VIDYASAGAR UNIVERSITY

REGULATIONS, CURRICULUM & SYLLABUS

For

B. Sc. (Hons) Agriculture

(w.e.f. Academic Year 2021-2022)

B. Sc. (Hons) Agriculture

Regulations, Curriculum and Syllabus

(w.e.f. Academic Year 2021-2022)

As per recommendations of Vth Deans' Committee of

Indian Council of Agricultural Research (ICAR)

VIDYASAGAR UNIVERSITY

Paschim Midnapore 721102, West Bengal

REGULATIONS

1. Title and Commencement:

1.1 These Regulations shall be called The Academic Regulations for '**B. Sc. (Hons) Agriculture,** 4-YEAR UNDERGRADUATE DEGREE PROGRAMME, 2021-22 UNDER VIDYASAGAR UNIVERSITY' for obtaining Bachelor Degree in the Agriculture Science under Semester system.

1.2 These Regulations shall apply to the students admitted in B.Sc. (Hons) Agriculture from the Academic Year **2021 – 2022** onwards.

2. Degree Nomenclature:

B. Sc. (Hons) Agriculture

3. Duration of the Degree Programme

3.1 The duration of the Programme is **EIGHT (08)** consecutive **SEMESTERS** of six months each *i. e.*, **FOUR (04) YEARS**.

3.2 A candidate shall have to clear all the Semesters maximum within **SIX YEARS** from the academic year of his/her first admission and registration to the B.Sc. (Hons) Agriculture. Programme under Vidyasagar University failing which enrolment of the candidate shall stand cancelled.

3. Definitions

Academic Year: The 'Academic Year' shall ordinarily be formed as per Vidyasagar University rules.

Semester: An academic term consisting of not less than 90 instructional days, excluding days of final theory examinations.

Credit Hour: Each credit hour will be equivalent to one-hour lecture of theory or two hours of laboratory work for practical per week. It is also known as semester credit or credit.

Course: A course is a unit of instruction or a segment of subject to be covered in a semester. It has a specific number, title and credits.

Grade Point of a Course: Each course will be evaluated for 100 marks irrespective of the credits (theory or practical or theory and practical combined as per credits) for awarding grade point. The grade point shall be rounded to the second decimal place.

Credit Point of a Course: The product of credit hours and grade point obtained by the student in each course.

Grade Point Average (GPA): It is the quotient of the total credit points both in theory and

practical of various courses obtained by a student at the end of each semester divided by the total evaluated credit hours taken by the student in that semester. The grading is done on a 10-point scale. The GPA is to be rounded to the second decimal place.

Overall Grade Point Average (OGPA): It is the quotient of cumulative credit points obtained by a student in all the subjects both in theory and practical examinations taken by him/her from the beginning of the first academic year of the degree course divided by the total evaluated credit hours of all the subjects which he/she had completed up to the end of a given semester. It determines the overall performance of a student in all the subjects taken during entire course curriculum. The OGPA is to be rounded to the second decimal place. The Overall Grade Point Average obtained by a student on a 10-point scale is converted to percentage of marks by dividing the OGPA by 10 and multiplying with 100.

Grade Card or Marksheet: Based on the grade earned, a grade card or marksheet shall be issued after every semester. The grade card shall display the course details (code, title, marks, number of credits, grade secured) along with GPA and OGPA where applicable.

4. Admission

4.1 The admission to undergraduate degree programmes in B.Sc. (Hons) Agriculture will be governed by the guidelines of the Vidyasagar University and that of the Department of Higher Education, Govt. of West Bengal as laid down from time to time.

4.2 Age: Not less than 17 years as on 31st December in the year of application.

4.3 The candidate must pass the Higher Secondary (10+2) or its equivalent examinations with **Physics, Chemistry, Biology/Mathematics and English** as compulsory subjects with individual pass marks (in both theory and practical wherever applicable) in all the above four subjects in regular class mode.

4.4 The selection of students for admission will be done as per the merit list. The merit list will be prepared according to percentage of total marks obtained in the subjects of H.S. (10+2) or its equivalent examinations as stated above or through Entrance Examination or as laid down by Vidyasagar University from time to time.

4.5 A candidate shall be allowed to pursue any one of the degree undergraduate programme of the university at a time, not more than one.

4.6 Admission to the 1st Semester shall not be considered after the commencement of the classes.

5. Registration

5.1 Registration is mandatory for prosecuting studies. The registration for UG Degree programme will be governed by the University Regulations relating to Registration.

5.2 A student shall have to submit Registration Form only once at the time of entry to the UG Courses. He / She shall not be required to renew the registration at any subsequent stage.

5.3 A candidate provisionally admitted to B.Sc. (Hons) Agriculture degree but not registered under Vidyasagar University shall not be allowed to sit for 1st Semester Examination.

5.4. A candidate not being able to complete the programme within the Six subsequent Academic Years of his/her admission, the Registration of the candidate shall be treated as cancelled.

5.5. Migration/ Transfer of any student studying B.Sc. (Hons) Agriculture in any College affiliated to Vidyasagar University is not allowed during entire degree programme. Student shall not be allowed to change the college in the middle of his/her degree programme.

6. Attendance

6.1 A student having at least 75% attendance of scheduled theory and practical classes separately shall be allowed to sit for the concerned Semester Examination subject to the fulfilment of other conditions as laid down in the regulations.

6.2 Relaxation in attendance for NCC, NSS and Co-curricular activities is admissible as per University regulations subject to prior approval of College Authority.

6.3. The minimum attendance prescribed for Student READY programmes is 90%. Apart from medical ground no relaxation is allowed.

7. Course & Curriculum

7.1 Course of Study: Degree Course of B.Sc. (Hons) Agriculture shall comprise of a course of study consisting of Curriculum and Syllabi spread over four academic years including Student READY Programme. Each Course is allotted with credit-hour (s) of theory and practical classes. Course may be "Credit Course"/ "Non Credit Course". The Student READY Programme (SRP) is offered in two Semesters in the final year of the degree programme i.e., in Semester-VII **SRP-RAWE (Rural Agriculture Work Experience Programme)** and **AIA (Agro-industrial Attachment)**. In Semester VIII consists of 2 courses/papers under **Experimental Learning Module** which include Skill development of the students in Experimental learning program, planning, development, formulation, monitoring and evaluation of project for entrepreneurial proficiency.

7.2 The details of the Courses, Credits and Syllabi are framed in concurrence with the Vth Deans' Committee Recommendations by ICAR, 2017 and shall be prescribed by the University from time to time.

7.3 Medium of Instruction: Medium of instruction shall be English

7.4 Advisory System: The students after admission to B.Sc. (Hons) Agriculture programme shall be divided into different batches of convenient size by the College Authority and each batch shall be assigned a Student Advisor, one faculty member designated for the same. Among other things, the Advisors shall help the students in planning their academic programme.

7.5 Curriculum and Credits Requirement

The total credit requirement for the B.Sc. (Hons) Agriculture undergraduate degree programme shall be **181 credits** including **138 Instructional Credits** (Evaluated) + **20 for SRP (RAWE – AIA)** (Semester-VII) + **20 Experimental Learning programme** (Semester-VIII) + **3 Compulsory Non-credit courses** (Non-Evaluated Course).

8. Examination and Evaluation System

8.1 Date of Examination:

Exact dates and the schedule of examination shall be notified by the Controller of Examinations, Vidyasagar University. In the event of any unforeseen exigency the Controller of Examinations shall be competent for any adjustment in the prescribed schedule.

8.2 Schedule of Examination:

The schedule of examinations of B.Sc. (Hons) Agriculture consists of Internal and External Examinations. End Semester Examination (External) shall be conducted at the end of the academic activities of the respective Semester. There shall be one Midterm (Internal) examination to be conducted by the Colleges offering the course after completing 60% of the course in a Semester.

The details of examination are given below:

External Theory - 50%
Internal Theory + Practical - 50%

Course with both theory and practical: ***Total marks: 100***

- Theory: 80
  - (i) End Semester Examination = 50 marks
  - (ii) Midterm / Internal Assessment = 30 marks
- End Semester Practical Examination = 20 marks

Course with only theory: ***Total marks: 100***

(i) End Semester Examination: = 50 marks
(ii) Midterm / Internal Assessment: = 30 marks
(iii) Assignment = 20 marks

Course with only Practical: ***Total marks: 100***

(i) End Semester Practical Examination = 50 marks
(ii) Midterm/Internal Assessment = 30 marks
(iii) Assignment / Practical Note Book = 20 marks

8.3 Midterm (Internal) Examination: There shall be one Midterm (Internal) examination comprising of objective and subjective questions in the ratio of 40:60. The midterm examination shall be conducted by the concerned college offering B.Sc. (Hons) Agriculture programme at least after 60% completion of respective course. The Principal/ Officer In-charge of the respective college shall be responsible for conducting examination and providing the marks to the Controller of the Exanimation, Vidyasagar University maintaining the confidentiality of the examination. The modalities of such assessment be recorded and documents will be preserved by the respective college and those must be placed before any committee or team constituted by the university for verification.

8.4 End Semester (External) Examination: The End Semester (External) Examination An examination conducted by the University in each course for which an external examiner shall set the question paper (based on the Syllabus/Lecture Outlines of the concerned course) and also evaluate the answer papers as per the schedule of examination during the period scheduled by the Vidyasagar University at the end of each semester. End Semester (External) Examinations shall be conducted by the University as per the examination rules & regulations of Vidyasagar University. The date and schedule of end semester examination shall be determined by the Controller of Examination, Vidyasagar University

8.5 Practical Examination and Class Assessment/Assignment: There shall be one Practical Examination in each course at the end of Semester before the end of instructional days. Practical examination shall be conducted by the respective College offering B.Sc. (Hons) Agriculture. programme in presence of expert/ evaluator nominated by the Vidyasagar University. The Principal/ Officer In-charge of the respective college shall be responsible for conducting examination with intimation to the University and providing the marks to the Controller of the Exanimation, Vidyasagar University maintaining the confidentiality of the examination. The modalities of such assessment be recorded and documents will be preserved by the respective college and those must be placed before any committee or team constituted by the university for verification.

8.6 Hour of End Semester Examination:

a. External Examination (**Theoretical) paper** of full marks **50,** duration **2** hours.
b. Midterm Examination (**Theoretical)** papers of full marks **30,** duration **1** hour.
c. Practical / Assignment **(Internal)** of full marks **20,** duration **2** hour.

8.7 Eligibility criteria of examination and types of assessment:

A candidate shall be eligible for appearing at any of the semester of examination fulfilling the following essential condition:

1. A student must have at least 75% class attendance (theory and practical separately).
2. Unless a student appears for the midterm examination and practical examination, the student should not be permitted to appear for the Semester Final Theory examinations in the course concerned.
3. Student shall have to fill-up the examination form of the University paying the required fees as stipulated by the Vidyasagar University from time to time.
4. Registration is mandatory prior to form fill-up for the 1st Semester Examination.
5. Admit card shall be issued by the Controller of Examinations before the End Semester Examination and is mandatory for appearing at the examination.

8.8 Evaluation / Grading System:

Based on the performance of the students, each student will be awarded Grade in subjects at the end of the semester examination following grading system on the base of TEN (10). On the basis of Cumulative Grade Point Average the student shall be awarded the Division to corroborate with the traditional scoring system.

i. **Grade Point** in a course shall be the total marks obtained by a student out of 100 divided by 10
ii. **Credit Point** is the Grade Point of the course multiplied by course credit.
iii. **Total Credit Point** shall be the sum of credit point secured by the student.
iv. **Grade Point Average (GPA)**shall be the sum of the total credit point earned divided by the sum of credit hours
v. Overall Grade Point Average (OGPA) shall be the grand total of credit points earned divided the grand sum of credit hours

Degree	Percentage of Marks Obtained	Conversion into Points
B.Sc. (Hons) Agriculture	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
	Eg. 80.76	8.076
	43.60	4.360
	72.50 (but shortage in attendance)	Fail (1 point)

GPA = Total points scored / Total credits (for 1 semester)
OGPA = ∑ Total points scored / Course credits
% of Marks = OGPA/10 x 100

Classification of Successful Candidates: The successful candidates who after completion of the graduation requirements, have secured a CGPA of 5.00 or more in the 10.00 point scale shall be classified as under:

OGPA	Division
5.00 – 5.99	Pass
6.00 – 6.99	II division
7.00 – 7.99	I division
8.00 and above	I division with distinction

8.9 Promotion:

i. A candidate has to secure **minimum of 50% marks** of each course including the **minimum of 30% marks in end semester theory examination and 50% marks in practical examination** in order to qualify for the next semester.

ii. Progression to the next higher semester shall be allowed with maximum upto 2 (two) supplementary courses in a semester which to be cleared in corresponding end semester examinations. Candidate shall have two chances to clear supplementary in the subsequent examinations.

iii. A candidate shall have to clear all the Semesters maximum within **SIX YEARS** from the academic year of his/her admission and registration to the B.Sc. (Hons) Agriculture Programme under Vidyasagar University failing which enrolment of the candidate shall stand cancelled.

iv. The candidates remaining absent in the end semester theory examination will be marked as **ABSENT** and the candidate shall not be eligible to qualify for marks processing. The marks obtained in Internal Assessment shall be retained for the entire duration of his/her enrolment.

v. If a candidate secure pass marks in Practical Paper(s)/Project Work but fails to secure pass marks in theoretical papers, the marks of Practical Paper(s)/Project Work along with Internal Assessment of theoretical papers shall be retained.

vi. All backlog papers from 1st Semester to 6th Semester must be cleared before being promoted to **7th Semester.** Only after clearance of the entire supplementary student shall qualify to attend the Student READY programme.

vii. A student must secure **OGPA more than 5.00 out of 10.00** at the end of the degree programme to be eligible to get **B.Sc. (Hons) Agriculture Degree**.

9. Supplementary Examination:

i. A candidate who fails to secure pass marks in one or more courses maximum upto two courses of a Semester may appear in those paper(s) during Supplementary Examination when the concerned End Semester Examination will be held next.

ii. A candidate shall have to clear supplementary papers within two consecutive chances including his / her first appearance in the concerned End Semester Examination.

iii. A **Special Supplementary** examination will be held for **3rd year students** who have arrear paper only for **6th semester** to qualify them for Student READY programme.

Foot Note:

a) Principal / HOD of concern college shall ensure the coverage of syllabus.
b) End term theory and practical paper to be set by external examiner as per University regulation.
c) Evaluation of course paper to be done as per Vidyasagar University rules.
d) Practical examination shall be conducted by Internal and External teacher recommended by the BOS

SEMESTER WISE DISTRIBUTION OF COURSES

SEMESTER-I

Sl. No.	Course No.	Course Title	Credit hour
1	AGS-101	Fundamentals of Horticulture	2 (1+1)
2	AGS-102	Fundamentals of Crop Physiology	2 (1+1)
3	AGS-103	Fundamentals of Soil Science	3 (2+1)
4	AGS-104	Introduction to Forestry	2 (1+1)
5	AGS-105	Comprehension & Communication skills in English	2 (1+1)
6	AGS-106	Fundamentals of Agronomy	4 (3+1)
7	AGS-107	Introductory Biology / Elementary Mathematics	2 (1+1) / 2 (2+0)
8	AGS-108	Agricultural Heritage	1 (1+0)
9	AGS-109	Rural Sociology & Educational Psychology	2 (0+2)
10	AGS-110	Human Values & Ethics	***1 (1+0)****
11	AGS-111	NSS/NCC/Physical education and Yoga*	***2 (0+2)****
		Total	**23(12+11)/ (13+10)**

***CNC= Compulsory Non- credit Course (Non-Gradial)**

SEMESTER-II

Sl. No.	Course No.	Course Title	Credit hour
1	AGS-201	Fundamentals of Genetics	3 (2+1)
2	AGS-202	Agricultural Microbiology	2 (1+1)
3	AGS-203	Soil and Water Conservation Engineering	2 (1+1)
4	AGS-204	Fundamentals of Plant Biochemistry & Biotechnology	3 (2+1)
5	AGS-205	Fundamentals of Agricultural Economics	2 (2+0)
6	AGS-206	Fundamentals of Plant Pathology	4 (3+1)
7	AGS-207	Fundamentals of Entomology	4 (3+1)
8	AGS-208	Fundamentals of Agricultural Extension Education	3 (2+1)
9	AGS-209	Communication Skills and Personality Development	2 (1+1)
		Total	**25 (17+8)**

SEMESTER-III

Sl. No.	Course No.	Course Title	Credit hour
1	AGS-301	Crop Production Technology – I (Kharif Crops)	2 (1+1)
2	AGS-302	Fundamentals of Plant Breeding	3 (2+1)
3	AGS-303	Agricultural Finance and Cooperation	3 (2+1)
4	AGS-304	Agri- Informatics	2 (1+1)
5	AGS-305	Farm Machinery and Power	2 (1+1)

6	AGS-306	Production Technology for Vegetables and Spices	2 (1+1)
7	AGS-307	Environmental Studies and Disaster Management	3 (2+1)
8	AGS-308	Statistical Methods	2 (1+1)
9	AGS-309	Livestock and Poultry Management	4 (3+1)
		Total	**23 (14+9)**

SEMESTER-IV

Sl. No.	**Course No.**	**Course Title**	**Credit hour**
1	AGS-401	Crop Production Technology –II *(Rabi Crops)*	2 (1+1)
2	AGS-402	Production Technology for Ornamental Crops, MAP and Landscaping	2 (1+1)
3	AGS-403	Renewable Energy and Green Technology	2 (1+1)
4	AGS-404	Problematic Soils and their Management	2 (2+0)
5	AGS-405	Production Technology for Fruit and Plantation Crops	2 (1+1)
6	AGS-406	Principles of Seed Technology	3 (1+2)
7	AGS-407	Farming System & Sustainable Agriculture	1 (1+0)
8	AGS-408	Agricultural Marketing Trade & Prices	3 (2+1)
9	AGS-409	Introductory Agro-meteorology & Climate Change	2 (1+1)
Elective Course (Any One) – TBD			
	AGEC-451	Agrochemicals	**3 (2+1)**
	AGEC-452	Biopesticides & Biofertilizers	
	AGEC-456	Micro propagation Technologies	
		Total	**19 (11+8) +3 (Elec.)**

