; Planting of gerbera suckers; Gladiolus corms; Establishment and maintenance of lawn; Preparation of flower preservatives and their use in extending the vase life of cut flowers; Training and pruning of ornamental plants and raising of hedge and edge; Planning and layout of garden.

4. Genetics and Plant Breeding	
1.	**GPB 3.1 Principles of Genetics 3(2+1)**
	Theory: Pre and post Mendelian concepts of heredity, Mendelian principles of heredity, Study of model organisms (Drosophila, Arabidopsis, Garden pea, E. coli, and mice), Architecture of chromosomes, chromonemata, chromosome matrix, chromomeres, centromere, secondary constriction and telomere, Special types of chromosomes, Chromosomal theory of inheritance, Cell cycle and Cell division: mitosis and meiosis. Probability and Chi-square test. Dominance relationships, Epistatic interactions with examples. Multiple alleles, pleiotropism and pseudo alleles, Sex determination and sex linkage, sex limited and sex influenced traits, Blood group genetics, Linkage and its estimation, crossing over mechanism, chromosome mapping, Structural and numerical variations in chromosomes and their implications, Use of haploids, dihaploids and double haploids in genetics, Mutation, classification, Methods of inducing mutations, mutagenic agents and induction of mutation. Detection of mutation. Qualitative and quantitative traits, Polygenes and continuous variations, multiple factor hypothesis, Cytoplasmic inheritance, Nature, structure and replication of genetic material, Types of DNA and RNA, Protein synthesis, Transcription and Translational mechanism of genetic material, Gene concept: Gene structure, function and regulation, Lac and Trp. operons. **Practical:** Study of microscope, Study of cell structure, Mitosis and Meiosis cell division, Experiments on monohybrid, dihybrid, trihybrid, test cross and back cross, Experiments on epistatic interactions including test cross and back cross, Practice on mitotic and meiotic cell division, Experiments on probability and chi-square test, Determination of linkage and crossing over analysis (through two-point test cross and three-point test cross data), Study on sex-linked inheritance in Drosophila, Study on models on DNA and RNA structures.
2.	**GPB 4.2 Basics of Plant Breeding 3(2+1)**
	Theory: Historical development, concept, nature and role of plant breeding, major achievements and future prospects; Genetics in relation to plant breeding, modes of reproduction and apomixes, Plant genetic resources, Self-incompatibility and Male-sterility-genetic consequences, cultivar

	options, Domestication, Acclimatization and Introduction; Centres of origin/diversity, Components of Genetic variation; Heritability and genetic advance; Pre-breeding and Universal Plant Breeder's equation. Genetic basis and breeding methods in self-pollinated crops: mass and pureline selection, hybridization techniques and handling of segregating population; Multiline concept, Concepts of population genetics and Hardy-Weinberg Law, Genetic basis and methods of breeding cross-pollinated crops, modes of selection; Population movement schemes: Ear to Row method, Modified Ear to Row, recurrent selection schemes; Heterosis and inbreeding depression, development of inbred lines and hybrids, composite and synthetic varieties; Breeding methods in asexually propagated crops, clonal selection and hybridization; Maintenance of breeding records and data collection; Wide hybridization and pre-breeding; Polyploidy in relation to plant breeding, Mutation breeding: methods and uses; Breeding for important biotic and abiotic stresses; Biotechnological tools: DNA markers and marker assisted selection. Participatory plant breeding; Variety Release and notification. Intellectual Property Rights, Patenting, Plant Breeders & Farmer's Rights. Speed breeding. **Practical:** Plant Breeder's kit, Study of germplasm of various crops, Study of floral structures of self-pollinated and cross-pollinated crops, Emasculation and hybridization techniques in self and cross pollinated crops, Consequences of inbreeding on genetic structure of resulting populations, Study of male sterility system, Handling of segregating populations, Estimation of heterosis and inbreeding depression, Designs used in plant breeding experiments, Analysis of Randomized Block Design, Methods of calculating mean, range, variance, standard deviation, heritability and genetic advance. To work out the mode of pollination in a given crop and extent of natural out-crossing, Prediction of performance of double cross hybrids. Maintenance of breeding records and data collection, Screening tests for biotic and abiotic stresses.
3.	**GPB 5.3 Crop Improvement (*Kharif* Crops) - I 2(1+1)**
	Theory: Botanical name, family, Chromosome number,centre of origin, distribution of species, wild relatives in different cereals; pulses; oilseeds; fibres; fodders and cash crops; vegetable and other horticultural crops (**Selected Crops:** Rice, Maize, Sorghum, Pearl Millet, Ragi, Pigeopea, Mungbean, Urdbean, Cowpea, Soybean, Groundnut, Sesame, Castor, Cotton, Tobacco, Okra, Bottle gourd, Bitter gourd, Ridge gourd, Smooth gourd and Cucumber), Plant genetic resources, its utilization and conservation, Study of genetics of qualitative and quantitative characters; Important concepts of breeding self-pollinated, cross-pollinated and vegetatively propagated crops. Major breeding objectives including quality parameters) and procedures including conventional and modern innovative approaches for development of hybrids and varieties for yield, adaptability, stability, abiotic and biotic stress tolerance and quality (physical, chemical, nutritional); International, National and State level research station and varieties and hybrids released for selected crops, Hybrid seed production technology in Maize, Rice, Sorghum, Pearl Millet, Pigeonpea, Cotton and Castor etc. Ideotype concept of Rice, Pigeonpea and Cotton, Climate resilient crop varieties for future. **Practical:** Botany of crops, Floral biology, emasculation and hybridization techniques in different crop species *viz*. Rice, Maize, Sorghum, Pearl Millet, Ragi, Pigeopea, Mungbean, Urdbean, Cowpea, Soybean, Groundnut, Sesame, Castor, Cotton, Tabacco, Okra and cucurbitaceous crops (Bottle gourd, Bitter gourd, Ridge gourd, Smooth gourd and Cucumber). Maintenance breeding of different *kharif* crops. Handling of germplasm and segregating populations by different methods like pedigree, bulk and single seed decent methods; Study of field techniques for seed production and hybrid seed production in *kharif* crops (Maize, Rice, Sorghum, Pearl Millet,

	Pigeonpea, Cotton and Castor); Layout of field experiments; Study of quality characters, donor parents for different characters; Visit to seed production plots; Visit to AICRP breeding plots of different crops.
4.	**GPB 6.4 Crop Improvement (*Rabi* Crops) - II 2(1+1)**
	Theory: Botanical name, family, Chromosome number, centre of origin, distribution of species, wild relatives in different cereals; pulses; oilseeds; fibres; fodders and cash crops; vegetable and other horticultural crops (**Selected Crops:** Wheat, Barley, Oat, Chickpea, Garden pea, Indian bean, Rapeseed and Mustard, Sunflower, Potato, Lucerne, Sugarcane, Tomato, Brinjal, Chillies, Onion, Garlic, Cumin, Coriander), Plant genetic resources, its utilization and conservation, Study of genetics of qualitative and quantitative characters; Important concepts of breeding self-pollinated, cross-pollinated and vegetatively propagated crops. Major breeding objectives including quality parameters) and procedures including conventional and modern innovative approaches for development of hybrids and varieties for yield, adaptability, stability, abiotic and biotic stress tolerance and quality (physical, chemical, nutritional); International, National and State level research station and varieties and hybrids released for selected crops, Hybrid seed production technology in Wheat, Rapessed-Mustard, Sunflower, Tomato, Brinjal, Onion etc. Ideotype concept of Wheat, Mustard and Tomato, Climate resilient crop varieties for future. **Practical:** Botany of crops, Floral biology, emasculation and hybridization techniques in different crop species viz. Wheat, Barley, Oat, Chickpea, Garden pea, Indian bean, Rapeseed and Mustard, Sunflower, Potato, Lucerne, Sugarcane, Tomato, Brinjal, Chillies, Onion, Garlic, Cumin, Coriander etc. Study of field techniques for seed production and hybrid seed production in rabi crops (Mustard, Sunflower, Tomato, Brinjal, Onion), Study of quality characters, donor parents for different characters; Visit to seed production plots; Visit to AICRP breeding plots of different crops.
5.	**GPB 6.5 Fundamentals of Seed Science and Technology 2(1+1)**
	Theory: Introduction to seed technology, definition and importance. Seed quality - definition, characters of good quality seed, Causes of deterioration of varietal purity and assessment of genetic purity, different classes of seed. Foundation and certified seed production of important cereals, pulses and oilseed, field inspection, importance and procedures, Post-harvest seed quality management, seed processing procedures, seed drying. Seed treatment, its importance, method of application and seed packing; Seed storage - general principles, stages and factors affecting seed longevity during storage, Seed health management during storage. Seed Certification and Legislation, Seed Act and Seed Act enforcement, Duty and powers of Seed Inspector, offences and penalties. Seeds Control Order 1983, Basics of seed quality testing. New Seed Bill 2019; Seed quality enhancement techniques, OECD seed certification scheme. **Practical:** Seed Structure, Seed sampling, Physical purity, Moisture determination, Germination test, Seed and seedling vigour test, Seed Viability, Genetic purity test: Grow out test, Field inspection, Seed health testing using blotter and agar plate method. Seed priming, Seed pelleting. Visitto seed production farms, seed testing laboratories and seed processing plant.

