Course Syllabus of B. Sc. (Hons.)
Agriculture

(As per ICAR - V Dean’s Committee Recommendation)

2017-18

SCHOOL OF AGRICULTURE
GIET UNIVERSITY
GUNUPUR, RAYAGADA – 765022
ODISHA
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## Course Structure

### First Semester

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<th>Course Number</th>
<th>Course Title</th>
<th>Credit Hours</th>
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<tbody>
<tr>
<td>AG-111</td>
<td>Fundamentals of Agronomy</td>
<td>4(3+1)</td>
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<tr>
<td>AG-112</td>
<td>Agricultural Heritage-*</td>
<td>1(1+0)*</td>
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<tr>
<td>AC-111</td>
<td>Fundamentals of Soil Science</td>
<td>3(2+1)</td>
</tr>
<tr>
<td>AE-111</td>
<td>Fundamentals of Agricultural Economics</td>
<td>2(2+0)</td>
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<tr>
<td>HORT-111</td>
<td>Fundamentals of Horticulture-*</td>
<td>2(1+1)</td>
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<tr>
<td>FO-111</td>
<td>Introduction to Forestry</td>
<td>2(1+1)</td>
</tr>
<tr>
<td>EE-111</td>
<td>Fundamentals of Agricultural Extension Education</td>
<td>3(2+1)</td>
</tr>
<tr>
<td>PP-111</td>
<td>Fundamentals of Crop Physiology</td>
<td>2(1+1)</td>
</tr>
<tr>
<td>SE-111</td>
<td>Comprehension &amp; Communication skills in English</td>
<td>2(1+1)</td>
</tr>
<tr>
<td>BB/EM-111</td>
<td>Introductory Biology / Elementary Mathematics-*</td>
<td>2(1+1)<em>/2(2+0)</em></td>
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<tr>
<td>NSS/NCC/PE-111</td>
<td>NSS/NCC/Yoga**</td>
<td>2(0+2)**</td>
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**Total** 20(13+7)

* "R" Remedial Course, **Non-Gradial Course,

### Second Semester

<table>
<thead>
<tr>
<th>Course Number</th>
<th>Course Title</th>
<th>Credit Hours</th>
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<tbody>
<tr>
<td>AG-123</td>
<td>Introductory Agro-meteorology &amp; Climate Change</td>
<td>2(1+1)</td>
</tr>
<tr>
<td>PBG-121</td>
<td>Fundamentals of Genetics</td>
<td>3(2+1)</td>
</tr>
<tr>
<td>AC-122</td>
<td>Agricultural Microbiology</td>
<td>2(1+1)</td>
</tr>
<tr>
<td>ENT-121</td>
<td>Fundamentals of Entomology</td>
<td>4(3+1)</td>
</tr>
<tr>
<td>SWE(Ag)-121</td>
<td>Soil &amp; Water Conservation Engineering</td>
<td>2(1+1)</td>
</tr>
<tr>
<td>PPT-121</td>
<td>Fundamentals of Plant Pathology</td>
<td>3(2+1)</td>
</tr>
<tr>
<td>ABT-121</td>
<td>Fundamentals of Plant Biotechnology</td>
<td>2(1+1)</td>
</tr>
<tr>
<td>HORT-122</td>
<td>Production Technology for Fruits &amp; Plantation Crops</td>
<td>2(1+1)</td>
</tr>
<tr>
<td>AS-121</td>
<td>Statistical Methods</td>
<td>3(2+1)</td>
</tr>
<tr>
<td>EE-122</td>
<td>Human Values &amp; Ethics**</td>
<td>1(1+0)**</td>
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**Total** 23(14+9)
### Third Semester

<table>
<thead>
<tr>
<th>Course Number</th>
<th>Course Title</th>
<th>Credit Hours</th>
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<tbody>
<tr>
<td>AG-214</td>
<td>Crop Production Technology -I (Kharif Crops)</td>
<td>2(1+1)</td>
</tr>
<tr>
<td>PBG-212</td>
<td>Fundamentals of Plant Breeding</td>
<td>3(2+1)</td>
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<tr>
<td>AC-213</td>
<td>Fundamentals of Plant Biochemistry</td>
<td>2(1+1)</td>
</tr>
<tr>
<td>ENT-212</td>
<td>Pests of Crops &amp; Stored grain &amp; their Management</td>
<td>3(2+1)</td>
</tr>
<tr>
<td>AE-212</td>
<td>Agricultural Finance &amp; Co-operation</td>
<td>3(2+1)</td>
</tr>
<tr>
<td>EE-213</td>
<td>Rural Sociology &amp; Educational Psychology</td>
<td>2(2+0)</td>
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<tr>
<td>FMP(Ag)-211</td>
<td>Farm Machinery &amp; Power</td>
<td>2(1+1)</td>
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<tr>
<td>PPT-212</td>
<td>Fundamentals of Nematology</td>
<td>2(1+1)</td>
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<tr>
<td>HORT-213</td>
<td>Production Technology for Vegetables &amp; Spices</td>
<td>2(1+1)</td>
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<tr>
<td>AS-212</td>
<td>Agricultural Informatics</td>
<td>2(1+1)</td>
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<td><strong>Total</strong></td>
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### Fourth Semester

<table>
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<th>Course Title</th>
<th>Credit Hours</th>
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<tbody>
<tr>
<td>AG-225</td>
<td>Crop Production Technology-II (Rabi Crops)</td>
<td>2(1+1)</td>
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<tr>
<td>AG-226</td>
<td>Farming Systems &amp; Sustainable Agriculture</td>
<td>1(1+0)</td>
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<tr>
<td>SST-221</td>
<td>Principles of Seed Technology</td>
<td>2(1+1)</td>
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<tr>
<td>AC-224</td>
<td>Problematic Soils &amp; their Management</td>
<td>2(1+1)</td>
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<tr>
<td>ENT-223</td>
<td>Management of Beneficial Insects</td>
<td>2(1+1)</td>
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<tr>
<td>AE-223</td>
<td>Agricultural Marketing, Trade &amp; Prices</td>
<td>3(2+1)</td>
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<tr>
<td>FMP(Ag)-222</td>
<td>Renewable Energy &amp; Green Technology</td>
<td>2(1+1)</td>
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<tr>
<td>PPT-223</td>
<td>Mushroom Cultivation</td>
<td>1(0+1)</td>
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<tr>
<td>FO-222</td>
<td>Environmental Studies &amp; Disaster Management</td>
<td>3(2+1)</td>
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<tr>
<td>EE-224</td>
<td>Communication Skills &amp; Personality Development</td>
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<tr>
<td>AC(E)-221</td>
<td>Agricultural Chemicals</td>
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<td>HORT(E)-221</td>
<td>Hi-tech Horticulture</td>
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<td>AG(E)-221</td>
<td>Water Management</td>
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<tr>
<td>PBG(E)-221</td>
<td>Commercial Plant Breeding</td>
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<td><strong>Total</strong></td>
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<th>Course Title</th>
<th>Credit Hours</th>
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<tbody>
<tr>
<td>CP(AG)-311</td>
<td>Practical Crop Production-I (kharif Crops)</td>
<td>2(0+2)</td>
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<tr>
<td>AG-317</td>
<td>Rainfed Agriculture &amp; Watershed Management</td>
<td>2(1+1)</td>
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<tr>
<td>PBG-313</td>
<td>Intellectual Property Rights</td>
<td>1(1+0)</td>
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<tr>
<td>PBG-314</td>
<td>Crop Improvement-I (Kharif Crops)</td>
<td>2(1+1)</td>
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<tr>
<td>SST-312</td>
<td>Seed Quality Testing</td>
<td>1(0+1)</td>
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<tr>
<td>AC-315</td>
<td>Manures, Fertilizers &amp; Soil Fertility Management</td>
<td>3(2+1)</td>
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<tr>
<td>ENT-314</td>
<td>Principles of Integrated Pests &amp; Disease Management</td>
<td>3(2+1)</td>
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<tr>
<td>PPT-314</td>
<td>Diseases of Field &amp; Horticultural Crops &amp; their Management-I</td>
<td>3(2+1)</td>
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<tr>
<td>HORT-314</td>
<td>Production Technology for Ornamental, MAP &amp; Landscaping</td>
<td>2(1+1)</td>
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<tr>
<td>EE-315</td>
<td>Entrepreneurship Development &amp; Business Communication</td>
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<tr>
<td>HORT(E)-312</td>
<td>Landscaping</td>
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<tr>
<td>AC(E)-312</td>
<td>Bio-Pesticides &amp; Bio-Fertilizers</td>
<td>3(2+1)</td>
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<tr>
<td>AG(E)-312</td>
<td>Weed Management</td>
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<tr>
<td>ABT(E)-311</td>
<td>Micro Propagation Technologies</td>
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<th>Credit Hours</th>
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<tbody>
<tr>
<td>CP(AG)-322</td>
<td>Practical Crop Production-II (Rabi Crops)</td>
<td>2(0+2)</td>
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<tr>
<td>AG_328</td>
<td>Principles of Organic Farming</td>
<td>2(1+1)</td>
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<tr>
<td>PBG-325</td>
<td>Crop Improvement-II (Rabi Crops)</td>
<td>2(1+1)</td>
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<tr>
<td>AG-329</td>
<td>Geo-informatics &amp; Nano-Technology for Precision Farming</td>
<td>2(1+1)</td>
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<tr>
<td>AE-324</td>
<td>Farm Management, Production &amp; Resource Economics</td>
<td>2(1+1)</td>
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<tr>
<td>SWE(Ag)-322</td>
<td>Protected Cultivation &amp; Secondary Agriculture</td>
<td>2(1+1)</td>
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<tr>
<td>PPT-325</td>
<td>Diseases of Field &amp; Horticultural Crops &amp; their Management-II</td>
<td>3(2+1)</td>
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<tr>
<td>HORT-325</td>
<td>Post-Harvest Management &amp; Value addition of Horticultural Crops</td>
<td>2(1+1)</td>
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<tr>
<td>LPM-321</td>
<td>Livestock &amp; Poultry Management</td>
<td>4(3+1)</td>
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<td>HORT(E)-323</td>
<td>Protected Cultivation</td>
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<td>AC(E)-323</td>
<td>Soil, Plant, Water &amp; Seed Testing</td>
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<tr>
<td>AG(E)-323</td>
<td>Agricultural Waste Management</td>
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<td>ABM(E)-321</td>
<td>Agricultural Business Management</td>
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<tbody>
<tr>
<td>RAWE-411</td>
<td>Village Attachment Programme</td>
<td>0+14</td>
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<tr>
<td>RAWE-412</td>
<td>Agro-Industrial Attachment Programme</td>
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<td><strong>Total</strong></td>
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### Eighth Semester

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<tbody>
<tr>
<td>ELP-421</td>
<td>Experiential Learning Programme</td>
<td>0+20</td>
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<td><strong>Total</strong></td>
<td><strong>0+20</strong></td>
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</table>
B. Sc. (Ag) SYLLABUS

I. AGRONOMY

I. Title: Fundamentals of Agronomy

Course No: AG-111

Cr hr: 4(3+1)

Theory

Agronomy and its scope, seeds and sowing, tillage and tilth, crop density and geometry, Crop nutrition, manures and fertilizers, nutrient use efficiency, water resources, soil plant water relationship, crop water requirement, water use efficiency, irrigation- scheduling criteria and methods, quality of irrigation water, water logging.


