BRIEF HISTORY OF THE UG PROGRAMME

In tune with the thoughts of Nobel Laureate Rabindranath Tagore, Sriniketan Experiment was started in 1921 concerning with four important areas *viz.* agriculture, crafts and rural industries, village welfare and education. Agriculture was at the core area of Sriniketan Experiment with association of Leonard Elmhirst, Rathindranath Tagore, Santosh Chandra Mazumdar and Nagendranath Ganguly. The Department of Agriculture and Village Economics was formally inaugurated on February 6, 1922 with Mr. L. K. Elmhirst as the first Director. Gurudeva Rabindranath Tagore confided to Mr. Elmhirst on March 1, 1922 that he wanted two things most - a good art department and a good agricultural school. In a unique way Tagore combined his desire to the collective good of mankind with the fullest development of the qualities of the individual. An all-round regeneration of the people, so that the choked bed of village life may again be flooded with stream of happiness was his ideal of rural reconstruction. He believed in missionary zeal and self-sacrifice. But at the same time be warned that the results of service should make people stand on their own legs. The best way of serving them is to help them to help themselves.

Visva-Bharati was declared a Central University and an Institution of National Importance by an Act of Parliament in 1951. In 1957, in accordance with the recommendation of the National Commission on Agriculture of which Mr. Elmhirst was a member, an Institute of Rural Higher Education (popularly known as Rural Institute) as one of few started all over India, was set up at the present site of the Institute of Agriculture. The Institute of Rural Higher Education offered 3-year Diploma Course in Rural Services and 2-year Certificate Course in Agriculture. This Institute was meant to produce Rural Leaders. ***Palli Siksha Sadana*** **took birth in 1963** in place of Rural Institute with two wings - one was **College of Agriculture offering 4-years Degree Course in Agriculture** and the other was Department of Social Science offering 3-year Degree Course in Social Science. After the passage of time Department of Social Science was renamed as Department of Social Work and shifted to *Palli Samgathana Vibhaga* in 1975. ***Palli Siksha Sadana*** **was renamed as** ***Palli Siksha Bhavana*** **(Institute of Agriculture) in 1984** with amendments of Visva-Bharati Act. *Palli Siksha Bhavana* (Institute of Agriculture) is engaged in teaching, research and extension in the field of Agriculture and following the course structure framed by the Indian Council of Agricultural Research (ICAR). The Agricultural Extension programme received impetus with the establishment of Rathindra Krishi Vigyan Kendra (Farm Science Centre) in 1994 to cater the training needs of farmers, farm women and rural youths of the Birbhum district, West Bengal.

Initially four composite departments of ***Palli Siksha Bhavana*** **(Institute of Agriculture) were established in 1989. After the passage of time, these four composite departments were reorganised and nine new Departments had started functioning on and from 1 October 2016** due to an administrative notification of Visva-Bharati dated 30 September 2016. *Palli Siksha Bhavana* (Institute of Agriculture) has always been striving to make higher agricultural education relevant to present day needs, produce graduates, post-graduates with excellence in academics and research skills,

entrepreneurial skills for self-employment and contributors of rural livelihood and food security need. Teaching, research and extension efforts give emphasis on building competence and confidence of the human resources in Agriculture.

The institute is engaged in teaching offering 4-year undergraduate course in Agriculture since 1963. A total of 65 seats (in addition 15% seats reserved for foreign students and 2 seats for students from Jammu & Kashmir state) are being offered in under-graduate (UG) programme during 2019-20. Fifteen percent seats are filled through ICAR.

A Unit on "Production of Edible mushrooms and spawn" has been established taking funding support from ICAR for the Experiential Learning programme. Final year UG students are placed in this Unit for experiential learning with the principle of earn while you learn.

The teaching programmes are being implemented following ICAR's Fifth Dean's Committee Recommendation at UG level since 2017-18.

UG ORDINANCE (w.e.f. 2017)

VISVA-BHARATI

PALLI SIKSHA BHAVANA

(INSTITUTE OF AGRICULTURE)

B.Sc. (Hons.) Agriculture (Fifth Dean's Committee Recommendation at UG level since 2017-18)

1. There shall be a course of studies in Agriculture for the Degree of **Bachelor of Science (Honours) in Agriculture [B.Sc. (Hons.) Agriculture]** at **Palli Siksha Bhavana** (Institute of Agriculture), the duration of which shall be of four years consisting of eight semesters. This course of studies will consist of six semesters of intramural teaching followed by one semester of Experiential Learning Programme and another semester of Rural Agricultural Work Experience and Agro-Industrial Attachment (RAWE &AIA). The maximum allowable semesters for completion of B.Sc.(Hons) Agric
2. ulture course is sixteen (16).
3. A candidate seeking admission to the **B.Sc. (Hons.) Agriculture** programme shall have **passed the two year Pre-Degree examination of Visva-Bharati** or an equivalent **10+2 level examination with a combination of Physics, Chemistry and Biology among others.** However, the eligibility criteria for ICAR nominated candidates shall be as prescribed by ICAR.
4. Candidates admitted to the **B.Sc. (Hons.) Agriculture** course shall abide by the regulations regarding the course curricula and the academic standards as prescribed by the University from time to time.
5. There will be two types of courses --- "credit-course" and "non-gradial course". Grade point obtained only in credit courses will be considered for the classification of results and marks/ grade obtained in non-gradial courses will not be considered for classification of results. Further, under credit courses, there will be five sub types of courses --- "Only theory course", "Only practical course", "Composite course", "Experiential Learning Programme" and "RAWE & AIA". The composite course will consist of both theory and practical components.
6. **One credit indicates one hour lecture** or **two hours practical** or **three hours field work per week**.
7. Each course, except "RAWE & AIA", bears a distinguishing code (three letters and three digits) which identifies the discipline, academic year and semester respectively. The numbering system is as follows: The three letters stand for the concerned disciplines. The1stdigit indicates the academic year (1,2, 3 or 4), the 2nd digit indicates the semester within the academic year (1 or 2) and the3rd digit denotes the number of courses offered from the same discipline within a semester.
8. Semester-wise distribution of courses and credit hours are as in the following:

Course code	Semester-I	Course structure credits		
		Theory	**Practical**	**Total**
AGR 111	Fundamentals of Agronomy-I	1	1	2
AGR 112	Introduction to Forestry	1	1	2
ACB 111	Fundamentals of Plant Biochemistry	1	1	2
HOR111	Fundamentals of Horticulture	1	1	2
AEX 111	Comprehension & Communication Skills in English	1	1	2
AEX 112	Rural Sociology & Educational Psychology	2	0	2
ANS 111	Livestock and Poultry Management	3	1	4
SSC 111	Fundamentals of Soil Science	2	1	3
PED 111	NSS/NCC/Physical Education & Yoga Practices**	0	2	2
TS	Tagore Studies	4	0	4
TOTALNC: Non-gradial courses**		**16**	**7**	**23+2****
	Semester-II			
AGR 121	Fundamentals of Agronomy-II	1	1	2
AEC 121	Fundamentals of Agricultural Economics	2	0	2
AEG 121	Introductory Soil and Water Conservation Engineering	1	1	2
AEN 121	Fundamentals of Entomology	3	1	4
AEX 121	Fundamentals of Agricultural Extension Education	2	1	3
AEX 122	Communication Skills and Personality Development	1	1	2
GPB121	Fundamentals of Genetics	2	1	3
PPC 121	Agricultural Microbiology	1	1	2
TS	Tagore Studies	4	0	4
EVS	Environmental Studies	2	0	2
Total		**19**	**7**	**26**
	Semester-III			
AGR 211	Crop Production Technology – I *(Kharif Crops)*	1	1	2
AEC 211	Agricultural Finance and Cooperation	2	1	3
AEG 211	Farm Machinery and Power	1	1	2
AEG 212	Principles of Food Science and Nutrition	2	0	2
AIN 211	Agriculture Informatics	1	1	2
CPH 211	Fundamentals of Crop Physiology	1	1	2
GPB 211	Fundamentals of Plant Breeding	2	1	3
HOR 211	Production Technology for Vegetables and Spices	1	1	2
PPC 211	Fundamentals of Plant Pathology	3	1	4
SSC 211	Manures, Fertilizers and Soil Fertility Management	2	1	3
Total		**19**	**8**	**27**
	Semester-IV			
AGR 221	Crop Production Technology –II *(Rabi Crops)*	1	1	2
AGR 222	Farming System & Sustainable Agriculture	1	0	1
AGR 223	Introductory Agro-meteorology & Climate Change	1	1	2
AEC 221	Agricultural Marketing, Trade & Prices	2	1	3
AEG 221	Renewable Energy and Green Technology	1	1	2
HOR 221	Production Technology for Ornamental Crops, MAP and Landscaping	1	1	2
HOR 222	Production Technology for Fruit and Plantation Crops	1	1	2

SSC 221	Problematic Soils and their Management	2	0	2
CPH 221	Principles of Seed Technology	1	2	3
Elective-I	Elective Course	2	1	3
Total		**13**	**9**	**22**
	Semester-V			
AGR 311	Geoinformatics and Nano-technology for Precision Farming	1	1	2
AGR 312	Principles of Organic Farming	1	1	2
AGR 313	Practical Crop Production – I (*Kharif* crops)	0	2	2
AEN 311	Management of Beneficial Insects	1	1	2
AEX 311	Entrepreneurship Development and Business Communication	1	1	2
AST 311	Statistical Methods	2	1	3
GPB 311	Crop Improvement-I *(Kharif Crops)*	1	1	2
PPC 311	Diseases of Field and Horticultural Crops and their Management –I	2	1	3
PPT 311	Principles of Integrated Pest and Disease Management	2	1	3
Elective-II	Elective Course	2	1	3
Total		**13**	**11**	**24**
	VI Semester			
AGR 321	Practical Crop Production –II (*Rabi* crops)	0	2	2
AGR 322	Rainfed Agriculture & Watershed Management	1	1	2
AEC 321	Farm Management, Production & Resource Economics	1	1	2
AEG 321	Protected Cultivation and Secondary Agriculture	1	1	2
AEN 321	Pests of Crops and Stored Grain and their Management	2	1	3
AEC 322	Intellectual Property Rights	1	0	1
GPB 321	Crop Improvement-II *(Rabi crops)*	1	1	2
GPB 322	Principles of Plant Biotechnology	1	1	2
HOR 321	Post-harvest Management and Value Addition of Fruits and Vegetables	1	1	2
PPC 321	Diseases of Field and Horticultural Crops and their Management-II	2	1	3
Elective-III	Elective Course	2	1	3
Total		**13**	**11**	**24**

EXPERIENTIAL LEARNING PROGRAMME

Semester-VII		Course structure credits		
Course code /Module	**Title of the module**	**Theory**	**Practical**	**Total**
EL SSC 411	Bioagents and Biofertilizer production	0	10	10
ELAGR 411	Seed Production and Technology	0	10	10
ELPPC 411	Mushroom Cultivation	0	10	10
EL SSC 412	Soil, plant , water and seed Testing services	0	10	10
EL ANS 411	Poultry Production	0	10	10
EL HOR 411	Applied Hi-Tech Horticulture	0	10	10
EL AEC 411	Agri-business management	0	10	10
ELGPB 412	Hybrid Seed Production Technologies	0	10	10
EL HOR 412	Floriculture and Landscaping	0	10	10
EL AEG 411	Food Processing and Food safety standards	0	10	10

EL HOR 413	Commercial vegetable production	0	10	10
EL CPH 412	Tissue-culture Technologies	0	10	10
EL AEG 412	Agriculture Waste Management	0	10	10
EL AGR 412	Organic Production Technology	0	10	10
EL AEX 411	Agro-advisory Services	0	10	10
EL HOR 414	Nursery Management	0	10	10
EL HOR 415	Practicing Protected Horticulture	0	10	10

Semester-VIII			
SN.	**Rural Agricultural Work Experience and Agro-industrial Attachment (RAWE &AIA)**		
	Activities	**No. of weeks**	**Credit Hours**
1	General orientation & On campus training by different faculties	01	14
2	Village attachment/ Unit attachment in Univ./ College. KVK/ Res. Stn.	12	
3	Agro-Industrial Attachment	06	06
4	Project Report Preparation, Presentation and Evaluation	01	
Total weeks for RAWE & AIA		20	20

Course code	**Elective Courses**	Course structure credits		
		Theory	**Practical**	**Total**
	Courses offered in Semester-IV			
AGR 224	Water Management	2	1	3
AEG 222	Agricultural Waste Management	2	1	3
AEC 222	Agribusiness Management	2	1	3
GPB 221	Commercial Plant Breeding	2	1	3
HOR 223	Landscaping	2	1	3
SSC 222	Agrochemicals	2	1	3
PPT 221	Bio-pesticides and Bio-control	2	1	3
Courses offered in Semester-V				
AGR 314	Advances in Crop Production	2	1	3
AEC 311	Emerging Issues in Agricultural Economics	2	1	3
AST 312	Statistical Techniques	2	1	3
CPH 311	Micro propagation Technologies	2	1	3
HOR 311	Protected Cultivation	2	1	3
SSC 311	Soil, Plant, Water and Seed Testing	2	1	3
AEX 312	Communication and information management	2	1	3
GPB 312	Breeding for Biotic and Abiotic Stresses	2	1	3
Courses offered in Semester-VI				
AGR 323	Weed Management	2	1	3
AEX 321	Emerging Trends in Agricultural Extension	2	1	3
AST 321	Design in Agricultural Experiment	2	1	3
HOR 322	Hi-tech. Horticulture	2	1	3
ACB 321	Food Safety Issues	2	1	3
SSC 321	Biofertilizers Technology	2	1	3

GPB 323	Bioinformatics	2	1	3

9. A student shall have to select three elective courses, one each from the list of elective courses offered during the three semesters --- Semester IV, Semester V and Semester VI.
10. The courses for Experiential Learning Programme will normally be offered in Semester VII and courses for RAWE & AIA in Semester VIII. However, courses under these two semesters may also be interchanged if situation so arises. Moreover, Experiential Learning and RAWE Programmes will be conducted as per guidelines of ICAR.
11. For Experiential Learning Programme, a student has to register 20 credits opting for two modules of (0+10) credits each (total 20 credits) from the package of modules available.
12. The Foundation course on Tagore Studies (Rabindra Charcha) and Ability Enhancing Compulsory Course on Environmental Studies will be governed by the University Ordinance.
13. The duration for semester terminal examination of different courses shall be as follows:

a. Composite courses: (Theory + Practical)	2 hours
b. Only theory courses	2 hours 30 minutes
c. Practical courses:	3 hours or more
d. Experiential Learning Programme:	4 hours or more

14. Students of the **B.Sc. (Hons.) Agriculture** degree shall have to pass all the fixed courses and such other courses opted under the choice based courses of studies.
15. Semester terminal examinations for Semesters I, III, V and VII shall normally be held in the first half of December while that for Semesters II, IV, VI and VIII in the first half of May in every academic year or as per academic calendar of the university.
16. There will be a **10 point grading system** of evaluation with **Point (P)** equal to percentage of marks obtained in a course divided by 10 and **Grade Point (GP)** equal to **Point (P)** multiplied by credit hours. A candidate has to secure a minimum of **5.00 Point** (P) for **passing a course**, a **Grade Point Average (GPA) of 5.00** for **passing a semester examination** and an **Overall Grade Point Average (OGPA) of 5.00** for successful completion of the **degree programme**. A candidate **failing to obtain** minimum **Point 5.00** in **not more than three courses, in a semester**, will be **allowed to repeat the examination of the course(s)**. A candidate **failing** in **more than three courses, in a semester**, will be **allowed to repeat the semester**. In both the cases he/she has to complete the degree programme including all the repeat courses within the maximum allowable sixteen semesters.

