V.B.S. Purvanchal University
Jaunpur (U.P.)

CREDIT BASED SEMESTER SYSTEM

SYLLABUS

for

M. Sc.(Ag.)

w.e.f. 2019- 2020

Submitted by:

Dean &Conveners, Board of studies

Faculty of Agriculture

V.B.S. Purvanchal University, Jaunpur (U.P.)

Resolution

We the undersigned conveners, Board of Studies, faculty of Agriculture, V.B.S. Purvanchal University, Jaunpur (U.P.) have revised the syllabus for M. Sc. (Ag.) as per Credit Based Semester system. The meeting held on 22 December,2020 along with Dr Vashistha Yati, Ex . Dean Faculty, of Agriculture & Dr, O. P. Singh, Dean Faculty of Agriculture , V.B.S. Purvanchal University, Jaunpur (U.P.).

Departments of Agriculture Faculty in V.B.S.Purvanchal University, Jaunpur (U.P.)

- **Agronomy**
- **Horticulture**
- **Genetics and Plant Breeding**
- **Agricultural Chemistry and Soil Science**
- **Agricultural Entomology**
- **Plant Pathology**
- **Agricultural Economics**
- **Agricultural Extension**
- **Animal Husbandry and Dairying**
- **Agricultural Engineering**

The restvised syllabus of above courses for degree of Master of Science in Agriculture (M.Sc. (Ag.) are submitted for your kind approval.

Dr. Santosh Kumar Singh (Agronomy)

Dr. D. R. Singh (Horticulture)

Dr .Alok Kumar Singh (Genetics and Plant Breeding)

Dr. Awadhesh Kumar Singh (Agril. Chemistry & soil Science)

Dr. Manoj Trpathi (Agril. Entomology)

Dr. Yogesh Kumar (Plant Pathology)

Dr. Arun Kumar Yadav (Agril, Economics)

Dr.Nalinj Kumar Mishra (Agril. Extension)

Dr. Digvijay Singh (Animal Husbandry and Daiyrying)

Dr. Jitendra Kumar (Agril. Ebgineering)

Dr. Vashistha Yati (Ex.Dean Faculty of Agriculture)

Dr. O.P. Singh (Dean Faculty of Agriculture0

V.B.S..Purvanchal University, Jaunpur (U.P.)

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SUMMARY

It is a well known fact that the Indian Council of Agricultural Research (ICAR) is the apex body for coordinating, guiding and managing the agricultural education and research in the whole country with association of the Education Division. The ICAR, which is an autonomous organization of the country, functions under the Ministry of Agriculture and Farmers' Welfare, Govt. of India. Besides agricultural education, ICAR has responsibility for national agricultural system in the entire country.

ICAR is the apex body for quality assurance in higher agricultural education in the country and, thus, strives for maintaining and upgrading quality assurance in higher agricultural education, research and transfer of agricultural technology to farmers. All the Central Agricultural Universities, State Agricultural Universities, Institutions and Deemed to be Universities of the country have been maintaining their standard of quality education in agriculture through ICAR guidelines and recommendations. The most important step for quality improvement of education, the Indian Council of Agricultural Research has been periodically appointing Deans Committees for revision of course curriculum. In the series, Fifth Deans Committee was constituted and given terms of reference considering contemporary challenges for employability of passing out graduates and to adopt a holistic approach for quality assurance in agricultural education.

Considering the fact that the report of the committee needs to be widely accepted, a bottom up approach in respect of curriculum development has been undertaken. To achieve this, inputs from different stakeholders of agricultural education have been obtained at different levels. The Committee has tried to make sure that the report represents a national consensus in respect of various issues that have been flagged to the Committee. The course curricula have been restructured develop much needed skills and entrepreneurial mind-set among the graduates to take up self employment, contribute to enhanced rural livelihood and food security, sustainability of agriculture and be propeller for agriculture transformation.

Declaring degrees in Agricultural Sciences as professional

Indian council of Agricultural Research constituted a Committee to Review Essential Qualifications and Degree Nomenclature of various programmes running in Agricultural Universities under the chairmanship of Dr R. B. Singh. This Committee has recommended considering degree in agriculture as professional. The Fifth Deans Committee endorses this view and recommends declaring all degrees in agricultural sciences as professional.

Making implementation of recommendations of Deans Committee mandatory

A lot of efforts are made to improve the quality of agricultural education to make it internationally competitive. Implementations of the recommendations of the Fifth Deans Committee to be made mandatory for accreditation of academic programmes and academic institutions by the National Agricultural Education Accreditation Board (NAEB).

ACADAMIC REGULATIONS

POST-GRADUATE PROGRAMME

Degree Nomenclature: M.Sc. (Ag.) in particular discipline as ----

- M.Sc. (Ag.) Agronomy
- M. Sc. (Ag.) Horticulture
- M. Sc. (Ag.) Genetics & Plant Breeding
- M.Sc. (Ag.) Soil Science and Agriculture Chemistry
- M. Sc. (Ag.) Entomology
- M. Sc. (Ag.) Plant Pathology
- M. Sc. (Ag.) Agricultural Economics
- M. Sc. (Ag.) Agricultural Extension & Communication
- M. Sc. (Ag.) Animal Husbandry and Dairying

1. **Programme Duration**
   - Minimum: 4 Semesters (2 academic years)
   - Maximum: 8 Semesters (4 academic years)

2. **Minimum eligibility requirement for admission:**
   Pass in B.Sc. in Agriculture, B.Sc. in Horticulture,
3. **Mode of Admission:**
   Through Entrance examination
4. **Reservation of seats:**
   Reservation of seats shall be governed by the rules of State Government as well as rules of V.B.S. Purvanchal University, Jaunpur, U.P, India.
5. **Semester Duration:**
   The minimum duration of each and every semester will be 110 working days, consisting of 95 Instructional day and 15 examination days.
6. **Credit Definition:**
   The University adopted the semester based course work and evaluation in the year 1976. One credit is defined as the lecture of 50 minutes (one period) duration or minimum of two-period (100 minutes) practical/tutorial work per credit per week are required. However, for many courses where field work is required, one credit requires 3 periods of field work per week.
7. **Medium of Instruction:**
   English
8. **Attendance:**
   80 per cent. (Relaxation in minimum attendance requirement should be given only in the case of indoor hospitalization as per university/ college rules and regulations).

Record of class attendance:

Each Instructor shall maintain a record of the student's attendance in each course taught by him in each semester.

Minimum class attendance:

Each student shall be regular in attending classes and shall be required to have a minimum of 80% attendance in each course in each semester, failing which he/she shall not be awarded grade in that course, unless withdrawal from the course is permitted.

The percentage of attendance of a student in course in a semester shall be computed on the basis of the total number of lectures, practical's and tutorials attended by him/her and those actually held between the date of commencement of instruction and the date of closing instruction, irrespective of the date of his/her registration and/or the duration of leave duly granted to him/her.

The Dean may on the recommendation of the instructor/advisor concerned, though the Head of the Department, condone shortage in attendance up to 5% in a course(s) in exceptional circumstances and allow students with an attendance of 75% or more to appear at the final examination. However, on the recommendation of the Dean, the Vice Chancellor may grant a condonation to the extent of 5% and allow students with an attendance of 70% or more to appear at the final examination. In a very exceptional case, if a student fails to secure even 70% attendance, his case can be referred to the Academic Council through Dean for condonation to the extent of further 5% and allow students with an attendance of 65% or more.

Notes:

1:- In computation of percentage of attendance, fractions of 0.5 or above shall be counted as 1.

2:- If student is called upon to repeat a course but/she has already put in required attendance in that course on a previous occasion, above requirements of attendance will not apply in his/her case.

3:- Whenever students resort to mass absence from classes, a fine of Rs. 15.00/ student/day may be levied from all such students. All such students will have to pay this fine before the final examination of the next semester and failure to do so shall render them liable to be debarred from appearing in the examination.

9. Course Curriculum and minimum credits requirement:

The ICAR Model Course Curriculum and Syllabus has been followed to meet regional requirements. The minimum credit requirement for the post graduate degree should be **55 credits.** The semester wise credit distributions of every discipline are as follows-

List o Cousesof M.Sc. (Ag.) Programme& schedule of marks distribution

1. Agronomy

Semester-I

Code No.	Course Title	Credit Hours	Theory		Practical	Total
			Mid	Final		
AGR-501	Modern Concept of Crop Production	4(3+1)	20	50	30	**100**
AGR-502	Principles and Practices of Soil Fertility and Nutrient Management	3(2+1)	20	50	30	**100**
AGR-506	Agronomy of Major Cereals and Pulses	3(2+1)	20	50	30	**100**
STAT-551	Statistical methods	3(3+0)	50	50	---	**100**
	Total	**13**				

Semester-II

Code No.	Course Title	Credit Hours	Theory		Practical	Total
			Mid	Final		
AGR-503	Principles and Practices of Weed Management	3(2+1)	20	50	30	**100**
AGR--504	Principles and Practices of Water Management	3(2+1)	20	50	30	**100**
AGR--507	Agronomy of Oilseeds, Fibre and Sugar Crops	3(2+1)	20	50	30	**100**
STAT-552	Experimental Designs	2(2+0)	50	50	---	**100**
	Total	**11**				

Semester-III

Code No.	Course Title	Credit Hours	Theory		Practical	Total
			Mid	Final		
AGR--509	Agronomy of Fodder and Forage Crops	3(2+1)	20	50	30	**100**
AGR--511	Cropping System and Sustainable Agriculture	2(1+1)	20	50	30	**100**
AGR--512	Dryland Farming and Watershed Managenemt	3(2+1)	20	50	30	**100**
AGR-591	Master Seminar **	3(2+1)				**100**
	Total	**09**				

Semester-IV

Code No.	Course Title	Credit Hours	Theory		Practical	Total
			Mid	Final		
AGR-513	Principle and Practices of Organic Farming	3(2+1)	20	50	30	**100**
AGR--599	Thesis/ Master/Research Work***	20	**SATISFACTRY**			**-S-----**
	Total	**23**				
	Total Credit Hours	**56**				

Master Seminar ** - The evaluation of Master Seminar should be incorporated through internal group of faculty members

Note:

Evaluation of Thesis/ Master Research Work- The evaluation of Thesis/ Master Research work should be incorporated by both external examiner and internal examiners as per university rules and regulations.

2. Horticulture

Semester-I

Code No.	Course Title	Credit Hours	Theory		Practical	Total
			Mid	Final		
HORT-501	Fundamental of Fruit Production	3(2+1)	20	50	30	**100**
HORT-502	Fundamentals of Vegetable Production	3(2+1)	20	50	30	**100**
HORT-503	Nursery Husbandry and Plant Propagation	2(1+1)	20	50	30	**100**
STAT-551	Statistical methods	3(3+0)	50	50	---	**100**
	Total	**11**				

Semester-II

Code No.	Course Title	Credit Hours	Theory		Practical	Total
			Mid	Final		
HORT-504	Production Technology of Fruit Crops	3(2+1)	20	50	30	**100**
HORT-505	Production Technology of Vegetable Crops	3(2+1)	20	50	30	**100**
HORT-506	Landscaping & Ornamental Gardening	3(2+1)	20	50	30	**100**
STAT-552	Experimental Designs	2(2+0)	50	50	---	**100**
	Total	**11**				

Semester-III

Code No.	Course Title	Credit Hours	Theory		Practical	Total
			Mid	Final		
HORT-507	Commercial Floriculture	3(2+1)	20	50	30	**100**
HORT-508	Production Technology of Medicinal, Aromatic, Spices and Plantation Crops	3(2+1)	20	50	30	**100**
HORT-509	Breeding of Horticultural Crops	3(2+1)	20	50	30	**100**
	Total	**09**				

Semester-IV

Code No.	Course Title	Credit Hours	Theory		Practical	Total
			Mid	Final		
HORT-510	Principle of Fruit and Vegetable Preservation	3(2+1)	20	50	30	**100**
HORT-591	Master Seminar**	1(1+0)			00	**100**
HORT--599	Thesis/Master Research Work***	20	**SATISFACTRY**			**-S-----**
	Total	**24**				
	Total Credit Hours	**55**				

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3. Genetics and Plant Breeding

Semester-I

Code No.	Course Title	Credit Hours	Theory		Practical	Total
			Mid	Final		
GPB 501	Principles of Genetics	3(2+1)	20	50	30	**100**
GPB 502	Principles of Cytogenetics	3(2+1)	20	50	30	**100**
GPB 503	Principles of Plant Breeding	3(2+1)	20	50	30	**100**
STAT 551	Statistical Methods	3(3+0)	50	50	---	**100**
	Total	**12**				

Semester-II

Code No.	Course Title	Credit Hours	Theory		Practical	Total
			Mid	Final		
GPB 504	Principles of Quantitative Genetics	3(2+1)	20	50	30	**100**
GPB 510	Breeding for Biotic and Abiotic Stress Resistance	3(2+1)	20	50	30	**100**
GPB 511	Breeding For Cereal, Forage and Sugarcane	3(2+1)	20	50	30	**100**
STAT 552	Experimental Design	2(2+0)	50	50	---	**100**
	Total Credit	**11**				

Semester-III

Code No.	Course Title	Credit Hours	Theory		Practical	Total
			Mid	Final		
GPB 508	Cell Biology and Molecular Genetics	3(2+1)	20	50	30	**100**
GPB 512	Breeding of Legume, Oilseed and Fibre crop	3(2+1)	20	50	30	**100**
	Total	**06**				

Semester-IV

Code No.	Course Title	Credit Hours	Theory		Practical	Total
			Mid	Final		
GPB 509	Biotechnology for Crop Improvement	3(2+1)	20	50	30	**100**
GPB 515	Maintenance Breeding, Concepts of Variety Release and Seed Production	2(1+1)	20	50	30	
GPB 591	Master Seminar**	1(1+0)	**SATISFACTRY**			**-S-----**
GPB 599	Thesis /Master Research Work***	20				
	Total	**26**				
	Total Credit Hours	**55**				

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4. Soil Science and Agriculture Chemistry

Semester-I

Code No.	Course Title	Credit Hours	Theory		Practical	Total
			Mid	Final		
SSAC-504	Soil Mineralogy, Genesis, Classification and Survey	3(2+1)	20	50	30	**100**
SSAC-509	Soil, Water and Air Pollution	3(2+1)	20	50	30	**100**
SSAC-511	Analytical Techniques and Instrumentals Methods	2(0+2)	00	00	100	**100**
STAT-551	Statistical methods	3(3+0)	50	50	---	**100**
	Total	**11**				

Semester-II

Code No.	Course Title	Credit Hours	Theory		Practical	Total
			Mid	Final		
SSAC-501	Soil Physics	3(2+1)	20	50	30	**100**
SSAC-502	Soil Fertility and Fertilizer Use	4(3+1)	20	50	30	**100**
SSAC-506	Soil Biology and Biochemistry	3(2+1)	20	50	30	**100**
STAT-552	Experimental Designs	2(2+0)	50	50	---	**100**
	Total	**12**				

Semester- III

Code No.	Course Title	Credit Hours	Theory		Practical	Total
			Mid	Final		
SSAC-503	Soil Chemistry	3(2+1)	20	50	30	**100**
SSAC-505	Soil Erosion and Conservation	3(2+1)	20	50	30	**100**
SSAC-510	Remote Sensing and GIS Techniques for Soil and Crop Studies	3(2+1)	20	50	30	**100**
	Total	**09**				

Semester - IV

Code No.	Course Title	Credit Hours	Theory		Practical	Total
			Mid	Final		
SSAC-513	Management of Problematic Soil	3(2+1)	20	50	30	**100**
SSAC-591	Master Seminar**	1(1+0)				**100**
SSAC-599	Thesis/ Master Research Work***	20	**SATISFACTRY**			**-S-----**
	Total	**24**				
	Total Credit Hours	**56**				

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5. Entomology

Semester- I

Code No	Course Title	Credit Hours	Theory		Practical	Total
			Mid-Term	End Term		
ENT-501	INSECT MORPHOLOGY	2 (1+1)	20	50	30	**100**
ENT-502	INSECT ANATOMY, PHYSIOLOGY &NUTRITION	3 (2+1)	20	50	30	**100**
ENT-504	CLASSIFICATIOB OF INSECT	3 (2+1)	20	50	30	**100**
ENT-505	INSECT ECOLOGY	2 (1+1)	20	50	30	**100**
STAT-551	STATISTICAL METHODS	3(3+0)	50	50	---	**100**
	Total	**13**				

Semester- II

Code No	Course Title	Credit Hours	Theory		Practical	Total
			Mid-Term	End Term		
ENT-507	BIOLOGICAL CONTROL OF CROP PEST& WEEDS	3 (2+1)	20	50	30	**100**
ENT-508	TOXICOLOGY OF INSECTICIDES	3 (2+1)	20	50	30	**100**
ENT-511	PEST OF FIELD CROPS	3 (2+1)	20	50	30	**100**
STAT-552	EXPERIMENTAL DESIGN	2(2+0)	50	50	---	**100**
	Total	**11**				

Semester- III

Code No	Course Title	Credit Hours	Theory		Practical	Total
			Mid-Term	End Term		
ENT-509	PLANT RESISTANCE TO INSECT	2 (1+1)	20	50	30	**100**
ENT-510	PRINCIPLES OF INTEGRATED PEST MANAGEMENT	3 (2+1)	20	50	30	**100**
ENT-5013	STORAGE ENTOMOLOGY	2 (1+1)	20	50	30	**100**
	Total	**07**				

Semester- IV

Code No	Course Title	Credit Hours	Theory		Practical	Total
			Mid-Term	End Term		
ENT-518	TECHNIQUES IN PLANT PROTECTION	1 (0+1)	20	50	30	**100**
ENT-519	COMMERCIAL ENTOMOLOGY	2 (1+1)	20	50	30	**100**
ENT-591	MASTER SEMINAR**	1 (1+0)	20	50	30	**100**
ENT-599	THESIS/ MASTER RESEARCH WORK***	2 0	**SATISFACTRY**			**-S-----**
	Total	**24**				
	Total Credit Hours	**55**				

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6. Plant Pathology

Semester- I

Code No	Course Title	Credit Hours	Theory		Practical	Total
			Mid-Term	End Term		
PPA 501	Mycology I	3 (2+1)	20	50	30	**100**
PPA 502	Mycology II	3 (2+1)	20	50	30	**100**
PPA 503	Introductory Bacteriology	3 (2+1)	20	50	30	**100**
STAT 551	Statistical Methods	3(3+0)	50	50	---	**100**
	Total	**12**				

Semester- II

Code No	Course Title	Credit Hours	Theory		Practical	Total
			Mid-Term	End Term		
PPA 504	Principle of Plant Pathology	3 (2+1)	20	50	30	**100**
PPA 505	Introductory Virology	3 (2+1)	20	50	30	**100**
PPA 506	Disease of Field Crop	3 (2+1)	20	50	30	**100**
PPA 507	Plant Pathological Technique	2(1+1)	20	50	30	**100**
	Total	**11**				

Semester- III

Code No	Course Title	Credit Hours	Theory		Practical	Total
			Mid-Term	End Term		
PPA 508	Diseases of Fruits & Vegetable Crops	3 (2+1)	20	50	30	**100**
PPA 509	Plant Disease Management	3 (2+1)	20	50	30	**100**
PPA 510	Seed Pathology	3 (2+1)	20	50	30	**100**
	Total	**09**				

Semester- IV

Code No	Course Title	Credit Hours	Theory		Practical	Total
			Mid-Term	End Term		
PPA 511	Mushroom Production Technology	2 (1+1)	20	50	30	**100**
PPA 591	MASTER SEMINAR**	1 (1+0)				**100**
PPA 599	THESIS/ MASTER RESEARCH WORK***	20	**SATISFACTRY**			**-S-----**
	Total	**23**				
	Total Credit hours	**55**				

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7.Agricultural Economics

Code No	Course Title	Credit Hours	Evaluation Pattern			
			Practical	Mid-term	Theory	Total
Semester - I						
AG- ECON-501	MICRO ECONOMIC THEORY AND APPLICATIONS	3 (3+0)	--	50	50	**100**
AG -ECON - 504	AGRICULTURAL PRODUCTION ECONOMICS	3 (2+1)	30	20	50	**100**
AG- ECON-505	AGRICULTURAL MARKETING AND PRICE ANALYSIS	3 (2+1)	30	20	50	**100**
STAT-ECON-511	STATISTICS FOR AGRICULTURAL ECONOMICS	3 (2+1)	30	20	50	**100**
	Total	**12**				
Semester - II						
AG- ECON - 502	MACRO ECONOMICS AND POLICY	3 (3+0)	--	50	50	**100**
AG- ECON-506	RESEARCH METHODOLOGY FOR SOCIAL SCIENCES	3 (2+1)	30	20	50	**100**
AG- ECON-509	AGRICULTURAL FINANCE AND PROJECT MANAGEMENT	3 (2+1)	30	20	50	**100**
AG -ECON - 510	INTERNATIONAL ECONOMICS	2(1+1)	20	50	30	**100**
	Total	**11**				
Semester - III						
AG- ECON - 503	EVOLUTION OF ECONOMIC THOUGHT	2 (2+0)	--	50	50	**100**
AG- ECON - 507	ECONOMETRICS	3 (2+1)	30	20	50	**100**
AG- ECON - 508	LINEAR PROGRAMMING	3 (2+1)	30	20	50	**100**
AG –ECON-515	RURAL MARKETING	3 (2+1)	30	20	50	**100**
	Total	**11**				
Semester- IV						
AG- ECON-591	MASTERS SEMINAR**	1	-	-	-	**100**
AG- ECON - 599	THESIS / MASTERS RESEARCH WORK***	20	**SATISFACTRY**			**-S-----**
	Total	**21**				
Total Credit Hours		**55**				

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8.Agricultural Extension

Course N0.	Course Title	Credit	Theory Marks		Practical Marks	Total
			Mid Term	Final		
Semester- I						
EXT -511	Development perspectives of extension education	3(2+1)	20	50	30	**100**
EXT-512	Development communication and information management	3(2+1	20	50	30	**100**
EXT -513	Diffusion and adoption of innovations	3(2+1)	20	50	30	**100**
STAT -551	Statistical Methods	3(3+0)	50	50	---	**100**
	Total	**12**				
Semester-II						
EXT-522	Entrepreneurship Development and Management in Extension	3(2+1)	20	50	30	**100**
EXT- 523	Human Resource Development	3(2+1)	20	50	30	**100**
EXT -524	Participatory Methods for Technology Development and Transfer	3(2+1)	20	50	30	**100**
EXT -611	Advances in agricultural extension	2(1+1)	20	50	30	**100**
	Total	**11**				
Semester-III						
Ext -521	E-Extension	3(2+1)	20	50	30	**100**
Ext -531	Research methods in Behavioural Sciences	3(2+1)	20	50	30	**100**
Ext- 532	Visual communication	3(2+1)	20	50	30	**100**
	Total	**9**				
Semester-IV						
Ext -510	Gender Sensitization for Development	2(1+1)	20	50	30	**100**
Ext - 591	**Master Seminar** **	1(1+0)	-	-	-	**100**
Ext -599	**Thesis / Master Research Work *****	**20**	**SATISFACTRY**			**-S-----**
	Total	**23**				
	Total Credit Hours	**55**				

Master Seminar ** **- The evaluation of Master Seminar should be incorporated through internal groupof faculty members**

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9.Animal Husbandry and Dairying

Semester- I

Code No	Course Title	Credit Hours	Theory		Practical	Total
			Mid-Term	End Term		
AHD -501	Production and Management of Dairy Animals	3 (2+1)	20	50	30	**100**
AHD-502	Poultry Production and Management	3 (2+1)	20	50	30	**100**
AHD-503	Market Milk Technology	3 (2+1)	20	50	30	**100**
STAT-551	Statistical Methods	3(3+0)	50	50	---	**100**
	Total	**12**				

Semester- II

Code No	Course Title	Credit Hours	Theory		Practical	Total
			Mid-Term	End Term		
AHD -504	Fundamentals of Animal Nutrition	3 (2+1)	20	50	30	**100**
AHD-505	Reproductive Physiology of Farm Animals	3 (2+1)	20	50	30	**100**
AHD-506	Dairy Processing and Dairy Plant Management	3 (2+1)	20	50	30	**100**
STAT-552	EXPERIMENTAL DESIGN	2(2+0)	50	50	---	**100**
	Total	**11**				

Semester- III

Code No	Course Title	Credit Hours	Theory		Practical	Total
			Mid-Term	End Term		
AHD -507	Feed Evaluation Techniques	3 (2+1)	20	50	30	**100**
AHD-508	Microbiology of Milk and Milk Products	4 (3+1)	20	50	30	**100**
AHD-509	Dairy Technology	3 (2+1)	20	50	30	**100**
	Total	**10**				

Semester- IV

Code No	Course Title	Credit Hours	Theory		Practical	Total
			Mid-Term	End Term		
AHD -510	Fundamentals of Animal Breeding & Tchniques	3 (2+1)	20	50	30	**100**
AHD-591	MASTER SEMINAR**	1 (1+0)	20	50	30	**100**
ENT-599	THESIS/ MASTER RESEARCH WORK***	2 0	**SATISFACTRY**			**-S-----**
	Total	**24**				
	Total Credit Hours	**57**				

Master Seminar ** - The evaluation of Master Seminar should be incorporated through internal group of faculty members

Note:

Evaluation of Thesis/ Master Research Work- The evaluation of Thesis/ Master Research work should be incorporated by both external examiner and internal examiners as per university rules and regulations.

10. Advisement:

(a) Student freshly admitted as well as continuing students shall present themselves in the beginning of each semester on dates notified by the Registrar/ Dean/ Principal for advisement and shall be assigned in groups to staff. Advisors/course instructors are nominated by the Dean Agriculture/Principal.

(b) The advisor shall help the PG student in planning the programme of their studies and the choice of courses. He shall also guide the student in determining the topic of master seminar as well as topic and field of thesis/ master research work.

11. Registration:

Following advisement as prescribed above, registration of candidates selected for admission and also of continuing students shall be completed on schedule date(s) notified earlier by Registrar/ Dean / Principal for each semester.

Mode of Registration:

Registration shall consist of the following steps:

- Payment of the college and university fee and other dues.
- Enrolment of the students in various courses with individual instructors at particular place, date and time.

Registration of fresh students:

Registration for the first Semester of the year of a PG degree programme is part of admission procedure and shall be governed by the admission rules. Admission of new students so fallen vacant shall be offered to the candidates in the waiting list.

Registration of continuing students:

Registration of continuing students in the subsequent semesters shall be held in a similar way on the date time notified by the Register/ Dean/ Principal

Late registration:

A continuing student, who does not register on the day of registration, shall be required to pay a prescribed the registration fee for the first day and further prescribed fee for subsequent two days.

Note: ***If under special circumstances, a student is unable to present him/self herself for registration, he/she may, with the prior permission of the Principal permitted to deposit his/her fee by the prescribed date through his/her representative. However, he/she should present himself/herself for registration within a period of 10 days from the initial date of the registration on payment of a prescribed late fee failing which he/she will not be allowed registration in that semester***.

Registration necessary for award of degree:

In case, a student studies a course without registration in the prescribed manner, he/she will liable to be summarily dropped from the University.

12. Examination and Evaluation System

A. Examination

- **Theory –** Paper setting and evaluation of answer books will be incorporated through inside and outside university examiners as per guidelines of University.

- **Practical**- The practical examination of the course / courses will be conducted by both internal and external examiners as per rules of university.
- **Mid-term examinations-** The mid-term examination will be conducted by course instructor /instructors on college / university expenses but answer books will be supplied by the Registrar or Examination controller of the university.

B. Marks Distribution

a. <u>Courses with Theory and Practical</u>

- **Mid-term Examination- 20% of the total marks**
- **Practical Examination- 30% of the total marks**
- **Final Theory Examination- 50% of the total marks**

b. <u>Courses with only Theory</u>

- **Mid-term Examination- 50% of the total marks**
- **Final Theory Examination- 50% of the total marks**

c. <u>Courses with only Practical</u>

- **Practical Examination - 100%.**

Note :

- Paper to be set by external/Internal examiner shall ensure the coverage of the entire prescribed syllabus.
- If needed moderation can be done for final theory exam papers..
- Syllabus of the concerned course shall be sent to the examiner, who shall prepare the question papers.
- For practical, it is recommended that examination shall be conducted by External examiner nominated by University and internal examiner nominated by Principal of the College.
- The ratios between External and Internal Examiner shall be appointed as per university rules and regulations for paper setting / evaluation of answer book / practical examinations

C. REGISTRATION OR FILLING OF UNIVERSITY EXAMINATION FORM FOR SEMESTER EXAMINATION

- It shall be mandatory to submit the complete examination form before each and every semester examination. The first and last date will be decided by university and shall be properly advertized by the Registrar / Controller of Examination. The fee or fees applicable according to university's rules and regulations.

- It is also advised to the students those who will interest to **clear the repeated course/ courses** shall also be submitted their repeated course/ courses in the examination form with additional fees when ever applicable. **(course of ODD semester in consecutive ODD SEMESTER, similarly course of EVEN SEMESTER in consecutive EVEN SEMESTER)**

D. Evaluation, Grading and Result

Marks Obtained by student	**Conversion into Grade Points** **(Marks obtained by student shall be divided by 10)** *VIZ*: Marks 78 ==7.8
100	10 Points
90 to <100	9 to <10
80 to <90	8 to <9
70 to <80	7 to <8
60 to <70	6 to <7
50 to <60	5 to <6
<50 (Fail)	<5

GPA (Particular Semester)	**Division**
Less than 5.00	**Fail**
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**

1. **GPA (Grade points average) = Total Grade Points scored divided by Total credits (for a particular semester)**

2. **OGPA (Overall Grade Points Average) = Total Points Scored after end of last semester dividedby Total Numbers of Course Credits prescribed for the Degree**

3. **% of Marks = OGPA x 100/10**

FINAL EXAMINATION:

Final examinations shall be held on the dates, which shall be notified by the Registrar/ Examination Controller either in the University calendar or at the beginning of each academic year or otherwise. If a student fails to appear in the final examination of semester, he will not be allowed for registration in the next semester. Such student will repeat the semester when it runs. However, this rule is not applicable for that student who has been permitted for makeup examination by the competent authority.