Practical

Identification of crops, seeds, fertilizers, pesticides and tillage implements, Effect of sowing depth on germination and seedling vigor, Identification of weeds in crops, Methods of herbicide and fertilizer application, Study of yield contributing characters and yield estimation, Seed germination and viability test, Numerical exercises on fertilizer requirement, plant population, herbicides and water requirement, Use of tillage implements-reversible plough, one way plough, harrow, leveler, seed drill, Study of soil moisture measuring devices, Measurement of field capacity, particle density, bulk density and infiltration rate, Measurement of irrigation water.

Text/ Reference Books:

Principles of Agronomy

Water management

Weed management

2. Title: Agriculture Heritage (New Course)

Course No: AG- 112  Cr hr: 1(1+0)

Theory
Introduction of Indian agricultural heritage, status of farmers in society; advice by sages to kings on their duties towards farmers, soil management in ancient, medieval & pre-modern India and its relevance in modern day sustainable agriculture, heritage of crop & water management, plant growth and development & plant protection through vrikshayurveda and traditional knowledge. Heritage of medicinal plants and their relevance today, seed health in ancient & medieval history and its relevance to present day agriculture, description of Indian civilization and agriculture by travelers from China, Europe and United States, our journey in agriculture, green revolution and its impact and concerns, vision for the future.

Text / Reference Books:

5. Agriculture in Ancient India - S. P. Raychaudhuri, Indian Council of Agricultural Research, New Delhi (1964)

3. Title: Introductory Agro meteorology & Climate Change

Course No: AG- 123  Cr hr: 2(1+1)

Theory

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, Energy balance of earth; Atmospheric humidity, concept of saturation, vapor 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 normals 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

Text / Reference Books:

4. Title: Crop Production Technology-I (Kharif Crops)
Course No: AG-214 Cr hr: 2(1+1)

Theory
Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of Kharif crops. Cereals – rice, maize, sorghum, pearl millet and finger millet & other minier millets, pulses-pigeonpea, mungbean, urdbean & horse gram; oilseeds- groundnut, soybean, niger, sesamum & castor; fibre crops- cotton, Jute, mesta & allied fibres; forage crops-sorghum, cowpea, cluster bean and napier.

Practical
Rice nursery preparation, transplanting of Rice, sowing of soybean, pigeonpea and mungbean. maize, groundnut and cotton, effect of seed size on germination and seedling vigour of kharif season crops, effect of sowing depth on germination of kharif crops, identification of weeds in kharif season crops, top dressing and foliar feeding of nutrients, study of yield contributing characters and yield calculation of kharif season crops, study of crop varieties and important agronomic experiments at experimental farm. study of forage experiments, morphological description of kharif season crops, visit to research centres of related crops.

Text / Reference Books:
5. Title: Crop Production Technology-II (Rabi crops)

Course No: AG- 225  
Cr hr: 2(1+1)

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, pea & rajmah; oilseeds-rapeseed, mustard, sunflower, safflower & linseed; sugar crops-sugarcane & sugarbeet; other crops- potato, narcotics-tobacco; Forage crops- berseem, lucerne and oat.

Practical

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, study of important agronomic experiments of rabi crops at experimental farms. Study of rabi forage experiments, oil extraction of medicinal crops, visit to research stations of related crops.

Text / Reference Books:


6. Title: Farming Systems and Sustainable Agriculture

Course No: AG- 226  
Cr hr: 1(1+0)

Theory

Farming System-scope, importance, and concept, Types and systems of farming system and factors affecting types of farming, Farming system components and their maintenance, Cropping system and pattern, multiple cropping system, Efficient cropping system and their evaluation, Allied enterprises and their importance, Tools for determining production and efficiencies in cropping and farming system; Sustainable agriculture-problems and its impact on agriculture, indicators of sustainability, adaptation and mitigation, conservation agriculture strategies in agriculture, HEIA, LEIA and LEISA and its techniques for sustainability, Integrated farming system-historical background, objectives and characteristics, components of IFS and its advantages, Site specific development of IFS model for different agro-climatic zones, resource use efficiency and optimization techniques, Resource cycling and flow of energy in different farming system, farming system and environment, Visit of IFS model in different agro-climatic zones of nearby states University/ institutes and farmers field.
7. Title: Rainfed Agriculture and Watershed Management – (New)

Course No: AG-317
Cr hr: 2(1+1)

Theory
Rainfed agriculture: Introduction, types, History of rainfed agriculture & watershed in India; Problems and prospects of rainfed agriculture in India; Soil and climatic conditions prevalent in rainfed areas; Drought: types, effect of water deficit on physio- morphological characteristics of the plants, Mechanism of crop adaptation under moisture deficit condition; Water harvesting: importance, its techniques, Efficient utilization of water through soil and crop management practices, Management of crops in rainfed areas, Contingent crop planning for aberrant weather conditions, Concept, objective, principles and components of 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 dry land areas in the country and demarcation of dry land 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 viz; mulching, plant density, depth of sowing, thinning and leaf removal for mitigating moisture stress. 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.

Text / Reference Books:

8. Title: Principles of Organic Farming

Course No: AG- 328
Cr hr: 2(1+1)

Theory
Organic farming, principles and its scope in India; Initiatives taken by Government (central/state), NGOs and other organizations for promotion of organic agriculture; Organic ecosystem and their concepts; Organic nutrient resources and its fortification; Restrictions to nutrient use in organic farming; Choice of crops and varieties in organic farming; Fundamentals of insect, pest, disease and weed management under organic mode of production; Operational structure of NPOP; Certification process and standards of organic farming; Processing, leveling, economic considerations and viability, marketing and export potential of organic products.

Practical
Visit of organic farms to study the various components and their utilization; Preparation of enrich compost, vermicompost, bio-fertilizers/bio-inoculants and their quality analysis; Indigenous technology knowledge (ITK) for nutrient, insect, pest disease and weed management; Cost of organic production system; Post harvest management; Quality aspect, grading, packaging and handling.

Text / Reference Books:

9. Title: Geoinformatics and Nano-technology for Precision Farming

Course No: AG- 329
Cr hr: 2(1+1)

Theory
Precision agriculture: concepts and techniques; their issues and concerns for Indian agriculture; Geo-informatics- definition, concepts, tool and techniques; their use in Precision Agriculture. Crop discrimination and Yield monitoring, soil mapping; fertilizer recommendation using geospatial technologies; Spatial data and their management in GIS; Geodesy and its basic principles; Remote sensing concepts and application in agriculture; Image processing and interpretation; Global positioning system (GPS), components and its functions; System Simulation- Concepts and principles, Introduction to crop Simulation Models and their uses for optimization of Agricultural Inputs; STCR approach for precision agriculture; Nanotechnology, definition, concepts and techniques, brief introduction about nanoscale effects, nano-particles, nano-pesticides, nano-fertilizers, nano-sensors, Use of nanotechnology in tillage, seed, water, fertilizer, plant protection for scaling-up farm productivity.
Practical


Text / Reference Books:
4. Precision Agriculture Technology Application - K. C. Swain

1. Title: Practical Crop Production-I (Kharif Crops)

Course No: CP- 311  Cr hr: 2(0+2)

Practical

Crop planning, raising field crops in multiple cropping systems: Field preparation, seed, treatment, nursery raising, sowing, nutrient, water and weed management and management of insect-pests diseases of crops, harvesting, threshing, drying winnowing, storage and marketing of produce. The emphasis will be given to seed production, mechanization, resource conservation and integrated nutrient, insect-pest and disease management technologies. Preparation of balance sheet including cost of cultivation, net returns per student as well as per team of 8-10 students.

Text / Reference Books:
6. Practical manuals on nutrient management, water management & weed management -
Department of Agronomy, College of Agriculture, OUAT, Bhubaneswar.

2. Title: Practical Crop Production-II (Rabi Crops)
Course No: CP- 322 Cr hr: 2(0+2)

Practical
Crop planning, raising field crops in multiple cropping systems: Field preparation,
seed, treatment, nursery raising, sowing, nutrient, water and weed management and
management of insect-pests diseases of crops, harvesting, threshing, drying winnowing,
storage and marketing of produce. The emphasis will be given to seed production,
mechanization, resource conservation and integrated nutrient, insect-pest and disease
management technologies. Preparation of balance sheet including cost of cultivation, net
returns per student as well as per team of 8-10 students.

Text / Reference Books:
1. Manures and Fertilizers - K. S. Yawalkar, J. P. Agarwal and S. Bokde, Agri-
Agrobios (India), Jodhpur (2001)
(1993)
6. Practical manuals on nutrient management, water management & weed management -
Department of Agronomy, College of Agriculture, OUAT, Bhubaneswar.
II. GENETICS AND PLANT BREEDING

1. Title: Fundamentals of Genetics

Course No: PBG-121  
Cr hr: 3(2+1)

Theory

Pre and Post Mendelian concepts of heredity, Mendelian principles of heredity, Cell division – mitosis, meiosis, Probability and Chi-square. Dominance relationships, gene interaction.


Practical

Study of microscope. Study of cell structure. 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 cross over analysis (through two point test cross and three point test cross data). Study on sex linked inheritance in Drosophila. Study of models on DNA and RNA structure.