17. There shall be the provision for review of answer scripts for Semester Terminal theory Examination as per University rule.
18. There shall be a provision for supplementary examination for back candidates as and when required.
19. The results of the **B.Sc. (Hons.) Agriculture** degree shall be declared on the basis of the OGPA obtained in eight semesters taken together. The classification of results will be as follows:

OGPA	**Division**
5.000 – 5.999	Pass
6.000 – 6.999	II division
7.000 – 7.999	I division
8.000 and above	I division with distinction

OGPA = ∑ Total grade points scored / ∑ Course credits

% of Marks = OGPA x 10

20. All students shall be required to register themselves as per University norms. Each student shall submit a roster in the prescribed form indicating his/her choice of the courses to the Adhakshya, Palli Siksha Bhavana before the commencement of a new semester.
21. A student seeking permission to appear Semester Terminal Examination of the **B.Sc.(Hons.) Agriculture** course shall:
    i. produce a certificate from the Adhyaksha, Palli Siksha Bhavana that he/she has attended at least 75% of the in–campus classes.
    However, relaxation allowed (, if any) will be guided by the University Ordinance,
    ii. produce a certificate from the Adhyaksha, Palli Siksha Bhavana that his/her conduct has been good and that he/she is a fit and proper candidate for the examination; and
    iii. pay examination fees, as decided by the University.
22. If a student **fails to complete a semester** for exigencies beyond his/her control he/she will be **allowed to repeat the semester** within the maximum allowable semesters.
23. The medium of instruction and examination shall be English.
24. The distribution of marks in 'Only theory courses', 'Only practical courses','Composite courses', courses under 'Experiential Learning Programme', and 'RAWE & AIA' programmes of the **B.Sc. (Hons.) Agriculture** shall be as follows:

A	For 'Only theory courses'	
	Semester Terminal Examination	60
	Internal Assessment	40
	Total	100
B	For 'Only practical courses' (other than RAWE& AIA)	100
C	For 'Composite courses' (Theory : Practical)=70:30	
	Semester Terminal Examination (Theory)	50
	Internal Assessment (Theory)	20
	Semester Terminal Examination (Practical) (Record and Viva-voce=10)	30
	Total	100
D	For 'Experiential Learning Programme'	100
E	For 'RAWE & AIA'	100

25. There shall be a **Course Leader in each course** who besides teaching the course will co-ordinate various activities of that particular course. The Adhakshya, Palli Siksha Bhavana will nominate the Course Leaders in consultation with concerned Head of the Departments.
26. There shall be **a UG Course Coordinator** who will co-ordinate various activities of the **B.Sc. (Hons.) Agriculture** Programme. In addition to the UG Course Coordinator, there shall be **one RAWE & AIA Coordinator** who will co-ordinate RAWE programmes as well as other out campus activities and **one Experiential Learning Programme Coordinator** for each module. The Adhakshya, Palli Siksha Bhavana will nominate the UG Course Coordinator, the RAWE & AIA Coordinator and the Experiential Learning Programme Coordinator in consultation with concerned Head of the Departments.
27. Paper setting and evaluation of semester terminal examinations:
    (i) Question papers for semester terminal examination (Theory) will be set by external examiners and evaluation to be done by internal examiners preferably by faculty members other than the Course Leader. Moderation of question papers for the semester terminal theory examinations shall be done by a committee appointed as per university rules including external moderator(s).
    (ii) Practical component of courses will be conducted and evaluated by course instructor(s) and / or one teacher nominated by HOD, if required.
    (iii) Evaluation of RAWE & AIA and Experiential Learning Programme will be done by an examination committee comprising of the respective Coordinators and component-in-charge Instructor.
    (iv) For evaluation procedure of RAWE & AIA, shall be as in the following:

ACTIVITY		Max. Marks
1. Village attachment training		
a.	Teacher-in Charge/KVK/ARS/NGO scientist	30
b.	Report Preparation	20
c.	Examination Committee (Presentation & Viva-voce)	20
2. Industrial attachment training		
a.	Teacher-in-Charge in association with Industry officials	10
b.	Report Preparation	10
c.	Examination Committee (Presentation & Viva-voce)	10

(v) Evaluation procedure of Experiential Learning Programme shall be as in the following:

Sl. No.	Parameters	Max. Marks
1.	Project Planning and Writing	10
2.	Presentation	10
3.	Regularity	10
4.	Monthly Assessment	10
5.	Output delivery	10
6.	Technical Skill Development	10
7.	Entrepreneurship Skills	10
8.	Business networking skills	10
9.	Report Writing Skills	10
10.	Final Presentation	10
	Total	100

ELIGIBILITY CRITERIA & INTAKE FOR ADMISSION TO B. Sc. (Hons.) Agriculture COURSE

COURSE CODE NO: 71 **DURATION: 4 YEARSCOURSE** **CODE : BSG**

Course	Code	Eligibility		Intake capacity					
		For general candidates	For OBC candidates	Gen	OBC	SC	ST	EWS	Total
B.Sc. (Hons.) Ag.	701	60% marks at +2 level with a combination of Physics, Chemistry, Biology (Life Science) and any one of the following subjects: Mathematics/Agronomy /Modern computer application / Computer Science / Statistics	54% marks at +2 level with a combination of Physics, Chemistry, Biology (life Science) and any one of the following subjects: Mathematics/Agronomy /Modern computer application / Computer Science / Statistics	23	12	07	04	05	51
ICAR Quota				05	02	01	01	00	09
Integrated candidates from Visva-Bharati School system				02	01	01	01	00	05
Jammu & Kashmir				Supernumerary – 02					

GENERAL CRITERIA FOR INTEGRATED STUDENTS

There shall be a provision to get admission at the undergraduate courses of Palli Siksha Bhavana for the Integrated candidates from Visva-Bharati School system subject to fulfillment of departmental criteria.

LIST OF GENERIC ELECTIVE (GE) TO BE OFFERED BY THE DEPARTMENT

S.L No.	Name of the Department	Course Title	Eligibility (if any)	Total Intake
1	Department of Agronomy	Principles of Agronomy	----	50

SYLLABUS UG PROGRAMME

(According to 5th Dean's Committee)

B.Sc. (Hons.) Agriculture

Abbreviations

AGR: Agronomy	CPH: Crop Physiology
ACB: Agricultural Biochemistry	GPB: Genetics & Plant Breeding
AEC: Agricultural Economics	HOR: Horticulture
AEG: Agricultural Engineering	PED: Physical Education
AEN: Agricultural Entomology	PPC: Plant Pathology
AEX: Agricultural Extension	SSC: Soil Science & Agricultural Chemistry
AIN: Agricultural Informatics	ELP: Experiential Learning Programme
ANS: Animal Science	RAWE & AIA: Rural Agriculture Work Experience & Agro-industrial Attachment
AST: Agricultural Statistics	

SUMMARY

Semester	No. of Courses	Theory (hours)	Practical (hours)	Total credit (hours)
I	10	16	14 +2 *	32
II	10	18	16	34
III	10	19	16	35
IV	11	17	18	35
V	10	13	22	35
VI	11	13	22	35
*VII		0	20	20
**VIII		0	20	20
	TOTAL CREDITS			**246**

*ELP: Experiential Learning Programme

**RAWE & AIA: Rural Agriculture Work Experience & Agro-industrial Attachment

DETAILS OF SYLLABUS UG LEVEL

DEPARTMENT OF AGRONOMY

AGR 111 Fundamentals of Agronomy-I 2 (1+1)

Objectives:

To impart knowledge on basics of Agronomy – its scope, identification of tillage implements, to understand the role of plant nutrients- their source, and rate, method and time of application and to identify weed flora, their occurrence and management strategies for major field crops, knowledge on use of herbicides, application methods, herbicide selectivity and resistance.

Syllabus:

Theory

Agronomy and its scope, seeds and sowing, tillage and tilth, crop density and geometry, Crop rotation and its principles; Crop nutrition, manures and fertilizers, nutrient use efficiency; harvesting and threshing of crops; Weeds- importance, classification, crop weed competition, concepts of weed management-principles and methods, herbicides- classification, selectivity and resistance, allelopathy.

Practical

Identification of crops, seeds, fertilizers, herbicides and tillage implements, Effect of sowing depth on germination and seedling vigour, Use of tillage implements-reversible plough, one way plough, harrow, leveler, seed drill; 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 and herbicides.

Learning Outcome

Developing the skill on crop-based plant nutrition, their sources and application schedule, techniques to apply nutrient as foliar spray. Ability in identifying weeds of crop fields and non-cropped areas, their management, herbicide types and their spraying techniques

AGR 112 Introduction to Forestry 2(1+1)

Objectives:

To impart fundamental knowledge of tree science and agroforestry

Syllabus:

Theory

Introduction – definitions of basic terms related to forestry, Objectivess 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 – Objectivess, choice between natural and artificial regeneration, essential preliminary considerations. Crown classification. Tending operations – weeding, cleaning, thinning – mechanical, ordinary, crown and advance thinning. Forest mensuration – Objectivess, 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- *Leucaena leucocephala* and *Dysoxylum binectariferum*.

Practical

Identification of tree-species. Diameter measurements using calipers and tape, diameter measurements of forked, buttressed, fluted and leaning trees. Height measurement of standing trees by shadow method, single pole method and hypsometer. Volume measurement of logs using various formulae. Nursery lay out, seed sowing, vegetative propagation techniques. Forest plantations and their management. Visits of nearby forest based industries.

Learning Outcome:

Students will gain fundamental knowledge of forestry as well as agroforestry.

AGR 121 Fundamentals of Agronomy-II 2 (1+1)

Objectives:

To give basic concept of growth, development, soil-water-plant relationship, quality of irrigation water, water logging, irrigation scheduling and method of irrigation

Syllabus:

Theory

Growth and development of crops, factors affecting growth and development, plant ideotypes, adaptation and distribution of crops, crop management technologies in problematic areas, water resources, soil plant water relationship, crop water requirement, water use efficiency, irrigation-scheduling criteria, methods of irrigation; quality of irrigation water; water logging.

Practical

Study of soil moisture measuring devices, Measurement of field capacity, bulk density and infiltration rate, Measurement of irrigation water; Numerical exercises on water requirement.

Learning Outcome:

Students learned about basic idea about growth and development, soil-water-plant relationship, quality of irrigation water, irrigation scheduling, different types of irrigation method and acquainted with different instruments related to soil moisture estimation and methodology.

AGR 211 Crop Production Technology-I (Kharif Crops) 2(1+1)

Objectives:

Students will be oriented with the origin, geographic distribution, morphology, classification, economic importance, soil and climatic requirement, varieties, cultural practices and yield of kharif cereals, pulses, oilseeds, fibre crops, forage crops

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, pulses-pigeonpea, mungbean and urdbean; oilseeds- groundnut, sesame and soybean; fibre crops- cotton & Jute; forage crops-sorghum, cowpea, rice bean and napier.

Practical

Rice nursery preparation, transplanting of rice, sowing of soybean, pigeonpea, sesame 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.

Learning Outcome:

Students were oriented with the origin, geographic distribution, morphology, classification, economic importance, soil and climatic requirement, varieties, cultural practices and yield of kharif cereals, pulses, oilseeds, fibre crops, forage crops

AGR 221 Crop Production Technology-II (Rabi crops) 2(1+1)

Objectives:

Students will be oriented with the Origin, geographic distribution, morphology, classification, economic importance, soil and climatic requirement, varieties, cultural practices and yield of Rabi cereals, pulses, oilseeds, fibre crops, forage crops and commercial crops

Syllabus:

Theory

Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of *Rabi* crops; cereals –wheat and barley, pulses-chickpea, lentil, peas,

grass pea, oilseeds-rapeseed & mustard, sunflower, safflower and linseed; sugar crop-sugarcane; tuber crop- potato, 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.

Learning Outcome:

Students were oriented with the origin, geographic distribution, morphology, classification, economic importance, soil and climatic requirement, varieties, cultural practices and yield of rabi cereals, pulses, oilseeds, fibre crops, forage crops and commercial crops

AGR 222 Farming System and Sustainable Agriculture 1(1+0)

Objectives:

To understand the farming system and integrated farming system (IFS)- and its components in different agro-climatic zones, efficient cropping systems and their evaluation, sustainable agriculture and its importance.

Syllabus:

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, Objectivess 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.

Learning Outcome:

Development of increased knowledge on farming system- its components, cropping systems and site specific IFS model and sustainable crop management practices.

