

COURSE STRUCTURE AND SYLLABUS

Diploma in Agriculture Science

(EFFECTIVE FROM 2018-2019)



SARDAR PATEL **UNIVERSITY**

**DIPLOMA IN AGRICULTURE SCIENCE SCHOOL OF
AGRICULTURE SCIENCE**

SARDAR PATEL UNIVERSITIES BALAGHAT

MADHYA PRADESH (INDIA)

SARDAR PATEL UNIVERSITIES

Revised Course Curriculum and Syllabus

{Diploma in Agriculture Science}

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SEMESTER – I

COURSE TITLE	CREDIT HOURS L- P-T	COURSE NO.
Agronomic Principles, Practices and Meteorology	1+1	DGAG1101
Soils and Soil Fertility Management	1+1	DGAC1101
Principles of Entomology and Economic Entomology	1+1	DGEN1101
Farm power, Machinery and Post Harvest Technology	1+1	DGAE1101
Vegetable culture and Nursery Management	1+1	DGHO1101
Water Harvest, Irrigation Technology & Weed Management	1+1	DGAG1101
Breeding of Field crops, seed production, Testing and Certification	1+1	DGPG1101
Manures and fertilizers	1+1	DGAC1101
Crop pests and their Management	1+1	DGEN1101
Computer Application	0+1	DGAS1101
	09+10=19	

SEMESTER –II

COURSE TITLE	CREDIT HOURS- P-T	COURSE NO.
Plant pathology, crop diseases and their Management	1+1	DGPP1102
Commercial floriculture and Ornamental Gardening	1+1	DGHO1102
Agronomy of Field Crops-I	1+1	DGAG1102
Fruit culture and Propagation	1+1	DGHO1102
Organic Farming and Integrated farming system	1+0	DGAG1102
Agricultural Extension , Communication and Rural Sociology	1+1	DGEE1102
Agroforestry, Medicinal and Aromatic Plants	1+1	DGHO1102
Agricultural Economics, Finance & Marketing	1+0	DGEC1102
Fundamentals of Livestock, Poultry and Fish Production	1+1	DGAP1102
Participatory Agricultural Management Programme	0+5	DGRW1102
	9+12=21	

SEMESTER – I

1. Agronomic Principles, Practices and Meteorology [DGAG1101] (1+1)

Theory: Meaning and scope of Agronomy: National and International Agricultural Research Institutes located in India, Agro-climatic zones of India and Orissa. Classification of crops. Crop rotation principles and advantages, cropping pattern, cropping schemes, multiple cropping and mixed cropping principles and advantages, intercropping types and advantages and assessment. Relay cropping, paira cropping and crop interactions. Selection of seed, sowing methods, tillage and its objectives, types and effect of tillage on soil, tillage implements and harvesting. Agricultural meteorology: Weather and climate, micro-climate, weather elements, Earths' atmosphere, Composition and structure, climate change : causes, effect on ecosystem, crop production, remedial measures and global warming, Wind: factors affecting, cyclones and anticyclones and Formation and classification of clouds, Introduction to monsoon.

Practical: Identification of field crops and under utilized crops and their growth stages; Study of tillage implements; Practice of ploughing; Practice of puddling; Study of seeding equipments; Different methods of sowing; Study of inter-cultivation implements and practice; Site selection for Agromet observatory; Measurement of temperature; Measurement of rainfall; Measurement of evaporation (atmospheric/soil); Measurement of atmospheric pressure; Measurement of sunshine duration and solar radiation; Measurement of wind direction and speed and relative humidity.