Text / Reference Books:


2. Title: Fundamentals of Plant Breeding

Course No: PBG-212  
Cr hr: 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, self – incompatibility and male sterility- genetic consequences, cultivar options. Domestication, Acclimatization, introduction; Centre of origin/diversity, component of
Genetic variation; Heritability and genetic advance; Genetic basis and breeding methods in self-pollinated crops-mass and pure line 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; Heterosis and inbreeding depression, development of inbred lines and hybrids, composite and synthetic varieties; Breeding methods in asexually propagated crops, clonal selection and hybridization; 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; Intellectual Property Rights, Patenting, Plant Breeders and & Farmer’s Rights.

**Practical**


**Text / Reference Books:**


**3. Title: Intellectual Property Rights**

**Course No: PBG -313**

**Cr hr: 1(1+0)**

**Theory**

Introduction and meaning of intellectual property, brief introduction to GATT, WTO, TRIPs and WIPO, Treaties for IPR protection: Madrid protocol, Berne Convention, Budapest treaty, etc.


Convention on Biological Diversity, International treaty on plant genetic resources for food and agriculture (ITPGRFA). Indian Biological Diversity Act, 2002 and its salient features, access and benefit sharing.

Text / Reference Books:


4. Title: Crop Improvement – I (Kharif)

Course No: PBG -314 Cr hr: 2(1+1)

Theory

Centers of origin, distribution of species, wild relatives in different cereals; pulses; oilseeds; fibres; fodders and cash crops; vegetable and horticultural crops; Plant genetic resources, its utilization and conservation Floral biology, study of genetics of qualitative and quantitative characters; Important concepts of breeding self pollinated, cross pollinated and vegetatively propagated crops; Major breeding objectives 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); Seed production technology in self pollinated, cross pollinated and vegetatively propagated crops. Hybrid seed production technology in Maize, Rice, Sorghum, Pearl millet and Pigeonpea, etc. Ideotype concept and climate resilient crop varieties for future.

Practical

Emasculation and hybridization techniques in different crop species; viz., Rice, Maize, Sorghum, Pearl Millet, Ragi, Pigeonpea, Urdbean, Mungbean, Soybean, Groundnut, Seasame, Caster, Cotton, Cowpea, Pearl millet and Tobacco. 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 seeds production in Kharif crops; Estimation of heterosis, inbreeding depression and heritability; Layout of field experiments; Study of quality characters, donor parents for different characters; Visit to seed production plots; Visit to AICRP plots of different field crops.
Text / Reference Books:


5. Title: Crop Improvement – II (Rabi)

Course No: PBG -325  Cr hr: 2(1+1)

Theory

Centers of origin, distribution of species, wild relatives in different cereals; pulses; oilseeds; fodder crops and cash crops; vegetable and horticultural crops; Plant genetic resources, its utilization and conservation; Floral biology, study of genetics of qualitative and quantitative characters; Important concepts of breeding self pollinated, cross pollinated and vegetatively propagated crops; Major breeding objectives 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); Seed production technology in self pollinated, cross pollinated and vegetatively propagated crops. Hybrid seed production technology of rabi crops. Ideotype concept and climate resilient crop varieties for future.

Practical

Emasculation and hybridization techniques in different crop species namely Wheat, Oat, Barley, Chickpea, Lentil, Field pea, Rapeseed Mustard, Sunflower, Potato, Berseem. Sugarcane, Cowpea; 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 seeds production in Rabi crops; Estimation of heterosis, inbreeding depression and heritability; Layout of field experiments; Study of quality characters, study of donor parents for different characters; Visit to seed production plots; Visit to AICRP plots of different field crops.

Text / Reference Books:

III. SOIL SCIENCE & AGRICULTURAL CHEMISTRY

1. Title: Fundamentals of Soil Science

Course No: AC - 111  Cr hr: 3(2+1)

Theory

Soil as a natural body, Pedological and edaphological concepts of soil; Soil genesis: soil forming rocks and minerals; weathering, processes and factors of soil formation; Soil Profile, components of soil; Soil physical properties: soil-texture, structure, density and porosity, soil colour, consistence and plasticity; Elementary knowledge of soil taxonomy classification and soils of India; Soil water retention, movement and availability; soil air, composition, gaseous exchange, problem and plant growth; source, amount and flow of heat in soil; soil temperature and plant growth; Soil reaction-pH, soil acidity and alkalinity, buffering, effect of pH on nutrient availability; soil colloids - inorganic and organic; silicate clays: constitution and properties; sources of charge ion exchange, cation exchange capacity, base saturation; soil organic matter: composition, properties and its influence on soil properties; humic substances - nature and properties; soil organisms: macro and micro organisms, their beneficial and harmful effects; Soil pollution - behaviour of pesticides and inorganic contaminants, prevention and mitigation of soil pollution.

Practical


Text / Reference Books:

2. **Title: Agricultural Microbiology**

**Course No:** AC - 122  
**Cr. hr:** 2(1+1)

**Theory**


**Practical**


**Text / Reference Books:**


3. **Title: Fundamentals of Plant Biochemistry**

**Course No:** AC - 213  
**Cr. hr:** 2(1+1)

**Theory**

Importance of Biochemistry. Properties of Water, pH and Buffer. Carbohydrate: Importance and classification. Structures of Monosaccharides, Reducing and oxidizing properties of Monosaccharides, Mutarotation; Structure of Disaccharides and Polysaccharides. Lipid:
Importance and classification; Structures and properties of fatty acids; storage lipids and membrane lipids. Proteins: Importance of proteins and classification; Structures, titration and zwitterions nature of amino acids; Structural organization of proteins. Enzymes: General properties; Classification; Mechanism of action; Michaelis & Menten and Line Weaver Burk equation & plots; Introduction to allosteric enzymes. Nucleic acids: Importance and classification; Structure of Nucleotides, A, B & Z DNA; RNA: Types and Secondary & Tertiary structure. Metabolism of carbohydrates: Glycolysis, TCA cycle, Glyoxylate cycle, Electron transport chain. Metabolism of lipids: Beta oxidation, Biosynthesis of fatty acids.

**Practical**


**Text / Reference Books:**


**4. Title: Problematic Soils and their Management (New)**

**Course No: AC - 224**

**Cr. hr: 2(1+1)**

**Theory**


Multipurpose tree species, bio remediation through MPTs of soils, land capability and classification, land suitability classification. Problematic soils under different Agroeco systems.

**Practical**

Text /Reference Books:


5. Title: Manures, Fertilizers and Soil Fertility Management

Course No: AC - 315 Cr. hr: 3(2+1)

Theory


Chemical fertilizers: classification, composition and properties of major nitrogenous, phosphatic, potassic fertilizers, secondary & micronutrient fertilizers, Complex fertilizers, nano fertilizers Soil amendments, Fertilizer Storage, Fertilizer Control Order.


Practical


Text / Reference Books:

IV. HORTICULTURE

1. Title: Fundamentals of Horticulture (New)

Course No: HORT - 111  
Cr. hr: 2(1+1)

Theory

Horticulture-Its definition and branches, importance and scope; horticultural and botanical classification; climate and soil for horticultural crops; Plant propagation-methods and propagating structures; principles of orchard establishment; Principles and methods of training and pruning, juvenility and flower bud differentiation; unfruitfulness; pollination, pollinizers and pollinators; fertilization and parthenocarpy; kitchen gardening; garden types and parts; lawn making; medicinal and aromatic plants; species and condiments; use of plant bio-regulators in horticulture. Irrigation & fertilizers application-method and quantity.

Practical


Text / Reference Books:

1. Introduction to Horticulture - N. Kumar, Oxford Publisher Ltd, Delhi (2010)

2. Title: Production Technology for Fruit and Plantation Crops

Course No: HORT - 122  
Cr. hr: 2(1+1)

Theory

Importance and scope of fruit and plantation crop industry in India; High density planting; Use of rootstocks; Production technologies for the cultivation of major fruits-mango, banana, citrus, grape, guava, litchi, sapota & papaya and minor fruits- pineapple, pomegranate, jackfruit & strawberry; plantation crops-coconut, arecanut, cashew, tea, coffee & rubber.

Practical

Text / Reference Books:

3. Title: Production Technology for Vegetable and Spices

Course No: HORT - 213  
Cr. hr: 2(1+1)

Theory
Importance of vegetables & spices in human nutrition and national economy, brief about origin, area, production, improved varieties and cultivation practices such as time of sowing, sowing, transplanting techniques, planting distance, fertilizer requirements, irrigation, weed management, harvesting, storage, physiological disorders of important vegetable crops like solanaceous fruit vegetables (brinjal, tomato & chilli), tuber crops (Potato), cucurbits (pumpkin, cucumber, watermelon & gourds), pod vegetables (pea & bean), cole crops (cabbage & cauliflower), bulb crops (onion, garlic), root crops (radish & carrot), common leafy vegetables, spices: turmeric and ginger, black pepper and cardamom.

Practical

Text / Reference Books:
1. Vegetable Crops in India - T.K. Bose and M. G. Som, Naya Prakash (1990)

4. Title: Production Technology for Ornamental Crops, MAPs and Landscaping

Course No: HORT - 314  
Cr. hr: 2(1+1)

Theory
Importance and scope of ornamental crops, 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, carnation, lilium and orchids under protected conditions and gladiolus, tuberose, chrysanthemum under open
conditions. Package of practices for loose flowers like marigold and jasmine under open conditions. Production technology of important medicinal plants like asparagus, aloe, costus, Cinnamomum, periwinkle, isabgol, Rauwolfia, Andropogon and aromatic plants like mint, lemongrass, citronella, palmarosa, ocimum, rose, geranium, vetiver & long pepper. Processing and value addition in ornamental crops and MAPs produce.

**Practical**


**Text / Reference Books:**


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5. **Title:** Post-harvest Management and Value Addition of Horticultural Crops

**Course No:** HORT - 325

**Cr. hr:** 2(1+1)

**Theory**

Importance of fruits and vegetables, extent and possible causes of post harvest losses; Pre-harvest factors affecting postharvest quality, maturity, ripening and changes occurring during ripening; Respiration and factors affecting respiration rate; Role of ethylene; Post harvest disease and disorders; Heat, chilling and freezing injury; Harvesting and field handling; Storage (ZECC, cold storage, CA, MA, and hypobaric); Value addition concept; Principles and methods of preservation; Intermediate moisture food - Jam, jelly, marmalade, preserve, candy – Concepts and Standards; Fermented and non-fermented beverages. Tomato products- Concepts and Standards; Drying/ Dehydration of fruits and vegetables – Concept and methods, osmotic drying. Canning -- Concepts and Standards, packaging of products.