AGR 223 Introductory Agrometeorology & Climate Change 2(1+1)

Objectives:

To impart knowledge on weather elements and their role in crop production, climate change – its causes and impact and basics of weather forecasting.

Syllabus:

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, vapour pressure, process of condensation, formation of dew, fog, mist, frost, cloud; Precipitation, process of precipitation, types of precipitation such as rain, snow, sleet, and hail, cloud formation and classification; Artificial rainmaking. Monsoon- mechanism and importance in Indian agriculture, Weather hazards - drought, floods, frost, tropical cyclones and extreme weather conditions such as heat-wave and cold-wave. Agriculture and weather relations; Modifications of crop microclimate, climatic 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

Visit of Agrometeorological Observatory, site selection of observatory, exposure of instruments and weather data recording. Measurement of total, shortwave and longwave radiation, and its estimation using Planck's intensity law. Measurement of albedo and sunshine duration, computation of Radiation Intensity using BSS. Measurement of maximum and minimum air temperatures, its tabulation, trend and variation analysis. Measurement of soil temperature and computation of soil heat flux. Determination of vapor pressure and relative humidity. Determination of dew point temperature. Measurement of atmospheric pressure and analysis of atmospheric conditions. Measurement of wind speed and wind direction, preparation of windrose. Measurement, tabulation and analysis of rain. Measurement of open pan evaporation and evapotranspiration. Computation of PET and AET

Learning Outcome:

Development of skill on determination, estimation and measurement of different weather parameters and analysis of atmospheric condition in relation to crop production.

AGR 311 Geoinformatics and Nano-technology for Precision Farming 2(1+1)

Objectives:

To give basic idea to students about Precision agriculture, GIS, Remote sensing concepts and application in agriculture, System Simulation, crop Simulation Models, STCR approach for precision agriculture, Nanotechnology.

Syllabus:

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

Introduction to GIS software, spatial data creation and editing. Introduction to image processing software. Visual and digital interpretation of remote sensing images. Generation of spectral profiles of different objects. Supervised and unsupervised classification and acreage estimation. Multispectral remote sensing for soil mapping. Creation of thematic layers of soil fertility based on GIS. Creation of productivity and management zones. Fertilizers recommendations based of VRT and STCR techniques. Crop stress (biotic/abiotic) monitoring using geospatial technology. Use of GPS for agricultural survey. Formulation, characterization and applications of nanoparticles in agriculture. Projects formulation and execution related to precision farming.

Learning Outcome:

Precision agriculture, GIS, Remote sensing concepts and application in agriculture, System Simulation, crop Simulation Models, STCR approach for precision agriculture, Nanotechnology.

AGR 312 Principles of Organic Farming 2(1+1)

Objectives:

To give basic concept of organic farming, various organic components, how to control disease and pest through organic inputs, certification of organic products

Syllabus:

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; Biological intensive nutrient management-organic manure, vermicompost, green manure, recycling of organic residues, biofertilizers; 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.

Learning Outcome:

Student can explain the concepts of organic farming. Use of various organic inputs for crop production, use of non-synthetic agents for crop production, will get some idea about organic certification.

AGR 313 Practical Crop Production-I *(Kharif* Crops*)* 2(0+2)

Objectives:

Students will be oriented with the principles of crop planning and selection of crop; students will be given practical experience on raising of crops in their field with special emphasis on the agronomic management of the crop; students will be familiarized with the calculation of economics of crop cultivation

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.

Learning Outcome:

Students got the knowledge of principles of crop planning and selection of crop; students gathered the field experience on raising of crops in their field with special emphasis on the agronomic management of the crop; students were familiarized with the calculation of economics of crop cultivation

AGR 321 Practical Crop Production-II *(Rabi Crops)* 2(0+2)

Objectives:

Students will be oriented with the principles of crop planning and selection of crop; students will be given practical experience on raising of crops in their field with special emphasis on the agronomic management of the crop; students will be familiarized with the calculation of economics of crop cultivation

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.

Learning Outcome:

Students got the knowledge of principles of crop planning and selection of crop; students gathered the field experience on raising of crops in their field with special emphasis on the agronomic management of the crop; students were familiarized with the calculation of economics of crop cultivation.

AGR 322 Rainfed Agriculture and Watershed Management 2(1+1)

Objectives:

To impart knowledge on rainfed agriculture and its problems, prospect, soil conditions, drought and its effect, mechanism of crop adaptation, water harvesting, Technologies for efficient precipitation collection, conservation and its utilization, contingent crop planning for aberrant weather conditions, Concept, Objectives, principles and components of watershed management, factors affecting watershed management.

Syllabus:

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; Technologies for efficient precipitation collection and conservation; Efficient utilization of water through soil and crop management practices, Management of crops in rainfed areas, Contingent crop planning for aberrant weather conditions, Concept, Objectives, principles and components of watershed management, factors affecting watershed management.

Practical

Studies on climate classification, studies on rainfall pattern in rainfed areas of the country and pattern of onset and withdrawal of monsoons. Studies on cropping pattern of different 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**.**

Learning Outcome:

Developing the knowledge about rainfed agriculture, learn about crop production technology under rainfed condition; learn about contingent crop planning for aberrant weather conditions, watershed management.

AGRICULTURAL BIOCHEMISTRY

ACB 111 Fundamentals of Plant Biochemistry 2(1+1)

Objectives:

The major Objectives of biochemistry is the complete understanding, at the molecular level, of all of the chemical processes associated with living cells and organisms. Biochemistry, as the name implies, is the chemistry of living organisms. It has its origin in chemistry and biology. It tries to explain life processes at molecular level. Living organisms have certain extraordinary properties. They can grow, respond to stimuli and replicate themselves with high fidelity. All these activities are ultimately interpretable in chemical terms. The lifeless organic molecules with appropriate complexity and properties make a living thing. The basic phenomena of biochemistry are to

understand how the collections of inanimate molecules that constitute living organisms interact with each other to maintain life.

Syllabus:

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

Preparation of solution, pH & buffers, Qualitative tests of carbohydrates and amino acids. Quantitative estimation of glucose/ proteins. Titration methods for estimation of amino acids/lipids, Effect of pH, temperature and substrate concentration on enzyme action, Paper chromatography/ TLC demonstration for separation of amino acids/ Monosaccharides.

Learning Outcome:

The study of Biochemistry helps to understand the biomolecules and actual chemical concepts of living cell and organisms. This knowledge helps to understand the functioning of various processes and pathways occurring in the plant at different stages of the life of the plant. Students will learn the importance of Biochemistry, properties of water and role of water in living organisms, buffers and pH. Students will learn the importance and structure biomolecules, i.e., carbohydrates, lipids, nucleic acids and proteins. Students will also understand the catalytic activity of enzymes and how the enzymes are regulated. Students will also understand how the energy is generated in the living organism from carbohydrates and lipids for the sustenance of the living organisms. Apart from this, students will also learn from the laboratory classes the preparation of standard solutions, preparation of buffers and how the buffer resists the change of pH. Students will learn how to differentiate the carbohydrates and amino acids by qualitative reactions of carbohydrates and amino acids, how to quantitatively estimate the molecules such as glucose, proteins, amino acids and lipids by colorimetry and titrimetry, enzyme activity and factors affecting the enzyme activity, and chromatographic separation of molecules such as sugars and amino acids.

GENETICS AND PLANT BREEDING

GPB 121 Fundamentals of Genetics 3(2+1)

Objectives:

This lesson deals with heredity and the reasons behind the variation among individuals of the same species. It also includes diagnostic techniques to find out the bases for types of sex determination, inheritance of blood groups in humans, hereditary disorders and gives an insight up the human genome as amniocentesis.

syllabus:

Theory

Pre and Post Mendelian concepts of heredity, Mendelian principles of heredity, Cell division – mitosis, meiosis, Probability and Chi-square. Dominance relationships, gene interaction. Multiple alleles, pleiotropism and pseudoalleles, Sex determination and sex linkage, sex limited and sex influenced traits, Blood group genetics, Linkage and its estimation, crossing over mechanisms, chromosome mapping. Structural changes in chromosome, Mutation, classification, Methods of inducing mutation & CIB technique, mutagenic agents and induction of mutation. Qualitative & Quantitative traits, Polygenes and continuous variations, multiple factor hypothesis, Epistatic interactions with examples. Cytoplasmic inheritance. Genetic disorders,. Nature, structure & replication of genetic material. Protein synthesis, Transcription and translational mechanism of genetic material, Gene concept: Gene structure, function and regulation, Lac and Trp operons.

Practical

Study of microscope. Study of cell structure. 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.

Learning Outcome:

Students will understand the basic concepts of the ultrastructure of cell, cell organelles, chromosomes and nucleic acids; apply the principles of inheritance to plant breeding; acquaint with the fundamentals of chromosomal and cytoplasmic inheritance; sex determination, mutations and chromosomal aberrations

GPB 211 Fundamentals of Plant Breeding 3(2+1)

Objectives:
To impart knowledge to the students on the principles and procedures of plant breeding in self and cross pollinated crops to develop the high yielding varieties / hybrids.

Syllabus:

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

Plant Breeder's kit, Study of germplasm of various crops. Study of floral structure of self-pollinated and cross pollinated crops. Emasculation and hybridization techniques in self & cross pollinated crops. Consequences of inbreeding on genetic structure of resulting populations. Study of male sterility system. Handing of segregation populations. Methods of calculating mean, range, variance, standard deviation, heritability. Designs used in plant breeding experiment, analysis of Randomized Block Design. To work out the mode of pollination in a given crop and extent of natural out crossing. Prediction of performance of double cross hybrids.

Learning Outcome:

Students will learn breeding procedures in self and cross pollinated crops; understand exploitation of heterosis utilizing male sterility and other methods; know about the various population improvement programmes; study about the fundamentals of mutation, polyploidy and wide hybridization and their role in crop improvement

GPB 311 Crop Improvement – I (*Kharif*) 2(1+1)

Objectives:

To impart knowledge to the students on the botanical description, origin, distribution and various breeding approaches used for the development of varieties / hybrids in various field and horticultural crops

Syllabus:

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 Pigeon pea, 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.

Learning Outcome:

Students will understand the origin, distribution and different breeding methods to be adopted for the development of varieties / hybrids in various field and horticultural crops; about the plant genetic resources, centres of diversity and breeding for resistance to biotic and abiotic stresses; learn about the influence of Genotype x Environment interaction on yield / performance.

GPB 321 Crop Improvement – II (*Rabi*) 2(1+1)

Objectives:

To impart knowledge to the students on the botanical description, origin, distribution and various breeding approaches used for the development of varieties / hybrids in various field and horticultural crops

Syllabus:

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 Objectivess 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.

Learning Outcome:

Students will understand the origin, distribution and different breeding methods to be adopted for the development of varieties / hybrids in various field and horticultural crops; about the plant genetic resources, centres of diversity and breeding for resistance to biotic and abiotic stresses; learn about the influence of Genotype x Environment interaction on yield / performance.

GPB 322 Principles of Plant Biotechnology 2 (1+1)

Objectives:
To impart knowledge to the students on the various techniques of plant tissue culture, principles of plant biotechnology and their role in crop improvement.
Syllabus:

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

Sterilization techniques. Composition of various tissue culture media and preparation of stock solutions for MS nutrient medium. Callus induction from various explants. Micro-propagation, hardening and acclimatization. Demonstration on isolation of DNA. Demonstration of gel electrophoresis techniques and DNA finger printing.

Learning Outcome:

Students will understand the various techniques of plant tissue culture; know about the fundamentals of genetic engineering; about molecular markers and Marker Assisted Selection.

SOIL SCIENCE & AGRICULTURAL CHEMISTRY

SSC 111 Fundamentals of Soil Science 3(2+1)

Objectives:

The students are expected to gain both theoretical as well as practical knowledge on different aspects of fundamental of soil science like genesis of soil, soil profile, various properties of soil viz., soil texture, soil structure, soil density, soil colour, soil temperature, soil air, soil colloid, soil organic matter, soil organisms etc.

Syllabus:

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.

Practical

Study of soil profile in field. Study of soil sampling tools, collection of representative soil sample, its processing and storage. Study of soil forming rocks and minerals. Determination of soil

density, moisture content and porosity. Determination of soil texture by feel and Bouyoucos Methods. Studies of capillary rise phenomenon of water in soil column and water movement in soil. Determination of soil pH and electrical conductivity. Determination of cation exchange capacity of soil. Study of soil map. Determination of soil colour. Demonstration of heat transfer in soil. Estimation of organic matter content of soil.

Learning Outcome:

Students will acquire knowledge on fundamental and basic aspects of soil science.

SSC 211 Manures, Fertilizers and Soil Fertility Management 3(2+1)

Objectives:

The students are expected to gain both theoretical as well as practical knowledge on classification, composition, and properties of N, P and K fertilizers, complex fertilizers, secondary and micro nutrient fertilizers, soil amendments, organic manures, integrated nutrient management, different techniques of soil fertility evaluation etc.

Syllabus:

Theory

Introduction and importance of organic manures, properties and methods of preparation of bulky and concentrated manures. Green/leaf manuring. Integrated nutrient management. 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. History of soil fertility and plant nutrition. criteria of essentiality. role, deficiency and toxicity symptoms of essential plant nutrients, Mechanisms of nutrient transport to plants, factors affecting nutrient availability to plants. Chemistry of soil nitrogen, phosphorus, potassium, calcium, magnesium, sulphur and micronutrients. Soil fertility evaluation, Soil testing. Critical levels of different nutrients in soil. Forms of nutrients in soil, plant analysis, rapid plant tissue tests. Indicator plants. Methods of fertilizer recommendations to crops. Factor influencing nutrient use efficiency (NUE), methods of application under rainfed and irrigated conditions.

Practical

Introduction of analytical instruments and their principles, calibration and applications, Colorimetry and flame photometry. Estimation of available N in soils. Estimation of available P in soils. Estimation of available K. Estimation of available S in soils. Estimation of available Ca and Mg in soils. Estimation of available Zn in soils. Estimation of N in plants. Estimation of P in plants. Estimation of K in plants. Estimation of S in plants.

Learning Outcome:

Students will acquire knowledge on manures, fertilizers and soil fertility management.