PREPARATION OF EXAMINATION SCHEDULE:

The Mid-term and Final examination schedule shall be prepared and notified by the Registrar/ Examination Controller/ Principal of the university/college at least fifteen days before the commencement of the examination.

SEATING ARRANGEMENT:

The Dean/Principal of the college shall conduct the examination and the respective centre superintendents shall make the proper seating arrangements.

SUPPLY OF EXAMINATION MATERIAL

- Examination materials such as examination papers, answer books, twine, drawing papers, log tables, graph papers etc. will be supplied by the Registrar/ examination controller of the University for Final Theory Examinations.
- Practical Examination Answer Book and Mid – Tern Examination Answer Book will be supplied by the Registrar/ examination controller of the University
- Every student shall be required to bring examination materials such as set squares, scales, pen, pencils, highlighters etc. as he shall not be permitted to borrow any of these materials from fellow students in the examination hall.

APPEARING IN THE FINAL EXAMINATION:

Candidates coming late by more than 30 minutes in the Final Semester examination shall not be allowed to appear in that examination and no examinee shall be allowed to go out of the examination hall for the first 30 minutes.

MAKE-UP EXAMINATION:

In case a student is seriously ill either in the campus and produces a medical certificate from CMO of district has or is hospitalized elsewhere and is unable to attend his examinations, the Registrar may permit him to appear in more than one make-up examination but not more than two make-up examinations during any one Semester.

MID TERM AND FINAL EXAMINATION:

Notification of Mid Term Examination:

Normally no make-up examination shall be permissible in lieu of the missed mid-term or final examination except as permitted by Dean/Registrar of the university.

- If a student fails to appear in any mid-term examination for reasons beyond his/her control, he/she must file an application on the day on which the examination is missed.
- As far as possible, make-up examination shall be discouraged, only in extremely genuine cases like hospitalization; a student can be permitted by the Dean/Registrar to appear at the make-up examination in the mid-term examinations.
- Dean/Registrar is empowered to allow a student for make-up only in mid-term examination, if he/she fulfills the requirements.

Note: The Student can be permitted to appear at the make-up examination only in extremely genuine cases, on the following grounds:

Case – I - If he/she is seriously ill.

Case – II - If he/she has taken leave on account of the death of his mother, brother, sister, spouse, child or grandparent.

Case – III - Any other genuine cause with which the Dean/Registrar is satisfied. Such cases should be reported to the Registrar.

Case – IV - Only one make-up examination will be permissible during a semester but not more than two.

About The Application for Makeup Examination

- The application for make-up examination must be supported by medical certificate either from the CMO or from the hospital concerned and should be routed through **Advisor/Principal**.
- No application for make-up examination shall be considered if received after one week from the expiry of the last date of mid-term examination.
- Make-up examination must be completed within one week from the date of grant of permission by the Dean. It will be the responsibility of the student to get in touch with his/her teacher and have a date fixed for the make-up examination after necessary permission is granted.
- Result of make-up examination will count along with the previous performance of the student during the term for awarding the final grade in course concerned.

Note:

Evaluation of Thesis/ Master Research Work–

The evaluation of Thesis/ Master Research work should be incorporated by both external examiner and internal examiners as per University rules and regulations.

Rules & Regulations About passing of semester / promotion of semester / repetition of course / repetition of semester

- To attain the final degree a student has to pass all the courses of each semester.
- The minimum **Grade Point Average (G.P.A.)** and **Over All Grade Point Average (O.G.P.A.)** for passing / promotion of a particular semester as well as degree course should not less than 5.00.
- If a student fails in more than one paper in a particular semester he/she will not be promoted in the next semester but he / she failed in a (**one paper)** paper of a semester and should secure at least **Grade Point Average(G.P.A.)** of **5.00**, he/ she will be promoted from that semester to the next semester.
- If a student fails in any course he/she will get **two opportunities to pass the course** in consecutive years of that semester**.(course of ODD semester in consecutive ODD SEMESTER similarly course of EVEN SEMESTER in consecutive EVEN SEMESTER)**
- In special case or cases Vice-Chancellor will have to right to allow the separate examination schedule to clear the repeated course/courses for individual or group of individuals.

Note:

In the case of National calamities or Pandemic disorder the semester promotion will be done according to norms of Central Government / State Government/ V.B.S. Purvanchal University, Jaunpur, U.P., India.

Restriction for students going out on educational tours and extra-curricular activities:

The educational tours and extra curricula activities may be organized in such a way not to disturb the academic programme particularly the final examination. As far as possible such programmes should be organized during semester break.

13. RULES AND REGULATIONS ABOUT IMPROVEMENT OF GPA / OGPA:

- Students will be able to improve their **GPA /OGPA** through improvement examination in consecutive semesters (**course of ODD semester in consecutive ODD SEMESTER similarly course of EVEN SEMESTER in consecutive EVEN SEMESTER)**. The number of course / courses in each semester shall be decided by competent committee of university.
- It shall be mandatory to fill up the course / courses offered by student in semester examination form for improvement examination with appropriate fees already decided by university.

14. SCRUTINY:

- Scrutiny means totaling of marks and evaluation of questions left unmarked.
- If any student desires scrutiny in any course, he shall be permitted to do so with a prescribed scrutiny fee per course.
- He/she shall have to file an application on the prescribed form which can be obtained from the office of the Registrar within a period of 7 days from the date of registration in the semester, failing which no such applications shall be entertained.
- After having the approval of the Registrar, he/she will present the form to the controller of examination.
- The answer book shall be scrutinized by the examiner concerned in collaboration with Dean faculty of Agriculture.
- The result of scrutiny shall be intimated to the controller of examination /Registrar as soon as possible but in no case later those three weeks from the date of registration.
- The result of the scrutiny by the examiner shall be final.

CHANGE OF GRADE AS A RESULT OF SCRUTINY:

After the grade has been revised as a result of scrutiny, the instructor will send the grade through theirincharge of the Department to the Registrar/ Controller of Examination, V.B.S. Purvanchal University, Jaunpue, U.P.

15. USE OF UNFAIR MEANS (UFM):

1. The terms “use of unfair means in the examination” or “attempt to use unfair means in the examination” shall denote the items prescribed by the Academic Council, through its resolution, from time to time. The following items are included in this category-

- Possession of any books, notes, chits, or such other material and also any notes or signs written on any part of the body, furniture or any other material pertaining to the subject matter of the examination in the examination hall during the examination hours.
- Talking, whispering or signaling in any form in the examination hall or outside the examination hall during the examination hours.
- Copying or allowing to copy.
- Any other activity which may give undue advantage in the examination to any student.
- Any attempt to use any other means, which in the opinion of the Superintendent of examination may be considered to be unfair.

2. Unfair means in examination:

The Dean/Principal of the college in which the student is registered shall be responsible for dealing with all the cases of use of unfair means in the semester test and examinations. In this matter, a Committee consisting of the Dean and two facu;ties of the College shall assist the Dean. This Committee shall be constituted by Vice Chancellor every year. The committee shall take appropriate action after effecting full opportunity to the student for his defense and the penalty will be as indicated below.

- A student if found using unfair during mid-term examination, he will be awarded zero in mid-term examination.
- A student found unfair means during the final examination shall be punished as under-----

I. If the material found with the student is related with the course and the student has not used it, he would be awarded 'F' grade in that course.

II. If the student has used the material found with the student he will be awarded 'F' grade in all the courses in the semester.

III. A student found to appear in the examination in place of another student would be treated under unfair means. Such student will be summarily expelled from the University.

- If a student repeats the offence more than twice, during a particular degree programme, he/she will be disqualified for being a student in this University and shall be immediately removed from College.

3. The instructor / invigilators concerned shall report to the Dean/Principal through the Head of the Department/Principal/Superintendent of Examinations on the day of occurrence of cases of unfair means with full details of the evidence and/ or exhibits. An explanation of the student concerned, if possible, shall also be submitted.

16. REPETITIONS OF COURSES:

- If a student secures 'F' grade, he shall be repeat the course whenever the university offers it.
- In case a student obtains 'F' grade in a course and repeats it, the grade secured by the student on repeating the course shall be reflected in the grade report.
- If a student secures 'F' grade in a course and fulfills attendance requirement, he may be permitted by Dean to take re-examination of that course after six month in the semester in which the said course is being offered. However, the student shall submit his application for permission within a month from the date of registration with prescribed fee.

Note:

Just after announcement of results, the Register will communicate to the students, who have obtained 'F' grade in their report card / marksheat as carry over

FORMAT OF SEMESTER REPORT CARD OF SEMESTERS

First Semester

Logo

MSI

वीर बहादुर सिंह पूर्वांचल विश्वविद्यालय
जौनपुर, उ. प्र. भारत ,पिन : २२२००३

Photo

Veer Bahadur Singh Purvancha University
Jaunpur, U.P. India. Pin : 222003

SEMESTER REPORT CARD
M. Sc. (Ag.)-Subject
FIRST SEMESTER EXAMINATION : Session

Name :----------
Father's Name :----------
Mother's Name :----------
Husband,s Name :----------
Name of College :----------

Roll Number :----------
Category :Regular/ Private
Enrollment Number :

Sl.No.	Course Code	Title of Courses	Credit Hours	Marks Obtained	Grade Points	Total Grade Points
1						
2						
3						
4						
Total						

RESULT : PASSED / PROMOTED / FAILED
CARRY- OVER COURSECODE :

TOTAL GRADE POINTS :
GRADE POINTS AVERAGE: (G.P.A.)

Date :

BAR CODE :

Checked By : 1. Signature **2. Signature** **(Name & Signature of Examination Controller)**
Full Name **Full Name**

Second & Third Semesters

Logo

MSI

वीर बहादुर सिंह पूर्वांचल विश्वविद्यालय
जौनपुर, उ. प्र. भारत ,पिन : २२२००३

Photo

Veer Bahadur Singh Purvancha University
Jaunpur, U.P. India. Pin : 222003

SEMESTER REPORT CARD
M. Sc. (Ag.)-Subject
SECOND OR THIRD SEMESTER EXAMINATION : Session

Name :----------
Father's Name :----------
Mother's Name :----------
Husband,s Name :----------
Name of College :----------

Roll Number :----------
Category :Regular/ Private
Enrollment Number :

Sl.No.	Course Code	Title of Courses	Credit Hours	Marks Obtained	Grade Points	Total Grade Points
1						
2						
3						
4						
Total						
		Total Up To Last Semester				
		Cumulative Up To This Semester				

RESULT : PASSED / PROMOTED / FAILED
CARRY- OVER COURSECODE :

TOTAL GRADE POINTS :
GRADE POINTS AVERAGE: (G.P.A.)

Date :

BAR CODE :

Checked By : 1. Signature **2. Signature** **(Name & Signature of Examination Controller)**
Full Name **Full Name**

Fourth r Final Semester (TRANSCRIPT)

Logo

वीर बहादुर सिंह पूर्वांचल विश्वविद्यालय
जौनपुर, उ. प्र. भारत ,पिन : २२२००३

Photo

MSI

Veer Bahadur Singh Purvancha University
Jaunpur, U.P. India. Pin : 222003

SEMESTER REPORT CARD
M. Sc. (Ag.)-Subject
FINAL SEMESTER EXAMINATION & TRANSCRIPT Session

A. Name :---------- **Roll Number :----------**
B. Father's Name :---------- **Category :Regular/ Private**
C. Mother's Name :---------- **Enrollment Number :**
D. Husband,s Name :----------
E. Name of College :----------

FRIST SEMESTER	**THIRD SEMESTER**
(FULL SEMESTE REPORT)	***(FULL SEMESTE REPORT)***
SECOND SEMESTER	**FOURTH SEMESTER**
(FULL SEMESTE REPORT)	***(FULL SEMESTE REPORT)***

	Credit Hours	**Grade Points**	**Total Grade Points**
Total Up To Last Semester			
Cumulative Up To This Semester			

RESULT : PASSED / PROMOTED / FAILED **TOTAL GRADE POINTS---------- :**

CARRY- OVER COURSECODE : **GRADE POINTS AVERAGE:-------**

Division :---------- **(G.P.A.)----------**

Date : **BAR CODE :**

Checked By : 1. Signature **2. Signature** **(Name & Signature of Examination Controller)**
Full Name **Full Name**

STUDENTS' DESCIPLINE and HOSTEL-RULES & REGULATIONS

(A) REGULATIONS FOR STUDENTS' DISCIPLINE:

1. Every student shall assume a sense of responsibility to the ordinary rules of good conduct, to protect private and public property and to make most effective use of his/her time in securing education at the University.
2. No custom or regulation which restricts or creates hindrance in making best use of students' time and talent towards University education, will be allowed to prevail.
3. The students are required to be regular and punctual at lectures and practical in each subject and will be granted leave at their own risk, as they are themselves responsible for completing the prescribed attendance in order to qualify for the University examinations. However, if no leave application in received and the student remains absent for ten days or more continuously from class/admission/registration may be cancelled. The Head/In-charge of Department shall report such cases to Dean/Principal and registrar of the University.
4. Student shall not be eligible for appearing at the University examinations unless he/she paid all the outstanding dues.
5. Person(s) cannot be invited to address or participating in any meetings within the University or hostel premises without the written permission of the Dean/DSW/Principal of the college.
6. If any collection of money for any fund or function shall be made without permission. The organizing committee concerned shall maintain proper account of money collected and the same shall be submitted to the Dean of Faculty/Principal 15 days after the function is over.
7. No student(s) shall be allowed to associate with or to attend any type of illegal activity and/or unauthorized meeting or society outside the campus or for collection of money for any such fund or functions without obtaining permission from Dean of Faculty/D.S.W./Principal.
8. Students are strictly forbidden to resort to or instigate a strike, hunger strike, picketing, demonstrations including political demonstration, unlawful assemblies' unauthorized processions, shouting of objectionable slogans, carrying of placards within the campus, hostels or at residences of officers/staffs.
9. Sticking of posters, distribution of handbills either within or outside the University/College campus is forbidden unless the competent authority has granted permission for students' union election.
10. It is compulsory for every student to obtain his identity card in the manner prescribed by the University/College All students shall get their residential address recorded in the office of the Dean/College and shall notify any change of address, which may take place subsequent to the registration.
11. When a student has been found guilty of grave misconduct of persistent idleness or of habitual breach of discipline within or outside the premises of the University, the Vice-chancellor on the advice of discipline committee may, according to the nature and gravity of the offence, summarily cancel the registration of a student during a semester/session and may not permit the student to register for any number of subsequent semesters/sessions.
12. Punishment awarded to students shall invariably be recorded in their personnel record for future reference and will be taken into consideration, if necessary, while awarding certificate of conduct on leaving the University.
13. Students are expected to maintain a high standard of discipline on the campus.

The following are the detailed outlines of student's indiscipline:

- Disregard of college/hostel rules, orders & notices.
- Disregard of orders and instructions of the member of college staff.
- Noisy, boisterous, disorderly and obnoxious behavior with fellow students and staffs.
- Ragging of junior students, which are strictly banned.
- Irregular attendance and unauthorized absence from classes and hostels.
- Lack of punctuality in attendance and in payment of college dues.
- Recourse to unfair means in tests and examinations.
- Recourse to false or fraudulent statements or acts.
- Keeping, carrying and supplying of any fire arms, lethal weapons, knife with a blade of more than 4" in the room or outside.
- Keeping, using, or supplying intoxicants in any form.
- Gambling in any form.
- Demonstration in any form including processions and meeting, except student union election.
- Strike or hunger strike.
- Boycotting of a University function, programme or activity.
- Abusing.
- Recourse to violence, intimidation, riots.
- Any breach of law of the Country of the State, Act, Statues, Regulations or Rules of the University or orders of a competent authority.
- Disturbing other students in their studies.
- Damaging any University property/College property.
- Failure to produce identify card on demand by a member of staff, warden etc. in and outside the campus at any time and place within the college, hostel and town.
- Gainful paid employment adversely affecting the studies.
- Un-sportsman like behavior in indoors and outdoors games.
- Any act specifically forbidden by the wardens, Dean, D.S.W. or any officer of the University.

14. Students(s) who has/have committed any cat or indiscipline is liable to any one or more of the following punishments.
    - Warning.
    - Reduction/Cancellation of scholarship/stipend/fellowship.
    - Fine.
    - Recovery in part of full of losses or damages to the college property or property of others caused by the students.
    - Suspension from availing any of the college amenities and services or from class.
    - Removal, rustication or expulsion from the college, hostel or university.
15. Any student who violates any regulation or otherwise indulges in any act of indiscipline as defined may be fined up to Rs. 100/- by the warden of the hostel if the warden is satisfied that the fine is adequate, punishment for the act fo indiscipline.
16. Cases of indiscipline, which in the opinion of the proctors of college/principal of the college are so serious that a fine of Rs.100/-or less would not be sufficient, punishment shall be referred by the wardens to Dean/D.S.W. principal for taking disciplinary action against the students. board or a committee proctors consisting of all wardens proctors of the college may fine up to Rs.1500/-and

this shall be noted on the students' permanent record card but shall not go necessarily on the character certificate. In addition, the student may also be placed on conduct probation. This will include and official warning to student that one more incident of indiscipline might lead to the dismissal of the student from the University. Any student during this period when he/she is on conduct probation will not be entitled for any financial aid and shall not represent university/college or anywhere.

17. On the basis of complaint(s) received against any student, if the Dean/principal is convinced, pending enquiry and final orders, the alleged/involved student(S) may also be placed on conduct probation.
18. Cases of more serious indiscipline shall be forwarded to the Vice-chancellor who on the recommendation of the disciplinary committee shall award adequate punishment.(s).
19. Students found directly or indirectly involved in ragging of newly admitted students inside or outside the campus will summarily by expelled from the college/university.
20. For indiscipline on playground, games president may fine students(s)up to Rs.100/-each and/ or debar a student from game (s) for up to two semesters/one session. For debarring, approval of Dean Students Welfare/ Principal will have to be obtained.

READMISSION BY SUSPENSION OF PUNISHMENT SHALL INVARIABLY BE SUBJECT TO THE FOLLOWING CONDITIONS:

1. The student concerned will be re-admitted not as a matter of right but only on compassionate ground, on the submission of an unconditional apology
2. He/she will remain on conduct probation during the remaining period of his/her stay in the University.
3. He/she will furnish a bond of good behavior as prescribed, duly countersigned by his/her parent/guardian, which should remain operative for the entire period of his stay in the college or university.
4. He/she will not apply nor will be entitled to admission to any new degree proramme in the University/College.
5. If the student concerned has been permanently dismissed, he/she will be entitled to apply for relief under this regulation only after the expiry of two semester/one session from the date of orders of punishment, but in no case will be entitled to readmission before the expiry of less than four semesters/two sessions from the effective date of punishment.
6. No Student shall be eligible for seeking relief under this regulation unless he has completed at least two semesters/one session satisfactorily in college/University prior to being awarded the punishment of permanent dismissal.
7. No student shall be eligible to seek or be granted relief under the regulation if he/she commits any act of indiscipline in the college/university campus or misbehaves with any officer or teacher of the College/University within campus or outside during the period laid down in clause(5) above:

HOSTEL RULES:

1. Allotment of hostel rooms to the students will be entirely the discretion of the wardens. The warden may change the allotment as and when they think necessary to do so. No change from one

room to another or the partnership shall be allowed except under special circumstances by prior written approval of the warden.

2. After a student is admitted to the College/University, it is compulsory for him to reside in the hostel maintained or recognized by the University except those living either with their parents or guardians within or outside University campus. Such students who do not want to reside in the hostel from the D.S.W./Dean must obtain written permission. On being admitted to the University, a student has to deposit a sum of Rs. 200/- payable in two installments or Rs. 100/- each to be paid at the time of registration of first two semester besides other dues, which shall be refundable to him/her when he/she vacates the hostel after clearing the dues.
3. The Dean/D.S.W./Warden of the hostels reserve the right to refuse admission in the hostels without assigning any reason to a student who's living in the hostel is considered pre judicial to the general discipline in the hostels.
4. The warden or any other official of the University competent or deputed shall open all the rooms in the hostel for inspection for the purpose at any time.
5. When required by the wardens for specific reasons, the student residents shall vacate the room temporarily or otherwise. In case of refusal, the wardens shall have power break open the room and get the room vacated.
6. The students must be present in their rooms at the time of roll call, which be taken every night between 9.30 and 10.00 P.M. by the prefects who will be appointed by the wardens. Any student found absent without permission is liable to fine up to 5/- per night of absence and/or disciplinary action. The cashier would realize the fine as fees on the report of the warden. Guardians of the students or the respective State Governments, as the case may be, will be informed. If unauthorized absence exceeded 15 days, the allotment of the room will be cancelled and hostel room rend will be forfeited.
7. When the warden finds a student frequently out during night without permission, he/she will, apart from imposing the usual fines, issue a warning to him/her if the warning has no effect on the students, Dean/D.S.W. on the recommendation of the warden may expel the student from the hostel or may take such other disciplinary action as he deems proper.
8. Before leaving the hostel for the night or for the holidays excluding semester breaks and summer vacations, the student must obtain prior permission of the warden on prescribed hostel permit slips.
9. No student shall quarrel or misbehave with any fellow student or employee of the hostel including dhobi, barber, chowkidar, sweeper, servant, maintenance staff, mess worker and cook etc. Any misbehavior on the part of the employees or fellow students shall be brought to the notice of the warden and the concerned student is liable to disciplinary action.
10. No meeting shall be held within the premises of the hostel without the prior permission of the warden. Disciplinary action will be taken against students who organize or attend such unauthorized meetings, except student's union election, outside of hostel.
11. If a student defaces or causes damage to the building, furniture of fitting, the cost or repair or replacement shall be recovered from him.
12. Friends and relatives of the students may visit them in the hostels during the daytime only. Non-authorized person is allowed to stay at night in the hostel after 10pm. If, however,parents/guardians or other guests of the students have to stay, the students must take permission from D.S.W./Dean on the recommendation of the wardens. This facility will be

available in Teacher's/ Farmer's guesthouse University/ College accommodation. If any for a period of maximum of three days only.

13. No guests of opposite sex are allowed to stay or visit the hostel at any time under any circumstances.
14. Students shall not shift fittings assigned to the rooms. When leaving for vacation, these must be handed over to the storekeeper or his/her representative. During the period of allotment of room, the student will be responsible for all property in the room.
15. No fire combustible articles,arms or lethal weapons are allowed to be kept in the hostel.
16. No resident student shall keep in his possession or use intoxicating drugs or liquor of any kind. Gambling or playing cards in any form in the hostel in strictly prohibited.
17. Students are not allowed to have their own recreational appliances viz. radio, transistor, tape recorder/ player, T.V. etc.
18. Students felling sick should inform the Medical Officer/any officer of the university/college under intimation to the warden.
19. Resident students would observe cleanliness around their surroundings and should keep their rooms neat and tidy.
20. Watchman/securityguard of hostels watch and wards of the University/College property. No student in any circumstances should ask the Watchman/securityguard to do any other work.
21. Students shall have to take care of their belongings themselves and are advised not keep any costly items with them in the hostel./ any officer of the university/college.
22. No electric point should be left on while locking the room at any time.
23. Students are not permitted to have electric heaters in their rooms. In case any student found in using electric heaters, a penalty of Rs. 1000/-is fined from the concerned student.
24. Cooking in any form is not allowed in the hostel room.

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Syllabus of M.Sc. (Ag.) Courses & schedule of marks distribution

1. Agronomy

Semester-I

Code No.	Course Title	Credit Hours
AGR-501	Modern Concept of Crop Production	4(3+1)
AGR-502	Principles and Practices of Soil Fertility and Nutrient Management	3(2+1)
AGR-506	Agronomy of Major Cereals and Pulses	3(2+1)
STAT-551	Statistical methods	3(3+0)

Semester-II

Code No.	Course Title	Credit Hours
AGR-503	Principles and Practices of Weed Management	3(2+1)
AGR--504	Principles and Practices of Water Management	3(2+1)
AGR--507	Agronomy of Oilseeds, Fibre and Sugar Crops	3(2+1)
STAT-552	Experimental Designs	2(2+0)

Semester-III

Code No.	Course Title	Credit Hours
AGR--509	Agronomy of Fodder and Forage Crops	3(2+1)
AGR--511	Cropping System and Sustainable Agriculture	2(1+1)
AGR--512	Dryland Farming and Watershed Management	3(2+1)
AGR-591	Master Seminar **	3(2+1)

Semester-IV

Code No.	Course Title	Credit Hours
AGR-513	Principle and Practices of Organic Farming	3(2+1)
AGR--599	Thesis/ Master/Research Work***	20

1. AGR- 501:MODERN CONCEPTS IN CROP PRODUCTION 4 (3+1)

Objective

To teach the basic concepts of soil management and crop production.

Theory

Unit- I

Crop growth analysis in relation to environment; agro-ecological zones of India.

Unit- II

Quantitative agro-biological principles and inverse yield nitrogen law; Mitscherlich yield equation, its interpretation and applicability; Baule unit.

Unit-III

Effect of lodging in cereals; physiology of grain yield in cereals; optimization of plant population and planting geometry in relation to different resources, concept of ideal plant type and crop modeling for desired crop yield.

Unit- IV

Scientific principles of crop production; crop response production functions; concept of soil plant relations; yield and environmental stress.

Unit-V

Integrated farming systems, organic farming, and resource conservation technology including modern concept of tillage; dry farming; determining the nutrient needs for yield potentiality of crop plants, concept of balance nutrition and integrated nutrient management; precision agriculture.

Practical:

1. Plant sampling at different crop growth stages for dry matter and leaf area measurement.
1- Computation of various growth indices with the help of recorded data of dry matter and leaf area.
2- Construction of crop growth curve based on growth analysis data.
3- Computation of harvest index of different crops based on biomass and energy equivalent.
4- Calculation of indices for assessment of cropping systems and input-use efficiency.
5- Assessment of crop yield on the basis of yield attributing characters.

6- Statistical analysis of fertilizer experiments to work out response equation and optimum / economic doses of nutrients

Suggested Readings:

Balasubramaniyan P & Palaniappan SP. (2001): Principles and Practices of Agronomy. Agrobios.

Fageria NK.(1992) :. Maximizing Crop Yields. Marcel Dekker.

Havlin JL, Beaton JD, Tisdale SL & Nelson W. L. (2006): Soil Fertility and Fertilizers. 7th Ed. Prentice Hall.

Paroda R.S. (2003): Sustaining our Food Security. Konark Publ.

Reddy SR. (2000): Principles of Crop Production. Kalyani Publ.

Sankaran S & Mudaliar TVS. (1997): Principles of Agronomy. The Bangalore Printing & Publ.

Singh SS. (2006): Principles and Practices of Agronomy. Kalyani.

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2. AGR- 502: PRINCIPLES AND PRCATICES OF SOIL FERTILITY AND NUTRIENT MANAGEMENT 3(2+1)

Objective

To impart knowledge of fertilizers and manures as sources of plant nutrients and apprise about the integrated approach of plant nutrition and sustainability of soil fertility.

Theory

UNIT- I - Soil fertility and productivity - factors affecting; features of good soil management; problems of supply and availability of nutrients; relation between nutrient supply and crop growth; organic farming - basic concepts and definitions.

UNIT- II - Criteria of essentiality of nutrients; Essential plant nutrients – their functions, nutrient deficiency symptoms; transformation and dynamics of major plant nutrients.

UNIT- III - Preparation and use of farmyard manure, compost, green manures, vermicompost, biofertilizers and other organic concentrates their composition, availability and crop responses; recycling of organic wastes and residue management.

UNIT- IV - Commercial fertilizers; composition, relative fertilizer value and cost; crop response to different nutrients, residual effects and fertilizer use efficiency, fertilizer mixtures and grades; agronomic, chemical and physiological methods of increasing fertilizer use efficiency; nutrient interactions.

UNIT- V - Time and methods of manures and fertilizers application; foliar application and its concept; relative performance of organic and inorganic manures; economics of fertilizer use; integrated nutrient management; use of vermin- compost and residue wastes in crops.

Practical

• Determination of soil pH, ECe, organic C, total N, available N, P, K and S in soils
• Determination of total N, P, K and S in plants
• Interpretation of interaction effects and computation of economic and yield optima

Suggested Readings:

- **Brady NC & Weil R.R (2002):** The Nature and Properties of Soils. 13th Ed. Pearson Edu.
- **Fageria NK, Baligar VC & Jones CA. (1991):** Growth and Mineral Nutrition of Field Crops. Marcel Dekker.
- **Havlin JL, Beaton JD, Tisdale SL & Nelson WL. (2006):** Soil Fertility and Fertilizers. 7th Ed. Prentice Hall.
- **Prasad R & Power JF. (1997)**. Soil Fertility Management for Sustainable Agriculture. CRC Press.
- **Yawalkar KS, Agrawal JP & Bokde S.(2000):** Manures and Fertilizers. Agri-Horti Publ.

3. AGR- 503:PRINCIPLES AND PRACTICES OF WEED MANAGEMENT 3(2+1)

Objective

To familiarize the students about the weeds, herbicides and methods of weed control.