**Practical**

Text / Reference Books:

V. ENTOMOLOGY

1. Title: Fundamentals of Entomology

Course No: ENT - 121
Cr. hr: 4(3+1)

Theory

Part - I


Part-II

Systematics: Taxonomy –importance, history and development and binomial nomenclature. Definitions of Biotype, Sub-species, Species, Genus, Family and Order. Classification of class Insecta upto Orders, basic groups of present day insects with special emphasis to orders and families of Agricultural importance like Orthoptera: Acrididae, Tettigonidae, Gryllidae, Gryllotalpidae; Dictyoptera: Mantidae, Blattidae; Odonata; Isoptera: Termitidae; Thysanoptera: Thripidae; Hemiptera: Pentatomidae, Coreidae, Cimicidae, Pyrrhocoridae, Lygaeidae, Coccinellidae, Delphacidae, Aphididae, Coccidae, Lophophidae, Aleurodidae, Pseudococcidae; Neuroptera: Chrysopidae; Lepidoptera: Pieridae, Papiloinidae, Noctuidae, Sphingidae, Pyralidae, Gelechiidae, Arctiidae, Saturnidae, Bombycidae; Coleoptera: Coccinellidae, Chrysomelidae, Curculionidae, Curculionidae, Bruchidae, Scarabaeidae; Hymenoptera: Tenthridinidae, Apidae, Trichogrammatidae, Ichneumonidae, Braconidae, Chalcididae; Diptera: Cecidomyiidae, Tachinidae, Agromyzidae, Culicidae, Muscidae, Tephritidae.

Part III


Part – IV

Pest surveillance and pest forecasting. Categories of pests. Host plant resistance, Cultural, Mechanical, Physical. Legislative. Biological (parasites, predators & transgenic plant pathogens such as bacteria, fungi and viruses) methods of control. Chemical control-

**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); Dissection of male and female reproductive systems in insects (Grasshopper); Study of characters of orders Orthoptera, Dictyoptera, Odonata, Isoptera, Thysanoptera, Hymenoptera, Lepidoptera, Neuroptera, Coleoptera, Hymenoptera, Diptera and their families of agricultural importance. Acquaintance with plant protection appliances and their use.

**Text / Reference Books:**


2. **Title: Pests of Crops and Stored Grains and their Management**

**Course No: ENT - 212**

**Theory**

General account on nature and type of damage by different arthropods pests. Scientific name, order, family, host range, distribution, biology and bionomics, nature of damage, and management of major pests and scientific name, order, family, host range, distribution, nature of damage and control practice other important arthropod pests of various field crops such as cereals (rice, wheat, maize, sorghum, ragi), Pulses (green gram, black gram, arhar, Bengal gram), oil seeds (ground nut, mustard, sesamum, castor, sunflower), fiber crops (cotton, jute), vegetable crops (brinjal, potato, sweet potato, tomato, chilli, cucurbits, cole crops, okra, beans), fruit crops (mango, citrus, banana, pomegranate, ber, sapota, litchi, guava, papaya, grapes & apple), plantation crops (coconut, cashew nut, tea, coffee), ornamental crops (rose, marigold, tuberose, chrysanthemum), spices and condiments (onion, garlic, cardamom, black pepper, turmeric, ginger) & sugarcane. Factors affecting losses of stored grain and role of physical, biological, mechanical and chemical factors in deterioration of grain. Insect pests, mites, rodents, birds and microorganisms associated with stored grain
and their management. Storage structure and methods of grain storage and fundamental principles of grain store management.

**Practical**

Identification of different types of damage. Identification and study of life cycle and seasonal history of various insect pests attacking crops and their produce: (a) Field Crops; (b) Vegetable Crops; (c) Fruit Crops; (d) Plantation, gardens, Narcotics, spices & condiments. Identification of insect pests and Mites associated with stored grain. Determination of insect infestation by different methods. Assessment of losses due to insects. Calculations on the doses of insecticides application technique. Fumigation of grain store / godown. Identification of rodents and rodent control operations in godowns. Identification of birds and bird control operations in godowns. Determination of moisture content of grain. Methods of grain sampling under storage condition. Visit to nearby ware house. Visit to nearest FCI godowns.

**Text / Reference Books:**


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3. **Title: Management of Beneficial Insects**

**Course No: ENT - 223**  
**Cr. hr: 2(1+1)**

**Theory**

Importance of beneficial Insects pollinating plants. Types of honey bees and their caste system, history of bee keeping, bee biology, commercial methods of rearing, equipment used, seasonal management, bee enemies and disease. Bee pasturage, bee foraging and communication. Insect pests and diseases of honey bee. Insecticidal poisoning in honey bees.


Species of lac insect, morphology, biology, host plant, lac production – seed lac, button lac, shellac, lac- products. Natural enemies of lac insects and their management. Identification of major parasitoids and predators commonly being used in biological control.

Beneficial insects: parasites and predators used in pest control and their mass multiplication techniques. Important groups of microorganisms, bacteria, viruses and fungi used in pest
control and their mass multiplication techniques. Important species of pollinator, weed killers and scavengers with their importance.

Practical


Text / Reference Books:
4. Insects and Mites of Crops in India - M. R. G. K. Nair, ICAR Publication (1975)

4. Title: Principles of Integrated Pest and Disease Management

Course No: ENT - 314
Cr. hr: 3(2+1)

Theory


Practical

Methods of diagnosis and detection of various insect pests, and plant diseases, Methods of insect pests and plant disease measurement, Assessment of crop yield losses, calculations based on economics of IPM, Identification of biocontrol agents, different predators and natural enemies. Mass multiplication of Trichoderma, Pseudomonas, Trichogramma, NPV etc. Identification and nature of damage of important insect pests and diseases and their management. Crop (agro-ecosystem) dynamics of a selected insect pest and diseases. Plan & assess preventive strategies (IPM module) and decision making. crop monitoring attacked by insect, pest and diseases. Awareness campaign at farmers fields.
Text / Reference Books:
VI. PLANT PATHOLOGY

1. Title: Fundamentals of Plant Pathology

Course No: PPT - 121  
Cr. hr: 3(2+1)

Theory


Fungi: general characters, definition of fungus, somatic structures, types of fungal thalli, fungal tissues, modifications of thallus, reproduction (asexual and sexual). Nomenclature, Binomial system of nomenclature, rules of nomenclature, classification of fungi. Key to divisions, sub-divisions, orders and classes; Bacteria and mollicutes: general morphological characters. Basic methods of classification and reproduction; Viruses: nature, architecture, multiplication and transmission; Study of phanerogamic plant parasites.

Principles and methods of plant disease management; Nature, chemical composition, classification, mode of action and formulations of fungicides and antibiotics.

Practical


Text / Reference Books:


2. Title: Fundamentals of Nematology

Course No: PPT - 212  
Cr. hr: 2(1+1)

Theory

Structure of plant parasitic Nematodes, association of plant parasitic Nematodes in various crop plants, economic importance of nematodes, classification of nematodes based on feeding habits, various above and below ground symptoms, economically important nematodes affecting rice, wheat, important vegetable, fruits and ornamentals with their symptoms, biology, spread of diseases and integrated nematode management.
Practical


Text / Reference Books:


3. Title: Mushroom Cultivation

Course No: PPT - 223 Cr. hr: 1(0+1)

Practical


Text / Reference Books:


4. Title: Diseases of Field & Horticultural Crops & their Management-I

Course No: PPT - 314 Cr. hr: 3 (2+1)

Theory

Symptoms, etiology, disease cycle and management of major diseases of following crops:

Field Crops: Rice: blast, brown spot, bacterial blight, sheath blight, false smut, khaira and tungro; Maize: stalk rots, downy mildew, leaf spots; Sorghum: smuts, grain mold and anthracnose, Bajra : downy mildew and ergot; Groundnut: early and late leaf spots, wilt
Soybean: Rhizoctonia blight, bacterial spot, seed and seedling rot and mosaic; Pigeonpea: Phytophthora blight, wilt and sterility mosaic; Finger millet: Blast and leaf spot; black & green gram: Cercospora leaf spot and anthracnose, web blight and yellow mosaic; Castor: Phytophthora blight; Tobacco: black shank, black root rot and mosaic. Horticultural Crops: Guava: wilt and anthracnose; Banana: Panama wilt, bacterial wilt, Sigatoka and bunchy top; Papaya: foot rot, leaf curl and mosaic; Pomegranate: bacterial blight; Cruciferous vegetables: Alternaria leaf spot and black rot; Brinjal: Phomopsis blight and fruit rot and Sclerotinia blight; Tomato: damping off, wilt, early and late blight, buck eye rot and leaf curl and mosaic; Okra: Yellow Vein Mosaic; Beans: anthracnose and bacterial blight; Ginger: soft rot; Colocasia: Phytophthora blight; Coconut: wilt and bud rot; Tea: blister blight; Coffee: rust

**Practical**

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.

**Text / Reference Books:**

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5. **Title:** Diseases of Field & Horticultural Crops & their Management-II

**Course No:** PPT - 325  
**Cr. hr:** 3 (2+1)

**Theory**

Symptoms, etiology, disease cycle and management of following diseases:

**Field Crops:**

Wheat: rusts, loose smut, karnal bunt, powdery mildew, alternaria blight, and ear cockle;

Sugarcane: red rot, smut, wilt, grassy shoot, ratoon stunting and Pokkah Boeng;

Sunflower: Sclerotinia stem rot and Alternaria blight; Mustard: Alternaria blight, white rust, downy mildew and Sclerotinia stem rot; Gram: wilt, grey mould and Ascochyta blight; Lentil: rust and wilt; Cotton: anthracnose, vascular wilt, and black arm; Pea: downy mildew, powdery mildew and rust; Horticultural Crops: Mango: anthracnose, malformation, bacterial blight and powdery mildew; Citrus: canker and gummosis; Grape vine: downy mildew, Powdery mildew and anthracnose; Apple: scab, powdery mildew, fire blight and crown gall.

Strawberry: leaf spot; Potato: early and late blight, black scurf, leaf roll, and mosaic;

Cucurbits: downy mildew, powdery mildew, wilt; Onion and garlic: purple blotch, and Stemphylium blight; Chillies: anthracnose and fruit rot, wilt and leaf curl; Turmeric: leaf spot; Coriander: stem gall; Marigold: Botrytis blight; Rose: dieback, powdery mildew and black leaf spot.
Practical

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.