SSC 221 Problematic Soils and their management 2(2+0)

Objectives:

The students are expected to gain knowledge on distribution, genesis, characteristics, reclamation and management of various problematic soils like acid soil, saline soil, alkali soil, saline-alkali soil, eroded soil, flooded soil, compact soil etc, irrigation water quality and standard, soil health and quality, polluted soils, bio remediation of problem soil through MPTs of soils, land capability classification etc.

Syllabus:

Theory

Soil quality and health, Distribution of Waste land and problem soils in India. Their categorization based on properties. Reclamation and management of Saline and sodic soils, Acid soils, Acid Sulphate soils, Eroded and Compacted soils, Flooded soils, Polluted soils. Soil pollution - behaviour of pesticides and inorganic contaminants, prevention and mitigation of soil pollution. Irrigation water – quality and standards, utilization of saline water in agriculture. Remote sensing and GIS in diagnosis and management of problem soils. Multipurpose tree species, bio remediation through MPTs of soils, land capability and classification, land suitability classification. Problematic soils under different Agroeco systems.

Learning Outcome:

Students will acquire knowledge on knowledge on distribution, genesis, characteristics, reclamation and management of various problematic soils.

AGRICULTURAL ENTOMOLOGY

AEN 121 Fundamentals of Entomology 4(3+1)

Objectives:

To acquaint the students about classification of insect upto infra-ordeal characteristics and external morphology of the insect's body i.e., head, thorax and abdomen. Make them aware about different physiological systems of insect and to have a basic concept on Insect Ecology.

Syllabus:

Theory

Part - I

History of Entomology in India. Factors for insect's abundance. Major points related to dominance of Insecta in Animal kingdom. Classification of phylum Arthropoda upto classes. Relationship of class Insecta with other classes of Arthropoda. Morphology: Structure and functions of insect cuticle and molting. Body segmentation. Structure of Head, thorax and abdomen. Structure and modifications of insect antennae, mouth parts, legs, Wing venation,

modifications and wing coupling apparatus. Structure of male and female genital organ. Metamorphosis and diapause in insects. Types of larvae and pupae. Structure and functions of digestive, circulatory, excretory, respiratory, nervous, secretary (Endocrine) and reproductive system, in insects. Types of reproduction in insects. Major sensory organs like simple and compound eyes, chemoreceptor.

Part-II

Insect Ecology: Introduction, Environment and its components. Effect of abiotic factors– temperature, moisture, humidity, rainfall, light, atmospheric pressure and air currents. Effect of biotic factors – food competition, natural and environmental resistance. Concepts of Balance of life in nature, biotic potential and environmental resistance and causes for outbreak of pests in agro-ecosystem.

Part – III

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, Cicadellidae, Delphacidae, Aphididae, Coccidae, Lophophidae, Aleurodidae, Pseudococcidae; Neuroptera: Chrysopidae; Lepidoptera: Pieridae, Papiloinidae, Noctuidae, Sphingidae, Pyralidae, Gelechiidae, Arctiidae, Saturnidae, Bombycidae; Coleoptera: Coccinellidae, Chrysomelidae, Cerambycidae, Curculionidae, Bruchidae, Scarabaeidae; Hymenoptera: Tenthridinidae, Apidae. Trichogrammatidae, lchneumonidae, Braconidae, Chalcididae; Diptera: Cecidomyiidae, Tachinidae, Agromyziidae, Culicidae,Muscidae, Tephritidae.

Practical

Methods of collection and preservation of insects including immature stages; External features of Grasshopper/Blister beetle; Types of insect antennae, mouthparts and legs; Wing venation, types of wings and wing coupling apparatus. Types of insect larvae and pupae; Dissection of digestive system in insects (Grasshopper); Dissection of male and female reproductive systems in insects (Grasshopper); Study of characters of orders Orthoptera, Dictyoptera, Odonata, Isoptera, Thysanoptera, Hemiptera, Lepidoptera, Neuroptera, Coleoptera, Hymenoptera, Diptera and their families of agricultural importance.

Learning Outcome:

Outcome: At the end of the course students will acquire the knowledge on insect's body structure and function. Also they will learn the various interactions in the environment including population dynamics of insect and natural balance of life.

AEN 311 Management of Beneficial Insects 2(1+1)

Objectives:

To familiarize the students with entrepreneurial opportunities in entomology, provide information on productive insects and their products, as well as acquaint them with the mass production techniques and field evaluation of various biological control agents like parasitoids, predators and various entomopathogenic microorganisms.

Syllabus:

Theory

Importance of beneficial Insects, Beekeeping, pollinating plant and their cycle, 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.

Types of silkworm, voltinism and biology of silkworm. Mulberry cultivation, mulberry varieties and methods of harvesting and preservation of leaves. Rearing, mounting and harvesting of cocoons. Pest and diseases of silkworm, management, rearing appliances of mulberry silkworm and methods of disinfection.

Species of lac insect, morphology, biology, host plant, lac production – seed lac, button lac, shellac, lac- products. 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

Honey bee species, castes of bees. Beekeeping appliances and seasonal management, bee enemies and disease. Bee pasturage, bee foraging and communication. Types of silkworm, voltinism and biology of silkworm. Mulberry cultivation, mulberry varieties and methods of harvesting and preservation of leaves. Species of lac insect, host plant identification. Identification of other important pollinators, weed killers and scavengers. Visit to research and training institutions devoted to beekeeping, sericulture, lac culture and natural enemies.

Learning Outcome:

Upon completion of the course students will acquire the skills through hands on training on sericulture, apiculture and lac culture and develop entrepreneurship. Also they will learn different pest suppression strategies including bioagents.

AEN 321 Pests of Crops and Stored Grains and their Management 3(2+1)

Objectives:

To familiarize the students about nature of damage and seasonal incidence of insect pests that causes loss to major field & vegetable crops along with their effective management by different methods. To understand the role of stored grain pests and to acquaint with various stored grain pest management techniques Also to impart knowledge on theory and practice of biological control.

Syllabus:

Theory

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-importance, hazards and limitations. Classification of insecticides, toxicity of insecticides and formulations of insecticides. Recent methods of pest control, repellents, antifeedants, hormones, attractants, gamma radiation and genetic control. Practices, scope and limitations of IPM. Insecticides Act 1968-Important provisions. Application techniques of spray fluids. Phytotoxicity of insecticides. Symptoms of poisoning, first aid and antidotes. 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 pollinators, weed killers and scavengers, their importance.

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 crop, vegetable crop, fruit crop, plantation crops, ornamental crops, narcotics, spices and condiments. 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 Indian Storage Management and Research Institute, Hapur and Quality Laboratory, Department of Food., Delhi. Visit to nearest FCI godowns.

Learning Outcome:

After completion of the course students will be acquainted with various insect-pests of crops their damage symptoms and learn the techniques of integrated pest management. Also develop an idea on stored grain pests and storage structure. They will develop expertise in biological control.

AGRICULTURAL ECONOMICS

AEC 121 Fundamentals of Agricultural Economics 2(2+0)

Objectives:

To develop the theoretical concept of the subject matter and its' application in the field of agriculture in general.

Syllabus:

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.

Learning Outcome:
Students will be able to develop theoretical concepts regarding the subject matter and will be able to understand the possible application in the field of agriculture

AEC 211 Agricultural Finance and Co-Operation 3(2+1)

Objectives:
To understand the concept, role and importance of Agricultural Finance in India and to develop the knowledge of functioning of different financial organizations and financial policies pertaining to agriculture sector.

Syllabus:

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, Objectivess, 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.

Practical

Determination of most profitable level of capital use. Optimum allocation of limited amount of capital among different enterprise. Analysis of progress and performance of cooperatives using published data. Analysis of progress and performance of commercial banks and RRBs using

published data. Visit to a commercial bank, cooperative bank and cooperative society to acquire firsthand knowledge of their management, schemes and procedures. Estimation of credit requirement of farm business – A case study. Preparation and analysis of balance sheet – A case study. Preparation and analysis of income statement – A case study. Appraisal of a loan proposal – A case study. Techno-economic parameters for preparation of projects. Preparation of Bankable projects for various agricultural products and its value added products. Seminar on selected topics.

Learning Outcome:

On the completion of the course, students will be able to develop knowledge about the financial system prevailing in India and functioning of different financial organization along with developing quantitative ability to judge financial statements.

AEC 221 Agricultural Marketing, Trade and Prices 3(2+1)

Objectives:

To understand the concept and process of marketing of farm products produced by farmers and of farm inputs and services required by them in the production of these farm products.

Syllabus:

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 Objectivess 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.

Learning Outcome:

Students will develop the theoretical concept of process of marketing of farm products and cultivate the quantitative skills to analyse different marketing functions and efficiency of different markets

AEC 321 Farm Management, Production and Resource Economics 2(1+1)

Objectives:

To develop the understanding of production process and the guiding economic principle for agricultural production; to apply the appropriate economic principle under different production scenario to optimize the production process

Syllabus:

Theory

Meaning and concept of farm management, Objectivess 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

Preparation of farm layout. Determination of cost of fencing of a farm. Computation of depreciation cost of farm assets. Application of equi-marginal returns/opportunity cost principle in allocation of farm resources. Determination of most profitable level of inputs use in a farm production process. Determination of least cost combination of inputs. Selection of most profitable enterprise combination. Application of cost principles including CACP concepts in the estimation of cost of crop and livestock enterprises. Preparation of farm plan and budget, farm records and accounts and profit & loss accounts. Collection and analysis of data on various resources in India.

Learning Outcome:

Students will be able to acquire necessary theoretical and analytical skills to optimise the agricultural production and analyse the financial health of any farm for possible progress towards maximisation of profit.

AEC 322 Intellectual Property Rights 1(1+0)

Objectives:

To understand the concept of Intellectual property rights and its implications.

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. Types of Intellectual Property and legislations covering IPR in India:-Patents, Copyrights, Trademark, Industrial design, Geographical indications, Integrated circuits, Trade secrets. Patents Act 1970 and Patent system in India, patentability, process and product patent, filing of patent, patent specification, patent claims, Patent opposition and revocation, infringement, Compulsory licensing, Patent Cooperation Treaty, Patent search and patent database.

Origin and history including a brief introduction to UPOV for protection of plant varieties, Protection of plant varieties under UPOV and PPV&FR Act of India, Plant breeders rights,

Registration of plant varieties under PPV&FR Act 2001, breeders, researcher and farmers rights. Traditional knowledge-meaning and rights of TK holders.

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.

Learning Outcome:

Students will be able to grasp the concept of Intellectual Property rights and different acts related to IPR issues.

AGRICULTURAL ENGINEERING

AEG 121 Introductory Soil and Water Conservation Engineering 2(1+1)

Objectives:

To acquaint and equip the students with soil and water conservation techniques, soil erosion problems and control measures, design of irrigation channels, land surveying and levelling.

Syllabus:

Theory

Introduction to Soil and Water Conservation, causes of soil erosion. Definition and agents of soil erosion, water erosion: Forms of water erosion. Gully classification and control measures. Soil loss estimation by universal Loss Soil Equation. Soil loss measurement techniques. Principles of erosion control: Introduction to contouring, strip cropping. Contour bund. Graded bund and bench terracing. Grassed water ways and their design. Surveying: survey equipment, chain survey, cross staff survey, plotting procedure, calculations of area of regular and irregular fields; compass surveying-calculation of bearings and area; plane table surveying-calculation of area by radiation method; levelling-levelling equipment, terminology, methods of calculation of reduced levels. Water harvesting and its techniques. Wind erosion: mechanics of wind erosion, types of soil movement. Principles of wind erosion control and its control measures.

Practical

General status of soil conservation in India. Calculation of erosion index. Estimation of soil loss. Measurement of soil loss. Preparation of contour maps. Design of grassed water ways. Design of contour bunds. Design of graded bunds. Design of bench terracing system. Acquaintance with chain survey equipment; plotting of chain triangulation; plotting of cross staff survey; plotting compass surveying; plotting plane table survey; levelling-calculation of reduced levels, profile levelling. Problem on wind erosion.

Leaning Outcome:

This course enables the students to have understanding about the soil degradation and their effects, estimation of soil loss, soil erosion control measures, soil and water conservation technologies, water conveyance systems, land surveying and levelling.

AEG 211 Farm Machinery and Power 2(1+1)

Objectives:

To acquaint and equip the students with various farm tools, implements and machinery available for agricultural operations in the field to reduce drudgery of the farmers ensuring timely farm operations.

Syllabus:

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.

Practical

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.

Learning Outcome:

The students will know different machines, their operations as well as repair and maintenance. They will have sound knowledge on various engines their power output and cost estimation. It will also support them for selecting suitable equipment for a particular agricultural operation.

AEG 212 Principles of Food Science and Nutrition 2(2+0)

Objectives:

To acquaint and equip the students with fundamentals of food science, food microbiology, food processing and preservation, food nutrition, malnutrition, energy metabolism, menu planning and modern trends

Syllabus:

Theory

Concepts of Food Science (definitions, measurements, density, phase change, pH, osmosis, surface tension, colloidal systems etc.); Food composition and chemistry (water, carbohydrates, proteins, fats, vitamins, minerals, flavours, colours, miscellaneous bioactives, important reactions); Food microbiology (bacteria, yeast, moulds, spoilage of fresh & processed foods, Production of fermented foods); Principles and methods of food processing and preservation (use of heat, low temperature, chemicals, radiation, drying etc.); Food and nutrition, Malnutrition (over and under nutrition), nutritional disorders; Energy metabolism (carbohydrate, fat, proteins); Balanced/ modified diets, Menu planning, New trends in food science and nutrition.

Leaning Outcome:

This course enables the students to have basic knowledge on various methods of food processing and preservation, food composition, food chemistry, food microbiology, food nutrition, nutritional disorders, energy metabolism and balanced diets.

AEG 221 Renewable Energy and Green Technology 2(1+1)

Objectives:

To understand and explore various alternatives sources of energy to replace the traditional energy sources, such as: coal or petroleum etc.