5. Entomology	
1.	**ENT 1.1 Fundamentals of Entomology 3(2+1)**
	Theory History of Entomology in India. Basics of Entomology and Insect. Major points related to dominance of Insects in Animal kingdom. Classification of phylum Arthropoda up to classes. Relationship of class Insects with other classes of Arthropoda. Morphology: Structure and functions of insect cuticle and moulting. Body segmentation. Structure of head, thorax and abdomen. Structure and modifications of insect antennae, mouth parts, legs, Wing venation, modifications and wing coupling apparatus. Metamorphosis and diapause in insects. Types of larvae and pupae. Structure and functions of digestive, circulatory, excretory, respiratory, nervous, secretary (Endocrine) and reproductive system, in insects. Types of reproduction in insects. Major sensory organs. Systematics: Taxonomy – importance, history and development and binomial nomenclature. Definitions of Biotype, Sub-species, Species, Genus, Family and Order. Classification of class Insecta up to Orders, basic groups of present day insects with special emphasis to orders and families of Agricultural importance like Orthoptera: Acrididae, Tettigoniidae, Gryllidae, Gryllotalpidae; Dictyoptera: Mantidae, Blattidae; Odonata; Isoptera: Termitidae; Thysanoptera: Thripidae; Hemiptera: Pentatomidae, Coreidae, Cimicidae, Pyrrhocoridae, Lygaeidae, Cicadellidae, Delphacidae, Aphididae, Coccidae, Lophophidae, Aleurodidae, Pseudococcidae; Neuroptera: Chrysopidae; Lepidoptera: Pieridae, Papiloinidae, Noctuidae, Sphingidae, Pyralidae, Gelechiidae, Arctiidae, Saturnidae, Bombycidae; Coleoptera: Coccinellidae, Chrysomelidae, Cerambycidae, Curculionidae, Bruchidae, Scarabaeidae; Hymenoptera: Tenthridinidae, Apidae. Trichogrammatidae, lchneumonidae, Braconidae, Chalcididae; Diptera: Cecidomyiidae, Tachinidae, Agromyziidae, Culicidae, Muscidae, Tephritidae. **Practical** Methods of collection and preservation of insects including immature stages; External features of Grasshopper/Blister beetle; Types of insect antennae, mouthparts and legs; Wing venation, types of wings and wing coupling apparatus. Types of insect larvae and pupae; Dissection of digestive system in insects (Grasshopper); Study of characters of orders Orthoptera, Dictyoptera, Odonata, Isoptera, Thysanoptera, Hemiptera, Lepidoptera, Neuroptera, Coleoptera, Hymenoptera, Diptera and their families of agricultural importance.
2.	**ENT 5.2 Pest management in Crops and Stored Grains 3(2+1)**
	Theory General description on nature and type of damage by different arthropod pests; Scientific name, order, family, host range, distribution, biology and bionomics; Nature of damage and management of major insect pests of various Field crops *viz.*, Cotton, sugarcane, tobacco, maize, bajra, sorghum, paddy, wheat, millets, pigeonpea, chickpea, cowpea, green gram, groundnut, castor, mustard, soyabean, sesame, sunflower etc., Vegetable crops *viz.*, Brinjal, okra, potato, tomato, chilli, cruciferous and cucurbits, onion, garlic and reddish etc. Fruit crops *viz.*, Mango, sapota, citrus, guava, pomegranate, custard apple, ber, aonla, banana, papaya, cashew etc. Plantation crops *viz.*, Coconut, datepalm etc. Ornamental crops *viz.*, rose, marigold, lily etc. Spices and condiments *viz.*, cumin, fennel, coriander, fenugreek, ginger, turmeric etc. Structural entomology and important household pests, their nature of damage and management. Factors affecting loss of stored grains. Insect pests, mites, rodents, birds and microorganisms associated with stored grains and their management. Storage structures and methods of grain storage and

	fundamental principles of stored grains management. Management of non insect pest of mites, snails and slugs, Concept of IPM, Practices, scope and limitations of IPM. Classification of insecticides, toxicity of insecticides and formulations of insecticides, Biorational pesticides including insect repellents, antifeedants, Use of drones and AI in pest management, **Practical** Field visit, identification of major insect pests and their damage symptoms. Collection and preservation of major insect pests; collection of damage samples, their identification and herbarium preparation. Methods of monitoring of pest incidence *in situ*. Management strategies of insect pests of different crops. Study on structural entomology and household pests. Storage structures and methods of grain storage. Spraying techniques for selected field and horticultural crops. Vertebrate pest management, Mass multiplication of NPV and entomopathogenic nematodes.

6. Plant Pathology	
1.	**PL. PATH 2.1 Fundamentals of Plant Pathology 3(2+1)**
	Theory Introduction to Plant Pathology: Concept of disease in plants; Different terms used in Plant Pathology, History of Plant Pathology with special references to India; Causes of plant disease: Inanimate and animate causes; Classification of plant disease; Parasitism and pathogenesis; Development of disease in plants: Disease Triangle, Disease cycle; Fungi and their morphology, reproduction and classification of fungi; Bacteria: Morphology, reproduction classification of phytopathogenic bacteria; Other plant pathogens: Mollicutes; Flagellant protozoa; FVB; Green algae and parasitic higher plants; Viruses and viroids, virus transmission; Principles of Plant disease management: Disease management with chemicals, Host resistance, cultural and biological method of Integrated Disease Management (IDM). **Practical** Study of the microscope; Acquaintance with laboratory material and equipment; Study of different plant disease symptoms; Microscopic examination of general structure of fungi; Simple staining of bacteria: Direct and indirect staining, Gram staining of bacteria; Microscopic examination of fungal diseased specimen; Microscopic examination of bacterial diseased specimen; Preparation of culture media; Isolation of plant pathogens: Fungi, bacteria and viruses; Purification of plant pathogens; Study on plant disease diagnosis: Koch's Postulates, Characteristics, formulation, methods of application and calculation on fungicides.
2.	**PL. PATH 5.2 Diseases of Field & Horticultural Crops & their Management 3(2+1)**
	Theory Symptoms, etiology, disease cycle, epidemiology and management of major diseases of the following field and horticultural crops: Field crops- Rice (blast, brown spot, sheath blight, false smut, bacterial leaf blight, bacterial leaf streak, tungro, khaira); Wheat (rusts, loose smut, Karnal bunt); Maize (banded leaf and sheath blight, southern and northern blight, downy mildew); Sorghum (smuts, grain mold, anthracnose); Bajra (downy mildew, ergot) and Finger millet (blast, leaf spot); Groundnut (early and late leaf spots, rust, wilt and **collar rot**); Soybean (rhizoctonia blight, bacterial spot, seed and seedling rot, mosaic); Grams (Ascochyta blight, wilt, grey mold); Pea (downy mildew, powdery mildew, rust); Black gram and Green gram (web blight, Cercospora leaf spot, anthracnose, yellow mosaic); Sugarcane (red rot, smut, grassy shoot, ratoon stunting, Pokah Boeng); Mustard (Alternaria blight, white rust, downy mildew, sclerotinia stem rot) and Sunflower (sclerotinia stem rot, Alternaria blight); Cotton (anthracnose, vascular wilts, black arm and **leaf spot**). Castor (Wilt and root rot), Tobacco (Damping off, mosaic virus, ring spot virus, leaf curl, frog eye leaf spot, leaf blight and sore skin) pigeon pea (Wilt, dry root rot, leaf spot, powdery mildew, sterility mosaic and phytophthora blight; Horticultural crops: Citrus (canker, gummosis) and Guava (wilt,