Text / Reference Books:
VII. AGRICULTURAL ECONOMICS

1. Title: Fundamentals of Agricultural Economics

Course No: AE - 111  
Cr. hr: 2 (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. Agricultural planning and development in the country. **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. Market structure: meaning and types of market, basic features of perfectly competitive and imperfect markets. Price determination under perfect competition; short run and long run equilibrium of firm and industry, shut down and break even points. 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. Population: Importance, Malthusian and Optimum population theories, natural and socio-economic determinants, current policies and programmes on population control. 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. Banking: Role in modern economy, types of banks, functions of commercial and central bank, credit creation policy. Agricultural and public finance: meaning, micro v/s macro finance, need for agricultural finance, public revenue and public expenditure. **Tax:** meaning, direct and indirect taxes, agricultural taxation, VAT. **Economic systems:** Concepts of economy and its functions, important features of capitalistic, socialistic and mixed economies, elements of economic planning.

**Text / Reference Books:**

2. Title: Agricultural Finance and Co-Operation

Course No: AE - 212  
Cr. hr: 3(2+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.

Practicals

Text/Reference Books:

3. Title: Agricultural Marketing, Trade and Prices

Course No: AE - 223  
Cr. hr: 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; product life cycle (PLC) and competitive strategies: Meaning and stages in PLC; characteristics of PLC; strategies in different stages of PLC; pricing and promotion strategies: pricing considerations and approaches – cost based and competition based pricing; market promotion – advertising, personal selling, sales promotion and publicity – their meaning and merits & demerits; marketing process 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 labeling (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 & DMI – their objectives and functions; cooperative marketing in India; Risk in marketing: Types of risk in marketing; speculation & hedging; an overview of futures trading; Agricultural prices and policy: Meaning and functions of price; administered prices; need for 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; GATT and WTO; Agreement on Agriculture (AoA) and its implications on Indian agriculture; IPR.

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 over time 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.

Text / Reference Books:
4. Title: Farm Management, Production and Resource Economics

Course No: AE - 324  
Cr. hr: 2(1+1)

Theory

Meaning and concept of farm management, objectives and relationship with other sciences. Meaning and definition of farms, its types and characteristics, factor determining types and size of farms. Principles of farm management: concept of production function and its type, use of production function in decision-making on a farm, factor-product, factor-factor and product-product relationship, law of equi-marginal/or principles of opportunity cost and law of comparative advantage. Meaning and concept of cost, types of costs and their interrelationship, importance of cost in managing farm business and estimation of gross farm income, net farm income, family labor income and farm business income. Farm business analysis: meaning and concept of farm income and profitability, technical and economic efficiency measures in crop and livestock enterprises. Importance of farm records and accounts in managing a farm, various types of farm records needed to maintain on farm, farm inventory, balance sheet, profit and loss accounts. Meaning and importance of farm planning and budgeting, partial and complete budgeting, steps in farm planning and budgeting-linear programming, appraisal of farm resources, selection of crops and livestock’s enterprises. Concept of risk and uncertainty occurs in agriculture production, nature and sources of risks and its management strategies, Crop/livestock/machinery insurance – weather based crop insurance, features, determinants of compensation. Concepts of resource economics, differences between NRE and agricultural economics, unique properties of natural resources. Positive and negative externalities in agriculture, Inefficiency and welfare loss, solutions, Important issues in economics and management of common property resources of land, water, pasture and forest resources etc.

Practical


Text / Reference Books:

VIII. AGRICULTURAL EXTENSION EDUCATION

1. Title: Fundamentals of Agricultural Extension Education

Course No: EE - 111
Cr. hr: 3(2+1)

Theory

Education: Meaning, definition & 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.); various extension/ agriculture development programmes launched by ICAR/ Govt. of India (IADP, IAAP, HYVP, KVK, IVLP, ORP, ND,NATP, NAIP, etc.). New trends in agriculture extension: privatization extension, cyber extension/ e-extension, market-led extension, farmer-led extension, expert systems, etc.

Rural Development: concept, meaning, definition; various rural development programmes launched by Govt. of India. Community Dev.-meaning, definition, concept & principles, Physiology of C.D. Rural Leadership: concept and definition, types of leaders in rural context; extension administration: meaning and concept, principles and functions. Monitoring and evaluation: concept and definition, monitoring and evaluation of extension programmes; transfer of technology: concept and models, capacity building of extension personnel; extension teaching methods: meaning, classification, individual, group and mass contact methods, media mix strategies; communication: meaning and definition; models and barriers to communication. Agriculture journalism; diffusion and adoption of innovation: concept and meaning, process and stages of adoption, adopter categories.

Practical

To get acquainted with university extension system. Group discussion- exercise; handling and use of audio visual equipments and digital camera and LCD projector; preparation and 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; to study organization and functioning of DRDA and other development departments at district level; visit to NGO and learning from their experience in rural development; understanding PRA techniques and their application in village development planning; 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.
2. **Title: Human Value and Ethics**  

**Course No:** EE - 122  
**Cr. hr:** 1(1+0)  

**Theory**  

**Text / Reference Books:**  

3. **Title: Rural Sociology & Educational Psychology**  

**Course No:** EE - 213  
**Cr. hr:** 2(2+0)  

**Theory**  

**Text / Reference Books:**  
1. Introductory Rural Sociology - J.B. Chitamber, New Age International (P) Ltd., Kolkata (1960)  
3. Rural Sociology and Educational Psychology - Sagar Mandal, Kalyani publisher, Kolkata (2001)  

4. **Title: Communication Skills and Personality Development**

**Course No:** EE - 224  
**Cr. hr:** 2(1+1)

**Theory**

Communication Skills: Structural and functional grammar; meaning and process of communication, verbal and nonverbal communication; listening and note taking, writing skills, oral presentation skills; field diary and lab record; indexing, footnote and bibliographic procedures. Reading and comprehension of general and technical articles, precise writing, summarizing, abstracting; individual and group presentations, impromptu presentation, public speaking; Group discussion. Organizing seminars and conferences.

**Practical**

Listening and note taking, writing skills, oral presentation skills; field diary and lab record; indexing, footnote and bibliographic procedures. Reading and comprehension of general and technical articles, precise writing, summarizing, abstracting; individual and group presentations.

**Text / Reference Books:**

5. **Title: Entrepreneurship Development and Business Communication**

**Course No:** EE - 315  
**Cr. hr:** 2(1+1)

**Theory**

Concept of Entrepreneur, Entrepreneurship Development, Characteristics of entrepreneurs; Assessment of entrepreneurship skills, SWOT Analysis & achievement motivation, Entrepreneurial behavior, Government policy and programs and institutions for entrepreneurship development, impact of economic reforms on agri-business/agri-enterprise, Entrepreneurial Development Process; Business Leadership Skills; Communication skills for entrepreneurship development, Developing organizational skill , Developing Managerial skills, Problem solving skill, Achievement motivation; time management; Supply chain management and Total quality management, Project Planning Formulation and report preparation, financing of enterprise. Opportunities for entrepreneurship and rural enterprise.
**Practical**
Assessing entrepreneurial potential, problem solving ability, managerial skills and achievement motivation, exercise in creativity, time audit, preparation of business plan and proposal writing, visit to entrepreneurship development institute and entrepreneurs.

**Text / Reference Books:**
1. Indian Agriculture & Agri-Business Management - S. Diwase, Scientific Publisher India (2014)
IX. SEED SCIENCE AND TECHNOLOGY

1. Title: Principles of Seed Technology

Course No: SST - 221  Cr. hr: 2(1+1)

Theory
Seed and seed technology: introduction, definition and importance. Deterioration causes of crop varieties and their control; Maintenance of genetic purity during seed production, seed quality; Definition, Characters of good quality seed, different classes of seed. Foundation and certified seed production of important cereals, pulses, oilseeds, fodder and vegetables. Seed certification, phases of certification, procedure for seed certification, field inspection. Seed Act and Seed Act enforcement. Duty and powers of seed inspector, offences and penalties. Seeds Control Order 1983, Varietal Identification through Grow Out Test and Electrophoresis, Molecular and Biochemical test. Detection of genetically modified crops, Transgene contamination in non-GM crops, GM crops and organic seed production.

Seed drying, processing and their steps, seed testing for quality assessment, seed treatment, its importance, method of application and seed packing. Seed storage; general principles, stages and factors affecting seed longevity during storage. Measures for pest and disease control during storage. Seed marketing: structure and organization, sales generation activities, promotional media. Factors affecting seed marketing, Role of WTO and OECD in seed marketing.

Practical
Seed production in major cereals: Wheat, Rice, Maize, Sorghum and Bajra. Seed production in major pulses: Urd, Mung, Pigeonpea, Lentil, Gram, Fieldpea. Seed production in major oilseeds: Soybean, Rapeseed and Mustard. Seed production in vegetable crops. Seed certification: Procedure, Field inspection, Preparation of field inspection report. Visit to seed production farms, seed testing laboratories and seed processing plant.

Text / Reference Books:

2. Title: Seed Quality Testing

Course No: SST - 312  Cr. hr: 1(0+1)

Practical
Seed testing objectives, types of seed quality test, management of seed testing works in STL. Seed sampling – procedure of drawing samples and preparation of working sample. Moisture estimation, purity analysis and related tests, germination test, seed viability test, assessment of seed vigour, genetic purity testing – laboratory (chemical, biochemical & molecular)
methods and field plots (grow out) test. Seed health testing for pathogen and insect damage, detection of GM seeds.

Text / Reference Books:

X. PLANT PHYSIOLOGY

1. Title: Fundamentals of Crop Physiology

Course No: PP - 111  
Cr. hr: 2(1+1)

Theory
Introduction to crop physiology and its importance in Agriculture; Plant cell: an Overview; Diffusion and osmosis; Absorption of water, transpiration and Stomatal Physiology; Mineral nutrition of Plants: Functions and deficiency symptoms of nutrients, nutrient uptake mechanisms; Photosynthesis: Light and Dark reactions, C3, C4 and CAM plants; Respiration: Glycolysis, TCA cycle and electron transport chain; Fat Metabolism: Fatty acid synthesis and Breakdown; Plant growth regulators: Physiological roles and agricultural uses, Physiological aspects of growth and development of major crops: Growth analysis, Role of Physiological growth parameters in crop productivity.