TBD – To be decided

SEMESTER-V

Sl. No.	**Course No.**	**Course Title**	**Credit hour**
1	AGS 501	Principles of Integrated Pest & Disease Management	3 (2+1)
2	AGS-502	Manures, Fertilizers and Soil Fertility Management	3 (2+1)
3	AGS-503	Pests of Crops and Stored Grain and their Management	3 (2+1)
4	AGS-504	Diseases of Field and Horticultural Crops and their Management –I	3 (2+1)
5	AGS-505	Crop Improvement-I *(Kharif*	2 (1+1)
6	AGS-506	Entrepreneurship Development and Business Communication	2 (1+1)
7	AGS-507	Geoinformatics and Nano- technology and Precision Farming	2 (1+1)

8	AGS-508	Practical Crop Production – I	2 (0+2)
9	AGS-509	Intellectual Property Rights	1 (1+0)
Elective Course (Any One) – TBD			
	AGEC-553	Weed Management	**3 (2+1)**
	AGEC-557	Commercial Plant Breeding	
	AGEC-558	Protected Cultivation	
		Total	**21 (12+9) +3 (Elec.)**

TBD – To be decided

SEMESTER-VI

Sl. No.	**Course No.**	**Course Title**	**Credit hour**
1	AGS-601	Rainfed Agriculture & Watershed Management	2 (1+1)
2	AGS-602	Protected Cultivation and Secondary Agriculture	2 (1+1)
3	AGS-603	Diseases of Field and Horticultural Crops and their Management-II	3 (2+1)
4	AGS-604	Post-harvest Management and Value Addition of Fruits and Vegetables	2 (1+1)
5	AGS-605	Management of Beneficial Insects	2 (1+1)
6	AGS-606	Crop Improvement-II *(Rabi crops)*	2 (1+1)
7	AGS-607	Practical Crop Production--II (Rabi Crops)	2 (0+2)
8	AGS-608	Principles of Organic Farming	2 (1+1)
9	AGS-609	Farm Management, Production and Resource Economics	2 (1+1)
10	AGS-610	Principles of Food Science and Nutrition	2 (2+0)
Elective Course (Any One) – TBD			
	AGEC-654	System Simulation and Agro- advisory	**3 (2+1)**
	AGEC-655	Landscaping	
	AGEC-659	Hi-tech. Horticulture	
		Total	**21 (11+10) +3 (Elec.)**

TBD – To be decided

SEMESTER-VII: Student READY programme (SRP)

Sl. No.	**Course No.**	**Course Title**	**Credit hour**
1	RAWE-701	Rural Agricultural Work Experience (RAWE)	10 (0+10)
2	AIA-702	Agro Industrial Attachment (AIA)	10 (0+10)
		Total	**20 (0+20)**

SEMESTER-VIII: Experiential Learning Programme (ELP)

Sl. No.	Course No.	Course Title	Credit hour
ELP - Any Two Modules of (0+10) credits (TBD)			
1	ELP-801	Seed Production and Technology	10 (0+10)
2	ELP-802	Production Technology for Bioagents and Biofertilizer	10 (0+10)
3	ELP-803	Mushroom Cultivation Technology	10 (0+10)
4	ELP-804	Soil, Plant, Water and Seed Testing	10 (0+10)
5	ELP-805	Seed Production and Technology	10 (0+10)
6	ELP-806	Production Technology for Bioagents & Biofertilizer	10 (0+10)
7	ELP-807	Mushroom Cultivation Technology	10 (0+10)
8	ELP-808	Soil, Plant, Water and Seed Testing	10 (0+10)
9	ELP-809	Commercial Beekeeping	10 (0+10)
10	ELP-810	Poultry Production Technology	10 (0+10)
11	ELP-811	Commercial Horticulture	10 (0+10)
		Total	**20(0+10x2)**

Semester-wise Credit loads

Semester	Credit(s)
Semester I	23 (12+8+3*)
Semester II	25 (17+8)
Semester III	23 (14+9)
Semester IV	22 (11+8+3)
Semester V	24 (12+9+3)
Semester VI	24 (11+10+3)
Semester VII	20 (0+ 20)
Semester VIII	20 (0+ 20)
Grand Total	**181**

FIRST SEMESTER

Fundamental of Horticulture

Code: AGS 101 **Full Marks-100**
1L+1P=2
Credit-2

COURSE OUTCOME:

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

Theory

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

Practical

Identification of garden tools. Identification of horticultural crops. Preparation of seed bed/nursery bed. Practice of sexual and asexual methods of propagation. Layout and planting of orchard plants. Training and pruning of fruit trees. Transplanting and care of vegetable seedlings. Making of herbaceous and shrubbery borders. Preparation of potting mixture, potting and repotting. Fertilizer application in different crops. Visits to commercial nurseries/orchard.

Recommended Reading:

1. Introduction to Horticulture - N. Kumar, Oxford Publisher Ltd, Delhi (2010)
2. Basic Horticulture - Jitendra Singh, Kalyani Publishers, Delhi (2014)
3. Fruit Growing - Jules Janick, Willey Blackwell, New York (1994)
4. Floriculture in India - G.S. Randhawa and A. Mukhopadhyay, Kalyani Publishers, Delhi (1990)

Fundamentals of Crop Physiology

Code: AGS 102 **Full Marks-100**
1L+1P=2
Credit-2

COURSE OUTCOME:

To give students a greater understanding of the crop physiological processes such as water metabolism, mineral nutrition, photosynthesis, respiration, fatty acid metabolism, flowering and plant growth regulators.

Theory

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

Practical

Study of plant cells, structure and distribution of stomata, imbibitions, osmosis, plasmolysis, measurement of root pressure, rate of transpiration, Separation of photosynthetic pigments through paper chromatography, Rate of transpiration, photosynthesis, respiration, tissue test for mineral nutrients, estimation of relative water content, Measurement of absorption spectrum of chlorophyll

Recommended reading:

1. Principles of Seed Technology - G.N. Kulkarni, Kalyani Publishers, Delhi (2004)
2. Plant Physiology - R.G.S. Bidwell, Academic Press Inc (1991)
3. A Text book of plant physiology - C.P. Mallick and A.K. Srivastav, Student Advisor Publications Pvt. Ltd. (2015)
4. The germination of seeds - A.M. Mayer and A. Poljakoff-Mayber, Pergamon Press (1929)
5. Plant Physiology - R.K.Sinha, Kalyani Publisher (1998)
6. The physiology and biochemistry of seed development, dormancy and germination - A.A.Khan, Kalyani Publisher, Delhi (2004)
7. Seed Physiology - K. Vanangamudi, Associated Publishing Company (2006)

Fundamentals of Soil Science

Code: AGS 103 **Full Marks - 100**

2L+1P=3

Credit-3

COURSE OUTCOME:

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

Theory

Soil as a natural body, Pedological and edaphological concepts of soil; Soil genesis: soil forming rocks and minerals; weathering, processes and factors of soil formation; Soil Profile, components of soil; Soil

physical properties: soil texture- Methods of particle size analysis, structure, density and porosity, soil ; Soil reaction-pH, soil acidity and alkalinity, buffering, effect of pH on nutrient availability; soil colloids - inorganic and organic; silicate clays: constitution and properties; sources of charge ion exchange, cation exchange capacity, base saturation; soil organic matter: composition, properties and its influence on soil properties; humic substances - nature and properties; soil organisms: macro and micro-organisms, their beneficial and harmful effects.

Practical

Study of soil sampling tools, collection of representative soil sample, its processing and storage. Study of soil profile in field. Study of soil forming rocks and minerals. Determination of particle density and bulk density of soil and computation of porosity, Determination of soil moisture content and maximum water holding capacity and computation of moisture constants. Determination of soil texture by feel and international pipette method. Studies of capillary rise phenomenon of water in soil column and water movement in soil. Study of soil map. Determination of soil colour. Demonstration of heat transfer in soil. Determination of soil pH and electrical conductivity. Determination of cation exchange capacity of soil. Estimation of organic matter content of soil

Recommended Reading:

1. ISSS. 2009. Fundamentals of Soil Science. 2nd Ed. Indian Society of Soil Science, New Delhi- 110 012. pp. 728.
2. Das D. K. 2011. Introductory Soil Science, 3rd revised and Enlarged Ed, Kalyani Publisher, Ludhiana. pp. 645.
3. Brady, N. C. 2016. The Nature and Properties of Soils. 15th edition Publisher: Pearson Education, ISBN: 978-0133254488
4. Daji J A; Daji J A; Kadam J R; Patil N D.1996. Textbook of Soil Science Bombay Media Promoters and publishers Pvt. Ltd.
5. Biswas, T.D.; Mukherjee, S.K.. 1995. Text Book of Soil Science 2nd sEd. Tata McGraw Hill Publisher, Delhi pp 433.
6. Somawanshi, et al. 2012. Laboratory Methods for Analysis of Soil, Irrigation Water and Plants., Department of Soil Science and Agriculturasl Chemistry, MPKV., Rahuri. Revised Ed. pp. 307.

Introduction to Forestry

Code: AGS 104 **Full Marks-100**
1L+1P=2
Credit-2

COURSE OUTCOME:

To impart knowledge on basics of Forest trees, agro forestry and silviculture– its scope and prospects.

Theory

Introduction – definitions of basic terms related to forestry, objectives of silviculture, forest classification, salient features of Indian Forest Policies. Forest regeneration, Natural regeneration - natural regeneration

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

Practical

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

Recommended Reading:

1. Principles and Practices of Silviculture - S. Khanna, Sanskrit Press, Kolkata (1995)
2. A Text book of Silviculture - P. Dwivedi, International Book, Dehradun (1995)
3. Text book of Agro-forestry - S. Chundawat and S. K. Goutam, Kalyani Publishers, Delhi (1980)

Comprehension & Communication skills in English

Code: AGS 105 **Full Marks-100**

1L+1P=2

Credit-2

COURSE OUTCOME:

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

Theory:

Selected Short Stories of eminent writers from India and abroad: Rabindranath Tagore, Mulk Raj Anand, Premchand, R K Narayan, Isaac Asimov (Science Fiction), Sudha Murthy, Leo Tolstoy, O Henry, Anton Chekhov, Guy De Maupassant, K A Abbas Basic Grammar: Articles, Prepositions, Concord, Transformation, Synthesis, Reported Speech, Active- Passive Voice

Practical

Reading Comprehension Practice in reading short paragraphs, notices, announcements, advertisements, newspaper articles, reports, etc. Writing Skills: Writing experimental reports and journals, Writing informal letters, leave applications, Writing short notices, announcements, Filling simple forms for different purposes, Short Notes Listening Comprehension: Listening to announcements at public places like

Railway Station, Bus Station, Airports, Malls, etc., Listening to short conversations on basic language functions, Listening to short speeches and lectures, Listening to news on TV & Radio Speaking: Introduction, Greeting people on different occasions, Carrying out basic language functions like Asking for Permission, Asking and Showing directions, Describing people and places, Reporting ongoing events, etc.

Recommended Reading:

1. Personality Development and Soft Skills - B. K. Mitra, Oxford University Press (2011)
2. Communication Skills and Personality Development - P. C. Sharma, Nirali Prakashan (2014)
3. Personality Development and Communication Skills - S. S. Narula, Taxmann Publications Private Limited (2011)

Fundamentals of Agronomy

Code: AGS 106 **Full Marks - 100**
3L+1P=4
Credit-4

COURSE OUTCOME:

To impart knowledge on basics of Agronomy – its scope and to give basic concept of growth, development, soil-water-plant relationship, quality of irrigation water, water logging, irrigation scheduling and method of irrigation.

Theory

Agronomy and its scope, seeds and sowing, tillage and tilth, crop density and geometry, Crop nutrition, manures and fertilizers, nutrient use efficiency;

Water resources, soil-plant-water relationship, crop water requirement, water use efficiency, irrigation-scheduling criteria and methods, quality of irrigation water, logging. Water resources and irrigation development in India and West Bengal; Irrigation: definition and objectives; Soil-plant-water relationship; Soil moisture tension and retention, methods of moisture estimation, Soil water classification: physical and biological, and soil water constants; Water and irrigation requirement of different crops, and water use efficiency, evapo-transpiration, crop water requirement; Irrigation scheduling and methods, irrigation efficiencies; Quality of irrigation water; Water logging and drainage;

Weeds: importance, classification, crop-weed association / competition; Weeds- importance, classification, crop weed competition, concepts of weed management principles and methods, herbicides-classification, selectivity and resistance, allelopathy. Growth and development of crops, factors affecting growth and development, plant ideotypes, crop rotation and its principles, adaptation and distribution of crops, crop management technologies in problematic areas, harvesting and threshing of crops. Weed management: concept, principles, methods, merits, demerits and utilization; Cultural and mechanical weed management practices; 19 Chemical weed management, herbicides: classification, selectivity, resistance, formulations and mixtures, concept of adjuvants, safeners and surfactants; Biological weed management, bio-herbicides and allelopathy.

Practical

Identification of crops, seeds, fertilizers, pesticides and tillage implements, study of agro-climatic zones of India, Identification of weeds in crops, Methods of herbicide and fertilizer application, Study of yield contributing characters and yield estimation, Seed germination and viability test, Numerical exercises on fertilizer requirement, plant population and herbicides. Use of tillage implements-reversible plough, one way plough, harrow, leveler, seed drill. Study on soil moisture measuring devices, Measurement of field capacity, bulk density and infiltration rate, Measurement of irrigation water and determination of irrigation efficiency; Calculation on water requirement; Identification of weeds in crop fields and study on weed seed bank; Cultural, mechanical and biological methods of eco-safe weed management; Calibration of sprayer, types of herbicides and application methods; Numerical exercise on herbicide and weed control efficiency.

Recommended Reading:

1. Principles of Agronomy - T. Y. Reddy and G.H. Sankar Reddi, Kalyani Publishers (2015)
2. Principles of Agronomy - S. R. Reddy, Kalyani Publishers (2016)
3. The Nature and Properties of Soils - N. C. Brady and R. R. Weil, Prentice Hall Inc. (1996)
4. Manures and fertilizers - K. S. Yawalkar, J. P. Agarwal, and S. Bokde, Agri-Horticultural Publication House. (1967)
5. Soil Conditions and Plants Growth - J.E. Russell, Daya Books (2002)
6. Principles of Agronomy by S. R. Reddy
7. Crop production and Management by Y. B. Morachand
8. Principles of Agronomy by Sankaran S and V. T. SubbiahMudliyar
9. Irrigation Water Managemnt by Dilip Kumar Muzumdar
10. Principles and Practices of Water Management by A. M. Michel
11. Irrigation and Drainage by Lenka D. .
12. Soil Management and organic farming By S.C. Panda Agrobios.

Introductory Biology

Code: AGS 107 **Full Marks-100**

1L+1P=2

Credit-2

COURSE OUTCOME:

To impart knowledge on basics of plant morphology, physiology, basic plant life and evolution and classification of plants.

Theory

Introduction to the living world. Composition and biological classification., Diversity and characteristics of life.Definition of diversity;

studying relationship between different organisms, Origin of life ; theories of origin of life ,Oparin-Haldane theory of chemical origin of life, Evolution and Eugenics ; evidences of organic evolution, theories of evolution; Definition of Eugenics , genetics and Mendel'sexperiment, Binomial nomenclature and classification, Cell and cell division: Cell Structure, Composition and cell

organelles and their functions; Mitosis and meiosis their significance, Morphology of flowering plants, (roots, stems, leaves, flowers and fruits), Seed and seed germination: Structure of monocot and dicot seed, Types of germination, factors affecting germination, Plant systematic – Study of families *viz*. A) Brassicaceae, B) Fabaceae, C) Poaceae Role of animals in agriculture.

Practical

1. Morphological studies of flowering plant.
2. Study of different root system and their Modifications.
3. Study of different forms of stems and their modifications.
4. Study of Branching pattern of plants.
5. Study of leaves and their modifications.
6. Study of stipules of leaves, leaf blade leaf venation.
7. Study of inflorescence, flowers and aestivation
8. Study of reproduction organs and placentation.
9. Study of fruits and their different parts.
10. Seed germination studies in different crops.
11. Study of Cell, Tissue and cell division through specimens and slides
12. Internal structure of root, stem and leaf of monocot and dicot plants.
13. Description of plant belongs to family Brassicacea. viz. Mustard/ Cabbage/ Cauliflower/ Radish. (Any one)
14. Description of plant belongs to family Fabaceae. viz. Pigeon pea/ Pea/ Cowpea/ Wal. (Any one)
15. Description of plant belongs to family Poaceae. viz. Rice/ wheat/ Jowar/ Maize. (Any one)

Suggested Readings:

1) Cell Biology, Genetics, Molecular Biology and Evolution by P.S. Verma, V.K. Agrwal. S. Chand and Company Ltd. Ram Nagar New Delhi.
2) Evolution of Vertebrates by Edwin H. Colbert, Publisher- A Wiley, Interscience Publication, John Wiley and Sons New York.
3) A class- book of Botany by A.C. Dutta, Publisher- Oxford University press YMCA Library Building. 1 Jai Singh Road, New Delhi 110001, India
4) Fundamentals of Genetics by B.D. Singh, Publisher- Kalyani Publishers B-I/1292, Rajinder Nagar, Ludhiana- 141008
5) A Text book of Practical Btoany-2 by Dr. Ashok M. Bendre, Dr. Ashok Kumar, Publisher- Rastogi Publications Shivaji Road, Meerut – 25002, India
6) Botany- An introduction to Plant Biology by Jamesh D. Mauseth, Publisher- Continental Prakashan 1962, Pune
7) Anatomy of seed Plants by A.C. Datta, Sigh V. Pande P.G, Publisher- Sai printopack New Delhi Rastogi, Publication Meerut
8) Hand book of Animal Husbandry by ICAR, New Delhi Publication, Publisher- Directorate of knowledge management in agriculture, Krishi Anusandhan Bhavan, Pusa New Delhi 110012

OR

Elementary Mathematics

Code: AGS 107 **Full Marks-100**

2L+0P=2

Credit-2

COURSE OUTCOME:

To impart knowledge on basics mathemetics and its application with agriculture.