Theory

UNIT- I - Weed biology and ecology, crop-weed competition including allelopathy; principles and methods of weed control and classification; weed indices.

UNIT- II - Herbicides introduction and history of their development; classification based on chemical, physiological application and selectivity; mode and mechanism of action of herbicides.

UNIT- III - Herbicide structure - activity relationship; factors affecting the efficiency of herbicides; herbicide formulations, herbicide mixtures; herbicide resistance and management; weed control through bio-herbicides, myco-herbicides and allelochemicals; Degradation of herbicides in soil and plants; herbicide resistance in weeds and crops; herbicide rotation.

UNIT- IV - Weed management in major crops and cropping systems; parasitic weeds; weed shifts in cropping systems; aquatic and perennial weed control.

UNIT- V - Integrated weed management; cost : benefit analysis of weed management.

Practical

- Identification of important weeds of different crops
- Preparation of a weed herbarium
- Weed survey in crops and cropping systems
- Crop-weed competition studies
- Preparation of spray solutions of herbicides for high and low-volume sprayers
- Use of various types of spray pumps and nozzles and calculation of swath width
- Economics of weed control
- Herbicide resistance analysis in plant and soil
- Bioassay of herbicide resistance
- Calculation of herbicidal requirement

Suggested Readings:

- **Aldrich RJ & Kramer RJ. (1997).** Principles in Weed Management. Panima Publ.
- **Ashton FM & Crafts AS. (1981)**. Mode of Action of Herbicides. 2nd Ed. Wiley Inter-Science.
- **Gupta OP. (2007).** Weed Management – Principles and Practices. Agrobios.
- **Mandal RC. (1990)**. Weed, Weedicides and Weed Control - Principles and Practices. Agro-Botanical Publ.
- **Rao VS.(2000). Principles** of Weed Science. Oxford & IBH.
- **Subramanian S, Ali AM & Kumar RJ. (1997)**. All About Weed Control. Kalyani.
- **Zimdahl RL. (1999)**. Fundamentals of Weed Science. 2nd Ed. Academic Press.

4. AGR- 504: PRINCIPLES AND PRACTICES OF WATER MANAGEMENT 3 (2+1)

Objective

To teach the principles of water management and practices to enhance the water productivity.

Theory

Unit- I

Water and its role in plants; water resources of India, major irrigation projects, extent of area and crops irrigated in India and different states.

Unit-II

Soil water movement in soil and plants; transpiration; soil-water-plant relationships; water absorption by plants; plant response to water stress, crop plant adaptation to moisture stress condition.

Unit-III

Soil, plant and meteorological factors determining water needs of crops; scheduling, depth and methods of irrigation; micro-irrigation system; fertigation; management of water in controlled environments and poly-houses.

Unit-IV

Water management of the crops and cropping systems; quality of irrigation water and management of saline water for irrigation; water use efficiency.

Unit-V

Excess of soil water and plant growth; water management in problem soils; drainage requirement of crops and methods of field drainage, their layout and spacing.

Practical

• Measurement of soil water potential by using tensiometer, and pressure plate and membrane apparatus
• Soil-moisture characteristics curves
• Water flow measurements using different devices
• Determination of irrigation requirements
• Calculation of irrigation efficiency
• Determination of infiltration rate
• Determination of saturated/unsaturated hydraulic conductivity Suggested Readings

Suggested Readings:

- **Lenka D.(1999)**. Irrigation and Drainage. Kalyani
- **Michael AM. (1978).** Irrigation: Theory and Practice. Vikas Publ.
- **Paliwal KV. (1972)**. Irrigation with Saline Water. IARI Monograph, New Delhi.
- **Panda SC. (2003).** Principles and Practices of Water Management. Agrobios.
- **Prihar SS & Sandhu BS.(1987)**. Irrigation of Food Crops - Principles and Practices. ICAR.
- **Reddy SR. (2000).** Principles of Crop Production. Kalyani.
- **Singh Pratap & Maliwal PL. (2005)**. Technologies for Food Security and Sustainable Agriculture. Agrotech Publ.

5.AGR- 506 : AGRONOMY OF MAJOR CEREALS AND PULSES 3(2+1)

Objective

To teach the crop husbandry of cereals and pulse crops.

Theory

Origin and history, area and production, classification, improved varieties, adaptability, climate, soil, water and cultural requirements, nutrition, quality components, handling and processing of the produce for maximum production of

Unit- I	**:**	Rabi cereals.
Unit-II	**:**	Kharif cereals.
Unit- III	**:**	Rabi pulses.
Unit-IV	**:**	Kharif pulses.

Practical

• Phenological studies at different growth stages of crop
• Estimation of crop yield on the basis of yield attributes
• Formulation of cropping schemes for various farm sizes and calculation of cropping and rotational intensities
• Working out growth indices (CER, CGR, RGR, NAR, LAD), aggressiveness, relative crowding coefficient, monetary yield advantage and ATER of prominent intercropping systems of different crops

• Estimation of protein content in pulses
• Planning and layout of field experiments
• Judging of physiological maturity in different crops
• Intercultural operations in different crops
• Determination of cost of cultivation of different crops
• Working out harvest index of various crops
• Study of seed production techniques in various crops
• Visit of field experiments on cultural, fertilizer, weed control and water management aspects
• Visit to nearby villages for identification of constraints in crop production

Suggested Readings:

- **Das NR. (2007)**. Introduction to Crops of India. Scientific Publ.
- **Hunsigi G & Krishna KR. (1998)**. Science of Field Crop Production. Oxford & IBH.
- **Jeswani LM & Baldev B. (1997)**. Advances in Pulse Production Technology. ICAR.
- **Khare D & Bhale MS. (2000).** Seed Technology. Scientific Publ.
- **Kumar Ranjeet & Singh NP. (2003)**. Maize Production in India: Golden Grain in Transition. IARI, New Delhi.
- **Pal M, Deka J & Rai RK. (1996)**. Fundamentals of Cereal Crop Production. Tata McGraw Hill.
- **Prasad, Rajendra. (2002)**. Text Book of Field Crop Production. ICAR.
- **Singh C, Singh P & Singh R. (2003)**. Modern Techniques of Raising Field Crops. Oxford & IBH.
- **Singh, SS. (1998)**. Crop Management. Kalyani.
- **Yadav DS. (1992).** Pulse Crops. Kalyani.

6. AGR- 507: <u>AGRONOMY OF OILSEED, FIBRE AND SUGAR CROPS</u> 3(2+1)

Objective

To teach the crop husbandry of oilseed, fiber and sugar crops.

Theory

Origin and history, area and production, classification, improved varieties, adaptability, climate, soil, water and cultural requirements, nutrition quality component, handling and processing of the produce for maximum production of :

Unit-I	**:**	Rabi oilseeds – Rapeseed and mustard, linseed, etc.
Unit-II	**:**	Kharif oilseeds - Groundnut, sesame, castor, sunflower, soybean etc.
Unit-III	**:**	Fiber crops - Cotton, jute, sunhemp etc.
Unit-IV	**:**	Sugar crops – Sugar-beet and sugarcane.

Practical

• Planning and layout of field experiments
• Cutting of sugarcane setts, its treatment and methods of sowing, tying and propping of sugarcane
• Determination of cane maturity and calculation on purity percentage, recovery percentage and sucrose content in cane juice phenological studies at different growth stages of crop
• Intercultural operations in different crops
• Cotton seed treatment
• Working out growth indices (LER, CGR, RGR, NAR, LAD) aggressivity, relative crowding coefficient, monetary yield advantage and ATER of prominent intercropping systems
• Judging of physiological maturity in different crops and working out harvest index
• Working out cost of cultivation of different crops
• Estimation of crop yield on the basis of yield attributes
• Formulation of cropping schemes for various farm sizes and calculation of cropping and rotational intensities
• Determination of oil content in oilseeds and computation of oil yield

• Estimation of quality of fibre of different fibre crops
• Study of seed production techniques in various crops
• Visit of field experiments on cultural, fertilizer, weed control and water management aspects
• Visit to nearby villages for identification of constraints in crop production

Suggested Readings

Das NR.(2007). Introduction to Crops of India. Scientific Publ.
Das PC. (1997). Oilseed Crops of India. Kalyani**.**
Lakshmikantam N. (1983). Technology in Sugarcane Growing. 2nd Ed. Oxford & IBH**.**
Prasad, Rajendra. (2002). Text Book of Field Crop Production. ICAR**.**
Singh C, Singh P & Singh R. (2003). Modern Techniques of Raising Field Crops. Oxford & IBH**.**
Singh SS. (1998). Crop Management. Kalyani**.**

7. AGR– 509: AGRONOMY OF TOBBACO, POTATO AND FORAGE CROPS 3(2+1)

Objective

To teach the crop husbandry of different forage and fodder crops along with their processing.

Theory

Unit-I

Adaptation, distribution, varietal improvement, agro-techniques and quality aspects including anti-quality factors of tobacco, potato and important fodder crops like maize, bajra, guar, cowpea, oats, barley, berseem, senji, lucerne etc.

Unit-II

Adaptation, distribution, varietal improvement, agro-techniques and quality aspects including anti-quality factors of important forage crops/grasses- lime, napier grass, Panicum, Lasiuras, Cenchrus etc.

Unit-III

Year-round fodder production and management, preservation and utilization of forage and pasture crops.

Unit-IV

Principles and methods of hay and silage making; chemical and biochemical changes, nutrient losses and factors affecting quality of hay and silage; use of physical and chemical enrichments and biological methods for improving nutrition; value addition of poor quality fodder.

Unit-V

Economics of forage cultivation uses and seed production techniques.

Practical

- Practical raining of farm operations in raising fodder crops;
- Canopy measurement, yield and quality estimation, viz. crude protein, NDF, ADF, lignin, silica, cellulose etc. of various fodder and forage crops
- Anti-quality components like HCN in sorghum and such factors in other crops
- Hay and silage making and economics of their preparation

Suggested Readings

- **Chatterjee BN.(1989)**. Forage Crop Production - Principles and Practices. Oxford & IBH.
- **Das NR. (2007)**. Introduction to Crops of India. Scientific Publ.
- **Narayanan TR & Dabadghao PM.(1972)**. Forage Crops of India. ICAR.
- **Singh P & Srivastava AK. (1990)**. Forage Production Technology. IGFRI, Jhansi.
- **Singh C, Singh P & Singh R.(2003)**. Modern Techniques of Raising Field Crops. Oxford & IBH.
- **Tejwani KG.(1994)**. Agroforestry in India. Oxford & IBH.

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8. AGR- 511:<u>CROPPING SYSTEMS AND SUSTAINABLE AGRICULTURE</u> 2(2+0)

Objective

To acquaint the students about prevailing cropping systems in the country and practices to improve their productivity.

Theory

Unit-I

Cropping systems: definition, indices and its importance; physical resources, soil and water management in cropping systems; assessment of land use.

Unit-II

Concept of sustainability in cropping systems and farming systems, scope and objectives; production potential under monoculture cropping, multiple cropping, alley cropping, sequential cropping and intercropping, mechanism of yield advantage in intercropping systems.

Unit-III

Above and below ground interactions and allelopathic effects; competition relations; multi-storied cropping and yield stability in intercropping, role of non-monetary inputs and low cost technologies; research need on sustainable agriculture.

Unit-IV

Crop diversification for sustainability; role of organic matter in maintenance of soil fertility; crop residue management; fertilizer use efficiency and concept of fertilizer use in intensive cropping system.

Unit-V

Plant ideotypes for drylands; plant growth regulators and their role in sustainability.

Suggested Readings

- **Palaniappan SP & Sivaraman K. (1996)**. Cropping Systems in the Tropics; Principles and Management. New Age.
- **Panda SC. (2003)**. Cropping and Farming Systems. Agrobios.
- **Reddy SR. (2000)**. Principles of Crop Production. Kalyani.
- **Sankaran S & Mudaliar TVS. (1997)**. Principles of Agronomy. The Bangalore Printing & Publ. Co.
- **Singh SS. (2006)**. Principles and Practices of Agronomy. Kalyani.
- **Tisdale SL, Nelson WL, Beaton JD & Havlin JL. (1997)**. Soil Fertility and Fertilizers. Prentice Hall.

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9. AGR- 512:DRYLAND FARMING AND WATERSHED MANAGEMENT 3(2+1)

Objective

To teach the basic concepts and practices of dry land farming and soil moisture conservation.

Theory

Unit-I

Definition, concept and characteristics of dry land farming; dry land versus rainfed farming; significance and dimensions of dry land farming in Indian agriculture.

Unit-II

Soil and climatic parameters with special emphasis on rainfall characteristics; constraints limiting crop production in dry land areas; types of drought, characterization of environment for water availability; crop planning for erratic and aberrant weather conditions.

Unit- III

Stress physiology and resistance to drought, adaptation of crop plants to drought, drought management strategies; preparation of appropriate crop plans for dry land areas; mid contingent plan for aberrant weather conditions.

Unit- IV

Tillage, tilth, frequency and depth of cultivation, compaction in soil tillage; concept of conservation tillage; tillage in relation to weed control and moisture conservation; techniques and practices of soil moisture conservation (use

of mulches, kinds, effectiveness and economics); anti-transpirants; soil and crop management techniques, seeding and efficient fertilizer use.

Unit-V

Concept of watershed resource management, problems, approach and components.

Practical

- Seed treatment, seed germination and crop establishment in relation to soil moisture contents
- Moisture stress effects and recovery behaviour of important crops
- Estimation of moisture index and aridity index
- Spray of anti-transpirants and their effect on crops
- Collection and interpretation of data for water balance equations
- Water use efficiency
- Preparation of crop plans for different drought conditions
- Study of field experiments relevant to dryland farming
- Visit to dry land research stations and watershed projects

Suggested Readings

1. **Das NR. 2007**. Tillage and Crop Production. Scientific Publishers.
2. **Dhopte AM. 2002.** Agrotechnology for Dryland Farming. Scientific Publ.
3. **Dhruv Narayan VV. 2002**. Soil and Water Conservation Research in India. ICAR.
4. **Gupta US. (Ed.). 1995**. Production and Improvements of Crops for Drylands. Oxford & IBH.
5. **Katyal JC & Farrington J. 1995**. Research for Rainfed Farming. CRIDA.
6. **Rao SC & Ryan J. 2007**. Challenges and Strategies of Dryland Agriculture. Scientific Publishers.
7. **Singh P & Maliwal PL. 2005**. Technologies for Food Security and Sustainable Agriculture. Agrotech Publishing Company.
8. **Singh RP. 1988**. Improved Agronomic Practices for Dryland Crops. CRIDA.
9. **Singh RP. 2005**. Sustainable Development of Dryland Agriculture in India. Scientific Publ.
10. **Singh SD. 1998**. Arid Land Irrigation and Ecological Management. Scientific Publishers.
11. **Venkateshwarlu J. 2004**. Rainfed Agriculture in India. Research and Development Scenario. ICAR.

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10. AGR- 513:PRINCIPLES AND PRACTICES OF ORGANIC FARMING 3(2+1)

Objective

To study the principles and practices of organic farming for sustainable crop production.

Theory

Unit-I

Organic farming - concept and definition, its relevance to India and global agriculture and future prospects; land and water management - land use, minimum tillage; shelter zones, hedges, pasture management, agro-forestry.

Unit- II

Organic farming and water use efficiency; soil fertility, nutrient recycling, organic residues, organic manures, composting, soil biota and decomposition of organic residues, earthworms and vermicompost, green manures and biofertilizers.

Unit-III

Farming systems, crop rotations, multiple and relay cropping systems, intercropping in relation to maintenance of soil productivity.

Unit-IV

Control of weeds, diseases and insect pest management, biological agents and pheromones, biopesticides.

Unit-V

Socio-economic impacts; marketing and export potential: inspection, certification, labeling and accreditation procedures; organic farming and national economy.

Practical

• Aerobic and anaerobic methods of making compost
• Making of vermicompost
• Identification and nursery raising of important agro-forestry tress and tress for shelter belts
• Efficient use of biofertilizers, technique of treating legume seeds with Rhizobium cultures, use of Azotobacter, Azospirillum, and PSB cultures in field
• Visit to an organic farm
• Quality standards, inspection, certification and labeling and accreditation procedures for farm produce from organic farms

Suggested Readings

- **Ananthakrishnan TN. (Ed.). (1992)**. Emerging Trends in Biological Control of Phytophagous Insects. Oxford & IBH.
- **Gaur AC. (1982)**. A Manual of Rural Composting, FAO/UNDP Regional Project Document, FAO.
- **Lampin N. (1990)**. Organic Farming. Press Books, lpswitch, UK.
- **Palaniappan SP & Anandurai K. (1999)**. Organic Farming – Theory and Practice. Scientific Publ.
- **Rao BV Venkata. (1995)**. Small Farmer Focused Integrated Rural Development: Socio-economic Environment and Legal Perspective: Publ.3, Parisaraprajna Parishtana, Bangalore.
- **Reddy MV. (Ed.). (1995)**. Soil Organisms and Litter Decomposition in the Tropics. Oxford & IBH.
- **Sharma A.(2002)**. Hand Book of Organic Farming. Agrobios.
- **Singh SP. (Ed.) (1994).** Technology for Production of Natural Enemies. PDBC, Bangalore.
- **Subba Rao NS. (2002).** Soil Microbiology. Oxford & IBH.
- **Trivedi RN.(1993).** A Text Book of Environmental Sciences, Anmol Publ.
- **Veeresh GK, Shivashankar K & Suiglachar MA. (1997)**. Organic Farming and Sustainable Agriculture. Association for Promotion of Organic Farming, Bangalore.
- **WHO.(1990)**. Public Health Impact of Pesticides Used in Agriculture. WHO.
- **Woolmer PL & Swift MJ. (1994)**. The Biological Management of Tropical Soil Fertility. TSBF & Wiley.

11. STAT- 551: <u>Statistical Methods</u> 3 (2+1)

Unit-I

Summarization of data, classification and tabulation of data, Diagrammatic and Graphical Representations, utility and limitations of graphical Representation. Measure of central tendency, definition, merit, demerit, uses and properties of different measure of central tendency, measure of dispersion, moments, skewness and kurtosis.

Unit-II

Probability distribution, discrete probability distribution- Bernouli, poission, normal distribution. Theorem of addition of probability, theorem of multiplication of probability, Definition- (simple and compound events independent and dependents, mutually exclusive, complimentary events.)

Unit-III

Statistical Hypothesis, Null hypothesis, Two type of error, Statistical significance, parametric and nonparametric hypothesis, critical region, level of significance, practical application of simple test of significance viz, 't' and 'F' test. X2 test as a goodness of Fit, properties of X2 distribution, conditions for application of X2 test.

Unit-IV

Correlation and its test of significance, line of regression and its test of significance. Correlation, measurement of correlation, limit and range of „ correlation coefficient expressed in term of regression coefficients. Rank correlation and its computations, regression equation.

12. STAT-552: Experimental Designs **2 (2+0)**

Theory

Unit- I

Principles of experimental design, precision and accuracy, advantage of replication, experimental technique. Analysis of variance, fundamental principles of analysis of variance. Critical difference, limitations of the analysis of variance.

Unit- II

Statistical analysis and advantage and disadvantage of basic design-completely randomized design, randomized block design, Latin square design.

Unit- III

Factorial concept: simple effects, main effects and interaction, factorial experiments (without confounding), Yates method. Confounding, principles of confounding in a 2^3 factorial experiments. Split plot design.

Unit- IV

Missing plot technique; Bartlett's techniques for missing plots, cross-overdesign or switch-over trials, Rotational experiments, progeny selection, compact family block design, uniformity trial, sire index, sampling in field experiments.

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2. Horticulture

Semester-I

Code No.	Course Title	Credit Hours
HORT-501	Fundamental of Fruit Production	3(2+1)
HORT-502	Fundamentals of Vegetable Production	3(2+1)
HORT-503	Nursery Husbandry and Plant Propagation	2(1+1)
STAT-551	Statistical methods	3(3+0)

Semester-II

Code No.	Course Title	Credit Hours
HORT-504	Production Technology of Fruit Crops	3(2+1)

HORT-505	Production Technology of Vegetable Crops	3(2+1)
HORT-506	Landscaping & Ornamental Gardening	3(2+1)
STAT-552	Experimental Designs	2(2+0)

Semester-III

Code No.	Course Title	Credit Hours
HORT-507	Commercial Floriculture	3(2+1)
HORT-508	Production Technology of Medicinal, Aromatic, Spices and Plantation Crops	3(2+1)
HORT-509	Breeding of Horticultural Crops	3(2+1)

Semester-IV

Code No.	Course Title	Credit Hours
HORT-510	Principle of Fruit and Vegetable Preservation	3(2+1)
HORT-591	Master Seminar**	1(1+0)
HORT--599	Thesis/Master Research Work***	20

1. HORT-501: Fundamentals of Fruit Production 3 (2+1)

Theory

Importance and scope of fruit production, importance of fruit in human nutrition. Classification of fruit crops. Factors affecting fruit production. Nutrition of fruit crops. Water and weed management in fruit production. Pruning and training. Growth and fruiting behavior of fruit plants. Pollination, fruit set, fruit developmentand fruit drop. Unfruitfulness, parthenocarpy and seedlessness, alternate bearing. Use of growth regulators in fruit production.

Practical:

1- Identification of horticultural tools and implements and their uses.
2- Methods of training and pruning in fruit plants.
3- Irrigation system followed in orchard
4- Fertilizer application in fruit crops including fertigation.
5- Visit of local commercial orchard.
6- Fruit behavior of fruit plant.
7- Use of growth regulators.

2. HORT-502: Fundamentals of Vegetable Production 3 (2+1)

Theory

Importance of vegetable in human nutrition. Area, production, productivity and potentiality of vegetable production. Type of vegetable gardening. Classification of vegetable crop, factors influencing vegetable production. Role of plant growth regulators in vegetable production. Nursery techniques, preparation of land, organic manures, fertilizers and method of their application, spacing, transplanting, irrigation practices, intercultural, mulching and control of weeds. Harvesting, grading, packaging, transport and storage.

Practical:

1. Layout of kitchen garden.
2. Identification of horticultural tools and implements and their uses.
3. Identification of cool and summer season vegetables.
4. Classification of vegetable crops.

5. Raising of vegetable nurseries.
6. Preparation of cropping scheme for commercial farm and kitchen garden
7. Visit of commercial greenhouse/poly house.

3. HORT-503: Nursery Husbandry and Plant Propagation 2(1+1)

Theory

Selection of site and nursery layout. Dormancy of seed and physiology of seed germination. Selection, certification and maintenance of mother plants and bud wood. Plant growing structure glass house, mist chamber etc. Polyembryony and its importance. Root stock and stionic effect in fruit crops. Basic concept and principles of plant propagation. Budding, grafting, cutting and layering in fruit plants. Anatomy and physiology of root formation and graft union.

Practical:

1. Prepare layout of nursery for ornamental plants, vegetables, fruits and forest trees.
2. Root stocks used in fruit crops.
3. Propagation by cutting.
4. Propagation by layering.
5. Propagation by budding and grafting.
6. Study of various plant growth structures.
7. Visit to commercial green house.

4. HORT-504: Production Technology of Fruit Crops 3 (2+1)

Theory

Origin history and distribution, botany, varieties, soil and climatic requirements. Root stocks, propagation, planting, training and pruning, manuring, irrigation and weed control, flowering and fruiting, harvesting, pest and diseases and their control in mango, banana, papaya, pineapple, sapota, cashewnut, citrus, grapes, guava, fig, jamun, karonda, litchi, loquat, jackfruit, aonla, pomegranate, strawberry, apple, pear, peach, plum.

Practical:

1. Identification of horticultural tools and implements and their uses.
2. Plant propagation, scarification and stratification.
3. Training and pruning in fruit plants.
4. Identification and description of varieties of fruit crops.
5. Visit to tropical, sub tropical and temperate orchards.

5. HORT-505: Production Technology of Vegetable Crops 3 (2+1)

Theory

Introduction, origin and history, distribution, area and production, improved varieties, climate and soil requirement, nursery techniques, sowing/planting, nutritional requirement, irrigation, intercultural, weed control, plant protection, harvesting, grading, packaging and storage of important vegetable crops such as cabbage, cauliflower, knol-khol, beet root, radish, turnip, carrot, garden pea, onion, garlic, palak and lettuce, brinjal, hot and sweet peper, tomato, beans, cowpea, cucurbitaceous crops, leafy vegetables, elephant foot yam and sweet potato.

Practical:

1. Planning of layout of kitchen garden.
2. Identification of important vegetable seeds and plants.
3. Raising of vegetable nursery.

4. Study of physiological disorders and deficiency of mineral elements.
5. Identification of important pests and diseases and their control.

6. HORT-506: Landscaping and Ornamental Gardening 3 (2+1)

Theory

Importance and scope of landscape gardening, history and development of garden, principles of gardening, element of design, different type and style of gardening, different components (features) of a garden such as garden wall, garden drive, paths, steps, hedge and edge plants, topiary, arches, pergolas, terrace gardening, paves garden, carpet bedding, flower bed, annuals, herbaceous border, shrubbery borders, avenue trees and rock garden. Selection, multiplication cultivation and management of trees, shrubs and climbers.

Practical:

1. Identification and selection of ornamental plants (Trees, shrubs, climbers, foliage, hedge, edge plants, etc.).
2. Planning and layout of garden and garden designs for public and private area.
3. Layout for avenue planting.
4. Planting herbaceous and shrubbery borders.
5. Visit to parks and botanical garden.
6. Layout of lawns and their maintenance.

7. HORT-507: Commercial Floriculture 3 (2+1)

Theory

Cultivation, improvement and utilization of roses, jasmine, dahlia, marigold, chrysanthemum, gladiolus, tuberose, gerbera, carnation, anthurium, fern, palm, orchids, cacti and succulents. Growing of important flower for exhibition. Bonsai. Principles of flower show and flower arrangement, flower exhibition and judging.

Practical:

1. Practice of wintering and pruning in roses.
2. Preparation ofr seed beds for different flower crops.
3. Practices of different asexual propagation methods for flower crops.
4. Preparation of Bonsai.
5. Important points for cultivation of flower for exhibition.

8.HORT-508: Production Technology of Medicinal, Aromatic, Spices and Plantation Crops 3(2+1)

Theory

Origin, history, distribution, economics, taxonomy, classification, variation, climate and soil requirements, propagation and nursery techniques, cultural practices, nutrition, water requirement, training and pruning system, regulation of shade, plant protection and management of ashwagandha, sarpgandha, isabgoal, kalmegh, safed musali, basil, mint, vitiver, palmarosa, lemon grass, scented rose, turmeric, coriander, ginger, fennel, cardamom, coffee, cocoa, coconut, rubber, etc.

Practical:

1. Identification and botanical description of medicinal, aromatic, spices and plantation crops.
2. Propagation technique in medicinal, aromatic, spices and plantation crops.
3. Production of essential oil and ingredient through distillation of important medicinal and aromatic plant.
4. Preparation of herbarium of these plants.

9. HORT-509: Breeding of Horticultural Crops 3 (2+1)

Syllabus

Importance and scope of breeding in horticultural crops. Centre of origin and their role in crop improvement. Breeding system, incompatibility, apomixes, parthenocarpy, polyembryony, sterility and dichogamy. Method of

crop improvement, introduction, clonal selection, hybridization, polyploidy breeding, mutation breeding. Resistance breeding for biotic and abiotic stress. Varietal situations and breeding properties in fruit crops like mango, grape, papaya, guava, citrus, apple and peaches and vegetable crops like tomato, brinjal, chilli, cabbage, cauliflower, okra, carrot, onion, garden pea and cucurbits.

Practical:

1. Identification the hybrid varieties.
2. List of the horticultural crop breeders and their fields.
3. List of the Institute related to horticulture breeding and germplam conservation.
4. Emasculation and pollination practices in important horticultural crops.
5. Visit to various institute related to horticultural breeding.

10. HORT-510: Principle of Fruit and Vegetable Preservation 3 (2+1)

Theory

Scope and importance for preservation industry in India, spoilage of fruit and vegetable produce. Principles and methods of preservation eg. Canning, freezing, dehydration, preserves, cordial, sauce, puree, squash, jam, jelly, marmalades, pickles and various vegetable products. Methods of storing of fresh and preserved products. Fruit products order. Detailed studies of the problems in connection with various methods of preservation and processing.

Practical:

1. Identification of equipments used in fruit and vegetable preservation.
2. Preparation of beverages (cordial, squash etc.).
3. Preparation of pectin products (jam, jelly, marmalades).
4. Preparation of preserves.
5. Preparation of tomato products (sauce, chutney, puree etc.).
6. Visit to fruit and vegetable processing unit.
7. Preservation by drying and dehydration.

11. STAT- 551: Statistical Methods 3 (2+1)

Unit-I

Summarization of data, classification and tabulation of data, Diagrammatic and Graphical Representations, utility and limitations of graphical Representation. Measure of central tendency, definition, merit, demerit, uses and properties of different measure of central tendency, measure of dispersion, moments, skewness and kurtosis.

Unit-II

Probability distribution, discrete probability distribution- Bernouli, poission, normal distribution. Theorem of addition of probability, theorem of multiplication of probability, Definition- (simple and compound events independent and dependents, mutually exclusive, complimentary events.)

Unit-III

Statistical Hypothesis, Null hypothesis, Two type of error, Statistical significance, parametric and nonparametric hypothesis, critical region, level of significance, practical application of simple test of significance viz, 't' and 'F' test. X2 test as a goodness of Fit, properties of X2 distribution, conditions for application of X2 test.