	anthracnose); Banana (sigatoka, Panama wilt, bacterial wilt, bunchy top); Papaya (foot rot, leaf curl, mosaic) and Pomegranate (bacterial blight); Apple (scab, powdery mildew, fire blight, crown gall) and Peach (leaf curl); Grapevine (downy mildew, powdery mildew, anthracnose) and Strawberry (leaf spot); Coconut (bud rot, Ganoderma wilt), Tea (blister blight) and Coffee (rust); Mango (anthracnose, malformation, bacterial blight, powdery mildew); date palm (Bayoud or wilt, Graphiola leaf spot**,** leaf spot, Lethal yellowing), dragon fruit(rust, fruit and stem rot, sun scale) Potato (early and late blight, black scurf, leaf roll, mosaic and scab) and Tomato (damping off, wilt, early and late blight, leaf curl, mosaic); sugar beet(leaf spot, downy mildew, powdery mildew, root rot, and yellow virus); Brinjal (phomopsis blight and fruit rot, sclerotinia blight) and Chilli (anthracnose and fruit rot, wilt, leaf curl); Cucurbits (powdery and downy mildew, wilts) and Cruciferous vegetables (Alternaria leaf spot, black rot, cauliflower mosaic); Beans (anthracnose, bacterial blight) and Okra (yellow vein mosaic, enation leaf curl and leaf spots); Onion and garlic (lead blotch, smudge, smut, bulb rot), Ginger (soft rot), Turmeric (leaf Spot) and Coriander (stem gall and powdery mildew); cumin (Wilt, blight and powdery mildew); fenugreek (powdery mildew); Rose (dieback, powdery mildew, black leaf spot) and Marigold (botrytis blight, leaf spots) chrysanthemum (Fungal Blight and leaf spots, bacterial blight and leaf spot, rust, wilt, powdery mildew, stunt and virus diseases) . **Practical** To study the symptoms of different diseases of field and horticultural crops: Blast and brown spot of rice, sheath blight and bacterial leaf blight of rice, downy mildew and powdery of cucurbits, rhizoctonia and Cercospora leaf spot of green gram / black gram, Alternaria blight and downy mildew of mustard, early blight of late blight of potato and tomato, Phomopsis blight of brinjal, powdery mildew and rust of pea, stem gall of coriander, anthracnose and fruit rot of chilli, taphrina leaf spot of turmeric, red rot of sugarcane, acquaintance with fungicides, antibiotics and biopesticides and their use in management of diseases of horticultural crops. Identification and histopathological studies of selected diseases of field and horticultural crops covered in theory. Field visit for the diagnosis of field problems, Collection and preservation of plant diseased specimens for herbarium.
3.	**PL. PATH 6.3 Agricultural Microbiology and Phyto-remediation 2(1+1)**
	Theory Introduction to Microbiology: Definition, applied areas of Microbiology and Importance of Microbiology. History of Microbiology: Discovery of microorganisms, spontaneous generation theory, Germ theory of diseases, Immunization, fermentation, and origin of life**.** Bacteria: cell structure, chemoautotrophy, photo autotrophy, growth. Bacterial genetics: Genetic recombination- transformation, conjugation and transduction, genetic engineering. Soil Microbiology: Nutrient mineralization and transformation**,** Air Microbiology: Phyllosphere microflora, Phylloplane microflora, microflora of floral parts etc. Industrial Microbiology: Microbial products, Biodegradation, Biogas production, Biodegradable plastics etc. Biological control: Microbial biopesticides for plant disease management Concepts of rhizosphere microbiology- Rhizodeposits-Biochemical nature, release mechanism in rhizosphere, function, Carbon flow in rhizosphere, Rhizosphere microbiome residents and their roles. Potential of plant growth promoting rhizobacteria (PGPR) and endophytes on soil health and sustainability**.** Bioremediation of polluted soils using microbial mediators**.** Phytoremediation of polluted soils**.** **Practical** Study of the microscope; Acquaintance with laboratory material and equipment; Microscopic observation of different groups of microorganisms: moulds (Fungi); Direct staining of bacteria by crystal violet; Negative or indirect staining of bacteria by nigrosin; Gram staining of bacteria; Study of phyllosphere and rhizosphere microflora; Measurement of microorganisms; Preparation of culture media; Isolation and purification of rhizospheric microbes; Isolation and

	purification of N-fixers; Isolation and purification of Nutrient solubilizers; Isolation and purification of Endophytes.

7. Extension Education	
1.	**EXTN 1.1 Rural Sociology and Educational Psychology 2(2+0)**
	Extension Education and Agricultural Extension: Meaning, definition, scope, and importance. Sociology and rural sociology: Meaning, definition, scope, importance of rural sociology in Agricultural Extension, and interrelationship between rural sociology and Agricultural Extension. Indian Rural Society: important characteristics, differences and relationship between rural and urban societies. Social Groups: Meaning, definition, classification, factors considered information and organization of groups, motivation in group formation and role of social groups in Agricultural Extension. Social Stratification: Meaning, definition, functions, basis for stratification, forms of social stratification- characteristics and- differences between class and caste system. Cultural concepts: culture, customs, folkways, mores, taboos, rituals. Traditions: Meaning, definition and their role in Agricultural Extension. Social Values and Attitudes: Meaning, definition, types and role of social values and attitudes in agricultural Extension. Social Institutions: Meaning, definition, major institutions in rural society, functions, and their role in agricultural Extension. Social Organizations: Meaning, definition, types of organizations and role of social organizations in agricultural Extension. Social Control: Meaning, definition, need of social control and means of social control. Social change: Meaning, definition, nature of social change, dimensions of social change and factors of social change. Leadership: Meaning, definition, classification, roles of leader, different methods of selection of professional and lay leaders. Training of Leaders: Meaning, definition, methods of training, Advantages and limitations in use of local leaders in Agricultural Extension, Psychology and educational psychology: Meaning, definition, scope, and importance of educational psychology in Agricultural Extension. Teaching: Learning process: Meaning and definition of teaching, learning, learning experience and learning situation, elements of learning situation and its characteristics. Principles of learning and their implication of teaching.
2.	**EXTN 3.2 Fundamentals of Extension Education2(1+1)**
	Theory Education: Meaning, definition and Types; Extension Education: meaning, definition, scope and process; objectives and principles of Extension Education; Extension Programme planning: Meaning, Process, Principles and Steps in Programme Development. Extension systems in India: extension efforts in pre-independence era (Sriniketan, Marthandam, Firka Development Scheme, Gurgaon Experiment, etc.) and post-independence era (Etawah Pilot Project, Nilokheri Experiment, etc.); Reorganised Extension System (T&V system) various extension/ agriculture development programs launched by ICAR/ Govt. of India (IADP, IAAP, HYVP, KVK, IVLP, ORP, ND, NATP, NAIP, PMSNY, MGMG, KCC, ARYA, FF etc.). Social Justice and poverty alleviation programme: ITDA, IRDP/SGSY/NRLM. Women Development Programme: RMK, MSY etc. New trends in agriculture extension: privatization extension, cyber extension/ e-extension, market-led extension, farmer-led extension, expert systems, etc., Attributes of Innovation, DWCRA, Commodity Interest Groups (CIGs)., Farmers Producer Group (FPG). Rural Development: concept, meaning, definition; various rural development programs launched by Govt. of India. Community Development: meaning, definition, concept and principles, Philosophy of C.D. Extension administration: meaning and concept, principles and