Theory

Straight lines : Distance formula, section formula (internal and external division), Change of axes (only origin changed), Equation of co-ordinate axes, Equation of lines parallel to axes, Slope-intercept form of equation of line, Slope-point form of equation of line, Two point form of equation of line, Intercept form of equation of line, Normal form of equation of line, General form of equation of line, Point of intersection of two st. lines, Angles between two st. lines, Parallel lines, Perpendicular lines, Angle of bisectors between two lines, Area of triangle and quadrilateral. Circle: Equation of circle whose centre and radius is known, General equation of a circle, Equation of circle passing through three given points, Equation of circle whose diameters is line joining two points (x1, y1) & (x2,y2), Tangent and Normal to a given circle at given point (Simple problems), Condition of tangency of a line $y = mx + c$ to the given circle $x2 + y2 = a2$.

Elementary learning on Differential and Integral Calculus. Simple problems based on it.

Matrices and Determinants: Definition of Matrices, Addition, Subtraction, Multiplication, Transpose and Inverse up to 3rd order, Properties of determinants up to 3rd order and their evaluation**.**

Suggested Readings:

1. A Text Book of Mathematics, 11th Part-I and Part II, 12th Part-I and Part-II, West Bengal Board of Secondary Education and West Bengal Council of Higher Secondary Education.
2. Mensuration- I by Pierpoint.
3. A text book Agricultural Mathematics by Ms. A. A. Chaudhari et.al

Agricultural Heritage

Code: AGS 108 **Full Marks - 100**

1L+0P=1

Credit-1

COURSE OUTCOME:

To impart knowledge on basics of Agriculture, history and traditions – its scope

Theory

Introduction of Indian agricultural heritage; Ancient agricultural practices, Relevance of heritage to present day agriculture; Past and present status of agriculture and farmers in society; Journey of Indian agriculture and its development from past to modern era; Plant production and protection through indigenous traditional knowledge; Crop voyage in India and world; Agriculture scope; Importance of agriculture and agricultural resources available in India; Crop significance and classifications; National agriculture setup in India; Current scenario of Indian agriculture; Indian agricultural concerns and future prospects.

Recommended Reading:

1. Kashyapriya Krishisukti (Atreatiseon Agriculture by Kashyapa), agri History Bulletin No: 4. Tr. - S. M. Ayachit, Asian Agri. History foundation, Secunderabad. (2002)
2. Ancient and Medieval History of Indian Agriculture and its relevance to Sustainable Agriculture in the 21 Century - S.L. Choudhary, G. S. Sharma, and Y. L. Nene, Proceedings of the summer school held from 28 May to 27 June 1999, Rajasthan College of Agriculture, Udaipur, India (2000)
3. Agricultural Heritage of India - Y.L. Nene and S. L. Choudhary, Asian Agri., History Foundation, Secunderabad (2002)

Rural Sociology & Educational Psychology

Code: AGS 109 **Full Marks-100**

2L+0P=2

Credit-2

COURSE OUTCOME:

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

Theory

Sociology and Rural sociology: Definition and scope, its significance in agriculture extension, Social Ecology, Rural society, Social Groups, Social Stratification, Culture concept, Social Institution, Social Change & Development. Educational psychology: Meaning & its importance in agriculture extension. Behavior: Cognitive, affective, psychomotor domain, Personality, Learning, Motivation, Theories of Motivation, Intelligence.

Suggested Readings:

1. Ray, G.L. (2003), Extension Communication and Management. Kalyani Publishers. Fifth revised and enlarged edition
2. Dahama, O.P. and Bhatnagar, O.P. (2003). Education and Communication for Development. Oxford and IBH Publishing Co. Pvt. Ltd.
3. Sandhu, A.S. (1993) Textbook on Agricultural Communication: Process and Methods.Oxford and IBH Publishing Co. Pvt. Ltd.
4. Chitambar, J.B. (2008). Introductory Rural Sociology. New Age International (P) Limited.

5. Sachdeva, D. R. and Bhushan, V (2007). An Introduction to Sociology. KitabMahal Agency.
6. Chitambar, J.B. (1973). Introductory rural sociology. New York, John Wilex and Sons.
7. Desai, A.R. (1978). Rural sociology in India. Bombay, Popular Prakashan, 5th Rev. ed.
8. Doshi, S.L. (2007). Rural sociology. Delhi Rawat Publishers.
9. Jayapalan, N. (2002). Rural sociology. New Delhi, Altanic Publishers.
10. Sharma, K.L. (1997). Rural society in India. Delhi, Rawat Publishers.

Human Values & Ethics

Code: AGS 110 **Full Marks-100**
1L+0P=1
Credit-1

COURSE OUTCOME:

To impart knowledge on values ethics and vision of life.

Theory

Values and Ethics-An Introduction, Goal and Mission of Life, Vision of Life, Principles and Philosophy, Self-Exploration, Self-Awareness, Self-Satisfaction, Decision Making, Motivation, Sensitivity, Success, Selfless Service, Case Study of Ethical Lives, Positive Spirit, Body Mind and Soul, Attachment and Detachment, Spirituality Quotient, Examination.

Suggested Readings:

1. Encyclopedia of Ethics, 2nd ed. D. H. Hill Ref. BJ63 .E452001 3 vols.
2. Gaur RR, Sangal R & Bagaria GP. 2011. A Foundation Course in Human Values and Professional Ethics. Excel Books.
3. Nagrajan R. S. 2006. Professional Ethics and Human Values. Text book. New Age International (P) Ltd Publishers.
4. Sharma RA. 2011. Human Values and Education -Axiology, Inculcation and Research. R. Lall Book Depot.
5. Sharma RP & Sharma M. 2011. Value Education and Professional Ethics. Kanishka Publishers.
6. Mathur SS. 2010. Education for Values, Environment and Human Rights. RSA International.

NSS/NCC

Code: AGS 111 **Full Marks-100**
0L+2P=2
Credit-2

COURSE OUTCOME:

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

Introduction and basic components of NSS:

Orientation: history, objectives, principles, symbol, badge; regular programmes under NSS, organizational structure of NSS, code of conduct for NSS volunteers, points to be considered by NSS volunteers awareness about health

NSS programmes and activities

Concept of regular activities, special camping, day camps, basis of adoption of village/slums, conducting survey, analysing guiding financial patterns of scheme, youth programme/ schemes of GOI, coordination with different agencies and maintenance of diary

Understanding youth

Definition, profile, profile, categories, issues and challenges of youth; and opportunities for youth who is agent of the social change

Community mobilisation

Mapping of community stakeholders, designing the message as per problems and their culture; identifying methods of mobilisation involving youth-adult partnership

Social harmony and national integration

Indian history and culture, role of youth in nation building, conflict resolution and peace-building

Volunteerism and shramdan

Indian tradition of volunteerism, its need, importance, motivation and constraints; shramdan as part of volunteerism

Citizenship, constitution and human rights

Basic features of constitution of India, fundamental rights and duties, human rights, consumer awareness and rights and rights to information

Family and society

Concept of family, community (PRIs and other community based organisations) and society

Suggested Readings:

1. Foundations of Physical Education, Exercise Science, and Sport by Deborah A. Wuest, Charles A. Bucher
2. O.P. Aneja. Encyclopedia of Physical education, sports and exercise science (4 volumes)
3. Pintu Modak, O P Sharma, Deepak Jain. Encyclopedia of Sports and Games with latest rules and regulations (8 volumes).
4. Research Process In Physical Education And Sports: An Introduction by K. G. Jadhav, Sachin B. Pagare and Sinku Kumar Singh, Year of Pub.: 2011
5. Sports Training And Biomechanics In Physical Education by Sinku Kumar Singh Year of Pub: 2011

OR

Physical Education & Yoga Practices

Code: AGS 111 **Full Marks=100**
0L+2P=2
Credit-2

COURSE OUTCOME:

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

Theory

Introduction to physical education, Posture, exercise for good posture, physical fitness exercises for agility, strength, coordination, endurance and speed. Rules are regulations of important games, skill development in any one of the games – football, cricket, volleyball, badminton, throw ball, Participation in one of the indoor games – shuttle badminton, chess and table tennis, Rules and regulations of athletic events, participation in any one of the athletic events – broad jump, high jump, discuss throw, shot put, short and long distance running, Safety education, movement education, effective way of doing day-to-day activities, First-aid training, coaching for major games and indoor games.

Yoga- History, Meaning and importance, Role of yoga in life, Asians and indigenous way for physical fitness, and curative exercise, Introduction to asanas and its importance, pranayama, meditation and yogic kriya, Omkar, Yogic Suksma vyayamas, Yogasan- Asanas in Standing posture (Tadasana, Vrikshasana, Padahastasana, Ardha- Chakrasana, Trikonasana), Sitting postures (Asanas viz: Bhadrasana, Vjrasana, Ardha- Ustrasana, Ushtrasana, sasakasana and Vakrasana), Prone postures (Makarasana, Bhujangasana and Salabhasana) and Supine posture (Setubandhasana, uttanapadasana, Ardha-halasana, and Pavanamuktasana, Shavasana), Suryanamaskar, Yognidra, Kapalbhati, Pranayam, Meditation in different mudras.

Suggested Readings:

1. Hatha Yogas Pradipika by Yogi Swatmarama, Publishcation: Bihar School of Yoga, Edn. 26th :1998
2. Yoganidra by swami saraswati, pblication, yoga publication trust, munger, edn 3rd 1976
3. The Key Muscles of Hatha Yoga by Ray Long, Publication: Bandh Yoga, Edn.; 3rd : 2006
4. Patanjali Yogasutras by Swami Premeshanand, Publication: Advaita Asharm, Edn.: 2015

SECOND SEMESTER

Fundamentals of Genetics

Code: AGS 201 **Full Marks-100**

2L+1P=3

Credit-3

COURSE OUTCOME:

This lesson deals with heredity and the reasons behind the variation among individuals of the same species.

Theory

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

Practical

Study of microscope. Study of cell structure. Experiments on monohybrid, dihybrid, trihybrid, test cross and back cross, Experiments on epistatic interactions including test cross and back cross, Practice on mitotic and meiotic cell division, Experiments on probability and Chi-square test. Determination of linkage and cross over analysis (through two point test cross and three point test cross data). Study on sex linked inheritance in Drosophila. Study of models on DNA and RNA structure.

Recommended Reading:

1. Benjamin Cummings Genes VIII -Lewin (2003)
2. Fundamentals of Genetics- B. D. Singh, Kalyani Publishers (2009)
3. Principles of Genetics - E. W. Sinnott, L.C. Dunn, T. Dobzhansky, McGraw-Hill Inc.,US (1984)
4. Principles of Genetics - E.J.Gardner, M. J. Simmons and D.P. Snustad, John Willey & Sons (1991)

Agricultural Microbiology

Code: AGS 202 **Full Marks-100**

1L+1P=2

Credit-2

COURSE OUTCOME:

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

Theory

Introduction. Microbial world: Prokaryotic and eukaryotic microbes. Bacteria: cell structure, chemoautotrophy, photo autotrophy, growth. Bacterial genetics: Genetic recombination- transformation,

conjugation and transduction, plasmids, transposon. Role of microbes in soil fertility and crop production: Carbon, Nitrogen, Phosphorus and sulphur cycles. Biological nitrogen fixation- symbiotic, associative and aysmbiotic. Azolla, blue green algae and mycorrhiza. Rhizosphere and phyllosphere. Microbes in human welfare: silage production, biofertilizers, biopesticides, biofuel production and biodegradation.

Practical

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

Recommended Reading:

1. Introduction to Soil Microbiology – M. Alexander, Krieger Publishing Company (2011)
2. Agricultural Microbiology - G. Rangaswami and Bagyaraj, Prentice Hall India Learning Pvt. Ltd. (1992)
3. Soil Microorganism and Plant Growth - N.S. Subba Rao, Science Publishers, U.S. (1995)
4. Biofertilizers in Agriculture - N.S. Subba Rao, Science Publishers, U.S. (1993)

Introductory Soil and Water Conservation Engineering

Code: AGS 203 **Full Marks-100**

1L+1P=2

Credit-2

COURSE OUTCOME:

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

Theory

Introduction to Soil and Water Conservation, causes of soil erosion. Definition and agents of soil erosion, water erosion: Forms of water erosion, Gully classification and control measures, Soil loss estimation by universal Loss Soil Equation, Soil loss measurement techniques, Principles of erosion control: Introduction to contouring, strip cropping, Contour bund, Graded bund and bench terracing, Grassed water ways and their design, Water harvesting and its techniques.

Wind 95 erosion: mechanics of wind erosion, types of soil movement, Principles of wind erosion control and its control measures.

Practical

General status of soil conservation in India, Calculation of erosion index, Estimation of soil loss, Measurement of soil loss, Preparation of contour maps, Design of grassed water ways, Design of contour bunds, Design of graded bunds, Design of bench terracing system, Problem on wind erosion.

Suggested Readings:

1) Mahnot, S.C. 2014. Soil and Water Conservation and Watershed Management. International Books and Periodicals Supply Service, New Delhi.

2) Mal, B.C. 2014. Introduction to Soil and Water Conservation Engineering. 2014. Kalyani Publishers.
3) Michael, A.M. and T.P. Ojha. 2003. Principles of Agricultural Engineering. Volume II. 4th Edition, Jain Brothers, New Delhi.
4) Murthy, V.V.N. 2002. Land and Water Management Engineering. 4th Edition, Kalyani Publishers, New Delhi.
5) Norman Hudson. 1985. Soil Conservation. Cornell University Press, Ithaka, New York, USA.
6) Frevert, R.K., G.O. Schwab, T.W. Edminster and K.K. Barnes. 2009. Soil and Water Conservation Engineering, 4th Edition, John Wiley and Sons, New York.
7) Suresh, R. 2014. Soil and Water Conservation Engineering. Standard Publisher Distributors,New Delhi

Fundamentals of Plant Biochemistry and Biotechnology

Code: AGS 204 **Full Marks-100**
2L+1P=3
Credit-3

COURSE OUTCOME:

The major Objectives is the complete understanding, at the molecular level, of all of the chemical processes associated with living cells and organisms and their applications.

Theory

Importance of Biochemistry. Properties of Water, pH and Buffer. Carbohydrate: Importance and classification. Structures of Monosaccharides, Reducing and oxidizing properties of Monosaccharides, Mutarotation; Structure of Disaccharides and Polysaccharides. Lipid: Importance and classification; Structures and properties of fatty acids; storage lipids and membrane lipids. Proteins: Importance of proteins and classification; Structures, titration and zwitterions nature of amino acids; Structural organization of proteins. Introduction to secondary metabolites, Enzymes: General properties; Classification; Introduction to allosteric enzymes. Applications of enzymes.Vitamins and mineral nutrition for human health. Nucleic acids: Importance and classification; Chemical and physical properties of nucleic acids. Structure of Nucleotides, A, B & Z DNA; RNA: Types and Secondary & Tertiary structure. Metabolism of carbohydrates: Glycolysis, TCA cycle, Pentose phosphate pathway, Glyoxylate cycle, Electron transport chain. Substrate level and photo phosphorylation) reaction, Metabolism of lipids: Beta oxidation, Transamination reaction

Practical

Preparation of solution, pH & buffers, Qualitative tests of carbohydrates and amino acids.Quantitative estimation of glucose/ proteins. Titration methods for estimation of amino acids/lipids, Effect of pH, temperature and substrate concentration on enzyme action, Quantitative analysis of DNA and RNA Estimation of ascorbic acid and calcium by titration method Estimation of total phenols/plant pigments/total alkaloids.

Recommended reading:

1. Principles of Biochemistry - A. L. Lehninger, Freeman and Company, USA (2004)
2. Outlines of Biochemistry - E. E. Conn, P. K. Stumpf, G. Bruining and R. H. Doi, John Wiley and Sons, New York (2007)

3. Lehninger Principles of Biochemistry - D. L. Nelson and M. M. Cox, Worth Publishers, New York. (2000)
4. *Rastogi S. C.*. 2003 - *Biochemistry* Tata McGraw-Hill Education, New Delhi.
5. Goodwin, TW & Mercer EI. 1983. Introduction to Plant Biochemistry. 2nd Ed. Oxford, New York.Pergaman Press.
6. David L. Nelson and Michael M. Cox.2012. Lehninger Principles of Biochemisry, 6th Ed. Macmillan Learning, NY, USA

Fundamental of Agricultural Economics

Code: AGS 205 **Full Marks-100**
2L+0P=2
Credit-2

COURSE OUTCOME:

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

Theory

Economics: Meaning, scope and subject matter, definitions, activities, approaches to economic analysis; micro and macro-economics, positive and normative analysis. Nature of economic theory; rationality assumption, concept of equilibrium, economic laws as generalization of human behavior. Basic concepts: Goods and services, desire, want, demand, utility, cost and price, wealth, capital, income and welfare. Agricultural economics: meaning, definition, characteristics of agriculture, importance and its role in economic development. Agricultural planning and development in the country. *Demand:* meaning, law of demand, demand schedule and demand curve, determinants, utility theory; law of diminishing marginal utility, equi-marginal utility principle. Consumer's equilibrium and derivation of demand curve, concept of consumer surplus. Elasticity of demand: concept and measurement of price elasticity, income elasticity and cross elasticity. Production: process, creation of utility, factors of production, input output relationship. *Laws of returns*: Law of variable proportions and law of returns to scale. *Cost:* Cost concepts, short run and long run cost curves. Supply: Stock v/s supply, law of supply, supply schedule, supply curve, determinants of supply, elasticity of supply. Distribution theory: meaning, factor market and pricing of factors of production. Concepts of rent, wage, interest and profit. *National income:* Meaning and importance, circular flow, concepts of national income accounting and approaches to measurement, difficulties in measurement. Population: Importance, Malthusian and Optimum population theories, natural and socio-economic determinants, current policies and programmes on population control. Money: Barter system of exchange and its problems, evolution, meaning and functions of money, classification of money, money supply, general price index, inflation and deflation. *Economic systems:* Concepts of economy and its functions, important features of capitalistic, socialistic and mixed economies, elements of economic planning. Forms of business organizations, international trade and balance of payments. GST and its implication on Indian economy.

Recommended Reading:

1. Elementary Economic Theory - K. K. Dewett and J. D. Varma, S. Chand and Company Ltd., Ramnagar, New Delhi (1999)

2. International Econimics - H.G. Mannur, Vikas Publishing House, New Delhi (1999)
3. Fundamentals of Agricultural Economics - A. N. Sudhu and A. Singh, Kalyani Publishers (2010)
4. Econimics - P.A. Samuelson and W.D. Nordhaus, McGraw-Hill Inc. New York (1995)

Fundamentals of Plant Pathology

Code: AGS 206 **Full Marks-100**

3L+1P=4

Credit-4

COURSE OUTCOME:

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

Theory

Important plant pathogenic organisms, different groups: fungi, bacteria, fastidious vesicular bacteria, phytoplasmas, spiroplasmas, viruses, viroids, algae, protozoa, phanerogamic parasites and nematodes with examples of diseases caused by them.