Syllabus:

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, bioalcohol, biodiesel and biooil production and their utilization as bioenergy resource, introduction of solar energy, collection and their application, Familiarization with solar energy gadgets: solar cooker, solar water heater, application of solar energy: solar drying, solar pond, solar distillation, solar photovoltaic system and their application, introduction of wind energy and their application.

Practical

Familiarization with renewable energy gadgets. To study biogas plants, To study 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 pumping, solar fencing. To study solar cooker, To study solar drying system. To study solar distillation and solar pond.

Learning Outcome:

The students will knowledge on alternative energy sources, their advantages and limitations, idea of technology available to produce and utilize renewable energy in agriculture and daily uses, and encourage them to be the ambassador for new energy sources at low price.

AEG 321 Protected Cultivation and Secondary Agriculture 2(1+1)

Objectives:

To acquaint and equip the students with the greenhouse technology for crop cultivation and its design, materials and equipment and post harvest technology of cereals, pulses and oilseeds with special emphasis on their equipments.

Syllabus:

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. 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. 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.

Leaning Outcome:

This course enables the students to have basic knowledge on greenhouse construction, greenhouse cooling, heating, micro irrigation, drying systems, properties of biological materials, seed processing, drying, driers, grain storage, parboiling, milling, size reduction.

PLANT PATHOLOGY

PPC 121 Agricultural Microbiology 2(1+1)

Objectives:

To provide basic knowledge about the microorganisms, their importance and role in nature.

Syllabus:

Theory

Introduction & applied areas of Microbiology; Microbial world: Prokaryotic and eukaryotic microbes. History of Microbiology in brief. Origin of Life: Spontaneous generation theory; roles of microbes in fermentation, germ theory of disease, protection against vaccination. Bacteria: Morphology and cell structure, chemoautotrophy, photo autotrophy, growth. Bacterial genetics: Genetic recombination- transformation, conjugation and transduction, plasmids, transposon. Bacteriophages: structure and properties of bacterial viruses, lytic and lysogenic cycles; Protozoa: Introduction, pathogenic, biocontrol and bioindicating agents; Algae & Cyanobacteria: Elementary idea. Soil microbiology: microbial biodiversity in soil and their role in soil fertility and crop production; Rhizosphere & Mycorrhiza. Carbon, Nitrogen, Phosphorus and sulphur cycles. Biological nitrogen fixation- symbiotic, associative and aysmbiotic. Azolla, blue green algae. Plant Microbe interactions and phyllosphere. Microbiology of water. Microbes in human welfare: silage production, biofertilizers, biopesticides, biofuel production and biodegradation.

Practical

Introduction to microbiology laboratory and its equipments; Microscope- parts, principles of microscopy, resolving power and numerical aperture. Methods of sterilization. Nutritional media and their preparations. Enumeration of microbial population in soil- bacteria, fungi, actinomycetes. Methods of isolation and purification of microbial cultures. Isolation of *Rhizobium* from legume root nodule. Isolation of *Azotobacter* from soil. Isolation of *Azospirillum* from roots. Staining and microscopic examination of microbes.

Learning Outcome:

Help the learners for identify the microorganisms, their role in eco-system and bio-diversity.

PPC 211 Fundamentals of Plant Pathology 4(3+1)

Objectives:

To provide basic knowledge about the pathogens their ecology, reproduction and concept of management of pathogens.

Syllabus:

Theory

Introduction: Importance of plant diseases, scope and Objectives of Plant Pathology. History of Plant Pathology with special reference to Indian work. Terms and concepts in Plant Pathology. Pathogenesis. Cause and classification of plant diseases. Important plant pathogenic organisms, different groups**:** fungi, bacteria, fastidious vesicular bacteria, phytoplasmas, spiroplasmas, viruses, viroids, algae, protozoa, phanerogamic parasites and nematodes with examples of diseases caused by them. Diseases and symptoms due to abiotic causes.

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. Nematodes: General morphology and reproduction, classification, symptoms and nature of damage caused by plant nematodes (Heterodera, Meloidogyne, *Anguina* etc.). Principles and methods of plant disease management. Nature, chemical combination, classification, mode of action and formulations of fungicides and antibiotics.

Practical

Acquaintance with various laboratory equipments and microscopy. Preparation of media, isolation and Koch's postulates. General study of different structures of fungi. Study of symptoms of various plant diseases. Study of representative fungal genera. Staining and identification of plant pathogenic bacteria. Transmission of plant viruses. Study of phanerogamic plant parasites. Study of morphological features and identification of plant parasitic nematodes. Extraction of nematodes from soil. Study of fungicides and their formulations. Methods of pesticide application and their safe use. Calculation of fungicide sprays concentrations**.**

Learning Outcome:

Help the learners for identify the pathogen, behaviour and their inter relationship with crop plants.

PPC 311 Diseases of Field & Horticultural Crops & their Management-I 3 (2+1)

Objectives:

To generate overall knowledge about the diseases of kharif cereals and horticultural crops.

Syllabus:

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 and leaf spots; Sorghum: smuts and grain mold, Bajra :downy mildew and ergot; Groundnut: early and late leaf spots, rust, bud necrosis & groundnut rosette; Pigeonpea: Phytophthora blight, wilt and sterility mosaic; Black & Green gram: Cercospora leaf spot, crinkle and yellow mosaic; Castor: Phytophthora blight; Tobacco: black shank, leaf curl and mosaic; Jute: Stem rot of jute & wilt complex.

Horticultural Crops: Guava: wilt and anthracnose; Banana: Panama wilt, bacterial wilt, Sigatoka and bunchy top; Papaya: foot rot, anthracnose, leaf curl and mosaic, Pomegranate: bacterial blight; Cruciferous vegetables: Alternaria leaf spot, black rot, boron & molybdenum deficiency; Brinjal: Phomopsis blight and fruit rot, bacterial and fungal wilt & little leaf; Okra: Yellow Vein Mosaic; Beans: anthracnose and bacterial blight; Ginger: soft rot; Colocasia: Phytophthora blight; Coconut: Leaf spot, root wilt and bud rot; Tea: blister blight and red rust; Coffee: rust; Betelvine: Stem & foot rot, Bacterial leaf spot; Tube rose: Collar rot & leaf blight.

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; Note: Students should submit 50 pressed and well-mounted specimens.

Learning Outcome:

Help the learners for identify the diseases through symptoms in field, their proper management as well as identification of causal agents by microscopic study.

PPC 321 Diseases of Field & Horticultural Crops & their Management-II 3(2+1)

Objectives:

To generate overall knowledge about the diseases of winter cereals and horticultural crops.

Syllabus:

Theory

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

Field Crops:

Wheat: rusts, loose smut, karnal bunt, powdery mildew, Alternaria and Helminthosporium leaf blight & ear cockle; Barley: Covered smut; Sugarcane: red rot, smut, wilt, grassy shoot, ratoon stunting and Pokkah Boeng; Sunflower: stem rot (Sclerotium, Sclerotiana and Macrophomina),

Alternaria blight; Mustard: Alternaria blight, white rust, downy mildew and club root; Bengal gram: wilt complex, grey mould and Ascochyta blight; Lentil: rust and wilt; Linseed: Rust; Pea: downy mildew, powdery mildew and rust; Soybean: Bacterial spot, rust and mosaic; Cotton: anthracnose, vascular wilt and black arm.

Horticultural Crops: Mango: Anthracnose, malformation, bacterial blight and canker, red rust & black tip; Citrus: canker, die back, gummosis and included greening; Grape vine: downy mildew and anthracnose; Sapota: Shooty mould; Apple: scab and crown gall; Peach: leaf curl; Pear: Fire blight; Strawberry: leaf spot; Tomato: damping off, early and late blight, buck eye rot and leaf curl and mosaic; Potato: early and late blight, black scurf, wart, scab & bacterial soft rot; mild mosaic, sever mosaic, rugose mosaic, acuba mosaic, leaf roll and hairy sprout; Chillies: anthracnose and fruit rot, wilt and leaf curl; Cucurbits: downy mildew, powdery mildew, wilt and mosaic; Onion and garlic: purple blotch, and Stemphylium blight and potash deficiency; Turmeric: leaf spot; Coriander: stem gall; Marigold: Leaf spot & bud rot; 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. Note: Students should submit 50 pressed and well-mounted specimens.

Learning Outcome:

Help the learners for identify the diseases through symptoms in field, their proper management as well as identification of causal agents by microscopic study.

PPT 311 Principles of Integrated Pest and Disease Management 3(2+1)

Objectives:

To generate knowledge about IDM and IPM

Syllabus:

Theory

Categories of insect pests and diseases, Economic importance of insect pests, diseases; Methods of detection and diagnosis of insect pest and diseases. Monitoring: Survey, surveillance and forecasting of Insect pest and diseases; pest risk analysis. Calculation and dynamics of economic injury level and importance of Economic threshold level. Methods of control: Host plant resistance, cultural, mechanical, physical, legislative, biological and chemical control. Introduction to conventional pesticides for the insect pests and disease management. Safety issues in pesticide uses. IPM: Introduction, history, importance, concepts, principles and tools of IPM. Ecological management of crop environment. Development and validation of IPM module.

IPM module for Insect pest and disease. Implementation and impact of IPM. Political, social and legal implication of IPM. Role of Government in IPM dissemination, Case histories of important IPM programmes.

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 and nature of damage of important insect pests and diseases and their management. Preparation of insect pest and crop disease calendar. Identification of biocontrol agents, different predators and natural enemies. Mass multiplication of *Trichoderma, Pseudomona*s, *Trichogramma*, NPV etc. Crop monitoring attacked by insect pest and diseases. Crop (agro-ecosystem) dynamics of a selected insect pest and diseases. Plan & assess preventive strategies (IPM module) and decision making. Awareness campaign at farmers' fields.

Learning Outcome:

Acquired knowledge may help the students for developing IPM and IDM modules.

HORTICULTURE

HOR 111 Fundamentals of Horticulture 2(1+1)

Objectives:

The students are expected to gain knowledge on concept of horticulture along with different branches of horticulture, classification of horticultural crops, soil and climate, training pruning, kitchen garden, garden types, lawn, medicinal and aromatic plants, spices and condiments, plant bio-regulators and application of irrigation and fertilizer.

Syllabus:

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

Identification of garden tools. Identification of horticultural crops. Preparation of seed bed/nursery bed. Practice of sexual and asexual methods of propagation. Layout and planting of orchard plants. Training and pruning of fruit trees. Transplanting and care of vegetable seedlings.

Making of herbaceous and shrubbery borders. Preparation of potting mixture, potting and repotting. Fertilizer application in different crops. Visits to commercial nurseries/orchard.

Learning Outcome:

Students will acquire knowledge on fundamentals of horticulture

HOR 211 Production Technology for Vegetable and Spices 2(1+1)

Objectives:

To gain knowledge on production technology of vegetable and spice crops production technology.

Syllabus:

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, disease and pest control and seed production of important vegetables: tomato, brinjal & chilli, cabbage & cauliflower, okra, garden pea, cow pea & French bean, carrot & radish, onion & garlic, bottle gourd, bitter gourd, ridge gourd, pumpkin, cucumber & pointed gourd, sweet potato & tapioca, palak & vegetable amaranth) and spices: black pepper, ginger, turmeric, cardamom, cumin, coriander, fennel and fenugreek.

Practical

Identification of vegetables & spices crops and their seeds. Nursery raising. Direct seed sowing and transplanting. Study of morphological characters of different vegetables & spices. Fertilizers applications. Raising of nursery of vegetables & spices. Vegetables & spices seed extraction. Harvesting & preparation for market. Economics of vegetables and spices cultivation.

Learning Outcome:

This is expected that the students will acquire basic knowledge on different vegetable and spice crops. They are expected to gain skill on field management of different vegetable and spice crops.

HOR 221 Production Technology for Ornamental Crops, MAPs and Landscaping 2(1+1)

Objectives:

The students are expected to gain knowledge on production technology of ornamental crops, aromatic and medicinal plants, their importance and uses.

Syllabus:

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 and aromatic plants like mint, lemongrass, citronella,palmarosa, ocimum, rose, geranium, vetiver. Processing and value addition in ornamental crops and MAPs produce.

Practical

Identification of Ornamental plants. Identification of Medicinal and Aromatic Plants. Nursery bed preparation and seed sowing. Training and pruning of Ornamental plants. Planning and layout of garden. Bed preparation and planting of MAP. Protected structures – care and maintenance. Intercultural operations in flowers and MAP. Harvesting and post harvest handling of cut and loose flowers. Processing of MAP. Visit to commercial flower/MAP unit.

Learning Outcome:

Students will acquire knowledge on production technology and processing of ornamental crops, aromatic and medicinal plants, their importance and uses.

HOR 222 Production Technology for Fruit and Plantation Crops 2(1+1)

Objectives:

The students are expected to gain knowledge on fruit and plantation crop industry in India along with the production technology of some important fruits and plantation crops.

Syllabus:

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, papaya, apple, pear, peach and; minor fruits- pineapple, pomegranate, jackfruit, strawberry, nut crops; plantation crops-coconut, arecanut, cashew, tea, coffee & rubber.

Practical

Seed propagation. Scarification and stratification of seeds. Propagation methods for fruit and plantation crops including Micro-propagation. Description and identification of fruit.

Preparation of plant bio regulators and their uses, Pests, diseases and physiological disorders of above fruit and plantation crops, Visit to commercial orchard.

Learning Outcome:

Students will acquire knowledge on production technologies of important fruits and plantation crops grown in India

HOR 321 Post-harvest Management and Value Addition of Fruits and Vegetables 2(1+1)

Objectives:

The students are expected to gain knowledge on various management technologies on pre-harvest and post harvest of fruits and vegetables. Students are also expected to gain knowledge on conventional and modern packaging methods; principles of preservation and methods of preservation.

Syllabus:

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

Applications of different types of packaging containers for shelf life extension. Effect of temperature on shelf life and quality of produce. Demonstration of chilling and freezing injury in vegetables and fruits. Extraction and preservation of pulps and juices. Preparation of jam, jelly, RTS, nectar, squash, osmotically dried products, fruit bar and candy and tomato products, canned products. Quality evaluation of products -- physico-chemical and sensory. Visit to processing unit/ industry.