Practical
Study of plant cells, structure and distribution of stomata, imbibitions, osmosis, plasmolysis, measurement of root pressure, rate of transpiration, Separation of photosynthetic pigments through paper chromatography, Rate of transpiration, photosynthesis, respiration, tissue test for mineral nutrients, estimation of relative water content, Measurement of photosynthetic CO₂ assimilation by Infra Red Gas Analyser (IRGA).

Text / Reference Books:
XI. AGRICULTURAL STATISTICS

1. Title: Statistical Methods

Course No: AS - 121  
Cr. hr: 2(1+1)

Theory

Practical

Text / Reference Books:
2. Title: Agricultural Informatics

Course No: AS - 212  
Cr. hr: 2(1+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.


e-Agriculture, concepts, design and development. Application of innovative ways to use information and communication technologies (IT) in Agriculture. Computer Models in Agriculture: statistical, weather analysis and crop simulation models, concepts, structure, inputs-outputs files, limitation, advantages and application of models for understanding plant processes, sensitivity, verification, calibration and validation. IT application 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 advises, 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.

Practical

Study of Computer Components, accessories, practice of important DOS Commands. Introduction of different operating systems such as windows, Unix/ Linux, Creating, Files & 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/CropSyst/ 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, for generating information important for Agriculture. Hands on practice on preparation of Decision Support System. Preparation of contingent crop planning.
Text / Reference Books:

XII. AGRICULTURAL BIOTECHNOLOGY

1. Title: Fundamentals of Plant Biotechnology

Course No: ABT - 121
Cr. hr: 2(1+1)

Theory

Concepts and applications of plant biotechnology: Scope, organ culture, embryo culture, cell suspension culture, callus culture, anther culture, pollen culture and ovule culture and their applications; Micro-propagation methods; organogenesis and embryogenesis, Synthetic seeds and their significance; Embryo rescue and its significance; somatic hybridization and cybrids; Somaclonal variation and its use in crop improvement; cryo-preservation; Introduction to recombinant DNA methods: physical (Gene gun method), chemical (PEG mediated) and Agrobacterium mediated gene transfer methods; Transgenics and its importance in crop improvement; PCR techniques and its applications; RFLP, RAPD, SSR; Marker Assisted Breeding in crop improvement; Biotechnology regulations.

Practical


Text / Reference Books:
6. Handbook of Plant Tissue Culture – ICAR Publication
XIII. AGRICULTURAL ENGINEERING

1. Title: Soil and Water Conservation Engineering
Course No: SWE (Ag) - 121
Cr. hr: 2(1+1)

Theory

Practical

Text / Reference Books:

2. Title: Farm Machinery and Power
Course No: FMP (Ag) - 211
Cr. hr: 2(1+1)

Theory
Status of Farm Power in India, Sources of Farm Power, I.C. engines, working principles of I C engines, comparison of two stroke and four stroke cycle engines, Study of different components of I.C. engine, I.C. engine terminology and solved problems, Familiarization with different systems of I.C. engines: Air cleaning, cooling, lubrication, fuel supply and hydraulic control system of a tractor, Familiarization with Power transmission system: clutch, gear box, differential and final drive of a tractor, Tractor types, Cost analysis of tractor power and attached implement, Familiarization with Primary and Secondary Tillage implement, Implement for hill agriculture, implement for intercultural operations, Familiarization with sowing and planting equipment, calibration of a seed drill and solved
examples, Familiarization with Plant Protection equipment, Familiarization with harvesting and threshing equipment.

**Practicals**

Study of different components of I.C. engine. To study air cleaning and cooling system of engine, Familiarization with clutch, transmission, differential and final drive of a tractor, Familiarization with lubrication and fuel supply system of engine, Familiarization with brake, steering, hydraulic control system of engine, Learning of tractor driving, Familiarization with operation of power tiller, Implements for hill agriculture, Familiarization with different types of primary and secondary tillage implements: mould plough, disc plough and disc harrow. Familiarization with seed-cum-fertilizer drills their seed metering mechanism and calibration, planters and transplanter Familiarization with different types of sprayers and dusters Familiarization with different inter-cultivation equipment, Familiarization with harvesting and threshing machinery.

**Text/Reference Books:**


3. **Title: Renewable Energy and Green Technology**

**Course No:** FMP (Ag) - 222

**Cr. hr:** 2(1+1)

**Theory**

Classification of energy sources, contribution of these of sources in agricultural sector, Familiarization with biomass utilization for biofuel production and their application, Familiarization with types of biogas plants and gasifiers, biogas, bio-alcohol, biodiesel and biooil production and their utilization as bioenergy resource, introduction of solar energy: solar radiation, spectral distribution of solar radiation, beam and diffuse radiation, air mass. Collection and their application, solar radiation measuring instruments, pyrhliometer, pryrnanometer and sun shine recorder their working principle and components. Familiarization with solar energy gadgets: solar flat and focusing type plate collector, solar cooker, solar water heater, application of solar energy: solar drying, solar pond, solar distillation, solar photovoltaic system: its basics and applications, solar cell, solar module and solar array. Solar photovoltaic application: solar PV water pumping system, solar lantern and solar fencing. Introduction of wind energy: wind energy resources, origin of wind, advantages and disadvantages, power of wind. Type of wind turbine, components and
operation of horizontal and vertical axis wind turbine. Operational characteristics of wind turbines and application of wind mill for water pumping.

**Practical**
Familiarization with renewable energy gadgets. To study biogas plants. To study the constructional details of different types of gasifier. To study the production process of biodiesel. To study briquetting machine. To study the production process of bio-fuels. Familiarization with different solar energy gadgets. To study solar photovoltaic system: solar light, solar water heater, solar dryer, solar pumping, solar fencing. To study constructional details of solar cooker. To study solar drying system. To study solar distillation and solar pond. Familiarization of various components of horizontal and vertical axis wind mill.

**Text / Reference Books:**

4. **Title: Protected Cultivation and Secondary Agriculture**

**Course No:** SWE (Ag) – 322   **Cr. hr:** 2(1+1)

**Theory**
Green house technology: Introduction, Types of Green Houses; Plant response to Green house environment, Planning and design of greenhouses, Design criteria of green house for cooling and heating purposes. Green house equipments, materials of construction for traditional and low cost green houses, Naturally ventilated solar greenhouse, high-tech greenhouse, concept and construction of low tunnel greenhouse, use of shade net house in protected cultivation. Irrigation systems used in greenhouses, typical applications, passive solar green house, hot air green house heating systems, green house drying. Cost estimation and economic analysis.

Important Engineering properties such as physical, thermal and aero & hydrodynamic properties of cereals, pulses and oilseed, their application in PHT equipment design and operation. Concept of cleaning and grading. Drying and dehydration; moisture measurement, EMC, drying theory, various drying method, commercial grain dryer (deep bed dryer, flat bed dryer, tray dryer, fluidized bed dryer, recirculatory dryer and solar dryer). Material handling equipment; conveyer and elevators, their principle, working and selection.
Practical
Study of different type of green houses based on shape. Determine the rate of air exchange in an active summer winter cooling system. Determination of drying rate of agricultural products inside green house. Study of green house equipments. Visit to various Post Harvest Laboratories. Determination of Moisture content of various grains by oven drying & infrared moisture methods. Determination of engineering properties (shape and size, bulk density and porosity of biomaterials). Determination of Moisture content of various grains by moisture meter. Field visit to seed processing plant.

Text / Reference Books:
XIV. FORESTRY

1. Title: Introduction to Forestry (New)

Course No: FO - 111

Cr. hr: 2(1+1)

Theory

Introduction – definitions of basic terms related to forestry, objectives of silviculture, forest classification, salient features of Indian Forest Policies. Forest regeneration, Natural regeneration - natural regeneration from seed and vegetative parts, coppicing, pollarding, root suckers; Artificial regeneration – objectives, choice between natural and artificial regeneration, essential preliminary considerations. Crown classification. Tending operations – weeding, cleaning, thinning – mechanical, ordinary, crown and advance thinning. Forest mensuration – objectives, diameter measurement, instruments used in diameter measurement; Non instrumental methods of height measurement - shadow and single pole method; Instrumental methods of height measurement - geometric and trigonometric principles, instruments used in height measurement; tree stem form, form factor, form quotient, measurement of volume of felled and standing trees, age determination of trees. Agroforestry – definitions, importance, criteria of selection of trees in agroforestry, different agroforestry systems prevalent in the country, shifting cultivation, taungya, alley cropping, wind breaks and shelter belts, home gardens. Cultivation practices of two important fast growing tree species of the region (Acasia & Bamboo).

Practical


Text / Reference Books:


2. Title: Environmental Studies and Disaster Management

Course No: FO - 222

Cr. hr: 3(2+1)

Theory

Multidisciplinary nature of environmental studies Definition, scope and importance.

Natural Resources: Renewable and non-renewable resources, Natural resources and associated problems. a) Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people. b)
Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. c) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies. d) Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. e) Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. Case studies. f) Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification. • Role of an individual in conservation of natural resources. • Equitable use of resources for sustainable lifestyles.


Disaster management

Natural Disasters- Meaning and nature of natural disasters, their types and effects. Floods, drought, cyclone, earthquakes, landslides, avalanches, volcanic eruptions, Heat and cold waves, Climatic change: global warming, Sea level rise, ozone depletion.

Man Made Disasters- Nuclear disasters, chemical disasters, biological disasters, building fire, coal fire, forest fire, oil fire, air pollution, water pollution, deforestation, industrial waste water pollution, road accidents, rail accidents, air accidents, sea accidents.

Disaster Management- Effect to migrate natural disaster at national and global levels. International strategy for disaster reduction. Concept of disaster management, national disaster management framework; financial arrangements; role of NGOs, community –based organizations and media. Central, state, district and local administration; Armed forces in disaster response; Disaster response; Police and other organizations.

Practical

Pollution case studies - Field work: Visit to a local area to document environmental assets river/ forest/ grassland/ hill/ mountain, visit to a local polluted site-Urban/Rural/Industrial/Agricultural, study of common plants, insects, birds and study of simple ecosystems-pond, river, hill slopes, etc.