Fungi: general characters, definition of fungus, somatic structures, types of fungal thalli, fungal tissues, modifications of thallus, reproduction (asexual and sexual) 11 Nomenclature, Binomial system of nomenclature, rules of nomenclature, classification of fungi. Key to divisions,sub-divisions, orders and classes.
Bacteria and mollicutes: general morphological characters. Basic methods of classification and reproduction. Viruses: nature, architecture, multiplication and transmission, Study of phanerogamic plant parasites.

Introduction to plant diseases, Importance of plant diseases, scope and objectives of Plant Pathology, History of Plant Pathology with special reference to Indian work, Terms and concepts in Plant Pathology, Pathogenesis, Cause and classification of plant diseases, Diseases and symptoms due to abiotic causes, Phenomenon of of Infection, Pre penetration, penetration and post penetration. Pathogenesis – Role of enzymes, toxin, growth regulators and polysaccharides: Defense mechanism in plants – structural and biochemical (pre and post infection), Plant disease epidemiology Plant disease forecasting, remote sensing, Principles and methods of plant disease management. Application of Biotechnology in plant disease management- development of disease resistant transgenic plants through gene cloning IDM concept, advantage and importance, Nature, chemical combination, classification, mode of action and formulations of fungicides and antibiotics

Practical

Acquaintance with various laboratory equipments and microscopy, Collection and preservation of disease specimen, Preparation of media, isolation and Koch's postulates, General study of different structures of fungi, Study of symptoms of various plant diseases, Study of representative fungal genera, Staining and identification of plant pathogenic bacteria, Transmission of plant viruses, Study of phanerogamic plant parasites, Study of morphological features and identification of plant parasitic nematodes, Sampling and extraction of nematodes from soil and plant material, preparation of nematode mounting, Study of

fungicides and their formulations, Methods of pesticide application and their safe use, Calculation of fungicide sprays concentrations**.**

Suggested Reading:

1. N.G. Ravichandra, 2013.Fundamentals of Plant Pathology. PHI Hall of India, New Delhi
2. R.S. Mehrohtra, Ashok Agarwal. *Fundamental of Plant Pathologyyy* Sambamurthy *A textbook of Plant Pathologyyy*
3. R.S.Singh *Introduction to principles of plant pathology*
4. Alexopoulos, C.J. Mims, C.W. and Blackwell, M. 1996. Introduction to Mycology Wiley Eastern Ltd., New York.
5. Mandahar,C.L. 1987. Introduction to Plant Viruses. Chand and Co. Pvt. Ltd., New Delhi.
6. Mehrotra, R.S. and Aneja, K.R. 1990. . An Introduction to Mycology. New Age International (P) Ltd., New Delhi.
7. Singh, R.S. 1982. Plant Pathogens - The Fungi. Oxford and IBH Publishing Co., New Delhi.
8. Singh, R.S. 1989. Plant Pathogens - The Prokaryotes .Oxford and IBH Publishing Co., New Delhi.
9. Agrios, G.N. 2006. Plant Pathology. Elsevier Academic press, London.

Fundamentals of Entomology

Code: AGS 207 **Full Marks-100**

3L+1P=4

Credit-4

COURSE OUTCOME:

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

Theory

Part – I: History of Entomology in India. Factors for insect's abundance. Major points related to dominance of Insecta in Animal kingdom. Classification of phylum Arthropoda up to classes. Relationship of class Insecta with other classes of Arthropoda. Harmful and useful insects.

Part – II: Morphology: Structure and functions of insect cuticle, moulting and body segmentation. Structure of Head, thorax and abdomen. Structure and modifications of insect antennae, mouth parts, legs, wing venation, modifications and wing coupling apparatus. Metamorphosis and diapause in insects. Types of larvae and pupae.

Part – III: Structure of male and female genital organs. Structure and functions of digestive, circulatory, excretory, respiratory, nervous, secretary (Endocrine) and reproductive systems in insects. Types of reproduction in insects. Major sensory organs

Part – IV: Systematics: Taxonomy –importance, history and development and binomial nomenclature. Definitions of Biotype, Sub-species, Species, Genus, Family and Order. Classification of class Insectaupto Orders. Major characteristics of orders. Basic groups of present day insects with special emphasis to orders and families of Agricultural importance like Orthoptera: Acrididae, Tettigonidae, Gryllidae, Gryllotalpidae; Dictyoptera: Mantidae, Blattidae; Odonata; Isoptera: Termitidae; Thysanoptera:

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

Practical

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

Recommended reading:

1. Awasthi, V.B. 1997. *Introduction to general and applied entomology*. Scientific Publishers, Jodhpur, 379 p.
2. Borror, D.J., C.A. Triple Horn and N.F.Johnson. 1987. *An introduction to the study of insects (VI Edition)*. Harcourt Brace College Publishers, New York, 875p.
3. Chapman, R.F. 1981. The Insects: Structure and function. Edward Arnold (Publishers) Ltd, London, 919p.
4. Gullan, P.J. and Cranston, P.S. 2001. *The insects- An outline of entomology*, II edition, Chapman & Hall, Madras, 491p
5. Nayar, K.K., T.N.Ananthakrishnan and B.V. David. 1976. *General and applied entomology*, Tata McGraw Hill Publishing Company Limited, New Delhi, 589p.
6. Richards, O.W. and R.G. Davies. 1977. *Imm's general text book of entomology*, Vol.1&2, Chapman and Hall Publication, London, 1345p.
7. Romoser, W.S. 1988. *The Science of Entomology*, McMillan, New York, 449p. H. Lewin and Devasahayam. Practical manual of entomology insect and non-insect pests.
8. Pant, N.C. and Ghai, S. 1981Insect physiology and anatomy, ICAR, New Delhi.
9. Snodgrass, R.E. 2001.Principles of Insect Morphology. CBS Publishers and Distributors, New Delhi

Fundamentals of Agricultural Extension Education

Code: AGS 208 **Full Marks-100**

2L+1P=3

Credit-3

COURSE OUTCOME:

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

Theory

Education: Meaning, definition &types; Extension Education- meaning, definition, scope and process; objectives and principles of Extension Education; Extension Programme planning- Meaning, Process, Principles and Steps in Programme Development.

Extension systems in India: extension efforts in pre-independence era (Sriniketan, Marthandam, Firka Development Scheme, Gurgaon Experiment, etc.) and post-independence era (Etawah Pilot Project, Nilokheri Experiment, etc.); various extension/ agriculture development programmes launched by ICAR/ Govt. of India (IADP, IAAP, HYVP, KVK, IVLP, ORP, ND,NATP, NAIP, etc.).

New trends in agriculture extension: privatization extension, cyber extension/ eextension, market-led extension, farmer-led extension, expert systems, etc.

Rural Development: concept, meaning, definition; various rural development programmes launched by Govt. of India. Community Dev.-meaning, definition, concept & principles, Philosophy of C.D. Rural Leadership: concept and definition, types of leaders in rural context;

extension administration: meaning and concept, principles and functions. Monitoring and evaluation: concept and definition, monitoring and evaluation of extension programmes; transfer of technology: concept and models, capacity building of extension personnel.

Agriculture journalism, Diffusion and adoption of innovation: concept and meaning, process and stages of adoption, adopter categories.

Practical

1. Acquaintance with university extension system,
2. Group discussion- exercise
3. Handling and use of audio visual equipments and digital camera and LCD projector; Preparation and use of AV aids
4. Preparation of extension literature – leaflet, booklet, folder, pamphlet news stories and success stories
5. Presentation skills exercise; micro teaching exercise
6. Visit to village to understand the problems being encountered by the villagers/ farmers; Study the organization and functioning of DRDA and other development departments at district level; Visit to NGO and learning from their experience in rural development; Understanding PRA techniques and their application in village development planning.

Suggested Readings:

1. Dahama, O.P. and Bhatnagar, O.P. 1980. Education and Communication for Development. Oxford &IBH Publishing Co. Pvt. Ltd., New Delhi.
2. Dudhani, C.M.; Hirevenkatgoudar, L.V., Manjunath, L.; Hanchinal, S.N. and Patil, S.L. (2004). Extension Teaching Methods and Communication Technology, UAS, Dharwad.
3. Kamat, M.G. (1985). Writing for Farm Families. Allied Publishers, New Delhi.
4. Kelsey, L.D. and Hearne, G.C. (1963). Cooperative Extension Work, Comstar Publishing Associate, New York.
5. Mehta, D.S.(1981). Mass Communication and Journalism in India. Vikas Publication, New Delhi.
6. Ray, G.L. (1991). Extension Communication and Management. Noya Prakash, Calcutta.
7. Reddy, A.A 2005 Extension Education. Sri Lakshmi Press, Bapatla.

8. Rogers, E.M. 2003. Diffusion of Innovations. Free Press, New Delhi.
9. Samanta, R.K. (1990). Development Communication for Agriculture. BR Publishing Corporation, Delhi.
10. Sandhu, A.S. (1993).Textbbok on Agricultural Communication : Process and Methods. Oxford and IBH Publishing Pvt.Ltd., New Delhi.
11. Singh, A.K., Lakhan Singh, R. and Roy Burman (2006). Dimensions of Agricultural Extension. Aman Publishing House, Meerut.

Communication Skills and Personality Development

Code: AGS 209 **Full Marks-100**
1L+1P=2
Credit-2

COURSE OUTCOME:

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

Theory

Communication Skills: Meaning, Definition and process of communication. Verbal and non-verbal communication, models and barriers to communication, Extension teaching 'Methods': Meaning, classification, individual and group and mass contact method, media mix strategies. Writing Skills, oral presentation skills, individual and group presentations, impromptu presentation, public speaking, group discussion, Organizing seminars and conferences, leader, leadership styles, characteristics of leader and Manager, Stress, Adaptation, Distress and Eustress, Sources of job stress and consequences, Group dynamics and team building, group, group formation, group dynamics. Inter-group relation in organization, team building, nature of team, effectiveness of team. Conflict, levels of conflict, intra and inter personal conflict, organizational conflict, conflict resolution. Motivation, sources of motivation and theories of motivation. Personality: Definition, types, analysis and profiling and development.

Practical

Interactive lecture with AV aids for improving listening skills and note taking of students. Impact analysis of oral presentation skills by using standard format, Writing skills: Directed writing precise, Summary, field report etc., Indexing, footnote and bibliographic procedures etc. Reading and comprehension skills: Testing of pitch, intonation, pause, fidelity and impact analysis. Group discussion, presentations and skill analysis

Suggested Reading:

1. Balasubramanian T. 1989. A Textbook of Phonetics for Indian Students. Orient Longman, New Delhi.
2. Balasubrmanyam M. 1985. Business Communication. Vani Educational Books, New Delhi
3. Carnegie, Dale. 2012. *How to Win Friends and Influence People in the Digital Age*. Simon & Schuster.

4. Spitzberg B, Barge K & Morreale, Sherwyn P. 2006. *Human Communication: Motivation, Knowledge & Skills*. Wadsworth.
5. Verma, KC. 2013. *The Art of Communication.* Kalpaz.
6. Dr. T. Bharati, Dr. M. Hariprasad and Pro. V. Prakasam, Personality Development and Communicative English. Neelkamal Publications Pvt. Ltd, New Delhi.
7. Wren and Martin, S. Key to High School English Grammar and Composition- Chand and Company Ltd., New Delhi
8. Raymond Murphy, English Grammar in Use. Cambridge University Press
9. The Official Guide to the TOEFL Test-IV Edition, Educational Testing Services. Mc Graw Hill, New Delhi.
10. KrishnaMohanandMeeraBanerjee1990.DevelopingCommunicationSkills. Mac Millan IndiaLtd.

THIRD SEMESTER

Crop Production Technology – I (Kharif Crops)

Code: AGS 301 **Full Marks-100**
1L+1P=2
Credit-2

COURSE OUTCOME:

Students will be oriented with the origin, geographic distribution, morphology, classification, economic importance, soil and climatic requirement, varieties, cultural practices and yield of some kharif crops.

Theory

Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of *Kharif*crops. Cereals – rice, maize, sorghum, pearl millet, vari and finger millet, pulses-pigeonpea, mungbean and urdbean, cluster bean, oilseeds- groundnut, Castor, Sesame and Soybean; fibre crops- cotton & Jute; forage crops sorghum, cowpea and napier hybrid, fodder maize Cash crop- Bidi tobacco Green manure Crops-Sunhemp and Dhaincha.

Practical

Rice nursery preparation, transplanting of Rice, sowing of soybean, pigeon pea and mung bean. maize, groundnut and cotton, effect of seed size on germination and seedling vigour of kharif season crops, effect of sowing depth on germination of kharif crops, identification of weeds in kharif season crops, top dressing and foliar feeding of nutrients, study of yield contributing characters and yield calculation of kharif season crops, study of crop varieties and important agronomic experiments at experimental farm. Study of forage experiments, morphological description of *kharif* season crops.

Recommended reading:

1. Modern technique of raising field crops by Chidda singh
2. Agronomy of field crop by S.R. Reddy
3. Hand book of Agriculture, ICAR New Delhi

Fundamentals of Plant Breeding

Code: AGS 302 **Full Marks-100**
2L+1P=3
Credit-3

COURSE OUTCOME:

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

Theory

Historical development, concept, nature and role of plant breeding, major achievements and future prospects; Genetics in relation to plant breeding, modes of reproduction and apomixes, self-incompatibility and male sterility- genetic consequences, cultivar options. Domestication, Acclimatization

and Introduction; Centres of origin/diversity, components of Genetic variation; Heritability and genetic advance; Genetic basis and breeding methods in self- pollinated crops - mass and pure line selection, hybridization techniques and handling of segregating population; Multiline concept. Concepts of population genetics and Hardy-Weinberg Law, Genetic basis and methods of breeding cross pollinated crops, modes of selection; Population improvement Schemes- Ear to row method, Modified Ear to Row, recurrent selection schemes; Heterosis and inbreeding depression, development of inbred lines and hybrids, composite and synthetic varieties; Breeding methods in asexually propagated crops, clonal selection and hybridization; Maintenance of breeding records and data collection; Wide hybridization and prebreeding; Polyploidy in relation to plant breeding, mutation breeding-methods and uses; Breeding for important biotic and abiotic stresses; Biotechnological tools-DNA markers and marker assisted selection. Participatory plant breeding; Intellectual Property Rights, Patenting, Plant Breeders and & Farmer's Rights.

Practical

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

Recommended reading:

1. B. D. Singh. Plant Breeding Principles and Methods. Kalyani Publication, New Delhi.
2. Phundan singh. Essentials of Plant Breeding. Kalyani Publication, New Delhi
3. J. R. Sharma. Principles and Practices Plant Breeding. McGraw Hill Publishing company Limited , New Delhi.
4. V. L. Chopra. Plant Breeding Theory and Practices Oxford and IBH. Publishing Company, New Delhi.
5. R. C. Choudhary. Introduction to Plant Breeding. Oxford and IBH. Publishing Company, New Delhi.
6. R. C. Choudhary. Elementary Principles of Plant Breeding. Oxford and IBH. Publishing Company, New Delhi.

Agricultural Finance and Cooperation

Code: AGS 303 **Full Marks-100**

2L+1P=3

Credit-3

COURSE OUTCOME:

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

Theory

Agricultural Finance- meaning, scope and significance, credit needs and its role in Indian agriculture, Agricultural credit: meaning, definition, need, classification, Credit analysis: 4 R's, and 3C's of credits, Sources of agricultural finance: institutional and noninstitutional sources, commercial banks, social control and nationalization of commercial banks, Micro financing including KCC, Lead bank scheme, RRBs, Scale of finance and unit cost. An introduction to higher financing institutions – RBI, NABARD, ADB, IMF, world bank, Deposit Insurance and Credit Guarantee Corporation of India. Cost of credit, Recent development in agricultural credit, Preparation and analysis of financial statements – Balance Sheet and Income Statement, Basic guidelines for preparation of project reports- Bank norms – SWOT analysis

Agricultural Cooperation – Meaning, brief history of cooperative development in India, objectives, principles of cooperation, significance of cooperatives in Indian agriculture. Agricultural Cooperation in India- credit, marketing, consumer and multi-purpose cooperatives, farmers' service cooperative societies, processing cooperatives, farming cooperatives, cooperative warehousing; role of ICA, NCUI, NCDC, NAFED

Practical

Determination of most profitable level of capital use, Optimum allocation of limited amount of capital among different enterprise

Analysis of progress and performance of cooperatives using published data. Analysis of progress and performance of commercial banks and RRBs using published data

Visit to a commercial bank, cooperative bank and cooperative society to acquire firsthand knowledge of their management, schemes and procedures

Estimation of credit requirement of farm business – A case study

Preparation and analysis of balance sheet – A case study

Preparation and analysis of income statement – A case study

Appraisal of a loan proposal – A case study

Techno-economic parameters for preparation of projects, Preparation of Bankable projects for various agricultural products and its value added products

Seminar on selected topics

Suggested Readings:

1. Ghosal, S.N., Agricultural Financing in India, Asia Publishing House, Bombay, 1966
2. Johl, S.S. and C.V. Moore., Essentials of Farm Financial Management, Today and Tomorrow's Printers and Publishers, New Delhi, 1970
3. John, J. Hamptron., Financial Decision Making: Concepts, Problems and Cases, Prentice- Hall of India , New Delhi, 1983
4. Kenneth, Duft D., Principles of Management in Agribusiness, Reston Publishing Company, Reston, 1979
5. Mamoria, C.B. and R.D. Saksena., Co-operation in India, Kitab Mahal, Allahabad, 1973
6. Mamoria, C.B. and Saksena., Agricultural Problems in India, Kitab Mahal, Allahabad
7. Mukhi, H R. Cooperation in India and Abroad. New Heights Publishers, New Delhi, 1983
8. Muniraj, R., Farm Finance for Development, Oxford & IBH Publishing Company Private Ltd., New Delhi, 1987
9. Subba Reddy, S. and P.Raghuram., Agricultural Finance and Management, Oxford & IBH Publishing Company Private Ltd., New Delhi, 2005

10. Subba Reddy, S., P.Raghuram., P. Sastry, T.V.N. and Bhavani Devi I. Agricultural Economics., Oxford & IBH Publishing Company Private Ltd., New Delhi, 2010
11. William, G. Murray and Nelson Aarson, G., Agricultural Finance, The Iowa State University Press, Ames, Iowa, 1960

Agri- Informatics

Code: AGS 304 **Full Marks-100**

1L+1P=2

Credit-2

COURSE OUTCOME:

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

Theory

Introduction to Computers, Operating Systems, definition and types, Applications of MSOffice for document creation & Editing, Data presentation, interpretation and graph creation, statistical analysis, mathematical expressions, Database, concepts and types, uses of DBMS in Agriculture, World Wide Web (WWW): Concepts and components, Introduction to computer programming languages, concepts and standard input/output operations. e-Agriculture, concepts and applications, Use of ICT in Agriculture. Computer Models for understanding plant processes. IT application for computation of water and nutrient requirement of crops, Computer-controlled devices (automated systems) for Agri-input management, Smartphone Apps in Agriculture for farm advises, market price, postharvest management etc; Geospatial technology for generating valuable agri-information, Decision support systems, concepts, components and applications in Agriculture, Agriculture Expert System, Soil Information Systems etc. for supporting Farm decisions, Preparation of contingent crop-planning using IT tools.