Learning Outcome:

Students will acquire knowledge on maturity indices and physiology of ripening of horticultural crops, pre and post harvest management practices, methods of harvesting diseases and disorders, novel packaging and modern storage techniques, value addition and preservation of fruits and vegetables and ornamental crops.

AGRICULTURAL EXTENSION AND COMMUNICATION

AEX 111 Comprehension and Communication Skills in English 2(1+1)

Objectives:

To make the students knowledgeable about functional and corporate English as well as to enhance their skill in English communication in profession and academics.

Syllabus:

Theory

War Minus Shooting- The sporting Spirit. A Dilemma- A layman looks at science Raymond B. Fosdick. You and Your English – Spoken English and broken English G.B. Shaw. 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. Written Skills: Paragraph writing, Precise writing, Report writing and Proposal writing. The Style: Importance of professional writing. Preparation of Curriculum Vitae and Job applications. Synopsis Writing. Interviews: kinds, Importance and process.

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.

Learning Outcome:

Students are expected to have sufficient knowledge and skill in English communication in corporate and professional field.

AEX 112 Rural Sociology & Educational Psychology 2(2+0)

Objectives:

To orient the students regarding different concepts and issues of rural sociology and educational psychology.

Syllabus:

Theory

Sociology and Rural sociology: Definition and scope, its significance in agriculture extension, Rural society, Social Groups, Social Stratification, Culture concept, Social Institution, Social Change & Development. Educational psychology: Meaning & its importance in agriculture

extension. Behavior: Cognitive, affective, psychomotor domain, Personality, Learning, Motivation, Theories of Motivation, Intelligence. Attitudes.

Learning Outcome:

The learners are expected to develop expertise on different concepts and issues of rural sociology and educational psychology.

AEX 121 Fundamentals of Agricultural Extension Education 3(2+1)

Objectives:

To orient the students regarding fundamental concept of agricultural education, extension programme planning, rural development programmes, rural leadership, extension administration, extension journalism, extension teaching methods, adoption and diffusion of innovation, monitoring and evaluation.

Syllabus:

Theory

Education: Meaning, definition & Types; Extension Education- meaning, definition, scope and process; Objectivess 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.

Learning outcome:

The students are expected to develop concept and skills on the following aspects of extension education: fundamental concept of agricultural education; extension programme planning; rural development programmes; rural leadership; extension administration; extension journalism; extension teaching methods; adoption and diffusion of innovation; monitoring and evaluation

AEX 122 Communication Skills and Personality Development 2(1+1)

Objectives:

Personality development is an indispensable tool that helps the student community to flourish personal and professional skill. Good communication is vital to any institution's successful operation and equally imperative for personality development. This course is a thorough attempt to present the aforesaid concepts to the students to gaze the difficult situations and handle them appropriately.

Syllabus:

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.

Learning Outcome:

A student community that think positively and masterfully with confidence and faith, and life becomes more secure, more fraught with activity, richer in achievement and experience.

AEX 311 Entrepreneurship Development and Business Communication 2(1+1)

Objectives:

To orient the students regarding genesis, concept, types and importance of entrepreneurship.
To provide understanding of the functioning and management aspects of entrepreneurship and associated policies, programmes, approaches and business communication; to develop knowledge and skills in analyses of entrepreneurial motivation, SWOT, management of entrepreneurship.

Syllabus:

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, 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; Opportunities for entrepreneurship and rural entrepreneurship.

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.

Learning Outcome:

Understanding of the concept and features of entrepreneurs and entrepreneurship and the related management and communicational aspects
Learning of different tools and techniques for analyses of entrepreneurial activities and entrepreneurship including development, implementation, management, monitoring and evaluation of the entrepreneurship/ enterprise.

CROP PHYSIOLOGY

CPH 211 Fundamentals of Crop Physiology 2(1+1)

Objectives:

To give students a greater understanding of the crop physiological processes such as water metabolism, mineral nutrition, photosynthesis, respiration, fatty acid metabolism, flowering and plant growth regulators; to stimulate their learning of basic concepts in crop growth, development and factors affecting growth and productivity of crops; to make the students familiar with recent advances in crop physiological research; to integrate their knowledge of crop physiology in research of other disciplines of agriculture

Syllabus:

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 CO_2 assimilation by Infra Red Gas Analyser (IRGA).

Learning Outcome:

Students will understand about different aspects of crop physiological processes and their applications in agricultural research; students will understand the physiological basis of yield variation in crop plants; the knowledge in crop physiology acquired by the students will be useful for achieving higher productivity of crops.

CPH 221 Principles of Seed Technology 3(1+2)

Objectives:

To give students a greater understanding about various aspects of seed science and technology including seeds of genetically modified crops; to develop awareness among the students on seed laws and regulations; to train the students in research on seed production, certification, testing,

drying, processing, storage, marketing; to strengthen human resources in the seed production technology of field crops and vegetables

Syllabus:

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 sampling and testing: Physical purity, germination, viability, etc. Seed and seedling vigour test. Genetic purity test: Grow out test and electrophoresis. Seed certification: Procedure, Field inspection, Preparation of field inspection report. Visit to seed production farms, seed testing laboratories and seed processing plant.

Learning Outcome:

The students will understand various aspects of seed technology such as quality, production, multiplication, certification, testing, processing, storage and marketing; the students will become aware of different legislative measures which regulate production and sale of seeds in India; the knowledge in seed production technology and marketing will be useful for developing entrepreneurships among students

COMPUTER APPLICATION

AIN 211 Agricultural Informatics 2(1+1)

Objectives:

To understand the basic function of a computer and the computing process; to understand the operation of different hardware and software used in computer; to have first hand knowledge in using different mobile applications; to develop the knowledge of different application software and use the internet

Syllabus:

Theory

Introduction to Computers, Anatomy of Computers, Memory Concepts, Units of Memory, Operating System, definition and types, Applications of MS-Office for creating, Editing and Formatting a document, Data presentation, tabulation and graph creation, statistical analysis, mathematical expressions, Database, concepts and types, creating database, uses of DBMS in Agriculture, Internet and World Wide Web (WWW), Concepts and components.

Computer Programming, General Concepts, Introduction to Visual Basic, Java, Fortran, C/ C++, etc, concepts and standard input/output operations.

e-Agriculture, concepts, design and development. Application of innovative ways to use information and communication technologies (IT) in Agriculture. Computer Models in Agriculture: statistical, weather analysis and crop simulation models, concepts, structure, 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.

Learning Outcome:

Students will excel in using modern day computing techniques and will effectively amalgamate the knowledge to different uses in everyday life

STATISTICS

AST 311 Statistical Methods 2(1+1)

Objectives:

This course is meant for students who do not have any background knowledge of Statistics. Students would be exposed to various concepts of descriptive statistical methods and statistical inferential procedures what would help them in understanding the importance of statistics in drawing valid conclusions in every walk of their life. It would also help them in understanding the concepts involved in data presentation, their analysis and interpretation. The students would also get to know about how to describe and present data, various descriptive measures, probability distributions, procedures of parameter estimation, test of significance, concepts of correlation and regression, concept of drawing a good sample and designing field experiments.

Syllabus:

Theory

Introduction to Statistics and its Applications in Agriculture, Graphical Representation of Data, Measures of Central Tendency & Dispersion, Definition of Probability, Addition and Multiplication Theorem (without proof). Simple Problems Based on Probability. Binomial & Poisson Distributions, Definition of Correlation, Scatter Diagram. Karl Pearson's Coefficient of Correlation. Linear Regression Equations. Introduction to Test of Significance, One sample & two sample test t for Means, Chi-Square Test of Independence of Attributes in 2 ×2 Contingency Table. Introduction to Analysis of Variance, Analysis of One Way Classification. Introduction to Sampling Methods, Sampling versus Complete Enumeration, Simple Random Sampling with and without replacement, Use of Random Number Tables for selection of Simple Random Sample.

Practical

Graphical Representation of Data. Measures of Central Tendency (Ungrouped data) with Calculation of Quartiles, Deciles & Percentiles. Measures of Central Tendency (Grouped data) with Calculation of Quartiles, Deciles & Percentiles. Measures of Dispersion (Ungrouped Data). Measures of Dispersion (Grouped Data). Moments, Measures of Skewness & Kurtosis (Ungrouped Data). Moments, Measures of Skewness & Kurtosis (Grouped Data). Correlation & Regression Analysis. Application of One Sample t-test. Application of Two Sample Fisher's t-test. Chi-Square test of Goodness of Fit. Chi-Square test of Independence of Attributes for 2×2 contingency table. Analysis of Variance One Way Classification. Analysis of Variance Two Way Classification. Selection of random sample using Simple Random Sampling.

Learning Outcome:

It is expected that the students will be equipped with basic statistical tools used for analysing data sets and will be able to draw valid conclusion supported by statistical mechanism.

ANIMAL PRODUCTION

ANS 111 Livestock & Poultry Management 4(3+1)

Objectives:

To give basic idea to students about the livestock, live stock management, livestock and poultry diseases.

Syllabus:

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 swine. Incubation, hatching and brooding. Management of growers and layers.

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.

Learning outcome:

Students will get knowledge about the livestock, live stock management, livestock and poultry diseases.

ELECTIVE COURSES

AGR 224 Water Management 3(2+1)

Objectives:

To make the students knowledge about water management in principles crops and to enrich their views and ideas related to water resources, water movement in soil and plant, irrigation situation in India, method of irrigation, irrigation scheduling and excess water and its management.

Syllabus

Theory

Soil water relations, water retention by soil, soil moisture characteristics, field capacity, permanent wilting point, plant available water and extractable water; Soil-plant water relationship; soil water potential and its components; Movement of soil water- saturated and unsaturated water flow; run off, infiltration, percolation and seepage; Methods of soil moisture estimation, evapotranspiration and crop water requirement; effective rainfall; Effect of excess water on plant growth and production; agricultural drainage, irrigation scheduling, methods of irrigation-surface, subsurface, sprinkler and drip, irrigation and water use efficiencies, water productivity, deficit irrigation; irrigation water quality and its management. Water management of different crops (rice, wheat, maize, chickpea, rapeseed-mustard, groundnut, sugarcane and potato).

Practical

Estimation of ET by using empirical formulae, Demonstration of irrigation scheduling based on tensiometer, pan evaporimeter, critical growth stages and indicator plant; Use of lysimeter for determination of ET; Determination of ET by water balance method; Field demonstration of surface irrigation systems; Installation, operation and maintenance of sprinkler and drip irrigation systems; Quality testing of irrigation water; Numerical exercises on water requirement,

irrigation requirement and irrigation efficiency. Irrigation water – duty, delta and base; Layout of different surface and subsurface drainage systems.

Learning outcome:

Students will be expected to develop expertise on different aspects and issues of irrigation water management; students will be known about method of irrigation, irrigation scheduling and excess water and its management.

AGR 314 Advances in Crop Production 3(2+1)

Objectives:

To give basic idea to students about the crop plants in relation to environments and climate resilient agriculture; to give the knowledge of crop growth and development; concept of growth analysis, Agro-biological principles, Crop growth modeling, crop production under problem soil, principles of conservation agriculture.

Syllabus:

Theory

Crop plants in relation to environments; Climate resilient agriculture. Crop growth and development; concept of growth analysis; growth variables - RGR, CGR, NAR, LAI, LAD, RLGR, grain filling efficiency (G), and harvest index (HI); light interception and utilization efficiency; potential crop productivity; Canopy architecture, light interception and utilization, energy use efficiency optimum LAI, critical and ceiling LAI. Agro-biological principles, 318N concept, Mitscherlich yield equation, inverse yield nitrogen law and their interpretations, concept of Baule unit; Physiological limits of crop productivity; crop growth modelling; crop production under problem soils-salt affected soil, acid soils, water logged soils and degraded soils. Resource conservation technology including modern concept of tillage, principles of conservation agriculture; concept of balanced nutrition and integrated nutrient management.

P**ractical**

Plant sampling for measurement of biomass, LAI, LAD, CGR, NAR. Measurement of light interception, light extinction coefficient and critical LAI. Preparation of crop calendar, calendar of operations, Economics and energetics of crop production; raising crops under different problematic soils.

Learning Outcome:

Students will get basic idea about crop plants in relation to environments and climate resilient agriculture; to will get the knowledge of crop growth and development; concept of growth analysis, Agro-biological principles, Crop growth modeling, crop production under problem soil, principles of conservation agriculture.

AGR 323 Weed Management 3(2+1)

Objectives:

To impart basic ideas about weeds, their characteristics, importance, weed ecology and biology, principles and practices of weed management, herbicide- selectivity and mode of action and their judicious and safe use in different crops and cropping systems.

Syllabus:

Theory

Introduction to weeds, characteristics of weeds their harmful and beneficial effects on ecosystem. Classification, reproduction and dissemination of weeds. Herbicide classification, concept of adjuvant, surfactant, herbicide formulation and their use. Introduction to mode of action of herbicides and selectivity. Allelopathy and its application for weed management. Bio-herbicides and their application in agriculture. Concept of herbicide mixture and utility in agriculture. Herbicide compatibility with nutrients and their application. Integration of herbicides with non chemical methods of weed management. Herbicide Resistance and its management.

Practical

Techniques of weed preservation. Weed identification and their losses study. Biology of important weeds. Study of herbicide formulations and mixture of herbicide. Herbicide and nutrient compatibility study. Shift of weed flora study in long term experiments. Study of methods of herbicide application, spraying equipments. Calculations of herbicide doses and weed control efficiency and weed index.

Learning outcome:

Students will be able to develop comprehensive ideas about weeds, their ecology and biology, principles and practices of weed management in different crops and cropping systems, recent development of herbicides- their selectivity, mode of action,develop knowledge on selection of crop specific herbicides- their application with proper dose time and safe handling and integrated weed management.

ACB 321 Food Safety Issues 3(2+1)

Objectives:

The major Objectives of this course is to have basic understanding of the importance and management of food safety. It teaches the importance, factors affecting the food safety, hazards and their management, food storage, sanitation and packaging, food safety management and food laws and standards.