Reference Book:

- Principles of Agronomy - T.Y. Reddy and G. H. SankarReddi
- Principles of Agronomy - S. R. Reddy
- The Nature and Properties of Soil - N.C.Brady and Ray R. Weil
- Manures and Fertilizers - K. S. Yawalkar, J.P. Agrawal and S. Bokde
- Soil Conditions and Plant Growth – E.W.Russel and E.J. Russell
- Agrometeorology and remote sensing - D.D. Sahu
- Text book of Agricultural Meteorology - Edited by M.C. Varshney
- Introduction to Agrometeorology - H.S.Mavi
- Crops and Weather – S. Venkataraman and A. Krishnan (ICAR)

2. Soils and Soil Fertility Management [DGAC1101] (1+1)

Theory: Soil: Pedological and edaphological concepts, Definition of Rocks and minerals, Weathering, soil formation factors and processes, components of soils, Soil profile, soil physical properties, soil texture, Soil fertility and productivity-factors affecting, features of good soil management, problems of supply and availability of nutrients, relation between nutrient supply and crop growth, Criteria of essentiality of nutrients, Essential plant nutrients-their functions, nutrient deficiency symptoms, transformation and dynamics of major plant nutrients. Commercial fertilizers, composition, relative fertilizer value and cost; crop response to different nutrients, residual effects and fertilizer use efficiency, fertilizer mixtures and grades, agronomic, chemical and physiological methods of increasing fertilizer use efficiency nutrient interactions, organic fertilizers and its advantages, Time and methods of manures and fertilizers application, foliar application and its concept, relative performance of organic and inorganic manures, economics of fertilizer use, integrated nutrient management, use of vermin compost and residual waste in crops.

Practical: Determination of pH, EC, organic C, total N, available N, P, K and S in soils, Determination of total N, P, K and S in plants, Interpretation of interaction effects and computation of economic and yield optima.

Reference Book:

- Chemistry of the soils – F. Bear
- Soils and soil fertility – C.M. Thomson and F.R. Troeh
- Soil fertility and fertilizers – S.L.Tisdale, W.L.Nelson, J.D. Beaton and J.L. Havlin

3. Principles of Entomology and Economic Entomology [DGEN1101] (1+1)

Theory: Types of mouth parts- Biting and chewing type, Piercing and sucking type Rasping and sucking type Sponging and sucking type, Sucking type. Types of injury and symptoms of damage caused by pests. Integrated Pest Management- Introduction, importance concepts and principles of IPM; Tools of IPM - host plant resistance, cultural methods, mechanical and physical methods, legislative or quarantine measures. Bio agents – parasitoids and predators. Characters of parasitoids and predators. Chemical control - Importance of pesticides - classification of insecticides. Different formulations of insecticides. Study of important group of insecticides with examples – botanicals (neem), cyclodienes, organo phosphates, carbamates, synthetic pyrethroids, novel insecticides, nematicides, rodenticides, acaricides, antifeedants, attractants, sex pheromones. Compatibility of insecticides - insecticides mixtures, phytotoxicity.

Practicals: Methods of collection and preservation of insects including immature stages. External features of a grass hopper. Types of insect antenna. Types of insect legs. Types of insect mouth parts and study of biting and chewing (orthopteran) and sucking (Hemipteran) mouth parts. Study of mouth parts of Diptera. Hymenoptera and Lepidoptera. Wing venation, types of wings and wing symptoms. Types of insect larvae and pupae. Dissection of digestive system in insects. Dissection of male female reproductive system.

References:

- Elements of Economic Entomology Vasantharaj David B 2001.
- General and Applied Entomology Nayar K K Ananthakrishnan T N and David B V
- Imms General Text Book of Richards O W and Davies R G 1977, Entomology Vol I & II Chapman and Hall, London
- Insect Structure and Function Chapman R F 1988. Cambridge Univ. Press U K
- Insect Physiology and Anatomy Pant N C and Ghai S 1981. ICAR.

4. Farm power, Machinery and Post-Harvest Technology [DGAE1101] (1+1)

Theory: Primary (Mould board plough, Disc plough) and secondary tillage (Cultivator and harrows) implements, Field operation of line sowing equipment (Seed drill, transplanter), SRI method of planting with marker, Repair and maintenance of tractor, power tiller and matching implements, Operation, use and maintenance of sprayers and dusters, Operation and maintenance of harvesting tools (improved sickle, power reaper), Operation and maintenance of pedal operated thresher, power thresher-cum-winnowing, and Axial flow thresher.