	functions. Monitoring and evaluation: concept and definition, monitoring and evaluation of extension programs; transfer of technology: concept and models, capacity building of extension personnel; extension teaching methods: meaning, classification, individual, group and mass contact methods, ICT Applications in TOT (New and Social Media), media mix strategies; Agriculture journalism; diffusion and adoption of innovation: concept and meaning, process and stages of adoption, adopter categories. ATMA & ATIC- Concept, organizational structure and functions **Practical** • To get acquainted with university extension system. • Group discussion- exercise; • Identification of rural leaders in village situation; preparation • use of AV aids, • preparation of extension literature (leaflet, booklet, folder, pamphlet news stories and success stories); • Presentation skills exercise; micro teaching exercise; • A visit to village to understand the problems being encountered by the villagers/ farmers; understanding PRA techniques and their application in village development planning; • to study organization and functioning of DRDA/PRI and other development departments at district level; • visit to NGO/FO/FPO and learning from their experience in rural development; • exposure to mass media: visit to community radio and television studio for understanding the process of programme production; • script writing, writing for print and electronic media, developing script for radio and television.
3.	**AEC - I Communication skills 2(1+1)**
	Theory ***Communication Process:*** The magic of effective communication; Building self-esteem and overcoming fears; Concept, nature and significance of communication process; Meaning, types and models of communication; Verbal and non-verbal communication; Linguistic and non-linguistic barriers to communication and reasons behind communication gap/ miscommunication. ***Basic Communication Skills:*** Listening, Speaking, Reading and Writing Skills; Precis writing/ Abstracting/Summarizing; Style of technical communication Curriculum vitae/resume writing; Innovative methods to enhance vocabulary, analogy questions. ***Structural and Functional Grammar:*** Sentence structure, modifiers, connecting words and verbals; phrases and clauses; Case: subjective case, possessive case; objective case; Correct usage of nouns, pronouns and antecedents, adjectives, adverbs and articles; Agreement of verb with the subject: tense, mood, voice; Writing effective sentences; Basic sentence faults. **Practical** Listening and note taking; Writing skills: precis writing, summarizing and abstracting; Reading and comprehension (written and oral) of general and technical articles; Micro-presentations and Impromptu Presentations: Feedback on presentations; Stage manners: grooming, body language, voice modulation, speed; Group discussions; Public speaking exercises; vocabulary building exercises; Interview Techniques; organization of events.
4.	**AEC - II Personality development 2(1+1)**
	Theory Personality: Definition, Nature of personality, theories of personality and its types. The humanistic approach - Maslow's self-actualization theory, shaping of personality, determinants

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	of personality, Myers-Briggs Typology Indicator, Locus of control and performance, Type A and Type B Behaviours, personality and Organizational Behaviour. Foundations of individual behaviour and factors influencing individual behaviour, Models of individual behaviour, Perception and attributes and factors affecting perception, Attribution theory and case studies on Perception and Attribution. Learning: Meaning and definition, theories and principles of learning, Learning and organizational behaviour, Learning and training, learning feedback. Attitude and values, Intelligence- types of Intelligence, theories of intelligence, measurements of intelligence, factors influencing intelligence, intelligence and Organizational behaviour, emotional intelligence. Motivation- theories and principles, Teamwork and group dynamics. **Stress management & time management** **Practical** • MBTI personality analysis • Learning Styles and Strategies • Motivational needs • Firo-B, Interpersonal Communication • Teamwork and team building • Group Dynamics • Win-win game • Conflict Management • Leadership styles • Case studies on Personality and Organizational Behavior. • Modules as given in the IPDC workbook-1

8. Agricultural Meteorology	
1.	**VAC – I Environmental Studies and Disaster management 3(2+1)**
	Theory Introduction to Environment - Environmental studies - Definition, scope and importance - Multidisciplinary nature of environmental studies - Segments of Environment - Spheres of Earth - Lithosphere - Hydrosphere - Atmosphere - Different layers of atmosphere. Natural Resources: Classification - Forest resources. Water resources. Mineral resources. Introduction to Environment - Environmental studies -Definition, scope and importance - Multidisciplinary nature of environmental studies - Segments of Environment - Spheres of Earth - Lithosphere - Hydrosphere - Atmosphere - Different layers of atmosphere. Natural Resources: Classification - Forest resources. Water resources. Mineral resources Food resources. Energy resources. Land resources. Soil resources. Ecosystems - Concept of an ecosystem - Structure and function of an ecosystem - Energy flow in the ecosystem. Types of ecosystems. Biodiversity and its conservation: Introduction, definition, types. Biogeographical classification of India. Importance and Value of biodiversity. Biodiversity hot spots. Threats and Conservation of biodiversity Environmental Pollution: Definition, cause, effects and control measures of: a. Air pollution. b. Water pollution. c. Soil pollution. d. Marine pollution. e. Noise pollution. f. Thermal pollution. h. light pollution. Solid Waste Management: Classification of solid wastes and management methods, Composting, Incineration, Pyrolysis, Biogas production, Causes, effects and control measures of urban and industrial wastes. Social issues and the Environment: Urban problems related to energy. Water conservation, rain water harvesting, watershed management. Environmental ethics: Issues and possible solutions, climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Environment Protection

	Act. Air (Prevention and Control of Pollution) Act. Water (Prevention and control of Pollution) Act. Wildlife Protection Act. Forest Conservation Act. Human Population and the Environment: Environment and human health: Human Rights, Value Education. Women and Child Welfare. Role of Information Technology in Environment and human health. Disaster management - Disaster definition - Types - Natural Disasters - Floods, drought, cyclone, earthquakes, landslides, avalanches, volcanic eruptions, Heat and cold waves. Man Made Disasters - Nuclear disasters, chemical disasters, biological disasters, building fire, coal fire, forest fire, oil fire, road accidents, rail accidents, air accidents, sea accidents. International and National strategy for disaster reduction. Concept of disaster management, national disaster management framework; financial arrangements; role of NGOs, community-based organizations and media in disaster management. Central, state, district and local administration in disaster control; Armed forces in disaster response; Police and other organizations in disaster management. **Practical** Visit to a local area to document environmental assets river/ forest/ grassland/ hill/ mountain. Energy: Biogas production from organic wastes. Visit to wind mill / hydro power / solar power generation units. Biodiversity assessment in farming system. Floral and faunal diversity assessment in polluted and un polluted system. Visit to local polluted site - Urban/Rural/ Industrial/Agricultural to study of common plants, insects and birds. Study of simple ecosystem – Visit to pond/river/hills. Visit to areas affected by natural disaster
2.	**AG. MET 5.1 Introduction to Agro-meteorology 2(1+1)**
	Theory Meaning and scope of agricultural meteorology; Earth atmosphere: its composition, extent and structure; Atmospheric weather variables; Atmospheric pressure, its variation with height; Wind, types of wind, daily and seasonal variation of wind speed, cyclone, anticyclone, land breeze and sea breeze; Nature and properties of solar radiation, solar constant, depletion of solar radiation, short wave, longwave and thermal radiation, net radiation, albedo; Atmospheric temperature, temperature inversion, lapse rate, daily and seasonal variations of temperature, vertical profile of temperature, Application of Thermal time concept and Crop/Pest weather calendar; Energy balance of earth; Atmospheric humidity, concept of saturation, vapour pressure, process of condensation, formation of dew, fog, mist, frost, cloud; Precipitation, process of precipitation, types of precipitation such as rain, snow, sleet, and hail, cloud formation and classification; Artificial rainmaking. Monsoon- mechanism and importance in Indian agriculture; Weather hazards - drought, floods, frost, tropical cyclones and extreme weather conditions such as heat-wave and cold-wave; Agriculture and weather relations; Modifications of crop microclimate, climatic normal for crop and livestock production. Weather forecasting- types of weather forecast and their uses. Climate change, climatic variability, global warming, causes of climate change and its impact on regional and national agriculture. **Practical** Visit of Agrometeorological Observatory, site selection of observatory, exposure of instruments and weather data recording. Measurement of sunshine duration, computation of Radiation Intensity using BSS; Measurement of maximum and minimum air temperatures, its tabulation, trend and variation analysis, Measurement of soil temperature and computation of soil heat flux, Determination of vapor pressure and relative humidity, Determination of dew point temperature, Measurement of atmospheric pressure and analysis of atmospheric conditions, Measurement of

	wind speed and wind direction, preparation of windrose, Measurement, tabulation and analysis of rain, Measurement of open pan evaporation and evapotranspiration, Computation of PET and AET, Use of synoptic charts, weather reports, weather forecasting-types and methods, crop weather calendar.