Practical

Study of Computer Components, accessories, practice of important DOS Commands, Introduction of different operating systems such as windows, Unix/ Linux, Creating, Files & Folders, File Management, Use of MS-WORD and MS Power-point for creating, editing and presenting a scientific Document. MS-EXCEL - Creating a spreadsheet, use of statistical tools, writing expressions, creating graphs, analysis of scientific data. MS-ACCESS: Creating Database, preparing queries and reports, demonstration of Agri-information system, Introduction to World Wide Web (WWW). Introduction of programming languages, Hands on Crop Simulation Models (CSM) such as DSSAT/Crop-Info/CropSyst/ Wofost; Computation of water and nutrient requirements of crop using CSM and IT tools, Introduction of Geospatial Technology for generating valuable information for Agriculture, Hands on Decision Support System, Preparation of contingent crop planning.

Suggested Readings

1. Computer Fundamentals by Pradeep K. Sinha and Priti Sinha, III edition, BPB Publications, B-14, Connaught Place, New Delhi – 110 001.
2. Computer Fundamentals by P.K. Sinha, BPB Publications, B-14, Connaught Place, New Delhi – 110 001.

3. Mastering Office Professional for window 95, BPB Publications, B-14, Connaught Place, New Delhi – 110 001.
4. Statistical Methods for Agricultural workers by V.G. Panse and P.V. Sukhatma, ICAR, New Delhi.
5. http://www.tutorialsforopenoffice.org/category_index/base.html
6. http://mkisan.gov.in/downloadmobileapps.aspx
7. http://www.nrsc.gov.in/Agriculture
8. http://iasri.res.in/
9. http://communicationtheory.org/berlos-smcr-model-of-communication/

Farm Machinery and Power

Code: AGS 305 **Full Marks-100**

1L+1P=2

Credit-2

COURSE OUTCOME:

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

Theory

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

Practical

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

Recommended reading:

1. Principles of Agricultural Engineering Vol. 1. Reprint Edition: 2012. by T. P. Ojha, A. M. Michael, Jain Brothers, New Delhi
2. Elements of Agricultural Engineering by JagadishwarSahay. Forth Edition, 2010 Standard Distributor and Publishers, New Delhi

3. Agricultural Engineering by O P Singhal (2011) Aman Publishing House, Meerut
4. Elements of Farm Mechaneries by A C Srivastava, Oxford and IBH Publishing Co Pvt Ltd, New Delhi
5. Farm Tractor -Repair and Maintenance by S.C. Jain and C.R. Rai.
6. Principles of Farm Machineies by R A Kepner, R Bainer, E C Barger (2000) CBS Publishers and Distributors, Delhi
7. Farm Engines and Tractors by H E Gulvin (2001) McGraw Hill, New York
8. Servicing and Maintenance of Farm Tractors (2005) E J Johnson and A HHollenburg, McGraw Hill, New York
9. Tractor Implement System by Alcock and Ralph (1986) Athe AVI Publishing Co. Inc Springer, New York.

Production Technology for Vegetables and Spices

Code: AGS 306 **Full Marks-100**
1L+1P=2
Credit-2

COURSE OUTCOME:

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

Theory

Importance of vegetables & spices in human nutrition and national economy, kitchen gardening, brief about origin, area, climate, soil, improved varieties and cultivation practices such as time of sowing, sowing, transplanting techniques, planting distance, fertilizer requirements, irrigation, weed management, harvesting and yield, physiological disorders, of important vegetable and spices (Tomato, Brinjal, Chilli, Capsicum, Cucumber, Melons, Gourds, Pumpkin, French bean, Peas; Cole crops such as Cabbage, Cauliflower, Knol-khol; Bulb crops such as Onion, Garlic; Root crops such as Carrot, Raddish, Beetroot; Tuber crops such as Potato; Leafy vegetables such as Amaranth, Palak. Perennial vegetables)

Practical

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

Suggested Readings

1. Vegetables. B. Choudhary
2. Vegetable Crops. T. K. Bose, M. G. Som and T. Kabir
3. Vegetable, Tuber and Spices. S.Thamburaj
4. Production technology of vegetable crops. S. P. Singh
5. Vegetables – Production Technology. Haldavnekar, P.C.; Parulekar, Y.R.; Mali, P.C. and Haldankar, P.M.
6. Major Spices of India. J.S.Pruthi
7. Minor Spices and Condiments. J.S.Pruthi

Environmental Studies and Disaster Management

Code: AGS 307 **Full Marks-100**

2L+1P=3

Credit-3

COURSE OUTCOME:

To impart knowledge on nature of environment, natural resources and its associated problems related to agriculture and their management.

Theory

Multidisciplinary nature of environmental studies Definition, scope and importance. Natural Resources: Renewable and non-renewable resources, Natural resources and associated problems. a) Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people. b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. c) Mineral resources: Use and xploitation, environmental effects of extracting and using mineral resources, case studies. d) Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. e) Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. Case studies. f) Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification. Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyles. Ecosystems: Concept of an ecosystem, Structure and function of an ecosystem, Producers, consumers and decomposers, Energy flow in the ecosystem. Ecological succession, Food chains, food webs and ecological pyramids. Introduction, types, characteristic features, structure and function of the following ecosystem: a. Forest ecosystem b. Grassland ecosystem c. Desert ecosystem d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries). Biodiversity and its conservation: - Introduction, definition, genetic, species & ecosystem diversity and biogeographical classification of India. Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values. Biodiversity at global, National and local levels, India as a mega-diversity nation. Hot-sports of biodiversity. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts. Endangered and endemic species of India. Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity. Environmental Pollution: definition, cause, effects and control measures of: a. Air pollution b. Water pollution c. Soil pollution d. Marine pollution e. Noise pollution f. Thermal pollution g. Nuclear hazards. Solid Waste Management: causes, effects and control measures of urban and industrial wastes. Role of an individual in prevention of pollution. Social Issues and the Environment: From Unsustainable to Sustainable development, Urban problems related to energy, Water conservation, rain water harvesting, watershed management. Environmental ethics: Issues and possible solutions, climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. dies. Wasteland reclamation. Consumerism and waste products. Environment Protection Act. Air (Prevention and Control of Pollution) Act. Water (Prevention and control of Pollution) Act. Wildlife Protection Act. Forest Conservation Act. Issues involved in enforcement of environmental legislation. Public awareness. Human Population and the Environment: population growth, variation among nations, population explosion, Family Welfare Programme. Environment and human health: Human Rights, Value Education, HIV/AIDS. Women and Child Welfare. Role of Information Technology in Environment and human health.

DISASTER MANAGEMENT

Natural Disasters- Meaning and nature of natural disasters, their types and effects. Floods, drought, cyclone, earthquakes, landslides, avalanches, volcanic eruptions, Heat and cold waves, Climatic change: global warming, Sea level rise, ozone depletion. Man Made Disasters- Nuclear disasters, chemical disasters, biological disasters, building fire, coal fire, forest fire, oil fire, air pollution, water pollution, deforestation, industrial waste water pollution, road accidents, rail accidents, air accidents, sea accidents. Disaster Management- Effect to migrate natural disaster at national and global levels. International strategy for disaster reduction. Concept of disaster management, national disaster management framework; financial arrangements; role of NGOs, community –based organizations and media. Central, state, district and local administration; Armed forces in disaster response; Disaster response; Police and other organizations.

Practical

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

Recommended reading:

1. Perspective of Environmental Sciences - Kaushik & Kaushik, Agrobios, Delhi (1992)
2. Air Environment and Pollution - S. S. Purohit, New Age Publishers, Delhi (1990)
3. Water Pollution Causes, Effects and Control - P. K. Goel, Agrobios Publisher, Delhi (1991)
4. Biodiversity and Forest Genetic Resource - D. N. Tiwari, Oxford Publishers, Delhi (1990)
5. Environmental Engineering - G. Kiely, Pearson India Ltd. (1990)
6. Environmental Engineering - B. K Nanda and T. Biswal, Oxford Publishers, Delhi (1990)

Statistical Methods

Code: AGS 308 **Full Marks-100**

1L+1P=2

Credit-2

COURSE OUTCOME:

This course is meant for students who do not have any background knowledge of Statistics. Students would be exposed to various concepts of descriptive statistical methods and statistical inferential procedures what would help them in understanding the importance of statistics in agriculture.

Theory

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

Random Sampling with and without replacement, Use of Random Number Tables for selection of Simple Random Sample.

Practical

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

Recommended reading:

1. Statistical methods for Agricultural workers by Panse V.G. Sukhatme P.V.
2. Mathematical statistics by Gupta and Kapoor.
3. Statistical Methods by Snedocor and Cochran.
4. A Text book of Agriculture Statistics by R. Rangaswami
5. Statistics for Agriculture Sciences by Nageshwar Rao G.
6. Experimental Designs by Cochran G.W. and Cox G.W.
7. Design and Analysis of Experiment by Das M.N. and Giri N.C.
8. Statistical procedures for Agricultural Research by Gomez K.A. and Gomez A.A.
9. Applied statistics by Gupta and Kapoor

Livestock and Poultry Management

Code: AGS 309 **Full Marks-100**

3L+1P=4

Credit-4

COURSE OUTCOME:

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

Theory

Role of livestock in the national economy. Reproduction in farm animals and poultry. Housing principles, space requirements for different species of livestock and poultry. Management of calves, growing heifers and milch animals. Management of sheep, goat and swine. Incubation, hatching and brooding. Management of growers and layers. Important Indian and exotic breeds of cattle, buffalo, sheep, goat, swine and poultry. Improvement of farm animals and poultry. Digestion in livestock and poultry. Classification of feedstuffs. Proximate principles of feed. Nutrients and their functions. Feed ingredients for ration for livestock and poultry. Feed supplements and feed additives. Feeding of livestock and poultry.

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

Practical

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

Recommended reading:

1. A Text Book of animal Husbandry VIII ed. - G. C. Banerjee, Oxford and IBH Publications, New Delhi (2011)
2. Hand Book of Animal Husbandry –DIPA, ICAR, New Delhi (2011)
3. Animal Nutrition and Feeding Practices - S. K. Ranjan, Vikash Publication, New Delhi (1994)
4. Poultry Production - R. A. Singh, Kalyani Publications, New Delhi (1985)
5. Outlines of Dairy Technology - Sukumar Dey, Oxford University Press, New Delhi (2000)
6. Farm Animal Management and Poultry Production - Thomas C. K. Sastry, NSR and R. A. Singh, Vikash Publishing House (1982).

FOURTH SEMESTER

Crop Production Technology –II (Rabi Crops)

Code: AGS 401 **Full Marks-100**

1L+1P=2

Credit-2

COURSE OUTCOME:

Students will be oriented with the origin, geographic distribution, morphology, classification, economic importance, soil and climatic requirement, varieties, cultural practices and yield of some Rabi crops.

Theory

Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of *Rabi* crops; cereals –wheat and barley, pulses-chickpea, lentil, pea & rajmah; oilseeds-rapeseed, mustard, sunflower, safflower & linseed; sugar crops-sugarcane & sugar beet; other crops- potato, narcotics-tobacco; Forage crops-berseem, lucerne and oat.

Practical

Sowing methods of wheat and sugarcane, identification of weeds in rabi season crops, study of morphological characteristics of rabi crops, study of yield contributing characters of rabi season crops, yield and juice quality analysis of sugarcane, study of important agronomic experiments of *rabi* crops at experimental farms. Study of *rabi* forage experiments, oil extraction of medicinal crops, visit to research stations of related crops.

Recommended reading:

1. Manures and Fertilizers - K. S. Yawalkar, J. P. Agarwal and S. Bokde, Agri-Horticultural Pub. House, Nagpur (1992)
2. Principles and Practices of Agronomy - P. Balasubramaniyam, and S. P. Palaniappan, Agrobios (India), Jodhpur (2001)
3. Principles of Agronomy - S. R. Reddy, Kalyani Publishers, New Delhi (2002)
4. Principles and Practices of Agronomy - S. S. Singh, Kalyani Publishers, New Delhi (1993)
5. Text book of Field Crops Production – R. Prasad, ICAR, New Delhi

Production Technology for Ornamental Crops, MAP and Landscaping

Code: AGS 402 **Full Marks-100**

1L+1P=2

Credit-2

COURSE OUTCOME:

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

Theory

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

Practical

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

Recommended reading:

1. Floriculture in India - G. S. Randhawa and A. Mukopadhyay, Allied Publishers (1998)
2. Complete Gardening in India - K.S.G. Gopalswami, Oxford, Delhi (1990)
3. Commercial Flowers - T.K. Bose and L.P. Yadav, New Age Publishers (1990)
4. Text Book of Floriculture and Land scaping - N. Roychowdhury and H.P. Mishra, Allied Publishers (2000)

Renewable Energy and Green Technology

Code: AGS 403 **Full Marks-100**
1L+1P=2
Credit-2

COURSE OUTCOME:

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

Theory

Classification of energy sources, contribution of these of sources in agricultural sector, Familiarization with biomass utilization for biofuel production and their application, Familiarization with types of biogas plants and gasifiers, biogas, bioalcohol, biodiesel and biooil production and their utilization as bioenergy resource, introduction of solar energy, collection and their application, Familiarization with solar energy gadgets: solar cooker, solar water heater, application of solar energy: solar drying, solar pond, solar distillation, solar photovoltaic system and their application, introduction of wind energy and their application

Practical

Familiarization with renewable energy gadgets, To study biogas plants, To study gasifier, To study the production process of biodiesel, To study briquetting machine, To study the production process of bio-fuels, Familiarization with different solar energy gadgets, To study solar photovoltaic system: solar light, solar pumping, solar fencing, To study solar cooker, To study solar drying system, To study solar distillation and solar pond

Suggested Readings

1. Non-conventional Energy Sources by G. D Rai 5th Edition. Khanna Pubhishers, Delhi
2. Renewable Energy Theory and Practice by N.S. Rathore, N.L. Panwar, A.K. Kurchania. Himanshu Publications, Udaipur.
3. Handbook of Agricultural Engineering, ICAR Publication.
4. Solar Energy Utilization by G.D. Rai 5th Edition. KhannaPubhishers, Delhi.
5. Solar Energy: Principles of Thermal Collection and Storage by S.P. Sukhatme& J.K. Nayak 3rd Edition. McGraw Hill Education, Delhi.
6. Principle of Renewable Energy – Twidell and Weir.
7. Principle of Energy Conversion. Culp A.W. 1991. McGraw Hill Pub. Co. Inc.
8. Dufee J.A. and Beckman W.A. 1986. Renewable Energy Sources. E and FA Spon. Ltd. London
9. Biotechnology and Other Alternative Technologies for Utilization of Biomass and Agricultural Wastes by AmlenduChakravarti.
10. Biogas Technology; A practical Handbook by K. C. Khandalwal and S.S Mahdi, 1986.

Problematic Soils and their Management

Code: AGS 404 **Full Marks-100**

2L+0P=2

Credit-2

COURSE OUTCOME:

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

Theory

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

Practical

pH, EC & ESP of the saturation extract of the saline soil, SAR & Gypsum requirement of sodic soils, Lime requirement and Gypsum requirement of problem soils, Parameters of quality of irrigation water, Determination of lime requirement of acid soils

Suggested Reading

1. RichardsL. A.. 1954. Diagnosis and Improvement of Saline and Alkali Soils. United State Department of Agriculture.
2. Maliwal, G. La. and SomaniL.L. 2010. Nature Properties and Management of Sine and Alkali Soils. Agrotech Publishing Academy, Udaipur 313 002. pp. 335.
3. Mahendran , et al. Soil Resource Inventory and Management of Problamatic [i.e. Problematic] Soils. Published by Agrotech Publishing Academy (2012) ISBN 10:818321097X / ISBN 13: 9788183210973
4. Abrol, I. P., Yadav, J. S. P and Massoud, F. I. 1988. Salt-Affected Soils and their Management. FAO SOILS BULLETIN 39. FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS, Rome, 1988.
5. Tyagi, N.K. and P.S. Minhas. 1998. Agricultural Salinity Management in India Published by CSRI., Kernal.
6. Yaduvanshi, N. P. S. 2008. Chemical Changes and Nutrient Transformation in Sodic/ Poor Quality water Irrigated Soils . Published by CSRI., Kernal.
7. Dey, P. , Gupta, S. K. 2012. Diagnostics, Remediation and Management of Poor Quality Waters: Lectures for Summer School by R. L. Meena,

Production Technology for Fruit and Plantation Crops

Code: AGS 405 **Full Marks-100**

1L+1P=2

Credit-2

COURSE OUTCOME:

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

Theory

Importance and scope of fruit and plantation crop industry in India; Importance of rootstocks; Production technologies for the cultivation of major fruits-mango, banana, citrus, grape, guava, litchi, papaya, sapota, apple, pear, peach, walnut, almond and; minor fruits- date, ber, pineapple, pomegranate, jackfruit, strawberry, plantation crops-coconut, arecanut, cashew, tea, coffee and rubber.