Text/ Reference Books:
1. Perspective of Environmental Sciences - Kaushik & Kaushik, Agrobios, Delhi (1992)
3. Water Pollution Causes, Effects and Control - P. K. Goel, Agrobios Publisher, Delhi (1991)
XV. ANIMAL SCIENCE

1. Title: Livestock & Poultry Management

Course No: LPM - 321  
Cr. hr: 4(3+1)

Theory
Role of livestock in the national economy. Reproduction in farm animals and poultry.  
Housing principles, space requirements for different species of livestock and poultry.  
Management of calves, growing heifers and milch animals. Management of sheep, goat and  

Important Indian and exotic breeds of cattle, buffalo, sheep, goat, swine and poultry.  
Improvement of farm animals and poultry.

Digestion in livestock and poultry. Classification of feedstuffs. Proximate principles of feed.  
Nutrients and their functions. Feed ingredients for ration for livestock and poultry. Feed  
supplements and feed additives. Feeding of livestock and poultry.

Introduction of livestock and poultry diseases. Prevention (including vaccination schedule)  
and control of important diseases of livestock and poultry.

Practical
External body parts of cattle, buffalo, sheep, goat, swine and poultry. Handling and  
restraining of livestock. Identification methods of farm animals and poultry. Visit to IDF and  
IPF to study breeds of livestock and poultry and daily routine farm operations and farm  
records. Judging of cattle, buffalo and poultry. Culling of livestock and poultry. Planning and  
layout of housing for different types of livestock. Computation of rations for livestock.  
Formulation of concentrate mixtures. Clean milk production, milking methods. Hatchery  
operations, incubation and hatching equipments. Management of chicks, growers and layers.  
Debeaking, dusting and vaccination. Economics of cattle, buffalo, sheep, goat, swine and  
poultry production.

Text / Reference Books:

   Publications, New Delhi (2011)
   Delhi (1994)
5. Outlines of Dairy Technology - Sukumar Dey, Oxford University Press, New Delhi  
   (2000)
6. Farm Animal Management and Poultry Production - Thomas C. K. Sastry, NSR and  
XVI. ELECTIVES

GROUP - I

1. Title: Agrochemicals

Course No: AC (E) - 221  Cr. hr: 3(2+1)

Theory
An introduction to agrochemicals, their type and role in agriculture, effect on environment, soil, human and animal health, merits and demerits of their uses in agriculture, management of agrochemicals for sustainable agriculture.

Herbicides-Major classes, properties and important herbicides. Fate of herbicides.

Fungicides - Classification – Inorganic fungicides - characteristics, preparation and use of sulfur and copper, Mode of action-Bordeaux mixture and copper oxy chloride.

Organic fungicides-Mode of action-Dithio carbamates-characteristics, preparation and use of Zineb and manebl.

Systemic fungicides-Benomyl, carboxin, oxycarboxin, Metalaxyl, Carbendazim, characteristics and use. Introduction and classification of insecticides: inorganic and organic insecticides Organo-chlorine, Organo-phosphates, Carbamates, Synthetic pyrethroids Neo-nicotinoids, Biorationals, Insecticide Act and rules, Insecticides banned, withdrawn and restricted use, Fate of insecticides in soil & plant. IGRs Bio pesticides, Reduced risk insecticides, Botanicals, plant and animal systemic insecticides their characteristics and uses.


Plant bio-pesticides for ecological agriculture, Bio-insect repellent.

Practical
Sampling of fertilizers and pesticides. Pesticides application technology to study about various pesticides appliances. Quick tests for identification of common fertilizers. Identification of anion and cation in fertilizer. Calculation of doses of insecticides to be used. To study and identify various formulations of insecticide available kin market. Estimation of nitrogen in Urea. Estimation of water soluble P₂O₅ and citrate soluble P₂O₅ in single super phosphate. Estimation of potassium in Muraithe of Potash/ Sulphate of Potash by flame photometer. Determination of copper content in copper oxychloride. Determination of
sulphur content in sulphur fungicide. Determination of thiram. Determination of ziram content.

Text / Reference Books:
3. Toxicology of Insecticides - F. Matsumura, Plenum Publication (1985)

2. Title: Hi-tech. Horticulture

Course No: HORT (E) - 221      Cr. hr: 3(2+1)

Theory
Introduction & importance; Nursery management and mechanization; micro propagation of horticultural crops; Modern field preparation and planting methods, Protected cultivation: advantages, controlled conditions, method and techniques, Micro irrigation systems and its components; EC, pH based fertilizer scheduling, canopy management, high density orcharding. Components of precision farming: Remote sensing, Geographical Information System (GIS), Differential Geo-positioning System (DGPS), Variable Rate applicator (VRA), application of precision farming in horticultural crops (fruits, vegetables and ornamental crops); mechanized harvesting of produce.

Practical
Types of playhouses and shade net houses, Intercultural operations, tools and equipments identification and application, Micro propagation, Nursery-portrays, micro-irrigation, EC, pH based fertilizer scheduling, canopy management, visit to hi-tech orchard/nursery.

Text / Reference Books:
3. **Title**: Water Management and Micro Irrigation

**Course No**: AG (E) - 221  
**Cr. hr**: 3(2+1)

**Theory**
Irrigation: definition and objectives, water resources and irrigation development in India and Orissa; Soil plant water relationships; Methods of soil moisture estimation, 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. Water management of different crops (rice, wheat, maize, groundnut, sun flower, mustard, pulses, sugarcane, cotton, potato, mango, banana and tomato); Agricultural drainage, Agricultural drainage Onfarm water management, water trading.

**Practical:**
Determination of particle & bulk density; 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 through flumes and weirs; 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; Erection and operation of sprinkler irrigation system; Measurement of emitter discharge rate, wetted diameter and calculation of emitter discharge variability; Determination of EC, pH, carbonates, bicarbonates, Ca++ and Mg++ in irrigation water (quality parameters)

**Text/Reference Book:**
1. Irrigation Principles and Practices - O.W. Israelsen and V.E. Hansen
2. Irrigation and Drainage - D. Lenka
7. Micro-Irrigation for Cash Crops – M.L. Choudhary
10. Irrigation Water Management: Principles and practices - D. K. Majumdar
11. Irrigation Agronomy - S. R. Reddy
12. Manual on Water management - Dept. of Agronomy, OUAT, Bhubaneswar
4. **Title: Commercial Plant Breeding**

**Course No: PBG (E) - 221**

**Cr. hr: 3(2+1)**

**Theory**

Types of crops and modes of plant reproduction. Line development and maintenance breeding in self and cross pollinated crops (A/B/R and two line system) for development of hybrids and seed production. Genetic purity test of commercial hybrids. Advances in hybrid seed production of maize, rice, sorghum, pearl millet, castor, sunflower, cotton pigeon pea, Brassica etc. Quality seed production of vegetable crops under open and protected environment. Alternative strategies for the development of the line and cultivars: haploid inducer, tissue culture techniques and biotechnological tools. IPR issues in commercial plant breeding: DUS testing and registration of varieties under PPV & FR Act. Variety testing, release and notification systems in India. Principles and techniques of seed production, types of seeds, quality testing in self and cross pollinated crops.

**Practical**

Floral biology in self and cross pollinated species, selfing and crossing techniques. Techniques of seed production in self and cross pollinated crops using A/B/R and two line system. Learning techniques in hybrid seed production using male-sterility in field crops. Understanding the difficulties in hybrid seed production. Tools and techniques for optimizing hybrid seed production. Concept of rouging in seed production plot. Concept of line its multiplication and purification in hybrid seed production. Role of pollinators in hybrid seed production. Hybrid seed production techniques in sorghum, pearl millet, maize, rice, rapeseed-mustard, sunflower, castor, pigeon pea, cotton and vegetable crops. Sampling and analytical procedures for purity testing and detection of spurious seed. Seed drying and storage structure in quality seed management. Screening techniques during seed processing viz., grading and packaging. Visit to public private seed production and processing plants.

**Text / Reference Books:**

GROUP - II

1. Title: Landscaping

Course No: HORT (E) - 312  Cr. hr: 3(2+1)

Theory

Practical
Identification of trees, shrubs, annuals, pot plants; Propagation of trees, shrubs and annuals, care and maintenance of plants, potting and repotting, identification of tools and implements used in landscape design, training and pruning of plants for special effects, lawn establishment and maintenance, layout of formal gardens, informal gardens, special type of gardens (sunken garden, terrace garden, rock garden). Use of computer software, visit to important gardens/ parks/ institutes.

Text / Reference Books:

2. Title: Biopesticides & Biofertilizers

Course No: AC (E) - 312  Cr. hr: 3(2+1)

Theory

Practical

To study about mass production technology of important biopesticides. Identification of important botanicals. Visit to biopesticide lab. working in nearby area. Field visit to explore naturally infected cadavers. Identification of entomopathogenic entities in field condition. Quality control of biopesticides.


Text / Reference Books:

3. **Title: Weed Management**

**Course No:** AG (E) - 312  
**Cr. hr:** 3(2+1)

**Theory**


**Practical**


**Text/Reference Books:**


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4. **Title: Micro propagation Technologies**

**Course No:** ABT (E) - 311  
**Cr. hr:** 3(2+1)

**Theory**

Meaning and concept of *in vitro* culture and micro-propagation; Historical milestones, advancement and future prospects of micro-propagation; totipotency, dedifferentiation; Tissue culture methodology: Sterile techniques, synthetic and natural media components, growth regulators, environmental requirement, genetic control of regeneration; Plant regeneration pathways - Organogenesis and Somatic embryogenesis;

Micro-propagation- Definition, methods, stages of micro-propagation and its significance; Axillary bud proliferation approach- Shoot tip and meristem culture; Organogenesis- Purpose, methods and requirements for organogenesis, indirect and direct organogenesis; Somatic embryogenesis- Procedures and requirements for organogenesis, indirect and direct...
embryogenesis; Differences between somatic and gametic embryogenesis, Synthetic seed-Concepts, necessity, procedure and requirements for production of synthetic seeds.

**Practical**

Laboratory organization, sterilization techniques for explants, glassware, plastic wares, lab wares and working platform. Preparation of stocks and working solution. Preparation and sterilization of growth regulators. Preparation of working medium and experimentation on determining optimum concentration of growth regulators. Callus induction and regeneration of whole plants from different parts of plants. Direct regeneration into whole plants using bud, node and other tissues. Induction of somatic embryos. Experiments of synthetic seeds production and testing storability and germination efficiency.