Syllabus:

Theory

Food Safety – Definition, Importance, Scope and Factors affecting Food Safety. Hazards and Risks, Types of hazards - Biological, Chemical, Physical hazards. Management of hazards - Need. Control of parameters. Temperature control. Food storage. Product design. Hygiene and Sanitation in Food Service Establishments- Introduction. Sources of contamination and their control. Waste Disposal. Pest and Rodent Control. Personnel Hygiene. Food Safety Measures. Food Safety Management Tools- Basic concepts. PRPs, GHPs, GMPs, SSOPs etc. HACCP. ISO series. TQM - concept and need for quality, components of TQM, Kaizen. Risk Analysis. Accreditation and Auditing, Water Analysis, Surface Sanitation and Personal Hygiene. Food laws and Standards- Indian Food Regulatory Regime, FSSA. Global Scenario CAC. Other laws and standards related to food. Recent concerns- New and Emerging Pathogens. Packaging, Product labeling and Nutritional labeling. Genetically modified foods\ transgenics. Organic foods. Newer approaches to food safety. Recent Outbreaks.

Practical

Water quality analysis physico-chemical and microbiological. Preparation of different types of media. Microbiological Examination of different food samples. Assessment of surface sanitation by swab/rinse method. Assessment of personal hygiene. Biochemical tests for identification of bacteria. Scheme for the detection of food borne pathogens. Preparation of plans for Implementation of FSMS - HACCP, ISO: 22000.

Learning outcome:

The study of Food Safety Issues helps to understand the importance and management of food safety. Students will learn the importance, factors affecting the food safety, hazards and their management, food storage, sanitation and packaging, food safety management and food laws and standards. Students will also learn practical experience in preparation of microbial culture media, physico-chemical and microbial analysis of water and food materials, microbiological examination of food samples. With this theoretical and practical learning, the student will get the comprehensive knowledge and experience in the area of food safety.

AEC 222 Agri-business Management 3(2+1)

Objectives:

To learn the managerial aspects in the field of agribusiness.

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. Institutional arrangement, procedures to set up agro based industries. Constraints in establishing agro-based industries. Agri-value chain: Understanding primary and support activities and their linkages. Business environment: PEST & SWOT analysis. Management functions: Roles & activities, Organization culture. Planning, meaning, definition, types of plans. Purpose or mission, goals or Objectivess, Strategies, polices procedures, rules, programs and budget. Components of a business plan, Steps in planning and implementation. Organization staffing, directing and motivation. Ordering, leading, supervision, communications, control. Capital Management and Financial management of Agribusiness. Financial statements and their importance. Marketing Management: Segmentation, targeting & positioning. Marketing mix and marketing strategies. Consumer behavior analysis, Product Life Cycle (PLC). Sales & Distribution Management. Pricing policy, various pricing
methods. Project Management definition, project cycle, identification, formulation, appraisal, implementation, monitoring and evaluation. Project Appraisal and evaluation techniques.

Practical

Study of agri-input markets: Seed, fertilizers, pesticides. Study of output markets: grains, fruits, vegetables, flowers. Study of product markets, retails trade commodity trading, and value added products. Study of financing institutions- Cooperative, Commercial banks, RRBs, Agribusiness Finance Limited, NABARD. Preparations of projects and Feasibility reports for agribusiness entrepreneur. Appraisal/evaluation techniques of identifying viable project- Non-discounting techniques. Case study of agro-based industries. Trend and growth rate of prices of agricultural commodities. Net present worth technique for selection of viable project. Internal rate of return.

Learning Outcome:

Student will be acquainted with managerial concepts and aspects of Agribusiness.

AEC 311 Emerging Issues in Agricultural Economics 3(2+1)

Objectives:

To learn the novel initiatives and recent development in the field of agricultural economics.

Syllabus:

Theory

Economic thoughts: Evolution of Economic Thoughts: Ancient economic thought – medieval economic thought – modern economic thoughts. Economic Thoughts in India – Gandhian Economics vs Nehru's economic philosophy. Globalization and Agricultural Economy: Concept of globalization and its impact on agriculture in India. International Trade agreements – GATT – WTO – AoA. Free trade versus Protectionism, Trade Blocks, and Business Cycle. Agricultural Policy: Agricultural Policies- National Agriculture Policy, National Water Policy, National Seed

Policy, National Fertilizer Policy, Agricultural Price Policy, Land Policy, EXIM Policy, etc. Monetary policy and Fiscal policy- Effectiveness of Monetary and Fiscal policy. IS & LM frame work. Growth and Development: Economic growth and development –concept, meaning, and theories. Role of agriculture in economic development. Income and Wealth distribution- Gini Coefficient and Lorenz Curve. Development Issues – Inflation, Unemployment, Poverty, Food Security, Sustainability and HDI. Business Laws and Ethics: Important laws and acts related to agriculture: Companies Act, APMC Act, Consumer Protection Act, PPV&FR Act, RTI Act, MRTP Act, etc. Quality standards for agriculture- FSSAI, AGMARK, ISO, CODEX, HACCP, etc. Ethics in business management. Rural Marketing and Rural Industrialization: Concept and scope of rural marketing, nature and characteristics of rural markets, potential of rural markets in India. Rural industrialization in India. Agro-industries in India. Research Methodology for Social Science: Concept and definition of Research Methodology. Types of data- Time Series, Cross-sectional, and Panel Data. Basic concepts of sampling & survey procedures. Regression analysis and Simultaneous Equation System. Basic concepts of econometrics and programming techniques. Linear programming- concept, definition, assumptions, and uses.

Practical

Estimation of competitive and comparative measures like NPC, EPC, ERP and DRC. Estimation of Gini-coefficient and Lorenz Curve. Estimation of HDI, TOT, Index Number, etc. Formulation and solution of LP Problems. Regression Analysis. Policy analysis. Market survey & Labeling.

Learning Outcome:

Student will be acquainted with new concepts in the field of agricultural economics.

AEG 222 Agricultural Waste Management 3(2+1)

Objectives:

The major Objectivess of the course to not only reduce issue of agricultural waste disposal but also makes new value added products from them. The course will explore and train various available technologies to reuse agricultural waste.

Syllabus:

Theory

Introduction to agricultural waste management, Nature and characteristics of agricultural waste and their impact on the environment, Kinds of wastes, Classification, role of soil and plants in waste management, sources of waste, impact of waste on soil and plant quality, Biological processes of waste management, Utilization and Recycling of Agricultural waste, Potential of Recyclable Crop Residues and its management, In-situ management of agriculture waste, Composting and Vermicomposting for bio conservation of biodegradable waste, Biogas Technology, Agricultural waste and water, air and animal resources, Impacts of waste on human,

animal health and environment. Management of bedding & litter, wasted feed, run-off from feed lots and holding areas and waste water form dairy parlors, agro-waste recycling through farming system, waste management machineries, environmental benefit of waste management.

Practical

Collection and preparation agricultural waste sample. Determination of pH, EC, CECe, heavy metals, BOD, COD, TSS, TDS, NH_4, Total P, and dissolved reactive P. Nutrient status (N, P, K, secondary and micronutrients) analysis of agricultural waste. Waste management equipment operation, Maintenance and safety hazards, computer software and models. Survey of different agri waste from live stock, dairy, poultry, food processing, fruit & vegetable and agri-chemicals, Preparation of compost, Vermicomposting, biogas and analysis of compost.

Learning Outcome:

Understand the sources of agricultural waste and techniques to manage them; carry out various hands on techniques to measurement of agricultural waste properties and explore means to dispose or recycle them; learn technique to produce compost, biofuel and biogas etc. from agricultural waste.

AST 312 Statistical Technique 3(2+1)

Objectives:

This course is meant for students who have some knowledge of Statistics. It would help them in understanding the concepts involved in data presentation, their analysis and interpretation. The students would also get to know about how to describe and present data, various probability distributions, concept of drawing a good sample from the population.

Syllabus:

Theory

Random Variable, Probability mass function. Probability density function. Mathematical Expectation, Moment generating function. Cumulant generating function. Probability Distributing: Negative Binomial, geometric, Uniform, Normal, Exponential, Gamma and Beta; Sampling Distributions: Chi-square, t and F test.

Concept of sampling; Sampling versus complete enumeration, Sample random sampling: SRSWAR and SRSWOR; Estimation of population proportion; Inverse sampling; Stratified Random Sampling; Concept of Systematic Sampling; Cluster Sampling; Sampling with varying probabilities.

Practical

Fitting of Binomial, Poisson, Normal distributions; Selection of a random sample, estimation using simple random sampling, drawing a PPS with replacement sample, Exercises on inverse sampling; Stratified Sampling; Cluster Sampling and Systematic Sampling.

Learning Outcome:
It is expected that the students will be equipped with basic statistical tools used for analysing data sets and will be able to draw valid conclusion supported by statistical mechanism.

AST 321 Design in Agricultural Experiment 3(2+1)

Objectives:
This course is designed to give a comprehensive knowledge on how to design a study or experiment so that the results of the experiments are free from errors or biases, and then how to draw a valid conclusion using the results so obtained. In this context, laying out of different agricultural field experiments will also be covered. Designing an experiment is an integrated component of research in almost all sciences.

Syllabus:
Theory
Basic principles of design of experiments; Uniformity trials; Basic of design; Basic concepts of factorial experiments: Simple factorial with concept of confounding; Split plot and Strip plot designs, Analysis of covariance (CRD & RCBD); Missing plot techniques.

Practical
Analysis of data obtained from CRD, RBD, LSD; Analysis of factorial experiments (2^3 and 2^4 experiments). Analysis of Split plot and Strip plot experiment in RBD; Analysis with missing plot data in RBD and LSD; Analysis of covariance (RBD)

Learning Outcome:

The students would be exposed to various concepts of designing an experiments so as to enable them understand the science involved in planning, designing their research experiments and how to make analysis of different experimental data.

CPH 311 Micro propagation Technologies 3(2+1)

Objectives:

Micropropagation is the practice of rapidly multiplying stock plant material to produce many progeny plants, using modern plant tissue culture methods. Micropropagation is used to multiply plants such as those that have been genetically modified or bred through conventional plant breeding methods.

Syllabus:

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.

Learning Outcome:

It's a basically practical oriented course for students; they can learn in this course are as follows: how to produce large number of plantlets from a small explants? students have a wide knowledge about the production of microbes free plantlets; how to save the endangered plants species by regenerating plantlets from small explants? with the help of micropropagation students can generate new variety of agriculturally important with short time span and space than the conventional breeding method. with these points kept in mind this course is important for students which give not only a theoretical knowledge to them but also give an opportunity of hands on training.

HOR 223 Landscaping 3(2+1)

Objectives:

Students are expected to gain the knowledge on styles, types, features and components of gardening and landscaping including modern aspects of landscaping.

Syllabus:

Theory

Importance and scope of landscaping. Principles of landscaping, garden styles and types, terrace gardening, vertical gardening, garden components, adornments, lawn making, rockery, water garden, walk-paths, bridges, other constructed features etc. gardens for special purposes. Trees: selection, propagation, planting schemes, canopy management, shrubs and herbaceous perennials: selection, propagation, planting schemes, architecture. Climber and creepers: importance, selection, propagation, planting, Annuals: selection, propagation, planting scheme, Other garden plants: palms, ferns, grasses and cacti succulents. Pot plants: selection, arrangement, management. Bio-aesthetic planning: definition, need, planning; landscaping of urban and rural areas, Peri-urban landscaping, Landscaping of schools, public places like bus station, railway station, townships, river banks, hospitals, play grounds, airports, industries, institutions. Bonsai: principles and management, lawn: establishment and maintenance. CAD application.

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) and designing of conservatory and lathe house. Use of computer software, visit to important gardens/ parks/ institutes.

Learning Outcome:

Students will gather theoretical and practical knowledge of styles, types, features and components of gardening including modern aspects of landscaping.

HOR 311 Protected Cultivation 3(2+1)

Objectives:

Students are expected to gather the insights of structural details of protected structures and technical details and cultivation technologies of various types of horticultural crops.

Syllabus:

Theory

Protected cultivation- importance and scope, Status of protected cultivation in India and World types of protected structure based on site and climate. Cladding material involved in greenhouse/ poly house. Greenhouse design, environment control, artificial lights, Automation. Soil preparation and management, Substrate management. Types of benches and containers. Irrigation and fertigation management. Propagation and production of quality planting material

of horticultural crops. Greenhouse cultivation of important horticultural crops – rose, carnation, chrysanthemum, gerbera, orchid, anthurium, lilium, tulip, tomato, bell pepper, cucumber, strawberry, pot plants, etc. Cultivation of economically important medicinal and aromatic plants. Off-season production of flowers and vegetables. Insect pest and disease management.

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.

Learning Outcome:

Students will acquire the knowledge on types, structural details, management of protected structures and technical details of protected horticultural crop cultivation.

HOR 322 Hi-tech. Horticulture 3(2+1)

Objectives:

Students are expected to know about the advanced technologies and their applications in horticulture like micro propagation techniques, precision farming high density orcharding etc.

Syllabus:

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.

Learning Outcome:

Students will gather details knowledge on modern advanced technologies and their application in horticulture like micro propagation, precision farming, high density orchard etc.

GPB 221 Commercial Plant Breeding 3(1+2)

Objectives:

This lesson deals with heredity and the reasons behind the variation among individuals of the same species. To impart knowledge to the students on the principles and procedures of plant breeding in self and cross pollinated crops to develop the high yielding varieties / hybrids.

Syllabus:

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.

Learning Outcome:

Students will understand the basic concepts of the ultrastructure of cell, cell organelles, chromosomes and nucleic acids; apply the principles of inheritance to plant breeding; acquaint with the fundamentals of chromosomal and cytoplasmic inheritance, sex determination, mutations and chromosomal aberrations; learn breeding procedures in self and cross pollinated crops; understand exploitation of heterosis utilizing male sterility and other methods; know about the various population improvement programmes; about the fundamentals of mutation, polyploidy and wide hybridization and their role in crop improvement

GPB 312 Breeding for Biotic and Abiotic Stresses 3(2+1)

Objectives:
To apprise about various abiotic and biotic stresses influencing crop yield, mechanisms and genetics of resistance and methods to breed stress resistance variety.