Practical : Adjustment and Operation of primary tillage implements (MB plough, Disc plough etc.), Adjustment and Operation of secondary tillage implements (Cultivator and Harrow), Field operation of seed drill, field operation of paddy transplanter), Paddy transplanting in SRI method using marker, Operation of manual and power weeder (Cono, Mandua and low land power weeder), Adjustment and operation of tractor, power tiller with matching implements, Precautionary measures in operation of sprayers and dusters, Operation of axial flow thresher, Operation of pedal operated, power operated and axial flow thresher. Moisture content determination of food grains. Study of cleaners and graders. Study of different types of dryers. Study of different storage structures. Visit to Rice mill, Dall mill and oil mill.

Reference Books :

- Principles of Agricultural Engineering, Vol: I by A.M. Michael and T.P. Ojha
- Post harvest technology of cereal, pulses and oil seeds, A Chakraverty

5. Vegetable culture and Nursery Management [DGHO1101] (1+1)

Theory: Importance and scope of the vegetable cultivation, classification of vegetables, Study of climate and environment effect on plant growth, study of climatic and soil requirement, varieties, sowing/planting times and methods, seed rate, seed treatment, nutritional and irrigation requirement, intercultural operations, physiological disorders, harvesting, cool season vegetables (Potato, Cole crops-Cabbage, Cauliflower , Knol-Khol, Root crops-Carrot, radish, Beetroot, Bulb crops- Onion, Garlic, Peas, Leafy vegetables). Warm season vegetables (Tomato, Brinjal, Chilli , Capsicum, Okra, Cluster bean, Cucurbits(Pumpkin, Cucumber, Pointed gourd, Bitter gourd , Bottle gourd), Cassava, Sweet potato, Leafy vegetables- Basella, Fenugreek), Perennial vegetables (Drumstick , Curry leaf)

Practical: Raising of nursery of vegetable crops, raising of some warm season and cool season vegetables, identification of seeds and plants, extraction of seeds from important crops, intercultural operations of vegetable, stages of maturity of vegetables and harvestings, visit to mandi, nearby farms & farmers cold storage.

Reference Book:

- Vegetable Science and Technology in India–Vishnu Swarup
- Vegetable for the tropical region- PremNath, S.Velayadhan and D.P.Singh

6. Water Harvest, Irrigation Technology & Weed Management[DGAG1101] (1+1)

Theory: Definition and objectives, water resources; Soil plant water relationships; soil water movement, evapotranspiration and crop water requirement; effective rainfall, scheduling of irrigation; Methods of irrigation: surface and subsurface, Micro irrigation, sprinkler and drip irrigation; Irrigation efficiency and water use efficiency, conjunctive use of water, irrigation water quality and its management. Weeds: Introduction, harmful and beneficial effects, classification, crop weed competition and allelopathy . Methods of weed control: physical, cultural, chemical and biological methods. Integrated weed management; Herbicides: advantages and limitation of herbicide usage in India, formulations, methods of application; Introduction to adjuvants and their use in herbicides; compatibility of herbicides with other agro chemicals.

Practical: Determination of field capacity by field method; Calculation of irrigation water requirement (Problems); Demonstration of furrow method of irrigation; Demonstration of check basin and basin method of irrigation; Erection and operation of sprinkler irrigation system; Identification of weeds; Survey of weeds in crop fields and other habitats; Computation of herbicide doses; Study of herbicide application equipment and calibration; Demonstration of methods of herbicide application; Tours and visits to experimental field and problem areas.

Reference Book:

- Irrigation Principles and Practices - O.W. Israelsen and V.E. Hansen
- Irrigation and Drainage - D. Lenka
- Irrigation, Theory and Practices - A. M. Michael
- Agricultural Drainage: Principles and Practices – U.S. Kadam
- Modern weed management - O.P.Gupta
- Principles of Weed science - V.S. Rao
- Weed management - V.N. Saraswat, V. M. Bhan and N.T. Yaduraju (ICAR)
- All about weed control - S. Subramaniam, A.Mohamed Ali and R. Jaykumar