Unit-IV

Correlation and its test of significance, line of regression and its test of significance. Correlation, measurement of correlation, limit and range of ,, correlation coefficient expressed in term of regression coefficients. Rank correlation and its computations, regression equation.

12. STAT-552: Experimental Designs **2 (2+0)**

Theory

Unit- I

Principles of experimental design, precision and accuracy, advantage of replication, experimental technique. Analysis of variance, fundamental principles of analysis of variance. Critical difference, limitations of the analysis of variance.

Unit- II

Statistical analysis and advantage and disadvantage of basic design-completely randomized design, randomized block design, Latin square design.

Unit- III

Factorial concept: simple effects, main effects and interaction, factorial experiments (without confounding), Yates method. Confounding, principles of confounding in a 2^3 factorial experiments. Split plot design.

Unit- IV

Missing plot technique; Bartlett's techniques for missing plots, cross-overdesign or switch-over trials, Rotational experiments, progeny selection, compact family block design, uniformity trial, sire index, sampling in field experiments.

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3. Genetics and Plant Breeding

Semester-I

Code No.	Course Title	Credit Hours
GPB 501	Principles of Genetics	3(2+1)
GPB 502	Principles of Cytogenetics	3(2+1)
GPB 503	Principles of Plant Breeding	3(2+1)
STAT 551	Statistical Methods	3(3+0)

Semester-II

Code No.	Course Title	Credit Hours
GPB 504	Principles of Quantitative Genetics	3(2+1)

GPB 510	Breeding for Biotic and Abiotic Stress Resistance	3(2+1)
GPB 511	Breeding For Cereal, Forage and Sugarcane	3(2+1)
STAT 552	Experimental Design	2(2+0)

Semester-III

Code No.	Course Title	Credit Hours
GPB 508	Cell Biology and Molecular Genetics	3(2+1)
GPB 512	Breeding of Legume, Oilseed and Fibre crop	3(2+1)

Semester-IV

Code No.	Course Title	Credit Hours
GPB 509	Biotechnology for Crop Improvement	3(2+1)
GPB 515	Maintenance Breeding, Concepts of Variety Release and Seed Production	2(1+1)
GPB 591	Master Seminar**	1(1+0)
GPB 599	Thesis /Master Research Work***	20

3. GENETICS AND PLANT BREEDING

1.GPB- 501 : PRINCIPLES OF GENETICS 3(2+1)

Objective

This course is aimed at understanding the basic concepts of genetics, helping students to develop their analytical, quantitative and problems solving skills from classical to molecular genetics.

Theory

Early concepts of inheritance, Mendel's laws; Discussion on Mendel's paper, Multiple alleles, Gene interactions. Sex determination, differentiation and sex-linkage, Sex-influenced and sex-limited traits; Linkage-detection, estimation; Recombination and genetic mapping in eukaryotes, Extra chromosomal inheritance.

Population - Mendelian population – Random mating population -Frequencies of genes and genotypes-Causes of change: Hardy-Weinberg equilibrium. Nature, structure and replication of the genetic material; Organization of DNA in chromosomes, Genetic code; Protein biosynthesis .Genetic fine structure analysis, Allelic complementation, Split genes, Overlapping genes, Pseudo-genes, Onco-genes, Gene families and clusters.

Regulation of gene activity in prokaryotes; Molecular mechanisms of mutation, repair and suppression; Gene regulation in eukaryotes, RNA editing. Gene isolation, synthesis and cloning, genomic and c DNA libraries.

Practical

Laboratory exercises in probability and chi-square; Demonstration of genetic principles using laboratory organisms; Chromosome mapping using three point test cross; Tetrad analysis; Induction and detection of mutations through genetic tests; DNA extraction and Electrophoresis – basic principles and running of amplified DNA - Extraction of proteins and isozymes – use of *Agrobacterium* mediated method and Biolistic gun; practical demonstrations - Detection of transgenes in the exposed plant material; visit to transgenic glasshouse and learning the practical considerations.

Suggested Readings

- Gardner EJ & Snustad DP. 1991. *Principles of Genetics*. John Wiley & Sons.
- Klug WS & Cummings MR. 2003. *Concepts of Genetics*. Peterson Edu.
- Lewin B. 2008. *Genes IX*. Jones & Bartlett Publ.
- Russell PJ. 1998. *Genetics*. The Benzamin/Cummings Publ. Co.
- Snustad DP & Simmons MJ. 2006. *Genetics*. 4th Ed. John Wiley & Sons.
- Strickberger MW. 2005. *Genetics (III Ed)*. Prentice Hall, New Delhi, India

- Tamarin RH. 1999. *Principles of Genetics*. Wm. C. Brown Publs.
- Uppal S, Yadav R, Subhadra & Saharan RP. 2005. *Practical Manual on*
- *Basic and Applied Genetics*. Dept. of Genetics, CCS HAU Hisar.

2. GPB- 502 : PRINCIPLES OF CYTOGENETICS 3(2+1)

Objective

To provide insight into structure and functions of chromosomes, chromosome mapping, polyploidy and cytogenetic aspects of crop evolution.

Theory

Architecture of chromosome in prokaryotes and eukaryotes, Chromonemata, chromosome matrix , chromomeres, centromere, secondary constriction and telomere; Artificial chromosome construction and its uses;Special types of chromosomes. Chromosomal theory of inheritance – Cell Cycle and cell division – mitosis and meiosis; Differences, significance and deviations – Synapsis, structure and function of synaptonemal complex and spindle apparatus, anaphase movement of chromosomes and crossing over-mechanisms and theories of crossing over-recombination models, cytological basis, - Variation in chromosome structure: Evolutionary significance - Introduction to techniques for karyotyping; Chromosome banding and painting - *in situ*hybridization and various applications. Structural and Numerical variations of chromosomes and their implications - Symbols and terminologies for chromosome numbers - euploidy - haploids, diploids and polyploids ; Utilization of aneuploids in gene location - Variation in chromosome behaviour ; Polyploidy and role of polyploids in crop breeding; Evolutionary advantages of autopolyploids vs allopolyploids –- Role of aneuploids in basic and applied aspects of crop breeding, their maintenance and utilization in gene mapping and gene blocks transfer – Alien addition and substitution lines – creation and utilization; Interspecific hybridization and allopolyploids; Synthesis of new crops (wheat, triticale and brassica) – Hybrids between species with same chromosome number, alien translocations - Hybrids between species with different chromosome number; Gene transfer using amphidiploids – Bridge species.

Practical

Learning the cytogenetics laboratory, various chemicals to be used for fixation, dehydration, embedding, staining, cleaning etc. - Microscopy: various types of microscopes, - Observing sections of specimen using Electron microscope; Preparing specimen for observation – Fixative preparation and fixing specimen for light microscopy studies in cereals - Studies on the course of mitosis in wheat, pearl millet - Studies on the course of mitosis in onion and *Aloe vera* - Studies on the course of meiosis in cereals, millets and pulses - Studies on the course of meiosis in oilseeds and forage crops - Using micrometers and studying the pollen grain size in various crops - Various methods of staining and preparation of temporary and permanent slides - Pollen germination *in vivo* and *in vitro;* Microtomy and steps in microtomy; Agents employed for the induction of various ploidy levels; Solution preparation and application at seed, seedling level - Identification of polyploids in different crops - Induction and identification of haploids; Anther culture and Ovule culture.

Suggested Readings

- Becker K & Hardin. 2004. *The World of Cell*. 5th Ed. Pearson Edu.
- Carroll M. 1989. *Organelles*. The Guilford Press.
- Charles B. 1993. *Discussions in Cytogenetics*. Prentice Hall.
- Darlington CD & La Cour LF. 1969. *The Handling of Chromosomes*.
- Georger Allen & Unwin Ltd.
- Elgin SCR. 1995. *Chromatin Structure and Gene Expression*. IRL Press.
- Gray P. 1954. *The Mirotomist's Formulatory Guide*. The Blakiston Co.
- Gupta PK & Tsuchiya T. 1991. *Chromosome Engineering in Plants:Genetics, Breeding and Evolution*. Part A. Elsevier.

- Gupta PK. 2000. *Cytogenetics*. Rastogi Publ.
- Johannson DA. 1975. *Plant Microtechnique*. McGraw Hill.
- Karp G. 1996. *Cell and Molecular Biology: Concepts and Experiments*.John Wiley & Sons.
- Khush GS. 1973. *Cytogenetics of Aneuploids*. Academic Press.
- Sharma AK & Sharma A. 1988. *Chromosome Techniques: Theory and Practice*. Butterworth.
- Sumner AT. 1982. *Chromosome Banding*. Unwin Hyman Publ.
- Swanson CP. 1960. *Cytology and Cytogenetics*. Macmillan & Co.

3. GPB- 503: PRINCIPLES OF PLANT BREEDING 3(2+1)

Objective

To impart theoretical knowledge and practical skills about plant breeding objectives, modes of reproduction and genetic consequences, breeding methods for crop improvement.

Theory

History of Plant Breeding (Pre and post-Mendelian era); Objectives of plant breeding, characteristics improved by plant breeding; Patterns of Evolution in Crop Plants- Centres of Origin-biodiversity and its significance. Genetic basis of breeding self- and cross - pollinated crops including mating systems and response to selection - nature of variability, components of variation; Heritability and genetic advance, genotype-environment Interaction ; General and specific combining ability; Types of gene actions and implications in plant breeding; Plant introduction and role of plant genetic resources in plant breeding. Self-incompatibility and male sterility in crop plants and their commercial exploitation. Pure line theory, pure line selection and mass selection methods; Line breeding, pedigree, bulk, backcross, single seed descent and multiline method; Population breeding in self-pollinated crops (diallel selective mating approach). Breeding methods in cross pollinated crops; Population breeding-mass selection and ear-to-row methods; S1 and S2 progeny testing, progeny selection schemes, recurrent selection schemes for intra and inter-population improvement and development of synthetics and composites; Hybrid breeding - genetical and physiological basis of heterosis and inbreeding, production of inbreds, breeding approaches for improvement of inbreds, predicting hybrid performance; seed production of hybrid and their parent varieties/inbreds. Breeding methods in asexually/clonally propagated crops, clonal selection apomixes, clonal selection Self-incompatibility and male sterility in crop plants and their commercial exploitation; Concept of plant ideotype and its role in crop improvement; Transgressive breeding. Special breeding techniques-Mutation breeding; Breeding for abiotic and biotic stresses. Cultivar development- testing, release and notification, maintenance breeding, Participatory Plant Breeding, Plant breeders' rights and regulations for plant variety protection and farmers rights.

Practical

Floral biology in self and cross pollinated species, selfing and crossing techniques. Selection methods in segregating populations and evaluation of breeding material; Analysis of variance (ANOVA); Estimation of heritability and genetic advance; Maintenance of experimental records; Learning techniques in hybrid seed production using male-sterility in field crops.

Suggested Readings

- Allard RW. 1981. *Principles of Plant Breeding*. John Wiley & Sons.
- Chopra VL. 2001. *Breeding Field Crops*. Oxford & IBH.
- Chopra VL. 2004. *Plant Breeding*. Oxford & IBH.
- Gupta SK. 2005. *Practical Plant Breeding*. Agribios.
- Pohlman JM & Bothakur DN. 1972. *Breeding Asian Field Crops*. Oxford & IBH.
- Roy D. 2003. *Plant Breeding, Analysis and Exploitation of Variation*. Narosa Publ. House.

- Sharma JR. 2001. *Principles and Practice of Plant Breeding*. Tata McGraw-Hill.
- Simmonds NW. 1990. *Principles of Crop Improvement*. English Language Book Society.
- Singh BD. 2006. *Plant Breeding*. Kalyani.
- Singh P. 2002. *Objective Genetics and Plant Breeding*. Kalyani.
- Singh P. 2006. *Essentials of Plant Breeding*. Kalyani.
- Singh S & Pawar IS. 2006. *Genetic Bases and Methods of Plant Breeding*. CBS.

4- GPB -504: PRINCIPLES OF QUANTITATIVE GENETICS 3(2+1)

Objective

To impart theoretical knowledge and computation skills regarding component of variation and variances, scales, mating designs and gene effects.

Theory

Mendelian traits *vs* polygenic traits - nature of quantitative traits and its inheritance - Multiple factor hypothesis - analysis of continuous variation; Variations associated with polygenic traits - phenotypic, genotypic and environmental - non-allelic interactions; Nature of gene action - additive, dominance, epistatic and linkage effects. Principles of Anaylis of Variance (ANOVA) - Expected variance components, random and fixed models; MANOVA, biplot analysis; Comparison of means and variances for significance. Designs for plant breeding experiments – principles and applications; Genetic diversity analysis – metroglyph, cluster and D2 analyses - Association analysis - phenotypic and genotypic correlations; Path analysis and Parent - progeny regression analysis; Discriminant function and principal component analyses; Selection indices - selection of parents; Simultaneous selection models- concepts of selection - heritability and genetic advance. Generation mean analysis; Mating designs- Diallel, partial diallel, line x tester analysis, NCDs and TTC; Concepts of combining ability and gene action; Analysis of genotype x environment interaction - adaptability and stability; Models for GxE analysis and stability parameters; AMMI analysis – principles and interpretation.

Practical

Problems on multiple factors inheritance - Partitioning of variance - Estimation of heritability and genetic advance - Covariance analysis - Metroglyph analysis - D2 analysis - Grouping of clusters and interpretation - Cluster analysis - Construction of cluster diagrams and dendrograms - interpretation - Correlation analysis - Path analysis - Parent-progeny regression analysis - Diallel analysis: Griffing's methods I and II – Diallel analysis: Hayman's graphical approach - Diallel analysis: interpretation of results - NCD and their interpretations - Line x tester analysis and interpretation of results - Estimation of heterosis : standard, mid-parental and better-parental heterosis - Estimation of inbreeding depression - Generation mean analysis: Analytical part and Interpretation – Estimation of different types of gene actions. Partitioning of phenotypic variance and co-variance into components due to genotypes, environment and genotype x environment interactions .

Suggested Readings

- Bos I & Caligari P. 1995. *Selection Methods in Plant Breeding*. Chapman & Hall.
- Falconer DS & Mackay J. 1998. *Introduction to Quantitative Genetics*. Longman.
- Mather K & Jinks JL. 1971. *Biometrical Genetics*. Chapman & Hall.
- Mather K & Jinks JL. 1983. *Introduction to Biometrical Genetics*. Chapman & Hall.
- Nadarajan N & Gunasekaran M. 2005. *Quantitative Genetics and Biometrical Techniques in Plant*
    - *Breeding* Kalyani.
- Naryanan SS & Singh P. 2007. *Biometrical Techniques in Plant Breeding. Kalyani.*
- Singh P & Narayanan SS. 1993. *Biometrical Techniques in Plant Breeding*. Kalyani.
- Singh RK & Choudhary BD. 1987. *Biometrical Methods in Quantitative Genetics*. Kalyani.
- Weir DS. 1990. *Genetic Data Analysis. Methods for Discrete Population Genetic Data*. Sinauer Associates.

- Wricke G & Weber WE. 1986. *Quantitative Genetics and Selection inPlant Breeding*. Walter de Gruyter.

5. GPB- 508: CELL BIOLOGY AND MOLECULAR GENETICS 3(2+1)

Objective

To impart knowledge in theory and practice about cell structure, organelles and their functions, molecules like proteins and nucleic acids.

Theory

Ultrastructure of the cell; Differences between eukaryotic and prokaryotic cells, macromolecules; Structure and function of cell wall, nuclear membrane and plasma membrane; Cellular Organelles – nucleus, plastidschloro/ chromoplast, mitochondria endoplasmic reticulum, Golgi complex, lysosomes, peroxisomes.Bioenergetics; Ultrastructure and function of mitochondria and biologicalmembranes; Chloroplast and other photosynthetic organelles; Interphasenucleus- Structure and chemical composition; Cell division and physiologyof cell division. Transposable elements; Mechanisms of recombination in prokaryote; DNA organization in eukaryotic chromosomes – DNA content variation, types of DNA sequences – Unique and repetitive sequences; organelle genomes; Gene amplification and its significance; Proteomics and protein-protein interaction; Signal transduction; Genes in development; Cancer and cell aging.

Practical

Morphological and Gram staining of natural bacteria; Cultivation of bacteria in synthetic medium; Determination of growth rate and doubling time of bacterial cells in culture; Demonstration of bacteriophage by plaque assay method; Determination of soluble protein content in a bacterial culture.Isolation, purification and raising clonal population of a bacterium; Biological assay of bacteriophage and determination of phage population in lysate; Study of lytic cycle of bacteriophage by one step growth experiment; determination of latent period and burst size of phages per cell; Quantitative estimation of DNA, RNA and protein in an organism; Numericals: problems and assignments.

Suggested Readings

- Bruce A.2004. *Essential Cell Biology*. Garland.
- Karp G.2004. *Cell and Molecular Biology: Concepts and Experiments*. John Wiley.
- Klug WS & Cummings MR 2003. *Concepts of Genetics*. Scot, Foreman & Co.
- Lewin B. 2008. *IX Genes*. John Wiley & Sons
- Lodish H, Berk A & Zipursky SL. 2004. *Molecular Cell Biology*. 5th Ed. WH Freeman.
- Nelson DL & Cox MM. 2005. *Lehninger's Principles of Biochemistry*. WH Freeman & Co.
- Russell PJ. 1996. *Essential Genetics*. Blackwell Scientific Publ.
- Schleif R.1986. *Genetics and Molecular Biology*. Addison-Wesley Publ. Co.

6- GPB- 509: BIOTECHNOLOGY FOR CROP IMPROVEMENT 3(2+1)

Objective

To impart knowledge and practical skills to use biotechnological tools in crop improvement.

Theory

Biotechnology and its relevance in agriculture; Definitions, terminologies and scope in plant breeding. Tissue culture- History, callus, suspension cultures, cloning; Regeneration; Somatic embryogenesis; Anther culture; somatic hybridization techniques; Meristem, ovary and embryo culture; cryopreservation. Techniques of DNA isolation, quantification and analysis; Genotyping; Sequencing techniques; Vectors, vector preparation and cloning, Biochemical and Molecular markers: morphological, biochemical and DNA-based markers (RFLP, RAPD, AFLP, SSR,SNPs, ESTs etc.), mapping populations (F2s, back crosses, RILs, NILs and DH). Molecular mapping and tagging of agronomically important traits. Statistical tools in marker analysis, Marker-assisted

selection for qualitative and quantitative traits; QTLs analysis in crop plants, Gene pyramiding Genomics and geoinformatics for crop improvement; Integrating functional genomics ,information on agronomically/economically important traits in plant breeding; Marker-assisted backcross breeding for rapid introgression, Generation of EDVs. Recombinant DNA technology, transgenes, method of transformation, selectable markers and clean transformation techniques, vector-mediated gene transfer, physical methods of gene transfer. Production of transgenic plants in various field crops: cotton, wheat, maize, rice, soybean, oilseeds, sugarcane etc. Commercial releases. Biotechnology applications in male sterility/hybrid breeding, molecular farming. GMOs and related issues (risk and regulations); GMO; International regulations, biosafety issues of GMOs.

Practical

Requirements for plant tissue culture laboratory-Techniques in plant tissue culture - Media components and media preparation -Aseptic manipulation of various explants ; observations on the contaminants occurring in media – interpretations - Inoculation of explants; Callus induction and plant regeneration - Plant regeneration; Standardizing the protocols for regeneration; Hardening of regenerated plants; Establishing a greenhouse and hardening procedures - Visit to commercial micropropagation unit. Transformation using *Agrobacterium* strains, GUS assay in transformed cells / tissues. DNA isolation, DNA purity and quantification tests, gel electrophoresis of proteins and isozymes, PCR-based DNA markers, gel scoring and data analysis for tagging and phylogenetic relationship, construction of genetic linkage maps using computer software.

Suggested Readings

- Chopra VL & Nasim A. 1990. *Genetic Engineering and Biotechnology: Concepts, Methods and Applications*. Oxford & IBH.
- Gupta PK. 1997. *Elements of Biotechnology*. Rastogi Publ.
- Hackett PB, Fuchs JA & Messing JW. 1988. *An Introduction to Recombinant DNA Technology - Basic*
- *Experiments in Gene Manipulation.* 2nd Ed. Benjamin Publ. Co.
- Sambrook J & Russel D. 2001. *Molecular Cloning* - a Laboratory Manual. 3rd Ed. Cold Spring Harbor Lab. Press.
- Singh BD. 2005. *Biotechnology, Expanding Horizons*. Kalyani.

7. GPB -510: BREEDING FOR BIOTIC AND ABIOTIC STRESS RESISTANC 3(2+1)

Objective

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

Theory

Importance of plant breeding with special reference to biotic and abiotic stress resistance; Classification of biotic stresses – major pests and diseases of economically important crops - Concepts in insect and pathogen resistance; Analysis and inheritance of resistance variation; Host defence responses to pathogen invasions-Biochemical and molecular mechanisms; Acquired and induced immunity and systemic acquired resistance (SAR); Host-pathogen interaction, gene-for-gene hypothesis. Types and genetic mechanisms of resistance to biotic stresses –Horizontal and vertical resistance in crop plants. Phenotypic screening methods for major pests and diseases; Recording of observations. Classification of abiotic stresses - Stress inducing factors –moisture stress/drought and water logging & submergence; Acidity, salinity/alkalinity/sodicity; High/low temperature, wind, etc. Stress due to soil factors and mineral toxicity; Physiological and Phenological responses; Emphasis of abiotic stresses in developing breeding methodologies.

Genetics of abiotic stress resistance; Genes and genomics in breeding cultivars suitable to low water regimes and water logging & submergence, high and low/freezing temperatures; Utilizing MAS procedures for identifying

resistant types in important crops like rice, sorghum, wheat, cotton etc.. Exploitation of wild relatives as a source of resistance to biotic and abiotic factors in major field crops - Transgenics in management of biotic and abiotic stresses, use of toxins, protease inhibitors, lectins, chitnases and Bt for diseases and insect pest management- Achievements.

Practical

Phenotypic screening techniques for sucking pests and chewing pests. Traits to be observed at plant and insect level - Phenotypic screening techniques for nematodes and borers; Ways of combating them; Breeding strategies - Weeds – ecological, environmental impacts on the crops; Breeding for herbicide resistance - Evaluating the available populations like RIL, NIL etc. for pest resistance; Use of standard MAS procedures - Phenotypic screening methods for diseases caused by fungi and bacteria; Symptoms and data recording; use of MAS procedures - Screening forage crops for resistance to sewage water and tannery effluents; Quality parameters evaluation - Screening crops for drought and flood resistance; factors to be considered and breeding strategies - Screening varieties of major crops for acidity and alkalinity- their effects and breeding strategies; Understanding the climatological parameters and predisposal of biotic and abiotic stress factors- ways of combating them.

Suggested Readings

Blum A. 1988. *Plant Breeding for Stress Environments*. CRC Press.
Christiansen MN & Lewis CF. 1982. *Breeding Plants for Less Favourable Environments*. Wiley International.
Fritz RS & Simms EL. (Eds.). 1992. *Plant Resistance to Herbivores and Pathogens: Ecology, Evolution and Genetics*. The University of Chicago Press.
Li PH & Sakai A. 1987. *Plant Cold Hardiness*. Liss, New York
Luginpill P. 1969. *Developing Resistant Plants - The Ideal Method of Controlling Insects*. USDA, ARS, Washington DC.
Maxwell FG & Jennings PR. (Eds.). 1980. *Breeding Plants Resistant to Insects*. John Wiley & Sons.
Painter RH. 1951. *Insect Resistance in Crop Plants*. MacMillan, New York.
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8. GPB -511: BREEDING CEREALS, FORAGES AND SUGARCANE 3(2+1)

Objective

To provide insight into recent advances in improvement of cereals and forage crops and sugarcane using conventional and modern biotechnological approaches.

Theory

Rice: Evolution and distribution of species and forms - wild relatives and germplasm; Genetics – cytogenetics and genome relationship – Breeding objectives- yield, quality characters, Hybrid rice breeding- potential and outcome - Aerobic rice, its implications and drought resistance breeding.

Wheat: Evolution and distribution of species and forms - wild relatives and germplasm; cytogenetics and genome relationship; Breeding objectivesyield, quality characters, exploitation of heterosis etc; Sorghum: Evolution and distribution of species and forms - wild relatives and germplasm - cytogenetics and genome relationship - Breeding objectives- yield, quality characters, Pearl millet: Evolution and distribution of species and forms - wild relatives and germplasm; Cytogenetics and genome relationship; Breeding objectives- yield, quality characters.

Maize: Evolution and distribution of species and forms - wild relatives and germplasm; Cytogenetics and genome relationship; Breeding objectives: yield, quality characters. QPM and Bt maize – strategies and implications. Sugarcane: Evolution and distribution of species and forms - wild relatives and germplasm; Cytogenetics and genome relationship – Breeding objectives- yield, quality characters. Forage grasses: Evolution and distribution of species and forms – Wild relatives and germplasm; Cytogenetics and genome relationship; Breeding objectives- yield, quality characters and palatability studies; synthetics, composites and apomixes. Forage legumes: Evolution and distribution of species and forms; Wild relatives and germplasm; Cytogenetics and genome relationship; Breeding objectives- yield, quality characters.

Practical

Floral biology – emasculation - pollination techniques ; Study of range of variation for yield and yield components – Study of segregating populations and their evaluation - Trait based screening for stress resistance in crops of importance– Use of descriptors for cataloguing Germplasm maintenance; learning on the Standard Evaluation System (SES) and descriptors; Use of softwares for database management and retrieval.Practical learning on the cultivation of fodder crop species on sewage water; analysing them for yield components and palatability; Laboratory analysis of forage crops for crude protein, digestibility percent and other quality attributes; Visit to animal feed producing factories, learning the practice of value addition; visiting the animal husbandry unit and learning the animal experiments related with palatability and digestibility of fodder.

Suggested Readings

Agarwal RL. 1996. *Identifying Characteristics of Crop Varieties*. Oxford & IBH.

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9. GPB- 512: BREEDING LEGUMES, OILSEEDS AND FIBRE CROPS 3(2+1)

Objective

To provide insight into recent advances in improvement of legumes, oilseeds and fibre crops using conventional and modern biotechnological approaches.

Theory

Pigeonpea: Evolution and distribution of species and forms; Wild relatives and germplasm; Genetics, cytogenetics and genome relationship; Morphological and molecular descriptors used for differentiating the accessions; Breeding objectives- yield, quality characters, biotic and abiotic stress *etc* - Hybrid technology; maintenance of male sterile, fertile and restorer lines, progress made at ICRISAT and other Institutes Chickpea: Evolution and distribution of species and forms - Wild relatives and germplasm - cytogenetics and genome relationship; Breeding objectives- yield, quality characters, biotic and abiotic stress etc; Protein quality improvement; Conventional and modern plant breeding approaches, progress made - Breeding for anti nutritional factors.Other pulses: Greengram, blackgram, fieldpea, lentil, Evolution, cytogenetics and genome relationship;Learning the descriptors; Breeding objectives- yield, quality characters,biotic and abiotic stress etc; Interspecific crosses attempted and its implications, reasons for failure, ways of overcoming them. Groundnut: Evolution and distribution of species and forms; Wild relatives and germplasm; Cytogenetics and genome relationship; Pod and kernel characters; Breeding objectives- yield, quality characters, biotic and abiotic stress etc. Rapeseed and Mustard: Breeding objectives, utilization of wild relatives for yield and quality improvement, biotic and abiotic stress etc; Oil quality – characteristics in different oils; Evolution and distribution of species and forms; Wild relatives and germplasm; Genetics, cytogenetics and genome relationship. Soybean: Breeding objectives, utilization of wild relatives for yield and quality improvement, biotic and abiotic stress etc. - Oil quality – characteristics; Evolution and distribution of species and forms; Wild relatives and germplasm; Genetics, cytogenetics and genome relationship. Other oilseed crops: Sunflower, sesame, safflower, Evolution and distribution of species and forms; Wild relatives and germplasm; Cytogenetics and genome relationship; breeding objectives- yield, quality characters, biotic and abiotic stress; Sunflower: Evolution and distribution of species and forms; Wild relatives and germplasm; Cytogenetics and genome relationship, hybrid sunflower, constraints and achievements Cotton: Evolution of cotton; Breeding objectives- yield, quality characters, biotic and abiotic stress etc; Development and maintenance of male sterile lines – Hybrid development and seed production – Scenario of Bt cottons, evaluation procedures for Bt cotton. Jute: Evolution and distribution of species and forms; Wild relatives and germplasm; Cytogenetics and genome relationship; breeding objectives- yield, quality characters, biotic and abiotic stress etc;

Practical

Use of descriptors for cataloguing – Floral biology - emasculation – pollination techniques; Study of range of variation for yield and yield components - Study of segregating populations in Redgram, Greengram, Blackgram and other pulse crops; Attempting crosses between blackgram and greengram. Use of descriptors for cataloguing – Floral biology, emasculation, pollination techniques of oilseed crops like Sesame, Groundnut, Sunflower and Castor, Cotton: Use of descriptors for cataloguing – Floral biology - Learning on the crosses between different species - Cotton: Study of range of variation for yield and yield components - Study of segregating populations - evaluation - Trait based screening for stress resistance - Cotton fibre quality evaluation – conventional and modern approaches; analysing the lint samples of different species, interspecific and interracial derivatives for fibre quality and interpretation –Development and maintenance of male sterile lines Evaluation of cotton cultures of different species for insect and disease resistance – Learning the mechanisms of resistance, quantifying the resistance using various parameters; Evaluating the germplasm of cotton for yield, quality and resistance parameters – learning the procedures on development of Bt cotton - Visit to Cotton Technology Laboratory and Spinning Mills – Learning on cotton yarn production, its quality evaluation and uses.