Syllabus:

Theory

Resistance breeding – its importance- general principles and methods of breeding for resistance. Breeding for resistance. Mechanism of resistance. Genetic basis of disease/pest resistance – gene for gene relationship, biochemical basis of disease resistance. Problems in breeding for biotic stresses Methods of breeding for resistance –recent approaches. Vertical resistance breeding. Horizontal resistance breeding Innovative techniques in breeding for biotic stresses. Breeding for abiotic stress –drought, salinity, heat cold flood. Achievements in breeding for biotic and abiotic stress

Practical:
Screening techniques for insect resistance. Screening techniques for disease resistance. Screening techniques for abiotic stress drought, salinity, nutrient stress. Screening for through biochemical methods – proline. In-vitro screening techniques Transfer of resistance through conventional and innovative techniques.

Learning Outcome:

Students will understand the genetic mechanisms of biotic and abiotic stresses; phenotyping screening methods for major pest and diseases; learn about the source of resistance.

GPB 323 Bioinformatics 3(2+1)

Objectives:

Theory:
The basic Objectives is to give students an introduction to the basic practical techniques of bioinformatics. Emphasis will be given to the application of bioinformatics and biological databases to problem solving in real research problems. The students will become familiar with the use of a wide variety of internet applications, biological database and will be able to apply these methods to research problems.

Practical:
The aim is to provide practical training in bioinformatics methods including accessing the major public sequence databases, use of the different computational tools to find sequences, analysis of protein and nucleic acid sequences by various software packages. It also provides a step by step, theoretical and practical introduction to the development of useful tools for automation of complex computer jobs, and making these tools accessible on the network from a Web browser

Syllabus:

Theory

Bioinformatics as a science and overview. Applications. Data application and management. Use of data bases in biology; genome database, sequence data base. Sequence analysis- genome sequencing, Structural comparisons, Alignment of pairs of sequences, Multiple sequence alignment. Similarity searches software and their applications. DNA marker data analysis. Primer designing and primer designing tools. Gene prediction and annotation. Phylogenetic software applications.

Practical:
Basic principles of computing in Bioinformatics, Drawing Bar charts and presenting data in different formats, Making spread sheets and doing transformations, scoring for similarity index data, Collecting and storing sequences in the laboratory, BLAST search, FASTA format primer designing , Genome sequence analysis, Identification of consensus sequences and domain identification, ORF finding.

Learning Outcome:

Students will learn the contents and properties of the most important bioinformatics databases, perform text- and sequence-based searches, and analyze and discuss the results in light of molecular biological knowledge; explain the major steps in multiple sequence alignment, finding ORF and conserved domains; to design PCR primers and do molecular phylogeny analysis.

SSC 222 Agrochemicals 3(2+1)

Objectives:

The students are expected to gain both theoretical as well as practical knowledge on agrochemicals - their type and role in agriculture, effect on environment, soil, human and animal health; management of agrochemicals for sustainable agriculture; major classes, properties of important herbicides; fate of herbicides; classification, fates of fungicides and classification of insecticides; manufacturing processes and properties of N, P and K fertilizers, complex fertilizers, secondary and micro nutrient fertilizers; fertilizer control order; fertilizer logistics and marketing; plant bio-pesticides for ecological agriculture; bio-insect repellent etc.

Syllabus:

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 sulphur and copper, Mode of action-Bordeaux mixture and copper oxychloride. Organic fungicides-Modeofaction-Dithiocarbamates-characteristics, preparation and use of Zineb and maneb. Systemic fungicides: Benomyl, carboxin, oxycarboxin, Metalaxyl, Carbendazim, characteristics and use. Introduction and classification of insecticides: inorganic and organic insecticides Organochlorine, Organophosphates, Carbamates, Synthetic pyrethroids Neonicotinoids, Biorationals, Insecticide Act and rules, Insecticides banned, withdrawn and restricted use, Fate of insecticides in soil & plant. IGRs Biopesticides, Reduced risk insecticides, Botanicals, plant and animal systemic insecticides their characteristics and uses. Fertilizers and their importance. Nitrogenous fertilizers: Feedstocks and Manufacturing of ammonium sulphate, ammonium nitrate, ammonium chloride, urea. Slow release N-fertilizers. Phosphatic fertilizers: feedstock and manufacturing of single superphosphate. Preparation of bone meal and basic slag. Potassic fertilizers: Natural sources of potash, manufacturing of potassium chloride, potassium sulphate and potassium nitrate. Mixed and complex fertilizers: Sources and compatibility–preparation of major, secondary and micronutrient mixtures. Complex fertilizers: Manufacturing of ammonium phosphates, nitrophosphates and NPK complexes. Fertilizer control order. Fertilizer logistics and marketing. 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 P_2O_5 and citrate soluble P_2O_5 in single super phosphate. Estimation of potassium in Muraite 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.

Learning Outcome:

Students will acquire knowledge on various types of agrochemicals and their role in agriculture, fates in soil, effect on environment, soil, human and animal health and their efficient management for sustainable agriculture.

SSC 311 Soil, Plant, Water and Seed Testing 3(2+1)

Objectives:

The students are expected to gain both theoretical as well as practical knowledge on working principles of various instruments like pH meter, EC meter, spectrophotometer, flame photometer and AAS; principles and procedure of determination of different properties of soil and plant;

interpretation of results; quality criteria of irrigation water; seed germination, viability, vigor and storage etc.

Syllabus:

Theory

Principle of pH meter, EC meter, spectrophotometer, flame photometer and AAS. Soil analysis: Objectivess, 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

Standardization of solutions and reagents, collection and preparation of soil samples, estimation of pH, EC, organic carbon, NPKS, micronutrients, CEC and exchangeable sodium in soil. Determination of EC and pH of saturation extract/paste. Estimation of cations and anions. Plant sampling and sample preparation for analysis, digestion of plant material and estimation of N, P, K in plant. Rapid plant tissue test for N, P, and K. Determination of EC, pH, cations (Ca^{++}, Mg^{++}, Na^{+}, K^{+}) and anions (B, $CO3^{--}$, $HCO3^{-}$, Cl^{-}) in irrigation water . Computation of SAR and RSC. Seed quality testing: Germination, viability, moisture and vigor.

Learning Outcome:

Students will acquire practical and theoretical knowledge on various soil parameters, plant nutrient contents, water quality parameters as well as seed quality testing parameters.

SSC 321 Biofertilizers Technology 3(2+1)

Objectives:

The students are expected to gain both theoretical as well as practical knowledge on various types of biofertilizers, their characteristics, application technology, quality control, mechanism of solubilization of nutrients in soil; productions technology; constraints in production of biofertilizers; factors influencing the efficacy of biofertilizers; cost and availability of biofertilizers etc.

Syllabus:

Theory

Biofertilizers - Introduction, status and scope. Types of biofertilizers - structure and characteristic features of bacterial biofertilizers- Azospirillum, Azotobacter, Bacillus, Pseudomonas, Rhizobium and Frankia; Cynobacterial biofertilizers- Anabaena, Nostoc, Hapalosiphon, fungal biofertilizers- AM mycorrhiza and ectomycorhiza; Azolla. Nitrogen fixation -Free living and symbiotic nitrogen fixation. Mechanism of phosphate solubilization and phosphate mobilization, K solubilization. Mass Production technology: Strain selection, sterilization, growth and fermentation, mass production of carrier based and liquid biofertiizers. FCO specifications and quality control of biofertilizers. Application technology for seeds, seedlings, tubers, sets etc. Biofertilizers -Storage, shelf life, quality control and marketing. Factors influencing the efficacy of biofertilizers. Constraints in Biofertilizer Technology. Economics, cost and availability of biofertilizers.

Practical

Isolation and purification of *Azospirillum, Azotobacter, Rhizobium*, P-solubilizers and cyanobacteria. Mass multiplication and inoculums production of biofertilizers. Isolation of AM fungi -Wet sieving method and sucrose gradient method. Mass production of AM inoculants. Quality control of biofertilizers.

Learning Outcome:

Students will acquire practical and theoretical knowledge on various types of biofertilizers as a whole.

AEX 312 - Communication and Information Management 3(2+1)

Objectives:

To make the students aware and knowledgeable different aspects of communication and information management like, communication process, types of communication, development communication, digital platform for communication and information management et. As well as to build up capacity of the students for effective communication, preparation of communication material and information management.

Syllabus

Theory

Communication – Meaning, Definition, Models, theories of communication. Communication process – concept, elements and their characteristics. Types and Barriers in communication. Communication skills – fidelity of communication, communication competence and empathy, communication effectiveness and credibility, feedback in communication. Methods of communication – Meaning and functions, classification. Forms of communication – Oral and written communication, Non-verbal communication, interpersonal communication, organizational communication. Key communicators – Meaning, characteristics and their role in development. Barriers in communication. Message – Meaning, dimensions of a message,

characteristics of a good message, Message treatment and effectiveness, distortion of message. Development communication- Meaning, definition, areas of Development Communication. Innovative Information sources and Modern communication media – Internet, Cyber Cafes, CAI, Video and Tele conferences, Kisan call centers, Consultancy clinics, Social networks etc and their implication in Extension Communication. Agricultural Journalism – Meaning, Scope and Importance, Sources of news, Types, Merits and Limitations. Basics of writing – News stories, feature articles, magazine articles, farm bulletins and folders. Media in communication – Role of mass media in dissemination of farm technology. Effect of media mix for Rural People.

Practical

Simulated exercises on communication. Planning and Writing of scripts for Radio and Television. Planning, Preparation and Presentation of visual aids, Power Point Slides, Handling of Public Address Equipment (PAE) System, Still Camera, Video Camera and Liquid Crystal Display (LCD) Projector. e-publication, website development.

Learning Outcome:

Through this course, students are expected to be knowledgeable about different aspects of communication and information management as well as they will be capable for preparation of communication material and will be able to communicate effectively.

AEX 321 Emerging Trends in Agricultural Extension 3(2+1)

Objectives:

To orient the students regarding changing scenario of Agricultural Extension, the emerging areas and approaches of extension in agriculture; to provide exposure on analyses of different extension approaches applying different tools and techniques and visits to the stakeholders

Syllabus:

Theory

Agricultural Extension – Emerging Issues and Strategies. Genesis and Evolution of Agricultural Extension in India and Other Countries. Women and Youth in Agricultural Extension – Role, Importance and Empowerment. Human Resource Development in Extension Organisations – Meaning, Issues and Strategies. Changing Roles of Agricultural Extension Professionals in the context of WTO - Issues and Strategies. Participatory Extension Approaches – RRA, PRA & PLA – Meaning, Features, Principles, Techniques. Demand Driven Extension – Meaning, Features, Model. Reorganized Extension System – Broad Based Extension- Meaning, Concept. Farmer Led Extension – Meaning, Features, Scope and Importance. Farming Systems Approach & Farming Situation Based Extension – Concept, Characters, Activities, Scope. Strategic Research and Extension Plan – Meaning, Importance. Group Led Extension – Meaning, Concepts, Procedures,

Advantages and Limitations. Market Led Extension – Meaning, Problems in Agricultural Marketing, Characteristics, Approaches and Strategies. Privatization of Agricultural Extension Services and Public Private Partnership – Meaning, Problems in Public Extension, Reasons for Privatization, Approaches, Possibilities. Cyber Extension – Meaning, Tools, Advantages and Limitations. Voluntary Organisations in Agricultural Extension – Scope and Importance, Limitations. Latest Rural Development and Agricultural Extension Projects and Programmes in India.

Practical

Analyzing the roles of Change Agents In State Department of Agriculture. Analyses of the extension activities at field level. Analyses of structure and functions of ATMA. Identification of technological needs of farmers through participatory approach. Identification of Suitable Alternative Extension approaches for solving extension problems in a specific farming situation. Analyzing the functions of a selected NGO/VO. Studying Role of Farm Women and Rural Youth in Agriculture. Studying RMGs & SHGs.

Learning Outcome:

Understanding of the emerging areas of agricultural extension, their features and effectiveness; learning of different tools and techniques of analyses of extension reforms and programmes, feedback of stakeholders.

PPT: 221 Bio-pesticides and Bio-control 3(2+1)

Objectives:

To generate knowledge about biological control agents including botanicals, their production and application in disease management.

Syllabus:

Theory

Definition, history, importance, scope, potential and concepts of biopesticides and biological control of crop pests and diseases. Understanding of ecological equilibrium in relation to biocontrol. Mechanisms of biological control. Classification of biopesticides viz. pathogen, botanicals and biorationals and their uses. Isolation, purification and pure culturing of recognized biocontrol organisms. Mass production technology of bio-pesticides.Virulence, pathogenicity and symptoms of entomopathogenic pathogens and nematodes. Methods of application of biopesticides. Methods of quality control and Techniques of biopesticides. Impediments and limitation in production and use of biopesticide. Different types of biocontrol formulation and their efficacy under field level. Legislature Acts in the production and marketing of biocontrol

agents and biopesticides. Organic amendments, culture filtrates and botanicals etc. for plant disease management. Enterprenureship development in biocontrol unit

Practical:

Visit to biological control laboratory, Identification of important botanicals, Isolation of biocontrol agents from different sources. Pure culturing and evaluation of biocontrol potential of isolates. Testing antibiotic production in culture, Antibiotics in culture filtrate. Identification of entomopathogenic entities in field condition. Quality control of 7.biopesticides. In-vitro screening of different bio-agents. Mechanisms of biological control- antibiosis, lysis, parasitism, competition. Mass multiplication of biocontrol agents. Application of biopesticides and biocontrol agents in soil and seed.

Learning Outcome:

Eco-friendly management of diseases through Biological controlling agents

NON-GRADIAL COURSES

PED 111 NSS/NCC/Physical Education & Yoga Practices 2(0+2)

Objectives:

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.

Syllabus:

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.

Learning Outcome:

The students will learn basic components of NSS; understand youth ; community mobilization; social harmony and national integration; volunteerism and shramdan; citizenship, constitution and human rights; family and society; importance and role of youth leadership; life competencies; health, hygiene, sanitation, HIV AIDS and first aid; issues related environment; disaster management; entrepreneurship development;; resource mobilization and activities directed by the Central and State Government