9. Agricultural Economics	
1.	**AG. ECON 4.1 Principles of Agricultural Economics and Farm Management2(2+0)**
	Theory Economics: Meaning, scope and subject matter, definitions, activities, approaches to economic analysis; micro- and macro-economics, positive and normative analysis. Nature of economic theory; rationality assumption, concept of equilibrium, economic laws as generalization of human behavior. Basic concepts: Goods and services, desire, want, demand, utility, cost and price, wealth, capital, income and welfare. Agricultural economics: meaning, definition, characteristics of agriculture, importance and its role in economic development. Demand: meaning, law of demand, demand schedule and demand curve, determinants, utility theory; law of diminishing marginal utility, equi-marginal utility principle. Consumer's equilibrium and derivation of demand curve, concept of consumer surplus. Elasticity of demand: concept and measurement of price elasticity, income elasticity and cross elasticity. Production: process, creation of utility, factors of production, input output relationship. Laws of returns: Law of variable proportions and law of returns to scale. Cost: Cost concepts, short run and long run cost curves. Supply: Stock v/s supply, law of supply, supply schedule, supply curve, determinants of supply, elasticity of supply. Distribution theory: meaning, factor market and pricing of factors of production. Concepts of rent, wage, interest and profit. National income: Meaning and importance, circular flow, concepts of national income accounting and approaches to measurement, difficulties in measurement. Money: Barter system of exchange and its problems, evolution, meaning and functions of money, classification of money, money supply, general price index, inflation and deflation. Economic systems: Concepts of economy and its functions, important features of capitalistic, socialistic and mixed economies, elements of economic planning. Forms of business organizations, Principles of Farm Management.
2.	**MDC - II Entrepreneurship Development and Business Communication 3(2+1)**
	Theory Development of entrepreneurship, motivational factors, social factors, environmental factors, characteristics of entrepreneurs, entrepreneurial attributes/competencies. Concept, need for and importance of entrepreneurial development. Evolution of entrepreneurship, objectives of entrepreneurial activities, types of entrepreneurs, functions of entrepreneurs, importance of entrepreneurial development, and process of entrepreneurship development. Schemes for entrepreneurship development; role of financial institutions, and other agencies in entrepreneurship development. Steps involved in functioning of an enterprise. Selection of the product / services, selection of form of ownership; registration, selection of site, capital sources, acquisition of manufacturing knowhow, packaging and distribution. Planning of an enterprise, project identification, selection, and formulation of project; project report preparation, Enterprise Management. Production management– product, levels of products, product mix, quality control, cost of production, production controls, Material management. Production management – raw material costing, inventory control. Personal management–manpower planning, labour turn over, wages / salaries. Financial management / accounting–funds, fixed

	capital and working capital, costing and pricing, long term planning and short-term planning, book keeping, journal, ledger, subsidiary books, annual financial statement, taxation. Marketing management- market, types, marketing assistance, market strategies. **Practical** Visit to small scale industries/agro-industries, interaction with successful entrepreneurs/agric-entrepreneurs. Visit to financial institutions and support agencies. Preparation of project proposal for funding by different agencies.

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3.	**MDC - III Agricultural Marketing and Trade 3(2+1)**
	Theory Agricultural Marketing: Concepts and definitions of market, marketing, agricultural marketing, market structure, marketing mix and market segmentation, classification and characteristics of agricultural markets; Demand, supply and producer's surplus of Agri commodities: nature and determinants of demand and supply of farm products, producer's surplus– meaning and its types, marketable and marketed surplus, factors affecting marketable surplus of agri-commodities; Pricing and promotion strategies: pricing considerations and approaches– cost based and competition based pricing; market promotion – advertising, personal selling, sales promotion and publicity – meaning, merits and demerits; Marketing process and functions: Marketing process concentration, dispersion and equalization; exchange functions – buying and selling; physical functions – storage, transport and processing; facilitating functions – packaging, branding, grading, quality control and labelling (Agmark); Market functionaries and marketing channels: Types and importance of agencies involved in agricultural marketing; meaning and definition of marketing channel; number of channel levels; marketing channels for different farm products; Integration, efficiency, costs and price spread: Meaning, definition and types of market integration; marketing efficiency; marketing costs, margins and price spread; factors affecting cost of marketing; reasons for higher marketing costs of farm commodities; ways of reducing marketing costs; Role of Govt. in agricultural marketing: Public sector institutions-CWC, SWC,FCI, CACP and DMI – their objectives and functions; cooperative marketing in India; Risk in marketing: Types of risk in marketing; speculation and hedging; an overview of futures trading; Agricultural prices and policy: Meaning and functions of price; administered prices; need for innovations in agricultural price policy; Trade: Concept of International Trade and its need, theories of absolute and comparative advantage. Present status and prospects of international trade in agri-commodities; WTO; Agreement on Agriculture (AoA) and its implications on Indian agriculture; IPR; Role of government in agricultural marketing; Role of APMC and its relevance in the present day context. **Practical** Plotting and study of demand and supply curves and calculation of elasticities; Study of relationship between market arrivals and prices of some selected commodities; Computation of marketable and marketed surplus of important commodities; Study of price behaviour overtime for some selected commodities; Construction of index numbers; Visit to a local market to study various marketing functions performed by different agencies, identification of marketing channels for selected commodity, collection of data regarding marketing costs, margins and price spread and presentation of report in the class; Visit to market institutions –NAFED,SWC, CWC, cooperative marketing society, etc. to study their organization and functioning. Application of principles of comparative advantage of international trade.
4.	**AG. ECON 6.2 Agricultural Finance & Cooperation 2(1+1)**
	Theory Agricultural Finance- meaning, scope and significance, credit needs and its role in Indian agriculture. Agricultural credit: meaning, definition, need, classification. Credit analysis: 4 R's, and 3C's of credits. Sources of agricultural finance: institutional and non-institutional sources, commercial banks, social control and nationalization of commercial banks. Micro financing including KCC. Lead bank scheme, RRBs, Scale of finance and unit cost. An introduction to higher financing institutions – RBI, NABARD, ADB, IMF, World bank, Insurance and Credit Guarantee Corporation of India. Cost of credit. Recent development in agricultural credit. Preparation and analysis of financial statements – Balance Sheet and Income Statement. Basic guidelines for preparation of project reports. Bank norms – SWOT analysis. Agricultural Cooperation – Meaning, brief history of cooperative development in India, objectives, principles of cooperation, significance of cooperatives in Indian agriculture. Agricultural Cooperation in India- credit, marketing, consumer and multi-purpose cooperatives, farmers' service cooperative societies, processing cooperatives, farming cooperatives, cooperative warehousing;

	role of ICA, NCUI, NCDC, NAFED. 3 R's, 5C's and 7 P's of credit. Crop insurance: its scope, significance and limitations and the potential of the newly launched 'Pradhan Mantri Fasal Bima Yojana' (Prime Minister's Crop Insurance Scheme). Successful cooperative systems in Gujarat (AMUL), Tamil Nadu (Aavin), Karnataka(Nandini), Maharashtra and Punjab. **Practical** Optimum allocation of limited amount of capital among different enterprise. Analysis of progress and performance of cooperatives using published data. Analysis of progress and performance of commercial banks and RRBs using published data. Visit to a commercial bank, cooperative bank and cooperative society to acquire first-hand knowledge of their management, schemes and procedures. Estimation of credit requirement of farm business – A case study. Preparation and analysis of balance sheet – A case study. Preparation and analysis of income statement – A case study. Appraisal of a loan proposal – A case study. Techno-economic parameters for preparation of projects. Preparation of Bankable projects for various agricultural products and its value-added products. Seminar on selected topics. Different types of repayment plans.