Suggested Readings

Agarwal RL. 1996. *Identifying Characteristics of Crop Varieties*. Oxford & IBH.

Bahl PN & Salimath PM. 1996. *Genetics, Cytogenetics and Breeding of Crop Plants*. Vol. I. *Pulses and Oilseeds*. Oxford & IBH.
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10. GPB -515: MAINTENANCE BREEDING AND CONCEPTS OF VARIETY RELEASE AND SEED PRODUCTION 2(1+1)

Objective

To apprise the students about the variety deterioration and steps to maintain the purity of varieties & hybrids and principles of seed production in self & cross pollinated crops.

Theory

Variety Development and Maintenance; Definition- variety, cultivar,extant variety, essentially derived variety, independently derived variety, reference variety, farmers' variety, hybrid,and population; Variety testing, release and notification systems in India and abroad. DUS testing- DUS Descriptors for major crops; Genetic purity concept and maintenance breeding. Factors responsible for genetic deterioration of varieties - safeguards during seed production; Maintenance of varieties in self and cross-pollination crops- isolation distance; Principles of seed production; Methods of nucleus and breeder seed production. Generation system of seed multiplication - nucleus, breeders, foundation, certified, - Quality seed production technology of self and cross-pollinated crop varieties viz. cereals & millets (wheat, barley, paddy, pearlmillet, sorghum, maize); Pulses (greengram, blackgram, cowpea, pigeonpea, chickpea, fieldpea, lentil); Oilseeds (groundnut, soybean, castor, sunflower, safflower, rapeseed and mustard);Seed certification procedures; Seed laws and plant variety protection regulations in India and international systems.

Practical

Identification of suitable areas/locations for seed production; Ear-to-row method and nucleus seed production - Main characteristics of released and notified varieties, hybrids and parental lines; Identification of important weeds/objectionable weeds; Determination of isolation distance and planting ratios in different crops; Seed production techniques of varieties in different crops; Hybrid seed production technology of important crops.

Suggested Readings

Agarwal RL. 1997. *Seed Technology*. 2nd Ed. Oxford & IBH.
Chhabra AK. 2006. *Practical Manual of Floral Biology of Crop Plants*. Department of Plant Breeding. CCS HAU Hisar.
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11. . STAT- 551: Statistical Methods **3 (2+1)**

Unit-I

Summarization of data, classification and tabulation of data, Diagrammatic and Graphical Representations, utility and limitations of graphical Representation. Measure of central tendency, definition, merit, demerit, uses and properties of different measure of central tendency, measure of dispersion, moments, skewness and kurtosis.

Unit-II

Probability distribution, discrete probability distribution- Bernouli, poission, normal distribution. Theorem of addition of probability, theorem of multiplication of probability, Definition- (simple and compound events independent and dependents, mutually exclusive, complimentary events.)

Unit-III

Statistical Hypothesis, Null hypothesis, Two type of error, Statistical significance, parametric and nonparametric hypothesis, critical region, level of significance, practical application of simple test of significance viz, 't' and 'F' test. X2 test as a goodness of Fit, properties of X2 distribution, conditions for application of X2 test.

Unit-IV

Correlation and its test of significance, line of regression and its test of significance. Correlation, measurement of correlation, limit and range of „ correlation coefficient expressed in term of regression coefficients. Rank correlation and its computations, regression equation.

12. STAT-552: Experimental Designs **2 (2+0)**

Theory

Unit- I

Principles of experimental design, precision and accuracy, advantage of replication, experimental technique. Analysis of variance, fundamental principles of analysis of variance. Critical difference, limitations of the analysis of variance.

Unit- II

Statistical analysis and advantage and disadvantage of basic design-completely randomized design, randomized block design, Latin square design.

Unit- III

Factorial concept: simple effects, main effects and interaction, factorial experiments (without confounding), Yates method. Confounding, principles of confounding in a 2^3 factorial experiments. Split plot design.

Unit- IV

Missing plot technique; Bartlett's techniques for missing plots, cross-overdesign or switch-over trials, Rotational experiments, progeny selection, compact family block design, uniformity trial, sire index, sampling in field experiments.

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4. Soil Science and Agriculture Chemistry

Semester-I

Code No.	Course Title	Credit Hours
SSAC-504	Soil Mineralogy, Genesis, Classification and Survey	3(2+1)
SSAC-509	Soil, Water and Air Pollution	3(2+1)
SSAC-511	Analytical Techniques and Instrumentals Methods	2(0+2)
STAT-551	Statistical methods	3(3+0)

Semester-II

Code No.	Course Title	Credit Hours
SSAC-501	Soil Physics	3(2+1)
SSAC-502	Soil Fertility and Fertilizer Use	4(3+1)

SSAC-506	Soil Biology and Biochemistry	3(2+1)
STAT-552	Experimental Designs	2(2+0)

Semester- III

Code No.	Course Title	Credit Hours
SSAC-503	Soil Chemistry	3(2+1)
SSAC-505	Soil Erosion and Conservation	3(2+1)
SSAC-510	Remote Sensing and GIS Techniques for Soil and Crop Studies	3(2+1)

Semester - IV

Code No.	Course Title	Credit Hours
SSAC-513	Management of Problematic Soil	3(2+1)
SSAC-591	Master Seminar**	1(1+0)
SSAC-599	Thesis/ Master Research Work***	20

1.SSAC- 504:SOIL MINERALOGY,GENESIS CLASSIFICATION AND SURVEY 3(2+1)

Objective

To acquaint students with basic structure of alumino- silicate minerals and genesis of clay minerals, soil genesis in terms of factors and processes of soil formation, and to enable students conduct soil survey and interpret soil survey reports in items of land use planning

Theory

Unit-I

Fundamentals of crystallography, space lattice, coordination theory isomorphism and polymorphism

Unit-II

Classification, structure, chemical composition and properties of clay minerals , genesis and transformation of crystalline and non-crystalline clay minerals. Identification techniques, amorphous soil constituents and other non-crystalline silicate minerals and their identification, clay minerals in Indian soils.

Unit-III

Concepts and definition of soil, soil profile, formation and weathering of rocks and minerals, weathering sequences of minerals, factors of soil formation, soil forming processes.

Unit-IV

Concepts of soil individual; soil classification system –historical developments and modern systems of soil classification with special emphasis on soil taxonomy; Application of soil taxonomy

Unit-V

Soil survey and its types, soil survey techniques – conventional and modern, soil series – characterization and procedure for establishing soil series, benchmark soils and soil correlations; soil survey interpretations; soil mapping

Unit-VI

Landform- soil relationship; major soil groups of India and UP; land capability and irrigationbility classification; land evaluation and use type (LUT)- concept and application; approaches for managing soils and landscapes in the framework of agro-ecosystem.

Practical

Identification and quantification of minerals in soil fractions.Morphological properties of soil profile in different landforms.Classification of soils using soil taxonomy.Calculation of weathering indices and its application in soil

formation.Grouping soils using available data basic in terms of soil quality.Aerial photo and satellite data interpretation for soil and land use.Cartographic techniques.Land use planning exercises using conventional and R S tools

2.SSAC- 509:SOIL, WATER AND AIR POLLUTION 3(2+1)

Objective

To make the students aware of the problems of soil, water and air pollution associated with use of soils for crop production .

Theury

Unit-I

Soil, water and air pollution problems associated with agriculture, nature and extent.

Unit-II

Nature and sources of pollution –agriculture, industrial, urban wastes, fertilizers and pesticides, acid rains .oil spitls etc; air water and soil pollutants- their CPS standards and effect on plant, animals and human beings.

Unit-III

Sewage and industrial effluents – their composition and effect on soil properties health, and plant growth and human beings; soil as sink for wastes disposal.

Unit-IV

Pesticide-their classification behavior in soil and effect on soil micro-organisms

Unit-V

Toxic elements- their sources, behavior in soils, effect on nutrients availability, effect on plant and human health.

Unit-VI

Pollution of water resources due to leaching of nutrients and pesticides from soil; emission of greenhouse gases – carbon dioxide, methane and nitrous oxide.

UnitVII

Remediation /amelicration of contaminated soil and water . remote sensing applications in monitoring and management of soil and water pollution.

Practical

Sampling of sewage waters, sewage sludge, sliod/liquid industrial wasters,Polluted soil and plants. Estimation of dissolved and suspended solids, chemical oxygen demand(cod), biological demand (BOD),nitrate and ammonical nitrogen and phosphorus heavy metal content in effluents. Heavy metals and pesticides in contaminated soils and plant

3.SSAC- 511: ANALYTICAL TECHNOQUE AND INSTRUMENTAL METHODS 2 (0+2)

Objective

To familiarize the students with commonly used instruments- their working, preparations of common analytical reagents for qualitative and quantitative analysis of both soil as well as plant sample.

Practical

Unit-I

Preparation of solution for standard curves analytical reasons qualitative reagents, indicators and standard solution for acid-base oxidation reduction and complexmetric titration,soil,water and plant sampling technique their processing and handling.

Unit-II

Principles of visible, ultraviolet and infrared spectrophotometry . Atomic absorption flame-photometry, inductively coupled plasma spectrometry chromatographic techniques, mass spectrometry and X-ray defractrometery; identification of minerals by different methods,

Unit-III

Analysis of soil and plant samples for N,P,K,Ca,Mg,S,Zn,Cu,Fe,Mn,B and Mo; analysis of plant materials by digesting plant material by wet and dry ashing and soil by digestion methods.

4. STAT- 551: Statistical Methods **3 (2+1)**

Unit-I

Summarization of data, classification and tabulation of data, Diagrammatic and Graphical Representations, utility and limitations of graphical Representation. Measure of central tendency, definition, merit, demerit, uses and properties of different measure of central tendency, measure of dispersion, moments, skewness and kurtosis.

Unit-II

Probability distribution, discrete probability distribution- Bernouli, poission, normal distribution. Theorem of addition of probability, theorem of multiplication of probability, Definition- (simple and compound events independent and dependents, mutually exclusive, complimentary events.)

Unit-III

Statistical Hypothesis, Null hypothesis, Two type of error, Statistical significance, parametric and nonparametric hypothesis, critical region, level of significance, practical application of simple test of significance viz, 't' and 'F' test. X2 test as a goodness of Fit, properties of X2 distribution, conditions for application of X2 test.

Unit-IV

Correlation and its test of significance, line of regression and its test of significance. Correlation, measurement of correlation, limit and range of „ correlation coefficient expressed in term of regression coefficients. Rank correlation and its computations, regression equation.

5. SSAC- 501: SOIL PHYSICS **3(2+1)**

Objective

To impart basic knowledge about soil physical properties and processes in relation to plant growth.

T**heory**

Unit-I

Scope of soil physics and its relation with other branches of soil science soil as a three phase system.

Unit-II

Soil texture textural classes mechanical analysis specifio surface .

Unit-III

Consistence dispersion and workability of soils,. Soil compaction and Consolidutaion, soil strength, swelling and shrinkage-basic concepts.

Unit-IV

Soil structure –genesis type, characterization and management soil, Structure, soil aggregation aggregate stability soil tilth characteristics of good Soil tilth., soil crusing- mechanism, factor affecting and evaluation; soil Conditioners; puddling , its effect on soil physical properties; oled formation .

Unit-V

Soil water; content and poteatial soil water retention soil water constant measurement of soil water content energy state of soil water ,soil water potential ,soil moisture characteristics curve ,hysteresis measurement of soil – moisture potential

Unit-VI

Water flow in saturared and unsaturated soils , potseulles law dracys law , hoydrolic condectivity permeability and fluidility hydrolic diffusivity; measurement of hydraulic conductivity in saturated and unsaturated soils.

Unit-VII

Infiltration; internal drainage and redistribution ; evaporation; hydrologic cycle, field water balance; soil-plant atmosphere continuum

Unit-VIII

Composition of soil air renewal of soil air- convective flow and diffusion measurement of soil aeration ; aeration requirement for plant growth; soil air management .

Unit-IX

Modes of transfer in soils; energy balance; thermal properties of soil;Measurement of soil temperature; soil temperature in relation to plant growth; soil temperature management.

Peactical

Mechanical analysis by pipette and international methods ,.Measurement of Arterberg limits-.Aggregate analysis-dry and wet, .Measurement of soil- water content by different methods, Measurement of soil- water potential by using tensiometer and gypsum blocks, Determination of soil-moisture charecteristics curve and computation of pore- size distribution. .Determination of hydraulic conductivity under saturated and unsaturated condition..Determination of infiltration rate of soil, .Determination of aeration porosity and oxygen diffusion rate, Soil temperature measurements by different methods .Estimation of water balance components in bare and cropped fields.

6. SAAC- 502:SOIL FERTILITY AND FERTILISER USE 4 (3+1)

Objective

To impart knowledge about soil fertility and its control, and to understand the role of fertilizers and manures in supplying nutrients to plant so as to achieve high fertilizer use efficiency.

Theory

Unit-I

Soil fertility and soil and soil productivity ; nutrient sources – fertilizer and manures; essential plant nutrients – functions and deficiency symptoms.

Unit-II

Soil and fertilizer nitrogen –sources, forms , immobilization and mineralization nitrification ,denitrification; biological nitrogen fixation-type mechanism microorganisms and factor affecting, nitrogenous fertilizer and their role in soil, management of fertilizer nitrogen in low land and upland conditions for high fertile use efficiency.

Unit-III

Soil and fertilizer phosphorus –forms, immobillization mineralization ,reactions in acid and alkali soils,

Factors affecting phosphorus availability in soils, phosphate fertilizer –behavior in soils and management under field condition

Unit-IV

Potassium –forms equllibrium in soils in soils and its agricultural significance ,mechanism of potassium fixation. management of potassium fertilizer under field condition

Unit-V

Sulphur –source ,forms, fertilizer and their behavior in soils, calcium and magnesium- factors affecting their availability in soils, management of sulphur, calcium and magnesium fertilizer.

Unit-VI

Micronutrients-critical limit in soils and plants factors affecting their availability and correction of their deficiency in plants, role of elements in nutrient availability .

Unit-VII

Common soil test methods for fertilizer recommendation , quantity-intensity relationship ,soil test crop response corrilations and response functions .

Unit-VIII

Fertilizer use efficiency; blanket fertilizer recommendation _usefulness and limitations,specific nutrient management plant need based nutrient management and IPM.

Unit-IX

Soil fertility evaluation –biological methods soil plant and tissue, soil quality in relation to sustainable agriculture.

Practical

Principles of colorimetricFlame-photometry and atomic absorption spectroscopy.Chemical analysis of soil for total and available nutrients.Analysis of plants for essential eliments

7. SSAC -506: SOIL BIOLOGY AND BIOCHEMISTRY 3(2+1)

Objective

To teach the students the basics of soil biology and biochemistry , including biogeochemical cycles , plant growth promoting rhizobacteria , microbial interactions in soil and other activities.

Theory

Unit-I

Soil biota soil microbial ecology types of organisms in different soils,; soil microbial biomass ; microbial interactions; un- culturable soil biota .

Unit-II

Microbial and biochemistry of root soil interface , phyllosphere, soil enzymes, origin activites and importance; soil characteristics influencing growth and activity of microflon.

Unit-III

Microbial transformations of nitrogen. Phosphorus. Sulphur, iron and manures in soil; biochemical composition and biodegradation of soil organic matter and crop residues, Basic principle of humus formation.

Unit-IV

Biodegradation of pesticides. Organic waste and their use for production of bloms and manure biotic factors in soil development; toxins in soils.

Unit-V

Preparation of farmyard manure. Annual manures. Rural and urban composts and Vermicomposts.

Unit-VI

Biofertilizer- Definition , classification specifications, method of production and role in crop production.

Pratical

.Determination of soil microbial population , Soil microbial biomass, Elements composition ,formation of organic matter and functional groups, Decomposition of organic matter in soil and soil enzymes.

Measurment of important soil microbial processes such as ammonification,nitrification,N2 fixation,P solubllization of other micro nutrients, Study of rhizosphare effect.

8. STAT-552: EXPERIMENTAL DESIGNS 2(2+ 0)

Unit-I

Principles of experimental design, precision and accuracy, advantage of replication, experimental technique. Analysis of variance, fundamental principles of analysis of variance. Critical difference, limitations of the analysis of variance.

Unit-II

Statistical analysis and advantage and disadvantage of basic design-completely randomized design, randomized block design, Latin square design.

Unit-III

Factorial concept: simple effects, main effects and interaction, factorial experiments (without confounding), Yates method. Confounding, principles of confounding in a 23 factorial experiments. Split plot design.

Unit-IV

Missing plot technique; Bartlett's techniques for missing plots, cross-overdesign or switch-over trials, Rotational experiments, progeny selection, compact family block design, uniformity trial, sire index, sampling in field experiments.

9. SSAC-503: SOIL CHEMISTRY 4Crs 4(3+1)

Objective

To introduce the classical concepts of soil chemistry and to familiarize students with modern developments in chemistry of soils in relation to using soils as a medium for plant growth.

Theory

Unit-I

Chemical composition of the earths crust and soils.

Unit-II

Elements of equilibrium thermodynamics, chemical equilibrium electrochemistry and chemical kinetics.

Unit-III

Soil colloids inorganic and organic colloids –origin of charge, concept of point of zero- charge (PZC) and its dependence o variable charge characteristics of soils; diffuse double layer theories of soil colloids, zeta potential, stability, coagulation/flocculation and peptization of soil colloids; electrometric properties of soil colloids; properties of soil colloids; clay-organic interactions.

Unit-IV

Ion exchange processes in soils; cation exchange theories based on law of mass action (Kerr-Vanselow,Gapon equation, hysterosis, Jennys concept), adsorption isotherms, doman-membrane equilibrium concept, ionic activity measurement, thermodynamic, anion and ligand exchange-inner sphere and outer-sphere surface complex formation, fixation of oxyanions, hysterosis in sorption-desorption of oxy-anions and anions, shift of PZC on ligand exchange, AEC, CEC; experimental methods to study ion exchange phenomena and practical implication in plant nutrition.

Unit-V

Potassium, phosphate and ammonium fixation in soils covering specific and non-specific sorption; precipitation-dissolution equilibrium step and constant-rate K management aspects.

Unit-VI

Chemistry of acid soils; active and potential acidity; lime potential, chemistry of acid soils; sub-soil acidity.

Unit-VII

Chemistry of salt affected soils and amendments; soil pH, ESP, SAR, and important relation; soil management and amendments.

Unit-VIII

Chemistry and electrochemistry of submerged soils.

Practical

Determination of CEC and AEC of soils.Analysis of equilibrium soil solution for pH, EC, Eh by the use of Eh, pH meter and conductivity meter.Determination of point of zero-charge and associated surface charge characteristics by the serial potentiometric titration method, Potentiometric and conductometric titration of soil humic and fulvic acids, Ratio of soil humic and fulvic acids by visible spectrophotometric studies and the A values at two pH values. Adsorption-desorption of phosphate/sulphate by soil using simple adsorption isotherm Construction of adsorption envelope of soils by using phosphate/fluoride/sulphate and ascertaining the mechanism of the ligand exchange process involved , Determination of titrable acidity of an acid soil by BaC12-TEA method ,Determination of lime requirement of an acid soil by buffer method, Determination of gypsum requirement of an alkali soil.

10. SSAC- 505: SOIL EROSION AND CONSERVATION 4(3+1)

Objective

To enable students to understand various types of soil erosion and measures to be taken for controlling soil erosion to conserve soil and water .

Theory

Unit-I

History, distribution, identification and description of soil erosion problems in India.

Unit-II

Forms of soil erosion; effects of soil erosion and factors affecting soil erosion; types and mechanisms of water erosion; raindrop and soil erosion; rainfall erosivlity – estimation as Elm) index and kinetic energy; factors affecting water erosion; empirical and quantitative estimation of water erosion; methods of measurement and prediction of runoff; soil losses in relation to soil properties and precipitation.

Unit-III

Wind erosion-types mechanism and factors affecting wind erosion; extent of problem in the country.

Unit-IV

Principle of erosion control, agronomical and engineering erosion control structures-their design and layout .

Unit-V

Soil conservation planning land capability classification, soil conservation in special problem areas such as hilly, arid and semi arid regions, waterlogged and wetlands.

Unit-VI

Watershed management-concept, objectives and approach, water harvesting, and recycling, flood control in watershed management, socioeconomic aspects of watershed management. case studs in respect to controlling and evaluation of watershed, use of remote sensing in assessment and planning of watersheds.

Practical

1.Determination of different soil terodibiliy Indians ,percolation ratio, raindrop erodibility index.

2.Computation of kinetic energy of falling rain drops.

3. Computation of rainfall erosivility index using rain gauge data.

4. Visits to watersheds.

11. SSAC- 510: REMOTE SENSING AND GIS-TECHNIQUES FOR SOIL WATER AND CROP STUDIES 4(3+1)

Objective

To impart knowledge about the basic concepts of remote sensing, areal photographs and imageries , and their interpretation ; application of remote sensing in general and with special reference to soil, plants and yields forecasting , to impart knowledge about geo-statistical technique with special reference to krigging , and GIS and application in Agriculture.

Theory

UNIT I Introduction and history of remote sensing ,sources propagation of radiations in atmosphere, interactions with matter.

Unit-I

Sensor systems –control microwave radiation and scanners, fundamentals of aerial photographs and image processing and interpretations.

Unit-II

Application of remote sensing techniques – land use soil surveys, crop stress and yield forecasting, prioritization in watershed and drought management ,watershed identification and management,

Unit-III

Significance and sources of the special and temporal variability in soils, variability in relation to size of sampling ,classical and geo-statistical techniques of evolution of soil variability.

Unit-IV

Introduction to GIS and its Application for special and non-special soil and land attributes.

Practical

1.Famillarization with different remote sensing equipments and data products

2. Interpretation of aerial photograph and satellite data for mapping of land resources

3. Analysis of variability of different soil properties with classical and geo-statistical techniques.

4. creation of data files in a database programmed

5. Use of GIS for soil spatial simulation and analysis

6. To enable the students to conduct soil survey and interpret soil survey report in terms of land use planning.

12. SSAC- 512:MANAGEMENT OF PROBLEMATIC SOILS AND WATERS 4(3+1)

Objective To educate students about basic concepts of problem soils and brackish water, and their management. attention will; be on management of problem soils and safe use of brackish water in relation to production.

Theory

Unit-I

Aria and distribution of problem soil –acidic ,saline and sodic soil ,origin of problematic soils ,and factors responsible.

Unit-II

Morphological features of saline , sodic and saline-sodic soils, characterization of salt affected soils-soluble salts ,ESP, pH, physical, chemical and ,microbiological properties.

Unit-III

Management of salt affected soil, salt tolerance of crops-mechanism and ratings; monitoring of soils-salinity in the field; management principle for sandy ,clayey ,red laterite and dry land soils.

Unit-IV

Acid soils- nature of soil acidity , sources of soil acidity; effect on plant growth lime requirement of acids soil; management of acid soils biological stckness of soils and its managements.UNIT V

Quality of irrigation water ;management of brackish water for irrigation; characterization of brackish water ; relationship in water use and quality.

Unit-Unit-V

Agronomic practices in relation to problematic soils; cropping pattern for utilizing poor quality ground water.

Practical

1. characterization of acid , acid sulfate, salt affected and calcareous soil.

2. determination of cations (Na+ ,K+ ,Ca++ and Mg++) in ground water and soil sample.

3. determination of anions (Cl ,SO4 ,CO3 and HCO3) in ground water and soil sample.

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5. Entomology

Semester- I

Code No	Course Title	Credit Hours
ENT-501	INSECT MORPHOLOGY	2 (1+1)
ENT-502	INSECT ANATOMY, PHYSIOLOGY &NUTRITION	3 (2+1)
ENT-504	CLASSIFICATIOB OF INSECT	3 (2+1)
ENT-505	INSECT ECOLOGY	2 (1+1)
STAT-551	STATISTICAL METHODS	3(3+0)

Semester- II

Code No	Course Title	Credit Hours
ENT-507	BIOLOGICAL CONTROL OF CROP PEST& WEEDS	3 (2+1)
ENT-508	TOXICOLOGY OF INSECTICIDES	3 (2+1)

ENT-511	PEST OF FIELD CROPS	3 (2+1)
STAT-552	EXPERIMENTAL DESIGN	2(2+0)

Semester- III

Code No	Course Title	Credit Hours
ENT-509	PLANT RESISTANCE TO INSECT	2 (1+1)
ENT-510	PRINCIPLES OF INTEGRATED PEST MANAGEMENT	3 (2+1)
ENT-5013	STORAGE ENTOMOLOGY	2 (1+1)

Semester- IV

Code No	Course Title	Credit Hours
ENT-518	TECHNIQUES IN PLANT PROTECTION	1 (0+1)
ENT-519	COMMERCIAL ENTOMOLOGY	2 (1+1)
ENT-591	MASTER SEMINAR **	1 (1+0)
ENT-599	THESIS/ MASTER RESEARCH WORK***	2 0

1. ENT-501: INSECT MORPHOLOGY 2(1+1)

Theory

Principles, utility and relevance: Intetument- structure, outgrowths, colouration, appendages and function.Head- Origin, structure and modification; types of mouthparts and antennae, tentorium and neck sclerites. Thorax- sclerites, sutures, ridges, areas of tergum, sternum and pleuron, pterothorax; Wings: structure and modifications, venation, wing coupling apparatus. Legs: structure and modifications. Abdomen-Segmentation and appendages; Genitalia and their modifications; Embryonic and post-embryonic development; Types of metamorphosis.

Practical

Preparation of permanent and temporary mounts/ slides, integumentry outgrowth. General morpholpgy of grass hopper. Head- sclerites, sutures, areas, types, tentorium, types of antenna, mouth parts and their modifications, grasshopper, honeybee, red cotton bug, housefly. Thorax sclerites, wings- types and venation, wing coupling. Legs- types. Abdomen- genitalia, post embryonic development.

2. ENT- 502: INSECT ANATOMY, PHYSIOLOGY AND NUTRITION 3(2+1)

Theory

Scope and importance of insect anatomy and physiology. Anatomy and physiology of digestive, circulatory, respiratory, excretory, nervous, endocrine and reproductive systems. Metabolism of carbohydrates, lipids nitrogenous compounds. Insect nutrition-importance of insect nutrition of phytophagous insect, stored grain insect and beneficial insect. Role of vitamins, proteins, amino acids, carbohydrates, lipids, minerals and other food constituents of insect nutrition. Extra and intra cellular micro-orgnisms and their role in physiology. Sensory organs and insect behaviours.

Practical

Dissection of insects to study comparative modification in different systems of grasshopper bugs,flies,bees.Experiment to study gas exchange, specific gravity and voloume of hemolymph excretory efficiency and excretory products and digestibility. Formulation and preparation of artificial diets for rearing insects.

3. ENT-504:CLASSIFICATIONOFINSECTS 3(2+1)

Theory

Brief evolutionary history of Insects- introduction to phylogeny of insects and Major Classification of Superclass Hexapoda – Classes - Diplura and Insecta- Orders contained. Distinguishing characters, of Insect orders and economically important families contained in them. Collembola, Protura, Diplura. Class Insecta: Subclass

Apterygota – Archaeognatha, Thysanura. Subclass: Pterygota, Division Palaeoptera – Odonata and Ephemeroptera. Division: Neoptera: Subdivision: Orthopteroid and Blattoid Orders (Plecoptera, Blattodea, Isoptera, Mantodea, Grylloblattodea, Dermaptera, Orthoptera, Phasmatodea, Mantophasmatodea, Embioptera, Zoraptera), Subdivision: Hemipteroid Orders Psocoptera, Thysanoptera and Hemiptera Distinguishing characters, of Insect orders and economically important families contained in them (Continued). Division Neoptera – Subdivision Endopterygota, Section Neuropteroid- Coleopteroid Orders: Strepsiptera, Megaloptera, Raphidioptera, Neuroptera and Coleoptera, Section Panorpoid Orders Mecoptera, Siphonaptera, Diptera, Trichoptera, Lepidoptera, and Section Hymenopteroid Orders: Hymenoptera.

Practical

Study of Orders of insects and their identification.Keying out families of insects of different major Orders: Odonata, Orthoptera, Mantodea, Isoptera, Hemiptera, Thysanoptera, Neuroptera, Coleoptera, Diptera, Lepidoptera and Hymenoptera. Field visits to collect insects of different orders.

4. ENT- 505: INSECT ECOLOGY 2(1+1)

Theory

Basic concepts-Population and enviornment. Population regulation-natural control and current theories. Characteristics of population. Biotic potential and environmental resistance. Stable age distribution. Population dynamics. Dispersal and migration. Diapause hibernation and aestivation. Effect of environmental factor on distribution and abundance of insect. Food chain and ecological succession. Ecological indicator.

Practical

Measurement of microenvironment. Concept of life table and construction of life tables. modeling, estimates of population density, sampling methods and plans, estimation of dispersal and migration.

5. ENT-507:BIOLOGICAL CONTROL OF CROPPESTSANDWEEDS 3(2+1)

Theory

The philosophy, scope, history, and importance of biological control. important groups of parasitoids, predators and pathogens; principles of classical biological control- importation, augmentation and conservation. Theoretical and empirical basis of biological control. Parasitism and predatism. Important parasitic and predatory groups of insects and insect pathogens. Ecological basis of biological control. Introduction, culture, establishment and management of natural enemy population. Biological control of weeds. Role of natural enemies in integrated pest management. Microbial pesticide.

Practical

Identification of common natural enemies of crop pests (parasitoids, predators, microbes) and weeds. Rearing of egg, egg-larval, larval, larval-pupal and pupal parasitoids, common predators, microbes and their laboratory hosts, phytophagous natural enemies of weeds. Field collection of parasitoids and predators. Hands-on training in culturing, identification of common insect pathogens.