7. Breeding of Field crops, Seed production, Testing and Certification[DGPG1101] (1+1)

Theory: Plant Breeding- Introduction, History, Landmark achievements.Objectives of Plant Breeding. Flower biology, Mode of reproduction in crop plants, Procedure of sexual fertilization, self-pollination mechanism, Cross pollination mechanism, Male sterility and its types, Self-incompatibility and its classification, vegetative reproduction. Crop improvement, Open pollinated variety, Composite and synthetic variety, Multiline variety, Hybrids, Heterosis, Steps in hybridization, Steps involved in Testing and release of variety/Hybrids.Seed&its Importance, Difference between seed and grain, Characteristics of quality seed; Process of seed, Types of seed- Nucleus, Breeder , Foundation, Certified,Truthful and Labelled seed. Principle of seed production, Isolation distance, Rouging, Synchronization, Supplementary pollination techniques, Maintenance of Physical and Genetic purity in released varieties. Seed production technique of varieties/Hybrids in Rice, Maize, Jower, Bajra, Sunflower, Castor, Cotton, Groundnut, Sesamum, Green gram, Black gram, Bengal gram, Red gram. Seed certification, Seed processing, Seed drying, Seed threshing, Seed cleaning, Seed treatment, Seed storage, Seed testing, Seed moisture, Physical purity and Genetic purity. Seed viability, Vigour, Germination, Factor influencing seed germination. Seed dormancy, Factors and method of breaking seed dormancy, seed health, Seed packing, Seed act, Introduction to seed pelleting. Biotechnology and Intellectual Property Rights (I.P.R).

Practical: Emasculation and crossing techniques in rice,emasucation and crossing techniques in cotton, vegetative propagation in Napier grass, seed sampling methods, seed moisture test and seed germination test, unfilled grains and pods identification and separation in Rice and Groundnut, seed viability test, methods to overcome seed dormancy, seed physical purity determination test, seed genetic purity determination test, visit to seed technology testing laboratory, visit to seed processing centre, visit to seed production units, emasculation and crossing techniques in Okra/Brinjal/Chilli, seed treatment methods in Rice and Groundnut, Visit to National seed corporation or Andhra Pradesh State Seed Development Corporation (APSSDC) & other seed corporations.

Reference Book:

- Principles of Plant Breeding - R.W. Allard
- Plant Breeding Principles and Methods - B. D. Singh
- Plant Breeding - (Ed.) V. L. Chopra
- Plant Breeding. Analysis and Exploitation of Variation - D. Roy

8. Manures and fertilizers [DGAC1101] (2+1)

Theory: Introduction-Raw materials-Manures-Bulky and concentrated-FYM, Composts Different methods, Mechanical compost plants, Vermicomposting, Green manures, oil cakes, sewage and sludge-Biogas plant slurry, plant and animal refuges, Fertilizers-classification, Manufacturing processes and properties of major nitrogenous (ammonium sulphate, urea, calcium ammonium nitrate, ammonium nitrate, ammonium sulphate nitrate) Phosphatic (single super phosphate, enriched super phosphate, diammonium phosphate, ammonium poly phosphate), Potassic and complex fertilizers, their fate and reactions in the soil, Secondary and micronutrients fertilizers, cz Amendments, Fertilizer control order, fertilizer storage, Biofertilizers and their advantage.

Practical: Total nitrogen and phosphorus in manures/composts-Ammonical and nitrate nitrogen water soluble P_2O_5 , potassium, calcium, sulphur and zinc contents of fertilizers. COD in organic wastes-Adulteration in fertilizer, Compatibility of fertilizers with pesticides.

Reference Book:

- Soil fertility and fertilizers-S.L.Tisdale, W.L.Nelson, J.D. Benton and J.L. Havlin
- Manures and Fertilizers – K.S. Yawalker, J.B. Agarwal and S. Bokde
- Soil Fertility, Theory and Practice – J.S. Kanwar
- A text Book of fertilizers – R.K. Basak
- Toxicology of insecticides-F. Matsumura
- Insecticides, action & metabolism-R.D. O'Brien
- Chemistry of insecticides & fungicides- V.S. Sreeramulu

9. Crop pests and their Management[DGGEN1101](1+1)

Theory: Biology nature of damage and management of insect pests of major field crops like rice, wheat, maize, sorghum, ragi, sugar cane, cotton, jute, pulses, groundnut, mustard, sunflower, sesamum, castor, commonly grown vegetable crops of Odisha belonging to cucurbits, colecrops and solonaceous crops, sweet potato etc. Pest of coconut, cashewnut, coffee and their management.