10. Agricultural Statistics	
1.	**VAC - II Agriculture informatics and Artificial Intelligence 3(2+1)**
	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. 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 echnologies (IT) in Agriculture, Computer Models in Agriculture: Statistical, weather analysis and crop simulation models, concepts, structure, inputs outputs 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 Power-point 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
2.	**AG. STAT 6.1 Basic and Applied Agril. Statistics 3(2+1)**
	Theory Introduction to Statistics and its Applications in Agriculture. Types of Data. Scales of measurements of Data. Summarization of Data. Classification of Data. Frequency Distribution. Methods of Classification. Definition of Grouped and Ungrouped Data. Definition of Class Interval (formula for determining the no. of class interval), Width of CI, Class Limits (Boundaries), MidPoints. Types of Frequency Distribution. Diagrammatic Presentation of Data. Bar Diagrams – Simple, Multiple, Sub-divided and Percentage Bar Diagrams. Pie-diagram. Graphical Presentation of Data – Histogram, Frequency Polygon and Ogives. Measures of Central Tendency. Requisites for an Ideal Measure of Central Tendency. Different Types of Measure. Arithmetic Mean– Definition, Properties, Merits, Demerits and Uses. A.M. (examples) for Grouped and Ungrouped Data. Step-deviation Method. Weighted Mean. Definition of Geometric Mean and Harmonic Mean. Relationship between A.M., G.M. and H.M. Median- Definition, Merits, Demerits and Uses. Graphical Location of Median. Mode-Definition, Merits, Demerits and Uses. Graphical Location of Mode. Relationship between Mean, Median and Mode. Measures of Dispersion. Characteristics for an Ideal Measure of Dispersion. Different Types of Measures of Dispersions. Definition of Range, Interquartile Range, Quartile Deviation and Mean Deviation. Standard Deviation- Definition, Properties. S.D. and Variance for Grouped and Ungrouped Data. Variance of Combined Series. Co-efficients of Dispersions. Co-efficient of Variation. Measures of Skewness and Kurtosis. Definition of Symmetrical Distribution. Definition of Skewness, Measures of Skewness. Definition of Kurtosis. Measure of Kurtosis. Relationship between Mean, Median and Mode for Symmetrical and Skewed Distribution. Probability Theory and Normal Distribution. Introduction to Probability. Basic Terminologies. Classical Probability-Definition and Limitations. Empirical Probability- Definition and Limitations. Axiomatic Probability. Addition and Multiplication Theorem (without proof). Conditional Probability. Independent Events. Simple Problems based on Probability. Definition of Random Variable. Discrete and Continuous Random Variable. Normal Distribution- Definition, Prob. Distribution, Mean and Variance. Assumptions of Normal Distribution. Normal Probability Curve. Correlation and Regression. Definition of Correlation. Scatter Diagram. Karl Pearson's Coefficient of Correlation. Types of Correlation Coefficient. Properties of Correlation Coefficient. Definition of Linear Regression. Regression Equations. Regression Coefficients. Properties of Regression Coefficients. Tests of Significance. Definition. Null and Alternative Hypothesis. Type I and Type II Error. Critical Region and Level of Significance. One Tailed and Two Tailed Tests. Test Statistic. One Sample, Two Sample and Paired t-test with Examples. F-test for Variance. ANOVA and Experimental Designs. Definition of ANOVA. Assignable and Non assignable Factors. Analysis of One-way Classified Data. Basic Examples of Experimental Designs. Terminologies. Completely Randomized Design (CRD). Sampling Theory. Introduction. Definition of Population, Sample, Parameter and Statistic. Sampling Vs Complete Enumeration. Sampling Methods. Simple Random Sampling with Replacement and without Replacement. Use of Random Number Table.

	Practical Diagrammatic and Graphical representation of data. Calculation of A.M., Median and Mode (Ungrouped and Grouped data). Calculation of S.D. and C.V. (Ungrouped and Grouped data). Correlation and Regression analysis. Application of t-test (one sample, two sample independent and dependent). Analysis of variance one-way classification. CRD. Selection of random sample using simple random sampling.
3.	**MATHS 1.1 Introductory Mathematics 1(1+0)** Non- gradial
	Theory: Algebra: Progressions- Arithmetic, Geometric and Harmonic Progressions. Matrices: Definition of Matrices, Addition, Subtraction, Multiplication, Transpose and Inverse up to 3rd order by adjoint method, Properties of determinants up to 3rd order and their evaluation. Differential Calculus: Definition - Differentiation of function using first principle, Derivatives of sum, difference, product and quotient of two functions, Methods, Increasing and Decreasing Functions. Application of Differentiation- Growth rate, Average Cost, and Marginal cost, Marginal Cost, Marginal Revenue. Partial differentiation: Homogeneous function, Euler's theorem, Maxima and Minima of the functions of the form y = f (x) and y = f (x1, x2). Integral Calculus: Integration -Definite and Indefinite Integrals-Methods- Integration by substitution, Integration by parts. Area under simple well-known curves. Mathematical Models: Agricultural systems - Mathematical models - classification of mathematical models- Fitting of Linear, quadratic and exponential models to experimental data.

11. Agricultural Engineering

1.	**AG. ENGG 4.1 Farm Machinery and Power 2(1+1)**
	Theory • Status of Farm Power in India • Sources of Farm Power • I.C. engines • working principles of I C engines • Study of different components of I.C. engine & numerical • I.C. engine terminology and solved problems. • comparison of two stroke and four stroke cycle engines • Familiarization with different systems of I.C. engines: fuel supply, cooling and lubrication system of a tractor • Demonstration of Power transmission system: clutch; gear box, differential and final drive of a tractor • Tractor types • Criteria for selection of tractor and matching implements. • Cost analysis of tractor power and attached implement • Introduction to Primary and Secondary Tillage implements • Field capacity and related solved example • implements for intercultural operations • Acquaintance with sowing and planting equipment • calibration of a seed drill and solved examples • Familiarization with Plant Protection equipment (Sprayers and dusters) • Introduction to harvesting and threshing machines **Practical** • Study of different components of I.C. engine. • I.C. engine terminologies and solved problems

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	• To study cooling system of engine • To study the clutch system, transmission mechanism, differential and final drive of a tractor • To study lubrication and fuel supply system of engine • To Study different types of primary and secondary tillage implements mould plough, disc plough and disc harrow; • Calculation of power requirement for different implements • To study seed-cum-fertilizer drills their seed metering mechanism and calibration and planters • To study different types of sprayers and dusters • To study with different inter-cultivation equipment • To study with harvesting and threshing machine • Learning of tractor driving
2.	**AG. ENGG 5.2 Renewable energy in Agriculture and Allied Sector 2(1+1)**
	Theory • Classification of energy sources • Contribution of these of sources in agricultural sector • Familiarization with biogas, types of biogas plants their utilization as bioenergy resource & numerical on Biogas • Introduction of solar energy, collection and their application & Numerical on Solar energy • Familiarization with solar energy gadgets: solar cooker, solar water heater, application of solar energy: solar drying, solar distillation, solar photovoltaic system and their application • Introduction of wind energy and their application & numerical • Availability of biomass and their application in different places i.e. briquetting and gasifiers & numerical on gasifiers Production of biofuels (Ethanol), Production process of biodiesel and their utilization as bioenergy resource **Practical** • Familiarization with renewable energy gadgets. • To study biogas plants, Janta, KVIC and Deen Bandhu type • To Study Solar Cooker • To Study Solar water heating systems • To study the solar ponds • To Study of solar dryer (Direct & indirect type) • To study solar photovoltaic system, solar lantern, solar pumping system and solar fencing • To Study the windmill and Solar wind hybrid system • To study the briquetting machine • To study the production process of biofuels • To Study the different types of the gasifier • Field visit to Solar –Wind farm/ research stations/ departments

12. Nematology	
1.	**NEMA 3.1 Fundamentals of Nematology 2(1+1)**
	Theory Introduction: History of phytonematology, habitat and diversity, economic importance of nematodes. General characteristics of plant parasitic nematodes. Nematode: definition, general morphology and biology. Classification of nematodes up to family level with emphasis on groups containing economically important genera. Classification of nematodes on the basis of

	feeding/ parasitic habit. Symptomatology, role of nematodes in disease development, Interaction between plant parasitic nematodes and disease-causing fungi, bacteria and viruses. Nematode pests of crops: Rice, wheat, vegetables, pulses, oilseed and fiber crops, citrus and banana, tea, coffee and coconut. Different methods of nematode management: Cultural methods, physical; methods, Biological methods, Chemical methods, Plant Quarantine, Plant resistance and INM. **Practical** Sampling methods, collection of soil and plant samples; Extraction of nematodes from soil and plant tissues following Cobb's sieving and decanting technique, Baermann funnel technique, Picking and counting of plant parasitic nematode. Identification of economically important plant nematodes up to generic level with the help of keys and description: Meloidogyne, Pratylenchus; Heterodera, Tylenchulus, Xiphinema, and Helicotylenchus etc. Study of symptoms caused by important nematode pests of cereals, vegetables, pulses, plantation crops etc. Methods of application of nematicides and organic amendments, Killing and fixing of Nematode, Mounting, Preparation of perennial pattern and cone top