**Text / Reference Books:**


**GROUP - III**

1. **Title: Protected Cultivation**

**Course No:** HORT (E) - 323  
**Cr. hr:** 3(2+1)

**Theory**


**Practical**

Raising of seedlings and saplings under protected conditions, use of protrays in quality planting material production, Bed preparation and planting of crop for production, Inter cultural operations, Soil EC and pH measurement, Regulation of irrigation and fertilizers through drip, fogging ad misting.

**Text / Reference Books:**


2. Title: Soil, Plant, Water and Seed Testing

Course No: AC (E) - 323  Cr. hr: 3(2+1)

Theory

Principle of pH meter, EC meter, spectrophotometer, flame photometer and AAS.

Soil analysis: Objectives, sampling of soil, procedure and precautions. Determination of texture, bulk density. Interpretation of analytical data viz., pH, EC, organic carbon, N, P, K, S and micronutrients (Fe, Mn, Zn, Cu, B) and nutrient index.

Plant analysis: Sampling stages and plant part to be sampled. Analysis of nutrients, Quantitative rating of plant analysis data and interpretation of results, critical nutrient concentration, critical nutrient ranges.

Water analysis: Quality criteria, classification and suitability of irrigation water and water quality index.

Seed: Introduction, definition and importance, seed germination, viability, vigor and storage.

Use of soil testing kit for major and micronutrient analyzer.

Practical


Suggested Text book / Reference books:
3. Title: Agricultural Waste Management

Course No: AG (E) - 323
Cr. hr: 3(2+1)

Theory

Practical

Text/Reference books
1. Agricultural Waste Management: Problems, Processes, and Approaches - Raymond C. Loehr

4. Title: Agri-business Management

Course No: ABM (E) - 321
Cr. hr: 3(2+1)

Theory
Transformation of agriculture into agribusiness, various stakeholders and components of agribusiness systems. Importance of agribusiness in the Indian economy and New Agricultural Policy. Distinctive features of Agribusiness Management: Importance and needs of agro-based industries, Classification of industries and types of agro based industries.

**Practical**


**Text / Reference Books:**

3. Indian Agriculture & Agri-Business Management - S. Diwase, Scientific Publisher India (2014)
XVII. LANGUAGE

1. Title: Comprehension and Communication Skills in English

Course No: SE - 111  Cr. hr: 2(1+1)

Theory


Reading Comprehension, Vocabulary- Antonym, Synonym, Homophones, Homonyms, often confused words. Exercises to Help the students in the enrichment of vocabulary based on TOEFL and other competitive examinations. Functional grammar: Articles, Prepositions, Verb, Subject verb Agreement, Transformation, Synthesis, Direct and Indirect Narration.


Practical

Listening Comprehension: Listening to short talks lectures, speeches (scientific, commercial and general in nature). Oral Communication: Phonetics, stress and intonation, Conversation practice. Conversation: rate of speech, clarity of voice, speaking and Listening, politeness & Reading skills: reading dialogues, rapid reading, intensive reading, improving reading skills.

Mock Interviews: testing initiative, team spirit, leadership, intellectual ability. Group Discussions.

Text / Reference Books:

XVIII. REMEDIAL COURSES

1. Title: Agriculture Heritage (New Course)

Course No: AG-112
Cr hr: 1(1+0)

Theory
Introduction of Indian agricultural heritage, status of farmers in society; advice by sages to kings on their duties towards farmers, soil management in ancient, medieval & pre-modern India and its relevance in modern day sustainable agriculture, heritage of crop & water management, plant growth and development & plant protection through vrikshayurveda and traditional knowledge. Heritage of medicinal plants and their relevance today, seed health in ancient & medieval history and its relevance to present day agriculture, description of Indian civilization and agriculture by travelers from China, Europe and United States, our journey in agriculture, green revolution and its impact and concerns, vision for the future.

Text / Reference Books:
5. Agriculture in Ancient India - S. P. Raychaudhuri, Indian Council of Agricultural Research, New Delhi (1964)

2. Title: Introductory Biology (New)

Course No: BB-111
Cr. hr: 2(1+1)

Theory
Practical

3. Title: Elementary Mathematics (New)

Course No: EM - 111
Cr. hr: 2(2+0)

Theory
Straight lines: Distance formula, section formula (internal and external division), Change of axes (only origin changed), Equation of co-ordinate axes, Equation of lines parallel to axes, Slope-intercept form of equation of line, Slope-point form of equation of line, Two point form of equation of line, Intercept form of equation of line, Normal form of equation of line, General form of equation of line, Point of intersection of two st. lines, Angles between two st. lines, Parallel lines, Perpendicular lines, Angle of bisectors between two lines, Area of triangle and quadrilateral. Circle: Equation of circle whose centre and radius is known, General equation of a circle, Equation of circle passing through three given points, Equation of circle whose diameters is line joining two points \((x_1, y_1)\) & \((x_2,y_2)\), Tangent and Normal to a given circle at given point (Simple problems), Condition of tangency of a line \(y = mx + c\) to the given circle \(x^2 + y^2 = a^2\). Differential Calculus: Definition of function, limit and continuity, Simple problems on limit, Simple problems on continuity, Differentiation of \(x^n\), \(e^x\), \(\sin x \& \cos x\) from first principle, Derivatives of sum, difference, product and quotient of two functions, Differentiation of functions of functions (Simple problem based on it), Logarithmic differentiation (Simple problem based on it), Differentiation by substitution method and simple problems based on it, Differentiation of Inverse Trigonometric functions. Maxima and Minima of the functions of the form \(y=f (x)\) (Simple problems based on it).

Integral Calculus: Integration of simple functions, Integration of Product of two functions, Integration by substitution method, Definite Integral (simple problems based on it), Area under simple well-known curves (simple problems based on it).

Matrices and Determinants: Definition of Matrices, Addition, Subtraction, Multiplication, Transpose and Inverse up to 3rd order, Properties of determinants up to 3rd order and their evaluation.
XIX. NON-GRADIAL COURSES

1. Title: Human Value and Ethics

Course No: EE - 122  
Cr. hr: 1(1+0)

Theory

Text / Reference Books:

2. Title: NSS/NCC/Physical Education & Yoga Practices

Course No: NSS/NCC/PE - 111  
Cr. hr: 2(0+2)

Theory
Course aims at evoking social consciousness among students through various activities viz., working together, constructive and creative social work, to be skilful in executing democratic leadership, developing skill in programme development to be able for self employment, reducing gap between educated and uneducated, increasing awareness and desire to help sections of society.

Following activities are to be taken up under the NSS course:

- Introduction and basic components of NSS: Orientation
- NSS programmes and activities
• Understanding youth
• Community mobilisation
• Social harmony and national integration
• Volunteerism and shramdan
• Citizenship, constitution and human rights
• Family and society
• Importance and role of youth leadership
• Life competencies
• Youth development programmes
• Health, hygiene and sanitation
• Youth health, lifestyle, HIV AIDS and first aid
• Youth and yoga
• Vocational skill development
• Issues related environment
• Disaster management
• Entrepreneurship development
• Formulation of production oriented project
• Documentation and data reporting
• Resource mobilization
• Additional life skills
• Activities directed by the Central and State Government

All the activities related to the National Service Scheme course is 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 year. 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.
**Rural Agriculture Work Experience**

*The minimum attendance for RAWE programme is 85%. Students shall complete the record work based on daily field observation notebooks and weekly diaries maintained by them. They will be evaluated by course coordinator as well as by a designated evaluation committee.*

<table>
<thead>
<tr>
<th>SN</th>
<th>Activities</th>
<th>No. of Weeks</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>General Orientation &amp; On campus training by different faculties</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Village attachment</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Unit attachment in Univ. / College. KVK / Research Station Attachment</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Plant Clinic</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Agro-Industrial Attachment</td>
<td>3</td>
<td></td>
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<tr>
<td></td>
<td>• The students would be attached with the agro-industries for a period of 3 weeks to get an experience of the industrial environment and working.</td>
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<tr>
<td>6</td>
<td>Project Report Preparation, Presentation and Evaluation</td>
<td>1</td>
<td></td>
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<tr>
<td></td>
<td><strong>TOTAL</strong></td>
<td><strong>20</strong></td>
<td><strong>20</strong></td>
</tr>
</tbody>
</table>
Experiential Learning Programme

Modules for skill development and Entrepreneurship: A student has to register 20 credits opting for two modules of (0+10) credits each (total 20 credits) from the package of modules in the VIII Semester.

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Title of the Module</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Bioagents and Biofertilizer Production</td>
<td>0+10</td>
</tr>
<tr>
<td>2</td>
<td>Seed Production and Technology</td>
<td>0+10</td>
</tr>
<tr>
<td>3</td>
<td>Mushroom Cultivation</td>
<td>0+10</td>
</tr>
<tr>
<td>4</td>
<td>Soil, Plant, Water and seed Testing Services</td>
<td>0+10</td>
</tr>
<tr>
<td>5</td>
<td>Beekeeping</td>
<td>0+10</td>
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<tr>
<td>6</td>
<td>Poultry Production</td>
<td>0+10</td>
</tr>
<tr>
<td>7</td>
<td>Applied Hi-Tech Horticulture</td>
<td>0+10</td>
</tr>
<tr>
<td>8</td>
<td>Agri-Business Management</td>
<td>0+10</td>
</tr>
<tr>
<td>9</td>
<td>Hybrid Seed Production Technologies</td>
<td>0+10</td>
</tr>
<tr>
<td>10</td>
<td>Floriculture and Landscaping</td>
<td>0+10</td>
</tr>
<tr>
<td>11</td>
<td>Commercial Vegetable Production</td>
<td>0+10</td>
</tr>
<tr>
<td>12</td>
<td>Tissue-Culture Technologies</td>
<td>0+10</td>
</tr>
<tr>
<td>13</td>
<td>Agriculture Waste Management</td>
<td>0+10</td>
</tr>
<tr>
<td>14</td>
<td>Organic Production Technology</td>
<td>0+10</td>
</tr>
<tr>
<td>15</td>
<td>Nursery Management</td>
<td>0+10</td>
</tr>
<tr>
<td>16</td>
<td>Practicing Protected Horticulture</td>
<td>0+10</td>
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<tr>
<td></td>
<td><strong>TOTAL</strong></td>
<td><strong>0+20</strong></td>
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