Practical

Seed propagation, Scarification and stratification of seeds, Propagation methods for fruit and plantation crops, Description and identification of fruit, Preparation of plant bio regulators and their uses, Important pests, diseases and physiological disorders of above fruit and plantation crops, Visit to commercial orchards.

Suggested Readings:

1. Handbook of Horticulture ICAR publication
2. Tropical and Subtropical Fruit crops. T.K.Bose and others
3. Fruit Culture in India. Sham Singh and others
4. Fruits. Ranjit Singh
5. Physiology of Fruit Production. Amar Singh
6. Coconut. Thumpan
7. Advance s in Horticulture. Ed by K.L.Chadha
8. Temperate fruits. Mitra, Thakur and Bose
9. Introduction to spices and Plantation crops. N.Kumar
10. Plantation Crops. J. S. Pruthi

Principles of Seed Technology

Code: AGS 406 **Full Marks-100**

1L+2P=3

Credit-3

COURSE OUTCOME:

To give students a greater understanding about various aspects of seed science and technology including seeds of genetically modified crops; to develop awareness among the students on seed laws and regulations; to train the students in research on seed production, certification, testing, drying, processing, storage, marketing; to strengthen human resources in the seed production technology of field crops and vegetables

Theory

Seed and seed technology: introduction, definition and importance. Deterioration causes of crop varieties and their control; Maintenance of genetic purity during seed production, seed quality; Definition, Characters of good quality seed, different classes of seed. Foundation and certified seed production of important **cereals, pulses, oilseeds, fodder and vegetables**. Seed certification, phases of certification, procedure for seed certification, field inspection. Seed Act and Seed Act enforcement. Duty and powers of seed inspector, offences and penalties. Seeds Control Order 1983, Varietal Identification through Grow Out Test and Electrophoresis, **Molecular and Biochemical test. Detection of genetically modified crops, Transgene contamination in non-GM crops, GM crops and organic seed production.** Seed drying, processing and their steps, seed testing for quality assessment, seed treatment, its importance, method of application and seed packing. Seed storage; general principles, stages and factors affecting seed longevity during storage. Measures for pest and disease control during storage. Seed marketing: structure and organization, sales generation activities, promotional media. Factors affecting seed marketing, Role of WTO and OECD in seed marketing.

Practical

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

Recommended reading:

1. Seed Technology - R. L. Agrawal, Oxford & IBH (2008)
2. Principles of Seed Technology - G.M. Kulkarni, Kalyani Publishers (2015)
3. Structure Development and Reproduction in Angiosperms - V. Singh, P. C. Pande & D. K Jain, Kalyani Publishers (1998)

Farming System & Sustainable Agriculture

Code: AGS 407 **Full Marks=100**

1L+0P=1
Credit-1

COURSE OUTCOME:

To understand the different farming system and integrated farming system (IFS)- and its components in different agro-climatic zones.

Theory

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

Recommended reading:

1. Fundamental Approaches in Sustainable Agriculture -J. P. Sharma, IK Publishers (2010)
2. Farming System in Tropics - A. Rangaswami, Prentice Hall India ltd (1992)
3. Farming System: Theory and Practice - S. A. Solaimalai, Kalyani Publishers (1990)
4. Text book of Farming System - U. K. Behera, India Agrobios (1992)

Agricultural Marketing Trade & Prices

Code: AGS 408 **Full Marks-100**

2L+1P=3

Credit-3

COURSE OUTCOME:

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

Theory

Agricultural Marketing: Concepts and definitions of market, marketing, agricultural marketing, market structure, marketing mix and market segmentation, classification and characteristics of agricultural markets**;** demand, supply and producer's surplus of agri-commodities: nature and determinants of demand and supply of farm products, producer's surplus – meaning and its types, marketable and marketed surplus, factors affecting marketable surplus of agri-commodities; product life cycle (PLC) and competitive strategies: Meaning and stages in PLC; characteristics of PLC; strategies in different stages of PLC; pricing and promotion strategies: pricing considerations and approaches – cost based and competition based pricing; market promotion – advertising, personal selling, sales promotion and publicity – their meaning and merits & demerits; marketing process and functions: Marketing process-concentration, dispersion and equalization; exchange functions – buying and selling; physical functions – storage, transport and processing; facilitating functions – packaging, branding, grading, quality control and labeling (Agmark);Market functionaries and marketing channels: Types and importance of agencies involved in agricultural marketing; meaning and definition of marketing channel; number of channel levels; marketing channels for different farm products; Integration, efficiency, costs and price spread: Meaning, definition and types of market integration; marketing efficiency; marketing costs, margins and price spread; factors affecting cost of marketing; reasons for higher marketing costs of farm commodities; ways of reducing marketing costs; Role of Govt. in agricultural marketing: Public sector institutions- CWC, SWC, FCI, CACP & DMI – their objectives and functions; cooperative marketing in India; Risk in marketing: Types of risk in marketing; speculation & hedging; an overview of futures trading; Agricultural prices and policy: Meaning and functions of price; administered prices; need for agricultural price policy; Trade: Concept of International Trade and its need, theories of absolute and comparative advantage. Present status and prospects of international trade in agri-commodities; GATT and WTO; Agreement on Agriculture (AoA) and its implications on Indian agriculture; IPR.

Practical

Plotting and study of demand and supply curves and calculation of elasticities**;** Study of relationship between market arrivals and prices of some selected commodities; Computation of marketable and marketed surplus of important commodities; Study of price behaviour over time for some selected commodities; Construction of index numbers; Visit to a local market to study various marketing functions performed by different agencies, identification of marketing channels for selected commodity, collection of data regarding marketing costs, margins and price spread and presentation of report in the class; Visit to market institutions – NAFED, SWC, CWC, cooperative marketing society, etc. to study their organization and functioning; Application of principles of comparative advantage of international trade.

Recommended reading:

1. Agricultural Marketing in India - S. S. Acharya and N. L. Agarwal, Kalyani Publishers (1990)
2. Agricultural Price Policy - S. S. Acharya and N. L. Agarwal, Prentice Hall India (1990)
3. Marketing of Agricultural Products - R. L. Kohis and N. Joseshuhf, Oxford India (1992)
4. Agricultural Price Analysis - G. E. Shephard, Orient longman India (2000)

Introductory Agro-meteorology & Climate Change

Code: AGS 409 **Full Marks-100**

1L+1P=2

Credit-2

COURSE OUTCOME:

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

Theory

Meaning and scope of agricultural meteorology; Earth atmosphere- its composition, extent and structure; Atmospheric weather variables; Atmospheric pressure, its variation with height; Wind, types of wind, daily and seasonal variation of wind speed, cyclone, anticyclone, land breeze and sea breeze; Nature and properties of solar radiation, solar constant, depletion of solar radiation,short wave, longwave and thermal radiation, net radiation, albedo; Atmospheric temperature, temperature inversion, lapse rate, daily and seasonal variations of temperature, vertical profile of temperature, Energy balance of earth; Atmospheric humidity, concept of saturation, vapor pressure, process of condensation, formation of dew, fog, mist, frost, cloud; Precipitation, process of precipitation, types of precipitation such as rain, snow, sleet, and hail, cloud formation and classification; Artificial rainmaking. Monsoon- mechanism and importance in Indian agriculture, Weather hazards - drought, floods, frost, tropical cyclones and extreme weather conditions such as heat-wave and cold-wave. Agriculture and weather relations; Modifications of crop microclimate, climatic normals for crop and livestock production. Weather forecasting- types of weather forecast and their uses. Climate change, climatic variability, global warming, causes of climate change and its impact on regional and national Agriculture.

Practical

1. Measurement of Bright sunshine hours, total, shortwave and long wave radiation.
2. Measurement of maximum, minimum air temperatures and soil temperature.
3. Measurement of wind speed and wind direction, preparation of wind rose.
4. Determination of vapor pressure and relative humidity.
5. Measurement of rainfall.
6. Analysis of rainfall data for climatological studies.
7. Measurement of Pressure
8. Estimation of heat indices.
9. Measurement of open pan evaporation.
10. Computation of PET and AET.

Recommended reading:

1) Agricultural Meteorology- G.S.L.H.V. Prasad Rao, Kerala Agricultural University Publications.
2) Text book of Agricultural Meteorology – M. C. Varshneya and P. Balkrishna Pillai.
3) Introduction to Agro-meteorology- H. S. Mavi
4) Our Atmosphere- Smita Bhutani
5) Atmosphere, weather and climate – Barry R. G. and Charley R. J. The English Language Book Society and Mathuen and Co. Ltd., Sultolk.
6) Climate, weather and crops in India – D. Lenka.

Agrochemicals

Code: AGEC 451 **Full Marks-100**

2L+1P=3

Credit-3

COURSE OUTCOME:

The students are expected to gain both theoretical as well as practical knowledge on agrochemicals - their type and role in agriculture, effect on environment, soil, human and animal health; management of agrochemicals for sustainable agriculture.

Theory

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

- Herbicides-Major classes, properties and important herbicides. Fate of herbicides.
- Fungicides - Classification – Inorganic fungicides - characteristics, preparation and use of sulfur and copper, Mode of action-Bordeaux mixture and copper oxychloride Organic fungicides- Mode of action- Dithiocarbamates-characteristics, preparation and use of Zineb and maneb

Systemic fungicides- Benomyl, carboxin, oxycarboxin, Metalaxyl, Carbendazim, characteristics and use, Introduction and classification of insecticides: inorganic and organic insecticides Organochlorine, Organophosphates, Carbamates, Synthetic pyrethroids Neonicotinoids, Biorationals, Insecticide Act and rules, Insecticides banned, withdrawn and restricted use, Fate of insecticides in soil & plant, IGRs Biopesticides, Reduced risk insecticides, Botanicals, plant and animal systemic insecticides their characteristics and uses

Fertilizers and their importance, Nitrogenous fertilizers: Feedstocks and Manufacturing of ammonium sulphate, ammonium nitrate, ammonium chloride, urea. Slow release N-fertilizers. Phosphatic fertilizers: feedstock and manufacturing of single superphosphate, Preparation of bone meal and basic slag. Potassic fertilizers: Natural sources of potash, manufacturing of potassiumchloride, potassium sulphate and potassium nitrate.

Mixed and complex fertilizers: Sources and compatibility–preparation of major, secondary and micronutrient mixtures. Complex fertilizers: Manufacturing of ammonium phosphates, nitrophosphates and NPK complexes. Fertilizer control order, Fertilizer logistics and marketing. Plant bio-pesticides for ecological agriculture, Bio-insect repellent

Practical

Sampling of fertilizers and pesticides, Pesticides application technology to study about various pesticides

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

Suggested Reading

1. Manures and fertilizers – Yavalkar, Agarwal and Bokde
2. Chemistry of fertilizers and manures – Mariakulandi and Manickam
3. Nature and properties of soil – N.C. Brady
4. Organic manures – Gour, (ICAR publication)
5. Recycling of crop, animal, human and industrial waste in Agriculture – H.L.S. Tondon

Biopesticides & Biofertilizers

Code: AGEC 452 **Full Marks-100**
2L+1P=3
Credit-3

COURSE OUTCOME:

The students are expected to gain both theoretical as well as practical knowledge on various types of biofertilizers, biopesticides their characteristics, application technology, quality control, mechanism of solubilization of nutrients in soil

Theory

History and concept of biopesticides, Importance, scope and potential of biopesticide, Definitions, concepts and classification of biopesticides viz. pathogen, botanical pesticides, and biorationales, Botanicals and their uses. Mass production technology of bio-pesticides, Virulence, pathogenicity and symptoms of entomopathogenic pathogens and nematodes, Methods of application of biopesticides, Methods of quality control and Techniques of biopesticides, Impediments and limitation in production and use of biopesticide

Biofertilizers - Introduction, status and scope. Structure and characteristic features of bacterial biofertilizers- *Azospirillum, Azotobacter, Bacillus, Pseudomonas, Rhizobium* and *Frankia*; Cynobacterial biofertilizers- *Anabaena*, *Nostoc*, Hapalosiphon and fungal biofertilizers- AM mycorrhiza and ectomycorhiza, Nitrogen fixation -Free living and symbiotic nitrogen fixation, Mechanism of phosphate solubilization and phosphate mobilization, K solubilization. Production based and liquid biofertiizers. FCO specifications and quality control of biofertilizers. Application technology for seeds, seedlings, tubers, sets etc. Biofertilizers -Storage, shelf life, quality control and marketing. Factors influencing the efficacy of biofertilizers

Practical

Isolation and purification of important biopesticides: *Trichoderma Pseudomonas, Bacillus, Metarhyzium* etc. and its production. Identification of important botanicals, Visit to biopesticide laboratory in nearby area, Field visit to explore naturally infected cadavers. Identification of entomopathogenic entities in field condition, Quality control of biopesticides, Isolation and purification of *Azospirillum , Azotobacter, Rhizobium*, P-solubilizers and cyanobacteria, Mass multiplication and inoculums production of biofertilizers, Isolation of AM fungi -Wet sieving method and sucrose gradient method, Mass production of AM inoculants

Suggested Readings:

1. Bergerson F.J. 1980. Methods for Evaluating Biological Nitrogen Fixation. John Wiley and Sons.
2. Motsara, I.M.R., Bhattacharyya, P. and Srivastava, B. 1995. Biofertilizer Technology, Marketing and Usage- A Source Book-cum-glossary. FDCO, New Delhi.
3. Subba Rao, N.S. Biofertilizers in Agriculture and Forestry. 1993. Oxford and IBH. Publ. Co., New Delhi.
4. Burges, H.D. and Hussey, N.W. (1971). Microbial Control of Insects and mites. Academic Press, New York.
5. Burges, H.D. Formulation of microbial pesticides – Kluversep, ACB, Dordrecht-ISBN. 0412 625 202.
6. Coppel H.C. and J.W. Martin. (1977). Biological control of insect pest suppression. Springail.
7. Gautam, R.D. (2006). Biological suppression of insect pests. Kalyani Publisher, New Delhi.
8. Huffaker, C.B. and Messenger, P.S. (1976). Theory and Practice of Biological control. Academic Press, New York.
9. Ignacimuthu, S.S. and Jayaraj, S. (2003). Biological Control of Insect Pests. Phoenix Publ. New Delhi.
10. Saxena, A.B. (2003). Biological Control of Insect Pests. Anmol Publ. New Delhi.
11. A century of Nitrogen Fixation Research Present status and Future propects. 1987. F.J. Bergersen and J.R. Postgate The Royal Soc., London.
12. Biology and Biochemistry of Nitrogen fixation. 1991. M.J. Dilworth,and A.R. Glenn, Elsevier, Amsterdam.

Micro propagation Technologies

Code: AGEC 456 **Full Marks-100**

1L+2P=3

Credit-3

COURSE OUTCOME:

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

Theory

Introduction, History, Advantages and limitations; Types of cultures (seed, embryo, organ, callus, cell), Stages of micropropagation, Axillary bud proliferation (Shoot tip and meristem culture, bud culture),Organogenesis (callus and direct organ formation), Somatic embryogenesis, cell suspension cultures, Production of secondary metabolites, Somaclonal variation, Cryopreservation

Practical

Identification and use of equipments in tissue culture Laboratory, Nutrition media composition, sterilization techniques for media, containers and small instruments, sterilization techniques for explants, Preparation of stocks and working solution, Preparation of working medium, Culturing of explants: Seeds, shoot tip and single node, Callus induction, Induction of somatic embryos regeneration of whole plants from different explants, Hardening procedures.

Recommended reading:

1. Introduction to Plant Biotechnology - H. S. Chawala, Oxford & IBH (2000)
2. Elements of Biotechnology - P. K. Gupta, Rastogi Publications, Meerut (2008)
3. Plant Biotechnology, in vitro principles, Techniques and Applications – M. S. Shekhawat, MJP Publishers, Chennai (2011)
4. Hand book of Plant Tissue Culture - A. F. Mascarenhas, ICAR (2008)

FIFTH SEMESTER

Principles of Integrated Pest and Disease Management

Code: AGS 501 **Full Marks-100**

2L+1P=3

Credit-3

COURSE OUTCOME:

To generate knowledge about IDM and IPM.

Theory

IPM: Introduction, history, importance, concepts, principles and tools of IPM, Economic importance of diseases and pest risk analysis.Methods of detection and diagnosis of diseases, Measurment of lossess causes due to diseases. Methods of control: Host plant resistance, cultural, mechanical, physical, legislative, biological and chemical control, Ecological management of crop environment.Introduction to conventional pesticides for the disease management, Survey surveillance and forecasting of plant diseases, Development and validation of IPM module, Implementation and impact of IPM (IPM module for diseases. Safety issues in pesticide uses. Political, social and legal implication of IPM, Case histories of important IPM programmes

Practical

Methods of diagnosis and detection of various plant diseases, Methods of plant disease measurement, Assessment of crop yield losses, calculations based on economics of IPM, Identification of biocontrol agents, Mass multiplication of *Trichoderma, Pseudomonas*, NPV etc. identification of diseases and their management, Crop (agro-ecosystem) dynamics of selected diseases. Plan & assess preventive strategies (IPM module) and decision making. crop monitoring attacked by diseases, Awareness campaign at farmers' fields

Suggested Readings

1. Singh RS. 2013. *Introduction to Principles of Plant Pathology.* Oxford and IBH Co., New Delhi.
2. Pathak, V. N. Essentials of plant pathology. Prakash Pub., Jaipur
3. Agrios, G. N. Plant Pathology. 5th edition, Published by a division of Reed Elsvier India Pvt., Ltd., New Delhi (2005)
4. Kamat, M. N. Introductory Plant Pathology. Prakash Pub, Jaipur
5. Stakman EC & Harrar JG. 1957. *Principles of Plant Pathology*. Ronald Press, USA
6. *Tarr SAJ*. 1964. *The Principles of Plant Pathology*. McMillan, London
7. *Vander Plank, JE.* 1975. *Principles of Plant Infection.* Acad. Press
8. Verma JP, Varma A & Kumar D. (Eds). 1995. *Detection of Plant Pathogens and their Management*. Angkor Publ., New Delhi
9. Mehrotra RS & Aggarwal A. 2003. *Plant Pathology*. 2nd Ed. Oxford & IBH
10. Dhingra OD & Sinclair JB. 1986. *Basic Plant Pathology Methods*. CRC Press

Manures, Fertilizers and Soil Fertility Management

Code: AGS 502 **Full Marks-100**

2L+1P=3

Credit-3

COURSE OUTCOME:

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

Theory

Introduction and importance of organic manures, properties and methods of preparation of bulky and concentrated manures. Green/leaf manuring. Fertilizer recommendation approaches. Integrated nutrient management. Chemical fertilizers: classification, composition and properties of major nitrogenous, phosphatic, potassic fertilizers, secondary & micronutrient fertilizers, Complex fertilizers, nano fertilizers Soil amendments, Fertilizer Storage, Fertilizer Control Order. History of soil fertility and plant nutrition. criteria of essentiality. role, deficiency and toxicity symptoms of essential plant nutrients, Mechanisms of nutrient transport to plants, factors affecting nutrient availability to plants. Chemistry of soil nitrogen, phosphorus, potassium, calcium, magnesium, sulphur and micronutrients. Soil fertility evaluation, Soil testing. Critical levels of different nutrients in soil. Forms of nutrients in soil, plant analysis, rapid plant tissue tests. Indicator plants. Methods of fertilizer recommendations to crops. Factor influencing nutrient use efficiency (NUE), methods of application under rainfed and irrigated conditions.