13. Biochemistry	
1.	**BIOCHEM 6.1 Essentials of Plant Biochemistry 3(2+1)**
	Theory Biochemistry – Introduction and importance, Properties of water, pH and buffer, plant cell and its components. Bio-molecules – Structure, classification, properties and function of carbohydrates, amino acids, proteins, lipids and nucleic acids. Vitamins – physiological and metabolic role. Enzymes: General properties; Classification; Mechanism of action; Michaelis and Menten and Line Weaver Burk equation and plots; Introduction to allosteric enzymes, use of enzymes. Metabolic energy and its generation – Metabolism – Basic concepts, Glycolysis, Citric acid Cycle, Pentose phosphate pathway, oxidative phosphorylation, Fatty acid oxidation. Biosynthetic Pathways – Photosynthesis, Gluconeogenesis, nitrogen fixation, fatty acid and starch formation. Regulation of metabolic pathways. Secondary metabolites, Terpenoids, Alkaloids, Phenolic and their applications in food and pharmaceutical industries. **Practical** Preparation of standard solutions and reagents, Determination of pH, Qualitative tests of carbohydrates and amino acids, Quantitative estimation of soluble sugars and starch, Estimation of protein by Kjeldhal method and Lowry's method, Preparation of mineral solution from ash, Estimation of fat by Soxhlet method, Determination of acid value, saponification value and iodine number, Estimation of ascorbic acid, Qualitative/quantitative tests of secondary metabolites

14. Crop Physiology	
1.	**CR. PHY 5.1 Fundamentals of Crop Physiology 3(2+1)**
	Theory 1. Definitions of plant physiology and crop physiology; Importance of crop physiology; Relationship of crop physiology with other branches of crop science. 2. Overview of plant cell – Introduction to cell, cell theory, cell organelles and its function. 3. Diffusion and osmosis: Diffusion, osmosis and processes, cell as an osmotic system. Importance of osmosis, Imbibition, Plasmolysis 4. Definition of water potential and components of water potential;

5. Water absorption by plants: Physiological roles of water to crop plants, Field capacity, permanent wilting point and available soil moisture; Mechanism of water absorption, Factors affecting water absorption.
6. Transpiration: Types of water loss, stomatal physiology, Significance of transpiration. Stomatal opening and closing mechanisms and guttation, Antitranspirants - types and examples.
7. Mineral nutrition of plants: Introduction, Criteria of essentiality of nutrients, Classification of nutrient; Essential and beneficial elements, Functions of essential elements, deficiency symptoms of macro and micro nutrients, Foliar nutrition and root feeding – significance; Aeroponics, Hydroponics, Mechanism of nutrient uptake, Factor affecting nutrient uptake
8. Ascent of sap – theories and mechanism; Soil-plant-atmospheric continuum.
9. Brief outline of Photosynthesis: Structure of chloroplast, Examples of different photosynthetic pigments (chlorophyll, carotenoids, phycobilins etc.), Difference between chlorophyll a and chlorophyll b, Structure of chlorophyll a and chlorophyll b. Short discussion on quantum requirement and quantum yield, Red drop and Emerson enhancement effect, Pigment system I and II. Introduction to light reaction of photosynthesis, Hill reaction; Brief introduction to cyclic and non-cyclic photo-phosphorylation: production of assimilatory powers; Introduction to C3, C4 and CAM pathways: Calvin Cycle, Hatch and Slack Cycle, CAM Cycle; Significance of these pathways (concept of photorespiration, absence of photorespiration in C4 plant: Productivity of C4 plant, CAM: an adaptive mechanism); Factors affecting photosynthesis (light, temperature, CO2, O2 etc.).
10. Outline of the process of respiration: Definition and importance, Glycolysis, Kreb Cycle and ETC, Factors affecting respiration (O2, temperature, CO2 etc.).
11. Terminologies / Definitions: Growth, Development and Differentiation. Measurement of plant growth (fresh weight, dry weight, linear dimension, area etc.). Introduction to CGR, RGR, NAR etc.
12. Photoperiodism: Photoperiodic classification of plants: Short Day Plant, Long Day Plant, Day Neutral plant etc. Introduction to Photoperiodic induction site of photo-inductive perception, Role of Phytochrome. Introduction to Vernalization (What is vernalization, devernalization etc.),
13. Meaning, classification (seasonal, sequential etc), relation with abscission. Physiological and biochemical changes during senescence, Abscission and its significance, Concept of stay green, Hormonal regulation of senescence.
14. Terminologies / Definitions: Plant hormone, Plant growth regulators (PGR), Plant growth inhibitor. Recognized classes of PGR (Auxins, Gibberellins, Cytokinins, Ethylene and Abscisic acid) and their major physiological roles, Agricultural uses of PGRs (IBA, NAA, 2, 4 –D, GAs, Kinetin etc).

Practical

1. Study on structure and distribution of stomata;
2. Demonstration of imbibition
3. Demonstration of osmosis
4. Demonstration of plasmolysis
5. Estimation of water potential
6. Estimation relative water content
7. Tissue test for mineral nutrient analysis
8. Estimation of photosynthetic pigments.
9. Demonstration of photosynthesis, leaf anatomy of C_3 and C_4 plants.
10. Demonstration of respiration process
11. Demonstration of transpiration;

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	12. Study about plant growth analysis 13. Study on senescence, abscission and hormonal regulation of senescence 14. Identification of nutrients by hydroponics;

15. Animal Husbandry	
1.	**AH 2.1 Livestock and poultry Management 2(1+1)**
	Theory 1. Introduction to Animal Husbandry, Common terminology of Livestock. 2. Role of livestock in the national economy. 3. Important Indian and exotic breeds of cattle, buffalo and poultry. 4. Housing principles, space requirements for different species of livestock and poultry. 5. Management of calves. 6. Management of growing heifers. 7. Management of milch animals. 8. Reproduction in farm animals and poultry. 9. Incubation and hatching 10. Chicks (Brooding) & grower's management 11. Management of Layers 12. Management of Broilers 13. Feeding & Digestion in livestock and poultry. 14. Proximate principles of feed, Nutrients and their functions. 15. Classification of feedstuffs. 16. Feed ingredients, Feed supplements and feed additives for ration for livestock and poultry. 17. Introduction of livestock and poultry diseases. 18. Prevention (including vaccination schedule) and control of important diseases of livestock and poultry. **Practical** 1. External body parts of cattle, buffalo and poultry. 2. Handling and restraining of livestock. 3. Identification methods of farm animals and poultry. 4. Visit to IDF to study breeds of livestock and daily routine farm operations. 5. Visit to IPF to study breeds of poultry and daily routine farm operations. 6. Study of farm records 7. Judging & Culling of livestock and poultry. 8. Planning and layout of housing for different types of livestock. 9. Computation of rations for livestock & Formulation of concentrate mixtures. 10. Milking methods & Clean milk production, 11. Hatchery operations, incubation and hatching equipment. 12. Brooding Management 13. Beak trimming and vaccination in poultry 14. Economics of cattle, buffalo and poultry production

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16. Agricultural Bio-technology

1. AG. BIOTECH 6.1 Fundamentals of Agri Biotechnology 3(2+1)

Theory

Introduction to Plant Tissue Culture and Genetic Engineering: History; Cellular totipotency and cytodifferentiation; Callus culture, Single-cell/suspension culture and their applications; Organogenesis and somatic embryogenesis; Somaclonal variation, Embryo rescue technique and its significance in hybrid development; In vitro fertilization, ovule culture and its significance in hybrid development; Protoplast isolation, culture and regeneration; Somatic hybridization (somatic hybrids and cybrids) and its application in crop improvement; Anther and pollen culture for haploid production; Development of disease-free (virus free) plants through apical meristem culture; Micropropagation technique for the generation of quality planting material; Synthetic seeds and its applications. *In vitro* germplasm conservation.