Practical: Identification of crop pests with symptoms of damage in major crops belonging to cereals, pulses, oil seeds, fiber crops, sugar cane, important vegetables and plantation crops.

Reference Book:

- Insect pest of India and S.E Asia – A.S.Atwal 2. Elements of Economic Entomology – B.V.David
- Insect and mites of crops in India – MRGK Nair 4. Agricultural insect pests and their control V.B.Awasthi

10. Computer Application[DGAS1101] (0+1)**Practical:**

1. Introduction to Computers; Study of Computer Components; Booting of Computer and its Shut Down.
2. Practice of some fundamental DOS Commands, TIME, DATE, DIR, COPY, FORMAT, VOL, LABEL, and PATH.
3. Operating System, Units of memory, Use of Mouse, Title Bar, Minimum, Maximum and Close Buttons, Scroll Bars, Menus and Tool Bars; WINDOWS Explorer, Creating Folders, COPY and PASTE functions.
4. MSWORD: Creating a Document, Saving and editing; MSWORD, Use of options from Tool Bars, Format, Insert and Tools (Spelling & Grammar) Alignment of text.
5. MSWORD: Creating a Table, Merging of Cells, Column and Row width, advanced options (like Water marking, mailings).
6. MSEXCEL: Overview of Excel, Formatting cells, Cut, Copy, Paste, Insert, Printing, Page Setup, Use of options from Tool Bars.
7. MSEXCEL: Entering Expressions through the formula tool bar and use of inbuilt functions, SUM, AVERAGE, and STDEV
8. MSEXCEL: Data Analysis using different charts. Creating Graphs and saving with & without data.
9. MS Power Point: Preparation of slides on Power Point.
10. MSACCESS: Creating Database, Structuring with different types of fields.
11. Internet Browsing: Browsing a Web Page and Creating of E-Mail ID.

Reference Book:

- Computer Studies – a First course – J. Shelly and R. Hunt.
- Computer Fundamentals – Anita Goel.
- Microsoft Windows XP Manual
- Microsoft Office XP Manual.

SEMESTER –II

1.Plant pathology, Crop diseases and their Management[DGPP1102](1+1)

Theory: Introduction, important plant pathogenic organisms, different groups, fungi, bacteria, fastidious vesicular bacteria, phytoplasmas, viruses, virioids, algae, protozoa and phanerogamic parasites with examples of disease caused by them. Economic importance, symptoms, cause, epidemiology, disease cycle and integrated management of disease of rice, sorghum, bajra, maize, wheat, sugarcane, turmeric, ginzer, tobacco, groundnut, sesamum, sunflower, cotton, redgram, blackgram, greengram, tea, soyabean.

Practical: Plant disease symptom identification and preservation of disease samples. Study of symptoms, etiology, host-parasite relationship and specific control measures of the following crop diseases. Presentation of disease samples survey and collection of diseases of rice, sorghum; diseases of wheat, bajra and maize; diseases of sugarcane, turmeric and tobacco; diseases of groundnut, castor and sunflower; diseases of sesamum and cotton; diseases of redgram, greengram, blackgram, bengalgram and beans; Field visits at appropriate time during the semester.

Note: Students should submit 50 pressed, well mounted diseased specimens in three installments during the semester.

Reference Book:

- Plant Pathogens : The Fungi - R. S. Singh
- An Introduction to Fungi- H. C. Dubey
- Principles of Plant Pathology - R. S. Singh
- Plant Pathology - R. S. Mehrotra

2. Commercial floriculture and Ornamental Gardening[DGHO1102] (1+1)

Theory: Scope and importance of ornamental horticulture, Garden types and its parts. planning of ornamental garden, house plants and seasonal flowers in garden cultivation, Propagation of flowering and ornamental plants, Production technology of important commercial flowers like rose, tuberose marigold, gladiolus and chrysanthemum and some house plants.