6. ENT - 508:TOXICOLOGY OF INSECTICIDES 3(2+1)

Theory

History and principles of toxicology. Classification of insecticides and based on mode of entry, mode of action and chemical nature. Structure activity relationship. Metabolism and toxicity, synergism, antagonism systemic and selective insecticides. Insect resistance to insecticides; insecticide residue-their significance .Analysis of environmental implications. Diagnosis and treatment of insecticide poisoning. Plant products .Development of new insecticides, formulations, mixtures. Application techniques. Insecticide Act, safe use of insecticides

Practical

Insecticide formulations and mixtures standerd concentration of insecticide. bioassay techniques. evaluation of insecticide toxicity and joint action. Compatibility of pesticide, Phytotoxicity Toxicity to beneficial insects. Pesticide appliances.

7. ENT-509:PLANTRESISTANCETOINSECTS 2(1+1)

Theory

History and importance of resistance, principles, classification, components, types and mechanisms of resistance. Insect-host plant relationships; theories and basis of host plant selection in phytophagous insects. Factors affecting plant resistance including biotypes and measures to combat them. Screening techniques; breeding for insect resistance in crop plants; exploitation of wild plant species; gene transfer, successful examples of resistant crop varieties in India and world. Role of biotechnology in plant resistance to insects.

Practical

Screening techniques for measuring resistance; measurement of plant characters and working out their correlations with plant resistance; testing of resistance in important crops; bioassay of plant extracts of susceptible/resistant varieties; demonstration of antibiosis, tolerance and antixenosis.

8. ENT- 510:PRINCIPLES OF INTEGRATED PEST MANAGEMENT 3 (2+1)

Theory

The concept and History of pest management. Tools of pest management. Ecological and socio-economic aspects, costs/benefit and risk/benefit ratio. Cultural, biological, chemical, genetic, legal and other control tactics and their integration for the pest management. sampling and measuring the economic level of damage, economic injury level, economic threshold. Analysis and modeling for the pest management and case histories. Pest management in major crops. Integration of IPM option in integrated farming system and sustainable agriculture.

Practical

Study the flora and fauna in different crop habitats. Calculation of diversity index and economic threshold. Demonstration of IPM technology in field crops.

9. ENT - 511:INSECT PESTS OF FIELD CROPS 3 (2+1)

Theory

Systematic position, identification, distribution, host-range, nature of damage, life and seasonal history, natural enemies and management strategies of insect pest of cereals crop (Paddy,Wheat,Barley),Millets(Maize,Sorghum,Bajra),Fiber crop (Cotton ,jute, Sunhemp), Oilseed (Groundnut ,Brassica crops,Sesame,Linseed and sunflower),Pulses (Pigeonpea, Chikpea, Pea, Lentil, Mung, Urd) and Sugercane.

Practical

Field visits, collection and identification of important pests and their natural enemies; detection and estimation of infestation and losses in different crops; study of life history of important insect pests. Study of life cycle of two insect-pest one each from hemi and holometabolous group.

10. ENT-513: STORAGEENTOMOLOGY 2(1+1)

Theory

Storage losses (seed and food) due to insect , mites ,rodents, birds, moulds. Source of infestation. Biology of major stored grain pest. Significance of temperature and moisture migration in the development of mould and insect population. biochemical changes due to stored commodities due to pest infestation.Principle of safe grain

storage. Storage structures, and warehouse management. Management and safe use of pesticide in stored commodities, Prevention of seeds on long term basis,seed and seed health laws, quarantine laws. Radiation protection of stored grain and seed.

Practical

Collection, identification of pest and stored commodities and their damage. Detection of insect infestation in storage losses. estimation of losses in stored food grains; determination of moisture content in stored food grains. Study of different storage structure..

11. ENT-518: TECHNIQUES IN PLANT PROTECTION 1(0+1)

Practical

Pest control equipments, principles, operation, maintenance, selection, application of pesticides and bio-control agents, seed dressing, soaking, root-dip treatment, dusting, spraying, application through irrigation water. Soil sterilization, solarization, deep ploughing, flooding, techniques to check the spread of pests through seed, bulbs, corms, cuttings and cut flowers. Use of light, transmission. Forcasting pest attack and identification.

12. ENT-519: COMMERCIAL ENTOMOLOGY 2(1+1)

Theory

Bee keeping- General colony management during different seasons. Seasonal management. Managing colonies for honey production and pollination. Artificial queen rearing. Pests and diseases of honey bees. Bee poisoning. Production and marketing of quality honey and value added honey products. Establishment and maintenance of apiaries.

Silkworm

History, Development and organization of silk industry. Study of different species of silkworms, characteristic features, moriculture, silk and its uses, pests and diseases of silkworms, rearing and management of silkworms. Predator and parasitoid of silkworm and their management.

Lac insect

Cultivation of Lac, natural enemies, Lac processing, production technology and their management. Lac based products.

Practical

Identification of honey bee species, identification and handling of bee-keeping equipments, bee seasonal management,colony multiplication, queen rearing, control of bee enemies and diseases ,production. Identification of mulberry and non –mulberry silkworms. Rearing of mulberry silkworm, identification of various disease, Predator and parasitoid of silkworm. Identification life stages of different lac insects.Life history of lac insect.Techniques for preparing seed lac,care and maintinance of host of lac insect.Identification of natural enemies of lac insect and maintinance of host of lac insect.

13. STAT- 551: Statistical Methods 3 (2+1)

Unit-I

Summarization of data, classification and tabulation of data, Diagrammatic and Graphical Representations, utility and limitations of graphical Representation. Measure of central tendency, definition, merit, demerit, uses and properties of different measure of central tendency, measure of dispersion, moments, skewness and kurtosis.

Unit-II

Probability distribution, discrete probability distribution- Bernouli, poission, normal distribution. Theorem of addition of probability, theorem of multiplication of probability, Definition- (simple and compound events independent and dependents, mutually exclusive, complimentary events.)

Unit-III

Statistical Hypothesis, Null hypothesis, Two type of error, Statistical significance, parametric and nonparametric hypothesis, critical region, level of significance, practical application of simple test of significance viz, 't' and 'F' test. X2 test as a goodness of Fit, properties of X2 distribution, conditions for application of X2 test.

Unit-IV

Correlation and its test of significance, line of regression and its test of significance. Correlation, measurement of correlation, limit and range of „ correlation coefficient expressed in term of regression coefficients. Rank correlation and its computations, regression equation.

14. STAT-552: Experimental Designs 2 (2+0)

Theory

Unit- I

Principles of experimental design, precision and accuracy, advantage of replication, experimental technique. Analysis of variance, fundamental principles of analysis of variance. Critical difference, limitations of the analysis of variance.

Unit- II

Statistical analysis and advantage and disadvantage of basic design-completely randomized design, randomized block design, Latin square design.

Unit- III

Factorial concept: simple effects, main effects and interaction, factorial experiments (without confounding), Yates method. Confounding, principles of confounding in a 2^3 factorial experiments. Split plot design.

Unit- IV

Missing plot technique; Bartlett's techniques for missing plots, cross-overdesign or switch-over trials, Rotational experiments, progeny selection, compact family block design, uniformity trial, sire index, sampling in field experiments.

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6. Plant Pathology

Semester- I

Code No	Course Title	Credit Hours
PPA 501	Mycology I	3 (2+1)
PPA 502	Mycology II	3 (2+1)
PPA 503	Introductory Bacteriology	3 (2+1)
STAT 551	Statistical Methods	3(3+0)

Semester- II

Code No	Course Title	Credit Hours
PPA 504	Principle of Plant Pathology	3 (2+1)
PPA 505	Introductory Virology	3 (2+1)
PPA 506	Disease of Field Crop	3 (2+1)
PPA 507	Plant Pathological Technique	2(1+1)

Semester- III

Code No	Course Title	Credit Hours
PPA 508	Diseases of Fruits & Vegetable Crops	3 (2+1)
PPA 509	Plant Disease Management	3 (2+1)
PPA 510	Seed Pathology	3 (2+1)

Semester- IV

Code No	Course Title	Credit Hours
PPA 511	Mushroom Production Technology	2 (1+1)
PPA 591	MASTER SEMINAR **	1 (1+0)
PPA 599	THESIS/ MASTER RESEARCH WORK***	20

1. PPA-501:MYCOLOGY- I 3(2+1)

Theory

Introduction - Milestones in mycology, General characteristics and classification of Protists Plasmodiophora, Dictyostelium and life cycles of typical Myxomycetes, Asco and Basidio-lichens. Fungal genetics, sexuality and variability in fungi. General characteristics and classification of kingdom Straminopila with special emphasis of life cycle of following of genera-Pythium, *Phytoph- thora, Albugo, Peronospora, Achlya* and *Saprolegnia.* fungal systematics, general characteristics and classification of kingdom fungi phylum: Cytridiomycota - *Synchytrium endobioticum, Allomyces, Chytriomyces,* phylum: Zygomycota- , *Rhizopus, Mucor, Endogone* and *Glomus.*

Practical: Related with the Course.

2. PPA -502:MYCOLOGY -II 3(2 + 1)

Theory

General characteristics and classification of kingdom fungiphylum: Ascomycota - *Saccharomyces* spp.; *Taphrina Aspergillus, Penicillium, Claviceps purpurea, Neurospora sitophila, Monilinia, venturia,* phylum: Basidiomycota -*Agaricus, pleurotus, Puccinia, Melampsora, Uromyces, Tilleiia, - Ustilago,* Imperfect fungi,- *Colletotrichum, Phoma, A scochyta, helmmthosporiurn, Cercospora, Botrytis, Fusarium* and *Rhizoctonia.*

Practical : Realated with the Course

3. PPA- 503: INTRODUCTORY BACTERIOLOGY 3(2 + 1)

Theory

Bacteria : History and development, origin of bacteria, fossil bacteria, classification, morphology, structure, metabolism and Reproduction. Classification and identification of phytopathogenic bacteria. Nutrition: autotrophic and heterotrophic. Comparison of Prokaryote, Eukaryote and Archeabacteria. Bacterial toxins and enzymes, elementary bacterial genetics and mechanism of variability. Bacteriophages. General characteristics of rickettsia, bdellobrios and L-form bacteria.

Mollecutes - Introduction, history and milestones, definition, characteristics cell morphology and replication, classification, differences between Mycoplasma, Phytoplasma and Spiroplasma.

Practical: Related with the Course.

4. STAT- 551: STATISTICAL METHODS **3(2 + 1)**

Unit-I

Summarization of data, classification and tabulation of data, Diagrammatic and Graphical Representations, utility and limitations of graphical Representation. Measure of central tendency, definition, merit, demerit, uses and properties of different measure of central tendency, measure of dispersion, moments, skewness and kurtosis.

Unit-II

Probability distribution, discrete probability distribution- Bernouli, poission, normal distribution. Theorem of addition of probability, theorem of multiplication of probability, Definition- (simple and compound events independent and dependents, mutually exclusive, complimentary events.)

Unit-III

Statistical Hypothesis, Null hypothesis, Two type of error, Statistical significance, parametric and nonparametric hypothesis, critical region, level of significance, practical application of simple test of significance viz, 't' and 'F' test. X2 test as a goodness of Fit, properties of X2 distribution, conditions for application of X2 test.

Unit-IV

Correlation and its test of significance, line of regression and its test of significance. Correlation, measurement of correlation, limit and range of ,, correlation coefficient expressed in term of regression coefficients. Rank correlation and its computations, regression equation.

5. PPA- 504: PRINCIPLES OF PLANT PATHOLOGY **3(2 + 1)**

Theory

Importance of plant diseases, scope & objective of plant pathology, Brief history of plant pathology. Classification of plants diseases, Symptoms and sings of plant's diseases. Environmental effects on the development of infectious plants disease. Physiologic specialization anti variation in plant pathogens. Parasitism and disease development, role of enzymes and toxins during infections. General principles of plant disease managements.

Practical: Related with the Course.

6. PPA- 505: INTODUCTORY VIROLOGY **3(2 + 1)**

Theory

Brief history and economic importance of viruses, plant viruses morphology and structure, composition, replication, nomenclature and classification of plant viruses. Induction of disease symptoms caused by viruses. and transmission. Physiology of virus infected plants. Detection of isolation, purification and serology of plant viruses. Bacteriophase

Practical : Related With Course

7. PPA– 506: DISEASE OF FIELD CROP **3(2 + 1)**

Theory

Symptoms, etiology, transmission and control of important disease of field and oil seed crops. Disease of wheat - Rust, Loose smut, Hill bunt, Karnal bunt, Leaf smut, Alternaria blight, Ear cockle. Diseases of paddy – Blast, Helminthosporium leaf spot, Stem rot, Kernal bunt, Leaf smut, False smut, Bakanae disease, Sheath blight, Bacterial blight, Khaira disease. Diseases of jowar - Downy mildew, Loose, covered, head and long smuts Diseases of bajra - Downy mildew or Green ear, Leaf rust, Grain smut and Ergot. Disease of maize - Smut Brown spots, Pythium .stalk rots. Diseases, tobacco - Damping off, Mosaic.Diseases of barley - Covered smut.

Disease of sugarcane - Red Rot, Wilt, Smut. Diseases of pigeon pea - wilt, Sterility mosaic, Phytophthora blight.

Diseases of gram - Wilt and blight. Diseases of mung and urd - Cercospora leaf spots. Symptoms, etiology, transmission and control of important diseases of oil seed crops. Ground nut – Tikka disease, rust, wilt and collar rot. Linseed – Rust, Blight & wilt, Mustard – White rust, Leaf blight, Sunflower – Rust Leaf spot and wilt , Sesamum – Leaf spot and Phyllody , Castor – Seedling blight, rust, blight, leaf spot.

Practical : Realated with the Course

8. PPA- 507:PLANT PATHOLOGICAL TECHNIQUE 3(2 + 1)

Theory

Microscopy: Calibration and measurement of spore, camera Iucida drawing, microtomes and microtomy procedures (paraffin embedding and freeze microtome), Preparation of mount, preservation of fungi, cleaning and sterilization of glassware and culture media (natural, semi synthetic and synthetic). Determination. of pH. Inoculation and isolation of pathogens, purification of fungal culture, Koch's postulates. Methods of spore germination. Demonstration of appresoria and houstoria in plant pathogenic fungi. Stains and staining, detection of plant pathogens. In vitro evaluation of fungicides and bactricides. Field experiments, and collection of data and references. Laboratory Equipments and their use _ Autoclave, hot air oven, laminar air flow, pH meter, spectrophotometer micro tomes and B.O.D. Incubator.

Practical: Related with the Course.

9. PPA -508:DISEASES OF FRUIT AND VEGETABLE CROPS 3(2 + 1)

Theory

Symptoms, etiology, transmission and control of the following disease of fruits crops-

Mango - Anthracnose, scab malformation, Loranthus, black tip, powdery mildew.

Apple - Scab, powdery mildew, soft rot.

Citrus - Canker, Fruit rots, Greening & Tristeza, Die-back. Root rots.

Guava - Wilt and Fruit blotch.

Papaya - Foot rot, mosaic, Leaf curl.

Grapes - Downy mildew and powdery Mildew

Jack fruit - Brown leaf spot & Rhizopus rot

Banana - Panama disease & bunchy top.

Disease of forest trees including neem and stored timber.

Turmeric - Rhizome rot, soft rot

Ginger - Rhhizome rot, soft rot, wilt/yellow diseases

Coriander- stem gall, wilt and powdery mildew

Cumin - Powdery mildew, damping off,

Cardamom: Rhizome rot, leaf rust, leaf spot

Diseases of brinjal- Phomosis, Fruit rot, Little leaf.

Diseases of pea - Downy mildew, powdery mildew, rust.

Diseases of coriander - Stern gall.

Diseases of cabbage and cauliflower - Club root, Damping Off, Black rot.

Diseases of okra - Yellow vein mosaic.

Diseases of onion - Smut.

Diseases of garlic - Garlic blotch.

Diseases of chillies - Anthracnose, Fruit rot, Virus diseases'.

Disease of tomato - Early blight, Leaf curl, Root - knot.

Diseases of cucurbits - Powdery mildew, Downy mildew.

course.

Practical: Related with the Course.

10. PPA-509: PLANT DISEASE MANAGEMENT3 (2 + 1)

Theory

Principles of plant disease management by cultural, physical, biological, chemical, organic amendments and botanicals methods of plant disease control, integrated control measures of plant diseases. Disease resistance and molecular approach for disease management. History of fungicides, bactericides, concepts of pathogen immobilization, chemical protection and chemotherapy, nature, properties and mode of action of antifungal, antibacterial and antiviral chemicals. Foliage, seed and soil application of chemicals, role of stickers, spreaders and other adjuvants, health vis-a-vis environmental hazards, residual effects and safety measures.

Practical : Related with the Course

11. PPA- 510: SEED PATHOLOGY 3(2 + 1)

Theory

History and importance of seed pathology. International seed testing association its role and functions. Morphology and anatomy of seed; Entry points of seed infection. Plant-seed and seed-plant transillission. Establishment of infection and Course of disease. Environment affecting establishment, seed crop management. Seed treatment, quarantine for seed certification. Detection of seed borne pathogen. Seed health testing methods. Important seed transmitted disease, their symptoms and disease cycles. Storage fungi. Impact of storage fungi on stored grains seeds. Factors influencing invasion of stored grain seed by fungi. Management of seed brone pathogens.

Practical: Related with the Course.

12.PPA- 511: MUSHROOM PRODUCTION TECHNOLOGY 2(1+1)

Theory

Mushroom morphology different parts of a typical mushroom & variations in mushroom morphology. Key to differentiate Edible from Poisonous mushrooms. Mushroom Classification: Based on occurrence- Epigenous & Hypogenous, Natural Habitats-Humicolous, Lignicolous & Coprophilous, Color of spores- white,yellow ,pink, purple brown & black, Morphology- fruiting layers exposed to air, fruiting layers not exposed to air, plants with predominantly pitted cap, cap saddled shape & saucer shape, Structure and texture of fruit bodies-gilled fungal& pore fungal, Fruit bodies and spores- Ainsworth et al (1973) classification. Recent Classification- 8 th edition of Ainsworth & Bisby's 'Dictionary of Fungi'. Biology of Mushrooms: Button, Straw& Oyster- General morphology, distinguishing characteristics, spore germination and life cycle. Cultivation Technique.

Practical : Related with the Course

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7.Agricultural Economics

Code No	Course Title	Credit Hours
AG-ECON- 501	MICRO ECONOMIC THEORY AND APPLICATIONS	3 (3+0)
AG -ECON -504	AGRICULTURAL PRODUCTION ECONOMICS	3 (2+1)
AG- ECON- 505	AGRICULTURAL MARKETING AND PRICE ANALYSIS	3 (2+1)
STAT-ECON- 511	STATISTICS FOR AGRICULTURAL ECONOMICS	3 (2+1)
AG- ECON -502	MACRO ECONOMICS AND POLICY	3 (3+0)

AG- ECON- 506	RESEARCH METHODOLOGY FOR SOCIAL SCIENCES	3 (2+1)
AG- ECON- 509	AGRICULTURAL FINANCE AND PROJECT MANAGEMENT	3 (2+1)
AG -ECON -510	INTERNATIONAL ECONOMICS	2(1+1)
AG- ECON -503	EVOLUTION OF ECONOMIC THOUGHT	2 (2+0)
AG- ECON -507	ECONOMETRICS	3 (2+1)
AG- ECON -508	LINEAR PROGRAMMING	3 (2+1)
AG –ECON- 515	RURAL MARKETING	3 (2+1)
AG- ECON- 591	MASTERS SEMINAR**	1
AG- ECON -599	THESIS / MASTERS RESEARCH WORK***	20

1. AES- 501: MICRO ECONOMIC THEORY AND APPLICATION 3(3+0)

Theory

Unit - I

Theory of Consumer Behavior - Cardinal Utility Approach - Ordinal Utility Approach – Income effect and substitution effect – Applications of Indifference curve approach - Revealed Preference Hypothesis – Consumer surplus - Derivation of Demand curve – Elasticity of demand.

Unit - II

Theory of Production - Production functions – Returns to scale and economies of scale – Technical progress – Theory of Costs – Cost curves– Profit maximization and cost minimization – Derivation of supply curve – Law of Supply – Producers' surplus.

Unit- III

Market Equilibrium - Behavior of Firms in Competitive Markets - Perfect Competition- Effect of Taxation and Subsidies on market equilibrium - Monopoly-Monopolistic - Oligopoly- Theory of Factor Markets.

Unit - IV

General Equilibrium Theory - Welfare Economics - Pareto Optimality – Social welfare criteria - Social Welfare functions.

Suggested Readings

David M Kreps 1990. *A Course in Microeconomic Theory*. Princeton University Press.

Dewitt KK. 2002. *Modern Economic Theory*. Sultan Chand & Co.

Henderson JM & Quandt RE. 2000. *Microeconomic Theory: A MathematicalApproach*. McGraw-Hill.

Koutsoyiannis A. 2003. Modern Microeconomics. The Macmillan Press. Silberberg E & Suen W. 2001. *The Structure of Economics – A Mathematical Analysis*. McGraw-Hill.

Varian Hal R. 1999. *Intermediate Microeconomics*. Affiliated East-West Press.

2. AES- 502:MACRO ECONOMICS and POLICY 3(3+0)

Theory

Unit- I

Nature and Scope of Macro Economics - Methodology and Keynesian Concepts National Income - Concepts and measurement- Classical theory of Employment and Say's Law-Modern theory of Employment and Effective Demand.

Unit - II

Consumption function- Investment and savings - Concept of Multiplier and Accelerator - Output and Employment - Rate of interest - Classical, Neo classical and Keynesian version- Classical theory Vs Keynesian theory - Unemployment and Full employment.

Unit - III

Money and classical theories of Money and Price - Keynesian theory of money and Friedman Restatement theory of money - Supply of Money - Demand for Money -Inflation: Nature, Effects and control.

Unit - IV

IS & LM frame work - General Equilibrium of product and money markets - Monetary policy - Fiscal policy- Effectiveness of Monetary and Fiscal policy - Central banking.

Unit - V

Business cycles - Balance of Payment - Foreign Exchange Rate determination.

Suggested Readings

Ahuja HL. 2007. *Macroeconomics: Theory and Policy*. S. Chand & Co.

Eugene A Diulio 2006. *Macroeconomics*. 4th Ed. Schaums' Outlines.

Gardner Ackely 1987. *Macro Economic: Theory and Policy*. Collier Macmillan. Dornbusch. 2006. *Macroeconomics*. McGraw Hill Publication

3. AES- 503: EVOLUTION OF ECONOMIC THOUGHT 2(2+0)

Theory

Unit- 1

Approaches for the study of history of economic thought – Absolutist vs. Relativist approaches – Evolution of Economic Thought vs. Economic History. Ancient economic thought – medieval economic thought – mercantilism – physiocracy – Forerunners of Classical Political Economy.

Unit -II

Development of Classical Thoughts (Adam Smith, Robert Malthus and David Ricardo) – Critics of Classical Thoughts- Socialist critics – Socialist and Marxian Economic Ideas – Austrian School of Thought – Origins of Formal Microeconomic Analysis – William Stanley Jevons, Cournot and Dupuit.

Unit - III

The birth of neoclassical economic thought – Marshall and Walras – General Equilibrium Theory - Welfare Theory – Keynesian economics.

Unit - IV

The Era of globalization – Experiences of developing world - Rigidity of the past vs. emerging realism – The changing path of international Institutions to economic growth and development approaches.

Unit -V

Economic Thought in India – Naoroji and Gokhale – Gandhian Economics - Economic thought of independent India – Nehru's economic philosophy - Experiences of the Structural adjustment programmes of the post liberalization era.

Suggested Readings

Blaug M. 1964. *Economic Theory in Retrospect*. Heineman.

Blaug M. 1986. *Economic History and the History of Economic Thought*. Wheatsheaf Books, Brighton.

Ekelund RB & Hebert RF. 1975. *A History of Economic Theory and Methods*. McGraw-Hill.

John Mills A. 2002. *Critical History of Economics: Missed Opportunities*. Palgrave Macmillan.

Screpanti E & Zamagni S. 1995. *An Outline of the History of Economic Thought*. Clarendon Press, Oxford.

4. AES -504: AGRICULTURAL PRODUCTION ECONOMICS 3(2+1)

Theory

Unit -I

Nature, scope and significance of agricultural production economics - Agricultural Production processes, character and dimensions-spatial, temporal - Centrality of production functions, assumptions of production functions, commonly used forms Properties, limitations, specification, estimation and interpretation of commonly used production functions.

Unit - II

Factors of production, classification, interdependence, and factor substitution - Determination of optimal levels of production and factor application -Optimal factor combination and least cost combination of production - Theory of product choice; selection of optimal product combination.

Unit - III

Cost functions and cost curves, components, and cost minimization -Duality theory – cost and production functions and its applications -Derivation of firm's input demand and output supply functions -Economies and diseconomies of scale.

Unit -IV

Technology in agricultural production, nature and effects and measurement - Measuring efficiency in agricultural production; technical, allocative and economic efficiencies - Yield gap analysis-concepts-types and measurement - Nature and sources of risk, modeling and coping strategies.

Practical

Different forms of production functions - specification, estimation and interpretation of production functions – returns to scale, factor shares, elasticity of production - physical optima -economic optima-least cost combination-optimal product choice- cost function estimation, interpretation-estimation of yield gap - incorporation of technology in production functions- measuring returns to scale-risk analysis through linear programming.

Suggested Readings

Beattie BR & Taylor CR. 1985. *The Economics of Production*. John Wiley & Sons.

Doll JP & Frank O. 1978. *Production Economics - Theory andApplications*.

John Wiley & Sons.

Gardner BL & Rausser GC. 2001. *Handbook of Agricultural Economics*. Vol. I. *Agricultural Production*. Elsevier.

Heady EO. *Economics of Agricultural Production and Resource Use*. Prentice-Hall.

Sankayan PL. 1983. *Introduction to Farm Management*. Tata Mc Graw Hill.

5. AES- 505: AGRICULTURAL MARKETING AND PRICE ANALYSIS 3(2+1)

Theory

Unit - I

Review of Concepts in Agricultural Marketing - Characteristic of Agricultural product and Production – Problems in Agricultural Marketing from Demand and Supply and Institutions sides. Market intermediaries and their role - Need for regulation in the present context - Marketable & Marketed surplus estimation. Marketing Efficiency - Structure Conduct and Performance analysis - Vertical and Horizontal integration - Integration over space, time and form-Vertical co-ordination.

Unit -II

Marketing Co-operatives – APMC Regulated Markets - Direct marketing, Contract farming and Retailing - Supply Chain Management - State trading, Warehousing and other Government agencies -Performance and Strategies - Market infrastructure needs, performance and Government role - Value Chain Finance.

Unit -III

Role of Information Technology and telecommunication in marketing of agricultural commodities - Market research-Market information service - electronic auctions (e-bay), e-Chaupals, Agmarket and Domestic and Export market Intelligence Cell (DEMIC) – Market extension.

Unit - IV

Spatial and temporal price relationship – price forecasting – time series analysis – time series models – spectral analysis. Price policy and economic development – non-price instruments.

Unit - V

Theory of storage - Introduction to Commodities markets and future trading - Basics of commodity futures - Operation Mechanism of Commodity markets – Price discovery - Hedging and Basis - Fundamental analysis - Technical Analysis - Role of Government in promoting commodity trading and regulatory measures.

Practical

Supply and demand elasticities in relation to problems in agricultural marketing. Price spread and marketing efficiency analysis. Marketing structure analysis through concentration ratios. Performance analysis of Regulated market and marketing societies. Analysis on contract farming and supply chain management of different agricultural commodities, milk and poultry products. Chain Analysis - quantitative estimation of supply chain efficiency - Market Intelligence – Characters, Accessibility, and Availability Price forecasting. Online searches for market information sources and interpretation of market intelligence reports – commodity outlook - Technical Analysis for important agricultural commodities - Fundamental Analysis for important agricultural commodities - Presentation of the survey results and wrap-up discussion.

Suggested Readings

1.Purecell WD & Koontz SR. 1999. *Agricultural Futures and Options: Principlesand Strategies*. 2nd Ed. Prentice-Hall.

2.Rhodes VJ. 1978. *The Agricultural Marketing System*. Grid Publ., Ohio.

3.Shepherd SG & Gene AF. 1982. *Marketing Farm Products*. Iowa State Univ. Press.

4.Singhal AK. 1986. *Agricultural Marketing in India*. Annual Publ., New Delhi.

6. AES- 506: RESEARCH METHODOLOGY FOR SOCIAL SCIENCES 3(2+1)

Theory

Unit - I

Importance and scope of research in agricultural economics. Types of research - Fundamental vs. Applied. Concept of researchable problem – research prioritization – selection of research problem. Approach to research – research process.

Unit - II

Hypothesis – meaning - characteristics - types of hypothesis – review of literature – setting of Course Objective and hypotheses - testing of hypothesis.

Unit - III

Sampling theory and sampling design – sampling error - methods of sampling – probability and non-probability sampling methods - criteria to choose. Project proposals – contents and scope – different types of projects to meet different needs – trade-off between scope and cost of the study. Research design and techniques – Types of research design.

Unit - IV

Data collection – assessment of data needs – sources of data collection – discussion of different situations. Mailed questionnaire and interview schedule – structured, unstructured, open ended and closed-ended questions. Scaling Techniques. Preparation of schedule – problems in measurement of variables in agriculture. Interviewing techniques and field problems - methods of conducting survey – Reconnaissance survey and Pre testing.