Introduction to Molecular Biology: DNA structure, structure and function; RNA, types and function; Structure of prokaryotic and eukaryotic gene; Central dogma of life - Nucleic acid hybridization; Polymerase chain reaction and its applications, DNA sequencing – Sanger method.

Introduction to recombinant DNA technology: DNA modifying enzymes and vectors; plant genetic transformation – physical (Gene gun method), chemical (PEG mediated) and Agrobacterium-mediated gene transfer methods; Transgenic and its importance in crop improvement with successful stories; biosafety.

Introduction to various molecular markers: RFLP, RAPD, SSR, SNP etc.; Marker-assisted breeding in crop improvement

Practical

Introduction to Plant Tissue Culture Laboratory; Good Laboratory Practices; Media Preparation and sterilization; Glassware sterilization; Apical meristem culture; Preparation of synthetic seeds; Quantification of DNA; Restriction digestion of plasmid DNA and agarose gel electrophoresis; Isolation of Plant genomicDNA; PCR amplification of DNA; Gel electrophoresis of amplified DNA; Visit to tissue culture units/biotech labs.

17. Students' Welfare

1 AEC - IV National Cadet Corps (NCC) 1(0+1)

Unit:1 General

Aims, objectives, organization of NCC and NCC song. DG's cardinals of discipline. NCC Song, NCC Flag, Duties of NCC Cadet, Incentives to Cadets, Military Forces, NCC Camps. Organization, badges of rank, honors, and awards.

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	Unit:2 Drill
	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.
	Unit:3 Nation Building
	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 defense organization, types of emergencies, firefighting, protection. Maintenance of essential services, disaster management, aid during development projects.
	Unit:4 Social Service
	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.
	Unit: 5 Health, Hygiene and Environment Awareness
	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.
2	**AEC - V National Service Scheme (NSS) 1(0+1)**
	Practical: Evoking social consciousness among students through various activities *viz.*, working together, constructive, and creative social work, to be skillful in executing democratic leadership, developing skill in programme, to be able to seek self-employment, reducing gap between educated and uneducated, increasing awareness and desire to help sections of society. All the activities related to the National Service Scheme are distributed under four different courses *viz.*, National Service Scheme I, National Service Scheme II, National Service Scheme III and National Service Scheme IV; each having one credit load. The entire four courses should be offered continuously for two years. A student enrolled in NSS course should put in at least 60 hours of social work in different activities in a semester other than five regular one-day camp in a year and one special camp for duration of 7 days at any semester break period in the two years. Different activities will include orientation lectures and practical works. Activities directed by the Central and State Government have to be performed by all the volunteers of NSS as per direction. **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, analyzing 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

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	• Indian history and culture, role of youth in nation building, conflict resolution and peacebuilding. 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 rights to information. Family and society. Concept of family, community (PRIs and other community-based organizations) and society
3	**AEC - VI National Cadet Corps (NCC) 1(0+1)**
	Unit:1 Drill Arms Drill- Attention, stand at ease, stand easy. Getting on parade. Dismissing and falling out. Ground/take up arms, examine arms. Shoulder from the order and vice-versa, present from the order and vice-versa. Saluting at the shoulder at the halt and on the march. Short/long trail from the order and vice- versa. Guard mounting, guard of honor, Platoon/Coy Drill. **Unit:2 Weapon Training** Characteristics of rifle (.22/.303/SLR), ammunition, fire power, stripping, assembling, care, cleaning, and sight setting. Loading, cocking, and unloading. The lying position and holding. Trigger control and firing a shot. Range Procedure and safety precautions. Aiming and alteration of sight. Theory of groups and snap shooting. Firing at moving targets. Miniature range firing. Characteristics of Carbine and LMG. **Unit:3 Map Reading** Introduction to map, scales, and conventional signs. Topographical forms and technical terms. The grid system. Relief, contours, and gradients. Cardinal points and finding north. Types of bearings and use of service protractor. Prismatic compass and its use. Setting a map, finding north and own position. Map to ground and ground to map. Knots and lashings, Camouflage and concealment, Explosives and IEDs **Unit:4 Obstacle Training and Communication** Field defenses obstacles, mines and mine lying. Bridging, waterman ship. Field water supplies, tracks and their construction. Judging distance. Description of ground and indication of landmarks. Recognition and description of target. Observation and concealment. Field signals. Section formations. Fire control orders. Fire and movement. Movement with/without arms. Section battle drill. Types of communication, media, latest trends and developments.
4	**AEC - VII National Service Scheme (NSS) 1(0+1)**
	Practical: • Importance and role of youth leadership • Meaning, types and traits of leadership, qualities of good leaders; importance and roles of youth leadership, Life competencies • Definition and importance of life competencies, problem-solving and decision-making interpersonal communication. Youth development programs • Development of youth programs and policy at the national level, state level and voluntary sector; youth-focused and youth-led organizations • Health, hygiene and sanitation. Definition needs and scope of health education; role of food, nutrition, safe drinking water, water borne diseases and sanitation (Swachh Bharat Abhiyan) for health; national health programs and reproductive health. Youth health, lifestyle, HIV AIDS and first aid. Healthy lifestyles, HIV AIDS, drugs and substance abuse, home nursing and first aid. Youth and yoga. History, philosophy, concept, myths, and misconceptions about yoga; yoga traditions and its impacts, yoga as a tool for healthy lifestyle, preventive and curative method.
5	**AEC – III Physical Education, First Aid and Yoga Practices 2(0+2)**

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	Practical Physical education; Training and Coaching - Meaning and Concept; Methods of Training; aerobic and aerobic exercises; Calisthenics, weight training, circuit training, interval training, Fartlek training; Effects of Exercise on Muscular, Respiratory, Circulatory and Digestive systems; Balanced Diet and Nutrition: Effects of Diet on Performance; Physiological changes due to ageing and role of regular exercise on ageing process; Personality, its dimensions and types; Role of sports in personality development; Motivation and Achievements in Sports; Learning and Theories of learning; Adolescent Problems and its Management; Posture; Postural Deformities; Exercises for good posture. Yoga; History of Yoga, Types of Yoga, Introduction to Yoga: • Asanas: Definition and Importance, Padmasan, Gaumukhasan, Bhadrasan, Vajrajasan, Shashankasan, Pashchimotasan, Ushtrasan, Tadasan, Padhastasan, Ardhchandrasan, Bhujangasan, Utanpadasan, Sarvangasan, Parvatasan, Patangasan, Shishupalanasan– left legright leg, Pavanmuktasan, Halasan, Sarpasan, Ardhdhanurasan, Sawasan • Suryanamskar Pranayama (Definition and Importance) Omkar, Suryabhedan, Chandrabhedan, AnulomVilom, Shitali, Shitkari, Bhastrika, Bhramari • Meditation (Definition and Importance), Yogic Kriyas (Kapalbhati), Tratak, Jalneti and Tribandh • Mudras (Definition and Importance) Gyanmudra, Dhyanmudra, Vayumudra, Akashmudra, Pruthvimudra, Shunyamudra, Suryamudra, Varunmudra, Pranmudra, Apanmudra, Vyanmudra, Uddanmudra • Role of yoga in sports • Teaching of Asanas – demonstration, practice, correction and practice. History of sports and ancient games, Governance of sports in India; Important national sporting events; Awards in Sports; History, latest rules, measurements of playfield, specifications of equipment, skill, technique, style and coaching of major games (Cricket, football, table Tennis, Badminton, Volleyball, Basketball, Kabaddi and Kho-Kho) and Athletics Need and requirement of first aid. First Aid equipment and upkeep. First AID Techniques, First aid related with respiratory system. First aid related with Heart, Blood and Circulation. First aid related with Wounds and Injuries. First aid related with Bones, Joints Muscle related injuries. First aid related with Nervous system and Unconsciousness. First aid related with Gastrointestinal Tract. First aid related with Skin, Burns. First aid related with Poisoning. First aid related with Bites and Stings. First aid related with Sense organs, Handling and transport of injured traumatized persons. Sports injuries and their treatments.

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