Practical

Introduction of analytical instruments and their principles, calibration and applications, Colorimetry and flame photometry. Estimation of soil organic carbon, Estimation of alkaline hydrolysable N in soils. Estimation of soil extractable P in soils. Estimation of exchangeable K; Ca and Mg in soils . Estimation of soil extractable S in soils. Estimation of DTPA extractable Zn in soils. Estimation of N in plants. Estimation of P in plants. Estimation of K in plants. Estimation of S in plants.

Recommended reading:

1. Mariakulandi and Manickam: 1975: Chemistry of fertilizers and manures.
2. Mariakulandi and Manickam (1975): Chemistry of manures an fertilizers
3. Tandon H. L. S. (1994): Recycling of crop, animal, human and industrial Wastes in Agriculture. FDCO, Delhi
4. Krishna and Murthy (1978): Manual on compost and other organic manures.
5. Rakshit A. 2015.Manures Fertilizers and Pesticides Paperback – Import. CBS Publishing; 1ST edition, pp. 266.
6. Zhongqi Heand Hailin Zhang). 2016. Applied Manure and Nutrient Chemistry for Sustainable Agriculture and Environment Paperback – Import. Springer. pp. 379.

7. Havlin , John L, Samuel L. Tisdale (Author), Werner L. Nelson (Author), James D. Beaton (2004). Soil Fertility and Fertilizers (8th Edition) 8th Edition. Published July 23rd 2004 by Prentice Hall. pp. 528.
8. ISSS. 2009. Fundamentals of Soil Science. 2nd Ed. Indian Society of Soil Science, New Delhi- 110 012. pp. 728.
9. Das D. K. 2011. Introductory Soil Science, 3rd revised and Enlarged Ed, Kalyani Publisher, Ludhiana. pp. 645.
10. *Chapman*, H.D., and P.F. *Pratt*. *1961*. Methods of analysis for soils, plants and waters. Division of Agricultural Sciences, University of California.
11. Brady, N. C. 2016. The Nature and Properties of Soils. 15th edition Publisher: Pearson Education, ISBN: 978-0133254488.

Pests of Crops and Stored Grain and their Management

Code: AGS 503 **Full Marks-100**
2L+1P=3
Credit-3

COURSE OUTCOME:

To familiarize the students about nature of damage and seasonal incidence of insect pests that causes loss to major field crops along with their effective management by different methods.

Theory

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

Practical

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

and bird control operations in godowns. Determination of moisture content of grain. Methods of grain sampling under storage condition. Visit to nearby ware house. Visit to nearest FCI godowns.

Recommended reading:

1) A.S. Atwal and G.S. Dhaliwal : Agricultural Pests of South Asia and their Management
2) B.V. David and V.V. Rammurthy: Elements of Economic Entomology
3) Manishekharan and Sudarrajan : Pest Management in Field Crops.
4) Pedigo L.P. : Entomology and Pest Management.
5) VenuGopal Rao: Insect Pest Management.
6) B.P. Khare : Storage Entomology

Diseases of Field and Horticulture Crops and their Management-I

Code: AGS 504 **Full Marks-100**
2L+1P=3
Credit-3

COURSE OUTCOME:

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

Theory

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

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

Practical

Identification and histopathological studies of selected diseases of field and horticultural crops covered in theory. Field visit for the diagnosis of field problems. Collection and preservation of plant diseased specimens for Herbarium.

Recommended reading:

1. An Introduction to Fungi - H. C. Dubey, Scientific Publishers (2012)
2. Plant Disease - R. S. Singh, Oxford and IBH Publishing (2009)
3. Plant Pathology - R.S. Mehrotra, Tata Mc Grow Hill Pub. Co. Ltd., New Delhi (1998)
4.

Crop Improvement – I (*Kharif Crops*)

Code: AGS 505 **Full Marks-100**
1L+1P=2
Credit-2

COURSE OUTCOME:

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

Theory

Centers of origin, distribution of species, wild relatives in different cereals; pulses; oilseeds; fibres; fodders and cash crops; vegetable and horticultural crops; Plant genetic resources, its utilization and conservation Floral biology, study of genetics of qualitative and quantitative characters; Important concepts of breeding self-pollinated, cross pollinated and vegetatively propagated crops; Major breeding objectives and procedures including conventional and modern innovative approaches for development of hybrids and varieties for yield, adaptability, stability, abiotic and biotic stress tolerance and quality (physical, chemical, nutritional); Seed production technology in self-pollinated, cross pollinated and vegetatively propagated crops. Hybrid seed production technology in Maize, Rice, Sorghum, Pearl millet and Pigeonpea, etc. Ideo type concept and climate resilient crop varieties for future

Practical

Emasculation and hybridization techniques in different crop species; viz., Rice, Maize, Sorghum, Pearl Millet, Ragi, Pigeonpea, Urdbean, Mungbean, Soybean, Groundnut, Seasame , Caster, Cotton, Cowpea, Pearl millet and Tobacco. Maintenance breeding of different kharif crops. Handling of germplasm and segregating populations by different methods like pedigree, bulk and single seed decent methods; Study of field techniques for seed production and hybrid seeds production in *Kharif* crops; Estimation of heterosis, inbreeding depression and heritability; Layout of field experiments; Study of quality characters, donor parents for different characters; Visit to seed production plots; Visit to AICRP plots of different field crops.

Recommended reading:

1. Introduction to Cytogenetics, G. Prasad, Kalyani Publishers (2002)
2. Cytogenetics of Crop Plants, P. K. Gupta, U. Sinha and M. S. Swaminathan, Macmillan India Ltd (1983)
3. Cytogenetics - C. P. Swanson, T. Merz and W. J. Young, Prentice-Hall. Inc., Englewood Cliffs, N. J. (1981)

Entrepreneurship Development and Business Communication

Code: AGS 506 **Full Marks-100**
1L+1P=2
Credit-2

COURSE OUTCOME:

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

Theory

Concept of Entrepreneur, Entrepreneurship Development, Characteristics of entrepreneurs. SWOT Analysis & achievement motivation. Government policy and programs and institutions for entrepreneurship development. Role of economic reforms *viz.* Agri-clinics, Agribusiness/Agri-enterprises, Entrepreneurial Development. Business Leadership Skills; Developing organizational skill (controlling, supervising, problem solving, monitoring & evaluation), Developing Managerial skills, Business Leadership Skills (Communication, direction and motivation Skills), Problem solving skill, Supply chain management and Total quality management. Project Planning Formulation and report preparation; Financing of enterprise, Opportunities for agri-entrepreneurship and rural enterprise. Extension administration: meaning and concept, principles and functions.

Practical

Assessing entrepreneurial traits of entrepreneur. Exercise on problem solving skills. Exercise on managerial skills. Exercise on achievement motivation. Collection of traditional wisdom in agricultural field. Time audit through planning, monitoring and supervision (PERT). Identification and selection of business idea. *Preparation* of business plan and proposal writing. Exposure to entrepreneurship development institution (GDI, and Gandhinagar) and Successful entrepreneurs (Input Dealers/Bio-pesticide/Vermi-compost). Exposure of NABARD, GFSC etc.

Recommended reading:

1. Indian Agriculture & Agri-Business Management - S. Diwase, Scientific Publisher India (2014)
2. A Textbook of Agri-Business Management - Sanket S. Kadam, Universal Prakashan, Pune, India (2016)
3. Agri-Business Management - Yashasvi R Rajpara, Pragun Publication, India (2012)
4. Management and Entrepreneurship –N. V. R. Naidu, T. Krishna Rao, I K International Publishing House Pvt. Ltd. (2008)
5. Entrepreneurship - Madhurima Lall, Shikha Sahai, Excel Books (2008)

Geoinformatics and Nano-technology for Precision Farming

Code: AGS 507 **Full Marks = 100**

1L+1P=2

Credit-2

COURSE OUTCOME:

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

Theory

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

Practical

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

Recommended reading:

1. Nanotechnology: Fundamentals and Applications - M. Karkare, IK International Pvt. Ltd. (2008)
2. Applied Nanotechnology in Agriculture - S. Choudhary Arise Publishers & Distributors (2011)
3. Geoinformation Applications in Agriculture - A. K. Singh, New India Publishing Agency (2007)
4. Precision Agriculture Technology Application - K. C. Swain
5. Text book of Remote Sensing & GIS - K. C. Sahu

Practical Crop Production-1 (Kharif crops)

Code: AGS 508 **Full Marks-100**
0L+2P=2
Credit-2

COURSE OUTCOME:

Students will be oriented with the principles of crop planning and selection of crop; students will be given practical experience on raising of crops in their field with special emphasis on the agronomic management of the crop (Kharif crops) .

Practical

Crop planning, raising field crops in multiple cropping systems: Field preparation, seed, treatment, nursery raising, sowing, nutrient, water and weed management and management of insect-pests diseases of crops, harvesting, threshing, drying winnowing, storage and marketing of produce. The emphasis will be given to seed production, mechanization, resource conservation and integrated nutrient,

insect-pest and disease management technologies. Preparation of balance sheet including cost of cultivation, net returns per student as well as per team of 8-10 students.

Intellectual Property Rights

Code: AGS 509 **Full Marks-100**
1L+0P=1
Credit-1

COURSE OUTCOME:

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

Theory

Intellectual property: history and concept; Brief introduction to GATT, WTO, TRIPs and WIPO; Treaties for IPR protection: Madrid protocol, Berne convention, Budapest treaty, etc.; Types of intellectual property and legislations related to IPR in India: Patents, Copyrights, Trademark, Industrial design, Geographical indication, Integrated circuits, Trade secrets; Patents Act 1970 and patent system in India: patentability, process and product patent, filing of patent, patent specification, patent claims, patent opposition and revocation, infringement, compulsory licensing, Patent Co-operation Treaty, patent search and patent database; Origin, history and introduction to UPOV for protection of plant varieties; PPV&FR Act 2001: origin, structure and chapters, rights of breeders, researcher and farmers, registration of plant varieties and genome saviour awards; Traditional knowledge and rights of TK holders; Convention on biological diversity, International treaty on plant genetic resources for food and agriculture (ITPGRFA); Indian Biological Diversity Act, 2002: salient features, access and benefit sharing.

Suggested Readings:

1. Introduction to Intellectual Property Rights by H.S. Chawla, Oxford & IBH Publishing Co. Pvt. Ltd. 113-B ShahpurJat, 2nd Floor, *Asian Games Village side* New Delhi 110 049, India
2. Encyclopedia of Intellectual Property rights Volume No. 1 to 10 by Priyanjan Trivedi (2008)
3. Plant Breeding by B.D. Singh (2006), Kalyani Publication
4. Intellectual Property Right Under Golbalization by Tawar S. Serials Publication, New Delhi.

Weed Management

Code: AGEC 553 **Full Marks-100**
2L+1P=3
Credit-3

COURSE OUTCOME:

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

Theory

Introduction to weeds, characteristics of weeds their harmful and beneficial effects on ecosystem, Classification, reproduction and dissemination of weeds. Herbicide classification, concept of adjuvant, surfactant, herbicide formulation and their use, Introduction to mode of action of herbicides and selectivity,

Allelopathy and its application for weed management, Bio-herbicides and their application in agriculture, Concept of herbicide mixture and utility in agriculture. Herbicide compatibility with agro-chemicals and their application, Integration of herbicides with non chemical methods of weed management. Herbicide Resistance and its management

Practical

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

Suggested Readings:

1. Aldrich, R.J. and Kramer R.J. (1997), Principles in Weed Management.
2. Gupta O.P. (2007), Weed management Principles and Practices.
3. Gupta, O.P. (2008), Modern Weed Management
4. Gupta, O.P. 1984. Scientific Weed Management Today and Tomorrows.
5. Jayakumar, R. and Jagannathan, R. (2007). Weed Science Principles.
6. Mandal R.C. (1999), Weed, Weedicides and Weed control Principles and Practices.
7. Rao V.S. (2006), Principles of Weed Science.

Commercial Plant Breeding

Code: AGEC 557 **Full Marks-100**
2L+1P=3
Credit-3

COURSE OUTCOME:

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

Theory

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

Practical

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

Suggested Readings:

1. Hybrid Seed Production in Field Crops: Principles and Practices by N. C. Singhal, 2003, Kalyani publication, Delhi
2. Principles of Seed Technology by P.K. Agrawal, 2002, Oxford
3. Seed Production of Vegetables. By Prabhakar Singh and B. S. Asati
4. Seed Technology, 1996, Agarwal R L, Oxford
5. Plant Breeding; Principles and Methods by B.D. Singh, 2006, Kalyani publication, Delhi

Protected Cultivation

Code: AGEC 558 **Full Marks-100**

2L+1P=3

Credit-3

COURSE OUTCOME:

To acquaint and equip the students with the greenhouse technology for crop cultivation and its design, materials and equipment.

Theory

Protected cultivation- importance and scope, Status of protected cultivation in India and World types of protected structure based on site and climate. Cladding material involved in greenhouse/ poly house. Greenhouse design, environment control, artificial lights, Automation.

Soil preparation and management, Substrate management. Types of benches and containers. Irrigation and fertigation management. Propagation and production of quality planting material of horticultural crops. Greenhouse cultivation of important horticultural crops – rose, carnation, chrysanthemum, gerbera, orchid, anthurium, lilium, tulip, tomato, bell pepper, cucumber, strawberry, pot plants, etc. Cultivation of economically important medicinal and aromatic plants. Off-season production of flowers and vegetables. Insect pest and disease management.

Practical

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

fogging ad misting.

Suggested Readings

1. Singh Brahma and Balraj Singh. 2014. Advances in protected cultivation, New India Publishing Company.
2. Reddy P. Parvatha, 2003. *Protected Cultivation*. Springer Publications. USA.
3. Reddy, P. Parvatha. 2011. *Sustainable crop protection under Protected Cultivation*. Springer Publications. USA.

SIXTH SEMESTER

Rainfed Agriculture and Watershed Management

Code: AGS 601 **Full Marks=100**

1L+1P=2

Credit-2

COURSE OUTCOME:

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

management.

Theory

Rainfed agriculture: Introduction, types, History of rainfed agriculture and watershed in India; Problems and prospects of rainfed agriculture in India ; Soil and climatic conditions prevalent in rainfed areas; Soil and water conservation techniques, Drought: types, effect of water deficit on physio- morphological characteristics of the plants, Crop adaptation and mitigation to drought; Water harvesting: importance, its techniques, Efficient utilization of water through soil and crop management practices, Management of crops in rainfed areas, Contingent crop planning for aberrant weather conditions, Concept, objective, principles and components of watershed management, factors affecting watershed management.

Practical

Studies on climate classification, studies on rainfall pattern in rainfed areas of the country and pattern of onset and withdrawal of monsoons. Studies on cropping pattern of different rainfed areas in the country and demarcation of rainfed area on map of India. Interpretation of meteorological data and scheduling of supplemental irrigation on the basis of evapo-transpiration demand of crops. Critical analysis of rainfall and possible drought period in the country, effective rainfall and its calculation. Studies on cultural practices for mitigating moisture stress. Characterization and delineation of model watershed. Field demonstration on soil & moisture conservation measures. Field demonstration on construction of water harvesting structures. Visit to rainfed research station/watershed**.**

Recommended reading:

1. Dry farming in India - U.S. Sree Ramulu, New Age Publishers (1990)
2. Dryland Agriculture - G. Subba Reddy, Agrotech India Ltd (2008)
3. Watershed Management - V. V. Narayan, G. Shastry and U. S. Pattanaik, Prentice hall (2000)

Protected Cultivation and Secondary Agriculture

Code: AGS 602 **Full Marks-100**
1L+1P=2
Credit-2

COURSE OUTCOME:

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

Theory

Green house technology: Introduction, Types of Green Houses; Plant response to Green house environment, Planning and design of greenhouses, Design criteria of green house for cooling and heating purposes. Green house equipments, materials of construction for traditional and low cost green houses. Irrigation systems used in greenhouses, typical applications, passive solar green house, hot air green house heating systems, green house drying. Cost estimation and economic analysis. Important Engineering properties such as physical, thermal and aero & hydrodynamic properties of cereals, pulses and oilseed, their application in PHT equipment design and operation. Drying and dehydration; moisture measurement, EMC, drying theory, various drying method, commercial grain dryer (deep bed dryer, flat bed dryer, tray dryer, fluidized bed dryer, recirculatory dryer and solar dryer). Material handling equipment; conveyer and elevators, their principle, working and selection.

Practical

Study of different type of green houses based on shape. Determine the rate of air exchange in an active summer winter cooling system. Determination of drying rate of agricultural products inside green house. Study of green house equipments. Visit to various Post Harvest Laboratories. Determination of Moisture content of various grains by oven drying & infrared moisture methods. Determination of engineering properties (shape and size, bulk density and porosity of biomaterials). Determination of Moisture content of various grains by moisture meter. Field visit to seed processing plant

Recommended reading:

1. Elements of Agricultural Engineering - J. Sahay, Prentice Hall India (1990)
2. Principles of Agriculturl Processing - P. H. Pandey, Orient longman India (1990)
3. Post Harvest Technology of Cereals, Pulses and Oilseeds - A. Chakravorty, FAO (1990)

Diseases of Field and Horticultural Crops and their Management-II

Code: AGS 603 **Full Marks-100**
2L+1P=3
Credit-3

COURSE OUTCOME:

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

Theory

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

Field Crops: Wheat: rusts, loose smut, karnal bunt, powdery mildew, alternaria blight, and ear cockle; Sugarcane: red rot, smut, wilt, grassy shoot and ratoon stunting; Sunflower: Sclerotinia stem rot and Alternaria blight; Mustard: Alternaria blight, white rust, downy mildew, powdery mildew and Sclerotinia stem rot; Gram: wilt, root rot and Ascochyta blight; Lentil: rust and wilt; Cotton: anthracnose, vascular wilt, and black arm; Pea: downy mildew, powdery mildew and rust.