Practical: Identification of seeds and plants (Flowers, trees, climbers, house plants, seasonal plants etc.) Layout of lawn and its maintenance. Care and maintenance of house plants. Training and pruning of Rose. Pinching, disbudding and dishooting of chrysanthemum, prolonging the shelf life of flowers, Raising nursery of commercial flowers.

Reference Book:

- Floriculture in India - G.S.Randhawa and A. Mukopadhyay
- Complete gardening in India -K.S.G.Gopalswami

3. Agronomy of Field Crops-I[DGAG2102] (1+1)

Theory: Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices and yield of kharif crops, Cereals – rice, maize, sorghum, pearl millet and minor millets; Pulses:pigeonpea, mungbean, urdbean and horsegram; Oilseeds: groundnut, sesame, niger and soybean; Fibrecrops: cotton, jute, mesta and sun hemp; and Forage crops: sorghum, maize, bajra, guinea grass, deenanath grass, hybridnapier, para grass, cowpea, rice bean and stylosanthes.

Practical: Rice nursery preparation and transplanting/seed bed preparation and sowing of Kharif crops; Calculations on seed rate; Sowing of soybean, pigeonpea, mungbean, maize, groundnut, and cotton; Effect of seed size on germination and seedling vigour of soybean/groundnut; Effect of sowing depth on germination of groundnut; Identification of weeds in rice, maize and soybean fields and study of weed control experiments in these crops; Top dressing of nitrogen in maize and rice and study of fertilizer experiments on rice, maize, sorghum and millets; Study of yield contributing characters, yield calculations, harvesting and yield estimation of above crops; Study of forage experiments. Judging the maturity stage of kharif crops viz: rice maize pulses and oilseed crops.

Reference Book:

- Modern Techniques of raising field crops - Chida Singh
- Crop management under rainfed and irrigated condition - S.S.Singh
- Agronomy of field crops - S.R.Reddy
- Text book of field crop production - Edited by R. Prasad (ICAR)

4. Fruit culture and Propagation[DGHO1102] (1+1)

Theory: Importance and scope of fruit crops in India, important varieties, propagation methods, soil and climatic requirements for important commercial fruits, Layout and planting, manuring, irrigation, interculture, training and pruning, intercropping and physiological disorders, harvesting of important fruits like mango, banana, citrus, guava, pineapple, papaya and custard apple.

Practical: Identification of major and minor fruits, nursery management and maintenance of grafts, lifting and packing of plants, Orchard layout and planting management. Intercultural operations, special care, use of growth regulators, post harvest handling of fruits, visit to commercial orchards, tissue culture labs.

Reference Book:

- Fruits - Ranjit Singh

5. Organic Farming and Integrated farming system[DGAG1102] (1+0)

Theory: Organic farming – Definition, relevance, biological nutrient management- Organic manures, vermicompost, green manure, organic residue, biofertilizer soil amendments, Integrated pest and weed management- use of biocontrol agents, bio pesticides etc. Organic certification in brief. Integrated farming system- definition, goal, components, factors affecting ecological balance, land degradation, soil health management, models of IFS for rainfed and irrigated conditions and different categories of farmers.

Reference Book:

- Farming system : Theory and Practice - S.A.Solaimalai
- Organic Farming : Theory and Practice- S.P.Palaniappan and K.A. Annadurai
- A hand book of Organic Farming by A.K.Sharma

6. Agricultural Extension, Communication and Rural Sociology[DGEE1102] (1+1)

Theory: Meaning of Education, Extension and agricultural extension. Principles of Agricultural Extension, Communication, Meaning and definition of communication Elements of Communication and their characteristics, Types and barriers of Communication, Extension teaching methods, Individual contact methods, group contact method, mass contact method. Diffusion and Adoption of Innovations Meaning, definition. Adopt categories and their characteristics, Factors influencing adoption process. Sociology and Rural Sociology: Meaning, Definition, Scope, Importance of Rural Sociology in Agriculture Extension. Indian Rural Society Important characteristics, Social groups-Meaning Definition, Classification, Cultural concepts Culture, Customs, Folkways, Mores, Taboos, Rituals and Traditions. Social Control-Meaning, Definition Social change-Meaning, Definition, Nature of Social change.