Unit -V

Coding editing – tabulation – validation of data. Tools of analysis – data processing. Interpretation of results – Preparing research report / thesis – Universal procedures for preparation of bibliography – writing of research articles.

Practical

Exercises in problem identification. Project proposals – contents and scope. Formulation of Objective and hypotheses. Assessment of data needs – sources of data – methods of collection of data. Methods of sampling – criteria to choose – discussion on sampling under different situations. Scaling Techniques – measurement of scales. Preparation of interview schedule - Field testing. Method of conducting survey. Exercise on coding, editing, tabulation and validation of data. Preparing for data entry into computer. Hypothesis testing – Parametric and Non-Parametric Tests. Exercises on format for Thesis / Report writing. Presentation of the results.

Suggested Readings

Black TR. 1993. *Evaluating Social Science Research - An Introduction***.** SAGE Publ.

Creswell JW. 1999. *Research Design - Qualitative and Quantitative Approaches***.** SAGE Publ.

Dhondyal SP. 1997. *Research Methodology in Social Sciences and Essentials ofThesis Writing*. Amman Publ. House, New Delhi.

CR. 2004. *Research Methodology - Methods and Techniques***.** Wishwa Prakashan, Chennai.

Rao KV. 1993. *Research Methodology in Commerce and Management***.** Sterling Publ., New Delhi.

Singh AK. 1993. *Tests, Measurements and Research Methods in BehaviouralSciences***.**Tata McGraw-Hill.

Venkatasubramanian V. 1999. *Introduction to Research Methodology inAgricultural and Biological Sciences*. SAGE Publ.

7. AES- 507: ECONOMETRICS **3(2+1)**

Theory

Unit -I

Introduction – relationship between economic theory, mathematical economics, models and econometrics, methodology of econometrics-regression analysis.

Unit - II

Basic two variable regression - assumptions estimation and interpretation-approaches to estimation - OLS, MLE and their properties - extensions to multi variable models-multiple regression estimation and interpretation.

Unit -III

Violation of assumptions – identification, consequences and remedies for Multicollinearity, heteroscedasticity, autocorrelation – data problems and remedial approaches - model misspecification.

Unit - IV

Use of dummy variables-limited dependent variables – specification, estimation and interpretation.

Practical

Single equation two variable model specification and estimation - hypothesis testing- transformations of functional forms and OLS application-estimation of multiple regression model - hypothesis testing - testing and correcting specification errors - testing and managing Multicollinearity - testing and managing heteroscedasticity - testing and managing autocorrelation - estimation of regressions with dummy variables - estimation of regression with limited dependent variable - identification of equations in simultaneous equation systems.

Suggested Readings

Gujarati DN. 2003. *Basic Econometrics*. McGraw Hill.

Johnson AG Jr., Johnson MB & Buse RC. 1990. *Econometrics - Basic andApplied.* MacMillan.

Kelejan HH & Oates WE. 1994.*Introduction to Econometrics Principles andApplications*. Harper and Row Publ.

Koutsoyianis A. 1997. *Theory of Econometrics*. Barner & Noble.

Maddala GS. 1992. *Introduction to Econometrics*. MacMillan.
Maddala GS. 1997. *Econometrics.* McGraw Hill.
Pindyck RS & Rubinfeld DL. 1990. *Econometrics Models and EconometricForecasts*. McGraw Hill.

8. AES- 508: LINEAR PROGRAMMIN 3(2+1)

Theory

Unit - I

Decision Making- Concepts of decision making, introduction to quantitative tools, introduction to linear programming, uses of LP in different fields, graphic solution to problems, formulation of problems.

Unit - II

Simplex Method: Concept of simplex Method, solving profit maximization and cost minimizations problems. Formulation of farms and nonfarm problems as linear programming models and solutions.

Unit -III

Extension of Linear Programming models: Variable resource and price programming, transportation problems, recursive programming, dynamic programming.

Practical

Graphical and algebraic formulation of linear programming models. Solving of maximization and minimization problems by simplex method. Formulation of the simplex matrices for typical farm situations.

Suggested Readings

Dorfman R. 1996. *Linear Programming & Economic Analysis*. McGraw Hill.
Loomba NP.2006. *Linear Programming*. Tata McGraw Hill.
Shenoy G. 1989. *Linear Programming-Principles & Applications*. Wiley Eastern Publ.
Vaserstein. 2006. *Introduction to Linear Programming*. Pearson Education Publication

9. AES- 509:AGRICULTURAL FINANCE AND PROJECT MANAGEMENT3 (2+1)

Theory

Unit -I

Role and Importance of Agricultural Finance. Financial Institutions and credit flow to rural/priority sector. Agricultural lending – Direct and Indirect Financing - Financing through Co-operatives, NABARD and Commercial Banks and RRBs. District Credit Plan and lending to agriculture/priority sector. Micro-Financing and Role of MFI's - NGO's, and SHG's.

Unit - II

Lending to farmers – The concept of 3 C's, 7 P's and 3 R's of credit. Estimation of Technical feasibility, Economic viability and repaying capacity of borrowers and appraisal of credit proposals. Understanding lenders and developing better working relationship and supervisory credit system. Credit inclusions – credit widening and credit deepening.

Unit -III

Financial Decisions – Investment, Financing, Liquidity and Solvency. Preparation of financial statements - Balance Sheet, Cash Flow Statement and Profit and Loss Account. Ratio Analysis and Assessing the performance of farm/firm.

Unit - IV

Project Approach in financing agriculture. Financial, economic and environmental appraisal of investment projects. Identification, preparation, appraisal, financing and implementation of projects. Project Appraisal techniques – Undiscounted measures. Time value of money – Use of discounted measures - B-C ratio, NPV and

IRR. Agreements, supervision, monitoring and evaluation phases in appraising agricultural investment projects. Net work Techniques – PERT and CPM.

Unit - V

Risks in financing agriculture. Risk management strategies and coping mechanism. Crop Insurance programmes – review of different crop insurance schemes - yield loss and weather based insurance and their applications.

Practical

Development of Rural Institutional Lending - Branch expansion, demand and supply of institutional agricultural credit and Over dues and Loan waiving- : An overview, Rural Lending Programmes of Commercial Banks, Lead Bank Scheme-Preparation of District Credit Plan, Rural Lending Programmes of Co-operative Lending Institutions, Preparation of financial statements using farm/firm level data, Farm credit appraisal techniques and farm financial analysis through financial statements, Performance of Micro Financing Institutions - NGO's and Self-Help Groups, Identification and formulation of investment projects, Project appraisal techniques – Undiscounted Measures and their limitations. Project appraisal techniques – Discounted Measures, Network techniques – PERT and CPM for project management, Case Study Analysis of an Agricultural project Financial Risk and risk management strategies – crop insurance schemes, Financial instruments and methods – E banking, Kisan Cards and core banking.

Suggested Readings

Dhubashi PR. 1986. *Policy and Performance - Agricultural and Rural Development in Post Independent India*. Sage Publ.

Gittinger JP 1982. *Economic Analysis of Agricultural Projects***.** The Johns Hopkins Univ. Press.

Gupta SC. 1987. *Development Banking for Rural Development*. Deep & Deep Publ.

Little IMD & Mirlees JA. 1974. *Project Appraisal and Planning for DevelopingCountries***.**Oxford & IBH Publ.

Muniraj R. 1987. *Farm Finance for Development*. Oxford & IBH Publ.

10. AES- 510: INTERNATIONAL ECONOMICS 2(1+1)

Theory

Unit - I

Scope and Significance of International Economics - The role of trade- General Equilibrium in a Closed Economy (Autarky Equilibrium) – Equilibrium in a Simple Open Economy - Possibility of World Trade - Trade gains and Trade Equilibrium.

Unit -II

Tariff, Producer Subsidy, Export Subsidy, Import Quota and Export Voluntary Restraints- The Case of Small Country and Large Country Case.

Unit -III

IMF, World Bank, IDA, IFC, ADB – International Trade agreements – Uruguay Round – GATT – WTO.

Practical

Producer's Surplus, Consumer's Surplus Estimation of Effect of Tariff, Export Subsidy, Producer Subsidy, Import Quota and Export Voluntary Restraints on National Welfare- Estimation of Ricardian Model –

Suggested Readings

Apple Yard DR & Field AJ Jr. 1995. *International Economics - Trade, Theory andPolicy*. Irwin, Chicago.

Cherunilam F. 1998. *International Economics*. Tata McGraw Hill.

Krugman PR & Obstfeld M. 2000. *International Economics – Theory and Policy*. Addison-Wesley.

11. AES- 511: STATISTICS AND MATHMETICS FOR AGRICULTURAL ECONOMICS 3(2+1)

Unit- I

Classification ,Diagramatic (Bar, Pie) and Graphic representation of data.Measures ofcentral tendency (Mean,median,Mode).Measure of dispersion ,correlation and Regression analysis.

Unit- II

Definition of probability,Addition and Multiplicaton theorem(without Proof).Simple Problem based on probability,Normed Distribution,concept of sampling distribution.Test of significant base on Z,t ,F and X chi-square test.

Unit- III

Elementry concept of Determinants, minor and co-factor and propertiesof Determinants .Use of Determinants solving eguation .Matrix algebra ,Matrix addition,substraction,and Multiplication .Some special type of Matrix and inverse of matrix.

Definition of variable and constant limit and differentiation .Some common law of differentiation.

Differentiation of functionof function (two function).Maxima and minima of function of form y=f(x)

Simple problem based and it .

Integration of standered Form,Integration of substitution in simple caser. Integration by part and concept of Definit integral(simple cases).

Use of integral calculus in economics.

Unit –IV

Time series,construction and use of index number.Interpolation and Extrapolation, theory of sampling ,Random and stratified sampling.

Practical

Constraction of Graph of continuous series. Calculation based on Measures of centrel Tendency and Dispersion . calculation on Karl pearson's coefficient of correlation .

Determination of Regression line. Calclulation based on Test of singnificance.

Use of Differentitaal and Intergal Calculus in Economics

Suggested Readings

Anderson TW. 1958. An Introduction to Multivariate Statistical Analysis. John Wiley.

Dillon WR & Goldstein M. 1984.Multivariate Analysis - Methods and 15Applications.John Wiley.

Goon AM, Gupta MK &Dasgupta B. 1977. An Outline of Statistical Theory.Vol.I.The World Press.

Goon AM, Gupta MK & Dasgupta B. 1983. Fundamentals of Statistics.Vol.I.The World Press.

Hoel PG. 1971. Introduction to Mathematical Statistics. John Wiley.

12. AES– 515:RURAL MARKETING (2+1)

Theory

Unit - I

Concept and scope of rural marketing, nature and characteristics of rural markets, potential of rural markets in India, rural communication and distribution.

Unit - II

Environmental factors - socio-cultural, economic, demographic, technological and other environmental factors affecting rural marketing.

Unit -III

Rural consumer's behaviour - behavior of rural consumers and farmers; buyer characteristics and buying behaviour; Rural v/s urban markets, customer relationship management, rural market research.

Unit - IV

Rural marketing strategy - Marketing of consumer durable and non-durable goods and services in the rural markets with special reference to product planning; product mix, pricing Course Objective, pricing policy and pricing strategy, distribution strategy.

Unit - V

Promotion and communication strategy - Media planning, planning of distribution channels, and organizing personal selling in rural market in India, innovation in rural marketing.

Practical

Conduct Survey of rural market, both primary and secondary case study of a minor and major commodity with respect to rural marketing channel prevailed in rural areas of UP. Estimation of Price spread-Costs, Margin and producer's share in consumer's rupee, Estimation of marketing efficiency, online search of market information and preparation of market intelligence report to various agricultural commodity with special reference to UP.

Suggested Readings

Krishnamacharyulu C & Ramakrishan L. 2002. Rural Marketing. Pearson Edu.

Ramaswamy VS & Nanakumari S. 2006. Marketing Management. 3rd Ed. MacMillan Publ.

Singh AK & Pandey S. 2005. Rural Marketing. New Age.

Singh Sukhpal. 2004. Rural Marketing. Vikas Publ. House.

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8.Agricultural Extension

Course N0.	Course Title	Credit

Semester- I		
EXT -511	Development perspectives of extension education	3(2+1)
EXT-512	Development communication and information management	3(2+1
EXT -513	Diffusion and adoption of innovations	3(2+1)
STAT -551	Statistical Methods	3(3+0)
Semester-II		
EXT-522	Entrepreneurship Development and Management in Extension	3(2+1)
EXT- 523	Human Resource Development	3(2+1)
EXT -524	Participatory Methods for Technology Development and Transfer	3(2+1)
EXT -525	Advances in agricultural extension	2(1+1)
Semester-III		
Ext -530	E-Extension	3(2+1)
Ext -531	Research methods in Behavioural Sciences	3(2+1)
Ext- 532	Visual communication	3(2+1)
Semester-IV		
Ext -510	Gender Sensitization for Development	2(1+1)
Ext - 591	**Master Seminar** **	1(1+0)
Ext -599	**Thesis / Master Research Work *****	**20**

1. EXT- 511:<u>DEVELOPMENT PERSPECTIVES OF EXTENSION EDUCATION</u> 3(2+1)

Objective

The course is intended to orient the students with the concept of extension education and its importance in Agriculture development and also to expose the students with various Rural development programmes aimed at poverty alleviation and to increase employment opportunites and their analysis. Besides, the students will be learning about the new innovations being brought into the Agricultural Extension in India.

Theory

Unit -I

Extension Education – Meaning, objectives, concepts, principles and philosophy, critical analysis of definitions – Extension Education as a Profession – Adult Education and Distance Education.

Unit- II

Pioneering Extension efforts and their implications in Indian Agricultural Extension – Analysis of Extension systems of ICAR and SAU – State Departments Extension system and NGOs – Role of Extension in Agricultural University.

Unit- III

Poverty Alleviation Programmes – SGSY, SGRY, PMGSY, DPAP, DDP, CAPART – Employment Generation Programmes – NREGP, Women Development Programmes – ICDS, MSY, RMK.

Unit- IV

Current Approaches in Extension: Decentralised Decision Making, Bottom up Planning, Farming System Approach, Farming Situation Based Extension, Farm Field School, ATIC, Kisan Call Centres, NAIP.

Practical

Visit to Gram Panchayat to study on-going Rural Development Programmes, Visit to KVK, NGO and Extension centers of State Agricultural University and State Departments.

Suggested Readings

Chandrakandan KM, Senthil Kumar &Swatilaxmi. PS. 2005. Extension Education What? And What Not ? RBSA Publ. Gallagher K. 1999. Farmers Field School (FFS) – A Group Extension Process based on Non-Formal

Education Methods. Global EPM Facility, FAO. Ganesan R, Iqbal IM &Anandaraja N. 2003. Reaching the Unreached: Basics of Extension Education. Associated Publishing Co. Jalihal KA &Veerabhadraiah V. 2007. Fundamentals of Extension Education and Management in Extension. Concept Publ. Khan PM. 2002. Textbook of Extension Education. Himalaya Publ. Ray GL. 2006. Extension Communication and Management. Kalyani Publ. Van Den Ban AW & Hawkins HS. 1998. Agricultural Extension .2nd Ed. CBS. Viswanathan M. 1994. Women in Agriculture and Rural Development. Printwell Publ.

2. EXT – 512:DEVELOPMENT COMMUNICATION AND INFORMATIONMANAGEMENT

3 (2+1)

Objective

In this course, students will learn about the concept, meaning and process of communication and various methods and modern media of communication.Besides, the students will also learn the information management and journalistic writing of various information materials and also study their readability.

Theory

Communication process – concept, elements and their characteristics – Models and theories of communication – Communication skills– fidelity of communication, communication competence and empathy, communication effectiveness and credibility, feedback in communication, social networks and Development communication – Barriers in communication, Message – Meaning, dimensions of a message, characteristics of a good message, Message treatment and effectiveness, distortion of message. 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..Media in communication – Role of mass media in dissemination of farm technology, Effect of media mix for Rural People. Agricultural Journalism as a means of mass communication, Its form and role in rural development, Basics of writing – News stories, feature articles, magazine articles, farm bulletins and folders. Techniques of collection of materials for news stories and feature articles; Rewriting Art of clear writing, Readability and comprehension testing procedures; photo journalism, communicating with pictures, Radio and TV Journalism, Techniques of writing scripts for Radio and TV.

Practical: Writing news for farm newspaper/ magazine. Reporting of various extension activities like field day, training, result demonstration and farmers fair etc. Preparing and delivering effective speech . Handling of communication and recording equipments (like computer, P&A system and camera). Script writing for radio, T.V. conducting student's visit to radio and TV station.

Suggested Readings

Dahama OP & Bhatnagar OP. 2005. Education and Communication for Development. Oxford & IBH.

Grover I, Kaushik S, Yadav L & Varma SK. 2002. Communication and Instructional Technology. Agrotech Publ. Academy.

Jana BL &Mitra KP. 2005. Farm Journalism. Agrotech Publ. Academy. Ray GL. 2006. Extension Communication and Management. Kalyani Publ. Rayudu CS.2002. Communication. Himalaya Publ. House. Reddy AA. 1987. Extension Education. Sree Lakshmi Press, Bapatla. Sandhu AS. 2004. Textbook on Agricultural Communication Process and Methods. Oxford & IBH.

3. EXT- 513 - DIFFUSION AND ADOPTION OF INNOVATIONS 3{ 2+1)

Objective

The students will learn how the agricultural innovations spread among the farmers in the society by getting into the insights of diffusion concept and adoption process, stages of adoption and innovation decision process, adopter categories and their characteristics, opinion leaders and their characteristics, attributes of innovations, and factors influencing adoption. In addition, the students would be learning various concepts related to diffusion and adoption of innovations.

Theory

Diffusion – concept and meaning, elements; traditions of research on diffusion; the generation of innovations; innovation-development process; tracing the innovation-development process, converting research into practice. The adoption process- concept and stages, dynamic nature of stages, covert and overt processes at stages, the innovation-decision process – a critical appraisal of the new formulation. Adopter categories – Innovativeness and adopter categories, adopter categories as ideal types, characteristics of adopter categories; Perceived attributes of Innovation and their rate of adoption, factors influencing rate of adoption. Diffusion effect and concept of over adoption, opinion leadership- measurement and characteristics of opinion leaders, monomorphic and polymorphic opinion leadership, multi-step flow of innovation; concepts of homophily and heterophily and their influence on flow of innovations; Types of innovation-decisions – Optional, Collective and Authority and contingent innovation decisions; Consequences of Innovation-Decisions – Desirable or Undesirable, direct or indirect, anticipated or unanticipated consequences; Decision making – meaning, theories, process, steps, factors influencing decision – making.

Practical

Case studies in individual and community adoption process, content analysis of adoption studies, Identification of adopter categories on a selected technology, study of attributes of current farm technologies, Identification of opinion leaders, Sources of information at different stages of adoption on a selected technology, study of factors increasing or retarding the rate of adoption, presentation of reports on adoption and diffusion of innovations.

Suggested Readings

Dasgupta. 1989. Diffusion Agricultural Innovations in Village India. Wiley Eastern. Jalihal KA &Veerabhadraiah V. 2007. Fundamentals of Extension Education and Management in Extension. Concept Publ. Co. Ray GL. 2005. Extension Communication and Management. Kalyani Publ. Reddy AA. 1987. Extension Education. Sree Lakshmi Press, Bapatla. Rogers EM. 2003. Diffusion of Innovations. 5th Ed. The Free Press, New York.

4. EXT- 522:ENTREPRENEURSHIP DEVELOPMENT AND MANAGEMENT IN EXTENSION

3(2+1)

Objective

The first part of the course is intended to provide overall picture of planning and development of enterprises for extending sustainable livelihoods for rural people. The second part of the course is structured to help the students to gain knowledge and skills in different concepts and techniques of management in extension organizations.

Theory

Entrepreneurship – Concept, characteristics, Approaches, Theories, Need for enterprises development. Agri – entrepreneurship – Concept, characteristics, Nature and importance for sustainable Livelihoods. Traits of entrepreneurs – Risk taking, Leadership, Decision making, Planning, Organising, Coordinating and Marketing, Types of Entrepreneurs. Stages of establishing enterprise – Identification of sound enterprise, steps to be considered in setting up an enterprise, feasibility report, product selection, risk and market analysis, legal requirements. Project Management and Appraisal – Market, Technical, Financial, Social Appraisal of Projects.

Micro enterprises – Profitable Agri enterprises in India – Agro Processing, KVIC industries. Success and Failure stories for enterprises – Issues relating to success and failure of enterprises – Personal, Production, Finance, Social, Marketing.. Extension Management – Meaning, Concept, Importance, Principles of management, Classification of Functions of Management. Planning – Concept, Nature, Importance, Types, Making planning effective. Organizing – Meaning of Organization, Concept, Principles, Organizational Structure, Span of Management, Departmentalization, Authority and responsibility, Delegation and decentralization, line and staff relations. Coordination – Concept, Need, Types, Techniques of Coordination. Staffing – Need and importance, , Performance appraisal – Meaning, Concept, Methods. . Leadership – Concept, Characteristics, Functions, Approaches to leadership, Leadership styles. Supervision – Meaning, Responsibilities, Qualities and functions of

supervision, Essentials of effective supervision. Managerial Control – Nature, Process, Types, Techniques of Control, Budgeting, Observation, PERT and CPM, MIS.

Practical

Field visit to Successful enterprises-Study of Characteristics of Successful entrepreneurs .Development of Project Proposal -Case Studies of Success / Failure enterprises-Exercise on Market Survey-Field visit to Financial institutions. Simulated exercise to understand management process-Field visit to extension organizations to understand the functions of management -Group exercise on development of short term and long term plan-Simulated exercise on techniques of decision making-Designing organizational structure -Group activity on leadership development skills.

Suggested Readings

Gupta CB. 2001. Management Theory and Practice. Sultan Chand & Sons. Indu Grover. 2008. Handbook on Empowerment and Entrepreneurship. AgrotechPublic Academy. Khanka SS. 1999. Entrepreneurial Development. S. Chand & Co. Singh D. 1995. Effective Managerial Leadership. Deep & Deep Publ. Tripathi PC & Reddy PN. 1991. Principles of Management. Tata McGraw Hill. Vasanta Desai. 1997. Small Scale Industries and Entrepreneurship. Himalaya Publ. House.

5. EXT – 523: HUMAN RESOURCE DEVELOPMENT 3(2+1)

Objective

To orient the students about key concepts importance, scope & conceptual frame work, growth & development of Human Resource Development, Subsystems of Human Resource Development for extension organization and process of HRD.

Theory

Human Resource Development – Definition, Meaning, Importance, Scope and Need for HRD; Conceptual frame work, inter disciplinary approach, function systems and case studies in HRD; HRD Interventions – Different Experiences; Selection, Development & Growth- Selection, Recruitment, Induction Staff Training and Development, Career planning; Social and Organizational Culture: Indian environment perspective on cultural process and social structure, society in transition; Organizational and Managerial values and ethics, organizational commitment ; Motivation productivity - job description – analysis and evaluation; Performance AppraisalOrganizational communication, Team building Process and functioning, Conflict management, Collaboration and Competition; HRD & Supervisors: Task Analysis; Capacity Building – Counseling and Mentoring; Role of a Professional Manager: Task of Professional Manager – Responsibility of Professional Manager; Managerial skills and Soft Stills required for Extension workers; Decision Making: Decision Making models, Management by Objectives; Behavioural Dynamics :Leadership styles – Group dynamics. Training – Meaning, determining training need and development strategies – Training types, models, methods and evaluation; Facilities for training – Trainers training – techniques for trainees participation; Research studies in training extension personnel.HRA.

Practical

Visit to different training organizations to review on going activities & facilities; Analysis of Training methods followed by training institutions for farmers and extension workers Studies on evaluation of training programmes; Study of HRD in organization in terms of performance, organizational development, employees welfare and improving quality of work life and Human resource information, Presentation of reports.

Suggested Readings

Agochiya D. 2002. Every Trainer's Handbook. Sage Publ. David Gross. 1997. Human Resource Management - The Basics. TR Publ. Davis Keth&Newston W John 1989. Human Behaviour at Work. 8th Ed. McGraw-Hill. Hersey Paul &Balanchard H Kenneth. 1992. Management of Organizational Behaviour Utilizing Human Resource. 5th Ed. Prentice-Hall of India. Knoontz Harold &Weihhrich Heinz 1990. Essentials of Management. 5th Ed. McGraw-Hill. Lynton RP &Pareek U. 1993. Training for Development. DB. Taraporewale Sons & Co.

Punna Rao P & Sudarshan Reddy M. 2001. Human Resource Development Mechanisms for Extension Organization. Kalyani Publ. Rao TV. 2003. Readings in Human Resource Development. Oxford Publ. Co. Silberman Mel. 1995. Active Training. Press Johnston Publ. Co., New Delhi. Singh RP. 2000. Management of Training Programmes. Anmol Publ. Subba Rao P. 2005. Management & Organizational Behaviour. Himalaya Publ. House. Sundaram RM, Gupta V, George SS. 2006. Case Studies in Human Resource Management. ICFAI, Hyderabad. Tripati& Reddy. 2004. Principles of Management. Tata McGraw-Hill. Wayne MR & Robert MN. 2005. Human Resource Management. International Ed. Pearson Prentice Hall.

6. EXT -524:PARTICIPATORY METHODS FOR TECHNOLOGY DEVELOPMENT AND TRANSFER 3(2+1)

Objective

This course is intended to orient the students with the key concepts, principles process of different participatory approaches for technology development and transfer and also to expose the students with various participatory tools and techniques like space related, time related, relation oriented methods. Besides the students will be learning the preparation of action plans participatory monitoring and evaluation.

Theory

Participatory extension – Importance, key features, principles and process of participatory approaches; Different participatory approaches (RRA, PRA, PLA, AEA, PALM, PAR, PAME, ESRE, FPR) and successful models. Participatory tools and techniques. Space Related Methods : village map (social & resource), mobility services and opportunities map and transect; Time related methods : time line, trend analysis, seasonal diagram. Daily activity schedule, dream map; Relation oriented methods : cause and effect diagram (problem tree), impact – diagram, well being ranking method, Venn diagram, matrix ranking, livelihood analysis. Preparation of action plans, concept and action plan preparation; Participatory technology development and dissemination; Participatory planning and management, phases and steps in planning and implementation aspects; Process monitoring, participatory evaluation.

Practical

Simulated exercises on space related methods, time related method and relation oriented methods; Documentation of PTD and dissemination; Preparation of action plan; Participatory monitoring and evaluation of developmental programmes.

Suggested Readings

Adhikary. 2006. Participatory Planning and Project Management in Extension Science. Agrotech Publ. Academy. Mukharjee N. 2002. Participatory Learning and Action. Concept Publ. Co. Singh BK. 2008. PRA/PLA and Participatory Training. Adhyayan Publ. & Distr. Somesh Kumar. 2002. Methods for Community Participation. VistaarPubl

7. EXT - 525:ADVANCES IN AGRICULTURAL EXTENSION 2(1+1)

Objective

By the End of the course student will be able to -

- Critically analyze different Agricultural Extension approaches
- Understand Agricultural Knowledge Information System (AKISs) ITK
- Understand Advances in Extension - Cyber extension, ICT enabled extension services; Market Led Extension, Public Private Partnership, Mainstreaming gender in extension organizational Innovations. • Visualize implications of WTO - AOA and develop extension strategies.
- Understand extension reforms and Farmer Field Schools Decentralized Decision Making, bottom up planning, ATMA, FSBE & CIGs etc., ATIC, IVLP &Kisan Call Centres

Theory

Unit- I

Approaches of Agricultural Extension: A critical analysis of different approaches of agricultural extension. Importance and relevance of indigenous knowledge system, identification and documentation of ITK, Integration of ITK system in research formulation, Concept of Agricultural Knowledge and Information System, Training of Stakeholders of AKIS.

Unit -II

Cyber Extension - Concept of cyber extension, national and international cases of extension projects using ICT and their impact of agricultural extension, alternative methods of financing agricultural extension - Scope, limitations and experience and cases. Research - Extension -Farmer - Market linkage: Importance, Scope, Implications etc., Market - Led Extension, Farmer - Led Extension, Concept of Farm Field School, Farm School, Public - Private Partnership: Meaning, Models, Identification of various areas for partnership. Stakeholder's analysis in Extension. Main streaming gender in Extension - Issues and Prospects.

Unit -III

Implications of WTO - AOA for extension services, re-orientation of extension services for agri-business and marketing activities, GOI-NGO collaboration to improve efficiency of extension.

Practical

Analysis of ITK systems, cases on integration of ITK and formal research system, Analysis of cases on cyber extension and privatization of extension. Analysis of ATMA and SREP. Practicing bottom up planning. Visit to Public-Private -Farmer partnership. .

Suggested Readings

Bagchi J. 2007. Agriculture and WTO Opportunity for India. Sanskruti. Chambers R, Pacy A &Thrupp LA. 1989. Farmers First. Intermediate Technology Publ. Crouch BR &Chamala S. 1981. Extension Education and Rural Development. Macmillan. John KC, Sharma DK, Rajan CS & Singh C. 1997. Farmers Participation in Agricultural Research and Extension Systems. MANAGE, Concept Publ. Co. Khan PM. 2002. Text Book of Extension Education. Himanshu Publ. Narasaiah ML. 2005. Agricultural Development and World Trade Organization. Discovery Publ. Talwar S. 2007. WTO Intellectual Property Rights. Serials Publ. Van den Ban BW & Hawkins BS. 1998. Agricultural Extension. S.K. Jain Publ. Venkaiah S. 2001. New Dimensions of Extension Education. Anmol Publ.