Horticultural Crops: Mango: anthracnose, malformation, powdery mildew and red rust; Citrus: canker and gummosis; Grape vine: downy mildew, Powdery mildew and anthracnose; Guava: wilt and anthracnose; Ber: powdery mildew; Apple: scab, powdery mildew, fire blight; Peach: leaf curl; Strawberry: leaf spot; Sapota: leaf spot; Potato: early and late blight, black scurf, bacterial brown rot, scab, leaf roll, and mosaic; Cucurbits: downy mildew, powdery mildew, wilt; Onion and garlic: purple blotch, and Stemphylium blight; Chillies: anthracnose and fruit rot, wilt and leaf curl; Ginger: soft rot; Turmeric: leaf spots; Fenugreek: powdery mildew; Cumin: Alternaria blight, powdery mildew and t; Fennel: Ramularia blight, stem rot; Coriander: stem gall and powdery mildew; Cruciferous vegetables: Alternaria leaf spot and black rot; Marigold: blight; Rose: dieback, powdery mildew and black leaf spot.

Practical

Identification and histopathological studies of selected diseases of field and horticultural crops covered in theory. Field visit for the diagnosis of field problems. Collection and preservation of plant diseased specimens for herbarium.

Recommended reading:

1. Agrios, GN. 2010. *Plant Pathology*. Acad. Press
2. Diseases of Horticultural Crops fruits (1999) By Verma L.R and Sharma R.c,Indus Publishing company, New Delhi
3. Diseases of fruit crops (1986) By V.N.Pathak ,Oxford & IBH publication, New Delhi
4. Diseases of fruit crops (1986) By R.S.Singh ,Oxford & IBH publication, New Delhi
5. Diseases of Fruits and vegetables (2007) S.A.M.H. Naqvi,Springer Science & Business Media
6. Diseases of Crops Plants in India (2009) By PHI learning Pvt. Ltd, pp 548
7. Diseases of Vegetable crops (2005) by Alferd Steferud ,Biotech Books ,New Delhi
8. Mehrotra RS & Aggarwal A. 2007. *Plant Pathology.* 7th Ed. Tata Mc Graw Hill Publ. Co. Ltd
9. Diseases of Vegetable Crops ,Diagonosis and Management (2014) Dinesh Singh and P.Chodappa, Today and Tomorrow Printers, pp734

Post-harvest Management and value Addition of Fruits and Vegetables

Code: AGS 604 **Full Marks-100**

1L+1P=2

Credit-2

COURSE OUTCOME:

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

Theory

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

Practical

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

Recommended reading:

1. Fruits and vegetables Preservation Girdharilal, Sidappa and Tondan
2. Post Harvest Physiology, Handling, Utilization of tropical and subtropical fruits and vegetables E.R.B. Pantastico
3. Preservation of fruits and vegetables – Principals and Practices Shrivastava and Sangeev Kumar
4. Commercial fruits and Vegetable Products W.V.Cruess
5. Post Harvest handling of fruits and Vegetables Bal and Sandhu

Management of Beneficial Insects

Code: AGS 605 **Full Marks-100**

1L+1P=2

Credit-2

COURSE OUTCOME:

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

Theory

Part I: Importance of beneficial Insects, Beekeeping, pollinating plant and their cycle, bee biology, species of honey bees**,** commercial methods of rearing, equipment used, seasonal management, bee enemies and diseases. Bee pasturage, bee foraging and communication. Division and uniting of honey bee boxes. Toxicity of pesticides to honey bees.

Part II: Types of silkworm, voltinism and biology of silkworm. Mulberry**/**castor cultivation, mulberry varieties and methods of harvesting and preservation of leaves. Rearing and mounting larvae and

harvesting of cocoons. Pest and diseases of silkworm and management. Rearing appliances of mulberry silkworm and methods of disinfection.

Part III: Species of lac insect, morphology, biology, host plant, lac production – seed lac, button lac, shellac, lac- products. Enemies of lac insects.

Part IV: Identification of major parasitoids and predators commonly being used in biological control. Insect orders bearing predators and parasitoids used in pest control and their mass multiplication techniques. Important species of pollinator, weed killers and scavengers with their importance.

Practical

Honey bee species, castes of bees. Beekeeping appliances and seasonal management, bee enemies and disease. Bee pasturage, bee foraging and communication. Division and uniting of honey bee boxes. Migration of honeybee boxes. Types of silkworm, voltinism and biology of silkworm. Mulberry/**castor** cultivation, mulberry varieties and methods of harvesting and preservation of leaves. Species of lac insect, host plant identification. Identification of other important pollinators, weed killers and scavengers. Insect orders bearing predators and parasitoids used in pest control and their mass multiplication techniques. Visit to research and training institutions devoted to beekeeping, sericulture, lac culture and natural enemies.

Recommended reading:

1. Integrated Pest Management: Concepts and Approaches - G. S. Dhaliwal, and R. Arora, Kalyani Publishers (2002)
2. Agricultural Entomology and Pest Control - S. Pradhan, ICAR Publication (1983)
3. Entomology and Pest Management - L. P. Pedigo, Macmillan Publishing Company (1989)
4. Insects and Mites of Crops in India - M. R. G. K. Nair, ICAR Publication (1975)

Crop Improvement-II (Rabi crops)

Code: AGS 606 **Full Marks-100**
1L+1P=2
Credit-2

COURSE OUTCOME:

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

Theory

Botanical Name, family, chromosome number, centre of origin, nature of pollination, list of wild relatives (donor parents for different characters), distributions of species of 14 selected crops (wheat, chickpea, mustard, sunflower, potato, lucerne, sugarcane, tomato, brinjal, chilies, onion, garlic, cumin and coriander); Floral biology as well as study of genetics of qualitative and quantitative characters of wheat, chickpea, mustard, sunflower, potato, lucerne, sugarcane, tomato, brinjal, chilies, onion, garlic, cumin and coriander; Breeding methods ofwheat, chickpea, mustard, sunflower, potato, lucerne, sugarcane, tomato, brinjal, chilies, onion, garlic, cumin and coriander; Major breeding objectives (including quality parameters) of wheat, chickpea, mustard, sunflower, potato, lucerne, sugarcane, tomato, brinjal, chilies,

onion, garlic, cumin and coriander; Ideotype concept for wheat, mustard and tomato; Climate resilient crop varieties for future. e. g short-duration crops and high temperature tolerance in wheat and chickpea; International, National and State level research station and varieties/hybrids released of wheat, chickpea, mustard, sunflower, potato, lucerne, sugarcane, tomato, brinjal, chilies, onion, garlic, cumin and coriander

Practical

Emasculation and hybridization techniques wheat; Emasculation and hybridization techniques in chickpea; Emasculation and hybridization techniques in mustard and sunflower; Emasculation and hybridization techniques in potato and sugarcane. Emasculation and hybridization techniques in Lucerne; Emasculation and hybridization techniques in tomato, brinjal and chilies; Emasculation and hybridization techniques in onion and garlic; Emasculation and hybridization techniques in cumin and coriander; Maintenance breeding of different *rabi* crops; Detailed procedure of hybrid seed production of mustard, sunflower, and onion; Visit to seed production plots and submission of report; Visit to AICRP plots of different field crops and submission of report.

Recommended reading:

1. Manures and Fertilizers - K. S. Yawalkar, J. P. Agarwal and S. Bokde, Agri-Horticultural Pub. House, Nagpur (1992)
2. Principles and Practices of Agronomy - P. Balasubramaniyam, and S. P. Palaniappan, Agrobios (India), Jodhpur (2001)
3. Principles of Agronomy - S. R. Reddy, Kalyani Publishers, New Delhi (2002)
4. Principles and Practices of Agronomy - S. S. Singh, Kalyani Publishers, New Delhi (1993)

Practical Crop Production-II (Rabi Crops)

Code: AGS 607 **Full Marks-100**

0L+2P=2

Credit-2

COURSE OUTCOME:

Students will be oriented with the principles of crop planning and selection of crop; students will be given practical experience on raising of crops in their field with special emphasis on the agronomic management of the crop (Rabi crops) .

Practical

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

Recommended reading:

1. Manures and Fertilizers - K. S. Yawalkar, J. P. Agarwal and S. Bokde, Agri-Horticultural Pub. House, Nagpur (1992)
2. Principles and Practices of Agronomy - P. Balasubramaniyam, and S. P. Palaniappan, Agrobios (India), Jodhpur (2001)

3. Principles of Agronomy - S. R. Reddy, Kalyani Publishers, New Delhi (2002)
4. Principles and Practices of Agronomy - S. S. Singh, Kalyani Publishers, New Delhi (1993)
5. Text book of Field Crops Production – R. Prasad, ICAR, New Delhi.
6. Practical manuals on nutrient management, water management & weed management - Department of Agronomy, College of Agriculture, OUAT, Bhubaneswar.

Principles of Organic Farming

Code: AGS 608 **Full Marks-100**

1L+1P=2

Credit-2

COURSE OUTCOME:

To impart knowledge on basics application of organic firming, its techniques, initiatives present scenario, benefits and future scope.

Theory

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

Practical

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

Recommended reading:

1) Organic Farming for Sustainable Agriculture by Dahama A. K. Agrobios Publication.
2) Organic Farming: Theory and Practices by Palanippan, S.P. and Anaadurai, K.
3) Organic Farming in India, Problems and Prospects byThapa, U. and Tripathi, P.
4) Trends in Organic Farming in India by Agrobios Publication
5) Handbook of Organic Farming.
6) Recent Developments in Organic farming by Gulati and Barik

Farm Management, Production and Resource Economics

Code: AGS 609 **Full Marks-100**

1L+1P=2

Credit-2

COURSE OUTCOME:

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

Theory

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

Practical

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

Recommended reading:

1. Fundamentals of Farm Business Management - S. S. Johl and T. Kapur, New Age Publishers (2005)
2. Production Economics - J. P. Doll and F. Orazem, CBS Publication, New Delhi (2007)
3. Economics of Agricultural Production and Farm Management - J. M. Dhaka, Pointer Publication (2009)

Principles of Food Science and Nutrition

Code: AGS 610 **Full Marks-100**
2L+0P=2
Credit-2

COURSE OUTCOME:

Theory

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

Recommended reading:

1. Owen R, Fennema. 1996. Food Chemistry, 3rd Ed. Marcel Dekker, Inc., New York, USA.
2. M. Shafiur Rahman. 2007. Handbook of Food Preservation, 2nd Ed. CRC Press, Boca Raton, FL, USA.
3. James G. Brennan. 2006. Food Processing Handbook. Wiley-VCH Verlag GmbH & Co. KGaA, Weinheim, Germany.
4. Fellows P. 2000. Food Processing Technology: Principles and Practice, 2nd Ed. CRC Press, Boca Raton, FL, USA.
5. William C. Frazier and & Dennis C. Westfoff. 1987. Food Microbiology, 4th Ed. Tata McGraw-Hill Education, New Delhi.
6. Carolyn D. Berdanier, Elaine B. Feldman and Johanna Dwyer. 2008. Handbook of Nutrition and Food, 2nd Ed. CRC Press, Boca Raton, FL, USA.
7. Sehgal, S. and Raghuvanshi, R.S. (2007) Text Book of Community Nutrition. ICAR, New Delhi.
8. Agarwal, A and Udipi, S. (2014). Text Book of Human Nutrition. Jaypee Medical Publication, Delhi.
9. Peter Zeuthen and Leif Bùgh-Sùrensen. 2003. Food Preservation Techniques. CRC Press LLC, Boca Raton, FL, USA.
10. Kalia, M. and Sood, S. (2010). Food Preservation and Processing. Revised Edition, Kalyani Publishers, New Delhi.

System Simulation and Agro-advisory

Code: AGEC 654 **Full Marks-100**

2L+1P=3

Credit-3

COURSE OUTCOME:

To make the students knowledge about a system approach of soil-plant-atmospheric continuum, system boundaries, Crop models, concepts & techniques.

Theory

System Approach for representing soil-plant-atmospheric continuum, system boundaries, Crop models, concepts & techniques, types of crop models, data requirements, relational diagrams, Evaluation of crop

responses to weather elements; Elementary crop growth models; calibration, validation, verification and sensitivity analysis. Potential and achievable crop production- concept and modelling techniques for their estimation. Crop production in moisture and nutrients limited conditions; components of soil water and nutrients balance. Weather forecasting, types, methods, tools & techniques, forecast verification; Value added weather forecast, ITK for weather forecast and its validity; Crop-Weather Calendars; Preparation of agro-advisory bulletin based on weather forecast. Use of crop simulation model for preparation of Agro-advisory and its effective dissemination.

Practical

Preparation of crop weather calendars. Preparation of agro-advisories based on weather forecast using various approaches and synoptic charts. Working with statistical and simulation models for crop growth. Potential & achievable production; yield forecasting, insect & disease forecasting models. Simulation with limitations of water and nutrient management options. Sensitivity analysis of varying weather and crop management practices. Use of statistical approaches in data analysis and preparation of historical, past and present meteorological data for medium range weather forecast. Feedback from farmers about the agroadvisory.

Landscaping

Code: AGEC 655 **Full Marks-100**

2L+1P=3

Credit-3

COURSE OUTCOME:

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

Theory

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

Practical

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

Recommended reading:

1) L.C. De. *Nursery and landscaping*.2013. Pointer publishers, Jaipur India.
2) Bose, T.K. Malti, R.G. Dhua, R.S. & Das, P. 2004. Nayaprakash, Calcutta. Floriculture and Landscaping Arora, J.S. 2006. Kalyani

Hi-tech. Horticulture

Code: AGEC 659 **Full Marks-100**

2L+1P=3

Credit-3

COURSE OUTCOME:

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

Theory

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

Practical

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

Suggested Readings:

1. T. A. More, Karale A. R. and Patil M.T. 2001. Hi-tech Horticulture, CAFT (Fruits), MPKV, Rahuri.
2. Balraj Singh.2005. Protected cultivation of vegetable crops, Kalyani Publishers, New Delhi.
3. Patil, M.T and Patil, P.V. 2004. Commercial Protected Floriculture, MPKV, Rahuri
4. Commercial Floriculture – Prasad & Kumar.
5. Proceedings of International seminar on protected cultivation in India, held at Bangalore (1997)
6. Greenhouse operation and management- Paul. V. Nelson

VII Semester

Rural Agricultural Work Experience and Agro Industrial Attachment (RAWE&AIA)

Sl. No.	Title of Course	Credit(s)
1	Rural Agricultural Work Experience	10
2	Agro Industrial Attachment	10
Total		**20**

Sl. No.	No. Activities	No. of weeks	Credit Hours
1	General orientation & on-campus training by different faculties	1	14
2	Village attachment	8	
3	Unit attachment in Univ. / College. / KVK / Research Station attachment	5	
4	Plant clinic	2	2
5	Agro-Industrial attachment	3	4
6	Project Report Preparation, Presentation and Evaluation	1	
Total		**20**	**20**

1. The total number of students of the session including extended campus should be divided in groups based on boy and girl students. Each group will consist of 25±5 students.
2. There will be a coordinating cell at the Faculty, which will be responsible to coordinate the entire programme during 7th semester.
3. Each group will be attached to a nearby village for a period of eight (8) weeks, when the programme will be managed by the departments of the faculty / associated faculties of the University Mainly for Rural System Analysis, farm improvement planning, etc.

The week-wise activities and tasks during the programme are:

- Orientation and survey of village (1 week)
- Agronomical interventions (1 week)
- Plant protection interventions (1 week)
- Soil improvement interventions including soil sampling and testing (1 week)
- Fruit and vegetable production interventions (1 week)
- Food processing and storage interventions (1 week)
- Animal production interventions (1 week)
- Extension and transfer of technology activities (1 week)

4. Each group will be attached to at least five (5) units (Krishi Vigyan Kendras / Research Stations / other Campus) under the University or others within the state for a period of five (5) weeks on rotation basis, wherein one week for one unit system.
5. Each group will be attached to at least three (3) Agro or Cottage Industries (seed companies, rice mills, pesticide-insecticide companies, cold storages, post-harvest processing and value-addition

sectors, agri-finance institutions, etc.) to get an experience of the industrial environment and working for a period of three (3) weeks on rotation basis, wherein one week for one industry system.

The activities and tasks during the programme are:

- Acquaintance with industry and staff
- Study on structure, functioning, objective and mandates of the industry
- Study on various processing units and hand-on training under supervision of industry staff
- Ethics of industry
- Employment generated by the industry
- Contribution of the industry promoting environment
- Learning business network including outlets of the industry
- Skill development in all crucial tasks of the industry
- Documentation of the activities and task performed by the students
- Performance evaluation, appraisal and ranking of student

6. Each group will be attached to a plant clinic of the University / KVK for a period of two (2) weeks.
7. Daily field observation note book and weekly diaries maintained by the students along with final report for each phase duly signed by the concerned teachers / scientists / technical persons should be submitted to the coordinating cell. The evaluation of the student's performance will be continuous, phase-wise at each unit and terminal in nature. The total marks for RAWE & AIA may be distributed unit / attachment-wise as: village attachment (30%), unit attachment in KVK / RRS / other campus (25%), plant clinic attachment (10%), agro-industries attachment (15%) and final evaluation (20%).
8. The final evaluation will be made through presentation of activities, group discussion and central viva-voce.

VIII semester

Experiential Learning Programme (ELP)

A student has to register 20 credits opting for two modules of (0+10) credits each (total 20 credits) from the package of modules in the **VIII semester.**

Sl. No.	Parameters	Max. Marks
1	Project Planning and Writing	10
2	Presentation	10
3	Regularity	10
4	Monthly Assessment	10

5	Output delivery	10
6	Technical Skill Development	10
7	Entrepreneurship Skills	10
8	Business networking skills	10
9	Report Writing Skills	10
10	Final Presentation	10
Total		**100**

END