Practical: Preparation of Interview Schedule to collect information from villager, Identification of village tour to identify the innovation and adaption pattern, Identifications of various social and cultural patterns of rural society through field visit, Visit to various rural institutions to study their structure and function.

Reference Book:

- Introductory Rural Sociology- J.B. Chitamber
- An Introduction to Sociology- Vidya Bhusan & D. R. Sachdev
- Extension Education- A. Adivi Reddy
- Education & Communication for Development – O.P. Dahama & O.P. Bhatnagar
- Extension Communication & Management – G.L. Ray

7. Agroforestry, Medicinal and Aromatic Plants[DGHO2204] (1+1)

Theory: Agro forestry- definition, objectives and scope. Advantages and disadvantages of agro forestry. Classification of agro forestry system. Tree – crop interaction in agro forestry. Trees suitable for agro forestry and their characteristics. Tree architecture and canopy management. Economics of agro forestry system. Agro forestry for wasteland and watershed management. Agro forestry and maintenance of biodiversity. Agroforestry for climate change adaptation and mitigation. Scope and importance of Medicinal and aromatic plants, study of general principles of climate and soil for cultivation of Medicinal and aromatic plants, production technology of some important plants like mentha, lemon grass, citronella, palmarosa, patchouli, ashwagandha, periwinkle, isabgol and Aloe vera.

Practical: Study of agro forestry layout. Visit to farmer's field where agro forestry is practiced and study of agro forestry system. Study of different traditional agro forestry system in field and designing the improved models. Visit to rural areas to study the land use pattern and preparing suitable designs for the farmers of the area. Identification of medicinal and aromatic plants. Visit to medicinal and aromatic plant garden. Extraction procedures and use.

Reference book:

- Text book of agro forestry- B.S. Chundawat & SK. Gautam
- An Introduction to agro forestry- P.K.R. Nair
- Hand book of agro forestry- S.P. Singh
- Agro forestry principle and practices- A.P. Dwivedi
- Medicinal and Aromatic Plants- Narain Singh Chauhan
- Hand book of Horticulture- IACR Publication

8. Fundamentals of Livestock, Poultry and Fish Production [DGAP2201] (1+1)

Theory: Place of livestock in the national economy, different livestock development programmes of Govt. of India. Important exotic and Indian breeds of cattle, buffalo, sheep, goat and swine. Measures and factors affecting fertility in livestock, reproductive behaviour like oestrus, parturition, farrowing etc. Milk secretion, milking of animals and factors affecting milk yield and composition. Selection and breeding of livestock for higher milk and meat production. Feeding and management of calves, growing heifers and milch animals and other classes and types of animals, housing principles, space requirements for different species of livestock. Disease control measures, sanitation and care, breeding, feeding and production records. Breed characteristics of poultry, their methods of rearing, breeding, feeding and management, incubation, hatching and brooding, vaccination and prevention of diseases, preservation and marketing of eggs, its economics and keeping quality. Cost of production of milk, economical units of cattle, buffalo, sheep, goat and swine, fresh water fish production technology.

Practical: Identification, handling and restraining of animals; Judging and culling; Feeding and ration formulation; Hatching, housing and management of poultry; Visit to livestock farms and Economics of livestock production.

Reference Book:

- A Textbook of Animal Husbandry – G.C. Benerjee
- Livestock Production and Management – N.S.R. Sastri, C.K. Thomas, R.A. Singh
- Essentials of Animal Production and Management – R. Singh
- A Handbook of Animal Husbandry – ICAR publication.
- A Textbook of Livestock Production Management in Tropics – D.N. Verma
- 6. Books on fish production - ICAR publication.

9.Participatory Agricultural Management Programme

[DGRW1101] (0+5)