8. EXT -530:E- EXTENSION 3(2+1)

Objective

Students will gain knowledge and skills in understanding the concepts of Information and communication technologies and how these ICT tools can be used for Agricultural Extension. Besides, he studies various ICT projects which are successful in delivering the services to the clientele fulfilling the objective of Transfer of Technology i.e. Reaching the unreached.

Theory

ICTs- Concept, definition, tools and application in extension education. Reorganizing the extension efforts using ICTs, advantages, limitations and opportunities. ICTs projects, case studies in India and developing world. Different approaches (models) to ICTs. ;Aricultural web sites and portals related crop production and marketing etc.. Computer Aided Extension. Knowledge management, Information kiosks, Multimedia. Online, Offline Extension. Tools-Mobile technologies, information and science needs of farming community. Need integration. Human resource information. Intermediaries. Basic e-extension training issues. ICT enabled extension pluralism. Emerging issues in ICT.

Practical

Agril.content analysis of ICT Projects. Handling of ICT tools. Designing extension content. Online extension service. Project work on ICT enabled extension. Creation of extension blogs. Visit to ICT extension projects.

Suggested Readings

Batnakar S &Schware R. 2000. Information and Communication Technology in Development- Cases from India. Sage Publ. Meera SN. 2008. ICTs in Agricultural Extension: Tactical to Practical. GangaKaveri Publ. House. JangamWadiMath, Varanasi. Willem Zip. 1994. Improving the Transfer and Use of Agricultural Information - A Guide to Information Technology. The World Bank, Washington.

9. EXT-531: RESEARCH METHODS IN BEHAVIOURAL SCIENCE 3(2+1)

Objective

This course is designed with a view to provide knowledge and skills in methods of behavioural sciences research and student will learn the Statistical Package for Social Sciences (SPSS) for choosing appropriate statistics for data analysis.

Theory

Research – Meaning, importance, characteristics. Behavioural sciences research – Meaning, concept and problems in behavioural sciences research. Types and methods of Research – Fundamental, Applied and Action research, Exploratory, Descriptive, Diagnostic, Evaluation, Experimental, Analytical, Historical, Survey and Case Study. Research design- meaning, purpose and criteria for research design. Types, advantages and limitations of each design. Variable – Meaning, types and their role in research. Definition – Meaning, characteristics of workable definitions, types and their role in research. Hypothesis- meaning importance and functions of hypothesis in research, types of hypothesis. Measurement – meaning and levels of measurement. Validity- meaning and methods of testing. Reliability –meaning and methods of testing. Sampling – universe, sample and sampling-meaning , basis for sampling, advantages and limitations. Data collection devices – social survey, its meaning, objectives, types and steps. Interview- meaning, purpose, types and techniques, advantages and limitations. Schedule –meaning, advantages and limitations. Questionnaires –meaning, difference between schedule and questionnaire, advantages and limitations of questionnaire..

Practical :

Selection and formulation of research problem- formulation of objectives and hypothesis, selection of variables based on objectives. Formulation of schedule and questionnaires for primary and secondary data.Formulation of secondary tables based on objectives of research. Writing of report, writing of thesis and research articles.

Suggested Readings

Chandrakandan K, Venkatapirabu J, Sekar V & Anand Kumar V. 2000. Tests and Measurements in Social Research. APH Publ. Kerlinger FN. 1973. Foundations of Behavioural Research. Holt Rhinehart. Kothari CR.1984. Research Methodology, Methods and Techniques. Chaitanya Publ. House. Krishnaswami OR &Ranganatham M. 2005. Methodology of Research in Social Sciences. Himalaya Publ. House. Mulay S &Sabaratnam VE.1983. Research Methods in Extension Education. Manasavan. Ranjit Kumar. 1999. Research Methodology - A Step by Step Guide for Beginners. Sage Publ. Ray GL &Sagar Mondal. 1999. Research methods in Social Sciences and Extension Education. NayaProkash. Wilkinson TS & Bhandarkar PC.1993. Methodology and Techniques of Social Research. Himalaya Publ.Home.

10.EXT-532:VISUAL COMMUNICATION 3(2+1)

Objective

This course is intended to give a clear perspective about the importance of visuals and graphics in communication. The course starts with the delineating about the characteristics of visuals and graphics followed by its main functions, theories of visual perception and its classification and selection. Further, the course deals with the designing the message, graphic formats and devices and presentation of data. It makes the students to understand, prepare and present the scientific data effectively by using low cost visuals. The course also exposes the students to various Digitized video material in multimedia and also enable to design visuals for print, TV and know-how about scanning of visuals.

Theory

Role of visuals & graphics in Communication. Characteristics of visuals & graphics. Functions of visuals and graphics. Theories of visual perception. Classification and selection of visuals. Designing message for visuals, Graphic formats and devices. Presentation of Scientific data. Principles and procuctionof low cost visuals. Photographs- reprographic visuals. PC based visuals. Degitized video material in multimedia production. Designing visuals for print and TV and video. Pre-testing and evaluation of visuals. Scanning of visuals.

Practicals

Preparation of low cost projected and Non-Projected visuals. Designing and layout of charts, posters, flash cards etc. Power point presentations. Generating computer aided presentation graphics. Scanning and evaluation of visuals.

Suggested Readings

Bhatia A. 2005. Visual Communication. Rajat Publications, New Delhi. Edgar Dale 1970. Audio Visual methods in Teaching. Holt, Rinehart & Winston. James WB, Richard BL, Fried F Harcleroad. 1952. A.V. Instructional Material & Methods. Mc.Graw Hill. Reddy YN. 1998. Audio Visual Aids in Teaching, Training and Extension. Haritha Publ. House, Hyderabad.

11. EXT– 533:GENDER SENSITIZATION FOR DEVELOPMENT 2(1+1)

Objective

In this course the students will learn about an overview of the concept of gender and gender balance on development and develop skills of identifying gender roles, rights, responsibilities and relationships on development. Besides the students will also learn the attitudinal change to internalize gender equity concerns as fundamental human rights and also enhance the capability for identifying and analyzing gender issues in agriculture and allied sectors.

Theory

Unit- I

Gender concepts, issues and challenges in development; Gender roles, gender balance, status, need and scope; Gender analysis tools and techniques.

Unit - II

National policy for empowerment of women since independence; Developmental programmes for women; Gender mainstreaming in agriculture and allied sectors – need and relevance; Gender budgeting – A tool for empowering women.

Unit - III

Women empowerment –Dimensions; Women empowerment through SHG approach; Women entrepreneurship and its role in economic development; Public Private Partnership for the economic empowerment of women; Building rural institution for women empowerment; Women human rights ; Action plans for gender mainstreaming.

Practical

Visits to rural institutions of women for studying in the rural institutions engaged in Women empowerment; Visits to entrepreneurial unit of women for studying the ways and means of establishing entrepreneurship units for Women and their development and also SWOT analysis of the Unit; Visit to Center for women development - NIRD to study the different activities related to projects and research on gender; Visit to gender cell, Office of the Commissioner and Director of Agriculture, Hyderabad, to study the mainstreaming of gender concerns and gender budget of the department.

Suggested Readings

Grover I & Grover D. 2002. Empowerment of Women. Agrotech Publ. Academy. Porter F, Smyth I & Sweetman C.1999. Gender Works: OxfarmExperience in Policy and Practice. Oxfarm Publ. Raj MK. 1998. Gender Population and Development. Oxford Univ. Press. Sahoo RK &Tripathy SN. 2006. SHG and Women Empowerment. Anmol Publ. Sinha K. 2000. Empowerment of Women in South Asia. Association of

Management Development Institution in South Asia, Hyderabad. Thakur Joshi S. 1999. Women and Development. Mittal Publ. Vishwanathan M. 1994. Women in Agriculture & RD. Rupa Books.

.12.STAT- 551: STATISTICAL METHODS **3 (3+0)**

Unit-I

Summarization of data, classification and tabulation of data, Diagrammatic and Graphical Representations, utility and limitations of graphical Representation. Measure of central tendency, definition, merit, demerit, uses and properties of different measure of central tendency, measure of dispersion, moments, skewness and kurtosis.

Unit-II

Probability distribution, discrete probability distribution- Bernouli, poission, normal distribution. Theorem of addition of probability, theorem of multiplication of probability, Definition- (simple and compound events independent and dependents, mutually exclusive, complimentary events.)

Unit-III

Statistical Hypothesis, Null hypothesis, Two type of error, Statistical significance, parametric and nonparametric hypothesis, critical region, level of significance, practical application of simple test of significance viz, "t" and "F"test.X^2test as a goodness of Fit, properties of X^2 distribution, conditions for application of X^2 test.

Unit-IV

Correlation and its test of significance, line of regression and its test of significance. Correlation, measurement of correlation, limit and range of „ correlation coefficient expressed in term of regression coefficients. Rank correlation and its computations, regression equation.

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9.Animal Husbandry and Dairying

Semester- I

Code No	Course Title	Credit Hours
AHD -501	Production and Management of Dairy Animals	3 (2+1)
AHD-502	Poultry Production and Management	3 (2+1)
AHD-503	Market Milk Technology	3 (2+1)
STAT-551	Statistical Methods	3(3+0)

Semester- II

Code No	Course Title	Credit Hours
AHD -504	Fundamentals of Animal Nutrition	3 (2+1)
AHD-505	Reproductive Physiology of Farm Animals	3 (2+1)
AHD-506	Dairy Processing and Dairy Plant Management	3 (2+1)
STAT-552	EXPERIMENTAL DESIGN	2(2+0)

Semester- III

Code No	Course Title	Credit Hours
AHD -507	Feed Evaluation Techniques	3 (2+1)
AHD-508	Microbiology of Milk and Milk Products	4 (3+1)
AHD-509	Dairy Technology	3 (2+1)

Semester- IV

Code No	Course Title	Credit Hours
AHD -510	Fundamentals of Animal Breeding & Tchniques	3 (2+1)
AHD-591	MASTER SEMINAR**	1 (1+0)
ENT-599	THESIS/ MASTER RESEARCH WORK***	2 0

1. AHD 501: <u>Cattle and Buffalo Production and Management</u> 3(2+1)

Introduction Development of Dairy Industry in India and world present status and future prospects of livestock development in India , important breeds of cattle and buffalo, Breeding management and method of Breeding , Management of labor ,Milking Management Machine Milking and Hand Milking, Feed and fodder resources used for feedings of cattle and buffalos-scientific technique of feedings, watering- computation of practical and economical ration, supply of green fodder around the Year and enrichment of poor quality roughages.

Practical: Visits of cattle farms and critical analysis of various types of managerial practices study of breeding management in the farm-Analysis of practical. Dairy cattle and Buffalo judging and body condition Scoring.

2. AHD 502: <u>Poultry Production & Management</u> 3(2+1)

Importance and scope of poultry industry in India, Different breeds of poultry, systems of breeding. Reproductive system and process of egg laying, Incubation and hatching of eggs. Digestive system of poultry, Nutrients requirement of different categories of poultry. Poultry farming, Requirement of houses and equipment's for poultry production, Management and practices during brooding and vaccination schedule. Nutrient deficiency disease, symptoms, preventing and treatment of Ranikhet (new castle), pullorum, coccidiosis and marek's disease of poultry.

Practical: External Anatomy of chicken and Nomenclature , Demonstration of Breeds of chicken , Brief an account on Nutrients required in poultry feed proteins, carbohydrate, Lipids , Vitamins and minerals, Draw a table including Disease name, causal agent and Incubation period.

3. AHD 503: <u>Market Milk Technology</u> 3(2+1)

Recent advances in marketing of milk in India. Agencies involved in the production & handling of market milk. Methods of procurement of milk, Payments & quality assessment by Organoleptic and platform test. Methods of Chilling of Milk and Transportation. Milk storage tanks, Maintenance and cleaning of equipment's in receiving room and storage. Preservatives commonly used in market milk. Definition and technology of Clean milk, Recombined milk, toned milk, filled milk and special milk production. Importance of Packaging of Milk.Pricing and Distribution of milk; Problems of city milk supply.

Practical: Study ofsensoryand platform test, Study of procurement of milk, Study of milk chilling and Transportation, Study of Maintenance and cleaning of equipment's in receiving room and storage, Preparation of Recombined milk, toned milk, filled milk and special milk.

4. AHD 504: Principle of Animal Nutrition and feed technology 3(2+1)

Importance of nutrients in animal production and health.Composition of animal body and plants.Nutritional terms and their definitions.Importance of minerals (major and trace elements) and vitamins in health and production, their requirements and supplementation in feed.Common feeds and fodders, their classification, availability and importance for livestock and poultry production.Measures of food energy and their applications – gross energy, digestible energy, metabolisable energy, net energy, total digestible nutrients, starch equivalent, food units, physiological fuel value. Protein evaluation of feeds – Measures of protein quality in ruminants and non-ruminants, biological value of protein, protein efficiency ratio, protein equivalent, and digestible crude protein. Calorie protein ratio.Nutrition ratio. Preparation, storage and conservation of livestock feed through silage and hay and their uses in livestock feeding. Harmful natural constituents and common adulterants of feeds and fodders.

Practical: Familiarization of various feed stuff, fodders and their selection. Preparation and processing of samples for chemical analysis – herbage, faeces, urine and silages.Weende'sSystem of analysis – Estimation of dry matter, total ash, acid insoluble ash, crude protein, ether extract, crude fiber, nitrogen free extract.

5. AHD 505: Physiology of Lactation 3(2+1)

Introduction and importance of physiology of lactation in relation with milking management , internal structure of udder of different species ,Duct System , blood supply ,lymphatic and nervous system of udder development of mammary gland , hormones and their role in development of mammary gland , involution of udder , initiation of lactation ,control of milk secretion, milk harvesting and milk management,factors affecting composition viz., physiological , genetics , nutritional and environmental .

Practical:

Study of internal structure of udder.Study ofexternal structure of udder.Studyof development of mammary gland.Study of milk harvesting and management.

6. AHD 506: Dairy Processing and Plant Management 3(2+1)

Processing of Market Milk, Milk Processing flow sheet, Collection, Reception, Quality and Quantity tests at reception, Preheating, Filtration, Clarification, Classification of Milk: purpose, principle, methods, Homogenization, Pasteurization, Sterilization, Uperization and Bactofugation of Milk, Cooling and Storage of Milk, Packaging of Milk and Milk products, Transportation and Distribution of Milk, Equipment used in each process, Cream separating centrifuges, Pasteurizers (Heat Exchangers), Homogenizers, Bottle and pouch fillers, Milk Chillers, Ghee Boilers, Plant piping, Pumps, Milk Pipe Line Layout, Standardization, toning of milk, Milk Standards, Milk Adulteration, Instantization of milk and milk products. Judging and grading of milk and its products. Dairy plant sanitization, In-plant cleaning system.Factors to be considered in location of Dairy plant.

Practical: Study of quality test for milk at dairy plant, Study of Packaging of Milk and Milk products, Study about the production of Homogenized milk, Study about the production of Pasteurized milk, Fitting and adjusting

of cream separator, Study about adulteration of milk and its detection, Study about standardization of milk and cream.

7. AHD 507: Milk and Milk Products 4(3+1)

Definition of Milk and milk Industry in India and abroad.Composition of milk and factor affecting composition of milk.Physico-chemical properties of milk and milk constituents.Paneer- Definition, composition, and manufacture.Channa- Definition, composition, and method of manufacture.Gulabjamun- Definition, composition, and method of manufacture. Manufacture of Indian Dairy products-Rabri, Lassi, Makkhan, Rasoglla, Dahi, Chakka, Peda, Kalakand, Burfi, ChhanaKheer..

Practical: Determination of specific gravity of milk by Lactometer, Determination of acidity of milk titration method, Determination of fat in milk by Gerber's method, Preparation of Paneer , Channa, Rasogolla, Peda, Burfi,Gulabjamun, Dahi, Rabri, Kheer and Lassiin laboratory.

8. AHD- 508: Introductory Dairy Microbiology3(2+1)

Hygienic milk – Introduction and significance of dairy microbiology, source of contamination of milk, Hygienic milk production, Classification of Dairy microbiology, and microorganism associated with milk, microbiological method of milk testing, microbial spoilage of milk, Mastitis milk, and milk borne disease- food infection, intoxication and toxi-infection, Antimicrobial substance in milk.

Practical: Study ofmicrobiological milk testing, Study of production of hygienic milk, Study about sources of contamination of milk, Methods for detection of mastitis milk, Study about the antimicrobial substances in milk.

9. AHD 509: Dairy Technology 3(2+1)

Introduction, Milk composition, Factors effecting composition of milk, Classification of Milk and Milk Products', Food and nutritive value, Physico-chemical properties, Pasteurization and types, Sterilization with its types, Dehydration, Homogenization, Re-constituted or Re-hydrated milk, Condensed milk, Toned, Double toned, Full cream milk, Flavored milk, UHT Milk, Manufacture of Cream, Butter, Ghee, Milk powder, Cheese, Types and Defects in cheese, Quality aspects of these products. Equipment's used for manufacture of each product like, Butter churn, ghee boiler, Spray and Drum Dryers, Product instantizing equipment etc., Manufacture of Ice cream, Chemistry and technology, Microbiology of ice cream, Quality aspects of ice cream, Manufacture methods and quality of Sweetened Condensed Milk, Basundi. Fermented products, Shrikhand, Yoghurt, , Butter milk, Lassi.

Practical: Study ofPhysico-chemical properties of milk. Preparation of flavored milk, Preparation of fermented milk products like Dahi, Yoghurt andshrikhand, Separation of cream by cream separator, Preparation of ice-cream,Preparation of ghee from cream and desi butter.

10. AHD 510: Introductory Animal breeding 3(2+1)

Introduction to Animal Breeding ,Domestication of livestock history of Animal breeding taxonomical classification of cattle buffalo sheep and goat, Selection- Natural, Artificial ,culling System of mating ,Selection based on individuality ,type probable breeding Value, selection based progeny testing system of breeding matting based on genetic relationship, inbreeding , genetic effect of breeding phenotypic effects of inbreeding , Classification of breeding .

Practical: Study of breeding methods, Study of taxonomical classification of Cattle and Buffalo, Study of semen collection by A. V. method from bull, Study about selection methods in animal, Study about A.V.

11. STAT- 551: Statistical Methods **3 (2+1)**

Unit-I

Summarization of data, classification and tabulation of data, Diagrammatic and Graphical Representations, utility and limitations of graphical Representation. Measure of central tendency, definition, merit, demerit, uses and properties of different measure of central tendency, measure of dispersion, moments, skewness and kurtosis.

Unit-II

Probability distribution, discrete probability distribution- Bernouli, poission, normal distribution. Theorem of addition of probability, theorem of multiplication of probability, Definition- (simple and compound events independent and dependents, mutually exclusive, complimentary events.)

Unit-III

Statistical Hypothesis, Null hypothesis, Two type of error, Statistical significance, parametric and nonparametric hypothesis, critical region, level of significance, practical application of simple test of significance viz, 't' and 'F' test. X2 test as a goodness of Fit, properties of X2 distribution, conditions for application of X2 test.

Unit-IV

Correlation and its test of significance, line of regression and its test of significance. Correlation, measurement of correlation, limit and range of ,, correlation coefficient expressed in term of regression coefficients. Rank correlation and its computations, regression equation.

12. STAT-552: Experimental Designs **2 (2+0)**

Theory

Unit- I

Principles of experimental design, precision and accuracy, advantage of replication, experimental technique. Analysis of variance, fundamental principles of analysis of variance. Critical difference, limitations of the analysis of variance.

Unit- II

Statistical analysis and advantage and disadvantage of basic design-completely randomized design, randomized block design, Latin square design.

Unit- III

Factorial concept: simple effects, main effects and interaction, factorial experiments (without confounding), Yates method. Confounding, principles of confounding in a 2^3 factorial experiments. Split plot design.

Unit- IV

Missing plot technique; Bartlett's techniques for missing plots, cross-overdesign or switch-over trials, Rotational experiments, progeny selection, compact family block design, uniformity trial, sire index, sampling in field experiments.

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Infrastructure facilities

1. Dean Office	1	20x24
2. P.A. Room	1	10x12
3. Committee Room with video conferencing facility	1	20x30
4. Assistant Administrative Officer including staff	1	20x12
5. Assistant Accounts Officer including staff	1	20x12
6. Assistant Academic Officer including staff	1	20x12
7. Exam Cell (300 capacity)	1	20x12
8. Evaluation Room	1	20x36
9. Faculty Room (Ladies)	1	10x12
10. Faculty Room (Gents)	1	20x12
11. Placement Cell	1	20x12
12. Smart Lecture Halls	5	40x30 (60 capacity)
13. Exam Hall Cum Auditorium	1	100x50
14. Library/Book Bank	1	30x72
15. Common Utility Room	1	20x36
16. Central Laboratory	1	50x36
17. Hostels including Mess, Gym/Indoor, Reading Room,Warden Room, Store etc.	1 (boys)	150,1 (girls) 150
18. Canteen	120x12 (kitchen withstore)20x36 Seating	
19. Wash room (with toilet & urinary facilities)	10	20x12 (keeping ladiesrequirements)
20. Parking space	As per requirement	
21. Farm stores, threshing yards including implements andtractor sheds, One core, complex		
22. VehiclesCar 1(Jeep/Car -staff 2,Bus 1,Pickup van 1,Motor Bikes 2,Minibus (30 capacity) 1, Tractors 2		
23. Drinking water and irrigation facilities	As per requirements	
24. Vehicles shed	1	10x80

Divisions/Departments/Sections – Requirements

No. Details	**No. of Rooms**	**Dimensions(ft)**
1. Office of Head	11	24x12 with wash room facility
2. Faculty Rooms 1+1	12	12x10 + 18x1224x10 depending on the strength of each deptt.
3. Clerical/technical staff	12	12x10 to 24x10 depending on the strength of each deptt.
5. Laboratories	12	30x 60 Larger deptt. will have two
6. Field/Lab Stores	5	

1. Agronomy
2. Genetics and Plant Breeding
3. Soil Science and Agricultural Chemistry
4. Horticulture
5. Pests & Chemicals

7. Green house/poly house/Nursery facilities (Horticulture Deptt.) 0.02 ha

Requirements of Lab/field equipment for each Division/Department/Section)

1. Agronomy

1. Crop Cafeteria . acre land, small implements like spade,hoe, khurpi, darati etc.
2. Museum for identification of seeds, fertilizer, weeds, commonly usedagro-chemical and medicinal and aromatic plants etc.

Storage bottle ,Herbarium posting material

3. Field of sowing method, fertilizer application, irrigation and soilproductivity and yield estimationSmall equipment/ implement

Equipment Number

i. Hot air oven 02
ii Moisture box 30
iii Moisture meter 05
iv Tube Auger 10
v Bucket auger 10

vi Weighing Balance 01
vii Seed Germinator 02
viii Conductivity Meter 01
ix pH Meter 02
x Water Bath 01
xi Shaker 01
xii Chlorophyll Meter 01
xiii Drip and Sprinkler System 03
xiv Sprayer 03
xv Spring Balance 50 Kg 05
xvi Spring Balance 10 Kg 05
xvii Top Pan Balance 1 kg capacity 05
xviii Top Pan Balance 2 kg capacity 05
xix Meter Scale 10
xx Tape 05
xxi Brix meter 02

2. Agricultural Economics
1. Computers 15
2. Camera 01
3. Software As per requirement

3. Agriculture Extension & Communication Lab
1. LCD projector 1
2. Camera (SLR) with zoom, wide-angle, tele-photo lens 1
3. Video camera with tripod, lighting accessories and editing facility 1
4. Computers (workstation) with editing softwares 1
5. Digital voice recorders 5
6. Audio recording-mixing consoles 1
7. Computation softwares for statistics

4. Entomology
1. Binocular Microscope 20
2. Insect Box 60
3. Insect Collection Nets 60
4. Collection Bottles 60
5. Insect Collection Big Boxes for Museum (1 for each order) 29
6. Insecticides for showing students/Representative for each group As per requirement
7. Stereomicroscope 01
8. Electronic Balance 01
9. Soxhlet Extraction Apparatus 01
10. Bee keeping equipment 01 Set
11. Oven 01
12. PattersTower 01
13. Sprayers 01 of each type
14. Light traps 01 set
15. Fumigation Chamber 01
16. Sides/cover slips as per requirement
17. pH meter 01
18. Computer with printer 01 set

5. Genetics and Plant Breeding + (Crop Physiology, Biotechnology, Seed Science & Technology)
1. Microscope 10
2. Binocular microscope 10

3. Electronic Moisture Meter 02
4. Electronic Balance 02
5. Seed Germinator 02
6. Automatic seed/grain counter 01
7. Hot Air Oven 01
8. BOD Incubator 01
9. Fluorescence microscope 01
10. Centrifuge 01
11. Growth Chamber 01
12. Distillation Assembly 01

6. Horticulture Labs (Post Harvest)
1 Hand Refractometer 05
2 Digital Refractometer 02
3 Oven 01
4 Refrigerator 01
5 Electronic Weighing Balance 02
6 Pan Balance (1 kg & 10 kg. capacity each) 02
7 Deep Freezer 01
8 pH Meter 01
9 Fruit crusher 01
10 Grinding and Mixing Machine 01
11 Distillation Assembly 01
b. Lab (UG Lab)No. Items Nos.
1. Seed Germinator 02
2. Grafting and budding knife 60
3. Secateur 60
4. Saw 05
5. Loppers 05
6. Mist Chamber 01
7. Poly house with drip irrigation system 02
8. Microscope

7. Agricultural Chemistry and Soil Science + (Biochemistry, Microbiology)
1. Electronic Top pan balance (0.1 g capacity) 02
2. Electronic Top pan balance (1 mg capacity) 02
3. Hot air oven 02
4. pH Meter 05
5. EC Meter 05
6. Flame Photometer 01
7. Visible spectrophotometer 01
8. Hot Plate 02
9. Distilled water unit 02
10. Water Bath 01
11. Rotary Shaker 02
12. Binocular Microscope 20
13. BOD Incubator 02
14. Autoclave 02
15. Laminar Air Flow 01
16. Microwave oven 01
17. Digestion block 02
18. Hydrometer 05
19. Infiltrometer 02
20. Hydraulic conductivity meter 01

21. Atterberg'slimitsmeter 05
22. Nitrogen Analyser 02
23. GPS 10
24. AWS 01
25. Lysimeter 01
26. Luxmeter 02
27. Solar Pyranometer 01
28. Nitrogen Distillation Unit 01
29.Chromatography equipment-01
30.Soil sampling tools 01 set
31.Moisture box 30
32.Moisture meter 05
33.Tube Auger 10
34. Bucket auger 10
35.Weighing Balance 01
36. Chlorophyl Meter 01
37.Centrifuge machine 01

8. Agricultural Engineering, Soil Conservation, Agro-meteorology and Agroforestry
1. Working models of MB plough, Disk plough and indigenous plough 2 sets each
2. Working model of different harrows Actual
3. Seed drill 01
4. Different types of threshing drums As per requirement
5. Working models of reaper and mowers 02
6. Different types of sprayers and dusters As per requirement
7. Cut model of CI & SI engine 01
8. Cut model of Tractor 01
9. Thermometer Max 05
10. Thermometer Min 05
11. Digital Anemometer 02
12. Cup Anemometer 02
13. Pan Evaporimeter 01
14. Soil thermometer05 cm.10 cm.15 cm.05,05,05,
15. Rain gauge 01
16. Self-recording Rain gauge 01
17. Sunshine Recorder 01
18. Stevenson's Screen 01
19. Thermograph 01
20. Hygrograph 01
21. Soil Heat Flux Plate 01

9. Plant Pathology
1. Microscope compound with photodisplay arrangement 03
2. Sterobinocular 05
3. Sample processing Board (Dry preservation of samples) 04
4. Wet preservation Jars 50
5. Autoclave 02
6. Oven 01
7. Deep Freeze 01
8. Centrifuge (3000 rpm) 01
9. Refrigerator 01
10. Water bath 02
11. Electronic balance 02
12. Weighing machine 01

13. Incubator 02
14. Occular meter 05
15. Stage Micrometer 05
16. Camera Lucida 05

10. Animal Husbandry &Dairy

1. 5000/6500 Feed and Forage Analyzer 01
2. Hand and electric centrifuge 01
3. Analytical balance 01
4. Hot air oven 01
5. Micro kjeldahl N digestion & distillation apparatus 01
6. Soxhlet unit for fat estimation 01
7. Hot plate, Fiber Tech. 01
8. Vacuum pump 01
9. Willy mill grinder 01
10. Platform balance (100 kg cap) 01
11. Gerber centrifuge unit (for milk fat testing) 01
12. Milk analyzer (automatic) 01
13. Crude fiber estimation unit 01
14. Distilled water unit 01
15. Incubator cum hatcher 01
16. Brooder machine 01
17. Feeder 01
18. Waterer 01
19. Egg candling machine 01
20. Debeaker 01
21. Vaccinator 01
22. Milking machine As per requirements
23. Milking bucket As per requirement
24. Milking can As per requirements
25. Animal and bird identification tools As per requirement
26. Chaff cutter 01
27. Lactometer 01
28. Castrator 01
29. Shearer 01
30. Electric dehorner 01
31. Artificial vagina 01
32. Common medication device 01
33. Cattle crate 01

11. Central Library and Information System

1. Internet Server	01
2. Intranet Server	01
3. Computers for Reading Hall	20
4. Heavy Duty Photocopiers	02
5. Computerized Issue and Catalogue Systems	02
6. Wi-Fi facility in college/library/hostels As per requirement	
7. CCTV monitoring system for library	01
8. RFID and Access Control System (Optional)	01
9. Broadband Internet Connectivity with minimum speed of 1Gbps	

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